J99343PB(L1, L2, AND L3) 2-2 TERMINAL REPEATER
INSTALLATION AND TESTING
METALIC FACILITY TERMINAL

CONTENTS PAGE

1. GENERAL

1.01 This section presents the installation testing and maintenance procedures for the Metallic Facility Terminal (MFT) 2-2 Wire Terminal Repeaters (nonloaded).

1.02 This section is being reissued to clarify installation procedures for 2-2 terminal repeaters (nonloaded) by deleting installation procedures for 2-2 terminal repeaters (loaded) from this section and adding them to a new section. Due to reformat and changed installation procedures, the information in this section has been completely revised. Since this reissue is a general revision, no revision arrows have been used to denote significant changes. Equipment Test Lists are not affected.

1.03 The J99343PB (L1, L2 and L3) 2-2 terminal repeaters, shown in Fig. 1, 2, and 3, respectively, provide gain and adjustable equalization between 900-ohm terminal equipment (A-side) and nonloaded 2-wire facilities (B-side). Additional detailed descriptive information about these units is provided in Section 332-912-114. Prescription setting information for these units is given in Section 332-912-212.

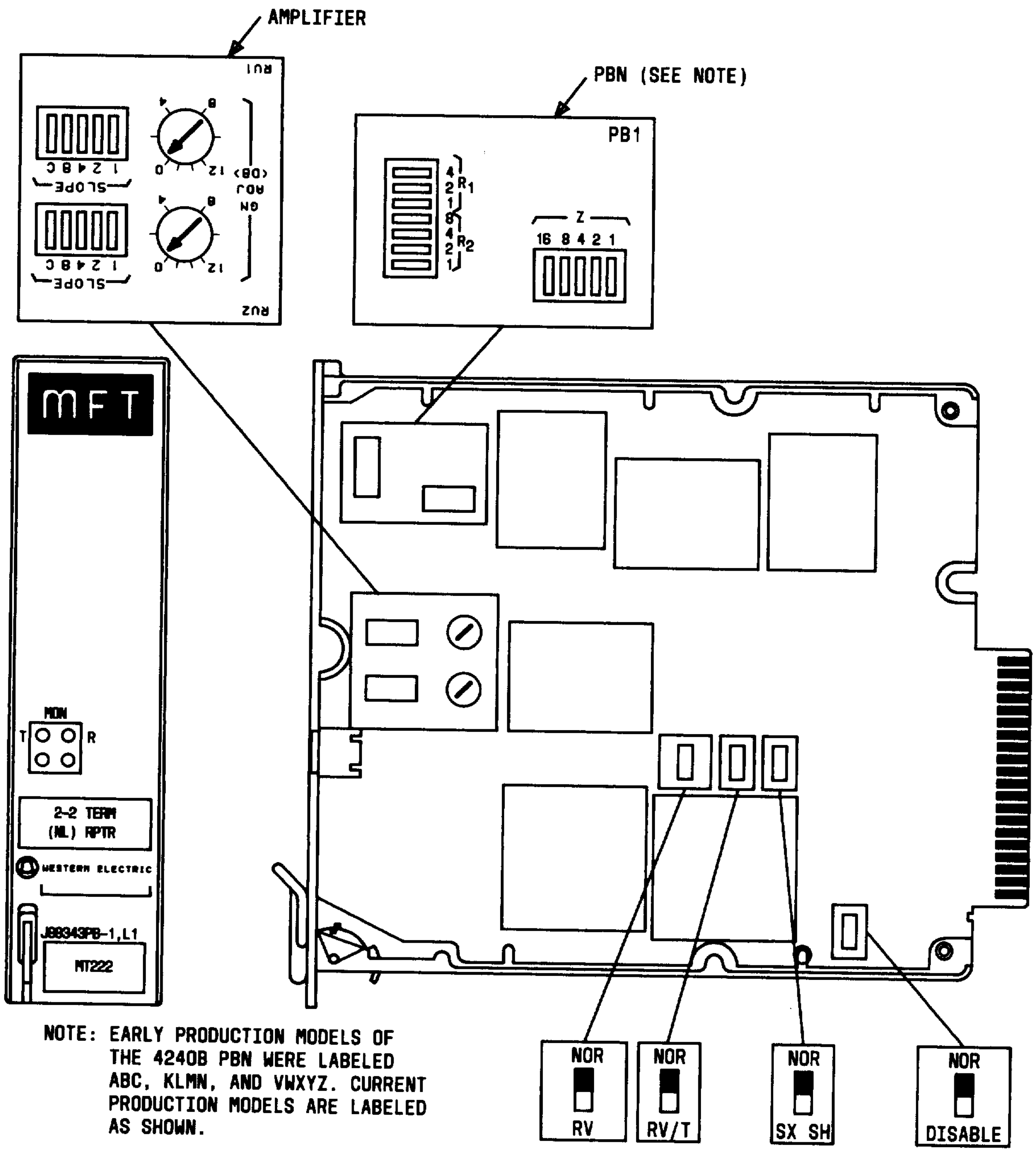


Fig. 1—Component Layout—J99343PB, L1

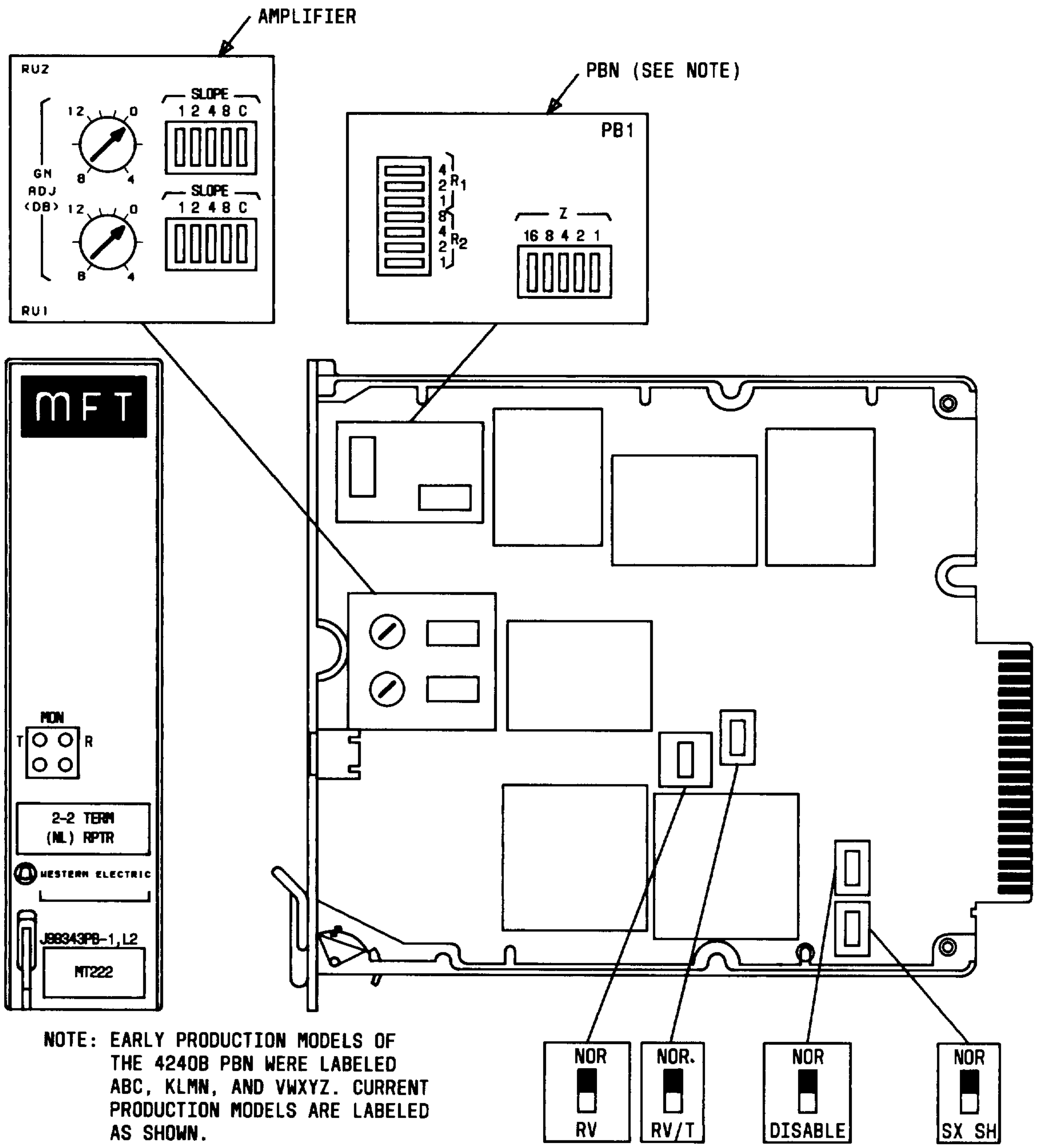


Fig. 2—Component Layout—J99343PB, L2

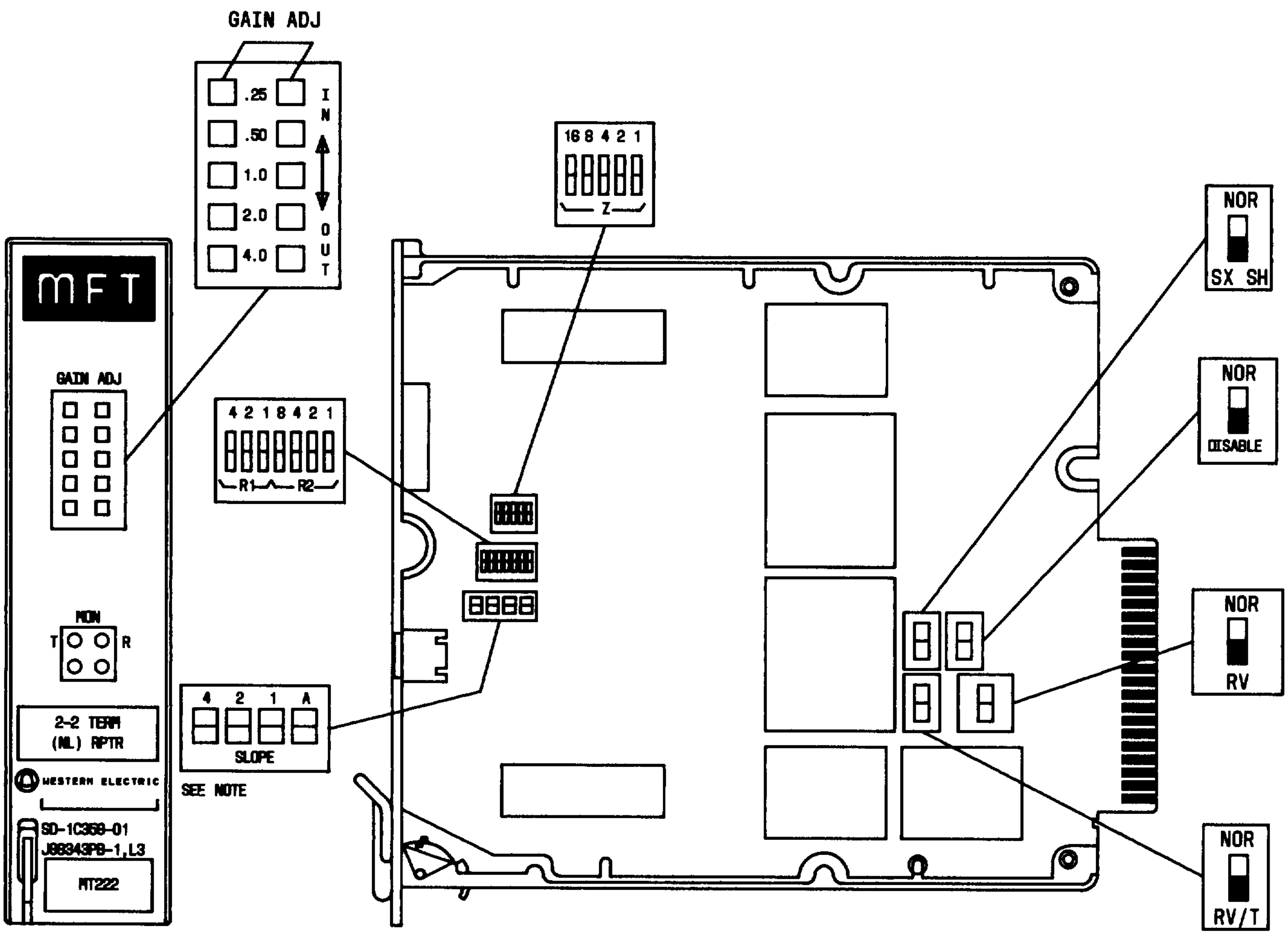
2. INSTALLATION

A. Mounting Arrangements

2.01 These units can be used in either a single- or a double-module mounting arrangement. They can be mounted in any slot of a single-module shelf or in the transmission slot of a double-module shelf. In double-module applications, the repeater may be used with or without a companion signaling unit. Section 332-910-101 contains additional information on MFT mounting arrangements.

B. Unit Controls

2.02 Figures 1 through 3 show the location of the individual unit controls. These controls must be set properly prior to the installation of these units. The settings are determined by circuit applications



NOTE: THE "A" SWITCH DOES NOT PERFORM THE SAME FUNCTION AS THE "C" SWITCH ON J99343PB (L1 & L2). SEE TEXT FOR DESCRIPTION

Fig. 3—Component Layout—J99343PB, L3

and are to be supplied by the local circuit layout organization. This organization can use the following sources to provide this information.

- 332-912-114 — (J99343PB [L1, L2 & L3]) Description Section
- 332-912-212 — (2-2 wire repeaters) Prescription Setting Section
- Universal Cable Circuit Analysis Program (UNICCAP)
- Standard design engineering sections (851-Division).

The manual procedures provided in this section can also be used to obtain the unit control settings. In addition, the J99343TN can Facility Matching Test Set can be used to determine the PBN settings.

2.03 The switches for a particular function are operated when pressed or depressed toward the respective designation of the switch. Part 4 of this section provides procedural information to aid in setting the various controls of the 2-2 wire terminal repeaters.

3. APPLICATION GUIDELINES

3.01 Transmission levels of 2-wire circuits are limited by two factors: crosstalk and stability. Separate objectives are given for satisfactory stability and crosstalk performance.

3.02 For stability consideration, the maximum allowable gain at 1 kHz across the 2-2 wire terminal repeaters is 6 dB. This gain is not the maximum available with the 2-2 wire terminal repeaters since they are capable of producing more than 6 dB of gain for some equalizer and gain settings.

3.03 Crosstalk objectives determine the following level requirements with respect to the 0 transmission level point (TLP).

(a) Maximum output level: +6 dB (TLP)

(b) Minimum output level: −9 dB (TLP).

3.04 The levels in the previous two paragraphs are based on the assumption that the 2-2 wire terminal repeaters are located in the central office (CO). The 2-2 wire terminal repeaters are not recommended for installation at customer locations due to repeater balance requirements which are better maintained at central offices. Also the impedance of most PBXs (considered to be 600 ohms +2.15 μF) does not match that of the 2-2 terminal repeaters (900 ohms +2.15 μF).

3.05 Roll-off objectives at 400 and 2800 Hz for the 2-2 terminal repeaters are shown in Table A. It is recommended, but not required, that the roll-off at 400 and 2800 Hz for both lines and trunks be greater than the 1-kHz loss.

TABLE A

ATTENUATION DISTORTION ROLLOFF OBJECTIVES FOR VOICEGRADE SWITCHED SPECIAL SERVICES CIRCUITS

CIRCUIT	ALLOWABLE DEVIATION FROM 1000-HZ LOSS	
	MEASURED AT 400 HZ (NOTE)	MEASURED AT 2800 HZ (NOTE)
Trunks	Within 3.0 dB more loss or 1.0 dB less loss	Within 4.5 dB more loss or 1.0 dB less loss
Lines	Within 5.0 dB more loss 1.0 dB less loss	Within 7.5 dB more loss or 1.0 dB less loss

Note: Relative to 1-kHz loss

3.06 The following facility characteristics are necessary for a MFT circuit to meet trunk requirements for roll-off. Since trunk requirements are more stringent than line requirements, these facility requirements will guarantee that line requirements are also met.

- The A-side impedance shall be equivalent to 900 ohms plus 2.15 μF.
- The maximum 1 kHz facility loss is 9 dB.

3.07 To meet the above trunk objectives, the facility shall also meet the following requirements:

- The nonloaded facility should not contain any load coils.
- The nonloaded facility should meet resistance design rules as described in Section 902-115-101.

3.08 For circuits which include a single repeater in a 2-wire facility, the equalization is on an end-to-end basis. Equalization should meet objectives outlined in paragraph 3.05.

3.09 Application guidelines for the J99343PB (L1, L2 & L3) are given in Section 332-912-114.

4. TESTS AND ADJUSTMENTS

4.01 Figure 4 provides a flowchart which presents the overall process for setting up the J99343PB (L1, L2, or L3) repeaters. This flowchart should be followed when using this section. Parts 5 through 11 of this section supplements Fig. 4 where additional information is required to perform the individual transmission tests while Part 12 gives similar information on setting the signaling lead switches.

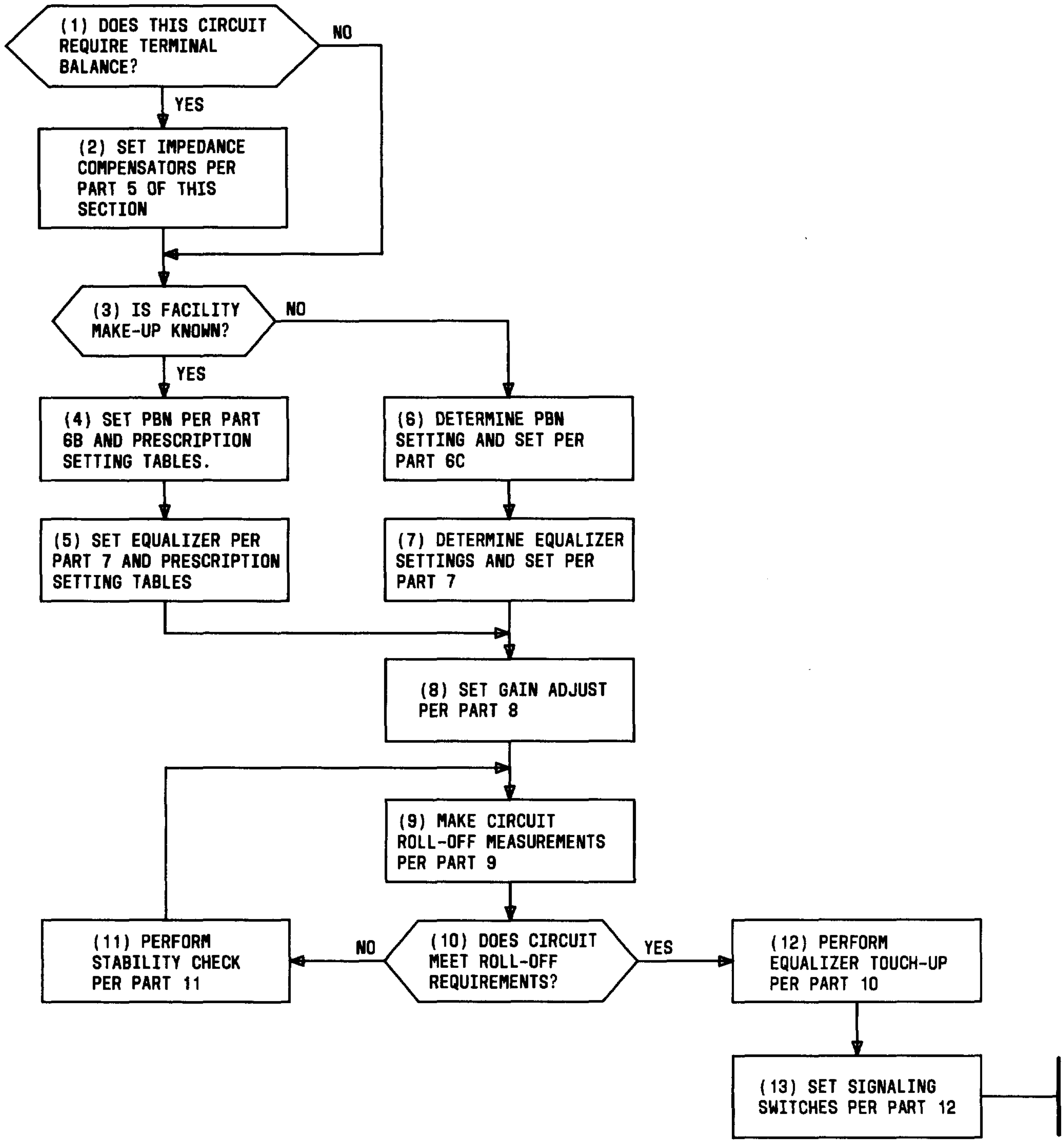


Fig. 4—Transmission Alignment Sequence Flowchart

5. PROCEDURES FOR CIRCUITS REQUIRING TERMINAL BALANCE

5.01 The J99343PB terminal repeaters in combination with the 837, J99380 or J99343 types of impedance compensators may be used for circuits with terminal balance requirements. When used in these arrangements, the 837D, J99380AA or J99343BL setting should be optimized using the procedures in Sections 332-205-500 (837D and J99380AA) or 332-912-206 (J99343BL). Also see Paragraph 7.04 for information on setting the A switch in the J99343PB, L3 equalizer when used in terminal balance applications.

6. ADJUSTMENT OF BALANCING NETWORKS

A. General

6.01 The procedures in this section cover the adjustments for balancing networks of the J99343PB (L1, L2, and L3) terminal repeaters.

6.02 The J99343PB repeaters contain two types of balancing networks: a compromise balancing network (900 ohm +2.15 μF) on the A-side to balance 2-wire terminal equipment and a two-transformer hybrid with a precision balancing network (PBN) on the B-side facing the nonloaded cable facility.

6.03 The following paragraphs discuss the adjustment of the transformer hybrid with the PBN for the J99343PB repeaters.

6.04 In applications where the make-up of the nonloaded facility is not known, the following test equipment is required to determine the PBN settings.

- J99343TB test extender
- Return loss measuring set (RLMS), KS-20501, List 3 or equivalent
- Office record sheet (circuit layout card or equivalent) to record new settings
- Various termination networks.

B. PBN Settings B-Side—J99343PB (L1, L2 & L3)

6.05 Adjustment of the PBN for the transformer hybrid is done through the operation of switches located on the printed wiring board. The switches for the J99343PB repeaters are labeled as follows (see note): three switches labeled R1 (designated 4, 2, 1), four switches labeled R2 (designated 8, 4, 2, 1) and five switches labeled Z (designated 16, 8, 4, 2, 1). If the B-side facility is known, the PBN setting can be determined from one of the sources given in paragraph 2.02.

> ***Note:*** Early production PBN models for the J99343PB repeaters were labeled ABC for the current R1(4, 2, 1), KLMN for the current R2(8, 4, 2, 1) and VWXYZ for the current Z(16, 8, 4, 2, 1).

C. Manual Procedures for Adjustment of Precision Balance Network

6.06 In applications where the nonloaded facility is not known or if the facility makeup is known and the circuit does not perform satisfactorily with prescribed settings, optimized PBN settings can be determined by performing the following procedure and steps in Fig. 5. A typical test configuration for setting the B-side PBN is shown in Fig. 6.

STEP	PROCEDURE
1	Terminate the B-side far end of the circuit in its nominal impedance. If the far end is a switch (900 ohms +2.16 μF) or PBX (600 ohms +2.16 μF), a compromise network (600 or 900 ohms + 2.16μF) should be used. If the far end terminates in a telephone set, use a 4066H network (Section 332-852-108) to simulate the telset.
2	Insert the J99343PB repeater into the J99343TB test extender. Plug the cable extender card of the J99343TB into the appropriate shelf mounting slot.

STEP	PROCEDURE
3	Set the repeater options as follows: (a) SLOPE equalizer switches — all switches to off (b) Signaling options as specified on CLR (NOR/RV, NOR/RV-T, NOR/SX-SH) (c) NOR/DISABLE switch to NOR position (d) Gain switches to OUT or gain potentiometers to fully counterclockwise
4	Set switches on the J99343TB test extender as follows.

A-SIDE	B-SIDE
600/900 to 900	600/900 to 900
2W/4W to 2W	2W/4W to 2W
COMP NET IN/OUT to IN	COMP NET IN/OUT to OUT

STEP	PROCEDURE
5	Set the switches on the KS-20501, List 3 RLMS as follows: (a) TEST LOCATION to 900-2W (b) NETWORK to INT ***Note:*** Section 103-106-115 provides operating information on the KS-20501, List 3 RMS.
6	Connect the TRMT jack (2-wire) of the RLMS to the A-side 2W EQUIP jack on the J99343TB test extender to set a B-side network. See Fig. 6 for test configuration.
7	Go to Fig. 5 for adjustment of the PBN.

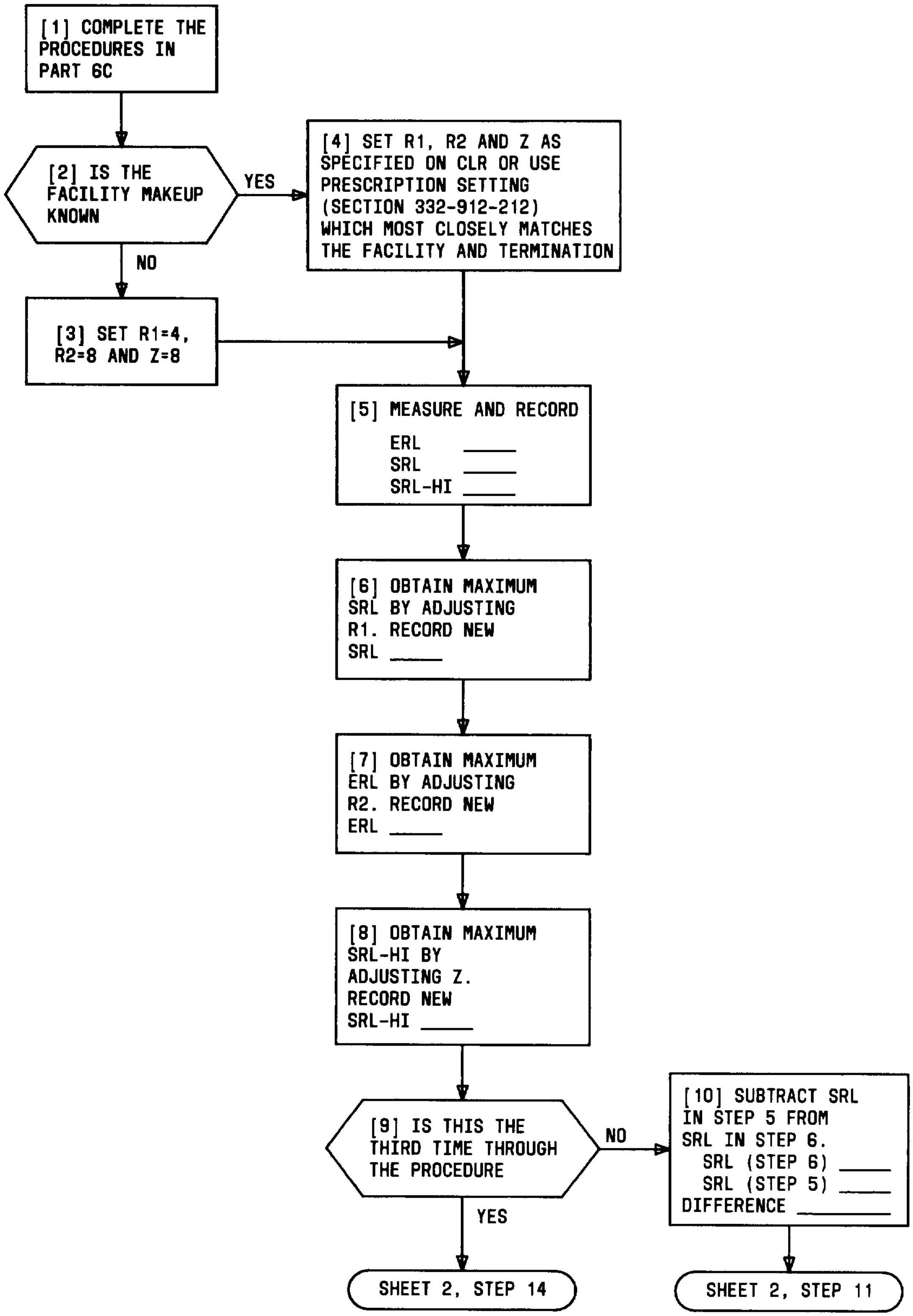


Fig. 5—Procedures for Adjustment of the B-Side PBN (Sheet 1 of 2)

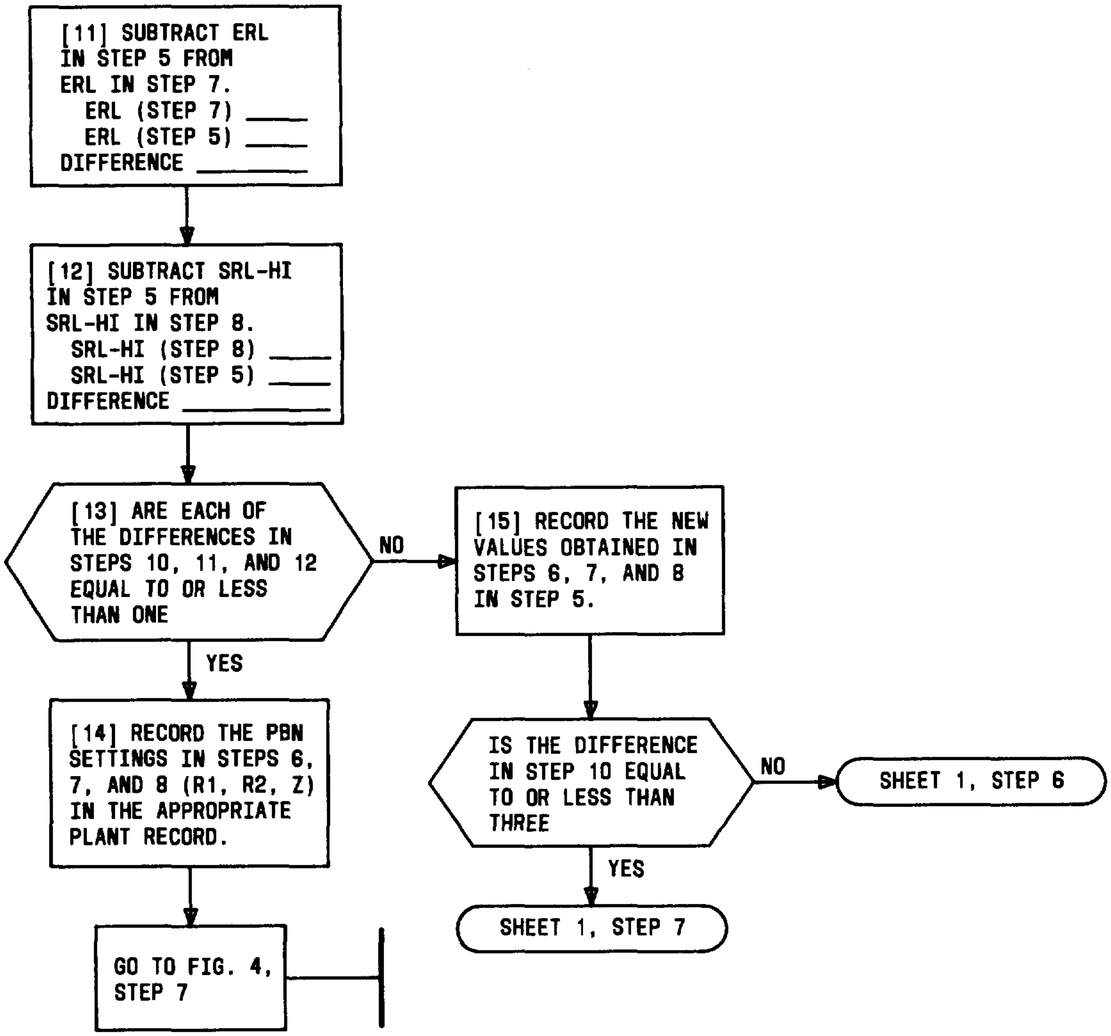
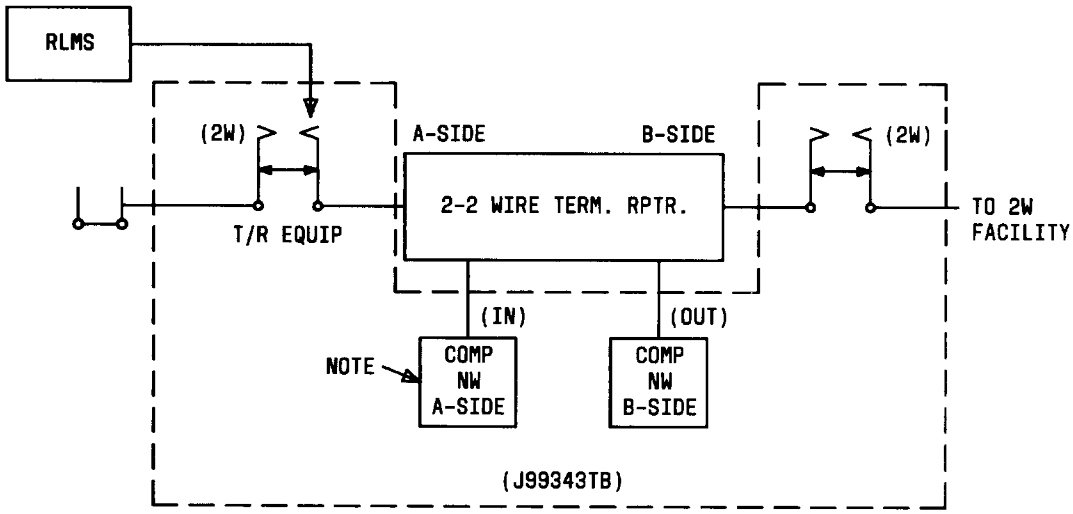


Fig. 5—Procedures for Adjustment of the B-Side PBN (Sheet 2 of 2)



NOTE:
THERE IS NO CONNECTOR ACCESS FOR THE TEST EXTENDER COMP NETWORK ON THE A-SIDE OF CANCELER TYPE HYBRIDS. TEST EQUIPMENT MUST HAVE A 900 OHM IMPEDANCE INPUT TO IMPEDANCE MATCH THE CANCELER HYBRID OF THE TERMINAL REPEATERS A SIDE.

Fig. 6—Typical Test Configuration for Setting B-Side Balance Network

7. EQUALIZER SETTINGS FROM FREQUENCY RESPONSE MEASUREMENTS

A. General

7.01 The information and procedures in this part are provided as a manual method to determine the J99343PB (L1, L2 & L3) equalizer settings. These procedures are normally used when equalizer settings cannot be determined from any other source, such as the prescription setting tables (332-912-212) or any of the various mechanized provisioning systems such as Trunk Integrated Record Keeping Sytem (TIRKS) or UNICCAP.

7.02 Cable loss information to calculate the equalizer settings is obtained from the frequency response measurement procedure. Figure 7 is a typical test configuration for obtaining the frequency response measurements and the procedure is given in Part 7B. Once the 400, 1000, and 2800 Hz cable loss has been determined, this information should be recorded in Step 1 of Fig. 8. The flowchart (Fig. 8) provides the procedure for determining the equalizer settings. An example calculation is also provided.

7.03 In normal use, the C switch and the #8 numerical switch of the slope switch group contained in the J99343PB (L1, & L2) terminal repeaters are not operated for terminal repeater applications. Equalization methods for terminal applications use switch settings, 1, 2, and/4 only for numerical sums 0 through 7.

7.04 The A switch of the slope switch group contained in the J99343PB L3 terminal repeater is operated when impedance compensators are used on the cable facility. When the J99343PB L3 repeater is used in conjunction with short lengths of cable incorporating the J99343BL, J99380AA or 837D impedance compensator, equalization improvements may be possible with the A switch operated. Gain provided by the A switch is shown in Table C (see Part 5).

B. Frequency Response Measurements

7.05 Figure 7 is the typical test configuration for making frequency response measurements on the J99343PB terminal repeaters when using the procedure of this part. The following equipment is required for these measurements:

(a) Transmitting location: Oscillator with selectable 600- and 900-ohm output impedances and variable frequency selection for 400, 1000, and 2800 Hz.

(b) Receiving location: J99343TB test extender and transmission measuring set (detector) with 900-ohm input impedance.

Once the level at 400, 1000, and 2800 Hz has been obtained from the following procedure, they should be recorded in Step 1 of Fig. 8.

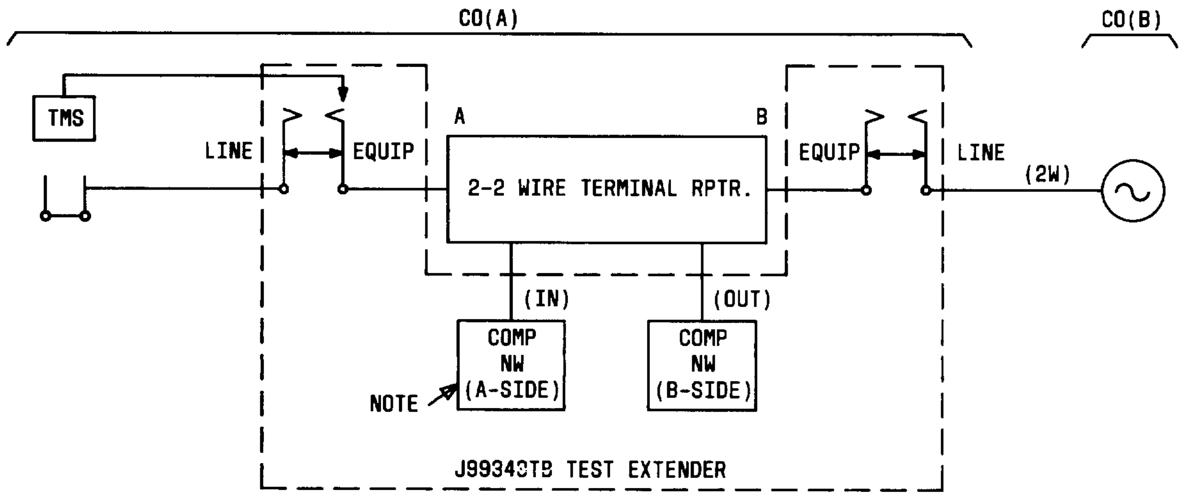
STEP	PROCEDURE
	At the Transmitting Location:
1	Connect the oscillator to the cable facility and set the oscillator impedance as follows:

TERMINATING EQUIPMENT	IMPEDANCE
Central Office	900 ohms
600-ohm PBX	600 ohms
900-ohm PBX	900 ohms
Station Set	600 ohms

STEP	PROCEDURE
	At the Receiving Location:
2	Remove repeater associated with circuit under test from its shelf location.
3	Insert repeater into test extender and connect test extender into the repeater shelf location slot.
4	Set repeater controls as follows:
	(a) Equalizer switches to OFF
	(b) PBN to proper value as shown on CLR or as determined in Part 6C.
	(c) Gain potentiometers fully counterclockwise or gain switches to OUT.
	(d) Signaling options (RV, RV/T, SX SH) to positions specified on CLR.
	(e) DISABLE/NOR switch to NOR position.
5	Set switches on J99343TB test extender as follows:

A-SIDE	B-SIDE
2W/4W to 2W	2W/4W to 2W
600/900 to 900	600/900 to 900
COMP NET IN/OUT to IN	COMP NET IN/OUT to OUT

STEP	PROCEDURE
6	Send 1-kHz tone at 0 dBm and adjust amplifier gain until receiving location receives −5 dBm.
7	Next, send 400 Hz at 0 dBm and record the level read at the receiving location.
8	Finally, send 2800 Hz at 0 dBm and record the level read at the receiving location.
9	For calculation of equalizer settings, record the received levels for 400, 1000, and 2800 Hz in Step 1 of Fig. 8.



NOTE:
THERE IS NO CONNECTOR ACCESS FOR THE TEST EXTENDER COMP NETWORK ON THE A-SIDE OF CANCELER TYPE HYBRIDS. TEST EQUIPMENT MUST HAVE A 900 OHM IMPEDANCE INPUT TO IMPEDANCE MATCH THE CANCELER HYBRID OF THE TERMINAL REPEATERS A SIDE.

Fig. 7—Typical Test Configuration for Frequency Response Measurements

7.06 The following is an example of using the procedures in Fig. 8 for obtaining equalizer settings by measurements:

Example: Tests level is 0 dBm at 1 kHz.

Step 1. Measure and record the 1000-, 400-, and 2800-Hz loss from Part 7B and round off to the nearest .5 dB.

1000-Hz loss 5

400-Hz loss 4.5

2800-Hz loss 8.0

Step 2. Is the loss at 400-Hz larger (absolute value) than the loss at 1000-Hz. If No, go to Step 4.

Step 4. Subtract the 400-Hz loss from the 1000-Hz loss.

1000-Hz loss 5

400-Hz 4.5

400-Hz Difference .5

Step 5. Subtract the 1000-Hz loss (Step 1) from the 2800-Hz loss (Step 1) and record the difference.

2800-Hz loss 8.0

1000-Hz loss 5

2800-Hz Difference 3.0

Step 6. 400-Hz difference .5

2800-Hz Difference 3.0

Equalizer setting from Table B 3

Step 7. Set SLOPE switches 1 & 2 for RU1 and RU2 of the J99343PB L1 and PB L2 repeaters or set SLOPE switches 1 & 2 of the J99343PB L3 repeater.

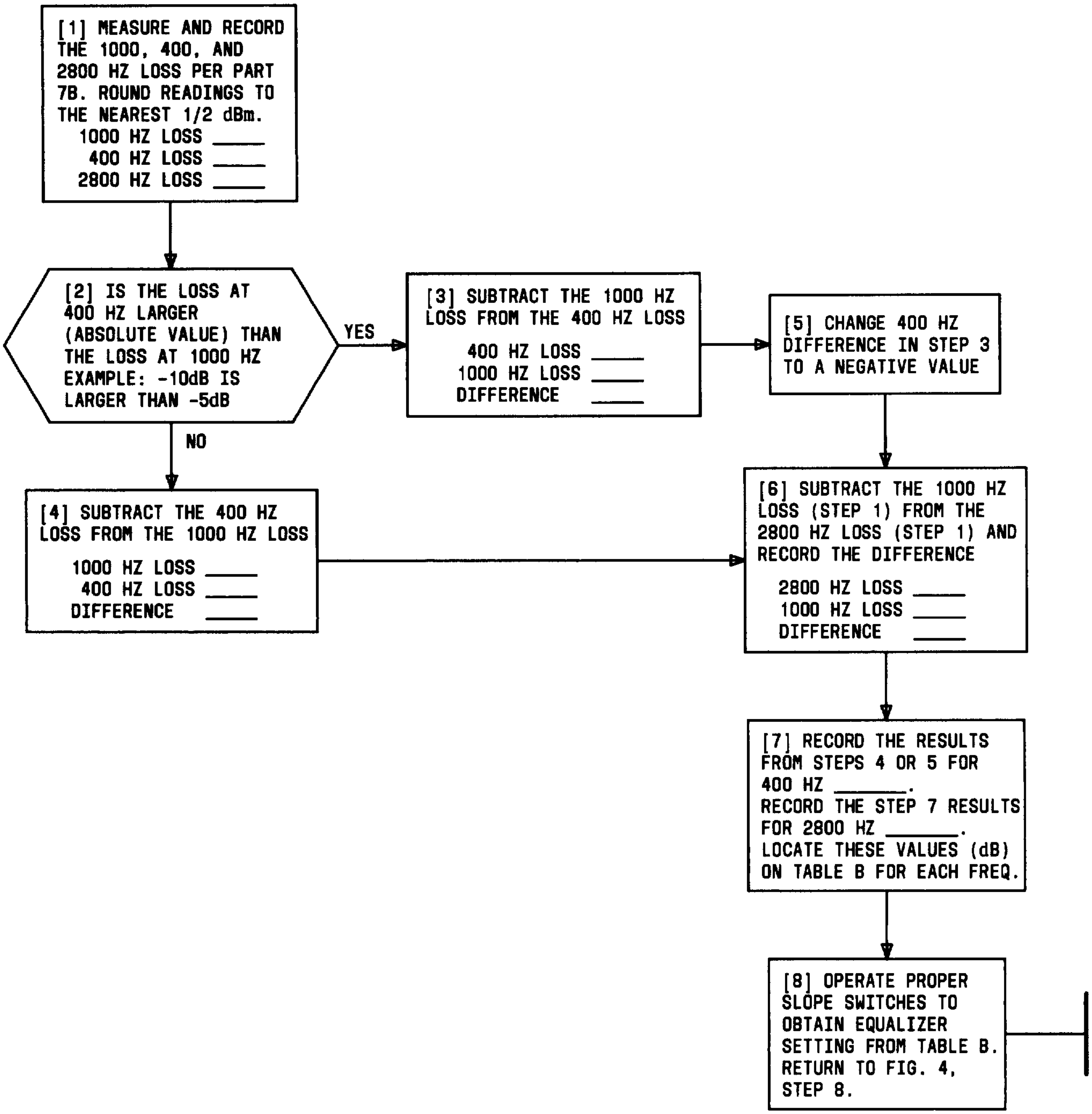


Fig. 8—Obtaining Equalizer Settings by Measurement

TABLE B

TERMINAL REPEATER EQUALIZER SETTINGS (NOTE)

400 Hz DIFFERENCE

2800 Hz Difference	−1.0	−.5	0	.5	1.0	1.5	2.0	2.5	3.0	3.5
1.0	0	0	0							
1.5	0	0	1							
2.0	0	1	1							
2.5	1	1	2							
3.0	1	2	2	3						
3.5	2	2	3	3						
4.0	2	3	3	4						
4.5	3	3	4	4	5	6				
5.0	3	4	4	5	6	7				
5.5	4	4	5	6	7	7	7			
6.0	4	5	6	7	7	7	7	7		
6.5	5	6	7	7	7	7	7	7	7	7
7.0	6	7	7	7	7	7	7	7	7	7
7.5	7	7	7	7	7	7	7	7	7	7
8.0	7	7	7	7	7	7	7	7	7	7
8.5	7	7	7	7	7	7	7	7	7	7
9.0	7	7	7	7	7	7	7	7	7	7
9.5	7	7	7	7	7	7	7	7	7	7
10.0	7	7	7	7	7	7	7	7	7	7
10.5	7	7	7	7	7	7	7	7	7	7
11.0	7	7	7	7	7					
11.5	7	7	7	7	7					
12.0	7	7	7	7	7	7				
12.5	7	7	7	7	7	7	7			

Note: The J99343PB,L3 amplifier A-switch value when operated is used with non-loaded circuits that contain impedance compensators (see paragraph 7.04) and does not serve the same function as the C-switch value in the J99343PBL1 & PBL2 (see paragraph 7.03)

8. GAIN ADJUSTMENT

A. J99343PB L3

8.01 The total gain provided by the J99343PB L3 terminal repeater is the combination of the gain contribution by the amplifier and equalizer units. In order to determine the setting of the gain switches (GAIN ADJ), the equalizer settings must be determined (Part 7). Once the equalizer setting has been determined, Table C will give the 1 kHz gain associated with that equalizer setting. The equalizer gain should then be subtracted from the total gain to be provided by the J99343PB, L3. The difference in the total and equalizer gain is the gain to be provided by the amplifier unit.

TABLE C

EQUALIZER GAIN OR LOSS AT 1 KHZ

SWITCH SETTING	J99343PB (L1 & L2)	J99343PB,L3	
	C=OFF	A=OFF	A=ON
0	0	0	–0.5
1	+0.2	+0.2	–0.3
2	+0.5	+0.5	+0.2
3	+0.8	+0.8	+0.5
4	+1.2	+1.1	+0.8
5	+1.5	+1.5	+1.2
6	+1.9	+1.9	+1.6
7	+2.3	+2.3	+2.0

8.02 Once the amplifier gain has been determined for the J99343PB, L3, the appropriate GAIN ADJ switches must be set. The GAIN ADJ switches, accessible through the front panel, are labeled .25, .5, 1.0, 2.0, and 4.0. These switches are additive and provide gain from 0 to 7.75 dB in .25 dB increments. They are also ganged to provide the same gain in each direction of transmission.

> ***Note:*** For crosstalk considerations, the maximum gain provided by the 2-2 wire terminal repeaters typically is 6 dB.

8.03 Once the gain setting has been determined, refer to Fig. 4, Step 9, and complete the alignment sequence.

B. J99343PB L1 and L2—Procedure for Setting Specified Gain

8.04 The J99343PB L1 and L2 terminal repeaters provide gain and adjustable equalization using two amplifiers contained in the same housing on the printed wiring board (see Note). Each amplifier is controlled individually by adjustable potentiometers labeled RU1 and RU2. Potentiometer RU1 controls the flat gain of the A- to B-side voice frequency (VF) transmission and RU2 controls the flat gain of the B- to A-side VF transmission.

> ***Note:*** Equalizer settings for the J99343PB L1 and L2 repeaters must be determined and installed before the gain switches are set (see paragraphs 8.01 and 8.02 for the J99343PB L3 repeater).

8.05 The following procedure is for setting the specified gain (per CLR) of 2-2 terminal repeaters which contain amplifiers with adjustable potentiometer type controls. The potentiometer controls have markings for coarse gain value adjustments. In order to obtain an accurate fine gain setting for a specified gain, the gain output must be measured by appropriate test equipment while adjusting each potentiometer.

8.06 The procedures for setting the specified gain require the following equipment:

- J99343TB test extender
- VF oscillator with adjustable output power and a 900-ohm output impedance
- Transmission measuring set (detector) with a 900-ohm input impedance

Note: The oscillator and measuring set may be combined in a single test instrument.

- CLR
- Appropriate test cords.

The test configuration for setting a specified gain is shown in Fig. 9.

STEP	PROCEDURE
1	Install equalizer settings. If equalizer settings are unknown determine them by using procedure in Part 7.
2	Set signaling options (RV, RV/T, SX SH) as specified by CLR.
3	Turn gain potentiometers to full counterclockwise.
4	Set DISABLE/NOR switch to NOR position.
5	Remove companion signaling unit if used.
6	Set switches on J99343TB test extender as follows:

A-SIDE	B-SIDE
2W/4W to 2W	2W/4W to 2W
600/900 to 900	600/900 to 900
COMP NET IN/OUT to IN	COMP NET IN/OUT to IN

STEP	PROCEDURE
7	Insert repeater into test extender and connect cable extender card into proper slot of MFT shelf.
8	Note gain specified on CLR and call it G.
9	Connect oscillator output to input of TMS. Adjust oscillator output for an indication of -G dBm on the TMS.
10	For gain adjustment of amplifier in the A to B direction, connect oscillator output to 2W EQUIP jack on A side of J99343TB test extender and connect TMS to 2W EQUIP jack on B side of J99343TB text extender.

STEP	PROCEDURE
11	For gain adjustment of the amplifier in the B to A direction, connect oscillator output to 2W EQUIP jack on the B side of the J99343TB test extender and connect TMS to 2W EQUIP jack on the A side of J99343TB test extender.
12	Adjust potentiometers associated with RU1 for A to B direction and RU2 for B to A direction for a 0-dBm indication on TMS.
	Note: If TMS does not follow adjustment of the potentiometer smoothly, either the test extender has not been set to match the test equipment, or the wrong potentiometer was adjusted.
13	After amplifier gain has been adjusted, set PBNs and DISABLE switch as previously determined or specified on work order.
14	Disconnect test extender from shelf and remove repeater from test extender.
15	Insert repeater and signaling unit (if required) into its proper shelf location.
16	Go to Fig. 4, Step 9, and complete alignment sequence.

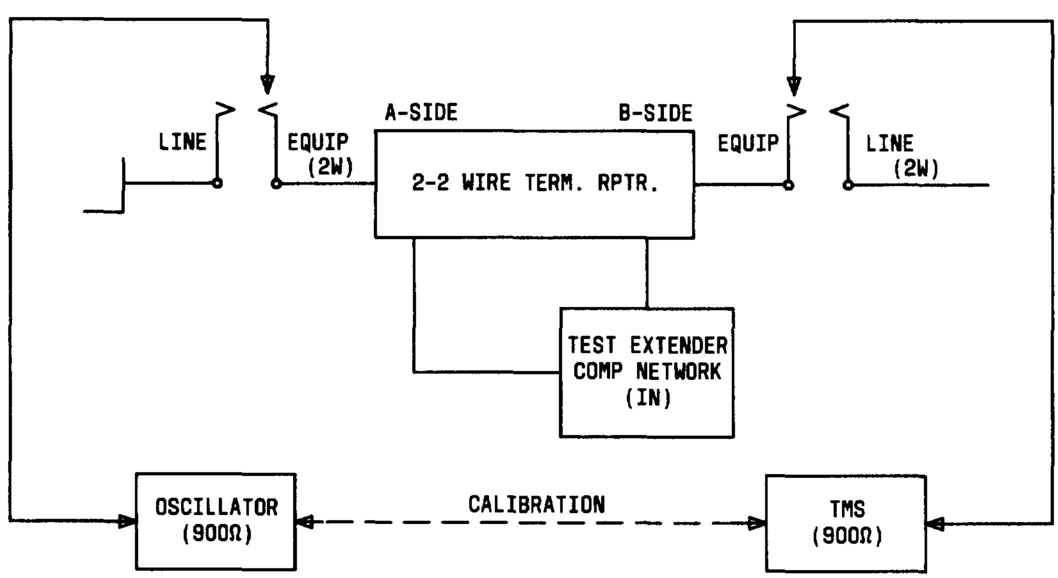


Fig. 9—Test Configuration for Setting Specific Gain

C. J99343PB L1 and L2—Procedure for Setting Output Level

8.07 If output level only is shown on the CLR or if the VF circuit does not fall within acceptable transmission levels after setting the specified gain, the alternate procedure of this part for setting the output level should be followed.

8.08 The procedures for adjusting the J99343PB L1 and L2 terminal repeaters to a specified output level differ slightly from those for adjusting to a specific gain. The most important difference is that the PBN on the input side of the amplifier being adjusted (B-side to A-side direction of transmission only for terminal repeaters with A-side facing office equipment) must be set to their proper values. The procedure for setting a specified output level for terminal repeaters in the A-side to B-side direction (A-side facing office equipment) will be the same as the procedure for setting specified gain (see Part 8B). If the PBN settings are unknown, they may be determined by using the procedures in Part 6C.

8.09 The test configuration shown in Fig. 10 is for A-side level adjustments. Test equipment used for the following procedures is listed in Paragraph 8.06.

STEP	PROCEDURE
1	Remove repeater under adjustment from its shelf location.
2	Install equalizer settings. If equalizer settings are unknown, determine them by using the procedures in Part 7.
3	Install PBN settings on repeater as shown on CLR or as determined in Part 6C.
4	Install proper signaling options (RV,RV/T, SX SH) as specified on CLR.
5	Set both gain potentiometers fully counterclockwise (no gain position).
6	Set DISABLE/NOR switch to NOR position.
7	For level adjustment on A-side (output of B-side to A-side), set switches on J99343TB test extender as follows.

A-SIDE	B-SIDE
2W/4W to 2W	2W/4W to 2W
600/900 to 900	600/900 to 900
COMP NET IN/OUT to IN	COMP NET IN/OUT to OUT

STEP	PROCEDURE
8	Insert repeater into test extender and connect cable extender card into proper slot of MFT shelf.
9	Note output level specified on CLR for direction of transmission being adjusted. Call this level L.
10	Have a 1-kHz tone at 0 dBm applied to the circuit at 0 TLP.
	Note: Adjustment of terminal repeater level in the B to A direction for this procedure requires that the 1-kHz tone be applied at a far-end office.
11	Connect TMS to A-side 2W EQUIP jack on the test extender (Fig. 10).

STEP	PROCEDURE
12	Adjust gain potentiometer RU2 for a reading of L on TMS.
13	An uneven response to changing the gain adjustment, such as a sudden increase in level for a very small change in the setting, indicates poor hybrid balance. Check the following for the most likely cause of this condition: (a) Potentiometer adjusted wrong (b) COMP NET switches on test extender in wrong position (c) PBN setting does not match the cable facility.
14	Adjust potentiometer RU1 (A to B direction of VF transmission for level specified on CLR following the procedure in Part 8B.
15	After amplifiers have been adjusted, set DISABLE/NOR switch to position specified on CLR.
16	Disconnect test extender from shelf and remove repeater from test extender.
17	Insert repeater into its proper shelf location.
18	Go to Fig. 4, Step 9.

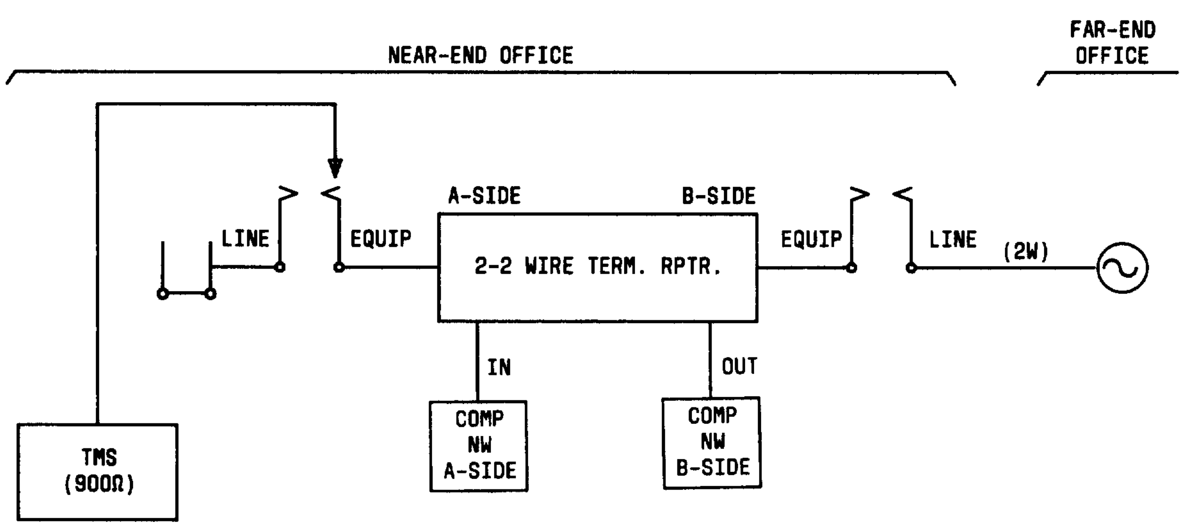


Fig. 10—Typical Test Configuration or Setting A-Side Level Output

9. ATTENUATION DISTORTION ROLL-OFF MEASUREMENT

A. General

9.01 This part provides information on the procedures for checking a circuit against given roll-off objectives. Since the 2-2 wire terminal repeater are typically used in voicegrade special service circuits, the roll-off objectives for these circuits are given in Table A (see Part 3). However, the 2-2 wire terminal repeaters can be used in other types of circuits with different roll-off objectives. The procedure of this part is for checking any circuit with given roll-off requirements.

B. Attenuation Distortion Roll-Off Measurement

9.02 The following procedures are very similar to the frequency response measurement given in Part 7. For this reason, the test configuration given in Fig. 7 and associated test equipment (paragraph 7.05) are the same for the roll-off measurements.

STEP	PROCEDURE
	At the Transmitting Location:
1	Connect the oscillator to the cable facility and set the oscillator impedance as follows:

TERMINATING EQUIPMENT	IMPEDANCE
Central Office	900 ohms
600-ohm PBX	600 ohms
900-ohm PBX	900 ohms
Station Set	600 ohms

At the Receiving Location:

2 Insert the 2-2 wire (NL) terminal repeater into test extender and insert test extender card into the repeater shelf location slot.

3 Set the 2-2 wire (NL) terminal repeater as follows:

(a) Equalizer switches to value per CLR or as determined in Part 7

(b) PBN to proper value per CLR or as determined in Part 6

(c) Gain set to value on CLR or as determined in Part 8

(d) Signaling options (RV, RV/T, SX SH) as specified on CLR

(e) NOR/DISABLE switch set to NOR position

STEP	PROCEDURE
4	Set the J99343TB test extender as follows: **A-SIDE** / **B-SIDE** 2W/4W to 2W / 2W/4W to 2W 600/900 to 900 / 600/900 to 900 COMP NET IN/OUT to IN / COMP NET IN/OUT to OUT
5	Connect TMS to A-side 2W EQUIP jack of test extender and set input impedance at 900Ω.
6	Send a 1 kHz tone at the transmitting location and verify the receive location is receiving the specified level. If the appropriate level is not received, readjust the gain controls to obtain the correct level.
7	Next, readjust the generator at the transmitting location to the specified frequencies and levels for the roll-off requirement. If the roll-off requirements are not met, go to the equalizer touch-up procedure (Part 10) of this section; otherwise, go to the stability check in Part 11.

10. GUIDELINES FOR EQUALIZER TOUCH-UP

10.01 These touch-up procedures assume that the initial equalizer settings were determined and did not meet roll-off objectives (Part 9).

10.02 When the procedure calls for increasing or decreasing the equalizer setting, it refers to the numerical sum of the operated switches.

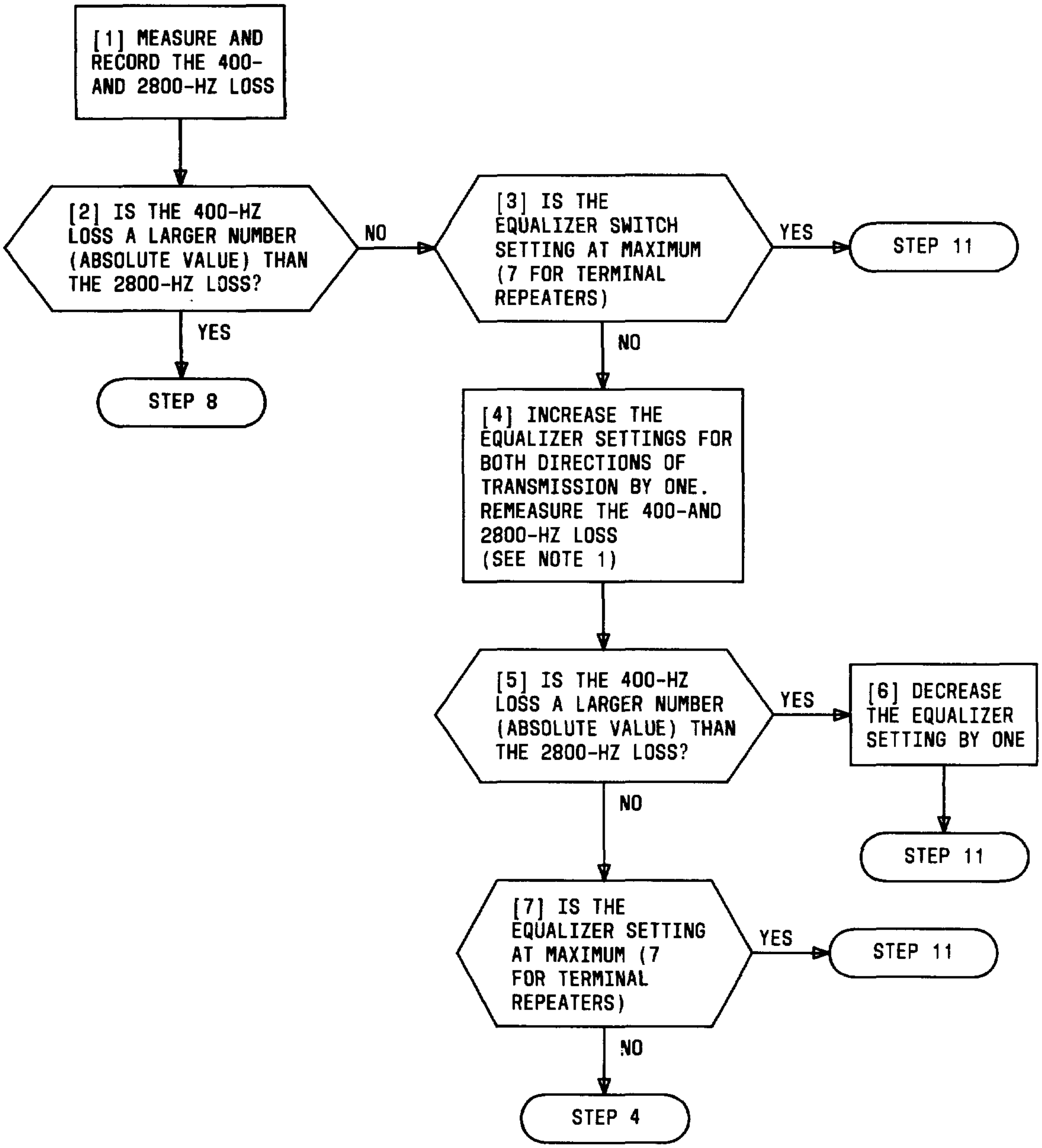
10.03 All measurements in the procedures are end-to-end as in Part 9 and Fig. 7.

10.04 Over equalization at either high or low frequencies could cause the circuit to become unstable.

10.05 The procedures for equalizer touch-up assumes that all options, balancing network settings, and 1 kHz levels have been set to their proper values. It is also assumed that frequency response measurements have been made and circuit requirements are ***not*** met.

> ***Note:*** The facility is considered to be properly equalized when the 2800-Hz loss is slightly more but as close as possible to the 400-Hz loss.

10.06 The procedure for equalizer touch-up is given in Fig. 11. If Step 11 of Fig. 11 is repeated twice without satisfactory result, the circuit cannot be properly equalized and should be referred to the proper personnel.



NOTES:

1. FOR EACH THREE TIMES THROUGH THIS STEP, THE 1-KHZ GAIN MUST BE READJUSTED TO THE LEVEL SPECIFIED ON THE CLR.
2. ACCESSING STEP 11 TWICE WITHOUT SATISFACTORY RESULTS IMPLIES THE FACILITY CANNOT BE PROPERLY EQUALIZED.

Fig. 11—Procedure for Equalizer Touch-Up (Sheet 1 of 2)

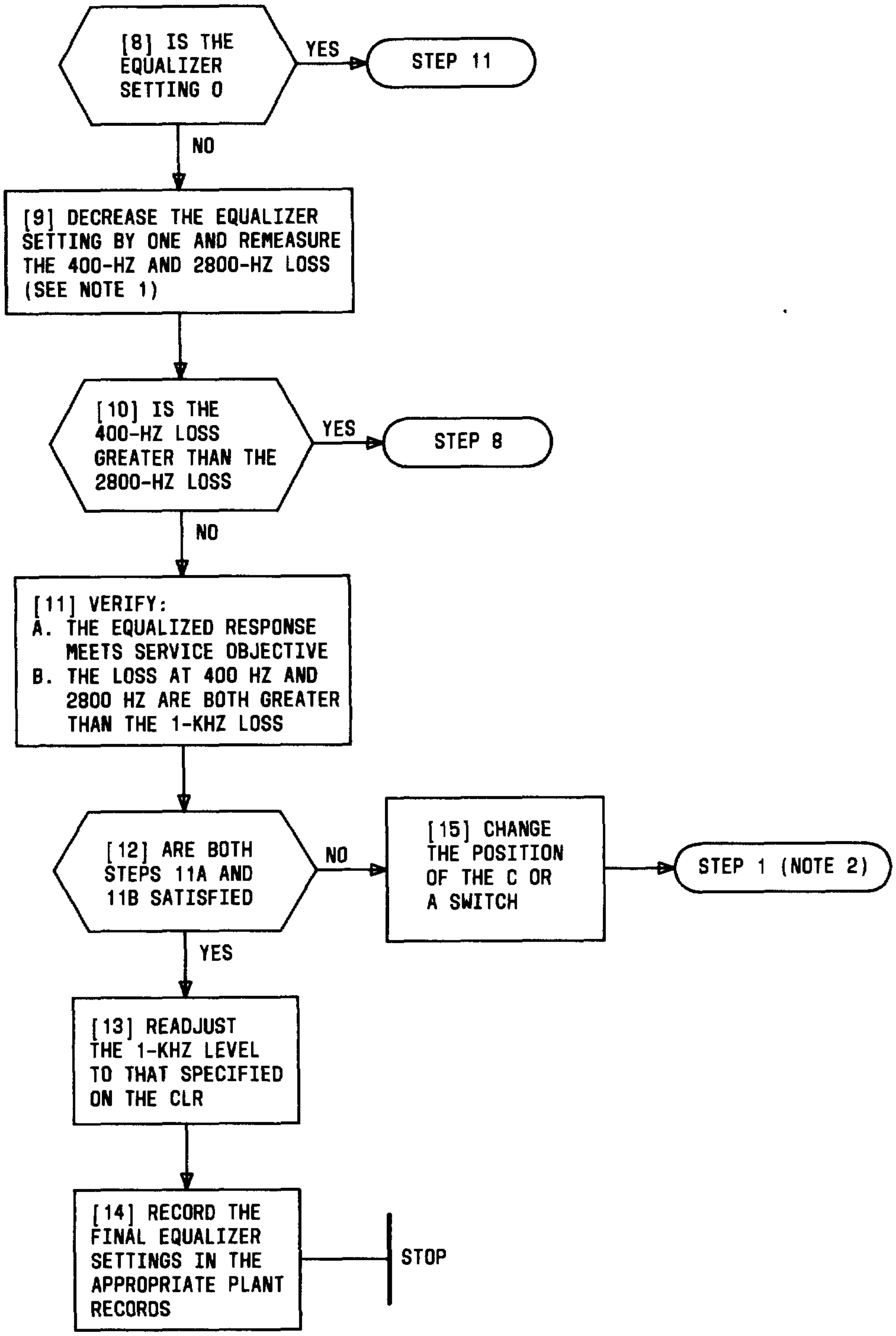


Fig. 11—Procedure for Equalizer Touch-Up (Sheet 2 of 2)

10.07 Figure 11 assumes the roll-off requirements are to be measured at 400 and 2800 Hz. However, if the roll-off requirements are at different frequencies, they can be substituted for the 400 and 2800 Hz in Fig. 11.

11. STABILITY TESTS

A. General

11.01 The final test to be made on the 2-2 wire (NL) terminal repeaters and associated circuits is the stability test. This test should be performed on all new circuits. It assumes that all the other adjustments on the transmission section have been made and the circuit is ready to be turned up.

11.02 Two types of stability tests can be made; (1) talk state, which is made with nominal termination on both ends of the circuit; and (2) idle state, which is made with the associated station and switching equipment in the idle condition.

B. Idle State Stability Tests

11.03 The following equipment is required for stability tests:

(a) J99343TB test extender

(b) High impedance monitoring device (1014A handset or equivalent in MON position or a high impedance meter).

11.04 It is assumed that the terminal repeater has been adjusted to its final settings and all options are set as specified on the CLR. Idle state stability tests are given in the following procedures and an example test set is shown in Fig. 12

STEP	PROCEDURE
1	Remove repeater under test from its shelf location.
2	Disconnect companion signaling unit if used.
3	Insert repeater into test extender and connect test extender into the repeater shelf location.
4	Set DISABLE/NOR switch on the repeater to NOR.
5	Set switches on J99343TB test extender as follows:

A-SIDE	B-SIDE
2W/4W to 2W	2W/4W to 2W
600/900 to 900	600/900 to 900
COMP NET IN/OUT to OUT	COMP NET IN/OUT to OUT

STEP	PROCEDURE
6	Connect high impedance monitoring device to monitor jack (MON) on the B-side of J99343TB test extender.
7	Monitor repeater for singing using high impedance monitoring device with the following combination of terminations:

Note: With the monitoring device connected as shown in Fig. 12 no sound other than battery noise should be audible.

STEP	PROCEDURE

Orginating	Terminating End
(1) 900 (600) ohms	900 (600) ohms
(2) Open circuit	Open circuit
(3) Open circuit	Short circuit
(4) Short circuit	Open circuit
(5) Short circuit	Short circuit

8 If the repeater sings, check the following for possible troubles:

(a) Improper test connections

(b) Insertion loss incorrectly measured and less than permissible

(c) Makeup of the facility outside limits

(d) Repeater incorrectly set for the facility it interfaces—should be manually optimized.

9 Disconnect test extender from shelf and remove repeater from test extender.

10 Insert repeater and signaling unit (if required) back into their proper locations.

11 Go to Step 9 of Fig. 4.

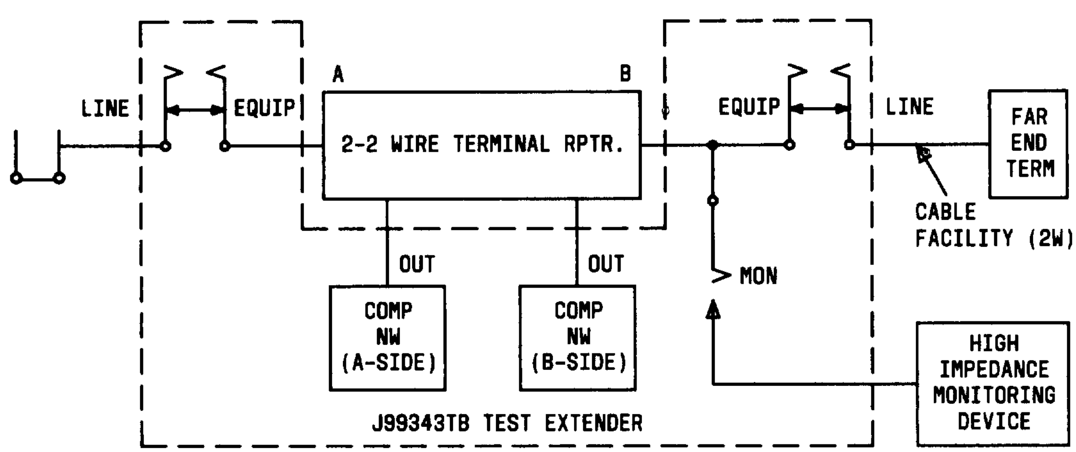


Fig. 12—Typical Circuit Configuration for Stability Margin Tests

12. SIGNALING SWITCH ADJUSTMENTS

12.01 The following switches provide the signaling options for the 2-2 wire (NL) terminal repeaters. These switches must be properly operated before placing the unit in service.

12.02 ***NOR·SX-SH, NOR·RV/T, NOR·RV:*** These switches are used to establish the normal, reverse, or through signaling mode. Section 332-912-114 gives the required switch positions to achieve a prescribed mode. These switches only affect the dc path to the signaling section.

12.03 ***NOR·DISABLE:*** The NOR-DISABLE slide switch permits the −48 Vdc power supply to the repeaters to be controlled by the companion signaling unit. When the NOR-DISABLE switch is in the DISABLE position, the companion signaling unit disconnects power to the repeater while the circuit is idle or open. In the NOR position, battery is supplied continuously to the terminal repeater.

13. MAINTENANCE

13.01 The MFT units require no routine maintenance. If a unit is determined to be faulty, it should be removed from service and replaced with a spare. The defective unit should be sent to the appropriate Western Electric Service center for repair.

14. REFERENCES

14.01 The following is a list of references that provide additional information concerning the J99343PB, L1, PB L2, and PB L3 terminal repeaters.

SECTION	TITLE
332-910-100	MFT—General Description
332-910-101	Shelf, Frame, Power Panel, and Distributing Frame Arrangements, Description
332-910-180	General Application Information
332-912-114	2-2 Wire (Nonloaded) Terminal Repeaters—Description
332-912-212	2-2 Wire Terminal/Intermediate Repeater—Prescription Settings

DRAWING	TITLE
CD-7C050-01	Common Systems, MFT—Circuit Description
SD-7C050-01	Common Systems, MFT—Schematic Drawing

The appropriate numerical index section should be consulted to find the current issue of the sections listed and any addendum that may have been issued. The pertinent numerical index for the sections listed here is Section 332-000-000.