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KS-20159 EQUALIZER-AMPLIFIER

DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 The KS-20159 L1 equalizer-amplifier has been Manufacture Discontinued and replaced by the KS-20159 L2 equalizer-amplifier. The equalizer-amplifier (Fig. 1) is used to provide equalization and amplification for 5-, 8-, and 15-kHz local program circuits utilizing nonloaded single-gauge or multigauge cables. The equipment is intended primarily as a line equalizer and amplifier for use on studio-to-transmitter loops and temporary pickup loops but may also be used in other high-quality applications. The amplifier is transistorized and operates on 48 Vdc.

1.02 This section is reissued for the following reasons:

- To add the KS-20159 L2 equalizer-amplifier which replaces the KS-20159 L1 equalizer-amplifier
- To add notes in Fig. 3 to turn the amplifier OFF when patching to AMPL IN jacks.

1.03 The equalizer-amplifier is arranged for portable or fixed use and can be rack mounted or, when installed in an apparatus case, can be used in manholes or on poles. For portable use the equipment consists of the KS-20159 equalizer-amplifier and one KS-20159 L6 power supply assembly mounted in a KS-20159 L5 carrying case.

KS-20159 Equalizer L3 and L4

1.04 The KS-20159 L3 and L4 equalizers are essentially identical and differ only in that the L3 (Fig. 2) is mounted in a 105B apparatus box. The L4 is intended for rack-mounting application or as a component part of the KS-20159 equalizer-amplifier. The unit uses a plug-in printed wiring board which contains the coil, capacitor, switch, and 10-turn potentiometer of the equalizer circuit. The chassis consists of a jack field of six twin jacks, two terminal strips, repeating coil, and an identification strip.

1.05 The transformer may be strapped to operate from either a 150- or 600-ohm source impedance and into either a 150- or 600-ohm load impedance. Table A gives strapping arrangements for the equalizer. The shunt-type equalizing circuit may be connected to either the line or drop side of the transformer. The rotary switch has a 5-kHz position, an 8-kHz position, and four 15-kHz positions. The jack field provides access to the line input (LINE IN), the equalizer input (EQ IN), the equalizer output (EQ OUT), and the line output (LINE OUT). The other two twin jacks are used only with the KS-20159 equalizer-amplifier. The terminal strips provide the necessary terminals for internal strapping and external connections. The identification strip provides for marking the equalizer for ease of identification.

KS-20159 Equalizer-Amplifier

1.06 This circuit consists of an L4 equalizer, a transistor amplifier, a cover which covers both the equalizer and the amplifier, and a mounting plate. The amplifier contains an ON-OFF switch, a step-type gain control having an OFF position and 19 steps of 2-dB increments, a continuously variable screwdriver gain control with a range of 2.5 dB, a twin jack for headphone monitoring, an output transformer which is normally strapped for either 150- or 600-ohm operation, and a terminal board with ten terminals.

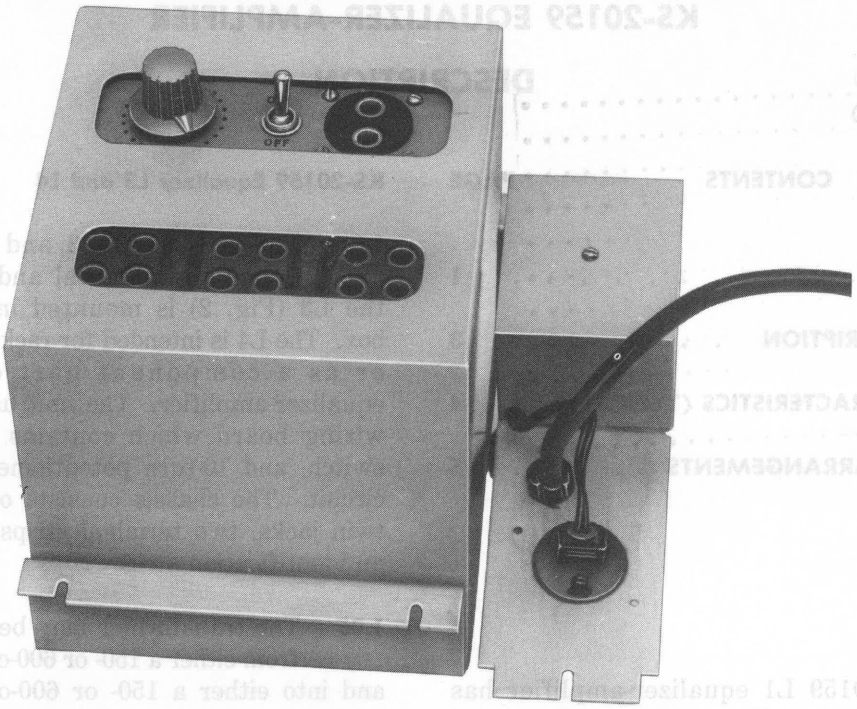


Fig. 1—KS-20159 Equalizer-Amplifier With Cover and L6 Power Supply Assembly

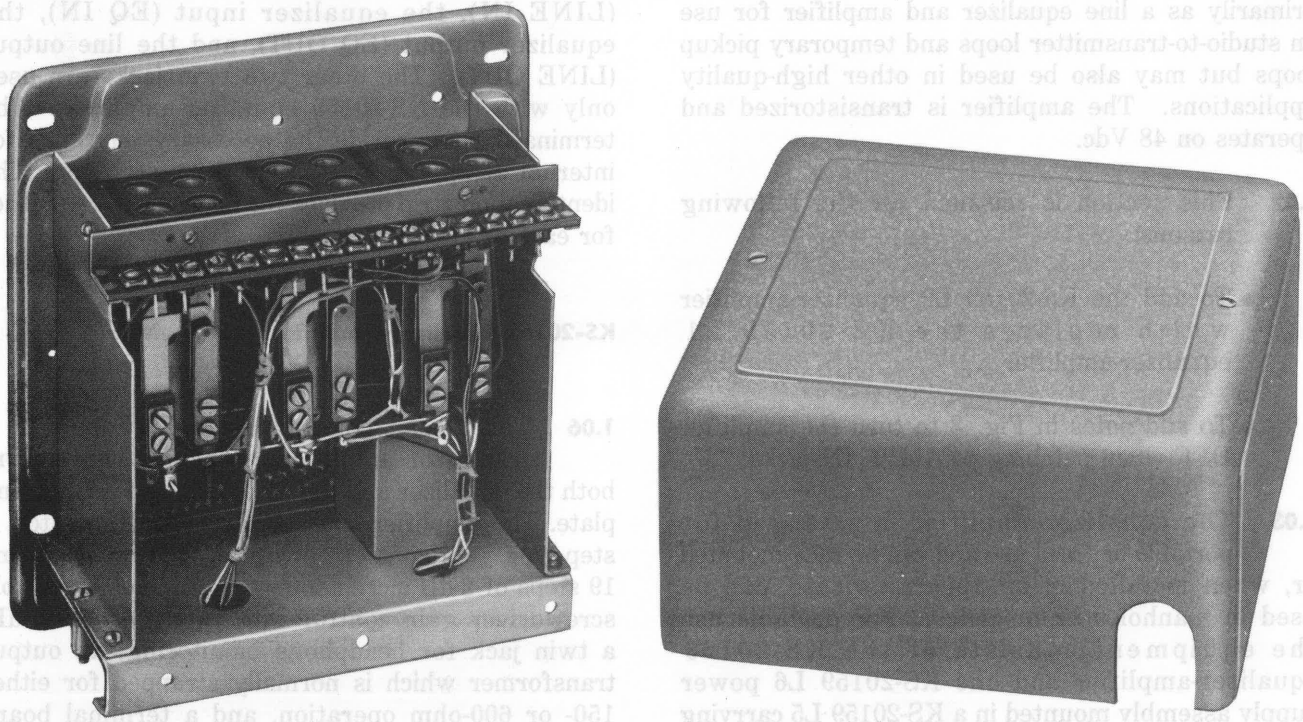


Fig. 2—L3 Equalizer and Apparatus Box Cover

TABLE A

EQUALIZER STRAPPING

EQUALIZER CONDITION	TERMINATING IMPEDANCE (NOTE 1)	TERMINAL STRAPPING		EQUALIZER INPUT TERMINALS	EQUALIZER OUTPUT TERMINALS TO AMPLIFIER (NOTE 2)	AMPLIFIER OUTPUT TERMINALS	LINE OUTPUT TERMINALS
		TB-3	TB-2				
5 and 8 kHz	600 (Note 3)	2 To 3	8 To 9 9 To 10 10 To 11 12 To 13 13 To 14	1 and 2 of TB-1	5 and 6 of TB-2	19 and 20 of TB-2	17 and 18 of TB-2
	150 (Note 4)	1 To 2					
15 kHz	600 (Note 3)	2 To 3	7 To 8 8 To 9 10 To 11 12 To 13 14 To 15				
	150 (Note 4)	1 To 2					

Note 1: Terminating impedance is the impedance into which the equalizer must operate.

Note 2: If the equalizer is used without an amplifier, terminals 5 and 6 on TB-2 should be connected to terminals 19 and 20.

Note 3: Input impedance of the KS-20159 amplifier is 600 ohms.

Note 4: To be used only with amplifier having 150-ohm input impedance.

1.07 For special applications the transistor amplifier has a low-impedance strapping option which lowers the internal output impedance of the amplifier to approximately 30 or 120 ohms. This special strapping option, however, does not change the load impedance requirements. The amplifier unit does not contain an input transformer. This transformer is contained in the equalizer where it serves both as a line repeating coil and an input transformer.

1.08 The cover, besides providing protection, also provides an identification strip for ease of identification. The mounting plate provides a rigid mounting base for the equalizer-amplifier and allows the unit to be mounted on bars on either a 19- or 23-inch rack or in a KS-20159 L5 carrying case.

KS-20159 L6 Power Supply Assembly

1.09 This assembly consists of a KS-16831 L4 power supply, a 115-Vac accommodation box, and a mounting plate. The power supply is described in CD-95297-01. The 115-Vac accommodation box provides a standard 115-Vac receptacle, a 6-foot power cord, and a knockout plug to facilitate permanent wiring whenever it is required. The mounting plate allows the assembly to be mounted adjacent to a KS-20159 equalizer-amplifier on a relay rack or in a KS-20159 L5 carrying case.

2. CIRCUIT DESCRIPTION

Equalizer Circuit

2.01 The equalizer circuit shown in Fig. 3 is essentially an adjustable RCL circuit which may be strapped across either the line or drop side of the transformer T1. The RCL circuit is composed of a continuously variable resistor R1, in series with a parallel combination of selected inductance and capacitance. Variable resistor R1 is a 1000-ohm, 10-turn potentiometer equipped with a dial which reads directly in ohms. Its setting determines the

amount of low-frequency loss introduced by the equalizer. The inductance and capacitance values are selected by ganged switch contacts S1A and S1B, respectively. The switch has six positions, one for 5-kHz equalization, one for 8-kHz equalization, and four for 15-kHz equalization. The four positions used for 15-kHz equalization are numbered 1 through 4 and select decreasing inductance values in that order. This arrangement provides a straightforward selection scheme with high-loss lines typically requiring higher numbered switch positions than low-loss lines.

2.02 The three terminal boards, TB1, TB2, and TB3, provide a total of 23 terminals for line and amplifier connections and interval strapping options (Table A). TB2 also provides the necessary terminals for wiring in external resistance and capacitance into the equalizer circuit. Under normal operating conditions, the input and output connections are made at the terminal board and the circuits are normalled through the jacks so that patching is not required.

Amplifier Circuit

2.03 The amplifier circuit shown in Fig. 3 consists of two gain controls, a 3-stage transistor amplifier, an output transformer, and a twin jack for headphone monitoring. The input transformer is contained in the equalizer portion of the circuit where it also serves as a line repeating coil.

2.04 The equalizer output is connected directly across AT101, the 600-ohm gain control. ▶Office battery appears on the tip of the AMPL IN jacks of the L1 amplifier. The input to the L2 amplifier differs from the L1 in that C114 and C113 are used to isolate the office battery from the AMPL IN jacks.◀ The output of the gain control is connected to the input of the first stage Q101. The input impedance of this stage is in the order of 40,000 ohms and has a negligible shunting effect on AT101 and thus assures that the input impedance of the amplifier is essentially constant at 600 ohms, regardless of the gain setting of AT101. Q101 and Q102 provide the first two stages of amplification and are direct coupled. The dc feedback from the emitter circuit of Q102 through R101 to the base of Q101 assures good thermal stability for the two stages. ▶C113 is used to reduce the possibility of radio frequency interference.◀ The Darlington output stage, consisting of Q103 and Q104, provides the final stage of amplification and also incorporates dc feedback from the collector circuit through R110 and R112 to the base of Q103 to assure good thermal stability. Overall loop feedback is provided from the emitter circuit of Q104 through C112, R116, and R119 to the emitter circuit of Q101, which assures good gain stability and low distortion. The variable resistor, R119, provides a continuous gain adjustment over a range of 2.5 dB. The output transformer, T101, has two secondary windings which can be strapped to provide an internal output impedance of 600 or 150 ohms when option (R) is provided at the primary. When option (P) is provided at the primary of T101, the internal output impedance options are lowered to 120 or 30 ohms. When using option (P), the load impedance requirements remain unchanged.

2.05 The monitoring circuit for ▶KS-20159 L1◀ is connected directly across the primary of T101 and consists of a voltage divider, resistors R117 and R118, and twin jacks J102 and J103 for headphones. Resistor R117 also provides protection from a short circuit across the monitoring line. ▶The monitoring circuit for KS-20159 L2 is connected across one winding of the secondary of T101.◀ Under normal operating conditions (+8 vu), the monitor connection provides approximately −15 vu to a standard 300-ohm headset.

2.06 The amplifier contains protectors against lightning and power surges. At the input ▶of the L1 amplifier, this protection is provided by varistor RV101. The input of the L2 amplifier is protected by varistors RV101 and RV102. The outputs of both L1 and L2 are protected by◀ voltage regulators CR103 and CR104. Whenever the amplifier receives supply voltage over a telephone line, protection may also be provided at the supply terminals by removing the strap between terminals 5 and 6 of TB101 [option (S)]. Once this has been done, protection is provided by voltage regulators CR101, CR102, CR105, and resistor R113.

3. CIRCUIT CHARACTERISTICS (TYPICAL)

3.01 The circuit characteristics of the KS-20159 L3 and L4 equalizers are as follows.

(a) ***Impedances:*** The source and load impedances are 150 or 600 ohms.

(b) ***Resonant Frequencies:*** Resonant frequencies are shown in Table B.

TABLE B

SWITCH POSITION	NOMINAL RESONANT FREQUENCY
5 kHz	6.0 kHz
8 kHz	9.6 kHz
15 kHz-1	26.0 kHz
15 kHz-2	25.0 kHz
15 kHz-3	27.0 kHz
15 kHz-4	25.0 kHz

(c) ***Longitudinal Balance:*** 70 dB or better up to 1 kHz and 55 dB or better at 15 kHz.

3.02 The circuit characteristics of the amplifier in the KS-20159 equalizer-amplifier are as follows.

(a) ***Gain:*** Maximum gain with any combination of 150- or 600-ohm input and output connections is 43.5 $\pm$1 dB.

(b) ***Gain Adjustments:*** Main gain control with nineteen 2-dB increments and an OFF position. Screwdriver adjustment with 2.5-dB continuous range.

(c) ***Frequency Response:*** 35 to 15,000 Hz $\pm$0.5 dB of 1000-Hz value.

(d) ***Output Power:*** +22 dBm within the temperature range of -25 to +130°F.

(e) ***Total Harmonic Distortion:*** Less than 0.25 percent between 50 and 15,000 Hz at rated output power.

(f) ***Noise:*** 26 dBrn, 15-kHz flat weighting using a power supply having a noise level not exceeding a reading of 59 dBrn when connected to the amplifier.

(g) ***Impedances:***

Internal input impedance is 150 or 600 ohms within 10 percent.

Internal output impedance:

Matched: 150 or 600 ohms within 10 percent.

Low: 30 or 120 ohms approximately.

Source and load impedances are 150 or 600 ohms.

(h) ***Longitudinal Balance for Output Circuit:*** 70 dB or better up to 1 kHz and 55 dB or better at 15 kHz.

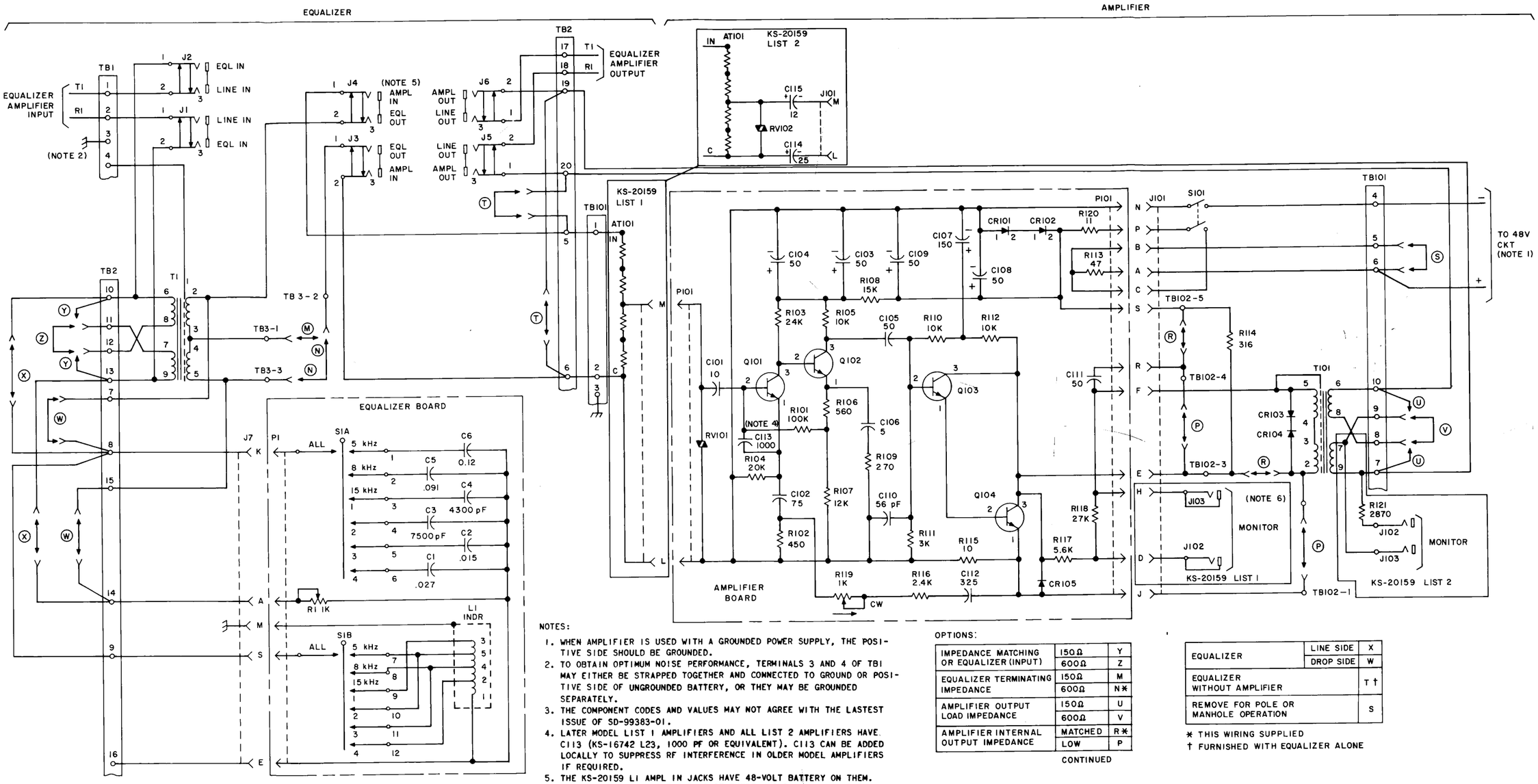
(i) ***Power Requirements:*** 48 Vdc at 100 milliamperes.

(j) ***Monitor Jacks for Headphones:*** Type 221E.

4. MOUNTING ARRANGEMENTS

4.01 The KS-20159 L4 equalizer can be mounted on a 3-1/2 or 4-inch mounting plate on either 19- or 23-inch racks. For either type of rack, a maximum of three L4 equalizers can be mounted horizontally adjacent.

4.02 The KS-20159 equalizer-amplifier can be mounted in a KS-20159 L5 carrying case or on bars on either 19- or 23-inch racks. Only one can be mounted in the carrying case. Two can be mounted on a 19-inch rack with or without two KS-20159 L6 power supply assemblies. Three can be mounted on a 23-inch rack without power supply assemblies.



NOTES:

1. WHEN AMPLIFIER IS USED WITH A GROUNDED POWER SUPPLY, THE POSITIVE SIDE SHOULD BE GROUNDED.
2. TO OBTAIN OPTIMUM NOISE PERFORMANCE, TERMINALS 3 AND 4 OF TB1 MAY EITHER BE STRAPPED TOGETHER AND CONNECTED TO GROUND OR POSITIVE SIDE OF UNGROUNDED BATTERY, OR THEY MAY BE GROUNDED SEPARATELY.
3. THE COMPONENT CODES AND VALUES MAY NOT AGREE WITH THE LASTEST ISSUE OF SD-99383-01.
4. LATER MODEL LIST 1 AMPLIFIERS AND ALL LIST 2 AMPLIFIERS HAVE C113 (KS-16742 L23, 1000 PF OR EQUIVALENT). C113 CAN BE ADDED LOCALLY TO SUPPRESS RF INTERFERENCE IN OLDER MODEL AMPLIFIERS IF REQUIRED.
5. THE KS-20159 L1 AMPL IN JACKS HAVE 48-VOLT BATTERY ON THEM. A GROUND APPLIED TO THE TIPS OF THESE JACKS WILL BLOW THE OFFICE FUSE. TURN THE AMPLIFIER OFF BEFORE PATCHING INTO AMPL IN JACKS TO AVOID BLOWING THE OFFICE FUSE.
6. THE KS-20159 L1 MONITOR JACKS HAVE 30 VOLTS ON THEM IN NORMAL OPERATION. A GROUND APPLIED TO THE UPPER MONITOR JACK (J103) WILL BLOW THE OFFICE FUSE.

OPTIONS:

IMPEDANCE MATCHING OR EQUALIZER (INPUT)	150Ω	Y
	600Ω	Z
EQUALIZER TERMINATING IMPEDANCE	150Ω	M
	600Ω	N*
AMPLIFIER OUTPUT LOAD IMPEDANCE	150Ω	U
	600Ω	V
AMPLIFIER INTERNAL OUTPUT IMPEDANCE	MATCHED	R*
	LOW	P

CONTINUED

EQUALIZER	LINE SIDE	X
	DROP SIDE	W
EQUALIZER WITHOUT AMPLIFIER		T †
REMOVE FOR POLE OR MANHOLE OPERATION		S

* THIS WIRING SUPPLIED
† FURNISHED WITH EQUALIZER ALONE

Fig. 3—KS-20159 Equalizer-Amplifier, Typical Schematic Diagram