

## AUXILIARY SIGNALS

### IDENTIFICATION, INSTALLATION, OPERATION, MAINTENANCE, AND CONNECTIONS

#### 1. GENERAL

1.01 This section provides information on the KS-16301 type, KS-8000 series, KS-20614 and KS-22001 signals with associated apparatus.

1.02 This section is reissued to:

- Rate KS-8229 Manufacture Discontinued (MD).
- Add information on KS-22001.
- Delete Table D and add information to Table A.
- Change Table E to D
- Delete KS-8233L2 Transformer Relay Set. (This information will be included in Section 463-120-100.)
- Delete KS-16626 Power Relay Set. (This information will be included in Section 463-120-100.)

Since this reissue is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 All KS-16301 codes of signals, relays, and backboxes are physically interchangeable.

1.04 These signals may be obtained with or without control relays for use in indoor and outdoor locations. Signals which do not contain a control relay require an externally mounted power relay set. One relay may operate several signals.

1.05 When tip party identification is required, it should be obtained through the ringer associated with each telephone set. Refer to the particular telephone set used for connections.

1.06 Certain signals are equipped with a 0.5- or 0.45- $\mu$ f capacitor in series with a relay which operates on telephone ringing current. The relay and capacitor constitute a high impedance ringing bridge.

1.07 All signals operate on 115-volts 60-Hz power unless otherwise noted. The operating voltage is stamped on the unit.

1.08 All KS-16301L2, L6, and L20 series signaling devices are not intended for use with 115-volts ac power and will be provided by the manufacturer with two warning tags, one on the signal unit frame and one on the signal unit power cord near the plug. The tags will specify:

**Warning: Do not use on 115 volts  
60 Hz.**

1.09 The KS-20614 relay switch is intended for use by handicapped persons. The List 1 is equipped with a power cord and switches 115 volts 60 Hz. The List 2 provides a contact closure for switching a customer low voltage supply not requiring Underwriter Approval.

1.10 Relays that operate on telephone ringing current have a 2-position sensitivity adjustment.

#### 2. IDENTIFICATION

2.01 **Purpose:** To produce loud or distinctive signals from:

- Vibrating bells
- Single-stroke bells
- Chimes
- Horns

#### NOTICE

Not for use or disclosure outside the  
Bell System except under written agreement

- Lamps.

## 2.02 Ordering Guide:

- Refer to Table A for auxiliary signals
- Refer to Table B for associated apparatus which must be ordered separately.

## 3. INSTALLATION

### A. Planning

3.01 Select a wall or column location for the signaling device in accordance with the following:

- Not hazardous to maintenance personnel—avoid stairways, areas of heavy traffic, and moving machinery
- Best sound distribution
- Safe from damage—remote from vehicular traffic, excessive heat, and flammable or corrosive fumes
- Accessible for maintenance or removal
- Near power receptacle or conduit, where required.

3.02 **Customer-Provided Wiring:** Prior to installation, a definite agreement must be made with the customer to provide any necessary power wiring (ac, dc, receptacle, conduit) in accordance with the following:

- Not controlled by a switch
- Separately fused, if possible
- Within access of power cord.

### 3.03 Line Ringer:

**Note:** Any telephone station having auxiliary signals (except a PBX station) must be equipped with a ringer connected to the line at all times to insure a ringing signal should commercial power fail.

### 3.04 Typical Installation Assembly:

- (a) A typical signal (Fig. 1) includes a backbox, a signal premounted to a grilled cover, and a control relay.
- (b) The armature on relays associated with auxiliary signals restores to normal (open contacts) by gravity. Always mount signal on a vertical surface. A control relay, if used, must be in the horizontal position.

3.05 **Type of Installation:** The type of installation determines the type of backbox (see Table C). Backboards are not necessary.

### B. Installing



**Make sure power is disconnected before working on circuit. Under no circumstances should the cord provided for commercial power be passed through a hole in a wall or be fastened to a wall.**

### 3.06 Weatherproof Power Outlet KS-16301-L18 (Fig. 8):

- Provided to customer as required
- Used with KS-16301L19 backbox (ordered separately).

### 3.07 Backbox, KS-16301 (Fig. 1, 2, 3, 4, and 5):

- Mount on a vertical surface
- Use two slotted holes and one regular hole for attaching backbox to surface
- Use rustproof fasteners
- Install backbox, List 9 or 11, so that the customer may have the commercial power connected (Fig. 2)
- Terminate 3-conductor cord as shown in Fig. 7
- Do not fasten power cord to any surface
- Do not pass power cord through wall holes or partitions

**TABLE A**  
**ORDERING GUIDE**

SIGNAL	LOCATION	STROKE	OPERATING VOLTAGE	CURRENT (AMPERES)	OUTPUT (dB)	RELAY OPERATION†	SEE FIG. NO.	SEE TABLE
<b>BELL</b>								
KS-8547L1	Hazardous Indoor	Vibrating	115-volt ac	0.21			12	
KS-8547L2	Hazardous Outdoor	Vibrating	115-volt ac	0.21			12	
KS-8547L3*	Hazardous Indoor	Single	115-volt ac	0.12			12	
KS-8547L4*	Hazardous Indoor Outdoor	Single	115-volt ac	0.12			12	
KS-16301L3	Indoor Outdoor	Vibrating	115-volt ac	0.125	101.6		9	B
KS-16301L4	Indoor Outdoor	Single	115-volt ac	0.350	99.6		10	B
KS-16301L20	Indoor Outdoor	Vibrating	18-volt ac	0.325	101.6		11	B
KS-20375L1	Indoor	Vibrating	18-volt ac	0.325	101.6		13	
<b>CHIME</b>								
KS-8229L13 (MD)	Indoor	Single	115-volt ac	0.07		48-volt dc	14	
KS-8229L14 (MD)	Indoor	Single	115-volt ac	0.07		48-volt ac	14	
KS-8229L15 (MD)	Indoor	Single	115-volt ac	0.07		Ringing Current	14	
KS-8229L23 (MD)	Indoor	Single	115-volt ac	0.07			14	
KS-16301L1	Outdoor Indoor	Single	115-volt ac	0.400			13	B
KS-22001L2	Indoor	Single	115-volt ac	0.07	75.0			
KS-22001L5	Indoor	Single	115-volt ac	0.07	75.0	48-volt dc		
KS-22001L6	Indoor	Single	115-volt ac	0.07	75.0	48-volt ac		
KS-22001L7	Indoor	Single	115-volt ac	0.07	75.0	Ringing Current		
<b>HORN</b>								
KS-16301L2	Indoor Outdoor		115-volt dc	0.031	101.6		16	
KS-16301L5	Indoor Outdoor		115-volt ac	0.450	106.6		17	
KS-16301L6	Indoor Outdoor		48-volt ac	1.30	101.6		18	

TABLE A (Contd)

## ORDERING GUIDE

SIGNAL	LOCATION	STROKE	OPERATING VOLTAGE	CURRENT (AMPERES)	OUTPUT (dB)	RELAY OPERATION†	SEE FIG. NO.	SEE TABLE
SWITCH, RELAY KS-20614L1	Indoor					Ring Current	7	
KS-20614L2	Indoor					Ring Current	8‡	

\* May be ordered equipped for 115-volt dc operation.

† • 48-volt ac relays will operate on 9-volt minimum.

• 48-volt dc relays will operate on 17-volt minimum.

• Ringing current relays will operate on 53-volt minimum with wide airgap and 34-volt minimum with close airgap.

‡ Does not include power receptacle or power cord.

TABLE B

## ORDERING GUIDE

ASSOCIATED APPARATUS	LOCATION	USE WITH				POWER CORD PROVIDED	FOR CONDUIT INST	SEE TABLE	FIG. NO
		BELL	HORN	CHIME	RELAY				
<b>BACKBOX</b>									
KS-16301L8*	Indoor	•	•	•	•	Yes	No	C	3
KS-16301L9*	Indoor	•	•	•	•	No	Yes	C	2
KS-16301L11*	Outdoor	•	•	•	•	No	Yes	C	4
KS-16301L19*	Outdoor	•	•	•	•	Yes	No	C	5
KS-22001L9	Indoor			•		No	Yes	C	
<b>MOUNTING PLATE</b>									
KS-22001L8	Indoor			•		No	No		
<b>OUTLET</b>									
KS-16301L18†	Outdoor								8
<b>RELAY</b>									
KS-16301L15	Indoor—Outdoor	•	•	•				A	9
KS-16301L16	Indoor—Outdoor	•	•	•				A	9
KS-16301L17	Indoor	•	•	•				A	9

\* Mounting hardware not furnished.

† Use with KS-16301L19 backbox (ordered separately).

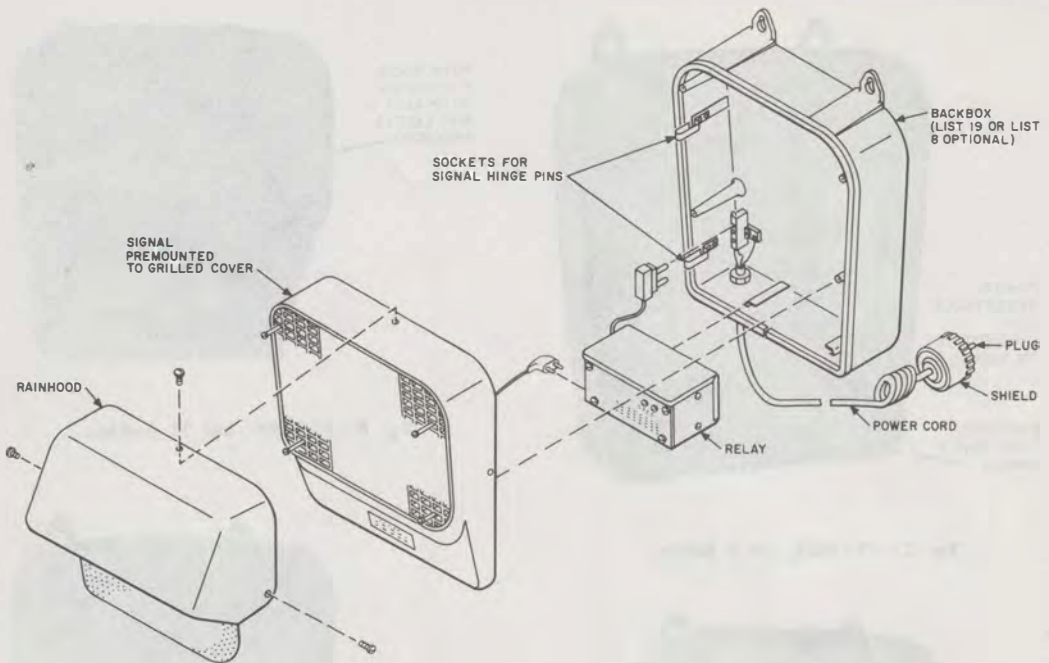


Fig. 1—Exploded View of Assembled Signal Using Relay

TABLE C

BACKBOX	TYPE OF INSTALLATION	
KS-16301L8	Indoor—Power Cord	For Use With or Without Relay (per job requirements)
KS-16301L9	Indoor—Conduit	
KS-16301L11	Outdoor—Conduit	
KS-16301L19	Outdoor—Power Cord	
KS-22001L9	Indoor—Conduit	

- An entrance hole for the telephone wires is located in the bottom of each backbox (Fig. 3)
- Be sure that the gasket on the backbox is in place (Fig. 7).
- Use a full cable pair for each signal circuit when signaling circuits are in the same cable.
- When no talking circuits are involved, low-voltage signal circuits may use half of a cable pair or inside wire.
- The List 15 units, manufactured after the 2nd quarter 1979, are provided with a 623P4 jack and connected to the wall jack

### 3.08 Control Relay, KS-16301 (Fig. 9):

- Mount relay in the horizontal position on mounts provided in backbox (Fig. 1).

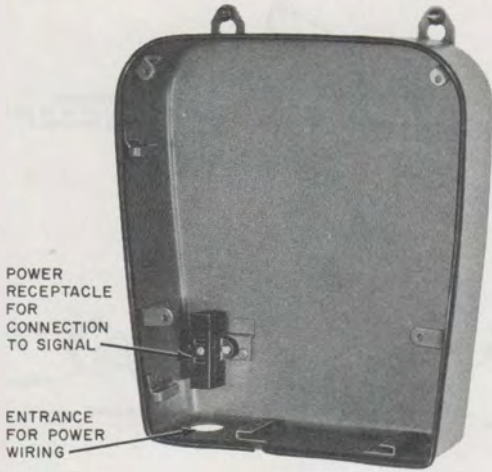


Fig. 2—KS-16301, List 9 Backbox



Fig. 4—KS-16301, List 11 Backbox

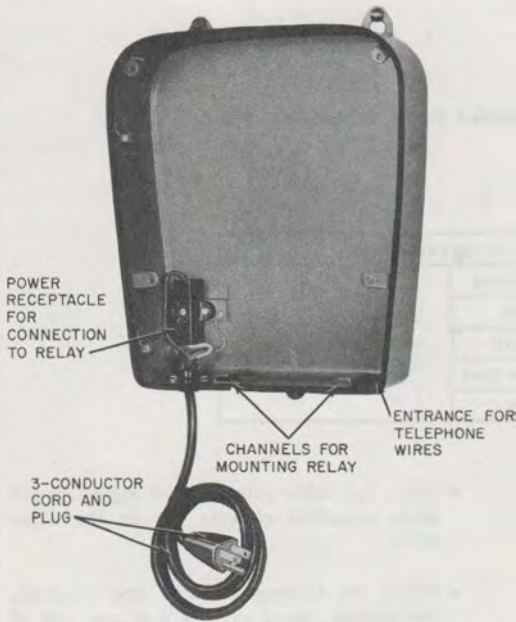


Fig. 3—KS-16301, List 8 Backbox



Fig. 5—KS-16301, List 19 Backbox

via a standard D4BU cord (ordered separately). For long loop areas, move the lead from the LO to the HI terminal.



Fig. 6—KS-22001, List 9 4-Inch Backbox

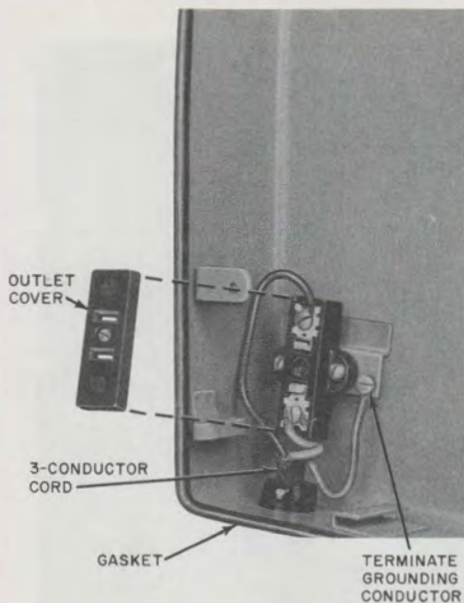


Fig. 7—Power Cord Termination



Fig. 8—KS-16301, List 18 Outlet

### 3.09 Signals, KS-16301 (Fig. 13, 14, 15, 19, 20, 21, and 22):

- Engage the two pins on front cover to form a hinge with the two sockets which emerge from backbox (Fig. 1)
- Fasten the signal to the backbox with four machine screws which are furnished (Fig. 1).

### 3.10 Rainhood, KS-16301L11 and L19 (Fig. 4):

- For protection against the weather and insects
- Attach with furnished screws to the signal unit (Fig. 1).

### 3.11 KS-20614L1 Relay Switch (Fig. 11 and 31):

- Mount relay to a vertical surface with contacts at the bottom and within 12 inches of local power receptacle.
- Units manufactured after the 2nd quarter 1977 are provided with a 623P4 jack and connected to the wall jack via a standard D4BU cord (ordered separately). For long loop areas, move the lead from the LO to the HI terminal.
- Set single-pole double-throw switch on nearby table or stand.
- Connect visual indicator to receptacle in relay housing.

### 3.12 KS-20614L2 Relay Switch (Fig. 12 and 32):

- Mount relay to a vertical surface with contacts at the bottom.
- Units manufactured after the 2nd quarter 1977 are provided with a 623P4 jack and connected to the wall jack via a standard D4BU cord (ordered separately). For long loop areas, move the lead from the LO to the HI terminal.
- Terminate 2-conductor cord on a 42A connecting block, or equivalent, as a junction point for the customer's low voltage circuit.
- Set single-pole double-throw switch on nearby table or stand.

### 3.13 Signals KS-8229 (MD) (Fig. 18):

- Has slotted mounting holes for easy removal from backboard





## NOTE:

PROVIDED ON USOC RJ11C JACK ( 623 P4), LIST 15 ONLY.

Fig. 9—KS-16301, Typical List 15, List 16, List 17 Relay

- Has 3-conductor cord for terminating on a 42-type connecting block or equivalent
- The signals are for indoor locations.

### 3.14 Signals, KS-8547 (Fig. 16):

- The signals are for indoor and hazardous locations

- Signal is already attached to a backboard.

**Caution:** When the KS-8547 bell is used in an explosive atmosphere, extreme caution should be taken to assure the installation conforms to the requirements specified in Section 502-415-100.

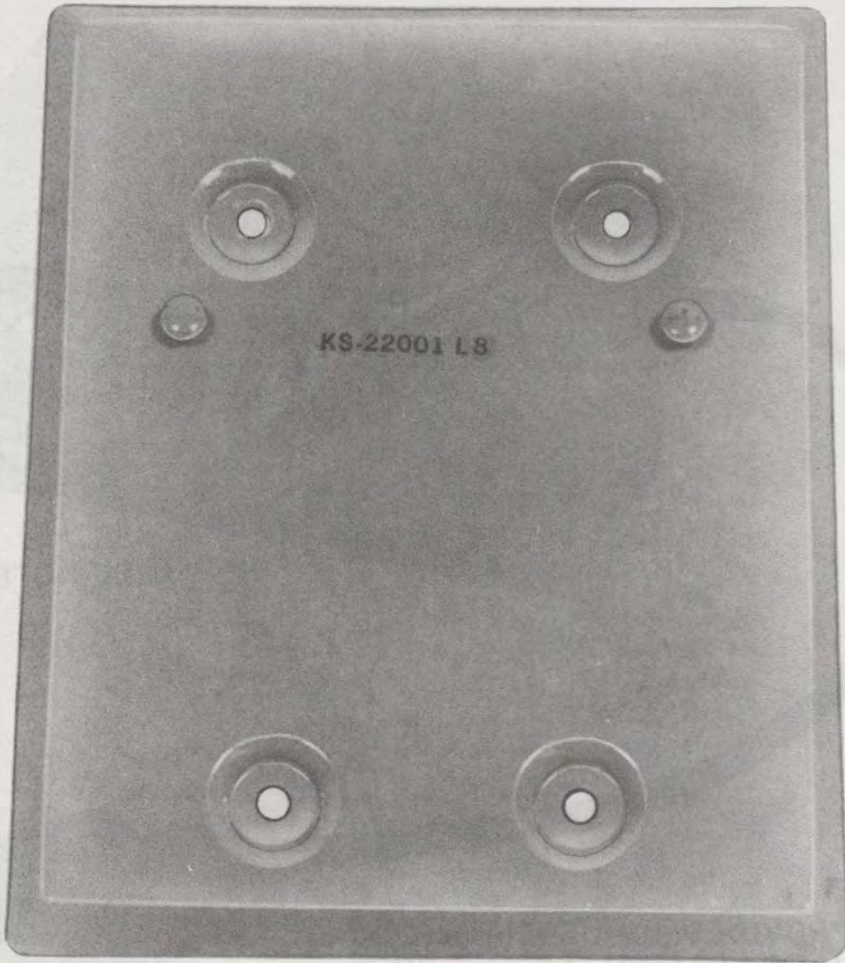


Fig. 10—KS-22001, List 8 Portable Mounting Plate

**3.15 Signals, KS-20375L1 (Fig. 17):**

- (a) The KS-20375L1 bell mounts directly on a 4-inch square outlet box.
- (b) The KS-20375L2 adapter is used when mounting to a 2-inch octagonal outlet box or a single or double gang plaster ring. The KS-20375L3 (olive-gray) outlet box is also available

for use with the bell. These items must be ordered separately.

**3.16 Signals, KS-22001 (Fig. 23):**

- Mount on a vertical surface.
- Use four slotted holes for attaching chime to surface.

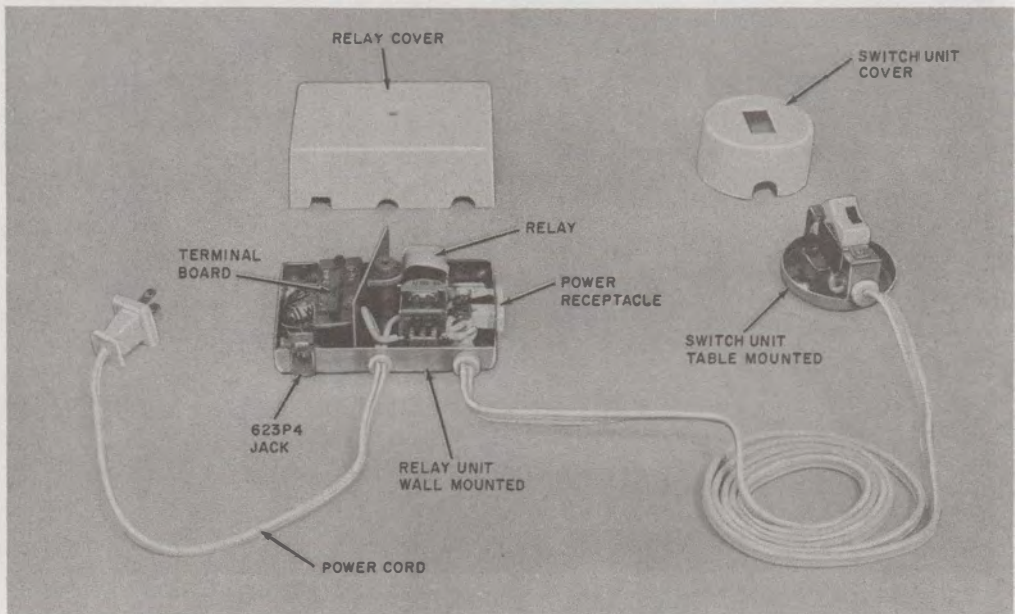


Fig. 11—KS-20614, List 1 Relay Switch

- The KS-22001L2, L5, L6, and L7 replace KS-8229L23, L13, L14, and L15, respectively.
- The KS-22001L1, L3, and L4 replace KS-5594L5, L9, and L10, respectively.
- The KS-22001L5, L6, and L7 are equipped with—
  - (a) One plug ended 3-conductor power cord 4-feet long for connection to the power circuit.
  - (b) One 2-conductor cord 9-inches long with spade terminals at one end.
- The KS-22001L7 is equipped with a 623P4 jack (USOC RJ11-C).
- The KS-22001L8 (Fig. 10) is a portable mounting plate used for applications where mounting the chime directly is not desirable.
- The KS-22001L9 (Fig. 6) is a standard 4-inch outlet box. It is provided with a screw-type terminal block, jumper leads, and screws for making connections to the chime signal.

#### 4. OPERATION

##### 4.01 *Noncontinuous Signals (Fig. 29):* The

687B subscriber set has a cold cathode tube and relay in place of the ringer. When the relay is operated by rectified ringing voltage, the relay contacts may be used to control a signal energized from a local low voltage source.

##### 4.02 *Continuous Signals (Fig. 30):* The circuit operates as follows:

- (a) Ringing current applied to line operates the R relay through its secondary winding and the top contacts 1 and 2 of SR relay to ground.
- (b) The R relay locks operated by battery through its primary winding, its own top contacts 1 and 2, bottom contacts 3 and 2 of SR

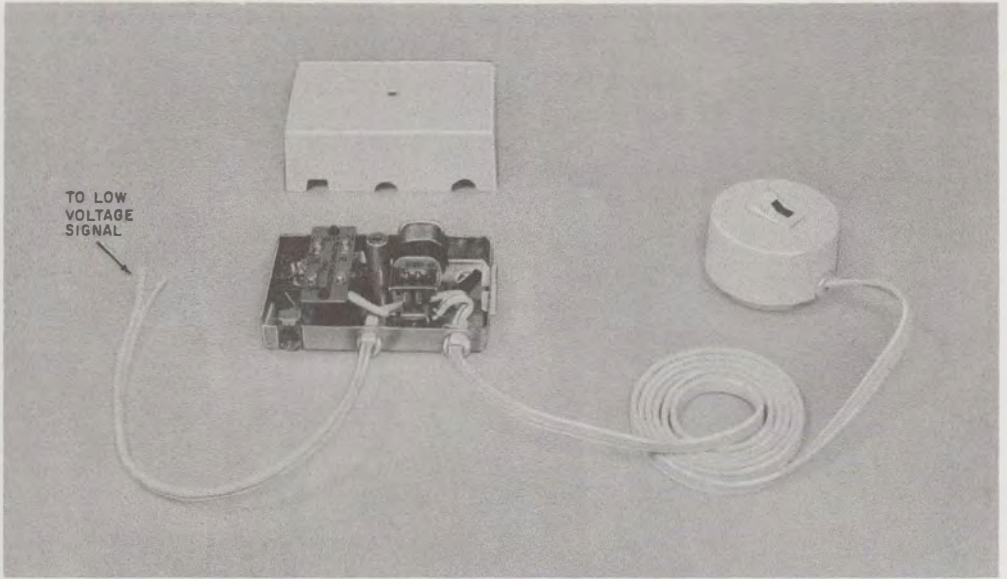


Fig. 12—KS-20614, List 2 Relay Switch



Fig. 13—KS-16301, List 3 Bell

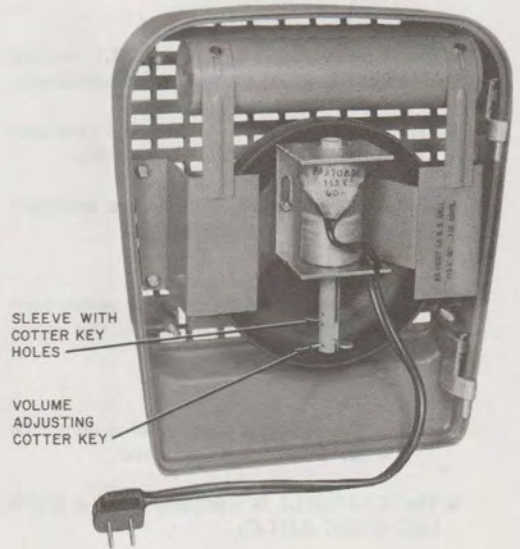


Fig. 14—KS-16301, List 4 Bell

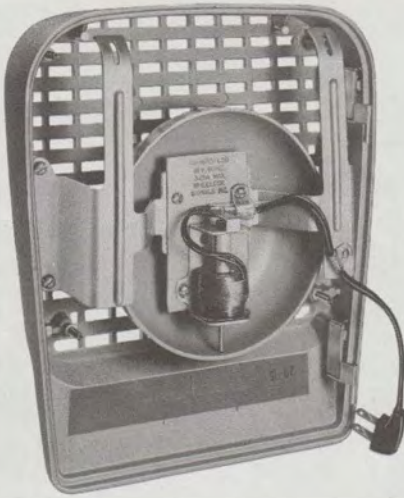


Fig. 15—KS-16301, List 20 Bell



Fig. 16—KS-8547, List 1 Bell

relay, bottom contacts 1 and 2 of TO relay (Z wiring) to ground, or to switch to ground (Y wiring).

- (c) The R relay operated completes circuit through its own top contacts 3 and 4 to operate auxiliary relay or signal.
- (d) Bottom contacts 1 and 2 of R relay may be used to operate a line lamp indicator.
- (e) When call is answered, B relay operates by central office or PBX battery through station.
- (f) The SR relay operates by battery through its winding, contacts of B relay (operated), and bottom contacts 1 and 2 of TO relay to ground (Z wiring).
- (g) Operation of SR relay opens locking circuit of R relay which releases.
- (h) Circuits to auxiliary signal and line lamps open when R relay releases.
- (i) Unanswered calls are handled by a timeout feature. When R relay operates, ground is connected through bottom contacts 3 and 4, 112-ohm heater winding of TO relay (Z wiring), and top contacts 3 and 2 of TO relay to battery. After approximately 30 seconds, thermally operated bottom contacts 1 and 2 of TO relay will open. This opens locking circuit of R relay and circuit restores to normal.
- (j) If call is answered, SR relay operates as previously described. Circuit is completed from battery through TO relay, bottom contacts 1 and 2 of SR relay (operated), and bottom contacts 1 and 2 of TO relay to ground. This opens heater winding circuit of TO relay.

#### 4.03 KS-20614L1 Relay Switch (Fig. 31):

This relay is operated by station ringing voltage to control a 2-conductor 115-volts 60-Hz receptacle. The switch reverses function of the relay contacts so that the 115-volts 60-Hz receptacle can be either normally on or off with reversal occurring during the ringing interval. Provides for control of any alerting device (visual, tactile, or audible) that operates on 115 volts 60 Hz and draws 5 amperes or less noninductive load.

#### 4.04 KS-20614L2 Relay Switch (Fig. 32):

Operation of the List 2 is similar except the contacts are used to control a customer-provided low voltage circuit (maximum 30 volts and 3.2

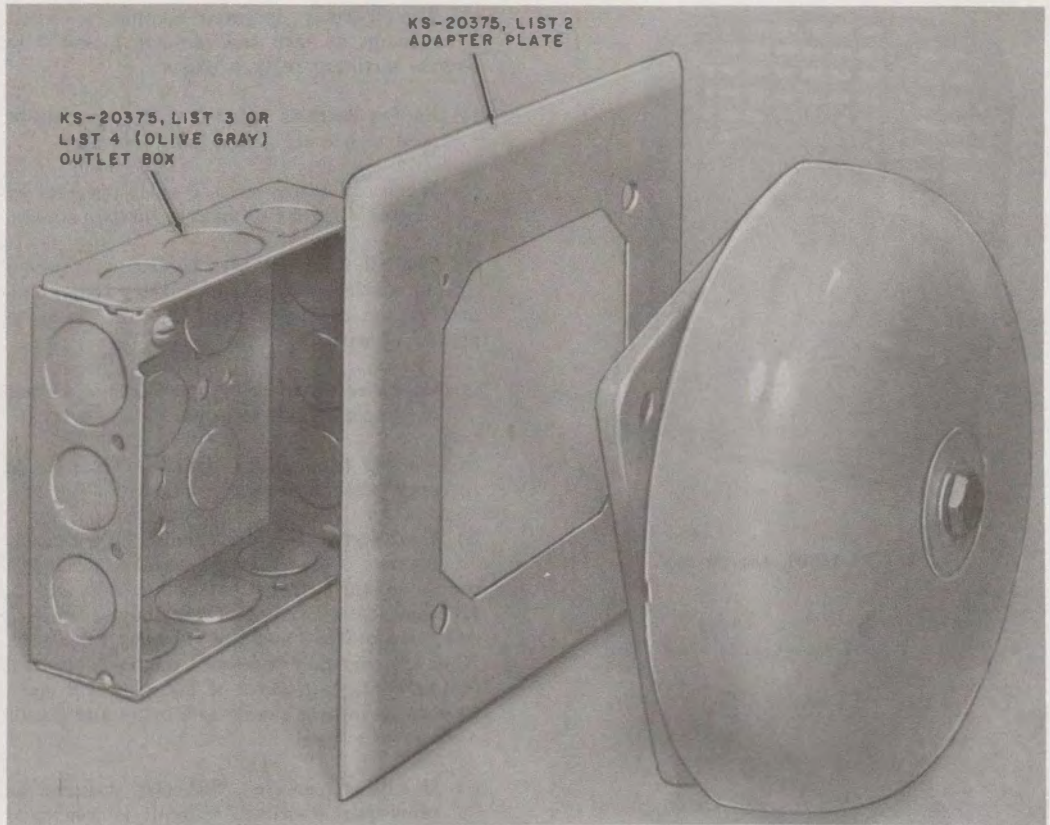


Fig. 17—KS-20375, List 1 Bell, List 2 Adapter Plate, List 3 or 4 (Olive Gray) Outlet Box

amperes) wired to the 12-inch 2-conductor cord provided.

## 5. MAINTENANCE

**Danger:** Before performing any work on equipment connected to commercial power, de-energize the power supply circuit. The customer shall arrange for power disconnection and reconnection on power circuits other than plug and outlet.

### A. Signals, KS-16301

5.01 The KS-16301L3 (vibrating bell) has a volume adjustment. On the Wheelock Signal Company type, the adjustment is a hexagonal nut on the rear of the signal (Fig. 13). The Sperti-Faraday Company type adjustment is on the back of the bell resonator. The direction of adjustment is stamped near the adjusting nut or screw. Table A shows operating currents.

5.02 The KS-16301L4 (single-stroke bell) uses a cotter key volume adjustment. The signal is shipped with the key inserted through the lowest of the three holes in the sleeve that contains the plunger for maximum volume. To decrease volume,

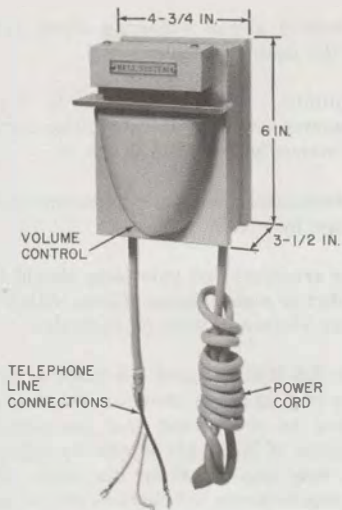


Fig. 18—KS-8229 Chime (MD)

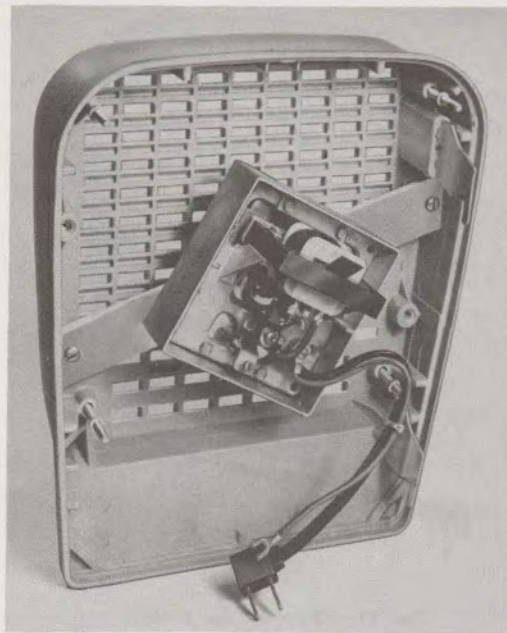


Fig. 20—KS-16301, List 2 Horn



Fig. 19—KS-16301, List 1 Chime

move cotter key to intermediate or top hole in the sleeve (Fig. 14).

5.03 Replace defective signals with complete list number.

#### B. Relays, KS-16301, KS-20614

5.04 The Lists 15, 16, and 17 relays should meet the following requirements: (Table D)

- The armature should not chatter when the relay is operated with the specified voltage.
- The armature should not bind or stick; gauge by feel.
- The armature airgap is adjusted on Wheelock Signal Company relays by moving a lever on the bottom of the relay.
- In Sperti-Faraday Company relay, the armature airgap is adjusted by rotating the



Fig. 21—KS-16301, List 5 Horn



Fig. 22—KS-16301, List 6 Horn

armature airgap adjusting screw 1/2 turn to the desired setting.

- Minimum contact pressure is 6 grams, measured with relay operated either electrically or manually; use 70H gauge.
- The contacts should make almost simultaneously; gauge by eye.
- The armature and pole piece should be free of dirt or metal filings. Clean with 1/2-inch relay cleaning strips or equivalent.

5.05 The KS-16301L15 and KS-20614 relays used as a ringing bridge should not chatter during dial pulsing to the extent that contacts make. Check position of HI or LO sensitivity adjustment, ie, HI for long loop or LO for dial area. If relay meets all requirements but chatters on dial pulsing, replace in accordance with local instructions.

#### C. KS-8229 (MD) Signal Chime

5.06 The volume of the KS-8229 (MD) signal chime (Fig. 18) may be adjusted by a screw. No other adjustment should be made. Should the plunger stick in its guide, remove plunger and clean with mineral spirits. If this does not correct operation, replace signal device.

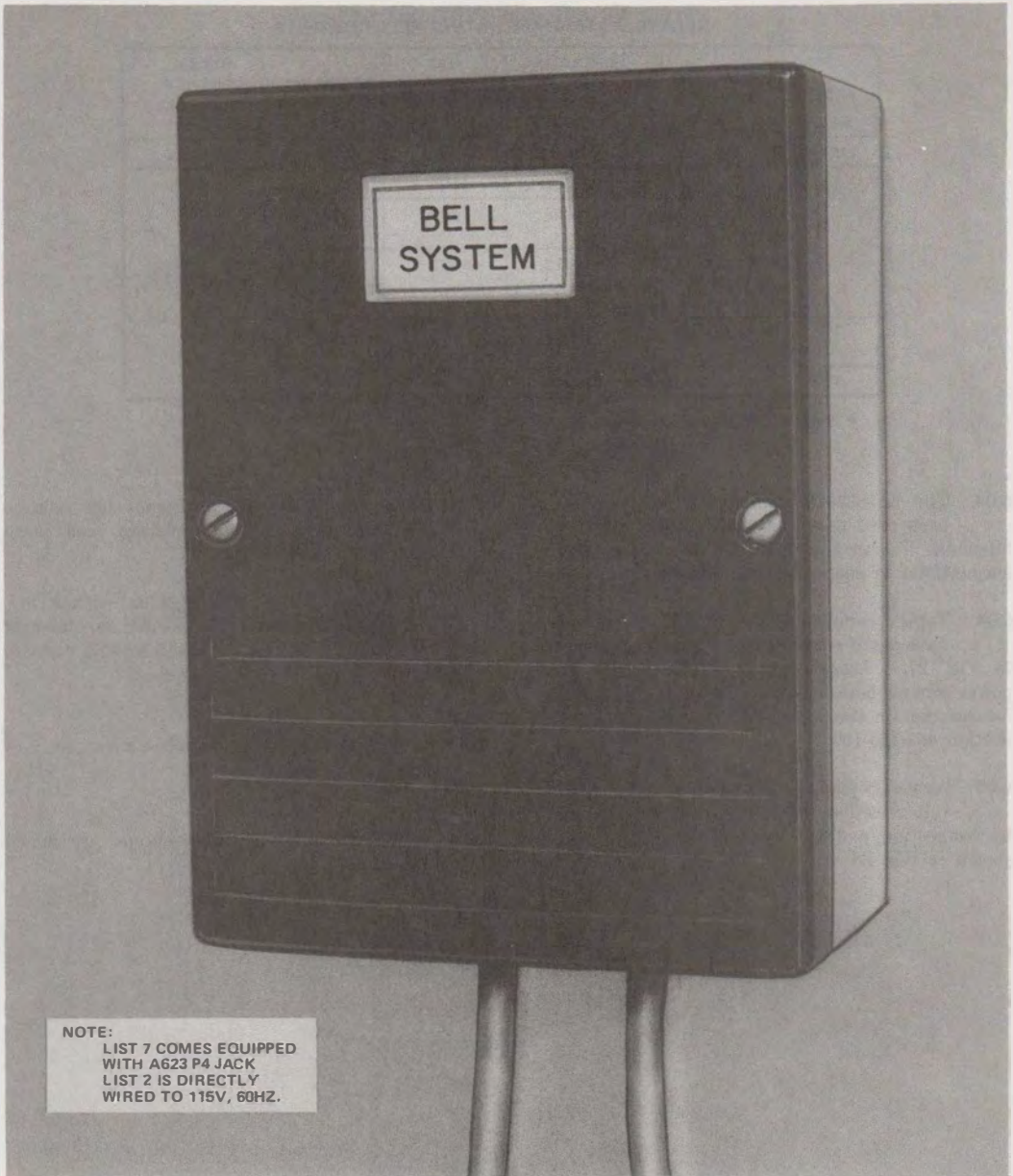
5.07 Some auxiliary signals can cause malfunctions in frequency counters at computer installations due to arcing of the ac contacts of the signal, inducing noise in the ac line, and radiating in the line cord of the computer. The problem can be alleviated by installing a 0.02- $\mu$ f capacitor across the ac contacts of the auxiliary signal.

#### 6. CONNECTIONS

6.01 Connections for KS-16301 signals and relays are shown in Fig. 24.

6.02 Several signals may be connected as shown in Fig. 25. This has the advantage of only one ringing bridge on the telephone line for several auxiliary signals. The total number of auxiliary signals connected to a power relay set should not exceed the current carrying capacity of the relay contacts. Special commercial power wiring is not needed between relay set and signals.





**NOTE:**

LIST 7 COMES EQUIPPED  
WITH A623 P4 JACK  
LIST 2 IS DIRECTLY  
WIRED TO 115V, 60HZ.

**Fig. 23—KS-22001 Chime**

TABLE D

## RELAYS, KS-16301 OPERATING REQUIREMENTS

RELAY LIST NO.	OPERATING VOLTAGE	OPERATING CURRENT AT MAX. VOLTAGE	DC RESISTANCE OF RELAY COIL	IMPEDANCE OF RELAY COIL	RELAY CONTACT- CARRYING CAPACITY
		AMPERES	OHMS	OHMS	AMPERES
15	18- to 48-volts dc	0.011	4500	—	5
	30- to 48-volts 60-Hz ac	0.025	1000	1920	
	39- to 90-volts 20-Hz ac (ringing voltage)	0.012	4500	7550*	
16	9- to 48-volts 60-Hz ac	0.404	26.3	118	
17	12- to 78-volts dc	0.069	1130	—	

\* Includes 0.45- $\mu$ f series capacitor.

**6.03** The KS-8233L2 transformer relay set has been used to connect several signals to one telephone line as shown in Fig. 26. This may be encountered in some existing installations.

**6.04** Typical connections for signals which do not have a self-contained power relay are shown in Fig. 27. These signals require commercial power wiring between relay set and signal. For information on the KS-16626 Power Relay Set, see Section 463-120-100.

**6.05** Auxiliary signals may be installed on 4-party full selective or 8-party semiselective lines by connecting a 531C or 687B subscriber set as shown in Fig. 28.

**6.06** Connections for noncontinuous low voltage signals such as bells, buzzers, and lamp indicators are shown in Fig. 29.

**6.07** Continuous operating signals, either low voltage or power operated, should be connected as shown in Fig. 30. Low voltage signals connect directly to the 15D key telephone unit.

**6.08** The KS-20614 relay switch connections are shown in Fig. 31 and 32.

**6.09** Connections for KS-22001 chimes are shown in Fig. 33.

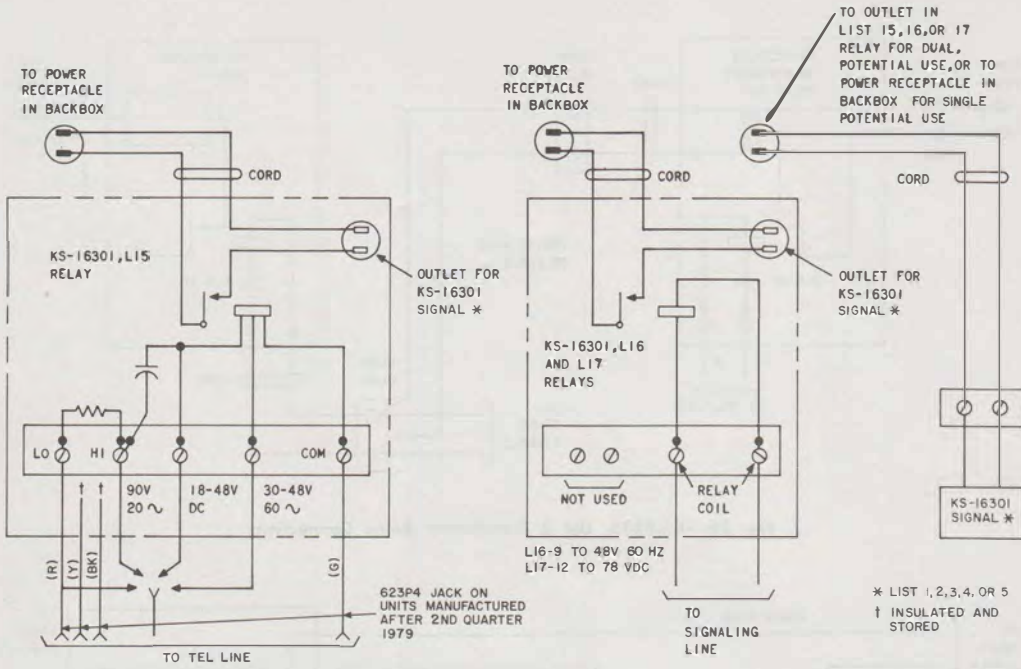


Fig. 24—KS-16301 Signal Connections

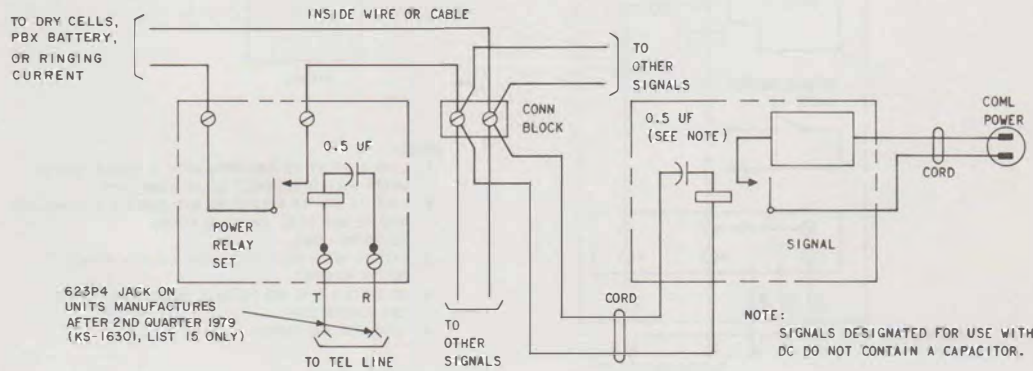


Fig. 25—Multiple Signal Connections

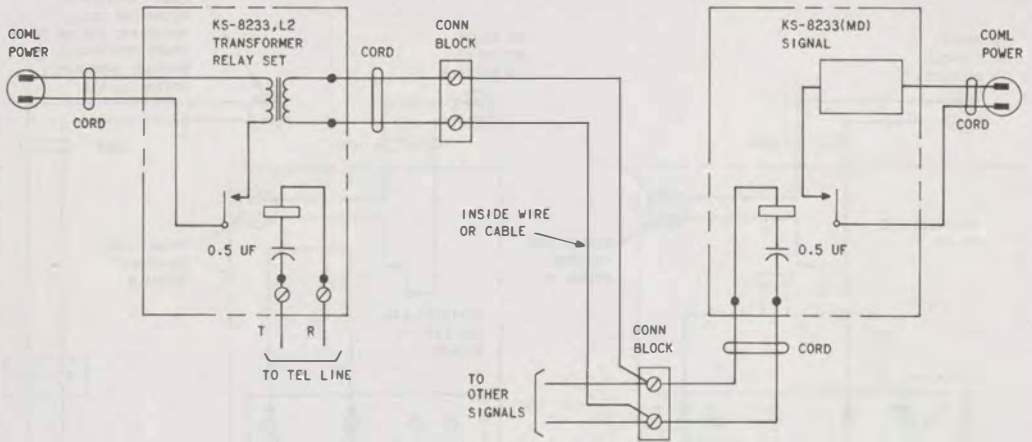
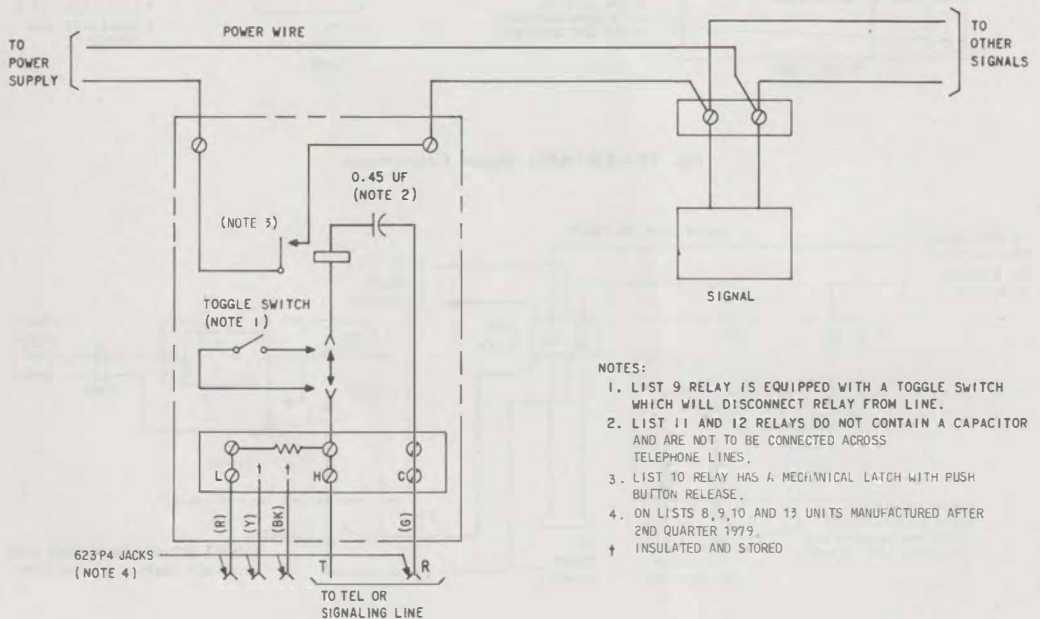


Fig. 26—KS-8233, List 2 Transformer Relay Connections



## NOTES:

1. LIST 9 RELAY IS EQUIPPED WITH A TOGGLE SWITCH WHICH WILL DISCONNECT RELAY FROM LINE.
  2. LIST 11 AND 12 RELAYS DO NOT CONTAIN A CAPACITOR AND ARE NOT TO BE CONNECTED ACROSS TELEPHONE LINES.
  3. LIST 10 RELAY HAS A MECHANICAL LATCH WITH PUSH BUTTON RELEASE.
  4. ON LISTS 8, 9, 10 AND 13 UNITS MANUFACTURED AFTER 2ND QUARTER 1979.
- † INSULATED AND STORED

Fig. 27—KS-16626 Power Relay Set Connections

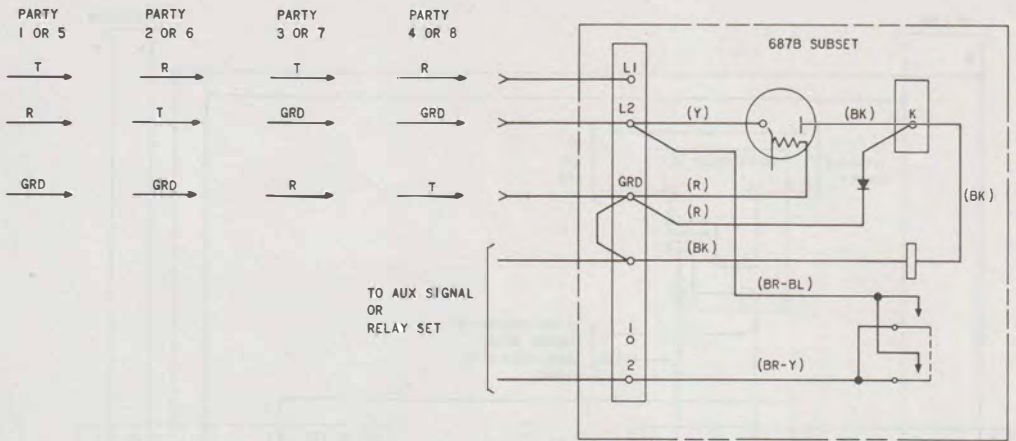


Fig. 28—Connections for Auxiliary Signals on Party Line

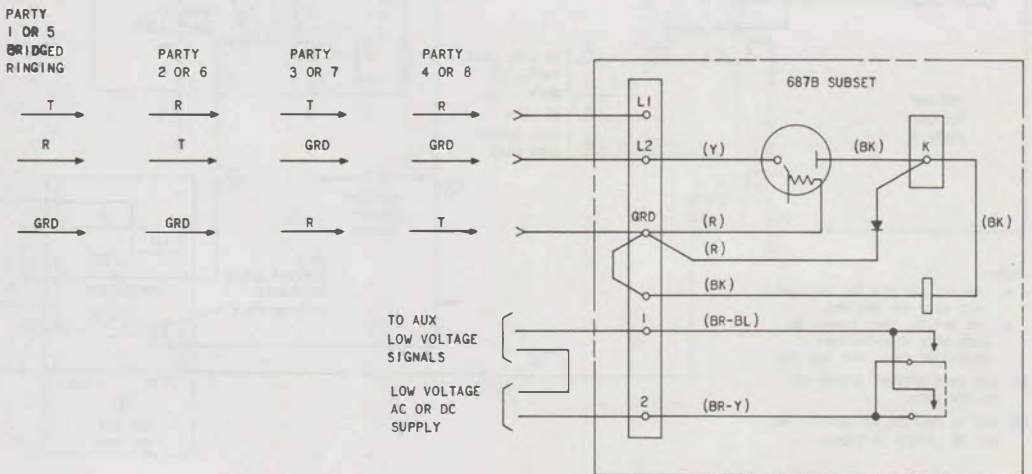


Fig. 29—Connections for Noncontinuous Low Voltage Auxiliary Signal

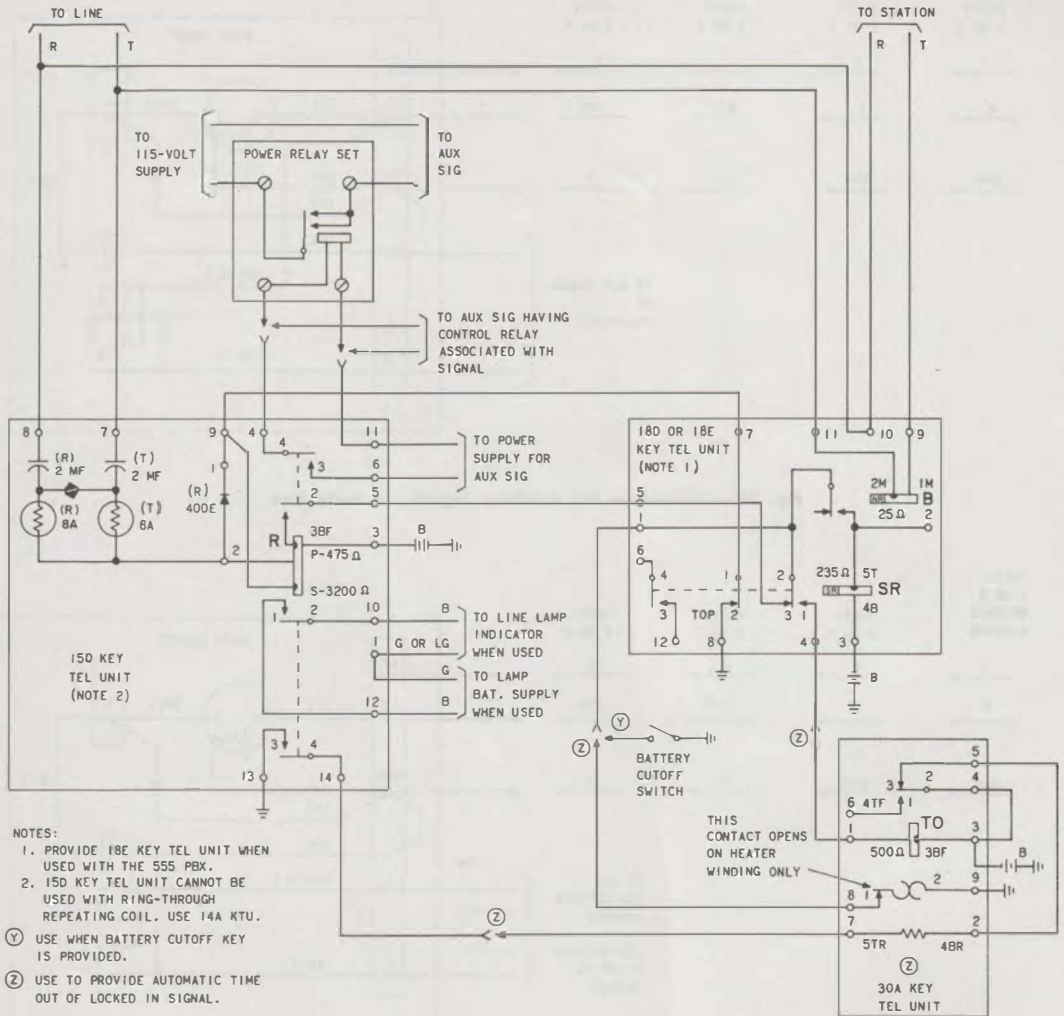


Fig. 30—Connections and Circuit Operation for Continuous Auxiliary Signals

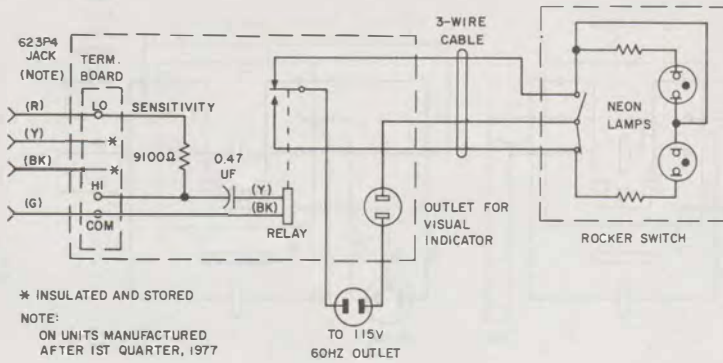


Fig. 31—KS-20614, List 1 Relay Switch—Schematic

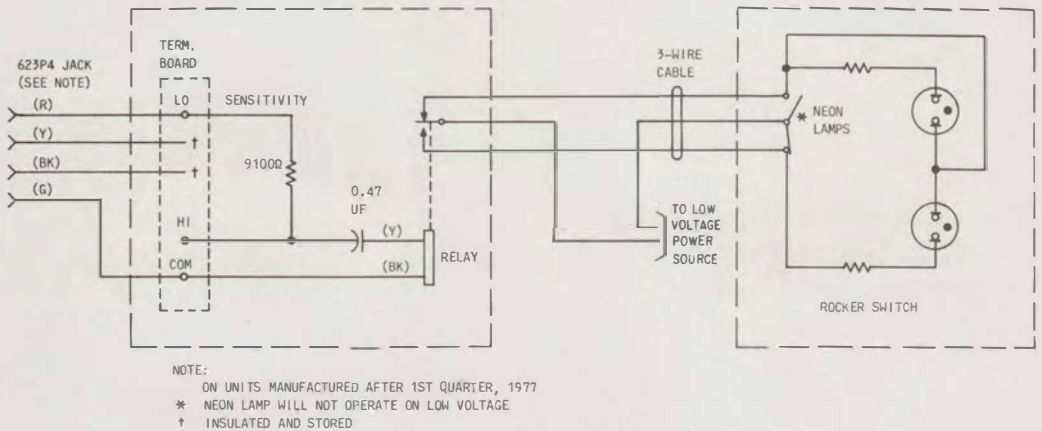


Fig. 32—KS-20614, List 2 Relay Switch—Schematic

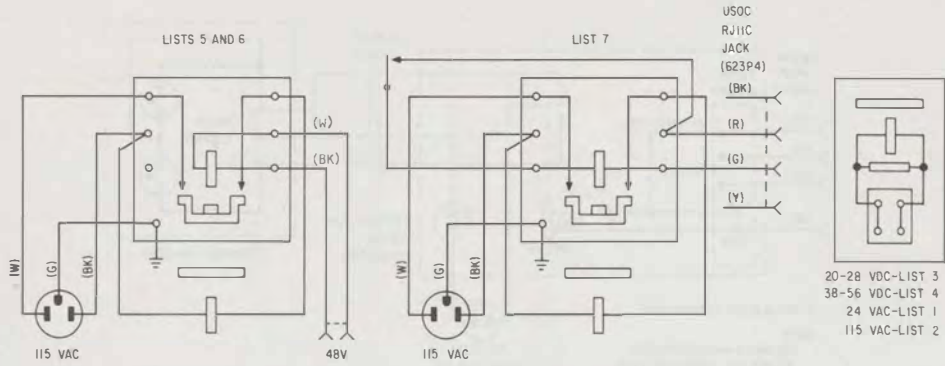


Fig. 33—Connections for KS-22001 Chimes