J99343PD (LISTS 1, 2 AND 3) 2-2 WIRE INTERMEDIATE (NONLOADED-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 wire, nonloaded to nonloaded cable (NL-NL) intermediate repeaters. The individual units are described in detail, and transmission and/or signaling 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 intermediate units 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 intermediate repeaters (NL-NL) are J99343PD, Lists 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 nonloaded facility and the B-side nonloaded facility.

1.06 The J99343PD, Lists 1, 2, and 3 are functionally similar. However, the switch format and

physical layout of the J99343PD, Lists 1 and 2 differs from List 3 and is therefore described separately. Section 332-912-215 provides installation, testing and touch-up procedures for these units.

2. FUNCTIONAL DESCRIPTION—J99343PD, LISTS 1 AND 2

2.01 The J99343PD, Lists 1 and 2 are shown in Fig. 1 and 2, respectively. They provide gain and equalization on 2-wire circuits between two 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 ampli-

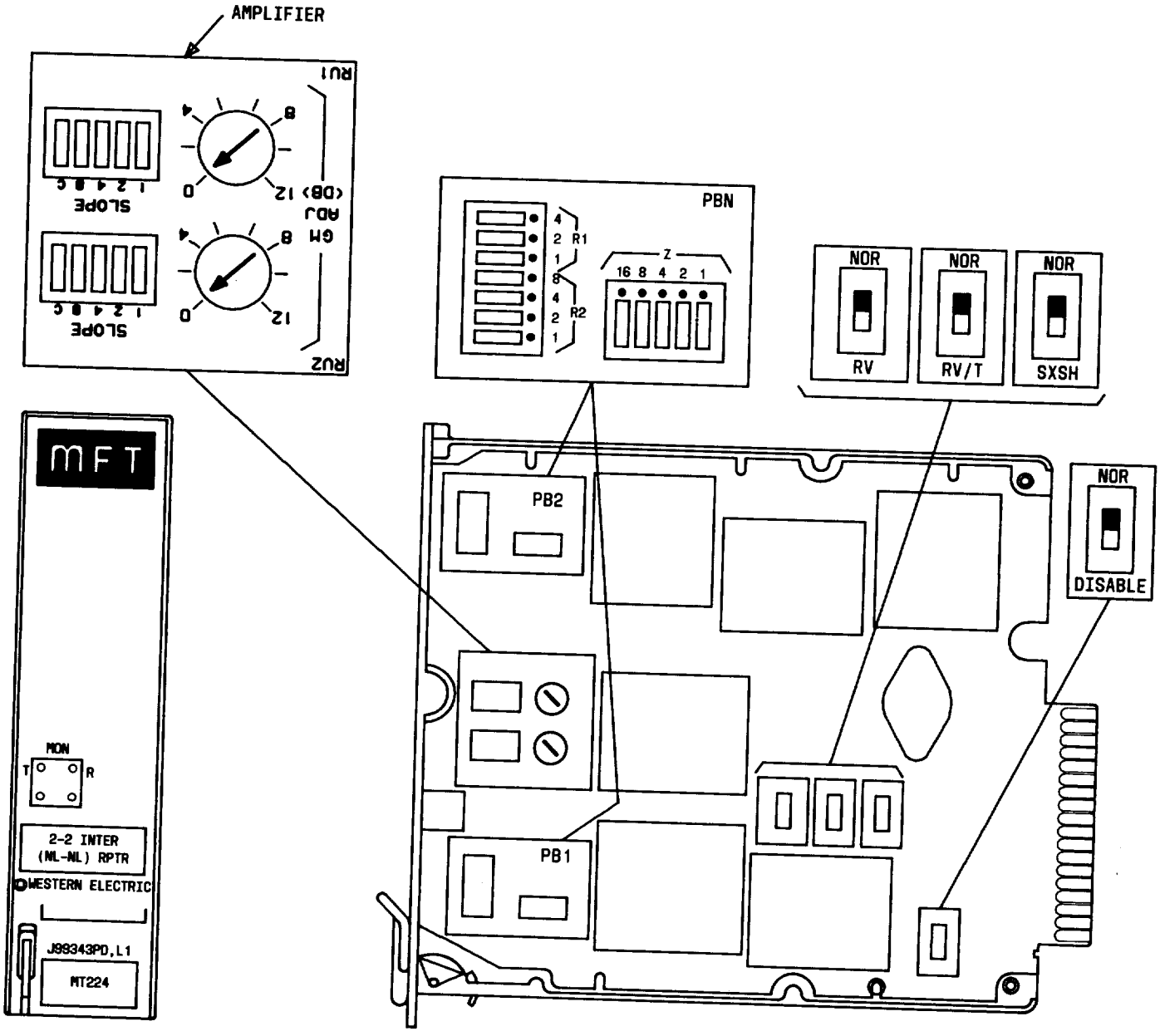


Fig. 1—2-2 Intermediate (NL-NL) Repeater J99343PD, L1 (MD) Component Layout

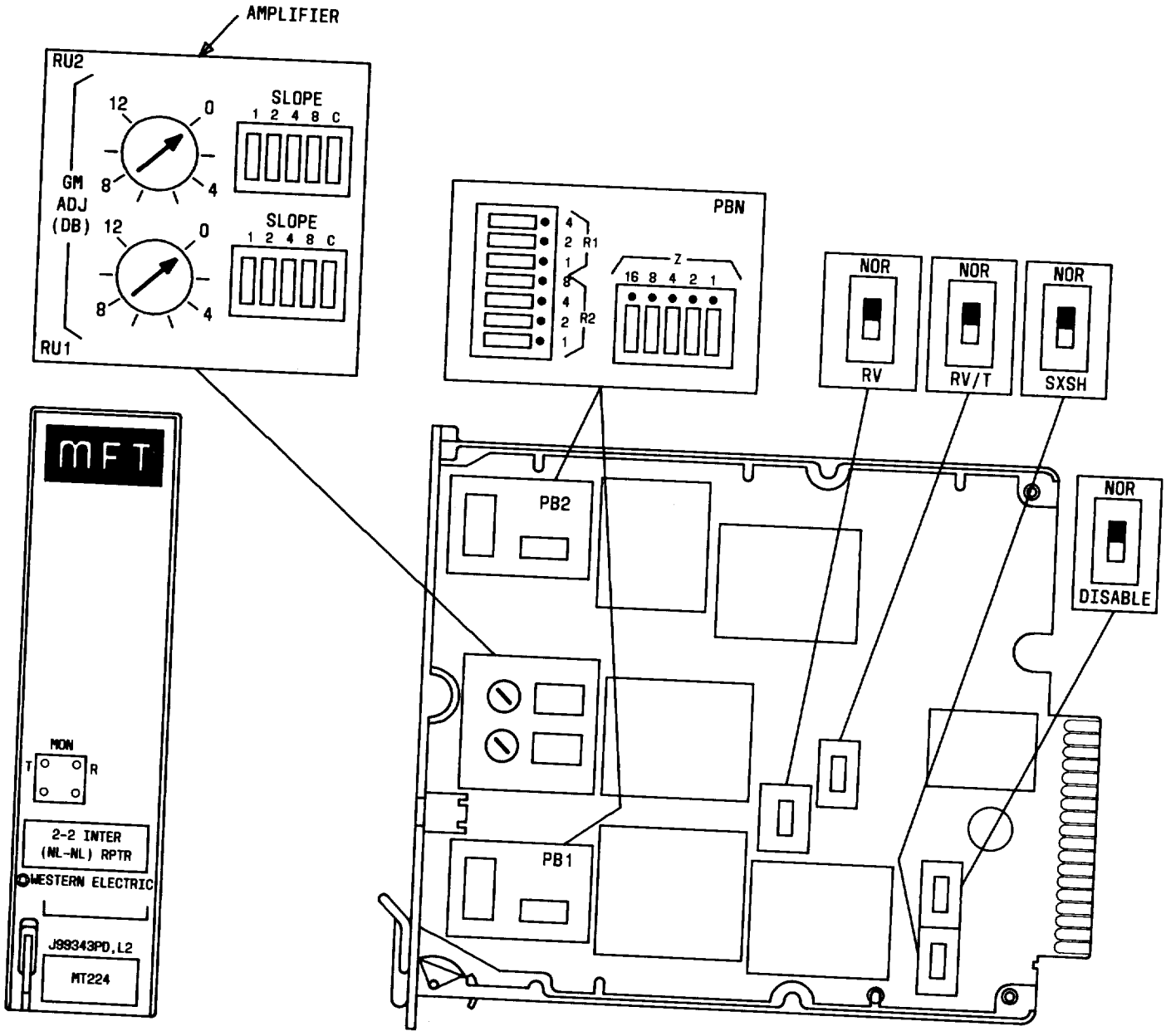


Fig. 2—2-2 Intermediate (NL-NL) Repeater J99343PD, L2 (MD) Component Layout

fier units. RU1 provides gain and equalization for the A-to-B direction of transmission, and RU2 for the B-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 intermediate repeaters typically is limited to 12 dB, including equalizer gain. The maximum equalizer setting should not exceed 0,15.

Two-Transformer Hybrid (A-Side/B-Side)

2.03 The two-transformer hybrid splits the 2-wire transmission interface into a 4-wire path through the repeater. This allows gain and equaliza-

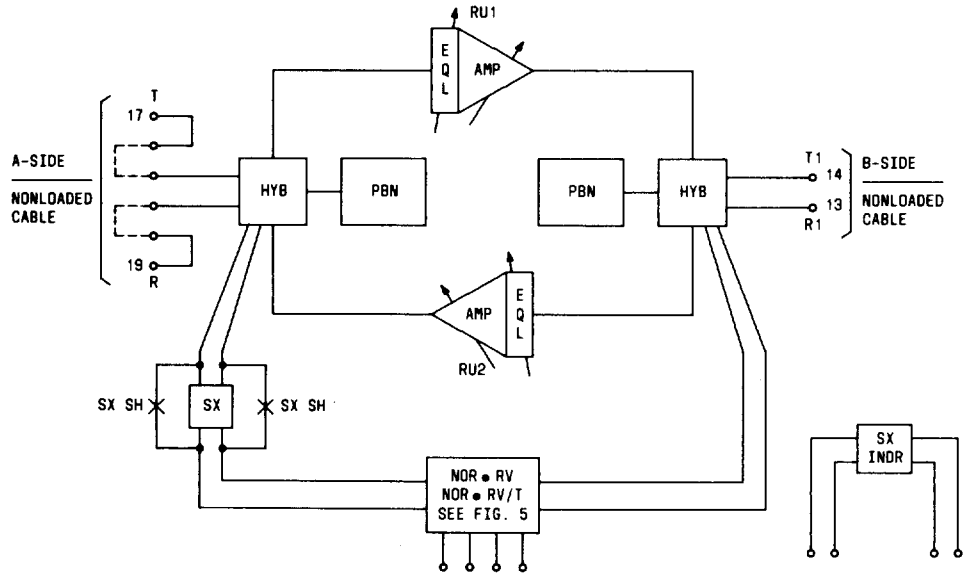


Fig. 3—Block Diagram of the 2-2 Intermediate (NL-NL) Repeater J99343PD, L1 and L2

tion 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

2.04 The precision balance network (PBN) 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 metropolitan area trunk (MAT low capacitance) facilities. The controls for the PBN are designated R1, R2, and Z. An older version of the J99343PD, L1 PBN switch is shown in Fig. 4.

Signaling

2.05 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.

B. Unit Controls

2.06 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

2.07 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

2.08 Five rocker switches (designated 1, 2, 4, 8, and C) adjust the 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. See Section 332-912-212 for prescription settings of the SLOPE switches.

PBN Controls

2.09 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 (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

2.10 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; they are not shorted 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

2.11 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

2.12 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 J99343PD, LIST 3

3.01 The J99343PD, L3 is shown in Fig. 6. It provides gain and equalization on 2-wire circuits between two 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 8DB, and SLOPE, respectively. The range of the amplifier unit gain is 0 to 15.75 dB. Additional gain is provided by the adjustable equalizer.

> ***Caution: For crosstalk considerations, the maximum total gain on intermediate repeaters is typically 12 dB including the equalizer gain. The maximum equalizer setting should not exceed C, 15.***

Two-Transformer Hybrid

3.03 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 2-wire facility by the precision balance network.

Precision Balance Networks

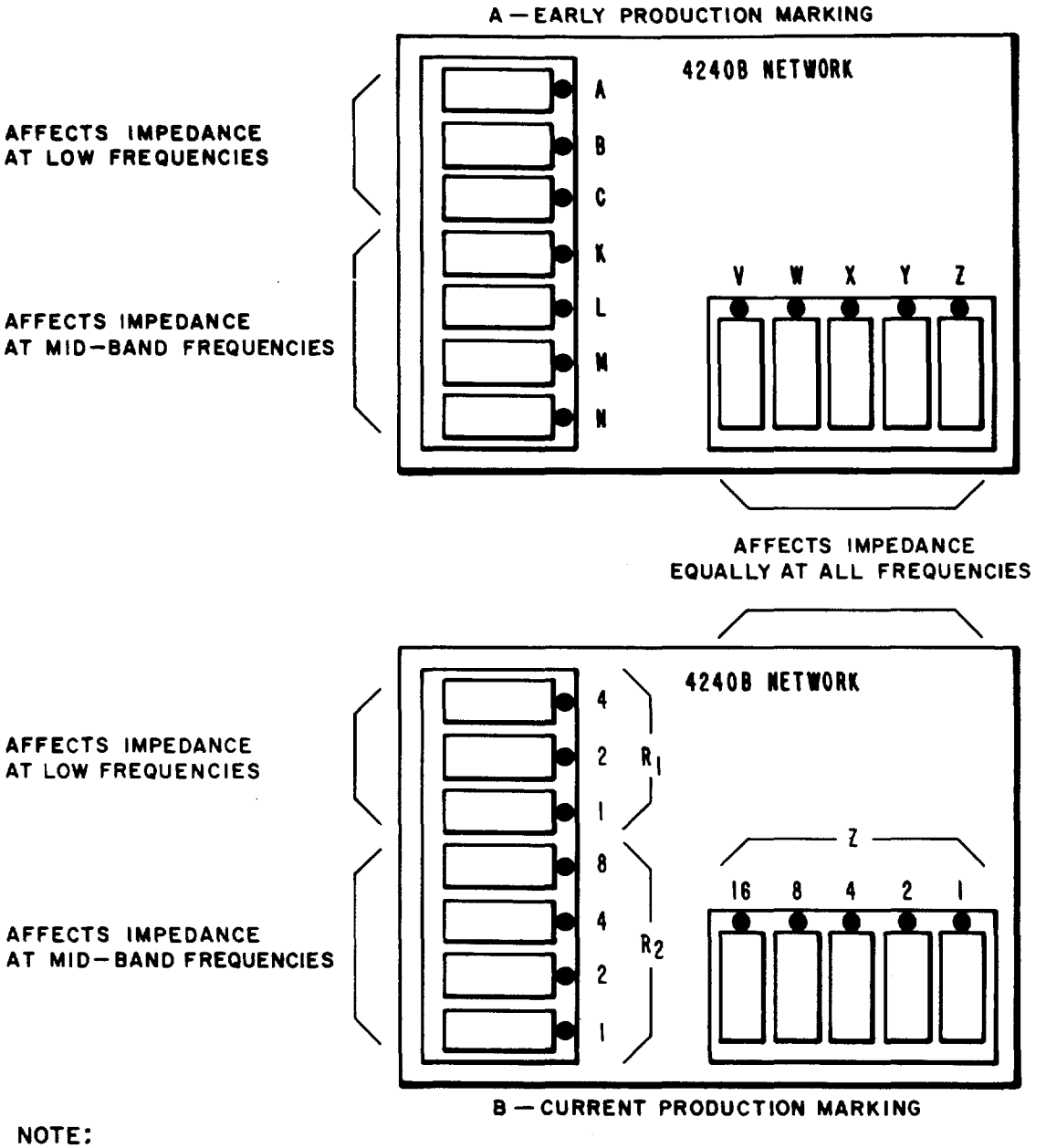
3.04 The precision balance network (PBN) in the repeater provides hybrid balance by matching the impedance of the 2-wire nonloaded facility. The PBN balances 19-, 22-, 24-, and 26-gauge (high impedance) facilities and 25-gauge metropolitan area trunk (MAT low capacitance) facilities. The controls for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

Signaling

3.05 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.

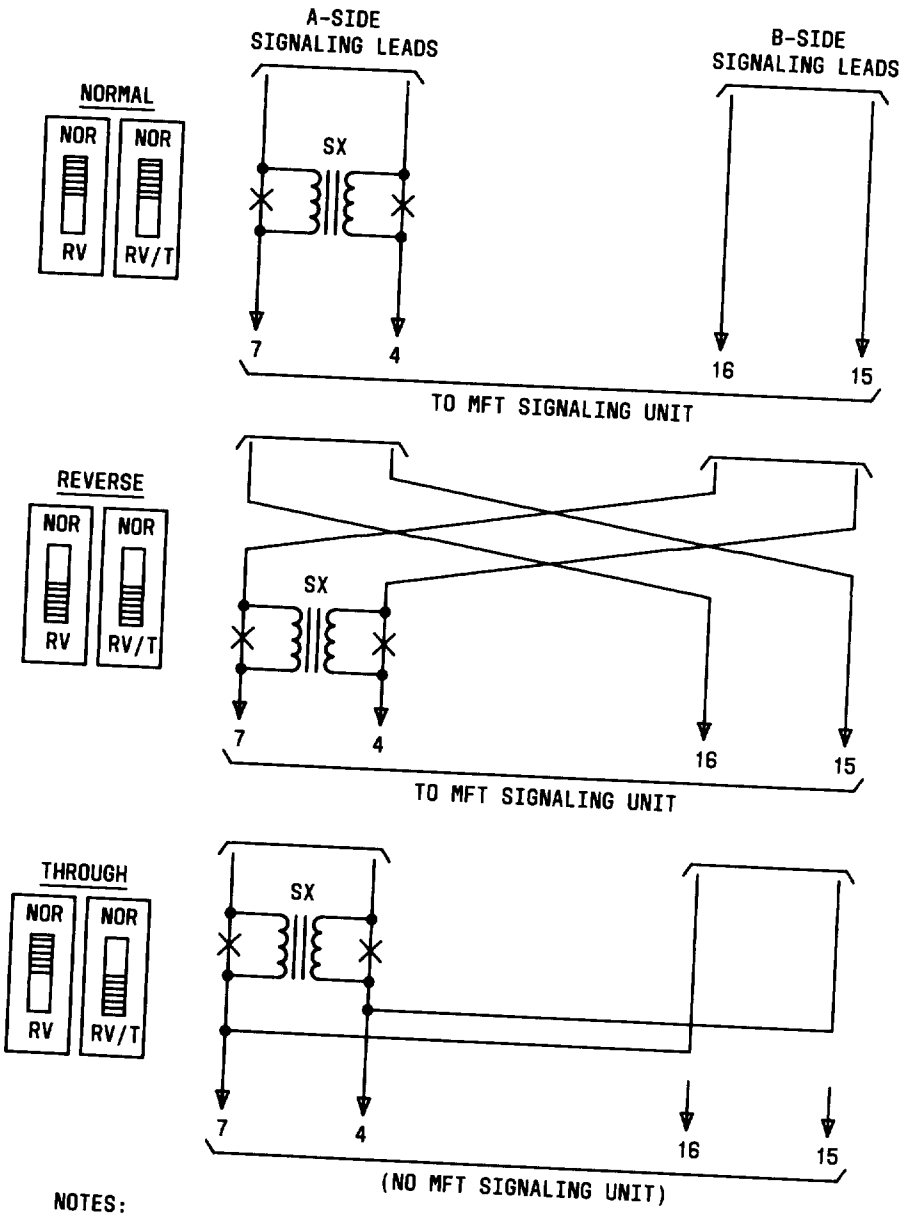
B. Unit Controls

3.06 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.



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

Fig. 4—J99343PD, L1 and L2 Precision Balancing Network Switch Functions



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—Three Options of RV and RV/T Switches

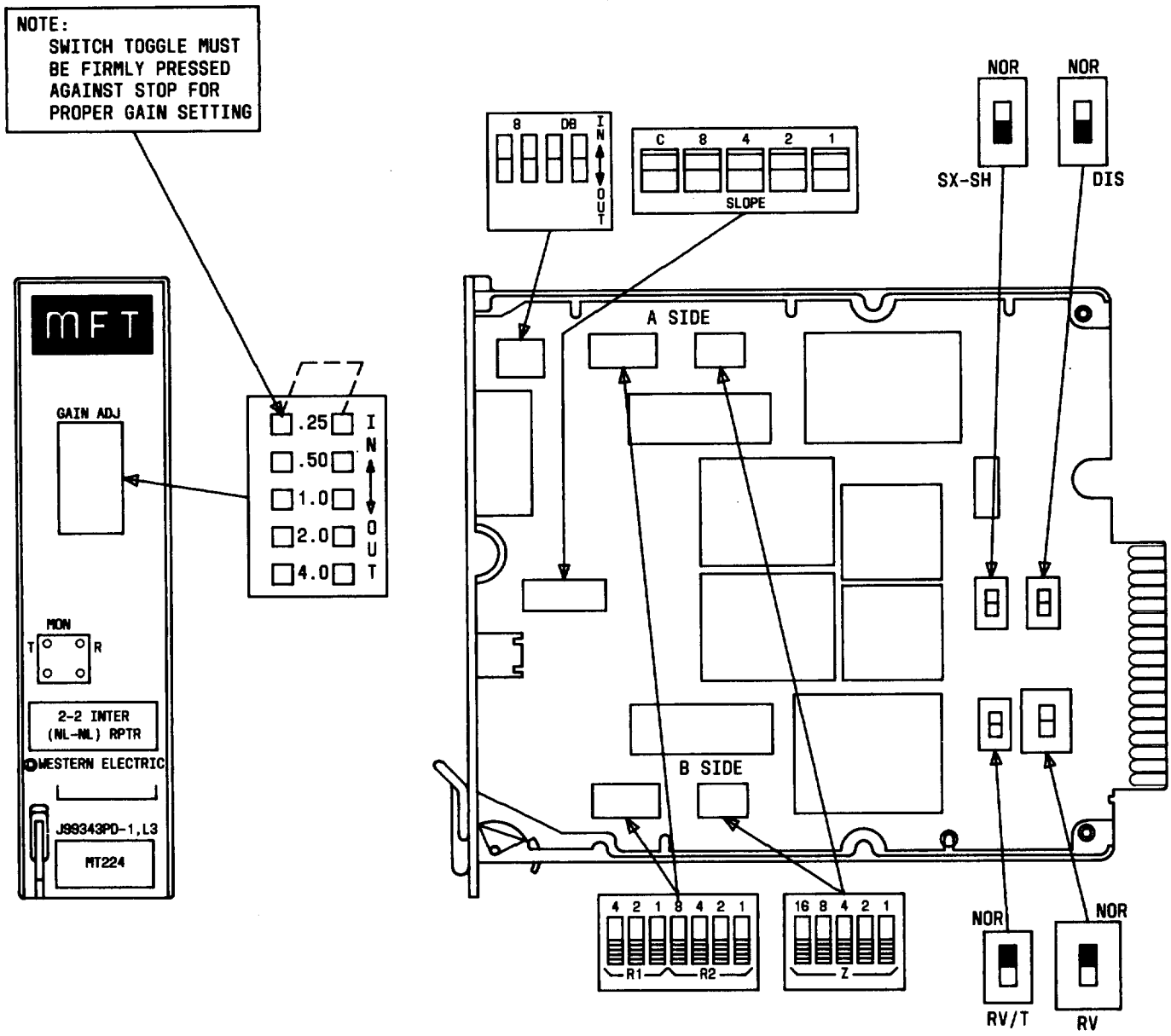


Fig. 6—2-2 Intermediate (NL-NL) Repeater J99343PD, L3 Component Layout

GAIN ADJ and 8DB

3.07 Five miniature switches (GAIN ADJ) and a group of four other switches (labeled 8DB) control the gain of the repeater. The GAIN ADJ switches, accessible through the front panel, are labeled .25, .5, 1.0, 2.0, and 4.0 (dB). These switches are ganged to provide the same gain in both directions of transmission. The 8DB switches, located on the component board, can provide 8 dB of additional gain in each direction (see Note). See Caution in paragraph 3.02.

Note: For proper operation, all four switches labeled 8DB must be in the same position, ie, all IN or all OUT.

SLOPE

3.08 Five rocker switches (designated 1, 2, 4, 8, and C) adjust the SLOPE equalization for both

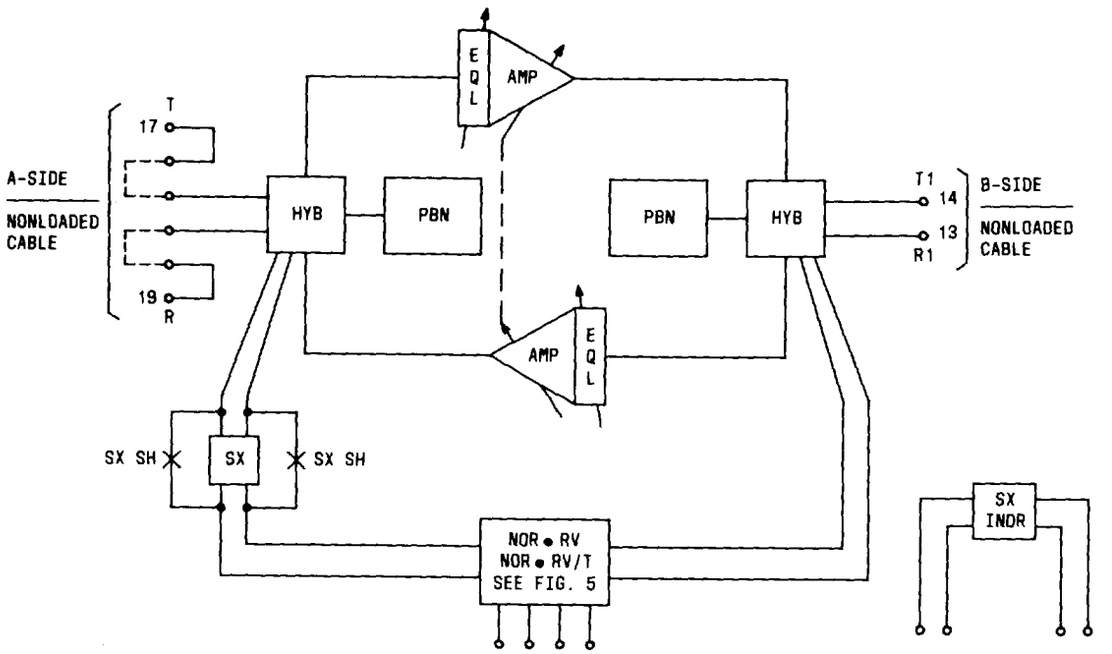


Fig. 7—Block Diagram of the 2-2 Intermediate (NL-NL) Repeater J99343PD,L3

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

PBN

3.09 The controls for the nonloaded facility PBN are illustrated in Fig. 6. This figure shows three groups of switches: R1 (4, 2, 1), R2 (8, 4, 2, 1), and Z (16, 8, 4, 2, 1). See Section 332-912-212 for prescription settings of the PBN (nonloaded).

NOR-SX SH

3.10 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; they are not shorted 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

3.11 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

3.12 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 J99343PD, L1, L2, and L3 repeaters are discussed in the following

paragraphs. Table A gives a comparison of characteristics for all versions of the 2-2 intermediate (NL-NL) repeaters.

A. Amplifier/Equalizer Frequency Response

4.02 Figures 8 and 9 give the frequency response of the gain and equalizer unit. 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.

B. Envelope Delay Distortion

4.03 Figures 10 and 11 give the Envelope Delay Distortion (EDD). Figure 10 shows the EDD for the various equalizer settings with the C switch set to 0. Figure 11 includes the same equalizer settings with the C switch operated.

C. Longitudinal Balance

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

D. Output Power Capability

4.05 Figure 12 shows the output power capability of the 2-2 intermediate (NL-NL) repeaters. The output power is determined by input power and repeater gain, as shown by the +6DB gain line in the figure. Power limiting occurs in this unit at about 13.5 dBm.

5. APPLICATIONS

5.01 The J99343PD, L1, L2, and L3 repeaters may be used to provide gain on any 2-wire circuit between nonloaded facilities. Figure 13 shows a typical application using the unit in an off-premises station (OPS) line. These units also can be used on foreign exchange (FX) trunks, WATS trunks and lines, and other special service metallic facilities. Section 332-910-180 provides additional information.

6. MAINTENANCE

6.01 MFT repeaters require no routine maintenance. If the repeater is determined to be

TABLE A

REPEATER CHARACTERISTICS

FUNCTION	J99343PD, L1, L2	J99343PD, L3
Repeater Gain	0 dB through 14 dB	0 dB through 15.75 dB
Equalization	Adjustable (see Fig. 8 and 9)	Adjustable (see Fig. 8 and 9)
Hybrid Balance A-side	PBN	PBN
B-side	PBN	PBN
DC Resistance	55 ohms - SX shorted 130 ohms - SX in 185 ohms - through signaling	55 ohms - SX shorted 130 ohms - SX in 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

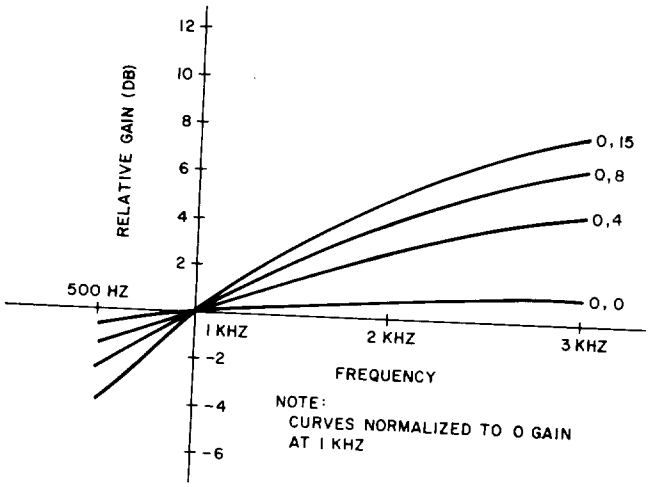


Fig. 8—Amplifier/Equalizer Frequency Response of the 309D Amplifier Unit—C Switch = O (off)

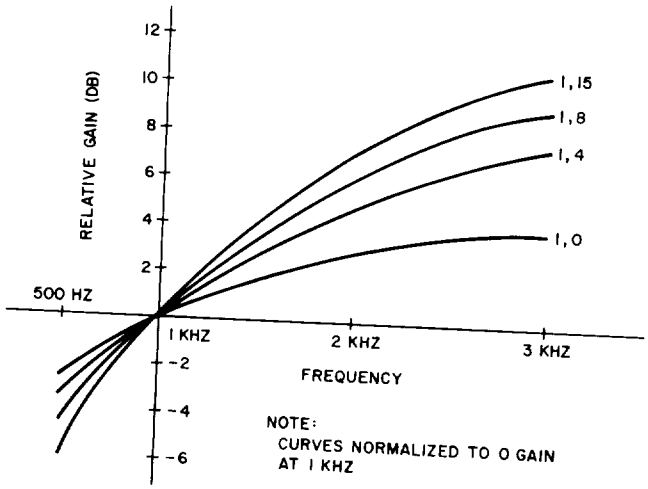


Fig. 9—Amplifier/Equalizer Frequency Response of the 309D Amplifier Unit—C Switch = 1 (Operated)

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 that provide additional information concerning 2-2 wire (NL-NL) intermediate repeaters.

SECTION	TITLE
332-910-100	MFT—General Description
332-910-101	Shelf, Frame, Power Panel, and Distributing Frame Arrangement—Description
332-910-180	General Application Information
332-912-212	2-2 Repeaters—Prescription Settings
332-912-215	MFT 2-2 Intermediate Repeaters—Installation and Testing
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.

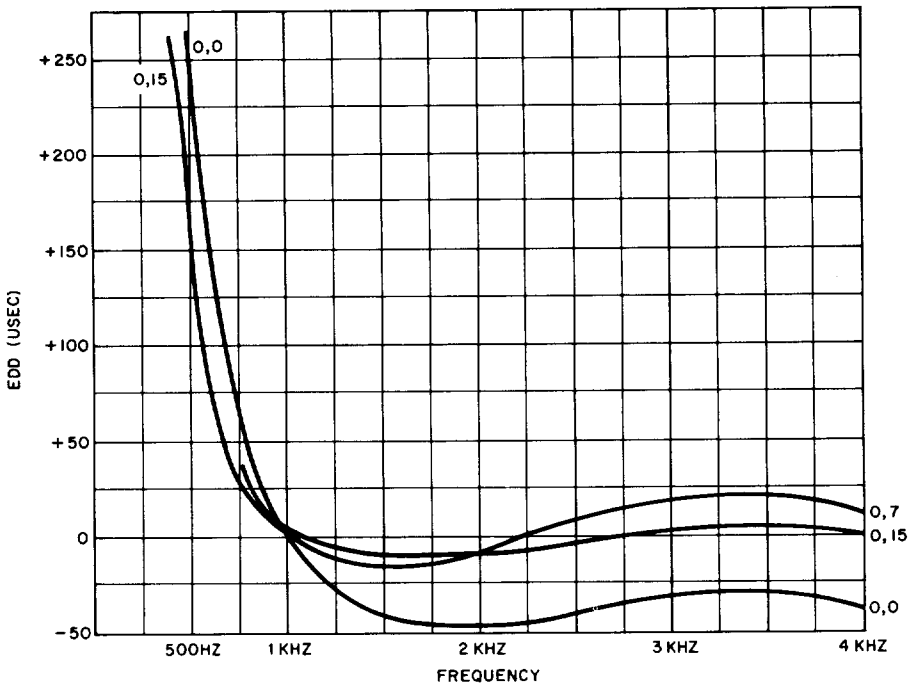


Fig. 10—Envelope Delay Distortion, C = O

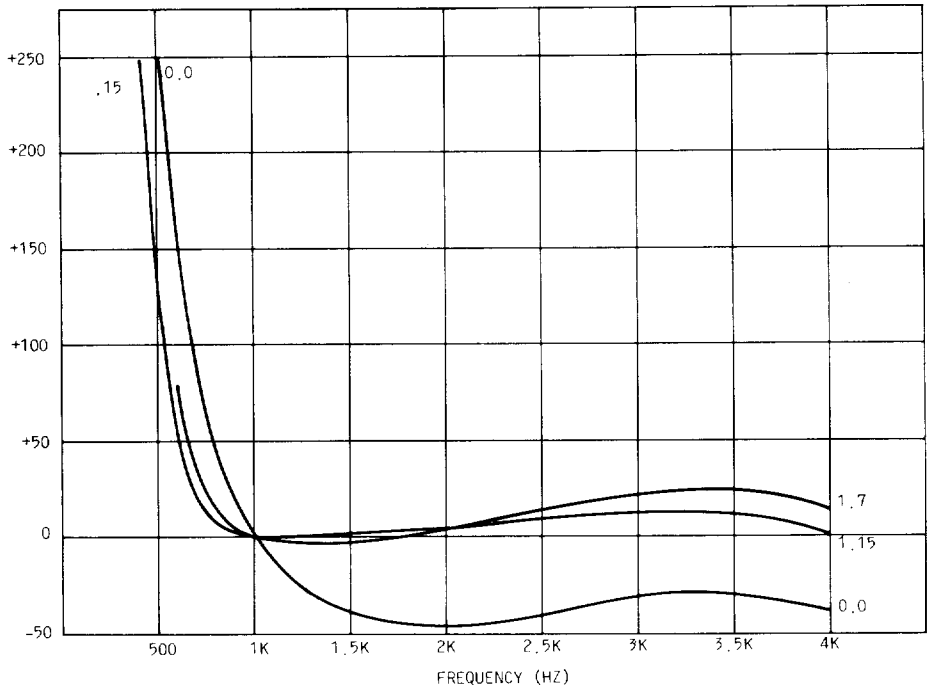


Fig. 11—Envelope Delay Distortion, C = 1

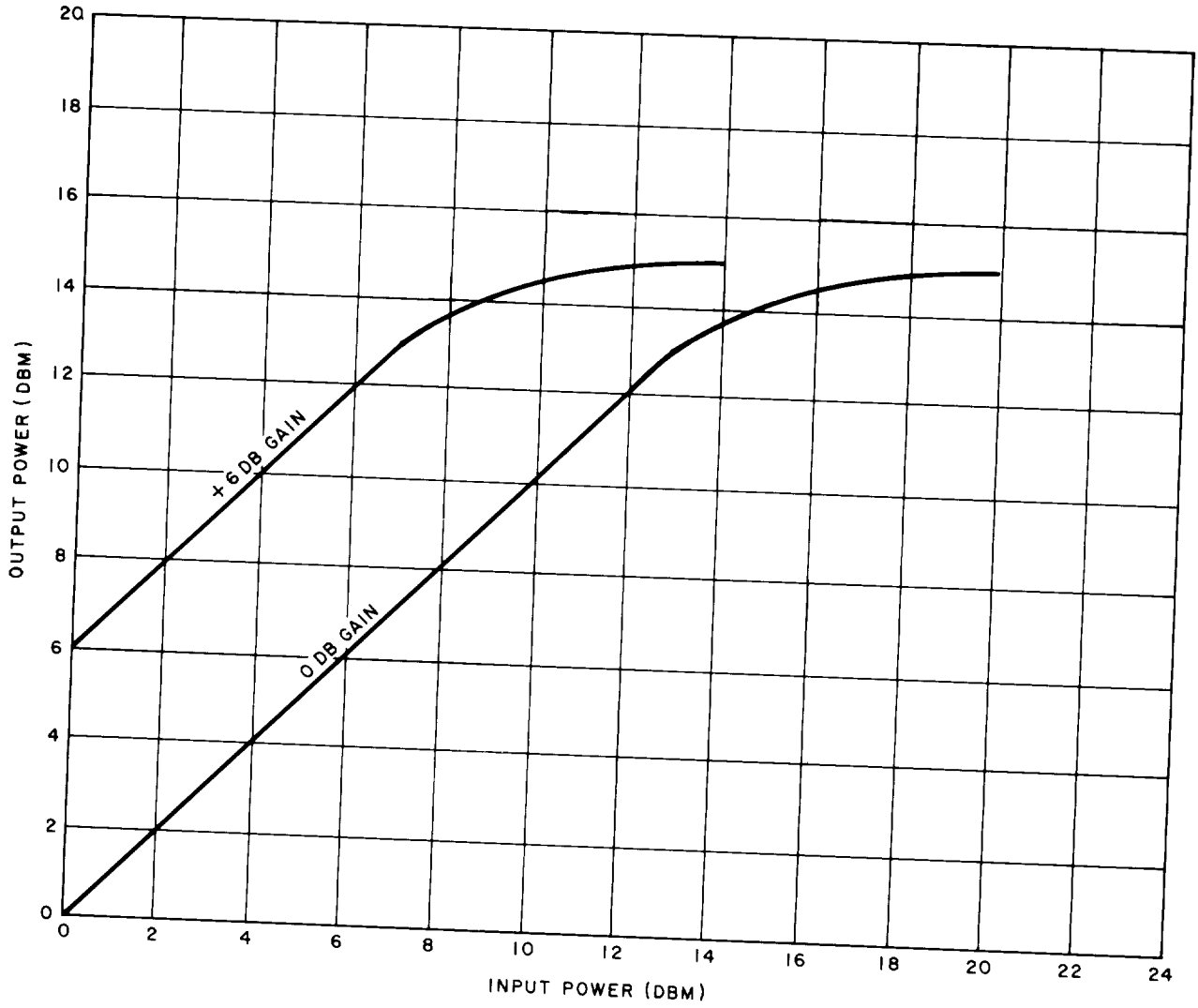


Fig. 12—Output Power Capability of the J99343PD

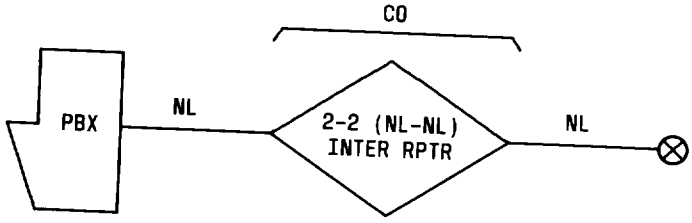


Fig. 13—Off-Premises Station Line Using J99343PD Repeaters