# STATION SYSTEMS
# SPEAKERPHONE SYSTEM NO. 1A
# TELEPHONE AND SPEAKERPHONE CIRCUIT

## 0. CHANGES

### 0.1 CHANGED AND ADDED FUNCTIONS

Arrangement for "A" lead control and station busy lamp as shown in Fig. 1 and 2.

### 0.2 CHANGES IN APPARATUS

None.

### 0.3 CHANGES IN CIRCUIT REQUIREMENTS (Not Associated with 0.2 Above)

None.

### 0.4 DESCRIPTION OF CIRCUIT CHANGES

(a) "X" and "Y" options are added in Fig. 1 and 2 for "A" lead control and station busy lamp features.

(b) Lead designation "SG" is changed to "A1" and "SG."

(c) Fig. 4, 6, 7, 9, and 10 are now Mfr Disc.

(d) R2EK cord in Fig. 5 is changed to R2FK cord.

(e) In Fig. 2 and 9 for the 685A subscriber set, designations of terminals Z and K on the terminal strip are interchanged. "LK" lead goes to the RR contact of the set switch.

(f) In Fig. 8 designations of terminals 2 and 3 are interchanged on the C3 capacitor unit. A strap has been added between punching (Z) of the KS-16091 transformer. Designation of punchings (P) and (F) are interchanged on the terminal strip.

(g) In Fig. 4 the (R1) resistor is changed to 620Ω from 260Ω.

(h) Delete options "Y" and "Q" from the feature and option table.

(i) Option "QX" is removed in Fig. 4 from punching (15).

(j) In Circuit Note 104, relay designation (LS) is changed to (S).

(k) Slate and slate brown leads are interchanged in Fig. 1: slate goes to C of the switchhook contacts; and slate brown goes to A.

## 1. PURPOSE OF CIRCUIT

This circuit provides distant talking speakerphone equipment which may be connected to special telephone sets to provide for a combination of close talking handset telephone circuits and distant talking speakerphone circuits, together with facilities for switching between the two types of telephone circuits. Specific single line sets are provided as part of this circuit, but the equipment may also be used with specific key telephone sets of connecting circuits to provide for use with line and signaling circuits of the Key Telephone Systems No. 1A and 1A1 and the PBXs 750A and 755A.

## 2. WORKING LIMITS

None.

## 3. FUNCTIONS

This circuit provides for:

(a) Talking with handset.

(b) Hands-free talking with the speakerphone set by momentary operation of a nonlocking key.

(c) Automatic switching from speakerphone set to handset by lifting the handset from its mounting.

(d) Switching during a conversation from the handset to the speakerphone circuit.

(e) A signal lamp to indicate when the speakerphone set is enabled.

(f) Restoring the circuit to the normal standby condition when using the speakerphone set by momentary operation of a nonlocking key.

## 4. 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:

(a) Key Telephone System No. 1A - Line and Signaling Circuit - SD-69091-01.

(b) Key Telephone System No. 1A1 - Line and Signaling Circuit - SD-69203-01.

(c) Key Telephone System No. 1A1 - Line Circuit for joint use with stations of other key telephone systems or key equipments - SD-69230-01.

(d) Key Telephone System No. 1A - Private Line Circuit - SD-69105-01.

(e) Key Telephone Systems No. 1A and 1A1 - Intercommunicating Line Circuit with dial selection of stations - SD-69199-01.

(f) Key Telephone System No. 1A - Key and Telephone Circuit - SD-69208-01.

(g) Key Telephone System No. 1A or 1A1 - Key and Telephone Circuit - SD-69219-01.

(h) Key Telephone System No. 1A or 1A1 - Key and Telephone Circuit with separately mounted keys - SD-69207-01.

(i) Station Busy Signal Circuit - SD-69241-01.

(j) PBX No. 750A Station Circuit - SD-66437-01.

(k) PBX No. 755A Station Circuit - SD-66507-01.

## 5. DESCRIPTION OF OPERATION

### 5.1 ORIGINATING OR ANSWERING A CALL

#### 5.11 Handset Operation

To originate or answer a call, the handset is lifted from its mounting, thus operating the set switch. The set switch, operated, supplies ground to the "A" lead to operate the (A) relay, if connected to the No. 1A1 Key Telephone System line circuit; or to the "BL" lead to operate the station busy lamp circuit, Fig. 6, if provided; or to the Key Telephone System No. 1A or 1A1, station busy lamp circuit, if provided. The set switch also completes the talking circuit from the tip and ring of the line through the telephone set equipment and, in sequence, removes a short circuit from the receiver circuit.

#### 5.12 Speakerphone Operation

##### 5.12.1 Using Subscriber Set (Control Unit KS-14964, List 2) Fig. 8

To originate or answer a call the (ON) key, Fig. 3 or 7, is operated momentarily. This places ground on the "S" lead to the control unit to operate the (K1) relay. The (K1) relay locks up through its own front contacts, over the "F1" lead, through back contacts of the (OFF) key, Fig. 3 or 7, over the "LK" lead (or by the strap "R" option, for Fig. 7) to ground through back contacts of the telephone set switch. The (K1) relay, operated, connects the transmitting and receiving coils of the control unit over the "T1" and "R1" leads, through terminals of the telephone set (and, with keysets, through the operated pickup key) to the line circuit; returns ground over the "AG" lead to the "A" lead of the line circuit, if connected to Key Telephone System No. 1A1, and to the "BL" lead to the station busy lamp circuit, if provided per "V" option; enables the (RF2) rectifier; connects the (RF1) rectifier to supply power to the amplifiers; and lights the signal lamp in Fig. 3 or 7 to indicate that the speakerphone is in the talking condition.

##### 5.12.2 Using Subscriber Set KS-16162, List 1, Fig. 4

To originate or answer a call, the (ON) key, Fig. 3 or 7, is operated momentarily. This places ground on the "S" lead to the subscriber set, Fig. 4, to operate the (S) relay. The (S) relay operates the (K1) relay. When the (ON) key is released, the (S) relay drops down, but the (K1) relay remains locked up over the "F2" lead through back contacts of the (OFF) key, over the "F1" lead, through its own front contacts, over the "LK" lead, through back contacts of the set switch to ground. The (K1) relay, operated, connects the transmitting and receiving coils of the subscriber set over the "T1" and "R1" leads through terminals of the telephone set (and, with keysets, through the operated pickup key) to the line circuit; returns ground over the "AG" lead to the "A" lead of the line circuit if connected to Key Telephone System No. 1A1; partially closes a lockup circuit for the (S) relay; enables the (CR5) rectifier; connects the (CR4) rectifier to supply power to the amplifiers and to the (ON) relay; removes a short circuit from the input to the receive amplifier; operates the station busy lamp directly over the "BAT. or ±" and "L" leads to Fig. 6, if provided; and lights the signal lamp in Fig. 3 or 7 to indicate that the speakerphone circuit is in the talking condition.

### 5.2 DIALING

#### 5.21 Handset Operation

The dial in the telephone set is operated in the usual manner after the handset is lifted from its mounting. The off-normal contacts connected to the "P3" and "P4" leads (or to the "ON" and "ON1" leads for keysets) perform no useful function at this time. The other pair of off-normal contacts short circuits the receiver circuit to prevent clicks during dialing. At the completion of dialing, the handset circuit is restored to the talking condition.

#### 5.22 Speakerphone Operation

##### 5.22.1 Using Subscriber Set (Control Unit KS-14964, List 2) Fig. 8

After the (ON) key in Fig. 3 or 7 is operated and the signal lamp lights, the dial is operated in the usual manner, except that the handset is not lifted from its cradle. The off-normal contacts connected to the "P3" and "P4" leads (or to the "ON" and "ON1" leads for keysets) short circuit the "P3" and "P4" leads from the control unit to the transmitter circuit at the station connecting blocks (or short circuit the input to the receive amplifier within the telephone set if Fig. 7 is used). The other pair of off-normal contacts performs no useful function at this time. At the completion of dialing, the short circuit is removed and the speakerphone circuit is restored to the talking condition.

5.22.2 Using Subscriber Set KS-16162, List 1, Fig. 4

After the (ON) key of Fig. 3 or 7 is operated and the lamp lights, the dial is operated in the usual manner, except that the handset is not lifted from its cradle. One pair of off-normal contacts connects ground to the "ON" lead to Fig. 4 to operate the (ON) relay. The (ON) relay, operated, short circuits the input to the receive amplifier and, in sequence, shorts the tip and ring of the speakerphone subscriber set during dialing. The other pair of off-normal contacts performs no useful function at this time. At the completion of dialing, the (ON) relay releases, and the speakerphone circuit is restored to the talking condition.

## 5.3 SHIFTING BETWEEN THE TWO TYPES OF OPERATION

### 5.31 Shifting from Handset to Speakerphone Operation

5.31.1 Using Subscriber Set (Control Unit KS-14964, List 2) Fig. 8

To change to the speakerphone circuit when talking with the handset, the (ON) key of Fig. 3 or 7 is operated. Operation of the (ON) key operates the (K1) relay of Fig. 8 which remains operated only so long as the (ON) key is depressed. For this reason it is necessary to hold the (ON) key depressed until the handset is replaced. When the handset is replaced, a lockup circuit for the (K1) relay is completed through back contacts of the set switch. The (K1) relay, operated, enables the speakerphone circuit as described in 5.12.1.

5.31.2 Using Subscriber Set KS-16162, List 1, Fig. 4

To change to the speakerphone circuit when talking with the handset, the (ON) key of Fig. 3 or 7 is operated momentarily. Operation of the (ON) key operates the (S) relay of Fig. 4 which locks up to ground over the "LS" lead either through front contacts of the telephone set switch or through contacts of the (SW) relay of Fig. 6 if provided. This lockup persists so long as the handset is off its cradle. Consequently, it is not necessary to hold the (ON) key depressed.

The (S) relay, operated, operates the (K1) relay which enables the speakerphone circuit as described in 5.12.2. When the (ON) key is released, no change takes place until the handset is replaced on its cradle. When the handset is replaced the lockup path for the (S) relay is broken, either at the set switch of the telephone set or at contacts of the (SW) relay of Fig. 6, and the (S) relay drops down. However, the (K1) relay stays up, since a new lockup path for the (K1) relay is provided through its own front contacts over the "LK" lead through back contacts of the continuity transfer on the set switch. This establishes the talking condition on the speakerphone circuit.

When subscriber set KS-16162, List 1 is used, and if the telephone set is connected to Key Telephone System No. 1A1, Fig. 6 must always be provided to separate the lockup circuit for the (S) relay of Fig. 4 with its positive dc supply, from the negative battery on the "A" leads to the line circuits. Fig. 6 is required, under these conditions, whether or not the station busy lamp feature is required. (See 5.6)

### 5.32 Shifting from Speakerphone to Handset Operation

To change to the handset when talking on the speakerphone circuit, it is necessary only to lift the handset from its mounting. This operates the set switch which removes ground from the lockup circuit of the (K1) relay of Fig. 4 or 8, releasing this relay. Relay (K1), released, opens the tip and ring at the speakerphone subscriber set, extinguishes the signal lamp in Fig. 3 or 7, and restores the speakerphone subscriber set to the idle standby condition. The operated set switch enables the talking circuit of the handset as described in 5.11.

## 5.4 TERMINATING A CONVERSATION WHEN USING THE SPEAKERPHONE

Operation of the (OFF) key of Fig. 3 or 7 breaks the lockup circuit of the (K1) relay which releases and restores the speakerphone circuit to the idle condition.

## 5.5 TIP PARTY IDENTIFICATION

The telephone set circuits of Fig. 7 can be adapted for tip party identification when used with subscriber set, Fig. 4. To provide for this class of service, an additional set of transfer contacts is provided for the set switch, and additional leads "R2", "G1", and "G2" are required. The switch contacts a, b, and c are used to provide the extra switching required. The connections must be changed as indicated in Table C for Fig. 7.

Under these conditions the tip conductor from the central office or PBX line circuit connects over the "R1" lead to the subscriber set, Fig. 4, through back contacts 2 and 3 at the bottom of the (K1) relay, over the "R2" lead to contact b of the set switch. In this way the ringer circuit may be cut off and the talking circuit of the handset or of the speakerphone subscriber set connected, respectively, by the operation of the set switch or by the (K1) relay.

The operation of the ringer is dependent on the continuity of the "G1" and "G2" leads which run from the center of the 425B network in the telephone set to the center of the line coil (L1) of the speakerphone set and through a winding of the ringer to ground. Tip party identification is not provided with control unit KS-14964, List 2.

## 5.6 STATION BUSY LAMP

A station busy lamp may be provided in connection with Fig. 7 or with the key telephone sets

of the connecting circuit SD-69219-01. When this feature is required in connection with Key Telephone System No. 1A1, and if subscriber set KS-16162, List 1 is used, Fig. 6 must also be provided to separate the lockup circuit of the (S) relay with its positive dc supply, from the negative battery on the "BL" lead and from the station busy lamp circuit. (See 5.31.2.)

A station busy lamp may also be provided when the speakerphone circuit is used in connection with the PBX 750A or 755A as described in 5.75.

## 5.7 USE OF AUXILIARY RELAYS WHEN SPEAKERPHONE SYSTEM NO. 1A IS USED WITH PBX 750A OR 755A

When the speakerphone circuit is used with the PBX 750A or 755A, the speakerphone control functions of the set switch are accomplished indirectly by means of the auxiliary relays of Fig. 10 or 11. This is necessary to separate the positive potential on the lockup paths of the subscriber set relays from the negative potential operating the PBX trunk circuit relays.

The following description of operation applies specifically to the 755A PBX trunk connections, but the operation of the speakerphone circuit is essentially the same for other connections or when the 750A PBX is used.

### 5.71 Originating or Answering a Call

#### 5.71.1 Handset Operation

To originate or answer a call, the handset is lifted from its mounting, thus operating the set switch. The set switch connects the tip and ring from the PBX equipment through to the telephone set equipment and supplies ground to operate the (CT) relay of Fig. 10 or 11. Current over the tip and ring operates the (L) relay of the PBX line circuit; and the (CT) relay, operated, connects battery from the (T) relay of the PBX trunk circuit through front contacts of the operated (L) relay of the PBX line circuit, through the operated trunk key of the telephone set over the "TR1" lead, through front contacts of the (CT) relay, back over the "G" lead, through front contacts of the (L) relay of the PBX line circuit, through the winding of the (L1) relay in the PBX call allotter circuit to ground, operating the (T) and (L1) relays. When operated, the (T) relay of the PBX trunk circuit and the (L1) relay in the PBX call allotter circuit start the sequence of operations which connect the telephone set through the PBX to the central office. The (CT) relay, operated, also lights the station busy lamp, if provided.

#### 5.71.2 Speakerphone Operation

##### 5.71.21 Using Subscriber Set (Control Unit KS-14964, List 2) Fig. 8

To originate or answer a call, the (ON) key of Fig. 3 is operated momentarily. This places ground on the "S" lead to the control unit, Fig. 8, to operate the (K1) relay. The (K1) relay, operated, locks up through its own front contacts over the (F1) lead through back contacts of the (OFF) key, Fig. 3, over the "LK" lead through back contacts of the continuity transfer of the (CT) relay of Fig. 11, to ground. The (K1) relay, operated, connects the transmitting and receiving coils of the control unit over the "T1" and "R1" leads through terminals of the telephone set to the line circuit of the PBX; returns ground over the "AG" lead to operate the (SW) relay of Fig. 11; enables the (RF2) rectifier; connects the (RF1) rectifier to supply power to the amplifiers; removes a short circuit from the input to the receive amplifier; and lights the signal lamp in Fig. 3 to indicate that the speakerphone circuit is enabled. The PBX circuits, and the station busy lamp, if provided, are now operated through contacts of the (SW) relay in the same manner as described for the (CT) relay in 5.71.1.

##### 5.71.22 Using Subscriber Set KS-16162, List 1, Fig. 4

To originate or answer a call, the (ON) key of Fig. 3 is operated momentarily. This places ground on the "S" lead to the subscriber set, Fig. 4, to operate the (S) relay. The (S) relay operates the (K1) relay. When the (ON) key is released the (S) relay drops down, but the (K1) relay remains locked up over the "F2" lead through back contacts of the (OFF) key, over the "F1" lead through its own front contacts, over the "LK" lead through back contacts of the continuity transfer of the (CT) relay of Fig. 10 to ground. The (K1) relay, operated, connects the transmitting and receiving coils of the subscriber set over the "T1" and "R1" leads through terminals of the telephone set to the line circuit of the PBX; returns ground over the "AG" lead to operate the (SW) relay of Fig. 10, if provided; partially closes a lockup circuit for the (S) relay; enables the (CR5) rectifier; connects the (CR4) rectifier to supply power to the amplifiers and to the (ON) relay; removes a short circuit from the input to the receive amplifier; and lights the signal lamp in Fig. 3 to indicate that the speakerphone circuit is enabled. The PBX circuits are also operated through front contacts of the (K1) relay in the same manner as described for the (CT) relay in 5.71.1.

### 5.72 Dialing

Dialing, when connected to the PBX 750A or 755A, is essentially the same as described in 5.2, except, when the subscriber set, Fig. 4, is used, the leads from the off-normal contacts of the dial, which operate the (ON) relay, are designated "ON" and "P5". Both connect to the subscriber set.

### 5.73 Shifting Between the Two Types of Operation

#### 5.73.1 Shifting from Handset to Speakerphone Operation

##### 5.73.11 Using Subscriber Set (Control Unit KS-14964, List 2) Fig. 8

To change to the speakerphone circuit when talking with the handset, the (ON) key of Fig. 3 is operated. Operation of the (ON) key operates the (K1) relay of Fig. 8 which remains operated only

so long as the (ON) key is depressed. For this reason it is necessary to hold the (ON) key depressed until the handset is replaced on its mounting. When the handset is replaced, a lockup circuit is provided through back contacts 1 and 3 of the (CT) relay of Fig. 11. The (K1) relay, operated, enables the speakerphone circuit as described in 5.71.21.

5.73.12 Using Subscriber Set KS-16162, List 1, Fig. 4

To change to the speakerphone circuit when talking with the handset, the (ON) key of Fig. 3 is operated momentarily. Operation of the (ON) key operates the (S) relay of Fig. 4 which locks up to ground over the "LS" lead to front contacts of the continuity transfer of the (CT) relay of Fig. 10. This lockup persists so long as the handset is off its cradle. Consequently, it is not necessary to hold the (ON) key depressed.

The (S) relay, operated, operates the (K1) relay which enables the speakerphone circuit as described in 5.71.22. When the (ON) key is released, no change takes place until the handset is replaced on its cradle. When the handset is replaced, the (CT) relay of Fig. 10 drops down and the lockup path for the (S) relay is broken at the front contacts of the continuity transfer of the (CT) relay of Fig. 10. The (S) relay releases; but the (K1) relay remains operated, since a new lockup path is provided through back contacts of the continuity transfer of the (CT) relay.

5.73.2 Shifting from Speakerphone to Handset Operation

To change to the handset when talking on the speakerphone circuit, it is only necessary to lift the handset from its mounting. This operates the set switch which operates the (CT) relay of Fig. 10 or 11. The (CT) relay, operated, breaks the lockup circuit of the (K1) relay which disables the speakerphone circuit and enables the handset circuit as described in 5.71.1.

5.74 Terminating a Conversation When Using the Speakerphone

Operation of the (OFF) key of Fig. 3 breaks the lockup circuit of the (K1) relay of Fig. 4 or 8 which releases and restores the circuit to the idle condition.

5.75 Station Busy Lamp

The station busy lamp, if provided, is controlled by the (CT) relay of Fig. 10 or 11 when the handset is used, or by the (SW) relay of Fig. 10 or 11 when the speakerphone is used.

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