

## KEY TELEPHONE SETS

### STANDARD FEATURES AND OPTIONS

### BASIC WIRING REQUIREMENTS

#### 1. GENERAL

**1.01** This section contains standard configurations of the various service features available in key telephone systems and note the conditions or limitations in their application.

**1.02** This section is reissued to:

- Include 4A speakerphone information
- Revise all figures and section references
- Show 3-type speakerphone MD.

**1.03** For clarity, the schematics show only that portion of the circuit involved and in some instances, such as the TOUCH-TONE® dial or a network, in an abbreviated form. Detached contact format is used throughout.

**1.04** In addition, terminals, lead colors, contacts, etc. have been designated only where there is assurance the designation is common in all cases. Where designations are not shown, variations exist and it will be necessary to refer to the Bell System Practice, SD, or other related data of the telephone set or apparatus involved.

**1.05** Additional information on the various features can be found in the following:

- Multiline Exclusion—CD- and SD-69489-01, ♦Section 518-215-401♦
- ♦3-Type (MD) Speakerphone—CD- and SD-69403-01♦
- ♦4A Speakerphone—CD- and SD-69909-01♦
- Station Busy Lamp—CD- and SD-69241-01, CD- and SD-69580-01

- Supplementary Hold—CD- and SD-69530-01
- Signaling—CD- and SD-69203-01
- Add-on Conference Circuit—CD- and SD-69561-01, ♦Section 518-215-401♦
- Combining 1A and 1A1 or 1A2 KTS Line Circuits in CALL DIRECTOR® sets equipped with 590- and 650-Series Keys—CD- and SD-69495-01, CD- and SD-69497-01

For telephone set connections, refer to the section covering the specific set involved.

#### 2. FEATURES

##### A. Exclusion

**2.01** Two types of exclusion are available (Fig. 1)—single line using the exclusion switch in the telephone set and multiline using a 428A or 405A (MD) KTU. The KTU will handle two CO or PBX lines associated with 1A1 or 1A2 KTS.

**2.02** Both methods of exclusion are under control of the line switch of the control station eliminating the possibility of the station being accidentally left excluded.

**2.03** With either arrangement, A1 ground must be supplied directly to the excluded station(s) rather than under control of the exclusion feature to permit access to other lines that are not excluded.

**2.04** Refer to ♦Section 518-215-401♦ or SD-69489-01 for excluded station connections when furnishing the multiline feature.

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**B. Polarity Guard**

**2.05** Polarity guards should be inserted when authorized by local instructions to prevent reversal of line current in end-to-end signaling.

**2.06** Polarity guards should be inserted in the telephone circuit as shown in Fig. 2 to prevent damage to the surge protector if the set dial has been disconnected for maintenance reasons, and the set is off-hook and connected to a line.

**C. Speakerphone**

**2.07** Connections shown for speakerphone are divided into those showing transmission leads (Fig. 3 and 4) and control leads (Fig. 5 and 6).

**2.08** Certain functions are performed in the dial of a speakerphone set that are not required in nonspeakerphone sets. In a rotary dial set this involves the second set of off-normal dial contacts terminated on the yellow leads which prevent clicks in the loudspeaker during on-hook dialing. In the TOUCH-TONE dial, the s, t contacts connect negative line voltage to the oscillator for on-hook dialing and the q, p contacts open to remove the shunt across the level limiting resistor in series with the tip side of the line (T1 lead).

**2.09** Certain wiring precautions must be observed when multiplying sets wired for speakerphone. The T1, R1, IT or P3, IR or P4, 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 may result in:

- Tip and ring cross through the T1 and R1 leads (Fig. 7)
- False operation of an A relay through the AG lead (Fig. 8)
- Shorting the receive input to the speakerphone unit, disabling the loudspeaker through the P3 and P4 leads (Fig. 9).

**2.10** Separate speakerphone leads must be supplied to each station.

**2.11** For full speakerphone connections, refer to Division 512 for the particular telephone set involved.

**D. Station Busy Lamp**

**2.12** This feature furnishes a visual indication to other locations anytime the station is off-hook or the speakerphone is turned on (Fig. 10).

**2.13** The A1 ground (1A1 or 1A2 KTS) or SG ground (1A KTS) is supplied to the BL lead under control of the line switch to light the lamp directly or to operate an auxiliary relay (17B KTU) when it is desired to use 10 volt ac to light the lamp. Use of an auxiliary relay makes changing out of a line lamp in key telephone sets unnecessary. In the case of speakerphone operation the ground is returned over the AG lead.

**2.14** At 1A1 or 1A2 KTS installations, false operation of the busy lamp is possible if the station, though idle, has a line button depressed and another station having access to the same line grounds the A lead. To prevent this, all sets having busy lamp (except headset jack equipped CALL DIRECTOR telephone sets) must be equipped with a diode as shown in Fig. 10A.

**2.15** The CALL DIRECTOR sets having headset jacks require the addition of a Printed Wiring Board Assembly instead of the diode (Fig. 11). If the set is not designed for concentrator use, the kit of parts is mounted in the set. Where a concentrator is used, the kit of parts is installed in the 235- or 236-type KTU and connected as shown in Section 518-310-405.

**E. Signaling**

**2.16** Several forms of signaling are possible using the convertible line pickup buttons on key telephone sets. The first is regular signaling in which the line button is converted to nonlocking, one set of contacts being used as a pushbutton to operate a signal control circuit (Fig. 12). With this arrangement a separate button(s) is required for the intercommunicating circuit.

**2.17** Common signaling (Fig. 13) uses one converted line button to signal over several intercom circuits. The A1 or SG ground used to operate the signal circuits should be under control of the line switch to prevent false signaling if the customer

is toying with the common signaling key even though on-hook.

**2.18** When the A1 ground is used for signaling arrangements, it cannot be used to operate an ac or dc buzzer directly. Instead the ground should be used to operate a signal control relay whose contacts in turn control the device.

#### F. Supplementary Hold

**2.19** In 1A1 or 1A2 key systems, the standard hold is operated by removing the A1 ground at the hold key, giving a steady lamp or lamp wink visual signal. The supplementary hold requires a 429A or 406A (MD) KTU and a 430A or 408A (MD) KTU, and furnishes a distinctive lamp flutter signal which interrupts the lamp circuit 12 times per second.

**2.20** Two versions of supplementary hold can be furnished.

(a) "I" hold is supplied on a station basis so that only that station initiating the special hold receives the distinctive lamp signal. Any telephone set whose hold key can be rewired to transfer the A lead from ground to -24 volt dc on the SP lead as shown in Fig. 14A and B can be used for "I" hold. The 599H, 657H, or 657L key is not required for this function but can be used. A separate detector circuit [one-half of the 429A or 406A (MD) KTU] must be supplied for each station having "I" hold.

(b) Priority Hold, supplied on a per line basis so that all stations with access to the same line will receive the distinctive signal when that line is placed on hold. Priority Hold can only be supplied in these sets that can be modified as follows:

- Addition of a D-180411 Kit of Parts in sets equipped with 635-type keys (Fig. 14C)
- Replacement of 590- or 650-series keys with 599H, 657H, or 657L key (Fig. 14D).

#### G. Cutoff

**2.21** Some telephone sets are equipped with a two position turnbutton as part of the 6-button key which has two sets of transfer contacts. The key can be used in any application requiring

circuit connection, cutoff, or transfer, some samples of which are shown in Fig. 15. The key is not self-restoring and does not short the disconnected circuit as true exclusion does, therefore cutoff circuits stand the chance of being accidentally disconnected if the control key is not manually restored. For this reason it may be better to use the exclusion key to perform these functions.

**2.22** Some CALL DIRECTOR sets do not have all the cutoff key contacts wired to mounting cord conductors thereby limiting its use. In this case it may be necessary to use the cutoff key to operate an auxiliary relay (Fig. 15D) with sufficient contacts to perform the desired functions.

#### H. Conferencing

**2.23** Conferencing permits add-on of a third party to a conversation without operator assistance. The circuit is designed to be used with PBX lines. Use on CO lines may result in poor transmission. The two PBX lines used must be wired to the controlling station as shown in Fig. 16.

**2.24** After connection to the third party is established using the second PBX line, the two lines are conferenced by operating a signal key which can optionally be a converted pickup key, external pushbutton or the set exclusion key.

**2.25** The circuit permits the control station to either hold or disconnect without affecting conversation of the remaining two parties.

#### I. Combining 1A and 1A1 or 1A2 KTS Line Circuits

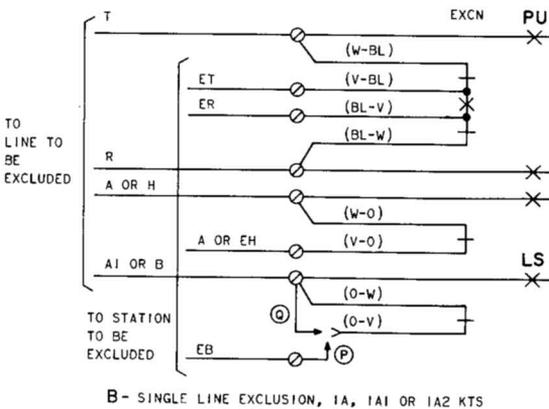
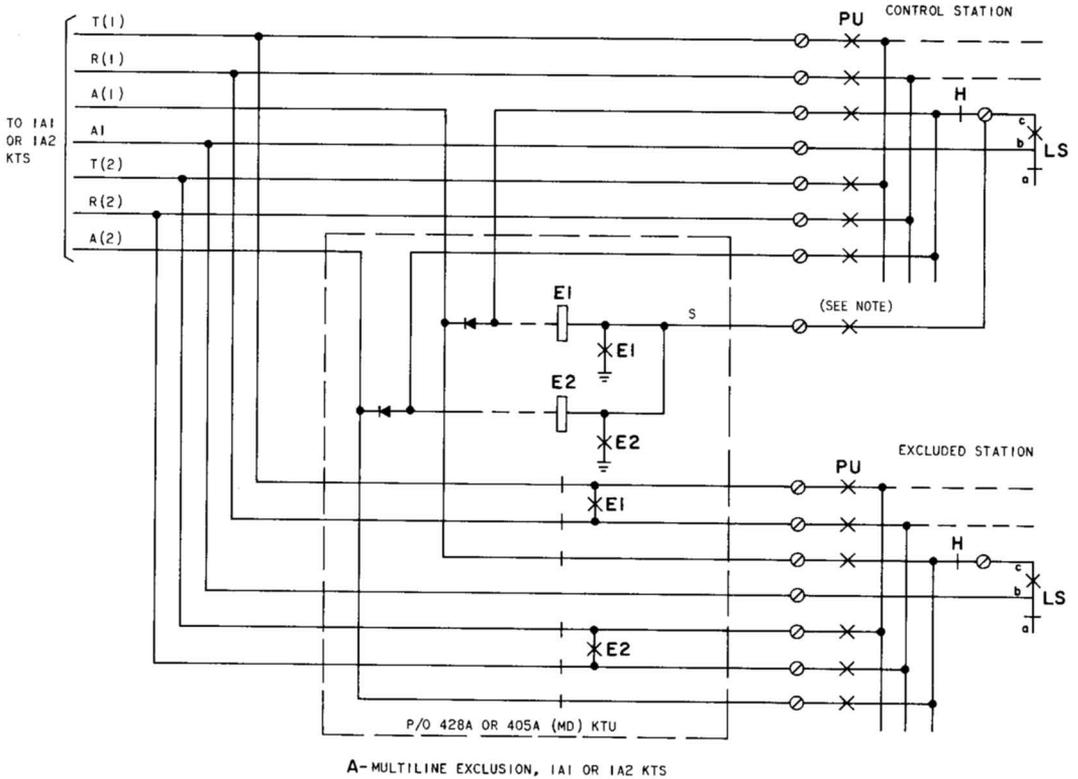
**2.26** Sets equipped with a single 6-button key cannot have 1A KTS line circuits intermixed on the key with 1A1 or 1A2 KTS because of the different hold operation.

**2.27** General purpose CALL DIRECTOR sets, however, are wired to permit mixing of circuits within the set but only under the following conditions.

- 1A line circuits cannot be mixed with 1A1 or 1A2 on the same 6-line key unit.
- With mixed line circuits, the 1A1 or 1A2 circuits must appear on the first key units (from left to right as required) and the 1A circuits on succeeding key units.

- 1A1 KTS circuits should not be mixed with 1A2 circuits on the same CALL DIRECTOR set because of the difference in time-out functions.

**2.28** The CALL DIRECTOR sets equipped with 590- or 650-series keys (Fig. 17) must be modified differently than the newer sets equipped with 635-type keys (Fig. 18).



- Ⓟ 1A KTS
- Ⓞ 1A1 OR 1A2 KTS SUPPLY AI GRD DIRECTLY TO EXCLUDED STATION

LS - LINE SWITCH  
 H - HOLD KEY  
 PU - PICKUP KEY

NOTE:  
 CONTACT USED IN S LEAD CAN BE LOCKING OR NON-LOCKING PICKUP KEY, TURNBUTTON, EXCLUSION SWITCH IN SET OR EXTERNAL KEY.

Fig. 1 - Exclusion Feature

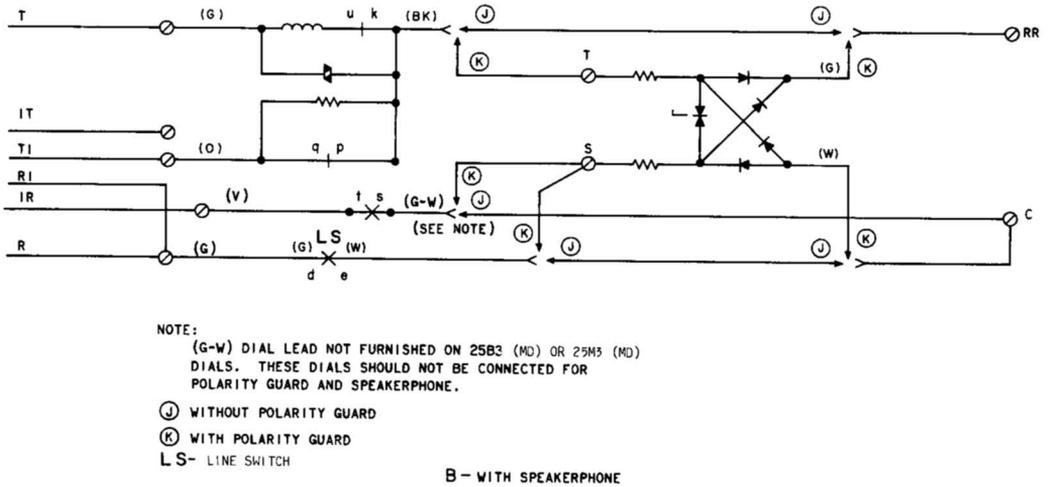
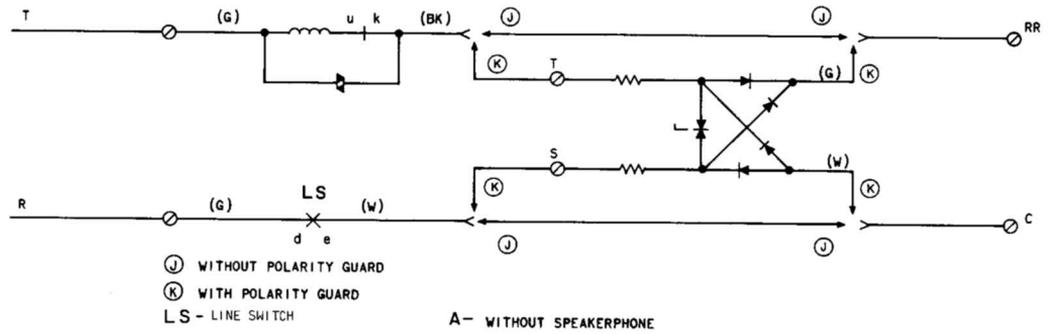
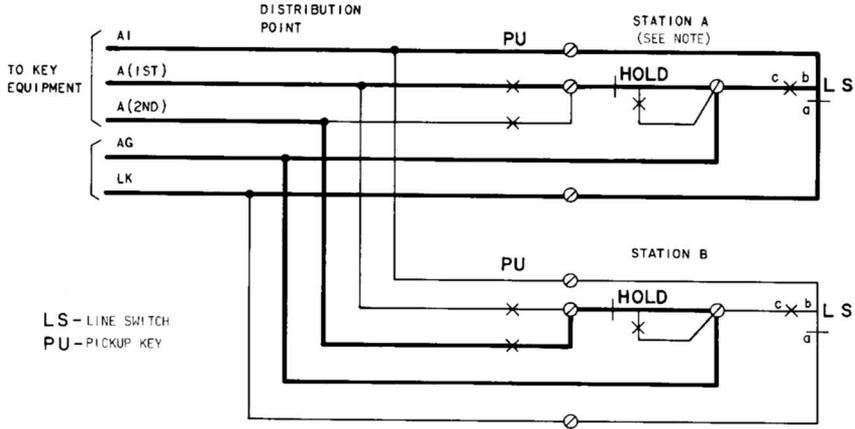


Fig. 2—Polarity Guard Connections





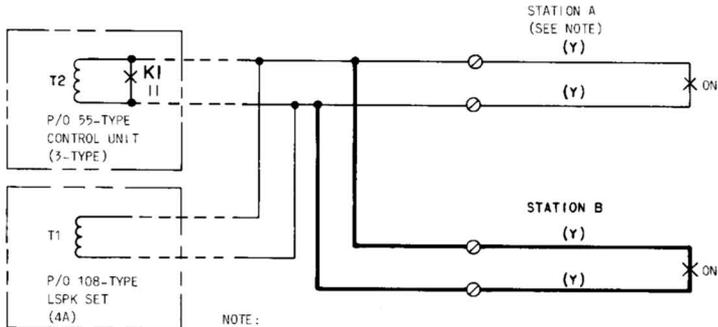




LS - LINE SWITCH  
PU - PICKUP KEY

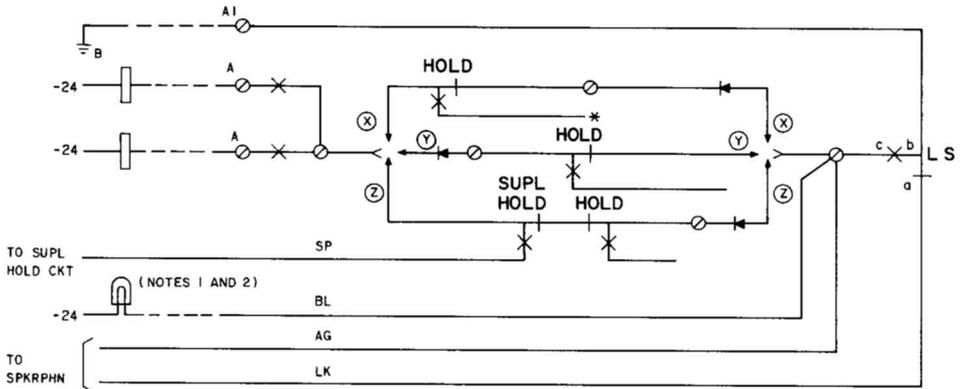
NOTE:  
FALSE OPERATION OF 2ND LINE A RELAY CAUSED BY A1 GRD FROM STATION A OVER AG LEAD OR AG GRD IF STATION A IS ON SPEAKERPHONE.

Fig. 8—Trouble Encountered When AG and LK Leads are Multiplexed



NOTE:  
RECEIVER INPUT OF SPEAKERPHONE SHUNTED OUT AT STATION A WHILE STATION B IS DIALING.  
ON - DIAL OFF NORMAL CONTACTS

Fig. 9—Trouble Encountered When P3 and P4 Leads are Multiplexed



LS - LINE SWITCH

NOTES:

1. BL LEAD MAY BE WIRED DIRECTLY TO LAMP OR TO LAMP CONTROL RELAY (SD-69580-01)
2. WHEN A LAMP INDICATOR IS USED FOR BUSY LAMP, EITHER A 51A (10V) OR 52A (24V) LAMP MAY BE USED. IF THE LAMPS OF A KEY OR LAMP SOCKET INSTALLED IN A TELEPHONE SET ARE USED, ONLY 51A (10V) LAMPS SHALL BE USED TO AVOID OVERHEATING.

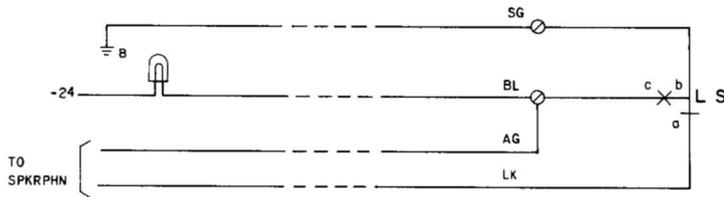
\* CONNECT TO SP LEAD FOR "I" HOLD

(X) AND (Y) ELECTRICALLY EQUIVALENT, DIFFER ONLY IN WAY DIODE AND HOLD KEY ARE WIRED.

(X) WIRING MUST BE USED IF FURNISHING "I" HOLD, USE 533K DIODE

(Z) SUPPLEMENTARY HOLD (599H, 657H, OR 657L KEY)

A. 1A1 OR 1A2 KTS



LS - LINE SWITCH

B - 1A KTS

Fig. 10—Station Busy Lamp With Speakerphone

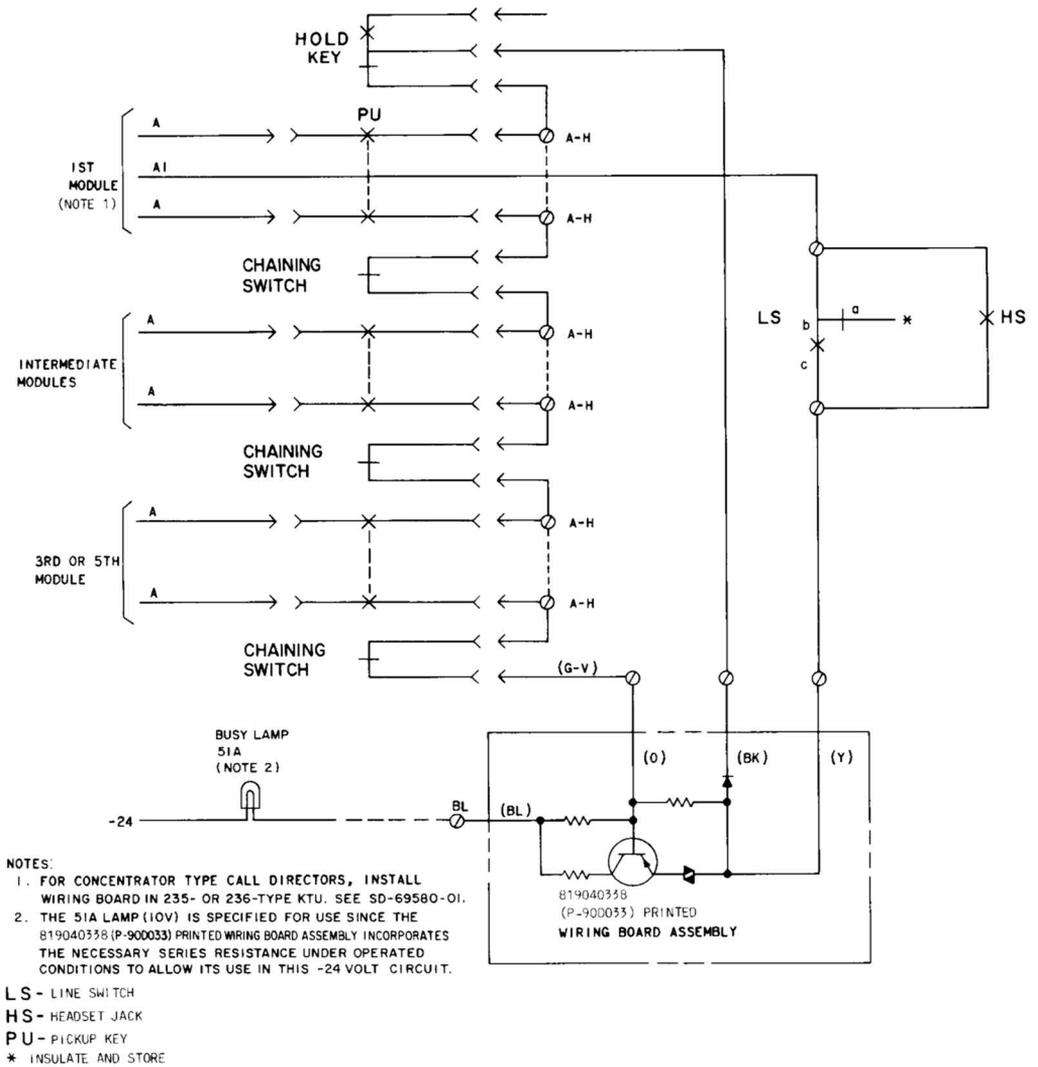
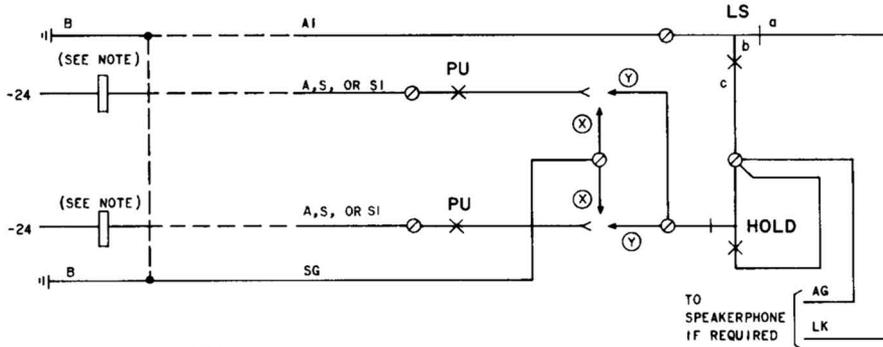


Fig. 11—Station Busy Lamp Circuit for Headset Jack Equipped CALL DIRECTOR Sets



NOTE:  
A RELAY IN LINE CIRCUIT OR SIGNAL CONTROL RELAY (SD-69203-01)

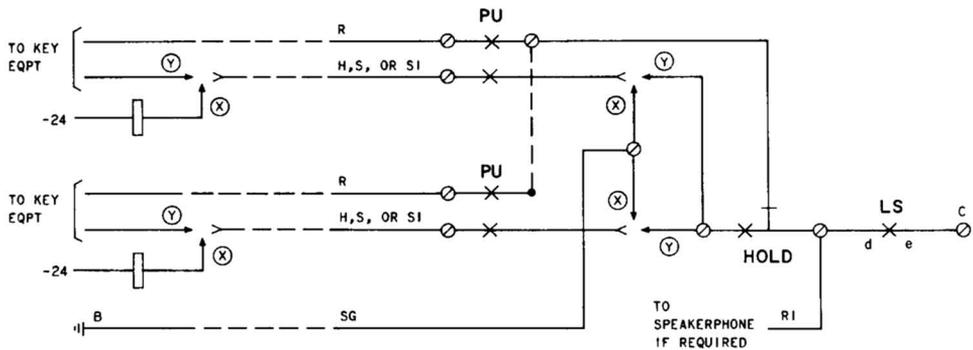
(X) SIGNALING-CONVERT KEY INVOLVED TO NON-LOCKING  
(USE SIGNAL CONTROL RELAY)

(Y) A LEAD CONTROL

LS - LINE SWITCH

PU - PICKUP KEY

A. 1A1 OR 1A2 KTS



(X) SIGNALING-CONVERT KEY INVOLVED  
TO NON-LOCKING

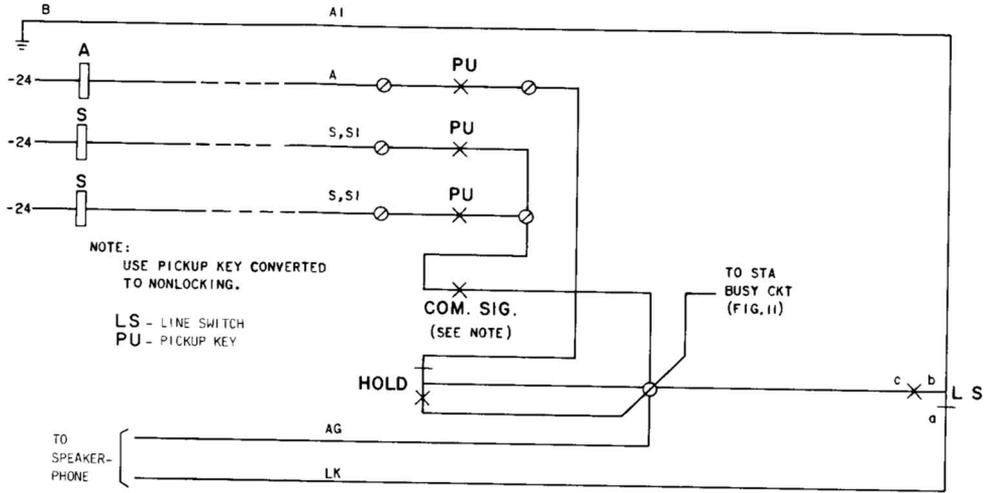
(Y) HOLD

LS - LINE SWITCH

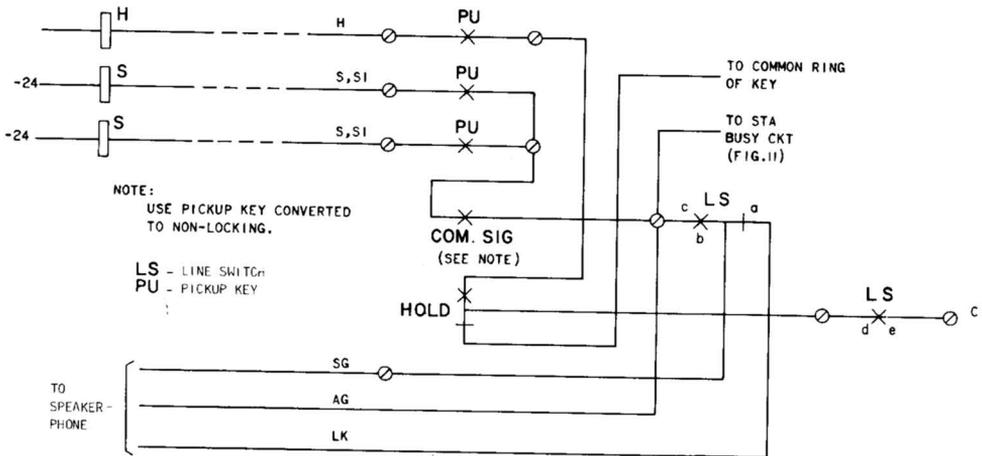
PU - PICKUP KEY

B. 1A KTS

Fig. 12—♦Signaling, Using Converted Line Pickup Buttons♦

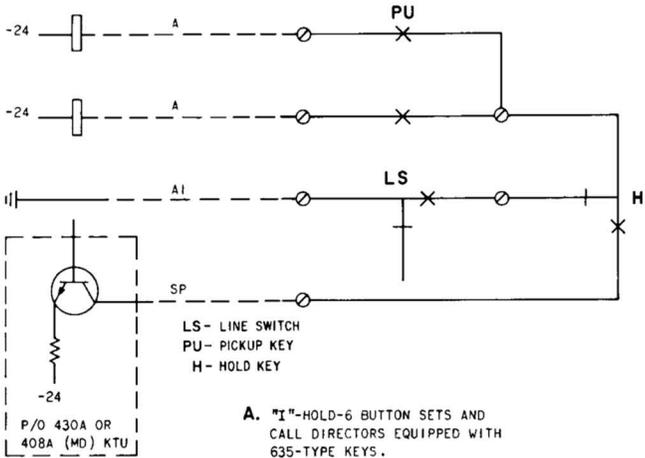


A- 1A1 OR 1A2 KTS

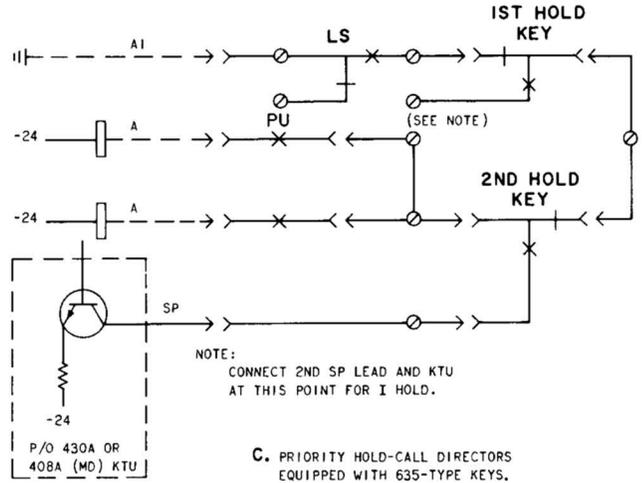


B- 1A KTS

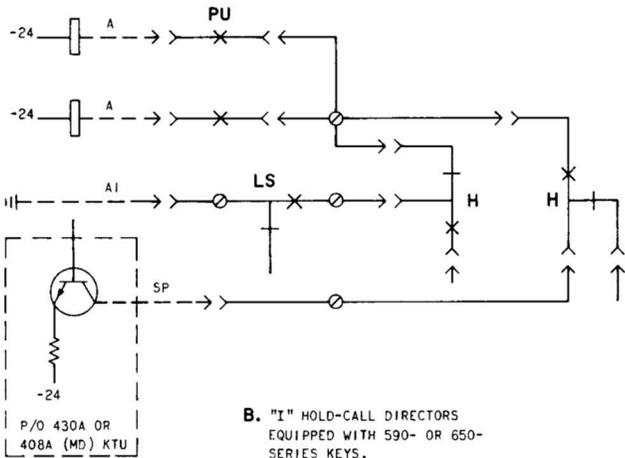
Fig. 13—Common Signaling Key Arrangements



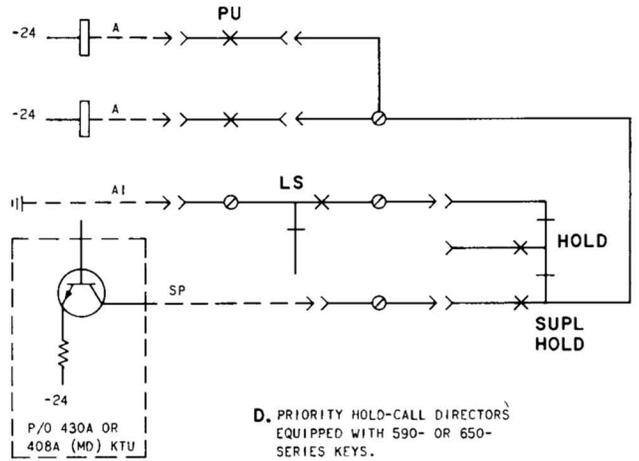
A. "I" HOLD-6 BUTTON SETS AND CALL DIRECTORS EQUIPPED WITH 635-TYPE KEYS.



C. PRIORITY HOLD-CALL DIRECTORS EQUIPPED WITH 635-TYPE KEYS.



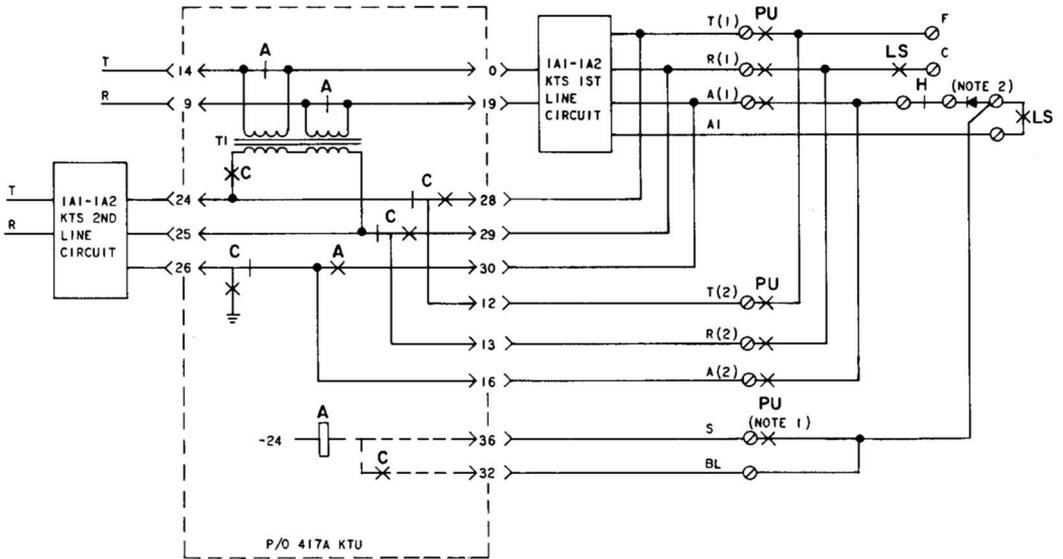
B. "I" HOLD-CALL DIRECTORS EQUIPPED WITH 590- OR 650-SERIES KEYS.



D. PRIORITY HOLD-CALL DIRECTORS EQUIPPED WITH 590- OR 650-SERIES KEYS.

Fig. 14—Supplementary Hold Options





NOTES:

1. USE PICKUP KEY CONVERTED TO NON-LOCKING
2. CONNECT DIODE PER BUSY LAMP CONNECTIONS FOR SET INVOLVED.

- LS - LINE SWITCH  
 PU - PICKUP KEY  
 H - HOLD KEY

Fig. 16—Add-on Conference Circuit (PBX Lines)

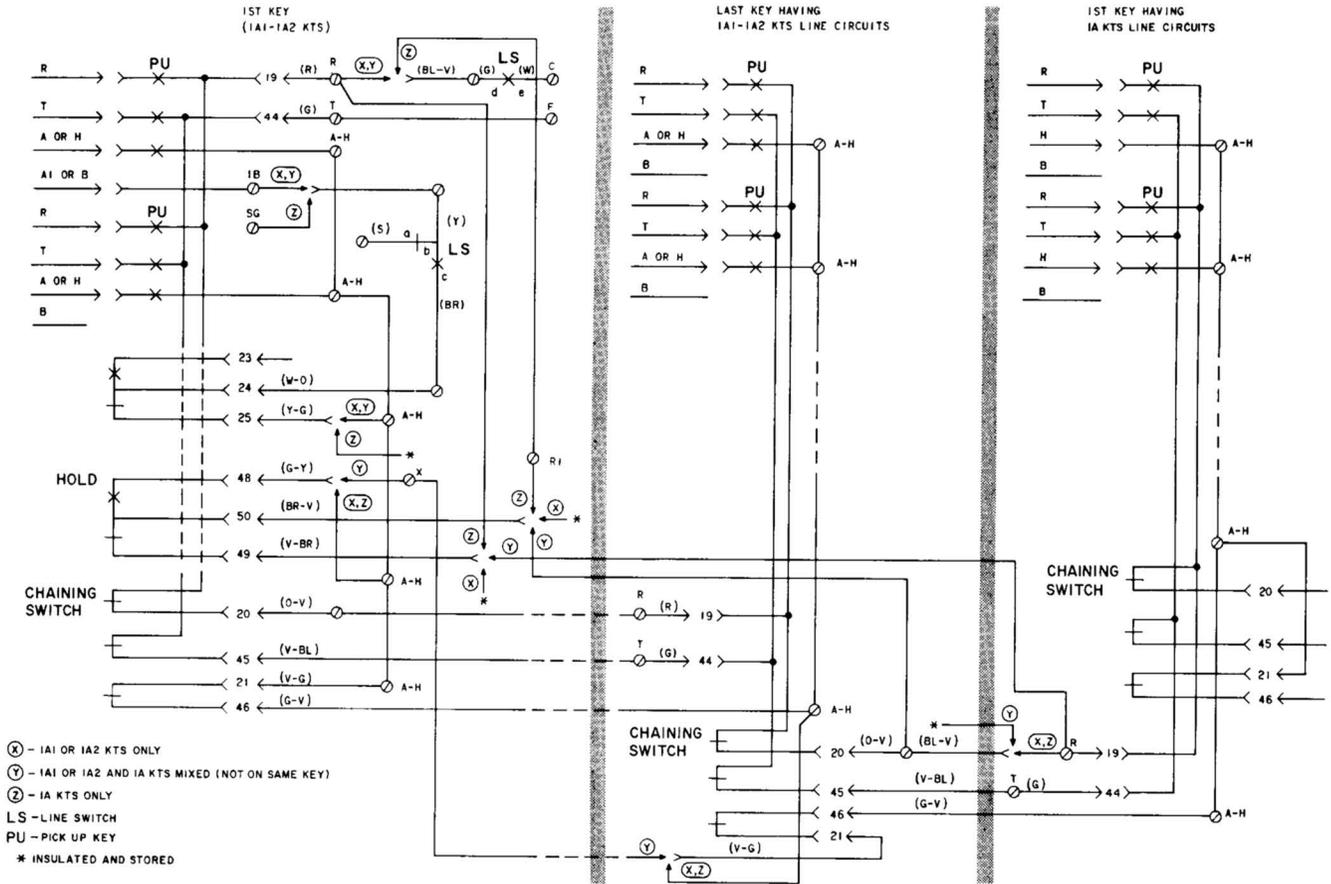


Fig. 17—Combining 1A and 1A1 or 1A2 KTS in CALL DIRECTOR Sets Equipped With 590- or 650-Series Keys

