

## 4A COMMUNICATION SYSTEM

### COM KEY\* 416

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#### 1. GENERAL

1.01 This section provides identification, installation, connection, and maintenance information for the 4A Communication System (COM KEY 416).

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The system provides basic line services such as pickup, hold and illumination, one or two intercom paths, tone and voice signaling, multiline conferencing, built-in loudspeaker service, flexible tone ringing, automatic button restoration (ABR), outgoing service during power failure, privacy release, and recall (operator flash) when used

behind a PBX). Available optional features are privacy, music-on-hold (utilizing customer-provided music source), supplementary external ringing, station restriction and TOUCH-TONE® dialing. TOUCH-TONE and rotary sets may be intermixed in the same system.

*Note:* Speakerphone capability is not provided.

1.04 The 4A System has a maximum capacity of 4 CO/PBX lines and 16 stations. Two basic types of telephone sets, called primary and satellite, are employed. Each primary station contains the logic circuitry, power supply and clock circuitry for two CO/PBX lines and one intercom path. For small systems, one primary set may be used to provide two CO/PBX lines, one intercom path, and up to seven satellite stations. The addition of the second primary station simply doubles the system capacity. Satellite station sets provide the same service as primary station sets except they do not contain any control circuits.

1.05 Every station can be programmed to ring on any combination of CO/PBX lines. All stations have access to all lines in the system; therefore, an attendant may or may not be used.

1.06 The system components are protected by a self-resetting thermal cut-off in the power supply of the primary stations, making separate fusing unnecessary.

#### 2. IDENTIFICATION

2.01 The 4A System provides up to 4 CO/PBX lines, up to 16 stations and 2 intercom paths. A brief description of system features is listed.

#### BASIC FEATURES

(a) *Pickup, Hold, and Illumination*—Standard key system pickup, hold and line status lamps, including wink hold.

(b) **Two-Path Intercom**—Each intercom path is associated with a separate button and lamp on each telephone set.

(c) **Multiline Conferencing**—Two or more CO/PBX lines may be conferenced by *simultaneously* depressing the line buttons of the lines to be conferenced.

**Note:** Intercom and CO/PBX lines cannot be conferenced together.

(d) **Tone and Voice Signaling**—CO/PBX line alerting signal is by tone source rather than conventional ringer. By lifting the handset, selecting an idle intercom path, and depressing a DSS button, the calling station may voice-signal the called party. Multiple stations may be signaled by depressing more than one DSS button at a time.

(e) **Built-in Loudspeaker Service**—By depressing the button designated SPKR, the telephone set user can bridge the speaker in his set onto the receiver of his handset. This enables others in the room to hear both sides of a conversation. If so desired, this feature may be disabled by the installer.

(f) **Automatic Button Restoration**—ABR returns depressed line or intercom buttons to the unoperated position when the handset is replaced on the set.

(g) **RECALL**—Used to drop a line in order to receive a second dial tone without going back on-hook. When the telephone set is used behind a PBX, a momentary depression of the RECALL button will signal the attendant (similar to switchhook flash function).

(h) **CO/PBX Ringing**—Each station can be arranged to ring on all lines, any combination of lines, or not at all. Ringing is programmed at each station set.

(i) **Wall Mounting**—Provides necessary hardware (D-180658 kit of parts) to wall-mount a satellite set.

**Note:** Primary sets cannot be wall-mounted.

(j) **Privacy Release**—Privacy Release allows a station to permit privacy-equipped stations that have been locked out of call to bridge into

the conversation. All 4A System telephone sets are factory-wired with Privacy Release which is activated when the optional privacy feature is installed.

#### OPTIONAL FEATURES



*The following features should be implemented only when specifically covered in the service order.*

(k) **Privacy**—Privacy prevents a station from bridging into a CO/PBX call in progress.

**Note:** Intercom lines have no privacy.

(l) **Music-on-Hold**—Provides music from customer-provided music source to calls placed on hold.

(m) **External Ringing**—External ringing may be provided by connecting an external ringer across the CO/PBX tip and ring leads at the primary station.

(n) **Station Restriction**—Provides for outgoing call restriction by changing dial connections in telephone set.

(o) **TOUCH-TONE Set**—Provides TOUCH-TONE dialing. Rotary and TOUCH-TONE dial sets may be intermixed in the system without additional equipment.

#### TELEPHONE SETS

**2.02** The 4A System uses telephone sets designed for this system (Fig. 1 and 2). They are not compatible with other systems.

**2.03** Two types of telephone sets are used in the system. The satellite set contains speech circuitry, line pickup key, DSS key, and loudspeaker. The primary set is a slightly larger set which, in addition to the components of the satellite set, contains the logic circuit to provide hold and lamp control for two CO/PBX lines and lamp control for one intercom line. Solid state lamps are associated with each line pickup button to indicate ringing, hold, active, or idle status by standard flashing rates, steady lamps, or no lamps. Intercom status is also indicated by an ON or OFF lamp.



Fig. 1—2836AM-50 (Primary) Telephone Set

**2.04** Each telephone set contains a 664A (DSS) key, a speaker and volume control, and a 647M6 (10 button) key. The DSS field is interconnected with the intercom buttons. After selecting one of the idle intercom paths, the user must depress the desired DSS button which connects his handset transmitter to the speaker in the telephone sets associated with that DSS button. The DSS button must be held depressed for the duration of the one-way voice transmission. Although the voice signaling path is unidirectional, the called station may establish a 2-way path by lifting his handset and depressing the intercom button on his set as instructed by the calling party. Calling party may then release DSS button. Multiple stations may be signaled by depressing more than one button at a time. The 664A key has a slide programming switch which connects that set speaker to the DSS number desired for that station. This key also has four vertical OFF-ON switches which control common

audible ringing at the station. The loudspeaker located under the telephone set handset receives both the tone and voice signaling. Loudness is controlled by the volume control. Button assignments of the 647M6 key are: HOLD, four CO/PBX lines, two intercom paths, privacy-release ((PRIV RLS), built-in loudspeaker service (SPKR), and RECALL. The SPKR button may be disabled by the installer if this feature is not required.

**2.05** The 4A System will interface with all PBXs except that it cannot provide for ground-start operation of CO trunks which bypass the PBX in the event of PBX power failure. In all other respects, the system performs on PBX lines in the same manner as on CO lines. For PBX use, the only restriction on the number of telephone sets is that each 25-pair connector cable system can serve a maximum of 2 primary stations and



A. DESK CONFIGURATION



B. WALL CONFIGURATION

Fig. 2—837AM-50 (Satellite) Telephone Set

14 satellite stations. Although 4A System telephone sets in each system have full capabilities, they can contact telephone sets in other systems only via PBX lines. To signal the PBX operator, the recall button should be used.

## ORDERING GUIDE

- Set, Telephone (order as required):

836AM-50 (rotary dial primary set)

837AM-50 (rotary dial satellite set)

2836AM-50 (TOUCH-TONE primary set)

2837AM-50 (TOUCH-TONE satellite set)

**Note:** Sets are supplied in ivory-50 only and are shipped with a disposable faceplate. Desired faceplate must be ordered separately.

- Plate, Face, 836A-\* (for 836AM or 837AM)
- Plate, Face, 2836A-\* (for 2836AM or 2837AM)

\*Add color suffix as follows:

Avocado—100

Teak—108

Walnut—109

Gold—111

Orange—112

Brown—113

Red—114

Blue—115

Black—118

- Kit of Parts, D-180658 (one required for each 837- or 2837-type set to be wall-mounted)
- Block, Connecting, 91A (order one for each primary station).

Order as required the following depending on the job requirements. Refer to Fig. 3 and 4 for typical wiring arrangements.

- Adapter, Bridging, KS-19252 (order by list number as required) (Fig. 3)
- Cable, Connector, B25A (specify desired length) (Fig. 3)

- Block Connecting 66E3-25 (Fig. 3)
- Block, Connecting 66B4-25 (Fig. 4)
- Cable, Connector, A25B (specify desired length) (Fig. 4)
- Backboard, 184B1 (Fig. 4).

#### **Optional Apparatus (Order as Required)**

- Coupler, Voice, 33A (one required when music-on-hold is provided)
- Kit of Parts, D-180605 (one required for each primary station to be equipped for music-on-hold)
- Kit of Parts, D-180604 (privacy circuit, one required for each station to be locked out).

#### **Replaceable Components**

- Dial, 8DT-119 or 35AH3D
- Cover, 840994560 (DSS key)
- Handset, K1B-50 and Cord H4DU-50
- Key, 647M6 (line)
- Assembly, Potentiometer, 840694350
- Assembly, Button, Lamp, 840362263
- Transformer, KS-21361, L1 (includes 6-foot power cord and heat sink).

### **3. INSTALLATION**

#### **PLANNING**

**3.01** The primary stations should be located within power cord length (6 feet) of a grounded ac receptacle. The ac receptacle should be separately fused and not under control of a switch.

**Caution:** *Except for the 110V power cord, no connection shall be made between any point in this system and building ground.*

**3.02** Normally, a 4A System installation will consist of a maximum of ten stations

(primary stations included). The following cable restrictions apply to any installation:

- There should be no more than 1000 running feet of cable between any satellite station and both primary stations.
- No more than 2000 running feet (total) of cable should be used in any installation.

The 4A System can be expanded to a maximum of 16 stations (including primary stations) provided the cable restrictions in Table A are followed. There are only ten DSS buttons so DSS lines must be shared, as required, when the system exceeds ten stations. In a system where only one primary station is required, the total number of satellite sets shall not exceed seven stations with no station more than 1000 feet from the primary station and no more than 2000 running feet (total) of cable in the system. See Fig. 3 and 4 for typical arrangements.

**3.03** Select appropriate apparatus according to job requirements (see ORDERING GUIDE).

#### **INSTALLING**

**3.04** Install 91A connecting blocks, KS-19252, L1 bridging adapters or 66E3-25 connecting blocks, at desired locations using shortest length of connector cables. Also install wall brackets from D-180658 kit of parts where wall sets are to be installed. Use proper mounting hardware depending on wall surface.

**3.05** Use care when unpacking telephone sets to avoid damage. Install sets in desired locations.

**3.06** Primary sets are factory-wired so that the CO/PBX lines appear on lines 1 and 2 and the intercom on IC1. If the system uses two primary sets, one must be modified to move the line appearances to 3 and 4 and IC2 as follows:

- (1) Unplug 110V power cord from power receptacle if connected. Remove the power transformer assembly by pulling out on the bottom of the heat sink. If desired, a screwdriver may be used to carefully pry the transformer loose (Fig. 5). **Do not pull on transformer cord.**

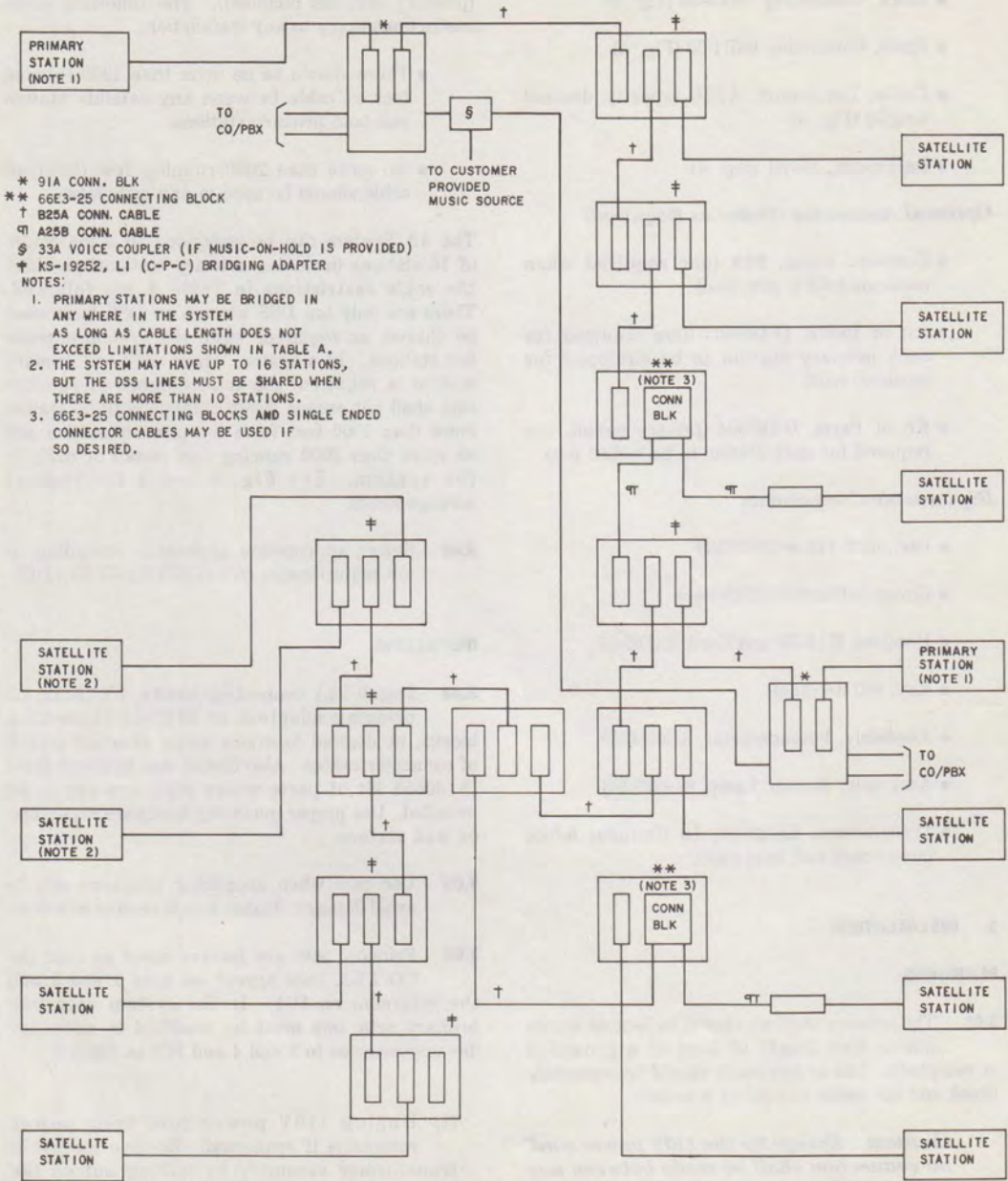
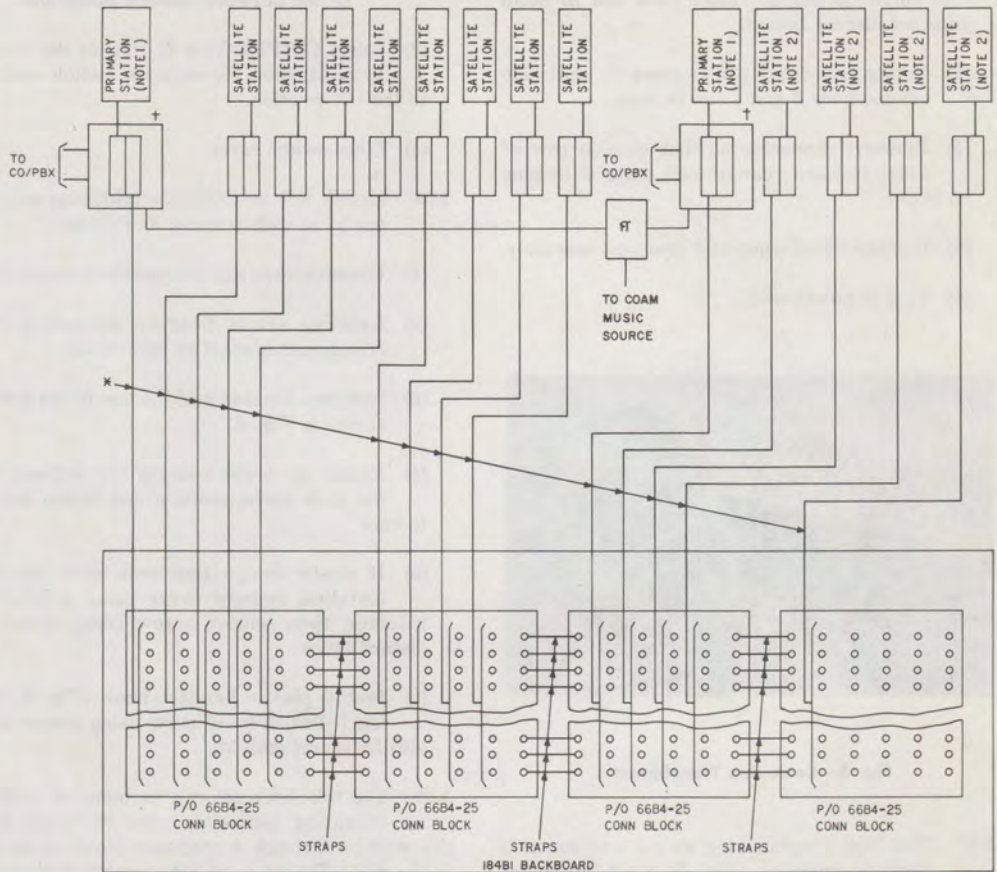


Fig. 3—Typical Installation, Using Bridging Adapters and Connecting Blocks



NOTES:

1. CONTROL STATIONS MAY BE BRIDGED IN ANYWHERE IN THE SYSTEM AS LONG AS CABLE LENGTH DOES NOT EXCEED LIMITATIONS SHOWN IN TABLE A.
  2. THE SYSTEM MAY HAVE UP TO 16 STATIONS BUT WITH ONLY 10 DSS LINES AVAILABLE, THE DSS LINES MUST BE SHARED WHEN THERE ARE MORE THAN 10 STATIONS.
- \* A25B CONN. CABLES (SINGLE-ENDED)
  - † 91A CONNECTING BLOCK
  - ‡ 33A VOICE COUPLER (IF MUSIC ON HOLD IS PROVIDED)

Fig. 4—Typical Installation, Using Home Run Method

- (2) Remove line assignment connector (Fig. 6) by pulling straight up until connector clears pins on circuit board. **Take care not to bend pins on circuit board.**
- (3) Rotate connector 180 degrees so that side labeled lines 3 and 4 can be seen.
- (4) Reinsert connector so that outside row of holes (toward rear of set) mate with pins on board.
- (5) Replace transformer and heat sink assembly.
- (6) Plug in power cord.



Fig. 5—Removing Transformer

**3.07** The DSS programming switch and common audible switches (Fig. 7) must be set as required at each station as follows:

- (1) Raise cover either by pressing on the extreme left end to tilt the cover or pry up the right end of the cover using a fingernail.

- (2) Determine the DSS code for that station and slide the program switch to that number.

For example, Fig. 7 shows the station designated as DSS code 7.



*More than one station set may be programmed for the same DSS code. Also, a set may be programmed so that it does not have a DSS code by moving the switch to the OFF (extreme*

*left) position. When positioning the program switch, take care the switch is not between detent positions.*

- (3) Select CO/PBX lines to ring at the stations by positioning the common audible switches to the ON position.
- (4) Close switch cover.

**3.08** Modify 837- or 2837-type telephone sets that are to be wall-mounted as follows:

- (1) Loosen screws and remove the lower housing.
- (2) Remove screw holding mounting cord attachment bracket at rear of set.
- (3) Refasten bracket using screw in the position shown in Fig. 8.
- (4) Rotate the lower housing 180 degrees from the desk model position and fasten housing to base.
- (5) If plastic designation card cover has been installed, remove cover using a KS-16750 releaser, then remove screw from recess and discard screw.
- (6) Install plastic handset hook (Fig. 9) from the D-180658 kit of parts using longer screw also furnished with kit.

**3.09** The telephone set can be mounted with the mounting cord either run vertically down the wall or through a customer-provided opening in the wall. The set is mounted on the wall bracket supplied with the kit of parts by positioning the set, so that the four tabs on the bracket engage the openings in the lower housing, and sliding the set downward until the snap-lock engages. Check to make sure that all tabs are engaged and the set locked on the bracket. To remove the set, press the tab on the wall bracket, which extends below the set, toward the wall while pushing the set upward.

#### OPTIONS

**3.10 External Ringer**—Connect leads from E1C ringer to screw terminals on 91A connecting block associated with primary telephone sets as shown in Table B. If an external ringer is desired



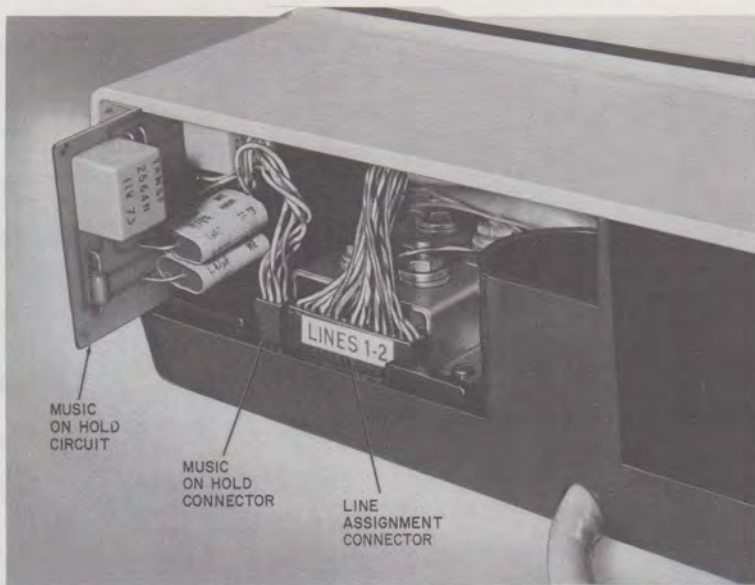


Fig. 6—Line Assignment Connector and Music-on-Hold Board

at a satellite station, install the ringer at that location using D inside wire to connect it to the proper R( ) and T( ) terminals of the primary set 91A connecting block. **Do not attempt to wire ringer to any other pair in the system. Do not connect more than three E1C ringers to any CO/PBX line.**

**3.11 Dial Restriction**—Restrict stations as follows:

- (1) Remove faceplate by inserting a KS-16750 tool in the notch near the center of the faceplate and raising upward to bow faceplate (Fig. 10).
- (2) Loosen two captive screws holding DSS key and move key to side.
- (3) On a TOUCH-TONE set, move the O-BK lead from terminal 36 to 31; on rotary sets, move the BL-R lead from terminal 28 to 39.
- (4) Replace DSS key.

- (5) Install faceplate by inserting in slots at bottom of set and bowing it until it will slide in slots at top of set (Fig. 11).

**3.12 Music-On-Hold**—This option requires the installation of a D-180605 kit of parts at each primary telephone set and one 33A voice coupler per system. Install kit of parts in the primary set(s) as follows:

- (1) Remove transformer as covered in 3.06 (1).
- (2) Insert music-on-hold circuit board vertically in slots provided in upper and lower housings (Fig. 6).
- (3) Plug in connector from circuit board to the pins provided as shown in Fig. 6. The connector may be plugged in either way.
- (4) Replace transformer and heat sink assembly.
- (5) Plug in power cord.

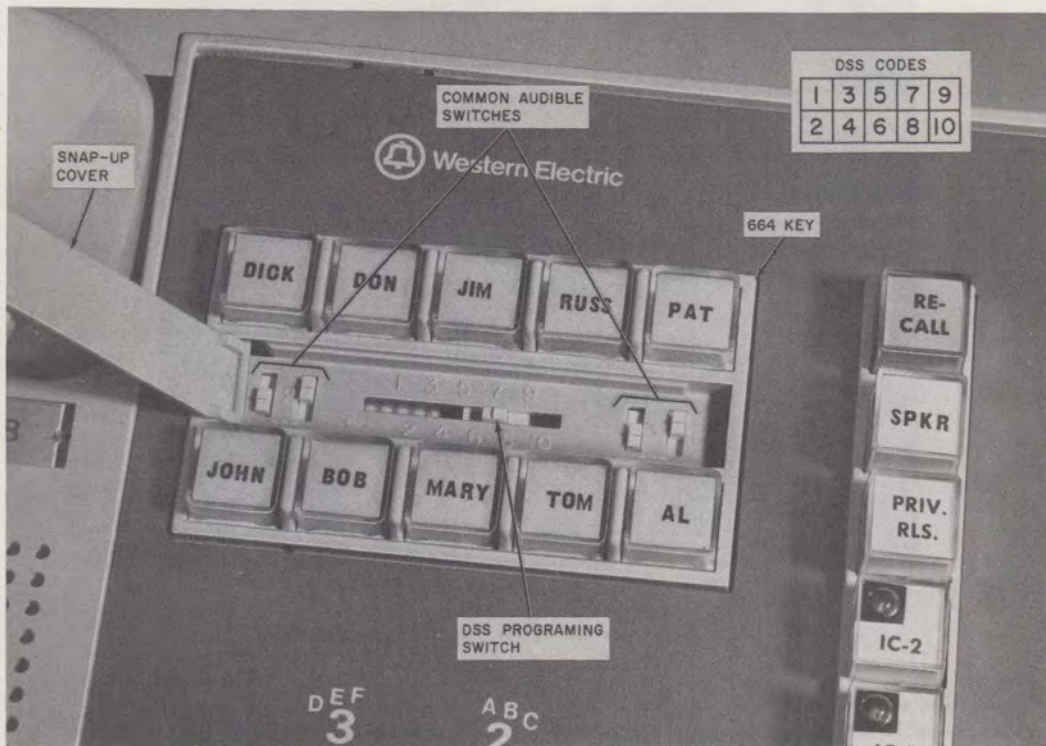


Fig. 7—DSS Key

### 3.13 Install the 33A voice coupler as follows:

- (1) Remove cover from coupler.
- (2) Mount coupler at location which permits customer to make connections and also allows connection to system.

**Caution:** Ensure that 35P fuses are installed with the spring at the bottom (Fig. 12) and set the volume control at approximately mid-range.

- (3) Connect primary station(s) to the voice coupler per Table C.
- (4) Replace cover.

- (5) Have customer connect his music source as shown in Table C.



*The customer-provided music source must be capable of providing one watt of undistorted RMS power into a four-ohm load. In addition, the output of the music source must be ac coupled. Do not connect a source that has a dc voltage on the output.*

### 3.14 Adjust volume level for music-on-hold as follows:

- Place a call to a station in the system.
- Answer call and place it on hold.

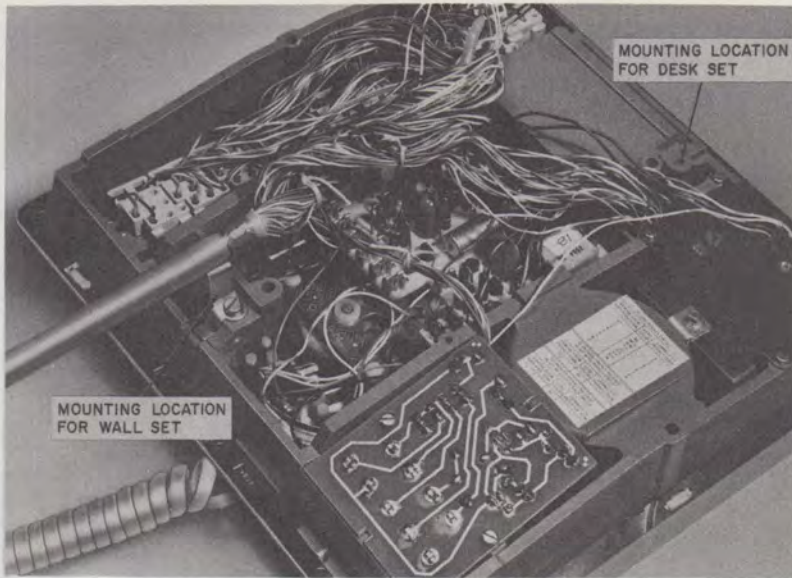


Fig. 8—Set Modification for Wall Mounting



Fig. 9—Handset Hook Attachment for Wall Set

- Have customer adjust his music source for a comfortable listening level at the held station.

**3.15** The 33A voice coupler will accept input from any customer-provided apparatus that does not blow a fuse in the voice coupler. If the customer wants a copy of the technical reference covering the 33A voice coupler, contact the Telephone Company Business Office or the Marketing Representative. If service call is caused by customer-provided equipment, billing should be made in accordance with BSP 660-101-312.

**3.16 Privacy**—This option requires the installation of a D-180604 kit of parts at each station to be locked out. Install as follows:

- (1) Remove telephone set lower housing to obtain access to the amplifier printed wiring board.
- (2) Transfer leads from push-on terminals on amplifier board to those on privacy circuit board (Fig. 13). See Table D or wiring label on loudspeaker housing in set.



Fig. 10—Faceplate Removal

(3) Mount privacy circuit board on the two bosses located under the front handset pocket with component side of board facing into the upper housing (Fig. 14).

(4) Secure board using two screws furnished with kit of parts.

(5) Replace lower housing.

### 3.17 Test privacy feature as follows:

(1) At another station, go off-hook on an idle CO/PBX line.

(2) At station under test, go off-hook on same line. Station should be locked out as evidenced by lack of sidetone.

(3) At station under test, select an idle line. Return to the line busied out by the first station by rapidly changing line buttons. The station under test should be locked out.

(4) Depressing the PRIV RLS button at this station should permit the station under test to bridge onto the busied-out line.

(5) If PRIV RLS button is not wired at first station, depress that station HOLD key.



Fig. 11—Replacing Faceplate

**3.18** Test privacy release as follows:

- (1) At station to be tested, go off-hook on an idle CO/PBX line to lock it out.
- (2) At another station equipped with a privacy circuit, go off-hook on the same line. No sidetone should be heard in this handset.
- (3) At the set under test, depress the PRIV RLS button momentarily. This should permit the privacy-equipped set to bridge onto the line.

**3.19** To disable SPKR:

- (1) Remove faceplate by inserting a KS-16750 tool in the notch near the center of the faceplate and raising upward. See Fig. 10.
- (2) Remove DSS key.
- (3) Remove W-BR lead from telephone set terminal 9 and W-G from terminal 38. Insulate and store leads.
- (4) Replace DSS key.
- (5) Replace faceplate (see Fig. 11).

**3.20** Install connector cables as required.

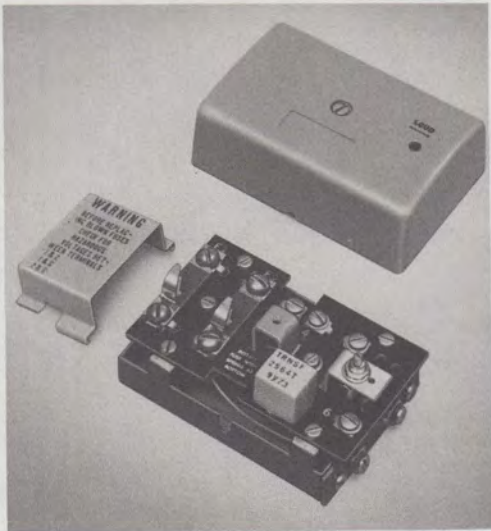


Fig. 12—33A Voice Coupler

#### 4. CONNECTIONS

- 4.01 Terminate the incoming CO/PBX lines on the 91A connecting block(s) associated with the primary station(s). See Table E.
- 4.02 Connect primary station line cords to customer-provided ac power.

#### 5. METHOD OF OPERATION

##### ANSWERING CALLS

##### *Incoming Call on CO/PBX Line*

- 5.01 When audible tone signal sounds and lamp associated with CO/PBX button flashes, answer call as follows:
  - (1) Lift handset (line buttons will not lock down unless handset is off-hook).

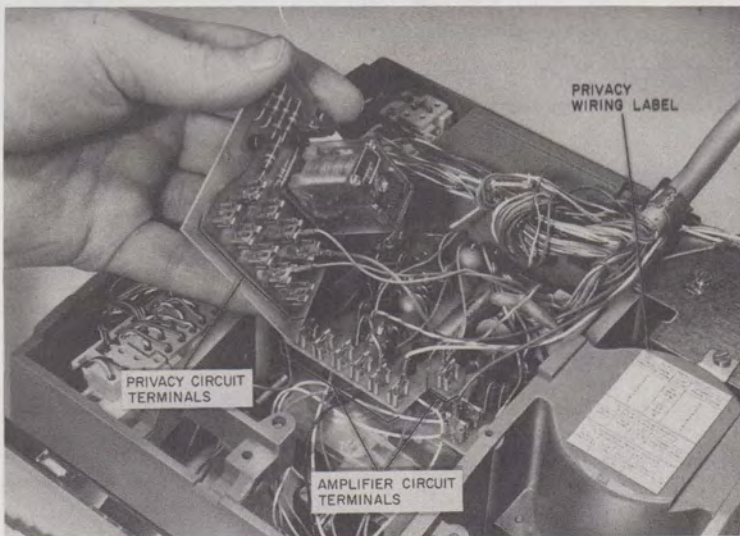


Fig. 13—Privacy Circuit Connections

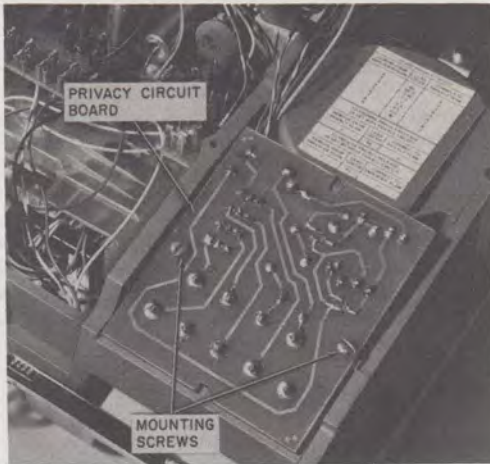


Fig. 14—Mounting Privacy Circuit

- (2) Depress CO/PBX button associated with flashing lamp—audible signal is silenced and lamp under CO/PBX button goes steady.
- (3) Answer call.

**Note:** The level of incoming voice signaling or tone ringing will be slightly reduced while off-hook.

### *Intercom Call*

**5.02** When voice signal is heard:

- (1) Calling party will tell you what action to take (if any).
- (2) If necessary, lift handset and depress intercom button as per instructions to converse with calling party.

### **PLACING CALLS**

#### *Outgoing Call (Any Station)*

**5.03** To make an outgoing call:

- (1) Lift handset.

- (2) Depress CO/PBX button associated with an idle line.
- (3) Dial number when dial tone is received.

#### *Intercom Call (Any Station)*

**5.04** To make an intercom call:

- (1) Lift handset.
- (2) Select idle intercom path and depress button. No dial tone is provided on intercom.
- (3) Depress and hold button on DSS key corresponding to desired station that is to receive voice message. Multiple stations may be signaled by depressing more than one DSS button at a time. Give message to called party. ***DSS button must be held depressed during entire one-way conversation.***
- (4) Release button when one-way message is completed.
- (5) To carry on a 2-way conversation, the called party must pick up handset and depress the intercom button on his set that is seized by the calling party.

#### *Multiple CO/PBX Conferencing*

**5.05** To conference CO/PBX lines:

- (1) Make outgoing call (5.03) to desired party.
- (2) Depress HOLD button; line button will restore and go on hold.
- (3) Make outgoing call on another idle CO/PBX line.
- (4) While holding the second CO/PBX line button down, depress the first held line button.
- (5) Additional parties may be added by repeating the above procedure.

**Note:** Since no amplification is provided, this type of conferencing is limited. When the number of conferenced parties exceeds three, satisfactory results are not to be expected. The distant parties may not be able to hear each other.

**5.06** All lines that are conferenced together may be put on hold simultaneously by depressing the HOLD button.

**5.07** To make a call during a conference:

- (1) Depress HOLD button—all buttons restore and lines go on hold.
- (2) Select an idle line.
- (3) Dial call.
- (4) To reenter conference again after call is completed, simultaneously depress conferenced buttons again.
- (5) If it is desired to add this call to the conference, hold this CO/PBX line button down and depress the conferenced CO/PBX line buttons.

**5.08** If it is desired to add another call to the conference, hold the conferenced CO/PBX line buttons down and depress button of CO/PBX line to be added.

**5.09** To prevent dropping one of the participants when setting up a conference, ensure that the conferenced CO/PBX line buttons are held down when adding another station.



**Intercom and CO/PBX lines cannot be conferenced together.**

### ***Privacy, Privacy Release***

**5.10** To bring a locked-out station into a conversation, depress the PRIV RLS button. The line will go on hold with the lamp winking. The button must be held depressed until the locked-out party bridges onto the line at which time the lamp goes steady. The button should then be released.

**5.11** To add a station equipped with privacy to a bridged conference, all of the sets already connected must depress their PRIV RLS button to allow the station to bridge onto the conference.

### ***Built-in Loudspeaker Service***

**5.12** To use, depress button on line key designated SPKR. When conversation is finished, depress button to release SPKR before replacing handset. Otherwise, a slight feedback "squeal" may be heard as the handset is brought near the speaker.



***Incoming voice and tone signaling will not be attenuated in the off-hook condition if the SPKR button is locked down. This button is not linked to the ABR mechanism.***

## **6. MAINTENANCE**

**6.01** Maintenance of the 4A System is limited to making wiring checks, replacement of telephone sets, or those set components covered in this section. Do not attempt to modify or repair sets in a manner other than coverd.

**6.02** When trouble is encountered, ***first make a thorough check of all connections***, then make the following checks before repair or replacement of telephone sets is considered.

- Primary station power cord is connected to a working ac receptacle.
- Primary station transformer(s) are securely in place.
- Sets are securely connected to adapters.
- Volume control is not turned all the way down.
- Lamps are not burned out.
- Incoming CO/PBX pairs are securely terminated on 91A connecting blocks associated with primary stations.
- Plugs are secure on line key.

**6.03** If more than one set has the same trouble, the trouble is usually in a primary station set. In multiple primary set installations (three and four CO/PBX lines), the trouble can be further isolated by unplugging one primary set and observing operation of the remaining primary set. If service provided by the disabled primary set does not



restore to normal when the power cord is reconnected, that primary set is defective.

**6.04** If normal service is provided on at least one set but not on any other set, the problem is probably in the cabling. If all sets beyond a point on the cable bus, relative to a primary set, exhibit the same trouble, the cable fault is an open conductor path. If all sets exhibit the same trouble and service can be restored to sets near a primary set by disconnecting the cable bus beyond that point, the fault is a conductor short.

**6.05** Diagnostic Table F contains information to assist in trouble-shooting the system.

### **Dial Replacement**

**6.06** Replace rotary or TOUCH-TONE dial as follows:

- (1) Remove faceplate (see 3.11).
- (2) Remove DSS key (do not disconnect leads).
- (3) Remove and retain two screws holding dial in set.
- (4) Disconnect dial leads.
- (5) Transfer dial mounting brackets to new dial.
- (6) Connect dial leads and replace dial in set using screws removed in (2).
- (7) Replace DSS key.
- (8) Replace faceplate.
- (9) Test dial.

### **Handset and Cord**

**6.07** The handset cord is equipped with standard modular set plugs. To remove cord from the set or handset, release catch by depressing with finger or KS-16750 tool. When reinserting plugs, make sure cord is locked in place.

### **DSS Key Cover Replacement**

**6.08** Replace cover as follows:

- (1) Raise cover perpendicular to key.
- (2) Move the No. 1 common audible switch to OFF.
- (3) Twist the cover clockwise and snap out.
- (4) Install new cover twisting in the reverse direction.
- (5) Reset No. 1 switch to proper position and close cover.

### **Replacement of Line (647M6) key**

**6.09** To replace the ten-button line key:

- (1) Remove faceplate and key collar.
- (2) Loosen key mounting screws at both ends of key and carefully lift key out of set.
- (3) Unplug all 508-type plugs from defective key.
- (4) Connect plugs to replacement key in the following order starting with the HOLD key: pink, blue, orange, green, brown, slate, white, red, black, yellow, and beige.

**Note:** Check that each plug is held in place by the matching locking tabs on the key body.

- (5) Replace key in its mounting **making sure that the key latch bar hook properly engages the telephone set ABR pivot bar.**
- (6) Check that the wiring will not interfere with contact or button operation and tighten the key mounting screws.

**6.10** Any time the line key has been removed or replaced, the following functional tests and necessary adjustments should be made:

- (1) With the set plugged in, check the ABR in each CO/PBX line by going off-hook, depressing and locking the line button and gently replacing handset. The associated lamp should

light while off-hook and the button restore when handset is replaced.

(2) Go off-hook, simultaneously lock down all four line buttons, and gently restore the handset. All buttons should release. Repeat for intercom buttons.

(3) Depress and lock one of the working CO/PBX line buttons and note lamp is steady. Very slowly depress any of the other line buttons until the first button is released. If the first line goes on hold as indicated by the steady lamp changing to wink, the key is defective and should be replaced. Make this test for each working line.

(4) With handset on-hook, completely depress each line and intercom button one at a time. The associated lamp should not light. If any of the lamps light, adjust the ABR by loosening the screw on the ABR bracket in the upper left-hand corner of the faceplate opening. Move the bracket slightly toward the front of the telephone set. Tighten the screw and repeat above test.

**6.11** After all tests and adjustments have been made, replace key collar and install faceplate (Fig. 11).

### *Lamp Assembly Replacement*

**6.12** If the lamp is defective, the button assembly must be replaced as follows:

(1) Remove faceplate and key collar.

(2) Pinch the button assembly between the thumb and forefinger at the second joint.

(3) Firmly but gently tilt the button to one side with the thumb until it snaps free from the plunger. Still holding the button slightly tilted, withdraw it from the lamp socket.

(4) Orient new button assembly so that lamp is in upper left corner of the button when viewed from front of set. Place button over lamp socket, gently slide it into the opening, and push on top until it snaps into place.

### *Volume Control*

**6.13** Replace potentiometer assembly as follows:

(1) Remove faceplate.

(2) Remove DSS key. Do not disconnect leads.

(3) Remove one screw holding assembly to base and disconnect leads from terminal field.

(4) Install assembly in reverse order.

### *Transformer*

**6.14** The transformer is removed as covered in 3.06 (1). When installing transformer, make sure plug is properly engaged.

SECTION 518-450-105

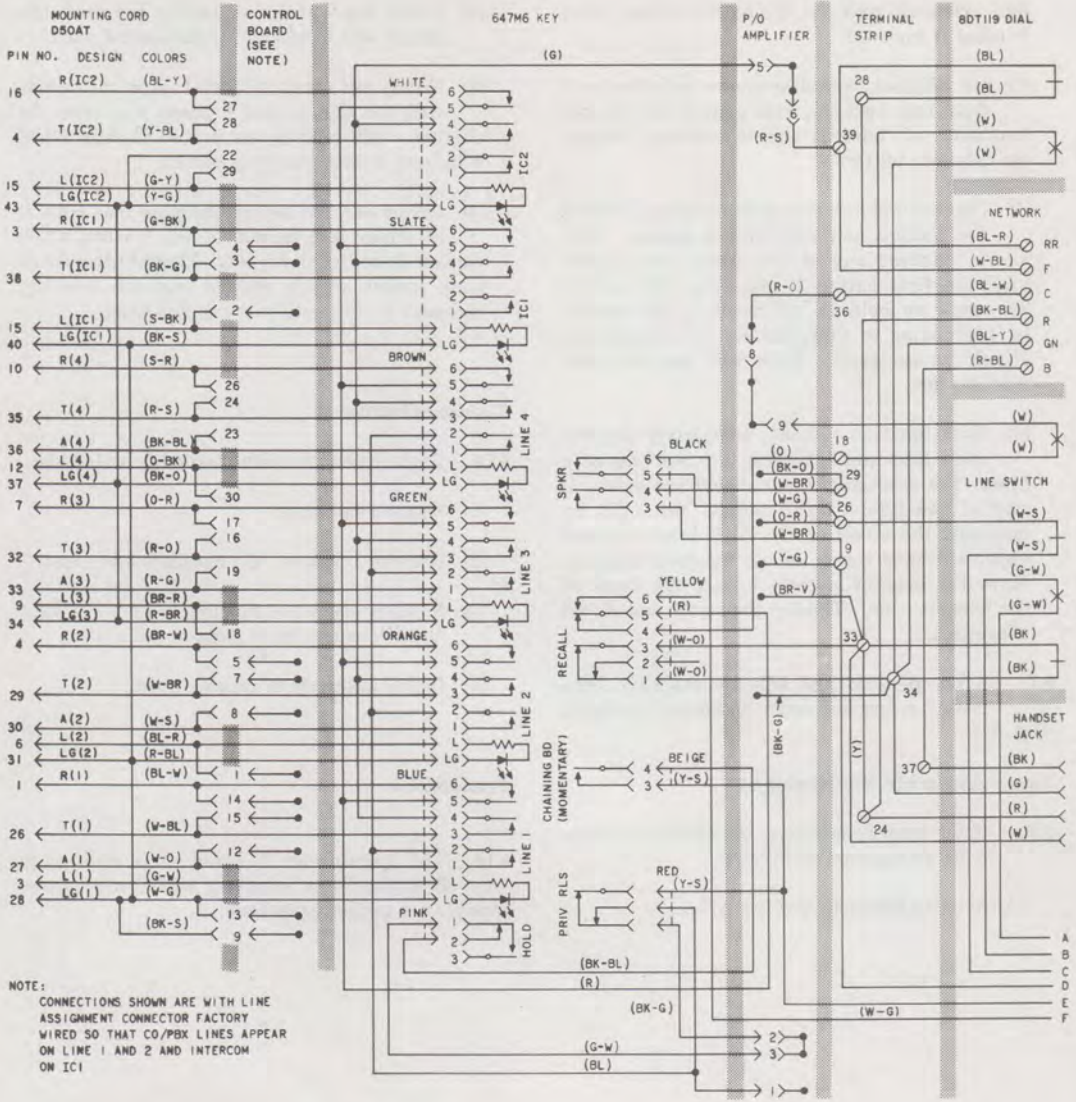


Fig. 15—Schematic, 836AM Telephone Set (Rotary Primary Station) (Sheet 1 of 2)

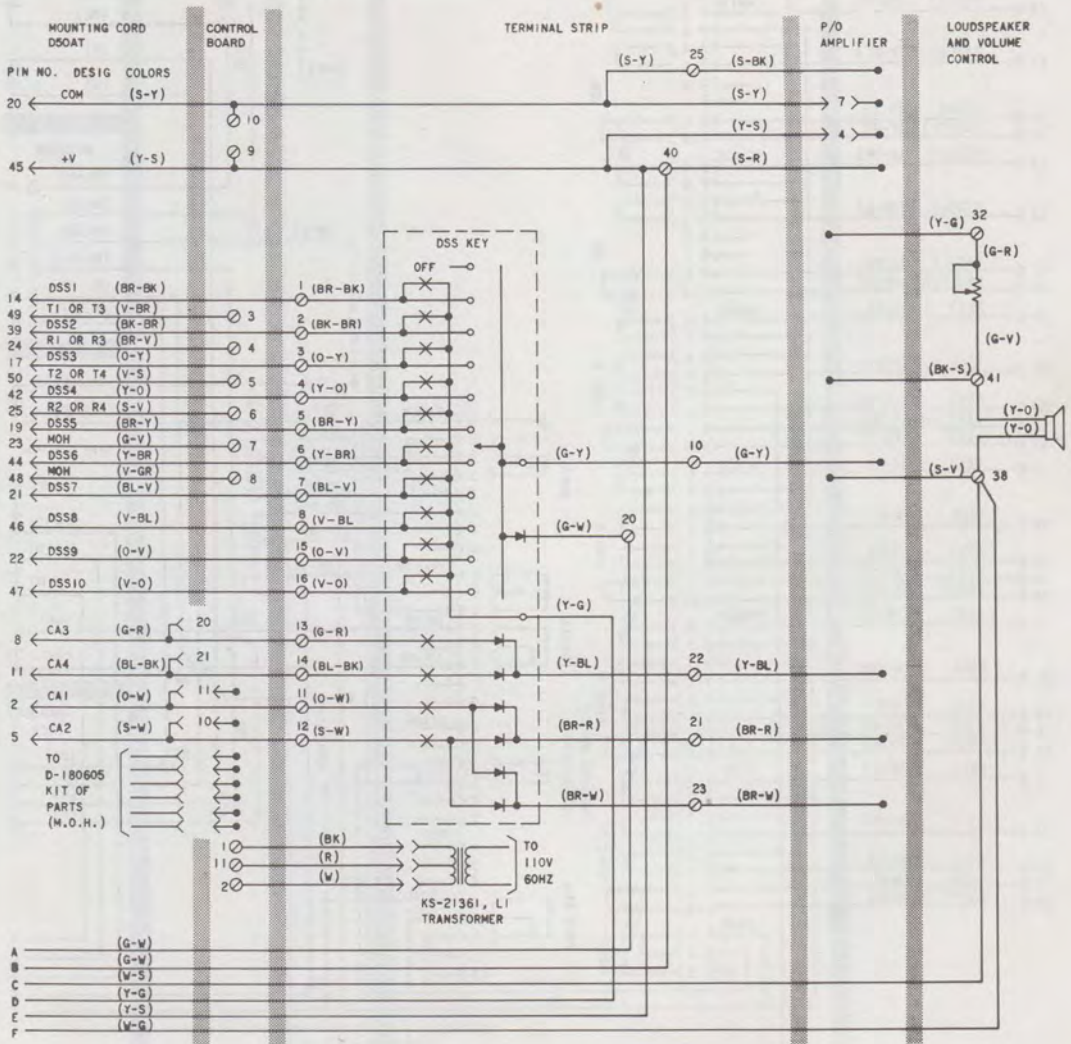


Fig. 15—Schematic, 836AM Telephone Set (Rotary Primary Station) (Sheet 2 of 2)

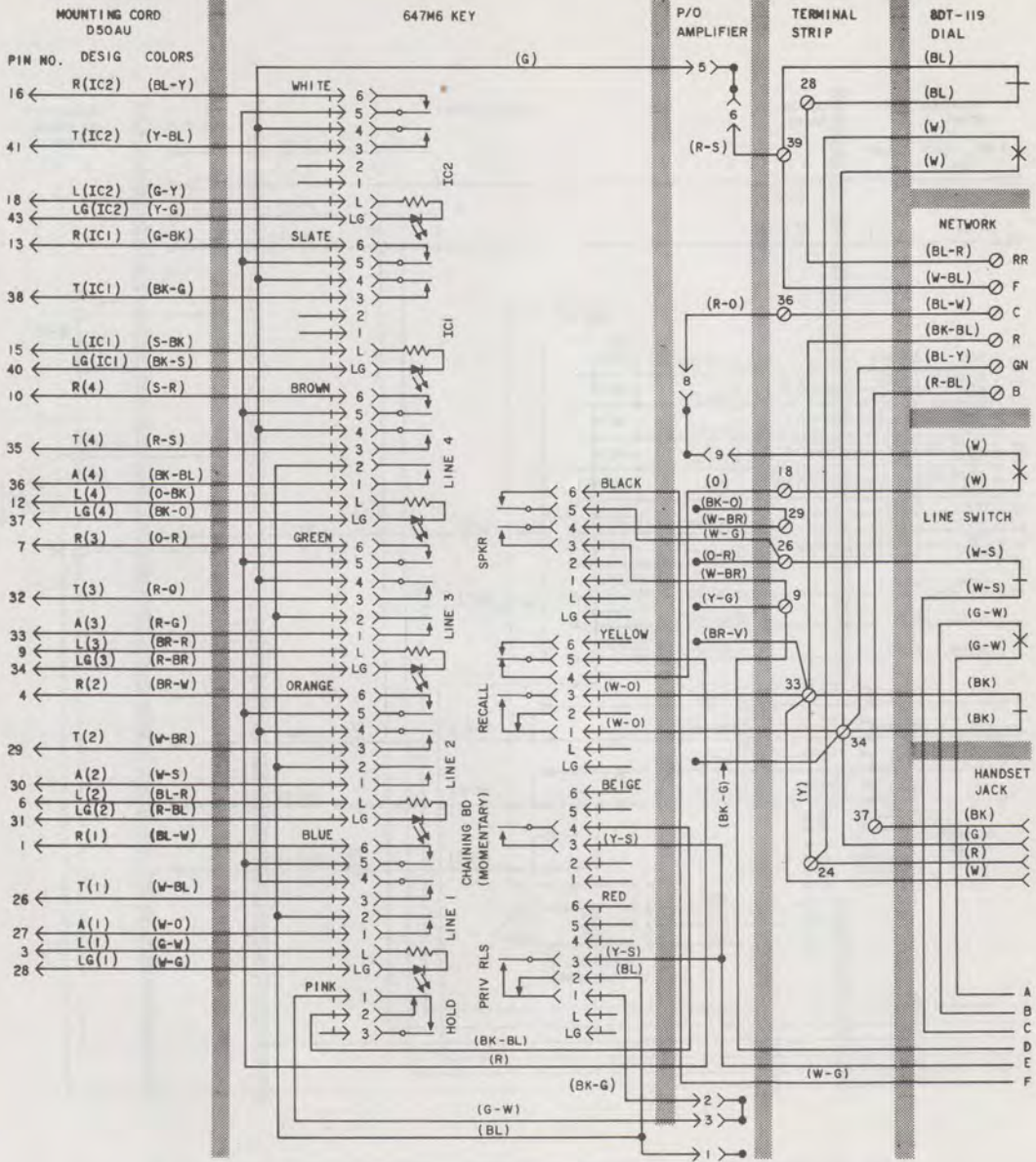


Fig. 16—Schematic, 837AM Telephone Set (Rotary Satellite Station) (Sheet 1 of 2)

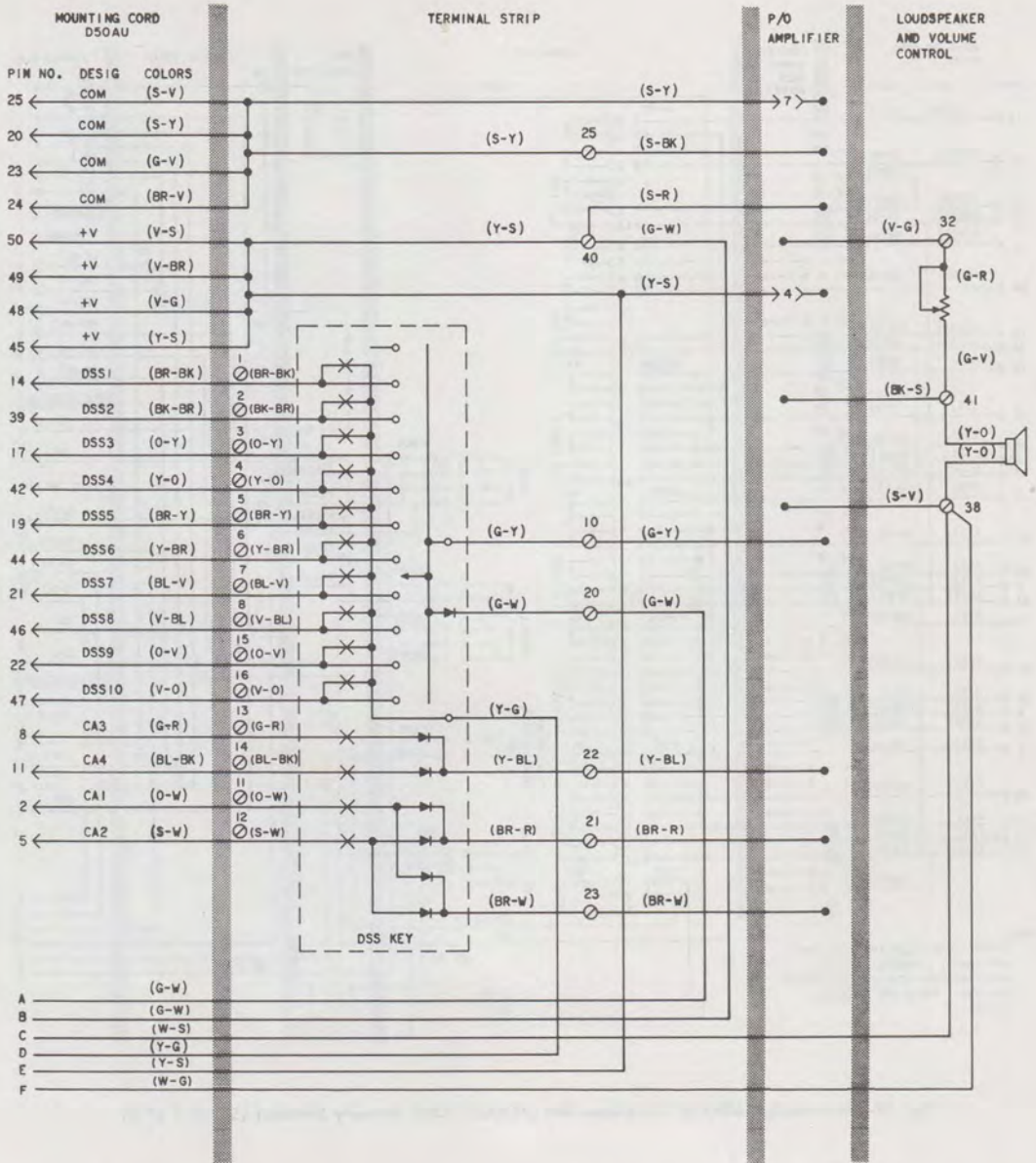


Fig. 16—Schematic, 837AM Telephone Set (Rotary Satellite Station) (Sheet 2 of 2)

SECTION 518-450-105

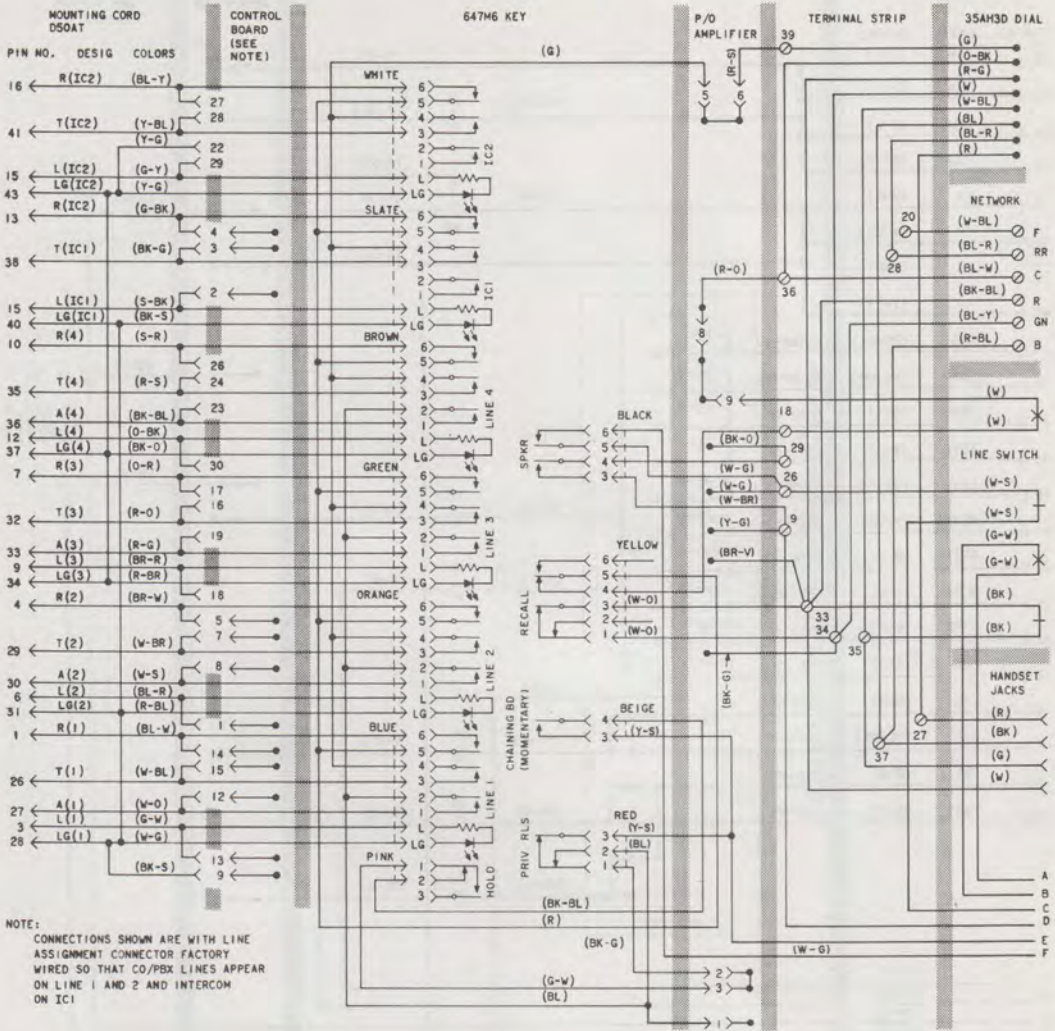


Fig. 17—Schematic, 2836AM Telephone Set (TOUCH-TONE Primary Station) (Sheet 1 of 2)

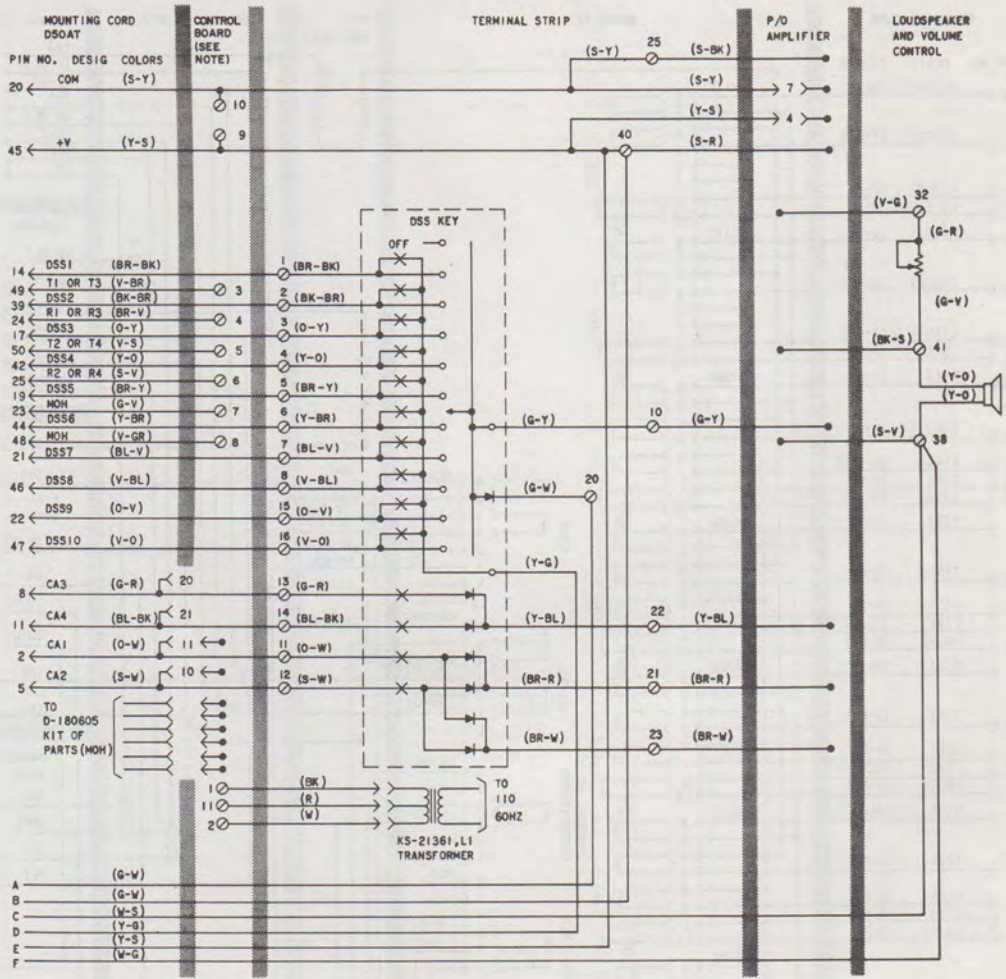


Fig. 17—Schematic, 2836AM Telephone Set (TOUCH-TONE Primary Station) (Sheet 2 of 2)



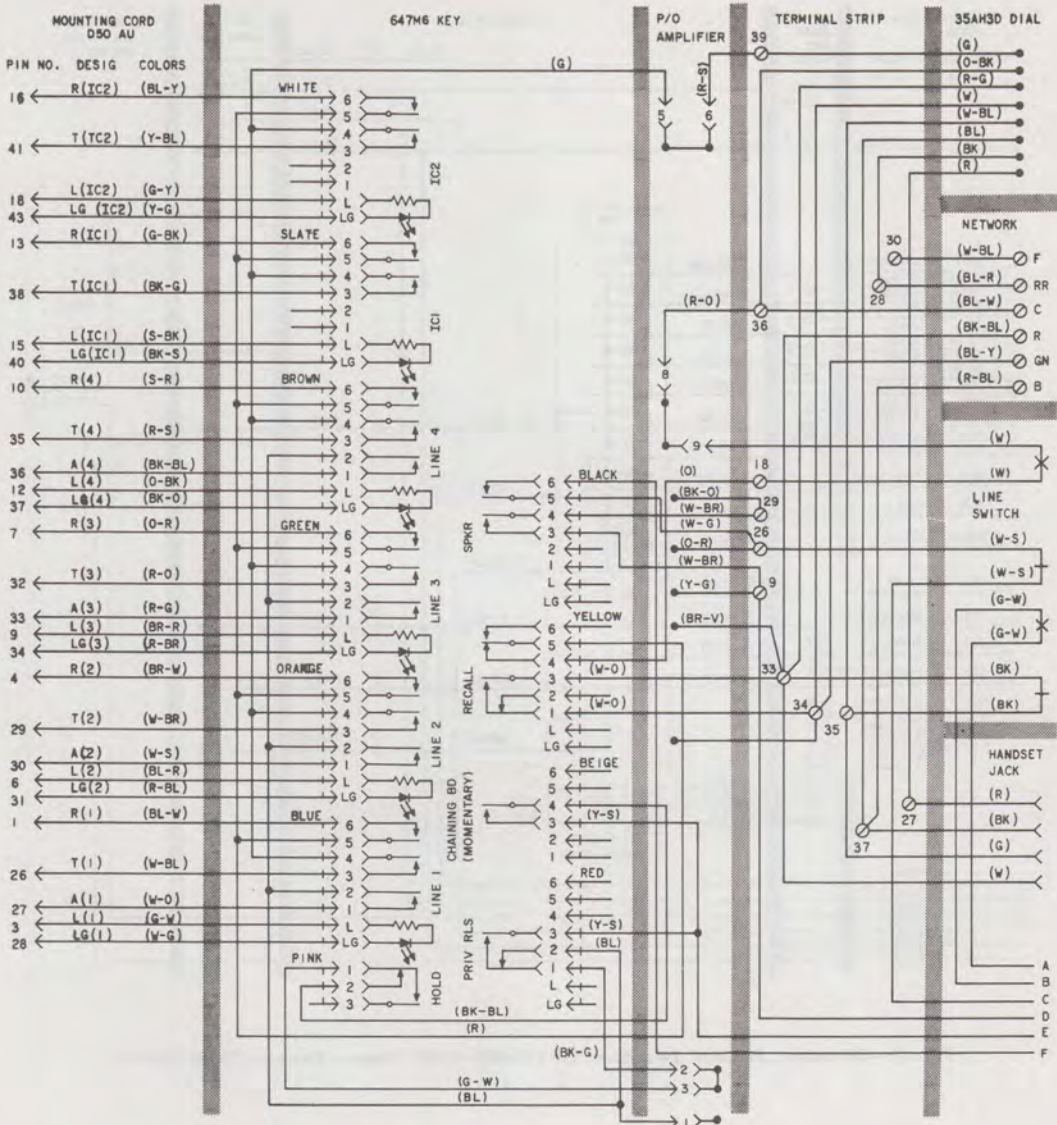


Fig. 18—Schematic, 2837AM Telephone Set (TOUCH-TONE Satellite Station (Sheet 1 of 2)

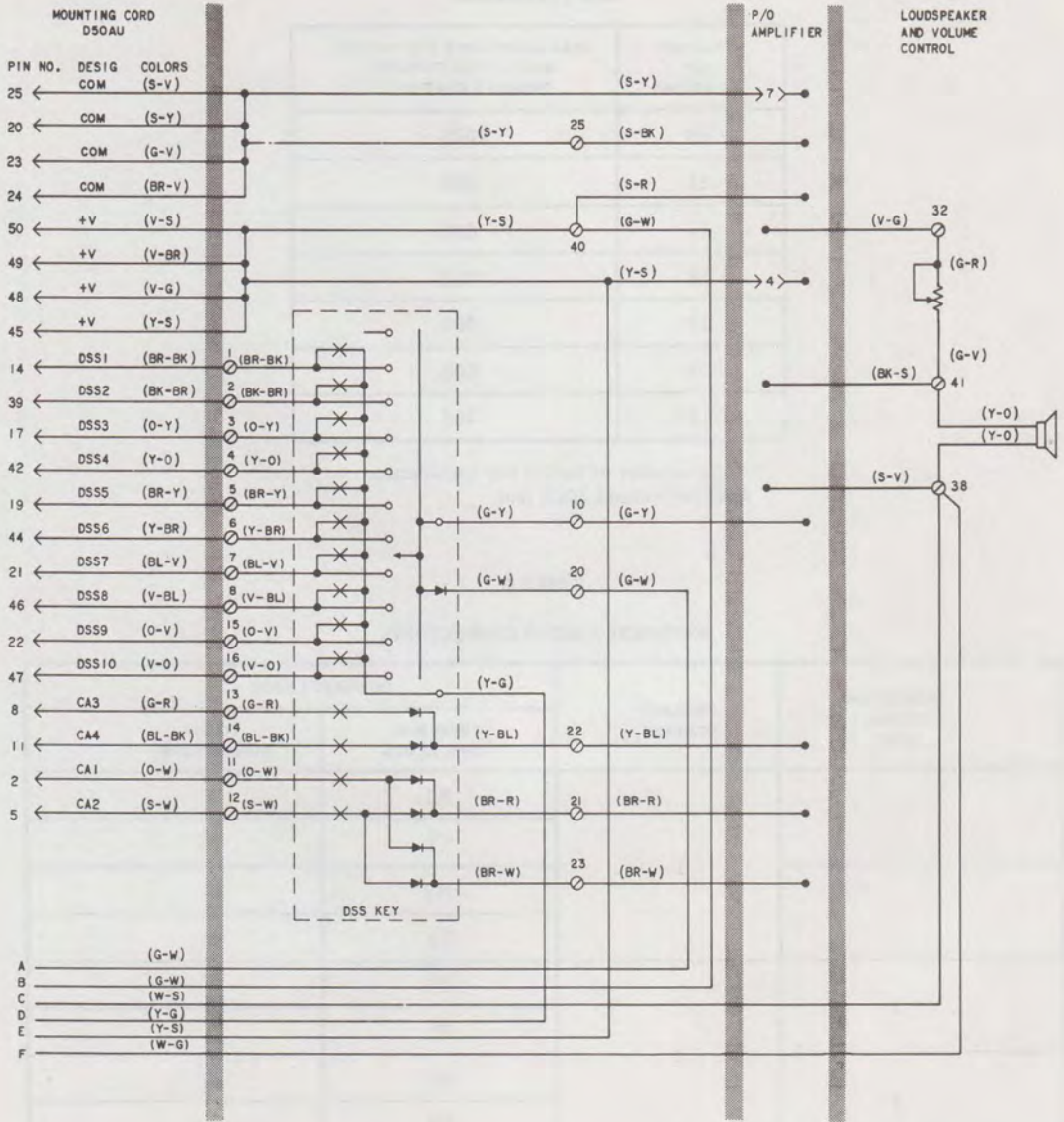


Fig. 18—Schematic, 2837AM Telephone Set (TOUCH-TONE) Satellite Station (Sheet 2 of 2)

TABLE A

LIMITATIONS ON CABLE LENGTH  
AND SYSTEM SIZE

NUMBER OF STATIONS	MAXIMUM CABLE FEET FROM SATELLITES TO BOTH PRIMARY STATIONS*
10	1000
11	900
12	800
13	700
14	600
15	500
16	400

\*Total number of feet in any installation shall not exceed 2000 feet.

TABLE B

## EXTERNAL RINGER CONNECTIONS

RINGER ON CO/PBX LINE	PRIMARY STATION	CONNECT LEADS	
		FROM 91A CONN. BLOCK	TO E1C RINGER TERM.
1	1	R1	5
		T1	6
2		R2	5
		T2	6
3	2	R1	5
		T1	6
4		R2	5
		T2	6

*Note:* Use inside wire to make connections.

TABLE C

## 33A VOICE COUPLER CONNECTIONS

33A VOICE COUPLER	91A CONN. BLOCK	CUSTOMER-PROVIDED MUSIC SOURCE
1		†
2		†
3	M	
4	M	
G*		

\*Connect to approved local ground using #14 gauge wire.

†Connections to be made by customer.

TABLE D

## TO ADD PRIVACY OPTION

LEAD COLOR	REMOVE FROM	CONNECT TO
	AMPLIFIER TERMINAL	PRIVACY TERMINAL
BL	1	1
BK-G	2	2
G-W	3	3
Y-S	4	4
G	5	5
R-S	6	6
S-Y	7	7
R-O	8	8
W	9	9

TABLE E

CO/PBX LINE CONNECTIONS

LEAD DESIG.	AT 1st PRIMARY STATION	AT 2nd PRIMARY STATION
	91A CONN. BLOCK	91A CONN. BLOCK
R(1)	R1	
T(1)	T1	
R(2)	R2	
T(2)	T2	
R(3)		R1
T(3)		T1
R(4)		R2
T(4)		T2

TABLE F

## DIAGNOSTIC TABLE

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
One set does not ring on specified line(s) but lamp flashes properly.	Common audible switches not set properly.	Set the four common audible switches for desired ringing at that station.
One set does not receive voice signal on DSS.	Station designation not coded properly on DSS key.	Check for correct position of slide switch. Be sure switch is properly engaged in a detent (centered on number).
Low volume on ringing or voice signaling.	Volume control set too low. Handset off-hook.	Readjust volume. Replace handset.
One lamp does not light on one station but lights on other stations.	Lamp failure.	Replace lamp per 6.12.
A lamp does not light at any station and there is an audible buzz on the line associated with lamp.	Lamp pair shorted in a station or transposed on a connecting block.	Correct wiring.
No music-on-hold.	Blown fuse on 33A voice coupler, improper wiring of music-on-hold option.	Replace fuse. Check wiring of music-on-hold circuit board and 33A coupler.
Excessive crosstalk on lines 1 and 2 or 3 and 4 when on hold.	Improper installation of music-on-hold option.	1. Check wiring of 33A coupler. 2. Music-on-hold board installed in a set, but option not being furnished.
Music distorted or too low.	Improper adjustment of music level; customer's music source does not have sufficient output.	See 3.12, 3.13, and 3.14.
Cannot drop a particular line at any station.	Failure of primary set logic circuit.	Replace primary set.
False hold condition when changing lines or lightly touching line buttons.	Defective line key.	Replace line key per 6.09.

TABLE F (Cont)  
DIAGNOSTIC TABLE

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
No sidetone on CO/PBX line.	Incoming CO/PBX line is dead.	Check incoming tip and ring with test set.
	Incoming tip and ring terminated on wrong terminals.	Check connections.
	Switch pileup on telephone set is defective.	Change out telephone set.
	Privacy circuit (if set is so equipped) may be operating incorrectly.	Check to see if privacy relay is falsely operating when going off-hook. If yes, check connections. If okay, replace privacy circuit.
	If rotary dial set has dial restriction.	BL-R lead of telephone set not moved from terminal 28 to 39.
	If 66-type connecting blocks are used, the cutdown may be incorrect.	Check station cutdown.
All four CO/PBX lamps light dim; noise on intercom on all sets.	Set has privacy circuit and CO/PBX line is in use by another station.	No corrective action; wait until line is not in use.
	System power supply shorted.	Disconnect sets (one at a time). If problem persists, check cable.
Sidetone on CO/PBX lines; but no lamps on CO/PBX or intercom lines, no ringing on above lines, no intercom talk battery. Transformer usually warm.	No power applied to associated control set.	Verify power at ac outlet and ensure that sets are plugged in.
	Power supply was shorted long enough to permit thermal cutout in transformer to operate.	<ol style="list-style-type: none"> <li>1. Replace transformer.</li> <li>2. Replace primary set.</li> <li>3. Wait (up to 30 minutes) for thermal circuit breaker to reset automatically.</li> </ol>
Cannot dial.	Set wired for dial restriction option.	No corrective action necessary.
Noise from speaker as volume control is rotated.	Defective volume control.	Replace assembly as covered in 6.13.

TABLE F (Cont)

DIAGNOSTIC TABLE

TROUBLE	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
Privacy circuit does not prevent pickup when going off-hook on a busy line.	Improperly wired or defective privacy circuit.	Correct wiring or replace privacy circuit.
Privacy circuit does not prevent pickup on busy line when rapidly changing lines, but is okay going off-hook.	Defective line key.	Replace line key.