

A.E. CO. TYPE 87A TELEPHONE SET
DESCRIPTION AND INSTALLATION

1. GENERAL

1.01 This section describes the A.E. Co. Type 87A three-line telephone instrument, its applications and installation.

1.02 With the exception of mechanical details, the earlier Type 87 sets, both those with the self-compensating transmission network and those with the original manually-adjusted loop rheostat, are not covered by this section. In the earlier Type 87 design, the bridge applied to a line by the operation of a hold key included only resistance, and imposed a severe transmission loss if inadvertently left connected during a conversation continued from a different station.

1.03 This section is reissued to provide corrected information concerning the proper position of the pushbutton in the original style of lamp shield, to add information concerning a change in manufacture of hookswitch plungers, and to revise and expand information concerning the lamp reflector and designation strip cover to incorporate manufacturing changes. New or revised material is indicated by marginal arrows.

2. DESCRIPTION

2.01 The Type 87A telephone instrument (see Figure 1a) is a six-key set arranged to initiate, answer and hold calls on a maximum of three central office, PBX, PABX or intercom lines without the need for auxiliary relay apparatus or power supplies. Incoming calls are indicated by neon lamp signals during each ringing interval, but no provision is made for busy lamp, hold lamp, or locked-in line lamp indications; nor can a line be released from hold except at the station from which it was placed on hold.

Physical Construction

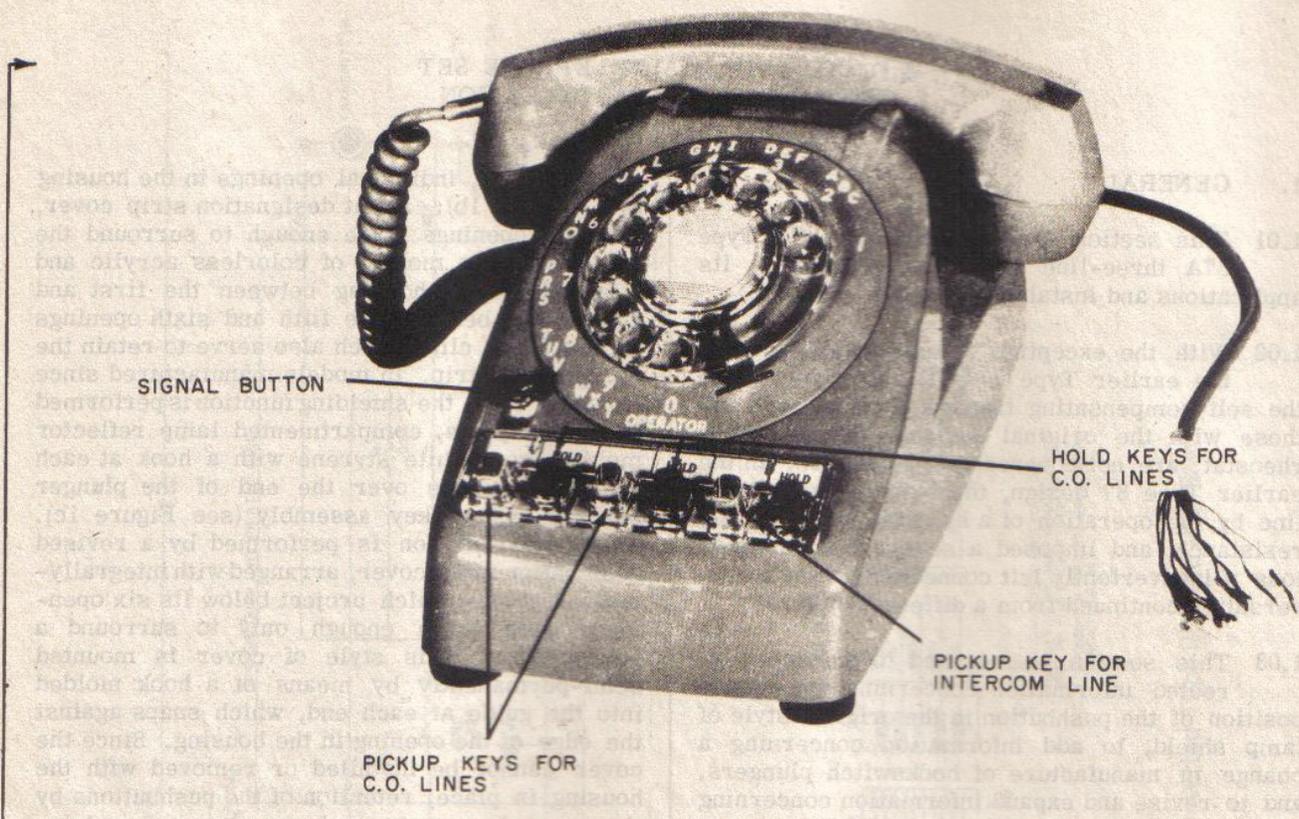
2.02 The six pushbutton keys are mounted in the front apron of the housing, beneath the dial.

Each pushbutton is molded of transparent acrylic with a convex-square cross-section. Three pushbuttons are colorless and three are red (on the earliest sets, all were colorless). In early models the pushbutton is retained by an individual guide or shield molded of colorless acrylic but painted white on the interior of all but its upper surfaces. The guides protrude through, and are

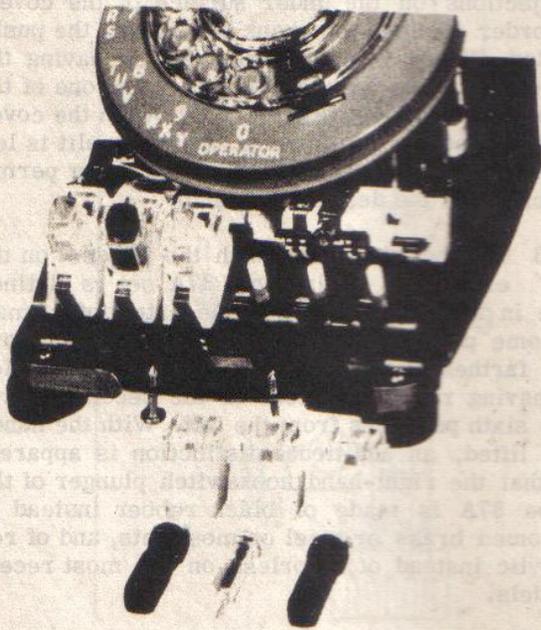
positioned by, individual openings in the housing (see Figure 1b). A flat designation strip cover, with six openings large enough to surround the guide ends, is molded of colorless acrylic and attached to the housing between the first and second and between the fifth and sixth openings by two metal clips which also serve to retain the designation strip. In models manufactured since January, 1966, the shielding function is performed by a one-piece, compartmented lamp reflector molded from white styrene with a hook at each end which snaps over the end of the plunger bracket on the key assembly (see Figure 1c). The guide function is performed by a revised designation strip cover, arranged with integrally-molded guides which project below its six openings, each large enough only to surround a pushbutton. This style of cover is mounted semi-permanently by means of a hook molded into the guide at each end, which snaps against the edge of the opening in the housing. Since the cover cannot be installed or removed with the housing in place, retention of the pushbuttons by the cover is necessary during removal and installation of the housing. This is provided by a retaining tab extending below each of the guide projections on the under surface of the cover. In order to clear the shank of this tab, the pushbutton differs from earlier types in having the shoulder at its base eliminated along one of the rimless sides (see Figure 13). When the cover is installed on the housing, a narrow slit is left between the two at the upper edge, to permit insertion of the designation strip.

2.03 In stock form and with the handset on the cradle, an early Type 87A set is distinctive in appearance only to the extent of a small chrome pushbutton designated SIG. located above the farthest-left pushbutton. Later sets differ in having red pushbuttons in the second, fourth and sixth positions from the left. With the handset lifted, an additional distinction is apparent in that the right-hand hookswitch plunger of the Type 87A is made of black rubber instead of chromed brass or steel on most sets, and of red acrylic instead of colorless on the most recent models.

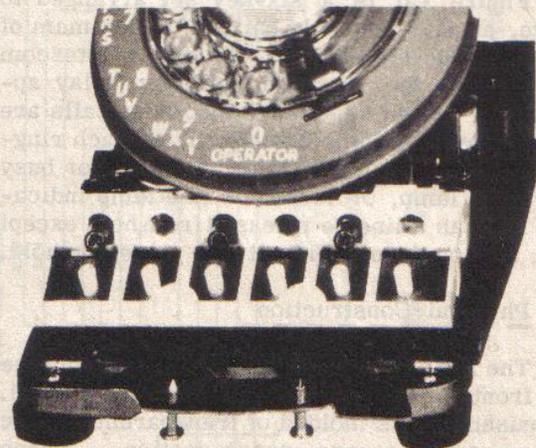
2.04 Unlike other six-key assemblies, the keys in the Type 87A assembly are paired in three sets of pickup and hold keys, one for each line. On newer sets, the hold keys have red



(a) External View, Showing Newer Type Designation Strip Cover.



(b) Old Assembly with Individual Lamp Shields.



(c) New Reflector in Position.

Figure 1. A.E. Co. Type 87A Telephone Set.

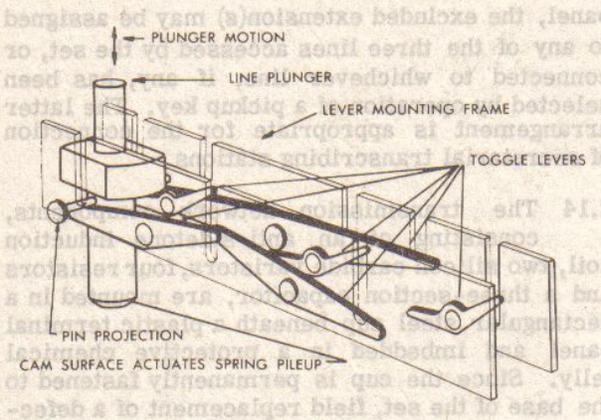


Figure 2. Pickup and Hold Key Restoring Linkage.

pushbuttons. As shown in Figure 2, depressing the farthest-left key to access line 1 not only operates the contact springs which complete the connection, but acts on (1) a long toggle lever which restores the pickup key for line 3, should it be in the operated position; (2) the farther-left of two medium-length toggle levers, which restores the pickup key for line 2, if operated; and (3) the farthest left of three short toggle levers, which restores the hold key for line 1, if operated. Similar linkage action among the other keys insures that operating any pickup key restores the hold key for that line, if operated, and whichever of the other two pickup keys may be operated, while operating any hold key restores the pickup key for that line, assuming it is operated.

2.05 An operated hold key is not affected by the operation of pickup or hold keys serving the other two lines. However, to insure that no line can be left on hold unintentionally, a restoring arm beneath the plunger of each hold key is controlled through a common shaft by a lever pivoted at the rear of the key assembly and actuated by the right-hand (black or red) hookswitch plunger. Restoring the handset to the cradle forces the plunger and thus the lever down at the rear, causing the front of the lever to rotate the shaft on which the restoring arms are mounted (see Figure 3). If any hold key is in the operated position, the restoring arm beneath it forces the plunger upward and thereby restores the key to remove the hold bridge from the line.

2.06 The lamp jack assembly was intended to accommodate six incandescent lamps, but in this modification has been provided with jack

springs only for the three positions adjacent to the pickup keys. Each jack is wired independently of the others and is equipped with an NE-84 neon lamp which protrudes forward slightly into the associated key shield, and thus serves to illuminate the key and designation when lit.

2.07 A 13-terminal board, located behind the lamp jack and underneath the dial assembly, is used to terminate the ten conductors of the line cord and provide for optional wiring. Three inductors and three resistors for the line holding bridges are mounted on top of the board, while series resistors for the three lamps are placed beneath the board and wired between board terminals and the lamp jack contacts.

2.08 The SIG. key is a non-locking, single-make assembly fastened to the left of the dial mounting tripod and terminal board. The key may be used for signaling between stations, or for call transfer in those PABX systems which require a grounding key for this function. For the latter application, the SIG. escutcheon may be removed in the field. Since the Type 87A housing is merely a Type 86 housing which has been modified by the addition of a hole in which an assembly of a captive plunger, threaded bushing and brass nut is mounted, a Type 86 housing, if available, may be substituted on the Type 87A set in those installations where the key will not be used.

2.09 The Type 87A set is ordinarily supplied with a Type 52 dial equipped with a metropolitan extended number plate. When required, a D-530168 numeric plate may be substituted. For use in manual exchanges, a D-49995 dial blank may be substituted for the dial. While the

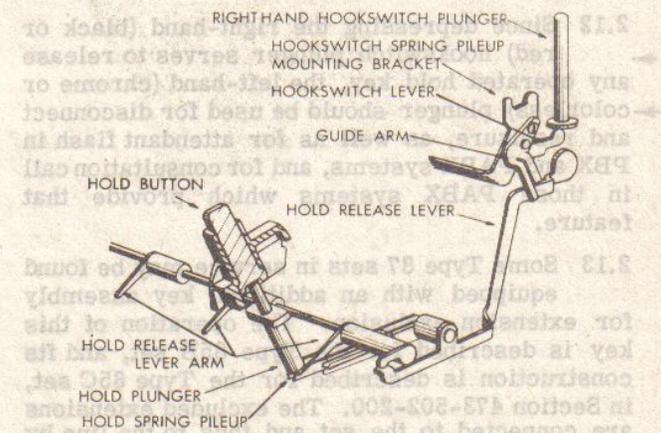


Figure 3. Hookswitch Plunger and Hold Key Restoring Linkage.

substitution of a Type 53 dial is feasible, the use of this instrument in exchanges arranged for Strowger Automatic Toll Ticketing should be confined to installations in which every central office line accessible to any given set is assigned the same identity pulse. The dial or blank is mounted on a dial bracket which is fastened to the tripod with two screws.

2.10 The hookswitch is an indirectly-actuated, seven spring type with spade-terminated leads soldered to lugs on the contact springs. A spring-loaded hookswitch-actuating lever is provided with a buffer which bears against the spring pile on its upper surface (through an aperture in the dust cover provided on earlier models). With the housing removed, a slight amount of over-center travel of the hookswitch lever permits the installer/repairman to set it in the on-hook position while working on the instrument, to avoid lost calls and excessive equipment holding time. As the housing is replaced, one of its internal ribs bears against the lever, forcing it back from the off-center rest position.

2.11 The first-operating group of contacts (see Figure 10) as the switch goes off-hook is a transfer set. Since the audible signal is connected to its line or lines independently of the position of the pickup keys or hookswitch, the break spring of this contact group is not required for signal disconnection and is left vacant. The remaining (make) contacts in the group connect one side of the line to the network. The second pair of contacts is a make set which connects the other side of the line, and the last-operating contact pair removes a shunt from the receiver.

2.12 Since depressing the right-hand (black or red) hookswitch plunger serves to release any operated hold key, the left-hand (chrome or colorless) plunger should be used for disconnect and reseizure, as well as for attendant flash in PBX and PABX systems, and for consultation call in those PABX systems which provide that feature.

2.13 Some Type 87 sets in service may be found equipped with an additional key assembly for extension exclusion. The operation of this key is described for the Type 85B set, and its construction is described for the Type 85C set, in Section 473-502-200. The excluded extensions are connected to the set and thus to the line by way of the E1 and E2 terminals on the terminal strip and their associated line cord conductors. By choice of lead connections at the terminal

panel, the excluded extension(s) may be assigned to any of the three lines accessed by the set, or connected to whichever line, if any, has been selected by operation of a pickup key. The latter arrangement is appropriate for the connection of secretarial transcribing stations.

2.14 The transmission network components, consisting of an anti-sidetone induction coil, two silicon carbide varistors, four resistors and a three-section capacitor, are mounted in a rectangular steel cup beneath a plastic terminal panel and imbedded in a protective chemical jelly. Since the cup is permanently fastened to the base of the set, field replacement of a defective network is not possible.

2.15 Provision is made for mounting either of two types of signal on the pressed-metal base to the left and to the rear of the network. Two threaded bosses riveted near the rear and a bracket near the center serve to support the signal at three points. A straight line, single-coil ringer (Leich Code 42C) may be used if only one line requires the addition of an audible signal at this location. Such a case may arise when the telephone user is situated within earshot of the ringers associated with two of the lines to which the set gives access. The ringer construction is such that one capacitor lead is permanently wired to the coil, and only two leads emerge for connection at the line terminals. For this reason, failure of a ringer capacitor requires field replacement of the entire ringer assembly, rather than of the capacitor alone. Code 44 frequency ringers are not presently adaptable to use in the Type 87A set, partially because there is no spare network terminal on which to terminate the separate ringer and capacitor leads, but chiefly because of interference between the armature rivets and the side of the network. The Code 42C ringer has no provision for sound output adjustment by the customer.

2.16 Where an additional signal must be provided at the station for each line accessed, a common audible signal assembly may be mounted in the space provided for the single ringer. This consists of a T-bracket, with a stud at the base of the T much like that on the Codes 42 and 44 ringers, which rests in the grommet on the mounting ear turned up from the base of the set. The arms of the T are slotted at the ends to receive grommets through which ringer screws pass to fasten the bracket to the threaded studs in the base. Mounted to the bracket in the area usually occupied by the ringer coil and armature assembly is a small chassis on which sockets are riveted to accommodate three

Sylvania 5823 miniature cold-cathode tubes, together with the resistors used to isolate their starter electrodes from one another. Common anode resistors and bypass capacitors are mounted on a strip at the end of the chassis, protruding into part of the area usually occupied by the ringer gongs. Also located in this area is the actual signal, a Class S relay mounted vertically on a small bracket which is held to the base by screws inserted through two of the sound-distributing holes. With only a single spring serving to stabilize its armature, the relay acts as a buzzer when ringing potential is applied to any of the three lines to which the associated control circuitry may be connected.

2.17 The Type 810 handset is arranged to accommodate the coordinated Type 810 transmitter and receiver units, which match the electrical characteristics of the transmission network. The earlier Type 81 handset, which is nearly identical in construction to the Type 810, should not be used for maintenance purposes, nor should the Type 81 transmitter and receiver units be substituted for the Type 810 units in a Type 810 handset. The Type 81 handset may be distinguished from the Type 810 by its use of only a three-conductor cord, the provision of contact springs in the receiver cavity to contact the receiver unit (which has no screw terminals), and the external location of the magnet on the rear of that unit.

2.18 The handset cord is a retractile type with four conductors in line cord colors: red, green, yellow and black. At the handset end a tapered grommet surrounds the jacket to prevent abrasion at the entrance hole, and a cord clamp screwed to the transmitter rim contact spring provides strain relief. At the instrument end a similar clamp fastens the cord to a screw on either the ringer frame or the signal control chassis. Before this screw is tightened over the clamp, the cord must be threaded through an opening in the rim of the base at the left rear. Once secured at its end, the cord can be stabilized at its point of entry by means of a clamping bar which engages a slot in the base, compresses the cord into a formed channel, and is screwed to the threaded insert in the left rear foot.

2.19 A ten-conductor line cord is provided, regardless of whether or not the set is equipped with an exclusion key. At the set end a bayonet-type clamp engages a slot at the left side of the dial mounting tripod, from which point the cord passes over the ringer, buzzer or common audible signal unit, above the network and down to a formed channel at the right rear, from which

it emerges. In this case it is unnecessary to thread the cord through an opening, since the rim of the base has been slotted. To keep the cord from fouling the ringer gong or buzzer-relay armature, a two-armed clamping bar is used at the entrance slot. At its free end the cord is pre-terminated on a Number 44A connecting block.

Circuits

2.20 Aside from the keys, the basic circuit of the Type 87A instrument is the same as that used in the self-compensating versions of the Type 80 and Type 90M sets (see Figure 4). Operation of any pickup key connects the transmission network, via panel terminals L1 and L2, to the terminals of one of the accessed lines (H1, P1; H2, P2; or H3, P3). An additional set of make contacts on each key establishes a connection between one common lead and one individual lead per key. These four leads, though provided with spade tips, are taped at the tips and stored beneath the terminal panel.

2.21 Operation of any hold key connects a 330 Ω resistor and a series inductor with a d-c resistance of 165 Ω across the associated line, before releasing the interlocked pickup key and disconnecting the transmission network from the line. This d-c bridge holds the central office connection, but the audio-frequency impedance of the inductor is sufficiently high so that transmission is not impaired if conversation is resumed from another station before the hold key is restored.

2.22 Each of the three lamp jacks is wired in series with a 27,000 Ω resistor across one of the lines to which the set has access. When ringing potential is applied from the central office, the lamp lights to indicate which pickup key should be operated in answer. Lamp flashes will also be noted during dialing or other line surges.

2.23 The common audible signal control (see Figure 5) as wired at the factory (with X-strapping in place) provides for each of three lines terminated on the set, a 5823 cold-cathode triode wired in common to a relay-buzzer in much the same fashion as a 426A tube is wired to a ringer for superimposed ringing service. The cathode of each tube is connected individually to the line conductor over which the station will be rung. The anodes of the tubes are connected in parallel to one side of the buzzer, and the starter electrodes are connected, through individual 100,000 Ω isolation resistors, to the other side of the buzzer and to ground. A 1/2

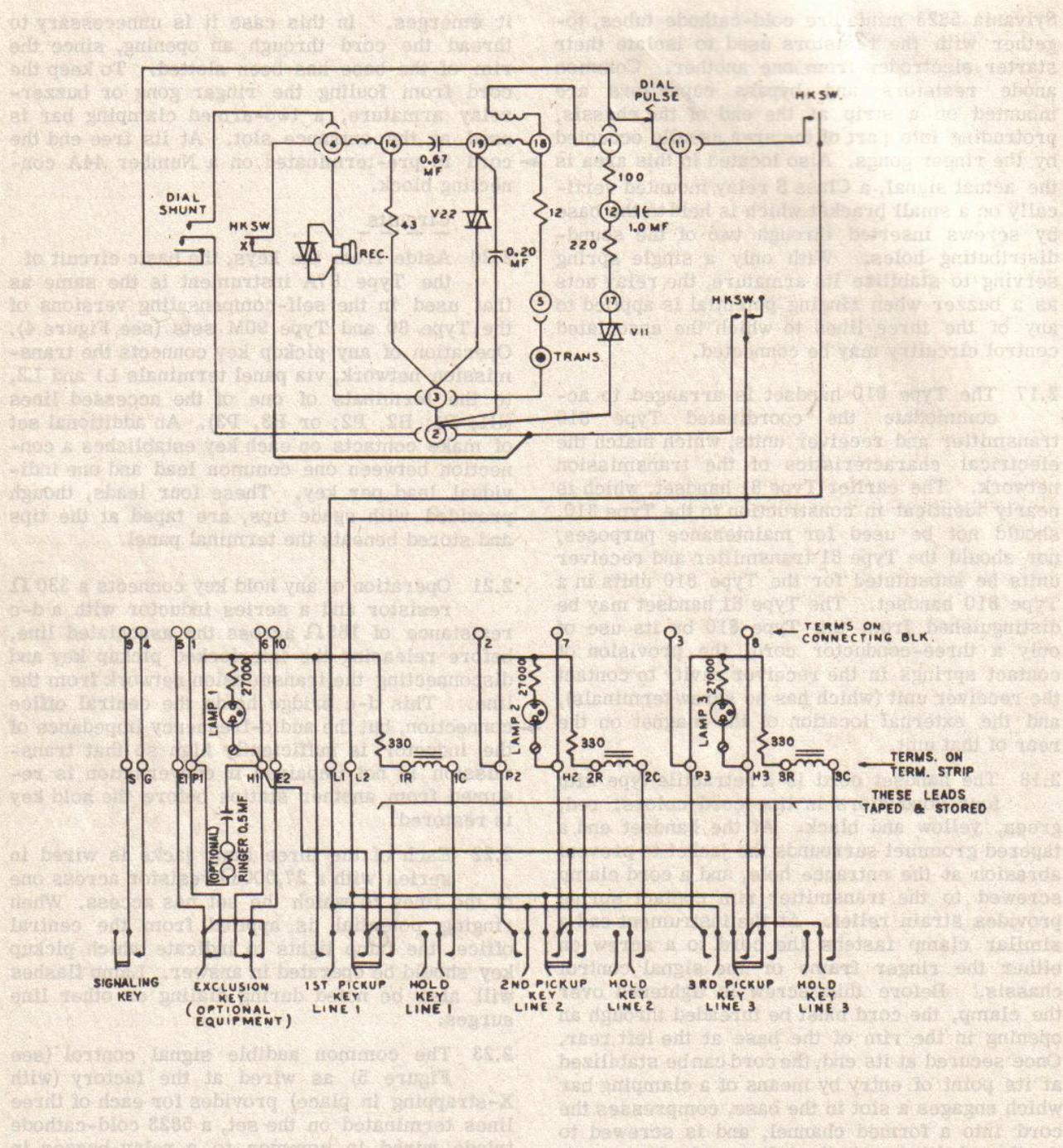


Figure 4. Schematic Diagram, Type 87A Telephone Set.

μfd. capacitor connected in parallel with the buzzer serves to shape the waveform and improve the buzzer tone. The X-strapping option is used in exchanges where the common lead of the ringing generator is connected to ground (so-called "ground-connected generator"), and ring

trip battery appears on the return conductor of the called line, rather than on the conductor to which the called party is assigned. This arrangement is more common in exchanges where a high proportion of the outside plant is in open wire.

2.24 In exchanges where that plant situation does not apply, the common lead of the ringing generator is often connected to battery (so-called "battery-connected generator"), with the ring trip relay either connected in series with the generator output lead, or else connected to ground and to the return conductor of the called line. The peak values of potential applied to the line conductor to which the called party is assigned are therefore higher (by the amount of the battery potential) than in the case of the ground-connected generator common lead. If the common audible signal unit is to be used under these conditions, X-strapping should be removed. Removal of one strap inserts an additional 12,200 Ω buffer resistance in series with the buzzer, partially bypassed by a 2 μ fd. capacitor, to compensate for the higher peak potential. Removal of the other strap inserts a .02 μ fd. capacitor in the common path from the starter electrodes to ground, in order to limit to a single click the response of the buzzer to a train of dial pulses.

2.25 Use of the common audible signal should be restricted to installations in which each line accessed by a given Type 87A set is served by switching equipment using the same type of ringing generator connection. Problems may arise in cases where one line is terminated on a PABX or foreign exchange, while others are served from the local central office. Although terminal-per-station connectors in exchanges with battery-connected generator common leads are usually arranged to apply ringing potential to the ring (-) conductor of the called line, while those in exchanges with ground-connected generator commons usually ring over the tip (+) conductor, no general rule can be applied to equipment of all manufacturers. In addition, the ringing assignment of a station in a terminal-per-line exchange may vary, depending on the grade of service or on ringing lead balance requirements. For this reason, the cathode of each 5823 tube should be connected, by way of its spade-ended lead, to whichever conductor of the associated line a conventional ringer would have to be connected for divided ringing, rather than in accordance with any rule based on the use or removal of the X-strapping option.

2.26 The number of Type 87CA common audible signal units which may be installed on a given line is dependent upon the ringing potential available at the central office generator terminals, and on the resistance of the line conductor over which the signal units are operated. These variables are correlated in Table 1, in which for

Table 1. Minimum Ringing Potential (Measured at the Generator) Required to Operate Type 87CA Common Audible Signal Units.

Battery Connected Generator					
Line Loop (ohms)	Number of Units				
	1	2	3	4	
0	97V	104V	116V	122V	
600	108V	116V	122V	133V	
1000	111V	118V	128V		
1200	113V	120V	130V		
Ground Connected Generator					
Line Loop (ohms)	Number of Units				
	1	2	3	4	5
0	74V	74V	74V	76V	80V
600	77V	80V	82V	85V	86V
1000	77V	82V	89V	97V	100V
1200	78V	82V	90V	101V	112V
Line Loop (ohms)	Number of Units				
	6	7	8	9	10
0	80V	87V	87V	87V	87V
600	95V	100V	102V	109V	130V
1000	101V	118V	126V	135V	
1200	119V	125V	135V		

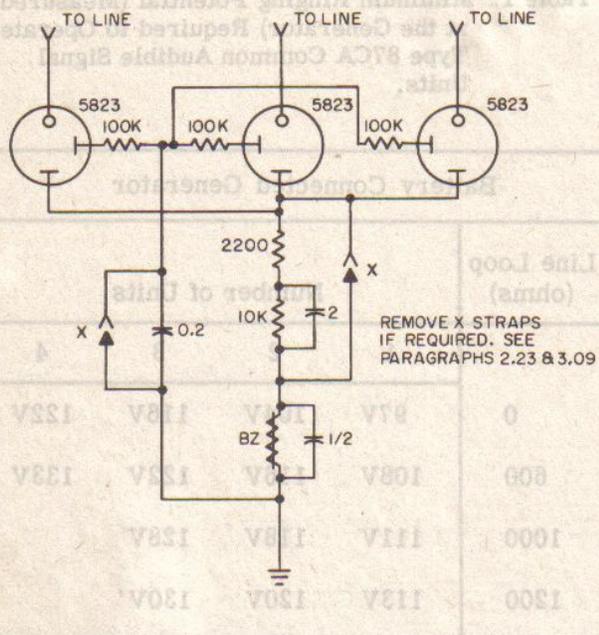


Figure 5. Schematic Diagram, Type 87CA Common Audible Signal Unit.

convenience the resistance is listed for the line loop, rather than for one conductor, and which assumes that all signals are to be installed at the same loop length. When the limit has been reached, it will often be found possible to add one or two high-impedance ringers to the line, if necessary.

Applications

2.27 The Type 87A instrument is usually installed as part of a planned complement of apparatus marketed as a "convenience system". Three such arrangements have been adopted as standard for service offering within the General System:

- (a) Access to two central office lines, where hold is required on both. (If hold is required only on line 1, the Type 85D set can be used.)
Or,
Access to three central office lines, with hold.
- (b) Access to two central office lines, with hold, and to an intercom line (hold provided, but nonessential), with pushbutton signaling among stations.

- (c) Access to two central office lines, with hold, and to a dial-selective-signaled intercom line (hold provided, but non-essential), with additional pushbutton signaling between stations, where desired.

2.28 Where access is limited to central office lines, but pushbutton signaling is not desired, no special apparatus is required. If the ringers for other lines are audible at the location of the Type 87A set, it may be equipped with a ringer to provide an audible signal for the one remaining line. If there are no other stations having access to any of the lines, or if existing stations do not lie within earshot of the Type 87A location, two options apply. A common audible signal unit may be installed to serve all lines on a self-contained basis, or one ringer may be mounted within the instrument and one or two others in external boxes. The latter arrangement offers the possibility of providing distinctive gong selections which serve to reinforce the action of the neon line lamps in indicating on which line an incoming call should be answered.

2.29 Where an intercom line with pushbutton signaling is to be provided, an intercom power supply unit such as the Proctor model P400BT is required (see the 490-101 series of General System Practices). This unit supplies 8.2 volts of filtered direct potential to serve as talking battery for up to five stations on the intercom line, and has 9 and 18 volt alternating potential taps to supply the buzzers. In this case all buzzers are connected in parallel, and all pushbuttons in parallel, so that keying the signal code assigned to a station from any station sounds the code on the buzzers at all stations in the group.

2.30 Where signaling is desired without intercom service, only a signal transformer such as the S-9883 model is required. This unit supplies 6, 12 or 18 volts alternating potential for buzzers. The most frequent application occurs when all incoming calls are answered at one station, and a party at another station picks up the call only in response to a coded buzzer signal from the answering party. If audible line signals are not desired at a station where calls are not normally answered, a buzzer may be mounted within the set, using the bracket designed for the Type 86 instrument. Control of the buzzer is provided by the pushbutton in the set at the answering station. In another common

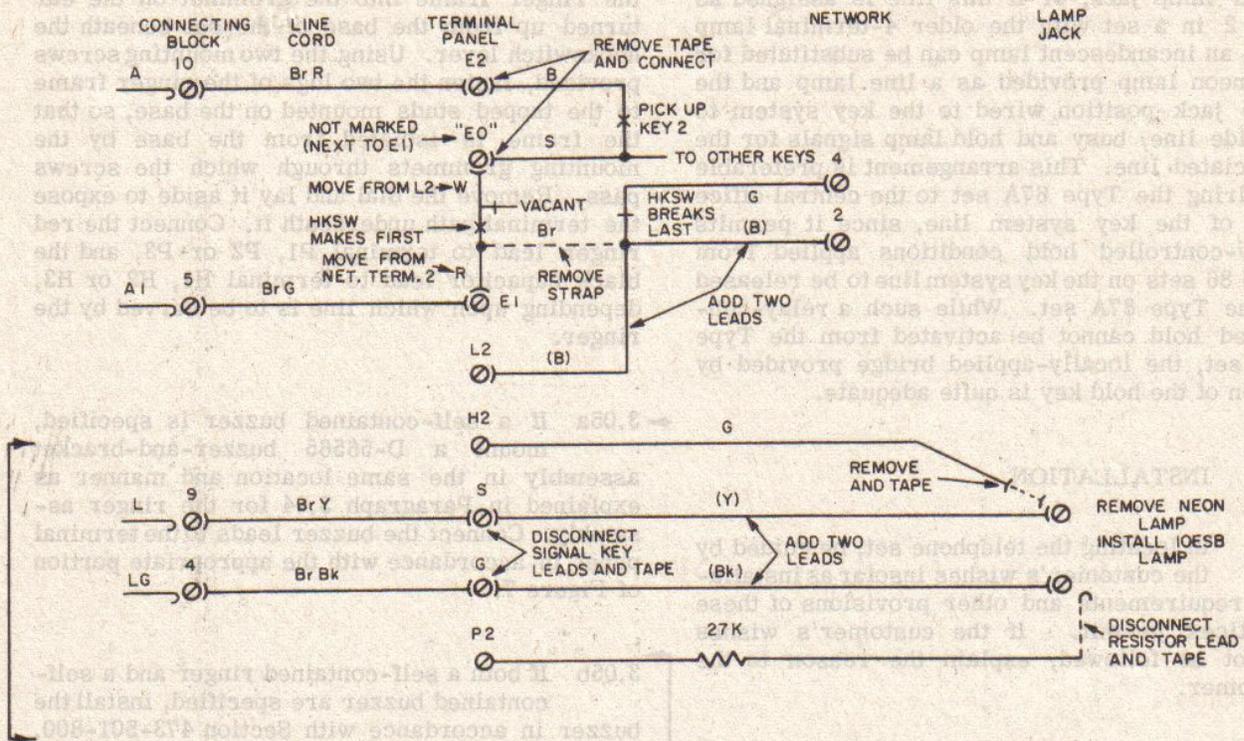


Figure 6. Wiring Modifications to Control One Key-System Line.

application, an external buzzer installed at a station equipped with audible line signals may be controlled from one or more stations at which calls are not normally answered. In some cases both types of station may wish buzzer service, either on the parallel basis mentioned above, or on a full duplex basis by use of an additional conductor between stations.

2.31 Where a dial-selective-signaled intercom line is to be provided, a key telephone system power supply unit is required as a source, not only for talking battery and buzzer power, but also for the 18 to 28 volt d-c supply needed for the selective signaling apparatus. The latter, an H-883002-70 dial intercom key telephone unit used in the Type 16A key telephone system, requires an H-884900 bracket assembly for mounting. (See the 484-400 series of General System Practices.) In this arrangement, up to nine stations may have access to a common intercom talking path, and an individual lead is run to each station for buzzer operation. To signal another station, the user accesses the intercom line by

operating the pickup key assigned to it, and then dials the single digit (2 through 0) of the desired station. The selector circuit causes the buzzer at the called station to sound once for a period of from one to three seconds. In addition, buzzer service may be provided between pairs of stations, using the built-in pushbutton.

2.32 Additional applications will arise from time to time, including those in which one or more of the lines accessed by a Type 87A set are terminated on a PABX or PBX, in a foreign exchange, or on some other non-exchange facility. Such installations ordinarily require no special provisions. However, it is possible that one of the lines accessed may require A-lead control, and that a d-c line lamp signal would be desirable. Figure 6 illustrates how existing unused contacts on the pickup keys, line cord conductors not in use for signal or exclusion service, a spare terminal next to E1 on the terminal strip and rearrangement of the hookswitch wiring will permit A-lead control to be provided on the key-system line. If the set is equipped with a 6-ter-

minal lamp jack, or if this line is assigned as line 2 in a set with the older 4-terminal lamp jack, an incandescent lamp can be substituted for the neon lamp provided as a line lamp and the lamp jack position wired to the key system to provide line, busy and hold lamp signals for the associated line. This arrangement is preferable to wiring the Type 87A set to the central office side of the key system line, since it permits relay-controlled hold conditions applied from Type 86 sets on the key system line to be released at the Type 87A set. While such a relay-controlled hold cannot be activated from the Type 87A set, the locally-applied bridge provided by action of the hold key is quite adequate.

3. INSTALLATION

3.01 In locating the telephone set, be guided by the customer's wishes insofar as installation requirements and other provisions of these practices permit. If the customer's wishes cannot be followed, explain the reason to the customer.

3.02 After the location has been determined, run station wire or inside wiring cable to that point as explained in other sections of these practices. The choice between the two types of wire facility should be made on the bases outlined in Section 434-201-070. If a flat wooden or fibre surface is available, mount the line cord connecting block directly to that surface, using two #8 x 5/8" or 3/4" round head wood screws. If the surface is irregular or not suited to such fastening, first install a 168D backboard and mount the block using the thread-cutting screws supplied with the backboard. On metal desks, where a mounting detail is provided in the base of a pedestal or on the kneewell shield (modesty panel), machine screws and nuts, or self-tapping screws, may be required in substitution. If no mounting detail is provided within a metal desk, use a #739 adhesive mounting plate and the machine screws provided with it.

Ringers and Buzzers

3.03 Mount external ringer boxes and buzzers as specified on the wiring plan or indicated on the service order, and run station wire from each such device to the connecting block.

3.04 If a self-contained ringer is specified, mount a Code 42C ringer assembly within the Type 87A set. Insert the stud at the base of

the ringer frame into the grommet on the ear turned up from the base of the set beneath the hookswitch lever. Using the two mounting screws provided, fasten the two lugs of the ringer frame to the tapped studs mounted on the base, so that the frame is isolated from the base by the mounting grommets through which the screws pass. Remove the dial and lay it aside to expose the terminal path underneath it. Connect the red ringer lead to terminal P1, P2 or P3, and the black capacitor lead to terminal H1, H2 or H3, depending upon which line is to be served by the ringer.

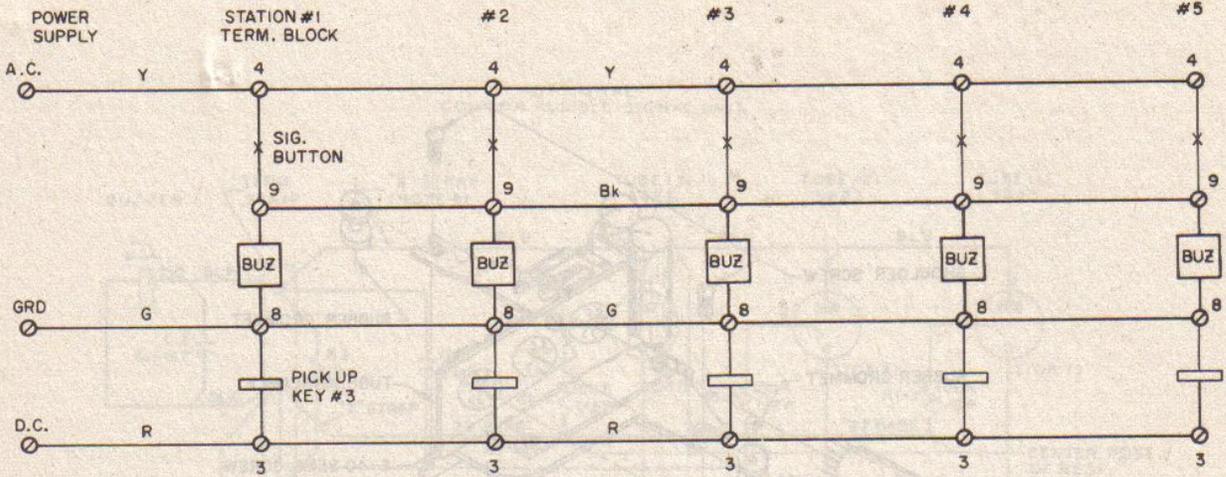
3.05a If a self-contained buzzer is specified, mount a D-56565 buzzer-and-bracket assembly in the same location and manner as explained in Paragraph 3.04 for the ringer assembly. Connect the buzzer leads to the terminal panel in accordance with the appropriate portion of Figure 7.

3.05b If both a self-contained ringer and a self-contained buzzer are specified, install the buzzer in accordance with Section 473-501-800.

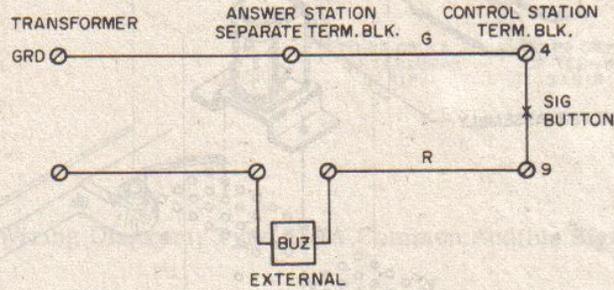
3.06 If a Type 87CA common audible signal unit is specified, remove the bracket containing the relay-buzzer from the main bracket on which the tube chassis is mounted. Take care not to damage the buzzer leads during subsequent operations. Retain the screw used for in-shipment mounting of the buzzer, as it will be required for permanent mounting.

3.07 Insert the two rubber grommets provided with the assembly into the slotted holes at the end of the T-shaped mounting bracket. Insert the stud at the base of the T into the grommet on the ear turned up from the base of the set beneath the hookswitch lever. Using the two shoulder-head mounting screws provided, fasten the ends of the T-bracket to the tapped studs mounted on the base, so that the bracket is isolated from the base by the grommets through which the screws pass. Should the chassis on which the tube sockets are mounted fail to clear the transmission network, loosen the two screws holding this chassis to the T-bracket, and slide it toward the edge of the base until the proper clearance is secured.

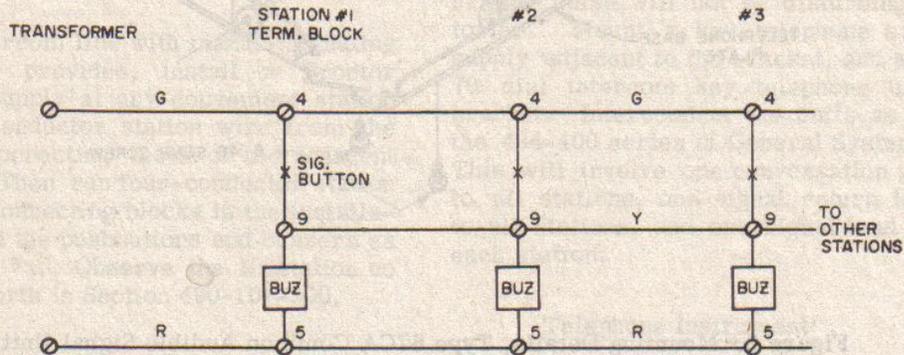
3.08 Mount the relay-buzzer bracket to the base, using the two screws provided, which are passed through sound-distribution holes in



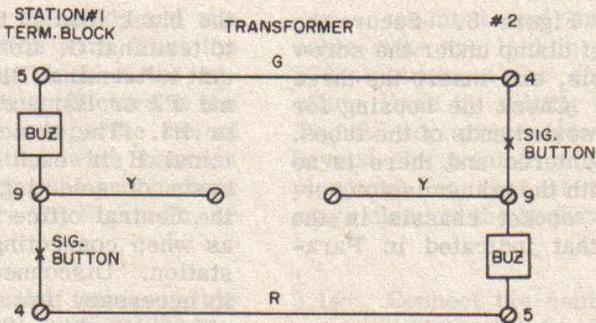
7a. Intercom Service with Coded Common Signaling.



7b. Single Buzzer with No Intercom.



7c. Multiple Buzzers.



7d. Independent Signaling Between Two Stations.

Figure 7. Pushbutton and Buzzer Connections.

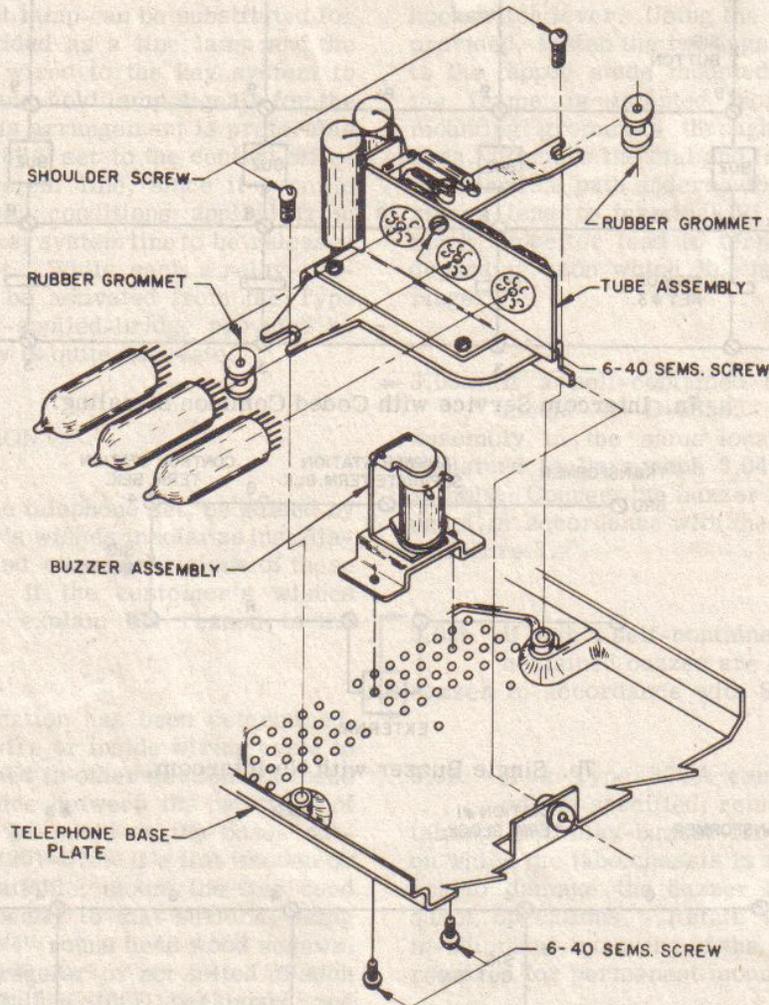


Figure 8. Mounting Details, Type 87CA Common Audible Signal Unit.

the base, as shown in Figure 8. Secure the handset cord strain relief clamp under the screw at the top of the chassis, and insert the three tubes in their sockets. Check the housing for proper clearance of the sealed ends of the tubes. If interference is encountered and there is no problem of clearance with the transmission network, adjust the tube socket chassis in the opposite direction to that indicated in Paragraph 3.07.

3.09 Remove the dial and lay it aside to expose the terminal panel underneath it. Connect

the black lead of the common audible signal unit to terminal G. Connect the red lead of the signal unit to terminal P1 or H1, the blue lead to terminal P2 or H2, and the green lead to terminal P3 or H3. The choice between terminal P and terminal H in each case should be made on the basis of selecting the line conductor to which the central office applies ringing potential, just as when connecting a ringer at a divided-ringing station. Disconnect X-strapping (see Figure 9) if necessary for lines served from a central office in which the ringing generator common lead is connected to battery.

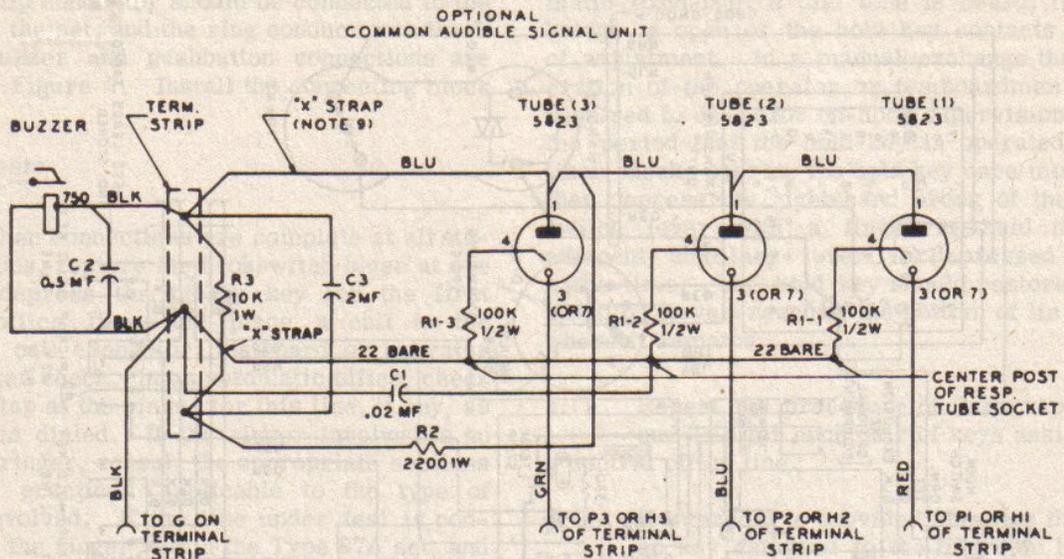


Figure 9. Wiring Diagram, Type 87CA Common Audible Signal Unit.

Intercom Apparatus

3.10 If an intercom line with manual signaling is to be provided, install a Proctor P400BT power supply at any convenient station and run three-conductor station wire from the supply to the connecting block of the adjacent Type 87A set. Then run four-conductor station wire among all connecting blocks in the installation, and connect the pushbuttons and buzzers as shown in Figure 7a. Observe the limitation on wire length set forth in Section 490-101-200.

3.11 If signaling is to be provided without intercom service, install an S-9883 transformer at the station to be signaled, and run two- or three-conductor station wire from the transformer to the connecting block of the adjacent Type 87A set. Use two conductors in the inside wiring cable, or add a separate run of two- or three-conductor station wire between the stations involved, connecting the pushbuttons and buzzers as shown in Figure 7b, Figure 7c, or Figure 7d.

3.12 If a dial-selective-signaled intercom line is to be provided, install an H-884900 key telephone selector mounting bracket in a location

remote from office areas where equipment operating noise will not be disturbing to the customer. Mount a key telephone system power supply adjacent to the bracket, and an H-883002-70 dial intercom key telephone unit onto the bracket. Interconnect the units as specified in the 484-400 series of General System Practices. This will involve one conversation pair common to all stations, one signal return lead common to all stations, and one signal lead individual to each station.

Telephone Instrument

3.13 When all accessory apparatus has been mounted and interconnecting wire and cable runs are laid in place, prepare the Type 87A instrument for connection of the central office lines by setting the installer's hooklock. To do so, press down the hookswitch lever beyond the point to which it is operated by the plungers, so that it travels over-center and stays clear of the hookswitch springs.

3.14 Connect the central office lines, and the intercom line, if any, according to the assignment given on the service order and the

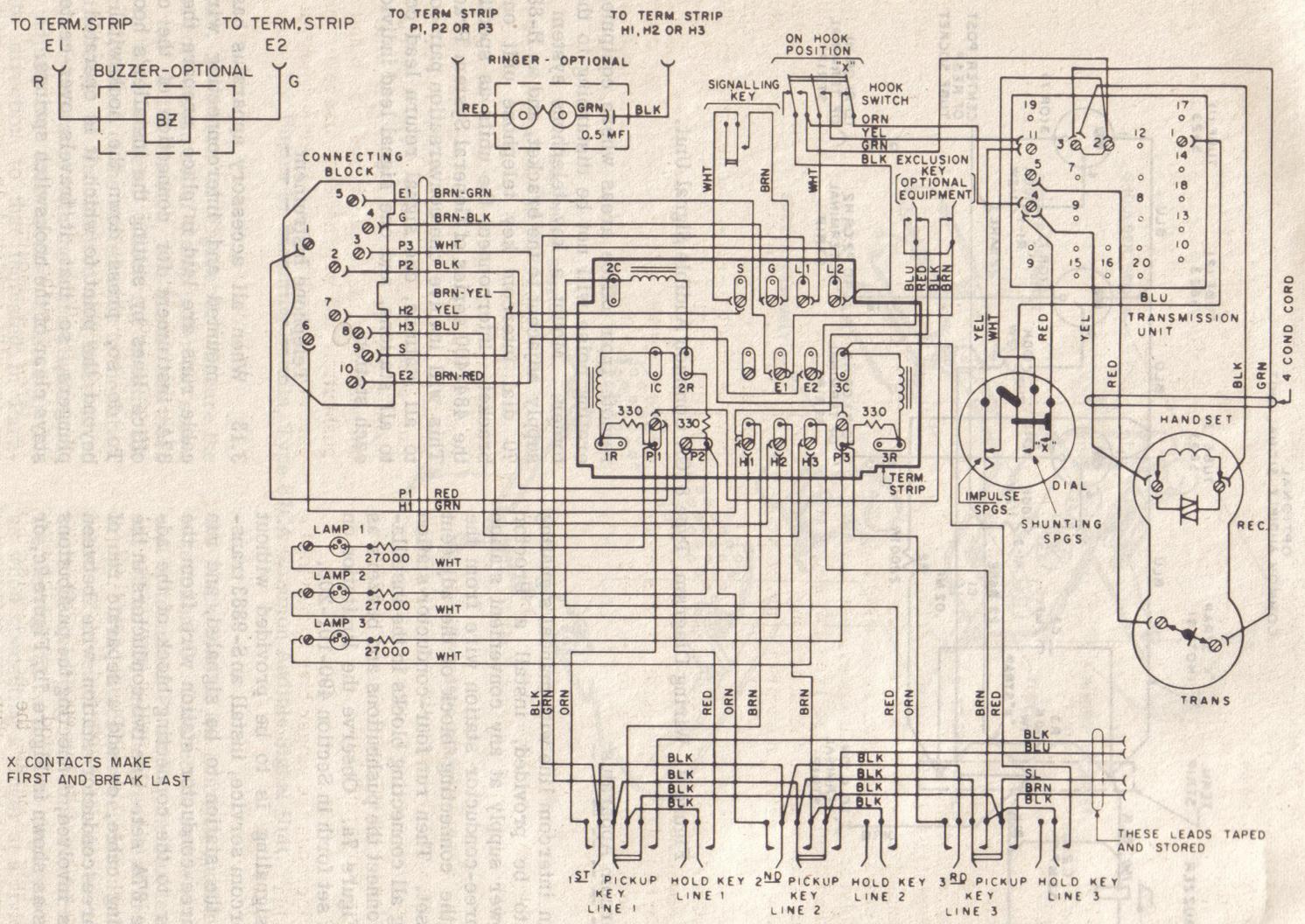


Figure 10. Wiring Diagram, Type 87A Telephone Set.

wiring diagram shown in Figure 10. In each case the tip conductor should be connected to the H lead of the set, and the ring conductor to the P lead. Buzzer and pushbutton connections are shown in Figure 7. Install the connecting block cover.

Tests

3.15 When connections are complete at all stations, restore the hookswitch lever at one station, depress the pickup key for the first central office line, and place a call to the reverting call connector, testboard or operator for a ringer check. In an automatic office, check for gong tap at the ringer for this line, if any, as the call is dialed. If the ringer involved is an external ringer, consult the appropriate sections of these practices applicable to the type of ringer involved. If the line under test is connected to the ringer within the Type 87A set, and the clapper taps against the near gong, one of the following corrective measures may be required:

- (a) Check the line connections at this station, at the protector, and at all intermediate connecting blocks to insure that the line has not been reversed.
- (b) Check the ringer lead connections to insure that they agree with those specified in Paragraph 3.04.
- (c) If (a) and (b) require no correction, presume a magnetic reversal within the ringer, and reverse the ringer lead connections from those specified in Paragraph 3.04.
- (d) Increase the ringer bias by moving the bias reed one notch farther over on the frame.
- (e) Replace the ringer.

3.16 Reoperate the hookswitch lever and await the incoming ring from the central office, to test the ringer or audible signal unit. Check that the lamp beneath the operated pickup key glows during each ring period. Release the lever to trip the ring. Operate the hold key for this line and check that the pickup key restores as the hold key is depressed. After a few seconds reoperate the pickup key and check that the hold key restores. The connection to the reverting

call connector should be maintained in an automatic exchange; if dial tone is heard, the hold bridge is open or the hold key contacts are out of adjustment. In a manual exchange the cooperation of the operator or testboardman will be required to check for on-hook supervision during the period that the hold key is operated. As a final check, operate the hold key once more, and then depress the right-hand prong of the hookswitch lever with a finger so held that the adjacent auxiliary lever is depressed at the same time. The hold key should restore as the auxiliary lever reaches the bottom of its travel, where it remains.

3.17 Repeat the procedure of Paragraphs 3.15 and 3.16 for each pair of keys assigned to a central office line.

3.18 If intercom is provided, depress the pickup key assigned to the intercom line and check for sidetone. With the help of an assistant, check intercom transmission between this station and each other station in the installation. If dial-selective signaling is provided, dial each assigned digit from one station and check for proper operation of the buzzer at the corresponding called station. Dial at least one digit from each other station to check that each one has proper control of the intercom pulsing circuit.

3.19 If manual signaling is provided between or among stations, check that operation of any given pushbutton sounds the buzzer at the appropriate station or stations indicated on the service order. If any station is not to be arranged for signaling, the Type 87A instrument housing may be replaced with the similar housing designed for the Type 86 set, which has no SIG. pushbutton and will not lead users to think that part of an intended signal system is out of order.

3.20 Before replacing the housing on the base, check to be sure that the line and handset cords do not foul the ringer gongs or the armature of the common audible signal relay-buzzer, and that leads from the network or common audible signal assembly do not interfere with the operation of the extension exclusion key (where provided). Replace the dial in its proper position. Seat the housing on the base and tighten the three base-mounting screws. When the housing is fully tightened in place, the installer's hooklock should restore, pushing up the hookswitch plungers. Replace the handset on the cradle.

4.03 One lead of the ringer capacitor is soldered to the ringer coil. If the capacitor proves to be faulty, the entire ringer assembly must be replaced and sent to the repair shop for substitution of a new capacitor.

4.04 The chassis of the common audible signal unit contains soldered connections. Should the unit develop trouble which cannot be cured by relay-buzzer adjustment or tube replacement (it is unlikely that such replacement will become necessary), the entire signal unit must be replaced and sent to the repair shop for servicing.

4.05 The neon lamps used for incoming-call signals are protected by a series resistor, have a long life potential and should rarely require replacement. Should such replacement become necessary, however, remove the housing of the set and depress the hookswitch lever to the hooklock position. If the key assembly is equipped with the newer style lamp reflector, remove the reflector from the plunger bracket by bowing gently at each end to release the molded hook. If the set is equipped with the older style lamp shields, operate the pickup key adjacent to the faulty lamp, and push downward on the pushbutton guide and lamp shield assembly for that key. It may be necessary to lift the pushbutton slightly, while pressing on the top of the shield (adjacent to the clear window) against the force of the spring clip on the lower surface. When the notch in the upper edge of the shield has cleared the bronze retainer, tilt the shield up and free

its lower edge from the clip. Maintain a grip on the pushbutton, as otherwise it will fall free of the shield.

4.06 Using a pair of small duckbill pliers, pull the defective lamp out of the jack assembly and insert a new D-94093-A neon lamp. On newer sets, snap the lamp reflector back in place on the plunger bracket. On older sets, replace the pushbutton and shield assembly, inserting the pushbutton in the shield so that the partial circular rim on the bottom surface lies at the left and right sides, and the portion (if any) of the bottom surface which lacks a rim lies at the top and bottom (see Figure 12). This allows freedom of movement to the key plunger which is actuated by the pushbutton. It may require trimming off the residual gate on the button to avoid interference with the side of the lamp shield. The very earliest style of pushbutton was molded with a completely circular rim. Since its orientation has no effect on plunger operation, it may be inserted with the residual gate positioned at the top. Place a test call to check the lamp for proper operation, and replace the housing of the set.

4.07 To remove a designation strip from the newer type of designation strip cover, insert the thinner blade of a pocket knife into the slit at the top of the cover, between the cover and the housing of the telephone set. The slit is interrupted in the center by a projection which nearly touches the housing between the pickup

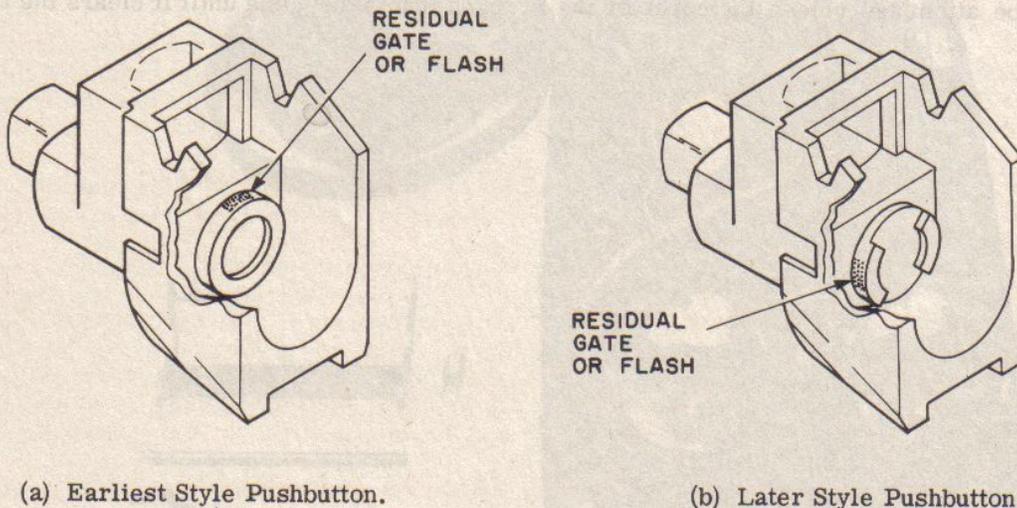


Figure 12. Proper Position of Pushbutton in Older Style Individual Lamp Shield and Pushbutton Guide.

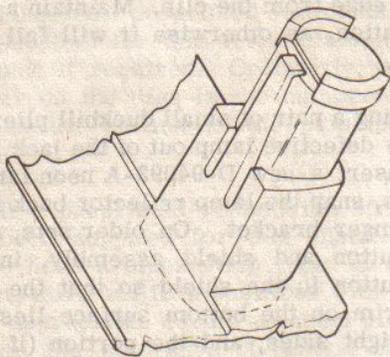


Figure 13. Proper Position of Latest Style Pushbutton in Newer Type Designation Strip Cover.

and hold positions for line 2. In order to secure clearance for the strip between this projection and the housing, force the cover slightly away from the housing with the blade. Insert a pointed object, such as a fingerwheel tool, into the slot near the right end of the cover, and push the strip up until the right end is far enough out of the slit to be grasped with the fingers. (See Figure 11. This operation cannot be performed at the left end, because the SIG. escutcheon interferes.) Pull the strip upward and to the right, and then remove the knife blade.

4.08 Removal of the newer type of designation strip cover from the instrument housing should not be attempted unless the cover or the

housing requires replacement because of damage. In such cases, remove the housing from the set and the pushbuttons from the guides in the cover, and grasp the housing and cover from the under side with both hands. With one thumb over the second guide, the other thumb over the fourth guide and the fingers at the outer ends of the cover, bow the cover slightly and extremely carefully until the hooks in the end guides clear the outer edges of the first and sixth openings. Then remove the cover from the front of the housing.

4.09 To install the newer type of designation strip cover in the housing of a Type 87A telephone set, insert the guide portion into the openings in the housing and grasp the housing and cover from the under side with both hands. With one thumb over each of the two center guides and the fingers at the outer ends of the cover, bow the cover very gently and press the outer ends into the openings until the hooks snap into place against the outer edges of the end openings.

4.10 To install pushbuttons in the newer type of designation strip cover, first be sure that the pushbuttons are of the new design from which the shoulder has been removed on one side (see Figure 13), and that the cover is already installed in the housing of the telephone set. Then with the shoulder-less side facing upward, toward the retaining tab, insert the pushbutton into the under side of the guide in the cover, and push it into the guide until it clears the tab.

