N AND ON CARRIER TELEPHONE SYSTEMS
ADJUSTABLE DEVIATION EQUALIZER
DESCRIPTION

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1. GENERAL

1.01 This section describes the J98703BE adjustable deviation equalizer. This equalizer introduces variable losses across the N or ON high-frequency band to compensate for the complex loss versus frequency characteristics encountered in individual N or ON carrier systems.

1.02 The equalizer is normally installed at the output of an N-carrier low-high repeater on an N-type line. The unit operates in the N or ON high-frequency band (172 to 268 kc for N and ON2 carrier and 168 to 264 kc for ON1 carrier). The equalizer is capable of operating in only one direction of transmission. Several equalizers may be required for each direction of transmission along some systems. The adjustable deviation equalizer provides up to ±10 db of slope equalization, ±5 db of bulge equalization, ±5 db of cubic equalization, and ±5 db quartic equalization. Slope equalization is the type of correction required for linear deviation in transmission level over the entire frequency spectrum. Bulge equalization is the type of correction required for excessive deviation at the center of the frequency spectrum. Cubic equalization is the type of correction required for excessive deviation at the center of both low and high portions of the frequency spectrum. Quartic equalization is a type of correction required for excessive deviation at the low, center, and high portion of the frequency spectrum. Four controls are provided, one to adjust each type of equalization in a positive or negative direction. Engraved on the face panel above each control is a sketch indicating the type of equalization provided. The flat loss introduced by the equalization networks is compensated by the gain of a two-stage feedback amplifier, so that the equalizer is essentially a 0-db gain device. Power, fusing, and fuse alarms are obtained from a J98703AL fuse panel which supplies +130 volts dc to the equalizer.

2. EQUIPMENT DESCRIPTION

2.01 The adjustable deviation equalizer is mounted in a 19-inch channel- or duct-type bay framework at powered repeater sites. The unit contains two hermetically sealed equalization networks, which are controlled by four panel-mounted potentiometers, and a two-stage vacuum tube amplifier. The potentiometers are labeled SLOPE, BULGE, CUBIC and QUARTIC. The equalization networks are mounted at the back of the chassis; pigtail mounted components associated with the amplifier are mounted in miniplas assemblies behind the front panel. Control knobs, vacuum tubes, transformers, test points, and a filament activity test switch are mounted on the face of the panel. The chassis is constructed of aluminum, approximately 3-1/2 inches high and 19 inches wide. Two covers are available for the equalizer: J98703BE, List 2 provides a cover for use when the equalizer is mounted in a duct-type bay and J98703BE, List 3 provides a cover for use in a channel-type bay. The cover prevents excessive crosstalk when two equalizers are mounted in the same bay. A photograph of the equalizer is shown in Fig. 1.

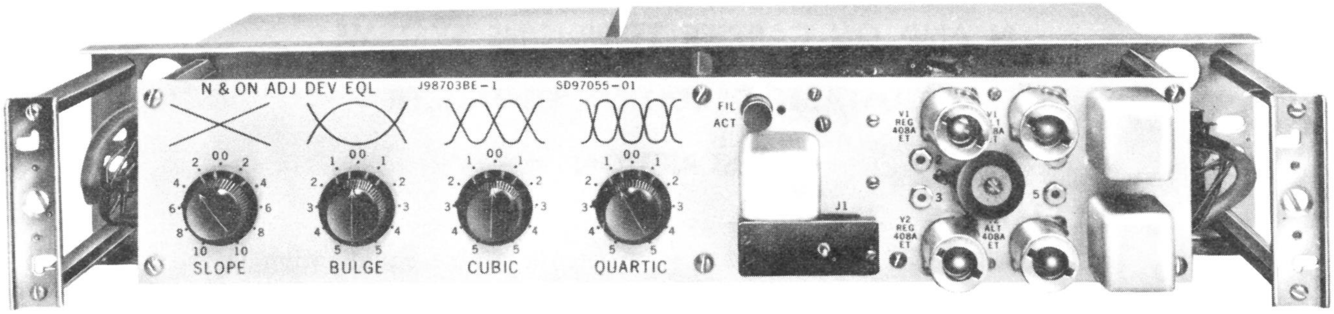

Fig. 1 — J98703BE Adjustable Deviation Equalizer

3. CIRCUIT DESCRIPTION

A. General

3.01 The adjustable deviation equalizer contains two control networks and an amplifier. Each control network contains two equalizers which provide slope, bulge, cubic and quartic equalization across the N or ON high-frequency band. Each type of equalization may be introduced individually to compensate for coarse deviations in transmission level, or in combination to compensate for more complex deviations. Equalization is accomplished in the two control networks, each of which contains two potentiometers to control the amount of equalization. The equalization networks introduce approximately a flat 52-db loss in transmission level. The two-stage amplifier provides a 52-db gain to compensate for this loss. The amplifier also provides a ±1 db gain adjustment (except early production units) which enables a flat gain control of the equalizer output.

B. Control Networks

3.02 The control networks consist of capacitors, inductors, and resistors in hermetically sealed containers. The resistance values of the networks are altered by adjusting the associated 10,000-ohm potentiometer, thus changing the magnitude and slope of equalization. The characteristic curves associated with each potentiometer are shown in Fig. 2.

3.03 Fig. 2 shows a block diagram of the adjustable deviation equalizer. Transformer T1 matches the impedance of the control networks to that of the line. Capacitors C1 and C2 are shunted across the transformer windings to improve the transformer insertion loss characteristic. A dc bypass path is provided around the equalizer for repeater power transmitted on the cable pairs. This path is between the center taps of the line sides of transformers T1 and T3. Control networks 218B and 219B provide the adjustable transmission frequency characteristics required to equalize transmission level deviations. The SLOPE control provides up to ±10 db of slope equalization to correct any linear deviation in transmission level over the entire frequency spectrum. Maximum slope equalization, in a positive direction, is achieved with the SLOPE control rotated fully clockwise (approximately 113 ohms). Maximum slope equalization, in a negative direction, is achieved with the SLOPE control rotated fully counterclockwise (approximately 5000 ohms). Minimum equalization is provided with the SLOPE control set at the center position (approximately 753 ohms). The BULGE control provides up to ±5 db of bulge equalization to correct nonlinear deviations in signal level that are maximum near the center of the frequency spectrum and minimum at the low and high ends of the frequency spectrum. Maximum equalization, in a positive direction, is achieved with the BULGE control rotated fully clockwise (approximately 5000 ohms). Maximum equalization, in a negative direction, is achieved with the BULGE control rotated fully counterclockwise (approximately 134 ohms). Minimum equalization is achieved with the BULGE control set at the center position (approximately 818 ohms). The CUBIC control provides up to ±5 db of cubic equalization to correct nonlinear deviations in signal level that are maximum at the center of both the low and high portions of the frequency

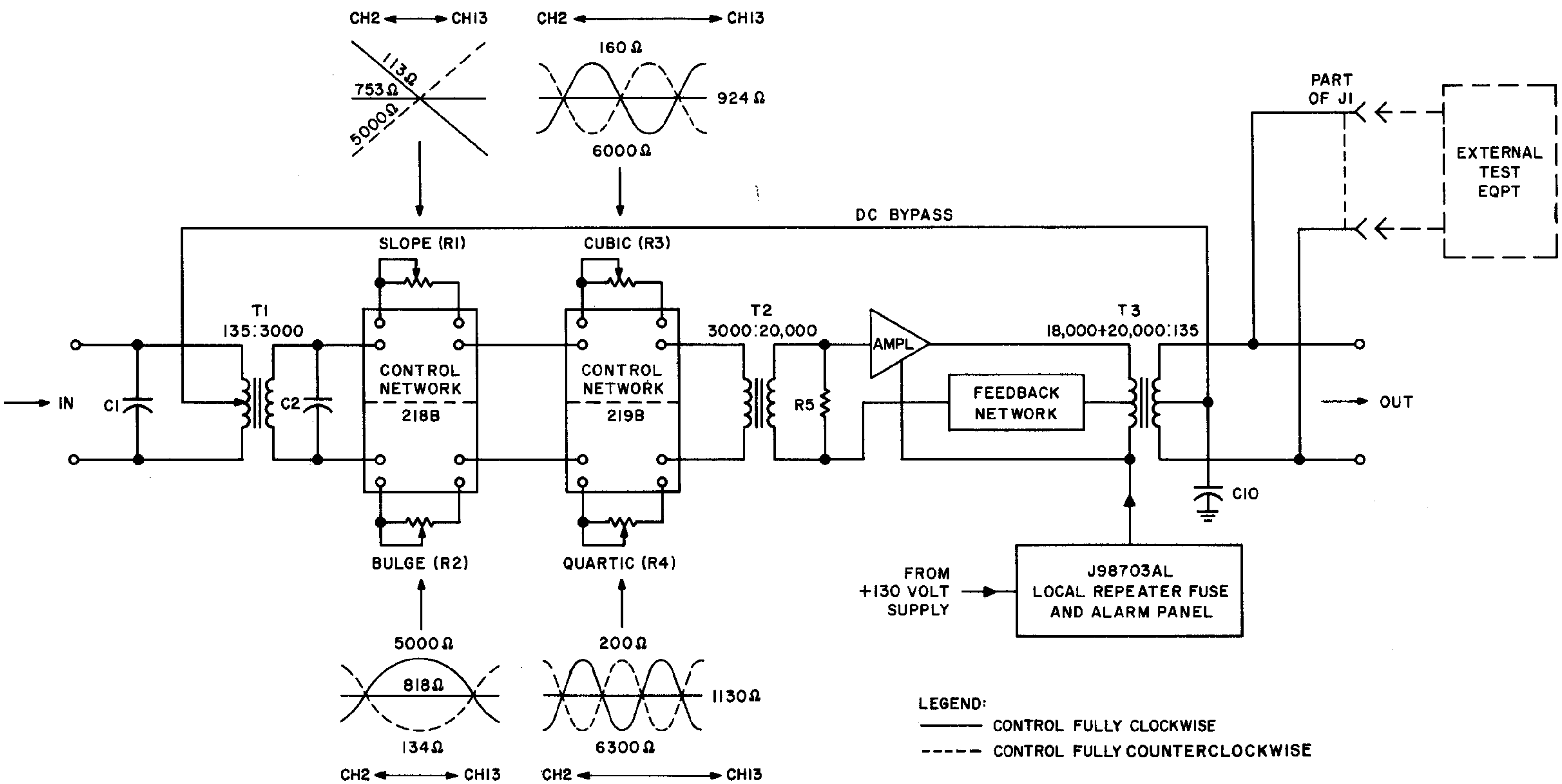

Fig. 2 — Adjustable Deviation Equalizer, Block Diagram

spectrum and minimum at the center and at extreme low and high ends of the frequency spectrum. Maximum equalization, in a positive direction, is achieved with the CUBIC control rotated fully clockwise (approximately 160 ohms). Maximum equalization, in a negative direction, is achieved with the CUBIC control rotated fully counterclockwise (approximately 6000 ohms). Minimum equalization is achieved with the CUBIC control set at the center position (approximately 924 ohms). The QUARTIC control provides up to ±5 db of equalization to correct nonlinear deviations in signal level that are maximum at the midpoints of the low, center, and high portion of the frequency spectrum and minimum between these points. Maximum equalization, in a positive direction, is achieved with the QUARTIC control rotated fully clockwise (approximately 200 ohms). Maximum equalization, in a negative direction, is achieved with the QUARTIC control rotated fully counterclockwise (approximately 6300 ohms). Minimum equalization is achieved with the QUARTIC control set at the center position (approximately 1130 ohms). The equalized signals are coupled, through impedance matching transformer T2, to the amplifier where signal is increased by 52 db to counteract the loss introduced by the control networks. The signals are then applied to the output circuits through impedance matching transformer T3.

3.04 Power, fusing, and fuse alarms for the adjustable deviation equalizer are obtained from a J98703AL fuse panel which applies +130 volts dc to the equalizer.

C. Amplifier

3.05 The amplifier portion of the adjustable deviation equalizer contains two stages of amplification and a feedback network. A schematic diagram of the amplifier is shown in Fig. 3. Transformer T2 matches the impedance of the 3000-ohm control networks to the 20,000-ohm resistance of resistor R5 and provides a voltage step-up. Impedance coupling is used between the amplifier stages. The coupling circuit consists of inductor L1, resistor R14, and coupling capacitor C8. The inductor is resonant with the tube and circuit capacitances at the lower end of the transmission range. Transformer T3 couples the output of the amplifier to pins 3 and 4 of terminal strip 2 and also provides coupling to the feedback circuit. The feedback voltage to the cathode of the input stage is controlled by a voltage divider consisting of resistors R10 and R12. Capacitor C3 provides an ac path to ground to prevent feedback voltage from reaching the grid of tube V1. Resistor R8 is the dc return for the grid. Capacitor C7 is a dc blocking capacitor and capacitors C5 and C9 are screen bypass capacitors. Resistors R6 and R7 are inserted in the grid circuits of tube V1 (REG and ALT), and R15 and R16 in the plate circuits of tube V2 (REG and ALT) to prevent high-frequency oscillations.

4. TESTING AND MAINTENANCE FEATURES

4.01 The adjustable deviation equalizer contains test points, controls, alternate tube sockets, and a test jack which enable periodic checks and maintenance. The alternate tube sockets are provided for in-service replacement of the 408A tubes. Only one alternate tube socket may be used at a time which reduces the number of voltage dropping resistors required. Jack J1 provides facilities for bridged measurements of the equalizer output, permitting checks and adjustments of system transmission level with the 2J repeater test set or the KS-15538 carrier frequency voltmeter. The FIL ACT switch in conjunction with the four test points enables checking the filament activity (space current) of tubes V1 and V2. When the FIL ACT switch is depressed, resistor R22 drops filament voltage by ten per cent. Test points 2 and 3 provide measuring facilities for checking filament activity in tube V1 and test points 4 and 5 provide measuring facilities for checking filament activity in tube V2.

5. DRAWINGS (NOT ATTACHED)

A. SD Drawings

SD-95124-01
SD-97055-01

B. J Drawings

J98703AL
J98703BE

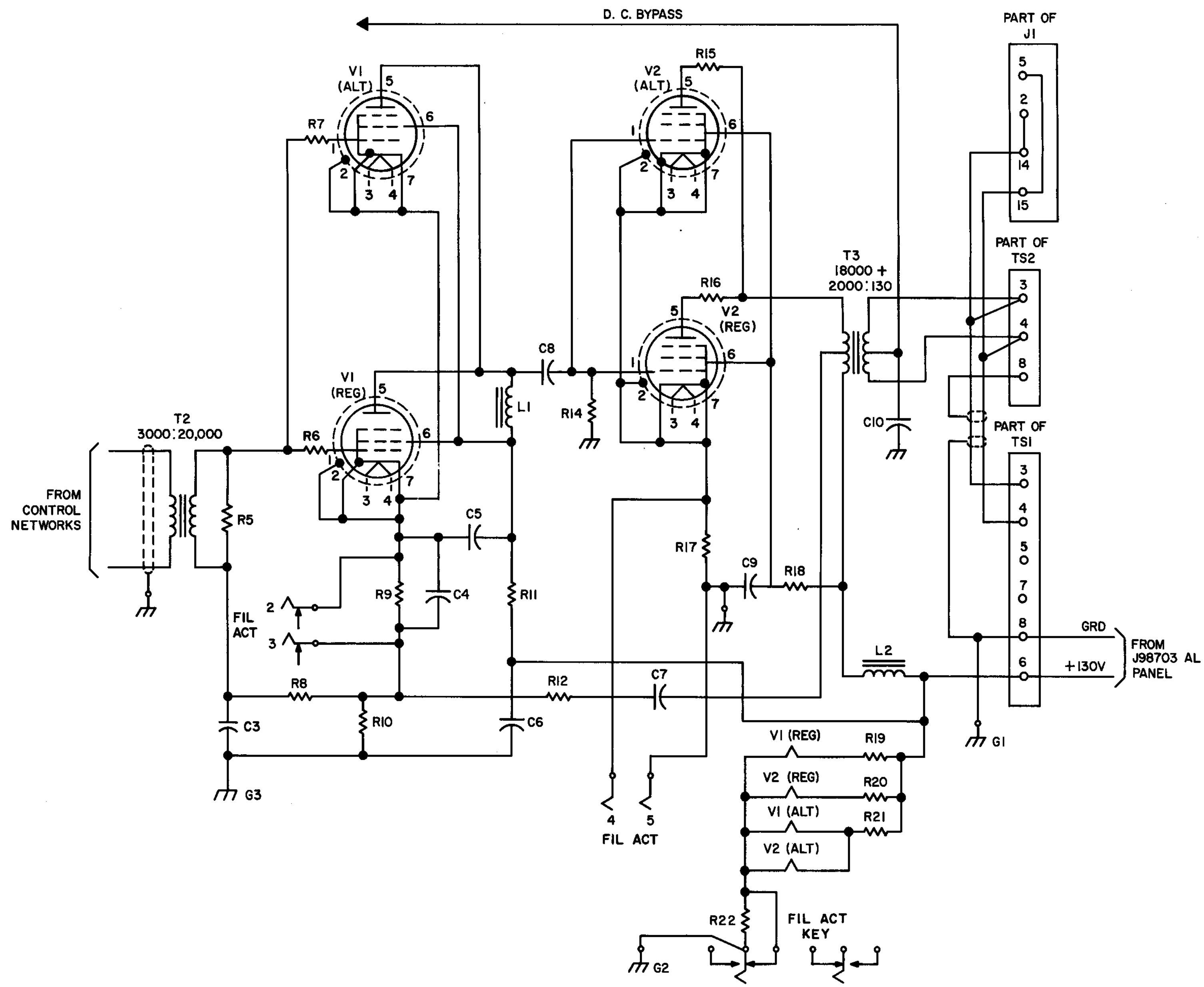

Fig. 3 — J98703BE Adjustable Deviation Equalizer, Schematic Diagram of Amplifier Section