

**SERVICE**  
**620A (MD), 641A, AND 642A MODULAR PANELS**  
**1A2 KEY TELEPHONE SYSTEM**  
**IDENTIFICATION, INSTALLATION, CONNECTIONS, AND MAINTENANCE**

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**NOTICE**

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## 1. GENERAL

**1.01** This section provides information for the 620A (MD), 620A2, 641A, and 642A modular panels (Fig. 1, 2, 3, and 4) and associated power units (Fig. 6).

**1.02** This section is reissued to add:

- Information on the treatment of 1A2 Key Telephone System (KTS) and key telephone units (KTUs) under the Federal Communications Commission's (FCC) Registration Program
- Maintenance diagrams for the 620A-type, 641A, and 642A modular panels
- Connections and testing information for the 452A KTU (power failure ringing circuit)
- Use of 620A-type, 641A, and 642 panels with 630A key service panel (KSP).

**1.03** This issue of the section is based on the following drawings:

- SD-69658-01, Issue 5A—Modular Panels, 620A (MD), 620A2, 626A, 641A, and 642A
- SD-82227-01, Issue 1—Power Unit, 79B1
- SD-82227-02, Issue 2—Power Unit, 79B2
- SD-82198-01, Issue 3—Power Unit, 90B1.

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the SDs and CDs to determine the extent of changes and the manner in which the section may be affected.

**1.04** Incoming central office (CO) lines to be installed in compliance with the FCC Registration Program must be routed through a standard network interface. Information on approved interfaces is contained in Sections 463-400-100 through 463-400-150.

**1.05** ♦After January 1, 1980, connection of customer-provided equipment (CPE) or telephone company-provided equipment to the 1A2 KTS requires the use of a 33B voice coupler when providing music-on-hold. Also, after January 1, 1980, the 415B, 471C, and 479C KTUs must be used when providing their related services. Previously connected or Class C voice couplers and KTUs may be used for additions and maintenance at grandfathered installation for the life of the equipment, provided they are not modified.♦

## 2. IDENTIFICATION

**2.01** The 600-series modular panels make installation easier, minimize connections, and reduce mounting and terminal space requirements.

**2.02** These panels provide standard 1A2 KTS features and accommodate the 1A2 KTUs listed in Table A.

## ORDERING GUIDE

**2.03** This section covers the three initial modular panels coded as follows:

- Panel, Modular 620A (MD) or 620A2 (Line Services)

- Panel, Modular, 641A (Dial Intercom)
- Panel, Modular, 642A (Miscellaneous).

Information on the 626A panel which provides button-per-path intercom can be found in Section 518-215-421.

**Note:** The 620A (MD), 620A2, and 642A panels are equipped with 834055907 (P-40V590) guide assemblies.

- (a) **Replaceable Components (Table B)**
- (b) **Associated Apparatus (order separately)**
  - Unit, Telephone, Key—order as required from Table A
  - Unit, Power—refer to Table C for selection
  - Block, Connecting, 92A—interconnects one 620A (MD), 620A2, 641A, or 642A modular

panel to a 19-, 20-, 29-, or 30-type power unit

- Cord, Power
  - 824013262 (P-40J326)—1-1/2 feet
  - 824013270 (P-40J327)—2 feet
  - 824013288 (P-40J328)—4 feet
  - 824013296 (P-40J329)—6 feet
  - 824010995 (P-40J099)—12 feet
- Cord, P12D—power interconnect cable extender
- Insulator, Terminal, C Clip—for insulating RN terminals on all panels and 105-volt terminals on 641A panel.
- (c) **Optional Apparatus (order separately; Table D)**

◆ TABLE A ◆

**600-SERIES MODULAR PANEL AND KTU  
SELECTION AND CONNECTION FIGURE INDEX**

| KTU        | SIZE   |      | CIRCUIT FUNCTION                                   | MODULAR PANEL |      |      | TEST | CONNECTION FIGURE<br>(SEE NOTE) |
|------------|--------|------|--|---------------|------|------|------|---------------------------------|
|            | INCHES | PINS |  | 620A/A2       | 641A | 642A |      |                                 |
| 400B, C, D | 4      | 18   | CO/PBX Line  | •             |      |      | A    | 18                              |
| 400G       | 4      | 18   | CO/PBX Line  | •             |      |      | A    | 19                              |
| 400H       | 4      | 18   | CO/PBX Line  | •             |      |      | A    | 20                              |
| 401-Type   | 4      | 18   | Manual Intercom                                    | •             |      |      | B    | 21                              |
| 407B, C    | 8      | 80   | Dial Intercom, 10-Code                             |               | •    |      | I    | 31 thru 38                      |
| 413A       | 4      | 18   | Auxiliary Ringup                                   | •             |      |      |      | 22                              |
| 414A       | 4      | 20   | Manual Signaling,<br>Ringdown, Private Line        | •             |      |      | C    | 23                              |
| 415A       | 4      | 18   | Automatic, DC Signaling,<br>Ringdown, Private Line | •             |      |      | D    | 24                              |
| 416A       | 4      | 20   | Station Line                                       | •             |      |      | E    | 25                              |
| 417A       | 4      | 40   | Add-On Conference                                  |               |      | •    | L    | 40                              |
| 418A       | 4      | 20   | Short Range, DC Signaling,<br>Private Line         |               |      | •    | M    | 41                              |
| 419A       | 8      | 80   | Automatic Signaling,<br>Ringdown, Private Line     | •             |      |      | F    | 26                              |
| 420A       | 4      | 18   | Long Line  |               |      | •    | K    | 37                              |
| 421A       | 4      | 40   | Power Failure Transfer                             |               |      | •    |      | 42                              |
|            |        |      | Direct Station Selection                           |               |      | •    |      | 38                              |
|            |        |      | Audible Signal Suppression                         |               |      | •    |      | 43                              |
| 422B       | 4      | 40   | Station Busy Selector                              |               |      | •    |      | 35,36                           |
| 424-Type   | 8      | 80   | Dial Intercom, 19-Code                             |               | •    |      | I    | 31 thru 38                      |
| 425-Type   | 8      | 80   | Dial Intercom, Flashing<br>Lamp                    |               | *    | •    |      | 33,34,35,36                     |
| 428A       | 4      | 40   | Multiline Exclusion                                |               |      | •    |      | 44                              |



◆ TABLE A (Contd) ◆

600-SERIES MODULAR PANEL AND KTU  
SELECTION AND CONNECTION FIGURE INDEX

| KTU      | SIZE   |      | CIRCUIT FUNCTION  | MODULAR PANEL |      |      | TEST | CONNECTION FIGURE (SEE NOTE) |
|----------|--------|------|---|---------------|------|------|------|------------------------------|
|          | INCHES | PINS |   | 620A/A2       | 641A | 642A |      |                              |
| 429A, B  | 4      | 40   | Supplementary Hold Detector                             |               |      | •    |      | 45                           |
| 430A     | 4      | 20   | Flutter Generator                                       |               |      | •    |      | 45                           |
| 440A     | 8      | 80   | TOUCH-TONE Adapter                                      |               | *    | •    |      | 31,33,34,36                  |
| 448A     | 4      | 40   | Variable Delay Timer                                    |               |      | •    |      | 46                           |
| 449A     | 4      | 40   | Immediate Transfer Control                              |               |      | •    |      | 47                           |
| 451B‡    | 4      | 40   | Music-On-Hold   |               |      | •    | N    | 48                           |
| 452A     | 4      | 40   | Power Failure Ringing Circuit                           |               |      | •    | O    |                              |
| 461A     | 4      | 18   | Manual Signaling, Ringdown, Private Line                | •             |      |      | C    | 23                           |
| 467A     | 4      | 18   | Low Voltage Monitor                                     | •             |      | •    |      |                              |
| 469A     | 4      | 18   | Lamp Extender   | •             |      |      | G    | 27                           |
| 471-Type | 4      | 18   | Battery Reversal Toll Restriction                       | •             |      |      | H    | 28                           |
| 476†     | 4      | 20   | Dial Tone, Station Busy Tone, and Audible Ringback Tone |               |      | •    |      | 34,35,36                     |
| 478B     | 8      | 80   | TOUCH-TONE Adapter                                      |               | *    | •    |      | 31,33,34,36                  |
| 479-Type | 8      | 80   | Rotary Dial Toll Restriction                            |               |      | •    |      | 9                            |
| 494A     | 8      | 80   | TOUCH-TONE Selector Circuit                             |               | •    |      | J    | 32                           |
| 498A‡    | 4      | 40   | Music-On-Hold   |               |      | •    | N    | 50                           |

*Note:* Connection figures are designed for current model KTUs but are applicable for all codes indicated in this table.

\* If 425A or B KTU is used in 641A panel, the 440A or 478B KTU must go in a 642A panel.

† 476A KTU replaces 423B (MD). Do not use 423A KTU in modular panels.

‡ The 451B KTU supplies music-on-hold for seven circuits. The 498A KTU contains four circuits and can be increased to seven by the addition of a 116A1 circuit module to the KTU.

**TABLE B**  
**REPLACEABLE COMPONENTS**

| UNIT          | DESCRIPTION     |             | IDENTIFICATION CODE |               |
|---------------|-----------------|-------------|---------------------|---------------|
| Modular Panel | Lamp            | 10V         | 51A                 |               |
|               | Indicator, Fuse | White       | KS-14174, L1        |               |
|               |                 | Brown       | KS-14174, L8        |               |
|               |                 | Green       | KS-14174, L4        |               |
|               | Fuse            | 1-1/3 amp   | 70A                 |               |
|               |                 | 3/4 amp     | 70H                 |               |
| 5 amp         |                 | 70D         |                     |               |
| Power Unit    | Fuse            | Input       | 2 amp*              | BUSSMAN MDL-2 |
|               |                 |             | 5 amp               | BUSSMAN MDX-5 |
|               |                 | Output      | 2 amp               | 24C           |
|               |                 |             | 3 amp               | 24B           |
|               |                 |             | 5 amp               | 24F           |
|               |                 | Interrupter | 10V                 | KS-19175, L3  |

\* 79B2 only.

**TABLE C0**  
**POWER UNIT CAPACITIES**

| POWER UNIT                | CAPACITY   |
|---------------------------|--|
| 79B1                      | Maximum three 620A or 620A2 panels<br>or<br>two 620A or 620A2 panels plus any combination of two 641A or 642A panels<br>or<br>any combination of four 641A or 642A panels<br>plus<br>four 66B4-25 connecting blocks or four 16A1-160 terminal blocks |
| 79B2                      | Maximum of four 620A, 620A2, 641A, or 642A panels in any combination<br>plus<br>four 66B4-25 connecting blocks or four 16A1-160 terminal blocks  |
| 90B1                      | Maximum of ten 620A, 620A2, 641A, or 642A panels in any combination<br>plus<br>sixteen 66B4-25 connecting blocks or sixteen 16A1-160 terminal blocks   |
| 19-, 20-, 29-, or 30-type | One or two 620A, 620A2, 641A, or 642A panels where interrupted power is not required or can be obtained from 584C panel or 232-type KTU.   |

*Note:* If 630 KSP is used, the 79- or 90-type power unit is not required until the third additional modular panel is added.

TABLE D  
 OPTIONAL APPARATUS  
 (ORDER SEPARATELY)

| DESCRIPTION                             |                   | IDENTIFICATION CODE |
|---|-------------------|---------------------|
| Adapter, Plug, Power Cord               |                   | HUBBELL BL-12433    |
| Adapter, Bridging, Quick-Connect        | Horizontal        | 183A2               |
|   | Vertical          | 183B2               |
| Block, Matrix                           |                   | 1A1                 |
| Backboards                              | Green             | 183A2*              |
|   | Blue              | 183B1*              |
|   | Red               | 184A1, B1†, B2†     |
|   | Yellow            | 185A1               |
|   | White             | 187B1               |
|   | White             | 198A                |
| Block, Connecting                       |                   | 66B4-25             |
|   |                   | 66B3-50             |
|   |                   | 66M1-50             |
| Block, Terminal                         |                   | 16A1-160            |
| Cord (Power Interconnect Cord Extender) | 8 ft. ‡           | P12D                |
| Cover                                   | For 620A or 620A2 | 151A                |
|   | For 641A or 642A  | 152A                |
| Cover (End Cap)                         |                   | 153A                |
| Tag, Ground                             |                   | E3013B              |
| Trough, Wiring (with Cover)             |                   | 840348288           |

\* Equipped with 89B brackets.

† Equipped with four 66B4-25 connecting blocks.

‡ 8 ft. is standard length. Available in other lengths if specified on order.

**DESIGN FEATURES****A. Common Features**

**2.04** The 600-series modular panels share the following features:

- Accommodate 400-series KTUs providing services described in Table A.
- 66-type quick-connect terminal field.
- Steady and interrupted power (Table F) provided by an external power source via factory-wired, 12-conductor, 42-inch power cable. Extender cords are available and must be ordered separately (Table D).
- Retainer and guide assembly serve to lock KTUs in connectors (Fig. 1).
- Dimensions: same height and depth; 620A twice as wide as 641A or 642A (Table E).
- Built-in lamp and fuse block assembly (Fig. 5) with self-indicating fuses and lamps which offer visual indications of the status of a related circuit.

**B. 620A (MD) Modular Panel**

- Provide line and auxiliary services (maximum 8) as listed in Table A.
- 913B connectors accommodate eight 4-inch KTUs.
- Two terminal fields (RED) divided into quadrants and wired to similarly positioned connectors (Fig. 2) which offer KTU services independent of each other.
- Lamp load not to exceed 100 lamps per panel (60 if 79B1 power unit is used) or 20 lamps per line circuit. Lamp loads in excess of these requirements must use lamp extenders (469A KTU).

**C. 620A2 Modular Panel (Fig. 1 and 2)**

The 620A2 panel, shown in Fig. 14 through 29, is identical to the 620A except for the following:

- Has a rigid metal PWB backplane.

- Provides access to the 10-volt ac signal required for the buzzer operation when manual intercom is desired. This access is provided on a quick-connect terminal in each of the 8-line quadrants of the termination field at the bottom of the panel (Fig. 14).

- Provides access to the -24 volt dc signal required for buzzer operation where manual intercom is to be provided. The -24 volt dc signal appears on a quick-connect terminal in quadrant 1A only of the termination field at the bottom of the panel (Fig. 14).

- Has a fourth fuse at the top of the panel for 10-volt ac (Fig. 5).

**D. 641A Modular Panel (Fig. 3)**

- Provides 10- and 19-code dial intercom services (Tables A, G, and H)

- Optionally accommodates either flashing lamp circuit (425B KTU) or TOUCH-TONE® adapter (440A or 478B KTU)

- Four 914B connectors are vertically paired to accommodate two 8-inch KTUs

- Terminal field (YELLOW) utilized by all connectors for a common dial intercom service [*NOT* related to individual connectors by quadrants as on the 620A (MD), 620A2, and 642A panels]

- Built-in lamp and fuse block assembly equipped with fuses in positions 1A and 1B, and a lamp in position 1A (remaining fuse and lamp positions unequipped) (Fig. 5)

- Provides station cross-connect field and option terminal field with designated areas TT (TOUCH-TONE), POWER, LAMP FLASH, and OPTIONS.

**E. 642A Modular Panel (Fig. 4)**

- Provides miscellaneous KTU services (Table A)

- Four 40-pin 914B connectors accommodate four 4-inch KTUs or two 8-inch KTUs (through removal of guide assemblies)

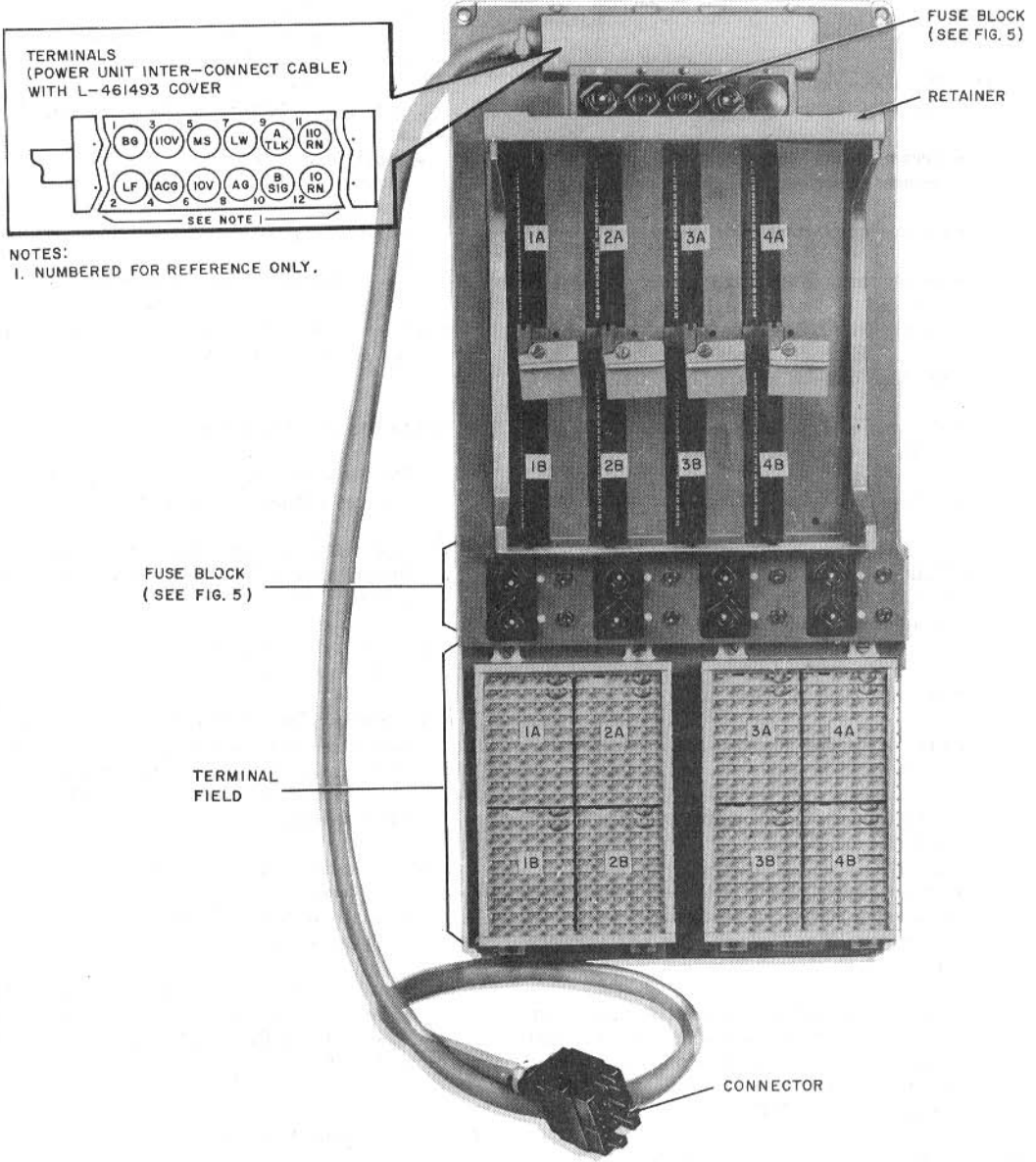


Fig. 1—620A2 Modular Panel

**TABLE E**  
**DIMENSIONS**

| DESCRIPTION   |                  | (IN INCHES) |        |        |
|---------------|------------------|-------------|--------|--------|
|               |                  | WIDTH       | HEIGHT | DEPTH  |
| Modular Panel | 620A<br>620A2    | 8-1/2       | 18-3/8 | 5-3/4  |
|               | 641A<br>642A     | 4-1/4       | 18-3/8 | 5-3/4  |
| Power Unit    | 79B1<br>79B2     | 14-1/8      | 8-3/8  | 6-5/16 |
|               | 90B1             | 16-1/8      | 9-1/4  | 6-5/16 |
|               | 19-, 20-<br>type | 8-3/4       | 9-1/4  | 5      |
|               | 29-, 30-<br>type | 14-1/8      | 18-3/8 | 6-3/8  |

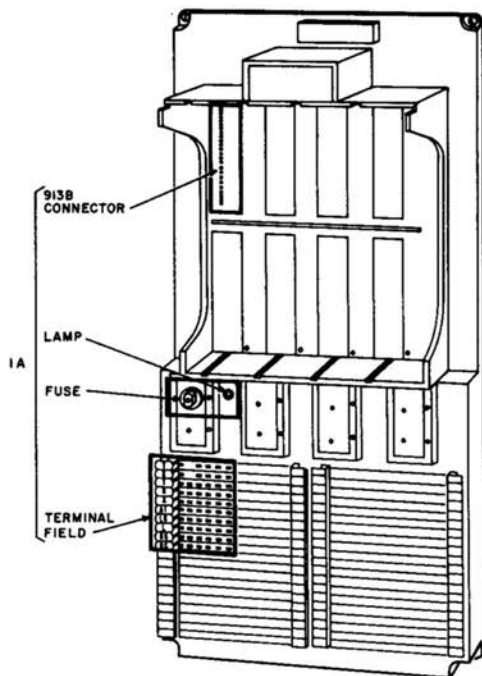
- Terminal field (YELLOW) divided into quadrants and wired to similarly positioned connectors which offer KTU services independent of each other.

## POWER

2.05 The 79B1, 79B2, and 90B1 power units (Fig. 6):

- Have capacity to serve modular panels in varied combinations (Table C)
- Provide all required KTS voltages per Table F
- Provide three ac voltage input taps
- Self-contained interrupter
- Designed for horizontal mounting on backboard assembly (provided) above modular panel.

**Note:** Modular panel installations using a 79- or 90-type power unit may be susceptible to KTU damage or operation of the -24B fuse due to transient voltages. The 79B2 and 90B1 power units manufactured after October 1975 have a diode added and are marked "521A



**Fig. 2—620A (MD) or 620A2 Modular Panel, Typical Connector, Fuse, Lamp, and Terminal Field Relationship**

Diode Added" on the insulator. Later versions of the 79B2 are manufactured with a KS-19175, List 5 interrupter and are marked "Protection Not Required." The 90B2 power unit will also be equipped with the List 5 and will also be marked. Any 79- or 90-type power unit not having the diode added or not equipped with the List 5 interrupter can be protected by installing a 140A protector in an unused socket of the power unit. If all sockets are in use, the transient energy will be sufficiently distributed among the panels so the surge protection is not required.

### A. 79B1 Power Unit

- Early production model utilizing 20A2 power unit

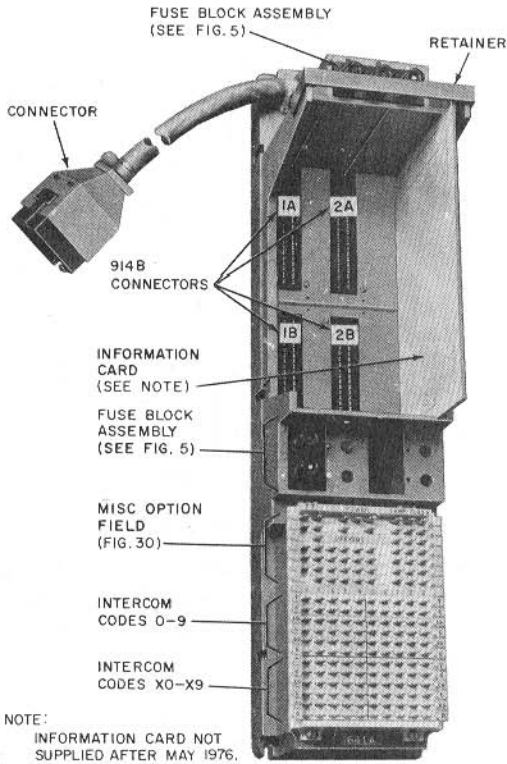


Fig. 3—641A Modular Panel

- Equipped with four multiplexed-wired output connectors
- Serves a maximum of three 620A-type panels or two 620A-type panels plus **any combination** of two 641A or 642A panel or **any combination** of four 641A or 642A panels; plus up to four 66B4-25 connecting blocks or four 16A1-160 terminal blocks if required for line multiples in excess of panel capacity.

**B. 79B2 Power Unit**

- Replacement for 79B1 model utilizing a 20A3 power unit and providing additional direct current and lamp power
- Equipped with four multiplexed-wired output connectors

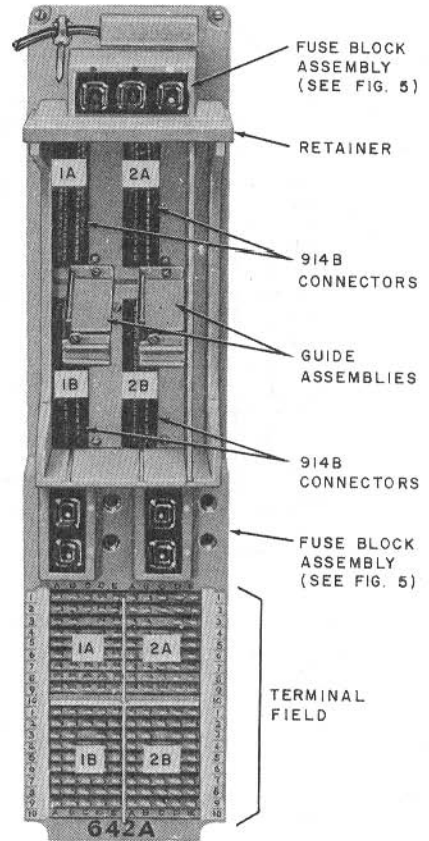


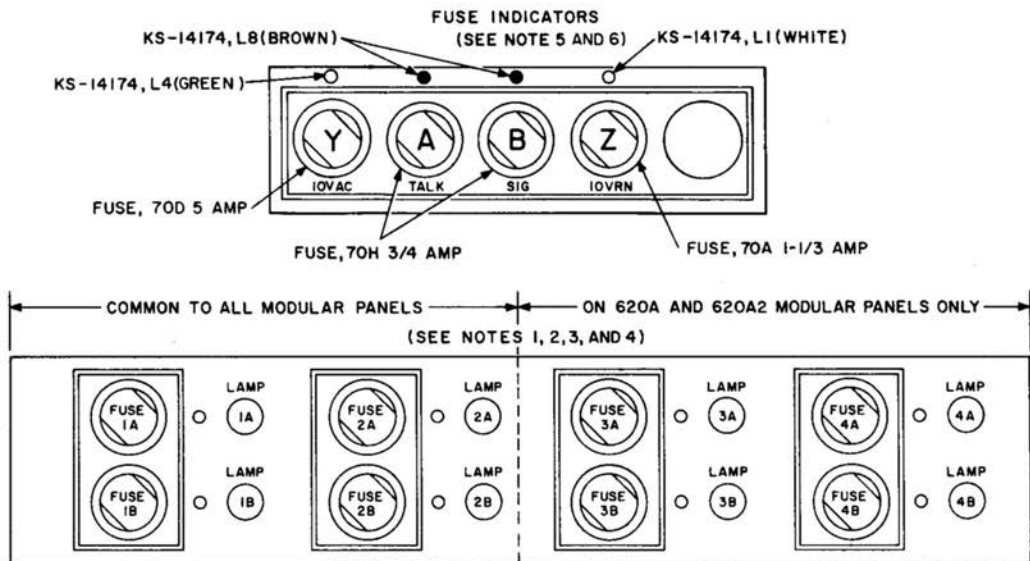
Fig. 4—642A Modular Panel

- Serves a maximum of four 620A-type, 641A, or 642A panels **in any combination** plus four 66B4-25 connecting blocks of four 16A1-160 terminal blocks if required for line multiples in excess of panel capacity.

**C. 90B1 Power Unit**

- Utilizes a 30A1 power unit
- Equipped with ten multiplexed-wired output connectors
- Serves a maximum of ten 620A-type, 641A, or 642A panels **in any combination** and





## NOTES:

- ALL PANELS (WHEN REQUIRED):
  - FUSES 1A-4B ARE 70A, 1-1/3 AMP.
  - LAMPS 1A-4B ARE 51A, 10V AC.
  - FUSE INDICATORS 1A-4B ARE KS-14174, L1 (WHITE).
- 620A OR 620A2 MODULAR PANEL:
  - FUSES AND LAMPS 1A-4B SERIES WIRED IN LINE LAMP OUTPUT CIRCUIT OF CONNECTORS 1A-4B RESPECTIVELY.
- 641A MODULAR PANEL:
  - FUSE AND LAMP 1A (10V STEADY) WIRED TO BUSY LAMP CIRCUIT OF SELECTOR (407 OR 424 KTU)
  - FUSE 1B (10V FLASH) WIRED TO INPUT OF FLASHING LAMP CIRCUIT (425 KTU)
  - REMAINING FUSE AND LAMP POSITIONS NOT EQUIPPED
- 642A MODULAR PANELS:
  - FUSE 1A (10V STEADY INPUT) WIRED TO CONNECTORS 1A AND 1B
  - FUSE 2A (10V STEADY INPUT) WIRED TO CONNECTORS 2A AND 2B
  - FUSE 1B (10V FLASH INPUT) WIRED TO ALL CONNECTORS
  - FUSE 2B (10V WINK INPUT) WIRED TO ALL CONNECTORS
  - LAMP POSITIONS TO BE FIELD EQUIPPED PER JOB REQUIREMENTS
- SOME EARLY PANELS WERE MANUFACTURED WITH THE 1-1/3 AMP FUSE IN POSITION A AND 3/4 AMP FUSES IN POSITIONS B AND Z. THE KS-14174 INDICATORS SHOULD BE REARRANGED TO AGREE WITH FUSES, WHERE REQUIRED THE NECESSARY INDICATORS CAN BE ORDERED AS: D-180586 KIT OF PARTS
- ON 620A2 PANELS SD-69658-01 ISSUE 5B CHANGED FUSE Y FROM 1 1/3 AMP TO 5 AMP AND INDICATOR FROM L1 TO L4

Fig. 5—Line Lamp and Fuse Block Assembly

up to sixteen 66B4-25 connecting blocks or sixteen 16A1-160 terminal blocks if required for line multiples in excess of panel capacity.

## D. 19-, 20-, 29-, or 30-Type Power Unit

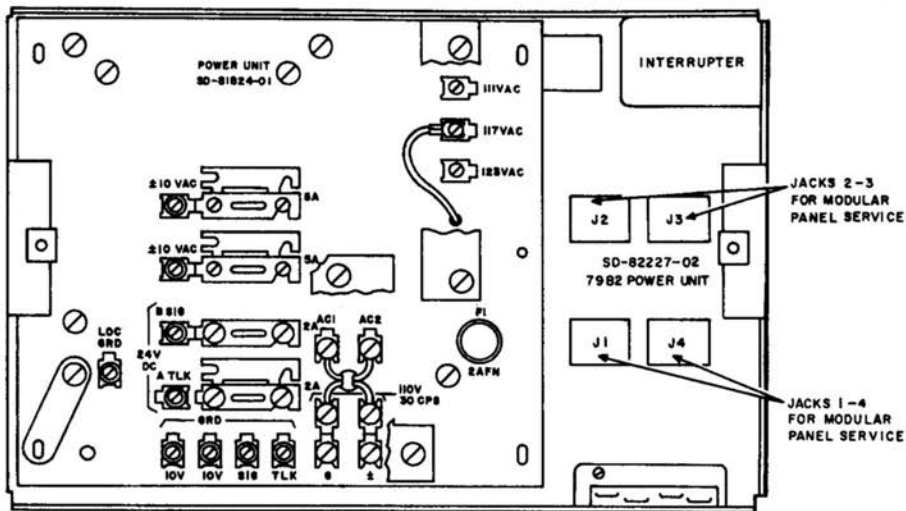
- Used at small installations for one or two panels where interrupted power is not required, or can be separately obtained from a 584C panel or 232-type KTU
- Requires a 92A connecting block as interface between power unit and modular panel power connector.

## 3. INSTALLATION

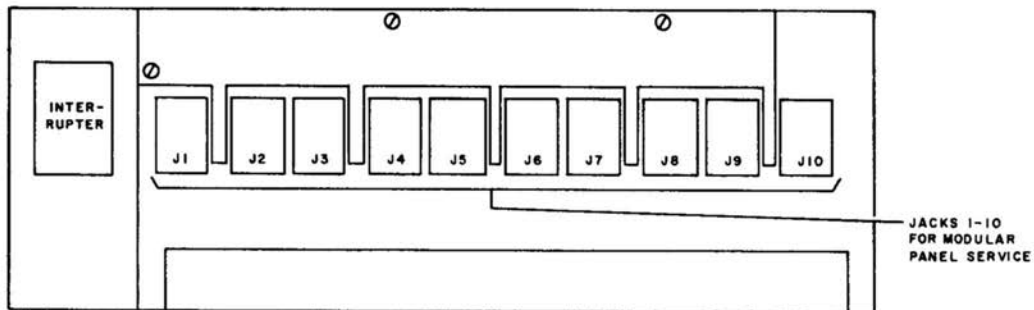
## PLANNING

3.01 Select a wall location for a centralized key telephone installation in accordance with the following:

- Customer approval and best interest.
- Accessible with adequate illumination for maintenance.
- Wall offering adequate support and stability.



FRONT VIEW OF 79B2 POWER UNIT



BOTTOM VIEW OF 90B1 POWER UNIT

Fig. 6—Modular Panel Power Jacks on 79B1, 79B2, and 90B1 Power Units

- As close as practicable to stations being served.
- Close to conduit or duct system for cabling purposes.
- Near commercial ac power receptacle(s).
- Sufficient clearance above floor to avoid damage from water or blows incident to cleaning.

**TABLE F**  
**POWER UNIT OUTPUT**

| POWER UNIT        |                   |                             | LEAD                |             | TERMINAL NUMBER                              |  |                                      |
|-------------------|-------------------|-----------------------------|---------------------|-------------|--|--|--------------------------------------|
| 7981              | 7982<br>9081      | 19-, 20-, 29-<br>OR 30-TYPE | DESCRIPTION         | DESIGNATION | POWER UNIT<br>JACKS AND<br>92A CONN.<br>BLK. | MOD. PANEL<br>INTERCONNECT<br>(FIG. 1) | MOD. PANEL<br>9138/9148<br>CONNECTOR |
| 20-26V<br>DC      | 20-26V<br>DC      | 20-26V<br>DC                | Signal              | B SIG       | 8  | 10                                     | 17                                   |
|                   |                   |                             |                     | B GRD       | 20   | 1                                      | 15                                   |
| 20-26V<br>DC      | 18-26V<br>DC      | 18-26V<br>DC                | Talk                | A TLK       | 12   | 9                                      | 18                                   |
|                   |                   |                             |                     | A GRD       | 16   | 8                                      | 3                                    |
| 105-125V<br>30 HZ | 105-125V<br>30 HZ | 105-125V<br>30 HZ           | Ringing             | 105V 30 HZ  | 9  | 3                                      | 10                                   |
|                   |                   |                             |                     | ACG and MG  | 24   | 4                                      | 6                                    |
| 9-11V<br>AC       | 8.75-11V<br>AC    | 8.75-11V<br>AC              | Lamp<br>Supply      | 10V AC      | 4  | 6                                      | 4                                    |
| 105-125V<br>30 HZ | 105-125V<br>30 HZ | 105-125V<br>30 HZ           | Interrupted<br>Ring | 105V RN*    | 1  | 11                                     |                                      |
| 9-11V<br>AC       | 8.75-11V<br>AC    | 16-20V<br>AC                | Interrupted<br>Buzz | 10V RN*     | 19   | 12                                     |                                      |
| 9-11V<br>AC       | 8.75-11V<br>AC    | 8.75-11V<br>AC              | Flash               | LF*         | 17   | 2                                      | 7                                    |
| 9-11V<br>AC       | 8.75-11V<br>AC    | 8.75-11V<br>AC              | Wink                | LW*†        | 21   | 7                                      | 2                                    |
|                   |                   |                             | Motor Start         | MS          | 22   | 5                                      | 5                                    |

\* Interrupter must be operating for interrupted voltages to be present. The 19-, 20-, 29-, and 30-type power units do not have an interrupter.

† LW does not appear on 641A panel.

- Clean, dry, well-ventilated, and free from flammable or corrosive fumes.
- Where the surrounding room temperature normally does not exceed 110°F. Avoid locations near radiators, steam pipes, registers, and similar heating devices which would subject the equipment to excessive heat.

**3.02** Select appropriate modular panels and KTUs (Table A), backboards and connecting blocks (Table D), per job requirements.

**3.03** Determine type and quantity of power units required (see POWER, paragraph 2.05 or Table C).

**Note:** Varied combinations of panels per power unit are desirable to more evenly balance power unit load; eg, on installations having more than one power unit, mix panel codes on any single power unit rather than having one power unit serve only 620A-type panels, and another to serve 641A or 642A panels.

**3.04** A 19-, 20-, 29-, or 30-type power unit can be used to supply a small number of 641A or 642A panels, either in installations where the power unit is in place or in new installations as long as the output of the power unit is not exceeded and interrupted power (flash, wink, etc) is not required by the KTUs. A 92A connecting block is required to provide a receptacle for the panel power connector and terminals for the leads from the power unit. The lack of interrupted power restricts usage to the following KTUs:

- 641A panel—407- and 424-type, 440A, 478B or 494A KTU
- 642A panel—417A, 420A, 421A, 422B, 428A, 429A/B, 430A, 440A or 478B, 448A, 449A, 451B, 476A, 471A/B or 479B KTU.

If interrupted power can be obtained from an associated 584C panel or 232-type KTU, any KTUs that can be mounted in the panels per Table A (including the 620A-type panel) may be used.

**3.05** Customer must provide adequate number of commercial ac receptacles to meet job requirements in accordance with the following:

- Not controlled by a switch
- Separately fused if possible
- Within access of power unit cord(s), preferably 6- to 7-foot high
- AC receptacles must be 3-wire grounded type.

**3.06** For additional information required to plan the installation of a KTS, refer to the following sections:

- 518-010-101—Centralized Key Telephone Installations
- 518-010-105—KTS, Grounding and Special Protection Requirements
- 518-215-100—1A2 KTS, Identification and Arrangements
- 518-215-400—Service, 1A2 KTS, Line Services

- 518-215-401—Service, 1A2 KTS, Auxiliary Line Services
- 518-215-402—Service, 1A2 KTS, Intercom Services
- 518-215-403—Service, 1A2 KTS, Control Services.

## INSTALLING

**3.07** Use care unpacking modular panels, power units, and KTUs to prevent damage to them.

### A. Centralized Installation

**3.08** ♦A preferred installation method is illustrated in Fig. 7 using the 630A KSP (Section 518-215-424) as the first modular panel in a centralized terminal field. The 287A1 power supply in the 630A KSP will power two additional modular panels. With the arrangement in Fig. 7, the installer has the option of using the 113A1 connecting unit (CU) and modular panel terminals as a station terminal (BLUE) field, or may use the 113A1 CU and modular panel terminals as a KTS equipment (RED) field with the station terminal (BLUE) field mounted below.♦

**3.09** ♦In Fig. 8, the 620A-type, 641A, and 642A panels are mixed in any order with 184-type backboards mounted in a single row directly above a WHITE and BLUE backboard field. No space between adjacent panels should be left unless stacking panels (see **Note**) or if covers and end panels are used (paragraph 3.10).♦

**Note:** Some locations may be limited for space or otherwise will not allow this arrangement and will require stacking of panels one above the other (see Stacking Panels, paragraph 3.11).

**3.10** A recommended sequence for mounting modular panels, backboards, and power units is as follows (Fig. 8):

- (1) Mount a 183A2 (GREEN) backboard in lower left corner, 1 foot above floor. Stack second GREEN backboard atop first (see **Note**).

**Note:** When job requirements call for less than two BLUE or GREEN backboards, the lower backboard may be omitted and adequate

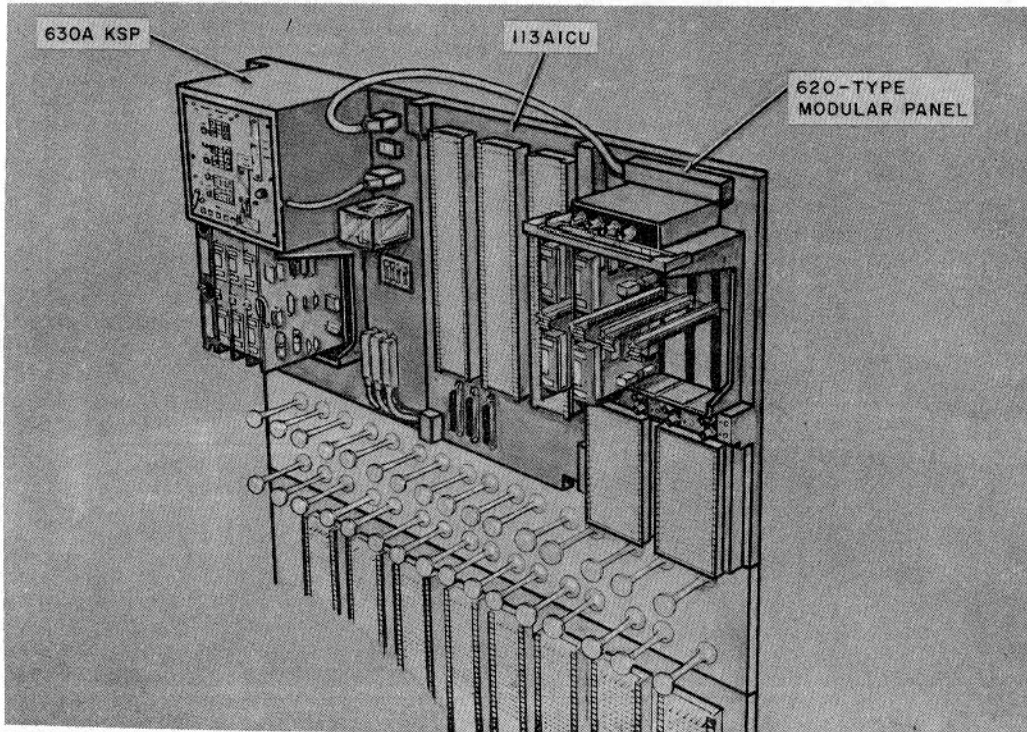


Fig. 7—Typical Large KTS Installation With 630A KSP, 113A1 CU, and 620-Type Modular Panel

space allowed for its addition as future growth demands.

- (2) Place a 185A1 (YELLOW) backboard atop second GREEN backboard.
- (3) Mount 183B1 (BLUE) backboards, stacked two high and butted next to GREEN backboards.
- (4) Mount a 187B1 (WHITE) backboard atop each uppermost BLUE backboard, butting first against the side of the YELLOW backboard, and expanding from left to right. WHITE backboards must be installed to the widest point of either the RED (modular panel) or BLUE terminal field.

- (5) Line, intercom, and miscellaneous panels, selected per job requirements, may be intermixed freely in the RED terminal field butting atop the WHITE backboards. First panel is placed above the extreme left BLUE backboard and the remaining panels suitably arranged and added in order from left to right. If covers are to be used on the panels, leave 1/2-inch space between the top of the WHITE backboards and the bottom of the panels and 1-inch space between adjacent panels. If wiring troughs are also used, allow 1/2 inch between top of panels and wiring trough. (A paper template is provided with each panel to facilitate mounting.)

**Note:** The 16A1-160 terminal blocks or 184A1, B1 or B2 (RED) backboards may also be intermixed with modular panels as desired to

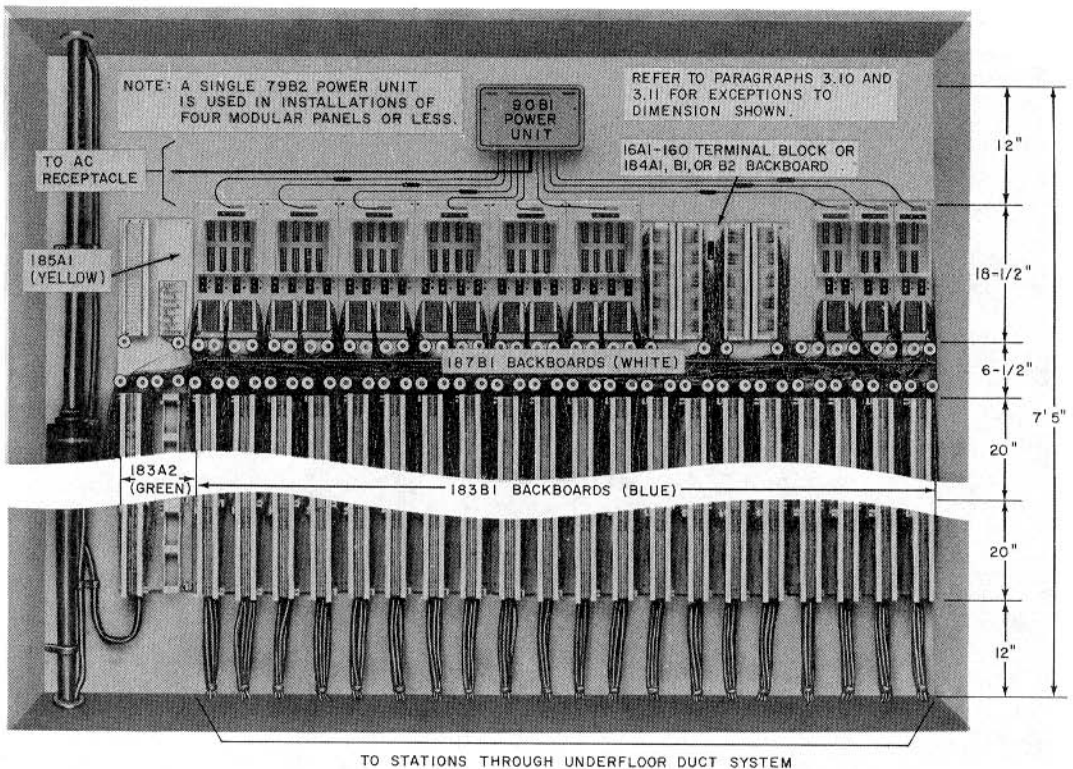


Fig. 8—Centralized Terminal Field, Typical Arrangement of Modular Apparatus

provide station terminations in excess of the panel terminal capacity (Fig. 8 or 9). The 16A1-160 terminal block is the same height as the modular panels and half the width of a 620A-type panel. Two connecting blocks are provided which duplicate the designations and quadrants of a 620A-type panel. If required, the terminal blocks will accept 152A covers and 153A end caps.

- (6) The 79B1, 79B2, and 90B1 power units are to be mounted above the cluster of modular panels they service with top of unit(s) 7 feet 5 inches from the floor. Add 1 inch to this dimension if wiring trough is used.

**Note:** Power units must be mounted in an area allowing adequate ventilation.

- (7) Fasten the backboard plate assembly to the wall using appropriate fasteners.
- (8) Hang power unit on backboard and secure it with the machine screw(s) provided.
- (9) Plug single-ended power interconnect cable of modular panel into appropriate connector of power unit. If it will not reach the power unit, use a P12D cord (Table D) to complete the connection. To disconnect power cord, squeeze the tabs on the top and bottom of the power cord connector and pull out.
- (10) Wiring troughs (Fig. 11) may be used to hold excess loops of power cable and improve the appearance of the installation. Mount the troughs horizontally on the wall directly above the modular panels (mounting screws to be

obtained locally). Press the loose power cable into the slots, looping it until slack is removed. Put cover on troughs. One trough will fit above two 620A-type panels or four 641As or 642As. Snap-on covers are provided with the wiring trough to retain the cables and to improve appearance.

**Caution:** Do not apply commercial ac power until completion of paragraph 3.29.

(11) For 19- or 20-type power unit, install and connect as indicated in Section 167-440-201. For 29- or 30-type power unit, install and connect as indicated in Section 167-446-101. Mount the 92A connecting block in reach of the power cable of the modular panel or extend with a P12D cord.

(12) Interconnect the 92A connecting block and the power unit as shown in Fig. 51. The recommended wiring is as follows:

- (a) For a 641A or 642A panel, use a 451M cable, a 12-pair D inside wiring cable, or individual 18-gauge solid wires. If a 12-pair inside wiring cable is used, each pair should be skinned, twisted together, and terminated as a single conductor.
- (b) For a 620A-type panel, use a 457M cable or individual 18-gauge solid wires. **Do not** use inside wiring cable since four conductors would be required for each connection to provide adequate current-carrying capacity. This number of twisted conductors cannot be reliably terminated.

Table I provides the color codes for D inside wiring cable and 451M or 457M cables. After all connections are made, insert the power interconnect cable of the modular panel into the connector on the 92A connecting block.

## B. Stacking Panels

3.11 Where modular panels must be stacked one above the other, the following installation method is recommended (Fig. 9 and 10).

- Place 198A backboards between the upper and lower rows of modular panels to provide

a means of routing wiring to the inner quadrants of the upper panels.

- The 620A-type and 642A panels and 184-type backboards, if required, may be mixed in any order provided similar size units are mounted atop one another.
- A 2-inch space must separate the sides of each panel. This space allows cross-connect wiring to be run vertically between panels.
- Power unit(s) mounts in an area allowing adequate ventilation with top of unit approximately 8 feet above floor.
- Power interconnect cables are routed in a direction up and over the top of the panels to the power unit connectors.

**Note:** Minimize intermeshing power interconnect cables and cross-connect wiring.

3.12 Cross-connect wiring should run straight down from the modular panel fanning strip to the WHITE field. All horizontal travel is made within the WHITE field.

## C. Grounding and Protection

3.13 **Grounding:** To prevent damage to the telephone equipment, it is imperative the KTS be properly grounded and protected to limit voltage surges which may occur due to:

- Malfunction of power unit
- Crosses between telephone and power lines
- Power line surges
- Lightning surges.



**The susceptibility of surge damage to semiconductor components used in 400-series KTUs requires the grounding and protection procedures be followed carefully. Properly protected and grounded installations will minimize service failures that can result from surge voltages or difference between dissimilar grounds. Refer to Section 518-010-105 for coverage**



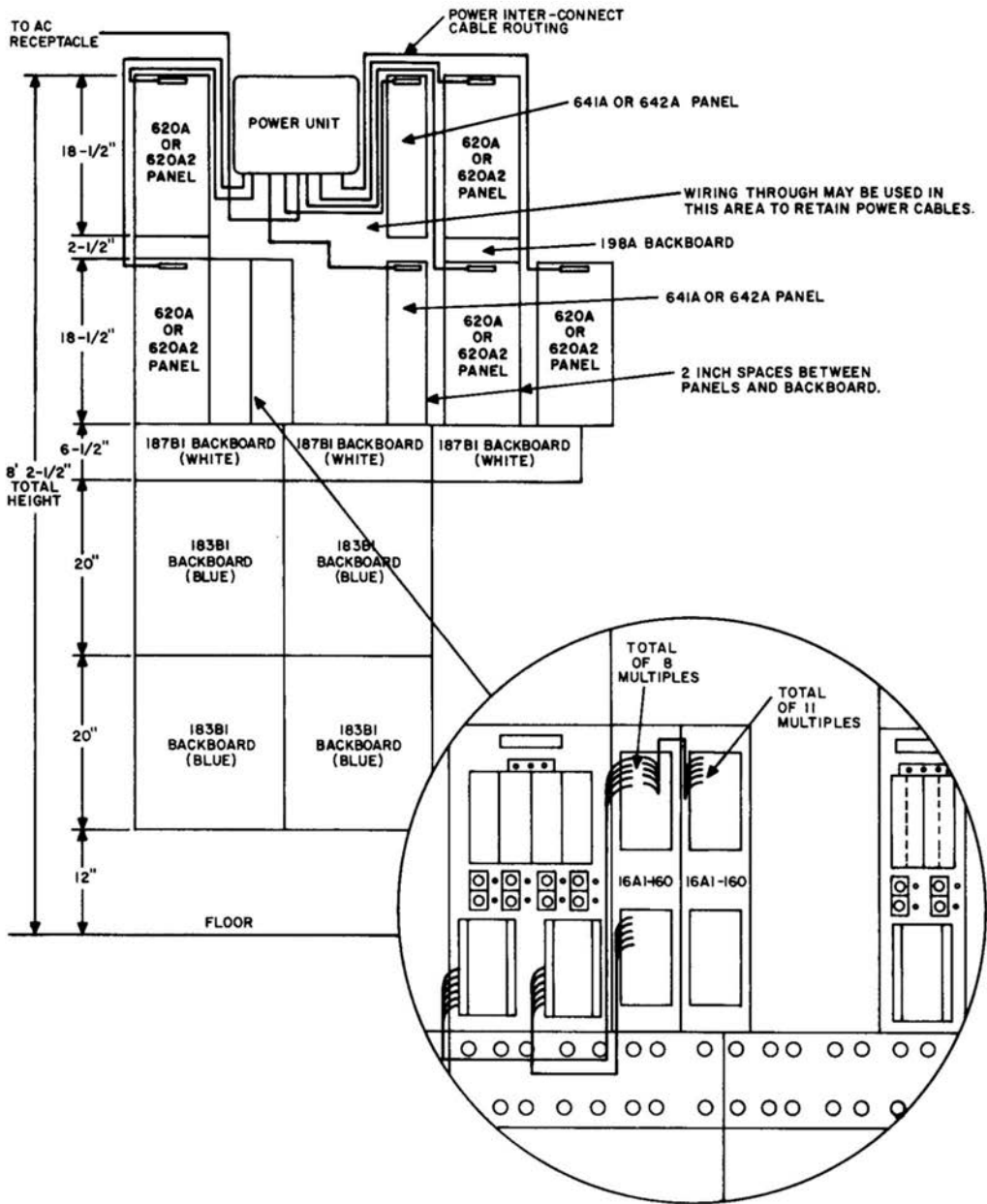


Fig. 9—Stacked Modular Apparatus and Method of Terminal Multiplying Using 16A1-160 Terminal Blocks



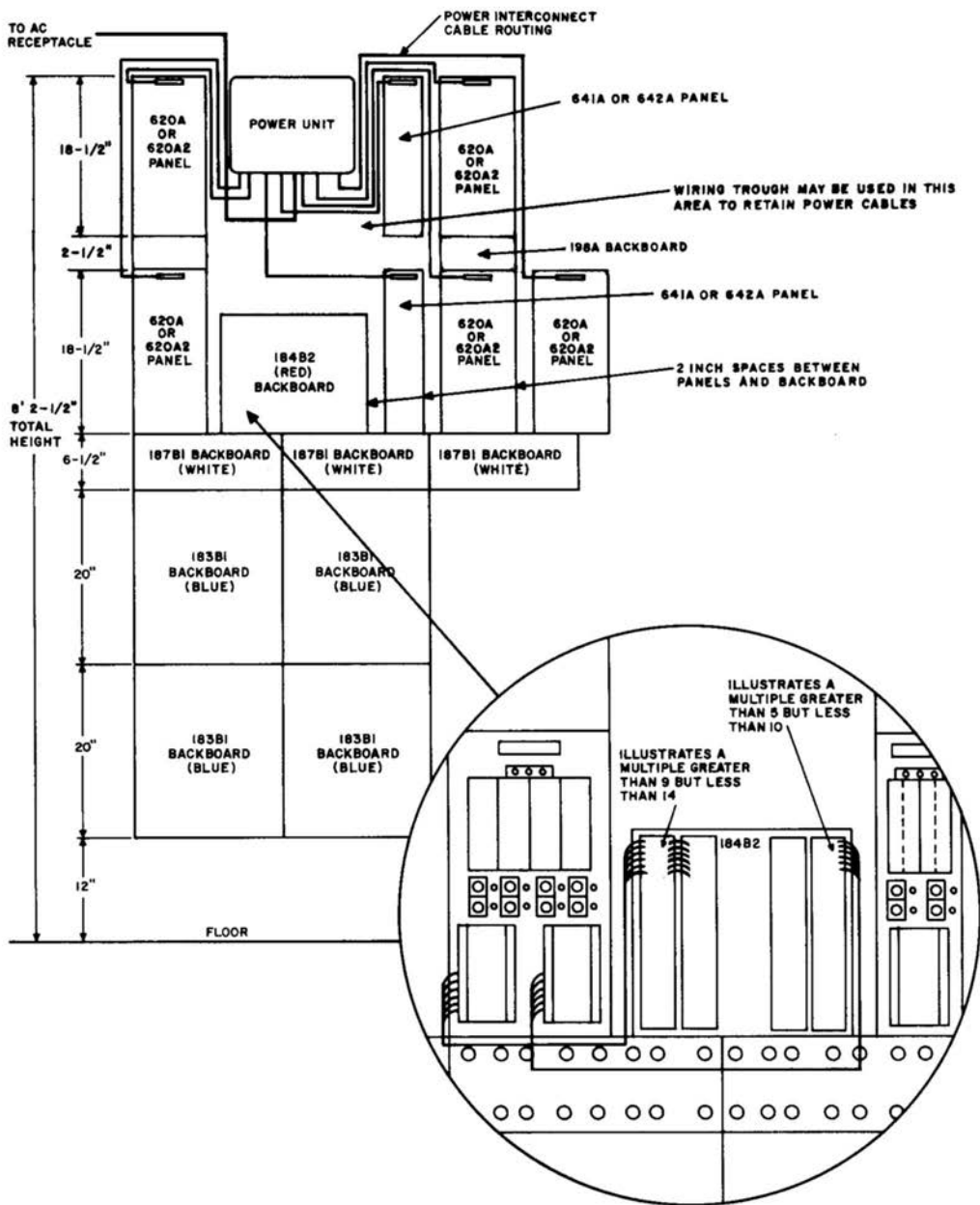


Fig. 10—Stacked Modular Apparatus and Method of Terminal Multiplying Using 184-Type Backboards

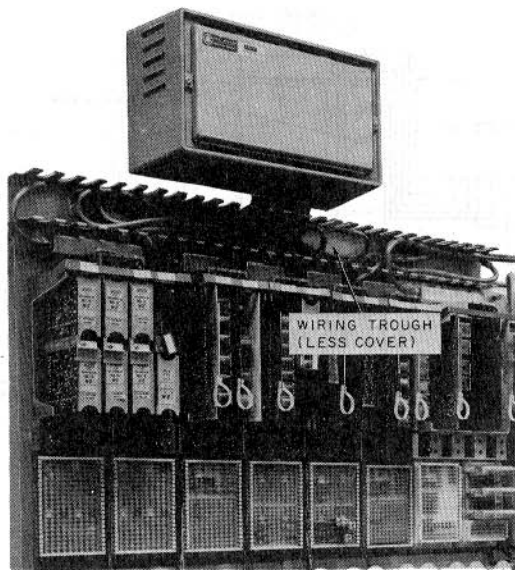


Fig. 11—Installation Using Wiring Troughs for Power Cabling

*of KTS grounding and protection requirements.*

**3.14 Protection:** It is recommended all incoming CO/PBX lines be connected to protectors. The protector ground terminal will serve as the primary KTS ground point and must be connected to the best available ground source, preferably the same as that used for the ac power service. In any case, the KTS ground source and the power service ground source should be bonded together.

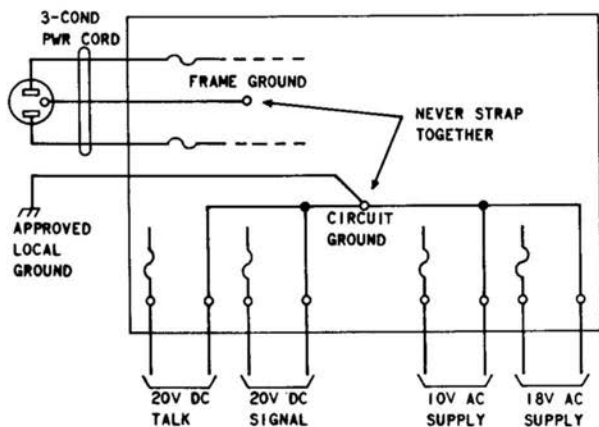
**3.15 Power Unit Circuit Ground:** Using No. 12 gauge wire, connect the circuit ground terminal (LOC GRD) of the power unit to the protector ground terminal (paragraph 3.14), if the incoming CO/PBX lines are protected. If they are not protected, connect LOC GRD to the best available ground source.

**Caution:** *DO NOT use sprinkler system, hot water, or gas pipes for ground.*

**3.16 Power Unit Frame Ground:** The framework of power units should be grounded where required by local regulations. The ground may be provided as follows:

- Via the grounding conductor in the 3-conductor power cord (ordered separately) when a grounded ac receptacle is available.
- Via a No. 12 gauge wire connected from the case, framework, or chassis ground terminal (if provided) of the power unit to an electrically approved ground. The power unit circuit ground shall be associated only with the output circuit of the power unit. **Do not strap the circuit ground to the frame or case of the power unit (Fig. 12).**

**3.17** After connecting the No. 12 gauge wire for circuit ground as in paragraph 3.15 and frame ground as in paragraph 3.16, attach an E-3013B station ground tag to each ground wire.



NOTE:  
THE CIRCUIT GROUND AND FRAME  
GROUND ARE INSULATED FROM EACH  
OTHER

Fig. 12—Grounding of Typical KTS Installation

3.18 Where local requirements permit, the following equipment, as covered in Section 167-400-210, may be employed:

- **Power-cord plug adapter (Hubbell BL-12433)**—when a 3-conductor ac power cord must be connected to a duplex 2-conductor ac power receptacle (Fig. 13)
- **Power-cord plug retainer assembly (KS-19266)**—to prevent accidental removal of a power-cord plug (Fig. 13).

**Caution:** The ac power cord should remain disconnected from commercial ac power until completion of paragraph 3.29.

#### D. KTU Installation

3.19 Prior to terminating distribution of telephone set cabling, cross-connections, or panel options, selected KTUs shall be unpacked, options applied as applicable, and installed in their appropriate modular panels.

3.20 Install KTUs by inserting the plug-end of the printed wiring boards into the modular panel connectors.



**Exercise care when handling and inserting plug-in KTUs to avoid damage to the printed wiring boards and other components.**

3.21 Installation of a 419A KTU (Automatic Signaling, Ringdown Private Line), an 8-inch unit in a 620A-type panel, requires two 913B connectors mounted in a vertical plane and removal of a guide assembly. Connections are made to the upper quadrant of the terminal field, and the lower quadrant remains vacant (Fig. 26).

3.22 The 498A KTU (Fig. 50) provides music-on-hold for four CO/PBX lines. Three more music-on-hold circuits may be added to the 498A KTU for a total of seven circuits by connecting a 116A1 circuit module to the 498A KTU.

3.23 A 498A KTU is compatible with 400D (MD), G (MD), or H KTU. When using a 451A or B KTU to provide music-on-hold, a 400D (MD) or G KTU (MD) must be used as a line circuit,

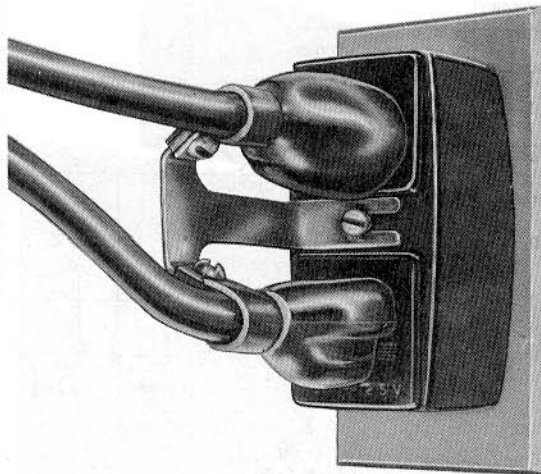


Fig. 13—Twin-Plug Retainer Mounted on a Power Cord Plug Adapter

since the 400H and the 451-type KTUs are not compatible with each other.

**3.24** A 467A KТУ is can be installed in any connector of a 620A-type or 642A panel. The 467A monitors the -24 volt signal battery supply for a low-voltage condition. If the voltage drops below the adjustable level (factory adjusted at 19 volts), a light emitting diode (LED) on the KТУ will light and remain lighted until the reset button is depressed. No external connections are required since the KТУ checks the B voltage available through the power interconnect cord.

**3.25** The following applies to the installation of a 641A modular panel (Fig. 30 and Table G):

- Connectors 1A and 1B are intended for an 8-inch dial intercom selector circuit (407B or 424-type KТУ) or a TOUCH-TONE selector circuit (494A KТУ). The 494A KТУ can be used to provide basic intercom in installations having TOUCH-TONE telephone sets only. Flashing lamps, audible ringback, and busy tone cannot be provided when using a 494A KТУ.
- Connectors 2A and 2B are intended primarily for an 8-inch TOUCH-TONE adapter (440A

or 478B KТУ) but will also accommodate a 425-type KТУ. **Add option Z to 478B KТУ when installed in a 641A panel.**

**Note:** When a 425-type KТУ is used and TOUCH-TONE service is desired, the 425-type KТУ is installed in connectors 2A and 2B. The 440A or 478B KТУ must then be installed in a 642A modular panel. **Apply option Y to 478B KТУ when installed in a 642A panel.**

- When audible tones (476A KТУ), station busy (422-type KТУ), TOUCH-TONE (440A or 478B KТУ, as previously described), or other related optional features are desired, they may be added to the dial intercom system by addition of the KTUs in a 642A modular panel and cross-connected as required.
- The lower portion of the quick-connect terminal field contains terminals for station codes, assigned from left to right, R-0 to R-9, and below those terminals in a similar manner, codes R-X0 to R-X9; X indicates the selected TD code, see the following.
- When a 19-code selector (424-type KТУ) is used, a transfer digit (TD) must be assigned

and cross-connected from the TD terminal in the option field to the chosen digit R(0-9) terminal in the cross-connect terminal field (Fig. 31 through 36). If a 494A KTU is used, the digit 1 is treated as the transfer digit. No strapping is required.



**The TD when using a 424-type KTU may be any digit; once selected, the digit code cannot be used as a single digit code.**

- When a 494A KTU is used, use 10-volt ac or -24 volt dc only as audible signal voltage. Use of 105-volt ac may result in damage to the KTU.
- 3.26** The following applies to installation of a 642A modular panel:
- Lamp positions in the line lamp and fuse block assembly are assigned to a related connector and are unequipped, except when locally provided at time of installation for use with a 417A, 418A, or 428A KTU.
- Note:** When a KTU is removed from service in the 642A modular panel, its related lamp, if provided, must be removed to prevent possible damage should another type KTU inadvertently be placed in the connector.
- Appropriate KTU features may be cross-connected to other quadrants, either within the panel or to other panels, if interrelating of features is desired.
  - Alphanumeric fanning strip designations are repeated for each quadrant to aid in locating and identifying terminals. (See Fig. 39 for terminal designations and connector pin identification and refer to Table A for appropriate KTU connection figure.)
  - Installation of a 440A or 478B KTU, an 8-inch unit, requires the removal of a guide assembly and connection through the lower 914B connector while occupying the space of two connectors in a vertical plane. Apply option Y to the 478B KTU.
- 3.27** Covers are available (Table D) for protecting the fronts and sides of modular panels. To mount a front cover (151A or 152A) on a panel,

engage the hooks on the top edge with the slots at the top of the panel. Cover the sides by attaching end cap covers (153A) to the front covers with the clips supplied. Where several panels are mounted next to each other, the front covers form a continuous surface, and only two end cap covers are installed at the extreme sides.

#### E. Applying Power

**Warning:** 105 volts is present on the 105-volt 30-Hz RN terminals of the 620A-type and 641A panel terminal fields when power is applied.

- 3.28** Put a C clip terminal insulator over the 105-volt 30-Hz RN terminals on the 620A-type and 641A panels (Fig. 14 and 30). One clip will cover the 105-volt terminal and the adjacent RN terminal.
- 3.29** Select appropriate length 3-conductor ac power cord and insert first into the power unit, and second into the commercial ac power receptacle. Excess length cord should be coiled, tied, and stored neatly.
- 3.30** If abnormal commercial ac input voltage is suspected:
- (1) **Remove the ac power cord from the ac receptacle.**
  - (2) Using an ac voltmeter, determine the ac voltage potential of the commercial ac receptacle.
  - (3) Move the ac voltage adjustment lead to that voltage tap nearest the actual line voltage.
- Note:** The power units are furnished with the adjustment lead connected to the 117-volt tap. With this connection, the unit will perform satisfactorily for line voltage between 111 and 123 volts.
- (4) Reconnect power cord to receptacle.
- 3.31** If desired, limited testing of KTUs may be made prior to placing station cabling or cross-connections. Apply commercial ac power and test as appropriate (see TESTING, paragraphs 5.05 and 5.06).

**TABLE G**  
**DIAL INTERCOM OPTIONS**

| FEATURE (Note 1)  |                       | OPTION                       |    |
|-------------------|-----------------------|------------------------------|----|
| Selector Circuit  | 10 or 19 Codes        | Non TOUCH-TONE               | Z  |
|                   |                       | TOUCH-TONE                   | N  |
|                   | 10 Codes              | TOUCH-TONE or Non TOUCH-TONE | F  |
| Station Busy      |                       | ZF*                          |    |
| Audible Ringback  |                       | ZE*                          |    |
| Dial Tone         |                       | ZD*                          |    |
| Long Line Circuit |                       | Q                            |    |
| Lamp Signal       | Steady                | W                            |    |
|                   | Flashing              | 10 Codes                     | H  |
|                   |                       | 19 Codes                     | V† |
| Audible Signal    | Interrupted (Note 2)  | 10V AC Buzzer                | E  |
|                   |                       | 110V 30-Hz Ringer            | X  |
|                   | Single Spurt (Note 3) | 10V AC Buzzer                | G  |
|                   |                       | 110V 30-Hz Ringer            | M  |
|                   |                       | 18V AC Buzzer                | J  |
|                   |                       | DC Buzzer                    | K  |

*Note 1:* Per SD-69567-01, Issue 14.

*Note 2:* 425B KTU required.

*Note 3:* Not to be used with station busy tone feature (422A and 476A KTUs).

\* Appear on KTU option block.

† No strapping. Requires removal of H option strap.

#### 4. CONNECTIONS

**4.01** Connection figures are grouped according to the types of services offered: CO/PBX and Private Lines, Dial Intercom, and Miscellaneous.

**4.02** Preceding the 620A-type and 642A modular panel connections are typical terminal field illustrations of those panels showing the upper left-hand quadrant (1A) of the quick-connect field as an example of all its quadrants (Fig. 14 and 39).

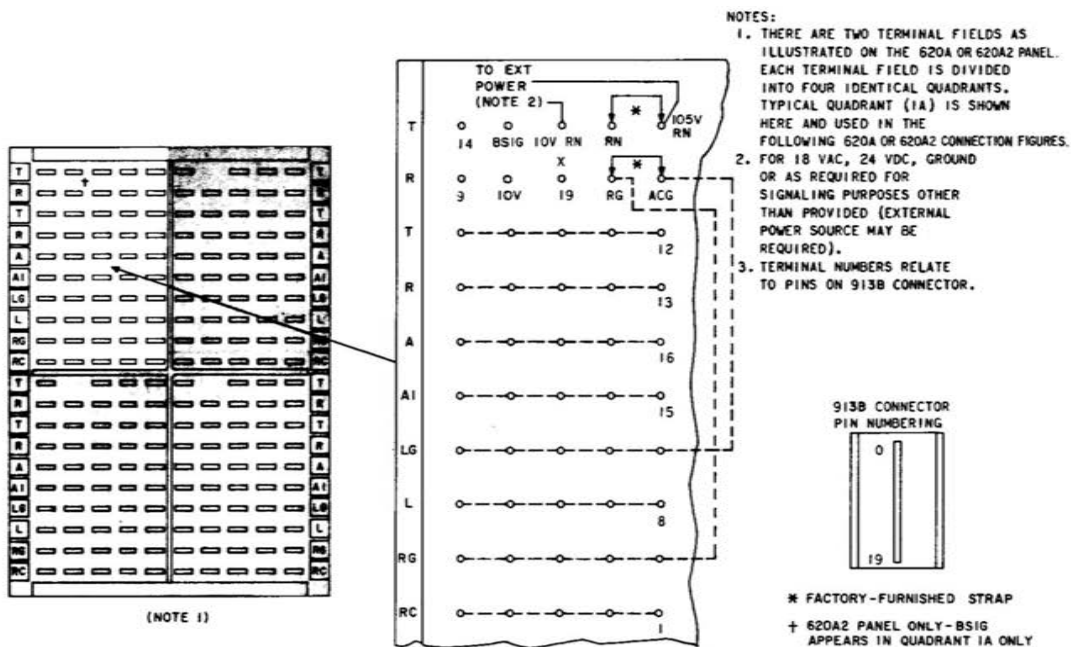


Fig. 14—Terminal Field Illustration and Terminal Designations for 620A (MD) or 620A2 Modular Panel (CO/PBX and Private Line Services)

- 4.03** The 641A modular panel terminal field is illustrated in its entirety (Fig. 30).
- 4.04** Typical terminal field illustrations provide terminal and option field locations, terminal designations, connector-pin identification, and factory-furnished wiring and straps.
- 4.05** Connections are applied to the quick-connect terminals of the modular panels through use of the 714B tool, or equivalent.
- 4.06** Each quick-connect terminal is limited to termination of a single lead. Terminations in excess of panel terminal field capacity may be applied in any of the following methods most appropriate:
- **Continuous strapping (looping)**—single leads common to more than one terminal.
  - **183A2 adapter**—provides two additional common terminals and is applied atop two terminals of like-designations in a horizontal plane.
  - **183B2 adapter**—provides two additional, but separate, terminals and is applied atop two terminals in a vertical plane.
  - **16A1-160 terminal block**—for additional line service terminations in excess of 620A-type or 642A panel capacity (Fig. 9).
  - **66B4-25 connecting block on a 184A1, B1, or B2 (RED) backboard**—for additional line service terminations in excess of 620A-type or 642A panel capacity (Fig. 10).
  - **66B3-50 or 66B4-25 connecting block on a 185A1 (YELLOW) backboard**—for additional dial intercom terminations in excess of 641A panel capacity (Fig. 8).
- 4.07** The 620A (MD) or 620A2 modular panel fanning strips are predesignated for typical line services and repeated for each quadrant (Fig. 14). Exceptions to the designations are the following:
- 401-type KTU—spare leads SP-1, SP-2, and SP-3 are substituted for T, R, and RC, respectively (Fig. 21).
  - 413A KTU—spare leads SP-1, SP-2, SP-3, and SP-4 are substituted for T, R, A, and L, respectively (Fig. 22).
  - 414A, 461A, and 416A KTUs—S and SG leads are substituted for A and A1, respectively (Fig. 23 and 25).
  - 471-type and 479-type KTUs—A(U) and A leads are substituted for A and RC, respectively (Fig. 28 and 29).
- 4.08** The KTU options: Apply to optional features offered by individual KTUs; they are indicated in table form on their connection figures only.
- 4.09** Intercom options (Table G): Wiring of associated KTUs providing features directly affecting or adding to the dial intercom system.



**Many KTU and intercom system options share like-designations and provide similar optional features, but several similarly-lettered options differ in features they provide in the two applications. Consult appropriate KTU or intercom option table for desired feature prior to applying any options.**

## CONNECTION INDEX

- 4.10** Table A provides an index to KTU connection figures and associated KTU tests. Other related figures and tables are as follows:

Fig. 14—Terminal Field Illustration and Terminal Designations for 620A (MD) or 620A2 Modular Panel (CO/PBX and Private Line Services)

Fig. 30—Terminal Field Illustration and Terminal Designations for 641A Modular Panel (Dial Intercom Services)

Fig. 39—Terminal Field Illustration and Terminal Designations for 642A Modular Panel (Miscellaneous Services)

Table H—Dial Intercom Arrangements (Fig. 31 through 36).



TABLE H  
DIAL INTERCOM ARRANGEMENTS

| DIAL INTERCOM FEATURE |    | KTU     | FIGURE              |    |    |         |    |    |      |    |   |  |
|-----------------------|----|---------|---------------------|----|----|---------|----|----|------|----|---|--|
|                       |    |         | 31                  | 32 | 33 | 34      | 35 | 36 |      |    |   |  |
|                       |    |         | BASIC               |    |    | DELUXE  |    |    |      |    |   |  |
|                       |    |         |                     |    |    | WITHOUT |    |    | WITH |    |   |  |
|                       |    |         | STATION BUSY OPTION |    |    |         |    |    |      |    |   |  |
| R                     | TT | TT      | R                   | TT | R  | TT      | R  | TT | R    | TT |   |  |
| Selector Codes        | 10 | 407     | •                   | •  |    | •       | •  | •  | •    | •  | • |  |
|                       | 19 | 424     |                     |    |    |         |    |    |      |    |   |  |
| TOUCH-TONE Selector   | 19 | 494     |                     |    | •  |         |    |    |      |    |   |  |
| Dialing               | R  | †       | †                   |    |    | †       |    | †  |      | †  |   |  |
|                       | TT | 440/478 |                     | •  |    | •       |    | •  |      | •  |   |  |
| Station Busy Selector |    | 422     |                     |    |    |         |    |    |      | •  | • |  |
| Audible Tones         |    | 476     |                     |    |    |         | •  | •  | •    | •  |   |  |
| Flashing Lamps*       |    | 425     |                     |    |    | •       | •  | •  | •    | •  | • |  |

\* Interrupter required with flashing lamps.

† No KTU required.

• Indicated KTU required.

## 5. MAINTENANCE

5.01 Maintenance of 600-series modular panels can be done in the areas of:

- Checks of terminal field cross-connections
- Replacement of defective fuses, lamps, and KTUs.

### ‡Continuity Diagrams

- Continuity testing power interconnect terminals and cable connectors, etc. Consult Table F and Fig. 1 through 4.

- Continuity testing (913-/914-type connectors to 66-type terminal connections). Consult Fig. 15, 16, and 17.‡

5.02 As a KTS, maintenance is limited to normal station repairs, wiring checks, and replacement of defective components.

5.03 When trouble is encountered, **first perform a thorough check of all cross-connections and, second, assure all station connections and related apparatus are properly applied;** then the following checks are



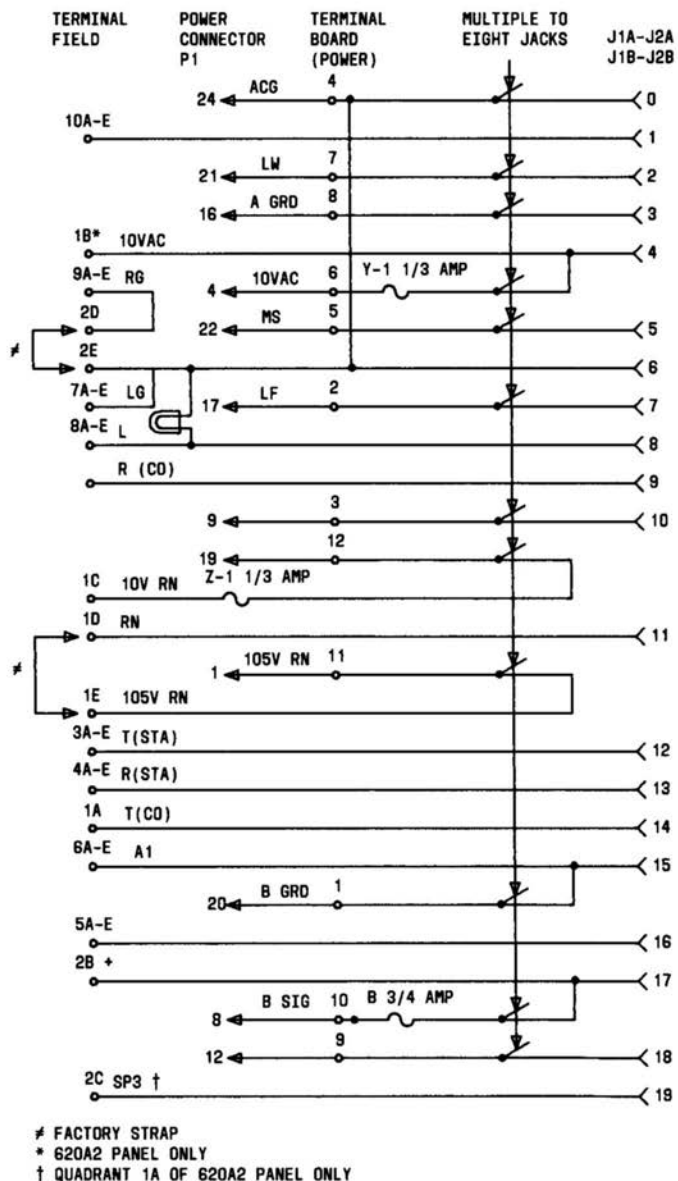


Fig. 15—620A (MD) or 620A2 Modular Panel Maintenance Diagram

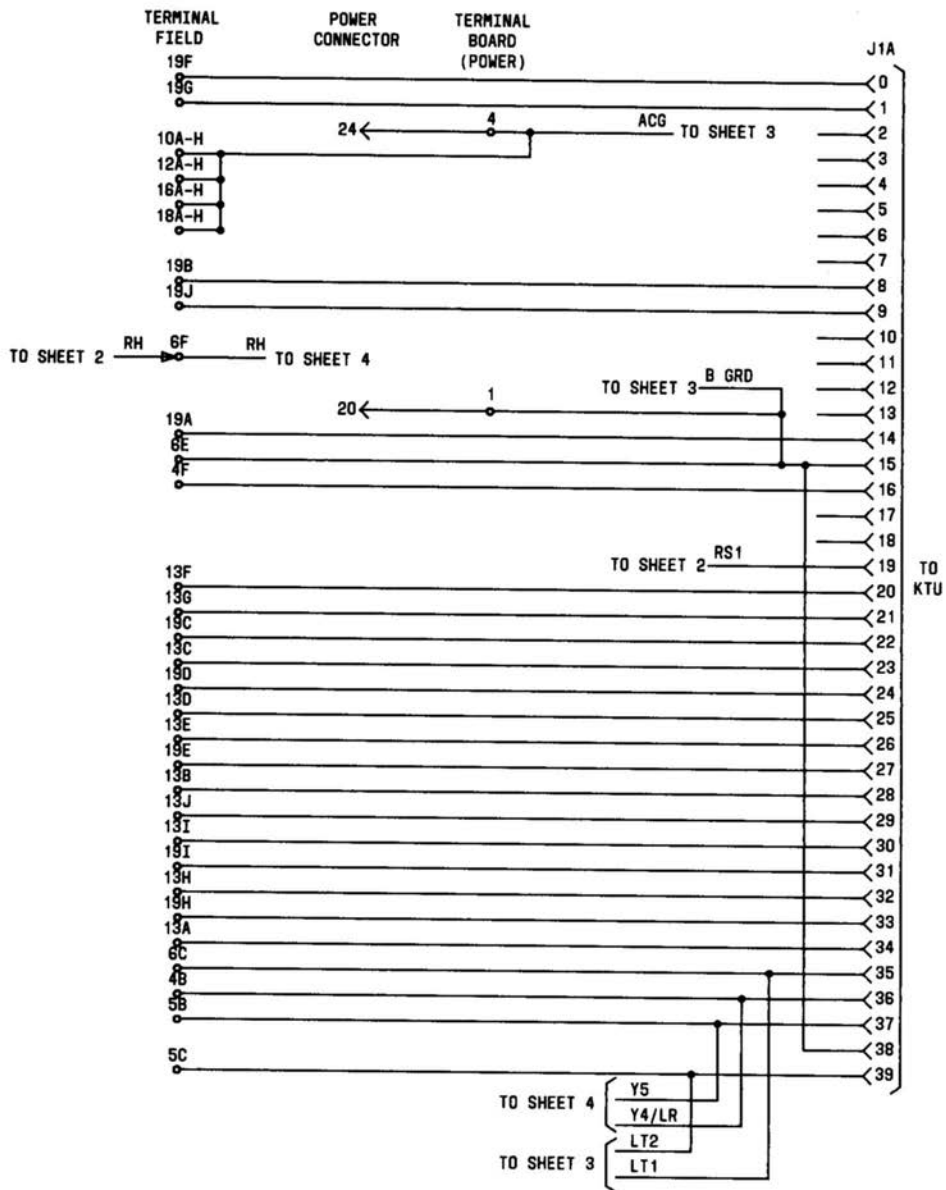


Fig. 16—#641A Panel Maintenance Diagram (Sheet 1 of 4)◆

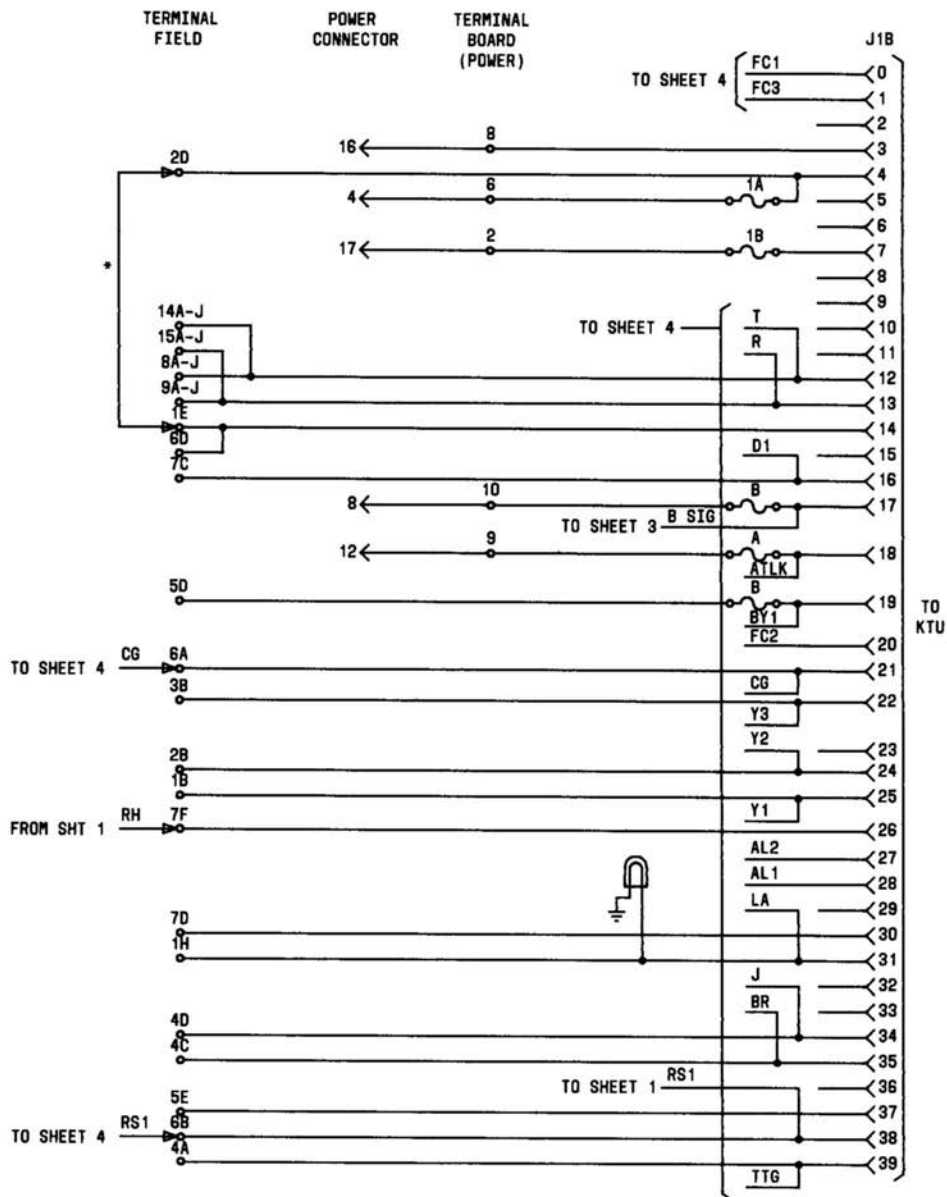


Fig. 16—#641A Panel Maintenance Diagram (Sheet 2 of 4)♦

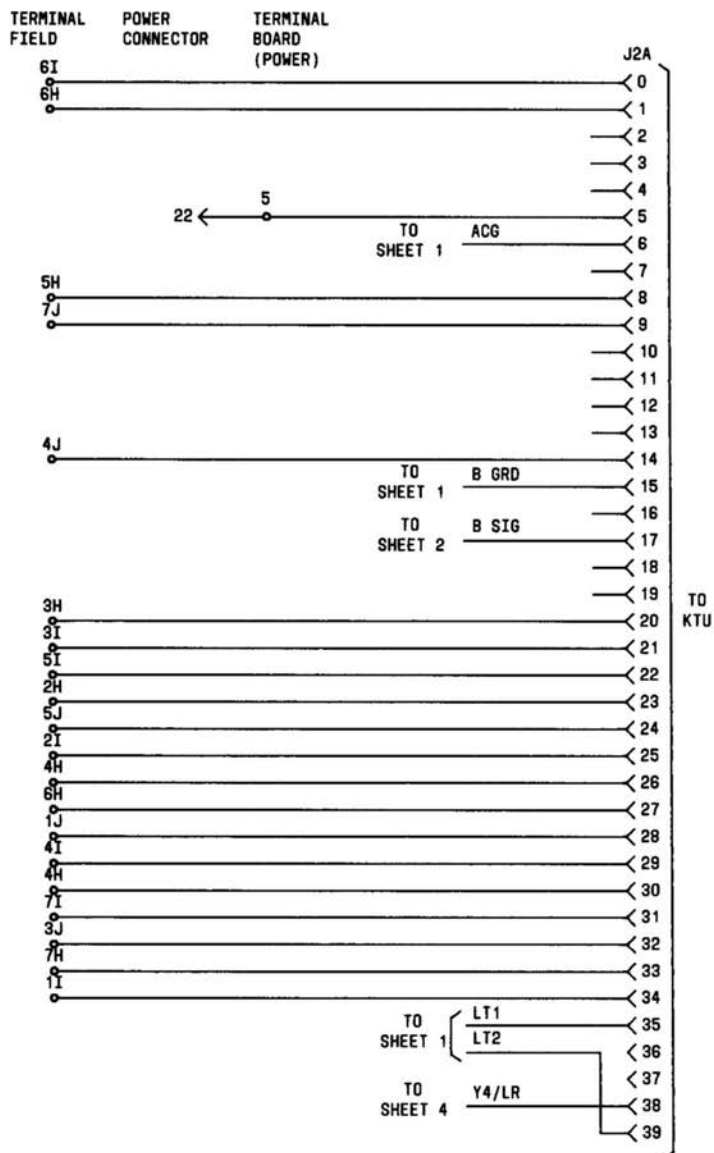


Fig. 16—641A Panel Maintenance Diagram (Sheet 3 of 4)

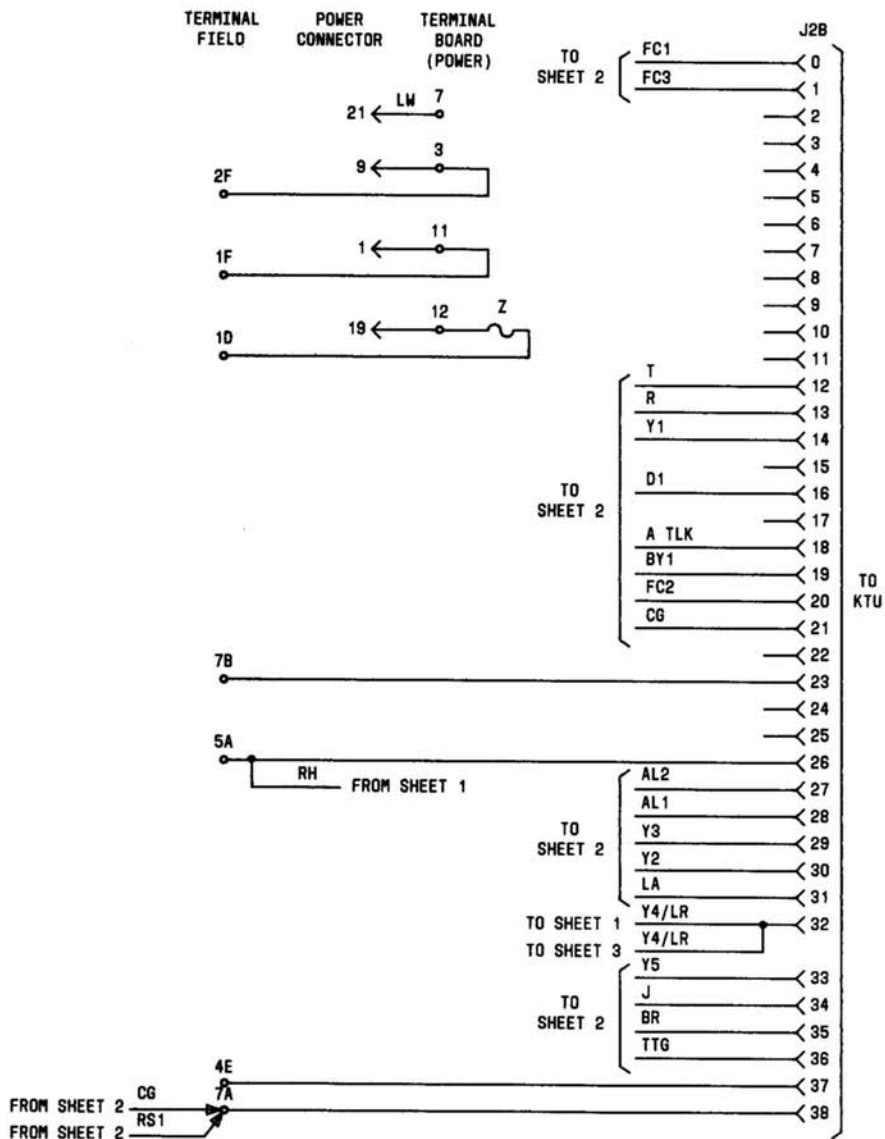


Fig. 16—641A Panel Maintenance Diagram (Sheet 4 of 4)†

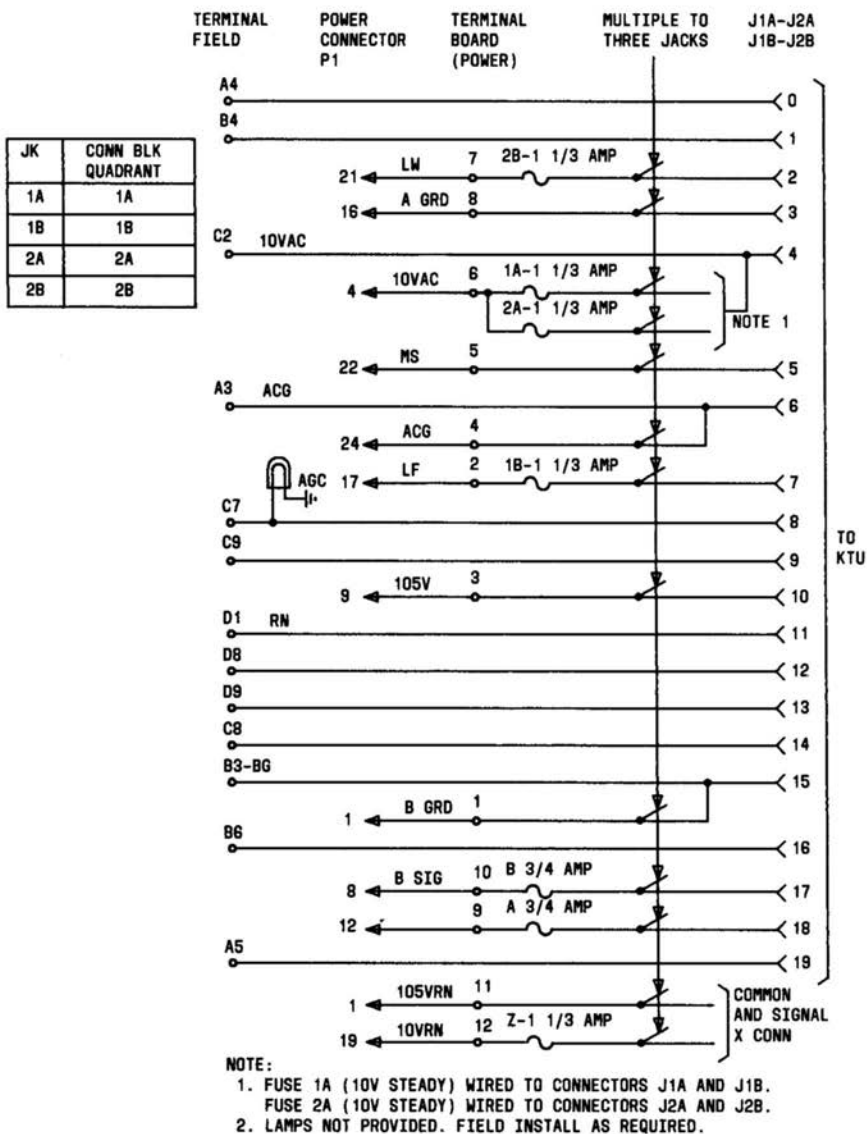


Fig. 17—642A Panel Maintenance Diagram (Sheet 1 of 2)†



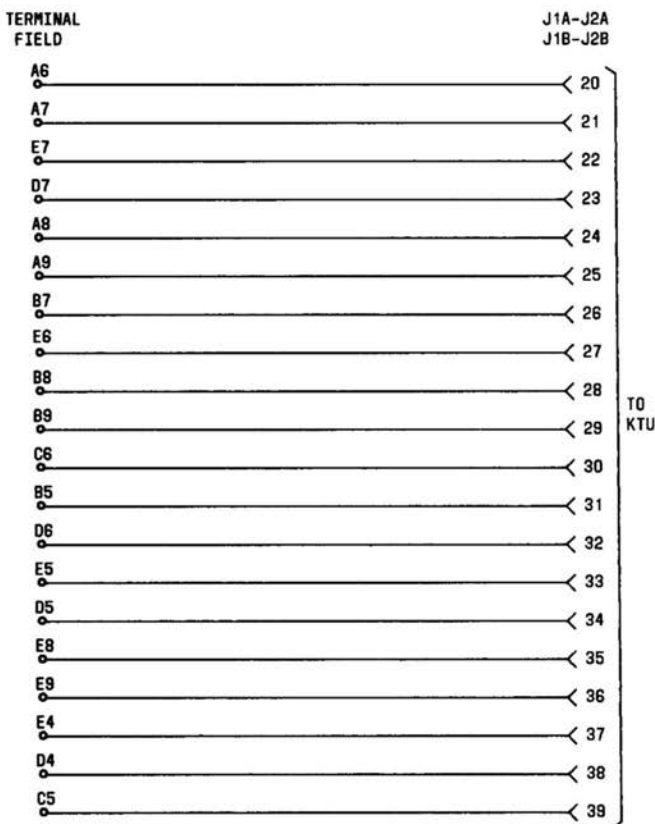


Fig. 17—642A Panel Maintenance Diagram (Sheet 2 of 2)

suggested before replacement of a KTU, modular panel, or power unit is considered:

**Caution:** *Several of the following checks require testing live potentials at the modular panel connectors and power interconnect terminal field. Closeness of these terminals to each other requires extra care be taken to avoid shorting or otherwise damaging them.*

#### KTUs

- Securely placed in proper connectors.

- Properly strapped for required option(s). (See appropriate KTU connection figures.)
- Replace suspected KTU with one known to be in good working order to determine whether trouble is in the KTU or external to it [be sure to strap in the correct option(s) on the replacement KTU, as applicable].
- Should the replacement KTU not clear the trouble, the trouble is external to it and the original KTU should be placed back in service.

#### MODULAR PANELS (Check as Applicable)

- Option straps(s) properly applied.

- Fuses in place and in good working condition (Fig. 5).
- Lamps in place and in good condition.
- Plug end of modular panel power interconnect cable securely positioned in power unit connector.
- KTUs securely mounted in 913-/914-type connectors with retainer and/or guide assemblies in place.
- Dedicated leads (Table F) may be tested for appropriate potential or function.

**Caution: Power interconnect cable must be disconnected and modular panel void of KTUs prior to attempting the following test.**

- Dedicated leads (Table F) may be continuity tested between the KTU connectors within a given panel.
- Using the appropriate modular panel terminal field illustration (Fig. 14, 30, or 39), continuity tests of the nondedicated wiring may be made between the KTU connectors and the terminal field.
- Continuity testing of power unit interconnect cable leads may be performed.

#### POWER UNIT (Fig. 6)

- All fuses in place and in good condition.
- The ac power cord securely in place in both the commercial ac receptacle and the power unit input connector.
- Commercial ac input present at receptacle and not controlled by a switch.
- Interrupter securely in place and operative. Place ground on start lead (MS) pin at power interconnect cable terminal field of modular panel (Fig. 1) and, using 1013A test set or equivalent, test for interrupted potentials on the LW, LF, 10-volt ac RN, and 105-volt RN terminals in the modular panel power interconnect field. The LW

does not appear on the 641A panel. Remove MS ground when check is completed.

- Using 1013A test set, or equivalent, verify that battery, ground, and signal potentials are present at output taps on the face of the power unit panel.
- Circuit and frame grounds properly applied (paragraphs 3.15 and 3.16).
- The ac voltage adjustment lead on appropriate tap.

**5.04** If the previous checks fail to reveal the source of trouble, it can be reasonably assumed the trouble is external to the power units, modular panels, and KTUs, and cross-connections, station wiring, and components should be checked.

#### TESTING

**5.05** Prior to termination of cross-connections, station and distributing cabling, continuity testing may be performed between terminal field terminals and like-designated connector pins. See appropriate terminal field illustration.

**Caution: Power unit connector cable must be disconnected and modular panel void of KTUs before attempting continuity tests.**

**5.06** The line lamp or circuit busy lamp (641A panel), provided in the lamp and fuse block assembly, offers a visual indication of a circuit under operational test.

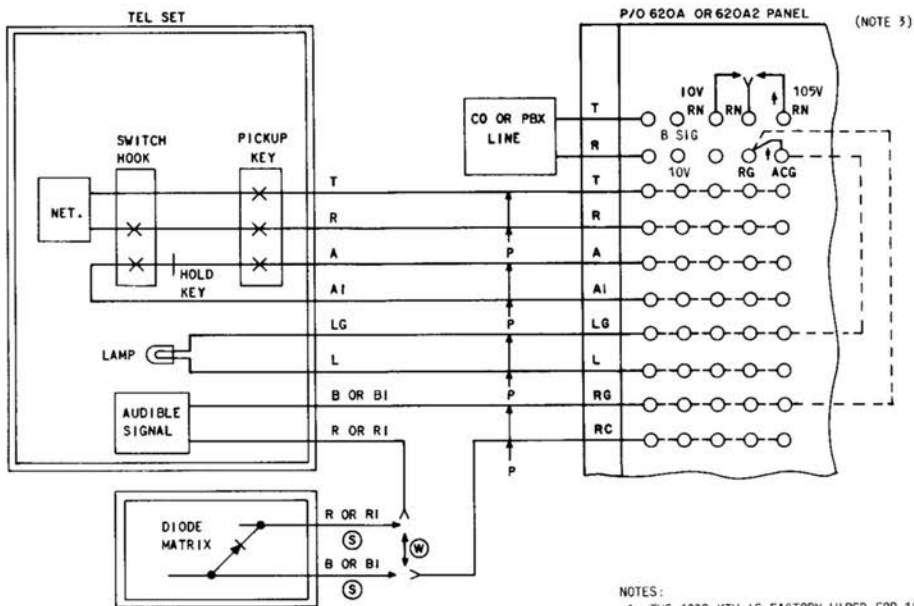
#### TESTS

**5.07** It is impractical to attempt operational tests of several KTUs prior to termination of appropriate cross-connections. The following KTUs may be tested at the modular panel regardless of cross-connections, station or distributing cables applied. The tests appear adjacent to the related KTU connection figures. (All circuits must be idle prior to starting tests.) The tests are:

**A. 400-Type KTU—CO/PBX Line Circuit**

**B. 401-Type KTU—Manual Intercom Circuit**

- C. *414A KTU and 461A KTU—Manual Signaling, Ringdown Private Line*
  - D. *415-Type KTU—Automatic, DC Signaling, Ringdown Private Line*
  - E. *416A KTU—Station Line Circuit*
  - F. *419A KTU—Automatic Signaling, Ringdown Private Line*
  - G. *469A KTU—Lamp Extender*
  - H. *471-Type KTU—Battery Reversal Toll Restriction*
  - I. *407- or 424-Type KTU—Basic Dial Intercom Selector Circuit*
  - J. *494A KTU—TOUCH-TONE Selector Circuit*
  - K. *420A KTU—Long Line Circuit*
  - L. *417A KTU—Add-On Conference Circuit*
  - M. *418A KTU—Short Range, DC Signaling Private Line*
  - N. *451B or 498A KTU—Music-On-Hold Circuit*
  - O. *452A KTU—Power Failure Ringing Circuit*
- 5.08 **Lettered Steps:** A letter a, b, c, etc, added to a step number in Part 5 of this section indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.



OPTION STRAPPING (SEE NOTE 1)

| FEATURES   |  |                              | KTU OPTION | OPTION STRAPPING ON                                |          |
|--|--|------------------------------|------------|--|----------|
|  |  |                              |            | MODULAR PANEL CONN BLK                             | 400D KTU |
| AUDIBLE SIGNALS  | INTERRUPTED  | WITHOUT DIODE MATRIX CONTROL | 10V AC     | W  | 5 TO 8   |
|  |  |                              | 105V AC    | W  |          |
|  |  | WITH DIODE MATRIX CONTROL    | 10V AC     | S  |          |
|  |  |                              | 105V AC    | S  |          |
| VISUAL HOLD CIRCUIT  | LAMP WINK  | Y                            |            | 7 TO 10  |          |
|  | LAMP STEADY  | X                            |            | 7 TO 9   |          |
| RING TIMEOUT   | SHORT TIME DELAY (10 SECONDS)  | Z *                          |            | 1 TO 2   |          |
|  | LONG TIME DELAY (30 SECONDS)   | †                            |            | †  |          |
| RELEASE OF HOLDING BRIDGE FROM CO OR PBX LINE CURRENT OPENS GREATER THAN | 500 MILLISECONDS WHEN ASSOCIATED WITH NO.1 ESS HAVING RESWITCH CAPABILITY  | ZC                           |            | 2 TO 3 USING 601A (5 UF) CAPACITOR OR EQUIVALENT § |          |
|  | 100 MILLISECONDS WHEN ASSOCIATED WITH 800A PBX AND/OR NO.5 X-BAR CENTREX NOT HAVING AUTOMATIC PERMANENT SIGNAL RELEASE | ZD (NOTE 2)                  |            | 2 TO 3 USING 575C (1 UF) CAPACITOR OR EQUIVALENT   |          |
|  | 50 MILLISECONDS WHEN ASSOCIATED WITH NO.5 X-BAR CENTREX HAVING AUTOMATIC PERMANENT SIGNAL RELEASE                      | ZJ                           |            | 2 TO 3 USING 575B (0.5 UF) CAPACITOR OR EQUIVALENT |          |

NOTES:

1. THE 400D KTU IS FACTORY WIRED FOR 10-SECOND TIMEOUT, PLUS WINKING-HOLD LAMP, AND W AND S WIRING OPTIONS.
2. ZD OPTION IS REPLACED BY ZJ OPTION, HOWEVER, IT IS NOT NECESSARY TO UPDATE CIRCUITS PREVIOUSLY MODIFIED WITH OPTION ZD.
3. ON 620 A2 PANELS, 10 VAC OR B SIG CAN BE CONNECTED ON TERMINAL FIELD TO OPERATE AUDIBLE SIGNALS, 10 VAC APPEARS IN ALL 8 QUADRANTS AND B SIG APPEARS IN 1A ONLY.

\* TO PROVIDE TIME-OUT CYCLES OF RING-UP CIRCUITS FROM 3.4 TO 7.5 SECONDS. INSTALL KS-13490L1, 1-WATT OR EQUIVALENT RESISTOR BETWEEN TERMINALS 1 AND 3 WITH A STRAP FROM 1 TO 2. TIME-OUT CYCLE AND RESISTOR VALUES ARE AS FOLLOWS:  
 3.4 SECONDS - 0.20 MEGOHM RESISTOR  
 5.0 SECONDS - 0.39 MEGOHM RESISTOR  
 6.7 SECONDS - 0.75 MEGOHM RESISTOR  
 7.5 SECONDS - 1.2 MEGOHM RESISTOR  
 WHEN THE DURATION OF MACHINE RINGING IS 1 SECOND OR LESS, TIME-OUT SHALL NOT BE REDUCED BELOW 5 SECONDS.

† FOR 30 SECOND TIME-OUT CYCLE REMOVE ALL STRAPS FROM TERMINALS 1, 2, AND 3.

‡ FACTORY-FURNISHED STRAPS

§ INSTALL POLARIZED CAPACITOR AS FOLLOWS:

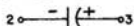
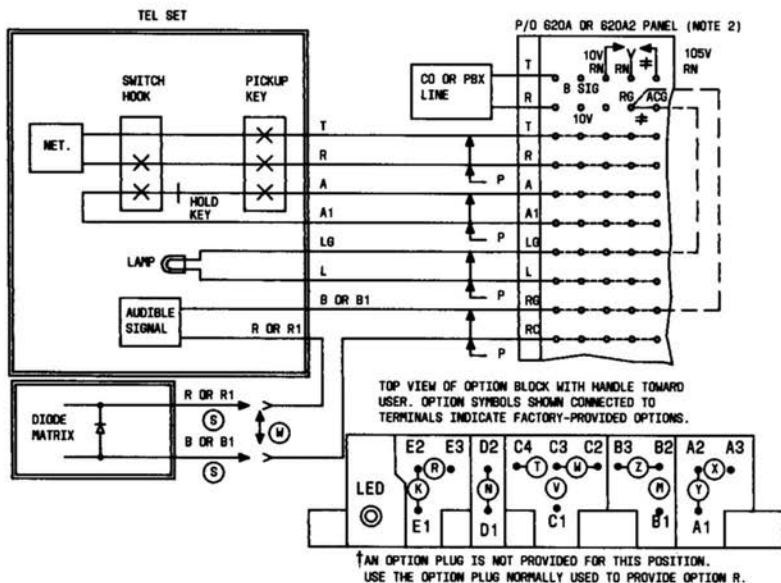


Fig. 18—400D KTU (MD) Connections (CO/PBX Line) in 620A (MD) or 620A2 Modular Panel



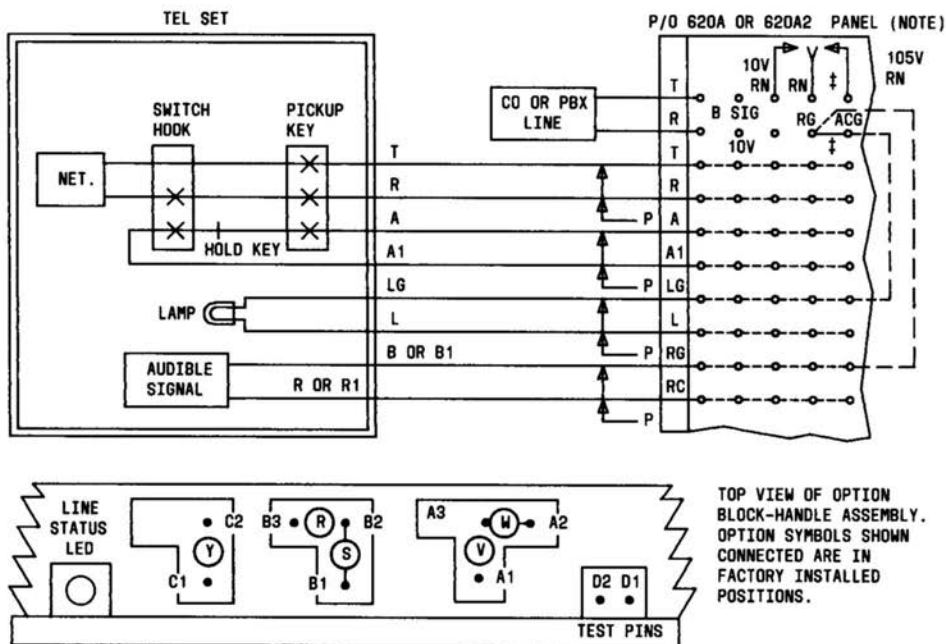
| OPTION | FEATURE              |  | CONNECT TERMINALS |
|--------|----------------------|--|-------------------|
| N      | RING TIMEOUT         | LONG TIME DELAY (APPROXIMATELY 20 SECONDS)                     | B1-B2             |
| Z      | RING TIMEOUT         | SHORT TIME DELAY (APPROXIMATELY 5.75 SECONDS)                  | B2-B3†            |
| Y      | VISUAL HOLD CKT      | LAMP WINK  | A1-A2†            |
| X      | VISUAL HOLD CKT      | LAMP STEADY  | A2-A3†            |
| M      | AUDIBLE SIGNAL       | INTERRUPTED RING   | C2-C3†            |
| T      | AUDIBLE SIGNAL       | STEADY RING  | C3-C4             |
| S      | AUDIBLE SIGNAL       | COMMON WITH DIODE MATRIX CONTROL                               | C1-C3             |
| V      | AUDIBLE SIGNAL       | COMMON WITH RELAY CONTROL                                      | C1-C3             |
| R      | DELAYED HOLD RELEASE | RELEASE OF HOLDING BRIDGE FROM CO OR PBX BY LINE CURRENT OPENS | E2-E3             |
| K      | DELAYED HOLD RELEASE | MINIMUM OF 25 MS   | E1-E2             |
|        |                      | 600 MS   |                   |

†DENOTES FACTORY PROVIDED OPTIONS

NOTES:

- DO NOT CONNECT RINGING VOLTAGE THROUGH TERMINAL 10 WHEN N OPTION IS PROVIDED
- ON 620A2 PANELS, 10V AC OR B SIG CAN BE CONNECTED ON TERMINAL FIELD TO OPERATE AUDIBLE SIGNALS. 10V AC APPEARS IN ALL 8 QUADRANTS AND B SIG APPEARS IN 1A ONLY.

Fig. 19—400G KTU (MD) Connections (CO/PBX Line) in 620A (MD) or 620A2 Modular Panel†



## OPTIONS

| OPT | FEATURES               |   |
|-----|------------------------|---|
| T*  | CO OR PBX LINE CIRCUIT |   |
| W*  | INTERRUPTED RING       |   |
| V   | AUDIBLE SIGNAL         | COMMON AUDIBLE WITH GROUND FOR RELAY CONTROL                                    |
| S*  | HOLD CIRCUIT RELEASE   | LONG HOLD ABANDON TIMEOUT (FOR ESS #1, ESS #2, 812 PBX, 770 PBX, DIMENSION PBX) |
| R   |                        | SHORT HOLD ABANDON (FOR ALL OTHERS)   |
| Y † | TIMEOUT                | WITH 14 SECONDS   |
|     |                        | WITHOUT 6 SECONDS   |

\*FACTORY INSTALLED

†OPTION PLUG IS NOT PROVIDED. USE KS-21290L7, OPTION PLUG COMCODE 841 732 613

## NOTE:

ON 620A2 PANELS, 10V AC OR B SIG CAN BE CONNECTED TO TERMINAL FIELD TO OPERATE AUDIBLE SIGNALS. 10V AC APPEARS IN ALL 8 QUADRANTS AND B SIG APPEARS IN 1A ONLY.

Fig. 20—400H KTU Connections (CO/PBX Line) in 620A (MD) or 620A2 Modular Panel

**A. 400-Type KTU—CO/PBX Line Circuit (Fig. 18, 19, and 20)**

| STEP | ACTION   | VERIFICATION   |
|------|--|--|
| 1    | Short A and A1 terminals.  | Panel lamp lights steadily (BUSY).   |
| 2a   | If CO/PBX T and R battery is present—<br>Maintaining A and A1 short, short T and R (STA) terminals.  |  |
| 3a   | Remove A and A1 short.   | Panel lamp winks.  |
| 4a   | Reapply A and A1 short.  | Panel lamp lights steadily.  |
| 5a   | Remove T and R short.  |  |
| 6    | Remove A and A1 short.   | Panel lamp extinguished.   |
| 7b   | If interrupter is operating (another line in<br>system in use and working from same power<br>unit as line under test)—<br>Place E1 ringer, or equivalent, across T and<br>R (STA). |  |
| 8b   | Place straps RG to T (CO) and 105V RN to<br>R (CO).  | Panel lamp flashes (CALL).<br>Ringer sounds.   |
| 9    | Remove straps 105V RN to R (CO) and RG<br>to T (CO)  | Panel lamp continues to flash.<br>Ringer continues (Time-out circuit operating<br>until . . .)<br>Panel lamp extinguishes.<br>Ringer silences.<br>(Time-out complete.) |
| 10b  | Remove ringer from T and R (STA).  | (END TEST)   |

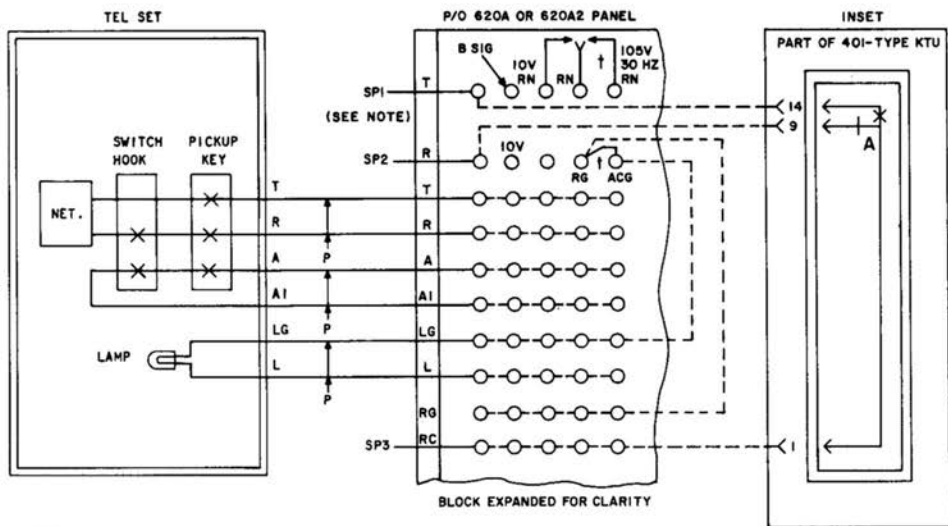


Fig. 21—401-Type KTU (Manual Intercom Circuit) in 620A (MD) or 620A2 Modular Panel



## B. 401-Type KTU—Manual Intercom Circuit (Fig. 21)

| STEP | ACTION   | VERIFICATION                |
|------|--|-----------------------------|
| 1    | Place 1013A, or equivalent, test set (MONITOR) across T and R (STA) terminals. |                             |
| 2    | Put test key in TALK position.   | Sidetone heard.             |
| 3    | Put test key in MONITOR position.  | Sidetone lost.              |
| 4    | Apply A and A1 short.  | Panel lamp lights steadily. |
| 5    | Remove A and A1 short.   | Panel lamp extinguished.    |
| 6    | Remove test set from terminals.  | (END TEST)                  |

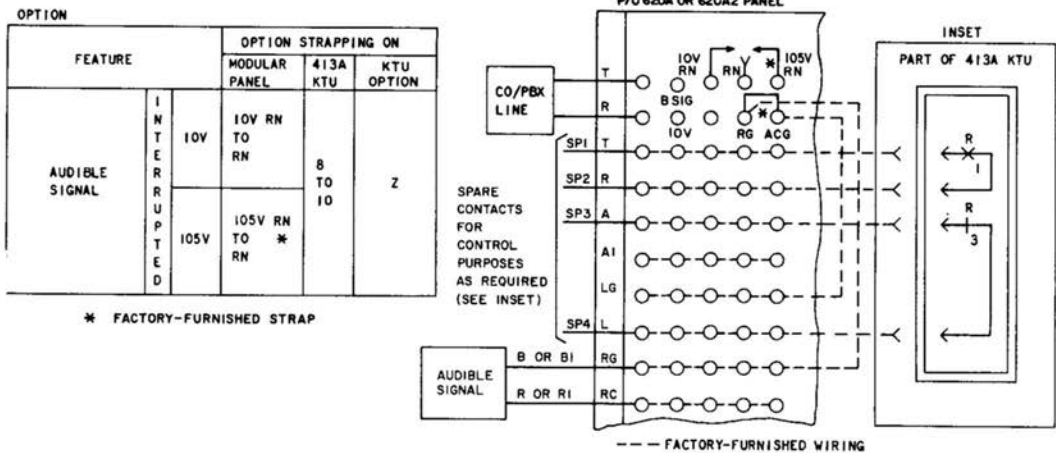
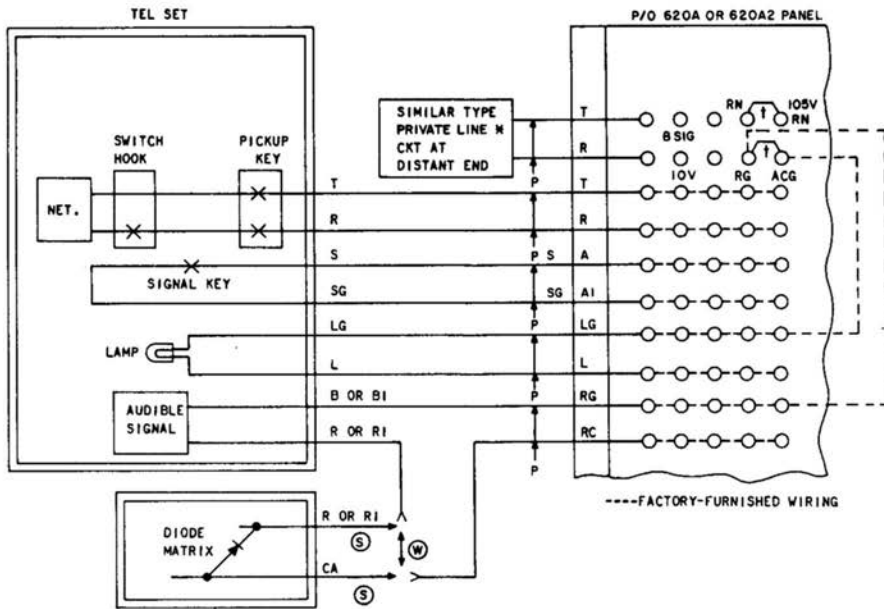


Fig. 22—413A KTU Connections (Auxiliary Ringup) in 620A (MD) or 620A2 Modular Panel



OPTIONS

| FEATURES              |   |                              |      | OPTION STRAPPING ON |                  | KTU OPTION           |                 |
|-----------------------|---|------------------------------|------|---------------------|------------------|----------------------|-----------------|
|                       |   |                              |      | MODULAR PANEL       | 414A OR 461A KTU |                      |                 |
| AUDIBLE SIGNALS       | UNDER CONTROL OF TIME-OUT CIRCUIT (B RELAY) | WITHOUT DIODE MATRIX CONTROL | 105V | 105V RN TO RN       | 7 TO 8           | W†                   |                 |
|                       |   | WITH DIODE MATRIX CONTROL    |      |                     |                  | S†                   |                 |
| TIME-OUT              | 10 SECONDS                                  |                              |      |                     |                  | 1 TO 2               | X               |
|                       | 16 SECONDS                                  |                              |      |                     |                  | 2 TO 3               | Z               |
|                       | 23 SECONDS                                  |                              |      |                     |                  | REMOVE X OR Z STRAPS | WITH OUT X OR Z |
| AUDIBLE RINGBACK TONE |   |                              |      |                     |                  | 9 TO 10              | M               |

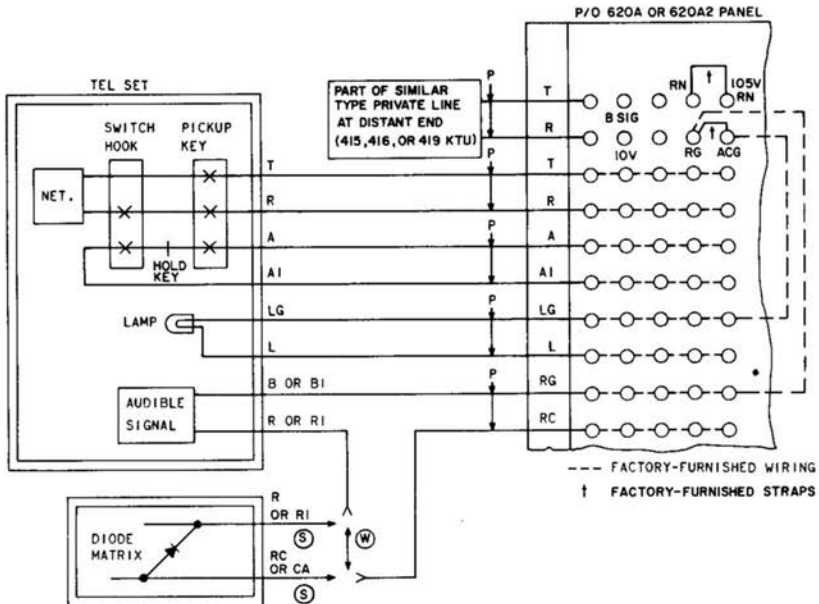
\* CIRCUIT AT DISTANT END MAY BE A 414A KTU, 419A KTU, 461A KTU, OR ANY OTHER TYPE PRIVATE LINE UNIT WHOSE RINGUP CIRCUIT REQUIRES RINGING VOLTAGE AND WHOSE SIGNALING CIRCUIT SENDS OUT SIGNALING VOLTAGE.

† FACTORY-FURNISHED STRAP

Fig. 23—414A KTU and 461A KTU Connections (Manual Signaling, Ringdown Private Line) in 620A (MD) or 620A2 Modular Panel

C. 414A KTU and 461A KTU—Manual Signaling,  
Ringdown Private Line (Fig. 23)

| STEP | ACTION   | VERIFICATION                                   |
|------|--|--|
| 1    | Place E1 ringer or equivalent across T and R (DISTANT END).                    |  |
| 2    | Place 1013A, or equivalent, test set (MONITOR) across T and R (STA) terminals. |  |
| 3    | Put test key in TALK position.   | Sidetone heard;<br>Panel lamp lights steadily. |
| 4    | Apply S and SG (A and A1) short.   | Ringer sounds (interrupted).                   |
| 5    | Remove S and SG short.   | Ringer silenced.                               |
| 6    | Put test key in MONITOR position.  | Sidetone lost;<br>Panel lamp extinguished.     |
| 7    | Remove test set from terminals.  |  |
| 8    | Remove ringer.   | (END TEST)                                     |



OPTIONS \*

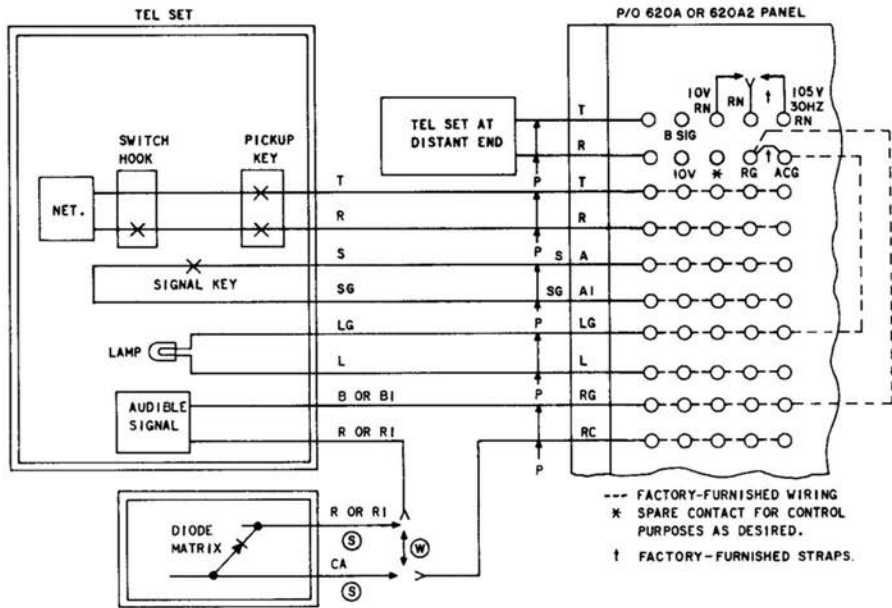
| FEATURES              |             |                              | OPTION STRAPPING ON      |               | KTU OPTION |        |    |
|-----------------------|-------------|------------------------------|--------------------------|---------------|------------|--------|----|
|                       |             |                              | MODULAR PANEL CONN BLOCK | 415A KTU      |            |        |    |
| AUDIBLE SIGNALS       | INTERRUPTED | WITHOUT DIODE MATRIX CONTROL | 105V                     | 105V RN TO RN | 4 TO 6     | WT     |    |
|                       |             | WITH DIODE MATRIX CONTROL    |                          |               |            | S†     |    |
| AUDIBLE RINGBACK TONE |             |                              |                          |               |            | 1 TO 2 | M† |
| VISUAL HOLD SIGNAL    |             |                              |                          |               |            | 7 TO 8 | Y† |

\* FOR IDLE LINE TERMINATION CONNECT A KS-13490LI 910-OHM RESISTOR IN SERIES WITH A 542F, 2UF CAPACITOR ACROSS TERMINALS 9 AND 10. ORDER COMPONENTS LOCALLY AND INSTALL.

Fig. 24—415-Type KTU Connections (Automatic, DC Signaling, Ringdown Private Line) in 620A (MD) or 620A2 Modular Panel†

**D. 415-Type KTU—Automatic, DC Signaling, Ringdown  
Private Line (Fig. 24)**

| STEP | ACTION   | VERIFICATION                                   |
|------|--|--|
| 1    | Place 1013A, or equivalent, test set (MONITOR) across T and R (STA) terminals. |  |
| 2    | Put test key in TALK position.   | Sidetone heard.                                |
| 3    | Put test key in MONITOR position.  | Sidetone lost.                                 |
| 4    | Remove test set from terminals.  |  |
| 5    | Place test set across T and R (DISTANT END) terminals.                         |  |
| 6    | Put test key in TALK position.   |  |
| 7    | Apply A and A1 short.  | Sidetone heard;<br>Panel lamp lights steadily. |
| 8    | Remove A and A1 short.   | Sidetone lost;<br>Panel lamp extinguished.     |
| 9    | Remove test set from terminals.  | (END TEST)                                     |



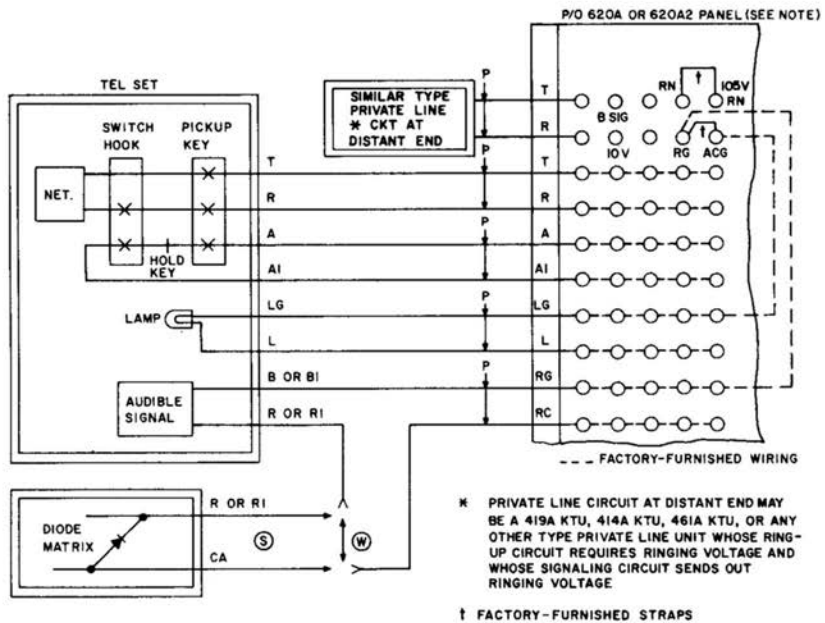
OPTIONS

| FEATURES              |                              | OPTION STRAPPING ON |               | KTU OPTION |    |
|-----------------------|------------------------------|---------------------|---------------|------------|----|
|                       |                              | MODULAR PANEL       | 416A KTU      |            |    |
| AUDIBLE SIGNALS       | WITHOUT DIODE MATRIX CONTROL | 10V                 | 10V RN TO RN  | 5 TO 8     |    |
|                       |                              | 105V                | 105V RN TO RN |            |    |
|                       | WITH DIODE MATRIX CONTROL    | 10V                 | 10V RN TO RN  |            | M† |
|                       |                              | 105V                | 105V RN TO RN |            |    |
| AUDIBLE RINGBACK TONE |                              |                     |               | 9 TO 10    |    |

Fig. 25—416A KTU Connections (Station Line Circuit) in 620A (MD) or 620A2 Modular Panel†

## E. 416A KTU—Station Line Circuit (Fig. 25)

| STEP | ACTION   | VERIFICATION   |
|------|--|--|
| 1    | Place ringer across RG and RC terminals.   |  |
| 2    | Place 1013A, or equivalent, test set (MONITOR) across T and R (DISTANT END) terminals. |  |
| 3    | Put test key in TALK position.   | Sidetone heard;<br>Panel lamp (STA) flashes;<br>Ringer sounds (interrupted).   |
| 4    | Apply T and R (STA) short.   | Momentary audible click in test set;<br>Sidetone continues;<br>Panel lamp (STA) lights steadily;<br>Ringer silenced.     |
| 5    | Remove T and R (STA) short.  | Momentary audible click in test set;<br>Sidetone continues;<br>Panel lamp (STA) flashes;<br>Ringer sounds (interrupted). |
| 6    | Put test key in MONITOR position.  | Sidetone lost;<br>Panel lamp (STA) extinguished;<br>Ringer silenced.   |
| 7    | Remove test set from T and R (DISTANT END).  |  |
| 8    | Remove ringer from RG and RC terminals.  | (END TEST)   |



| FEATURES              |   |                              |         | OPTION STRAPPING ON |                      | KTU OPTION |                 |
|-----------------------|---|------------------------------|---------|---------------------|----------------------|------------|-----------------|
|                       |   |                              |         | MODULAR PANEL       | 419A KTU             |            |                 |
| AUDIBLE SIGNALS       | UNDER CONTROL OF TIME-OUT CIRCUIT (B RELAY) | WITHOUT DIODE MATRIX CONTROL | 105V AC | 105V RN TO RN       | 6 TO 8               | W†         |                 |
|                       |   | WITH DIODE MATRIX CONTROL    |         |                     |                      | S†         |                 |
| TIME-OUT              | 6 SECONDS                                   |                              |         |                     |                      | 9 TO 10    | X               |
|                       | 17 SECONDS                                  |                              |         |                     |                      | 7 TO 10    | Z               |
|                       | 25 SECONDS                                  |                              |         |                     | REMOVE X OR Z STRAPS |            | WITH-OUT X OR Z |
| AUDIBLE RINGBACK TONE |   |                              |         |                     |                      | 1 TO 2     | M†              |

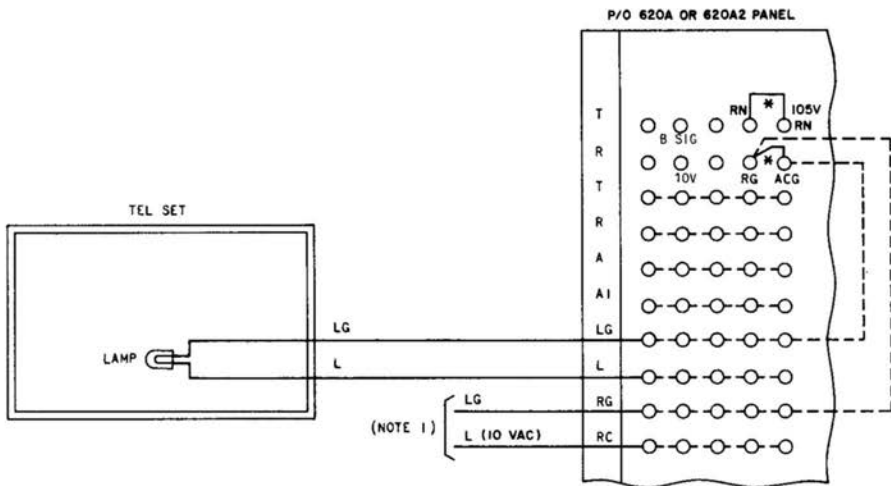
NOTE: INSTALLATION OF A 419A KTU IN A 620A OR 620A2 PANEL REQUIRES TWO 9138 CONNECTORS IN A VERTICAL PLANE AND REMOVAL OF A GUIDE ASSEMBLY. CONNECTIONS ARE MADE TO THE UPPER QUADRANT OF THE TERMINAL FIELD AND THE LOWER QUADRANT REMAINS VACANT.

Fig. 26—419A KTU Connections (Automatic Signaling, Ringdown Private Line) in 620A (MD) or 620A2 Modular Panel



**F. 419A KTU—Automatic Signaling, Ringdown  
Private Line (Fig. 26)**

| STEP | ACTION  | VERIFICATION  |
|------|---|---|
| 1    | Place ringer across T and R (DISTANT END) terminals.  |   |
| 2    | Place 1013A, or equivalent, test set (MONITOR) across T and R (STA) terminals.  |   |
| 3    | Put test key in TALK position.  | Sidetone heard.   |
| 4    | Apply A and A1 short.   | Ringer (DISTANT END) sounds;<br>Panel lamp (STA) lights steadily. |
| 5    | Remove A and A1 short.  | Ringer (DISTANT END) silenced;<br>Panel lamp extinguished.        |
| 6    | Put test key in MONITOR position.   | Sidetone lost.  |
| 7    | Remove test set from T and R (STA).   |   |
| 8    | Move ringer from T and R (DISTANT END) terminals to RC and RG (STA) terminals.  |   |
| 9    | Factory-furnished straps RN to 105V RN and RG to ACG in place, add strap RG to T (DISTANT END) and strap RN to R (DISTANT END). | Ringer (STA) sounds;<br>Panel lamp flashes.                       |
| 10   | Apply A and A1 short.   | Ringer (STA) silenced;<br>Panel lamp lights steadily.             |
| 11   | Remove A and A1 short.  | Ringer (STA) sounds;<br>Panel lamp flashes.                       |
| 12   | Remove RN to R (DISTANT END) strap.   | Ringer (STA) silenced;<br>Panel lamp extinguished.                |
| 13   | Remove RG to T (DISTANT END) strap.   |   |
| 14   | Remove ringer from T and R (STA) terminals.   | (END TEST)  |



## NOTES:

1. FROM L AND LG TERMINALS OF QUADRANT OF ASSOCIATED 400 LINE CIRCUIT OR ANOTHER 469A KTU.
2. 469A KTU CAN DRIVE MAXIMUM OF 20 LAMPS (OR 19 LAMPS AND ANOTHER 469A).

--- FACTORY-FURNISHED WIRING

\* FACTORY-FURNISHED STRAP

Fig. 27—469A KTU Connections (Lamp Extender) in 620A (MD) or 620A2 Modular Panel

| STEP                                       | ACTION | VERIFICATION |
|--|--------|--------------|
| <b>G. 469A KTU—Lamp Extender (Fig. 27)</b> |        |              |

| STEP | ACTION   | VERIFICATION                           |
|------|--|--|
| 1    | Place strap from 10V RN terminal on panel to RC (L lead) terminal. | Panel lamp flashes.                    |
| 2    | Remove strap.  | Panel lamp extinguished.<br>(END TEST) |

NOTES:

1. QUADRANT OF TERMINAL FIELD CORRESPONDING TO CONNECTOR CONTAINING 471A KTU.
2. QUADRANT OF TERMINAL FIELD CORRESPONDING TO CONNECTOR CONTAINING 400-TYPE KTU.

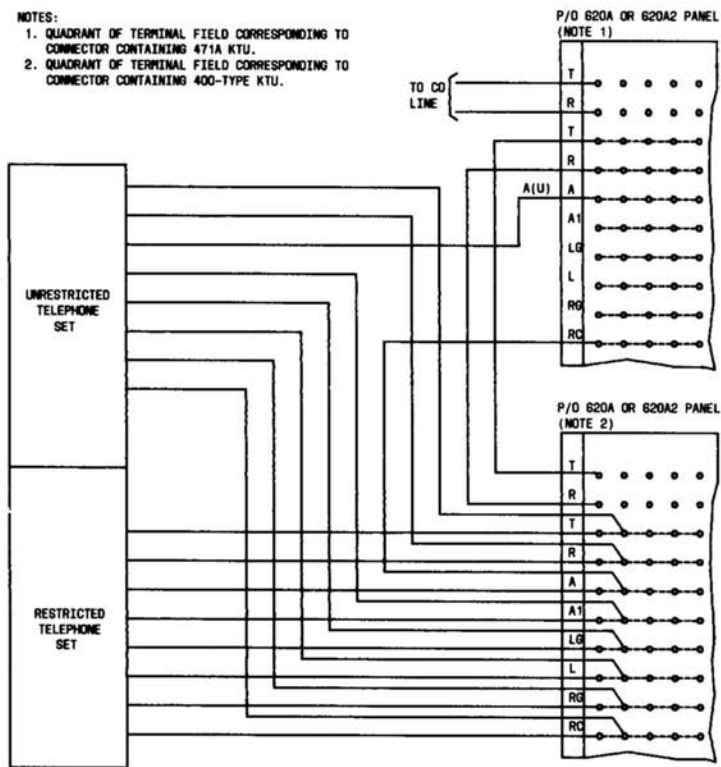


Fig. 28—471-Type KTU Connections (Battery Reversal Toll Restriction) in 620A (MD) or 620A2 Modular Panel

**H. 471-Type KTU—Battery Reversal Toll Restriction  
(Fig. 28)**

| STEP | ACTION  | VERIFICATION   |
|------|---|--|
| 1    | Test requires CO line be connected to T and R (CO) terminals.                           |  |
| 2    | Strap A1 and RC terminals.  |  |
| 3    | Connect 1013A test set or equivalent to T and R (STA) terminals with switch in MONITOR. |  |
| 4    | Operate switch to TALK.   | Dial tone heard.   |
| 5    | Dial toll code.   | CO line opened for approximately 1 second.<br>Dial tone heard. |
| 6    | Operate switch to MONITOR.  | CO disconnects.  |
| 7    | Move strap to A1 and A terminals.   |  |
| 8    | Operate switch to TALK.   | Dial tone heard.   |
| 9    | Dial toll code.   | Call not restricted.   |
| 10   | Operate switch to MONITOR.<br>Remove 1013A test set and A1 and A strap.                 | (END TEST)   |

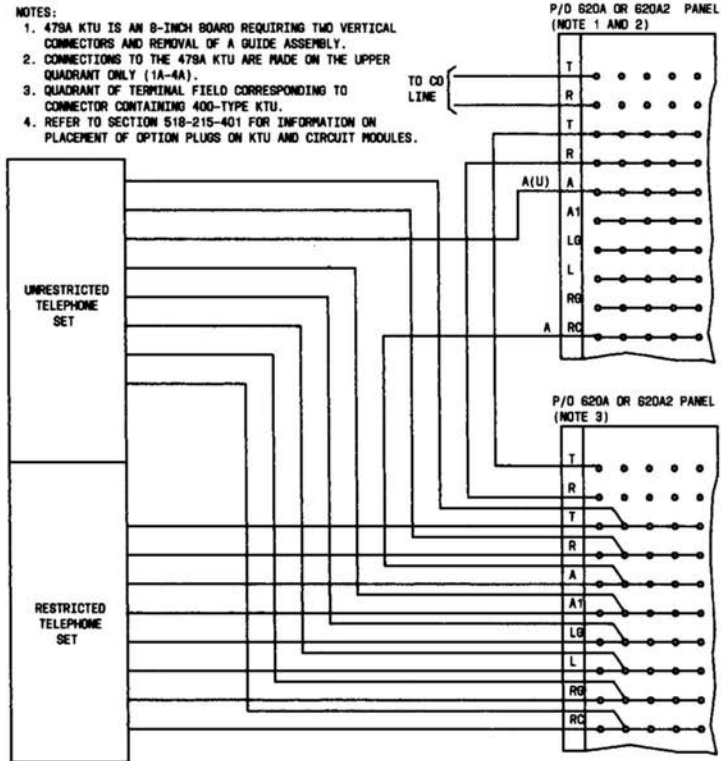
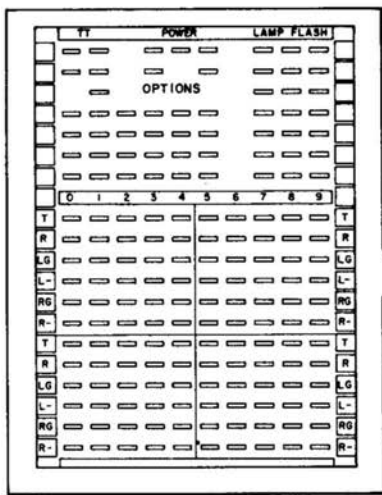
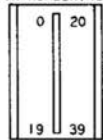


Fig. 29—479-Type KTU Connections (Rotary Dial Toll Restriction) in 620A (MD) or 620A2 Modular Panel



\* FOR 18V AC, 24V DC, GROUND OR AS REQUIRED FOR SIGNALING PURPOSES OTHER THAN PROVIDED (EXTERNAL POWER SOURCE MAY BE REQUIRED)

914B CONNECTOR PIN NUMBERING



NOTE: TERMINAL NUMBERS RELATE TO 914B CONNECTOR PINS.

| CONNECTOR | TERMINAL SYMBOL |
|-----------|-----------------|
| 1A        | ○               |
| 1B        | ⊙               |
| 2A        | ●               |
| 2B        | ⊙               |

TYPICAL WIRING TO INTERCOM STATION

STATION CODE "0"

TYPICAL WIRING TO INTERCOM STATION

STATION CODE "X0"

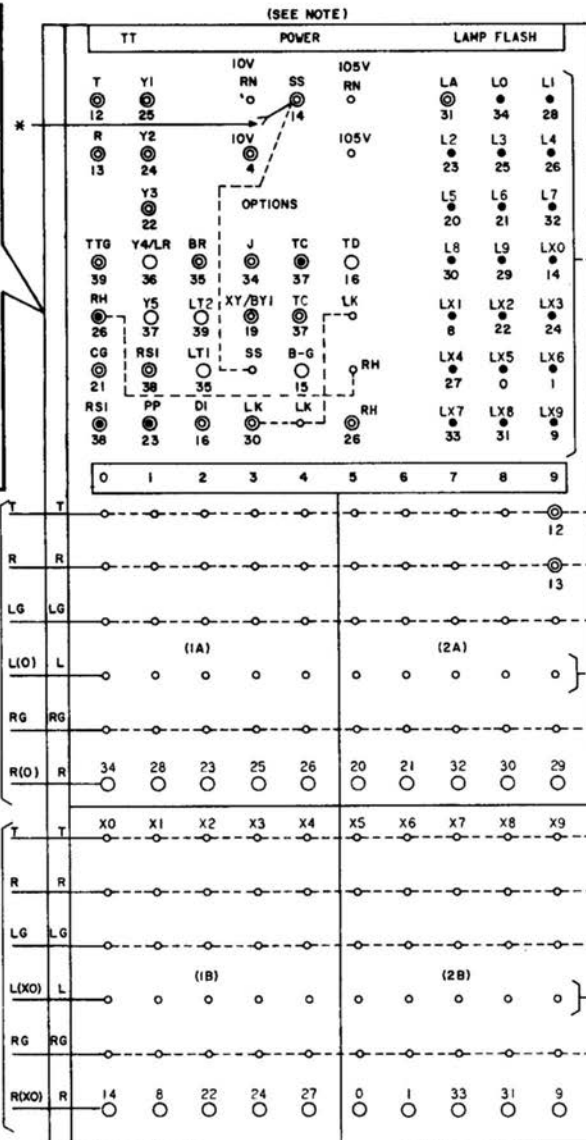
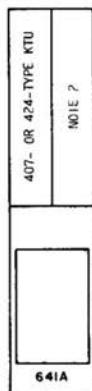
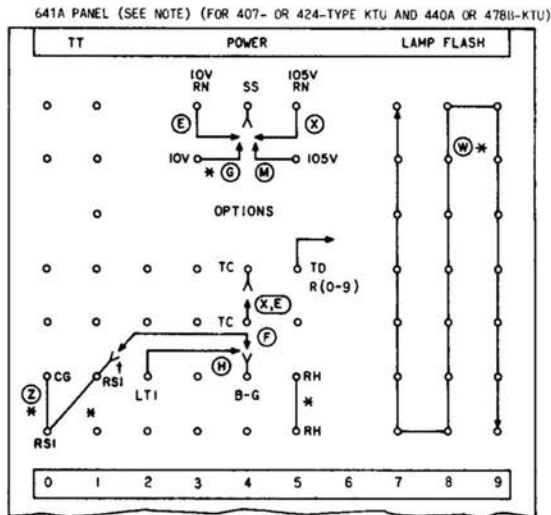


Fig. 30—Terminal Field Illustration and Terminal Designations for 641A Modular Panel (Dial Intercom Services)



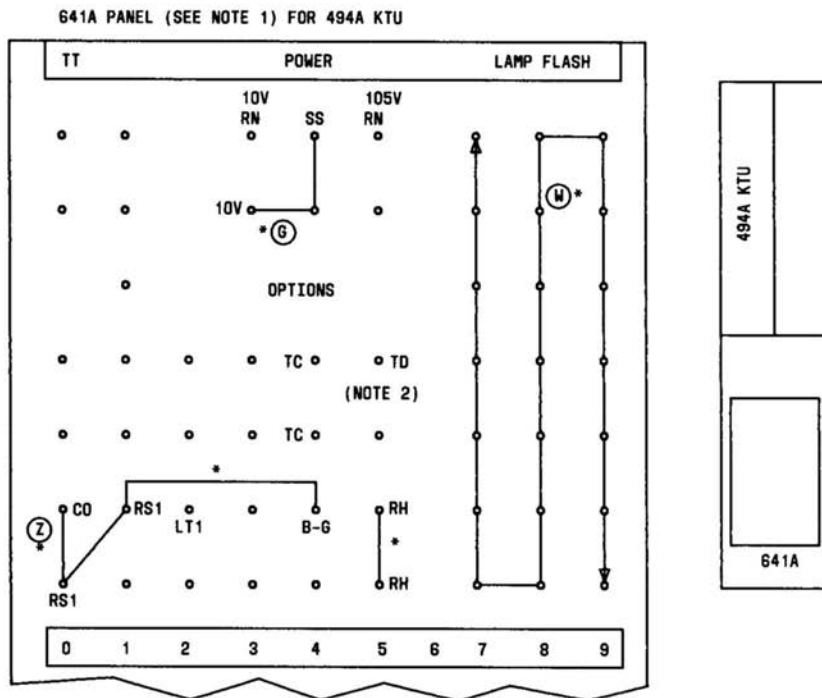
- NOTES:
1. SEE TABLE G FOR INTERCOM OPTIONS AND FIG. 30 FOR TYPICAL STATION CONNECTIONS.
  2. ADD 440A OR 478B KTU IN THIS SLOT IF OPTION (N) IS REQUIRED. REMOVE (Z) OPTION. IF 440A OR 478B KTU MUST BE MOUNTED IN 642A PANEL INSTALL PLR FIG. 32.
  3. PROVIDE OPTIONS ON THE 478B KTU BY TURNING DOWN OPTION SCREWS AS FOLLOWS:  
641A PANEL-STRAP A-B (Z)  
642A PANEL-STRAP B-C (Y)
  4. REMOVE (F) OPTION IF 424-TYPE KTU IS USED
- \* FACTORY PROVIDED STRAP  
† USE CONTINUOUS STRAPPING METHOD, WHEN REQUIRED.

Fig. 31—407- or 424-Type Connections (Basic Dial Intercom Selector Circuit) With Rotary or TOUCH-TONE Dialing (440A or 478B KTU)



I. 407- or 424-Type KTU—Basic Dial Intercom  
Selector Circuit (Fig. 31)

| STEP | ACTION  | VERIFICATION                                   |
|------|---|--|
| 1    | Place appropriate type audible signal device (bell or buzzer) across RG and R-5 terminals.                |  |
| 2    | Place 1013A, or equivalent, test set (MONITOR) across T and R (STA) terminals.                            |  |
| 3    | Put test key in TALK position.  | Sidetone heard;<br>Panel lamp lights steadily. |
| 4    | Dial digit 5.   | Audible signal sounds.                         |
| 5    | Put test key in MONITOR position.   | Sidetone lost;<br>Panel lamp extinguished.     |
| 6    | Remove test set from terminals.   |  |
| 7    | Remove audible signal device.   |  |
| 8a   | If 407-type KTU under test—   | (END TEST)                                     |
| 9b   | If 424-type KTU under test—<br>Place appropriate type audible signal device across RG and R-X7 terminals. |  |
| 10b  | Strap TD terminal to R-2 terminal.<br>(R-2 selected as transfer digit for testing purposes.)              |  |
| 11b  | Place 1013A, or equivalent, test set (MONITOR) across T and R (STA) terminals.                            |  |
| 12b  | Put test key in TALK position.  | Sidetone heard;<br>Panel lamp lights steadily. |
| 13b  | Dial intercom code 27.  | Audible signal sounds.                         |
| 14b  | Put test key in MONITOR position.   | Sidetone lost;<br>Panel lamp extinguished.     |
| 15b  | Remove test set from terminals.   |  |
| 16b  | Remove audible signal device.   |  |
| 17b  | Remove strap between TD and R-2 terminals.  | (END TEST)                                     |



## NOTES:

- SEE TABLE G FOR INTERCOM OPTIONS AND FIG. 30 FOR TYPICAL STATION CONNECTIONS.
- FOR 19-CODE INTERCOM, THE DIGIT 1 IS THE TRANSFER DIGIT. NO TRANSFER CODE STRAP IS REQUIRED.

\* FACTORY-PROVIDED STRAP. OPTIONS (G) AND (W) ARE REQUIRED. OTHER FACTORY-PROVIDED STRAPS MAY BE LEFT IN PLACE IF PRESENT.

Fig. 32 -494 KTU Connections (Basic Dial Intercom) With TOUCH-TONE Selector Circuit

J. 494A KTU—TOUCH-TONE Selector Circuit (Fig. 32)

| STEP | ACTION   | VERIFICATION |
|------|--|--------------|
| 1    | Place appropriate type audible signal device (bell or buzzer) across RG and R-5 terminals. |              |

| STEP | ACTION  | VERIFICATION                                   |
|------|---|--|
| 2    | Connect tip and ring leads of 2500D, or equivalent, telephone set across T and R (STA) terminals. |  |
| 3    | Go off-hook.  | Sidetone heard;<br>Panel lamp lights steadily. |
| 4    | Dial digit 5.   | Audible signal sounds.                         |
| 5    | Go on-hook.   | Panel lamp extinguished.                       |
| 6    | Move audible signal to RG and R-XS terminals.   |  |
| 7    | Go off-hook.  | Sidetone heard;<br>Panel lamp lights steadily. |
| 8    | Dial digit 15.  | Audible signal sounds.                         |
| 9    | Go on-hook.   | Panel lamp extinguished.                       |
| 10   | Remove audible signal device.   |  |
| 11   | Remove telephone set from terminals.  | (END TEST)                                     |

#### Functional Designations

**5.09** The following list provides functional designations for dial intercom leads and relates them to their function in the system.

|               |                             |           |                          |
|---------------|-----------------------------|-----------|--------------------------|
| BL,BL1,...BLO | STATION BUSY GROUND         | LX1, LX0  | TRANSFERRED STATION LAMP |
| BR            | SWITCHED B BATTERY          | R1,...RX0 | STATION RINGING LEAD     |
| BY1           | BUSY GROUND                 | RH        | R RELAY HOLD             |
| CG            | COUNTER GROUND              | RN        | INTERRUPTED RINGING      |
| D1            | OFF-HOOK DETECTION          | RS1       | RESET                    |
| J             | J GROUND                    | SS        | SIGNAL INPUT             |
| L             | LAMP                        | ST        | START                    |
| L1,...LX0     | STATION LAMP                | TC        | B RELAY CONTROL          |
| LG or MG      | LAMP GROUND or MOTOR GROUND | TD        | TRANSFER DIGIT           |
| LK            | DIAL TONE DISCONNECT        | TTG       | TOUCH-TONE GROUND        |
| LT1, LT2      | LAMP TRANSFER               | Y1,...Y5  | COUNTER RELAY SELECTION  |



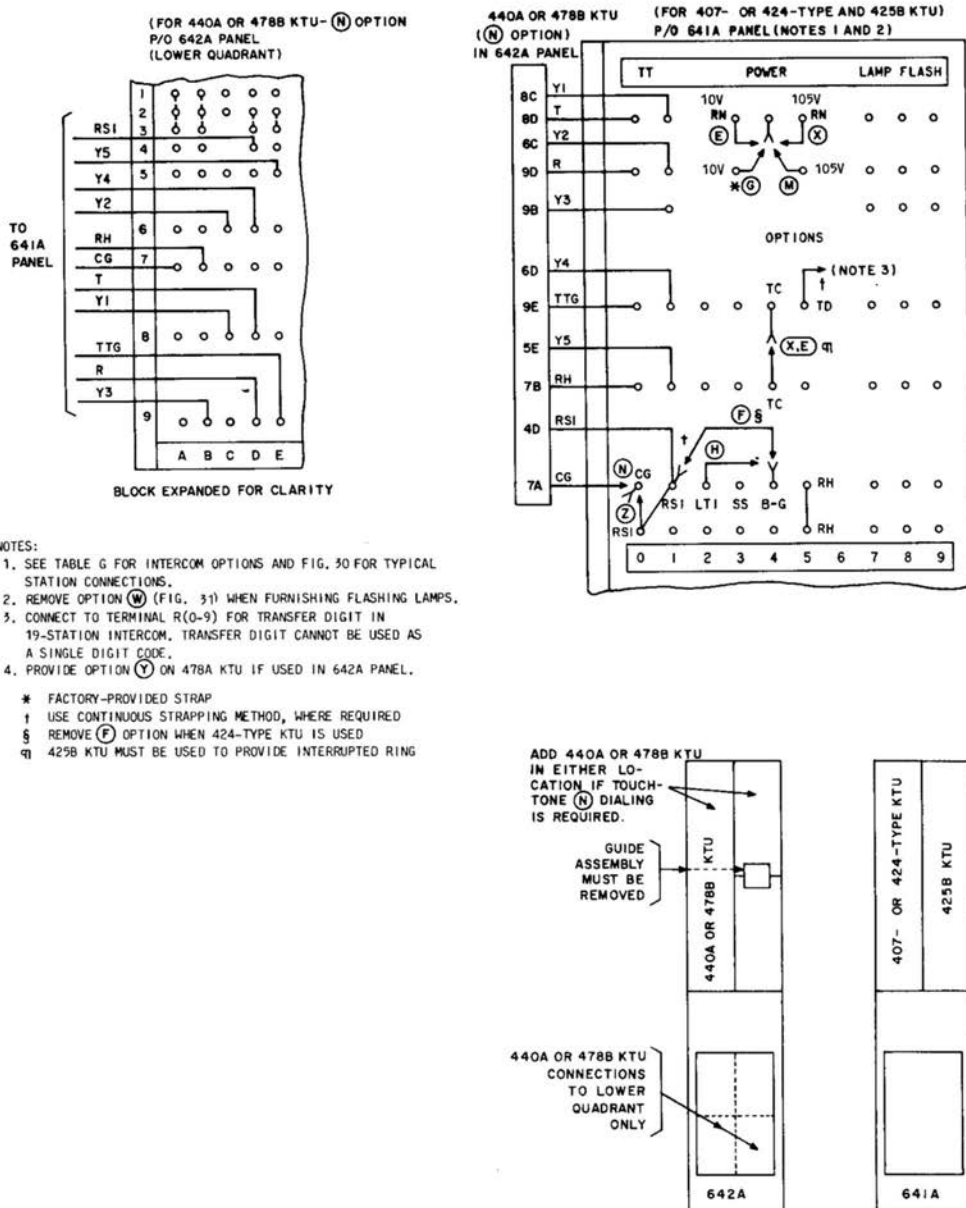
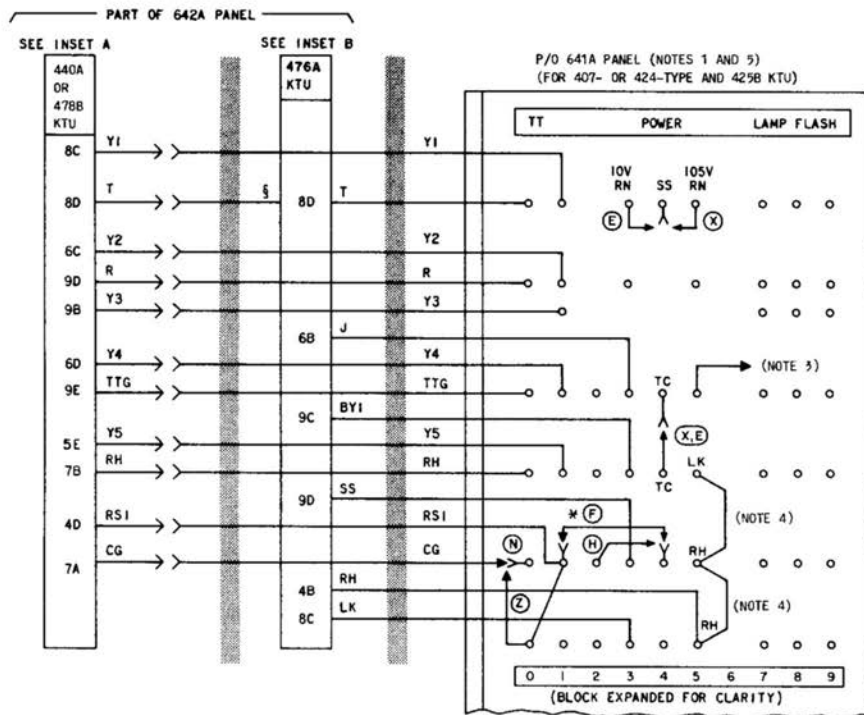


Fig. 33—Deluxe Dial Intercom Connections (407- or 424-Type KTU) With Flashing Lamp (425B KTU) and Rotary or TOUCH-TONE Dialing (440A or 478B KTU)



## NOTES:

- SEE TABLE G FOR INTERCOM OPTIONS AND FIG. 50 FOR TYPICAL STATION CONNECTIONS.
- WHEN 476A KTU IS USED, ALL POWER OPTIONS EXCEPT THE TC TO TC STRAP FOR (C, X) WILL BE APPLIED ON THE 642A PANEL INSTEAD OF THE 641A PANEL.
- CONNECT TO TERMINAL R(C-9) FOR TRANSFER DIGIT OF 19-CODE INTERCOM. TRANSFER DIGIT CAN NOT BE USED AS A SINGLE DIGIT CODE.
- STRAP RH TO LK WHEN 440A OR 478B AND 476A KTU ARE BOTH USED. STRAP RH TO RH WHEN EITHER IS NOT USED.
- REMOVE OPTION (W) (FIG. 311) WHEN FURNISHING FLASHING LAMPS.

\* REMOVE OPTION F WHEN 424-TYPE KTU IS USED.

OPTION STRAPPING ON KTUS

| KTU  | FEATURES           | OPTION          | STRAP TERMINALS |
|------|--------------------|-----------------|-----------------|
| 476A | DIAL TONE          | ZD              | 1 TO 2          |
|      | STA BUSY TONE      | ZF              | 7 TO 8          |
|      | RINGBACK TONE      | ± 110V<br>± 10V | ZE              |
| 478B | USED IN 642A PANEL | Y               | B TO C          |

Fig. 34—Deluxe Dial Intercom Connections (407- or 424-Type KTU) With Flashing Lamp (425B KTU), Audible Tone (476A KTU), and Rotary or TOUCH-TONE Dialing (440A or 478B KTU) (Sheet 1 of 2)

## INSET

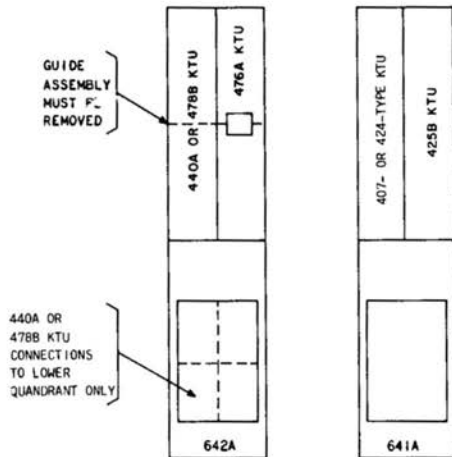
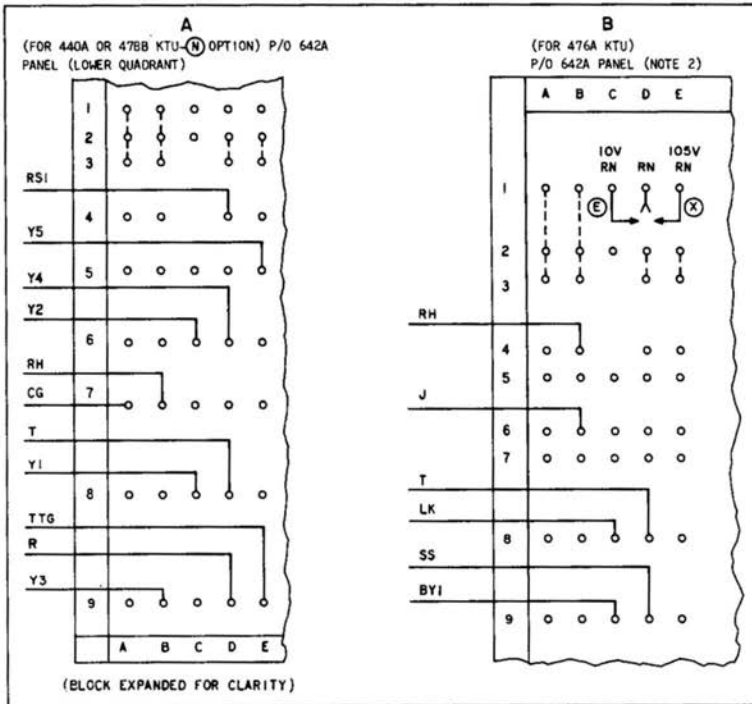
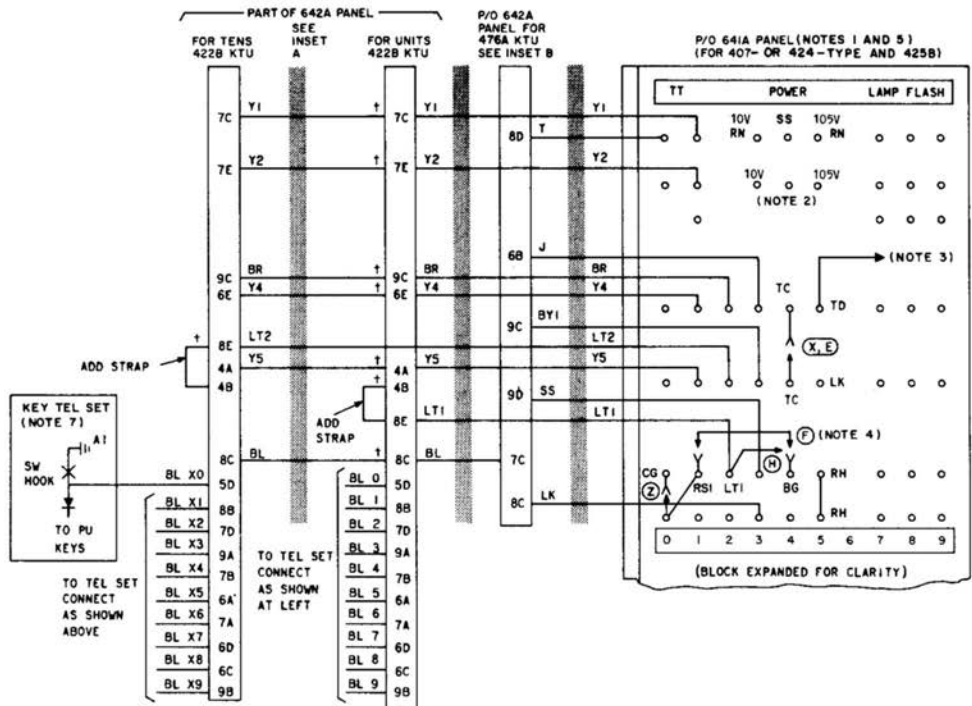


Fig. 34—Deluxe Dial Intercom Connections (407- or 424-Type KTU) With Flashing Lamp (425B KTU), Audible Tone (476A KTU), and Rotary or TOUCH-TONE Dialing (440A or 478B KTU) (Sheet 2 of 2)



OPTION STRAPPING ON 476A KTU OPTION BLOCK

| FEATURES      | OPTION          | STRAP TERMINALS |
|---------------|-----------------|-----------------|
| DIAL TONE     | ZD              | 1 TO 2          |
| STA BUSY TONE | ZF              | 7 TO 8          |
| RINGBACK TONE | ± 110V<br>+ 10V | ZE<br>4 TO 5    |

- NOTES:
- SEE TABLE G FOR INTERCOM OPTIONS AND FIG. 30 FOR TYPICAL STATION CONNECTIONS.
  - OPTIONS (M), (N) CANNOT BE USED WITH STATION BUSY TONE (476A KTU) OR FLASHING LAMPS (425B KTU).
  - CONNECT TO TERMINAL R(0-9) FOR TRANSFER DIGIT OF 19-CODE INTERCOM. TRANSFER DIGIT CANNOT BE USED AS A SINGLE DIGIT CODE.
  - REMOVE FACTORY-FURNISHED OPTION (F) WHEN A 424A KTU IS USED.
  - REMOVE OPTION (M) (FIG. 51) WHEN FURNISHING FLASHING LAMPS.
  - WHEN 476A KTU IS USED, ALL POWER OPTIONS EXCEPT THE TC TO TC STRAP FOR (E, X) WILL BE APPLIED TO THE 642A PANEL INSTEAD OF THE 641A PANEL.
  - FOR CONNECTION OF DIODE, USE BUSY LAMP OPTION AS SHOWN IN SECTION FOR SET USED.
- \* WHEN A 424-TYPE KTU IS USED, SEPARATE 422B KTUS MUST BE PROVIDED FOR THE UNITS GROUP (0-9) AND THE TENS GROUP (X0-X9). TENS GROUP LEADS ARE BRIDGED (LOOPED) FROM THE UNITS GROUPS, EXCEPTING THE LT1 AND LT2 LEADS.
- + USE CONTINUOUS STRAPPING METHOD

Fig. 35—Deluxe Dial Intercom Connections (407- or 424-Type KTU) With Flashing Lamp (425B KTU), Audible Tone (476A KTU), and Rotary Dialing With Optional Station Busy Selector (422-Type KTU) (Sheet 1 of 2)



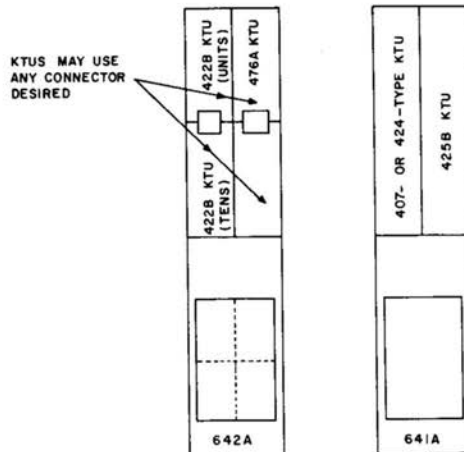
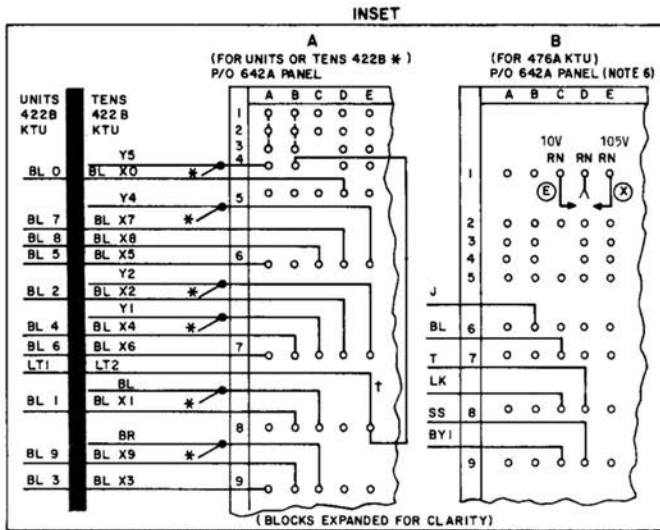


Fig. 35—Deluxe Dial Intercom Connections (407- or 424-Type KTU) With Flashing Lamp (425B KTU), Audible Tone (476A KTU), and Rotary Dialing With Optional Station Busy Selector (422-Type KTU) (Sheet 2 of 2)

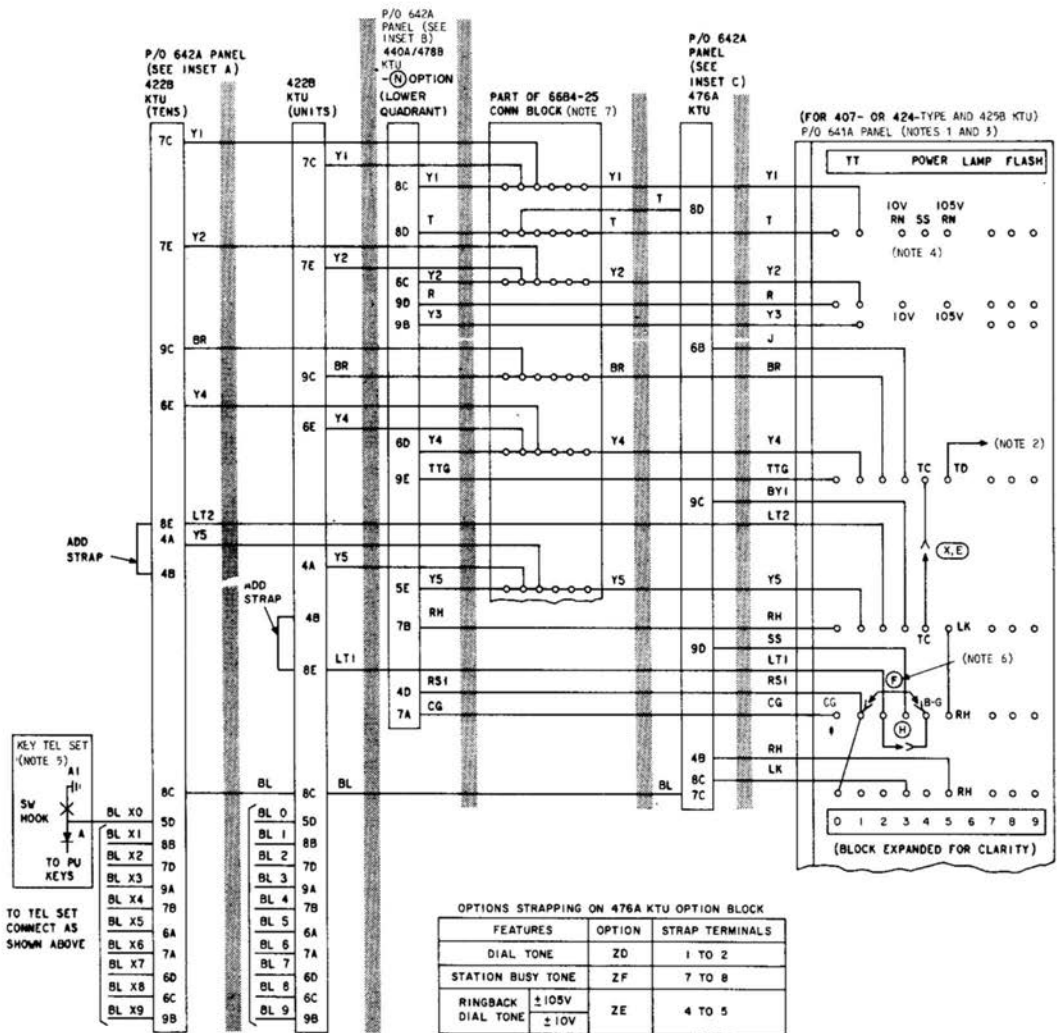
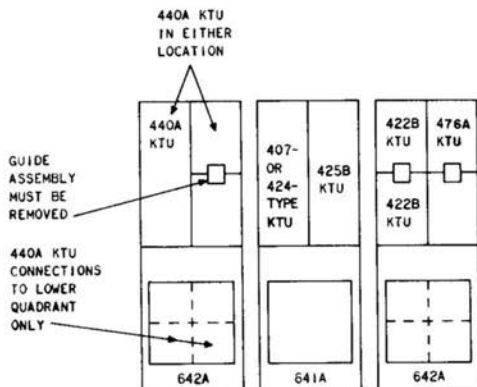
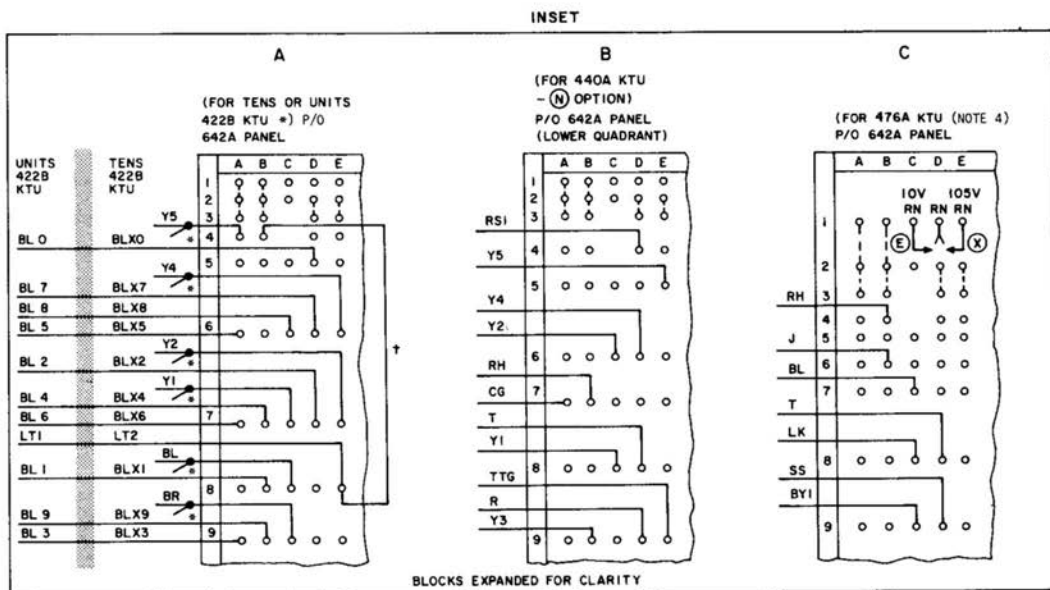


Fig. 36—Deluxe Dial Intercom Connections (407- or 424-Type KTU) With Flashing Lamp (425B KTU), Audible Tone (476A KTU), and TOUCH-TONE Dialing (440A or 478B KTU) With Optional Station Busy Selector (422-Type KTU) (Sheet 1 of 2)



## NOTES:

1. SEE TABLE G FOR INTERCOM OPTIONS AND FIG. 30 FOR TYPICAL STATION CONNECTIONS.
2. CONNECT TO R(0-9) TERMINAL FOR TRANSFER DIGIT OF 19-STATION INTERCOM. TRANSFER DIGIT CANNOT BE USED AS A SINGLE DIGIT CODE.
3. REMOVE OPTION (N) (FIG. 31) WHEN FURNISHING FLASHING LAMPS.
4. WHEN 476A KTU IS USED, ALL POWER OPTIONS EXCEPT THE TC TO TC STRAP FOR (E, X) WILL BE APPLIED TO THE 642A PANEL INSTEAD OF THE 641A. BOTH PANELS MUST USE SAME POWER SUPPLY.
5. FOR CONNECTION OF DIODE, USE BUSY LAMP OPTION AS SHOWN IN SECTION FOR SET USED.
6. REMOVE OPTION (P) IF A 424-TYPE KTU IS USED.
7. YELLOW BACKBOARD (185A1) RECOMMENDED.

- \* WHEN A 424-TYPE KTU IS USED, SEPARATE 422B KTUS MUST BE PROVIDED FOR THE UNITS GROUP (0-9) AND THE TENS GROUP (X0-X9). TENS GROUP LEADS ARE BRIDGED (LOOPED) FROM THE UNITS GROUP EXCEPTING THE SEPARATE LT1 AND LT2 LEADS.
- † USE CONTINUOUS STRAPPING METHOD
- \* DISCONNECT (Z) OPTION AT CG TERMINALS

**Fig. 36—Deluxe Dial Intercom Connections (407- or 424-Type KTU) With Flashing Lamp (425B KTU), Audible Tone (476A KTU), and TOUCH-TONE Dialing (440A or 478B KTU) With Optional Station Busy Selector (422-Type KTU) (Sheet 2 of 2)**

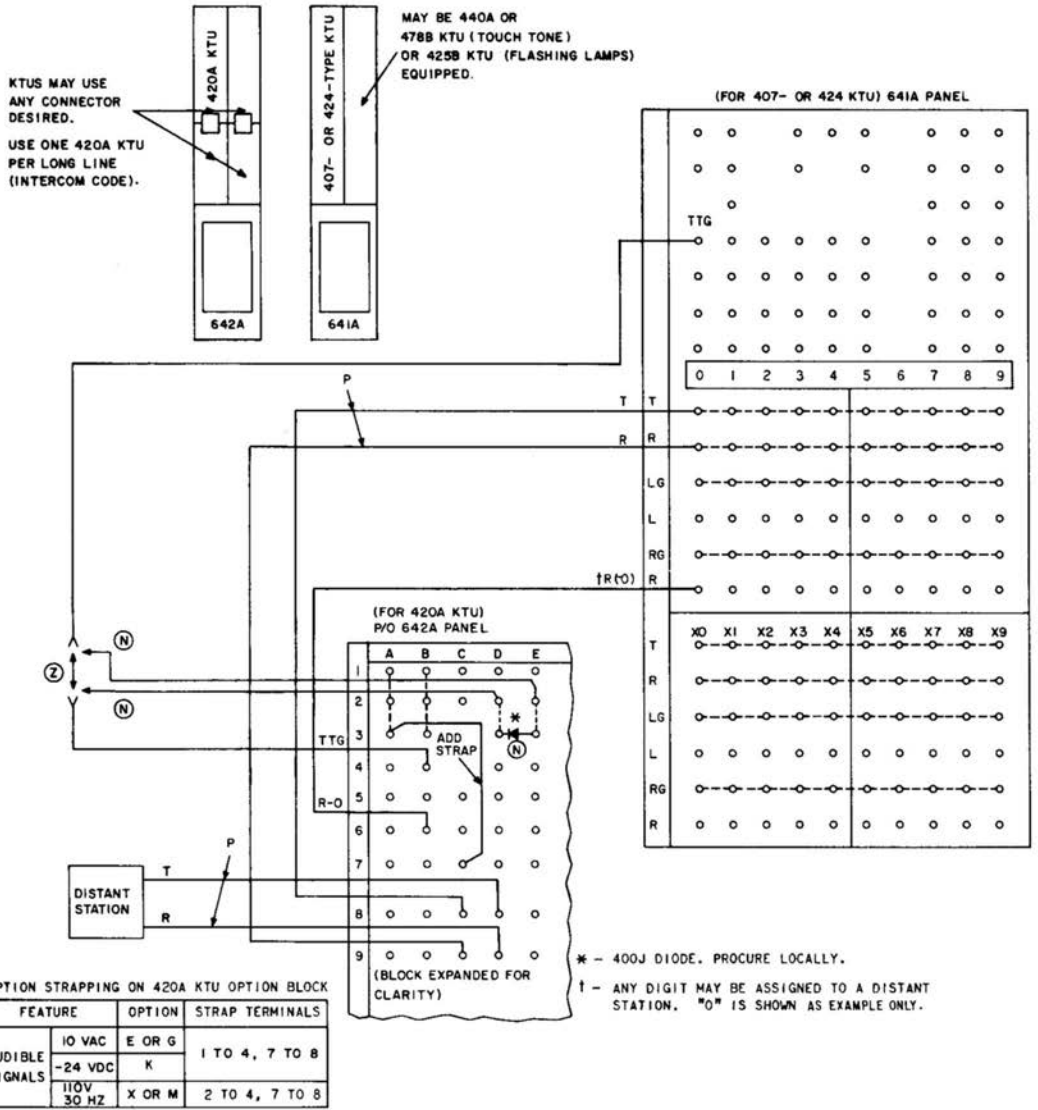
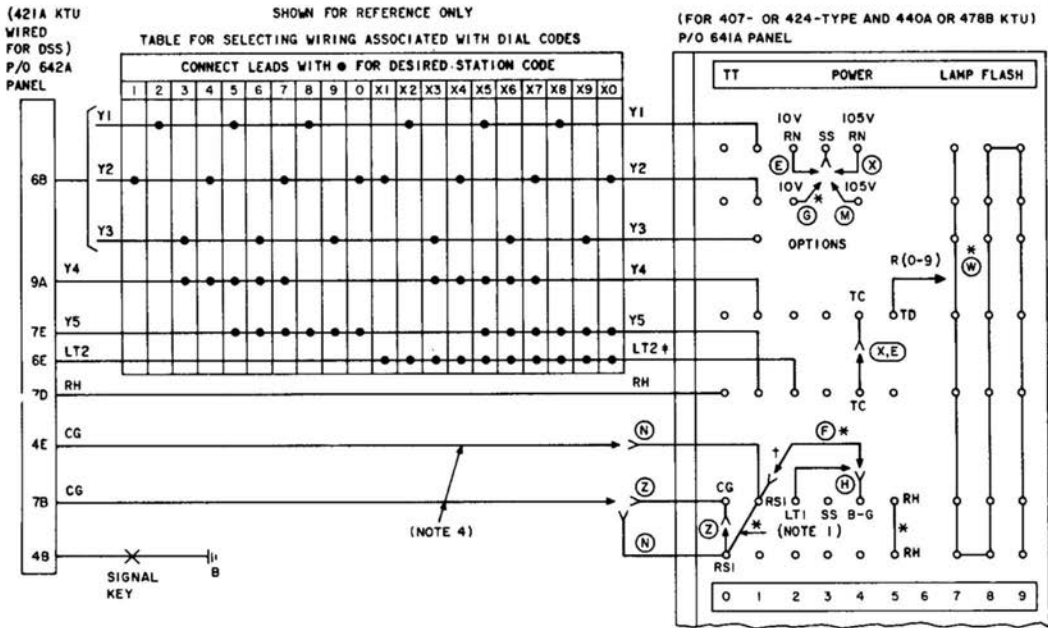


Fig. 37—Long Line Circuit (420A KTU) Option for Basic or Deluxe Dial Intercom

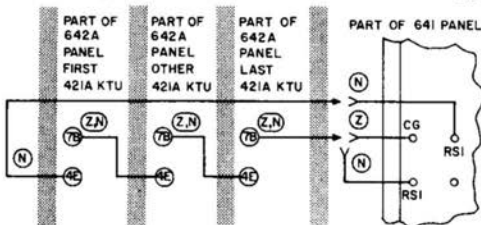
**K. 420A KTU—Long Line Circuit (Fig. 37)**

| <b>STEP</b> | <b>ACTION</b>  | <b>VERIFICATION</b> |
|-------------|--|---------------------|
| 1           | Place 1013A, or equivalent, test set (MONITOR) across T and R (DISTANT END) terminals. |                     |
| 2           | Put test key in TALK position.   | Sidetone heard.     |
| 3           | Put test key in MONITOR position.  | Sidetone lost.      |
| 4           | Remove test set from T and R (DISTANT END) terminals.                                  | (END TEST)          |



NOTES:

1. WHEN "TOUCH-TONE" AND DSS ARE BOTH PROVIDED REMOVE STRAP: ● RSI TO RSI
2. PROVIDE A SEPARATE 421A KTU AND SIGNAL KEY PER STATION CODE TO BE SELECTED.
3. FOR 18V AC, 24V DC, GROUND, OR AS REQUIRED FOR SIGNALING PURPOSES OTHER THAN PROVIDED (EXTERNAL POWER SOURCE MAY BE REQUIRED).
4. IF MORE THAN ONE 421A KTU IS USED FOR DSS, CONNECT AS SHOWN:



- \* FACTORY FURNISHED STRAP.
- † USE CONTINUOUS STRAPPING METHOD.
- \* USE WITH 424-TYPE KTU ONLY.

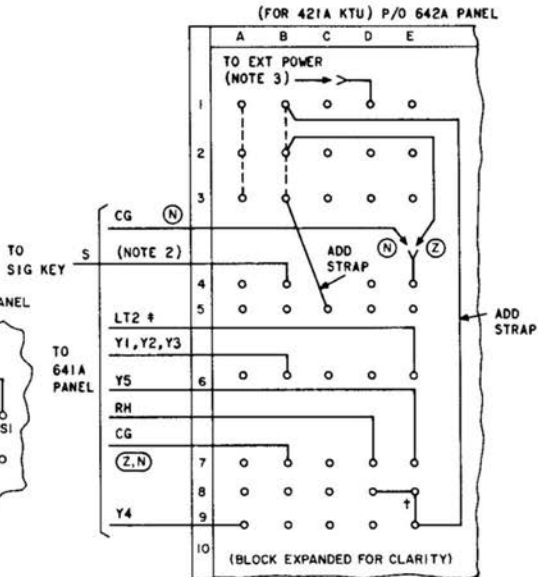


Fig. 38—Direct Station Selection Option (421A KTU in 642A Modular Panel) for Basic or Deluxe Dial Intercom (Sheet 1 of 2)

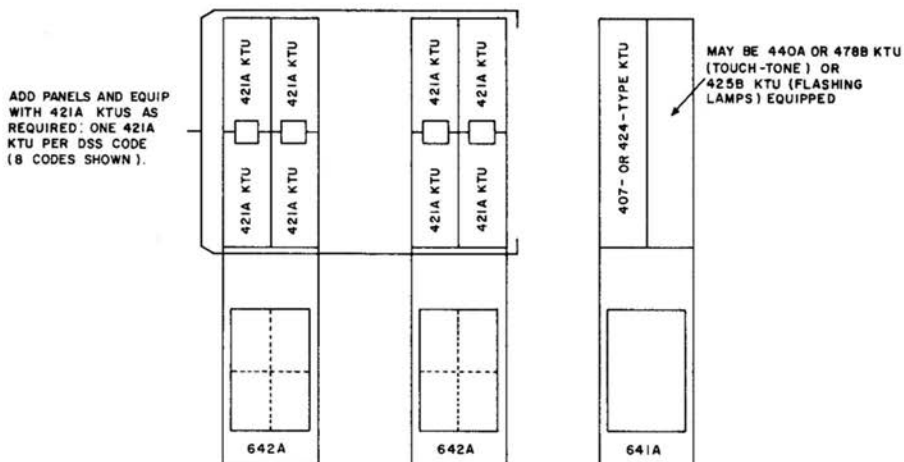
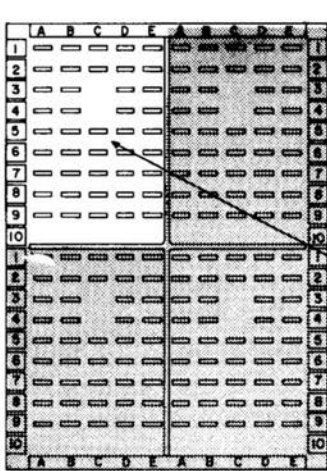


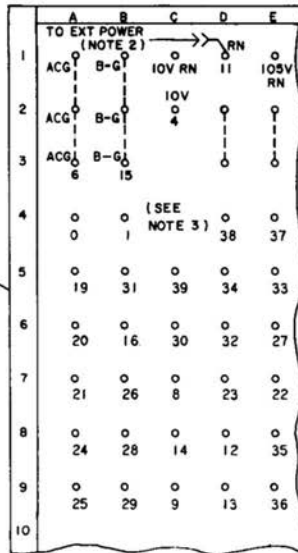
Fig. 38—Direct Station Selection Option (421A KTU in 642A Modular Panel) for Basic or Deluxe Dial Intercom (Sheet 2 of 2)







(NOTES 1 AND 2)



## NOTES:

1. TERMINAL FIELD IS DIVIDED INTO QUADRANTS. TYPICAL QUADRANT (1A) SHOWN HERE AND IN FOLLOWING 642A MODULAR PANEL CORRECTION FIGURES.
2. FOR 18V AC, 24V DC, GROUND OR AS REQUIRED FOR SIGNALING PURPOSES OTHER THAN PROVIDED (EXTERNAL POWER SOURCE MAY BE REQUIRED).
3. TERMINAL NUMBERS RELATE TO PINS ON 914B CONNECTOR.

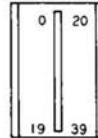
914B CONNECTOR  
PIN NUMBERING

Fig. 39—Terminal Field Illustration and Terminal Designations for 642A Modular Panel (Miscellaneous Services)

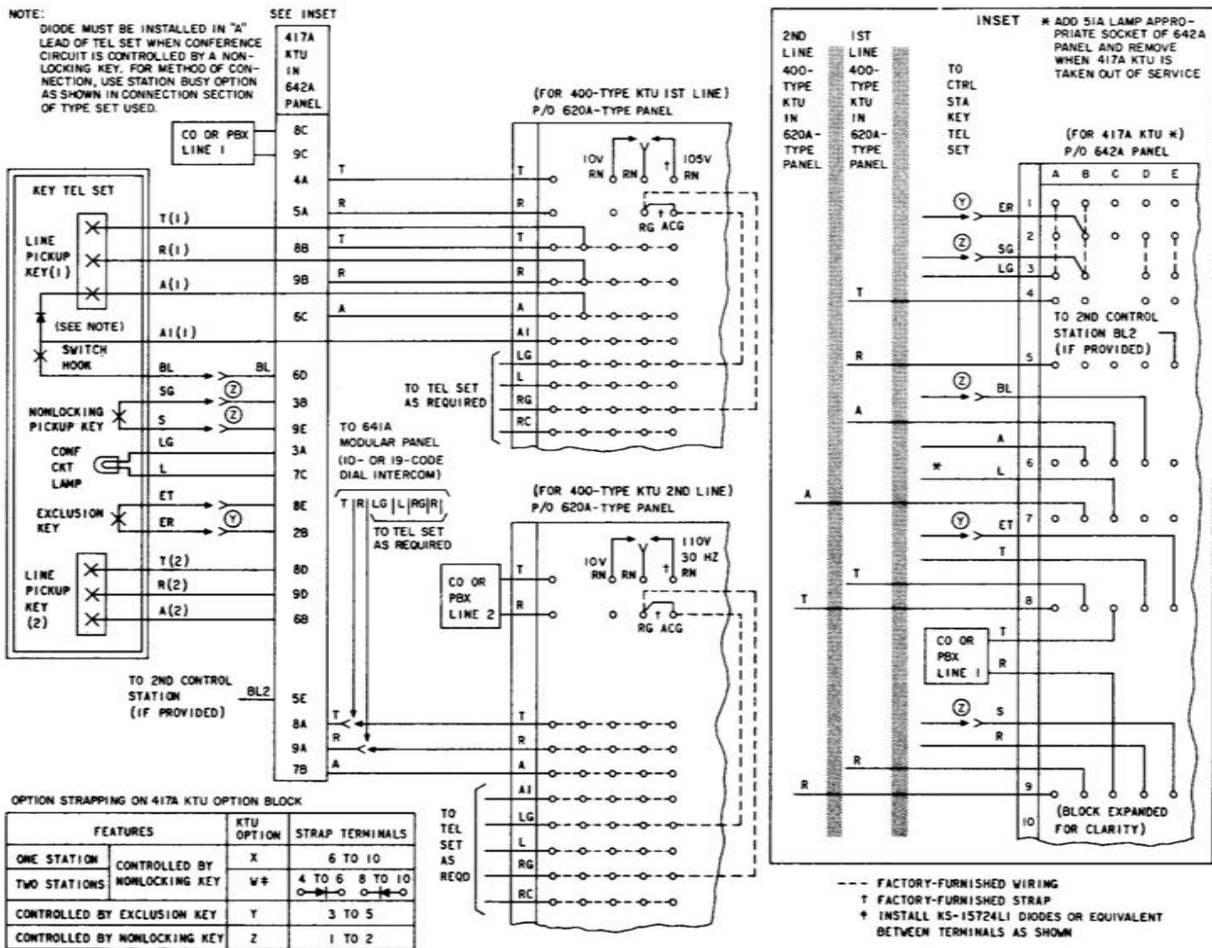
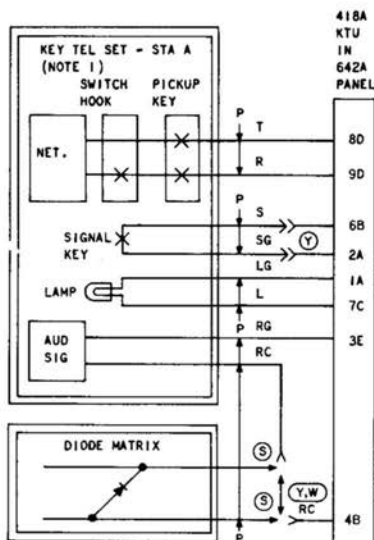


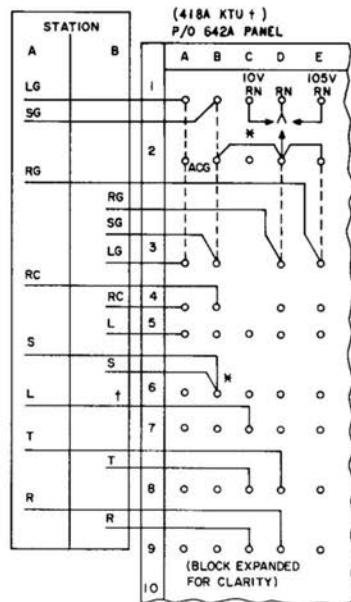
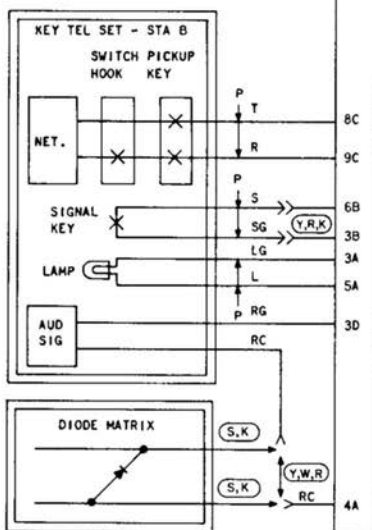
Fig. 40—417A KTU Connections (Add-On Conference Circuit) in 642A Modular Panel

## L. 417A KTU—Add-On Conference Circuit (Fig. 40)

| STEP | ACTION   | VERIFICATION                |
|------|--|-----------------------------|
| 1    | (Z option in place.)<br>Apply S and SG (A and A1) short. | Panel lamp lights steadily. |
| 2    | Remove S and SG short.                                   | Panel lamp extinguished.    |
|      |  | (END TEST)                  |



† ADD S1 LAMP IN APPROPRIATE SOCKET OF 642A PANEL AND REMOVE WHEN 418 KTU IS TAKEN OUT OF SERVICE.



## NOTES:

- FACTORY FURNISHED WIRING
1. STATION "A" IS ALWAYS ASSIGNED AS THE AUTOMATIC SIGNALING STATION WHENEVER THE ONE-WAY AUTOMATIC, ONE-WAY MANUAL SIGNALING OPTION IS USED.
  2. THESE OPTIONS APPLY TO THE SIGNAL KEY AND AUDIBLE SIGNAL AT STA "B" ONLY. THE AUDIBLE SIGNAL AT STA "A" IS UNDER CONTROL OF RELAY "S". THE AUDIBLE SIGNAL AT STA "A" MAY BE PART OF A COMMON AUDIBLE ARRANGEMENT PROVIDED THE DIODE MATRIX IS USED FOR CONTROL.
  3. THE AUDIBLE SIGNALS AT STA "A" AND "B" MAY BE PART OF A COMM AUD ARRANGEMENT PROVIDED THE DIODE MATRIX IS USED FOR CONTROL.
- \* USE CONTINUOUS METHOD OF STRAPPING, WHEN REQUIRED.

## OPTION STRAPPING ON 418A KTU OPTION BLOCK

|                   |                                   | FEATURES                | OPTION                       | STRAP TERMINAL         |               |
|-------------------|-----------------------------------|-------------------------|------------------------------|------------------------|---------------|
| AUDIBLE SIGNALS   | TWO-WAY AUTOMATIC                 | INTERRUPTED             | WITHOUT DIODE MATRIX CONTROL | W                      | 2 TO 3 TO 4 * |
|                   |                                   |                         | WITH DIODE MATRIX CONTROL    | S                      |               |
|                   | ONE-WAY AUTOMATIC                 |                         | WITHOUT DIODE MATRIX CONTROL | R                      | 3 TO 4        |
|                   | ONE-WAY MANUAL (NOTE 2)           |                         | WITH DIODE MATRIX CONTROL    | K                      |               |
|                   |                                   | TWO-WAY MANUAL (NOTE 3) | Y                            |                        |               |
| AUDIBLE RING-BACK | TWO-WAY AUTOMATIC                 |                         | Q                            | 9 TO 10, 5 TO 7 TO 8 * |               |
|                   | ONE-WAY AUTOMATIC, ONE-WAY MANUAL |                         | H                            | 5 TO 7, 9 TO 10        |               |
|                   | TWO-WAY MANUAL                    |                         | M                            | 9 TO 10                |               |

Fig. 41—418A KTU Connections (Short Range, DC Signaling Private Line) in 642A Modular Panel

**M. 418A KTU—Short Range, DC Signaling Private  
Line (Fig. 41)**

| STEP | ACTION   | VERIFICATION   |
|------|--|--|
| 1    | Place ringer across RG2 and RC2 (STA B) terminals.                               |  |
| 2    | Place 1013A or equivalent, test set (MONITOR) across T and R (STA A).            |  |
| 3    | Put test key in TALK position.   | Sidetone heard;<br>Panel lamp (STA A) lights steadily.<br>Ringer (STA B) sounds (interrupted). |
| 4    | Apply S and SG/A (A and A1) short (STA A).                                       | Ringer (STA B) sounds (steady).  |
| 5    | Remove S and SG short (STA A).   | Ringer (STA B) sounds (interrupted).   |
| 6    | Put test set in MONITOR position.  | Sidetone lost;<br>Panel lamp (STA A) extinguished.<br>Ringer (STA B) silenced.                 |
| 7    | Move ringer from RG2 and RC2 (STA B) terminals to RG1 and RC1 (STA A) terminals. |  |
| 8    | Move test from T and R (STA A) terminals to T and R (STA B).                     |  |
| 9    | Put test key in TALK position.   | Sidetone heard.<br>Ringer (STA A) sounds (interrupted).<br>Panel lamp (STA A) flashes.         |
| 10   | Apply S and SG (A and A1) short (STA B).   | Ringer (STA A) sounds (steady).  |
| 11   | Remove S and SG short (STA B).   | Ringer (STA A) sounds (interrupted).<br>Panel lamp (STA A) flashes.                            |
| 12   | Apply T and R (STA A) short.   | Ringer (STA A) silenced.<br>Panel lamp (STA A) lights steadily.                                |
| 13   | Put test key in MONITOR position.  | Sidetone lost.   |
| 14   | Remove test set from T and R (STA B) terminals.                                  |  |
| 15   | Remove ringer from RG1 and RC1 terminals.  | (END TEST)   |

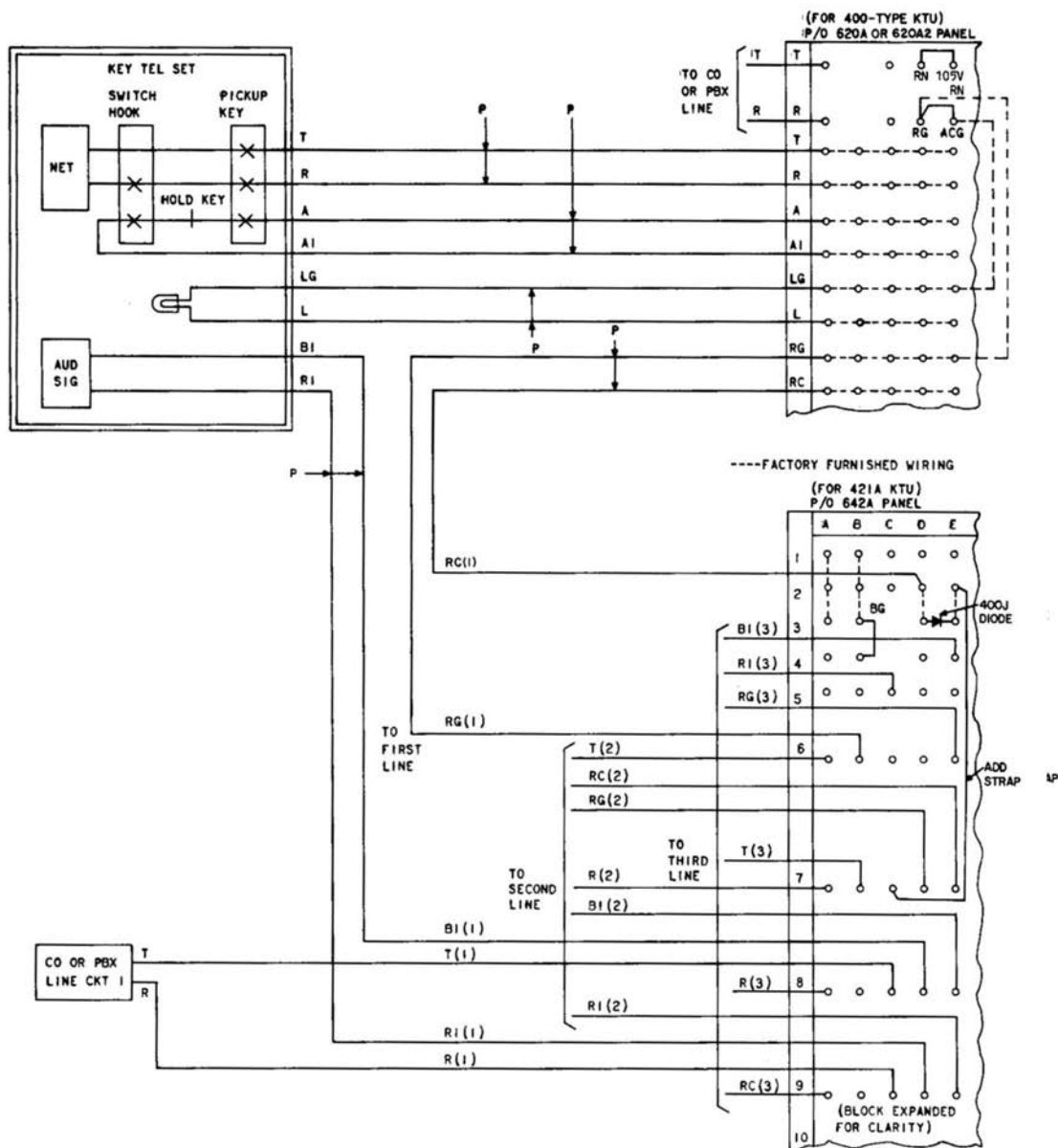


Fig. 42—421A KTU Connections (Power Failure Transfer) in 642A Modular Panel

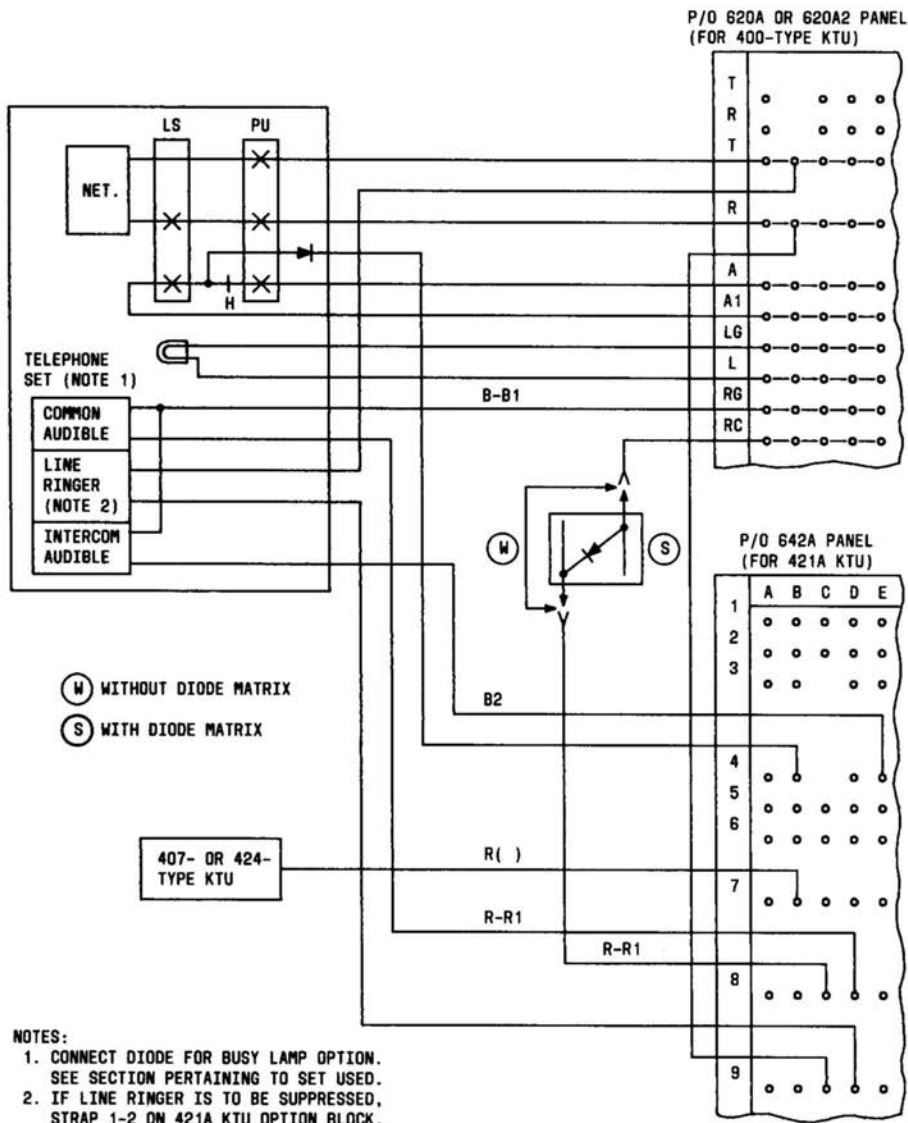


Fig. 43—421A KTU Connections (Audible Signal Suppression) in 642A Modular Panel

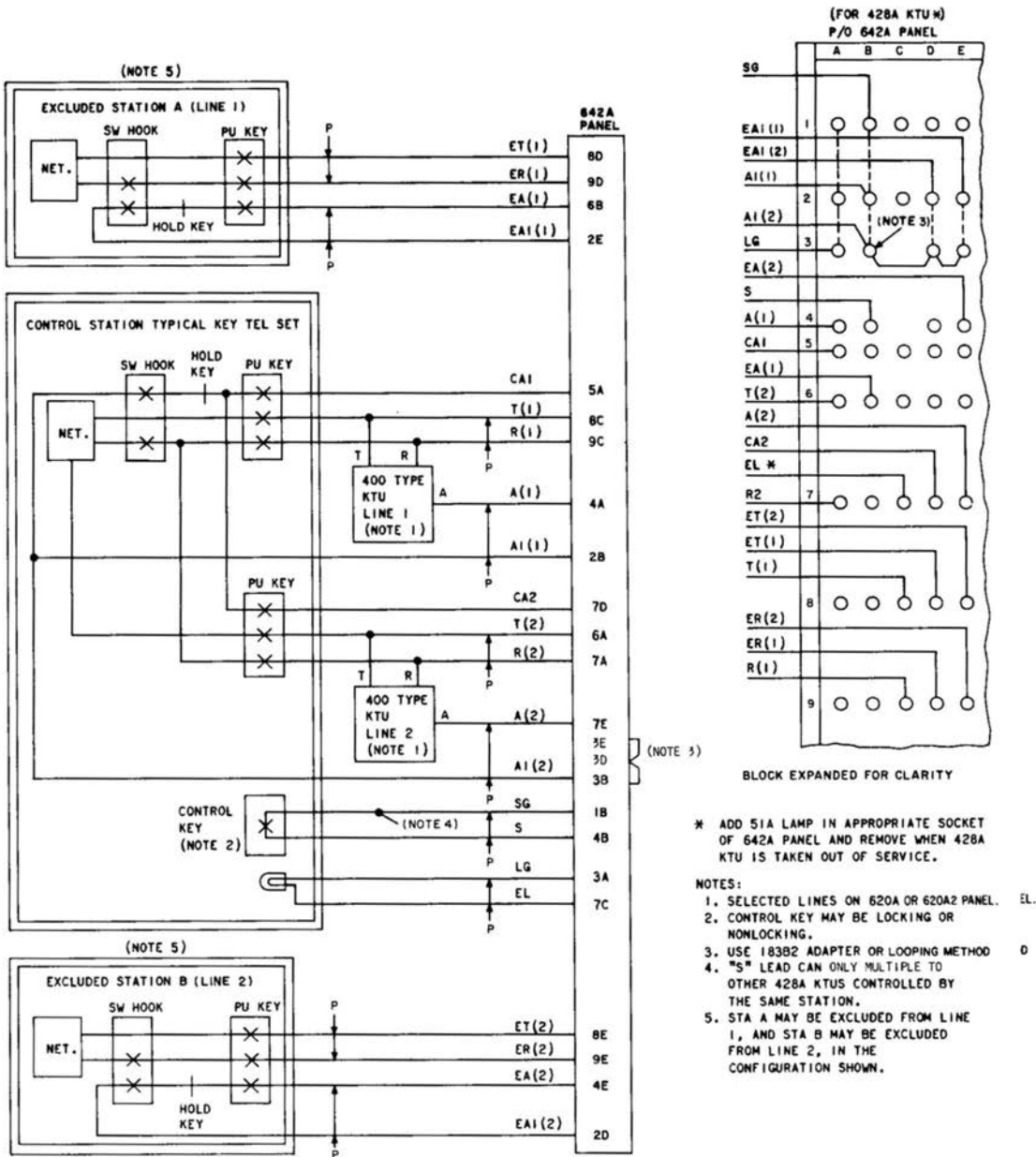


Fig. 44—428A KTU Connections (Multiline Exclusion) in 642A Modular Panel



## NOTES:

- FOR I HOLD, THE A AND L LEADS FROM THE TEL SET SELECTED FOR I HOLD CONNECT THROUGH THE 429B KTU TO THE 400D KTU. THE A AND L LEADS FROM THE OTHER TEL SETS CONN DIRECTLY TO THE 400D KTU.
- FOR PRIORITY HOLD, THE A AND L LEADS FROM EACH TEL SET CONNECT THROUGH THE 429B KTU TO THE 400-TYPE KTU.
- THE 429B KTU WILL PROVIDE SUPPLEMENTARY HOLD FOR TWO CO OR PBX LINE CIRCUITS. EACH HOLD CKT MAY BE ASSIGNED AS PRIORITY OR I HOLD.
- LIMITATIONS OF THE 430A KTU ARE AS FOLLOWS:
  - FL1 OR FL2 LEAD CAN SERVE A MAXIMUM OF 50 LAMPS.
  - SP LEAD CAN CONN TO A MAXIMUM OF 20 STATIONS.

\* - TO MESSAGE REGISTER IF PROVIDED

† - I HOLD

‡ - PRIORITY HOLD

§ - MAY REQUIRE CONTINUOUS STRAPPING METHOD

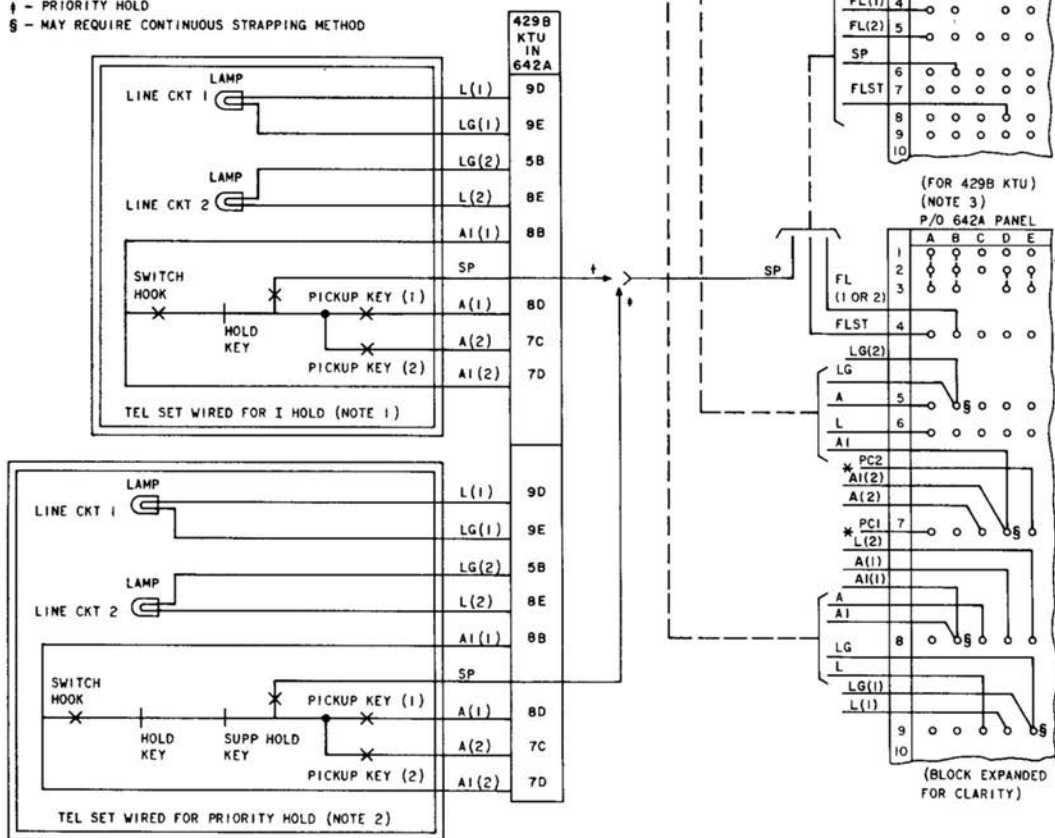


Fig. 45—429B KTU Connections (Supplementary Hold Detector) and 430A KTU (Flutter Generator) in 642A Modular Panel

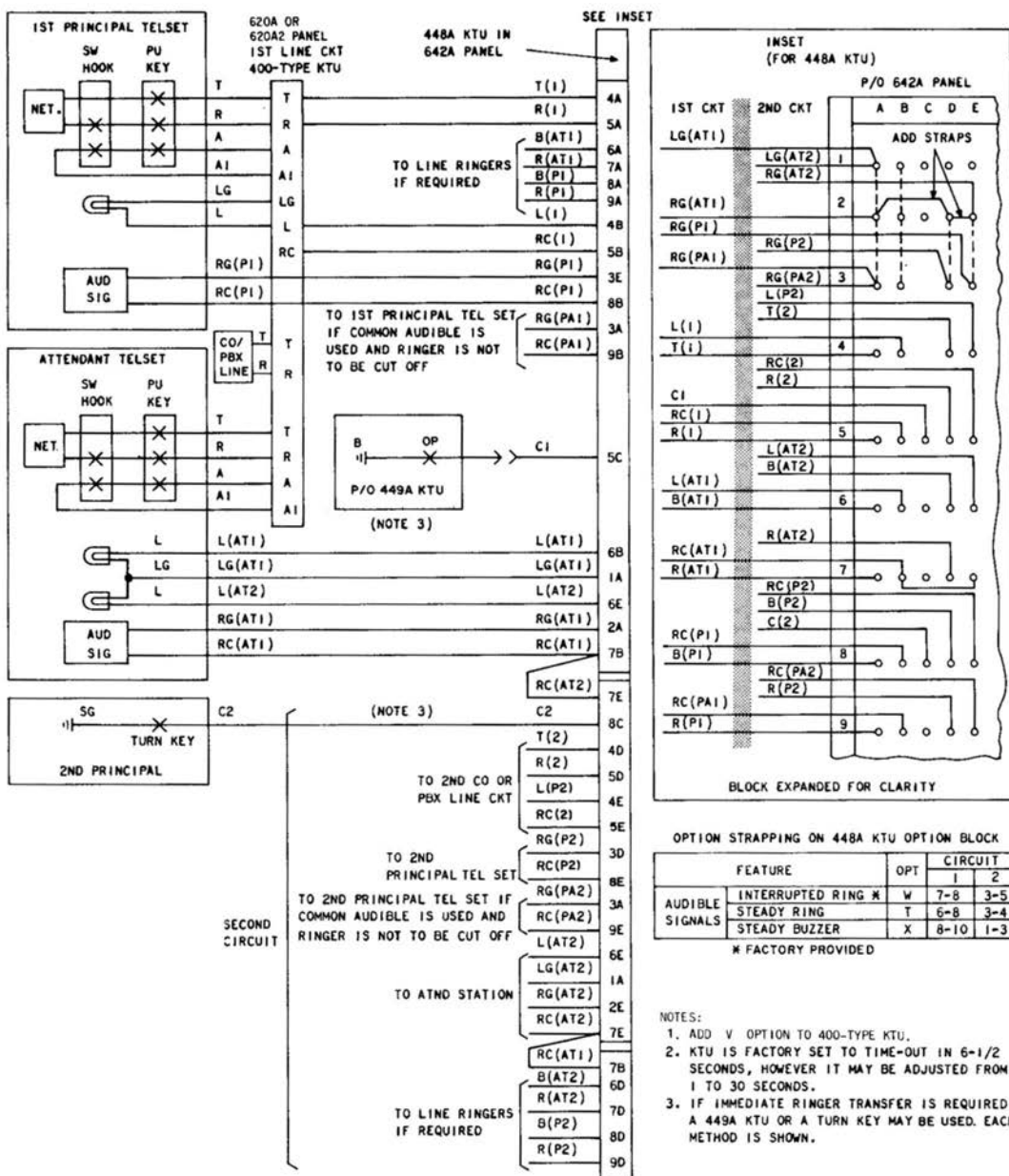


Fig. 46—448A KTU Connections (Variable Delay Timer) in 642A Modular Panel

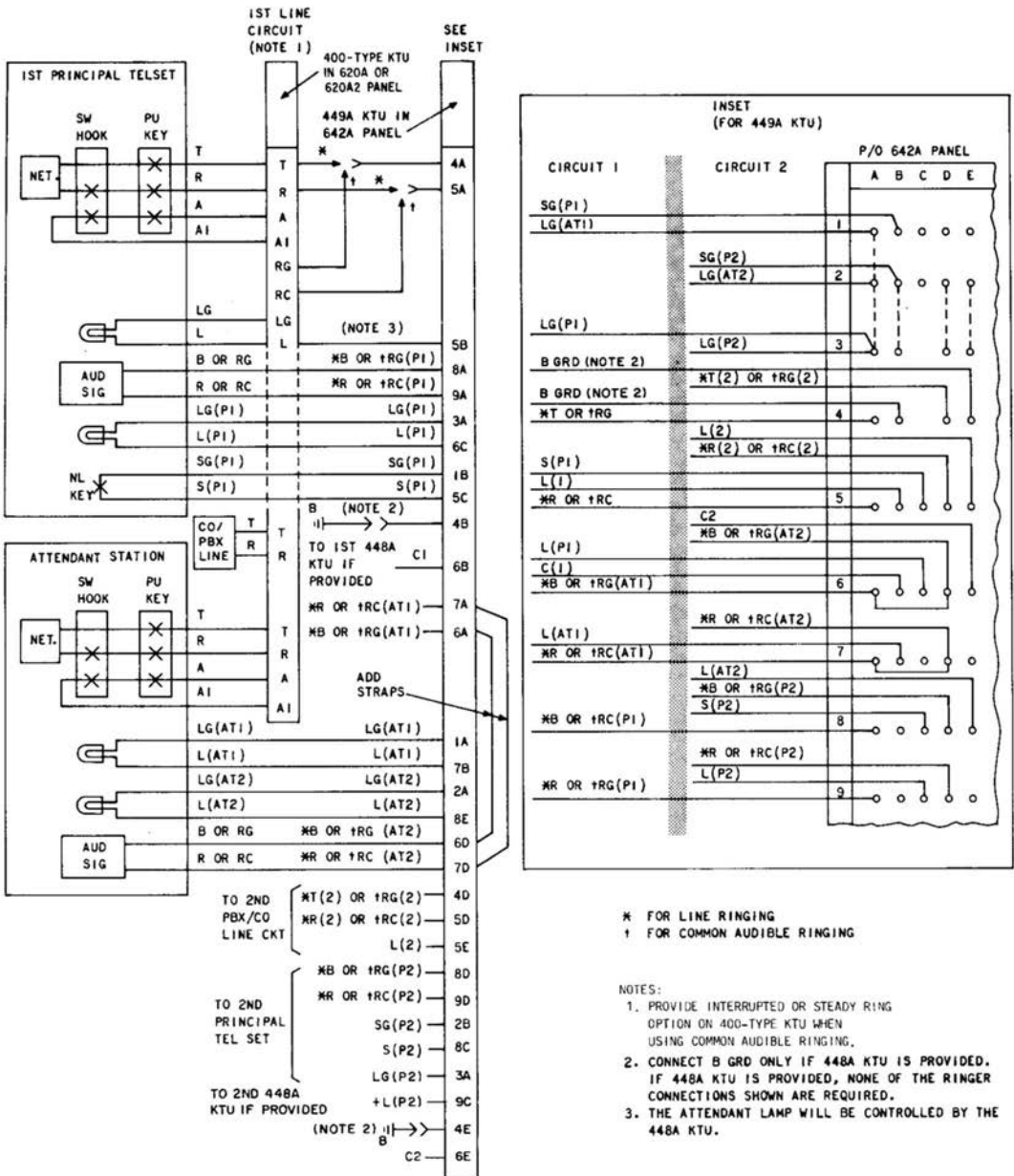


Fig. 47—449A KTU Connections (Immediate Transfer Control) in 642A Modular Panel

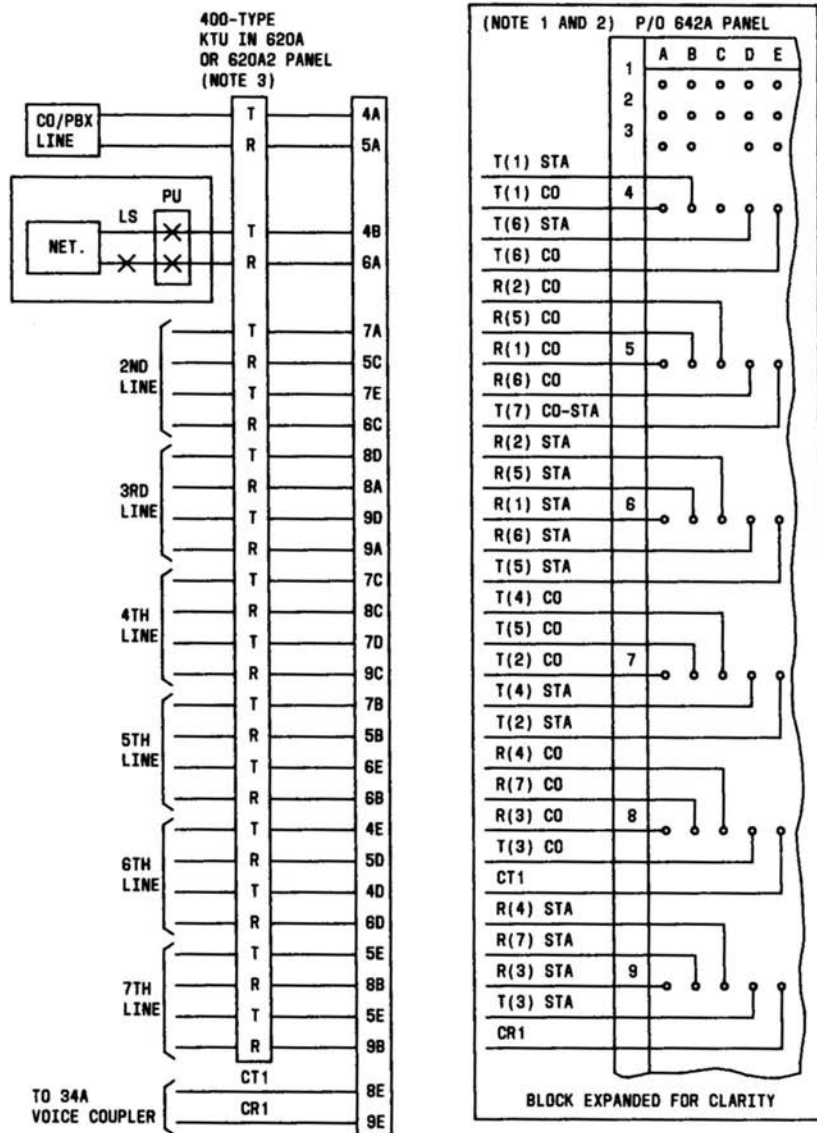


Fig. 48—451B KTU Connections (Music-On-Hold) in 642A Modular Panel

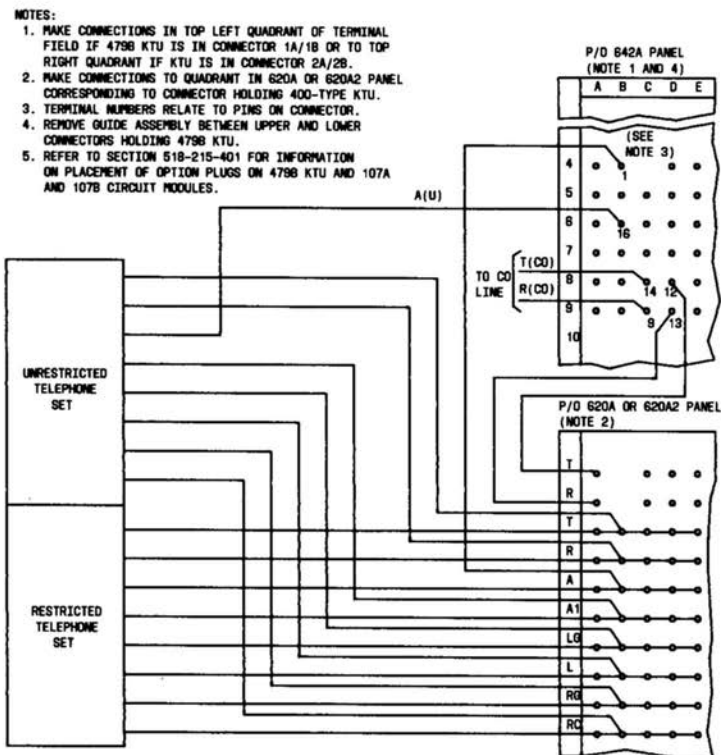
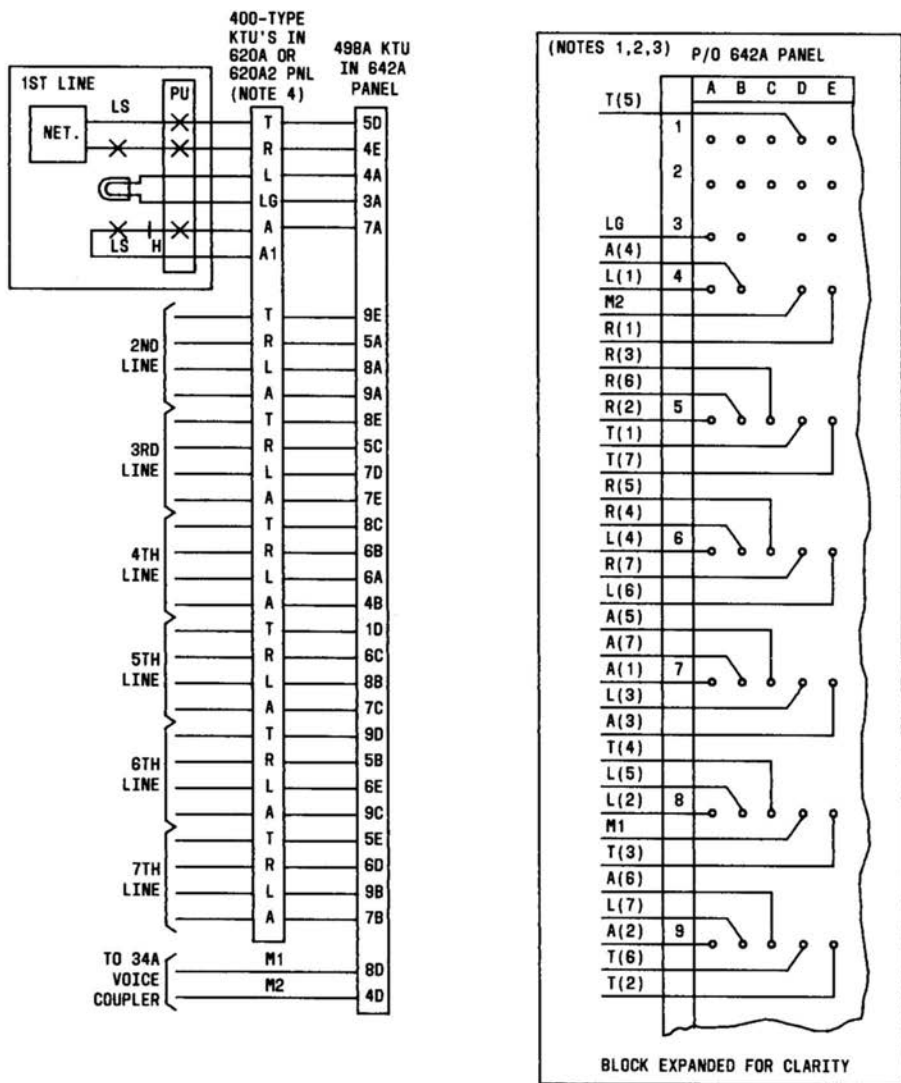


Fig. 49—479-Type KTU Connections (Rotary Dial Toll Restrictions) in 642A Modular Panel



## NOTES:

1. EACH 498A KTU CONTAINS FOUR CIRCUITS. TO INCREASE CAPACITY TO SEVEN, ADD 116A1 CM.
2. DO NOT CONNECT ANY SIGNAL VOLTAGE TO TERMINAL 1D OF QUADRANT CONTAINING 498A KTU.
3. DO NOT INSTALL STATUS LAMP FOR JACK CONTAINING 498A KTU.
4. USE A 400D, G, OR H KTU.

Fig. 50—498A KTU Connections (Music-On-Hold) in 642A Modular Panel

**N. 451B or 498A KTU—Music-On-Hold Circuit (Fig. 48 or 50)**

| <b>STEP</b> | <b>ACTION</b>                                       | <b>VERIFICATION</b>                    |
|-------------|---|--|
| 1           | Place a call to a CO/PBX line having music-on-hold. |  |
| 2           | After answering, place line on hold.                | Calling party hears music in receiver. |
| 3           | Depress winking CO/PBX line button.                 | Music ceases.                          |
|             |   | (END TEST)                             |

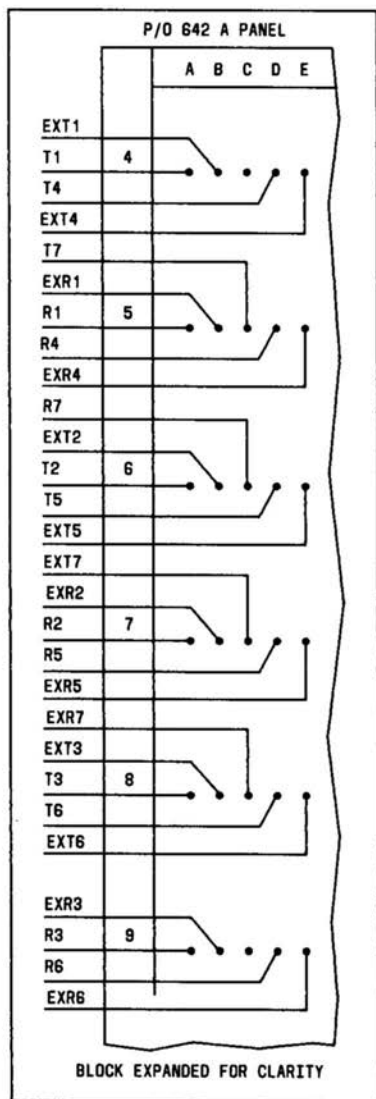
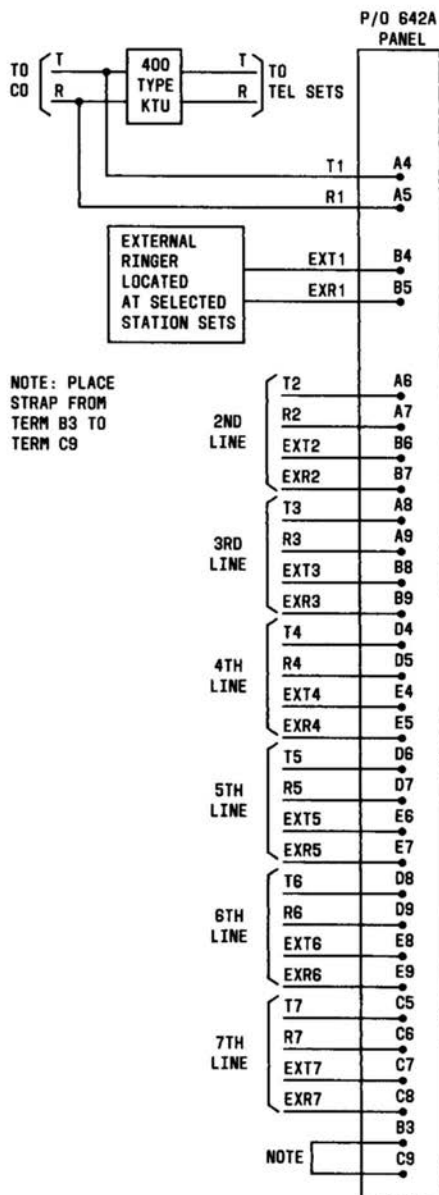
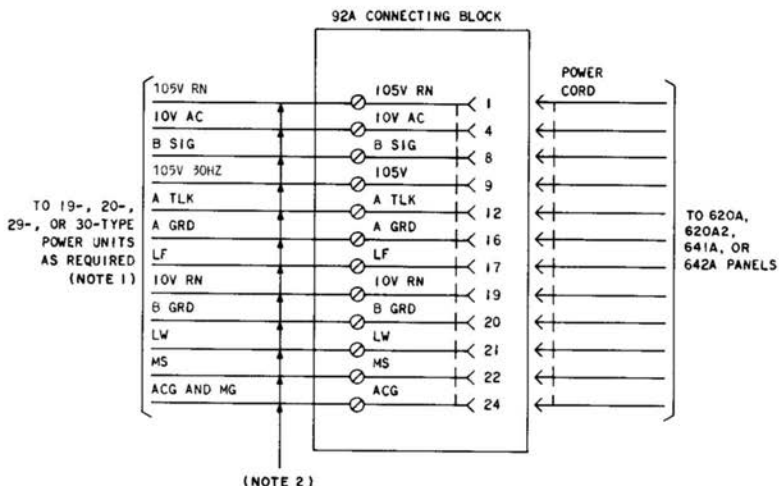


Fig. 51—452A KTU Connections (Power Failure Ringing Circuit) in 642A Modular Panel



O. 452A KTU—Power Failure Ringing Circuit  
(Fig. 51)

| STEP  | ACTION   | VERIFICATION                       |
|---|--|------------------------------------|
| 1   | Place a call to a CO/PBX line having a power failure ringer connected to it. |                                    |
| 2   | Remove power supply 110-volt ac plug from commercial power outlet.           | Power failure ringer will operate. |
| <p><b>Caution: Do not remove 110-volt ac commercial plug if other calls are being processed in the KTS.</b></p> |  |                                    |
| 3   | Reinsert 110-volt ac plug from power supply into commercial outlet.          | (END TEST)¶                        |



## NOTES:

1. INTERRUPTED VOLTAGES, WHEN REQUIRED MUST BE SUPPLIED THROUGH AN INTERRUPTER.
2. REFER TO 3.09 (12) FOR WIRING REQUIREMENTS.

Fig. 52—19-, 20-, 29-, or 30-Type Power Unit Connections Using 92A Connecting Block

TABLE I

## WIRING BETWEEN 92A CONNECTING BLOCK AND POWER UNIT

| LEAD DESIGNATION | D INSIDE WIRING CABLE | 451M OR 457M CABLE |
|------------------|-----------------------|--------------------|
| A TALK           | (W-BL) (BL-W)         | (BL)               |
| A GRD            | (W-O) (O-W)           | (BL-R)             |
| B SIG            | (W-G) (G-W)           | (O)                |
| B GRD            | (W-BR) (BR-W)         | (O-R)              |
| 10V AC           | (W-S) (S-W)           | (G)                |
| ACG and MG       | (R-BL) (BL-R)         | (G-R)              |
| LF               | (R-O) (O-R)           | (BR)               |
| LW               | (R-G) (G-R)           | (BR-R)             |
| 105V RN          | (R-BR) (BR-R)         | (S)                |
| 10V RN           | (R-S) (S-R)           | (S-R)              |
| 105V 30 Hz       | (BK-BL) (BL-BK)       | (BL-W)             |
| MS               | (BK-O) (O-BK)         | (BL-W-R)           |