

2-WIRE AND 4-WIRE PRIVATE LINE
STATION CIRCUIT

1.00 INTRODUCTION

This section covers installation and connection information for 2- and 4-wire private line circuits. It contains standard key telephone units and station equipment to be used for most installations.

2.00 GENERAL

This circuit provides the terminal equipment of 2-wire and 4-wire private line circuits, using modular-type key telephone units to provide various operating features at a customer's premises. It is arranged for incoming signaling by means of a bell or loudspeaker, and outgoing by means of a key or voice calling. Two-tone selective signaling, both incoming and outgoing, is also provided.

3.00 DESCRIPTION OF OPERATING FEATURES

The following is a list of features provided in the packaged 2- and 4-wire private line termination:

- For 4-wire lines, a 12 to 1 impedance step-down ratio, to permit bridging as many as six stations with a minimum transmission variation.
- Provision for one station only per 2-wire line, but optional wiring permits adjustment to match line impedance.
- Provision for voice calling by means of a loudspeaker.
- Cut-off of a common loudspeaker from a main and several extension stations.
- Provision of idle circuit terminations for stations in on-hook condition.

- Use of a subscriber set for audible incoming ringing.
- Use of 20-cycle outgoing ringing.
- Use of a two-tone selective signaling, both incoming and outgoing.
- Control of a central office switching function.
- Use of plug-in or hang-up handsets.
- Use of plug-in head telephone sets.
- Use of cradle-type telephone set.
- Provision of a dial to control two-tone selective signaling.
- Loudspeaker volume control.

4.00 DESCRIPTION OF CIRCUIT FEATURES

4.01 The 219A key telephone unit (see Fig. 1) provides two repeating coils and two capacitors, which may be arranged to terminate the sending and receiving halves of a 4-wire line. When a subscriber set is used, one of the capacitors is used between halves of the line side of the associated repeating coil to prevent shunting of the ringer. A grounded or metallic simplex may be derived for control of a central office switching function. For use on 2-wire lines, the 219A key telephone unit may be used for two such lines.

4.02 The 218A key telephone unit (see Fig. 2) provides a station termination. As many as six may be bridged on a line in 4-wire service. An induction coil is provided to match the transmitter impedance. A battery feed relay, under control of the head or handset push-to-talk key, removes an idle circuit termination

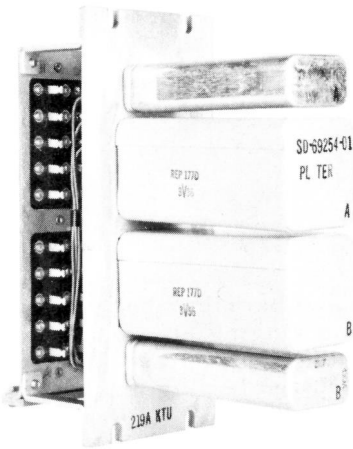


Fig. 1 - 219A Key Telephone Unit

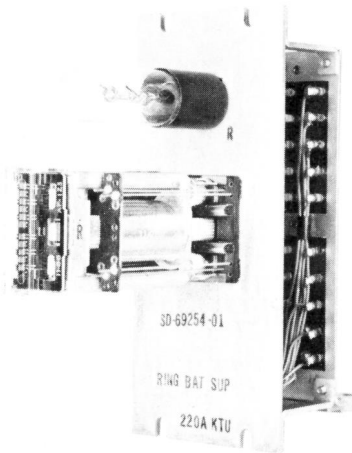


Fig. 3 - 220A Key Telephone Unit

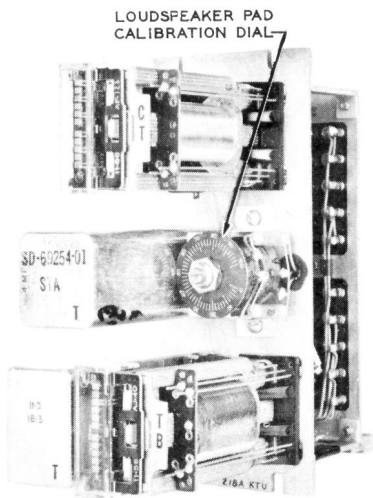


Fig. 2 - 218A Key Telephone Unit

and connects the transmitter. A cut-through relay, under control of a talk key or switchhook contacts, transfers the receiving circuit from a loudspeaker or idle circuit termination to the telephone receiver. Additional relay contacts are provided on the cut-through relay for use as special cases may require.

4.03 The 220A key telephone unit (see Fig. 3) provides a resistance lamp and a relay. It may be used to apply a 20-cycle ringing current to a line, or to control an emergency battery supply. When a single loudspeaker is associated with several adjacent stations on the same line, the loudspeaker leads may be carried

through transfer contacts of this relay. Operation of any cut-through relay in the main or extension stations causes the loudspeaker cut-off relay to operate, transferring the circuit to a resistive termination.

5.00 DESCRIPTION OF EQUIPMENT FEATURES

The 218A, 219A, and the 220A key telephone units are 3-1/32 inches wide overall and 6-15/16 inches high overall. They utilize wire spring relays and each key telephone unit is provided with legs projecting toward the rear, on which is mounted a 40-terminal panel arranged for screw connections (see Fig. 4). These units are designed to mount directly in the 6-plate cabinet, and by the use of suitable mounting bars in 11-plate, 18-plate, and larger cabinets, as well as relay racks.

6.00 TABLE OF DRAWINGS

| Title | Number |
|--|--------------------------------|
| 2- and 4-wire Private Line Station Circuit | SD-69254-0110 SD-69254-0120 |
| 218A Key Telephone Unit Circuit | SD-69288-0119 |
| 219A Key Telephone Unit Circuit | SD-69288-0120 |
| 220A Key Telephone Unit Circuit | SD-69288-0121 |

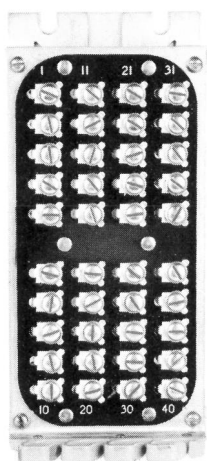


Fig. 4 - 218A, 219A, or 220A Key Telephone Unit (Rear View)

7.00 DESCRIPTION OF OPERATION, SD-69254-01

7.01 Figure numbers referred to in 7.02 through 7.09 apply primarily to station circuits shown in Fig. 5.

4-WIRE TOLL LINE (FIG. 2 AND FIG. A, B, C, OR D, AND FIG. G)

7.02 Fig. 2, with Fig. A, B, C, or D, and Fig. G, provides a 4-wire toll line termination arranged for an impedance step-down ratio of 12 to 1, which permits as many as six bridged stations with a minimum transmission variation. Fig. A, B, C, or D permits simplex signaling, central office switching, and/or outgoing 20-cycle ringing.

2-WIRE TOLL LINE (FIG. 3 AND FIG. E OR F)

7.03 Fig. 3 and Fig. E or F provide a 2-wire toll line termination, which will match the line impedance to one main station. Fig. E or F permits simplex control of central office switching or outgoing 20-cycle ringing.

STATION CIRCUIT - 4-WIRE TOLL STATION (FIGS. 1 AND 2 AND FIG. 7 OR R) (FIG. 1 USES Z WIRING)

7.04 Fig. 2 provides a low impedance transmitting and receiving circuit, on which as many as six Figs. 1 may be bridged. Transmitting leads TT and TR connect to the T induction coil, which

provides a further impedance reduction to match the head or handset transmitter unit. The receiving leads RT and RR connect through the normal CT relay to the loudspeaker (Fig. 7) or to an idle circuit termination (Fig. R). Operation of the talk key (Fig. 9) or switchhook contacts (Fig. 8) operates the CT relay (Fig. 1), which transfers the receiving circuit from the loudspeaker or idle circuit termination to the head or handset receiver. Depressing the push-to-talk button on the handset operates the TB relay, which removes a short circuit from the transmitter, and short circuits the idle circuit terminating resistance (F).

2-WIRE TOLL LINE STATION (FIGS. 1 AND 3 AND FIG. 7 OR R) FIG. 1 USES Y WIRING)

7.05 Fig. 3 matches the impedance of a 2-wire toll line to one Fig. 1. For line impedances between 500 and 800 ohms, M wiring should be used. For line impedances between 800 and 1500 ohms, N wiring should be used. Fig. 3 may be used to provide service for two 2-wire toll lines. The RT and RR leads connect through the normal CT relay to the loudspeaker (Fig. 7) or the idle circuit termination (Fig. R). Operation of the talk key (Fig. 9) or switchhook contacts (Fig. 8) operates the CT relay, connecting the RT and RR leads to the induction coil (T), which in turn connects to the head or handset transmitter and receiver. Depressing the push-to-talk button on the head or handset operates the TB relay, which removes a short circuit from the transmitter and short circuits the idle circuit termination resistance (F).

7.06 RINGING

- Incoming Calls - Fig. 6 provides a subscriber set which permits audible signaling on incoming calls.
- Outgoing Calls (Fig. 5, Fig. 13, and Fig. C or F) - Figs. 5 and 13 and Fig. C or F provide outgoing ringing on 2- or 4-wire toll lines. Operation of the signaling key (Fig. 13) causes the R relay (Fig. 5) to operate, connecting 20-cycle ringing current to the line.

7.07 VOICE CALLING (FIGS. 1, 7, 8, 9, AND FIG. R)

- Loudspeaker per Station - Each station (Fig. 1) may be equipped

with a loudspeaker for voice calling. When the switchhook contacts (Fig. 8) or the talk key (Fig. 9) is operated, the CT relay (Fig. 1) operates and transfers the receiving circuit from the loudspeaker to the head or hand-set receiver or to the induction coil (T).

Control of Loudspeaker from Several Stations - One Fig. 14 is required for each Fig. 1 equipped with loudspeaker. Figs. 1 not equipped with loudspeaker use V wiring and Fig. R. Figs. 8 and 9 use V apparatus. When a main, and one or more extension stations are adjacent to each other, only one station need be equipped with a loudspeaker. Operation of the CT relay in the main station cuts off the loudspeaker by transferring the receiving circuit to the telephone receiver. Operation of the CT relay in an extension station operates the R relay in Fig. 14, which substitutes a resistive termination for the loudspeaker.

EMERGENCY BATTERY SUPPLY (FIG. 10)

7.08 Fig. 10 provides a circuit which automatically transfers the station circuits from regular to emergency battery supply when the regular supply fails. The winding of the R relay (Fig. 10) is connected across the regular battery supply, keeping it operated. Failure of the regular supply releases the R relay, which connects the emergency dry battery to the load.

600- AND 1500-CYCLE SELECTIVE SIGNALING (FIGS. 1, 2, 4, AND FIG. G)

7.09 The outgoing 600- and 1500-cycle selective signaling equipment may be connected to the transmitting line of a 4-wire toll line in place of Fig. G. Fig. 4, provides the dial required to control the selective signaling equipment. Ground for the dial is furnished through contacts of the CT relay (Fig. 1), to prevent interference from other multiple stations. The incoming 600- and 1500-cycle selective signaling equipment may be connected by bridging on the RT and RR leads (Fig. 2).

8.00 CONNECTING CIRCUITS

When this circuit is listed on a key sheet, the connecting information thereon

is to be followed. The following are typical connecting circuits:

- 102A Key Equipment Line Circuits - SD-69164-01, SD-69158-01, and SD-69167-01
- 109A Key Equipment - SD-69163-01
- 11A Key Equipment - SD-69194-01
- Central Office Repeating Coil Circuit - SD-95022-01
- Central Office Signaling Circuit - SD-55647-01
- 600- and 1500-cycle Selective Signaling Circuit - SD-69168-01

9.00 STATION CONNECTIONS

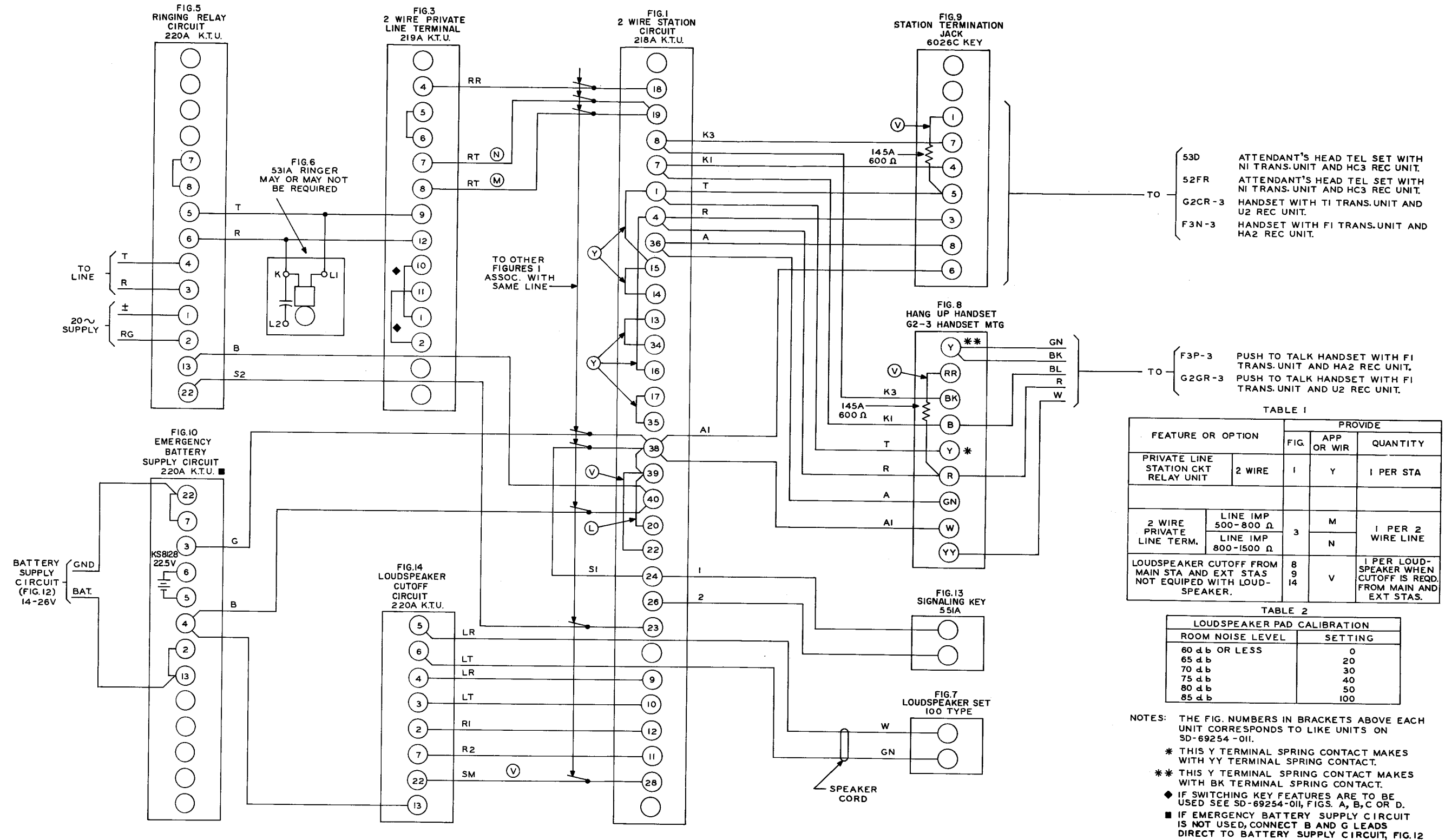
9.01 Desired features can be obtained by strapping the necessary key telephone units and terminating the incoming power and station lines as follows:

- 2-wire Circuit (Fig. 6) shows the key telephone units, station equipment, and options that are necessary to obtain the common features of the 2-wire private line station circuit.
- 4-wire Circuit (Fig. 7) shows the key telephone units, station equipment, and options that are necessary to obtain the common features of the 4-wire private line station circuit.
- Special Features (Fig. 5) show the options that are necessary to obtain special features of the 2- or 4-wire private line station circuit, such as central office signaling circuit or 600- or 1500-cycle selective signaling circuit.

9.02 Job requirements should be determined from the service order or work sheet. Required wiring options and loudspeaker pad calibrations may be determined from Tables A and B of Fig. 6 or Fig. 7.

10.00 WIRING AND CABLING

Inside wire and cable are used to install 2- or 4-wire private line systems. Information relating to placing wire and cable is contained in C23.000 series sections and will not be covered in this section.



- 53D ATTENDANT'S HEAD TEL SET WITH NI TRANS.UNIT AND HC3 REC UNIT.
- 52FR ATTENDANT'S HEAD TEL SET WITH NI TRANS.UNIT AND HC3 REC UNIT.
- G2CR-3 HANDSET WITH TI TRANS.UNIT AND U2 REC UNIT.
- F3N-3 HANDSET WITH FI TRANS.UNIT AND HA2 REC UNIT.

- F3P-3 PUSH TO TALK HANDSET WITH FI TRANS.UNIT AND HA2 REC UNIT.
- G2GR-3 PUSH TO TALK HANDSET WITH FI TRANS.UNIT AND U2 REC UNIT.

TABLE 1

| FEATURE OR OPTION | FIG. | PROVIDE | | |
|---|--------------|------------|----------|---|
| | | APP OR WIR | QUANTITY | |
| PRIVATE LINE STATION CKT RELAY UNIT | 2 WIRE | 1 | Y | 1 PER STA |
| 2 WIRE PRIVATE LINE TERM. | LINE IMP | 500-800 Ω | M | 1 PER 2 WIRE LINE |
| | | 800-1500 Ω | N | |
| LOUDSPEAKER CUTOFF FROM MAIN STA AND EXT STAS NOT EQUIPPED WITH LOUD-SPEAKER. | 8 9 14 | V | | 1 PER LOUD-SPEAKER WHEN CUTOFF IS REQD. FROM MAIN AND EXT STAS. |

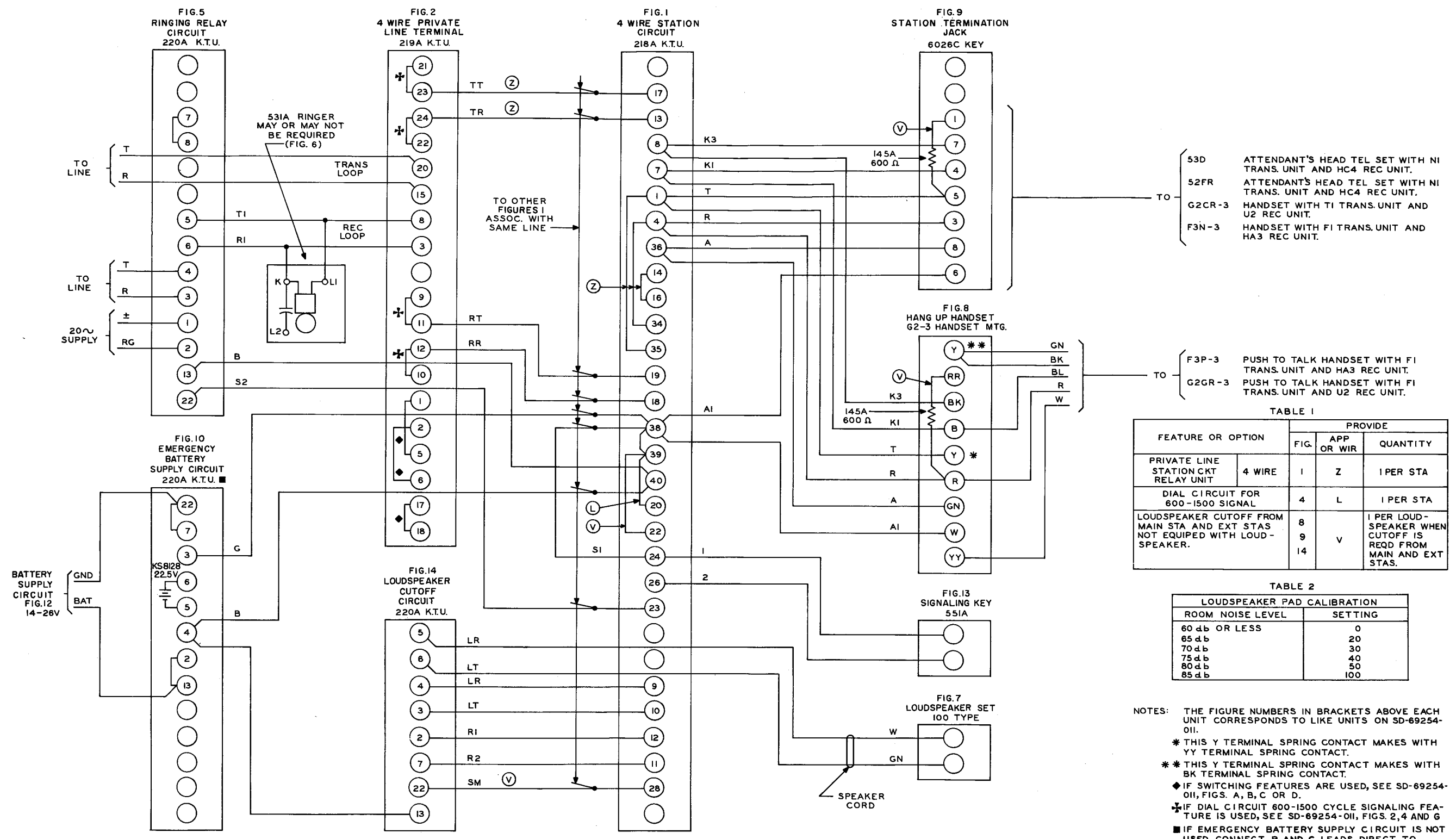
TABLE 2

| LOUDSPEAKER PAD CALIBRATION | |
|-----------------------------|---------|
| ROOM NOISE LEVEL | SETTING |
| 60 db OR LESS | 0 |
| 65 db | 20 |
| 70 db | 30 |
| 75 db | 40 |
| 80 db | 50 |
| 85 db | 100 |

NOTES: THE FIG. NUMBERS IN BRACKETS ABOVE EACH UNIT CORRESPONDS TO LIKE UNITS ON SD-69254-011.

- * THIS Y TERMINAL SPRING CONTACT MAKES WITH YY TERMINAL SPRING CONTACT.
- ** THIS Y TERMINAL SPRING CONTACT MAKES WITH BK TERMINAL SPRING CONTACT.
- ◆ IF SWITCHING KEY FEATURES ARE TO BE USED SEE SD-69254-011, FIGS. A, B, C OR D.
- IF EMERGENCY BATTERY SUPPLY CIRCUIT IS NOT USED, CONNECT B AND G LEADS DIRECT TO BATTERY SUPPLY CIRCUIT, FIG. 12

Fig. 6 - Station System 2-wire Private Line Station Circuit



- 53D ATTENDANT'S HEAD TEL SET WITH NI TRANS. UNIT AND HC4 REC UNIT.
- 52FR ATTENDANT'S HEAD TEL SET WITH NI TRANS. UNIT AND HC4 REC UNIT.
- G2CR-3 HANDSET WITH T1 TRANS. UNIT AND U2 REC UNIT.
- F3N-3 HANDSET WITH F1 TRANS. UNIT AND HA3 REC UNIT.

- F3P-3 PUSH TO TALK HANDSET WITH F1 TRANS. UNIT AND HA3 REC UNIT.
- G2GR-3 PUSH TO TALK HANDSET WITH F1 TRANS. UNIT AND U2 REC UNIT.

TABLE 1

| FEATURE OR OPTION | FIG. | PROVIDE | |
|--|--------|------------|--|
| | | APP OR WIR | QUANTITY |
| PRIVATE LINE STATION CKT RELAY UNIT | 4 WIRE | Z | 1 PER STA |
| DIAL CIRCUIT FOR 600-1500 SIGNAL | 4 | L | 1 PER STA |
| LOUDSPEAKER CUTOFF FROM MAIN STA AND EXT STAS NOT EQUIPED WITH LOUD-SPEAKER. | 8 | V | 1 PER LOUD-SPEAKER WHEN CUTOFF IS REQD FROM MAIN AND EXT STAS. |
| | 9 | | |
| | 14 | | |

TABLE 2

| LOUDSPEAKER PAD CALIBRATION | |
|-----------------------------|---------|
| ROOM NOISE LEVEL | SETTING |
| 60 db OR LESS | 0 |
| 65 db | 20 |
| 70 db | 30 |
| 75 db | 40 |
| 80 db | 50 |
| 85 db | 100 |

- NOTES:
- THE FIGURE NUMBERS IN BRACKETS ABOVE EACH UNIT CORRESPONDS TO LIKE UNITS ON SD-69254-011.
 - * THIS Y TERMINAL SPRING CONTACT MAKES WITH YY TERMINAL SPRING CONTACT.
 - ** THIS Y TERMINAL SPRING CONTACT MAKES WITH BK TERMINAL SPRING CONTACT.
 - ◆ IF SWITCHING FEATURES ARE USED, SEE SD-69254-011, FIGS. A, B, C OR D.
 - ✦ IF DIAL CIRCUIT 600-1500 CYCLE SIGNALING FEATURE IS USED, SEE SD-69254-011, FIGS. 2, 4 AND 6
 - IF EMERGENCY BATTERY SUPPLY CIRCUIT IS NOT USED, CONNECT B AND G LEADS DIRECT TO BATTERY SUPPLY CIRCUIT, FIG. 12.

Fig. 7 - Station System 4-wire Private Line Station Circuit