

CIRCUIT DESCRIPTION

CD-95281-01
ISSUE 1
APPENDIX 6D
DWG ISSUE 7D

8

COMMON SYSTEMS
KS-16754 AMPLIFIER CIRCUIT

CHANGES

D. Description of Changes

D.1 Note 302 is added.

D.2 In FS3 and FS4, the circuit schematic of A1 amplifier is revised to agree with KS-16728, List 1, Series 6 circuit board.

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DEPT 3325-EVK-FEF

CIRCUIT DESCRIPTION

CD-95281-01
ISSUE 1
APPENDIX 5B
DWG ISSUE 6B

COMMON SYSTEMS
KS-15754
AMPLIFIER CIRCUIT

CHANGES

B. Changes in Apparatus

B.1 In Fig. 3:

Superseded

R8-1500-Ohm, 1/2 Watt
Resistor

R12-1500-Ohm, 1/2 Watt
Resistor

Superseded By

R8-4700-Ohm, 1/2 Watt
Resistor

R12-2700-Ohm, 1/2 Watt
Resistor

B.2 In Fig. 4:

Superseded

R8-1500-Ohms 1/2 Watt
Resistor

Superseded By

R8-2700-Ohm, 1/2 Watt
Resistor

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DEPT 5111-EVK-CEP

COMMON SYSTEMS
KS-16754 AMPLIFIER CIRCUIT

CHANGES

B. Changes in Apparatus

B.1 In Fig. 1:

Superseded

R8 - 6200-ohm, 1/2 watt resistor
R12 - 240-ohm, 1/2 watt resistor

Superseded By

R8 - 1500-ohm, 1/2 watt resistor
R12 - 30-ohm, 1/2 watt resistor

B.2 In Fig. 2:

Superseded

R12 - 12,000-ohm, 1/2 watt resistor

Superseded By

R12 - 1500-ohm, 1/2 watt resistor

B.3 In Fig. 3:

Superseded

R8 - 6200-ohm, 1/2 watt resistor
R12 - 12,000-ohm, 1/2 watt resistor

Superseded By

R8 - 1500-ohm, 1/2 watt resistor
R12 - 1500-ohm, 1/2 watt resistor

B.4 In Fig. 4:

Superseded

R8 - 12,000-ohm, 1/2 watt resistor

Superseded By

R8 - 1500-ohm, 1/2 watt resistor

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CIRCUIT DESCRIPTION

CD-95281-01
ISSUE 1
APPENDIX 3D
DWG ISSUE 4D

COMMON SYSTEMS
KS-16754 AMPLIFIER CIRCUIT

CHANGES

B. Changes in Apparatus

B.1 ADDED

C10 - 0.02 μ f, 50-volt capacitor between terminals B and C
of the connector on the KS-16728, L1 amplifier (A1),
Fig. 1, 2, 3, and 4.

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DEPT 5111-EVK-CEP

COMMON SYSTEMS
KS-16754 AMPLIFIER CIRCUITCHANGES

D. DESCRIPTION OF CHANGES

D.1 Changes were made in Fig. 3 and 4 lead designations to conform with systems connecting information based on Fig. 1 and 2.

D.2 In Fig. 3, lead designations were changed as follows:

T1 was T5	R1 was R5
T2 was T6	R2 was R6
T3 was T1	R3 was R1
T4 was T2	R4 was R2
T5 was T3	R5 was R3
T7 was T4	R7 was R4

D.3 In Fig. 4, lead designations were changed as follows:

T1 was T6	R1 was R6
T2 was T7	R2 was R7
T3 was T1	R3 was R1
T4 was T2	R4 was R2
T5 was T3	R5 was R3
T6 was T4	R6 was R4
T7 was T5	R7 was R5

D.4 In Fig. 3 and 4, terminal 15 of T1 was connected to terminal 1 of T2, and terminal 19 of T1 was connected to terminal 3 of T2.

All other headings, no change.

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DEPT 5161-EVK/ELO-RAM

COMMON SYSTEMS
KS-16754 AMPLIFIER CIRCUIT

CHANGES

D. DESCRIPTION OF CHANGES

- D.1 In Note 102, KS-16754, List 3 and List 4 amplifiers are added.
- D.2 Note 202 is added.
- D.3 In Note 302, reference to KS-13490, KS-13491, and KS-13492 composition-type resistors is removed and information for commercial-type resistors is added.
- D.4 In Note 303, R2 is removed.
- D.5 In Fig. 1 and 2, "See Note 202" is added and value of R2 is changed to 270 ohms.
- D.6 Fig. 3 and 4 are added.

F. CHANGES IN CD SECTIONS

F.1 In SECTION I, Part 1, Paragraph 1.

Change: The KS-16754, List 1 amplifier, Fig. 1, is intended primarily for use in No. 300 Switching System and List 2 amplifier, Fig. 2, is intended-----meter.

To Read: The KS-16754, List 1 (Fig. 1) and List 3 (Fig. 3) amplifiers are intended primarily for use in No. 300 Switching System, and the list 2 (Fig. 2) and list 4 (Fig. 4) amplifiers are intended-----meter.

F.2 In SECTION I, Part 2, Paragraph 2

Change: The KS-16754, List 1 amplifier, Fig. 1, incorporates-----35 db.

To Read: The KS-16754, List 1 (Fig. 1) and List 3 (Fig. 3) amplifiers incorporate-----35 db.

F.3 In SECTION II, Part 1

Change: Note: Unless otherwise specified, characteristics are the same for list 1 and list 2 amplifiers.

To Read: Note: Unless otherwise specified, characteristics are the same for all amplifiers.

F.4 In SECTION II, Part 1(d)

Change: The list 2 amplifier also has a 10,000-ohm bridging input.

To Read: The list 2 and list 4 amplifiers also have a 10,000-ohm bridging input.

F.5 In SECTION II, Part 1(e)

Add: Lists 3 and 4 - Nominal rated loads of 3.2, 12, and 600 ohms. Internal impedances 1.5 to 3.2 ohms, 6 to 12 ohms, and 300 to 600 ohms.

F.6 In SECTION II, Part 2, Paragraph 2

Change: In the list 2 amplifier, resistors R6 and R7-----10,000 ohms.

To Read: In the list 2 and list 4 amplifiers resistors R6 and R7-----10,000 ohms.

Change: In the list 2 amplifier, capacitor C1-----function.

To Read: In the list 2 and list 4 amplifiers, capacitor C1-----function.

F.7 In SECTION II, Part 2, Paragraph 6

Change: The list 1 amplifier, Fig. 1, incorporates-----CR3 and CR4.

To Read: The list 1, Fig. 1, and list 3, Fig. 3, amplifiers incorporate-----CR3 and CR4.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5161-ELO/EVK-RAM

COMMON SYSTEMS
KS-16754 AMPLIFIER CIRCUITSECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

This circuit provides amplification of audio-frequency signals for speech applications. The KS-16754, List 1 amplifier, Fig. 1, is intended primarily for use in the No. 300 Switching System, and the list 2 amplifier, Fig. 2, is intended primarily for use in the Toll Volume Rating Program to operate a volume-indicating meter.

2. GENERAL METHOD OF OPERATION

This circuit provides a single channel of audio-frequency amplification consisting of a plug-in-type, 3-stage, transistor, printed circuit amplifier, an input transformer for operation from various impedances, a gain control, and an output transformer. Provision is made for operation from 24 or 48 volts dc or a combination of 12 and 30 volts dc.

The KS-16754, List 1 amplifier, Fig. 1, incorporates an automatic output level control circuit which maintains an essentially constant output level for input level variations of approximately 35 db. The automatic output level control may be disabled by removing T wiring.

SECTION II - DETAILED DESCRIPTION

1. CHARACTERISTICS (Typical)

Note: Unless otherwise specified, characteristics are the same for list 1 and list 2 amplifiers.

(a) Gain:

66 db between nominal source and load impedances. 47 db with bridging input of list 2 amplifier from 600-ohm source.

(b) Power Output:

0.5 watt into rated resistive load for 5 per cent harmonic distortion.

(c) Frequency Response:

Within 2 db of 1000-cycle value from 200 to 6000 cycles.

(d) Input Circuit:

Nominal source and internal input impedances of 1.5, 600, and 2400 ohms. The list 2 amplifier also has a 10,000-ohm bridging input.

(e) Output Circuit:

List 1 - Nominal rated loads of 3.2 and 12 ohms. Internal impedances 1.5 to 3.2 ohms and 6 to 12 ohms.

List 2 - Nominal rated loads of 3.2 and 600 ohms. Internal impedances 1.5 to 3.2 ohms and 300 to 600 ohms.

(f) Output Noise:

-35 dbm (unweighted)

(g) Power Requirements:

Voltage	Amplifier Current
24	85 ma continuous
48	85 ma continuous
12 and 30	12V - 2 ma standby, 70 ma max 30V - 5 ma

2. AMPLIFIER CIRCUIT

The amplifier circuit consists essentially of an input transformer, a gain control, a 3-stage transistor amplifier, an output transformer, and a voltage divider for the power supply.

The input transformer, T1, has two primary windings, one for operation from an impedance of 2400 ohms with a center tap for 600 ohm circuits and the other for 1.5-ohm circuits. In the list 2 amplifier, resistors R6 and R7 in series with the 2400-ohm input provide a bridging input with an impedance of approximately 10,000 ohms. Since the transformer windings are not designed to carry direct current, a 1-mf capacitor should be connected in the common side of the 600- and 2400-ohm input to block direct current from the windings when the amplifier is connected to a telephone line. In the list 2 amplifier, capacitor C1 in the bridging input circuit performs this function. The gain control, R5, forms a matching termination on the secondary winding of the transformer so that the internal impedances of the input circuits are equal to the nominal source impedances.

The output of the gain control, R5, is connected directly to the input of amplifier A1. This is a 3-stage, transistor amplifier assembled on a plug-in-type printed circuit card. The amplifier consists of two direct-coupled common emitter stages followed by a transformer-coupled class B push-pull output stage. A large amount of negative feedback

is employed to stabilize the transistor characteristics, reduce distortion, and increase the input impedance of the first-stage transistor, Q1. This feedback is obtained from the unbypassed emitter resistors R4, R12, and R13, and over-all from a separate winding on the output transformer, T2, through resistor R8 to the emitter of Q1. Thermistor RT1 in the biasing circuit of the output stage provides temperature compensation to keep the collector current of the transistors within acceptable limits over the operating temperature range.

The output of amplifier A1 operates into the output transformer, T2, which provides the correct impedance match between the output transistors and the load. As previously mentioned, a separate winding on T2 supplies voltage for over-all negative feedback.

Resistors R1, R2, R3, and R4, and diode CR1 form a voltage divider to adapt the amplifier to the various voltages from which it may be operated. CR1 operates as a Zener diode to maintain a constant potential of approximately 12 volts for the output transistors when the equipment is operated from a 24- or 48-volt supply.

The list 1 amplifier, Fig. 1, incorporates an automatic output level control circuit consisting of resistors R6, R7, R8, R9, R10, and R11, capacitors C1 and C2, and diodes CR2, CR3, and CR4. This circuit is a shunt-type variolossor which is connected between the base of the first stage transistor and ground. The germanium diode, CR3, connected to the primary of the output transformer, T2, rectifies signal current which flows through silicon diode CR4 and causes its resistance to vary inversely as the level of the output signal. The network, consisting of R1 in amplifier A1 and CR4, thus acts as a variable attenuator in which attenuation is a function of the output signal. Bias voltage obtained from the potentiometer, consisting of resistors R7 and R8, determines the signal level at which the variolossor becomes effective.

The function of silicon diode CR2 is to raise the impedance of the variolossor circuit under low-level signal conditions. Without this diode, resistor R10 and capacitor C2 would be shunted across the relatively high-impedance circuit and, under low-level signal conditions, would cause an unwanted loss. R10 stabilizes the discharge time of C2. The discharge of this capacitor determines the release time of the circuit. Without R10, the release time would vary over wide limits since the discharge rate would be controlled only by the forward resistance of diodes CR2 and CR4 which is low at high currents and very high at low currents. Resistor R6 limits the distortion which would result from the curvature of the resistance versus current characteristics of diode CR4 at large values of compression when the current through the diode is high. T wiring (furnished with the amplifiers as manufactured) connects the automatic output level control circuit to the output of the amplifier. The output level control circuit may be disabled by removing T wiring.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

None.

2. FUNCTIONS

This circuit provides:

- (a) Amplification of audio-frequency signals with automatic output level control (Fig. 1).
- (b) Amplification of audio-frequency signals without automatic output level control (Fig. 2).

3. CONNECTING CIRCUITS

When this circuit is listed on a key sheet, the connecting information thereon is to be followed.

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DEPT 5161-EL0/HJB-RAM