

## 4A SPEAKERPHONE COMPONENTS

### IDENTIFICATION, INSTALLATION, OPERATION, AND MAINTENANCE

#### 1. GENERAL

**1.01** This section contains information for the 4A speakerphone system.

**1.02** This section is reissued to:

- Show 680A and 680AD transmitters MD
- Add information on 680AE transmitter
- Add safety information for the 85B1 power unit

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

#### 2. IDENTIFICATION

**2.01** The 4A speakerphone system is a hands-free voice switching system for use as a telephone adjunct and is a replacement for the 3-type speakerphone system which is manufacture discontinued (MD).

**2.02** The 4A speakerphone system consists of a transmitter, loudspeaker set, power unit, and either a connecting block or adapter that when connected to a suitable telephone set, provides:

- Hands-free telephone operation
- On-hook dialing (when dial is not obstructed)
- Automatic switching from speakerphone to handset operation
- Transmitter cutoff for private conversation
- Visual indication when system is in use
- Cutoff common ringer or other signaling devices when desired.

**2.03** Components of the 4A speakerphone system are shown in Fig. 3.

**2.04** This system may be used with the 1A, 1A1, or 1A2 key telephone systems and all PBXs.

**2.05** For additional schematic and circuit information refer to SD- and CD-69909-01, respectively.

#### A. Ordering Guide

**2.06** Components which make up the various arrangements of the 4A speakerphone system are ordered separately as follows:

- Set, Loudspeaker, 108AA-\* (includes 7-foot D20N mounting cord)
- Transmitter, 680AE-\* (includes 7-foot, D8S mounting cord)
- Transmitter, 680AE14-\* (same as 680AE except includes 14-foot D8S mounting cord)
- Unit, Control 80B-49† (one required for each 4-wire or combination of 2-wire/4-wire station equipped with 4A speakerphone)
- Unit, Power, 85B1-49

- Block, Connecting, 82B-49†
- Adapter, 223C-49†
- Adapter, 223D-49†

\*Add color suffix; refer to paragraph 2.08.

†Only one of these four components required per installation, depending on telephone set type.

#### NOTICE

Not for use or disclosure outside the  
Bell System except under written agreement

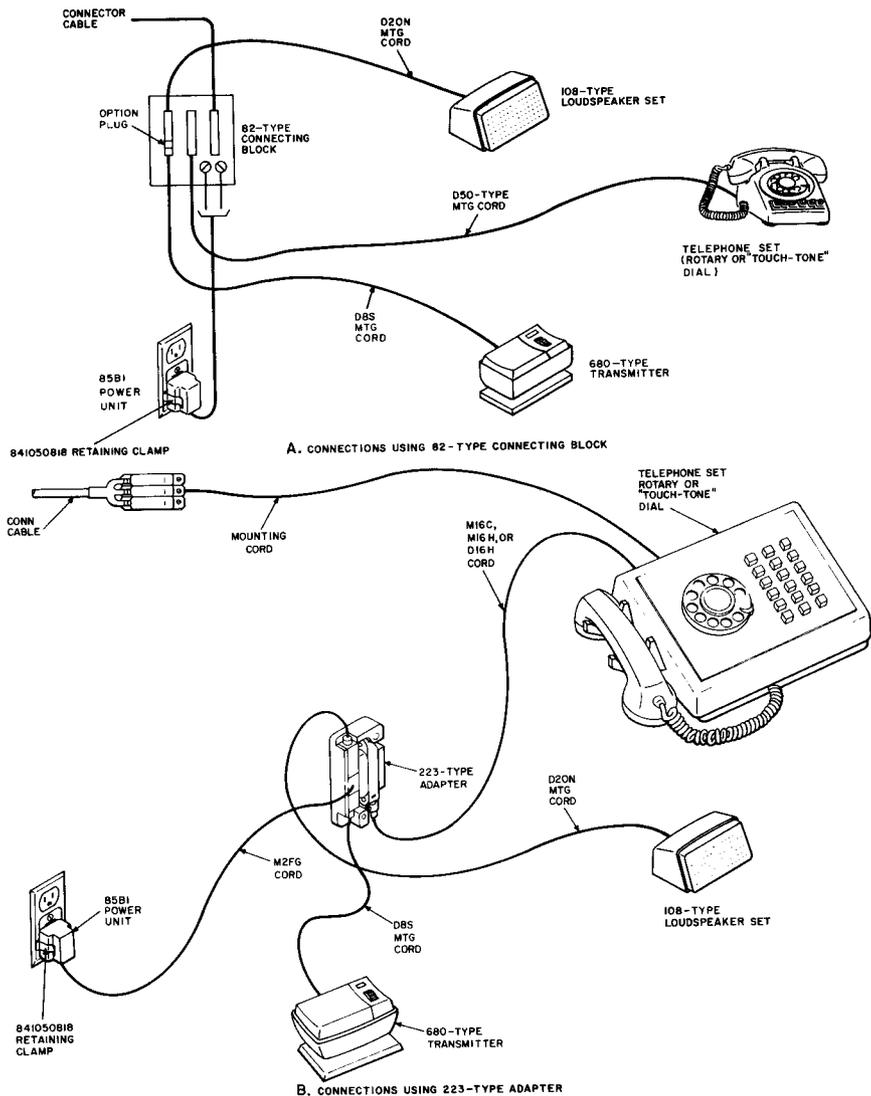


Fig. 1—Typical Arrangements of 4A Speakerphone System

2.07 A 14-foot cord may be ordered for field replacement for the loudspeaker set or 223-type adapter. Example:

Cord, D20N-87, 14 feet (108-type loudspeaker set)

Cord, D16H-50, 14 feet (223C adapter)

Cord, M16H-87, 14 feet (223D adapter)

2.08 The transmitter and loudspeaker set will be shipped in four promoted colors: Black (-03),

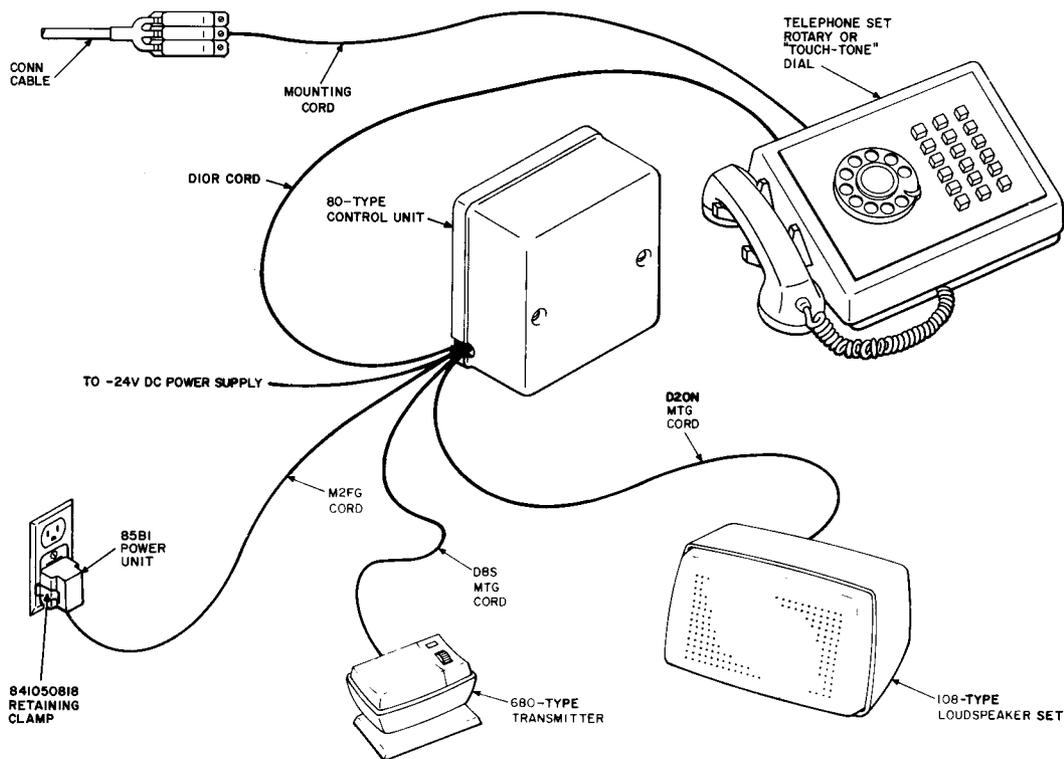


Fig. 2—Typical Arrangement of 4A Speakerphone System With 2- or 4-Wire Telephone Set

Green (-51), White (-58), and Light Beige (-60). The following kits may be ordered if a color change is desired. Each kit contains all necessary color significant parts to convert both the loudspeaker and transmitter.

| Kit of Parts | Color      |
|--------------|------------|
| D-180507     | Black      |
| D-180508     | Ivory      |
| D-180509     | Moss Green |
| D-180510     | Red        |
| D-180511     | Yellow     |

|          |           |
|----------|-----------|
| D-180512 | White     |
| D-180513 | Lt. Beige |
| D-180514 | Lt. Gray  |
| D-180515 | Aqua Blue |

**2.09 4A Speakerphone System Circuits.**

- (1) The 4A speakerphone incorporates a voice-switching circuit which eliminates singing and essentially eliminates far-end talker echo.
- (2) When there is no transmission of speech, loss is automatically inserted in the transmit circuit and gain is added to the receive circuit.

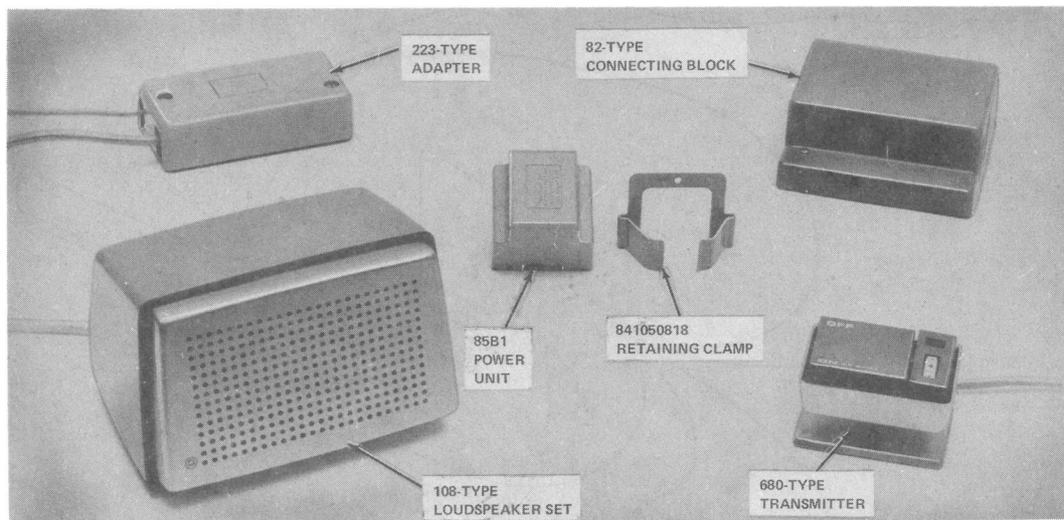


Fig. 3—Components of 4A Speakerphone System

This simultaneous transfer of loss and gain avoids a singing condition while receiving.

(3) When speech is transmitted, the gain of the transmitter circuit increases to normal. Simultaneously, the gain of the loudspeaker circuit lowers to avoid singing as a result of the increased transmitter gain. The amount of the gain change depends upon the setting of the volume control.

(4) A circuit, referred to as a switchguard, utilizes the voltage in the loudspeaker circuit to prevent false operation of the switching circuit from the receive speech output of the loudspeaker which is picked up by the microphone.

(5) A predetermined voice level is necessary to switch from the receiving to the transmitting condition. In the presence of steady room noise, such as a fan or an air conditioner, a special circuit, called noise-guard circuit, automatically raises the required threshold level to prevent operation of the switching control circuit by the noise. Talkers should still switch satisfactorily because they generally increase their speaking levels under noisy conditions.

#### B. Radio Frequency Interference (RFI) and/or Static Electricity Discharge Protection

2.10 In areas where RFI and/or static electricity is a problem, install a 680AD (MD) or 680AE transmitter and a 108AA loudspeaker set.

#### C. 680A (MD), 680A14 (MD), 680AR (MD), 680AR14 (MD), 680AD (MD), 680AD14 (MD), 680AE, or 680AE14 Transmitter

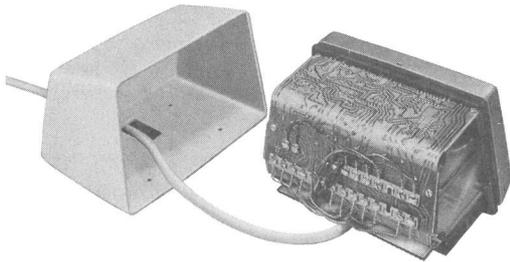
2.11 The transmitter is a small unit incorporating the microphone, preamplifier, an indicator lamp, and the operating controls for the speakerphone. The controls include the ON OR QUIET button, the OFF button, and the volume control. The control button and a stationary button comprise the color significant portions of the transmitter. The ON OR QUIET button activates the system and, if held depressed, disables the microphone so that the speakerphone user may conduct a private conversation without the party at the far end hearing. The OFF button simply turns off the system. The volume control varies the received sound level, but has no effect on the level of speech transmitted to the telephone line. The indicator lamp lights when the system is on.

2.12 The 680AE transmitter provides RFI and static discharge protection and replaces all other 680-type transmitters listed previously.

**Note:** Whenever the 680AD transmitter is used with either a 108A or 108AR loudspeaker set it is necessary to install a 106A varistor (shipped with the transmitter) between terminals 7 (TVL) and 5 (GRD) in the loudspeaker set to prevent damage to the loudspeaker set from discharge of static electricity.

**D. 108A (MD), 108AR (MD), or 108AA Loudspeaker Set**

2.13 The loudspeaker set contains the electronic circuitry, the loudspeaker, and the relay and transformer necessary to couple to the telephone system. The electronics, loudspeaker, and cord comprise the non-color-significant subassembly, and a color significant plastic housing completes the set.



**Fig. 4—Typical 108-Type Loudspeaker Set With Cover Removed**

2.14 The 108AA loudspeaker replaces the 108A and 108AR loudspeakers and provides the following additional options or features:

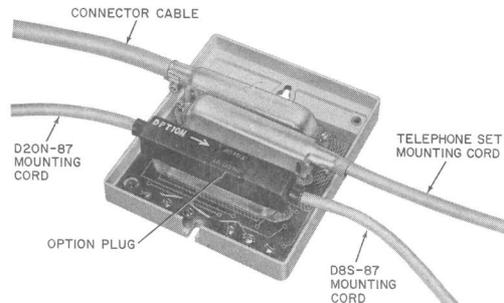
- Improved RFI suppression
- Protection against discharge of static electricity
- Provision for increased switchguard action by means of screw terminal connections. (Refer to paragraph 5.02.)

**Note:** Whenever the 108A or 108AR loudspeaker set is used with the 680AD transmitter it is necessary to install a 106A

varistor (shipped with the transmitter) between terminal 7 (TVL) and 5 (GRD) in the loudspeaker set to prevent damage to the loudspeaker set from discharge of static electricity.

**E. 82A (MD) or 82B Connecting Block**

2.15 The 82-type connecting block is used to interconnect the 4A speakerphone system (680-type transmitter, 108-type loudspeaker set, and the 85B1 power unit) for use with plug-ended 6-button key telephone sets. A reversible option plug provides the key system options, ringer cutoff or operation of an auxiliary relay. The connecting block includes three 50-pin connectors, one for the telephone set, one for the key system connector cable, and one that accepts the transmitter and loudspeaker set connectors with the reversible option plug. The arrow on the plug of the D20N mounting cord should point to the option required on the option plug. There are seven screw terminals on the 82A and eleven screw terminals on the 82B connecting block (Fig. 9 and 10).



**Fig. 5—82-Type Connecting Block With Cover Removed**

2.16 The 82B is the same as the 82A connecting block with the exception that on the 82B access to terminals 10 and 35 from the speakerphone plug and terminals 21 and 46 from the telephone set and line receptacle are made available by means of screw-type terminals (Fig. 9).

**F. 223A (MD), 223C, or 223D Adapters**

2.17 The 223-type adapter (Fig. 6) interconnects the 680-type transmitter, the 108-type loudspeaker set, the 85B1 power unit and certain

codes of telephone sets. The adapter consists of a plastic housing and a cord with a 50-pin connector on one end and either spade-tipped terminations or a post-type connector on the other end. The connector end accepts plugs from the transmitter and loudspeaker set and the plug from an M2FG cord (furnished with the adapter) which connects to the 85B1 power unit. The cord from the adapter connects to the telephone set. Three codes of the 223-type adapter are described as follows.

(a) **223A (MD) Adapter:** This adapter is equipped with an M16C cord having a 50-pin connector on one end and spade-tipped conductors on the other end for connection to telephone sets with screw terminal fields, see Fig. 11.

(b) **223C Adapter:** This adapter is equipped with a D16H-50 cord having a 953-type connector for connection to telephone sets equipped with square-post connection fields, see Fig. 12.

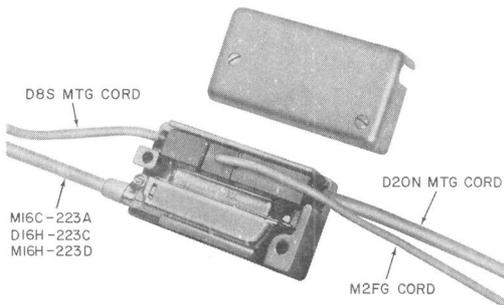


Fig. 6—223A (MD), 223C, or 223D Adapter

(c) **223D Adapter:** This adapter is the same as the 223A adapter except that it is equipped with a M16H-87 cord instead of the M16C (MD) cord. The (O-R) lead of the M16H cord is connected through to provide a remote ON lead for enabling the one-touch calling feature of the TOUCH-A-MATIC® telephone sets and adjunct dials, see Fig. 11.

#### G. 80A (MD) or 80B Control Unit

**2.18** One 80-type control unit is required for each 4-wire or combination 2-wire/4-wire station used with 4A speakerphone.

**2.19** The 80-type control unit (Fig. 2 and 7) provides for connecting the 4A speakerphone system to either a 2- or 4-wire telephone transmission network. All standard operating features of the 4A speakerphone system are retained. Attached to the chassis of the control unit is a connector (same as that used in the 223-type adapter) to which the 108-type loudspeaker set, the 680-type transmitter and the 85B1 power unit are connected.

**2.20** The 80B control unit replaces the 80A control unit. The 80B is the same as the 80A with one exception; an additional connection from the 4A speakerphone system has been added on a screw terminal of the 80B which is required for enabling the one-touch calling feature with TOUCH-A-MATIC telephone sets and dials.

**2.21** For additional schematic and circuit information, refer to SD- and CD-69923-01, respectively. For typical connection information, refer to Section 512-730-460.

#### H. 85B1 Power Unit

**2.22** The power unit transforms the local customer-provided 115-volt, 60 Hz power to the voltage required to operate the 4A speakerphone system.

**2.23** A retaining clamp (841050818) (Fig. 1 and 2) will be shipped with the 85B1 power unit.

### 3. INSTALLATION

#### A. Telephone Sets

**3.01** The telephone sets specified for use in 4A speakerphone system provide the following features.

- (1) A set of normally closed (with handset on-hook) line switch contacts to disconnect the speakerphone when the handset is lifted.
- (2) Two sets of off-normal (make) contacts in the dial (rotary dial sets dialed in an on-hook condition) to short loudspeaker receive path and handset receiver during dialing.
- (3) A set of make contacts (s and t) in the dial common switch (TOUCH-TONE® sets dialed in the on-hook condition) to connect line power IR lead from the loudspeaker set to the dial oscillator. If a polarity guard is provided these

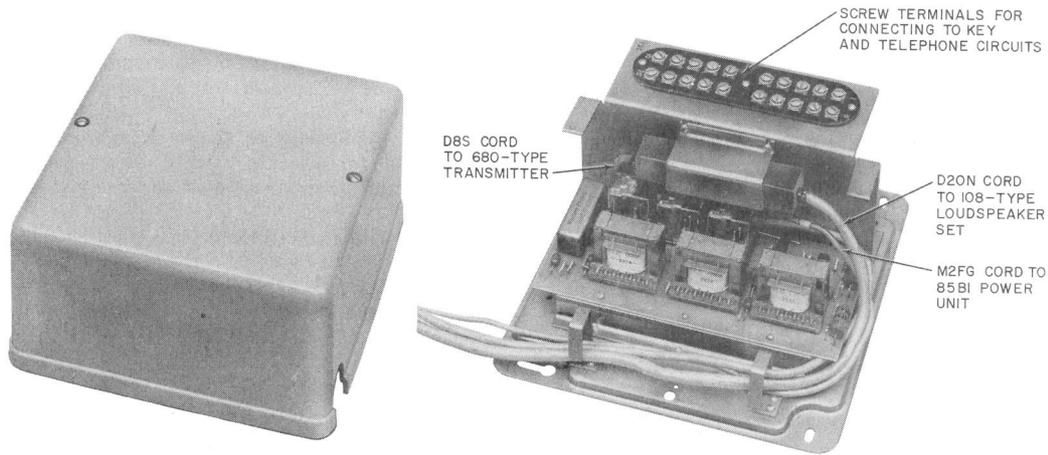


Fig. 7—80-Type Control Unit With Cover Removed

contacts (s and t) are isolated from the oscillator by the polarity guard.

**3.02** Certain wiring precautions must be observed when multiplying sets wired for speakerphone. The T1, R1, IR or P4, IT or P3, LK and AG leads should be disconnected at or as close as possible to the set in those stations not having speakerphone. Even though none of the multiplied sets have speakerphone, the leads involved should be disconnected. Failure to do so can result in:

- Tip and ring cross through the T1 and R1 leads
- False operation of an A relay through the AG lead
- Shorting the receiver input to loudspeaker set, disabling the loudspeaker through the P3 and P4 leads.

**3.03** An 85B1 power unit (UL approved) can be used to power only one speakerphone system. When power is provided via connector cable from a remote location the 85B1 power unit should be located less than 85 feet from the 108-type loudspeaker set when using 26 gauge wire or less than 125 feet from the 108-type loudspeaker set when using 24 gauge wire.

**3.04** A retaining clamp (841050818) (Fig. 1 and 2) should be mounted to the ac receptacle to hold the power unit securely and to prevent accidental loss of power.

**Danger:** For safety, securely attach retaining clamp to ac outlet using outlet cover screw **BEFORE** attempting to install 85B1 power unit. See Fig. 8. The power unit and any other cord plugged into the ac outlet should always be unplugged completely from outlet **BEFORE** attempting to attach or remove the clamp. This will prevent the possibility of a loosened retainer clamp or metallic outlet cover making contact with the ac prongs of the 85B1 power unit when partially withdrawn from outlet. Do not use retaining clamp on outlets where the cover mounting screw holds the duplex outlet in the box.

**Warning:** Care should be taken to trim and dress leads connecting to low voltage output of 85B1 power unit to assure that inadvertent connection to conducting surfaces or other power sources does not occur. If more than one power unit is plugged into a multiple receptacle

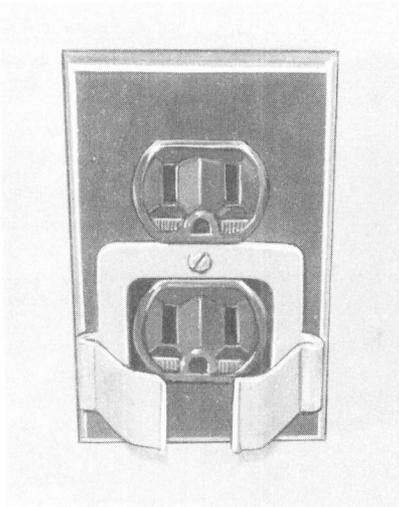


Fig. 8—841050818 Retaining Clamp Mounted on AC Outlet Box Using Outlet Cover Screw

*strip, there must be at least one-inch separation between power units. Only UL listed receptacle strips with adequate power rating shall be used. Use of a continuous terminal power strip that allows the secondary output terminals of the power unit to be in close proximity to the ac line source is not recommended.*

#### C. Planning An Installation

3.05 When planning an installation, observe the following.

- (1) Avoid placing apparatus with plastic covers or parts in location where ambient temperatures may exceed 140 degrees F.
- (2) Install 85B1 power unit observing procedures in paragraph 3.03 and 3.04.
- (3) Place loudspeaker set and transmitter within convenient reach of user and a minimum of one foot apart.

- (4) Transmitter must be at least two feet from transformer or any ac powered device.
- (5) There should be no obstructions between the user, loudspeaker set, and transmitter.
- (6) Make connections as shown in appropriate section for specific telephone set which indicate grandfathered and registered arrangements.
- (7) If 82-type connecting block is used, install audible signal cutoff using the RING CUTOFF or AUX RELAY option as needed. Use the leads to common signal control and common ringer or buzzer circuit for this cutoff feature (Fig. 10).
- (8) For station busy lamp circuit with 4A speakerphone system, refer to the appropriate Service section for telephone set involved.

#### 4. OPERATION

**Note:** The 4A speakerphone system permits normal use of the telephone set for originating, receiving, or transferring calls.

##### 4.01 To originate a call using speakerphone.

- (1) Depress transmitter ON OR QUIET button and release. The ON lamp will light indicating speakerphone is turned on, listen for dial tone transmitted through loudspeaker set. Telephone handset is not lifted during dialing (except where handset covers dial [paragraph 4.01(3)]).
- (2) Operate dial of telephone set in normal manner.
- (3) When originating calls from telephone sets which require off-hook dialing, dial in the normal manner, then depress and hold the ON OR QUIET button until the handset is restored.
- (4) When the complete number is dialed, ringing tones, busy signals or called party answer will be heard from the loudspeaker set.
- (5) When the called party answers, the transmitter and loudspeaker set are used to carry on a hands-free conversation. Adjust volume level as desired.

**Note:** Best *operational* results are obtained at the lowest acceptable volume setting.

**4.02** To answer an incoming call using speakerphone, depress ON OR QUIET button on transmitter. Ringing is tripped and system is automatically connected to the line through the loudspeaker set.

**4.03** To disable the transmitter when it is desired not to transmit conversation in the room to a distant party.

- (1) Depress ON OR QUIET button to full extent of its travel and hold down during entire time transmitter is to be disabled.

**Note:** With transmitter disabled, conversation will not be transmitted to the distant party, however, the distant party can still be heard over the loudspeaker.

- (2) After private conversation is completed and it is desired to transmit to the distant party again, release ON OR QUIET button. System is now restored to full hands-free capability.

**4.04** To terminate a call on speakerphone, depress OFF button on transmitter. ON lamp will extinguish, and speakerphone system will be restored to the OFF condition.

**4.05** To transfer from handset to speakerphone operation.

- (1) Depress and hold ON OR QUIET button of transmitter.
- (2) Return handset to mounting, and release ON OR QUIET button.
- (3) Adjust volume as required.

**4.06** To transfer from speakerphone to handset operation, lift handset which will automatically turn off speakerphone.

## 5. MAINTENANCE



**Remove power from 4A speakerphone system before attempting any maintenance of speakerphone components. Observe procedures in paragraph 3.04.**

## A. Tests and Adjustments

**5.01** When system is installed or maintenance is performed on any component, make the following tests.

- (1) Place a speakerphone call to the test desk.

**Note:** Excessively loud TOUCH-TONE signals will result at loudspeaker output during dialing if connections of IT and IR leads are reversed in the telephone set. Speakerphone test call should verify that TOUCH-TONE signals are not excessively loud.

- (2) Adjust loudspeaker volume to moderately loud listening level.

- (3) Have test center repeat the question "In what suburb does Joe live?" several times.

- (4) If clipping is detected in the sentence, particularly in the first b in *suburb* and the t in *what*, increase the distance between the transmitter and loudspeaker set. If condition still exists, see paragraph 5.02.

- (5) Repeat this test at a high listening level by turning the volume control to maximum volume.

**5.02** An alternate loudspeaker connection is provided in each 108AA loudspeaker to compensate for room conditions which cause voice-switching during reception. The effect of voice-switching is to clip portions of the incoming speech. To compensate for this condition, proceed as follows.

- (1) Remove cover of 108AA loudspeaker to access terminal strip (paragraph 5.06).
- (2) Move red loudspeaker lead from terminal 29 to terminal 32.

**Note:** Use care when locating spade tip lead on terminal so as not to contact adjacent circuit paths.

**5.03** If voice-switching is caused by external telephone audible signaling devices; proceed as follows.

- (1) Place audible signaling devices away from transmitter unit, if possible.
  - (2) Lower volume of audible signaling devices to level that will not cause voice-switching feature to operate.
  - (3) Install audible signal cutoff using the RING CUTOFF or AUX RELAY option as needed. Use the leads to common signal control and common ringer or buzzer circuit for this cutoff feature (Fig. 10).
- 5.04 If speakerphone fails to operate properly, refer to Table A for trouble analysis.

#### B. Cleaning

- 5.05 Clean plastic covers and housings with water dampened KS-2423 cloth or equivalent. Do not use scouring powders or cleaners.

#### C. Removal of Plastic Parts



***Do not attempt any changes or repairs to either the 680-type transmitter or 108-type loudspeaker set other than to replace the loudspeaker set mounting cord or the respective plastic parts for either the transmitter or loudspeaker set.***

- 5.06 The plastic housing on the 108-type loudspeaker set is held in place by two screws located on the bottom of the set. To remove the plastic housing, remove the two screws from the bottom of the set and slide the cover off the chassis (Fig. 4).

**Note:** Do not remove the circuit board from the chassis.

- 5.07 The plastic covers on the 680-type transmitter snap into place. First, remove the stationary cover by squeezing with fingers on the front and back surface and lifting gently. Second, pry up the rocker cover lifting along the edge adjacent to the thumb wheel.



***The loudspeaker set and transmitter are designed so that color significant components can be easily changed. In order to reduce shelf inventory it is suggested that the kits listed in paragraph 2.08 be stocked instead of extra loudspeaker sets and transmitters.***

#### D. Change of Loudspeaker Set Card

- 5.08 First remove housing as in paragraph 5.06. Two of the mounting cord leads are secured individually, the rest are permanently connected to plastic wafer strips (see Fig. 4). Loosen, but do not remove screws that secure individual leads and wafer strips. ***Do not attempt to remove spade tips from wafer strips.*** Next remove the screw that fastens the stay band of the cord. Slide the spade tips and wafers through the hole in the bottom of the plastic chassis. To install the new cord, reverse the procedures.

**Note:** Be careful not to damage the circuit board, particularly the flexible areas of the bends.

TABLE A

## 4A SPEAKERPHONE SYSTEM TROUBLE ANALYSIS

| TROUBLE INDICATION   | PROBABLE CAUSE  | CHECK  |
|--|---|--|
| Speakerphone inoperative; indicator does not light   | No power, or open wiring                                  | Power supply outlet with a neon lamp voltage tester or equivalent, or check LK lead for open |
| Lamp does not light but K-relay (108-type loudspeaker set) operates and releases when ON OR QUIET button is released | Loose connection in local wiring                          | Switchhook contacts or A1 and LK leads for open  |
| Rotary dial pulses heard over loudspeaker  | Dial wiring   | For proper dial P3 and P4 leads  |
| No dial tone heard when speakerphone is ON, but can be heard in handset  | Open wiring   | R1 and T1 leads from telephone set   |
| No dial tone heard on speakerphone or handset  | Open wiring   | Tip or ring from line  |
| Dial tone cannot be broken with dial when on speakerphone  | Incorrect wiring  | Connection of tip and ring from telephone line to telephone set                              |
| TOUCH-TONE dial inoperative when speakerphone is ON  | Dial wiring   | For proper TI, RI, IT, and IR leads  |
| Excessively loud TOUCH-TONE signals at loudspeaker output during dialing   | Incorrect Connections                                     | For proper IT and IR connections   |
| Noise on speech transmission associated with fluorescent lamp operation  | Electro-magnetic pickup                                   | Position transmitter on different area of desk, table etc, to reduce noise.                  |
| Noise on speech transmission associated with radio frequency interference  | High level radio frequency AM, FM, etc. in immediate area | Install 680AR, 680AD, or 680AE transmitter and 108AR or 108AA loudspeaker set.               |

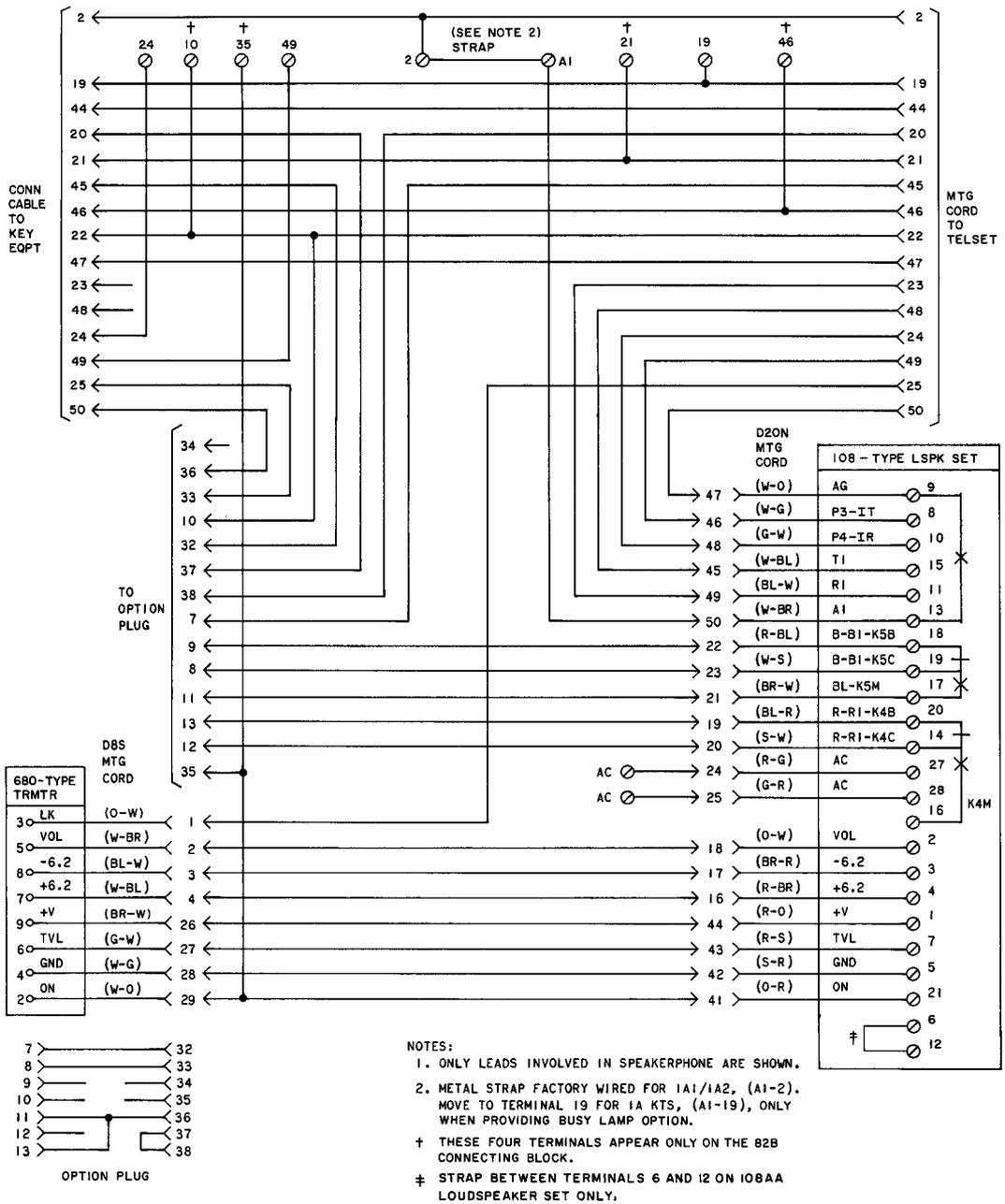
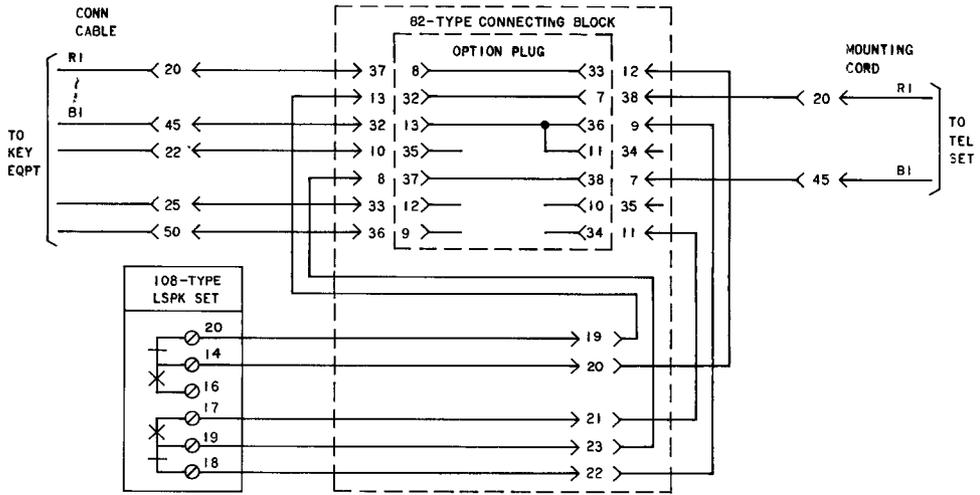
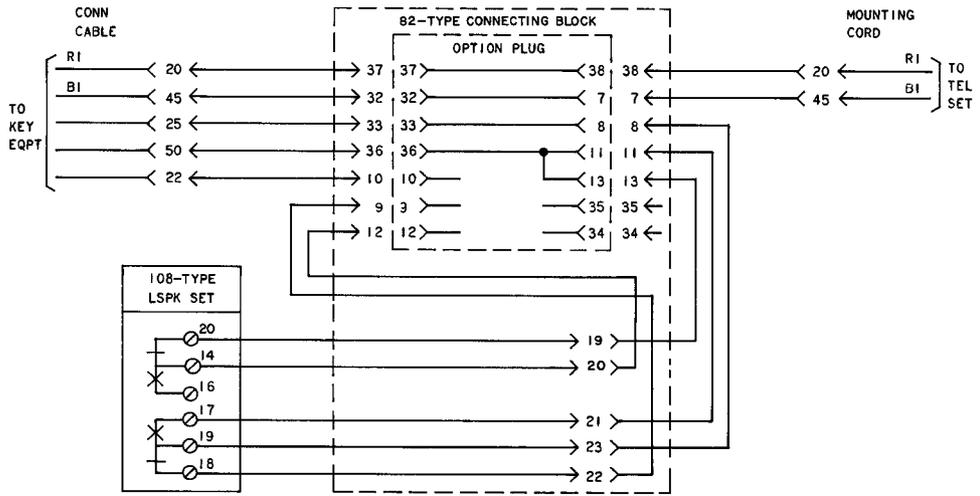


Fig. 9—4A Speakerphone System Connections Using 82-Type Connecting Block



A. OPTION PLUG POSITIONED FOR RINGER CUTOFF



B. OPTION PLUG POSITIONED FOR AUXILIARY RELAY OPERATION

Fig. 10—Wiring Involved in Options at 82-Type Connecting Block

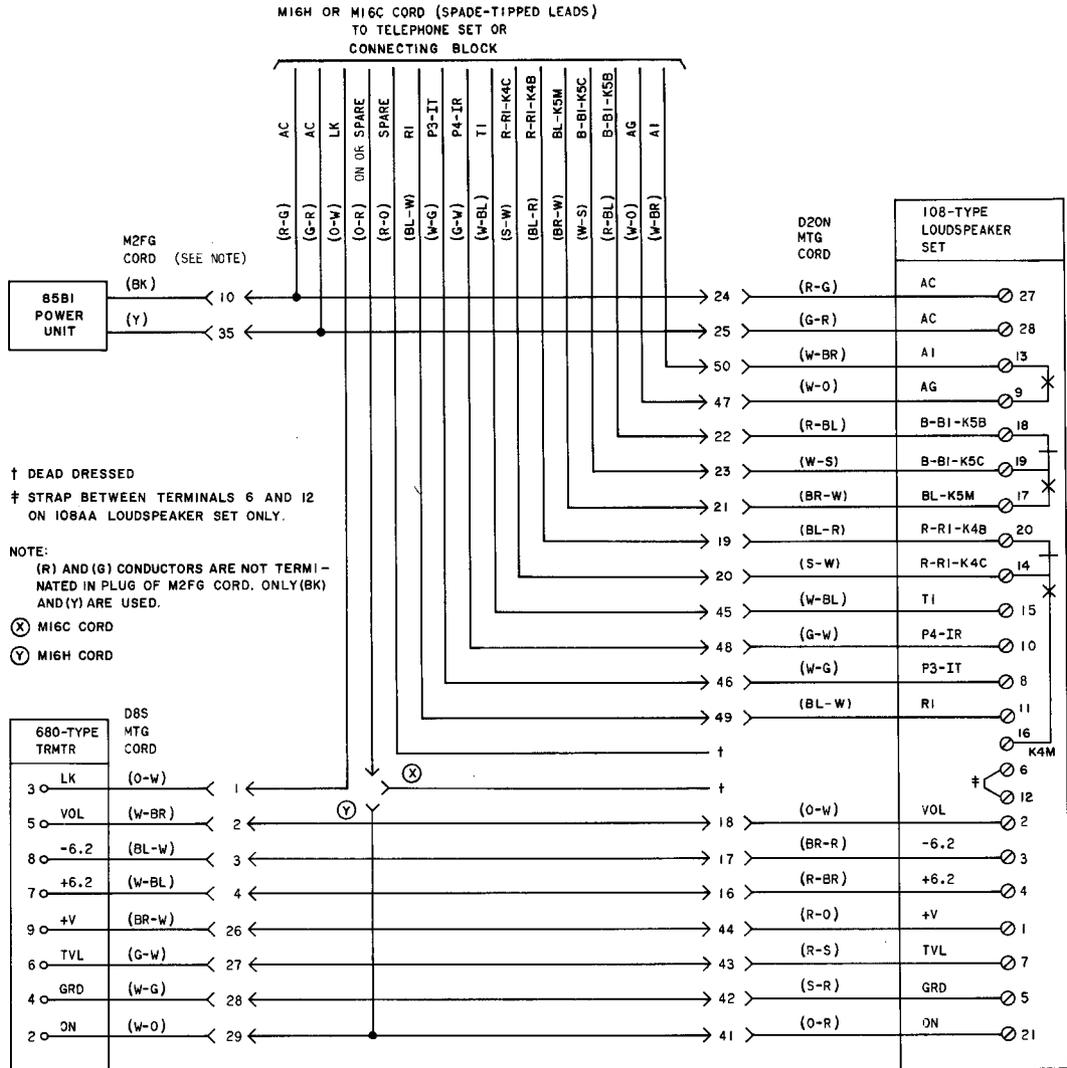


Fig. 11—4A Speakerphone System Connections Using 223A (MD) or 223D Adapter

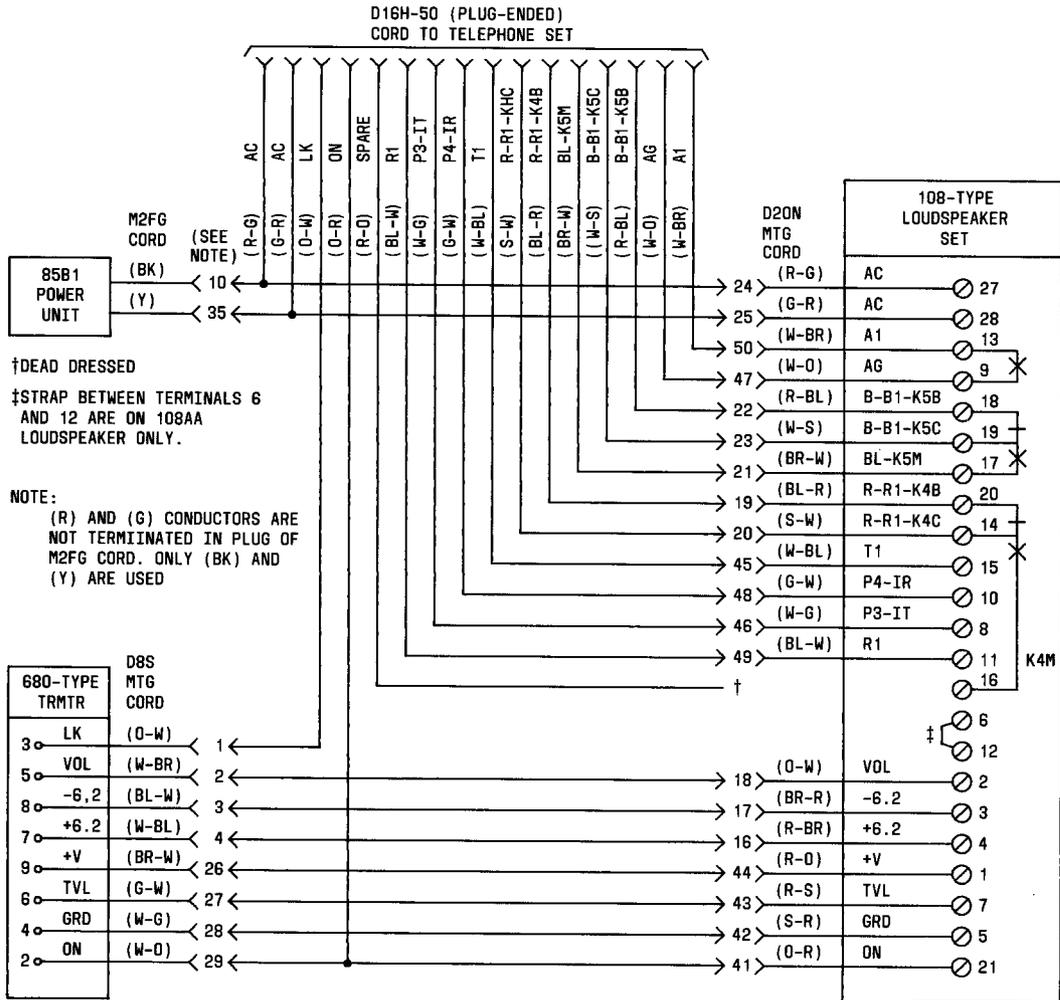


Fig. 12-4A Speakerphone System Connections Using 223C Adapter