

## REFERENCE

### 1A1 KEY TELEPHONE SYSTEM

### IDENTIFICATION AND ARRANGEMENTS

#### 1. GENERAL

**1.01** This section covers identification of various components of the 1A1 Key Telephone System (KTS) and provides service feature arrangements in the form of block diagrams. Refer to Section 518-114-425 entitled Service, 1A1 Key Telephone Units, for connections for arrangements covered in this section.

**1.02** This section is reissued to add information on the 1A2 KTS features and station features adaptable for use with the 1A1 KTS.

#### 2. IDENTIFICATION

**2.01** The main components of a 1A1 KTS are key telephone sets and/or nonkey telephone sets (with separately mounted keys) used in conjunction with the appropriate key telephone units. The complete system also includes power supplies, cabling, distribution terminals, adapters, fasteners, and mounting facilities such as apparatus mountings or equipment cabinets.

**2.02** The 1A1 KTS provides the following station switching service features:

- Holding on central office or PBX lines
- Visual and audible line signals
- Intercom
- Conferencing on two PBX lines
- Cutoff, exclusion, and selective privacy
- Private lines.

**2.03** The 1A1 system line circuit requires an **A** lead between station and line equipment for

control. A station ground (**A1** lead) must be furnished per station to control the line circuit **A** relay (via **A** lead) through the station switchhook and pickup key contacts. Local power must be furnished since there are no supervisory relays connected in series with the central office or PBX line to control a hold condition.

**2.04** Incoming signals are indicated audibly and/or visually. They may be steady or intermittent in operation. When a call is answered, relay operation silences the audible signal and changes the flashing line lamp, if provided, to a steady busy lamp. A common time-out feature is provided which releases locked-in relays and extinguishes incoming signal indication if the call is not answered within approximately 30 seconds and if no other line in the system is busy. The overall time-out interval varies from an extremely short (or no) interval up to 30 seconds, depending on whether the thermal control element has had sufficient time to cool following its last operation.

**2.05** Key telephone units are individual circuit packages which provide switching and control functions and are arranged for panel mounting in standard equipment cabinets or apparatus mountings (Fig. 1 and 2).

**2.06** Table A lists the 1A1-type KTUs and the features they provide. Table B lists the adaptable 1A2 KTU features and station features for use with the 1A1 KTS.

#### 1A1 KTS OPERATING FEATURES

##### A. Hold

**2.07** Permits holding of a central office or PBX line while using another line at the station. Hold circuit characteristics are explained as follows: Depressing the hold key opens the line circuit **A**

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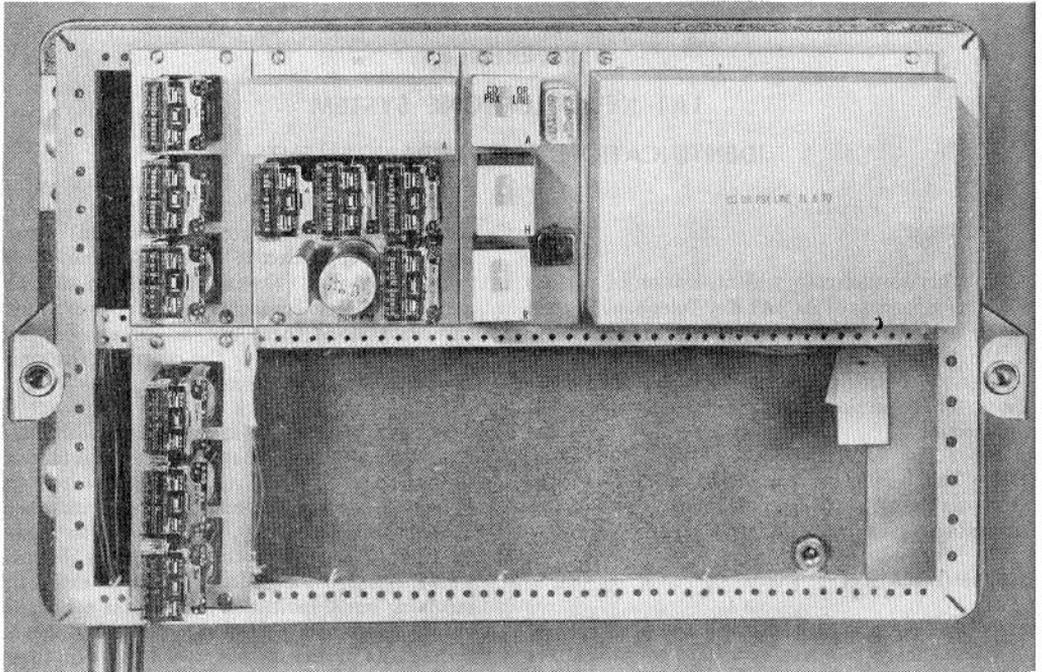


Fig. 1—1A1-Type Key Telephone Unit Mounted in a 16A Apparatus Mounting

lead causing **A** relay to release. **H** relay operates on the momentary station short, then holds on line current.

#### B. Audible and Visual Signals

##### Audible Signals

**2.08** The ringer may be connected to an individual line or wired as a common ringer for a group of lines. A bell or buzzer may be used as the audible signal for one or more groups of stations.

**2.09** Use of a 1A1 diode matrix block can provide flexibility in associating several key telephone system lines with one or more common audible signals. Matrix units consist of two electrical groupings—lines and ringers. Small clip-type mounting terminals are furnished in multiple combinations on the face of the unit. Pigtailed diodes (446F) are hand-inserted by the installer at appropriate electrical crosspoints to associate any line(s) with any ringer(s) connected through the unit. See Section 461-620-100 entitled Matrix

Block—1A1, Identification, Installation, Wiring, and Maintenance.

##### Visual Signals

**2.10** Visual signals are furnished as illuminated buttons in multiline telephone sets and separately mounted keys or in separate lamp indicators as follows:

- Flashing lamp, locked-in or nonlocked-in line lamp, signifying an incoming call
- Steady lamp indicating line busy or, in some cases, hold
- Winking signal-line on hold.

#### C. Make-Busy and Key Circuit

**2.11** This arrangement is not usually considered to be fundamental to key telephone system service. It provides a means for busying out a CO or PBX line (or a group of lines) to incoming

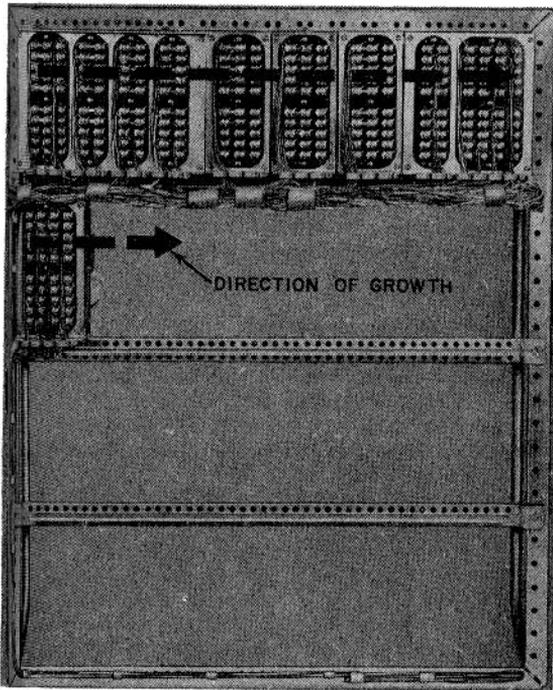


Fig. 2—Rear View of 1A1-Type Key Telephone Unit Mounted in a 26A Apparatus Mounting

off-hour traffic. Outgoing traffic is not affected. It connects to central office or PBX circuits which provide the make-busy feature. A separate control pair is required for each line or group of lines to be made busy.

#### D. Intercom

##### Manual Intercom

2.12 This intercom feature enables two or more stations to be connected to a common talking line, usually on the same premises. A person may communicate with other persons at one or more stations connected in the system without the use of a central office or PBX line.

2.13 The intercom line may be provided with a line and busy lamp and associated key telephone units. In addition to controlling these signals, it may also control the time-out feature.

2.14 Pushbutton and buzzer signaling devices are generally associated with the talking line

among stations. The signaling buttons may be part of the key telephone set or may be externally mounted 1-, 4-, 8-, or 12-key button assemblies, or combinations of these keys. The buzzer may be mounted either externally or within the set.

##### Automatic Intercom

2.15 This intercom circuit is arranged to signal automatically from one station to the other by going off-hook and to signal manually in the other direction. This is referred to as a **1-way automatic intercom line**. When the same type line is arranged to signal automatically from either end, it is referred to as a **2-way automatic intercom line**.

#### E. Conferencing

2.16 Two PBX lines may be bridged for conferencing purposes under control of an exclusion key or nonlocking key at a key station. This can be accomplished without returning the handset on-hook and without the assistance of an operator. When the station is equipped with a speakerphone feature, a nonlocking key arrangement should be used to control the bridging circuit.

#### F. Cutoff and Exclusion

##### Manual Cutoff and Exclusion

2.17 The cutoff and exclusion features are similar and differ only in the manner in which they are provided. Both of these features are controlled by the operation of a mechanical device as follows:

(a) **Cutoff:** The turnbutton key must be operated manually to disconnect or to reconnect various arrangements such as an extension ringer.

(b) **Exclusion:** The exclusion key is part of the switchhook assembly; it is operated manually by pulling the plunger up, and restored automatically when the handset is replaced on-hook. This circuit excludes extensions or other stations having access to the same line.

##### Automatic Cutoff and Exclusion

2.18 The circuit functions of automatic cutoff and exclusion are based on the station supervisory relay operation.

(a) **Cutoff:** Optional arrangements can be provided to cut off stations from the line as follows:

- (1) Station can cut off others but cannot be cut off.
- (2) Station can cut off others and can be cut off, except during a call.
- (3) Station or groups of stations cannot cut off others but can be cut off, except during a call.
- (4) Station or groups of stations cannot cut off others but can be cut off at any time.

(b) **Exclusion:** A main station may be arranged to exclude automatically one or more secondary stations regardless of whether or not the stations are in use.

#### G. Private Lines

**2.19** A private line is a metallic circuit between two stations which may or may not be on the same premises. It is used when two customers desire direct communication with each other without the need for routing the call through a central office or PBX switch train. The kind of private line service provided is determined by the type of terminating equipment used.

**2.20** A private line, arranged so that either end can be manually signaled by the other, is referred to as a **ringdown private line**.

**2.21** A private line, arranged for signaling automatically from either end when the handset is lifted, is referred to as an **automatic tie line**.

**2.22** A private line, arranged for signaling in one direction automatically and in the other manually, is referred to as a **station line circuit**. This circuit differs from the ringdown private line in that the station end requires no line circuit or other additional equipment.

#### 1A2 KTS FEATURES AND STATION FEATURES

##### A. Music-On-Hold

**2.23** This feature transmits music from a customer-provided music source to calling parties on CO or PBX lines that are placed on hold.

##### B. Audible Signal Suppression

**2.24** This feature provides a circuit arrangement to suppress audible alerting signals on a line or lines associated with a multibutton telephone set when that station is in an off-hook condition.

##### C. Power Failure Transfer

**2.25** When local commercial power supplying the KTS fails, local ringing on CO lines cannot continue. The power failure transfer feature automatically transfers the CO ringing current to selected station ringers. This allows calls to be answered on a limited basis during commercial power failures.

##### D. Battery Reversal Toll Restriction

**2.26** This feature disallows toll calls from restricted stations but allows toll calls from unrestricted stations. This feature can only be used with CO circuits that provide a polarity reversal on the tip and ring of the line on toll calls.

##### E. Rotary Dial Toll Restriction

**2.27** This feature provides toll restriction on rotary dial lines where CO toll diversion is not available. This rotary dial restriction circuit may be optionally provided with piggyback circuit modules to provide digit absorption or to allow restricted stations to call foreign number plan areas. It may be used for either loop-start or ground-start operation, with ground-start providing the most security against nonallowed calls being placed.

##### F. Message Waiting (MW) and/or Station Busy (SB) Consoles

**2.28** The 6B1 selector console is an 18-station MW console with SB lamps incorporated in the MW buttons.

**2.29** The 7B1 selector console is a 34-station MW console with SB lamps incorporated in the MW buttons.

#### **G. Hands-Free Answering on Intercom (HFAI)**

**2.30** Each station to be equipped with HFAI must have a 2A transmitter-receiver installed as an adjunct to its regular intercom service. This allows the station to be signaled by a 1/2-second tone burst through the speaker in its adjunct, turns on a mike-on LED (light emitting diode), and allows called party to answer without depressing any buttons. Called party has the option of using the DO NOT DISTURB (DND) button or MIKE-OFF button and the overriding adjunct operation by pushing INTERCOM button on key set and going off-hook; this cancels HFAI feature.

#### **H. Voice Signaling on Manual Intercom**

**2.31** This feature replaces buzzer with 107B loudspeaker where voice signaling on manual intercom is preferred.⚡

### **3. ARRANGEMENTS**

**3.01** A 1A1 KTS can provide all or some of the operating features listed in Part 2.

**3.02** The type and size of a key telephone system arrangement is dependent upon the following:

- Immediate needs of the customer

- Future requirements of the customer
- Number and type of key telephone units required to provide the desired features
- Adequate mounting facility for the key telephone units
- Available space for mounting the associated apparatus (cabinets, relay racks, power plants, etc).

**Note:** All of these factors must be taken into consideration in order to provide for the orderly growth of any arrangement.

**3.03** Where feasible, consideration should be given to centralizing the arrangements. A system should be arranged to permit maximum flexibility.

**3.04** Various system arrangements are shown as block diagrams in Fig. 3 through 13. These block diagrams depict the key telephone units required to provide the services listed for that particular arrangement. Refer to Table A for the quantity of key telephone units required.

**3.05** Refer to Section 518-114-425 for connection information for the arrangements shown in Fig. 3 through 13.

**TABLE A**  
**PANEL MOUNTED KTUS — PRINCIPALLY USED FOR 1A1 KEY TELEPHONE SYSTEMS**

| ORDERING GUIDE | FEATURE OR OPTION  | QUANTITY                                | PANEL WIDTH  |                   |    |
|----------------|--|---|--|-------------------|----|
|                |  |   | INCHES   | 7/16-INCH CENTERS |    |
| 201C           | Fuse-mounting unit and bridging terminal   | 1 per 7 fuses                           | 2-5/32   | 5                 |    |
| 202A*          | Central office or PBX line circuit (grounded ringing)  | 1 per line                              | 3-1/32   | 7                 |    |
| 202B*          |  |   |  |                   |    |
| 202C*          | Central office or PBX line circuit (Metallic or grounded ringing)  | 1 per line                              | 2-19/32  | 6                 |    |
| 202D           |  |   |  |                   |    |
| 203A           | Tie line circuit   | Automatic                               | 2 per line<br>(1 at originating end, 1 at terminating end) | 3-15/32           | 8  |
| 204A           |  | Ringdown                                | 3-29/32  | 9                 |    |
| 205A           | Station line circuit   | 1 per line                              | 3-29/32  | 9                 |    |
| 207A*          | Dial-selective intercom circuit  | 1 per 6A selector only system           | 5-21/32  | 13                |    |
| 207B*          |  |   | 5-7/32   | 12                |    |
| 207C           |  |   |  |                   |    |
| 208A†          | Flashing signal, intercom, and automatic cutoff control circuit  | 1 per 3 dial-selective intercom station | 3-15/32  | 8                 |    |
| 209A*          | Flashing intercom signal, time-out   | Without wink                            | 1 per 6 lines  | 4-25/32           | 11 |
|                |  | With wink                               | 1 per 5 lines  |                   |    |
| 210A†          | Wink circuit   | 1 per 5 lines                           | 2-19/32  | 6                 |    |
| 211A†          | Manual intercom, ringing lamp, noise suppression, interrupter audible signal circuit   | 1 per group of common aud sig           | 3-1/32   | 7                 |    |
| 212A*          | Three central office or PBX lines and common equipment for up to 6 lines (grounded ringing)  | As required                             | 9-5/32   | 21                |    |
| 213B           | Joint-use line circuit with holding  | 1 per line                              | 4-25/32  | 9                 |    |
| 227B           | Visual and audible signal control circuit  | As required                             | 3-1/32   | 7                 |    |
| 228A           | Blank 40-terminal apparatus unit for bridging or miscellaneous purposes  | As required                             | 3-15/32  | 8                 |    |
| 229B           | Auxiliary relay circuit  | As required                             | 3-1/32   | 7                 |    |
| 230A*          | Four central office or PBX line circuits (metallic or grounded ringing)  | 1 per 4 lines                           | 8-9/32   | 19                |    |
| 230B           |  |   |  |                   |    |
| 232A*          | Time-out and manual intercom circuit. When equipped with a KS-15900, L1 electro-mechanical interrupter, the unit provides flashing, wink, ringing, and busy-tone signal interruptions. | 1 per system                            | 3-15/32  | 8                 |    |
| 232B*          |  |   |  |                   |    |
| 232C           |  |   |  |                   |    |

TABLE A (Contd)

| ORDERING GUIDE | FEATURES OR OPTIONS  | PANEL WIDTH                          | QUANTITY |                      |
|----------------|--|--------------------------------------|----------|----------------------|
|                |  |                                      | INCHES   | CENTERS<br>7/16-INCH |
| KTU            |  |                                      |          |                      |
| 233A*          | Ten central office or PBX line circuits (metallic or grounded ringing). Circuits terminate on the back of the units in five KS-16671, L1 plugs. A-25B connector cables must be used for cabling to distributing frame or equivalent. Lamp fusing is provided on the unit.  | 1 per 10 lines                       | 23       | 49                   |
| 237B           | Bridging circuit for conferencing on 2 PBX lines.  | 1 per 2 PBX lines                    | 2-3/5    | 6                    |
| 238A           | Nine central office or PBX line circuits and common equipment. KS-15900, L1 interrupter is furnished and provides the signal interrupter features as listed for the 232B KTU. The manual intercom (BF) relay is not supplied. Time-out control circuits are furnished in three inter-strapped groups of 4-4 and 1 line(s). Straps are removable for connecting individual line groups to supplemental time-out and interrupter apparatus. Relay battery and lamp signal supplies are wired in four double plus one single circuit groupings. | 1 per 9 central office or PBX lines  | 23       | 49                   |
| 239A           | Eleven central office or PBX line circuits furnished in three inter-strapped groups of 4-4-3 lines. Each group can be associated with its own time-out and auxiliary interrupter equipment. Relay battery and lamp signal supplies are in five double plus one single circuit groupings.   | 1 per 11 central office or PBX lines | 23       | 49                   |

\* Manufacture discontinued (MD).

† Additions and maintenance only (A&M).

◆ TABLE B ◆

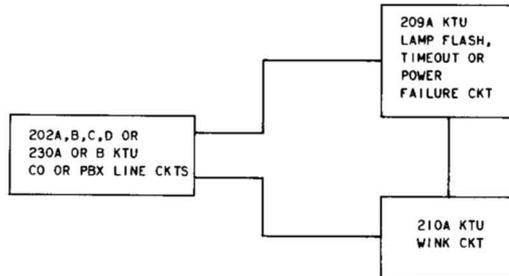
## ADAPTABLE 1A2 KTU AND STATION FEATURES FOR USE WITH 1A1 KTS

| ORDERING GUIDE              | FEATURE OR OPTION                                | QUANTITY                | SIZE (IN.) | CONTACTS       | BSP REFERENCE |
|-----------------------------|--|-------------------------|------------|----------------|---------------|
| 451B KTU                    | Music-On-Hold                                    | 1 per 7 CO or PBX lines | 4          | 40<br>(Note 1) | 518-215-401   |
| 421A KTU                    | Audible Sig Suppression                          | 1 per station           | 4          | 40<br>(Note 1) | 518-215-403   |
|                             | Power Failure Transfer                           | 1 per 3 CO or PBX lines |            |                |               |
| 471B KTU                    | Battery Reversal<br>Toll Restriction             | 1 per CO line           | 4          | 18<br>(Note 1) | 518-215-401   |
| 479B KTU*                   | Rotary Dial<br>Toll Restriction                  | 1 per CO line           | 8          | 40<br>(Note 2) | 518-215-401   |
| 6B1 Selector<br>Console     | Message Waiting and/or<br>Station Busy Indicator | 1 per 19<br>stations    |            |                | 518-010-111   |
| 7B1 Selector<br>Console     |  | 1 per 39<br>stations    |            |                |               |
| 2A Transmitter-<br>Receiver | Hands-Free Answering<br>on Intercom (HFAI)       | 1 per station           |            |                | 518-010-115   |
| 107B<br>Loudspeaker         | Voice Signaling on Manual<br>Intercom            | 1 per station           |            |                | 518-010-109   |

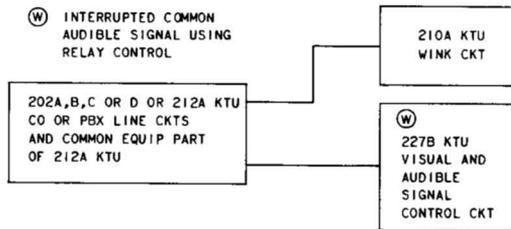
*Note 1:* The 259-type KTU may be used to mount 18- or 20-contact KTUs (4-inch). The 242A KTU may be used to mount 40-contact KTUs (4-inch).

*Note 2:* Requires a mounting facility with two 40-pin connectors in a vertical plane [642A panel (Section 518-215-419), 69D (Section 518-215-420) or 110A (Section 518-215-422) apparatus mounting.]

\* For use where CO battery reversal is not available.



**Fig. 3—Block Diagram of CO or PBX Line Circuits (202A, B, C, or D or 230A or B KTUs) With 209A and 210A KTUs for Line Pickup and Hold, Line and Busy Lamps, Metallic or Grounded Ringing, Time-Out, Power Failure, and Lamp Wink**



**Fig. 4—Block Diagram of CO or PBX Line Circuits (202A, B, C, or D and 212A KTUs) With 210A and 227B KTUs for Line Pickup and Hold, Line and Busy Lamps, Common Audible Signals, Time-Out, Lamp Wink, and Power Failure**

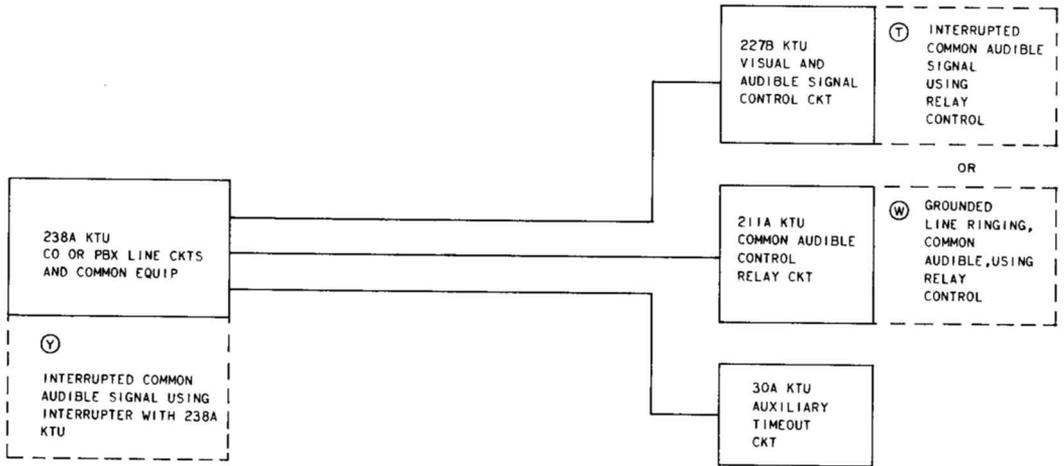


Fig. 5—Block Diagram of CO or PBX Line Circuits (238A KTU) With 30A, 211A and 227B KTUs for Line Pickup and Hold, Line and Busy Lamps, Interrupted Audible Signals, Common Audible Signals, Auxiliary Time-Out and Lamp Wink

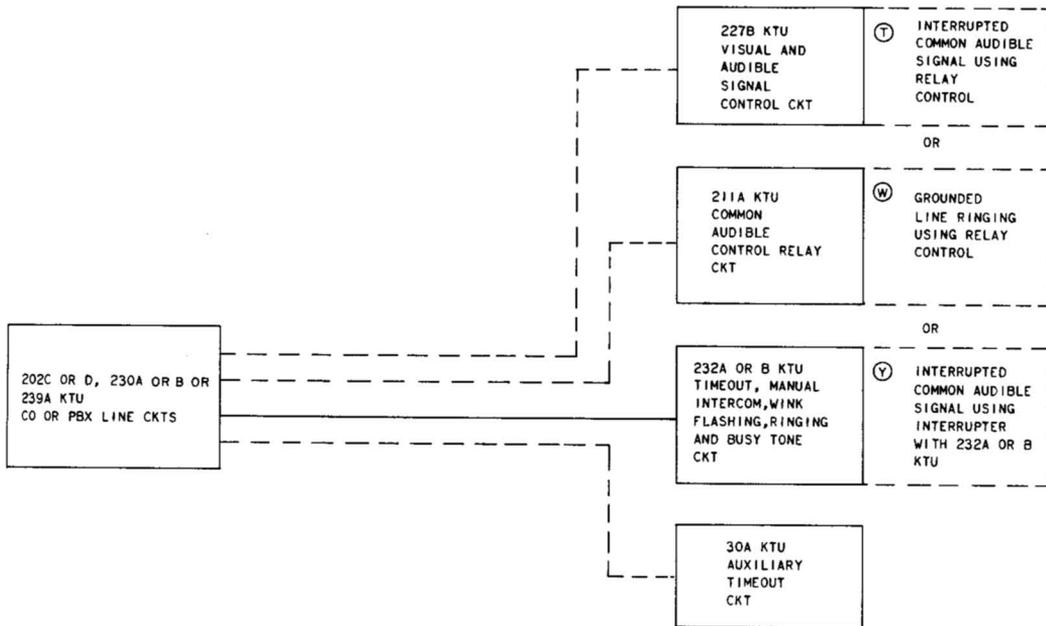


Fig. 6—Block Diagram of CO or PBX Line Circuits (202C or D, 230A or B, or 239A KTUs) With 30A, 211A, 227B and 232-Type KTUs for Line Pickup and Hold, Line and Busy Lamps, Interrupted Audible Signals, Common Audible Signals, Auxiliary Time-Out, Lamp Wink, and Manual Intercom

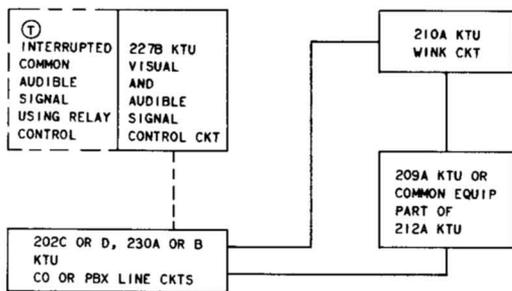


Fig. 7—Block Diagram of CO or PBX Line Circuits (202C or D, or 230A or B KTUs) With 210A, 227B, 209A or Common Equipment Part of 212A KTU for Line Pickup and Hold, Line and Busy Lamps, Common Audible Signals Lamp Wink, and Time-Out

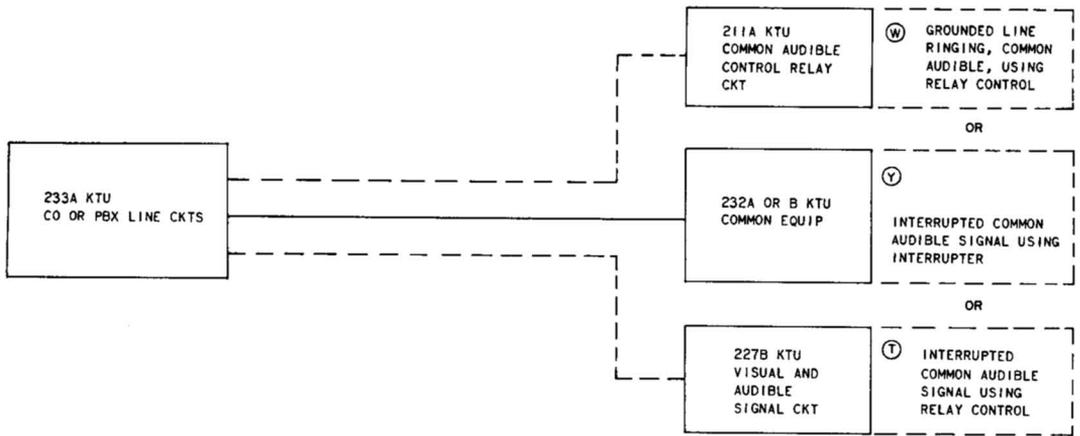


Fig. 8—Block Diagram of CO or PBX Line Circuits (233A KTU) with 211A, 227B and 232-Type KTUs for Line Pickup and Hold, Line and Busy Lamps, Interrupted Common Audible Signals, Lamp Wink, Time-Out, and Manual Intercom

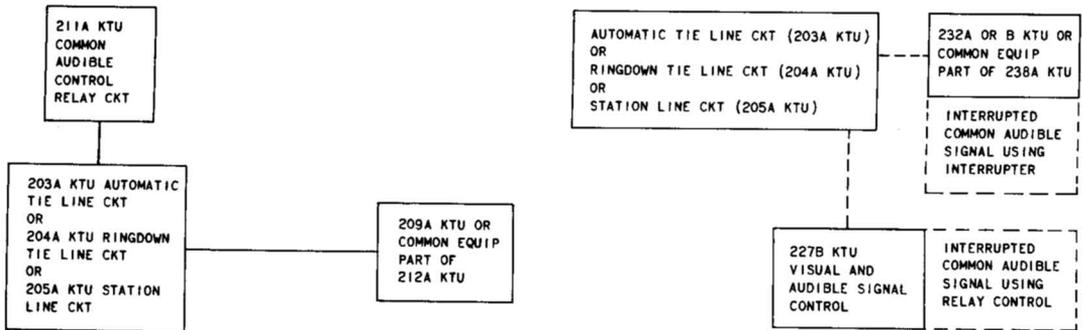


Fig. 9—Block Diagram of Automatic Tie Line Circuit (203A KTU) or Ringdown Tie Line Circuit (204A KTU) or Station Tie Line Circuit (205A KTU) With 211A and 209A or Common Equipment Part of 212A KTU for Steady Common Audible Signals, Line and Busy Lamps, and Time-Out

Fig. 10—Block Diagram of Automatic Tie Line Circuit (203A KTU) or Ringdown Tie Line Circuit (204A KTU) or Station Line Circuit (205A KTU) With 232-Type or Common Equipment Part of 238A KTU and 227B KTU for Interrupted Audible or Common Audible Signals, Line and Busy Lamps, Wink, and Time-Out

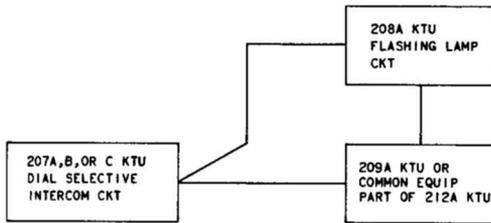


Fig. 11—Block Diagram of Dial Selective Intercom Circuit (207A, B or C KTU) With 208A, 209A or Common Equipment Part of 212A KTU for Flashing Line Lamps, Busy Lamps, Audible Signals, and Time-Out

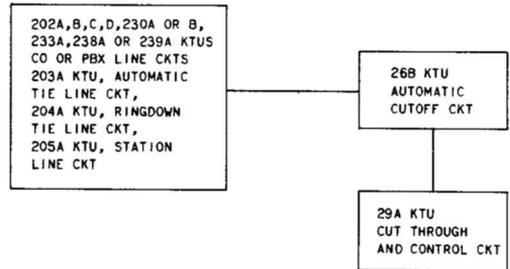


Fig. 13—Block Diagram of Cut-Through and Control Circuit for Automatic Cutoff (26B and 29A KTUs) with 202A, B, C, or D, 230A or B, 233A, 238A, 239A, 203A, 204A, or 205A KTUs

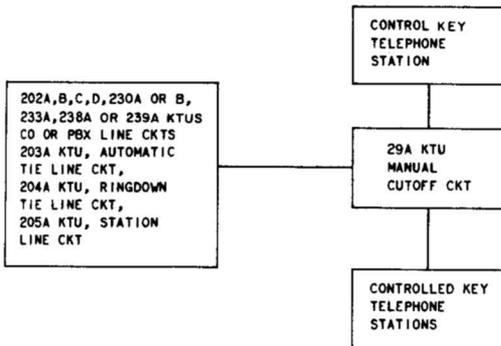


Fig. 12—Block Diagram of Manual Cut-off Circuit (29A KTU) With 202A, B, C or D, 230A or B, 233A, 238A, 239A, 203A, 204A, or 205A KTUs