INSTALLATION • OPERATION • MAINTENANCE

# INSTRUCTIONS

# TYPE KR VOICE ADAPTER

*WARNING: Do not plug a 48 volt adapter into a 125 volt KR set.*

## APPLICATION

These instructions apply to the voice adapter used with the type KR carrier set to provide voice communications. Two styles are available:

| | |
|---|---|
| S#148A431G01 | 125 V.D.C. |
| S#148A431G02 | 48 V.D.C. |

The S#330C191H01 resistor unit used with the KR set for 250 V.D.C. applications also provides 125 volts to the voice adapter. Accordingly use the 125 V.D.C. style voice adapter for 250 volt applications.

One portable voice adapter suffices for each station; however, one adapter per KR carrier set can be permanently mounted. Table 1 summarizes the the various arrangements. An explanation of this table appears under "Construction — Mechanical."

When the KR set is used for relaying, the relays shut off the transmitter should someone be talking when an internal fault occurs.

When the KR set is used for supervisory control a break contact from the supervisory equipment is needed to remove supply voltage from the voice adapter when the supervisory-control equipment is functioning. This arrangement gives supervisory-control preference over voice use.

## CHARACTERISTICS

### Volume Control

Control is obtained through a potentiometer. There is no AVC circuit in the Voice Adapter.

### RF Carrier Output (for voice communication)

The KR transmitter RF output will vary between 1.5 volts minimum and 3.4 volts nominal when the pushbutton on the test telephone is pressed. This level is the unmodulated carrier signal developed across a 60-ohm load.

### Power Requirements

70 milliamperes at 125 VDC. 70 milliamperes at 48 VDC. (Supplied by the KR Relaying Transmitter-Receiver Unit.)

### Insulation Level

All electrical circuits, normally connected to station batteries, are insulated for 2000 VDC to ground.

### Temperature Range

Operating Range (external ambient) −20°C to +50°C. Non-Operating Range −40°C to +70°C.

### Mechanical Specifications

a. Dimensions 5-5/8" x 4-1/32" x 3-11/16" b. Weight 2-1/2 lbs. c. Projection 3" in addition to projection of KR Transmitter-Receiver.

## CONSTRUCTION

### Mechanical

The unit is mounted in a black lacquered steel chassis which forms a box consisting of a cover and frame. Buckle-type straps secure the adapter to the socket assembly. See Fig. 1. The adapter plug may be inserted into octal socket X3 on the top front of the KR set (Group A of Table 1). Another portable adapter setup (Group B of Table 1) avoids the need to remove the cover of the KR set; here the voice adapter plugs into the socket on the voice adapter mounting assembly shown in Fig. 6. The S#757D650G03 assembly mounts on the switchboard panel; a six foot cable is included to connect to socket X4 on the rear of the KR set.

Supersedes I.B. 41-942
*Denotes Change from Superseded Issue

EFFECTIVE APRIL 1962

The voice adapter may also be permanently mounted and connected to a switchboard-mounted telephone jack. Where the KR set is mounted on the switchboard (Group C of Table 1), the adapter is permanently plugged into the rear socket x4 of the KR set; the patch cord assembly then interconnects the voice adapter and the S#1276346 telephone jack.

When the KR set mounts in a swing rack cabinet (Group D of Table 1) the voice adapter plugs into S#757D650G04 mounting assembly. The adapter and assembly mount on the swing rack under the KR set. The 15 inch cable interconnects the adapter and socket X4 of the KR set. The patch cord interconnects the adapter and the cabinet assembly terminal blocks.

S#330C678H04 telephone with plug is inserted into the jacks in the voice adapter with portable setups (Group A and B of Table 1). Otherwise the plug on the S#585C700H01 patch cord inserts in the voice adapter jacks; the telephone jack on the other end of this patch cord then accommodates the telephone plug.

An RF input control is at the same end of the chassis as the telephone jacks, permitting control of the received audio level. One reversible nameplate is provided. It is secured to the chassis and identifies the operating voltage; the reverse side identifies the alternate operating voltage. The word "TOP" stencilled on the chassis cover refers to the positioning of the telephone jacks (refer to Telephone Usage) and does not designate the top of the Voice Adapter Unit.

The chassis may be serviced by releasing the shaft support plate and removing the cover which is secured to the frame by self-tapping screws.

Ventilating holes are provided in the cover to permit operation where high ambient temperatures exist.

The majority of components are located on the printed wiring board. The telephone jacks, the 8-pin octal plug and the printed board connector are fastened to the bottom of the frame assembly. Test points are also provided on the printed board to facilitate servicing the unit.

## Electrical

The circuit consists of three grounded emitter transistor stages which include an RF amplifier, a power detector and an audio amplifier (see Figures 2 and 3). When receiving, the RF input signal passes from the coaxial cable connection at "D" on the KR Transmitter-Receiver, through a portion of the input filter FL-1, into the receiver section of the Voice Adapter. The signal is then fed through the level control R-1 to the RF amplifier Q-1. This stage is transformer coupled to the power detector circuit Q-2 which in turn drives the base of the audio output stage Q-3. This base drive is applied through capacitor C-6 and relay contacts K-1A. The signal is amplified by transistor Q-3 and then transformer coupled through T-2 to the telephone receiver line. This connection is made through relay contacts K-1B and K-1C. There is no AVC action in these receiver circuits, so it is necessary to adjust the input control R-1 for the best listening level.

The audio output stage Q-3 serves two functions. It is the output stage for the receiver section previously explained and it also serves as the modulator when transmitting. This is accomplished by relay K-1. Pressing the pushbutton on the test telephone energizes this relay and also closes the circuit which provides microphone current. The microphone output is applied to the base of amplifier Q-3 through capacitor C-7 and relay contacts K-1A (see Figures 2 and 3). When relay K-1 is energized, contact K-1A is switched to select the speech input signal at capacitor C-7 and opens the receiver circuits from capacitor C-6. Transistor Q-3 again serves as an amplifier and its output eventually reaches resistor R-50 and capacitor C-14 in the transmitter-receiver through relay contacts K-1B and K-1C. These same contacts disconnect the telephone receiver. Signal applied to the R-50 and C-14 combination will modulate the transmitter.

The carrier transmitter must be unblocked before it is possible to transmit the modulated carrier signal. This is accomplished by applying carrier start voltage to the transmitter through contacts K-1D in the Voice Adapter. Energizing relay K-1 in the adapter closes contacts K-1D which supply carrier start voltage to the transmitter-receiver bleeder circuit made up of resistors R-41, R-47 and R-48. This unblocks the emitter circuit of Q-10 in the transmitter which then permits transmission of carrier. The D-C voltage applied to this bleeder circuit by the adapter is less than 1/2 the voltage supplied when a relaying function occurs. Therefore, the unmodulated transmitter output when unblocked by the Voice Adapter is from 7.5 db to 14.5 db less than the output when unblocked for a relaying operation. This differential is necessary to provide proper blocking of speech when a relaying function occurs.

## TABLE I

### Voice Circuit Arrangements

| Material | PORTABLE ADAPTER | | FIXED ADAPTER | |
|---|---|---|---|---|
| | GROUP A | GROUP B | GROUP C | GROUP D |
| | KR on Swbd. Using Front KR Socket | KR on Swbd. Using Separate Socket | KR on Swbd. Adapter in Rear KR Socket | KR & Adapter In Swing-Rack Cabinet |
| KR Set | 1/Term. | 1/Term. | 1/Term. | 1/Term. |
| Voice Adapter | 1/Sta. | 1/Sta. | 1/Term. | 1/Term. |
| S#330C678H04 Telephone | 1/Sta. | 1/Sta. | 1/Sta. | 1/Sta. |
| S#585C700H01 Patch-Cord Assy. (10 Ft. Cable) | – | – | 1/Term. | 1/Term. |
| S#1276346 Swbd. Telephone Jack | – | – | 1/Term. | 1/Term. |
| S#757D650G03 Voice Adapter Mounting Assy. (6 Ft. Cable) | – | 1/Term. (†) | – | – |
| S#757D650G04 Voice Adapter Mounting Assy. (15 In. Cable) | – | – | – | 1/Term. |
| S#757D654G01 19 In. Rack Panel | – | – | – | 1/Two Term. |

† The lead between the adapter and KR Set should not exceed six feet.

As previously mentioned, voice communication is a secondary function and does not interfere with the primary function of relaying. To accomplish this, it is necessary to block the audio output stage Q-3 on the adapter whenever a relaying function occurs. The D-C voltage which unblocks the carrier transmitter at terminal 15 is also applied to pin 6 on plug P-1 in the adapter. The return of this circuit to B- in the adapter is through bleeder resistors R-20, R-24 and R-22. The junction of resistors R-24 and R-22 is connected through diode CR-1 to the base of transistor Q-3. When a relaying function occurs, the voltage developed across resistor R-22 is sufficiently high to make diode CR-1 conduct. This drives the base of stage Q-3 positive with respect to the emitter and therefore, blocks the circuit. This action greatly reduces the speech modulation of the carrier signal. Effectively, a voice conversation carried on over a relaying channel will be interrupted instantly when a relaying operation occurs.

On the other hand, as previously explained, the start voltage supplied by the adapter at pin 6, plug P-1, is less than half the start voltage supplied by the transmitter-receiver when a relaying operation occurs. Because of this difference in carrier start voltages, the Voice Adapter, when modulating, does not block stage Q-3. The voltage developed across resistor R-22 is not great enough to make diode CR-1 conduct.

When used with supervisory equipment, audio block is performed through supervisory preference contacts. The jumper normally connecting terminals 13 and 19 on the transmitter-receiver is removed and in its place is connected these contacts. These contacts open, removing the B+ supplied to the adapter unit when a supervisory function is initiated. Voice communication is interrupted when this occurs.

## INSTALLATION

### Voltage Rating

The adapter, as received, is wired for either 48 VDC or 125 VDC operation, as ordered. The supply voltage is clearly indicated on a rating nameplate. As indicated in the WARNING note, severe damage will result to the Voice Adapter if a 48 VDC unit is plugged into 125 VDC relaying equipment. The voltage rating of the adapter must correspond with the rating of the Transmitter-Receiver.

### Telephone Usage

Telephone jacks are provided as an integral part of the adapter to accommodate a Westinghouse S#330C678H04 noise cancelling handset. This telephone is an auxiliary and is not an integral part of the unit. It employs a push-to-talk button which must be pushed when transmitting and released when receiving. The side of the telephone plug marked "TOP" must be inserted into the corresponding socket marked "TOP" on the chassis of the adapter. Since this telephone has a noise cancelling handset, it is necessary to speak directly into the microphone. Talking over, or under the mouthpiece will result in severe attenuation of the speech signal. Optimum results can be achieved only by speaking directly into the telephone. See Figure 5.

### Connections for Relaying Channels

The adapter will perform satisfactorily with any of the relaying systems used to key the KR Transmitter-Receiver Unit. No internal wiring modifications are necessary in the adapter. However, the external wiring to the relaying transmitter-receiver for any particular system must be exactly as shown in the KR Transmitter-Receiver Unit Instruction Leaflet I.L. 41-941.

Signaling over a relaying channel is readily accomplished. Plugging in the test telephone short circuits the local alarm coil provided a connection has been made between terminal 16, on the KR carrier unit and the junction point of the RRH and alarm coils. The B+ return for the RRH coil is then returned through the Voice Adapter Unit directly to B+. This short circuits the alarm coil. Make certain the RRH and alarm coils are arranged as shown on the Schematic Diagrams or the connection will short the RRH coil instead of the alarm coil. Pushing the button on the telephone unblocks the local transmitter which will result in an alarm signal at the remote terminal. This alarm will continue to ring until the operator at the receiving terminal inserts his telephone or the transmitting telephone pushbutton is released. The two stations are then ready to carry on a conversation. Because of the reduced RF output of the transmitter when unblocked by the adapter, it may, in some cases of extreme channel attenuations, be necessary to use the carrier test button for ringing.

With the Voice Adapter plugged into the relaying equipment on a permanent basis, the external relaying scheme will not be altered. However, eliminate

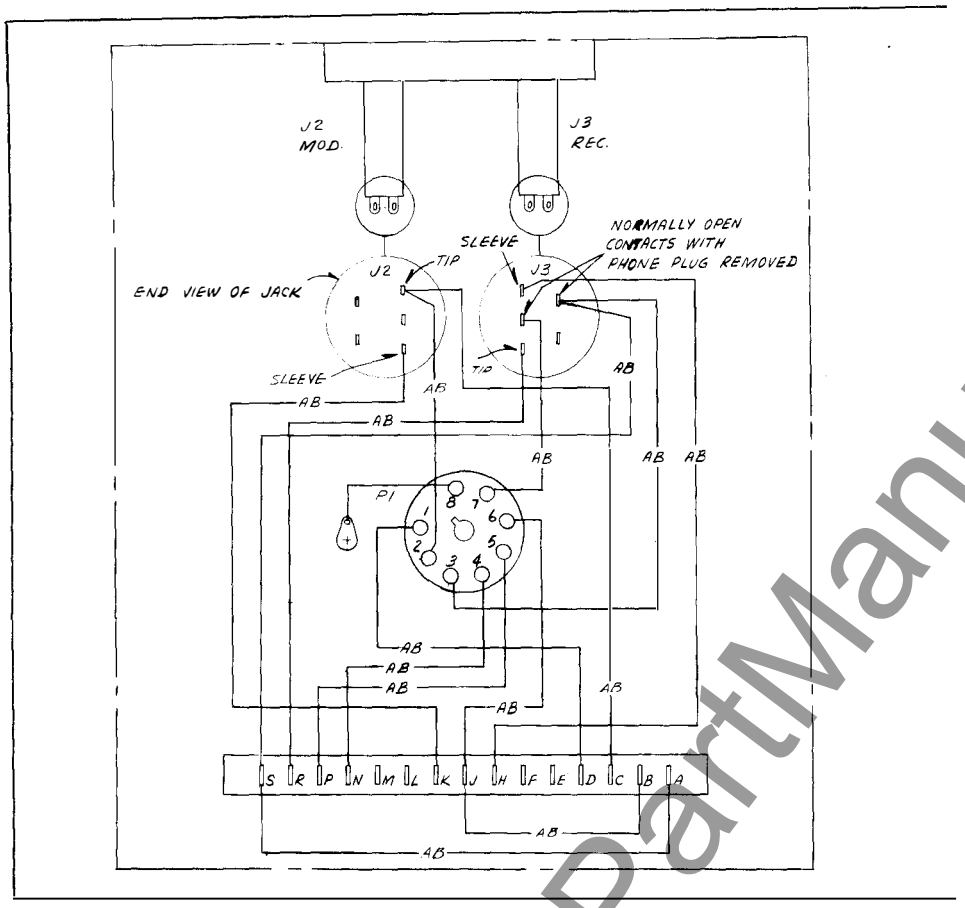


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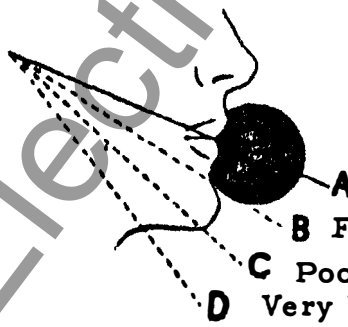
*Fig. 4. Wiring Diagram of Major Components.*

# LET'S TALK PROPERLY OVER THE TEL. NE

## THE EFFECT OF SWINGING HAND SET TRANSMITTER AWAY FROM LIPS



| | Relative Level |
|---|---|
| A Correct Position | 0 db |
| B Fair, 1/4 as good as A. | -12 db |
| C Poor, 1/20 as good as A. | -26 db |
| D Very bad, 1/80 as good as A. | -38 db |

**The diagram shows the greatly reduced efficiency of the telephone when the lips are not in the correct position for talking.**

**It not only is very annoying to repeat what you are saying, but also serious trouble may result from misunderstandings.**

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*Fig. 5. Proper Usage of Noise-Cancelling Telephone Handset.*

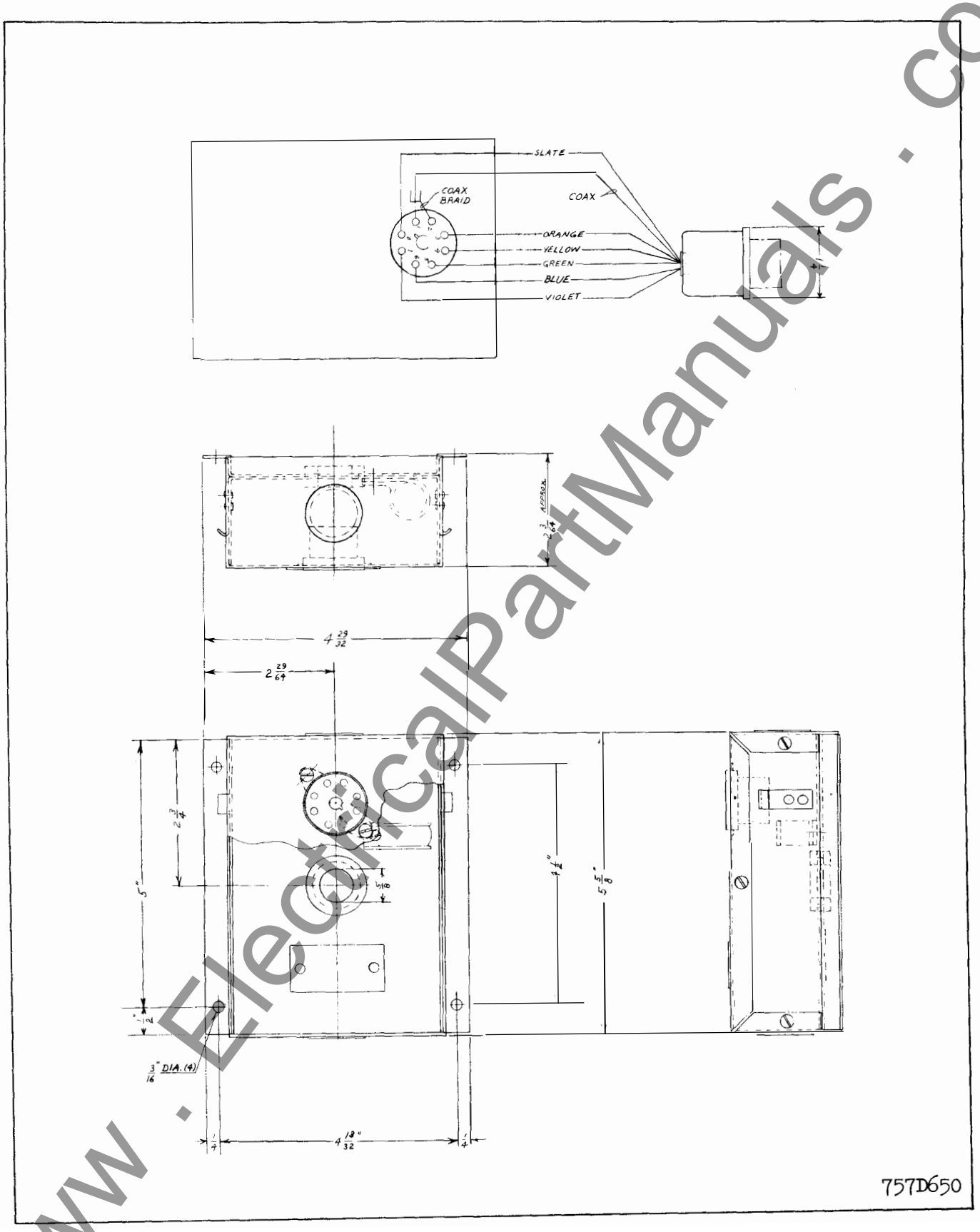


*Fig. 6. Voice Adapter Mounting Assembly with 6 ft. Cable, S#757D650G03.*

## TABLE 3

## D-C MEASUREMENTS

### Adapter Plugged Into KR Set

| Measurement | Typical Readings | | Limits |
|---|---|---|---|
| | 125 VDC Unit | 48 VDC Unit | |
| Condition #1 — No received signals — Test telephone not plugged in. | | | |
| Supply Current | 20 ma | 24 ma | ± 20% |
| TP-4 (B+) to TP-1 (B−) | 129 VDC | 51 VDC | * +10% −20% |
| Ter. J to B− | 1.0 VDC | 0.0 VDC | ± 20% |
| Ter. 16 on relaying unit to B− | 0.0 VDC | 0.0 VDC | — |
| TP-2 to B− | 17 VDC | 17 VDC | ± 20% |
| Condition #2 — Test telephone plugged in with test button pushed. | | | |
| Supply Current | 70 ma | 69 ma | ± 20% |
| TP-4 (B+) to TP-1 (B−) | 129 VDC | 51 VDC | * +10% −20% |
| Ter. J to B− | 50 VDC | 21 VDC | ± 10% |
| Ter. 16 on relaying unit to B− | 129 VDC | 51 VDC | ± 10% |
| Relaying transmitter RF output on coaxial cable | 3.5 VAC | 2.0 VAC | 1.5 VAC † |

† — Minimum

## TABLE 4

## TRANSISTOR D-C MEASUREMENTS

### Adapter Plugged Into KR Set

| Measurements (with respect to B-) | Typical Readings | | Limit |
|---|---|---|---|
| | 125 VDC Unit | 48 VDC Unit | |
| Condition #1 — Test telephone not plugged in. | | | |
| Transistor Q-1 | | | |
| Emitter | 15.1 VDC | 15.5 VDC | ± 20% |
| Base | 15.1 VDC | 15.3 VDC | ± 20% |
| Collector | 0.0 VDC | 0.0 VDC | — |
| Transistor Q-2 | | | |
| Emitter | 16.9 VDC | 17.1 VDC | ± 20% |
| Base | 16.9 VDC | 17.1 VDC | ± 20% |
| Collector | .24 VDC | 0.25 VDC | ± 20% |
| Transistor Q-3 | | | |
| Emitter | 16.9 VDC | 17.1 VDC | ± 20% |
| Base | 16.9 VDC | 17.1 VDC | ± 20% |
| Collector | 3.6 VDC | 3.5 VDC | ± 20% |
| Condition #2 — Test telephone inserted and push-to-start button pressed. | | | |
| Transistor Q-3 | | | |
| Emitter | 16.2 VDC | 17.0 VDC | ± 20% |
| Base | 16.1 VDC | 16.9 VDC | ± 20% |
| Collector | 3.2 VDC | 3.5 VDC | ± 20% |
| Condition #3 — 129 VDC HZM carrier start volts applied to Ter. 15 on relaying unit. | | | |
| Ter. J to B - | 100 VDC | 51 VDC | ± 10% |
| Transistor Q-3 (Audio Block) | | | |
| Emitter | 19 VDC | 19.3 VDC | ± 20% |
| Base | 19 VDC | 19.3 VDC | ± 20% |
| Collector | 0.7 VDC | 0.0 VDC | ± 20% |

### Removal of Printed Wiring Board

1. Loosen the screw securing the shaft support plate and allow the plate to swing clear.
2. Remove the 6 self-tapping screws holding the cover.
3. Lift cover off.
4. Remove the 2 screws securing the printed board to the jack block — do not misplace the insulating washers under the screw heads.

*NOTE: DO NOT EXERT ANY PRESSURE ON POTENTIOMETER ASSEMBLY OR OTHER COMPONENTS MOUNTED ON THE BOARD.*

5. Using a wide blade screwdriver as a wedge, insert between board and one side of plug mounting and gently twist screwdriver in a clockwise direction until board is clear of plug.
6. Lift board out of chassis.

### Assembly of Printed Wiring Board

1. Position board so that it aligns with the slot in the plug.
2. Grip both sides of board with thumbs and gently, but firmly, exert pressure so board is engaged by the springloads in the plug. Secure the board with the two screws provided, making sure the insulating washers are in place under the screw heads.
3. Completely re-assembly by executing in reverse steps 1, 2 and 3 of removal procedure.

### Test Equipment Required for Installation

No test equipment is required other than two test telephones, two adapter units and a working KR Relaying Channel. Control R-1 on the adapter is adjusted to a comfortable listening level.

### Test Equipment Required for Rountine Measurements

The data outlined in Tables 3 and 4 are considered routine measurements.

1. Test telephone.
2. D-C voltmeter (20 K ohms/volt)
   Voltage Ranges: 0 to 3 V
   0 to 15 V
   0 to 50 V
   0 to 150 V

### Desirable Test Equipment for Troubleshooting

1. Items listed previously.
2. Ohmmeter
3. Audio Signal Generator
   Frequency Range: 0.3 KC to 5 KC
   Output voltage into 600 ohms: 1.0 volt
4. A-C VTVM
   Ranges: 0 to 0.01 V
   0 to 0.1 V
   0 to 1.0 V
   0 to 10.0 V

   Frequency Range: 60 cycles/sec. to 230 KC

   Input Impedance: 7.5 megohms
5. Oscilloscope
6. Adapter Cable — Approximately 4 feet long equipped with an octal socket and octal plug.
7. Milliammeters — 0-100 ma
   0-5 ma

## ELECTRICAL PARTS LIST

| Circuit Symbol | Function | Description | Mfr. Code | Manufacturer's Designation |
|---|---|---|---|---|
| | | CAPACITORS | | |
| C-1 | Coupling | 0.25μf, ± 20%, 200VDC, Paper | 1 | 330C567H05 |
| C-2 | Bypass | 0.1μf, ± 20%, 200VDC | 1 | 330C567H02 |
| C-3 | Bypass | Same as C-1 | | |
| C-4 | Bypass | * 10μf, −10%, + 100%, 50VDC | 1 | 330C556H42 |
| C-5 | Bypass | Same as C-2 | | |
| C-6 | Coupling | Same as C-4 | | |
| C-7 | Coupling | .01μf, ± 10%, 300VDC | 1 | 330C661H36 |
| C-8 | Bypass | Same as C-4 | | |
| C-9 | Bypass | Same as C-7 | | |
| * C-10 | Blocking | Same as C-4 | | |
| C-11 | Bypass | 100μf, − 10%, + 100%, 25VDC | 1 | 330C556H19 |
| C-12 | Bypass | 50μf, − 10%, + 100%, 50VDC | 1 | 330C556H21 |
| C-13 | Bypass | Same as C-4 | | |
| | | DIODES | | |
| CR-1 | Crystal | IN63 | 1 | 584C433H02 |
| CR-2 | Crystal | Same as CR-1 | | |
| | | JACKS | | |
| J-1 | Printed Wir. Board | Printed Board Recp. | 1 | 330C589H01 |
| J-2 | Telephone | Jack Block Assembly | 1 | 7421907G03 |
| J-3 | Telephone | Part of J-2 Assembly | | |
| | | RELAY | | |
| K-1 | Relay | 48V, 1000-Ohm Coil, 4 Transfer Contacts | 1 | 330C588H01 |

## ELECTRICAL PARTS LIST

| Circuit Symbol | Function | Description | Mfr. Code | Manufacturer's Designation |
|---|---|---|---|---|
| | | PLUG | | |
| P-1 | Plug | Octal Plug | 1 | 330C580H02 |
| | | TRANSISTORS | | |
| Q-1 | RF Amplifier | * 2N247 or 2N274 | 1 | 330C587H05 |
| Q-2 | Detector | Same as Q-1 | | |
| Q-3 | AF Amplifier | * 2N43 or 2N525 | 1 | 330C587H02 or H07 |
| | | RESISTORS | | |
| R-1 | Input | 2.5K, ± 30%, 1/4 W, Pot. | 1 | 330C598H01 |
| R-2 | Q-1 Base | 1K, ± 10%, 1/2 W | 1 | 330C595H25 |
| R-3 | Q-1 Base | 3.9K, ± 5%, 1/2 W | 1 | 330C664H63 |
| R-4 | Q-1 Base | 560 Ohms, ± 10%, 1/2 W | 1 | 330C595H22 |
| R-5 | Q-1 Emitter | 2.2K, ± 10%, 1/2 W | 1 | 330C595H29 |
| R-6 | Q-2 Base | 39K, ± 5%, 1/2 W | 1 | 330C664H87 |
| R-7 | Q-2 Base | Same as R-2 | | |
| R-8 | Q-2 Emitter | Same as R-5 | | |
| R-9 | Q-2 Collector | 270 ohms, ± 5%, 1/2 W | 1 | 330C664H35 |
| R-10 | Q-2 Collector | Same as R-2 | | |
| R-11 | Q-3 Base | 22K, ± 10%, 1/2 W | 1 | 330C595H41 |
| R-12 | Q-3 Base | 820 Ohms, ± 5%, 1/2 W | 1 | 330C664H47 |
| R-13 | Q-3 Emitter | 150 Ohms, ± 10%, 1/2 W | 1 | 330C595H15 |
| R-14 | Microphone Current Bleeder | 1.5K, ± 5%, 10 W | 1 | 330C577H03 |
| R-15 | Voltage Divider | 1K, ± 10%, 2 W | 1 | 330C597H25 |

## ELECTRICAL PARTS LIST

| Circuit Symbol | Function | Description | Mfr. Code | Manufacturer's Designation |
|---|---|---|---|---|
| | | RESISTORS (Concluded) | | |
| R-16 | Voltage Divider | 750 Ohms, ± 5%, 1 W | 1 | 330C666H46 |
| R-17 | Voltage Divider | * 4K, ± 5%, 10W | 1 | 330C577H02 |
| R-18 | Voltage Divider | 20K, ± 5%, 1 W | 1 | 330C666H80 |
| R-19 | Voltage Divider | Same as R-11 | | |
| R-20 | Q-3 Base Blocking | 68K, ± 10%, 1/2 W | 1 | 330C595H47 |
| R-21 | Q-2 Base | 470 Ohms, ± 10%, 1/2 W | 1 | 330C595H21 |
| R-22 | Q-3 Base Blocking | 56K, ± 5%, 1/2 W | 1 | 330C664H91 |
| R-23 | Voltage Divider | Same as R-16 | | |
| R-24 | Q-3 Base Blocking | 15K, ± 10%, 1/2 W | 1 | 330C595H39 |
| R-25 | Q-3 Base Blocking | 560 Ohms, ± 10%, 1/2 W | 1 | 330C595H22 |
| | | TRANSFORMERS | | |
| T-1 | RF Coupling | Impedance Ratio 25 K/300 Ohms | 1 | L592171 |
| T-2 | AF Output | 25K/600 Ohms | 1 | 330C590H01 |
| | | TEST POINTS | | |
| TP-1 | B- | Terminal Stud | 1 | 330C592H01 |
| TP-2 | Transistor B+ | Same as TP-1 | | |
| TP-3 | Test Point R-16 | Same as TP-1 | | |
| TP-4 | Test Point B+ | Same as TP-1 | | |
| TP-5 | Test Point R-14 | Same as TP-1 | | |
| TP-6 | Test Point R-18 | Same as TP-1 | | |
| TP-7 | Test Point R-19 | Same as TP-1 | | |
| TP-8 | Test Point R-20 | Same as TP-1 | | |
| TP-9 | Test Point R-20 | Same as TP-1 | | |

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