4182C NETWORK
4-WIRE EXTENSIONS
DESCRIPTION

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1. GENERAL

1.01 This section describes the 4182C 4-wire network (Fig. 1). The network is one of a series of 4-wire extension networks. Four-wire extension networks extend circuits from carrier terminals or 4-wire metallic facilities to customer premises or to central office switching machines on 4-wire cable pairs. They are physically interchangeable with 1-type terminating sets (Fig. 2). Consequently, the choice of plug-in units — 1-type terminating sets or 4182C networks — makes the same physical equipment mountings suitable for either 2-wire or 4-wire extensions.

1.02 This section is reissued to include references to 25-gauge metropolitan area trunk (MAT) cable and to delete unessential information. Arrows normally used to indicate changes are not used due to the extensive revision.

1.03 The 4182C network provides transmission level control, derives simplex leads for signaling purposes, includes fixed impedance ratio line transformers, and loss equalization networks. Its principal use will be in the extension of carrier channels or 4-wire cable facilities on long 4-wire H88 loaded cable facilities.

2. EQUIPMENT DESCRIPTION

2.01 The 4182C network (Fig. 1) is a plug-in unit equipped with a 20-pin connector and is designed to be plugged directly into the 1-type terminating set socket of the mounting shelf.

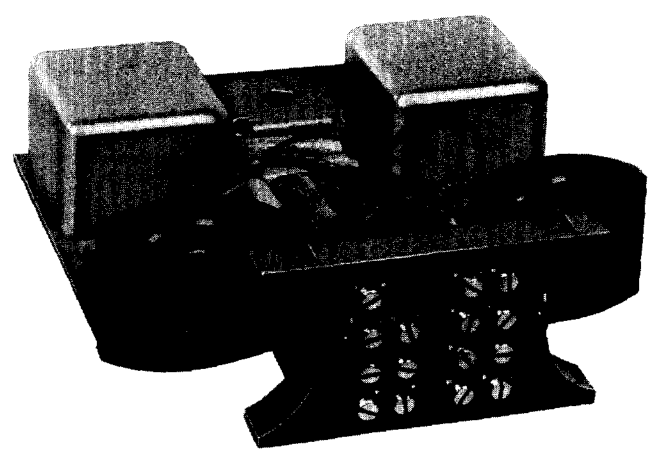


Fig. 1—4182C Network, 4-Wire Extension

2.02 The network consists of pad sockets for the 89-type resistors, transformers, resistors, capacitors, and inductor mounted on a printed wiring board and housed in a metal can approximately 5-1/4 inches wide by 1-3/4 inches high by 7 inches deep. Tabs are provided to facilitate removal of the network from the mounting shelf with the use

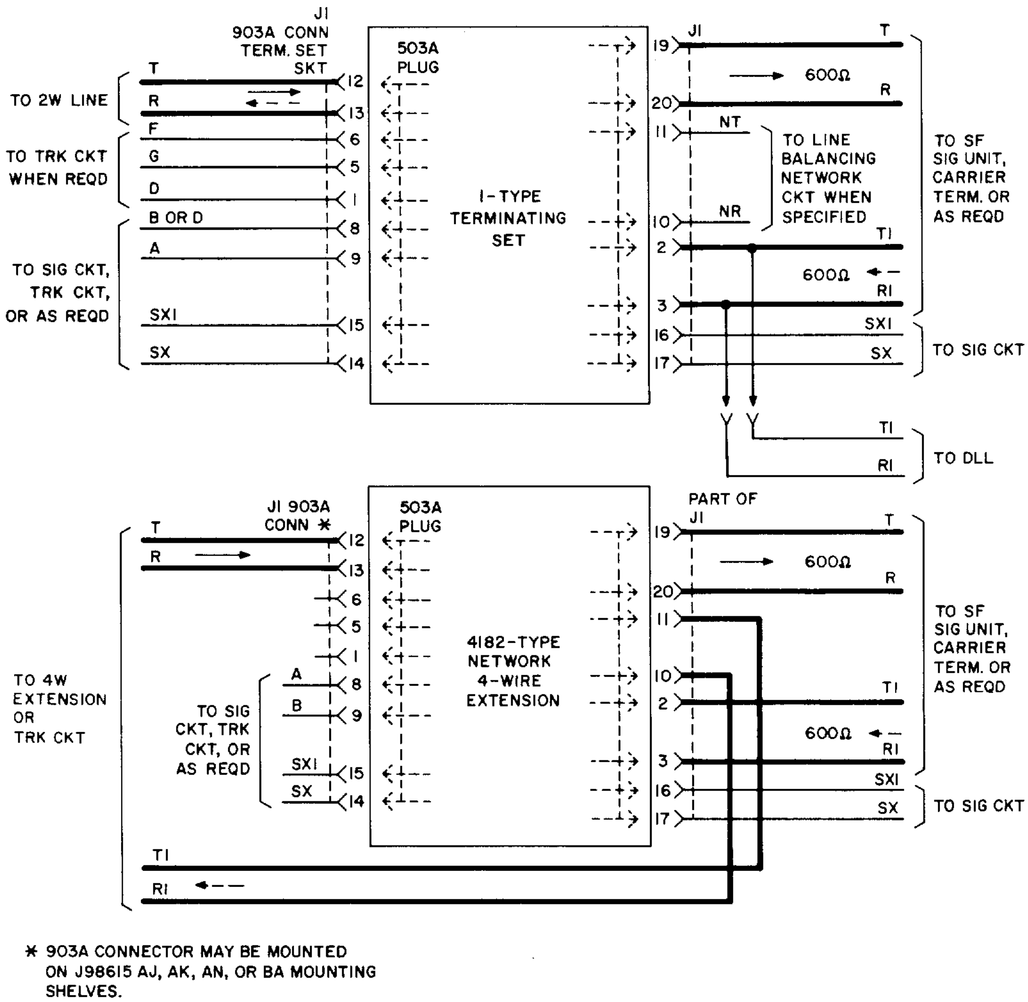


Fig. 2—Terminal Correspondence—1-Type Terminating Set and 4182-Type Network

of a 602D tool. An extender tool, 755A, is helpful in removing the 89-type plug-in resistor from its socket.

> ***Note:*** The 89-type resistors are not furnished with the network. They must be ordered separately as needed to meet job requirements.

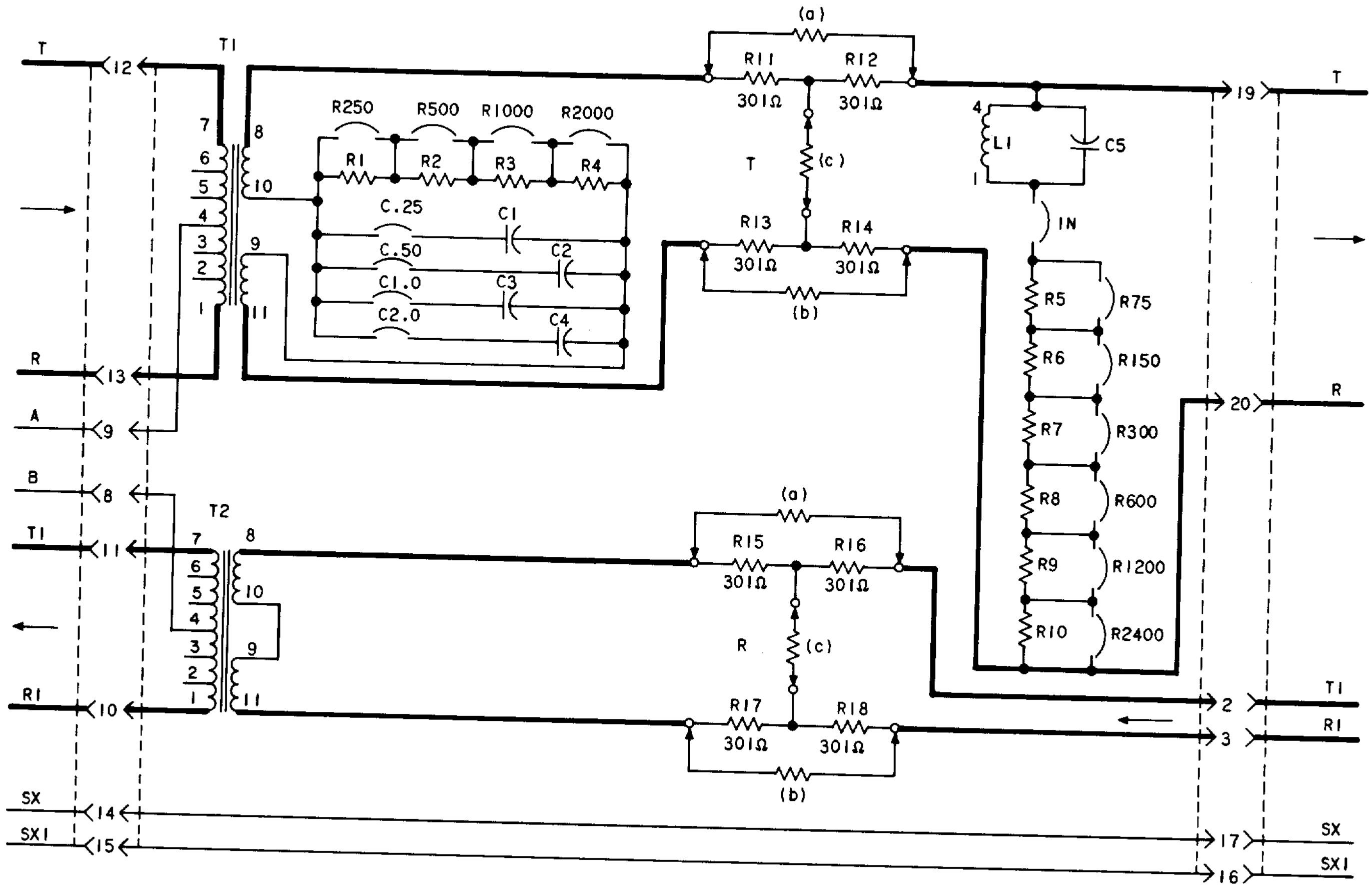
2.03 Fifteen screw-type switches are mounted on the network faceplate. These switches permit the indicated component values to be added to or removed from the circuit, as required, when adjusting equalization.

3. CIRCUIT DESCRIPTION

3.01 The 4182C 4-wire extension network is designed to post equalize H88 loaded 4-wire extensions. The network equalizes only one direction of transmission while supplying level control (89-type pad) and impedance matching in the other direction.

3.02 The schematic shown in Fig. 3 is used for the following discussion. The transmission path toward the 4-wire extension (T1,R1) supplies level control with 89-type resistors and, through transformer T2, matches the 600-ohm equipment impedance to the 1200-ohm impedance of the 4-wire extension.

3.03 Voice-frequency signals received from the 4-wire extension (T,R) enter the 4182C network through transformer T1 which matches the 1200-ohm cable impedance to the 600-ohm equipment impedance. The equalizing elements of



NOTE:
RESISTORS (a), (b), AND (c) ARE CONTAINED IN THE PLUG-IN 89-TYPE RESISTOR AND ARE NOT FURNISHED WITH THIS NETWORK.

Fig. 3—Schematic Diagram of 4182C Network

the 4182C network are divided into two sections: the low-frequency section (for frequencies below 1000 Hz) is wired in series with the tip and ring conductors and the high-frequency section (1000 to 3000 Hz) is wired across the tip and ring. Interaction between the high- and low-frequency equalizing sections is reduced by the level control pad designated T.

3.04 The high- and low-frequency sections are adjusted by means of the faceplate screw-type switches. In the low-frequency section, the capacitors are added to the circuit when the associated screw-type switches are closed (turned in) and are removed when the switches are opened (turned out). The resistors in both the high- and low-frequency sections are bypassed when the associated screw-type switches are closed and are placed in the circuit when the screw-type switches are opened. When closed, screw-type switch designated IN puts the high-frequency section in the circuit and removes the high-frequency section when opened.

4. TRANSMISSION PERFORMANCE

A. General

4.01 The 4182C network is used when the 4-wire extension consists of a section of H88 loaded cable that requires equalization of the transmission path. For short lengths of H88 loaded cable, as defined in Section 852-307-101, the 4182C network may be used with the equalizer disabled to produce 1200-ohm impedance to the cable. The 4182C network provides transmission level control, impedance matching between H88 loaded cable and 600-ohm circuits, and a transformer center tap on the 1200-ohm side for simplex signaling. The 4182C network has the same equalizing elements that are found in the 359D equalizer. Independently adjustable low- and high-frequency equalization sections provide the necessary equalization to obtain a substantially flat frequency response over the range of 250 to 3000 Hz. The high-frequency section is designed specifically for equalization of H88 loaded, high-capacitance cable. The low-frequency section is not limited to equalization of H88 loaded, high-capacitance cable but may also be used to provide low-frequency equalization in other loading systems, or in low-capacitance systems such as 25-gauge MAT cable. The 1000-Hz insertion loss varies between 0 and 3 dB as equalization is adjusted.

4.02 Prescription settings for the equalizer sections of the 4182C network for both high- and low-capacitance H88 loaded cable may be found in Section 332-116-201.

B. High-Capacitance (.083 μF per mile) H88 Loaded Cable

4.03 Figures 4 through 9 are curves that illustrate the effect of varying the values of the components of the equalizer sections of the network.

4.04 The series arm low-frequency components (R_{LF} and C_{LF}) provide compensation for amplitude distortion in the 4-wire line facilities at frequencies up to approximately 1000 Hz. Figures 4 and 5 illustrate typical equalization losses which can be obtained by various combinations of C_{LF} and R_{LF}. Figure 4 shows the results of keeping C_{LF} constant at 0.25 μF and varying R_{LF} with the HF section out of the circuit. Figure 5 shows the results of keeping R_{LF} constant at 1500 ohms and varying C_{LF} with the HF section out of the circuit.

4.05 The shunt arm high-frequency components provide amplitude equalization for H88 loaded, high-capacitance cable where the nominal cutoff is 3500 Hz. Capacitor C1 and inductor L1 form a parallel resonant circuit tuned to 3000 Hz which is in series with the adjustable resistor R_{HF}. Varying resistor R_{HF} adjusts the amount of high-frequency equalization for various lengths and gauges of facilities. Figure 6 illustrates the typical corrective losses which may be obtained by various settings of R_{HF}.

4.06 While the series arm low-frequency components (R_{LF} and C_{LF}) provide compensation for amplitude distortion, they introduce delay distortion at the same time. Figures 7 and 8 illustrate typical delay-frequency characteristics obtained by various combinations of C_{LF} and R_{LF}. Figure 7 illustrates results of keeping C_{LF} constant at 0.25 μF and varying R_{LF} with the HF section out of the circuit. Figure 8 shows the results of keeping R_{LF} constant at 1500 ohms and varying C_{LF} with the HF section out of the circuit.

4.07 While the shunt arm high-frequency components provide compensation for amplitude distortion, they also introduce delay distortion. Figure 9 illustrates typical delay-frequency characteristics obtained by varying R_{HF}.

C. Low-Capacitance (.064 μF per mile) H88 Loaded Cable

4.08 The 4182C network may be used to effectively equalize the low-capacitance MAT cable. Since the new MAT cable has a relatively flat frequency response between 1 and 3 kHz, only the low-frequency section of the equalizer is required. (The HF section of the equalizer must be removed from the circuit by opening the IN screw-type switch.)

4.09 The insertion loss of the network, not including the 89-type resistor, varies between 0.4 and 0.8 dB depending on the amount of equalization required.

4.10 The loss-frequency and delay characteristics are identical to those shown for high-capacitance cable.

5. APPLICATION

5.01 Optional wiring of the shelf mounting in the VF Terminal Equipment bay (J98617J) provides the additional transmission path on the extension side of the network by using the precision balance network leads (NT, NR) of the 1-type terminating set socket. Figure 10 illustrates the application of the network in the bay when no signal conversion is required. Figure 11 shows the application of the network when signal conversion is required.

5.02 When the network is used in the 1-type terminating set socket of the 24V4 repeater

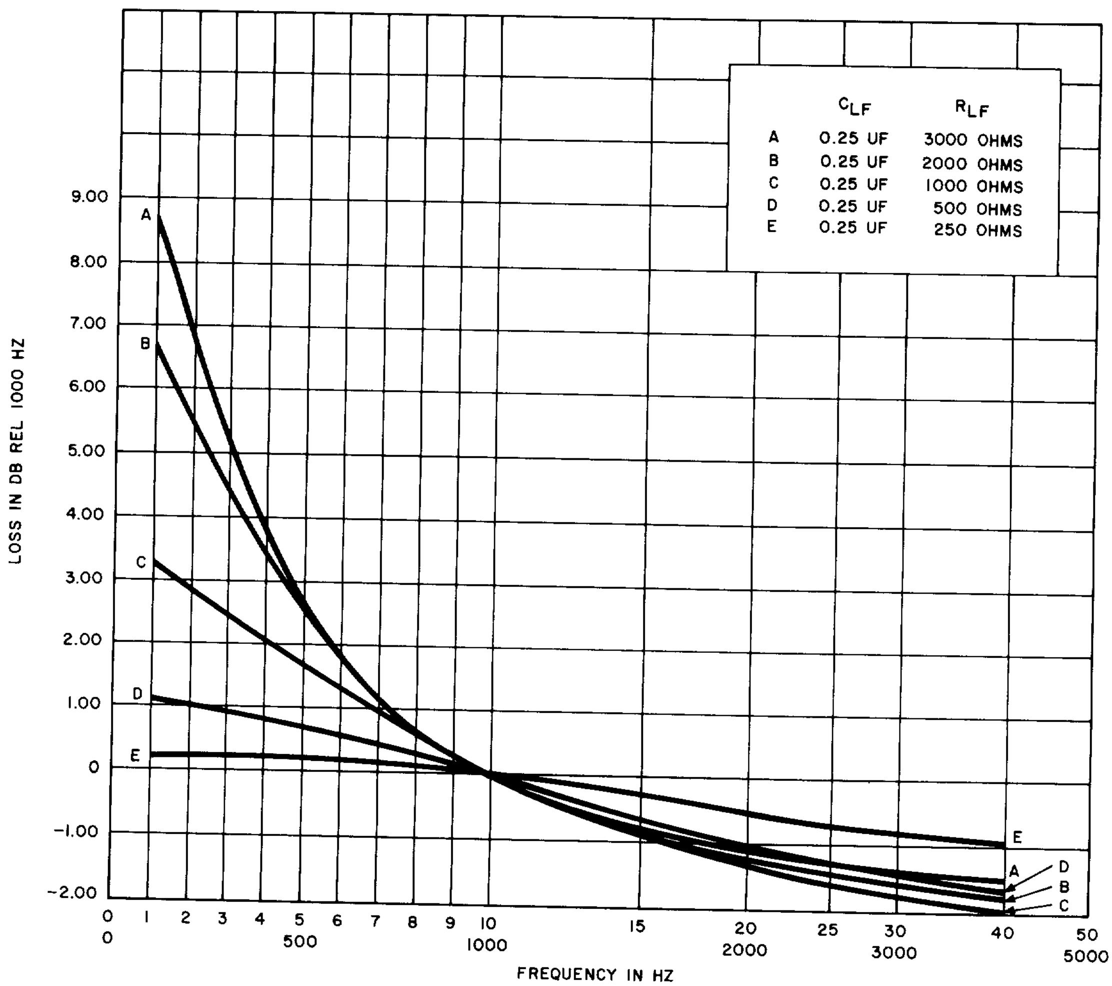


Fig. 4—4182C Network, Low-Frequency Section, Loss-Frequency Characteristics Between 600-Ohm Impedance—Varying R_{LF} For C_{LF} Constant at 0.25 μF

mounting, the repeater becomes the equivalent of a 44V4A repeater. On existing 24V4 shelves, the wiring needed for the NT and NR leads may not be provided. Where NT and NR leads of the terminating set socket are provided, they are used to obtain the additional transmission path toward the 4-wire extension. Figure 12 shows the application of the network when no signal conversion is required. When signal conversion is required, the application is shown in Fig. 13.

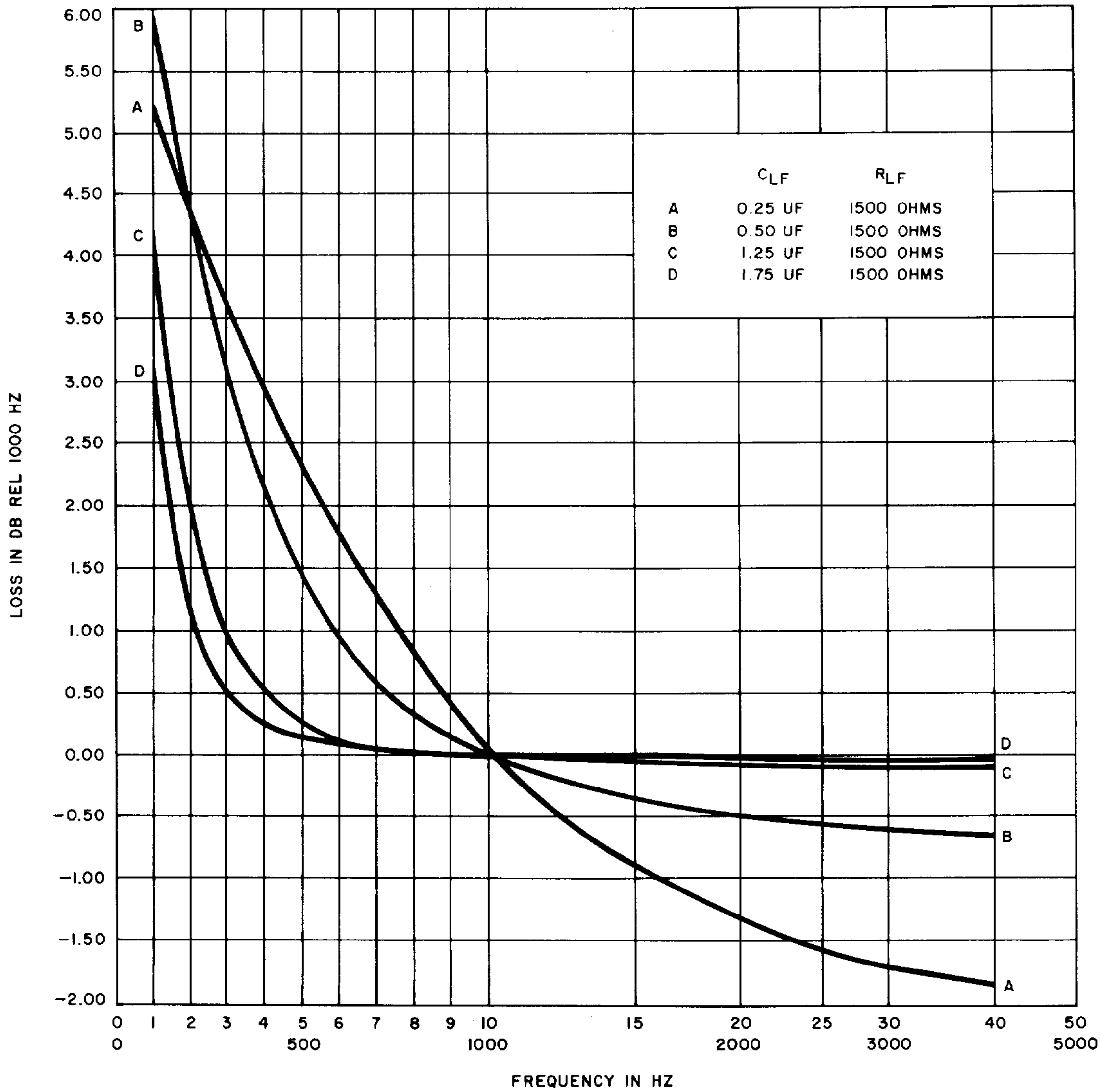


Fig. 5—4182C Network, Low-Frequency Section, Loss-Frequency Charcteristics Between 600-Ohm Impedances—Varying C_{LF} For R_{LF} Constant at 1500 Ohms

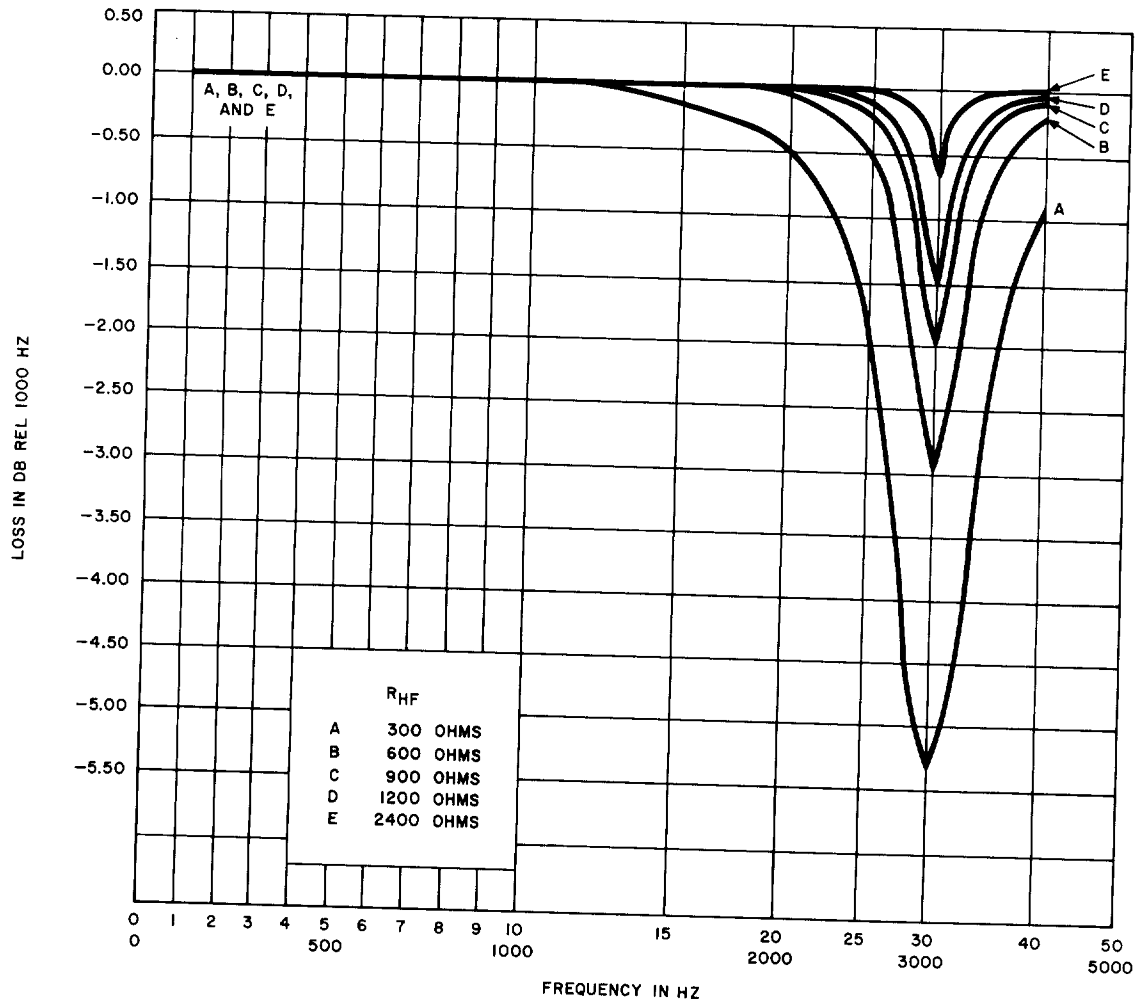


Fig. 6—4182C Network, High-Frequency Section, Loss-Frequency Characteristics Between 600-Ohm Impedances—At Various Settings of R_{HF}

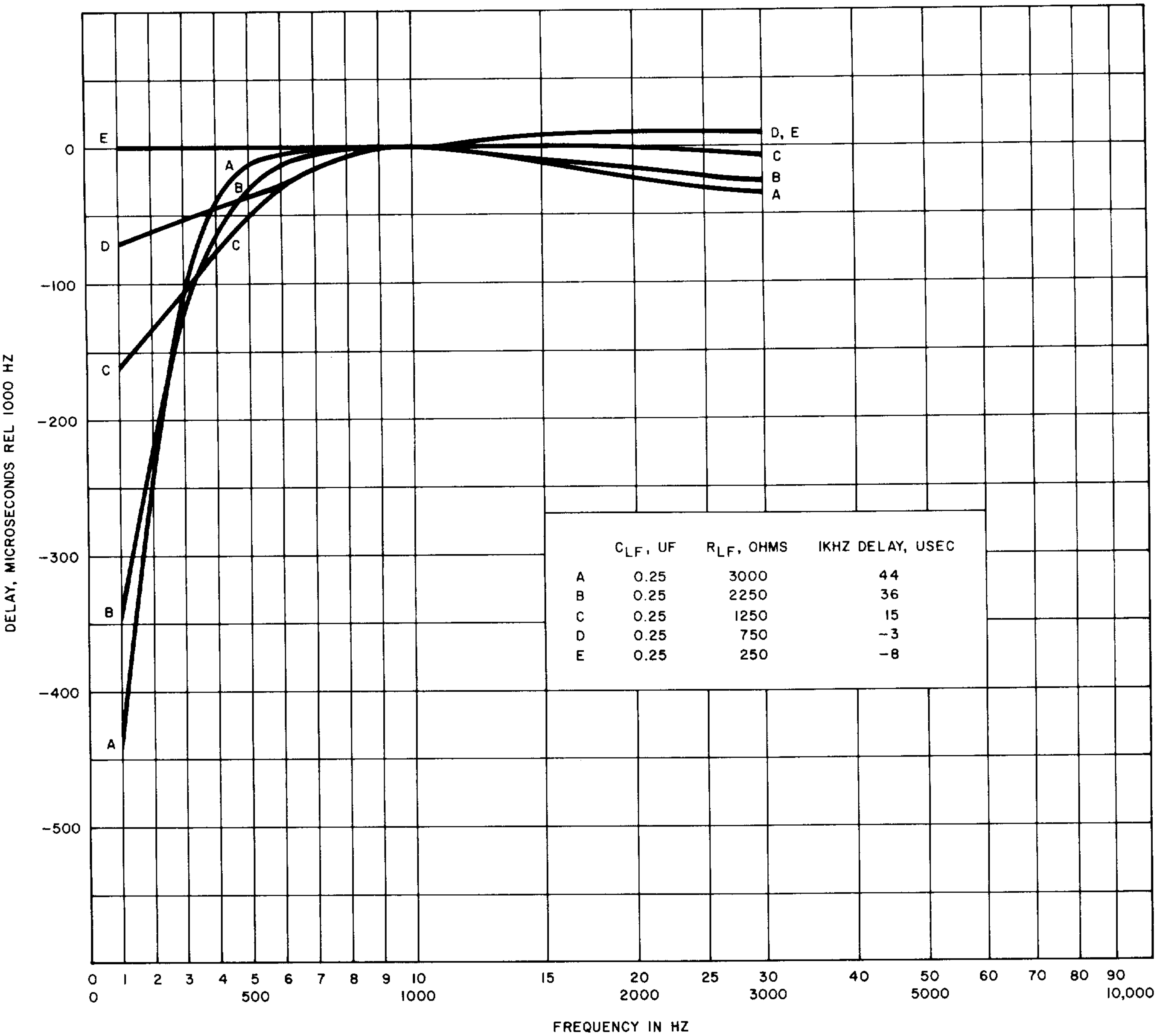


Fig. 7—4182C Network, Low-Frequency Section, Delay-Frequency Characteristics Between 600-Ohm Impedances— Varying R_{LF} For C_{LF} = 0.25 μF

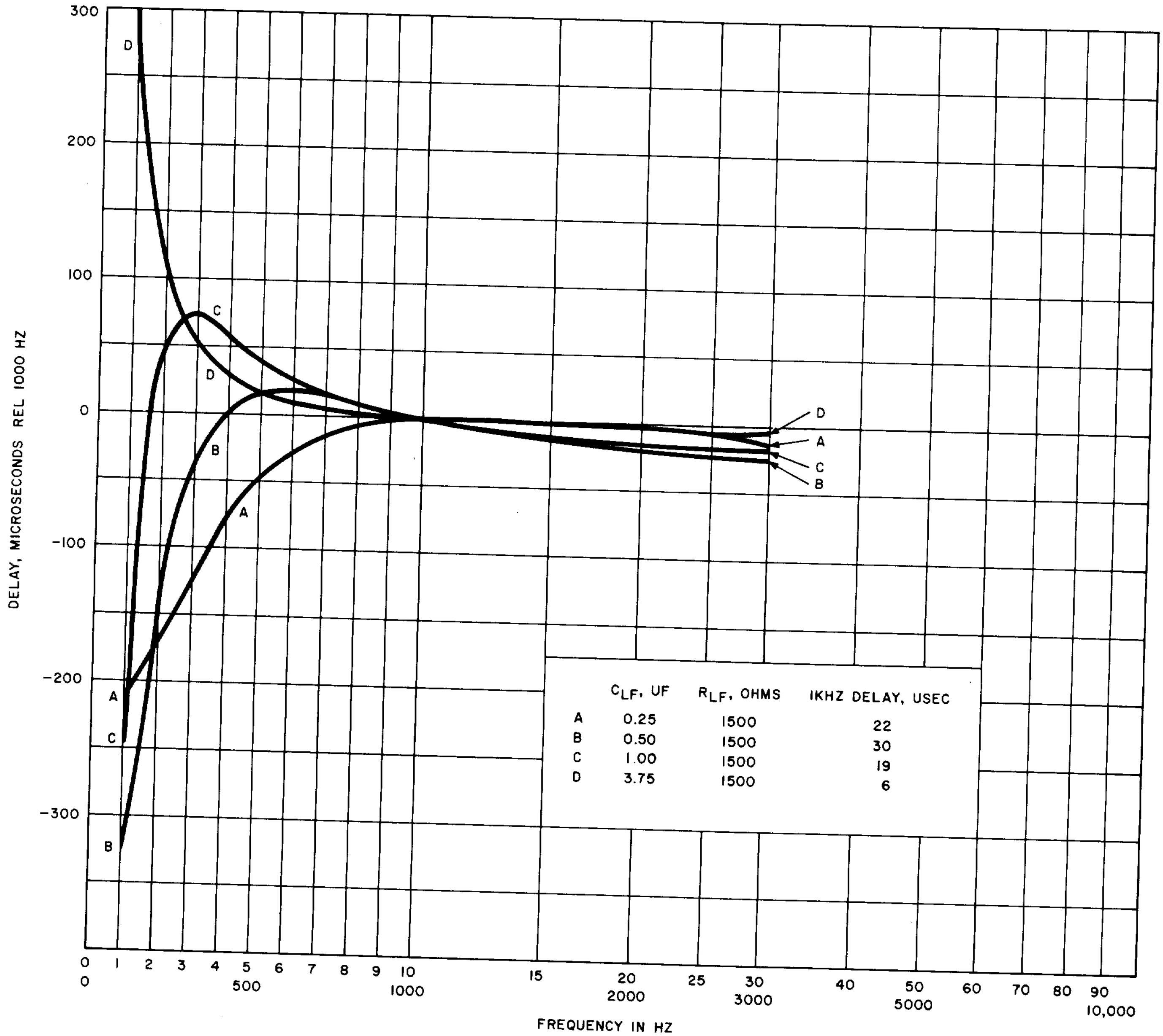


Fig. 8—4182C Network, Low-Frequency Section, Delay-Frequency Characteristics Between 600-Ohm Impedances—Varying C_{LF} For R_{LF} = 1500 Ohms

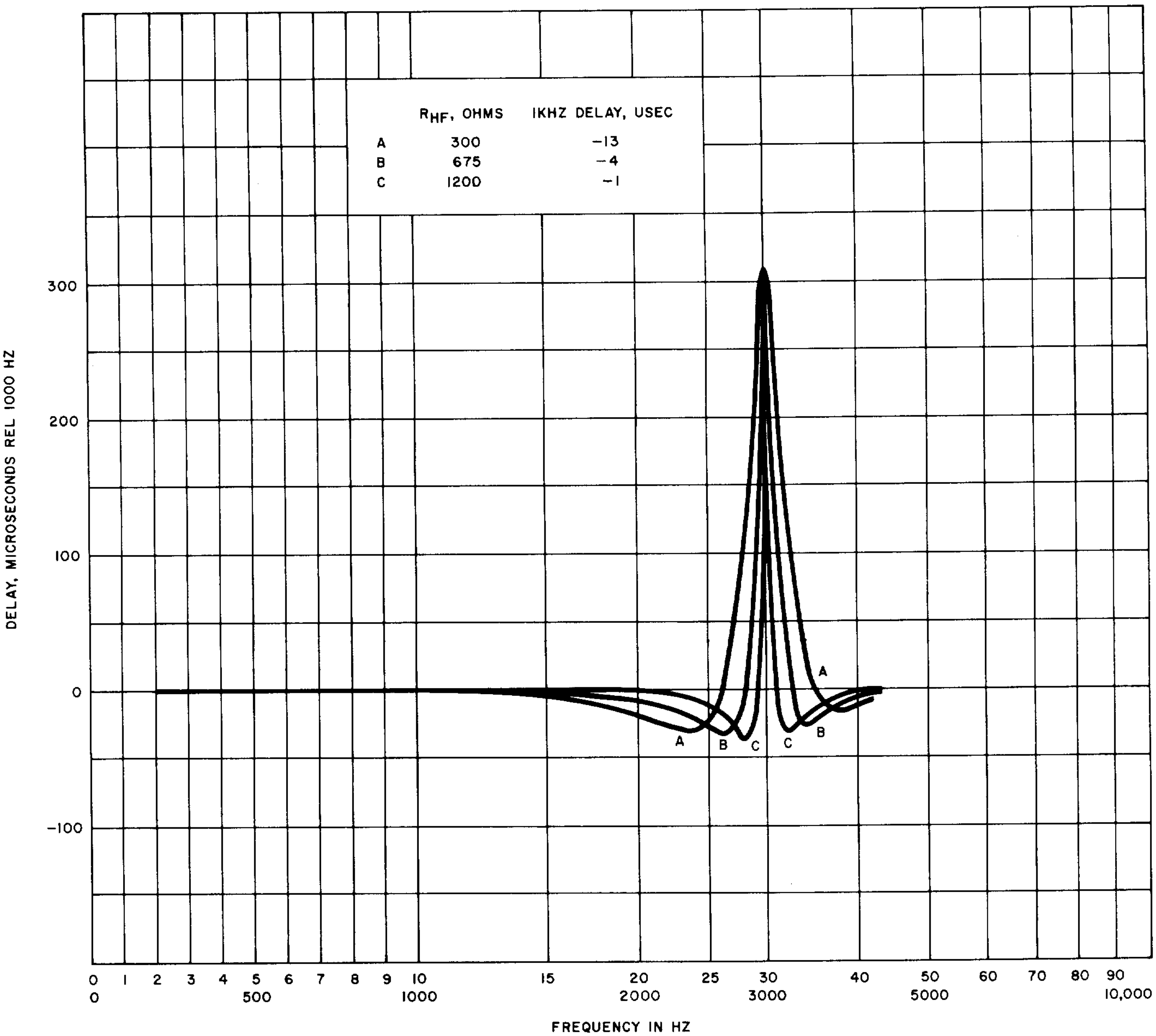


Fig. 9—4182C Network, High-Frequency Section, Delay-Frequency Characteristics Between 600-Ohm Impedances—At Various Settings of R_{HF}

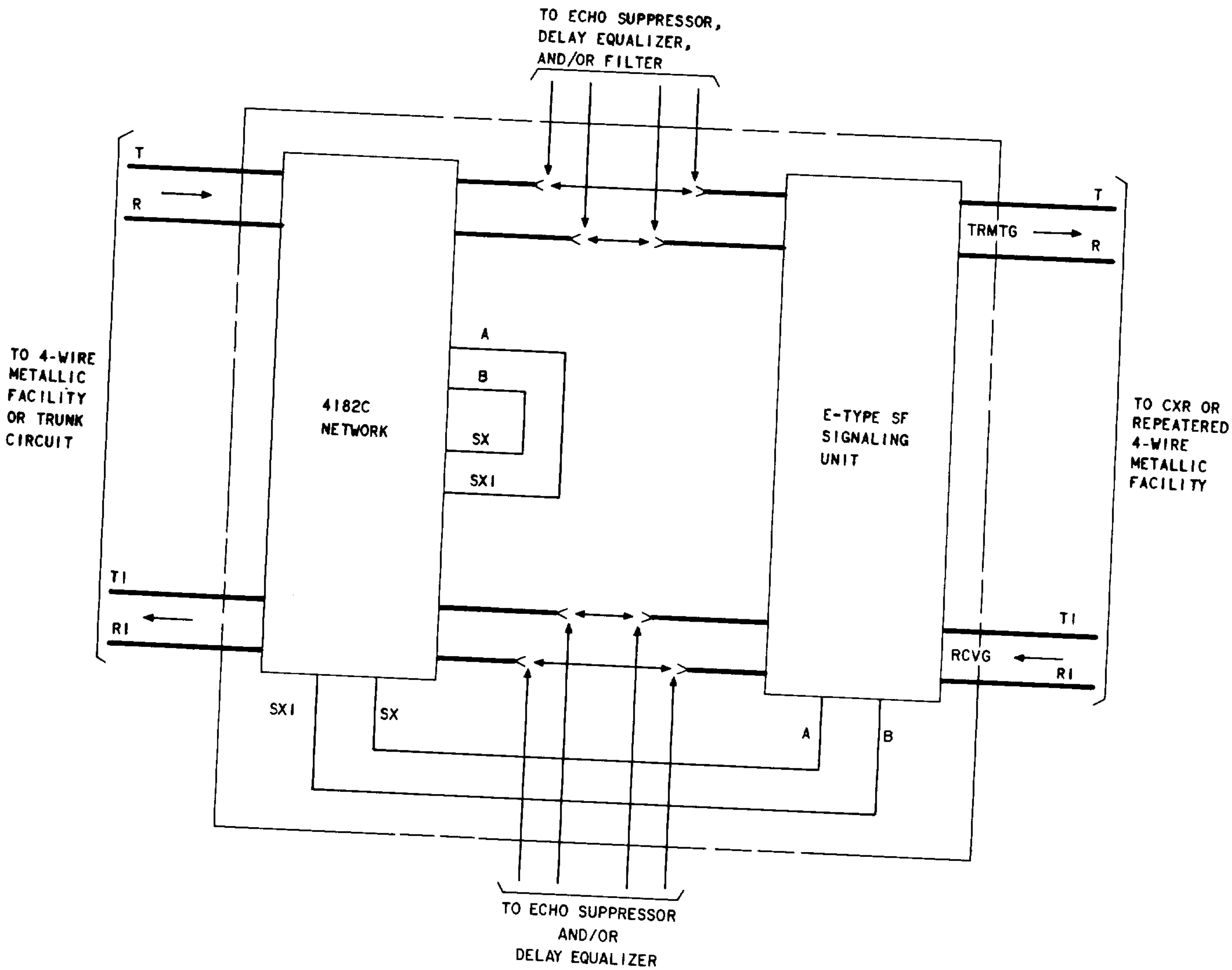


Fig. 10—4182C Network Used in VF Terminal Equipment Bay—No Signal Conversion Required

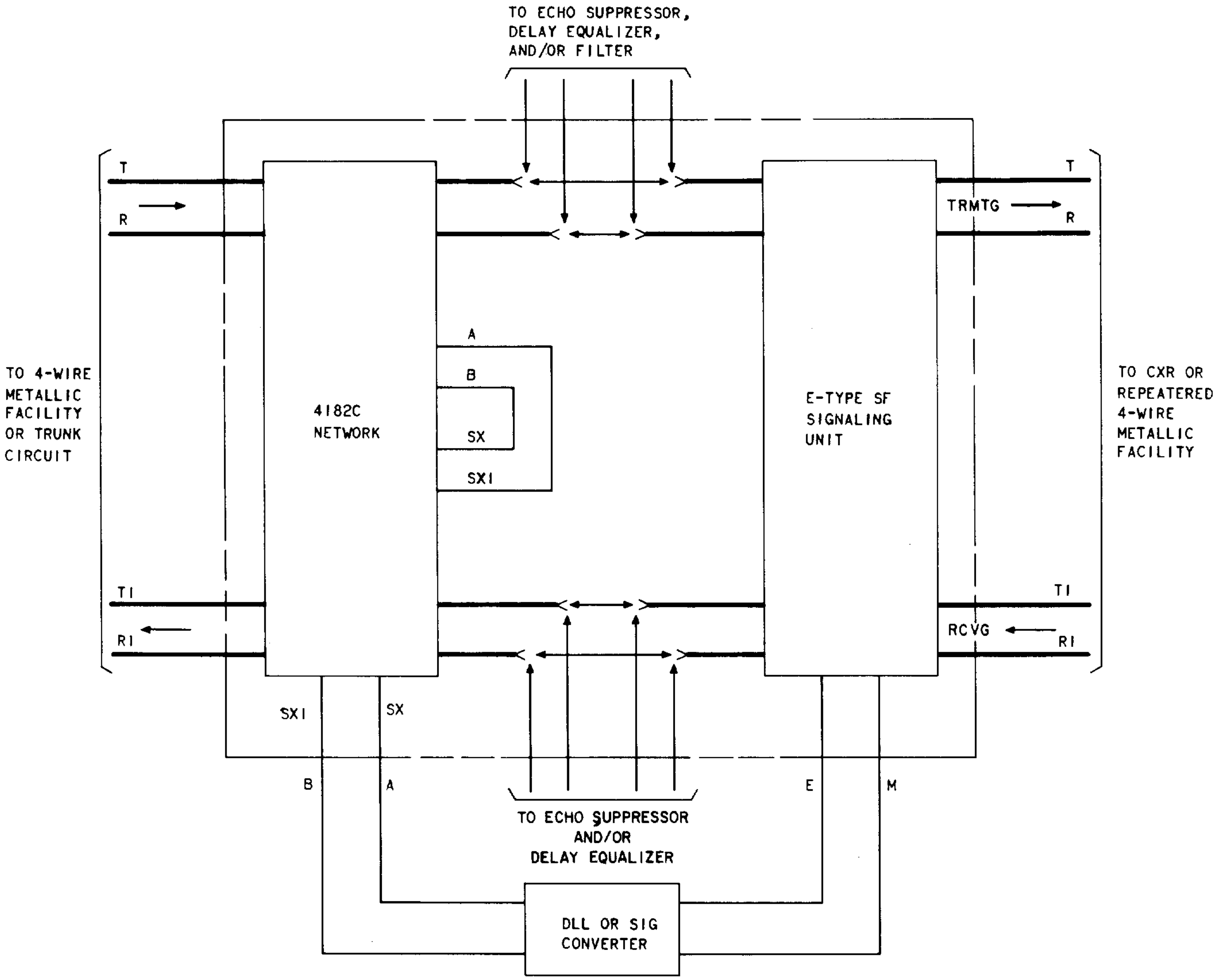


Fig. 11—4182C Network Used in VF Terminal Equipment Bay—Signal Conversion Required

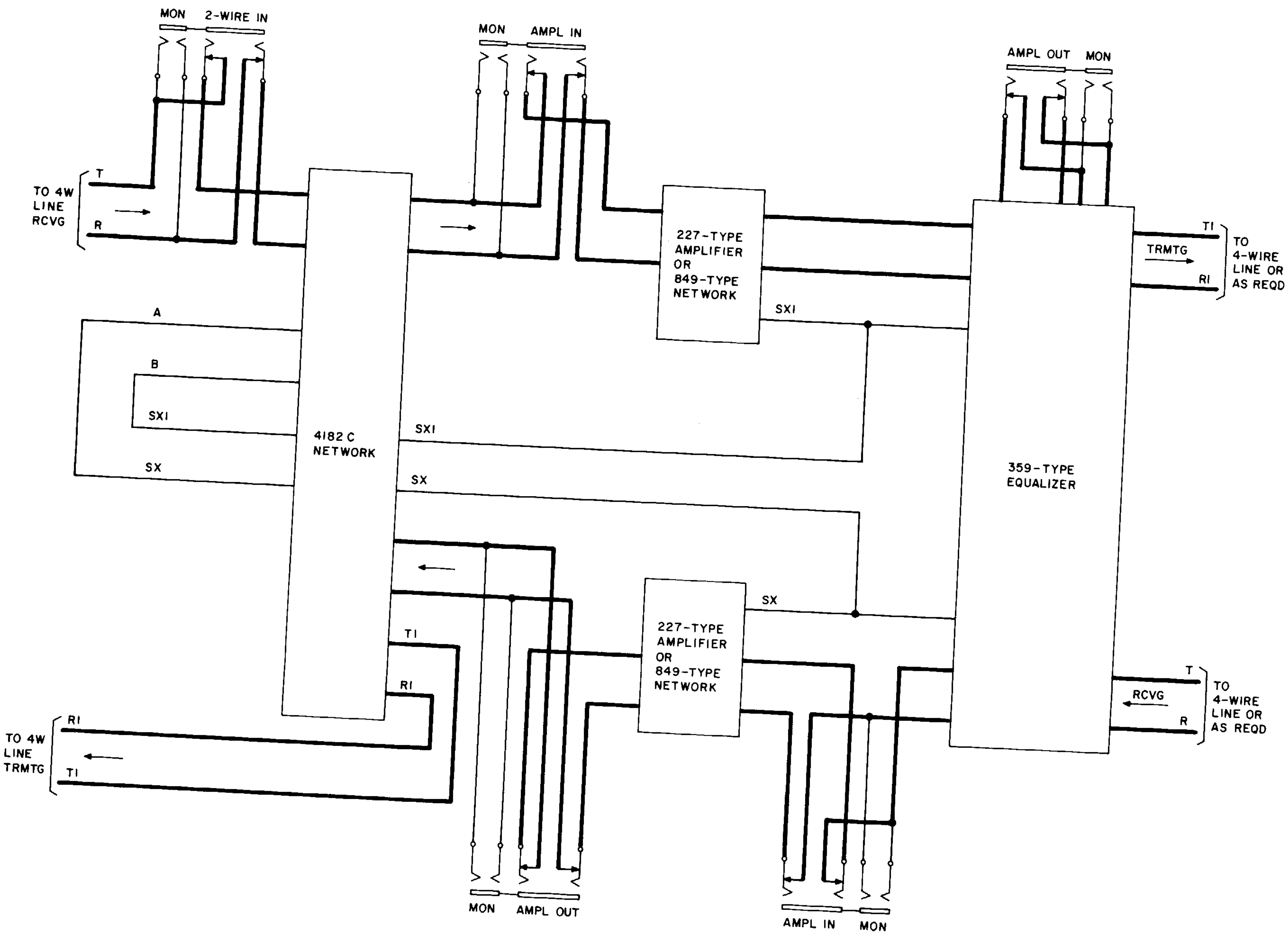


Fig. 12—4182C Network Used in 24V4 Repeater Mountings—No Signal Conversion Required

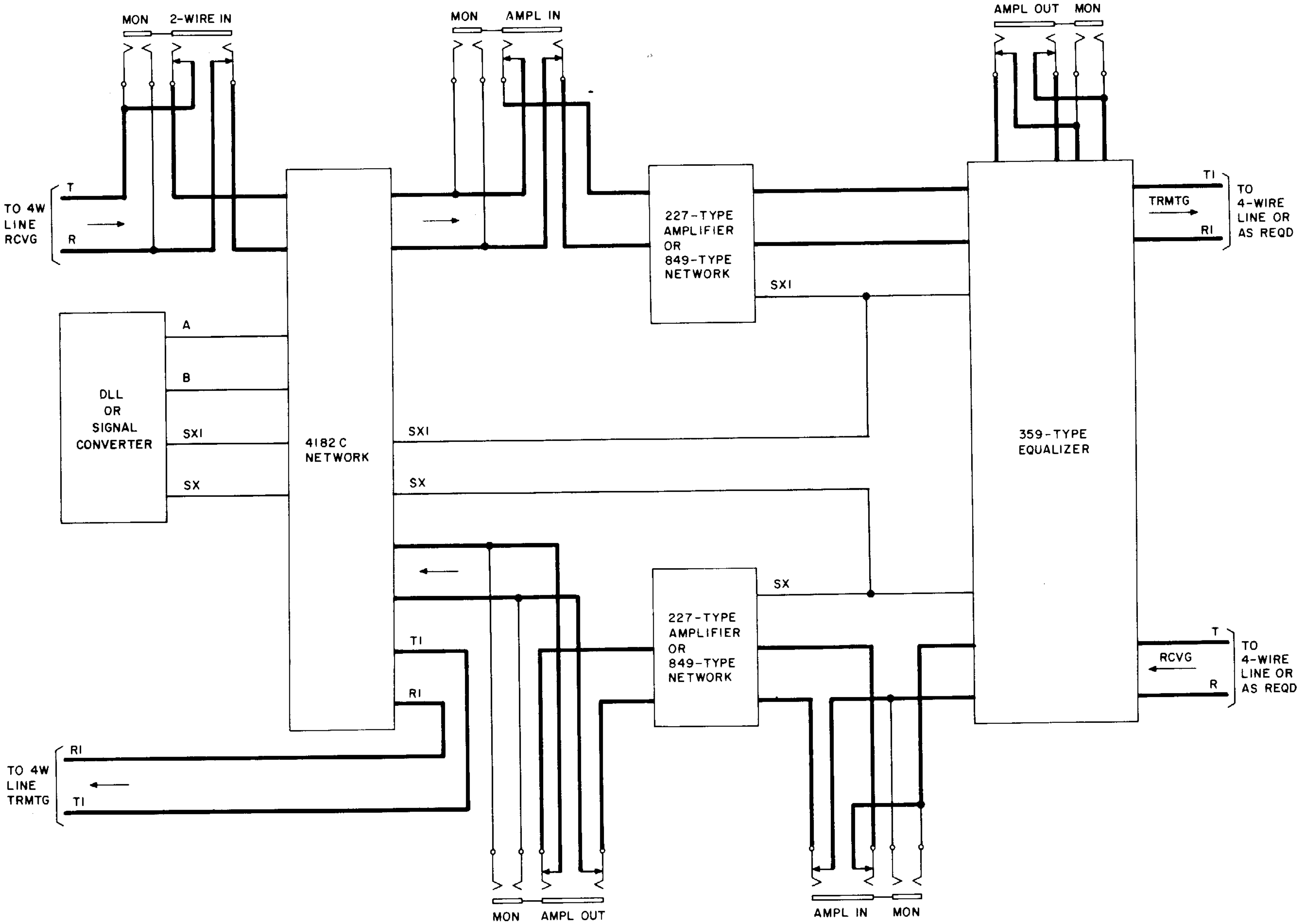


Fig. 13—4182C Network Used in 24V4 Repeater Mounting—Signal Conversion or Repeat Signal Required