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J99343PR UNIVERSAL ADAPTIVE REPEATER

DESCRIPTION

METALLIC FACILITY TERMINAL

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1. GENERAL

1.01 This practice describes the basic functions and physical description of the J99343PR 2-2 Wire Universal Adaptive (UA) Repeater. Transmission performance, typical applications, and maintenance philosophy are also discussed. The J99343PR repeater features a new system that continuously monitors and automatically balances each facility interface with the repeater. This repeater is described in detail in this practice.

1.02 When this practice is reissued, the reason(s) for reissue will be listed in this paragraph.

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 universal adaptive repeater is a 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.

1.04 The features and physical criteria of the J99343PR repeater are designed to the same format as current MFT repeaters. This allows the PR repeater to be integrated gracefully into a customer's existing administrative and circuit design systems. The J99343PR repeater 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 this repeater is used in the double-module arrangement, it is mounted in the transmission unit slot. A companion signaling unit may be installed in the sig-

naling unit slot if signaling treatment is required. Section 332-910-101 contains additional information on MFT mounting arrangements.

1.05 The UA repeater provides continuous automatic balancing for both loaded and nonloaded cable using digital techniques. The gain and equalization for both directions of transmission are adjusted manually using controls that interface with the digital electronics of the repeater.

1.06 Characteristics of the UA repeater can be found in Table A. Detailed installation and test information for this repeater can be found in Section 332-912-263.

2. FUNCTIONAL DESCRIPTION

2.01 Past methods for 2-2 wire repeaters to provide gain and equalization while controlling echo were accomplished through precision balance networks using hybrid type transformers. Once the adjustments for the hybrid transformers were set, they remained fixed regardless of any cable changes due to time, temperature, etc. In many cases, the cable changes could cause singing and/or crosstalk.

2.02 A block diagram of the J99343PR repeater which interfaces analog with digital electronic circuitry is shown in Fig. 1. This repeater provides continuous automatic balancing techniques which are used to cancel the return echo signal regardless of the line condition or impedance changes. To accomplish this feature, the input analog signals are converted to digital signals which are analyzed by a DSP (digital signal processor). Unique software is programmed into the DSP to do gain, equalization, and echo canceling.

2.03 The J99343PR repeater is shown in Fig. 2. This repeater can be used to furnish gain and equalization between 2-wire loaded/nonloaded cable facilities in intermediate applications or between terminal equipment and loaded/nonloaded facilities in terminal applications. The main circuits for this repeater are as follows:

- Digital Circuits
- Analog Circuits
- Power Supply Circuits
- Loop Signaling Circuits.

A. Operation

Digital Circuits

2.04 The digital circuitry consists of a single RAM DSP, two mu-law codecs with parallel logic inputs, a 10.24 MHz DSP clock, a 4.096 MHz codec clock, a TTL inverter package, a D flip-flop, and a divide by five circuit.

2.05 The DSP is a high speed specialized microcomputer. Under program control it provides gain, equalization, and automatic echo canceling in the PR repeater for both the A- and B-side facility interface. This microcomputer incorporates greater speed, less cost, and more reliability than conventional analog electronics.

2.06 The codecs function to connect the DSP to the inputs and outputs of the analog circuits. Two converters are used in the codecs to convert analog signals to digital and digital signals to analog.

2.07 The 10.24 MHz and 4.096 MHz clocks, inverter and flip-flop packages are required for timing functions between the associated digital circuits.

Analog Circuit

2.08 The input and output analog circuit components for the A- and B-sides of the J99343PR repeater are identical because the standard circuits required to balance a cable facility which are usually different, are not required. However, variations in circuit components and signals do exist in the DC signaling area.

2.09 The analog transmission section on the A- and B-side of the J99343PR repeater consists mainly of a 2-wire coupling transformer with op-amp drivers for passing signals between the cable facility and the codecs described in paragraph 2.06.

2.10 Adjustable gain and equalization are provided for each direction of transmission in the analog circuits. The controls for gain and equalization are designated GAIN and EQL respectively. The range of the amplifier unit gain is 0 to 15.75 dB. Additional gain is provided by the adjustable equalizer. The transformer on each side of the input coupling circuit contains a midpoint capacitor which blocks

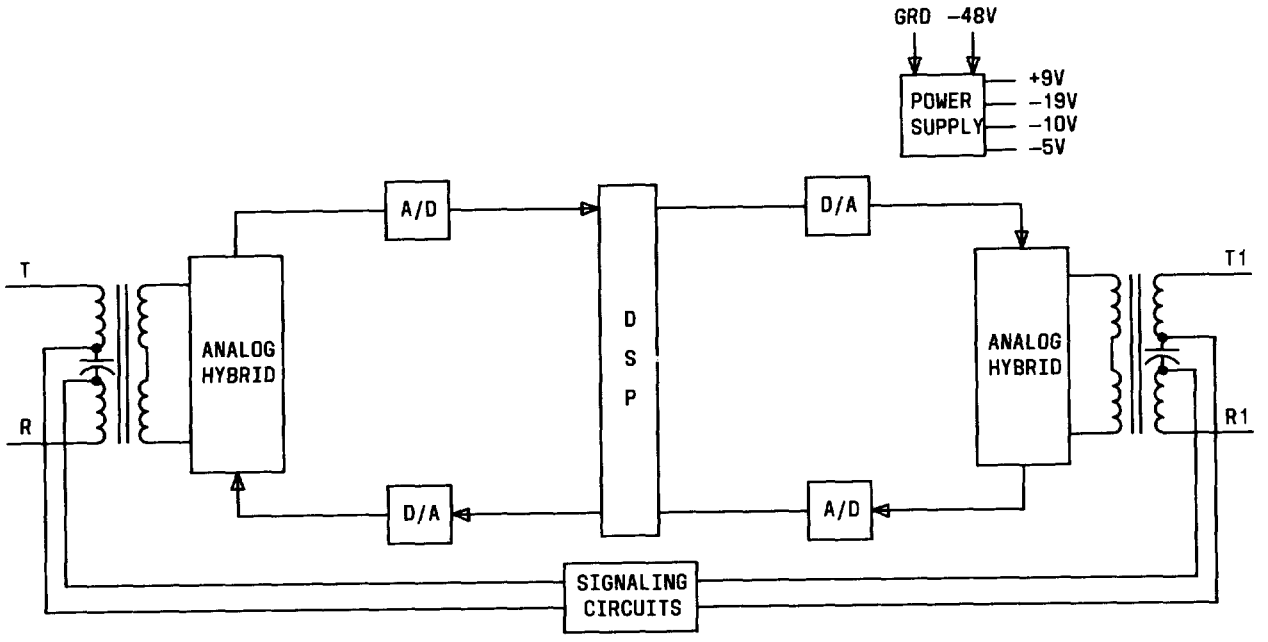


Fig. 1—J99343PR 2-2 Wire Repeater—Block Diagram

the DC signaling currents and allows them to be routed to either a companion MFT signaling unit, to an external signaling source, or around the repeater in a through signaling mode.

> ***Note:*** For crosstalk considerations the maximum gain is typically limited to 12 dB for intermediate repeaters and 6 dB for terminal repeaters.

Loop Signaling Circuits

2.11 The use of an opto isolator for large signal detection is incorporated into the J99343PR repeater. The presence of large signals such as ringing and dial pulsing is sensed and transmitted to the DSP which freezes the adjustments to the echo cancelers. This allows the echo cancelers to function properly in the presence of corrupting signals.

2.12 Several routing options controlled by two switches labeled NOR-RV and NOR-RV/T are available for DC loop signaling on the J99343PR repeater. Signaling leads may be routed directly to the companion signaling unit, routed with A-side and B-side reversed to the signaling unit, or connected so the DC loop signaling is passed around the transmission circuit in a through signaling mode. The NOR-SX SH switch permits shorting of the SX inductor when required for some DC loop signaling configurations.

Power Supply Circuit

2.13 Due to the design requirements of the J99343PR repeater, a power supply different from most standard MFT designs was required. The voltages are listed as follows:

- +9 and −19 volts with current capabilities of 25 mA
- −10 volts capable of delivering 25 mA
- −5 volts supply capable of driving a 300 mA load.

Switching transits in all the supplies are filtered using RC filters.

B. Unit Controls

Transmission Controls

2.14 Continuous automatic balancing for loaded and nonloaded cable which takes into consid-

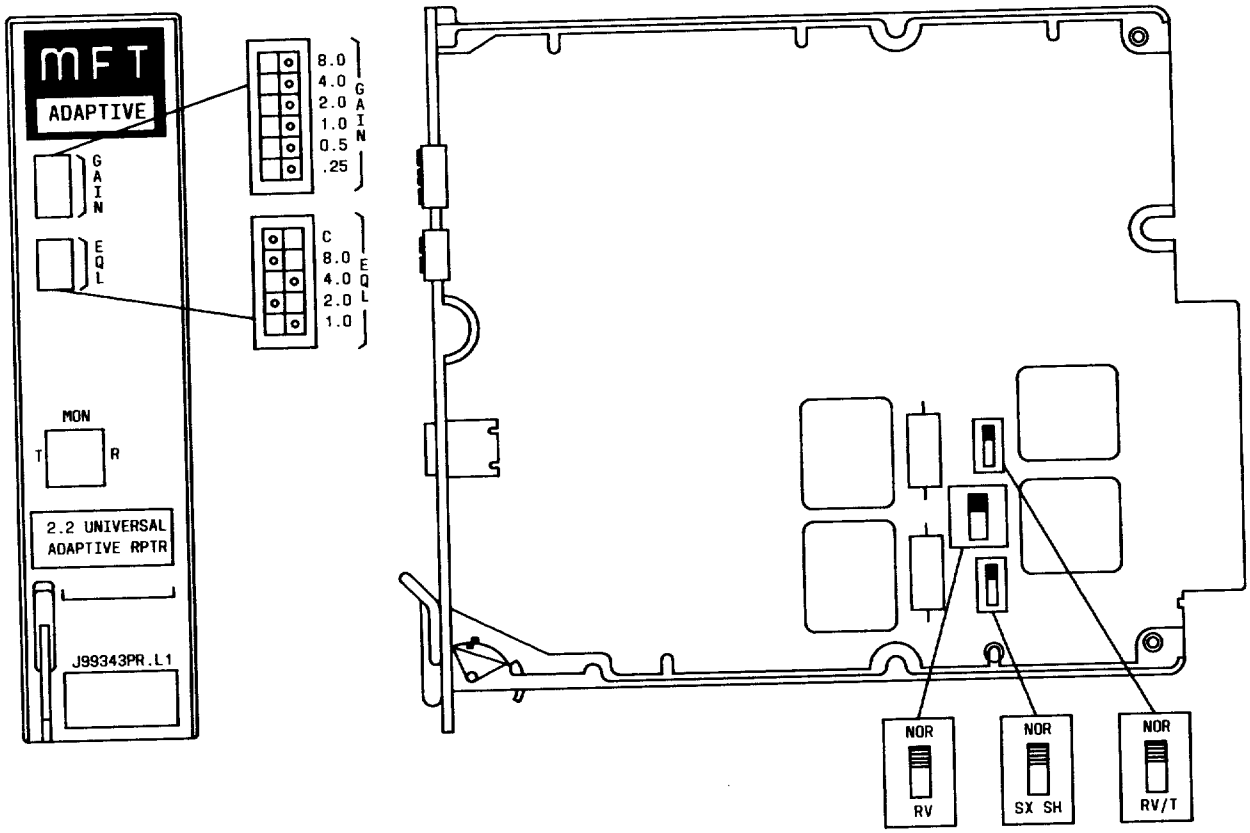


Fig. 2—J99343PR 2-2 Wire Repeater—Component Layout

eration line condition or impedances changes of the cable facility is provided by the new design techniques of the PR repeater. Manual balancing controls are not required for the J99343PR repeater.

2.15 Gain and equalization for both directions of transmission are set manually using slide type switches. These switches are operated when moved toward their respective designation. The sum of the values of the switches operated is the setting for that function. These switches are described in the following paragraphs.

2.16 *GAIN:* Six miniature switches labeled GAIN control the gain of the repeater. The GAIN switches, accessible through the front faceplate, are individually designated 8.0,4.0,2.0,1.0,.50, and .25 (dB). These switches provide the same gain in both directions of transmission simultaneously.

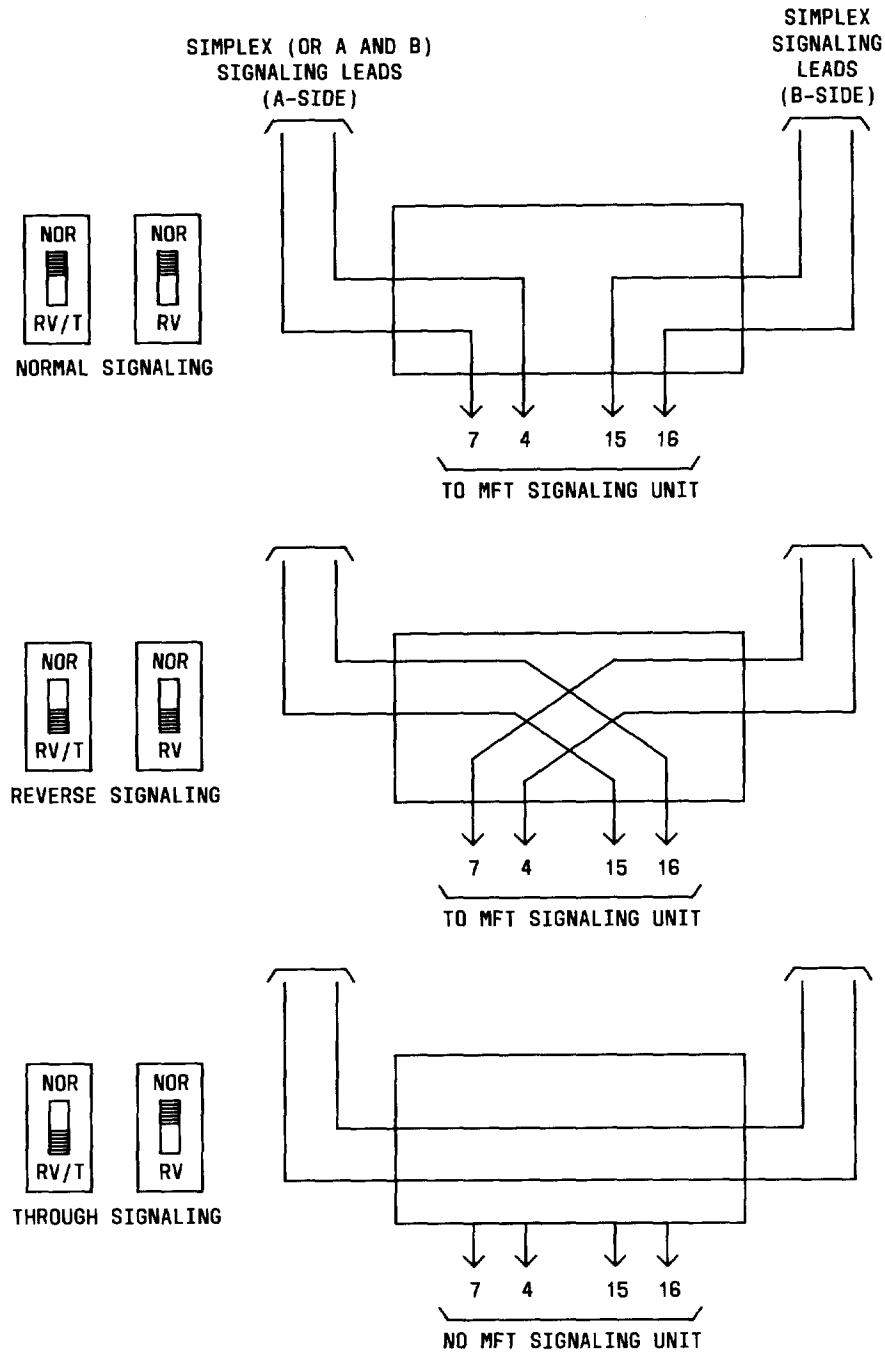
2.17 *EQL:* Five slide switches labeled EQL and individually designated C, 8, 4, 2, and 1 adjust the equalization for both directions of transmission simultaneously. The C switch acts as a range selector and, when operated toward the C designation, it introduces a steeper degree of equalization or slope across the voiceband. The other four numerical switches (1, 2, 4, 8) allow selection of 16 different equalizer shapes for each position of the C switch. The operated sum of the values of the numerical switches and the C switch position determine the equalization. See Section 332-912-212 for prescription settings of the equalization switches.

Signaling Controls

2.18 *NOR-RV and NOR-RV/T:* These switches are used to establish the normal, reverse or through signaling modes with respect to the transmission circuit of the J99343PR repeater. Figure 3 gives the required switch positions to achieve a pre-

scribed mode. These switches only affect the dc signaling path.

2.19 ***NOR-SX SH:*** The NOR-SX SH switch permits shorting of the A-side SX inductor when



NOTE:
1. These diagrams show functionally the three signaling modes. The exact wiring connections have been omitted for clarity.

Fig. 3—Signaling Options for the J99343PR Repeater

it is not required such as in E & M type signaling. The SX inductor is shorted when the NOR-SX SH switch is operated to the SX SH position.

3. PERFORMANCE CHARACTERISTICS

3.01 The performance of the J99343PR repeater is discussed in the following paragraphs. Table A gives a summary of characteristics for this repeater.

A. Amplifier/Equalizer Frequency Response

3.02 Figures 4 and 5 give the frequency response for various equalizer and gain settings. Figure 4 provides the response curves for various equalizer settings with the C switch set for 0 (off). Figure 5 provides curves for the same equalizer settings with the C switch set for 1 (operated).

Note: Equalizer settings are normally shown as two numbers separated by a comma. The first number is either 0 (off) or 1 (on) for the C switch setting. The second number is the sum of the numerical switches in the equalizer switch group.

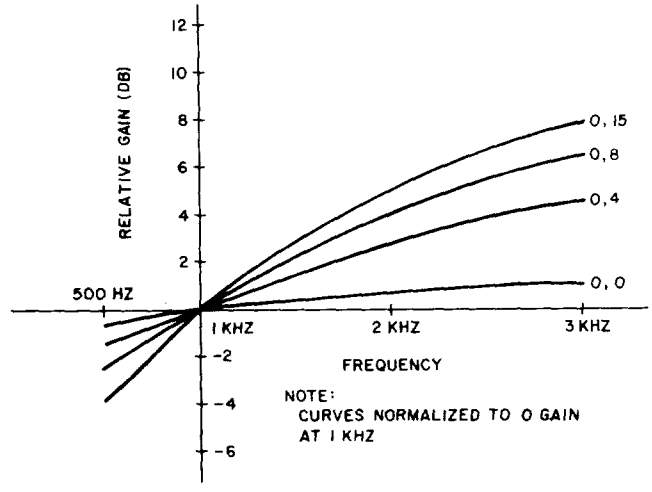


Fig. 4—Amplifier/Equalizer Frequency Response—C Switch =0 (Off)

TABLE A

J99343PR CHARACTERISTICS

FUNCTION	VALUE	
Repeater Gain	0 to 15.75 dB in .25 dB steps	
Equalizer Gain	Adjustable (See Fig. 4 and 5.)	
Maximum Undistorted Output Power	9 dBm	
DC Resistance	A-Side: SX shorted 65Ω SX normal 185Ω	B-Side: SX normal 185Ω
	Through Signaling — 250Ω	
Interface Impedance	600 or 900 Ohms (Adjusted Automatically)	
Current Drain (mA)	Range: 50—60 mA Nominal: 55 mA	

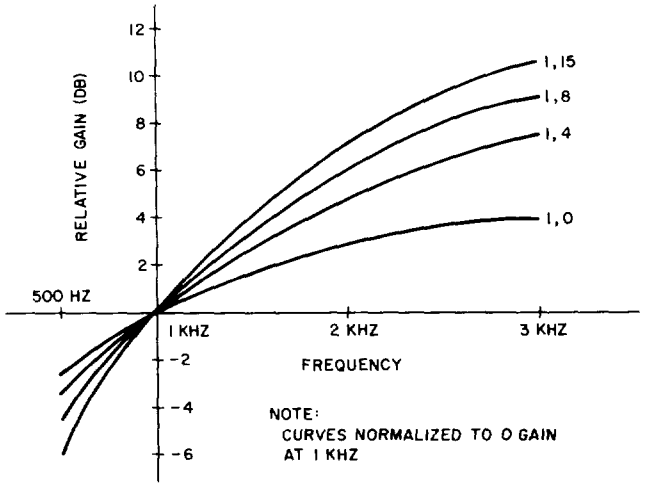


Fig. 5—Amplifier/Equalizer Frequency Response—C Switch =1 (Operated)

B. Longitudinal Balance

3.03 The longitudinal balance for the J99343PR repeater is at least 60 dB from 200 Hz to 3000 Hz.

C. Output Power Capability

3.04 Figure 6 shows the output power capability of the J99343PR UAA repeater. 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 9 dBm.

4. APPLICATIONS

4.01 The J99343PR Universal Adaptive Repeater is designed to replace all J99343P( ) type repeaters except the J99343PL dual repeater. Modification or wiring changes of the MFT bay will not be required for the PR repeater.

4.02 The two wire ports of the 2-2 wire universal adaptive repeater will interface with loaded or nonloaded cable, 600-ohm 2-wire switches or equipment, and 900-ohm 2-wire switches or equipment. It can interface with 19, 22, 24, 25, or 26 gauge nonloaded or H88 loaded cable facilities with central office end sections between 1.5 kft and 4.5 kft and customer end sections between 3 kft and 9 kft including bridged tap. No bridge tap is permitted between loading coils or at the central office end section.

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 service center for repair.

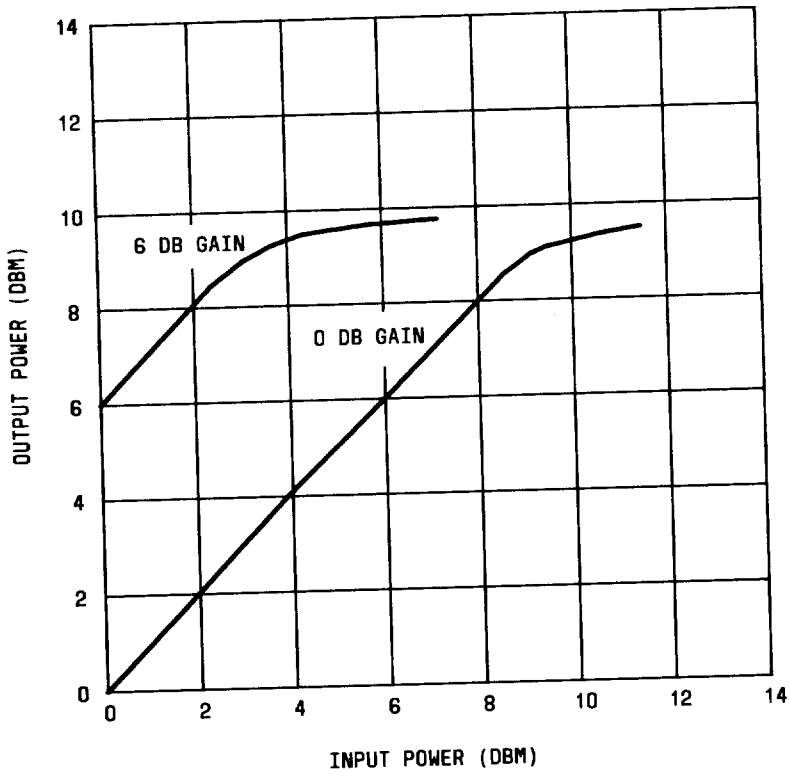


Fig. 6—Output Power Characteristics Curve