

Type 90M Telephone 912

# TYPE 90M TELEPHONE



Technical  
bulletin **912**

***AUTOMATIC ELECTRIC***

Subsidiary of

**GENERAL TELEPHONE & ELECTRONICS**



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# TYPE 90M TELEPHONE

## 1. GENERAL

The type 90M is a self-contained wall telephone (figure 1). A terminal strip within the telephone accepts wiring for either bridged or divided ringing. All leads to this terminal strip are spade terminated so that only a screwdriver need be used for wiring changes; no soldering is required.

The initial design of the type 90M telephone included a manually-adjusted rheostat which regulates the conductor-loop resistance, thus controlling the quality of transmission. The new type 90M telephone uses a self-compensating transmission unit which automatically reduces sidetone and balances the impedance characteristics of the line. Installation and maintenance for the self-compensating type 90M is contained in sections 2 and 3 of this publication. Installation and maintenance for the manually-adjusted type 90M telephones is covered in sections 4 and 5.

## 2. PHYSICAL DESCRIPTION

The type 90M wall telephone, contained in a plastic housing, measures (including the handset) 9-7/8" high, 8-1/2" wide, and 4" in depth. The hookswitch lever and handset are located on the left side of the telephone. The dial, mounted at an angle, is located at the top front of the telephone.

### 2.1 Features

Depending on service requirements, the type 90M wall telephone is supplied with one of four dials:

- a. Numerical 1-0 dial.
- b. Metropolitan ABC dial.
- c. SATT A dial.
- d. SATT B dial.

The type 90M wall telephone, equipped with a retractile handset cord, is available in black

and ten colors. The black type 90M telephone has a black metal finger plate; the colored type 90M telephones are equipped with a clear plastic finger plate. The ten colors are listed below:

Jade Green	Sand Beige	Classic Ivory
Camellia Pink	Dawn Gray	Forget-Me-Not
Sunlight Yellow	Garnet Red	Blue
Gardenia White	Turquoise	

Another feature of the type 90M wall telephone is the easy, one screw, removal of the plastic telephone housing.

## 3. INSTALLATION (Self-compensating Type 90M)

The following sections apply to installation of the self-compensating type 90M telephone. Section 5 gives installation information on the type 90M telephone equipped with a loop compensator.

### 3.1 Mounting

#### 3.1.1 Wall mounting.

To mount the type 90M telephone on a wall follow the steps below:

- a. The housing screw (shown on figure 17) must be loosened. Lift the plastic telephone housing.
- b. The line wires are passed through the wire hole (figure 2) and the telephone base is held in position against the wall.
- c. Refer to figure 2 and place a No. 8 round-head screw through either of the top two mounting holes. Place a second No. 8 round-head screw through the slot at the bottom of the plate. The slot at the bottom of the plate allows alignment of the telephone.
- d. After the telephone is aligned so that it is exactly vertical, tighten the two screws, and place a third No. 8 round-head screw through the other top mounting hole.



*Figure 1. Type 90M Telephone.*

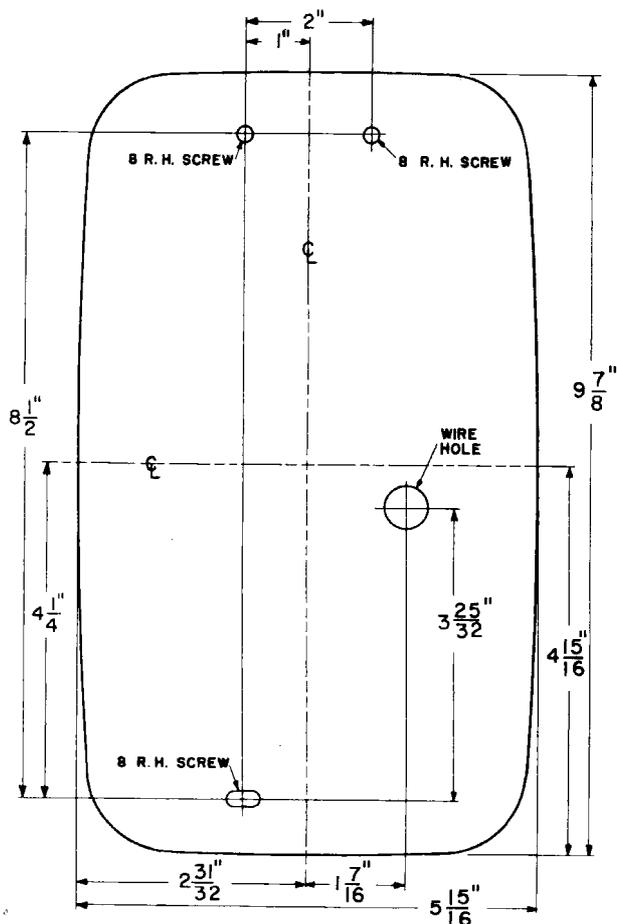


Figure 2. Location of wall-mounting holes.

When the telephone is to be mounted on masonry, use masonry anchors. Figure 2 provides mounting-hole spacing dimensions which can be used for drilling layout. (Note that the holes are not adjacent to the corners of the baseplate.)

### 3.1.2 To mount on an electric outlet box.

When mounting on an electric outlet box order A. E. Co. adapter plate D-780763-A, three D-760823 #8-32 x 25/64" RHIL screws, three D-750261-A bushings, and two #6-32 x 5/8" RHIM (or FHIM) screws. The adapter plate (figure 3) has a number of holes in it, so it can mount on a 4" square outlet box, a 4" octagonal outlet box, or an oblong utility or "handy box."

Pass the line wires through the adapter plate wire hole (figure 3). Using the two outlet box No. 3-32 x 1/2" RHIM screws (if any) or the two No. 6-32 x 5/8" RHIM or FHIM screws, and the appropriate two holes in adapter plate D-780763-A, attach the adapter plate (figure 3) to the outlet box. Align the cover vertically on the wall, and tighten the two screws.

Near the bottom of the plastic telephone housing, is a housing screw (see figure 17). Loosen this housing screw, and lift off the housing. Then pass the line wires through the line wire hole in the baseplate, as shown in figure 3. Use the three D-760823-A RHIL screws and the three D-750261-A bushings to attach the telephone baseplate to the adapter plate (figure 3). These bushings must be assembled so their tapped sides are toward the telephone baseplate.

### 3.2 Line Polarity

Connection instructions in this bulletin assume the interior wires between the protector or a P-B-X switchboard or similar equipment and the telephone location in the subscriber's premises have their polarities identified by standard tracers as shown in figure 4. Line polarity is important in divided-ring stations, and in SATT installations.

An alliteration (repetition of the same letter) of the letter R may help you to remember these connections. The R alliteration is: Ring, Red, Right-hand, Ridged, Right-hand. The corresponding connections are:

Ring (negative line) connects, in this order, to Red (or 1 ridge) interior wire conductor, Right-hand station protector terminal screw, Ridged (tracer) drop wire conductor, Right-hand cable terminal stud.

EXCEPTION: The "ring equals right" rule applies at a strand mounted or sheath mounted

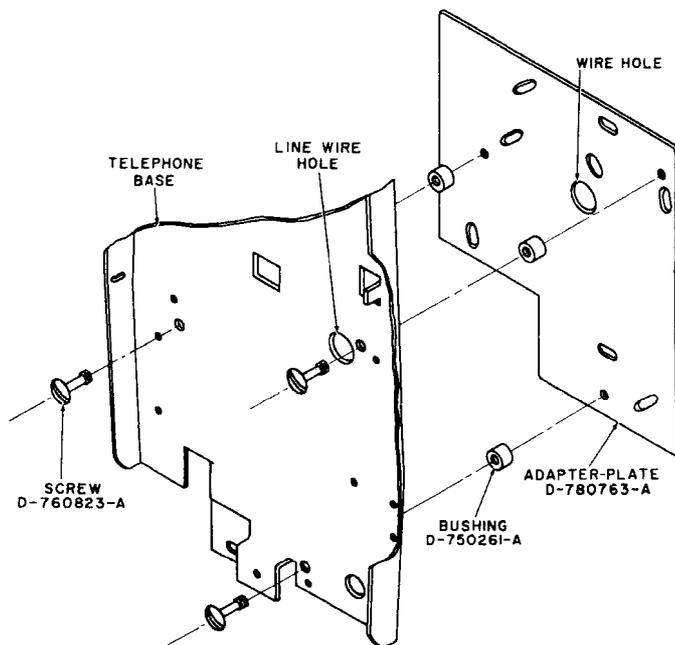


Figure 3. Adapter-plate assembly (exploded view).

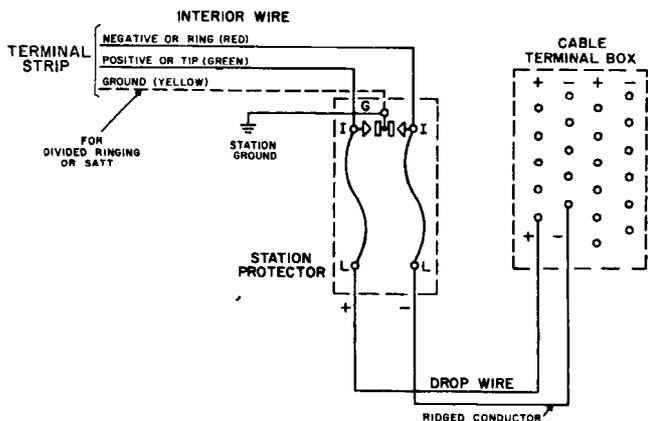


Figure 4. Typical connections to protector, cable terminals etc.

cable terminal, or at an unprotected pole-mounted or wall-mounted cable terminal. At a protected pole-mounted or wall-mounted cable terminal, connect the negative line to the lower terminal stud of the pair.

If you are uncertain of the polarities of the line conductors, use a hand-test telephone such as the Automatic Electric Company L-965-A2. Clip one lead to the ground wire which you have just installed and touch the other clip to each line wire. The louder click will identify the negative line. The positive line will usually give a weak click due to an earth potential difference. Where no ground connection is readily available, the line polarity may be readily determined with a portable d'Arsonval voltmeter.

### 3.3 Standard Self-compensating Type 90M Telephone

The "standard" type 90M is the basic telephone and the one most commonly used. The other type 90M telephones discussed in the publication are variations of the "standard."

The following instructions apply to the standard self-compensating type 90M wall telephone with straight-line or harmonic ringer (but without SATT dial or cold cathode tube for superimposed ringing).

Mount the telephone as described in section 3.1.1 or 3.1.2.

**Bridged ringing.** This telephone is shipped wired for bridged ringing as shown in figure 28. Connect the line wires as shown in figure 5.

**Divided ringing on the + (tip) line.** For divided ringing on the + (tip) line move the black capacitor lead from terminal strip position L2 to 4G as shown in figure 28. Connect the line wires as shown in figure 6

**Divided ringing on the - (ring) line.** For divided ringing on the - (ring) line move the black capacitor lead from terminal strip position L2 to 4G as shown in figure 28. Then connect the line wires as shown in figure 7.

To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw located at the bottom of the housing. Then call the central office for a ringing test, etc. Sections 3.7.1 and 3.7.2 supply instructions for stamping the directory number on the number card.

### 3.4 Standard Self-compensating Type 90M Telephone Used with SATT Systems

The following instructions apply to the self-compensating type 90M wall telephone (figure 28 - circuit D-530142-A) with straight-line or harmonic ringer and equipped for SATT operation (but not with the cold cathode tube for superimposed ringing).

Mount the telephone as described in section 2.1.1 or 2.1.2.

**Bridged ringing.** The telephone is shipped wired for bridged ringing as shown in figure 28. The brown lead from the dial must be connected to terminal strip position 4G. Connect the line wires as shown in figure 7.

**Divided ringing on the + (tip) line.** For divided ringing on the + (tip) line move the red ringer lead from terminal strip position L1 to 4G

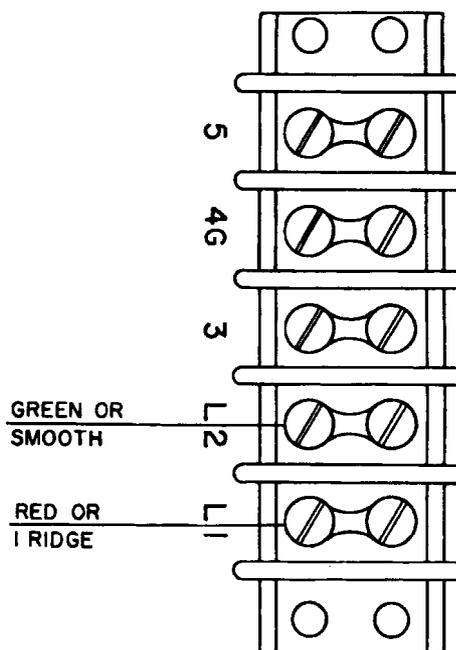


Figure 5. Terminal strip connections for bridged ringing (non-SATT).

(figure 28). Connect the line wires as shown in figure 7.

Divided ringing on the - (ring) line. For divided ringing on the - (ring) line move the black capacitor wire from terminal strip position L2 to 4G (figure 28). Connect the line wires as shown in figure 7.

Check that the party identity pulse will be on the + line. At the terminal strip, attach the clips of a hand-test telephone (such as A. E. Co. L-965-A2) to L1 and L2. Press test telephone button C, and with the subscriber's handset on the hook, dial 0 on the subscriber's dial. As the dial returns, listen at the test telephone. If no click is heard, the subscriber's telephone is connected correctly. If one or more clicks are heard, reverse the interior wires at telephone terminals L1 and L2 (figure 7) or reverse drop wires at the protector (figure 4).

To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw which is located at the bottom of the housing. Then call the central office for a ringing test, etc. Section 3.7.1 and 3.7.2 supply instructions on stamping the directory number on the number card.

### 3.5 Self-compensating Type 90M for Superimposed Ringing

The following instructions apply to the self-compensating type 90M telephone (figure 29) equipped with superimposed ringers and cold

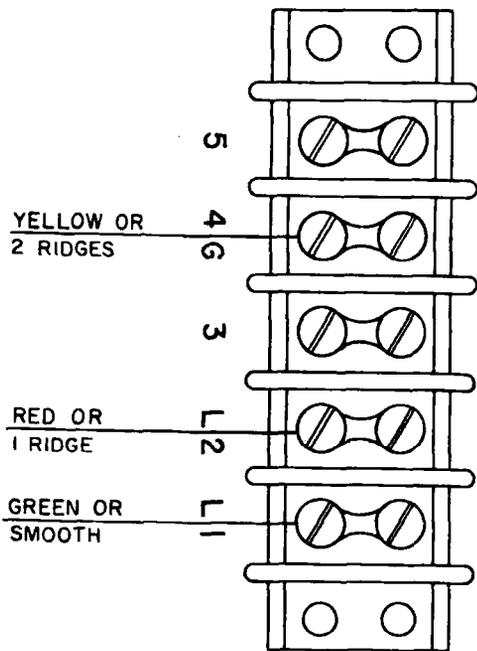


Figure 6. Terminal strip connections for party-line standard telephones rung on + line (tip).

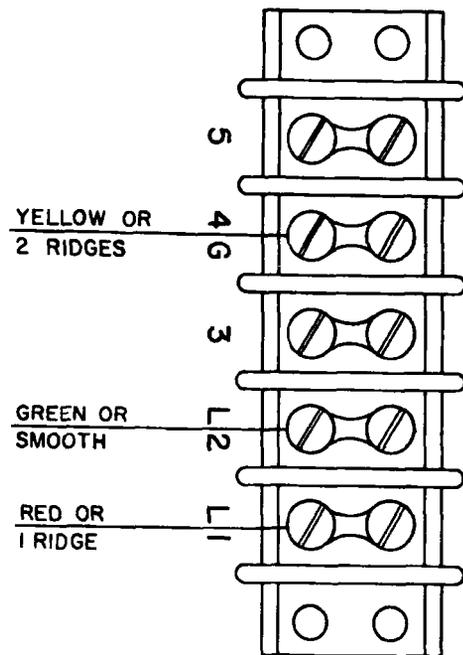


Figure 7. Terminal strip connections for party-line standard telephones rung on - line (ring) for SATT A or SATT B, or for superimposed.

cathode tube. For optimum operation either superimposed d.c. or a.c. on 20 cycles or pulsating d.c. of 20 pulses per second should be used for ringing current.

Mount the telephone as described in section 3.1.1 or 3.1.2.

If the telephone is not wired for the proper party-station, reconnect the ringer green and red leads, and cold cathode tube yellow, black, and red leads as shown in Table A.

Connect the line wires as shown in figure 7. Then, to replace the plastic housing, hook it over the top edge of the telephone baseplate, tighten the housing screw located near the bottom of the housing. Stamp the directory number on the number card as described in section 3.7.1 or 3.7.2. Then call the central office for a ringing test, etc.

### 3.6 Ringer Frequency Change

When it is necessary to use a new ringer frequency, the ringer and capacitor must be changed together as a unit, because each ringer has attached a capacitor of the correct capacitance. Table B gives ordering information on ringers.

To remove a ringer, loosen the housing screw and remove the plastic telephone housing. Disconnect the red and green ringer leads, and the white and black capacitor leads.

TABLE A

Station	Terminal Strip Terminals				
	Ringer Leads		Tube Leads		
	Green	Red	Yellow	Black	Red
No. 1 or No. 5 - station on the - (ring) line	L1	3	3	4G	4G
No. 2 or No. 6 - station on the + (tip) line	L2	3	3	4G	4G
No. 3 or No. 7 + station on the - (ring) line	3	L1	4G	3	3
No. 4 or No. 8 + station on + (tip) line	3	L2	4G	3	3

TABLE B

A. E. Co. Piece Number*	Ringer (frequency in cycles)	Capacitor (Capacitance in microfarads)
D-56548-ASLR	Straight line without volume control	0.4
D-56548-A16R	16.6	0.7
D-56548-A20R	20	0.7
D-56548-A25R	25	0.3
D-56548-A30R	30	0.2
D-56548-A33R	33.3	0.2
D-56548-A40R	40	0.08
D-56548-A42R	42	0.08
D-56548-A50R	50**	0.08
D-56548-A51R	50***	0.08
D-56548-A54R	54	0.08
D-56548-A60R	60	0.08
D-56548-A66R	66	0.08
D-56548-A67R	66.6	0.08
D-56548-AVTR	Superimposed	****
D-56548-AACR	For P-A-X type 34A16 only	0.7
D-56548-CVTR	Superimposed (self-comp.)	none

\*Each piece number in the table includes standard ringer (first suffix letter A). Piece number for humid-climate impregnated ringer has first suffix letter B; for example, to order impregnated straight-line ringer without volume control, order D-56548-BSLP.

\*\*For use in exchanges with harmonic ringers.

\*\*\*For use in exchanges with "Decimonic" ringers.

\*\*\*\*This has an 0.4 mf capacitor for the dial pulse-spring spark-suppression circuit.

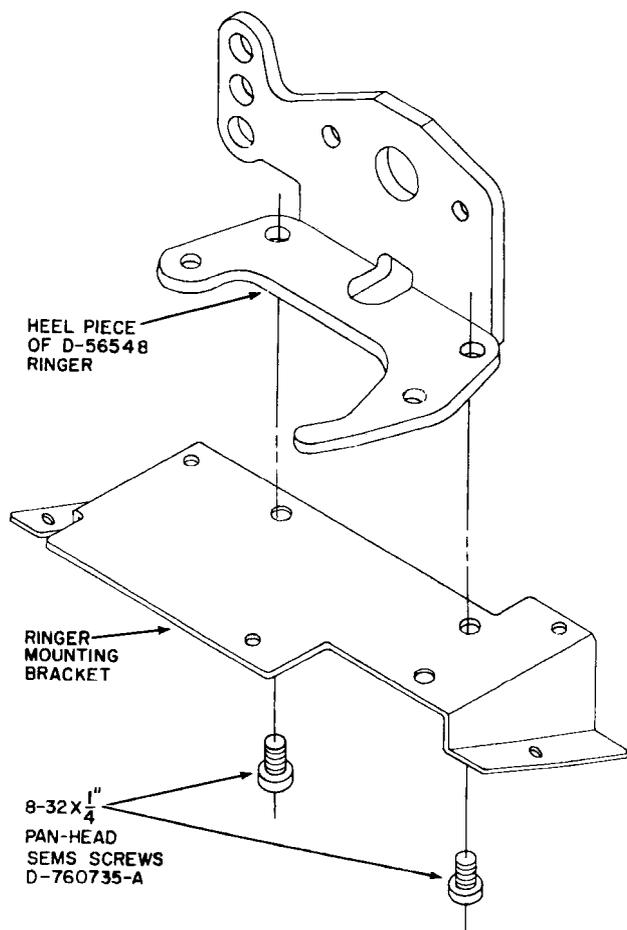


Figure 8. Mounting D-56548 ringer.

To change the D-56548 ringer, remove the three D-760764-A round-head sems screws (figure 9) while holding the ringer mounting bracket to the telephone baseplate. Then turn the ringer and mounting bracket over and remove the two D-760735-A sems screws (figure 8) holding the ringer and capacitor to the mounting bracket. Re-using the original screws, attach the new ringer and capacitor to the ringer mounting bracket as shown in figure 8. Then attach the ringer mounting bracket to the telephone baseplate as shown in figure 9.

To change the D-56562 ringer remove the three D-760735-A sems screws (figure 9) which hold the ringer to the ringer mounting bracket. There is usually no need to remove the three screws which hold the ringer mounting bracket to the telephone baseplate. Then, re-using the original screws, attach the new ringer and capacitor to the ringer mounting bracket as shown in figure 9.

The red and green ringer leads and the white and black capacitor leads can now be reconnected according to the applicable wiring diagram and/or party-line instructions.

### 3.7 Dial Number Card

#### 3.7.1 Metal finger plate.

Insert the dial escutcheon tool H-26917 or a small screwdriver between the escutcheon ring and the transparent cover opposite finger hole 5 (figure 10). Press the tool downward until the locking lever underneath is engaged. Next move the tool counterclockwise toward the finger hole 6. This will unlock the escutcheon ring. The ring may now be lifted from the dial with the tool. Figure 11 shows how a clamping plate holds the transparent cover and number card to the ring. Rotating the notched clamping plate counterclockwise will release the assembly.

Print or stamp the number clearly on the card.

To reassemble, first place the transparent cover in the escutcheon ring. Insert the number card and the clamping plate. Turn the clamping plate clockwise to engage its tongue and lock the assembly. Before mounting the assembly on the dial, note that the locking lever on the finger plate is midway between finger holes 6 and 7 (figure 12). Insert the small lug of the escutcheon ring into the slot near the finger stop and press the assembly into the finger plate. Then insert the dial tool under the escutcheon ring opposite finger hole 7, and press the tool down against the locking lever underneath the card. Move the tool clockwise to finger hole 6 to lock the assembly in place.

#### 3.7.2 Plastic finger plate.

At a point halfway between finger holes 5 and 6 (figure 13), insert a screwdriver (such as the A. E. Co. H-880622-1) between the edge of the escutcheon ring and the transparent cover to unlatch the escutcheon ring. Lift the ring with the screwdriver. Rotate the clamping plate (as shown in figure 16)

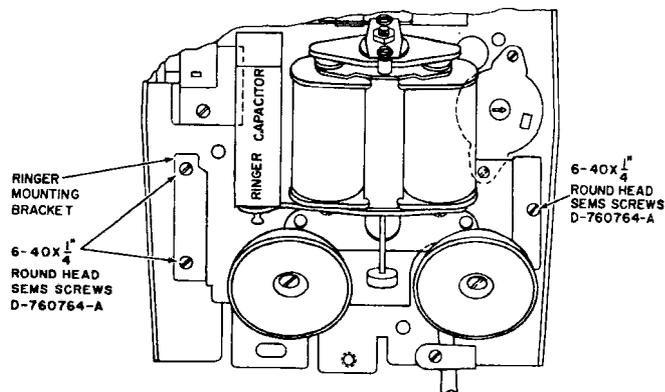


Figure 9. D-56562 ringer attached to telephone base.

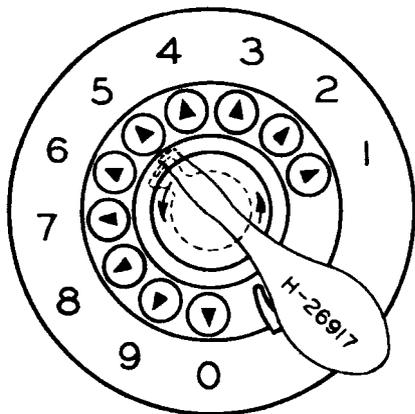


Figure 10. Unlocking escutcheon ring.

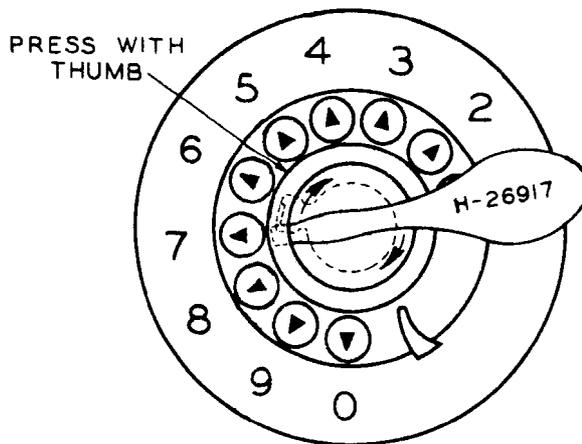


Figure 12. Locking escutcheon ring.

counterclockwise and remove the number card. Print or stamp the number clearly on the card.

Next, with the transparent cover in the escutcheon ring, add the number card and the clamping plate. Press lightly with the left thumb near one circular hole, say the lower left one in figure 14 and lock the clamping plate by inserting the right thumbnail in the other circular hole and turning the clamping plate clockwise. Then hook the escutcheon locating lug into the dial near the finger stop. Insert the screwdriver between finger holes 5 and 6. Finally, press in the screwdriver tip until the clamping plate latches.

### 3.8 Hooklatch (optional)

A hooklatch may be added to the type 90M telephone by ordering one each of the three D-numbered parts shown in figure 15. To install the hooklatch remove the plastic telephone housing. Pass the shouldered D-760774-A screw through the hooklatch and then through the washer, then put the hooklatch tip into the large irregular hole in the hookswitch lever, and tighten the screw into the tapped hole shown in figure 15.

The following wiring changes must be made when installing a hooklatch on the self-

compensating standard or SATT type 90M telephone (figure 28):

- Move the green switch wire from transmission unit terminal 2 to terminal L2 on the terminal strip.
- Move the white switch wire from terminal L2 on the terminal strip to transmission unit terminal 2.
- Move the orange switch wire from terminal 3 on the terminal strip to transmission unit terminal 1.
- Move the black switch wire from terminal L1 on the terminal strip to terminal 3 on the terminal strip.
- Move the violet switch wire from transmission unit terminal 13 to transmission unit terminal 2.
- Move yellow dial wire from transmission

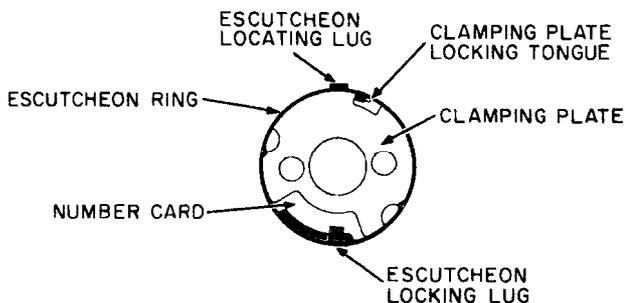


Figure 11. Number card in escutcheon ring.

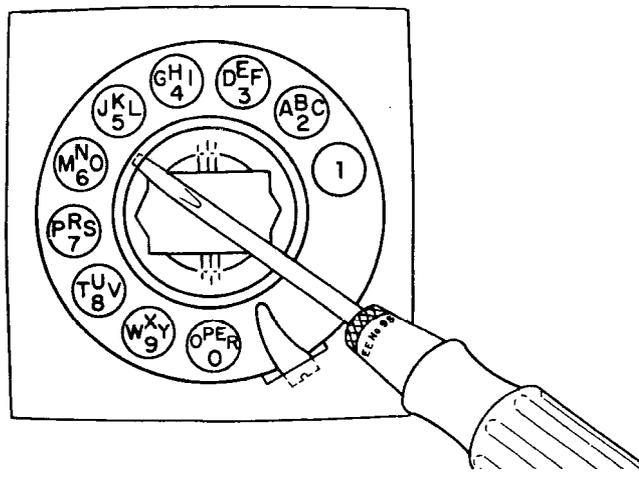


Figure 13. Use of screwdriver on escutcheon ring.

unit terminal 11 to terminal 3 on the terminal strip.

- g. Add a strap from terminal L1 on the terminal strip to transmission unit terminal 11.

The following wiring changes must be made when installing a hooklatch in the type 90M telephone for superimposed ringing (figure 29).

- a. Move the green switch wire from transmission unit terminal 2 to terminal L2 on the terminal strip.
- b. Move the white switch wire from terminal L2 on the terminal strip to transmission unit terminal 2.
- c. Move the orange switch wire from terminal 5 on the terminal strip to transmission unit terminal 1.

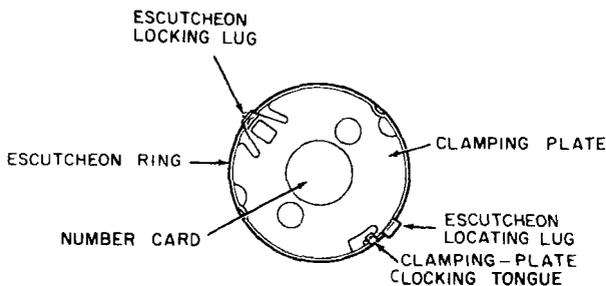


Figure 14. Escutcheon ring with number card.

- d. Move the black switch wire from terminal L1 on the terminal strip to terminal 5 on the terminal strip.
- e. Move the violet switch wire from transmission unit terminal 13 to transmission unit terminal 2.
- f. Move the yellow dial wire from transmission unit terminal 11 to terminal 5 on the terminal strip.
- g. Add a strap from terminal L1 on the terminal strip to transmission unit terminal 11.

Lift the handset off the hook, and be sure the hookswitch springs operate partially (only to connect the receiver). Figure 16 shows the partial operation of the self-compensating type 90M telephone's hookswitch. Then push the hooklatch handle. The hookswitch should operate completely (connecting the dial, and transmitter, etc.). Replace the plastic telephone housing.

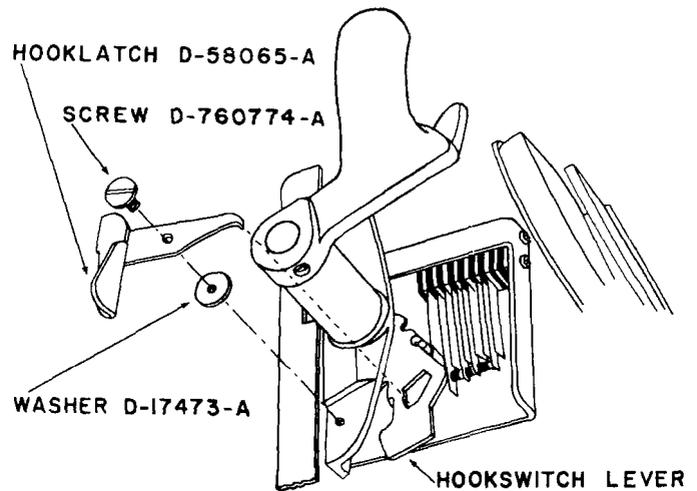


Figure 15. Hooklatch installation.

When a party-line caller wishes to make a call he takes the handset off the hook, connecting the receiver only. He then listens to see if the line is in use. If he hears nothing, he pushes the hooklatch and makes the call. Caution the subscriber that he must push the hooklatch to answer an incoming call also.

#### 4. MAINTENANCE (Self-compensating Type 90M Telephone)

##### 4.1 Housing Removal

To remove the plastic telephone housing, loosen the screw at the bottom of the housing (figure 17). Move the bottom of the housing out and lift it up. Replacement of the housing is accomplished by reversing the procedure.

##### 4.2 Dial Removal and Replacement

The type 90M telephone has a snap-on (bayonet-lug pin-type) dial mounting as shown in figure 17. To inspect the dial assembly, first remove the telephone housing (see 4.1 above). To remove the dial, press down on the dial and mounting plate. At the same time, apply pressure upward until the lugs are disengaged from the pins. Tip the bottom of the dial assembly up to expose the dial wiring and the

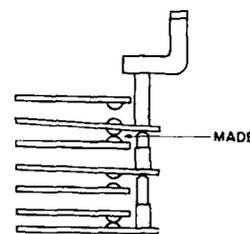


Figure 16. Hookswitch contact-sequence adjustments.

TABLE C

Dial	Order Number For Black Only
1 - 0	D-84908-A
ABC	D-84909-A
SATT A	D-84910-A
SATT B	D-84911-A

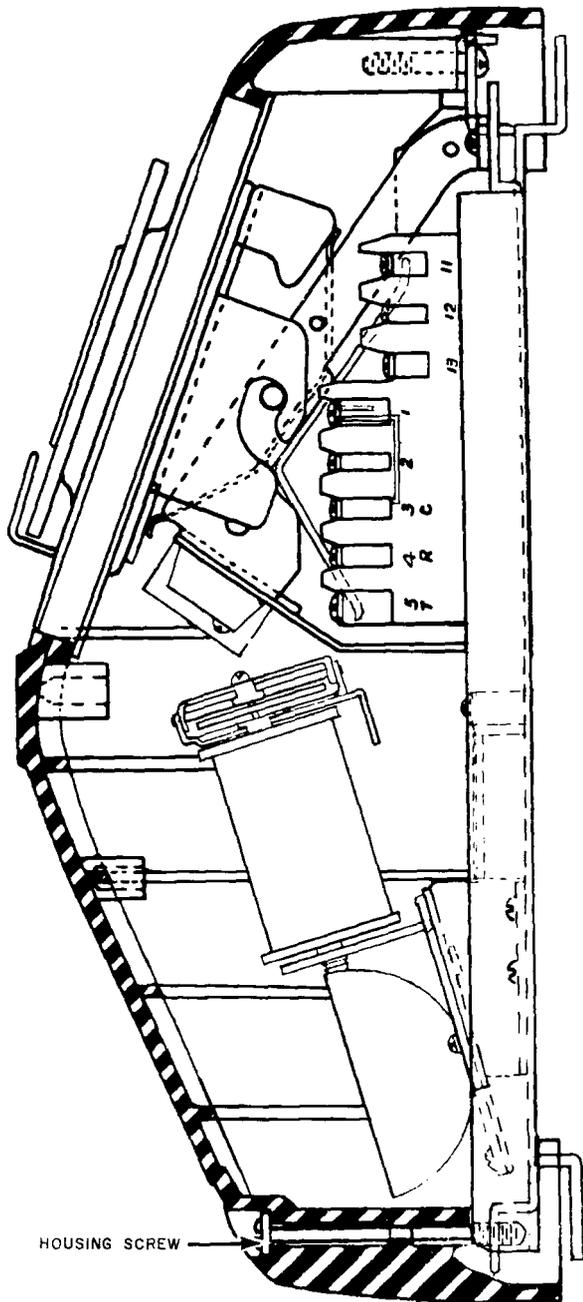


Figure 17. Dial removal.

transparent dust covering over the dial springs. Do not disconnect the dial leads from the transmission unit unless the dial assembly must be replaced. Disconnect the dial leads at the transmission unit. The entire dial assembly is now free and can be lifted from the housing. The four different dial assemblies can be ordered by consulting Table C below.

To replace the dial, press the dial assembly over the pins and slide the assembly downward until it latches. Replace the housing as per section 4.1 above.

#### 4.3 Transmitter and Receiver Capsule Replacement

The self-compensating type 90M telephone uses a type 810 handset only. The piece number for the type 810 transmitter capsule is D-38379-A. The piece number for the type 810 receiver capsule is D-51024-A. Type 810 handset components are shown in figure 18. To replace the transmitter and/or receiver capsule(s), proceed as follows:

- Hold the handset horizontally, with the caps up, so the capsules will not fall out.
- Remove the transmitter cap.
- Remove the transmitter capsule.
- Replace with the new capsule.
- Replace the transmitter cap.
- Remove the receiver cap.

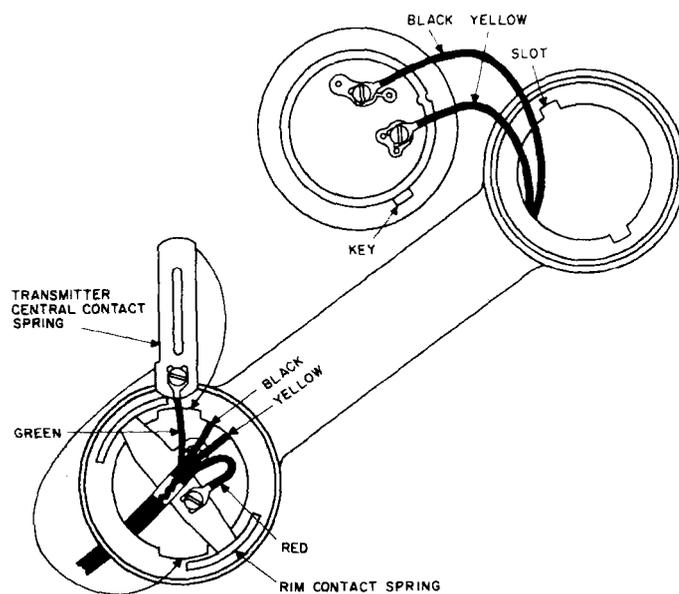
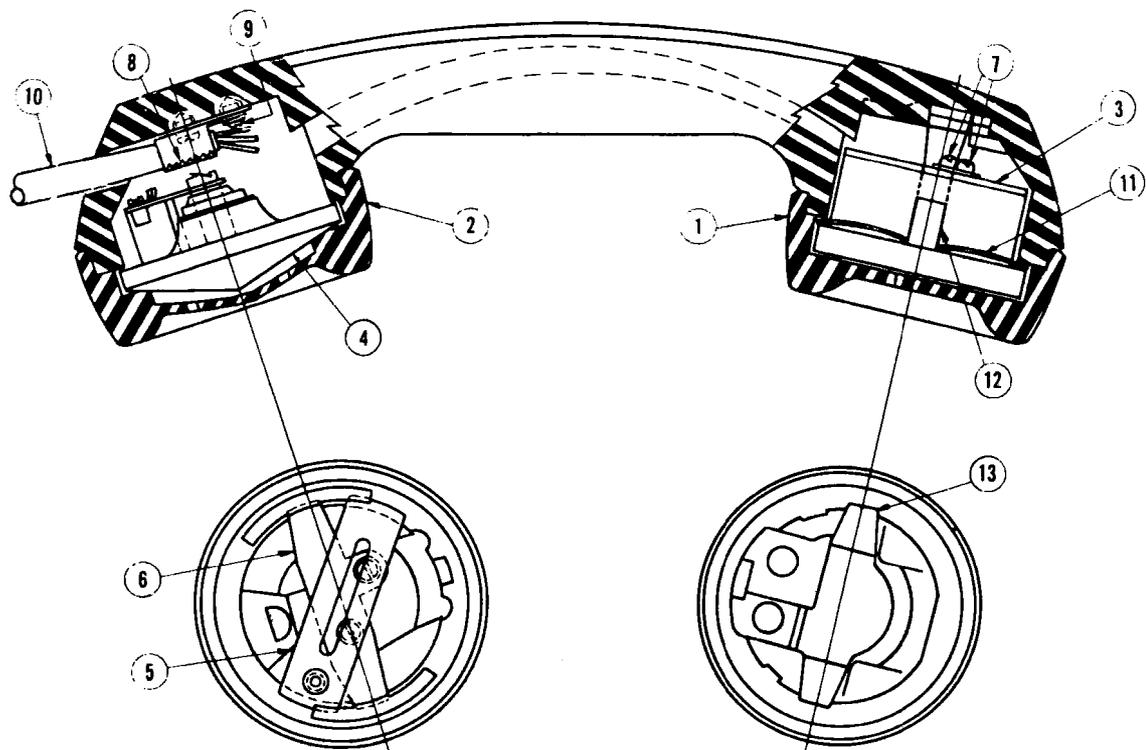


Figure 19. Handset connections and cord replacement (810 handset).



- |                                       |                                |
|---------------------------------------|--------------------------------|
| 1. Receiver cap.                      | 8. Strain relief clamp.        |
| 2. Transmitter cap.                   | 9. Strain relief clamp screw.  |
| 3. Receiving capsule.                 | 10. Handset cord.              |
| 4. Transmitting capsule.              | 11. Receiver float spring.     |
| 5. Transmitter center contact spring. | 12. Receiver capsule key.      |
| 6. Transmitter rim contact spring.    | 13. Receiver capsule key slot. |
| 7. Receiver terminal screws.          |                                |

Figure 18. Type 810 handset components.

- g. Lift the receiver capsule.
- h. Disconnect the wires from the back of the receiver capsule.
- i. Connect the wires to the new receiver capsule terminals as shown in figure 19.
- j. Insert the receiver capsule and the receiver float spring so that its key is in one of the spring slots.
- k. Replace the receiver cap.
- l. Make a test call.

#### 4.4 Handset Cord Replacement

To replace the handset cord proceed as follows:

- a. Loosen the housing screw and lift off the plastic telephone housing and disconnect the green and black wires from transmission unit terminal RT3 (shown on figure 28). Disconnect the red wire from transmission unit terminal T5. Disconnect the yellow wire from transmission unit terminal R4. Then at the bottom of the telephone baseplate, loosen the cord clamp screw, remove the clamp, and pull out the old cord.
- b. Insert the new cord through the cord clamp and under the ringer brackets. Connect the green and black wires to transmission unit terminal RT3. Connect the red wire to transmission unit terminal T5. Connect the yellow wire to transmission unit terminal R4.
- c. Without putting tension on the connections to the transmission unit, pull out the slack in the cord. Then replace the cord clamp and screw, and tighten the screw.
- d. Follow instructions for removing the handset capsules as described in section 4.3.
- e. Remove the transmitter center contact spring by lifting it out. When it is free, turn the center contact spring with the studs down and loosen the screw to remove the green wire (figure 19). Loosen the screw on the rim contact spring and remove the red wire. Loosen the strain relief clamp screw and free the clamp from the handset housing. Remove the black and yellow wires from the receiver capsule terminals and pull out the old cord.

Replace old cord with new:

- a. Insert the leads of the new cord through the cord entrance hole in the transmitter

end of the handset and through the hollow hand grip until the black and yellow leads appear in the receiver well. Connect the black and the yellow leads to the receiver capsule as shown in figure 19 and tighten the receiver capsule terminal screws. Replace the receiver capsule and the receiver float spring in the receiver well and screw on the receiver cap.

- b. Fasten the strain relief clamp to the rim contact spring at the bottom of the transmitter well. Connect the red wire to the rim contact spring and tighten the terminal screw. Connect the green wire to the center contact spring, tighten the terminal screw, and replace the spring in the transmitter well with the stud ends up.
- c. Replace the transmitter capsule and screw on the transmitter cap.
- d. Replace the telephone housing and make a test call.

#### 4.5 Transmission Unit

The transmission unit schematic (figure 20) is for information for continuity tests, ohmmeter measurements, etc. During manufacture, the transmission unit is sealed; do not attempt repairs in the field. If it becomes damaged; replace it.

#### 5. INSTALLATION (Type 90M Telephone with Loop Compensator)

The following sections apply to the installation of the type 90M telephone equipped with a loop compensator (circuit D-530253-A). For information on mounting, line polarity, ringer frequency change, and number card, refer to sections 3.1, 3.2, 3.6, and 3.7, respectively.

##### 5.1 Standard Type 90M Telephone

The following instructions apply to a type 90M telephone with straight-line or a harmonic ringer (figure 30), but without party-identity

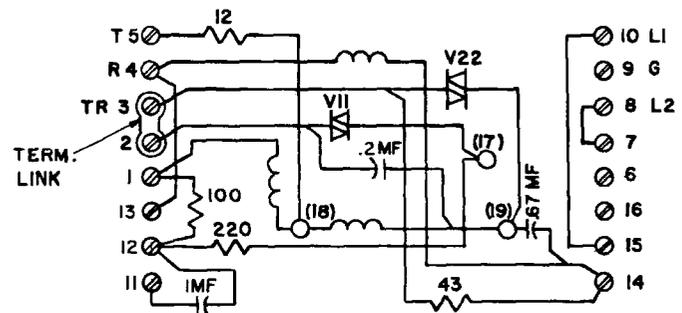


Figure 20. Transmission unit schematic D-38385.

(SATT) dial and without the cold-cathode tube for superimposed ringing.

Mount the telephone as described in section 3.1.1 or 3.1.2.

**Bridged ringing.** For bridged ringing, connect both the loop-compensator blue lead and the ringer red lead to terminal strip position L2 as shown in figure 30. Connect the line wires as shown in figure 5.

**Divided ringing on the + (tip) line.** For divided ringing on the + (tip) line, move the red ringer lead from terminal strip position L2 to 4 as shown in figure 30. Connect the line wires as shown in figure 6.

**Divided ringing on the - (ring) line.** For divided ringing on the - (ring) line, move the red ringer lead from terminal strip position L2 to 4 as shown in figure 30. Connect the line wires as shown in figure 7.

Loop-compensator settings for a normal line in a 48- or 50-volt exchange are as follows:

- a. If conductor-loop resistance is 200 ohms or less, set the loop compensator at 2.
- b. If conductor-loop resistance is over 200 ohms, set the loop compensator at 0. Conditions which require a special loop compensator setting are described in sections 5.7.3 and 5.7.4.

To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw (figure 17). Then call the central office for a ringing test etc. Sections 3.7.1 and 3.7.2 supply instructions for stamping the directory number on the number card.

## 5.2 Type 90M-W and Type 90M-Y

This telephone (circuit D-530257-A) differs from A. E. Co.'s standard type 90M only in that the ringer is connected to the line during conversation, requiring an additional capacitor. The dial pulse-spring spark-killer 1.0 mf capacitor mounts in the transmission unit (figure 27a). The type 90M-W is equipped with a dial; the type 90M-Y is not. Mount the telephone as described in section 3.1.1 or 3.1.2.

**Divided ringing on the + (tip) line.** For divided ringing on the + (tip) line, leave red ringer lead at terminal strip position 4 as shown in figure 31. Connect line wires as shown in figure 6.

**Divided ringing on the - (ring) line.** For divided ringing on the - (ring) line, leave the

red ringer lead at terminal strip position 4 as shown in figure 31. Connect the line wires as shown in figure 7.

**Bridged ringing.** For bridged ringing connect both the loop-compensator blue lead and red ringer lead to terminal strip position L2. Connect the line wires as shown in figure 5.

Loop-compensator settings for a normal line in a 48- or 50-volt exchange are as follows:

- a. If conductor-loop resistance is 200 ohms or less, set the loop compensator at 2.
- b. If conductor-loop resistance is over 200 ohms, set the loop compensator at 0.

Conditions which require a special loop-compensator setting are described in sections 5.7.3 and 5.7.4.

To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw located about 5'' below the dial. Sections 3.7.1 and 3.7.2 supply instructions for stamping the directory number on the number card. Call the central office for a ringing test.

## 5.3 Non-SATT or SATT System A

This telephone (circuit D-530258-A) has a dial pulse-spring spark suppressor 1.0 mf capacitor mounted in the transmission unit as shown in figure 27a.

Mount the telephone as described in section 3.1.1 or 3.1.2.

**Bridged ringing (Non-SATT).** This telephone is shipped from the factory wired for bridged ringing as shown in figure 32. Connect the line wires as shown in figure 5. Both the ringer red and loop-compensator blue leads should be connected to terminal strip position L2 as shown in figure 32.

**Bridged ringing (SATT system A).** This telephone is shipped wired for bridged ringing as shown in figure 32. Both the red ringer lead and the blue loop-compensator lead should be connected to terminal strip position L2. Connect the line wires as shown in figure 7.

**Divided ringing on the + (tip) line.** For divided ringing on the + (tip) line, move the white lead from terminal strip position L1 to 4. Connect the line wires as shown in figure 7.

**Divided ringing on the - (ring) line.** For divided ringing on the - (ring) line move the red ringer

lead from terminal strip position L2 to 4. Connect the line wires as shown in figure 7.

If this installation uses a SATT dial, check that the party-identity pulse will be on the + line. At the terminal strip, attach to terminals L1 and L2 the clips of a hand-test telephone (such as A. E. Co. L-965-A2). Press test-telephone button C, and with the subscriber's handset on the hook, dial 5 on the subscriber's dial. As the dial returns, listen at the test telephone. If no click is heard, the telephone is connected correctly; if a click is heard, reverse the interior wires at telephone terminals L1 and L2.

Loop-compensator settings for a normal line in a 48- or 50-volt exchange are as follows:

- a. If conductor-loop resistance is 200 ohms or less, set the loop compensator at 2.
- b. If conductor-loop resistance is over 200 ohms, set the loop compensator at 0.

Conditions which require a special loop-compensator setting are described in sections 5.7.3 and 5.7.4.

To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw. Then call the central office for a ringing test, etc. Sections 3.7.1 and 3.7.2 supply instructions for stamping the directory number on the number card.

#### 5.4 Spotter Dial for SATT System A

This telephone (circuit D-530255-A) uses the ringer capacitor for dial pulse spark suppression (figure 34). Mount the telephone as described in section 3.1.1 or 3.1.2.

Connect the line wires as shown in figure 7. (In some cases the first party on a line will be equipped with a standard telephone; connect it as an individual line as described in section 5.1.)

Check that the party-identity pulse will be on the + line. At the terminal strip, attach the clips of a hand-test telephone (such as A.E.Co.

L-965-A2) to terminals L1 and L2. Press the test-telephone button C, and with the subscriber's handset on the hook, dial 0 on the subscriber's dial. As the dial returns, listen at the test telephone. If no click is heard, the subscriber's telephone is connected correctly; if one or more clicks are heard, reverse the interior wires at telephone terminals L1 and L2 (figure 7) or reverse the drop wires at the protector (figure 4).

Loop-compensator settings for a normal line in a 48- or 50-volt exchange are as follows:

- a. If conductor-loop resistance is 200 ohms or less, set the loop compensator at 2.
- b. If conductor-loop resistance is over 200 ohms, set the loop compensator at 0.

Conditions which require a special loop compensator setting are described in sections 5.7.3 and 5.7.4.

To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw (figure 17). Then call the central office for a ringing test, etc. Sections 3.7.1 and 3.7.2 supply instructions for stamping the directory number on the number card.

#### 5.5 Party-line Station for SATT System B

This telephone (figure 34 - circuit D-530256-A) has a 1.0 mf capacitor, for the dial pulse-spring spark killer, mounted in the transmission unit (figure 27a).

Mount the telephone as described in section 3.1.1 or 3.1.2.

If the telephone is not already wired for the proper party-station, at the telephone terminal strip, reconnect the red ringer lead and/or the white capacitor lead as in Table D.

Connect the line wires as shown in figure 7.

Check that the party-identity pulse will be on the + line. At the terminal strip, attach the clips of a hand-test telephone (such as A.E.Co.

TABLE D

	Red Ringer Lead	White Capacitor Lead
For bridged ringing	L2	L1
For party on the + (tip) line	4	L2
For party on the - (ring) line	4	L1

TABLE E

Station	Terminal Strip Terminals				
	Ringer Leads		Tube Leads		
	Green	Red	Yellow	Black	Red
No. 1 or No. 5 - station on the - (ring) line	L1	3	3	4	4
No. 2 or No. 6 - station on the + (tip) line	L2	3	3	4	4
No. 3 or No. 7 + station on the - (ring) line	3	L1	4	3	3
No. 4 or No. 8 + station on the + (tip) line	3	L2	4	3	3

L-965-A2) to L1 and L2. Press the test-telephone button C, and, with the subscriber's handset on the hook, dial 0 on the subscriber's dial. As the dial returns, listen at the test telephone. If no click is heard, the subscriber's telephone is connected correctly; if a click is heard, reverse the interior wires at telephone terminals L1 and L2 (figure 7) or reverse drop wires at the protector (figure 4).

Loop-compensator settings for a normal line in a 48- or 50-volt exchange are as follows:

- a. If conductor-loop resistance is 200 ohms or less, set the loop compensator at 2.
- b. If conductor-loop resistance is over 200 ohms, set the loop compensator at 0.

Conditions which require a special loop-compensator setting are described in sections 5.7.3 and 5.7.4.

To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw (figure 17). Then call the central office for a ringing test, etc. Sections 3.7.1 and 3.7.2 supply instructions for stamping the directory number on the number card.

#### 5.6 Superimposed Ringing

The superimposed ringing circuit (figure 35) differs from standard type 90M in that it has a cold-cathode tube in place of ringer capacitor.

Mount the telephone as described in section 3.1.1 or 3.1.2.

If the telephone is not already wired for the proper party-station, reconnect red and green ringer leads, and cold cathode tube yellow, black, and red leads as in Table E.

Connect the line wires as shown in figure 7.

Loop-compensator settings for a normal line in a 48- or 50-volt exchange are as follows:

- a. If conductor-loop resistance is 200 ohms or less, set the loop compensator at 2.
- b. If conductor-loop resistance is over 200 ohms, set the loop compensator at 0.

Conditions which require a special loop-compensator setting are described in sections 5.7.3 and 5.7.4. To replace the plastic housing, hook it over the top edge of the telephone baseplate and tighten the housing screw. Then call the central office for a ringing test, etc. Sections 3.7.1 and 3.7.2 supply instructions for stamping the directory number on the number card.

#### 5.7 Loop Compensator

The following paragraphs provide loop-compensator information applying to the type 90M telephones described in sections 5.1 through 5.6 which are equipped with a manually-adjusted loop compensator.

The information in the following paragraphs does not apply to the type 90M telephones described in sections 3.3, 3.4, and 3.5, as they are equipped with varistors to make the circuit self compensating and minimize sidetone.

### 5.7.1 Description and purpose of the loop compensator.

Automatic Electric Company defines "conductor-loop resistance" as the total of the resistances of the line conductors, the heat coils, and the central office cabling. Thus, we do not count the resistance of the telephone instrument or of central office relays.

When the telephone housing has been removed (figure 21), the "loop compensator" will be found attached to the baseplate of the telephone. The "loop compensator" is a combined rheostat and switch. It can be set with the tip of a small screwdriver. As the arrow is turned counterclockwise from 0 to 4, the rheostat inserts 0 ohms to 400 ohms in series with the loop. When the rheostat is at 0 (as it should be for long cable loops), the switch element adds a capacitor and a resistor into the sidetone-balancing impedance to match more nearly the capacitive impedance of a long cable loop.

Thus, the loop compensator minimizes sidetone as follows:

- a. On a short loop, by limiting transmitter current.
- b. On a long loop, by improving the balance between the sidetone-balancing impedance and the impedance characteristics of the line.

Loop compensation lessens the current diverted by a party-line subscriber near the

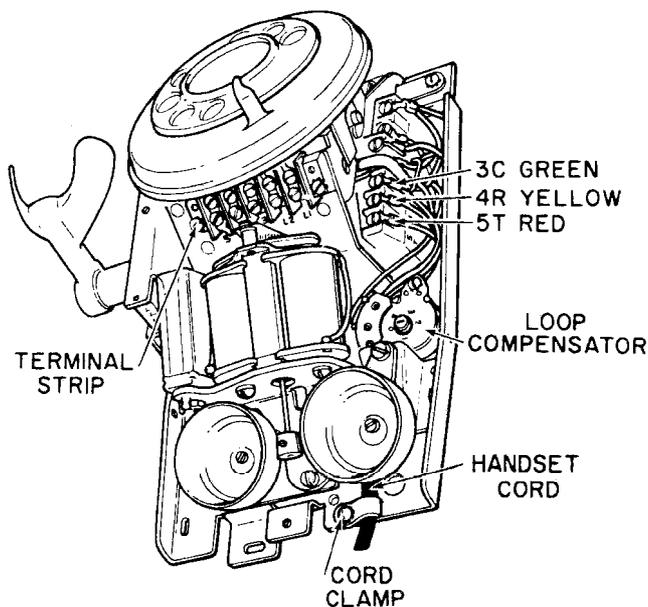


Figure 21. Type 90M telephone with housing removed.

central office listening in on the conversation of another subscriber on the same line more distant from the central office.

On a reverting call, loop compensation tends to equalize the currents available to the two conversing parties.

### 5.7.2 Adjustment.

The type 90M telephones listed in section 5.7 (with loop compensators) operate satisfactorily with the loop compensator adjusted according to the instructions in section 5.7.3, except in marginal or unusual locations. For such locations, adjust the loop compensator accurately (section 5.7.4).

### 5.7.3 Adjustment instructions.

- a. Usual lines in a 48- or 50-volt exchange: If conductor loop-resistance is 200 ohms or less, set the loop compensator at 2. If conductor-loop resistance is over 200 ohms, set the loop compensator at 0.

#### EXCEPTIONS:

Open-wire line: If the station is connected directly to an open-wire section of over 200 ohms resistance, set the loop compensator midway between 0 and 1. (Because the open-wire line or open-wire line section, or the loaded cable, has less effective capacitance than has unloaded cable, the aim here is merely not to close the switch mentioned in section 5.7.1.)

Near loading coil: If the station is on a loaded-subscriber loop and is less than one loading section (for type H loading, less than 6000 feet) from the nearest loading coil, set the loop compensator midway between 0 and 1. (Because the open-wire line or open-wire line section, or the loaded cable, has less effective capacitance than has unloaded cable, the aim here is merely not to close the switch mentioned in section 5.7.1.)

- b. Party-line or extension telephone. If two or more Automatic Electric Company telephones with loop compensators (type 80, 88, 90M, etc.) are used on one line (e.g., party-line or extension telephone), set the loop compensator of each as if it were the only telephone on the line.

If the type 90M telephone is used on the same line with an entirely different make or model of telephone, set the type 90M telephone loop compensator at 0 (or midway between 0 and 1 if one of the section 5.7.3a "exceptions" applies).

- c. 48-volt P-A-B-X, P-B-X, etc. In a key system or P-B-X or P-A-B-X, a type 90M telephone may receive its transmitter current from either of two different 48- or 50-volt sources.

The general idea is to adjust the loop compensator for the transmitter current received on a trunk (outside) call.

If station-loop plus trunk resistance equals 200 ohms or less, set the loop compensator at 2. (Exception: If the P-B-X switchboard uses non-relay series-lamp line circuits, set the loop compensator at 0.)

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

If long-line equipment or a pulse repeater at the P-B-X or P-A-B-X supplies transmitter current on trunk calls, set the loop compensator at 2. (Exception: If the P-B-X switchboard uses non-relay series-lamp circuits, set the loop compensator at 0.)

- d. 24-volt switchboard. If the central office or P-B-X switchboard operates from 24 volts, and has 100 ohms plus 100-ohm battery-feed coils, or uses non-relay series-lamp line circuits, set the loop compensator at 0; otherwise use one of the methods described in section 5.7.4.

#### 5.7.4 Accurate adjustment.

- a. Uses. Although the rules of section 5.7.3 are adequate for most installation, occasionally it becomes desirable that current through the line and the transmitter be adjusted accurately to 60 milliamperes.

Examples are: where there has been a transmission complaint; or where the subscriber does not hear well over the telephone, and this seems to be due to the noise in his room. (The sidetone from extreme room noise can be reduced further by setting the loop compensator to limit the line current to 55 or even 50 milliamperes.)

Use one of the methods stated in the following paragraphs:

- b. Adjustments without assistance from the central office. With the telephone housing removed, transfer the line-wire from terminal strip terminal L1 to a post on a milliammeter, then connect the other milliammeter post to terminal L1 (figure 22). Remove the handset from the hook, and

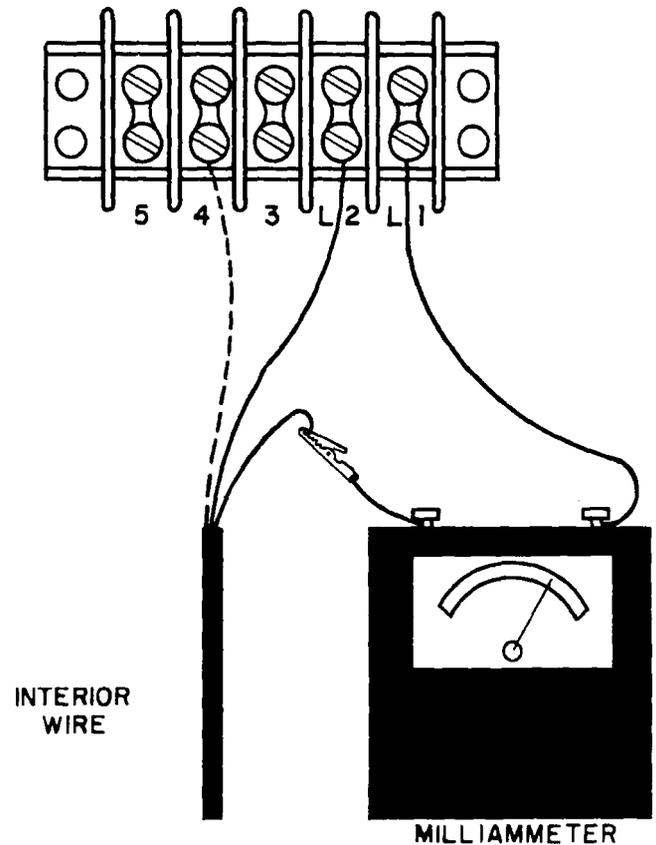


Figure 22. Line-current measurement at subscriber's premises.

vary the loop compensator until the milliammeter reads 60 milliamperes.

Disconnect the milliammeter, reconnect the line wire to terminal strip terminal L1, put on the housing, and test the transmission.

- c. Adjustments through a testboard equipped for line current measurement through usual 200 ohms plus 200-ohm battery feed. Upon completing the installation, dial the testboard. Request line current measurements. The testboard attendant will give you the readings. Vary the loop compensator until the current is 60 milliamperes.
- d. Adjustments through a testboard equipped for line resistance measurement. Upon completing the installation, dial the testboard. Request line resistance measurements. Short-circuit the line a few moments while the testboard attendant measures loop resistance. Set the loop compensator as shown on the chart (figure 23).
- e. Adjustment through a testboard equipped for line voltage measurement. Upon completing the installation, dial the testboard. Request

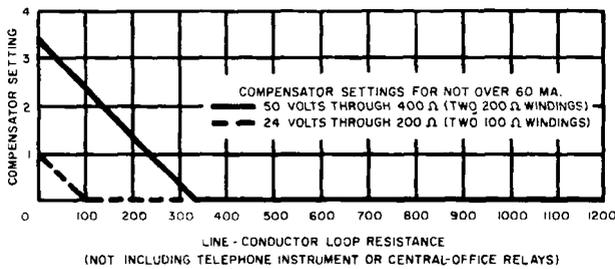


Figure 23. Line-conductor loop resistance chart.

line voltage measurement, and stay on the line. Through a test distributor or through a distributing frame test shoe, the testboard will be connected to the calling line, and a voltmeter will be connected across the line.

Battery fed through two 200-ohm windings (usual in 48- or 50-volt exchange): Vary the loop compensator until the testboard voltmeter reads 24 volts less than the central office battery voltage. (That is, when 60 milliamperes flow in the line, there will be 24 volts "drop" in the usual 200 ohms plus 200-ohm battery feed to the calling line.)

Battery fed through two 100-ohm windings (used in many 24-volt exchanges): Vary the loop compensator until the testboard voltmeter reads 12 volts less than the central office battery voltage.

## 5.8 Hooklatch

A hooklatch may be added to the type 90M telephone equipped with a loop compensator

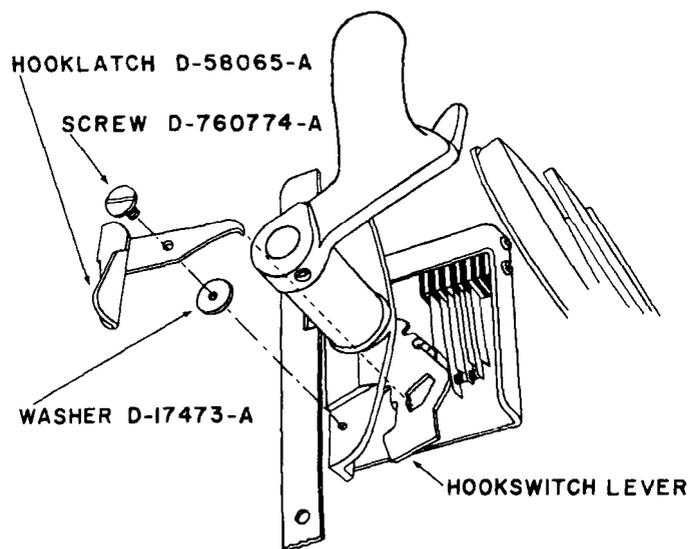


Figure 24. Hooklatch installation (loop compensating).

by ordering one each of the three D-numbered parts shown in figure 24. Follow the steps below to install the hooklatch:

- Remove the plastic telephone housing. Pass the shouldered D-760774-A screw through the hooklatch and then through the washer, then put the hooklatch tip into the large irregular hole in the hookswitch lever, and tighten the screw into the tapped hole shown in figure 24. No wiring changes are required.
- Lift the handset off the hook, and be sure the hookswitch springs operate partially only (connecting the receiver). Figure 25 shows the partial operation of the hookswitch springs. Push the hooklatch handle, the hookswitch should operate completely (connecting the dial, and transmitter, etc.). Replace the plastic telephone housing.
- When a party line caller wishes to make a call he lifts the handset causing the hook-

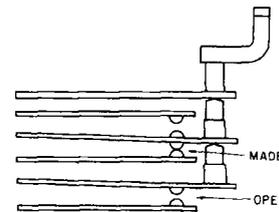


Figure 25. Hookswitch adjustment (loop compensator type).

switch to establish a connection to the receiver only. He then listens to see if the line is in use. If the line is idle, he pushes the hooklatch and makes the call. Caution the subscriber that he must push the hooklatch to answer an incoming call also.

## 6. MAINTENANCE (Type 90M with Loop Compensator)

For information on housing removal and dial removal and replacement, refer to sections 4.1 and 4.2.

### 6.1 Transmitter and Receiver Capsule Replacement

The type 90M telephone equipped with a loop compensator uses a type 81 handset only. The part number for the type 81 transmitter capsule is D-38363-A. The part number for the type 81 receiver capsule is D-51031-A. To replace the transmitter and/or receiver capsule(s), simply remove the transmitter and receiver caps, being careful to hold the handset

horizontally with the caps up, so the capsules do not fall out. Then remove the capsules and replace them with the new capsules. Transmitter and receiver capsules are designed so that they fit only in their respective housings. The capsules cannot be repaired at the subscriber's premises because it is impossible to open them without damaging them. If difficulty is experienced with a capsule, remove it, and insert a new one. The defective capsules may be repaired at the factory.

### 6.2 Handset Cord Replacement

To replace handset cord follow steps below:

- a. Loosen the housing screw and lift off the plastic telephone housing.
- b. Disconnect the red wire from transmission unit terminal 5T, the yellow wire from transmission unit terminal 4R, and the green wire from transmission unit terminal 3C.
- c. At the bottom of the telephone baseplate, loosen the cord clamp screw, remove the clamp, and pull out the old cord.
- d. Insert the new cord through the cord clamp and under the ringer brackets.
- e. Connect the red wire to transmission unit terminal 5T, the yellow wire to terminal 4R, and the green wire to terminal 3C.
- f. Without putting tension on the connections to the transmission unit, pull out the slack in the cord. Then replace the cord clamp and screw, and tighten the screw.
- g. Follow the instructions for removing the handset capsules as described in section 6.1. Remove the transmitter and receiver center contact springs (figure 26). Then loosen the screws and disconnect the leads from the center contact springs. Loosen the screws and disconnect the leads to the rim contact springs at the receiver and transmitter. Then pull out the old cord.

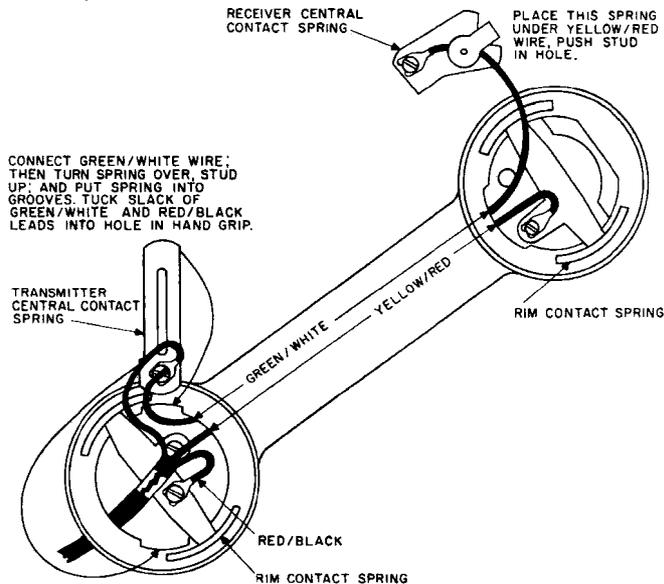


Figure 26. Type 81 handset cord replacement.

Replace old cord with new:

- a. Insert the leads of the new cord through the cord entrance hole in the transmitter end of the handset and through the hollow hand grip until the yellow and green leads appear in the receiver well.
- b. Connect the yellow lead to the receiver rim contact spring and the green lead to the receiver center contact spring as shown in figure 26.
- c. Return the receiver center contact spring to its proper location, replace the receiver capsule, and screw on the receiver cap.
- d. Fasten the strain relief clamp to the rim contact spring at the bottom of the transmitter well.
- e. Connect the red wire to the rim contact spring and tighten the terminal screw. Connect the green wire to the center contact spring, tighten the terminal screw and

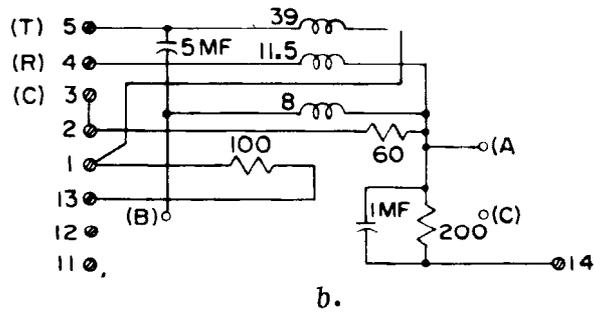
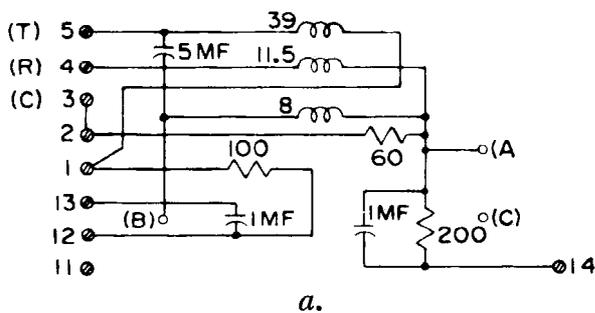


Figure 27a and 27b. Transmission unit schematic (loop compensator).

replace the spring into the grooves of the transmitter well with the stud ends up (figure 26).

- f. Then put the transmitter capsule back in and screw on the transmitter cap.
- g. Replace the plastic telephone housing and make a test call.

### 6.3 Transmission Unit

The transmission unit schematic (figures 27a and 27b) is for information for continuity tests, ohmmeter measurements, etc. During manufacture, the transmission unit is sealed; do not attempt repairs in the field. If it becomes damaged; replace it.

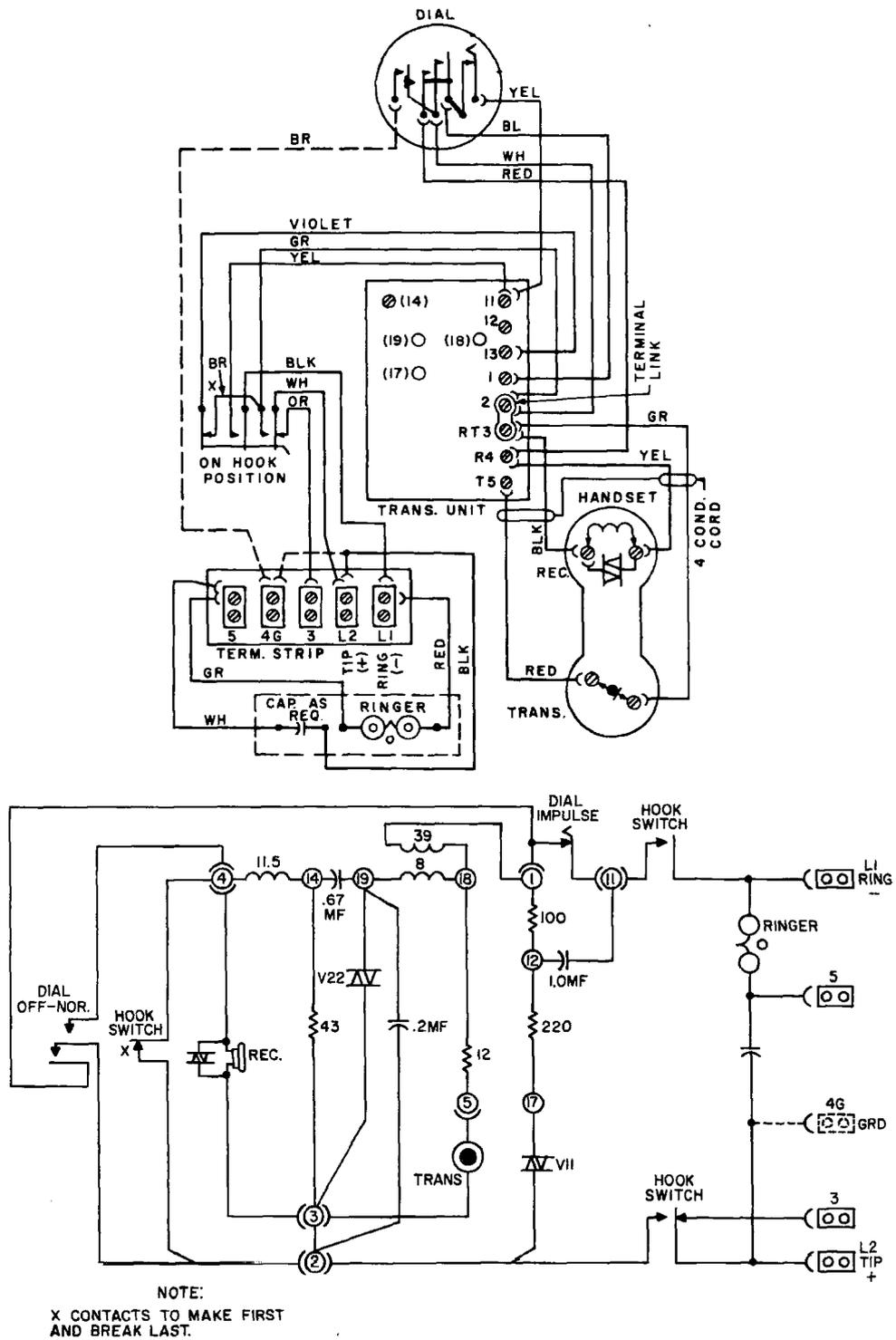


Figure 28. Standard and SATT type 90M telephone schematic and wiring diagram (self-compensating).



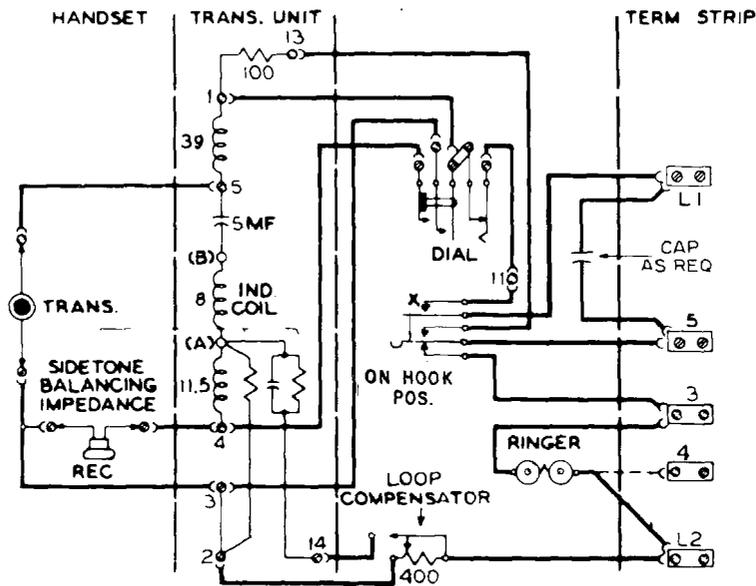
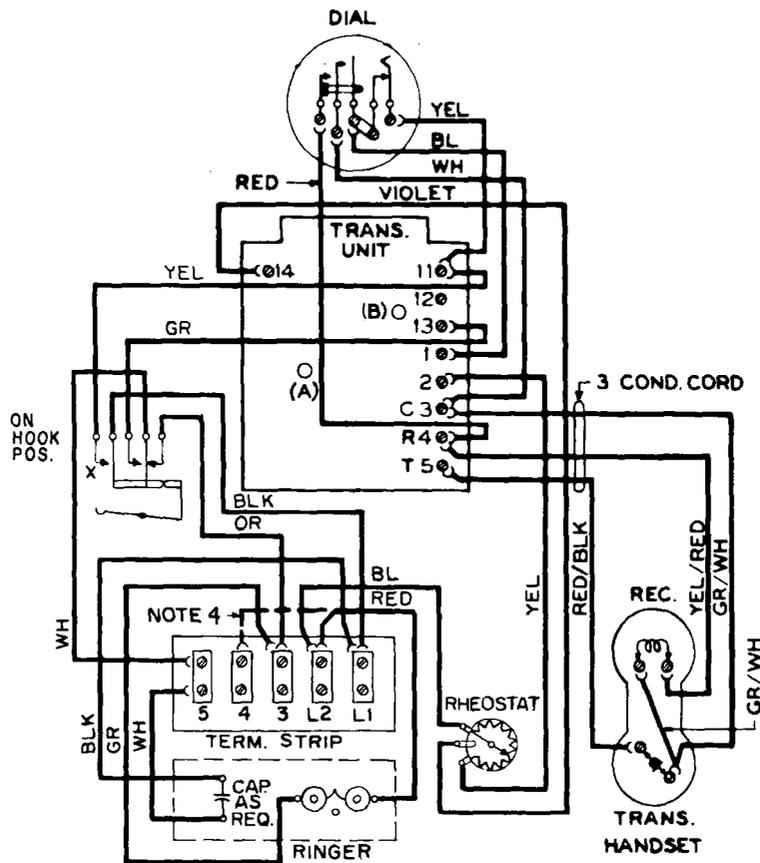


Figure 30. Standard type 90M (manually-adjusted) schematic and wiring diagram.

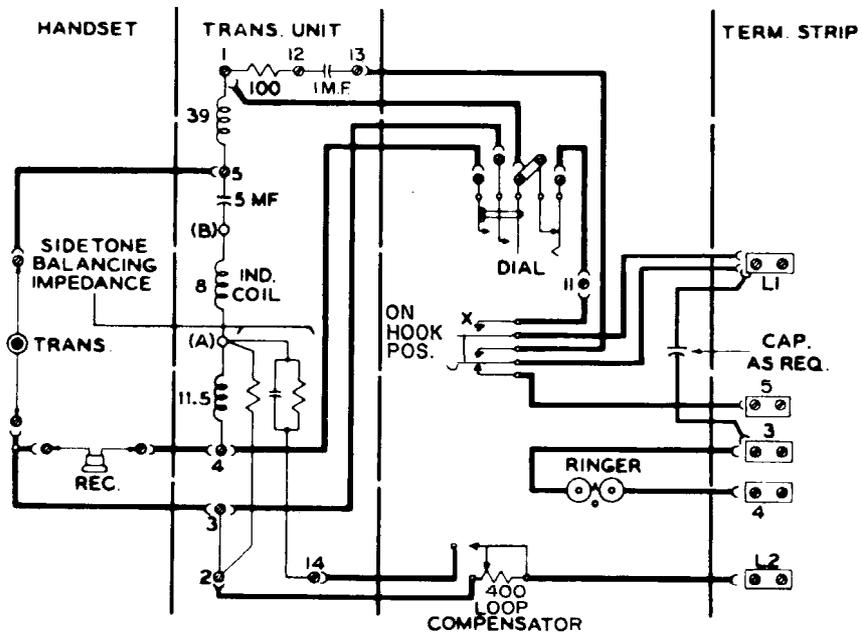
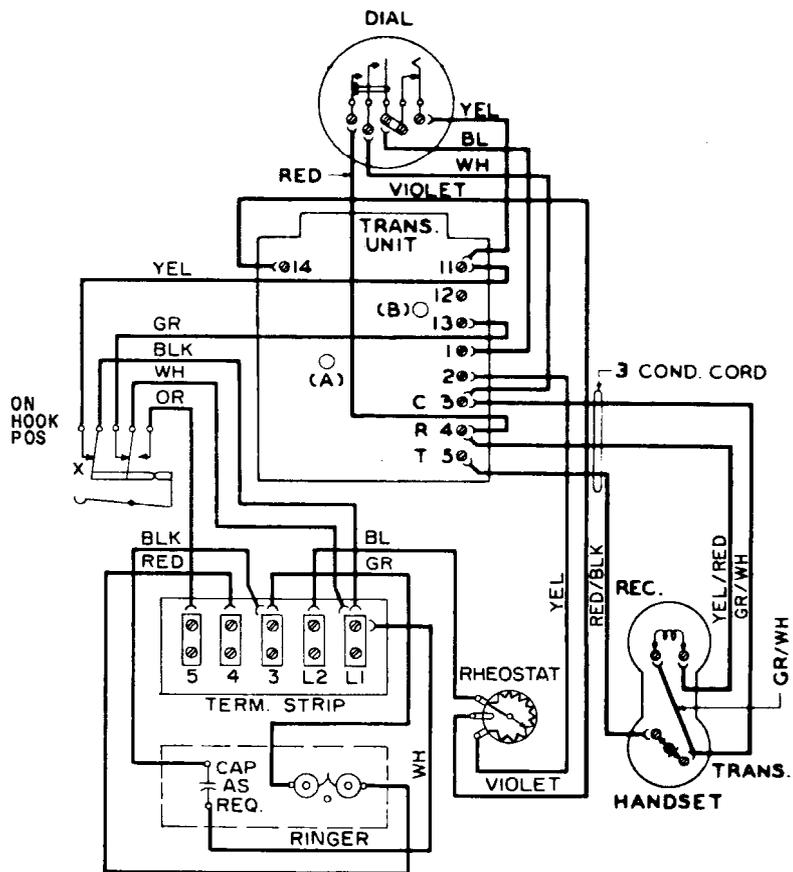


Figure 31. 90M-W and 90M-Y schematic and wiring diagram (manually-adjusted).

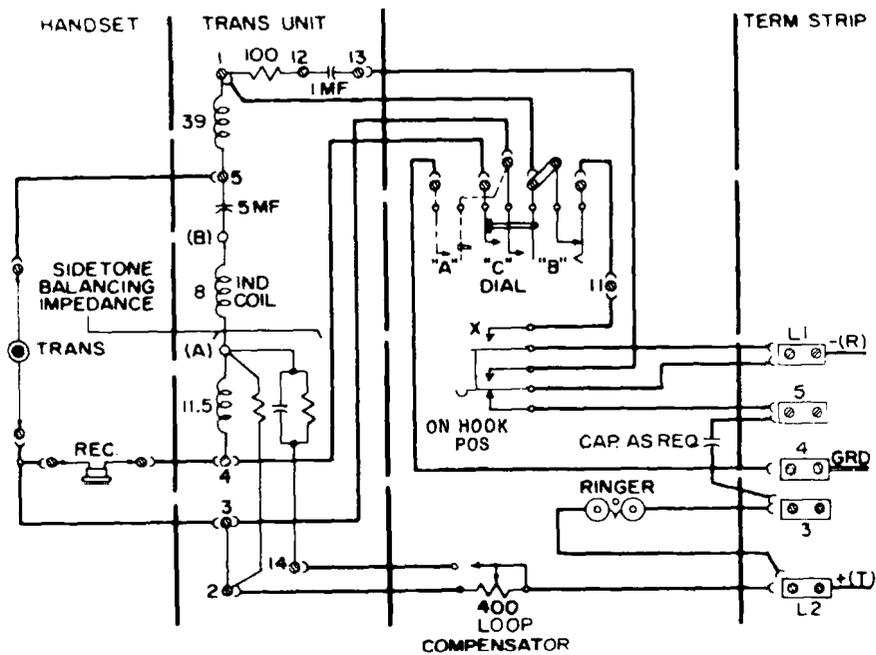
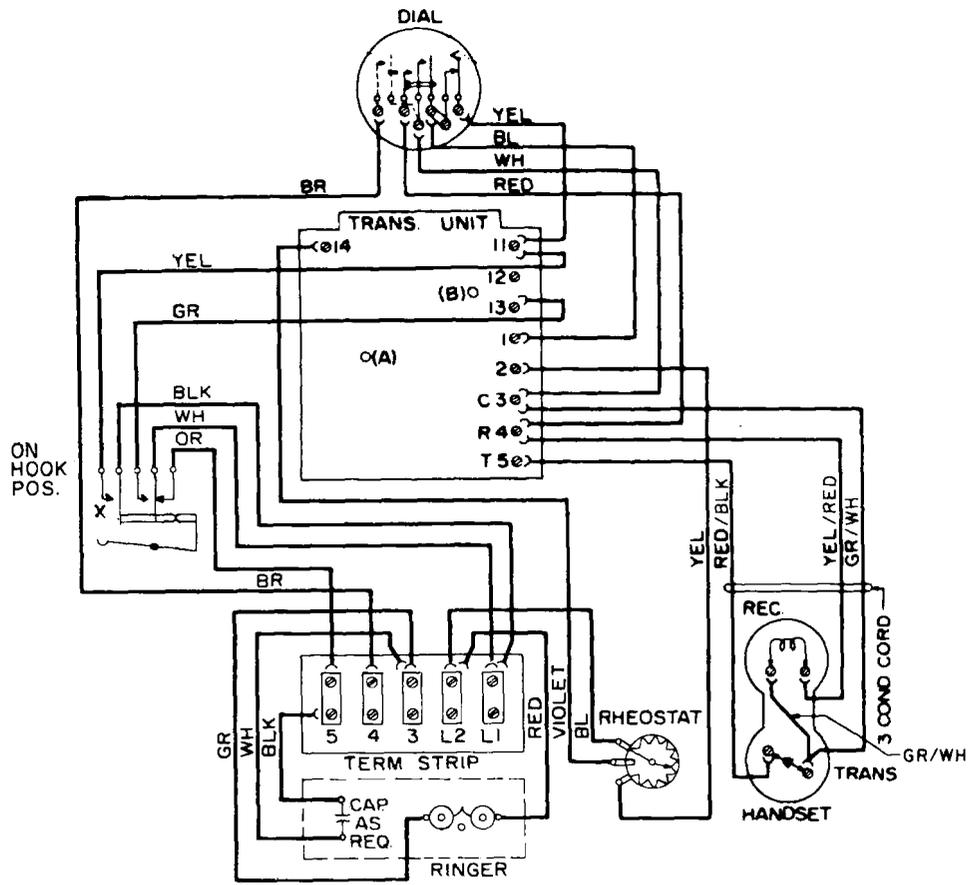


Figure 32. Non-SATT or SATT system A wiring diagram and schematic (manually-adjusted).

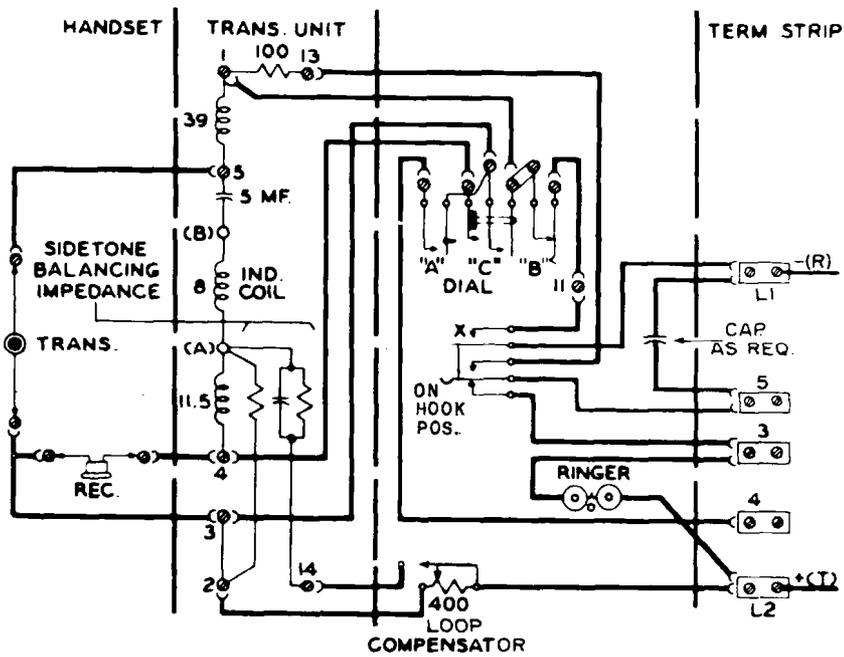
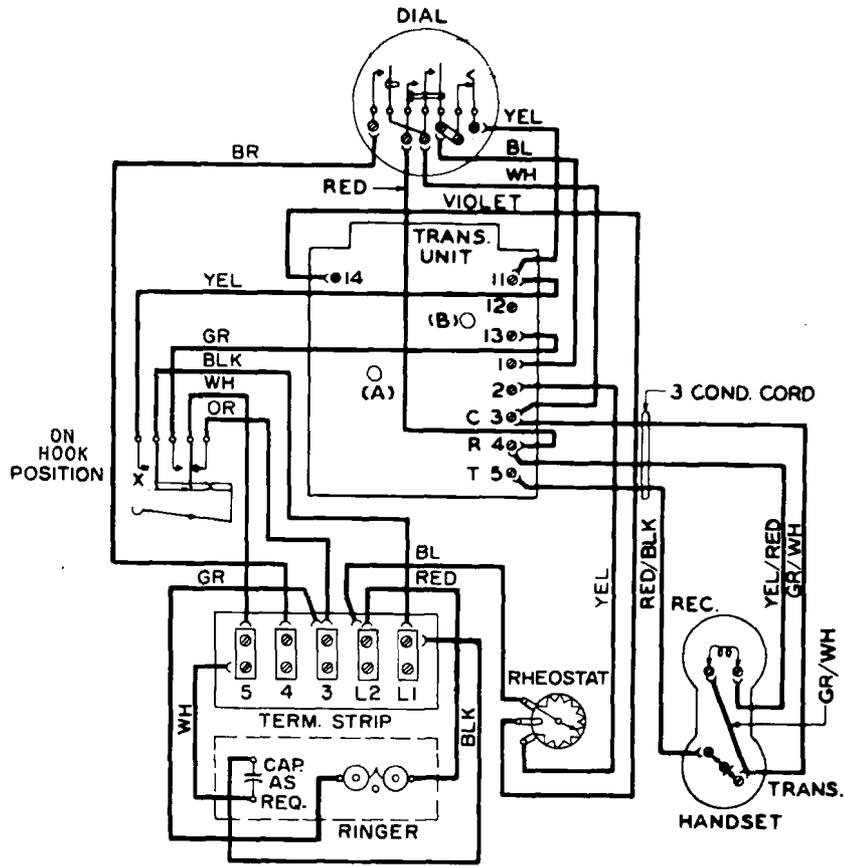


Figure 33. Spotter dial SATT system A wiring diagram and schematic (manually-adjusted).



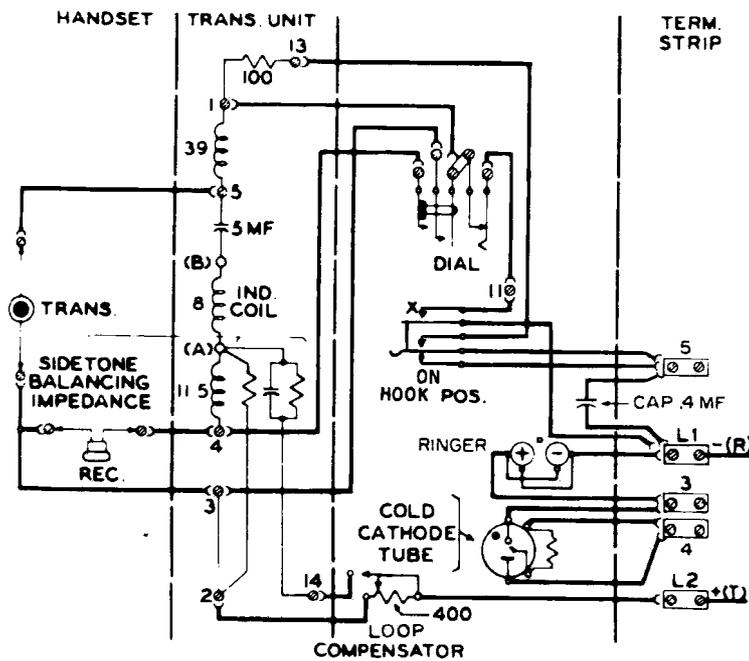
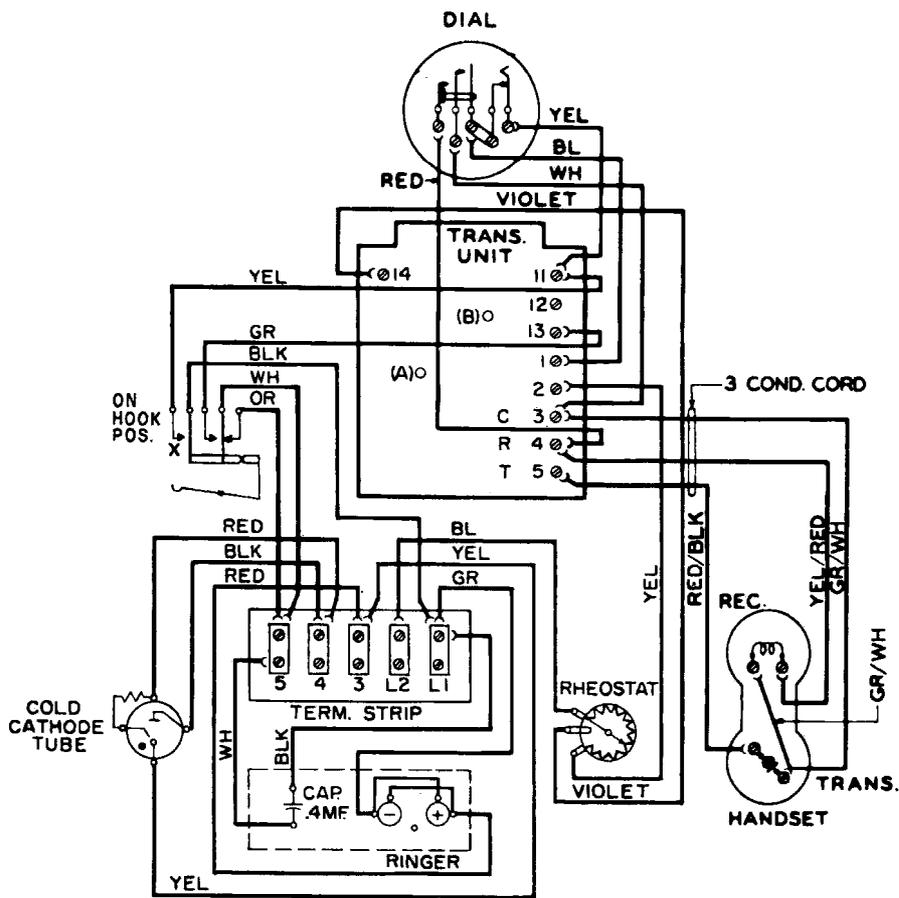


Figure 35. Superimposed type 90M wiring diagram and schematic (manually-adjusted).



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