J99343PB (LISTS 1, 2, AND 3) 2-2 WIRE TERMINAL (NONLOADED) REPEATERS

DESCRIPTION

METALLIC FACILITY TERMINAL

CONTENTS PAGE

1. GENERAL

1.01 This section provides a physical description and discusses the basic functions of the 2-2 terminal (NL) repeaters. The individual units are described in detail; transmission performance, typical applications, and maintenance philosophy are also discussed.

1.02 This section is reissued to provide a general update of information. Since this is an extensive revision, change arrows have been omitted.

Physical Description

1.03 The metallic facility terminal (MFT) is a standard equipment arrangement for providing various transmission and/or signaling functions that may be required by metallic facilities. The 2-2 wire terminal units described in this section are MFT plug-ins that consist of a component board held by either a die-cast aluminum or molded polycarbonate frame. The MFT unit measures 1-11/16 inches wide, 7-7/8 inches high, and 9 inches deep.

1.04 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.

1.05 The 2-2 wire terminal (NL) repeaters are the J99343PB List 1, 2, and 3. They are hybrid-type repeaters with signaling lead access. Gain and equalization are provided for both directions of transmission. The repeaters provide hybrid balance for the A-side terminal equipment and the B-side nonloaded facility.

1.06 The J99343PB, Lists 1, 2, and 3 are functionally similar. However, the switch format and physical layout of the J99343PB, Lists 1 and 2 differs from the List 3 and is, therefore, described separately. Section 332-912-214 provides installation, testing, and touch-up procedures for these units.

2. FUNCTIONAL DESCRIPTION, J99343PB LISTS 1 and 2

2.01 The J99343PB, L1 is shown in Fig. 1 and the J99343PB, L2 is shown in Fig. 2. They provide gain and equalization on 2-wire circuits between terminal equipment and nonloaded facilities. Figure 3 shows a block diagram of these units.

A. Operation

Equalizing Amplifier Units

2.02 Adjustable gain and equalization are provided in these repeaters by the RU1 and RU2 amplifier units. RU1 provides gain and equalization for the A-to-B direction of transmission, and RU2 for the B-

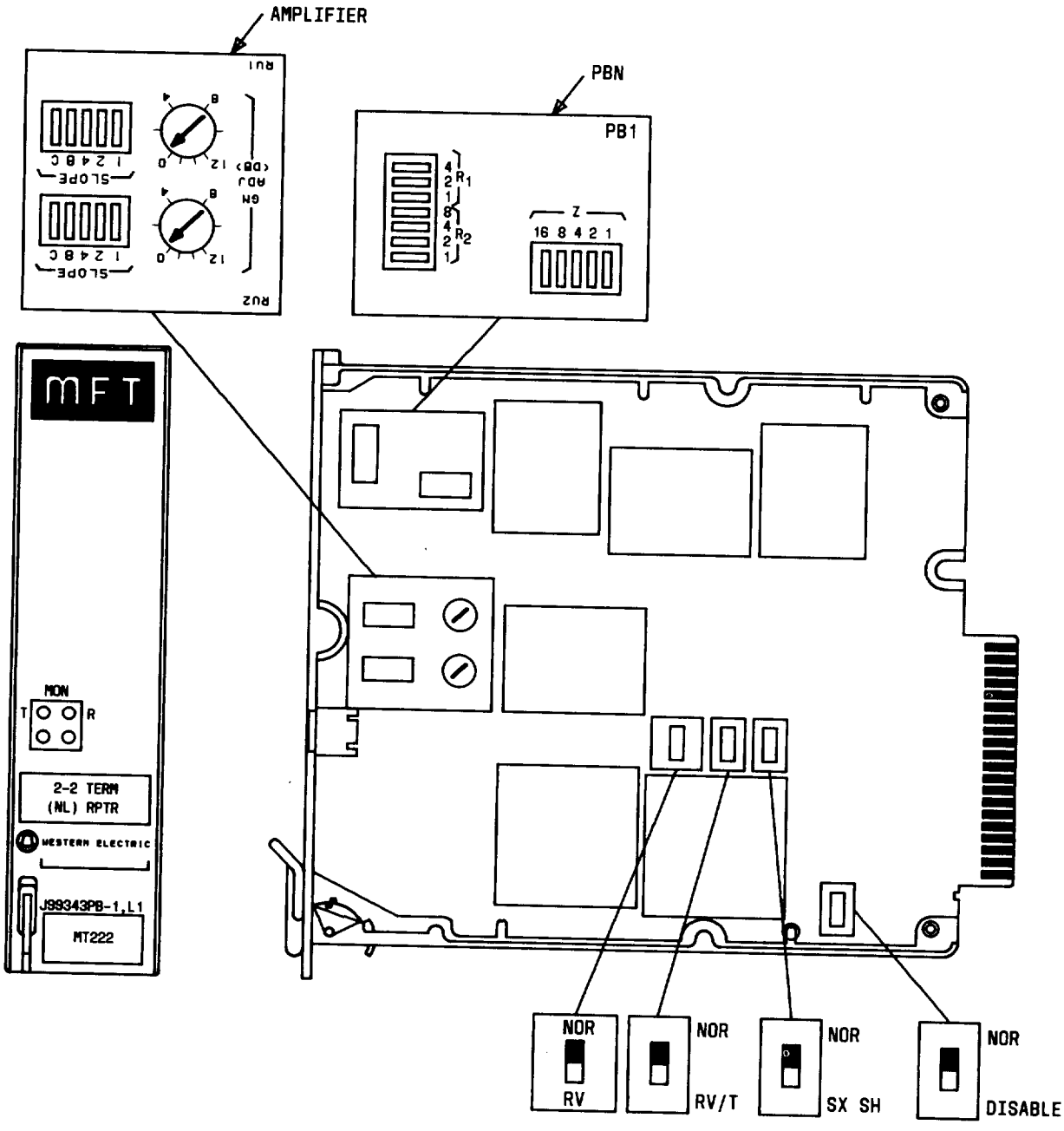


Fig. 1—Component Layout, J99343PB, L1

to-A direction. The controls for gain and equalization are designated GAIN ADJ and SLOPE, respectively. The range of the amplifier unit gain is approximately 0 to 14 dB. Additional gain is provided by the adjustable equalizer.

Caution: For crosstalk considerations, the maximum total gain of terminal repeaters typically is limited to 6 dB, including equalizer gain. The maximum equalizer setting should not exceed 0.7.

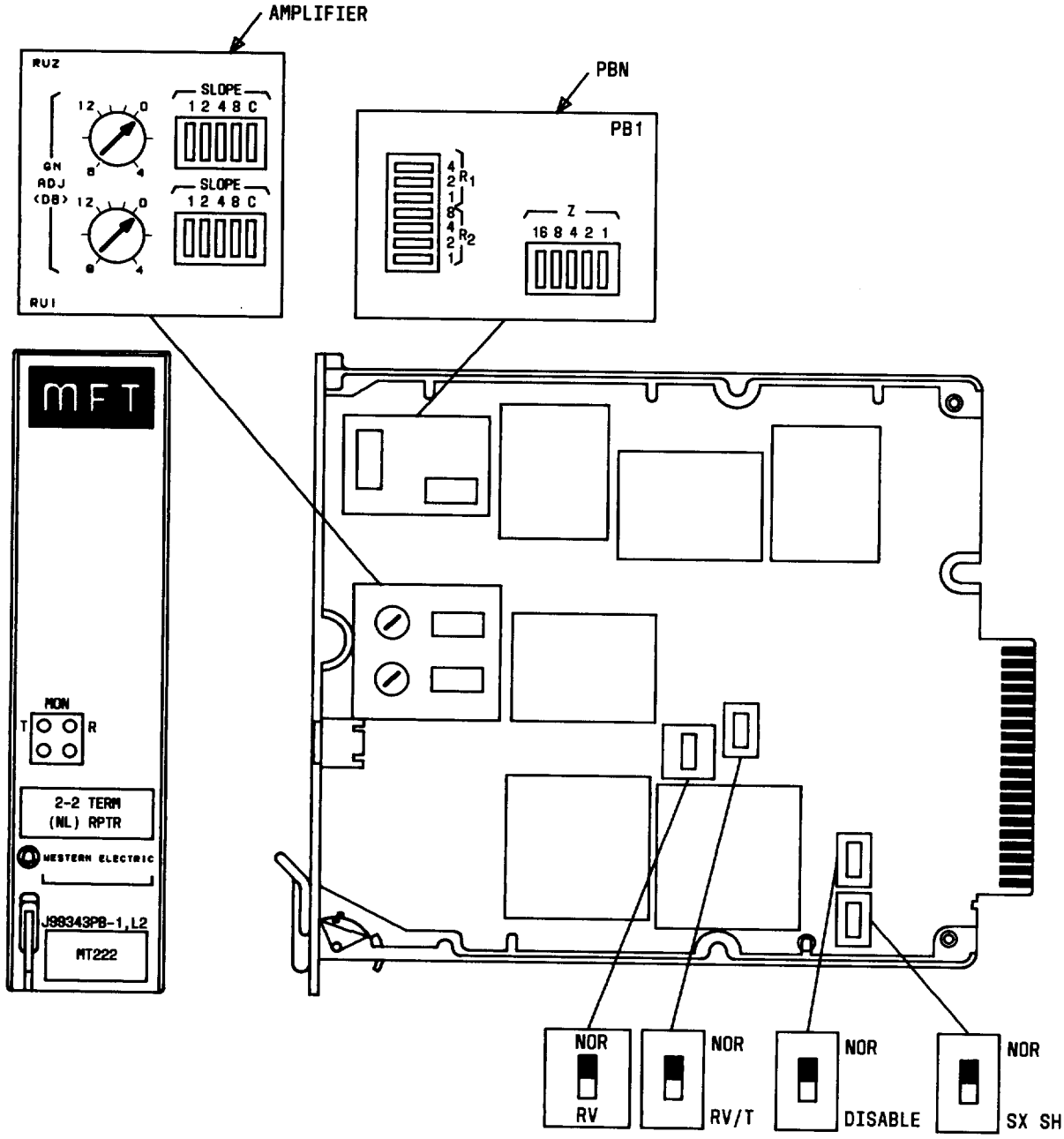


Fig. 2—Component Layout, J99343PB, L2

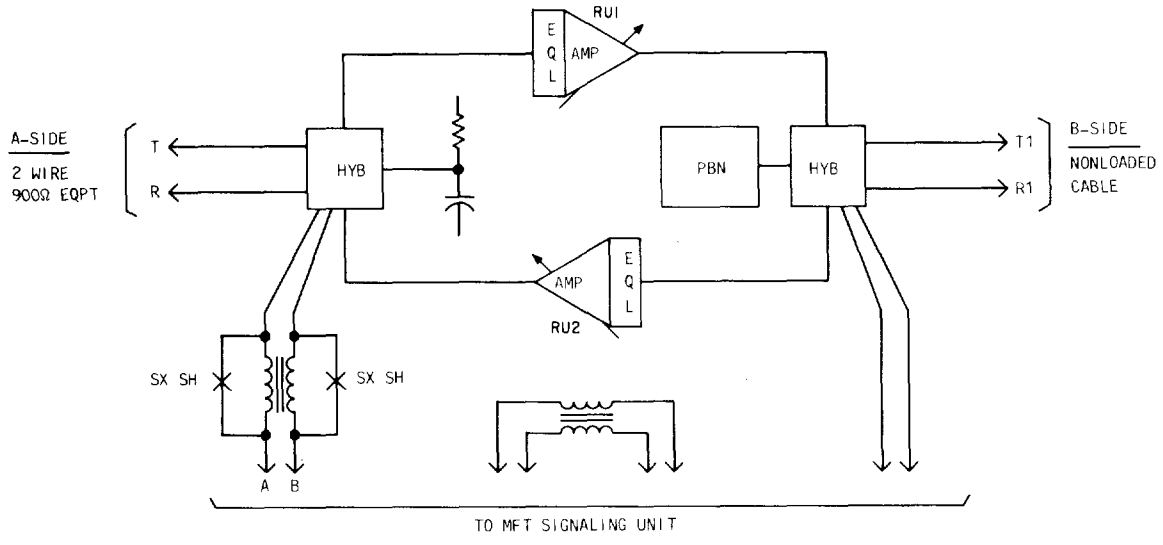


Fig. 3—Block Diagram, F99343PB, L1, L2

Two-Transformer Hybrid

2.03 The two-transformer hybrid splits the 2-wire transmission interface into a 4-wire path through the repeater. This allows gain and equalization to be provided in each direction of transmission. The transformer hybrid is matched to the terminal equipment by the compromise network and to the 2-wire facility by the precision balance network.

Compromise Networks (A-Side)

2.04 The compromise network (COMP NET) in the repeater provides hybrid balance by approximating the impedance of the 2-wire terminal equipment. The COMP NET uses 900 ohms in series with 2.15 μF in the hybrid balance circuit. There are no adjustments associated with this circuit.

Precision Balance Network (B-Side)

2.05 The precision balance network (PBN) in the J99343PB,L1 and L2 provides hybrid balance by matching the impedance of the 2-wire, nonloaded facility. The PBN balances 19-, 22-, 24-, and 26-gauge facilities and 25-guage Metropolitan Area Trunk (MAT) (low capacitance) facilities. The controls for this PBN are designated R1, R2, and Z. Early models had different markings as shown in Fig. 4.

Signaling

2.06 The signaling leads (A and B) are derived through the transformer windings and midpoint capacitor on each side of the repeater. The SX inductor(s) isolate the transmission path from the signaling circuit. The three basic signaling modes (normal, reverse, and through) are controlled by the NOR-RV and NOR-RV/T switches.

B. Unit Controls

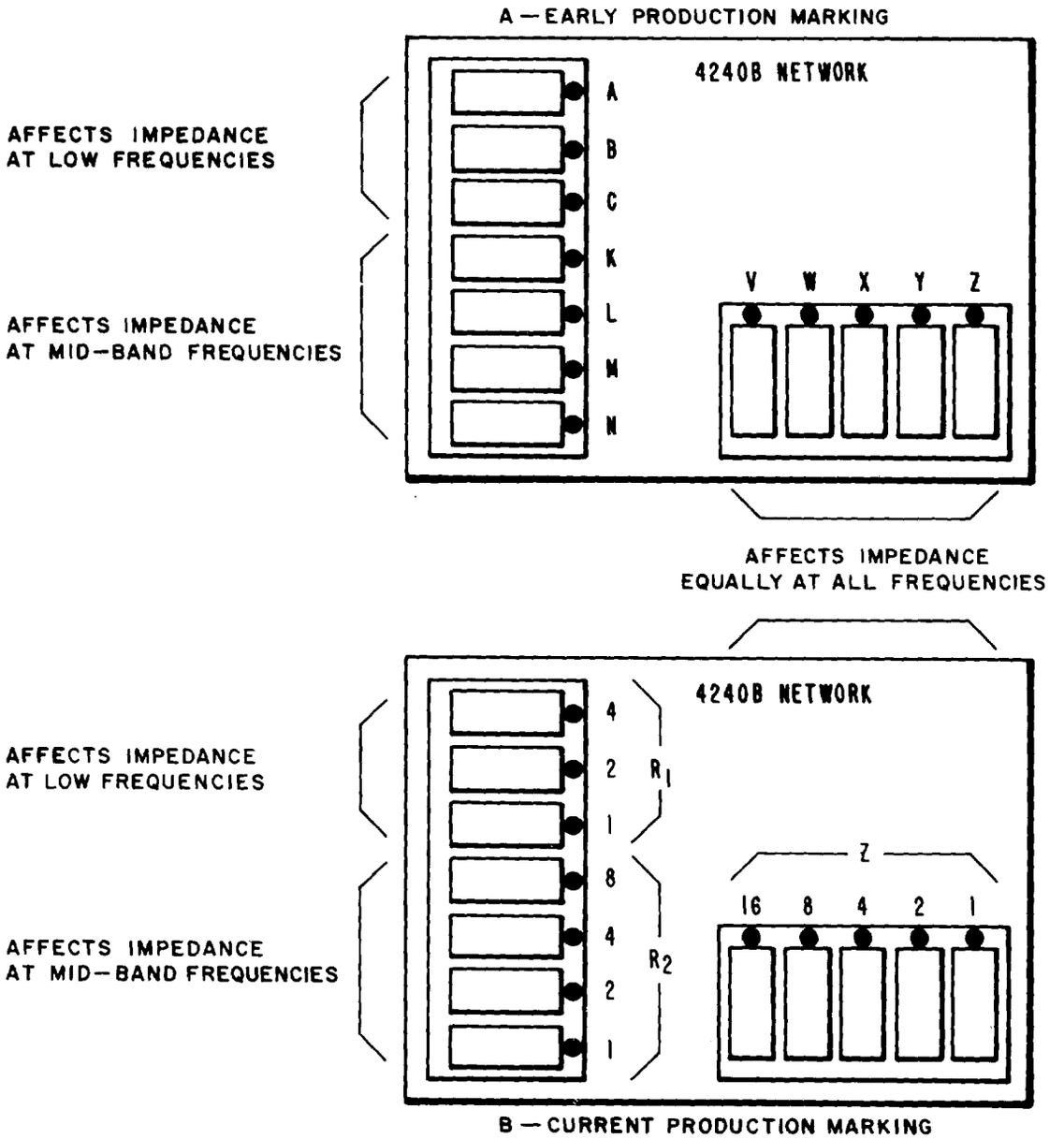
2.07 In the following paragraphs, the rocker-type switches for a particular function are operated when depressed toward the respective designation. The sum of the values of the switches operated is the setting for that function. The unit controls are illustrated in Fig. 1 and 2.

GAIN ADJ

2.08 The RU1 and RU2 amplifiers are controlled by dial-type potentiometers which are designated GAIN ADJ. The controls are calibrated in a range from 0 to 14 dB. Gain is increased by rotating the dial clockwise. See Caution in paragraph 2.02.

SLOPE

2.09 In each direction of transmission, five rocker switches, designated 1, 2, 4, 8, and C, adjust the



NOTE:
FUNCTIONS ARE SELECTED WHEN SWITCH(S) ARE PRESSED TOWARD THE DESIGNATIONS.

Fig. 4—Precision Balance Switch Functions J99343PB, L1, L2

SLOPE equalization. There is one set of switches for each direction of transmission. The sum of the values of the switches operated and the setting of the C switch determines the equalization. The C switch acts as a range selector and, when operated, provides a steeper degree of equalization. (The C switch should not be operated in terminal repeater applications.)

See Section 332-912-212 for prescription settings of the SLOPE switches.

PBN

2.10 The controls for the nonloaded facility PBN are illustrated in Fig. 4. This figure shows the

two labeling schemes for this PBN. Controls on the early production units were labeled ABC, KLMN, and VWXYZ. This has been changed to R1 (1, 2, 4), R2 (1, 2, 4, 8), and Z (1, 2, 4, 8, 16), respectively. See Section 332-912-212 for prescription settings of the PBN (nonloaded).

NOR·SX SH

2.11 This switch shorts one set of SX inductors when it is not required. (A and B signaling leads with SX inductors are available on both sides of the repeater.) The inductors are shorted when the switch is set in the SX SH position; nonshorted in the NOR position.

Note: If no companion SU is used, these switches should be in the NOR position.

NOR·RV and NOR·RV/T

2.12 These switches are used to establish a signaling mode of either normal, reverse, or through. Figure 5 gives the required switch positions to achieve a prescribed mode. These switches only affect the dc signaling path to the signaling unit.

Note: If no companion signaling unit is used, these switches should be set for the through mode.

NOR·DISABLE

2.13 This switch permits any companion signaling unit, having the disable function, to control the power to the repeater. In the DISABLE position, the power input to the repeater is removed during the idle circuit condition. In the NOR position, the power is continuous.

Note: If no companion signaling unit is used or if the signaling unit does not have the disabling function, the switch must be in the NOR position.

3. FUNCTIONAL DESCRIPTION, J99343PB LIST 3

3.01 The J99343PB,L3 is shown in Fig. 6. It provides gain and equalization on 2-wire circuits between terminal equipment and nonloaded facilities. Figure 7 shows a block diagram of this unit.

A. Operation

Equalizer and Amplifier Units

3.02 Adjustable gain and equalization are provided for each direction of transmission. The controls for gain and equalization are designated GAIN ADJ and SLOPE, respectively. The range of the amplifier unit gain is 0 to 7.75 dB. Additional gain is provided by the adjustable equalizer.

Caution: For crosstalk considerations, the maximum total gain on terminal repeaters is typically 6 dB including the equalizer gain.

Compromise Canceler Hybrid (A-Side)

3.03 The compromise canceler hybrid splits the 2-wire transmission interface into a 4-wire path through the repeater. This allows gain and equalization to be provided in each direction of transmission. The compromise canceler hybrid balances the 900-ohm plus 2.15 μF terminal equipment and has no associated adjustments.

Two-Transformer Hybrid (B-Side)

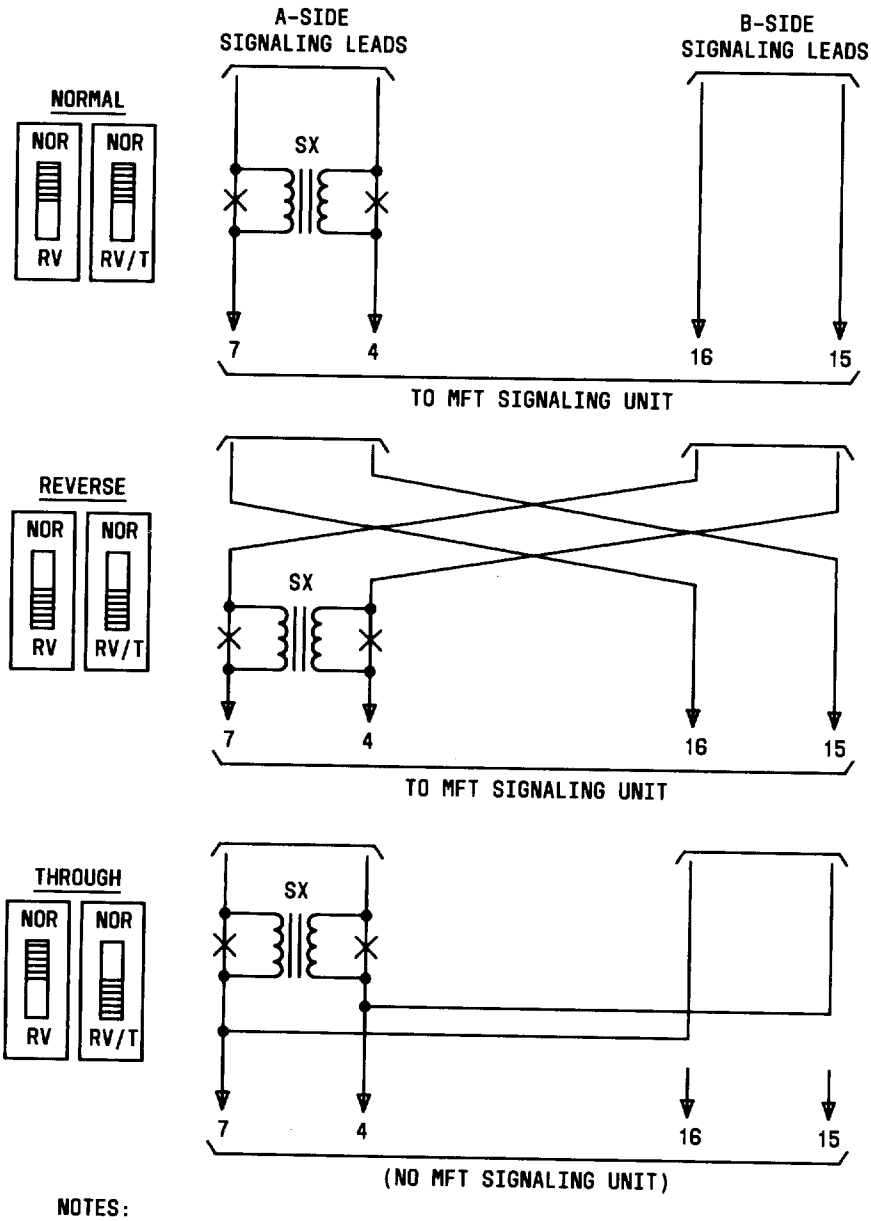
3.04 The two-transformer hybrid splits the 2-wire transmission interface into a 4-wire path through the repeater. This allows gain and equalization to be provided in each direction of transmission. The transformer hybrid is matched to the 2-wire facility by the precision balance network.

Precision Balance Networks (B-Side)

3.05 The precision balance network in the repeater provides hybrid balance by matching the impedance of the 2-wire nonloaded facility. The PBN balances 19-, 22-, 24-, and 26-gauge (high capacitance) facilities and 25-gauge MAT (low capacitance) facilities. The controls for the PBN are designated R1, R2, and Z.

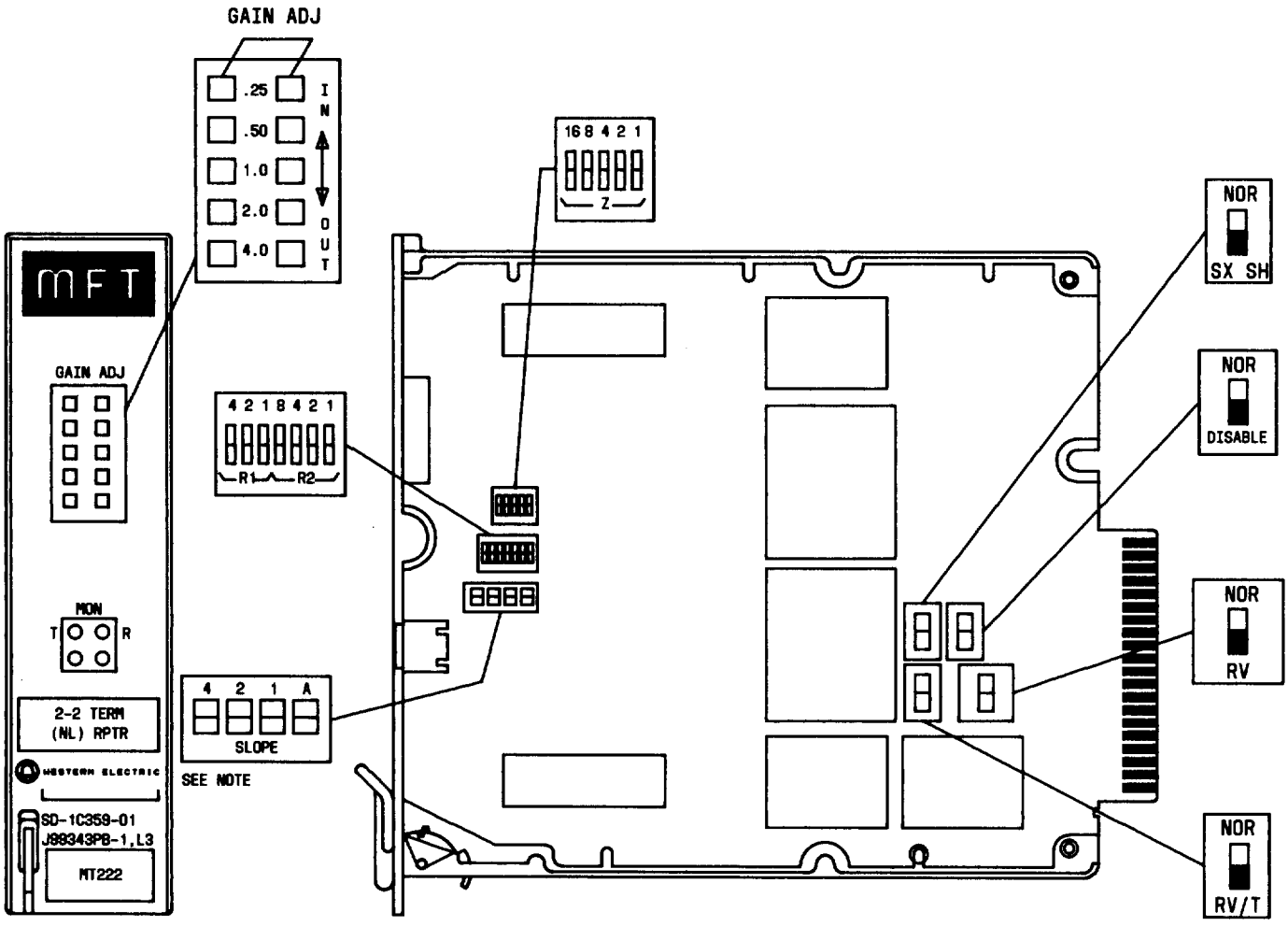
Signaling

3.06 The signaling leads (A and B) are derived through the transformer windings and midpoint capacitor on each side of the repeater. The SX inductors isolate the transmission path from the signaling circuit. The three basic signaling modes (normal, reverse, and through) are controlled by the NOR·RV and NOR·RV/T switches.



NOTES:
1. THESE DIAGRAMS SHOW FUNCTIONALLY THE THREE SIGNALING CONNECTIONS. THE EXACT WIRING CONNECTIONS HAVE BEEN OMITTED FOR CLARITY.
2. THE ORIENTATIONS OF THE RV AND RV/T SWITCHES MAY VARY ON SOME CODES.

Fig. 5—Signaling Options



NOTE: THE "A" SWITCH DOES NOT PERFORM THE SAME FUNCTION AS THE "C" SWITCH ON J99343PB-1,L1 & L2.

Fig. 6—Component Layout, J99343PB, L3

B. Unit Controls

3.07 In the following paragraphs, the rocker-type switches for a particular function are operated when depressed toward the respective designation. The sum of the values of the switches operated is the setting for that function. The unit controls are illustrated in Fig. 6.

GAIN ADJ

3.08 Five miniature switches, designated GAIN ADJ, control the gain of the repeater. These switches, accessible through the front panel, are labeled .25, .5, 1.0, 2.0, and 4.0 (dB). The gain is adjustable from 0 to 7.75 dB in 0.25 dB increments. These gain switches are ganged to provide the same gain in both directions of transmission. See Caution in paragraph 3.02.

SLOPE

3.09 One set of four rocker switches designated 1, 2, 4, and A adjusts the SLOPE equalization for both directions of transmission simultaneously. The sum of the values of the switches operated and the setting of the A switch determine the equalization. The A switch is used to introduce the appropriate

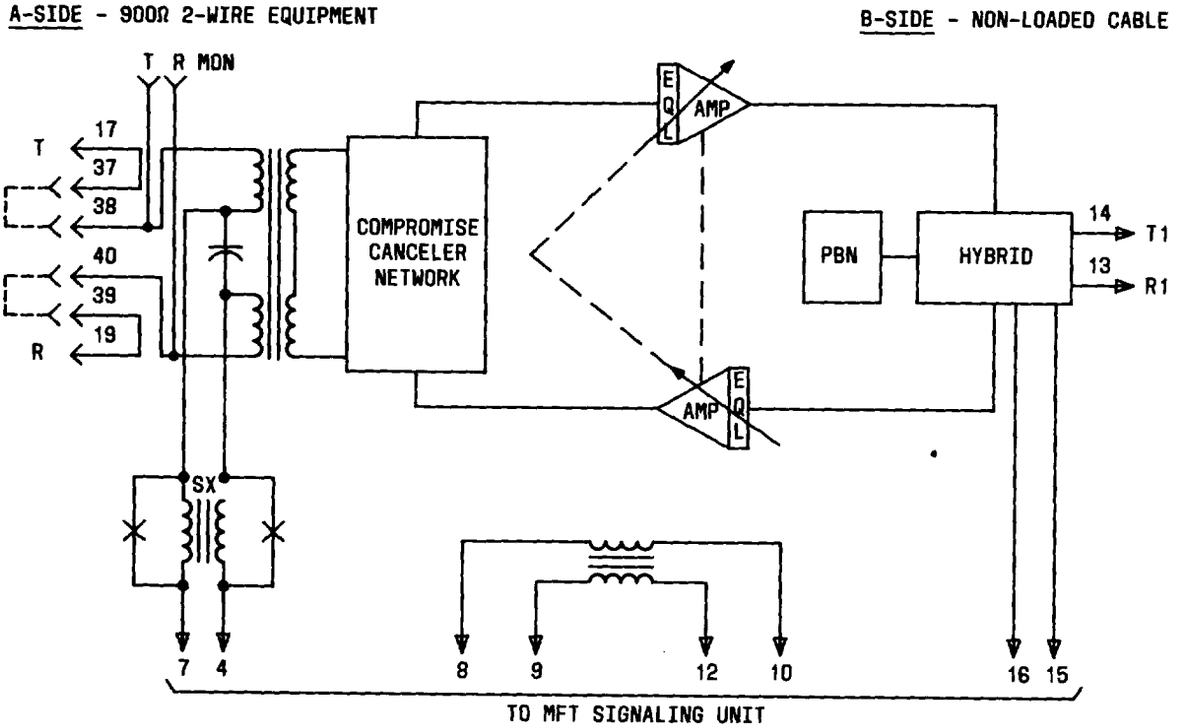


Fig. 7—Block Diagram, J99343PB, L3

equalization when impedance compensators are used at the far end of the nonloaded facility. See Section 332-912-212 for prescription settings of the SLOPE switches.

PBN

3.10 The controls for the nonloaded facility PBN are illustrated in Fig. 4. This figure shows three groups of switches: R1 (4, 2, 1), R2 (8, 4, 2, 1), and Z (16, 8, 4, 2, 1), respectively. See Section 332-912-212 for prescription settings of the PBN (nonloaded).

NOR-SX SH

3.11 This switch shorts one set of SX inductors when it is not required. (A and B signaling leads with SX inductors are available on both sides of the repeater.) The inductors are shorted when the switch is set in the SX SH position; nonshorted in the NOR position.

Note: If no companion signaling unit is used, these switches should be in the NOR position.

NOR-RV and NOR-RV/T

3.12 These switches are used to establish a signaling mode of either normal, reverse, or through. Figure 5 gives the required switch positions to achieve a prescribed mode. These switches only affect the dc path to the signaling unit.

Note: If no companion signaling unit is used, these switches should be set for the through mode.

NOR-DISABLE

3.13 This switch permits any companion signaling unit, having the disable function, to control the power to the repeater. In the DISABLE position, the power input to the repeater is removed during the idle circuit condition. In the NOR position, the power is continuous.

Note: If no companion signaling unit is used or if the signaling unit does not have the disabling function, the switch must be in the NOR position.

4. PERFORMANCE CHARACTERISTICS

4.01 The performance of the J99343PB repeaters are discussed in the following paragraphs. Table A gives a comparison of characteristics for all versions of the repeaters.

A. Amplifier/Equalizer Frequency Response

4.02 Figures 8 and 9 give the frequency response of the gain and equalizer unit for the J99343PB, L1 and L2. Figure 8 gives the response curves for various equalizer settings with the C switch set to 0. Figure 9 provides curves for the same equalizer settings with the C switch operated.

TABLE A

REPEATER CHARACTERISTICS

FUNCTION	J99343PD, L1, L2	J99343PD, L-3
Repeater Gain	0 dB through 14 dB	0 dB through 7.75dB
Equalization	Adjustable (See Figs. 8, 9)	Adjustable (See Figs. 10, 11)
Hybrid Balance A-side	PBN	PBN
Hybrid Balance B-side	PBN	PBN
DC Resistance	55 ohms — SX shorted 55 ohms — SX shorted 130 ohms — SX in 180 ohms — SX in 185 ohms — through signaling 250 ohms — through signaling	
Current Drain	Disabled: 0 mA No Signal: 29 mA Typical: 30-36 mA Maximum: 60 mA	Disabled: 0 mA No Signal: 33 mA Typical: 30-44 mA Maximum: 60 mA

4.03 Figures 10 and 11 give the frequency response of the gain and equalizer unit for the J99343PB, L3. Figure 10 gives the response curves for various equalizer settings with the A switch set to 0. Figure 11 provides curves for the same equalizer settings with the A switch operated.

B. Envelope Delay Distortion

4.04 Figures 12 and 13 give the Envelope Delay Distortion (EDD) for the J99343PB, L1 and L2. Figure 12 shows the EDD for the various equalizer settings with the C switch set to 0. Figure 13 includes the same equalizer settings with the C switch operated. Figure 14 shows the EDD for equalizer settings of the J99343PB,L3 with the A switch set to 0 and 1.

C. Longitudinal Balance

4.05 The longitudinal balance for these repeaters is at least 60 dB from 60 Hz to 4000 Hz.

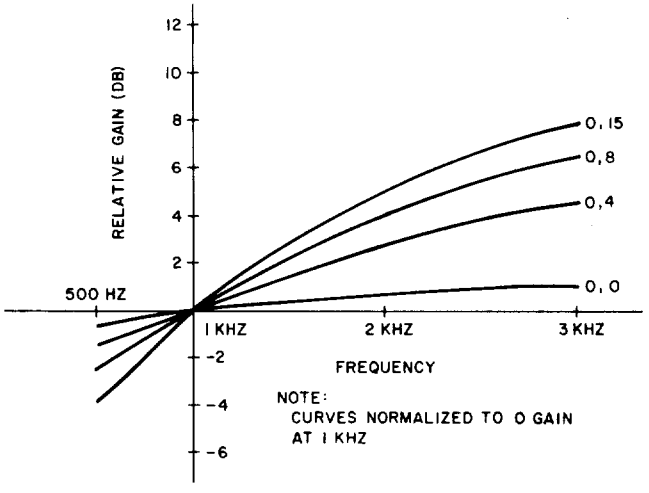


Fig. 8—Amplifier/Equalizer Response C=0

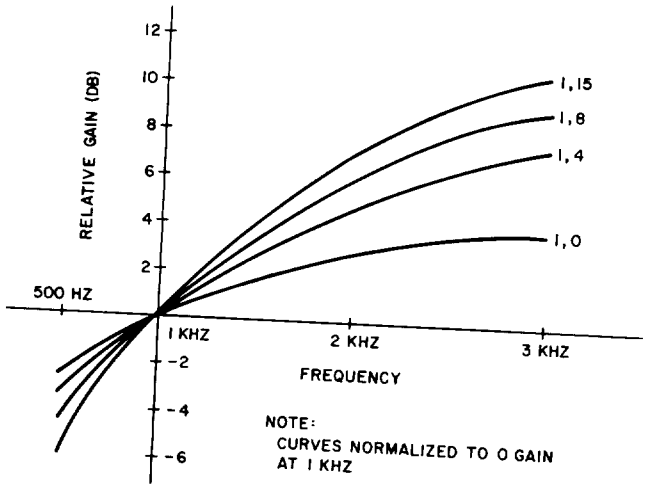


Fig. 9—Amplifier/Equalizer Response C=1

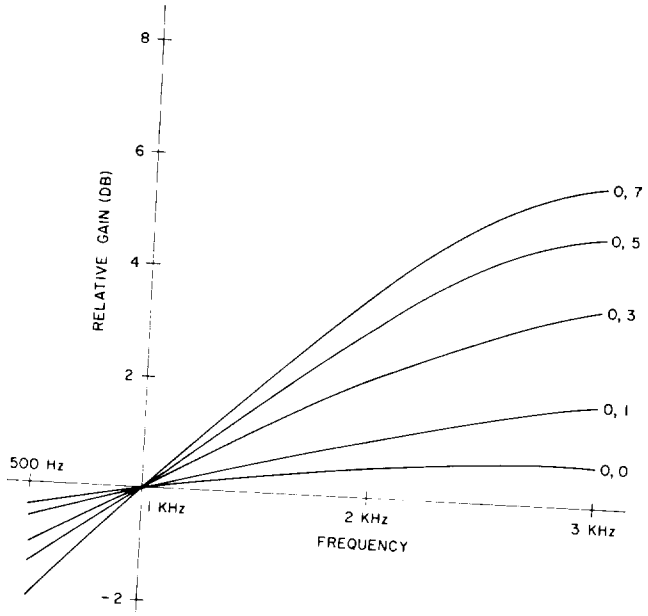


Fig. 10—Amplifier/Equalizer Response A=0

D. Output Power Capability

4.06 Figure 15 shows the output power capability of the 2-2 terminal (NL) repeaters. The output power is determined by input power and repeater gain, as shown by the +6 dB gain line in the figure. Power limiting occurs in this unit at about 13.5 dBm.

5. APPLICATIONS

5.01 The J99343PB units may be used to provide gain on any 2-wire circuit between nonloaded cable facilities and terminal equipment. Figure 16

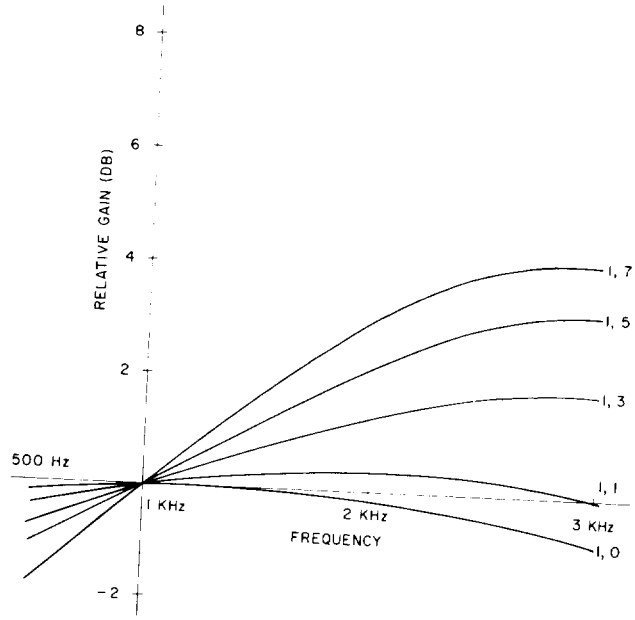


Fig. 11—Amplifier/Equalizer Response A=1

shows a typical application using the unit in a PBX-CO trunk and an FX trunk. These units also can be used on OPS lines, WATS trunks and lines, and other metallic facility special service. Section 332-910-180 provides additional information.

6. MAINTENANCE

6.01 MFT repeaters require no routine maintenance. If the repeater is determined to be faulty, it should be removed from service and replaced with a spare. The defective unit should be sent to the nearest Western Electric Service Center for repair.

7. REFERENCES

7.01 The following is a list of references which provide additional information concerning 2-2 wire (NL) terminal repeaters.

REFERENCE	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
332-912-212	2-2 Repeaters - Prescription Settings
332-912-214	2-2 Terminal Repeaters - Installation and Testing

REFERENCE	TITLE
CD-1C359-01	Common Systems, MFT - Circuit Description
SD-1C359-01	Common Systems, MFT - Schematic Drawing

The appropriate numerical index section should be consulted to find the current issue to 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.

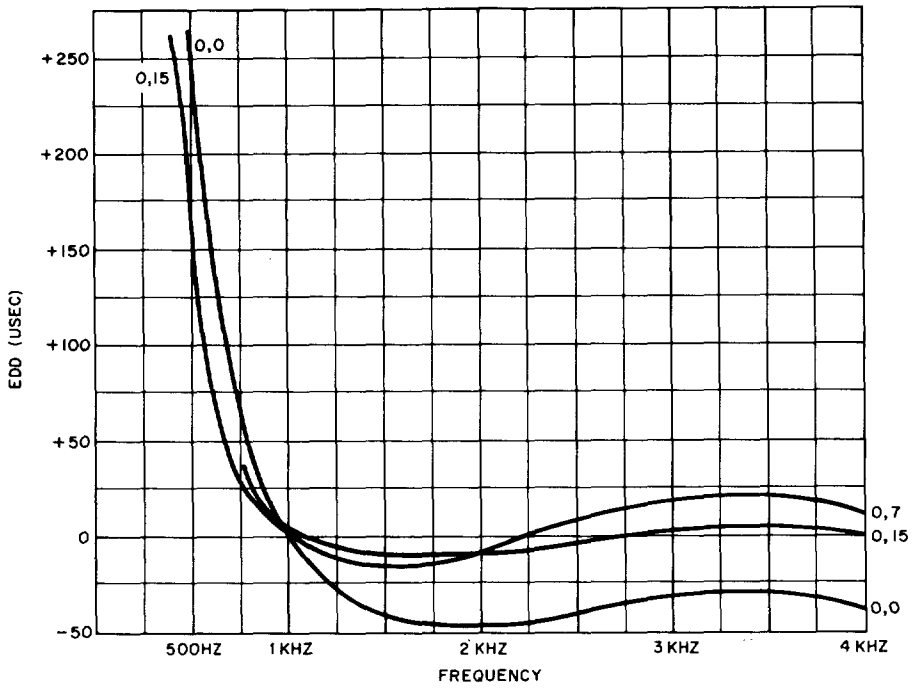


Fig. 12—Envelope Delay Distortion C=0

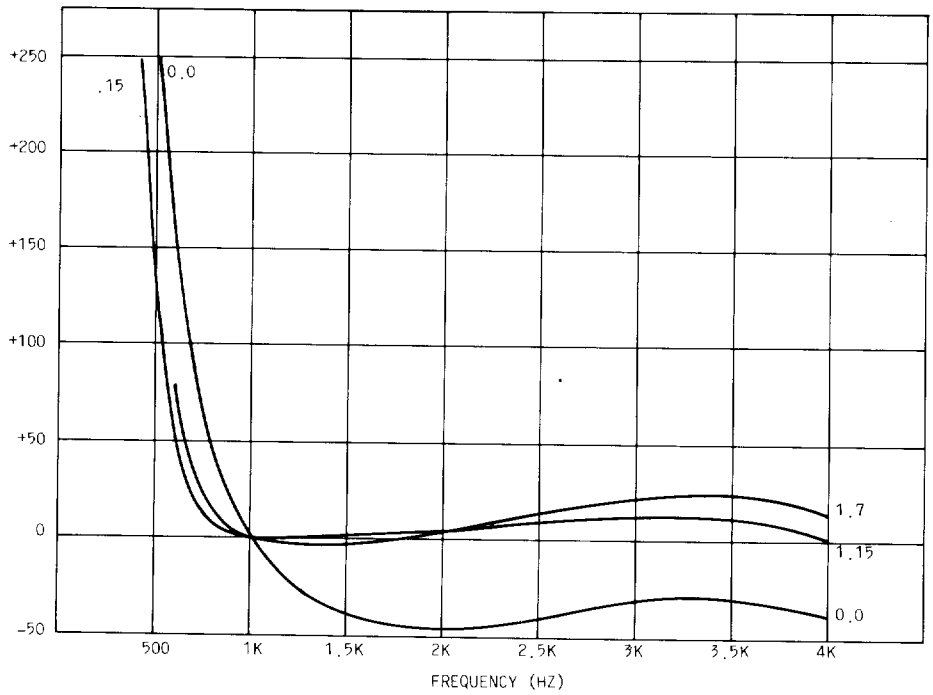


Fig. 13—Envelope Delay Distortion C=1

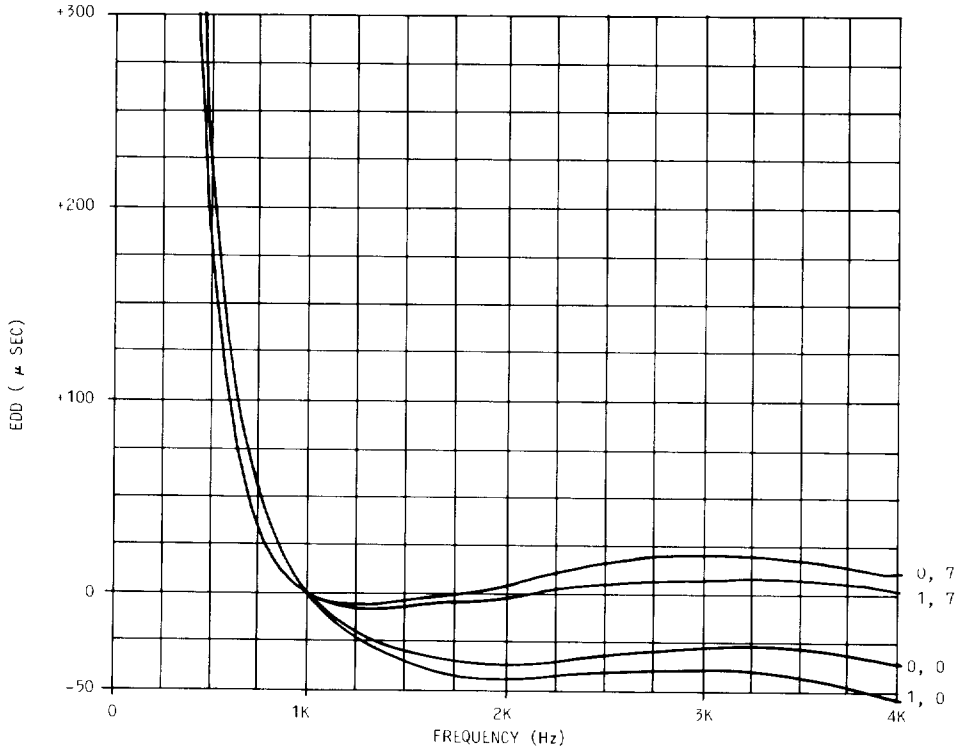


Fig. 14—Envelope Delay Distortion, J99343PB, L3

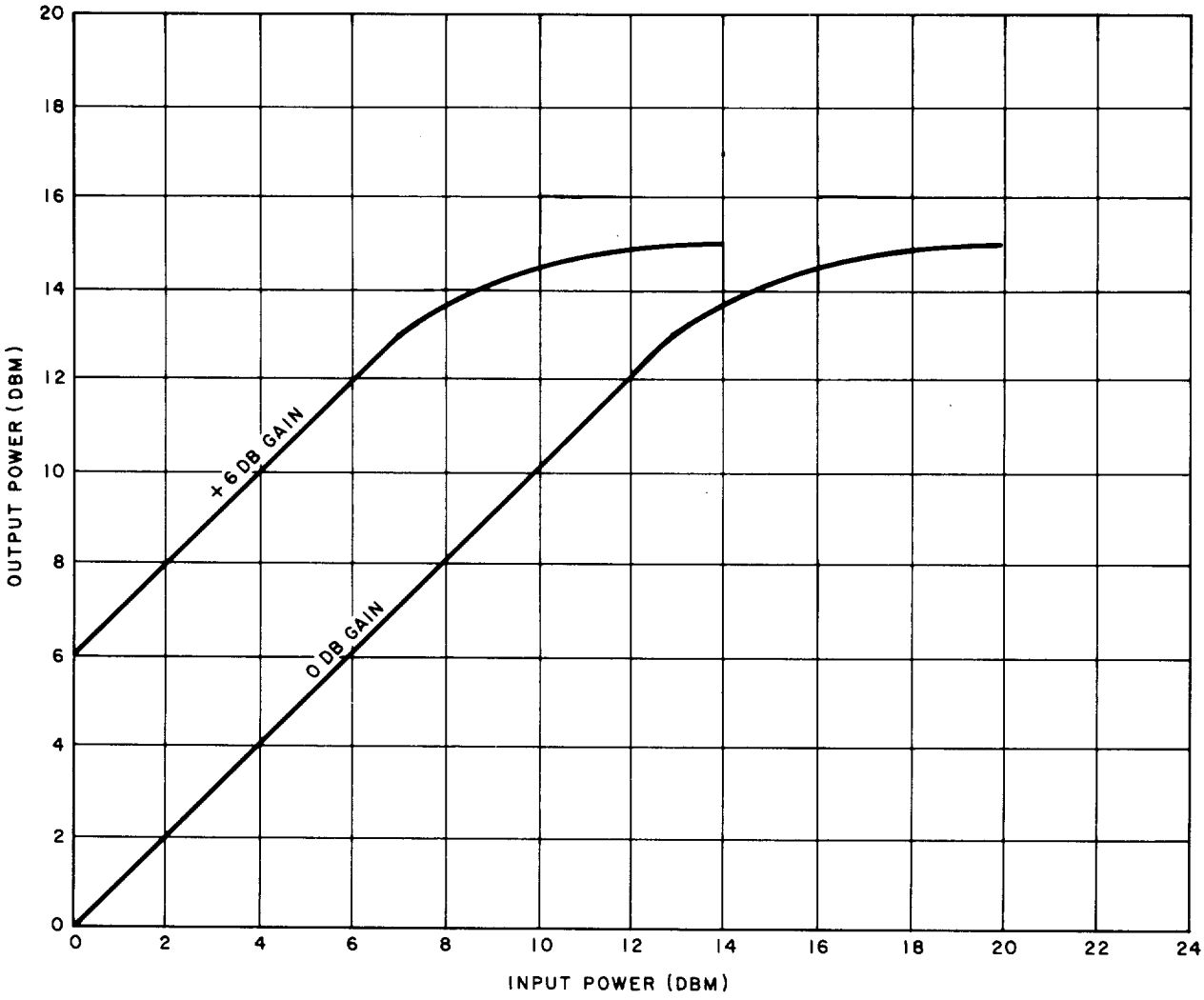
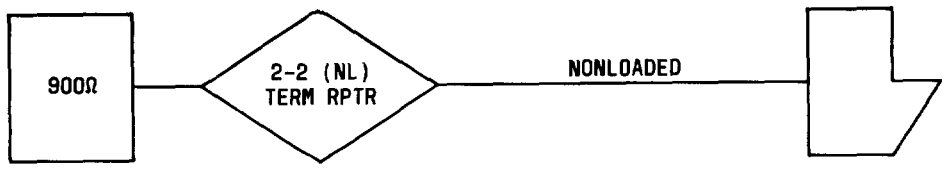
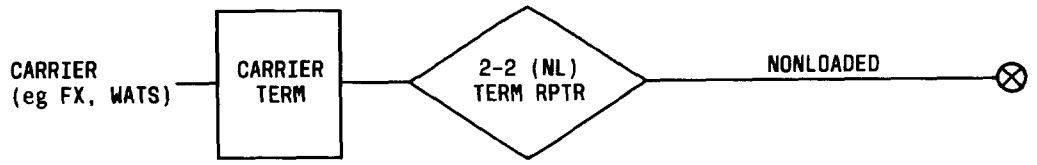


Fig. 15—Output Power Capability



PBX-CO TRUNK



2-WIRE (NL) EXTENSION OFF CARRIER OR FX TRUNK

Fig. 16—Typical Applications