TRANSISTOR AMPLIFIERS
KS-16831, L1, L2, L3

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1. GENERAL

1.01 This section describes the KS-16831, L1, L2 and L3 Amplifiers, the L4 Power Supply and the L5 Carrying Case. The amplifiers are transistorized and operate on 48V dc.

1.02 The section is reissued to incorporate material in the addendum and add information concerning the provision for reducing the internal output impedance. Changes from the previous issue are indicated by marginal arrows.

1.03 The KS-16831, L1 Amplifier is a 15 kc line amplifier for use on local program circuits such as studio-to-transmitter or pickup loops. When used with the KS-16816, L1 Equalizer, it will replace the KS-16740 Amplifier System. It is arranged for portable or fixed use and can be mounted in central offices or in an apparatus case for use in manholes or on poles.

1.04 A portable system can be assembled which is comprised of one or two List 1 Amplifiers, one or two List 4 Power Supplies and one List 5 Carrying Case. One KS-16816, L1 Equalizer should be associated with each amplifier for rapid equalization of the program channel. The equalizer ***CAN NOT*** be mounted in the carrying case.

1.05 The KS-16831, L2 Amplifier is a line amplifier for use on facsimile and high-speed data circuits requiring a bandwidth up to 100 kc. It can be mounted in the same manner as the List 1 Amplifier. The List 2 unit ***IS NOT*** equipped with input and output transformers or an equalizer. These are mounted external to the amplifier and are discussed later in this section.

1.06 The KS-16831, L3 Amplifier is a line amplifier for use on facsimile and high-speed data circuits requiring a bandwidth up to 500 kc. It has the same mounting arrangements as the List 1 Amplifier. The List 3 unit ***IS NOT*** equipped with input and output transformers or an equalizer. These are mounted external to the amplifier and are also discussed later in this section.

1.07 The KS-16831, L1 and L2 Amplifiers include, as part of the overall transistor circuit, the KS-16860, L1 Amplifier. The KS-16831, L3 Amplifier includes the KS-16860, L2 Amplifier. This is a printed wiring board assembly and plugs into jack "J1" on the chassis.

1.08 The KS-16831, L4 Power Supply derives 48V dc from commercial 115V 60 cycle — ac power. It provides 100 ma which is sufficient to operate one List 1 or 2 Amplifier. The List 3 Amplifier requires 34 ma. Hence, one power supply will operate three L3 Amplifiers. If one or two L3 Amplifiers are operated off one power supply, a bleeder resistor must be provided to drain 100 ma (total) from the supply. Two of these units can be mounted on a plate provided for this purpose in the List 5 Carrying Case. The 24V dc tap on the power supply is not used with these amplifiers.

1.09 The KS-16831, L5 Carrying Case is arranged to mount in a 19" bay by means of brackets stored in the cover and provided with the case. One or two List 1, 2 or 3 Amplifiers can be mounted in one case with one or two List 4 Power Supplies.

1.10 The KS-16831, L6 Bracket Assembly is designed for those applications where it is desired to provide a jack field, terminal strip, wiring harness and space to mount one KS-16816, L2 Equalizer and one KS-16831, L4 Power Supply in a List 5 Carrying Case with one KS-16831, L1 Amplifier. Fig. 1 shows a preproduction photograph of the bracket assembly.

1.11 The jack field is comprised of six 410D jacks marked as follows: LINE IN; EQUAL IN; EQUAL OUT; AMP IN; AMP OUT and LINE OUT. The terminal strip has solder- and screw-type terminals for external connections to the LINE IN and LINE OUT as well as GND. The wiring harness is equipped with spade lugs and is used to interconnect the equalizer and amplifier to the jack field.

1.12 The schematic drawing for the KS-16831, L1, L2 and L3 Amplifiers is SD-95297-01. This drawing includes information on the power supply and carrying case and is not attached to this section. The detailed description of the amplifiers is found in CD-95297-01.

1.13 The assembly per Fig. 2 consists of a KS-16831, L1 Amplifier, a KS-16831, L4 Power Supply, a KS-16831, L6 Bracket Assem-

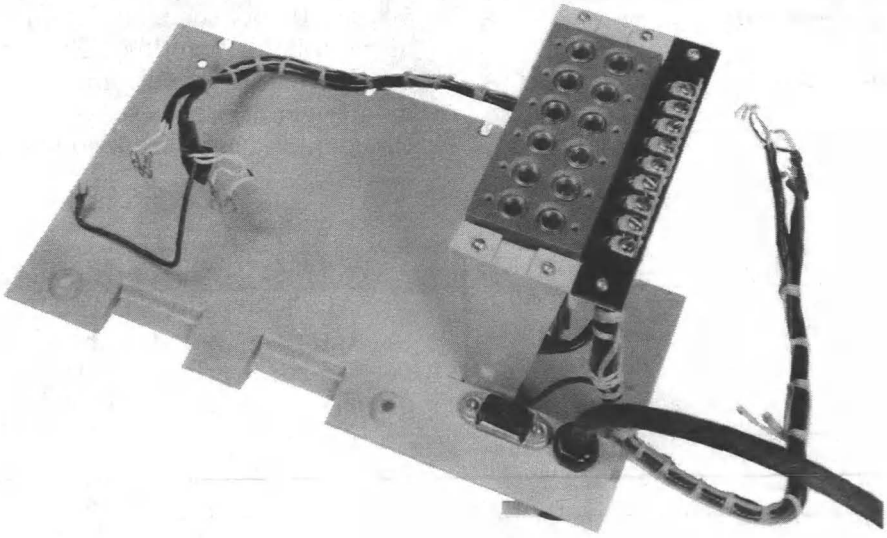

Fig. 1 – KS-16831, L6 Bracket Assembly

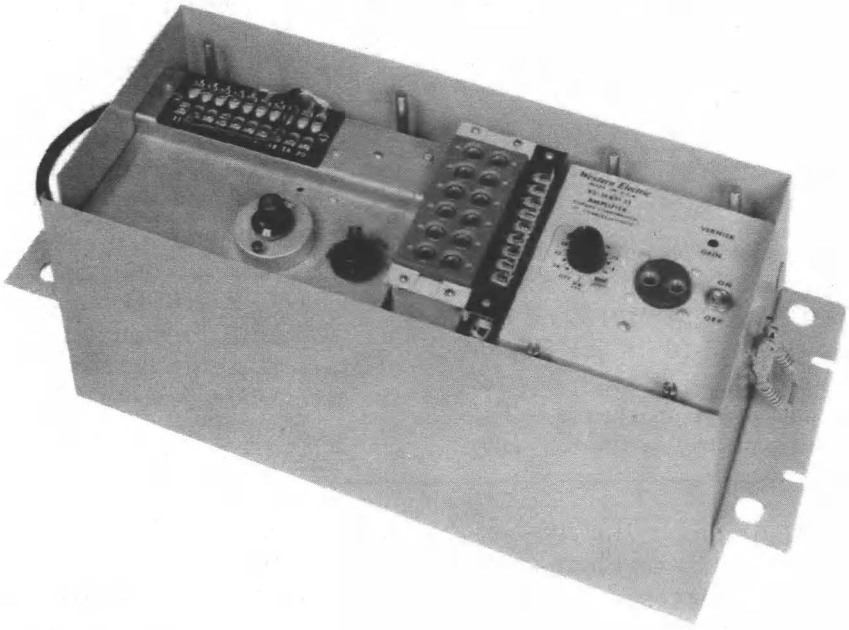

Fig. 2 – KS-16831, L5 Carrying Case with List 1 Amplifier, List 6 Bracket Assembled and List 4 Power Supply Assembled with KS-16816, L2 Equalizer

bly and a KS-16816, L2 Equalizer in a KS-16831, L5 Carrying Case. When these items are ordered, they are shipped disassembled because they are provided from several sources of supply.

1.14 The units should be connected in accordance with Drawing SD-97114-01 and Drawing T-97114-01, using the cabling furnished with the bracket assembly. The equalizer can be strapped in accordance with Drawing SD-95285-01 at assembly to fit the specific circuit on which the unit will be used.

1.15 Figs. 3 and 4 show a view of the L1 and L2 Amplifiers with the cover removed. The photographs show the location of the vernier gain adjustment in back of the monitoring jacks, the attenuator, power switch and terminal strip. The L3 Amplifier appears the same as the L2 Amplifier.

2. ELECTRICAL CHARACTERISTICS

2.01 The electrical characteristics of the KS-16831, L1 Amplifier are as follows:

1000-CYCLE GAIN:

Maximum gain between either 150- or 600-ohm input (source) and output impedance: 42.5 ±1 db. Minimum gain is approximately 2.5 db unless attenuator is in OFF position, in which case the output is 0.

FREQUENCY RESPONSE:

35 to 15,000 cps: ±0.5 db of 1000 cps value.

OUTPUT POWER:

+22 dbm with not more than 0.5% total harmonic distortion (rms) from 50 to 15,000 cps.

OUTPUT IMPEDANCE:

The output impedance as supplied may be strapped for 150 or 600 ohms. The impedance may be reduced to 25 or 100 ohms for applications where low impedance is required to reduce the increase in output voltage when the load impedance is increased or removed. The maximum increase is 1.3 db when the load is entirely removed. As supplied, the increase in voltage is 6 db when the load is removed. Reducing the impedance does not permit operating into lower load impedances than 150 or 600 ohms. The low impedance may be obtained with the S option of SD-95297-017 which requires the strapping of the internal terminal board in the base of the amplifier as follows:

Remove straps	A-B, D-C
Add straps	B-C, D-E

NOISE:

The output noise of the amplifier is dependent on the noise introduced by the 48V dc supply. When operated from a supply having a noise component not exceeding 64 dbrn with 15 kc Flat Weighting, the output noise of the amplifier is −60 dbm or less with maximum gain.

METER CIRCUIT:

Frequency response: Within ±0.5 db of line transmission frequency characteristics from 35 to 15,000 cps. With the 600-ohm line output of the amplifier terminated in 600 ohms and the meter circuit terminated in 7500 ohms, the output voltage of the ***meter circuit*** can be adjusted over a range of ±2.5 db with respect to the line output voltage. This adjustment permits a standard VI meter to read the actual line level.

AMPLIFIER GAIN ADJUSTMENT:

Main gain control has 19, 2 ±0.25 db steps (38 db total) and an OFF position. A screwdriver-operated, continuously adjustable vernier control with a nominal range of 2 db, is also provided.

PHASE SHIFT:

±30° from 35 to 15,000 cps.

LONGITUDINAL BALANCE:

70 db or better up to 1 kc and 55 db or better at 15 kc for both input and output circuits. Between 1 kc and 15 kc the balance may decrease from a minimum of 70 db to a minimum of 55 db, approximately.

MONITOR JACKS FOR HEADPHONES:

Type 221E.

2.02 The electrical characteristics for the KS-16831, L2 Amplifier are as follows:

1000-CYCLE GAIN:

Between 600-ohm source and 300-ohm load: Maximum gain 44 ±1.5 db. Minimum gain

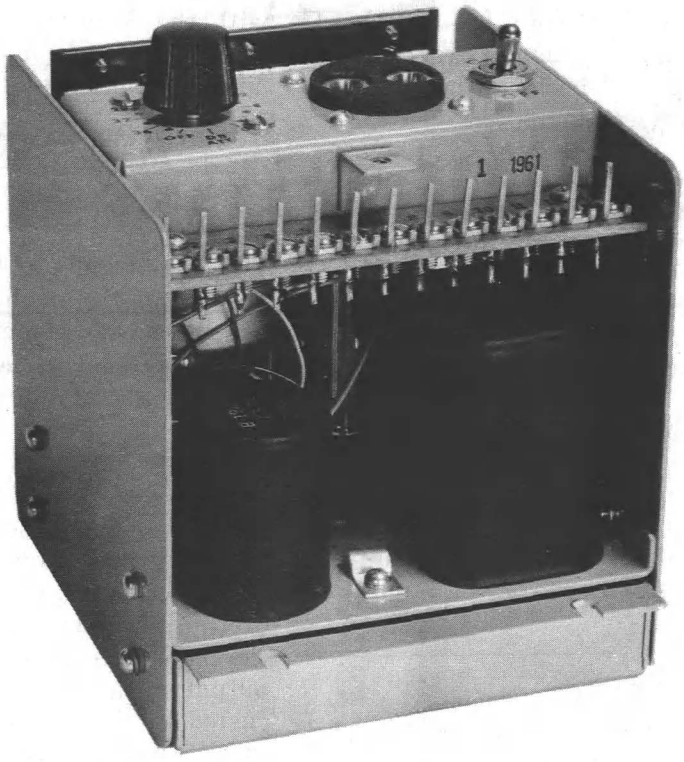

Fig. 3 – View of L1 Amplifier with Dust Cover Removed

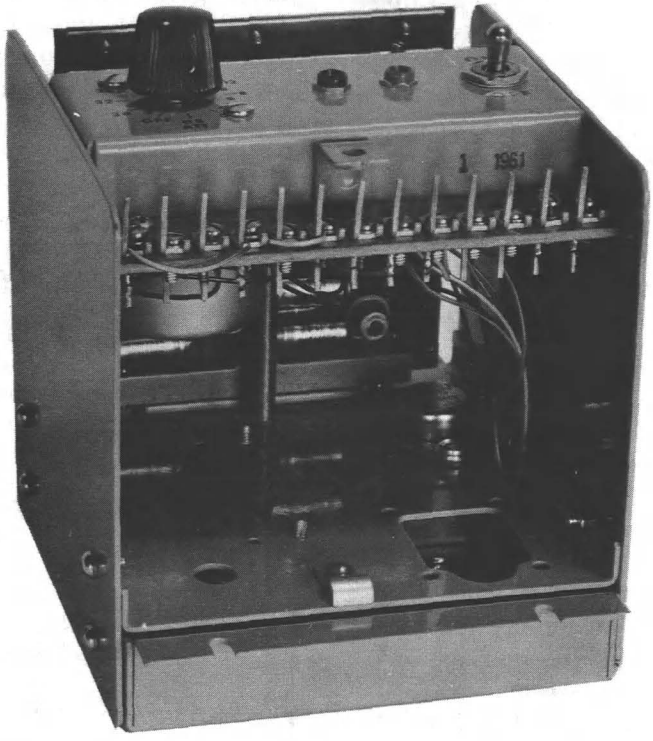

Fig. 4 – View of L2 and L3 Amplifier with Dust Cover Removed

approximately 4 db unless attenuator is in OFF position, in which case the minimum gain is 0.

FREQUENCY RESPONSE:

5 to 100,000 cps: ±2 db of 1000 cps value.
10 to 50,000 cps: ±0.6 db of 1000 cps value.

OUTPUT POWER:

+23 dbm with not more than 0.5% total harmonic distortion (rms) from 50 to 15,000 cps. With output power of +10 dbm, the T.H.D. at 100 kc will not exceed 1%. The output circuit is unbalanced and ungrounded. A grounded load should not be connected to it except through a transformer.

NOISE:

The output noise of the amplifier is dependent on the noise introduced by the 48V dc supply. When operated from a supply having a noise component not exceeding 64 dbrn with 15 kc Flat Weighting, the output noise of the amplifier is −60 dbm or less with maximum gain.

GAIN CONTROLS:

Main gain control has 19, 2 ±0.25 db steps (38 db total) and an OFF position. A screwdriver-operated, continuously adjustable vernier control with a nominal range of 2 db is also provided.

PHASE SHIFT:

Does not exceed ±30° from 5 to 50,000 cycles. Does not exceed −60° up to 100 kc.

MONITOR JACKS:

Pin-type jacks, with one connected to ***circuit ground*** for use with VTVM or oscilloscope.

2.03 The electrical characteristics of the KS-16831, L3 Amplifier are as follows:

1000-CYCLE GAIN:

Between 600-ohm source and 600-ohm load: Maximum gain 40.5 ±2 db. Minimum gain approximately 0.5 db unless attenuator is in OFF position, in which case the minimum gain is 0.

FREQUENCY RESPONSE:

5 to 500,000 cps: ±2 db of 1000 cps value.

OUTPUT POWER:

+10 dbm with not more than 1.0% total harmonic distortion (rms) from 5 to 500,000 cps. The output circuit is unbalanced and ungrounded. A grounded load should not be connected to it except through a transformer.

NOISE:

The output noise of the amplifier is dependent on the noise introduced by the 48V dc supply. When operated from a supply having a noise component not exceeding 64 dbrn with a 15 kc Flat Weighting, the output noise of the amplifier is −60 dbm or less with maximum gain.

GAIN CONTROLS:

Main gain control has 19, 2 ±0.25 db steps (38 db total) and an OFF position. A screwdriver-operated, continuously adjustable vernier control with a nominal range of 2 db is also provided.

PHASE SHIFT:

Not to exceed +40° at 5 cycles and −70° at 500 kc.

MONITOR JACKS:

Pin-type jacks with one connected to circuit ground for use with VTVM or oscilloscope.

3. EXTERNAL CONNECTIONS

3.01 The strapping arrangements for the external connections to the KS-16831, L1 Amplifier are as follows:

Input Connections:

INPUT IMPEDANCE	STRAP TERMINALS ON TERMINAL STRIP	CONNECT INPUT WIRES TO TERMINALS ON TERMINAL STRIP
150 ohms	2 to 3 and 4 to 5	2 and 5
600 ohms	3 to 4	2 and 5

Output Connections:

OUTPUT IMPEDANCE	STRAP TERMINALS ON TERMINAL STRIP	CONNECT OUTPUT WIRES TO TERMINALS ON TERMINAL STRIP
150 or 25* ohms	10 to 11 and 12 to 13	10 and 13
600 or 100* ohms	11 to 12	10 and 13

* With internal strapping changed for low output impedance.

Chassis Ground Connection:

Terminal 1

Power Connections to 48V dc Supply:

POLARITY	TERMINAL
+	6
−	7

3.02 The terminal arrangements for the external connections to the KS-16831, L2 and L3 Amplifiers are as follows:

Input Connections:

INPUT IMPEDANCE	CONNECT INPUT WIRES TO TERMINALS ON TERMINAL STRIP
600 ohms	3 and 4

Output Connections:

OUTPUT IMPEDANCE	CONNECT OUTPUT WIRES TO TERMINALS ON TERMINAL STRIP
L2 Amplifier — 300 ohms	12 and 13
L3 Amplifier — 600 ohms	12 and 13

Ground Connections:

Terminal 1 (Chassis)

Terminal 4 (Circuit)

Power Connections to 48V dc Supply:

POLARITY	TERMINAL
+	6
−	7

3.03 The external connection to the meter circuit for the L1, L2 and L3 Amplifiers are made to terminals 8 and 9 of the terminal strip. The meter must be ungrounded.

3.04 The strapping for the 146A Repeating Coil is shown in Fig. 5 below. This coil is used with the L2 and L3 Amplifiers as the input and output transformer. Hence, two are required per amplifier. The coil is connected to the input terminals as specified above. However, the output connections for the L2 Amplifier are different. Terminal 8 of the 146A Repeating Coil is connected to a 300-ohm resistor which, in turn, is connected to output terminal 13 of the List 2 Amplifier. Terminal 3 of the coil is connected to output terminal 12 of the List 2 Amplifier. Terminals 3 and 8 of the coil are connected to output terminals 12 and 13 of the List 3 Amplifier as previously indicated.

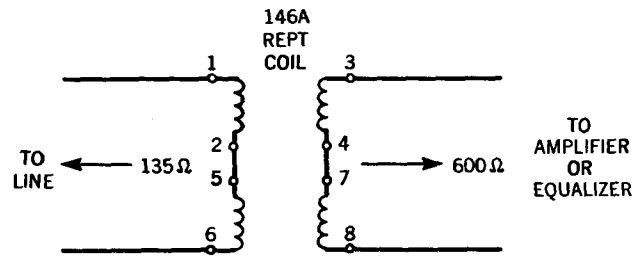

Fig. 5 – Strapping for 146A Repeating Coil

3.05 Resistor R3 in the battery supply circuit is normally furnished with a shorting strap. The strap is removed to become part of the lightning protection circuit when the amplifier is pole mounted and battery is supplied remotely using another cable pair.

3.06 In a few cases, it has been found in central office installations that the amplifier will crosstalk into other circuits served by the same central office battery filter. The strap on resistor R3 may be removed in these cases to provide additional filtering. Removal of the strap will cause a drop in battery voltage of 6.3 volts to List 1 Amplifiers and 2.1 volts to List 2 and List 3 Amplifiers. The List 1 Amplifiers will have lower maximum gain and some change in internal stability. Therefore, if this

change is applied to List 1 Amplifiers, the unit should be carefully checked to see that it still meets circuit requirements.

4. MOUNTING ARRANGEMENTS

4.01 The List 1, 2 and 3 Amplifiers should be mounted in the List 5 Carrying Case for use in 19″ central office bays. The L5 Carrying Case requires approximately 7″ of rack space. However, for space reasons this arrangement may not be satisfactory in situations where only one amplifier is required. In this event, mounting bars or a locally provided applique unit will be required. When mounting the amplifiers in a 23″ bay, an applique unit should be provided locally for the carrying case if it is used. Four amplifiers can be mounted on bars in a 23″ bay.

4.02 Three amplifiers can be mounted in one carrying case by removing the mounting plate and the power supplies. External 48V dc will then be required to operate the amplifiers.

4.03 When an amplifier is pole mounted or is located in a manhole and central office battery is used, protection will be required at the amplifier power terminals. A 68-ohm resistor and 426E diode are required at the 48V dc power terminals to protect the amplifier from external lightning and power voltages. Additional dropping resistors may be located on the main frame at the central office, when required, to reduce the 130V dc supply to the proper voltage at the remote amplifier.