

STATION SYSTEMS
KEY TELEPHONE SYSTEMS NO. 1A, 1A1, 1A2 AND 6A
636CA, 637DA, 2636CA, 2637DA
TELEPHONE SET CIRCUIT
18- AND 30- BUTTON CAPACITY
FOR USE WITH 2-WIRE LINES ARRANGED FOR
HANDSET OR HEADSET OPERATION AND DIAL PULSE
OR "TOUCH-TONE" CALLING

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phone system No. 1A, 1A1, 1A2, and 6A. It also provides for holding one or more lines, offers signal lamps which light the key buttons, and offers a ringer which may be associated with one or more lines as a common ringer. Pickup keys may be converted to nonlocking operation and used to provide individual or common signaling functions on private or intercommunication lines. The circuit shows information for headset or handset operation.

SECTION II - DETAILED DESCRIPTION OF 1A1 AND 1A2 KEY TELEPHONE SYSTEMS

1. TRANSMITTING AND RECEIVING - FS1, FS2 ON 2-WIRE LINES

1.01 The handset and network circuits, shown connected to rotary dial, FS1, and to TOUCH-TONE dial, FS2, function in the usual manner as a common battery subscriber station circuit.

HEAD TELEPHONE SET OPERATION

1.02 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.

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 telephone set are connected to the line associated with the key. The pickup keys are furnished in key units: 635A5C key consists of five pickup keys and a hold key, and 635G5C, option Z, consists of six pickup keys. Mechanical lockout releases any operated pickup key when another pickup key is operated in the same key unit and prevents operation of two key plungers at one time. A latch bar mechanism releases any operated pickup key in other key units, but does not prevent simultaneous operation of a pickup key in the other key units.

2.02 Connections to the pickup keys are made by means of separate colored plugs 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 leads for each key unit consists of two metal contact strips with pins for connection to the keys. These strips are located underneath the colored plugs and terminate in spade-tipped leads for connec-

tion to the common circuits and to other key units via terminals on the terminal board.

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

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

2-WIRE LINES

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

3. SIGNALING

VISUAL SIGNALS - FS7, FS11

A. Lighted Keys - FS7

3.01 Lamps are provided to light the pickup and hold key buttons. The lamps 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 - FS11

3.02 When additional lamps are required in the telephone 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 row, lamps 1 through 6, is connected to the same cord and cable conductors of the pickup key tips and rings. The right row, lamps 7 through 12, is connected to the same cord and cable conductors as the lamps of the pickup keys which the lamp socket replaces. The lamp socket is connected to the cord by means of colored plugs the same as the pickup key unit. The

lamp socket must be located in a key position to the right of the last position equipped with a pickup key unit.

AUDIBLE SIGNALS - FS8, FS9

A. Ringer - FS8

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

B. Buzzers - FS9

3.04 A mounting bracket for buzzers is provided inside the telephone set. It is arranged to mount one or two KS-8109, L2 buzzers, options Y or X, or KS-20419, L1 buzzers, option W, or combinations of the 2 types of buzzers. Telephone sets manufactured after December 31, 1972, will be equipped with KS-20419, L1 buzzer, option W. 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 telephone set. This is best accomplished by mounting the KS-8109, L2 buzzer only to the mounting bracket.

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

3.06 A pair of leads, BZ(S-Y) and BZ1(Y-S), in 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 the threaded pin from the plunger. The circuit is rearranged for signaling by moving one or more spade-tipped leads on the terminal board. 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 KEYS - FS4

3.08 The telephone set can be arranged for signaling on private or intercommunication lines by means of a common signaling key. On such lines lead A is not required, so it is used as leads S or S1 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 associated spade-tipped leads, connected to one key which has been arranged for signaling 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 - FS12

3.09 When additional signal keys are required in the telephone 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 row, buttons 1 through 6, is connected to the same cord and cable conductors (L designation) as the pickup key lamps 1 through 6. The right row, buttons 7 through 12, is connected to the same cord and cable conductors (LG designation) 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 colored plugs in the same manner as the pickup key unit. It must be located in a key position to the right of the last position equipped with a pickup key unit.

3.10 The common lead of buttons 1 through 6 is connected to terminal 17 of the terminal board. The common lead of buttons 7 through 12 is connected to terminal 18 of the terminal board. Terminals 17 and 18 are connected by means of a removable strap. The SG ground lead is connected to terminal 18. When required, the strap between terminals 17 and 18 may be removed and a one-wire cord connected to terminal 17 at one end. The other end is connected to a dissimilar ground or to other circuits. This is to provide separate common connections to the two rows of buttons.

DIALS

A. TOUCH-TONE Dial - FS2

3.11 A pushbutton dial 35C3A is provided for generating and transmitting the TOUCH-TONE frequencies to the switching equipment. The 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 additional buttons, * 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. The switch disconnects the handset transmitter circuit from the network and connects the dial output circuit in its place, thus 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 receiver to assure the user that the tones are being transmitted. These tones are fed back through a 5100-ohm resistor in the dial.

B. Polarity Guard - FS13

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 the current surges.

C. Rotary Dial - FS1

3.13 Rotary dial sets are furnished with an 8R dial having a pulsing contact and one set 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 DN makes to short circuit the handset receiver to prevent acoustic disturbances.

LINE SWITCH - FS1, FS2, FS4

3.14 Line switch (LS designation), having three sets of contacts, is provided. The continuity transfer contacts a, b, and c operate first when the handset is removed and restored last on hangup. This sequence prevents a false hold condition when the telephone 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 telephone set. They make after contacts b and c make and before contacts a and b break, and they restore after contacts a and b make and before contacts b and c break. The normally closed set of contacts f and g short circuit the handset receiver. They are arranged to break after the other contacts and restore before the other contacts to eliminate acoustic disturbances due to the transients produced by the other 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, FS15

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 the 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 at 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 - FS15

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 kit of parts, D-180411, consisting of a key unit, 635A5C and a pink plug, 509A, with spade-tipped leads, and two contact strips, is required. Assemble and connect the kit of parts to the set in accordance with Note 1 and option G of FS15. The hold button of a 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 option F of FS15.

5. STATION BUSY LAMP - FS14

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. CUTOFF KEY - FS16

6.01 When a cutoff key is required, the first key unit position can be equipped with a 635AD5C key unit, which is 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 unit to provide the wiring transition between the slate plug of the mounting cord and 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 unit. See the appropriate apparatus figure on the SD for ordering information.

6.02 It is necessary to disconnect any line circuits and all multiplies from the conductors to be associated with the cutoff key to prevent interference with other circuits.

6.03 To install the cutoff key, remove the colored plugs and contact strips from the 635A5C key unit 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 unit. Connect the common tip and ring leads of the new 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 terminal 10 of the terminal board in all cases. It may be connected as required or insulated and stored.

**7. CONNECTION TO VARIOUS CENTRAL OFFICE OR
PBX LINE CIRCUITS****1A1 OR 1A2 LINES**

7.01 The telephone set is shop wired for Key Telephone Systems No. 1A1 and 1A2 line circuits only and is used as furnished.

1A AND 1A1 OR 1A2 LINES

7.02 When the telephone set is connected to line circuits of the Key Telephone Systems No. 1A, 1A1, and 1A2, the 1A1 or 1A2 line circuits shall be connected to pickup keys in the first key unit position, then the second key unit position, etc, as required. (The first key unit position is the position to the right of the dial.) Central office or PBX line circuits of Key Telephone Systems No. 1A1 and 1A2 may be connected to the same key unit. Line circuits of Key Telephone System No. 1A shall be connected to pickup keys in the succeeding unused key unit. Central office or PBX line circuits of Key Telephone Systems No. 1A and 1A1 or 1A2

shall not be connected to the same key unit. To convert key units from 1A1 or 1A2 line circuits to 1A line circuits is described in circuit Notes 109, 110, 111, 112, and 113.

1A LINES ONLY

7.03 The information necessary to convert key units to 1A line circuits is contained in circuit notes 109, 110, 111, 112, and 113 of the SD.

8. RADIO FREQUENCY NOISE SUPPRESSOR

8.01 A radio frequency suppressor for dial interference is built into network 4010B.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

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

2. FUNCTIONAL DESIGNATIONS

2.01 Dial, Rotary

<u>Designation</u>	<u>Meaning</u>
PLS	Pulsing Contact
DN	Off-Normal Contact

2.02 Handset

<u>Designation</u>	<u>Meaning</u>
RCVR	Receiver
TRMTR	Transmitter

3. FUNCTIONS

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

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

3.03 Provides for operation of holding circuits.

3.04 Provides a ringer and a buzzer as audible signals.

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

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

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

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

3.09 Provides for arrangement of the lines on the keys by means of plug-ended line conductors.

3.10 Provides lamps as visual signals.

3.11 Provides a plug-ended mounting cord.

3.12 Provides signaling keys arranged to operate local circuits.

3.13 Provides for a cutoff key.

3.14 Provides for auxiliary lamps and signaling keys.

3.15 Provides arrangement for station busy.

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) Key Telephone System No. 1A2 - CD or PBX Line Circuit - SD-69513-01.
- (b) Key Telephone System No. 1A1 - CD or PBX Line Circuit - SD-69270-01.
- (c) Key Telephone System No. 1A1 - Visual and Audible Signal Circuit - SD-69294-01.
- (d) Station Connector Cables and Associated Components - SD-69368-01.
- (e) Key Telephone Systems No. 1A1 and 1A2 - Multiline Exclusion Circuit - SD-69489-01.
- (f) Key telephone System No. 1A1 or 1A2 - Station Busy Lamp Circuit - SD-69580-01.
- (g) Key Telephone System No. 1A1 or 1A2 - Supplementary Hold Circuit - SD-69530-01.
- (h) Key Telephone System No. 1A - Line and Signaling Circuit - SD-69136-01.
- (i) Key Telephone System No. 6A - Intercommunicating Communicating Line Circuit - SD-69286-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 Manufacturing testing requirements
are contained in drawing A-243135.

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