TYPE N1, O, AND ON CARRIER TELEPHONE SYSTEMS
OVERALL CHANNEL LINEUP
EXPANDOR OUTPUT

The voice frequencies from the demodulator are fed into the expandor circuit, which restores the original strength of the speech currents. In this test a 1000-Hz test tone is applied to the channel at the transmitting end, and the expandor output at the receiving end is measured at the E1-E2 jacks.

This section is reissued to include current test requirements. Arrows are used to indicate changes. This reissue does not affect Equipment Test Lists.

On the N carrier system the EXP potentiometer at the input to the expandor provides means for adjusting the signal to the required level. On O and ON carrier systems ▶the EXP and R potentiometers are used for adjusting the signal.◀

Where test jack appearances are available in a patching bay or testboard, the test may be made from those jacks. However, if adjustments are to be made, the channel unit test stand is required at the receiving terminal. ▶Detailed information on jack and test stand usage is given in Procedure A.◀

On the N carrier channels if the channel unit test stand is used in the LOOP position, a final adjustment of the EXP potentiometer must be made on an overall basis with the test stand in the N1-O1 NORM position. The LOOP position cannot be used for O and ON carrier channels.

The purpose of this test is to measure and adjust the expandor output. This adjustment should be made only when the lineup adjustments at the transmitting terminal and at the high-frequency line, and the other adjustments at the receiving terminal are within requirements.

Caution: The expandor-signaling subassemblies used in N1 and O1 channel units are similar in appearance but are not interchangeable. Refer to Caution in Fig. 1.

APPARATUS:

1—Hewlett-Packard 400-type Vacuum Tube Voltmeter (VTVM)

1—Channel Unit Test Stand J98705M

1—P19A Cord

1—W2DW Cord

1—262B Plug (600 ohms)

1—2B Signaling Test Set

1—2P1D Cord

STEP	PROCEDURE
	A. Adjustment of Expandor Output
	Note: Remove the channel from service before performing this test.
	At Transmitting Terminal
1	◗Place the channel in an OFF-HOOK toward line condition through the use of a 2B signaling test set, by applying −40V to the M jack in the patch bay, or by connecting the M jack on the channel unit to the −40V jack on the test stand. Any other suitable means may be used to achieve this condition.◖
	Note 1: The 2B signaling test set, when used, should be connected as follows. If testing at the patching bay, connect the L jack of the 2B test set to the SIG L jack of the patching bay, using a 2P1D cord or equivalent. If the channel unit test stand is used, connect the M jack of the 2B test set to the M jack of the test stand, using a 2P1D cord. Operate the TWD L key of the 2B test set to OFF HK.
	Note 2: The expandor output can vary between off-hook and on-hook conditions. These tests are made with the channel signaling circuit in the off-hook condition.
2	If jack appearances are available, patch a 1000-Hz test tone to the MOD IN jacks, or equivalent VF IN jacks, at the channel patching jack bay. Use the proper test tone power as follows: 2-wire operation: 0 dBm 4-wire operation: −16 dBm (−16 and +7 offices)
3	If jack appearances are not available, remove the channel unit from the terminal and reconnect using the channel unit test stand and the P19A cord. Then patch a 1000-Hz test tone to the VF IN jacks of the channel unit test stand using test power as follows for the channel wiring options: 2-wire operation: 0 dBm 4-wire operation: −16 dBm
4	If testing on N carrier, proceed to Steps 5 through 11. If testing on O or ON carrier, proceed to Steps 12 through 19.
	At Receiving Terminal—N Carrier (See Fig. 1)
5	Place the channel unit in the channel unit test stand and reconnect using a P19A cord.
6	Terminate the expandor using the 262B plug (600 ohms). For 2-wire operation connect the plug in the VF IN jack of the channel unit test stand. For 4-wire operation connect the plug in the VF OUT jack of the channel unit test stand.

STEP	PROCEDURE
7	Set the REC potentiometer for maximum gain (maximum clockwise position).
8	Measure the expandor input level by connecting the VTVM to terminal 6 of FL 42 (168B filter) and ground, using a W2DW cord. ***Requirement:*** +12.5 ±1.5 dB. ***Note:*** If the requirement is not met, refer to Section 362-030-501.
9	Using a W2DW cord, connect the VTVM to the E1-E2 jacks on the channel unit and measure the expandor output. ***Requirement:*** **Initial lineup:** +10.0 dBm. **Maintenance:** +10.0 ±1.5 dBm for N channels with modified regulators (blue label on handle). +10.0 ±2 dBm for N channels with unmodified regulators (silver or no label on handle). ***Note 1:*** For initial lineup adjust the EXP potentiometer to meet the requirement. ***Note 2:*** ▶If the maintenance requirement is not met, a trouble condition exists. At this point proceed to Part B of this section. After the troubles are cleared, completely realign the channel.◀
10	Remove the test connections and replace the channel unit in the terminal if no further tests are to be made.
11	Adjust the channel net gain as described in Section 362-305-512.
	At Receiving Terminal—O and ON Carrier (See Fig. 2)
12	Place the channel unit in the channel unit test stand and reconnect using a P19A cord.
13	Terminate the expandor using the 262B plug (600 ohms). For 2-wire operation connect the plug in the VF IN jack of the channel unit test stand. For 4-wire operation connect the plug in the VF OUT jack of the channel unit test stand.
14	Set the REC potentiometer for maximum gain (maximum clockwise position).

STEP	PROCEDURE
15	Using a W2DW cord, connect the VTVM to the E1-E2 jacks on the channel unit and measure the expandor output. ***Requirement:*** **Initial lineup:** +10.0 dBm. **Maintenance:** +10.0 ±1.5 dBm. ◗See Note 2, Step 16. ◖
16	◗Adjust the EXP potentiometer for maximum gain, adjust the R potentiometer to obtain a reading of +10.0 dBm, and then readjust the EXP potentiometer until the E1-E2 jack reading is +9.5 dBm. Readjust the R potentiometer to restore the E1-E2 jack reading to +10.0 dBm. ***Note 1:*** The following adjustment is recommended to obtain the same result and to reduce intermittent troubles experienced with the EXP potentiometers. Disconnect the wire from the center terminal (3) of the EXP potentiometer and connect it to terminal (2) of the EXP potentiometer. For identification purposes stencil a white dot on the face of the black expandor knob. Adjust the R potentiometer to meet the requirement. ***Note 2:*** If the maintenance requirement is not met, a trouble condition exists. At this point proceed to Part B of this section. After the troubles are cleared, completely realign the channel.◖
17	Using a W2DW cord, connect the VTVM to the R jack on the channel unit. Measure and ◗***record***◖ the receiving level. ***Requirement:*** +11.0 ±3.0 dBm.
18	Remove the test connections and replace the channel unit in the terminal if no further tests are to be made.
19	Adjust the channel net gain as described in Section 362-305-512.

B. Channel Trouble Investigation

When the expandor output limit is not met or when other indications of a trouble condition (such as unstable meter readings) are present, the trouble should be found and cleared. Adjusting various potentiometers to compensate temporarily for a trouble condition will not provide satisfactory service and, in the long run, will cause excessive maintenance effort.

◗The following procedure will aid in the clearance of such troubles by necessary tube replacement; sweeping of potentiometers, or visual inspection of equipment, such as jacks and plugs. Shortcuts in procedure should be avoided and in the event of intermittent failure, it may be necessary to interchange components.◖

STEP	PROCEDURE
1	Apply a 1000-Hz test tone to the channel input at the transmitting terminal as described in Step 2 or 3 of Part A. The following measurements will aid in isolating the trouble to the transmitting or receiving terminal.
2	Leave the channel units mounted undisturbed in both the transmitting and receiving terminals. Measure levels at the various accessible test jacks located on the faces of the channel units which are associated with the direction of transmission in trouble. Measurements should also be made at undisturbed twin-channel units for O and ON channels. ***Note:*** Measured values which are outside limits given in other sections will indicate whether the trouble is in the transmitting or receiving terminal or in the repeatered line.
3	At the transmitting channel, tap compressor tubes V1 and V2 while measuring the 1000-Hz test tone level at the F jack for N channels and at the T jack (carrier sideband) for O and ON channels. Replace tubes that cause a change in level. ***Note:*** Any change measured at this point is doubled at the expandor output.
4	At the receiving channel, tap expandor tubes V43 and V44, the V102 regulator tube for N1 channels, and the V201 demodulator-amplifier tube for O and ON channels while measuring the 1000-Hz test tone level at the E1-E2 expandor output jacks. Replace tubes that cause a change in level.
5	Remove the channel unit from the terminal and place it in the channel unit test stand. Continue to look for and clear troubles. Measurements made in Step 2 which were out of limits should help in locating troubles.
6	Realign the channel. Be sure to turn potentiometers back and forth to wipe the contacting surfaces before setting to final lineup value. If requirements cannot be met, replace tubes in the appropriate subassemblies. If requirements still are not met, replace the appropriate subassemblies.
7	Tap various components and subassemblies. Replace those that cause a change in level of the 1000-Hz test tone. Give special attention to the compressor and expandor potentiometers.
8	Ensure adequate clearance between wires and solder lugs and the channel unit cover or frame. Give special attention to the REC potentiometer terminals.
9	Replace or repair any broken or bent pins and jack terminals on the 20-pin connectors that connect the channel unit to the terminal or interconnect subassemblies.
10	After clearing all troubles, completely realign the channel. Replace it in the terminal and adjust to the required net gain. ***Note:*** Whenever tubes are changed or adjustments are made on an O or ON twin-channel unit, both channels associated with the twin-channel unit must be realigned in both directions of transmission.

STEP	PROCEDURE
11	Tag defective subassemblies after removing them. Give detailed information as to the trouble to help the shop in repairing the units.
12	If available, a recorder that will make 24-hour recordings of channel net gain has proved invaluable in helping to identify channels with intermittent troubles and in identifying various causes of channel instability. Use this technique whenever possible.
13	Severe daily variations in channel net gain on ON channels, especially when they occur on many channels of a system and in both directions of transmission, may be an indication of excessive drift in the frequency of the received carriers. To check this irregularity, measure the frequency of the received carriers at the twin-channel unit as covered in Section 362-125-501.

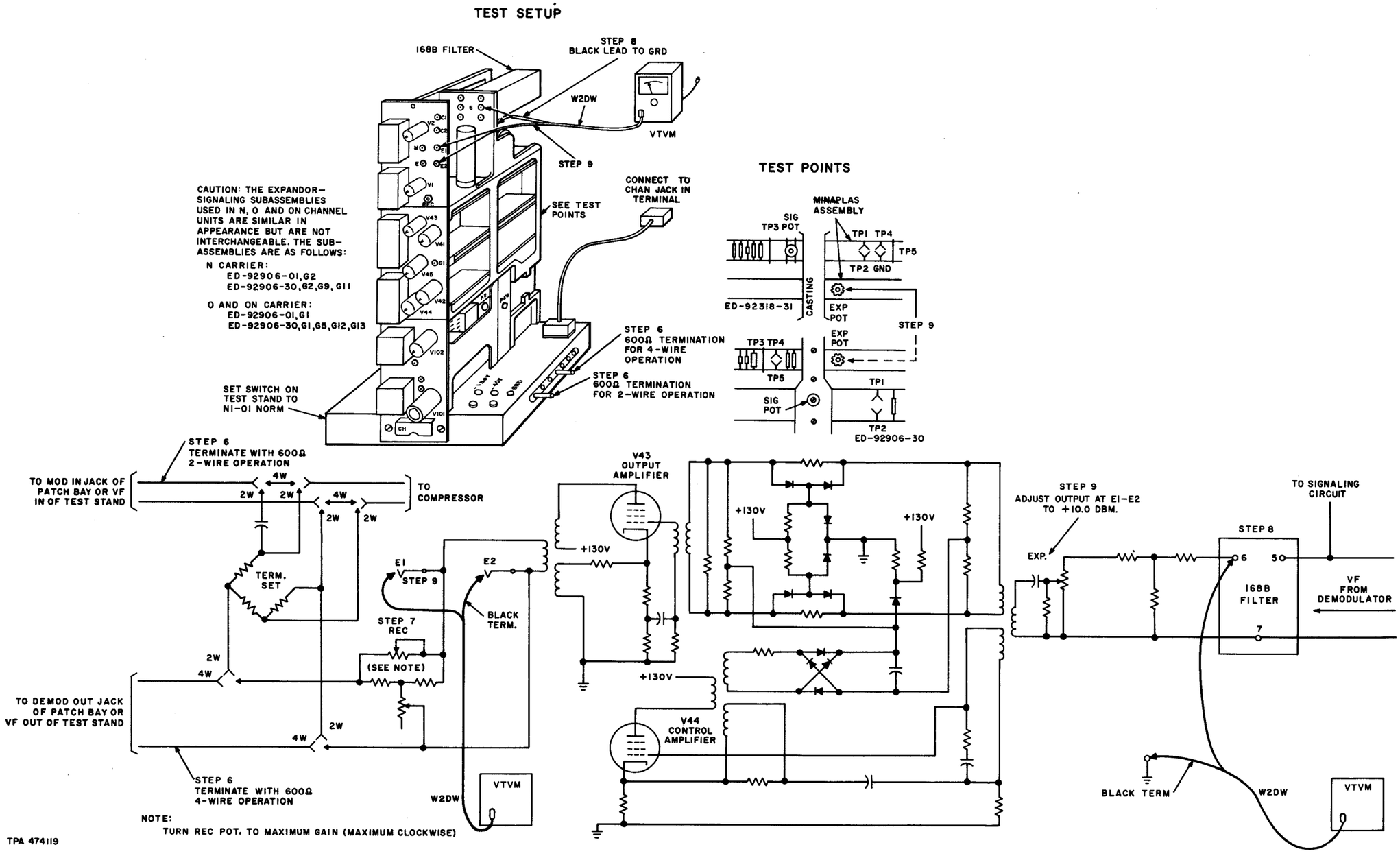
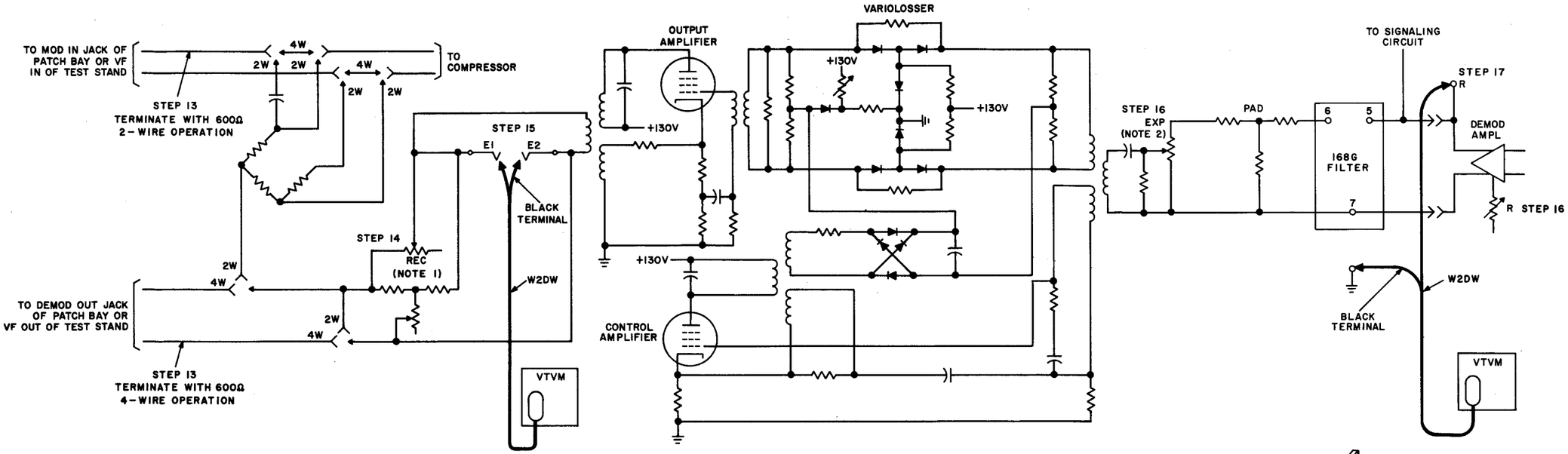
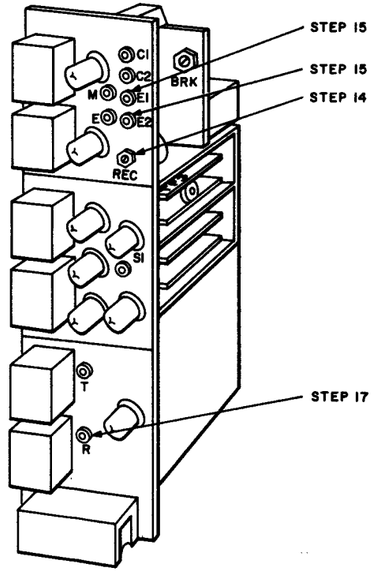
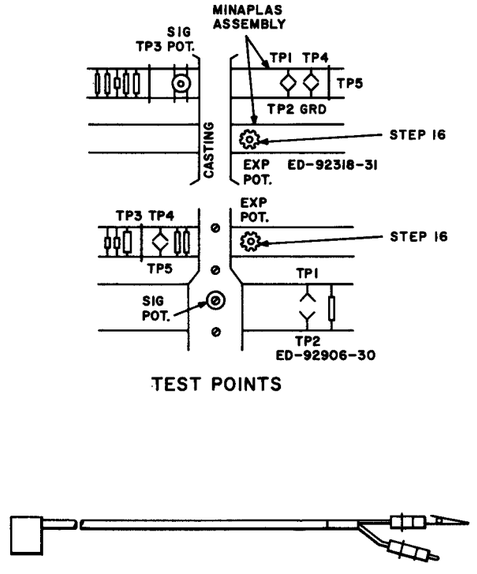


Fig. 1—Adjustment of Channel Unit Expandor Output—N1 Carrier





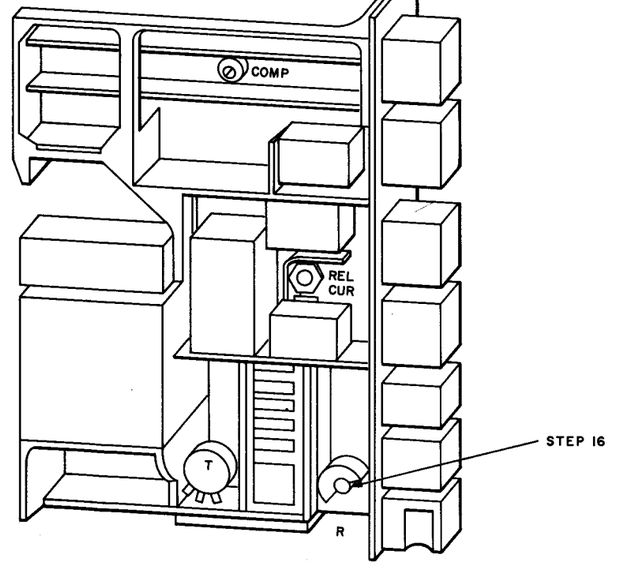
CHANNEL UNIT



TEST POINTS

W2DW CORD

NOTES:
1. TURN REC POTENTIOMETER TO MAXIMUM GAIN (MAXIMUM CLOCKWISE).
2. SEE STEP 15 IN PROCEDURE FOR ADJUSTMENT OF EXPANDOR OUTPUT.



CHANNEL UNIT

TPA 474120

Fig. 2—Adjustment of Channel Unit Expandor Output—O and ON Carrier