A.E.CO. TYPE 880 SPEAKERPHONE INSTALLATION AND FIELD MAINTENANCE

CONTENTS

1. GENERAL

1.01 This Section presents information on the A.E.Co. Type 880 Speakerphone (NB-880). A detailed description of the Speakerphone, operating instructions, and installation procedures covering mounting, electrical connections, and adjustments are included, as well as maintenance procedures. A circuit description of the Type 880 Speakerphone is also provided.

Features

1.02 The Type 880 Speakerphone (Figure 1) may be used as a regular telephone or as a loudspeaking telephone. Use of the loudspeaking feature eliminates the need of holding the handset and also makes group conference calls possible.

1.03 A neon lamp is incorporated within the OFF/ON switch button. The lamp flashes whenever the switch button is in the ON position, indicating an off-hook condition.

1.04 The standard Type 880 Speakerphone uses an electronic type tone signal, in place of a ringer, for signaling.

1.05 The Speakerphone is equipped with a transmission network which provides automatic level control on varying loop lengths, while maintaining adequate sidetone balance.

2. DESCRIPTION

Physical Description

2.01 Housing. The Type 880 Speakerphone (main unit assembly and speaker assembly combined) weighs 7 pounds. The main unit assembly measures 9-1/4" wide, 5" high, and 7-1/2" in depth. The associated speaker assembly measures 5-5/8" wide, 3-7/8" high, and 3-3/4" in depth. The lower housing of the main unit assembly and the speaker assembly housing are equipped with soft, rubber impregnated cork pads to protect desk and table tops. The Type 880 Speakerphone is available in black and five decorator colors.

2.02 Face plate. The dial, switch button, and speaker volume control wheel all project through the brushed aluminum face plate at the front of the main unit assembly (Figure 1). The switch button is located at the lower left of the face plate. Directly above the switch button are a number of small holes which indicate the position of the microphone. The speaker volume control wheel is placed just above the microphone holes. The dial is located at the right side of the face plate.

2.03 Handset. The handset rests in wells at the rear of the upper housing. The hookswitch lever consists of two clear plastic bars,

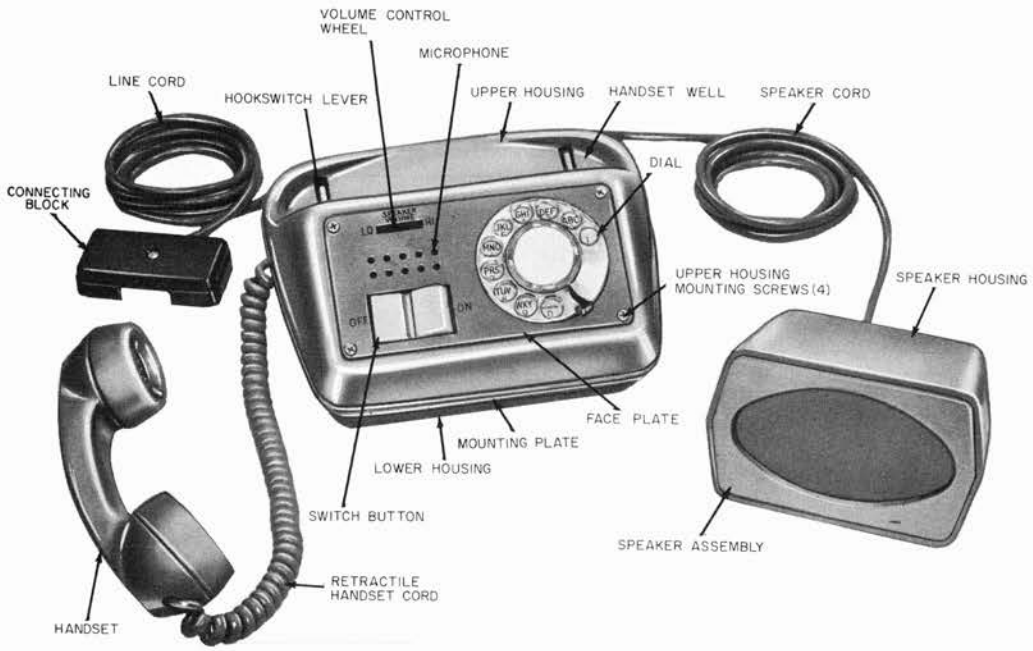


Figure 1. Type 880 Speakerphone.

one in each of the handset wells. The retractile handset cord extends from the left side of the main unit assembly, and the line cord and speaker cord extend from the rear of the main unit assembly, The line and speaker cords are approximately 6 feet in length.

Component Description

2.04 Face plate components. The OFF/ON switch button is used for switching from handset to loudspeaking operation (or loudspeaking to handset operation). The speaker volume control wheel controls the output of the speaker. Depending on service requirements, Type 880 Speakerphones may be equipped with one of four styles of dials: numerical 1 - 0, metropolitan ABC, SATT A or SATT B.

2.05 Signal circuit board. In place of a ringer, the Type 880 Speakerphone uses an electronic circuit to generate a tone signal for signaling. The signal circuit board is located in the speaker case. The signal circuit responds (on a non-selective basis) to any ringing frequency in the range of 16.6 to 66.6 cps. The frequency of the electronic ringing tone is essentially constant regardless or ringing frequency.

2.06 Type 33 ringer. The Type 880 Speakerphone may be ordered less the signal circuit board. In this case, an external Type 33 ringer unit must be used. When the Speakerphone is ordered without the signal circuit board, a blank circuit board is inserted in the space usually occupied by the signal circuit board and the four tone signal leads are taped.

2.07 Amplifier circuit boards. The microphone amplifier circuit board is located in the main unit assembly. The speaker amplifier circuit board is located in the speaker assembly.

2.08 Transmission network. The Type 880 Speakerphone is equipped with a transmission network of the automatic level- and sidetone-compensating type. Two varistors included in the network exhibit decreased resistance when the potential across them increases on shorter-loop connections due to the increase in loop current. Varistor V11, which is bridged across the line in series with a limiting resistor (see Figure 12), introduces a shunt loss between the impedance of the line and the impedance of the telephone, thus providing regulation of the transmit and receive levels. Varistor V22 an a-c path which shunts a 43-ohm resistor in the sidetone balancing impedance, as well as a d-c path which shunts the transmitter branch. It therefore serves the dual function of maintaining sidetone balance while controlling transmitter current.

2.09 Connecting block. A connecting block having ten terminals is provided with the Type 880 Speakerphone to facilitate use

with different ringing schemes, and to permit the use of an external power supply with the Speakerphone (if required). The connecting block also makes it possible to easily wire the Speakerphone for use with a Type 10A1 Key Telephone System.

2.10 Power is provided for the Type 880 Speakerphone's transistorized components by a self-contained power supply. This power supply operates directly from the 48-volt d-c central office battery, via the station interior wires. An external power supply may be needed in some cases. (Refer to paragraph 4.06.)

3. OPERATION

3.01 For handset operation, use the Type 880 Speakerphone as though it were a standard telephone. The switch button should remain in the OFF position.

To Answer a Call

3.02 To answer a call, press the ON side of the switch button (Figure 1). The neon lamp (located in the switch button) will start flashing. Upon hearing the distant party, adjust the speaker volume by rotating the speaker volume control wheel.

To Make a Call

3.03 To make a call, press the ON side of the switch button. The neon lamp within the switch button will start flashing indicating line seizure. When dial tone is heard, dial the desired number and listen for ringback tone or busy tone. Upon hearing the distant party, adjust the speaker volume by rotating the speaker volume control wheel.

To Disconnect

3.04 To disconnect, press the OFF side of the switch button. The neon lamp will stop flashing.

NOTE: The switch button must be pressed to the OFF position (on-hook condition) at the end of a conversation in order to receive or initiate other calls.

To Recall the Operator

3.05 To recall the operator, alternately press the OFF and ON sides of the switch button (flash) until the operator answers. (To talk privately to the operator, transfer to handset operation and push one of the hookswitch bars to flash the operator.)

To Transfer from Loudspeaker to Handset

3.06 To change from loudspeaker to handset operation, lift the handset and depress the OFF side of the switch button. The neon lamp in the switch button will stop flashing and the conversation may be continued via the handset. To switch from handset to loudspeaker operation, depress the ON side of the switch button and restore the handset.

Group Conference Calls

3.07 The Type 880 Speakerphone can be used for conferences. It is not necessary that the microphone be turned toward each person as he speaks. As the person speaking moves away from the microphone, the sound in the distant party's receiver decreases. When the Type 880 Speakerphone is used in quiet surroundings, the microphone will pick up words spoken several feet away. Under adverse conditions, such as a noisy room or a poor connection, speak within two feet of the microphone.

4. INSTALLATION

Mounting

4.01 Place the main unit assembly with attached speaker assembly in the desired location. Figure 2 shows a suggested arrangement of the Type 880 Speakerphone for best results. To minimize feedback, the main unit assembly must always be a sufficient distance from the loudspeaker. The microphone (in the main unit assembly) should never face toward the loudspeaker. The angle between the side of the Speakerphone and the nearest sound path from the loudspeaker should not exceed 90 degrees (Figure 2).

4.02 Mount the connecting block in an inconspicuous location on a wall or on the back of a desk.

Line Polarity

4.03 Line polarity is important at divided-ringing party-line stations, and in SATT offices. Connection information included in this Section assumes that the interior wires between the protector (or PBX switchboard, etc.) and the telephone location on the customer's premises have their polarities identified by the following standard tracers:

(a) Red - negative (-ring).

(b) Green - positive (+ tip).

(c) Yellow - ground.

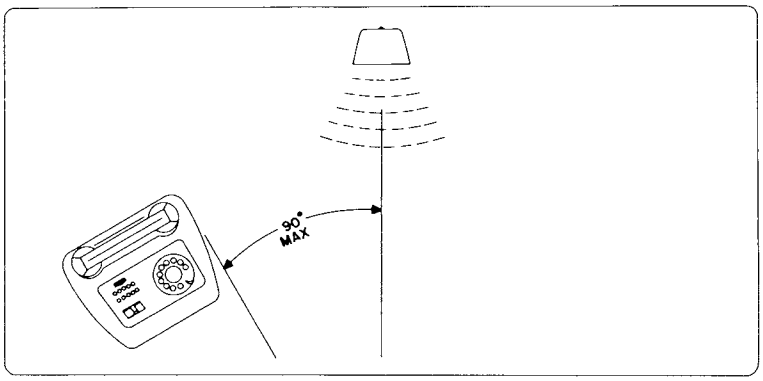


Figure 2. Suggested Arrangement for the Type 880 Speakerphone.

Electrical Connections

4.04 Interior wires. The Type 880 Speakerphone (with signal circuit board for tone signaling) is shipped wired for bridged ringing. Table 1 provides wiring information for the various types of ringing. The interior wires connect to the Speakerphone connecting block terminals as follows:

(a) The yellow (GRD) lead to terminal 4.

(b) The red (L1) lead to terminal 1.

(c) The green (L2) lead to terminal 6.

4.05 Type 33 ringer unit. When the Type 880 Speakerphone is supplied without the signal circuit board, a Type 33 ringer unit may be used for ringing. The Type 33 ringer unit must be ordered separately. The ringer unit may be connected to the Speakerphone connecting block as shown in Figures 3, 4, or 5; these figures also show the connections (in the ringer unit) to be made for the various types of ringing.

4.06 External power supply. When the total loop resistance exceeds 750 ohms, or when certain low-voltage switchboards such as the LEICH™ L55 or W.E.Co. No. 555 are used,

Table 1. Ringing Connections at the Connecting Block.

Connecting Block Terminals	Bridged Ringing		Divided Ringing + TIP (Non-SATT & SATT)		Divided Ringing - RING (Non-SATT & SATT)	
	Line Cord	Interior Wire	Line Cord	Interior Wire	Line Cord	Interior Wire
- RING 1	BRN-GRN RED	RED	RED	RED	BRN-GRN RED	RED
2	BLACK	-	BLACK	-	BLACK	-
3	-	-	-	-	-	-
GRD 4	BRN-YEL (SATT ONLY)	YELLOW (SATT ONLY)	BRN-GRN BRN-YEL (SATT ONLY)	YELLOW	YELLOW BRN-YEL (SATT ONLY)	YELLOW
5	-	-	-	-	-	-
+ TIP 6	YELLOW GREEN BLUE	GREEN	YELLOW GREEN BLUE	GREEN	GREEN BLUE	GREEN
7	WHITE	-	WHITE	-	WHITE	-
8	-	-	-	-	-	-
9	BRN-BLK	-	-	-	-	-
10	BRN-RED	-	BRN-RED	-	BRN-RED	-

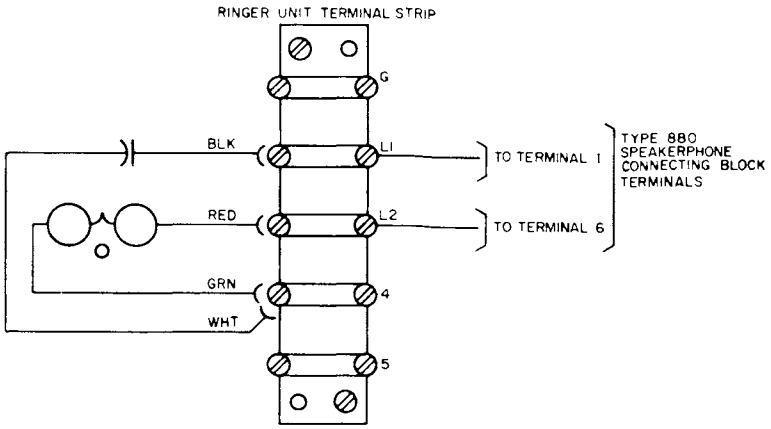


Figure 3. Type 33 Ringer Unit Wired for Bridged Ringing.

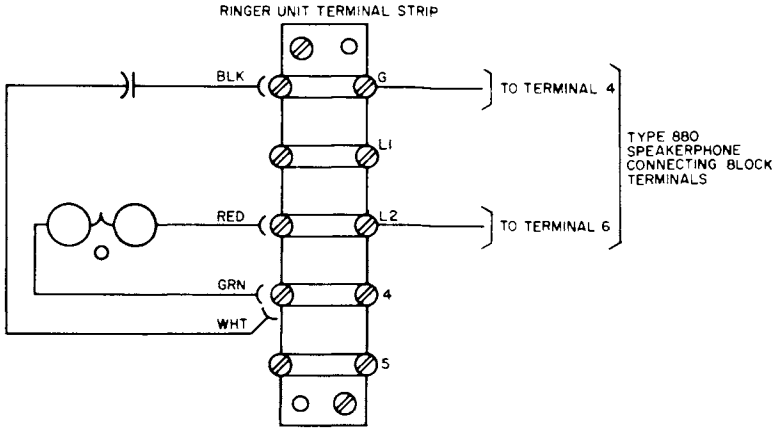


Figure 4. Type 33 Ringer Unit Wired for (+ Tip) Ringing.

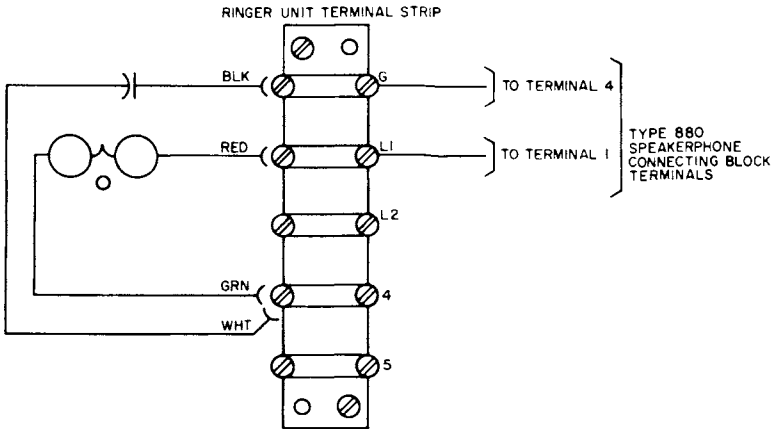


Figure 5. Type 33 Ringer Unit Wired for (-Ring) Ringing.

an external Type 88 power supply (L-7038-AO) is required. Move the BLU lead from terminal 6 to terminal 5 of the connecting block. Two leads (designated "Y" in Figure 6) connect to connecting block terminals 5 and 10, and a "Y" strap (Figure 6) connects terminals 6 and 10 on the connecting block.

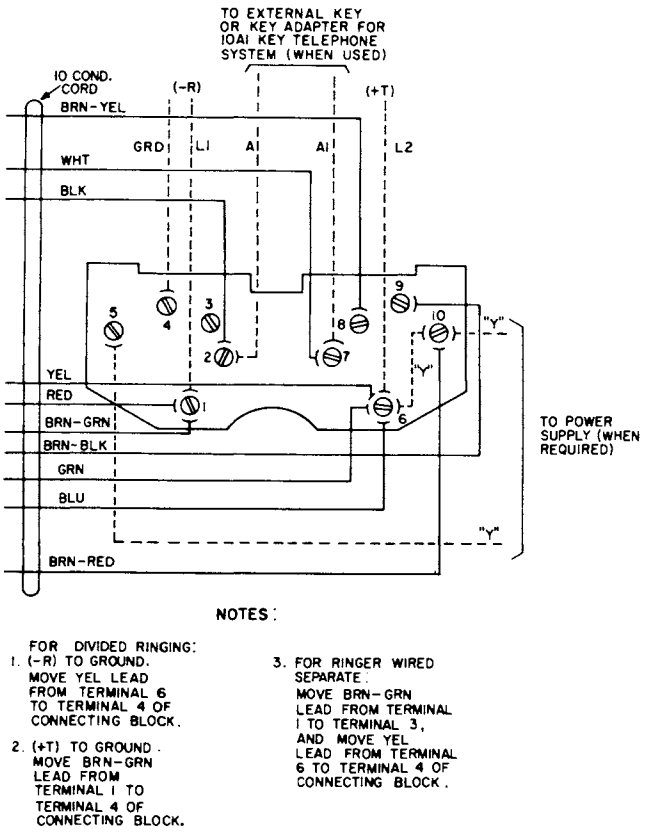


Figure 6. Connecting Block Wiring Diagram (Bridged Ringing).

Adjustments

4.07 Tone signal. The signal circuit board is located in the speaker assembly. To adjust the volume of the tone signal, insert a small screwdriver into the hole in the base of the speaker housing, and turn the screwdriver until the desired volume is attained.

4.08 Speaker volume. Adjust the speaker volume by rotating the speaker volume control wheel, so that the distant party's voice can be heard distinctly and without effort. Do not set the speaker volume higher than necessary since excessive volume may lead to acoustic feedback or "howling," and will also cause undesirable echo in the distant party's receiver.

Type 10A1 Key Telephone Systems

4.09 When the Type 880 Speakerphone is used with the Type 10A1 Key Telephone System, wire speakerphone connecting block terminals 1 and 6 to the appropriate R and T leads of the key telephone system, respectively. Then, wire speakerphone connecting block terminals 2 and 7 to the appropriate A and A1 leads of the external Key of Type 86A Key Adapter, respectively. (See Figure 6.)

4.10 When the handset is removed (or the ON side of the switch button is pressed), the answer relay of the key system operates and connects the telephone with line equipment through relay equipment.

5. FIELD MAINTENANCE

Main Unit Housing Removal

5.01 To remove the upper housing, remove the four Phillips-head screws located on the brushed aluminum face plate. Then lift off the face plate and remove the upper housing. To replace the upper housing just reverse the procedure.

5.02 To remove the lower housing of the main unit assembly, remove the three screws on the bottom.

Stamping Number Card

5.03 For information regarding stamping the dial number card, refer to the appropriate Section in the 473-820 series of General System Practices.

To Examine Dial Action

5.04 Use the following procedure to examine dial action:

(1) Remove the upper housing. With the upper housing removed, the backing plate is in view. See Figure 7.

(2) Remove the three flat-head backing plate mounting screws.

(3) Remove the backing plate from the backing plate mounting brackets (Figure 8) and turn it over to examine the dial action (Figure 9). Do not disconnect the dial leads unless the dial must be replaced.

Dial Replacement

5.05 Removal. To remove the dial, follow the procedure in paragraph 5.04, disconnect

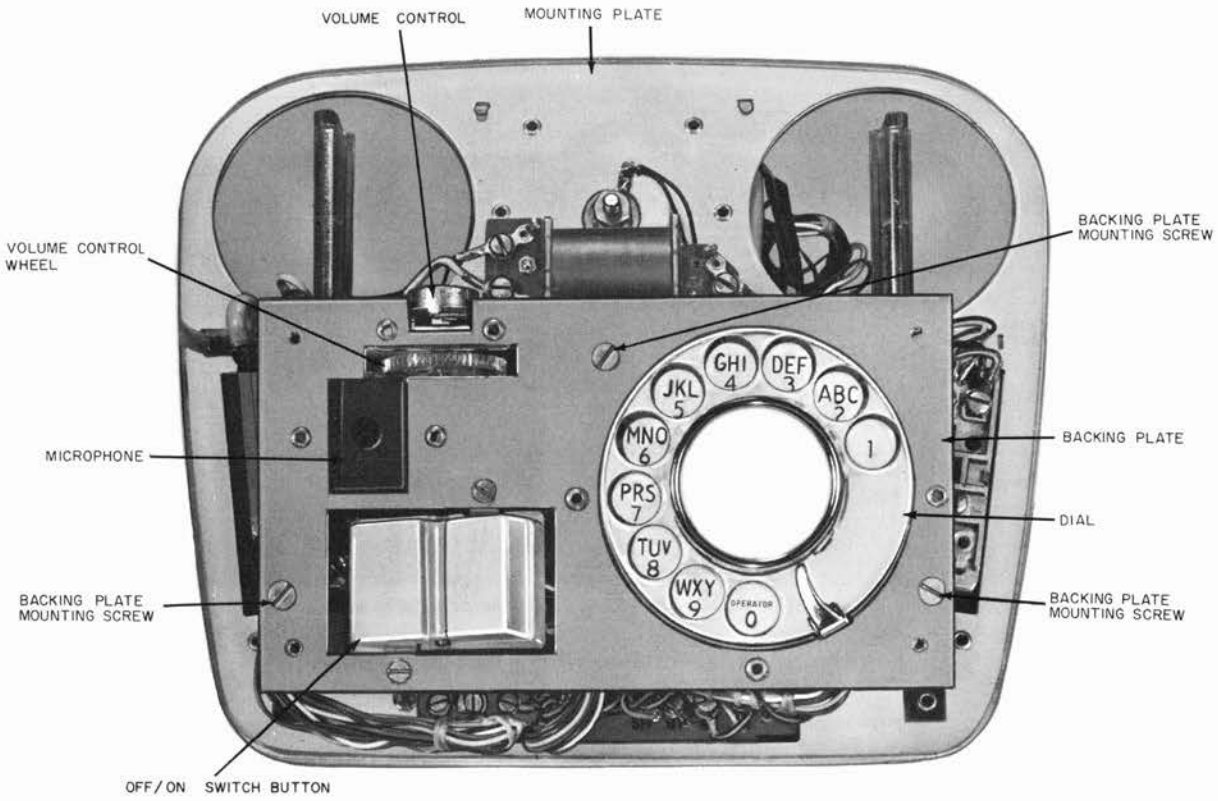


Figure 7. Main Unit Assembly with Upper Housing Removed.

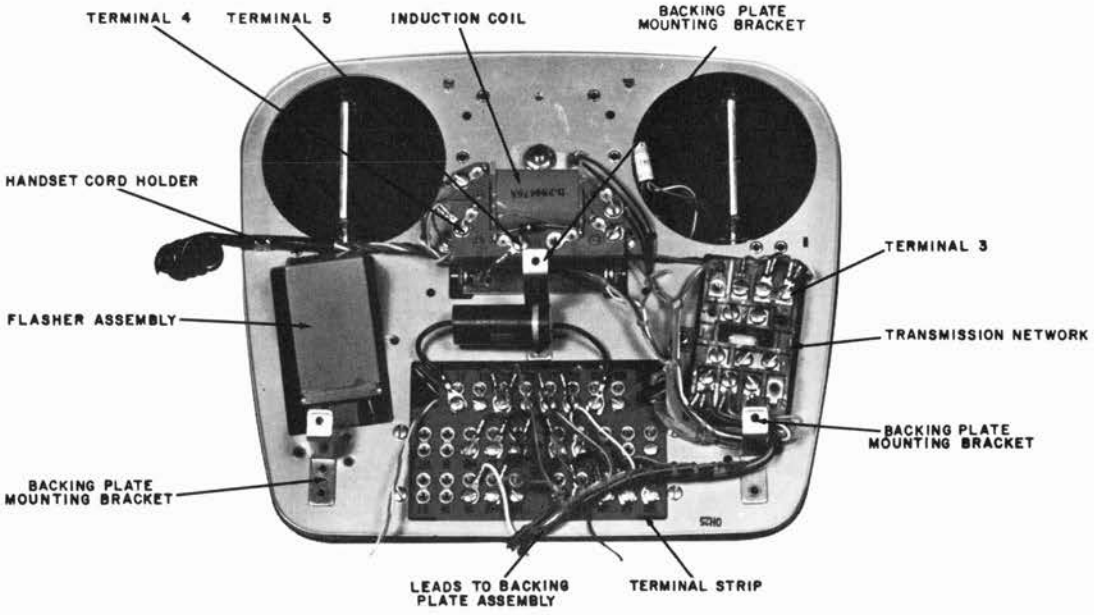


Figure 8. Main Unit Assembly with Upper Housing and Backing Plate Removed.

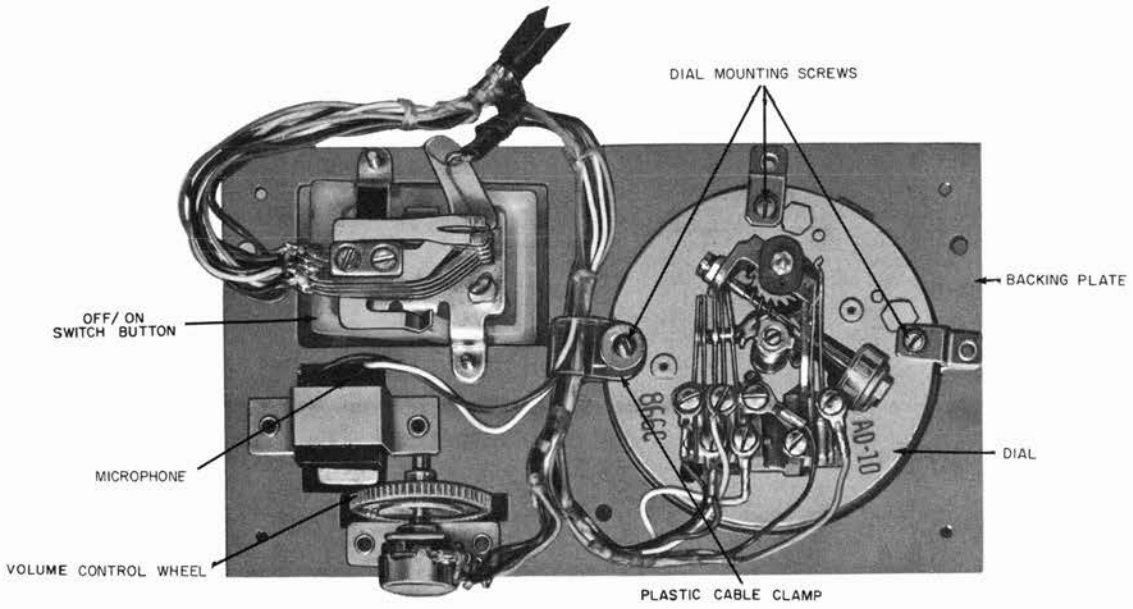


Figure 9. Rear of Backing Plate Assembly.

the dial leads, then remove the three dial mounting screws from the rear of the backing plate. See Figure 9. The complete dial assembly is now free and can be removed from the backing plate.

5.06 Installation. To install a dial assembly, use the following procedure:

(1) Position the dial assembly in the backing plate, and align the dial mounting screw holes with the holes in the backing plate.

(2) Fasten the dial to the backing plate with the three dial mounting screws.

(3) Connect the dial leads to their proper terminals (Figure 12) as follows (non-SATT dial):

(a) ORN to transmission network terminal 11.

(b) BLU to transmission network terminal 1.

(c) WHT to transmission network terminal 3.

(d) YEL to hookswitch.

(e) RED to front of internal terminal strip terminal 2T.

(f) BLK to transmission network terminal 2.

(4) Fasten the backing plate to the backing plate mounting brackets (Figure 8), and replace the upper housing.

5.07 For further dial information, refer to the appropriate Section in the 473-820 series of General System Practices.

Handset Cord Replacement

5.08 Use the following procedure to replace the handset cord at the Speakerphone:

(1) Remove the upper housing.

(2) Disconnect the GRN and BLK handset cord leads from transmission network terminal 3 (Figures 8 and 12).

(3) Disconnect the YEL lead from induction coil terminal 4, and the RED lead from induction coil terminal 5 (Figures 8 and 12).

(4) Release the handset cord holder from the Speakerphone mounting plate (Figure 8) and pull out the old cord.

(5) Connect the new handset cord leads to their proper terminals as follows (Figures 8 and 12).

(a) RED to induction coil terminal 5.

(b) YEL to induction coil terminal 4.

(c) GRN to transmission network terminal 3.

(d) BLK to transmission network terminal 3.

(6) Hook the handset cord holder to the Speakerphone mounting plate.

(7) Replace the upper housing.

5.09 For further handset maintenance, refer to the appropriate Section in the 473-802 series of General System Practices.

Line Cord Replacement

5.10 Use the following procedure to replace the line cord:

(1) Remove the lower housing.

(2) Release the amplifier circuit board by pressing aside the two spring type mounting brackets, and set it aside.

(3) Disconnect the line cord leads from the terminal strip.

(4) Release the line cord holder and pull out the old line cord.

(5) For bridged ringing, refer to Figure 12 and connect the new line cord leads to the terminal strip as follows:

(a) BRN-YEL to terminal EB.

(b) RED to terminal IR.

(c) WHT to terminal 4T.

(d) BLK to terminal 3R.

(e) BRN-GRN to terminal 1T.

(f) YEL to terminal 2R.

(g) BRN-BLK to terminal CR.

(h) GRN to terminal 2T.

(i) BRN-RED to terminal RC.

(j) BLU to terminal ER.

(6) Hook the line cord holder to the Speakerphone mounting plate.

(7) Remount the amplifier circuit board.

(8) Replace the lower housing.

5.11 Refer to Figure 12 and its appropriate note for divided ringing connections.

Speaker Housing Replacement

5.12 To remove the speaker housing, remove the Phillips-head screw from the rear of the speaker assembly. Removal of this screw frees the housing from the speaker components. The speaker cord passes through a hole in the rear of the speaker housing, making it necessary to slide the housing back along the speaker cord to expose the speaker components. Figure 10 shows the components free of the housing.

5.13 To replace the speaker housing, slide the housing forward on the speaker cord until it covers the components. Then replace and tighten the screw at the rear of the assembly.

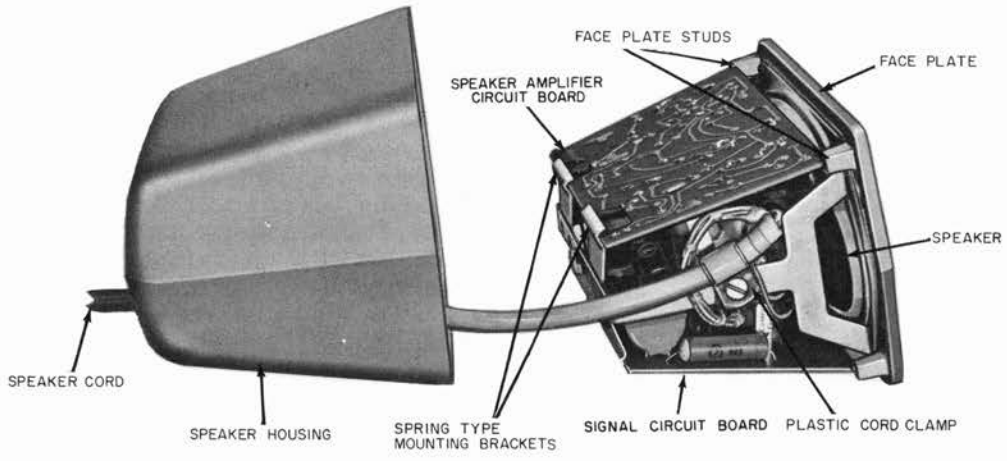


Figure 10. Speaker Assembly.

6. CIRCUIT DESCRIPTION

6.01 The Type 880 Speakerphone (refer to Figure 12) contains two separate telephone circuits (basic and electronic). Each circuit contains components peculiar to the mode of operation, and also those which are common to both circuits. Switching between circuits is accomplished through an ON/OFF switch which is interconnected with a standard hookswitch. When the ON/OFF switch is in the OFF position, the hookswitch functions in the same manner as the hookswitch of a standard dial telephone. When the ON/OFF switch is in the ON position, the switch serves as a hookswitch in the "off-hook" position. In addition to performing the same functions as a hookswitch, the ON/OFF switch also shunts the transmission network out of the circuit and closes the path between lines L1 and L2 and the rectifier, thus energizing the electronic circuits.

Basic Telephone Circuits

6.02 The dial pulsing circuit and ringer (or tone) circuit are identical for both standard telephone operation or loudspeaker telephone operation.

6.03 Figure 11 is a block diagram of the loudspeaker telephone circuit. Lines L1 and L2 are connected to the hybrid. The hybrid network is a bridge circuit used to couple the microphone and loudspeaker amplifiers to the line while minimizing the electrical coupling between these amplifiers. The ideal hybrid network should be exactly balanced against the impedance of the line, but since the balance actually varies with the characteristics of the particular line and its distant terminating impedance, some coupling always exists.

6.04 Sound waves produced by the user's voice are picked up by the microphone, amplified by the microphone amplifier, and applied to the hybrid for coupling to the line. Voice signals from the distant telephone flow into the hybrid via the line, are applied to the loudspeaker amplifier, amplified, and reproduced by the loudspeaker.

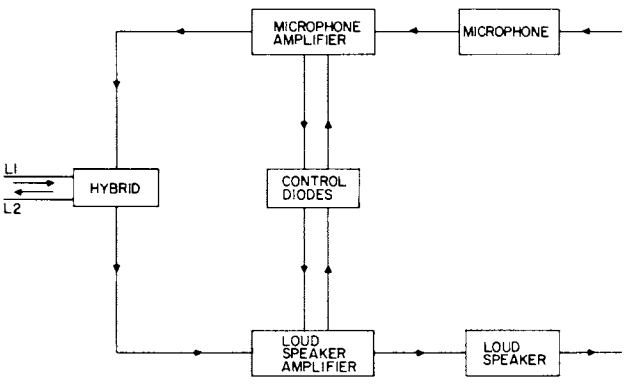


Figure 11. Block Diagram of Loudspeaker Telephone Circuit.

6.05 The circuitry is so arranged that the microphone and loudspeaker amplifier cannot operate at full gain simultaneously. When there is no signal in either channel, the loudspeaker amplifier is at full gain while the microphone amplifier output is attenuated approximately 15 db (attenuation is a general term used to denote a decrease in magnitude). Normal signal in the microphone channel causes the microphone amplifier to operate at full gain while the loudspeaker amplifier is attenuated approximately 20 db.

6.06 The loudspeaking telephone is normally powered from the telephone line. Diodes D10 through D13 assure proper polarity of the supply voltage to the transistors regardless of telephone line polarity, while zener diode D24 closely regulates the supply voltage so that no significant change in voltage occurs on loops from 0 to 1,000 ohms.

6.07 When a signal enters the microphone, it is amplified by transistor Q1. There is a delay in coupling the amplified signal to transistor Q2 because the low side of transformer T1 is floating. This condition is due to the audio appearing across the secondary of transformer T1 not being great enough (25 mv on a strong signal) to cause conduction of diodes D3 and D4, or D5 and D6. Some of the signal from transistor Q1 is coupled to the base of transistor Q4, and amplified by transistors Q4 and Q5, rectified by diode D1, and filtered. Some of this d-c signal then appears across control circuit diodes D3 through D8. The polarity of this signal is such that it causes these control diodes to conduct.

6.08 Since the diodes are now conducting and have a low internal resistance, the low side of the secondary winding of transformer T1 now has a ground path; the signal is transformer-coupled to transistor Q2, and amplified by transistors Q2 and Q3. The signal is then transformer-coupled to the telephone line via the resistance hybrid. Approximately 2-volts of d-c control signal is required to increase the microphone amplifier gain by 15 db. While the microphone amplifer gain is being increased, the diode control network is simultaneously decreasing the gain of the loudspeaker amplifier. The latter is accomplished by the control signal causing the conduction of diodes D7 and D8, thereby attenuating the speaker amplifier approximately 20 db.

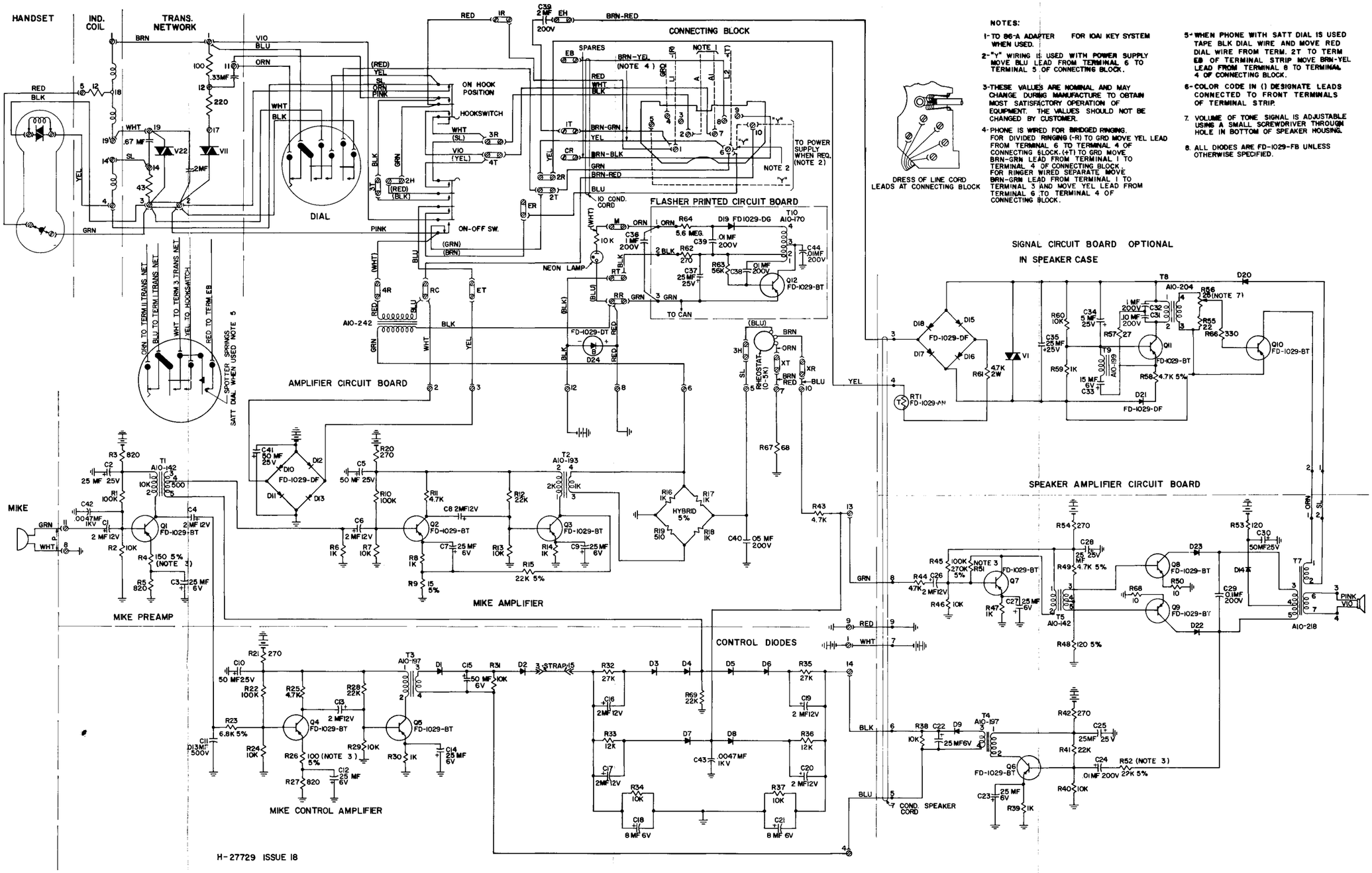
6.09 When there is no signal in the microphone channel and the distant party begins speaking, the incoming signal passes from the hybrid to transistor Q7, is amplified by transistors Q7, Q8, and Q9, and reproduced by the loudspeaker. Since the loudspeaker is to some degree acoustically coupled to the microphone, the signal would ordinarily enter the microphone. The microphone amplifier control circuit would greatly reduce the loudspeaker level, but the speaker control amplifier is connected to a rectifier and filter which are connected series-opposing with the microphone control rectifier and filter. Therefore, control voltage from the microphone circuit is effectively counteracted by the loudspeaker control signal, provided the loudspeaker unit is placed a reasonable distance (preferably 2-1/2 feet or more) away from the microphone.

Flasher Unit

6.10 Since the handset of a loudspeaker telephone remains in its cradle while the telephone is in use, it would be very easy to leave the unit on after use if no indication of this condition were provided. A flashing neon lamp, encased in the ON/OFF switch, is used to indicate that the telephone is in use. The 11-volt supply powers transistor Q12, a 50-kc transistor oscillator. The secondary of transformer T10 in the output circuit of transistor Q12 provides 150-volts at 50 kc, which is then rectified and filtered. This output is applied to a neon lamp in the oscillator circuit, through a 5.6-megohm resistor and a 100K resistor, providing the required voltage to fire the neon lamp, which flashes due to the charge and discharge action of capacitor C36. The neon lamp flashes at the rate of 20 flashes per minute.

Electronic Ringer

6.11 The electronic ringer is responsive (on a non-selective basis) to any ringing frequency in the range from 16 to 66 cps. The a-c ringing current is rectified and filtered. The resulting d-c voltage is used to power a two-frequency oscillator, Q11, operating at approximately 2,000 cps and self-quenched (self-interrupted) at 12 cps. The oscillator signal is amplified by a ringer output transistor, Q10, and applied to the loudspeaker.



NOTES:

1- TO 86-A ADAPTER FOR 10A1 KEY SYSTEM WHEN USED.

2- "Y" WIRING IS USED WITH POWER SUPPLY MOVE BLU LEAD FROM TERMINAL 6 TO TERMINAL 5 OF CONNECTING BLOCK.

3- THESE VALUES ARE NOMINAL AND MAY CHANGE DURING MANUFACTURE TO OBTAIN MOST SATISFACTORY OPERATION OF EQUIPMENT. THE VALUES SHOULD NOT BE CHANGED BY CUSTOMER.

4- PHONE IS WIRED FOR BRIDGED RINGING. FOR DIVIDED RINGING (-R) TO GRD MOVE YEL LEAD FROM TERMINAL 6 TO TERMINAL 4 OF CONNECTING BLOCK. (+T) TO GRD MOVE BRN-GRN LEAD FROM TERMINAL 1 TO TERMINAL 4 OF CONNECTING BLOCK FOR RINGER WIRED SEPARATE MOVE BRN-GRN LEAD FROM TERMINAL 1 TO TERMINAL 3 AND MOVE YEL LEAD FROM TERMINAL 6 TO TERMINAL 4 OF CONNECTING BLOCK.

5- WHEN PHONE WITH SATT DIAL IS USED TAPE BLK DIAL WIRE AND MOVE RED DIAL WIRE FROM TERM. 2T TO TERM EB OF TERMINAL STRIP MOVE BRN-YEL LEAD FROM TERMINAL 8 TO TERMINAL 4 OF CONNECTING BLOCK.

6- COLOR CODE IN () DESIGNATE LEADS CONNECTED TO FRONT TERMINALS OF TERMINAL STRIP.

7. VOLUME OF TONE SIGNAL IS ADJUSTABLE USING A SMALL SCREWDRIVER THROUGH HOLE IN BOTTOM OF SPEAKER HOUSING.

8. ALL DIODES ARE FD-1029-FB UNLESS OTHERWISE SPECIFIED.

Figure 12. Schematic and Wiring Diagram, Type 880 Speakerphone.