

**J99343GE LOOP SIGNALING EXTENDER/2-2 WIRE TERMINAL REPEATER (NL)
COMBINED FUNCTION UNIT
DESCRIPTION
METALLIC FACILITY TERMINAL**

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1. GENERAL

1.01 This section provides a physical description and discusses the basic functions of the Loop Signaling Extender/2-2 Wire Terminal Repeater (NL) Combined Function Unit (CFU). The basic CFU is described in detail, and transmission and 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 exten-

sive revision, change arrows have been omitted.

1.03 This equipment generates and uses radio frequency energy. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J, Part 15, of FCC Rules, which are designed to provide reasonable protection against radio frequency interference in commercial and residential installations. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, the user may find the following booklet, prepared by the Federal Communications Commission, helpful:

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00315 1.

Physical Description

1.04 The Metallic Facility Terminal (MFT) is a standard equipment arrangement for providing various transmission and signaling functions that may be required by metallic facilities. The Loop Signaling Extender/2-2 wire terminal repeater (NL) CFU is an MFT plug-in that consists of a component board held by a molded polycarbonate frame. The MFT unit measures 1-11/16 inches wide, 7-7/8 inches high, and 9 inches deep.

1.05 This CFU combines the functions of a transmission unit and a signaling unit on a single plug-in. A CFU can be used in either a single- or double-module mounting arrangement. It can be mounted in any slot of a single-module shelf. When

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the CFU is used in the double-module arrangement, it is mounted in the transmission slot. The companion signaling unit slot must be vacant. Section 332-910-101 contains additional information on MFT mounting arrangements.

1.06 The J99343GE CFU is a loop signaling extender/2-2 wire terminal repeater (NL). This CFU provides the function of the J99343CD loop signaling extender (LSE) II and the J99343PB, L3 repeater. This CFU provides DC range extension and hybrid balance for terminal equipment on the A-side and nonloaded facilities on the B-side.

1.07 Section 332-912-256 provides installation and testing and touch-up procedures for the unit.

2. FUNCTIONAL DESCRIPTION

2.01 The J99343GE is shown in Fig. 1. It provides gain, DC range extension, and equalization between terminal equipment and nonloaded facilities. Figure 2 shows a block diagram of this unit.

A. Operation

Transmission

2.02 *Equalizer and Amplifier Units*—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

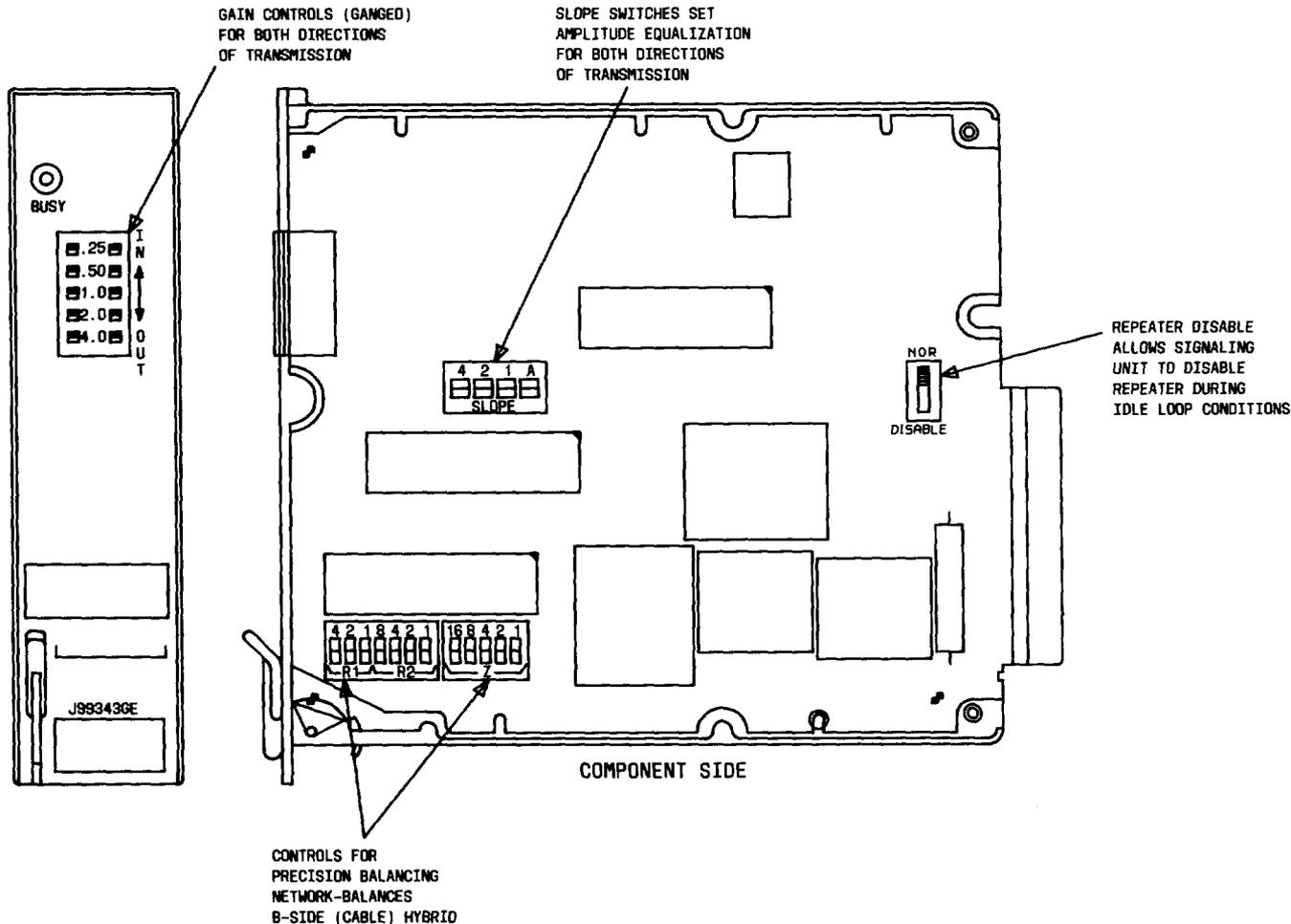


Fig. 1—J99343GE Combined Function Unit

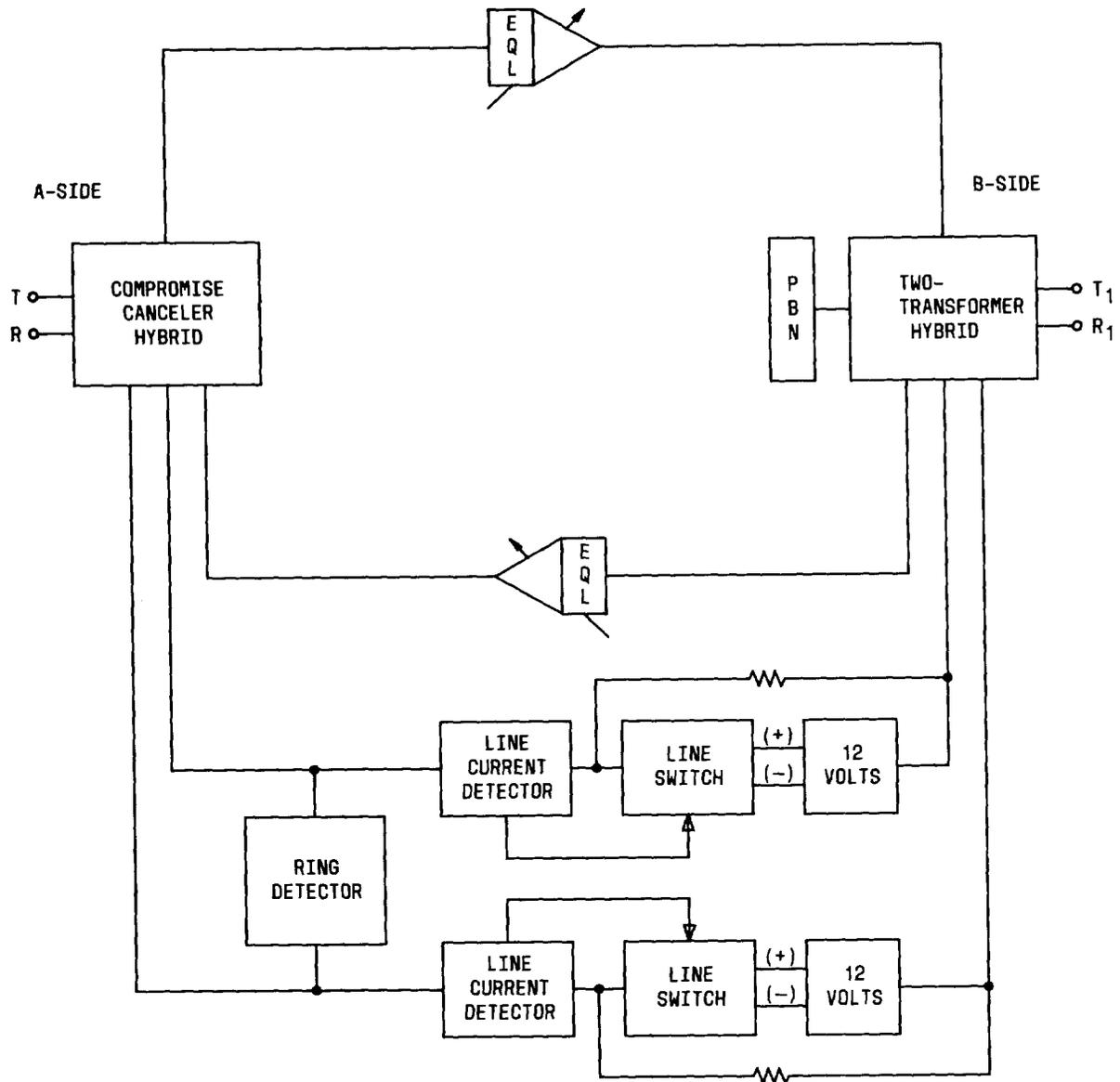


Fig. 2—Block Design of the J99343GE CFU

gain is 0 to 7.75 dB. Additional gain is provided by the adjustable equalizer.

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

2.03 Compromise Canceler Hybrid (A-Side)—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 trans-

mission. The compromise canceler hybrid balances the 900-ohm plus $2.15 \mu\text{F}$ terminal equipment and has no associated adjustments.

2.04 Two-Transformer Hybrid (B-Side)—

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.

2.05 Precision Balance Networks (B-Side)—

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 MAT® trunk cables (low capacitance) facilities. The controls for the PBN are designated R1, R2, and Z.

Signaling

2.06 The signaling section of the unit provides signaling range extension by:

- Boosting all dc signaling voltages for signaling range extension by maintaining a floating dc potential of up to 12 volts, which can be inserted in series with each of the tip and ring conductors.
- Sensing the loop current direction and maintaining the polarities of the floating boost voltages so that they always aid the CO battery.

The five principal parts of the LSE portion of the J99343GE CFU as shown in Fig. 2 are as follows:

- (a) Line current detector circuits
- (b) 12 volt supplies and current regulator
- (c) Line switch control circuit
- (d) Ringing detector circuit
- (e) Repeater disable circuit.

2.07 Line Current Detector Circuits—

The LSE uses optical isolators as loop current detectors and switches. These devices allow complete isolation between tip and ring conductors, the control circuitry, and power sources.

2.08 Line current detectors (optical isolators) are located in both the tip and ring circuits to detect ground-start or loop-start currents. A current of 5 mA or more of either polarity in the tip or ring circuits will operate the appropriate line current detector(s). Operation of a line current detector enables

the 12-volt power supplies and the appropriate line switches to supply boost voltage of the correct polarity (aiding) to the tip and ring circuits.

2.09 12 Volt Supplies and Current Regulator—

The 12-volt dc supplies for boost voltages are derived from a dc-to-dc converter source which is powered by -48 volt battery. The current regulation of the supplies is such that if the loop current increases for any reason (eg, a decrease in loop resistance) the boost voltage decreases. This tends to prevent excessive loop currents and helps stabilize the circuit from the effects of external influences.

2.10 The magnitude of the boost voltage is controlled by a line current regulation circuit in the dc-to-dc converter. The regulation circuit is biased so that the full boost voltage (12 volts) is in series with each of the tip and ring circuits until the loop current reaches 40 mA; at this point the regulation circuit begins to reduce the boost voltage. All boost functions cease when the loop current reaches 65 mA and the LSE portion of the J99343GE CFU is effectively out of the circuit.

2.11 One of the floating dc supplies is in series with the tip and the other in series with the ring. This arrangement helps maintain longitudinal balance and assures a boost voltage for either tip or ring ground-start operation. The polarity to be used is controlled by the line switch control circuit which operates the appropriate line switch.

2.12 Line Switch Control Circuit—The line switch control circuit, when enabled by the line current detectors, turns on the appropriate line switches to boost the loop current. Included in the line switch control circuit is a delay circuit which will prevent the LSE portion from following battery reversals of less than 20 ms.

2.13 Ringing Detector Circuit—When ringing is detected on the A side, the line switches are prevented from operating in the reverse direction. During a ringing cycle, the boost voltage is applied only in the normal direction. The dc component of the superimposed ringing signal is boosted assuring sufficient ring trip current during the ringing interval. The ringing characteristics of the LSE as used with various ringing signal sources are shown in Table A.

TABLE A

**RINGING CHARACTERISTICS OF J99343GE CFU—
LOOP SIGNALING EXTENER SECTION**

BRIDGED RINGING	RING TRIP BOOST DURING RINGING	RING TRIP BOOST DURING SILENT INTERVAL
-48 Volt Superimposed On Ring On Tip	Yes	Yes
	No	Yes
-48 Volt Superimposed Ringing Ring to Gnd Ringing Tip to Gnd	Yes	Yes
	No	Yes

2.14 Disable Circuit—The LSE features a repeater disable function. A slide switch labeled NOR/DISABLE, mounted on the component board, selects the mode of operation. When the NOR/DISABLE switch is set in the DISABLE position, power (-48 Vdc) is supplied to energize the repeater section of the GE CFU only when loop current flows. During idle or open circuit conditions, no power is supplied to operate the repeater section.

2.15 When the NOR/DISABLE switch is operated to the NOR position, power is supplied to the repeater portion at all times regardless of the circuit condition.

B. Unit controls

2.16 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.

Transmission

2.17 GAIN ADJ—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 Note in paragraph 2.02.

2.18 SLOPE—Four rocker switches (designated 1, 2, 4, and A) adjust 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 determines the equalization. The A switch is used to introduce the appropriate 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.

2.19 PBN(R1, R2, and Z)—The controls for the nonloaded facility PBN are illustrated in Fig. 1. This figure shows the three groups of controls: 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).

Signaling

NOR-DISABLE

2.20 This switch provides a special test arrangement for the CFU. With the switch in the NOR position, the repeater section can be tested independently of the signaling section. In this arrangement, the repeater is continuously activated. In the DISABLE position, the CFU operates in the normal manner.

3. PERFORMANCE CHARACTERISTICS

3.01 The performance of the J99343GE CFU is discussed in the following paragraphs. Table B gives a summary of characteristics of the CFU.

TABLE B
UNIT CHARACTERISTICS

FUNCTION	J9934GE, L1
Gain	0 — 7.75 dB
Equalization	Adjustable
Hybrid Balance A-Side B-side	Compromise Canceler Two-Transformer and PBN
Current Drain	—48v. Circuit Battery
Idle	10 mA
Typical	80 mA
Max.	110 mA

A. Amplifier/Equalizer Frequency Response

3.02 Figures 3 and 4 give the frequency response of the gain and equalizer unit. Figure 3 gives the response curves for various equalizer settings with the (A) switch set to 0. Figure 4 provides curves for the same equalizer settings with the (A) switch operated.

B. Envelope Delay Distortion

3.03 Figure 5 gives the Envelope Delay Distortion for the repeater.

C. Longitudinal Balance

3.04 The longitudinal balance for these repeaters is at least 58 dB from 200 Hz to 3000 Hz.

D. Output Power Capability

3.05 Figure 6 shows the output power capability of the 2-2 (NL) terminal 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.

4. APPLICATIONS

4.01 The J99343GE unit may be used to provide gain on any 2-wire circuit between nonloaded facilities and terminal equipment. Figure 7 shows a typical application using the unit on a PBX-CO trunk. This unit can also be used on off-premises station (OPS) lines, wide area telecommunications service (WATS) trunks and lines, and other metallic facility special service. Section 332-910-180 provides additional information.

5. MAINTENANCE

5.01 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.

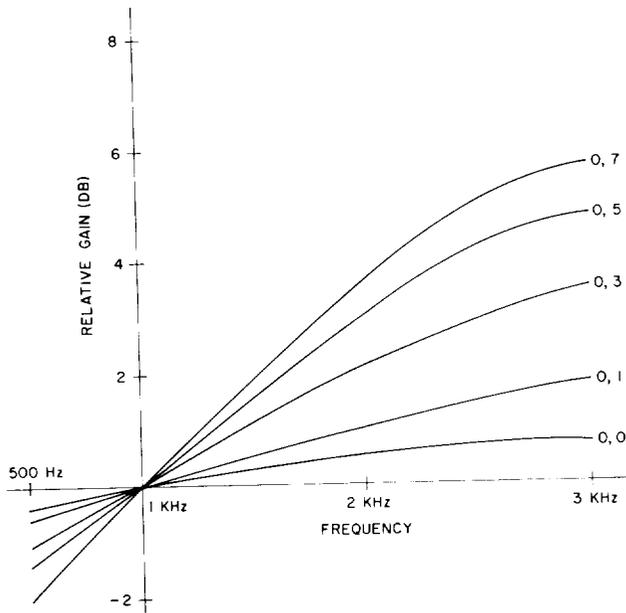


Fig. 3 — Relative Amplifier-Frequency Response of the J99343GE Amplifier Unit—A Switch = 0 (OFF)

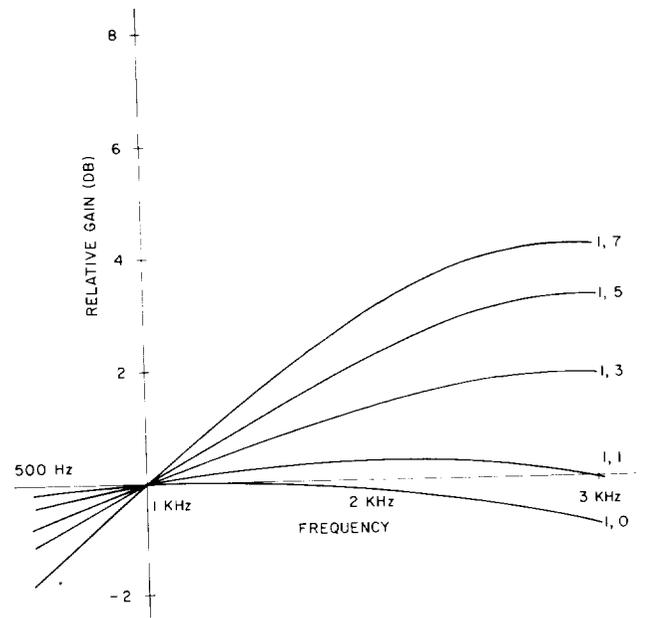


Fig. 4 — Relative Amplifier-Frequency Response of the J99343GE Amplifier Unit—A Switch = 1 (OPERATED)

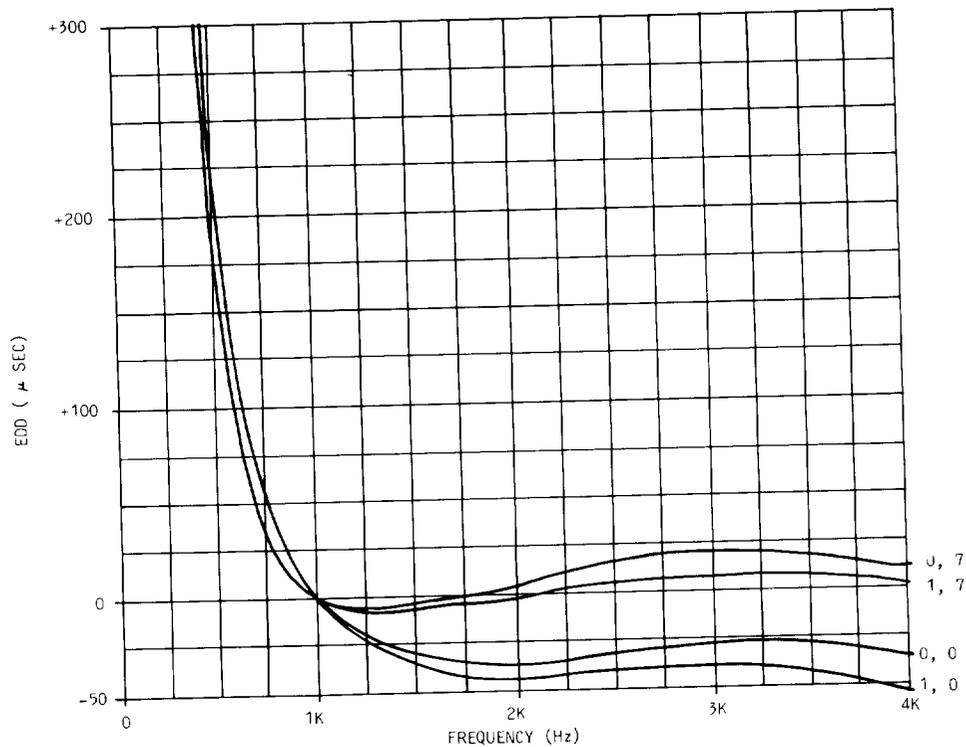


Fig. 5—Envelope Delay Distortion of the J99343GE CFU

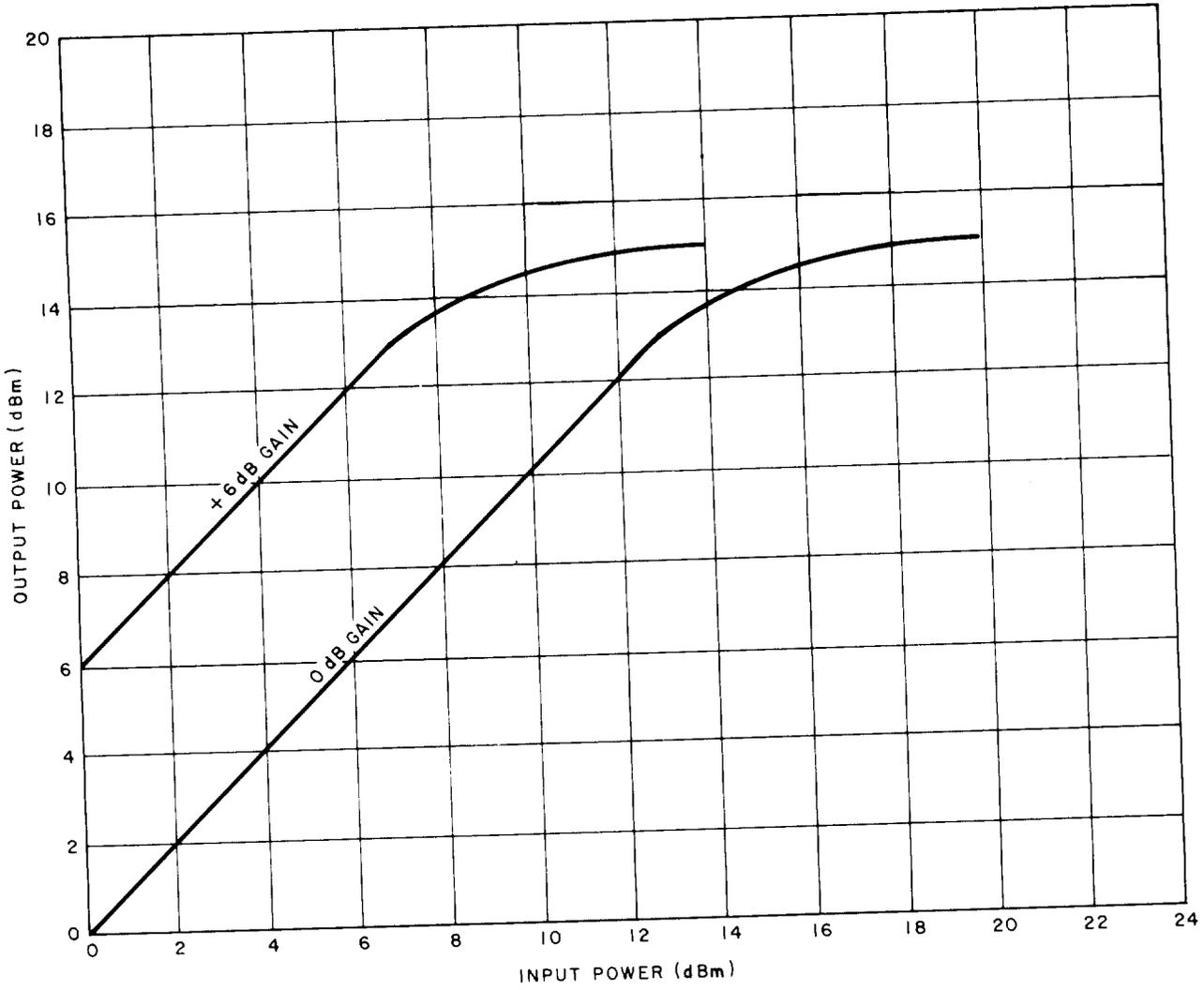


Fig. 6—Output Power Capability of the J99343GE CFU

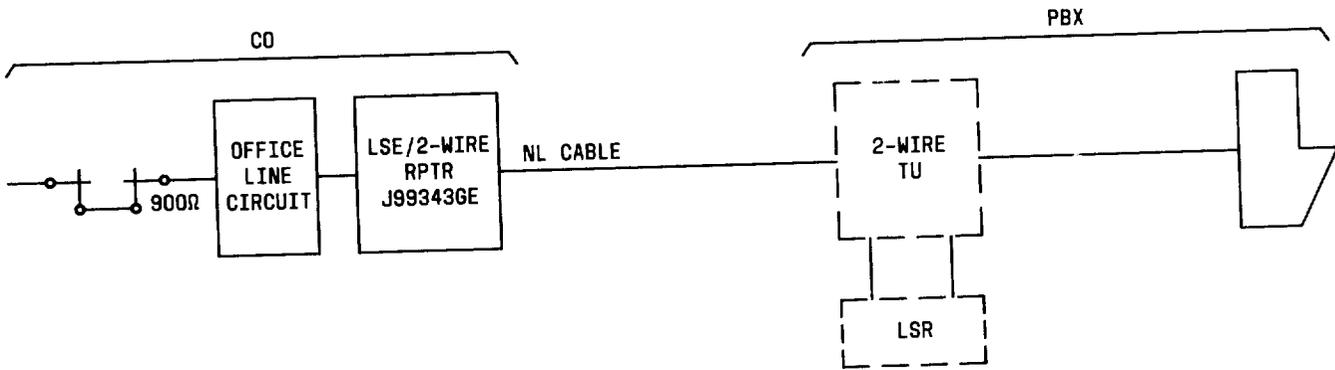


Fig. 7—Typical PBX-CO Trunk Application of the J99343GE-CFU

6. REFERENCES

6.01 The following is a list of references that provide additional information concerning 2-2 wire (L) terminal repeaters.

SECTION	TITLE	SECTION	TITLE
332-910-100	MFT—General Description	332-912-256	J99343GE—Installation and Testing
332-910-101	Shelf, Frame, Power Panel, and Distributing Frame Arrangements, Description		
332-910-180	General Application Information		
332-912-212	2-Wire Repeaters—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 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.	

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