

# TELEPHONE TYPE 87



Technical  
bulletin **498**

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***AUTOMATIC ELECTRIC***

Subsidiary of

**GENERAL TELEPHONE & ELECTRONICS**





*New factory, development laboratories, and general office at Northlake, Illinois, U.S.A.*

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*Figure 1. The type 87 telephone.*

# TYPE 87 TELEPHONE

## 1. INTRODUCTION

The type 87 telephone (figure 1) provides access to three individual lines and provides facilities for placing or answering calls and holding calls on these lines. The telephone may be used with several similar telephones to provide a complete three line system or it may be used in conjunction with a P-A-B-X, P-A-X, or P-B-X system. In either case, optional Automatic Electric Company services are available.

The features, operation, special services, installation and maintenance instructions, and common applications of the type 87 telephone are explained and illustrated in this bulletin.

### 1.1 Description

The features and components of the type 87 telephone offer convenience of operation and flexibility for multiple line service.

The housing of the type 87 telephone measures 5-3/8" by 10-1/4" and the height at the handset is approximately 5-1/4". It is available in the full range of colors. The transmission components of the type 87 telephone are the same as those used in the standard type 86 telephone. These components provide high quality transmission under all conditions.

This telephone may be supplied with a metropolitan dial, a 1-0 dial or dial blank. Dials on black telephones have black metal finger plates and on colored telephones, a clear plastic finger plate is supplied.

Each telephone has a ten conductor line cord that is terminated on a ten terminal connecting block. Spade terminals are used for connecting the cord so that any required changes can be made with only a screw driver. The connecting block, which is similar to W.E.Co. type 44A connecting block, measures 3-5/8" by 1-3/4".

All handset cords furnished with the type 87 telephone are retractible.

The keys mounted on the type 87 telephone (see figure 1) are provided to control the various features and services. These keys are components of the telephone and are wired at the factory ready for use.

### 1.1.1 Pickup and hold keys.

Six keys designated pickup and hold keys are mounted on a key strip below the dial. Each line associated with the telephone terminates at a pair of these locking type push button keys. The pickup keys are in positions 1, 3, and 5 and the hold keys are in positions 2, 4, and 6 counting from left to right. Line one terminates at keys 1 and 2, line two terminates at keys 3 and 4, and line three terminates at keys 5 and 6. Each key and its associated line may be designated on the blank key designation strip which is mounted just above the key strip. The designation strip is protected by a removable clear plastic covering. Each pickup and hold key pair is interlocked so that when one is operated the other restores automatically. All of the pickup keys are also interlocked. When a pickup key is operated, any other operated pickup key restores automatically. This prevents using more than one line at a time.

A neon lamp is associated with each pickup key and is wired across each line. These lamps are mounted internally and glow through the clear plastic key buttons and key button assemblies. Regular ringing current is sufficient to operate these lamps. A flashing lamp indicates an incoming call.

Also associated with the pickup and hold keys is a small rectifier. The rectifier is included to suppress clicking and static created when switching from one line to another.

### 1.1.2 Signal key.

A signal key of the non-locking push button type is located at the lower left side of the dial on all type 87 telephones. This key is used for common audible signaling when several telephones are multiplied to a local intercommunication line as shown in figure 10. Each telephone on the line is assigned a code. This code indicates which telephone is being signaled. A buzzer, which is mounted externally, provides the audible signal. If conditions permit, a common buzzer may provide the signal for all telephones on the line. Otherwise, each telephone must be provided with a separate buzzer. A battery eliminator or other low voltage power source is required to provide the necessary current for signaling and transmission on the local intercommunication line. Regular telephones multiplied to



this line require a special non-locking push key for signaling. When a local intercommunication line is not used, the signal key can be arranged to signal a secretary or an extension telephone.

#### 1.1.3 Exclusion key.

An optional key providing exclusion features is available with the type 87 telephone. This key may be wired across any one of the lines to exclude any other telephones connected to that line. Generally each line would have one telephone equipped with this component. This locking type key consists of two push buttons: one red and one chrome. These push buttons are mounted side-by-side between the arms of the handset cradle and are interlocked so that when one is depressed the other restores.

#### 1.1.4 Hookswitch functions.

The hookswitch plungers have other functions in addition to disconnecting the telephone from a line. The chrome plunger, on the left, is used to signal a central office operator. The black plunger, which is on the right, restores any operated hold keys when it is depressed. Either plunger will restore the exclusion key.

#### 1.1.5 Signaling equipment.

Signaling equipment may be either a ringer or a buzzer. However, a buzzer is used only with intercom lines requiring coded signaling. The ringer of the type 87 telephone may be wired to any one of the three lines. The ringers in two other telephones that have access to the same lines may be wired to the two remaining lines to provide an audible signal on all lines. If desired, three separate ringer boxes, each containing a ringer, can be used for signaling on the three lines. When separate ringer boxes are used, the ringer at each telephone can be disconnected. The ringers in the arrangements above are common to all telephones on a line. That is, all telephones have a common audible signal. These arrangements are functional only if the party at each telephone is within the range of the common audible signals. A separate set of ringer boxes may be provided for each telephone that is not within the range of the common audible signals. Ringers of different tone for each line are not necessary, since the neon lamps on each line distinguish the line of the incoming call. Modifications of ringer wiring are explained in section 3.1.

### 1.2 Operation

The operations involved in placing, holding, answering, and transferring calls and excluding and signaling extension telephones are described in this section.

#### 1.2.1 Answering a call.

The ringer indicates an incoming call and the neon lamp indicates the line of the incoming call. The pickup key associated with this line is depressed before the handset is removed. The pickup key locks in the operated position and connects the transmitter and receiver to the line.

#### 1.2.2 Releasing.

When a call is completed, the handset is replaced on the telephone to release the connection. The pickup key remains in the operated position and any subsequent calls on this line may be answered by simply removing the handset.

#### 1.2.3 Holding.

When it is necessary to hold a call on one of the lines, the hold key associated with that line is operated. This places a holding bridge across the line. The pickup key automatically restores when the hold key is operated. A call can then be placed or answered on any one of the other lines without interfering with the hold connection on this line. The call may be resumed on this line by reoperating the pickup key. This automatically restores the hold key and removes the holding bridge. When another party comes in on the held line, the pickup key of the original called party will not be operated to release the hold key. In this case the hold key is restored by pressing and then releasing the right hookswitch plunger. The pickup key does not have to be used. This, also, will not signal the central office operator or interfere with a conversation (see section 1.1.4).

#### 1.2.4 Placing a call.

To place a call, depress the pickup key on the line to be used before removing the handset. Remove the handset and check to see if the line is idle. (Visual busy signals may be provided for this purpose. See section 1.3). If the line is idle, dialing may proceed. Releasing and holding procedures are the same as described in the two preceding paragraphs.

#### 1.2.5 Excluding.

When it is desirable to exclude extension telephones from the line, the chrome button on the left is depressed after the handset is removed. This disconnects and shorts the line to the extension telephones and prevents their use on the line. When the handset is replaced, the excluded telephones once again have access to the line. This operation also restores



the chrome push button. To connect the excluded telephones to the line and restore the chrome button while a call is in progress, the red push button on the right is depressed.

#### 1.2.6 Signaling.

When the signal key is arranged to signal other telephones on an intercommunication line, operate and release the non-locking signal key in accordance with the pre-assigned code of that telephone.

#### 1.2.7 Transferring.

To transfer a call from one type 87 telephone to another, the hold key associated with the incoming line at the receiving telephone is depressed after the call has been answered. The telephone for which the call was intended is then called on another line (usually the local intercommunication line) to inform the party of the incoming call. The party at the intended telephone depresses the pickup key associated with the incoming line and is connected to this line. After the connection is made, the receiving telephone replaces the handset. This restores the hold key on the line.

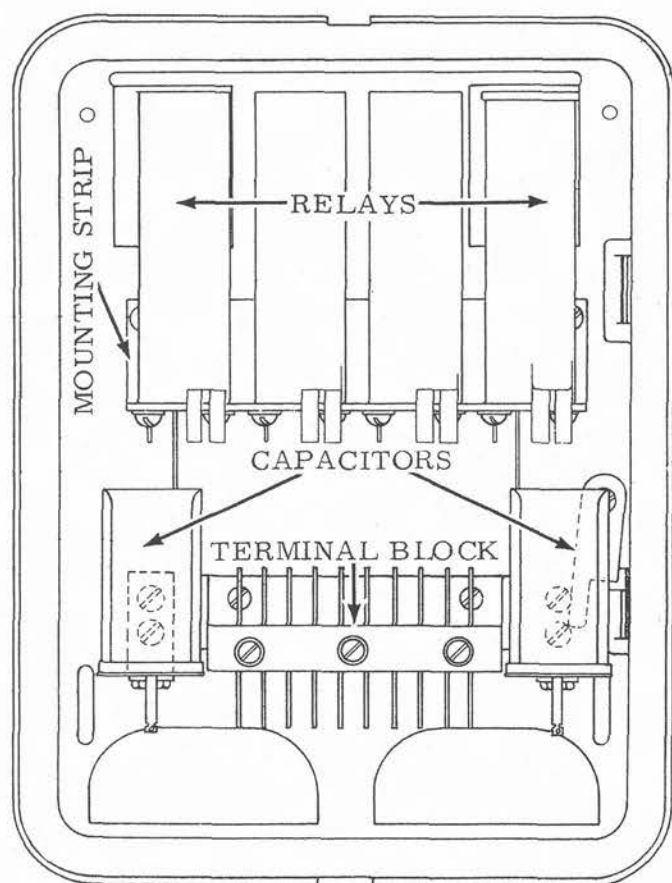


Figure 2. The auxiliary relay unit (H-881153 assembly 1).

### 1.3 Special Services

Special services are available which may be used in conjunction with the type 87 telephone in most applications. This section describes the special equipment necessary for the services, the features and functions of the services, and the types of applications where these services may be used.

#### 1.3.1 Auxiliary relays.

The auxiliary relay unit provides the secret service feature and visual busy signals. These relays are mounted in a small wall mounting box (see figure 2), and may be obtained by ordering part number H-881153 assembly 1.

- (a) Secret service. Secret service can be arranged to provide privacy on one or two central office lines. Usually this service is provided on line one and/or two for the first station in the arrangement. When it is desirable, one station on each line may have this service. Each line requires a relay, which, when operated, disconnects any other telephones from the line (see figure 3). The optional exclusion key and the signal key must also be modified slightly to supply positive battery to the relays and to control the operation of the relays. The exclusion or signal key controls this service on one of the lines and allows the service to be cut in or out as needed. When this service is desired on one line, only one relay is required and only one key must be modified (usually the exclusion key). Modification of the keys is explained in section 3.4. A 24 volt d-c power supply also is needed to operate the relays.
- (b) Visual busy signals. The visual busy signals provide a signal indicating that a line is being used. These signals are arranged for use on central office lines and local lines. A lamp unit with two lenses is available for signals on two lines. These lamps may be common to all telephones, or each telephone may be provided with an individual set of lamps. A relay with a paralleling capacitor is provided for each line and is wired in series with one side of the line (see figure 3). The paralleling capacitor provides a path for talking currents. The relay, which operates on line current when the line is in use, closes a set of contacts and places positive battery on the lead to the lamps which are associated with that line. Since the lamps are connected to common negative battery, they will operate. A twenty-four volt d-c power supply is also required to operate the lamps. Order D-94043-A for lamp unit.





## 2. APPLICATIONS

The type 87 telephone is arranged to be used in various applications where multi-line service is required. The lines terminating at the telephone may be central office lines, local intercommunication lines, or any combination of these. These lines may be from local telephones, central office equipment, or a P-A-B-X, P-A-X, or P-B-X cabinet. Basically there are three types of applications for the type 87 telephone. These applications are determined by the combinations of the lines and by the special equipment (P-A-B-X, P-A-X, or P-B-X cabinet) used in the application.

This section describes the three basic applications, the special services available with each, and some of the modifications of these applications.

### 2.1 Three Central Office Lines

In a system where intercommunication is not necessary, several type 87 telephones may be multiplied to three central office lines (see figure 9). With this arrangement, all telephones may answer, place, hold, or transfer calls on each line. Generally this arrangement is used where several parties must have access to the same lines for the same purpose.

The lines from the telephones may terminate directly at the central office equipment or they may terminate at an automatic or manual switchboard where they are switched through to the central office trunks. In either case, operating procedures for placing or answering calls are the same.

In most applications of this type, one set of ringers is sufficient for all telephones. If this is not the case, one of the ringing arrangements described in section 1.1.5 may be used.

The exclusion key is supplied for privacy on one central office line at each of three different stations. If privacy is desired on two central office lines at one station, the secret service feature is supplied. These features are explained in sections 1.1.3 and 1.3.1 (a).

When it is desirable to have a busy signal for each line, visual busy signals can be provided. These signals may be placed where they are visible at all telephones, or each telephone may have an individual set of busy signals. Details about these signals are described in section 1.3.1 (b).

Figure 9 shows an application without visual busy signals. The arrangement of signals is similar, however, for most applications.

### 2.2 Two Central Office Lines, One Local Line

In a system where intercommunication is necessary, several type 87 telephones can be arranged to provide service on two central office lines and one local intercommunication line. This is the most widely used application of the type 87 telephone. Several arrangements for providing this type of service are possible, and the examples given here will suggest how other special needs may be met. The exclusion feature or the secret service feature is available in any of these arrangements as are the visual busy signals. In these applications, the central office lines are usually lines one and two and the local intercom line is line three. Regular telephones can be multiplied to the local intercom line for stations requiring only local service.

Figure 10 shows an arrangement for this type of service between two or more stations. Signaling on the local line is provided with coded signaling as described in section 1.1.2. Central office signaling may be provided by one of the ringer arrangements described in section 1.1.5. The ringer arrangement shown is common to all stations. Secret service is available on one or two lines. Visual busy signals may also be provided for one or two central office lines.

If selective signaling is desired on the local line, the type 85 P-A-B-X is available as shown in figure 11. This arrangement is fully explained in A. E. Co. bulletin 693. Local service is provided for a maximum of ten stations in this arrangement.

Secret service, when provided, is available on one line. Each type 87 telephone must be modified slightly for use with the type 85 P-A-B-X. This modification is explained in section 3.3.

For organizations with only two central office lines, but requiring more than ten local stations, the combination of type 87 telephones and a small automatic switchboard provides a simple P-A-B-X without the need for an attendant. This is illustrated in figure 12.

In all the applications explained here, central office lines terminate directly at central office equipment.

### 2.3 Large Organizations

The type 87 telephone may be used in many special applications. All of the special features and services are available in these applications.



Figure 13 shows connections of the type 87 telephone with a P-A-B-X or P-B-X switchboard. Line three from each telephone is a separate line to the switchboard for individual service. This line serves local calls and making or receiving central office calls through the switchboard. Lines one and two may be arranged to provide separate central office service for the private use of several executives or other heavy users of central office lines. These lines when so used do not go through the switchboard. The ringer in the telephone may be used for line three with separate ringer boxes used for lines one and two.

A similar P-A-B-X, P-B-X arrangement is shown in figure 14. Line one of each type 87 telephone is connected to a private central office line that does not go through the switchboard. A separate ringer is provided on line one at each station. Line two of each telephone is connected to the switchboard and may be used for intercommunication and central office service. The ringer in the telephone is used for line two. Line three may also be connected to the switchboard or it may have various special services as explained in the note in figure 14. A separate ringer is necessary on line three when it is connected to a switchboard.

From the applications explained and illustrated in these sections, it is apparent that the type 87 telephone may be used in various other applications where multiple line service is necessary.

### 3. WIRING AND MODIFICATIONS

The basic circuit of the type 87 telephone is shown in figure 15. This circuit shows the various components of the telephone in schematic diagram form. The type 87 telephone circuit is similar to the circuit of the type 80 telephone with the exception of the click suppressor (rectifier).

Figure 16 is the wiring diagram of the telephone as it is shipped from the factory. This diagram shows the connection of the various components at the terminal strip. Some of the connections are made with spade terminals, which may be altered; others are permanent connections. The permanent connections are the pickup and hold keys on each line and the neon lamps on each line. These components are always connected to the terminal strip in the same manner and should not be altered.

The spade terminated leads allow the components to be wired in a number of ways as determined by the application of the telephone. Some of the modifications that can be made

are listed below. The telephone housing is first removed (section 5.1.1) to make any of the modifications.

#### 3.1 Ringer Connections

Figure 16 shows the ringer connected to line one at terminals P1 and H1. When it is desirable or necessary, the ringer may be connected to terminals P2 and H2 for an audible signal on line two or it may be connected to terminals P3 and H3 for an audible signal on line three. If external ringers are used, the ringer in the telephone can be completely disconnected, if required.

#### 3.2 Exclusion Key Connections

In figure 16 the black and red leads from the exclusion key are connected to line one at P1 and H1 respectively. The leads from the exclusion key may also be connected to one of the other two lines if the exclusion feature is desired on another line. If the exclusion feature is desired on line two, connect the black and red leads to P2 and H2 respectively. For exclusion on line 3 connect the black and red leads to P3 and H3 respectively.

#### 3.3 Secret Service Connections

Key modifications for secret service on two lines are made at the terminal strip and at the connecting block. The leads from the exclusion key to terminals P1 and H1 on the terminal strip are disconnected and taped. The lead connecting the exclusion key and terminal E1 is moved to terminal G. Positive battery must be connected to lead G at the connecting block. Lead SS1 of figure 3 is connected to lead S at the connecting block and lead SS2 of figure 3 is connected to lead E2 at the connecting block. When the signal key is operated, secret service is provided on line one and when the exclusion key is operated, secret service is provided on line two. It should be noted that in using the signal key for secret service, the signaling function can not be used.

The circuit for the secret service feature and visual busy signals is shown in figure 3. This circuit shows the secret service relays connected to negative battery with an SS1 lead extending from relay B on line one and an SS2 lead extending from relay D on line two. These leads terminate at the connecting block of a type 87 telephone that is modified for secret service. The busy relays are shown wired in series with one side of each line.

Figure 17 shows the wiring arrangement for an application having three central office lines. The wiring arrangement illustrated serves only as a guide for wiring of type 87 telephone in other applications.



### 3.4 Type 85 P-A-B-X Connections

When the type 87 telephone is used with the type 85 P-A-B-X, minor modifications are necessary in the wiring at the terminal strip and at the connecting block (figure 16). The ringer should be placed across the P and H terminals that are associated with the intercommunication line. The ringer lead at the P terminal is moved to terminal G on the terminal strip. A lead from the type 85 P-A-B-X unit, designated "GEN", is connected to lead G at the connecting block.

## 4. INSTALLATION

### 4.1 Placing and Mounting

Place the type 87 telephone (with attached connecting block) on the desk or table where the telephone station is to be located, usually at the far left corner or elsewhere as the subscriber wishes.

Loosen the cover-mounting screws on the connecting block and remove the cover.

Using the two wood screws supplied with each connecting block (or other screws as necessary) mount the base of the box on the back of the desk (or nearby wall) with the long direction running vertically.

Make the necessary connections to the connecting block and make the necessary modifications in the telephone. These modifications, which are determined by the type of application, are explained in section 3.

### 4.2 Loop Compensation

#### 4.2.1 Purpose of loop compensation.

The loop compensator is a rheostat-and-switch with a setting device located on the base of the telephone (figure 4). Using a small screwdriver, the setting device may be turned counterclockwise from 0 to 4, causing the rheostat to insert 0 ohms to 400 ohms in series with the loop. At 0, the switch adds a capacitor and resistor to the sidetone-balancing impedance of the telephone circuit.

In this way, the loop compensator minimizes sidetone on a short loop by limiting transmitter current and on a long loop by improving balance between the sidetone-balancing impedance and the impedance characteristics of the line.

#### 4.2.2 Adjustment rules, general.

- (a) Systems with 48-50 volt central office, or P-A-B-X or P-B-X lines (trunks). In systems with 48-50 volt central office,

P-A-B-X, or P-B-X lines (trunks), transmission current may be supplied from the central office, P-A-B-X, or P-B-X. Generally, adjust the loop compensator to favor the most distant source.

If station-loop plus trunk resistance equals more than 200 ohms, set loop compensator at 0.

If station-loop plus trunk resistance equals 200 ohms or less, set loop compensator at 2.

If long-line equipment or a pulse repeater supplies transmission current, set loop compensator at 2.

- (b) Other systems. In systems with 24 volt central office, P-A-B-X, or P-B-X lines, or with private lines, tie lines, station lines, or intercommunication lines, but no 48-50 volt central office, P-A-B-X, or P-B-X lines, set loop compensator at 0.

The type 87 telephone applications may sometimes be composed of 48-50 volt lines and of 24 volt lines. When this is true, set the loop compensator to favor the longest lines (most distant source of transmission current), but test all lines for sidetone, and if the other lines show poor transmission adjust the compensator until the best compromise is reached among all the lines.

#### 4.2.3 Adjustment rules, accurate.

The rules in section 4.2.2 above are usually adequate. In case of a transmission complaint more accurate adjustment of the loop compensator may be necessary to limit transmission current further.

To do this, connect a milliammeter in series with the "ring" side of the bad line at the station, pick up the line, and adjust the loop compensator until the milliammeter reads 60 ma.

Then, disconnect the milliammeter and test the transmission at the station on all lines, not just the one for which the complaint was made. If quality has not been sufficiently improved on the bad line and quality on other lines is not damaged, connect the milliammeter again and adjust the loop compensator to limit line current even further, but do not reduce it to less than 25 ma. Keep in mind always that you are working with transmission quality probably on several lines.

Accurate adjustment of station loop compensators for systems having central office, P-A-B-X, or P-B-X lines may also be made using the test board at the central office (see Technical Bulletin 700-80).

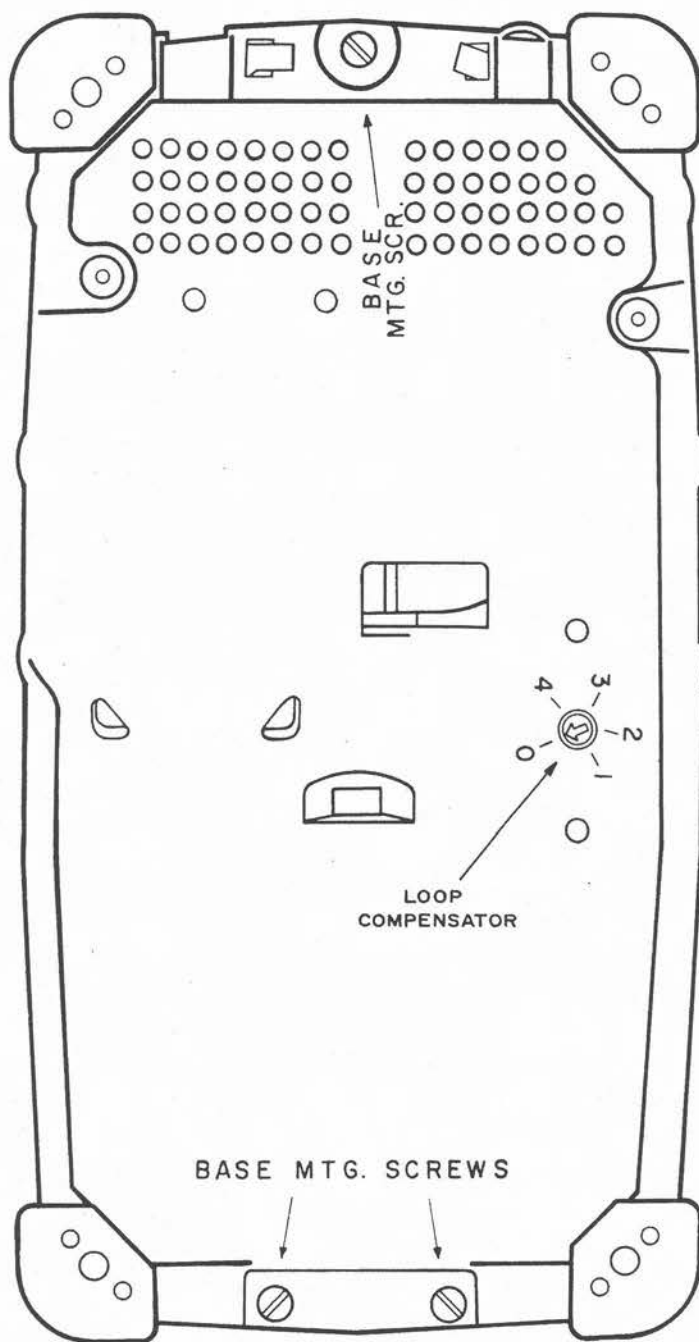


Figure 4. Position of setting device for loop compensator on telephone base.



### 4.3 Number Card

The installer and the customer should decide what number(s) if any appear on the number card at each station.

When trunk-hunting is provided at the central office for lines to the telephone system, the first number of the assigned group of trunks could appear on the number card.

When trunk-hunting is not provided, the number card could carry the exchange name and number, with the last four digits of the number appearing on the key designation strip.

When the telephone system is not connected to a central office, P-A-B-X, or P-B-X, the number card probably can be left blank.

Instructions follow for numbering the number card of dials with metal finger plates and dials with plastic finger plates.

#### 4.3.1 Dial with metal finger plate.

Tools and materials: dial escutcheon tool H-26917 or small screw driver.

Insert tool between escutcheon ring and transparent cover opposite finger hole 5 (figure 5). Press downward until tool engages locking lever. Then move tool counterclockwise toward finger hole 6. This unlocks the escutcheon ring. With tool, lift ring from dial.

A clamping plate holds the transparent cover and the number card to the ring. To disassemble, rotate the clamping plate counterclockwise.

Print or stamp the number clearly on the card.

Reassemble escutcheon ring, replacing transparent cover, number card, and clamping plate, in that order.

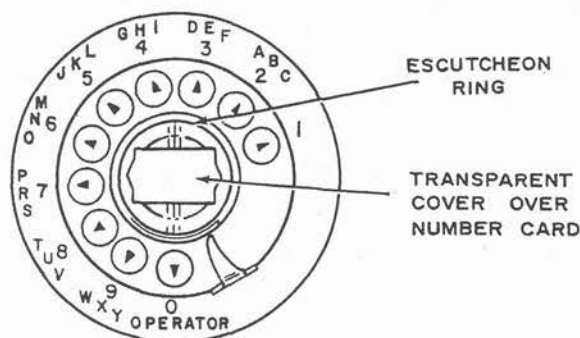


Figure 5. Unlocking escutcheon ring of dial.

To mount ring on dial, insert small lug on ring into slot near finger stop. Press assembly into finger plate. Insert tool under escutcheon ring opposite finger hole 7. Press down until tool engages locking lever and move tool clockwise to finger hole 6. Assembly is now locked in place.

#### 4.3.2 Dial with plastic finger plate.

Tools and materials: dial escutcheon tool H-26917 or small screw driver.

Insert tool between escutcheon ring and transparent cover opposite the halfway point between finger holes 5 and 6 (figure 5). This unlocks the escutcheon ring. With tool, lift ring from dial.

A clamping plate holds the transparent cover and the number card to the ring. To disassemble, rotate the clamping plate counterclockwise.

Print or stamp the number clearly on the card.

Reassemble escutcheon ring, replacing transparent cover, number card, and clamping plate, in that order.

To mount ring on dial, insert small lug on ring into slot near finger stop. Insert tool between escutcheon ring and transparent cover opposite the halfway point between finger holes 5 and 6. Press tool down until you hear or feel the ring lock.

### 4.4 Key Designation Strip

The plastic cover of the key-designation strip covers the strip and also fits around the keys. To remove this cover, lift it up with your finger tips.

With typewriter or pen, print the designations for the keys on the strip. Then, replace the strip and its cover.

## 5. MAINTENANCE

### 5.1 Telephone Maintenance

#### 5.1.1 Housing removal.

Tools and materials: medium-sized screw driver. Turn up the telephone base and loosen three captive screws labeled "base-mounting" (see figure 4).

Set the telephone down right-side-up and lift off the housing.

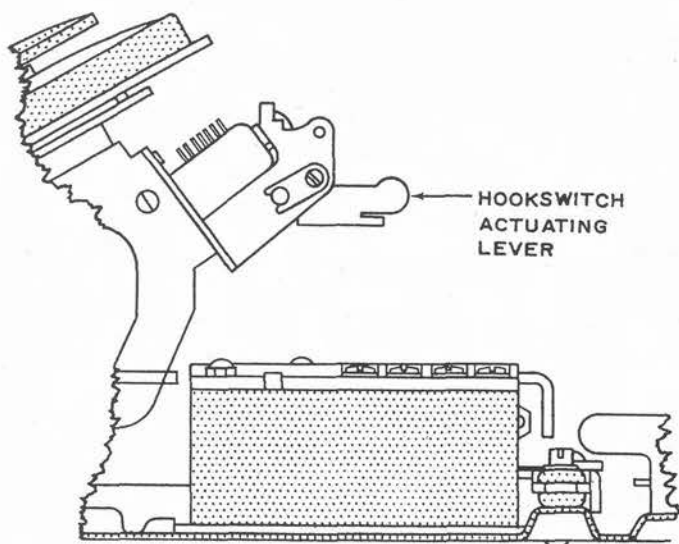


Figure 6. Setting the hooklock when working inside the telephone.

### 5.1.2 Hooklock.

When working inside a telephone that is connected to an operating key telephone system, press down the hookswitch-actuating lever (figure 6). The lever maintains the hookswitch in the on-hook position so that lines are not held busy and incoming calls are not lost. When the housing is put back on the base, contours inside the housing restore the actuating lever automatically.

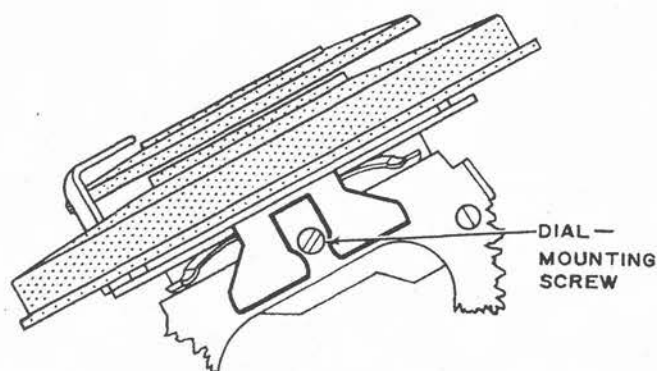


Figure 7. Dial removal to reach terminal strip.

### 5.1.3 Dial removal.

To reach most of the terminal strip, the dial must be removed. To do this, loosen the two screws holding the dial (but do not remove them) and tip the dial up to expose the terminal strip (figure 7).

Disconnect the dial leads only when the dial is not in working order and must be replaced. Then, supply a dial in good working order and connect its leads to the transmission-unit ter-

minals as follows: yellow to terminal 11, blue to terminal 2, white to terminal 9, and red to terminal 7.

### 5.1.4 Transmission unit.

The transmission-unit wiring diagram (figure 8) contains information for continuity tests, ohmmeter measurements, etc. The unit itself is sealed and cannot be repaired in the field. If it is damaged, replace it.

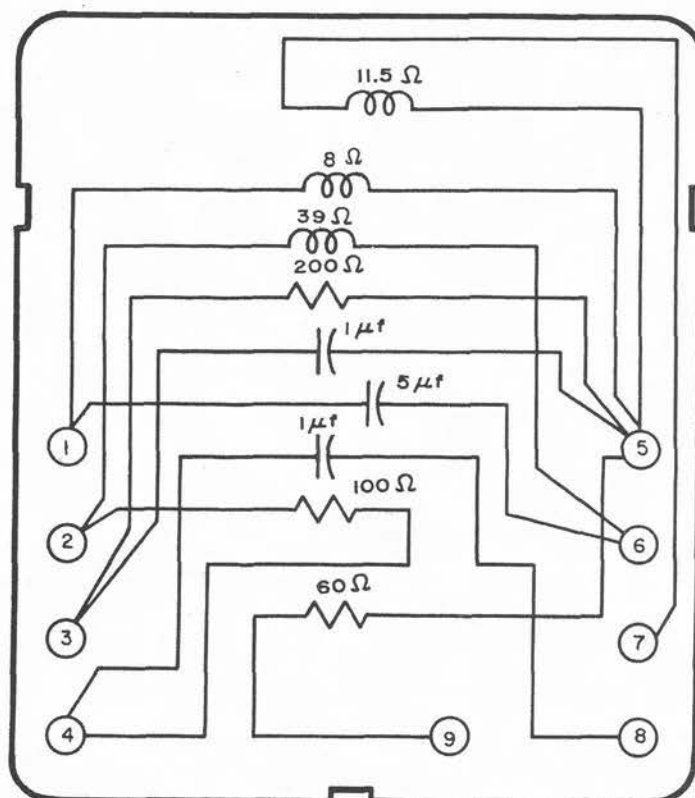


Figure 8. Transmission unit code D-38369-A wiring diagram.

## 5.2 Lamp Replacement

The lamps provided in the type 87 telephone are Automatic Electric Company code D-94093 lamps. Instructions follow for replacing a burned-out lamp.

Tools and materials: small duckbill pliers, code D-94093 lamps.

Remove the type 87 telephone housing (see section 5.1.1), and identify the burned-out lamp.

Remove the lamp cap and push button covering the lamp. (The push button is loose and may fall out of the lamp cap.)

With the pliers reach behind the key shaft and pull out the burned-out lamp. Insert the new lamp.

Replace the lamp cap and push button. Replace and screw down the key-telephone housing.



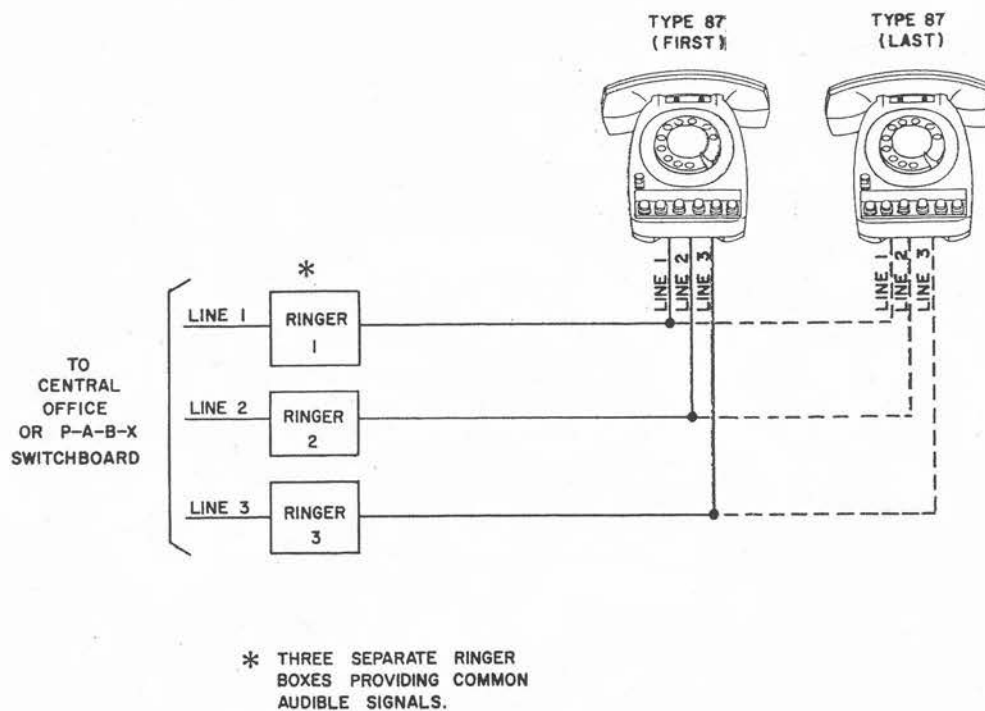


Figure 9. Three central office lines (for wiring arrangement see figure 16).

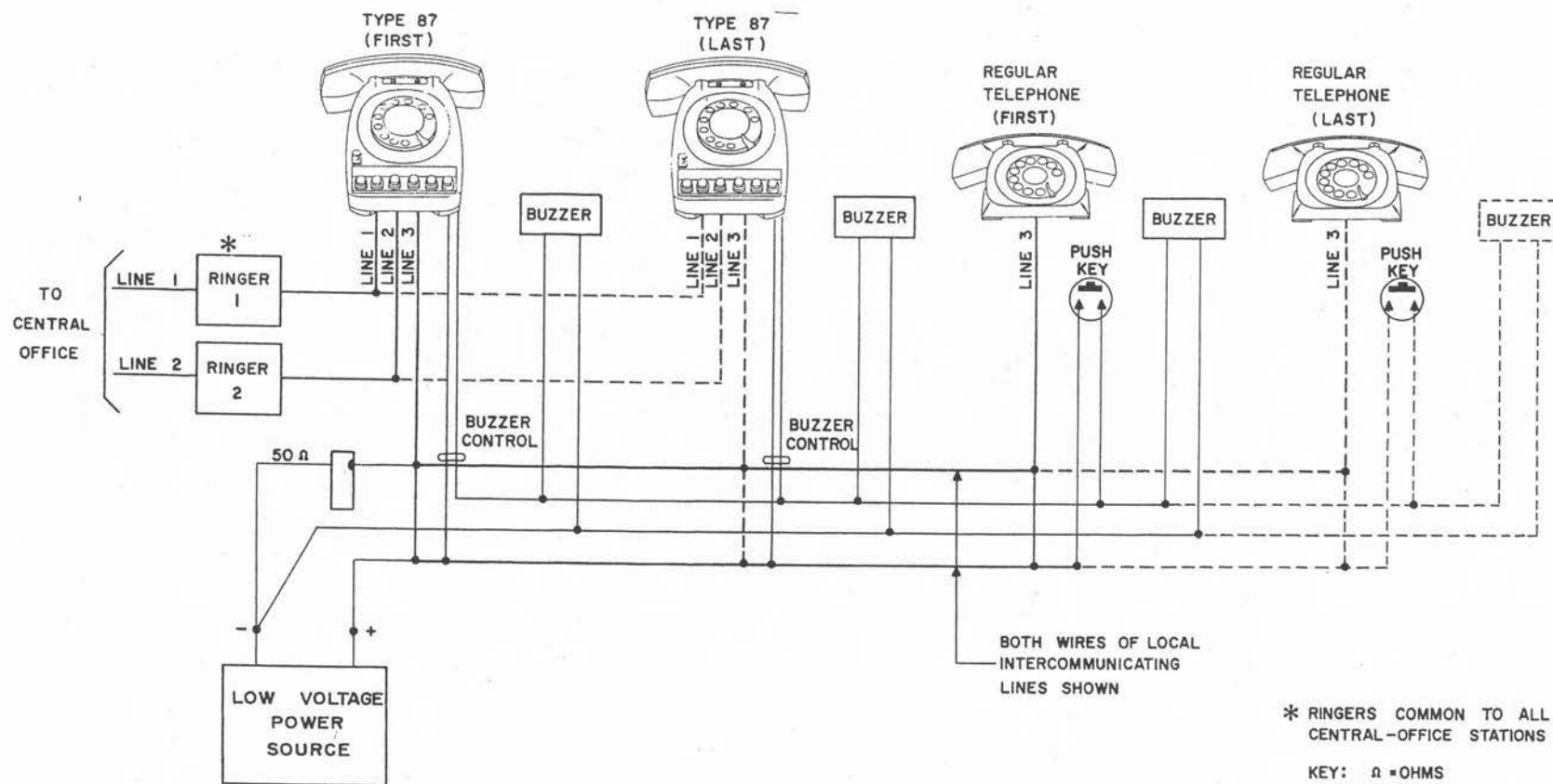


Figure 10. Two central office lines and one local intercommunication line with local code signaling with buzzers.



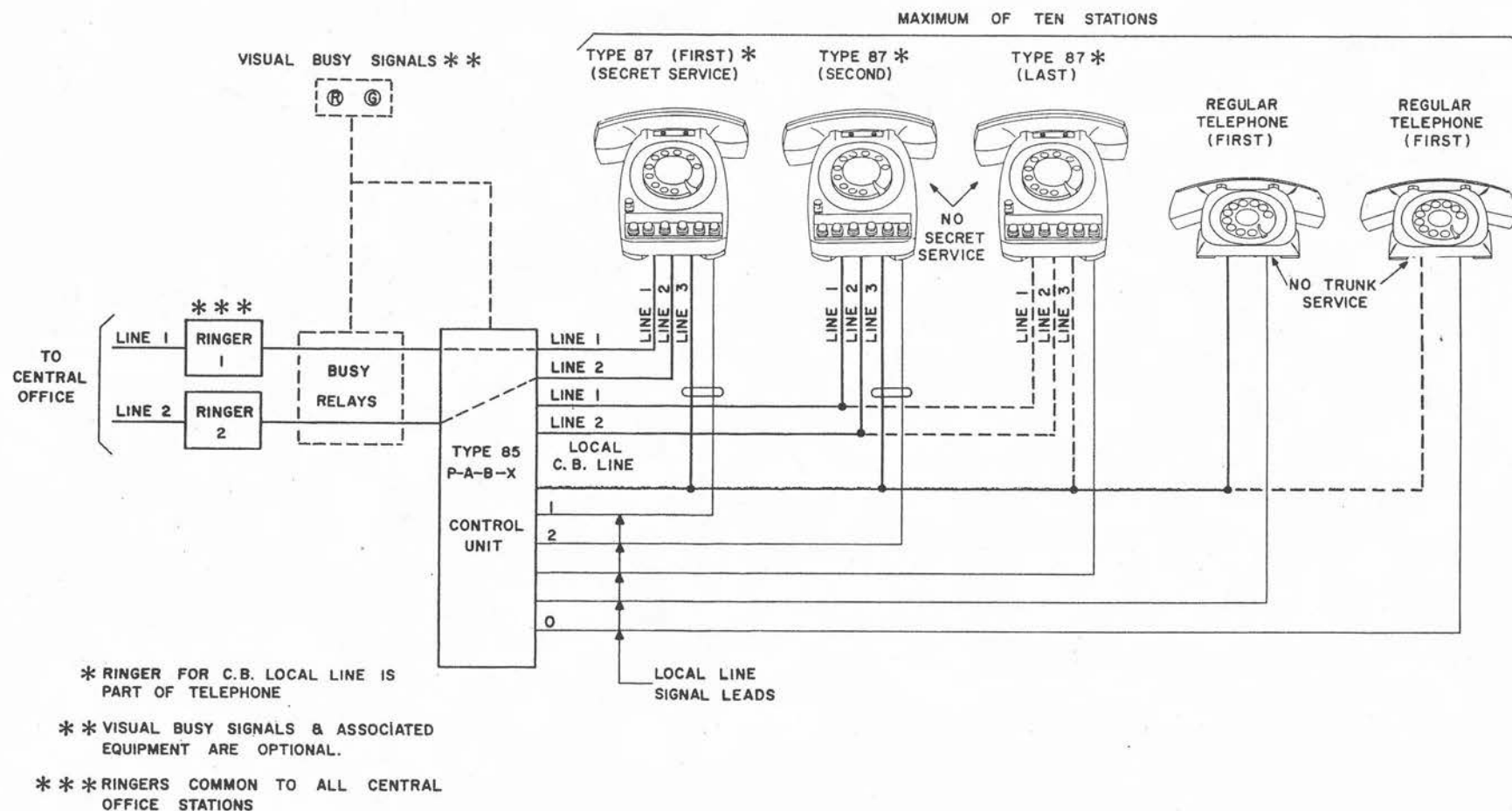


Figure 11. Two central office lines and one local intercommunication circuit (non-secret) with selective ringing (Type 85 P-A-B-X).

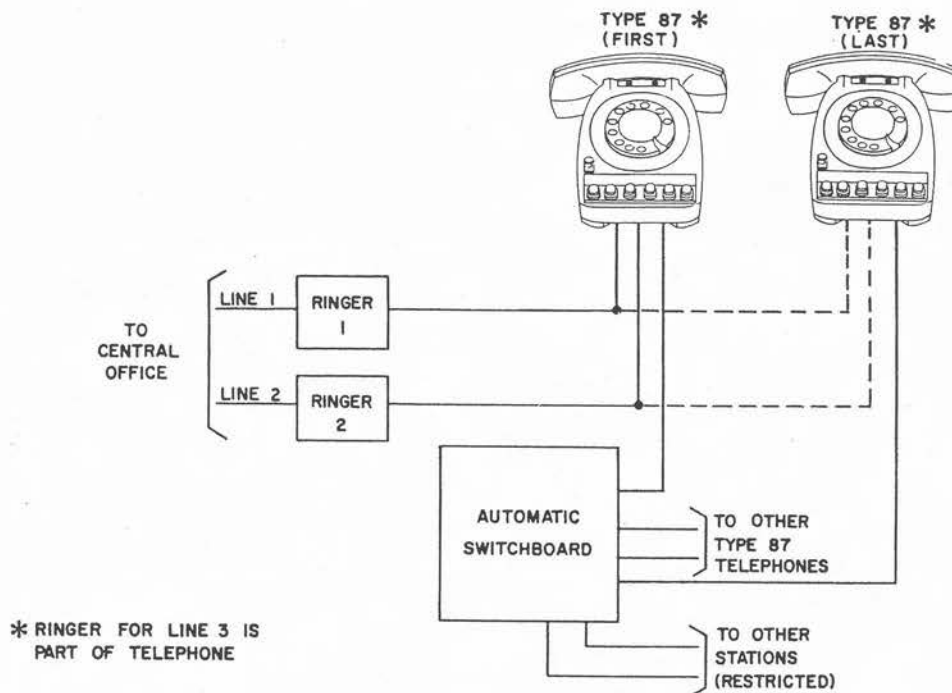


Figure 12. P-A-B-X without attendant cabinet serving two central office lines. Each local trunk station has one line to automatic switchboard. Local calls are made by dialing; service is secret and fully selective.

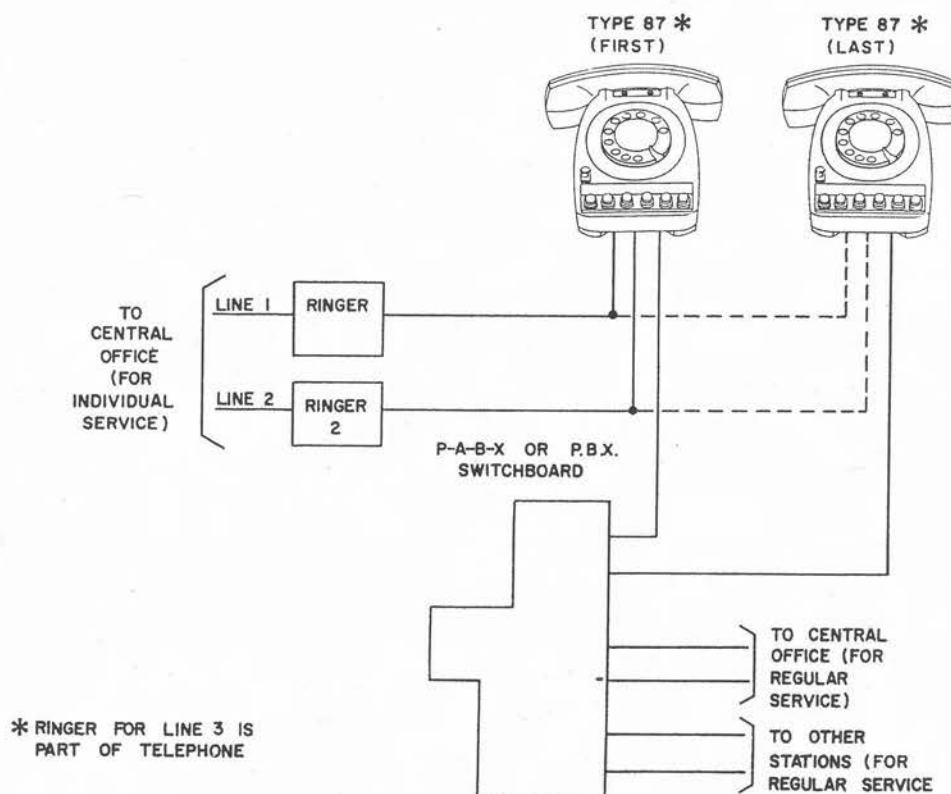


Figure 13. Two central office lines and one local line from P-A-B-X or P-B-X switchboard.



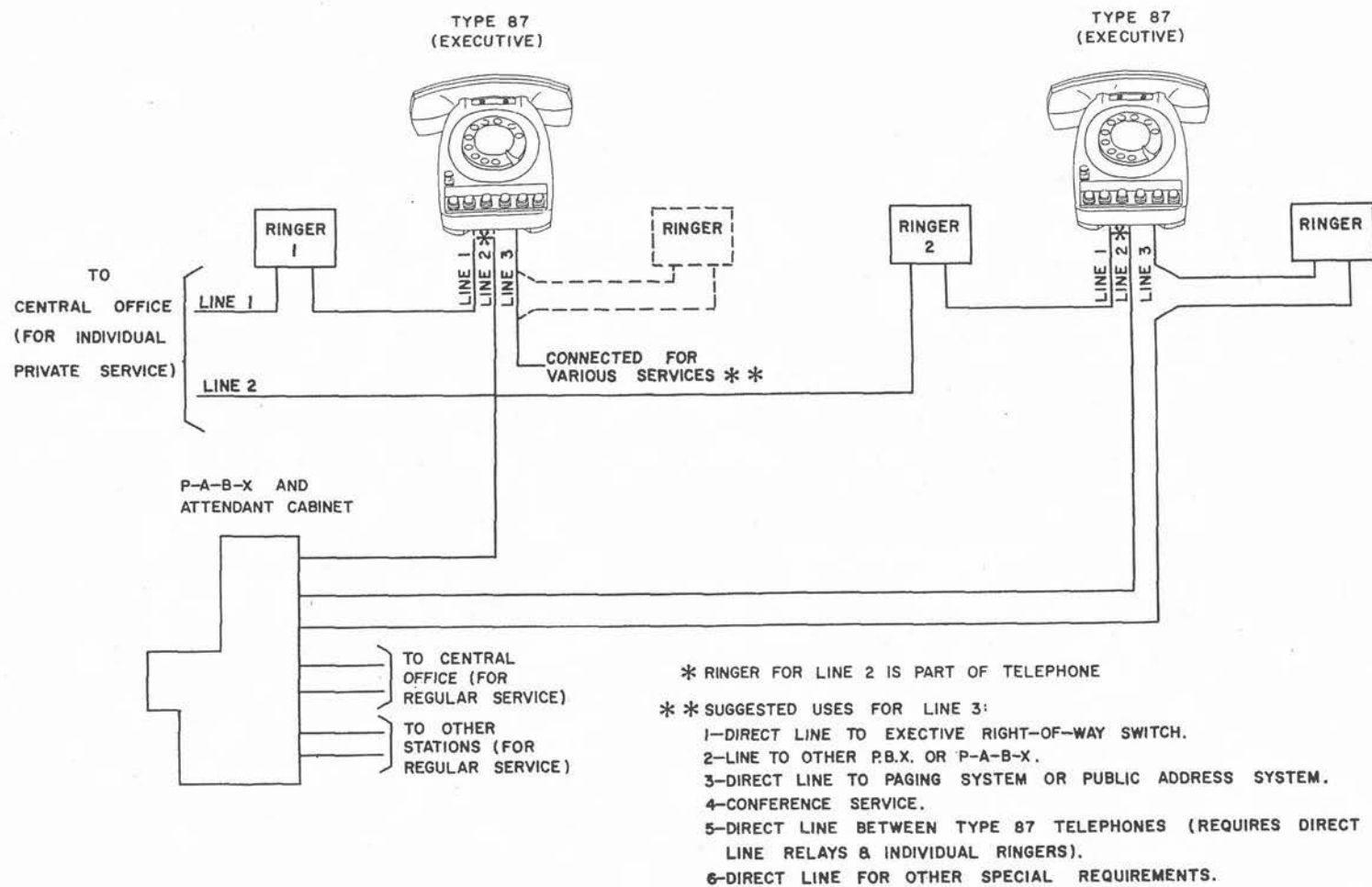


Figure 14. Private central office lines, one local line to P-A-B-X and one line for special service.

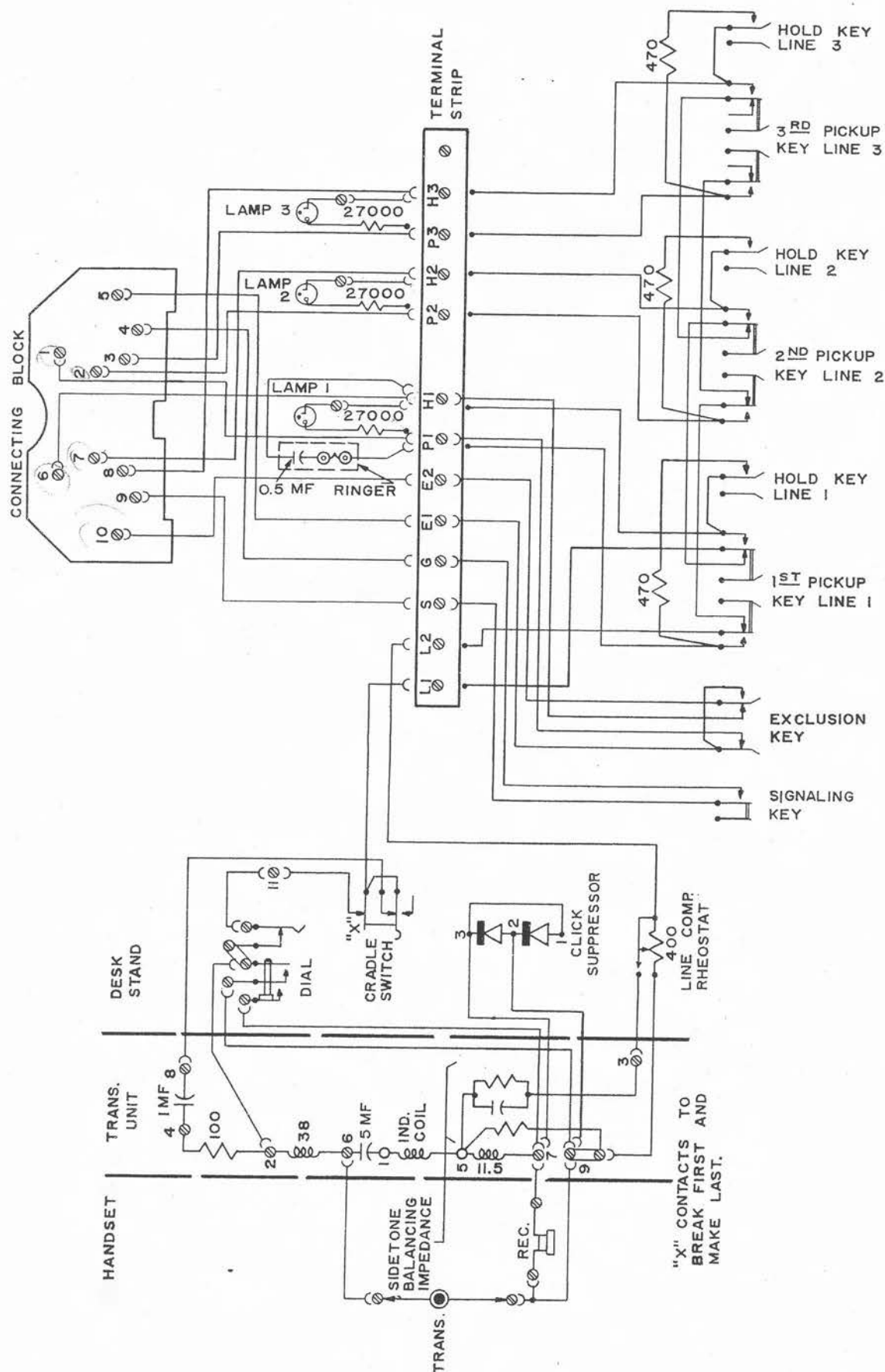


Figure 15. Type 87 telephone schematic circuit.



# LINE CORD COLOR CODE

CKT DESIG	PRESENT COLOR	PREVIOUS COLOR
P1	RED	VIOLET
P2	BLK	BR
P3	WH	RED
G	BR-BLK	GR-BR
E1	BR-GR	YEL-SL
H1	GR	GR
H2	YEL	OR
H3	BL	BLK
S	BR-YEL	YEL
E2	BR-RED	BL

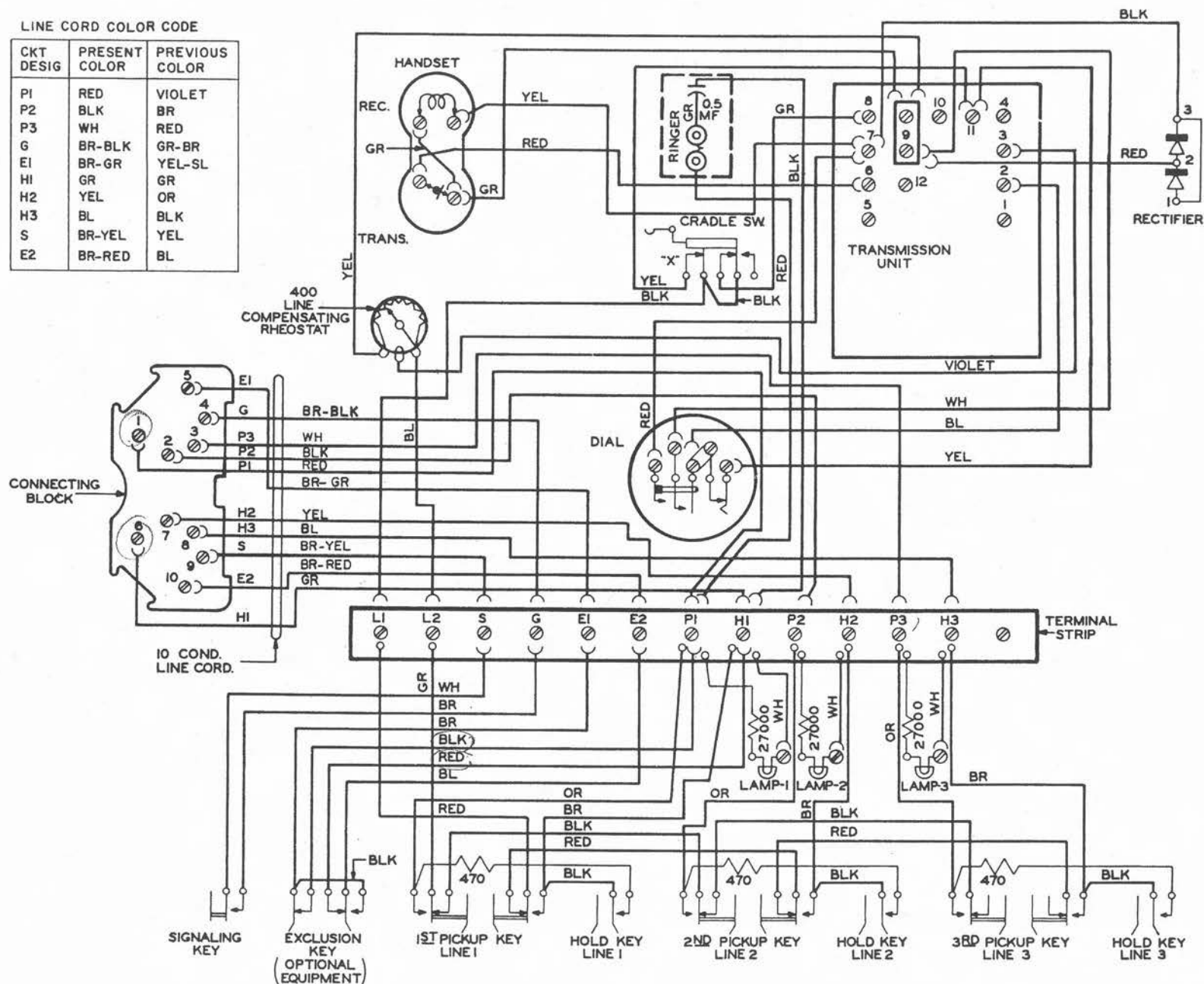
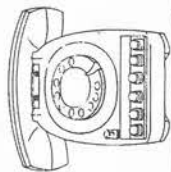


Figure 16. Type 87 telephone wiring diagram.



TYPE 87 TELEPHONE (LAST)

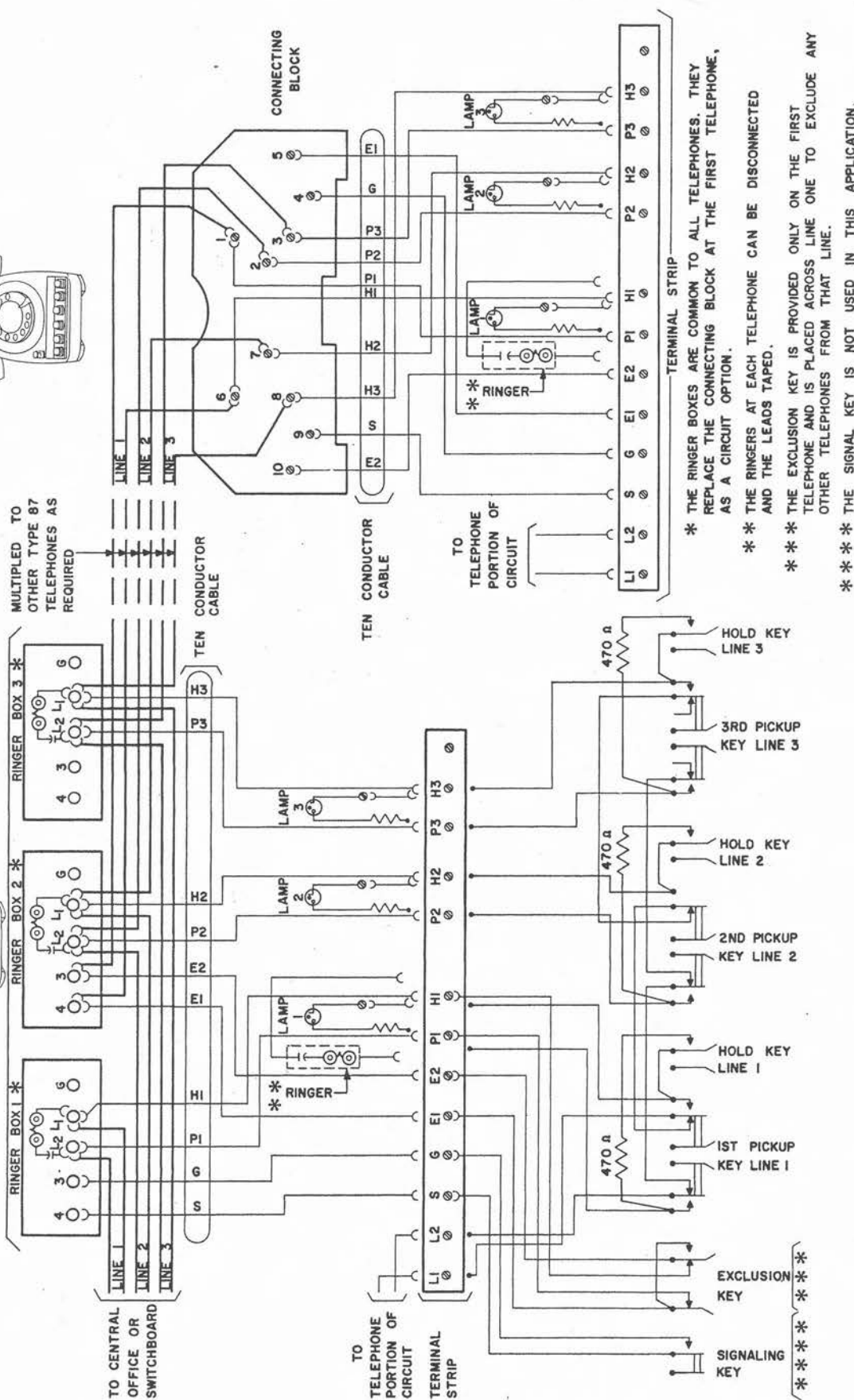
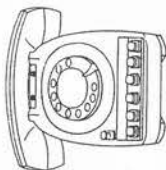


Figure 17. Wiring arrangement for application having three central office lines with separate ringer boxes on each line and exclusion feature for first telephone.



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