STATION SYSTEMS
KEY TELEPHONE SYSTEM NO. 1A2, 1A1, OR 6A
682AA, 2682AA, 683AA, AND 2683AA
TELEPHONE SET CIRCUITS
18- AND 30-BUTTON CAPACITY

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit provides station talking and listening circuits and TOUCH-TONE or rotary dialing arrangements together with pickup keys for connection to a maximum of 17 lines in 682- or 2682-type sets and 29 lines in 683- or 2683-type sets. Lines may be 2- or 4-wire central office, PBX, private, or intercom lines. It also provides for holding one or more lines and offers signal lamps which light the key buttons and a ringer which may be associated with one of the lines or used as a common ringer for two or more lines. In addition, pickup keys may be

converted to nonlocking operation and used to provide individual or common signaling functions on private or intercom lines. Jacks are provided so that a standard operator headset may be used instead of the handset. In addition, it is arranged for connection to a 2- and 4-wire speakerphone for hands-free use.

SECTION II - DETAILED DESCRIPTION

1. TRANSMITTING AND RECEIVING - FS1, FS2, FS3, FS19

ON 2-WIRE LINES

1.01 The handset and network circuits function in the usual manner as a common battery subscriber station circuit.

ON 4-WIRE LINES

1.02 When this set is connected to a 4-wire line, the associated 4-wire line circuit connects battery to the FW (four-wire) relay over the FW lead. Ground through either the operated line switch or the speakerphone control unit completes the circuit to operate the FW relay. Operation of the FW relay disconnects the handset or headset receiver from the network and connects it to the RR and RT leads, which are switched by the line circuit to the line being picked up by the set. The receiver leads RR and RT are switched externally to an impedance-matching transformer in the associated line circuit. The transmitter and network function in the usual manner as a common battery transmitter circuit.

HEAD TELEPHONE SET OPERATION

1.03 In addition to the normal handset operation, means are provided for connecting a standard head telephone set to the transmission circuit. When a head telephone set is plugged into the jacks, the handset is disabled and its functions are transferred to the head telephone set. A transistor amplifier is connected to raise the transmitter output to approximately the level of the handset transmitter.

PUSH-TO-TALK HANDSET - FS19

1.04 When push-to-talk operation is required a G5KR or equivalent handset, option 13, may be used to replace the regular handset provided with the telephone set. Connections shall be made as shown in FS19.

2. LINE SELECTION - FS3, FS4

PICKUP KEYS

2.01 Pickup keys are locking type and have three make contacts. When a pickup key is operated, the common circuits of the set are connected to the line associated with the key. The pickup keys are furnished in key units: a 635A5C key consists of five pickup keys plus a hold key; and a 635G5C key, option Z, consists of six pickup keys. Mechanical lockout releases any operated pickup key when a pickup key is operated in the same key unit and prevents operation of two keys at one time. A latch bar mechanism releases any operated pickup keys in other key units, but does not prevent simultaneous operation of a pickup key in each of several key units (see 2.04).

2.02 Connections to the pickup keys are made by means of a separate colored plug for each line. These plugs are part of the mounting cord. Lines may be interchanged by connecting the colored plug of any line to any pickup key of a key unit. The common tip and ring for each key unit consists of two metal contact strips with pins for connection to the keys (see Note 305). These strips are located underneath the colored plugs and terminate in spade-tipped leads for connection to the common circuits and to other key units.

RELEASE KEY

2.03 When these sets are used with a head telephone set connected to the jacks, the LS switch functions are performed by contacts on the jacks. It is therefore necessary to release any operated pickup keys after a call is terminated to avoid holding or seizing the associated line equipment. A nonlocking pushbutton release key is mechanically linked to the latch bar mechanism of the pickup keys so that, by operating it momentarily, any operated pickup keys will be released.

CHAINING SWITCH - FS5, FS6

2.04 To prevent simultaneous connection to two or more lines in different key units, a chaining switch consisting of three break contacts is furnished in each key unit. Operation of any pickup key operates the chaining switch in that key unit, disconnecting the common circuits from the succeeding key units. Thus, should pickup keys of two or more units be operated simultaneously, the chaining switches permit only the pickup key nearest the left-hand side of the set to connect its line to the common circuits.

2-WIRE LINES

2.05 When a pickup key is operated, the common circuits of the set are connected to the line circuit associated with that key and a call may be answered or originated in the usual manner.

4-WIRE LINES

2.06 When a pickup key is operated, the transmitting portion of the circuit is connected to the line associated with that key. The A lead ground operates a pickup relay in the line circuit which in turn supplies battery to operate the FW relay and connects the receiving leads RR and RT to the line circuit.

3. SIGNALING

VISUAL SIGNALS - FS7, FS12

A. Lighted Keys - FS7

3.01 Lamps are provided to light the pickup and hold key buttons and are controlled by the associated line circuits or lamp control circuits which provide distinctive signals by lighting the lamps steadily or with various interruption rates.

B. Auxiliary Lamp Socket - FS12

3.02 When additional lamps are required in the set a 76A lamp socket may be installed in place of a pickup key unit. The lamp socket consists of two rows of six lamps each. The left-hand row, lamps 1 through 6, is connected to the same cord and cable conductors as the pickup key tips and rings while the right-hand row, lamps 7 through 12, is connected to the cord and cable conductors for the lamps of the pickup key which the lamp socket replaces. The lamp socket is connected to the cord by means of the colored plugs the same as a pickup key unit. It must be located in a key position to the right of the last position equipped with a pickup key and to the left of the internal speakerphone transmitter if the set is so equipped.

AUDIBLE SIGNALS - FS8, FS9

A. Ringer - FS8

3.03 A ringer and capacitor are provided in the set for use as either a line ringer or a common ringer. The ringer is connected with the capacitor when used as a bridged ringer on a central office or PBX line. The ringer may be connected with or without the capacitor for a private line, intercom, or common signal as required. When the power failure feature is provided the capacitor is required. No provision is made inside the set for associating the ringer with a particular line. The R or R1 and B or B1 leads shall be connected externally for the desired type of operation.

B. Buzzers - FS9

3.04 A mounting bracket for buzzers is provided inside the set. It is arranged to mount one or two KS-8109,L2 buzzers, option Y or X or KS-20419,L1 buzzers, option W, or combinations thereof. While the KS-20419, L1 buzzer may be mounted under any convenient screw head that does not cause electrical or mechanical interference with other apparatus, the KS-8109,L2 buzzer shall always be mounted so that its frame is insulated from the base of the set. This is best accomplished by limiting the mounting of the KS-8109,L2 buzzer to the mounting bracket. Sets manufactured after December 31, 1972 will be factory equipped with the KS-20419, L1 buzzer, option W.

3.05 The KS-8109,L2 buzzer may be operated from a 14-30 volt dc supply using wiring option Y or from a 14-30 volt, 60-Hz ac supply using wiring option X. The KS-20419,L1 buzzer, option W, shall be operated only from a 10-volt, 60-Hz ac supply.

3.06 A pair of leads, S-Y and Y-S, in the orange-white binder are dedicated for buzzer use. When more than one buzzer is required spare pairs shall be used.

CONVERTIBLE KEYS - FS4

3.07 All keys except the hold key can be converted from pickup to signaling or vice versa. Transfer and loopback functions may be assigned to these keys when such circuits are furnished. The keys are converted from locking to nonlocking by removing a threaded pin from the plunger. The circuit is rearranged for signaling by moving one or more spade-tipped leads on the terminal boards. Such connections are described in detail in the Bell System Practices. When keys are used for signaling, the key contacts and cord conductors normally used for A lead functions are used for the signaling functions and are designated S or S1.

COMMON SIGNALING KEY - FS4

3.08 The set can be arranged for signaling on private or intercom lines by means of a common signaling key. On such lines the A lead is not required, so it is used as the S or S1 lead for signaling. In such an arrangement several lines may have their S or S1 leads extended through the pickup key contacts and, by means of the associated spade-tipped leads, connected to one key which has been arranged for signaling on whichever line has its pickup key operated. Such connections are described in detail in the Bell System Practices. The common signaling key is converted to nonlocking by removing the threaded pin from the plunger.

ADDITIONAL SIGNAL KEYS - FS13

3.09 When additional signal keys are required in the set a 658A key may be installed in place of a pickup key unit. The key consists of two rows of six buttons each. The left-hand row, buttons 1 through 6, is connected to the same cord and cable conductors (L) as the pickup key lamps 1 through 6.

The right-hand row, buttons 7 through 12, is connected to the same cord and cable conductors (LG) as the lamp grounds 1 through 6 of the pickup key which this key replaces. The key is connected to the cord by means of the colored plugs the same as a pickup key unit. It must be located in a key position to the right of the last position equipped with a pickup key unit and to the left of the internal speakerphone transmitter if the set is so equipped.

3.10 The common lead of buttons 1 through 6 is connected to TB1 terminal 17 and that of buttons 7 through 12 to terminal 18. Terminals 17 and 18 are connected together by means of a removable strap. SG ground is connected to terminal 18. When required, the strap may be removed to provide separate common connections to the two rows of keys.

DIALS

A. TOUCH-TONE Dial - FS2

3.11 A pushbutton dial is provided for generating and transmitting the TOUCH-TONE frequencies to the switching equipment. This dial contains a transistor oscillator capable of generating two frequencies simultaneously. The oscillator is powered by line current. In addition to the ten regular numerical buttons, this dial has two buttons designated * and #, for generating additional signals as may be required by the circuits to which the telephone set has access. When a button is operated, two frequencies are generated by the oscillator. A common switch on the dial operates when any button is pushed and disconnects the handset transmitter circuit from the network and connects the dial output circuit in its place, transmitting the two frequencies over the line to the switching equipment. In addition, small amounts of the transmitted tones are fed back to the handset or headset receiver to assure the user that tones are being transmitted. In the 2-wire mode, these tones are fed back through the 5100-ohm resistor in the dial. In the 4-wire mode, operation of the FW relay shunts the 5100-ohm resistor of the dial with the 2400-ohm FB resistor to compensate for the lower level of the tones at the 4-wire line receiving pair. This results in the user hearing approximately the same level of tone on both 2- and 4-wire lines.

B. Polarity Guard - FS14

3.12 Polarity guard PG, option V, may be provided when necessary to maintain proper polarity for operation of the TOUCH-TONE dial regardless of line polarity. Such a use would be end-to-end signaling after a connection is established. The polarity guard consists of a semiconductor diode bridge rectifier, a breakdown diode to limit voltage surges to a safe value, and two series resistors to limit current surges.

C. Rotary Dial - FS1, FS10

3.13 Rotary dial sets are furnished with a dial having a pulsing contact and two sets of off-normal contacts. The pulsing contact PLS makes and breaks the line current to signal the switching equipment. When the dial is rotated off-normal, contact ON makes to short circuit the handset or headset receiver to prevent acoustic disturbances and contact ON1, FS10, makes to provide switching for an external circuit such as muting a speakerphone loudspeaker or lifting a transmission bridge during dialing.

LINE SWITCH - FS1, FS2, FS4

3.14 A line switch, LS, having three sets of contacts is provided. The continuity transfer contacts a, b, and c operate first when the handset is removed and restore last on hangup. This sequence prevents a false hold condition when the set is connected to line circuits having A lead control. The normally open set of contacts d and e controls the talking circuit to the set. They make after and break before the continuity transfer previously mentioned. The third, or normally closed set of contacts f and g, short circuits the handset or headset receiver. They are arranged to break after and remake before the other contacts to eliminate acoustic disturbances due to the transients produced by those contacts.

JACK CONTACTS - FS1, FS2, FS4

3.15 Certain LS switch functions are performed by jack contacts when the plug of the head telephone set is inserted into the jacks. The contacts on the A jack connect A1 ground to the A lead, and the contacts on the B jack connect the ring of the line to the network. Each of these contacts is in parallel with the corresponding contacts on the LS switch, thus providing a means of switching from handset to head telephone set operation and vice versa as described in 1.03. The transfer contacts on the A and B jacks transfer the receiver and transmitter circuits, respectively, from the handset to the head telephone set when operated.

FLASH KEY - FS1, FS2

3.16 A flash key, FL, is provided adjacent to the release key of 2.03 for generating a switchhook flash to recall an operator or to supervise transfer functions when a headset is plugged into the A and B jacks making the LS switch ineffective. When this key is operated the a and b contacts make first to short-circuit the receiver circuit to eliminate acoustic disturbances that might be generated when contacts c and d operate to open the line. Upon release of the key the c and d contacts reclose the line before contacts a and b open.

3.17 While primarily intended for use in conjunction with headset operation, the flash key is also effective with handset operation as described. It is also effective with speakerphone operation; however, contacts a and b perform no useful function under this condition.

4. HOLDING - FS4, FS16

REGULAR HOLD - FS4

4.01 A hold key is provided for use with line circuits having the holding feature. Operation of the hold key opens the A lead, permitting a hold relay in the line circuit to operate. Release of the hold key restores the operated pickup key through mechanical linkage. The hold relay remains operated, holding the line until the line is picked up again at the same or another station. During the time the line is held, the lamp in the pickup key of the held line will indicate the hold condition by a suitable interruption rate. When the line is again picked up, the A lead is closed and the holding condition is removed by release of the hold relay. The lamp will return to a steady on condition.

SUPPLEMENTARY HOLD - FS16

4.02 The supplementary hold circuit for line circuits having A lead control provides a special lamp-flutter hold indication in addition to the normal lamp-wink associated with regular hold. The supplementary hold circuit may be connected to provide two features, priority hold and I hold.

PRIORITY HOLD - OPTION G

4.03 In the priority hold configuration, the lamp-flutter signal is provided to all stations picking up the lines that are equipped for this feature. A D-180411 Kit of Parts consisting of a 635A5C key, a pink 509A plug with spade tipped leads; and two contact strips is required. Assemble and connect the kit of parts to the set in accordance with Note 2 and option G of FS16. The hold button of the second key unit is used to activate the priority hold function.

I HOLD - OPTION F

4.04 The I hold configuration provides the lamp-flutter signal only to the set initiating the hold. This arrangement requires only the regular hold key wired according to FS16, option F.

5. STATION BUSY LAMP - FS15

5.01 The station busy lamp feature provides for lighting a 51A or equivalent 10 volt lamp at a remote location to indicate that a particular set is off-hook by monitoring the C contact of the line switch. In these sets, when a headset is plugged into the A and B jacks the line switch functions are transferred to the jack contacts, and the c contact of the line switch no longer indicates true on-hook - off-hook status (see 2.03). It is therefore necessary to monitor the c contact of the line switch, the 2 contact of the A jack, and the status of the chaining switches of the pickup keys to determine whether a true off-hook condition exists. This is accomplished by installing either a D-180463 Kit of Parts or a P-90D033 Printed Wiring Board Assembly in the set.

D-180463 KIT OF PARTS - OPTION K

5.02 The D-180463 Kit of Parts consists of a P-90D033 Printed Wiring Board Assembly plus a light beige 509A plug. The 509A plug has a G-V lead connected to pin 6 and a V-G lead connected to pin 5. When all positions are equipped with pickup keys use the D-180463 Kit of Parts and connect as shown in the FS.

P-90D033 PRINTED WIRING BOARD ASSEMBLY - OPTIONS K, M, N, Q, AND R

5.03 When all positions are not equipped with pickup keys only the P-90D033 Printed Wiring Board Assembly is required. Connect as shown in the FS with the orange lead to the appropriate terminal where the G-V lead of the last equipped key chaining switch plug terminates.

6. SPEAKERPHONE - FS17

6.01 Connecting information is shown for a 2- and 4-wire speakerphone arrangement, options B and E.

EXTERNAL TRANSMITTER, OPTION B

6.02 Connections are provided to conductors in the first plug of the cord for use with a 2- and 4-wire speakerphone using an external transmitter. Rearrange the connections in accordance with Table E of the FS.

INTERNAL TRANSMITTER, OPTION E

6.03 When it is desired, a 679A transmitter can be installed in the set in place of the last key unit. This transmitter is arranged to accept the slate colored plug of the mounting cord for connection to the last plug. All other plugs associated with the last key unit shall be insulated and stored. Connect the spade tipped S-V lead of the transmitter to TB1, terminal 4.

6.04 All other connections between the set and the 2- and 4-wire speakerphone shall be made via the last plug of the mounting

cord. Rearrange the connections in accordance with Table F of the FS.

6.05 If the 2- and 4-wire speakerphone control unit is at the station location the key system A1 ground (not to be confused with the internal transmitter A1 lead) may be extended through the mounting cord to the control unit or it may be run from the equipment via the connector cable.

7. CUTOFF KEY - FS18

7.01 When a cutoff key is required the first key unit can be replaced with a 635AD5C key arranged for a push-to-lock, push-to-release key in place of the fifth pickup key and adjacent to the hold key. The "push-push" key is equipped with two sets of transfer contacts. An adapter is provided with the 635AD5C key to provide the wiring transition between the slate plug of the mounting cord and the transfer contacts of the push-push key. New contact strips for the common tip and ring connections must be ordered separately to replace those on the 635A5C key. See the appropriate apparatus figure on the drawing for ordering information.

7.02 It will be necessary to disconnect any line circuits and all multiples from the conductors to be associated with the cutoff key to prevent interference with other circuits.

7.03 To install the cutoff key, remove the colored plugs and contact strips from the 635A5C key and disconnect the contact strip leads from their terminals on the terminal board. Install the new contact strips, the adapter, and the colored plugs on the 635AD5C key (see Note 305). Connect the common tip and ring leads of the contact strips to their terminals on the terminal board. The BL-Y and Y-BL leads of the adapter and the BK-BR, S-BK, and BK-S leads of the slate plug may be connected as required. See the appropriate Bell System Practice for detailed connection information. The BR-BK lead of the slate plug shall be disconnected from TB1, terminal 10 in all cases. It may be connected as required or insulated and stored.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Maximum loop resistance between this circuit and the lamp power supply - 50 ohms.

2. FUNCTIONAL DESIGNATIONS

2.01 None.

3. FUNCTIONS

3.01 Provides a handset or headset and anti-sidetone transmission circuit for connection to 2-wire common battery lines.

3.02 Provides a relay to switch the transmission circuit to permit connection through an external line circuit to a 4-wire line.

3.03 Provides for picking up a maximum of 17 or 29 lines.

3.04 Provides for operation of holding circuits.

3.05 Provides a ringer and buzzers as audible signals.

3.06 Provides TOUCH-TONE dialing by means of a pushbutton dial.

3.07 Provides dial pulse dialing by means of a rotary dial.

3.08 Provides keys that may be converted from pickup (locking) to signaling (nonlocking).

3.09 Provides a common signaling key to signal on two or more private or intercom lines.

3.10 Provides for rearrangement of the lines on the keys by means of plug-ended line conductors.

3.11 Provides lamps as visual signals.

3.12 Provides a plug-ended mounting cord.

3.13 Provides signaling keys arranged to operate local circuits.

3.14 Provides for operation with 2- and 4-wire speakerphone.

3.15 Provides for a cutoff key.

3.16 Provides for an optional push-to-talk handset.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a keysheet, the connecting information thereon is to be followed. The following are typical connecting circuits:

(a) Station Systems - 4-Wire Subscriber Line Circuits Arranged for Common Battery Operation - SD-69414-01.

(b) Station Systems - 4-Wire Private Line Circuit Arranged for Terminating in 2- and 4-Wire Key Telephone Sets - SD-69449-01.

(c) Station Systems - Auxiliary Service Transfer Circuit for 4-Wire Lines - SD-69422-01.

(d) Key Telephone System No. 1A2 - CO or PBX Line Circuit - SD-69513-01.

(e) Key Telephone System No. 1A1 - CO or PBX Line Circuit - SD-69270-01.

(f) Key Telephone System No. 1A1 - Visual and Audible Signal Circuit - SD-69294-01.

(g) Station Connector Cables and Associated Components - SD-69368-01.

(h) Key Telephone Systems No. 1A1 and 1A2 - Multi-Line Exclusion Circuit - SD-69489-01.

(i) Switching System No. 309 - Speakerphone Control Circuit for 2- and 4-Wire Lines - SD-69542-01.

(j) Key Telephone System No. 1A1 or 1A2 - Station Busy Lamp Circuit - SD-69580-01.

(k) Key Telephone System No. 1A1 or 1A2 - Supplementary Hold Circuit - SD-69530-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 Manufacturing testing requirements are contained in drawing A-243118.

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DEPT 3225-GRT-GES