PROTECTIVE CONNECTING ARRANGEMENTS
RCZ, RTT AND RC1, AND 4-WIRE SERVICE

1. GENERAL

1.01 This section provides information on the identification, installation, operation, maintenance, and connections of the KS-19645 type recorder connectors used for Protective Connecting Arrangements (PCA) RCZ, RTT and RC1, and 4-Wire Service.

1.02 This section is reissued to:

- Change rating of KS-19645, List 2 and List 6 recorder connectors from AT&T Standard to Manufacture Discontinue (MD)
- Add KS-19645, List 4 recorder connector
- Change customer interface to 44A connecting block
- Add new Fig. 18 to show connections for 832-, 2832-, 833-, and 2833-type key telephone sets
- Add new Fig. 31
- Revise Fig. 1, 2, 3, 8, 9, 10, 11, and 30
- Revise Tables A, B, C, and D, and add new Table E
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA).

1.03 The customer should be informed by the manufacturer or supplier of the proper use of his equipment with the recorder connector.

1.04 The customer can obtain a copy of the Technical Reference covering interface specifications PCA RCZ, RTT and RC1 by contacting the local Telephone Company Business Office or the Marketing Representative.

1.05 This issue of the section is based on the following drawing:

SD-99414-01, Issue 8—KS-19645, L4 Recorder Connector

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing, reference should be made to the SDs to determine the extent of the changes and the manner in which the section may be affected.

2. IDENTIFICATION

PURPOSE

- To provide facilities for connecting customer-provided equipment (CPE) to the telecommunications network
- To provide protection for telephone company personnel against hazardous voltages and to insure longitudinal balance
- To provide facilities for complying with the rules of the Federal Communications Commission for recording of 2-way telephone conversations (RCZ only).

2.01 ***PCA RCZ (Fig. 1 and 2):*** KS-19645, List 1 (MD), List 2 ▶(MD),◀ ▶List 6 (MD),◀ or List 4 recorder connectors provide 1400-Hz warning beeps on 2-wire station lines only when ▶2-way◀ conversations are being recorded by customer-provided (CP) voice recorders.

2.02 ***PCA RTT (Fig. 1 and 2):*** KS-19645, List 4 recorder connector modified to provide 440-Hz warning beeps in both directions on 2-wire station or PBX trunk lines to signal conversing parties that their call is exceeding a time limit predetermined by a CP call duration timer. Not to be used for the recording of 2-way conversations.

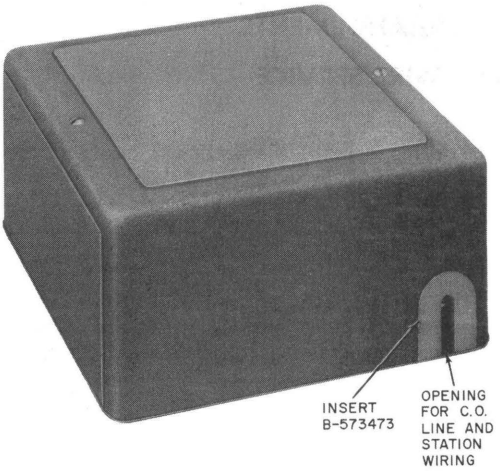


Fig. 1—KS-19645, List 4 Recorder Connector

2.03 ***PCA RC1 (Fig. 1 and 2):*** KS-19645, List 4 recorder connector modified to provide 1400-Hz warning beeps to the local party and reduce the level of the beep tone being transmitted to the distant party by approximately 60 dB. It is used to connect CP call duration timers to 2-wire station or PBX trunk lines to signal the local party that their call is exceeding a time limit predetermined by a CP call duration timer. Not to be used for the recording of 2-way conversations.

2.04 ***4-Wire Service (Fig. 3):*** KS-19645, List 4 recorder connector, modified for 4-wire use (4W), provides 1400-Hz warning beeps on 4-wire telephone lines when 2-way conversations are being recorded by CP voice recorders.

APPLICATION

- Central Office (CO), Centrex, or PBX station lines

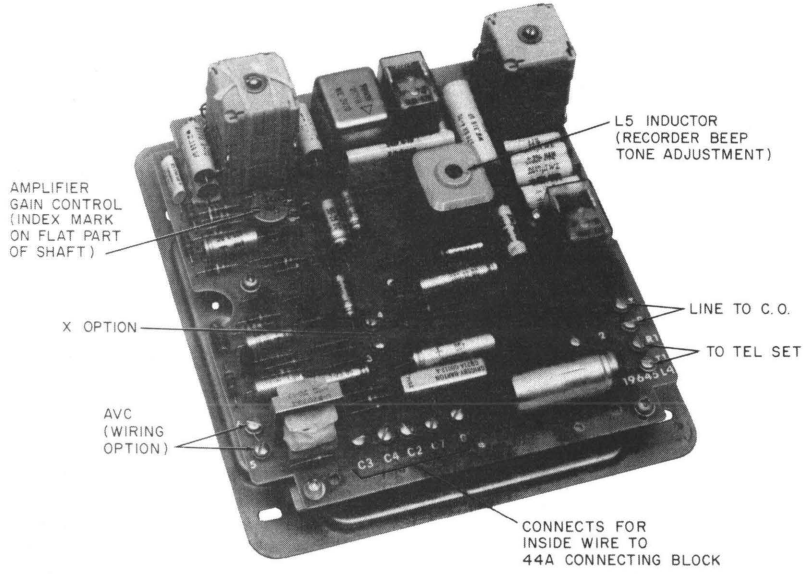


Fig. 2—KS-19645, List 4 Recorder Connector, Cover Removed

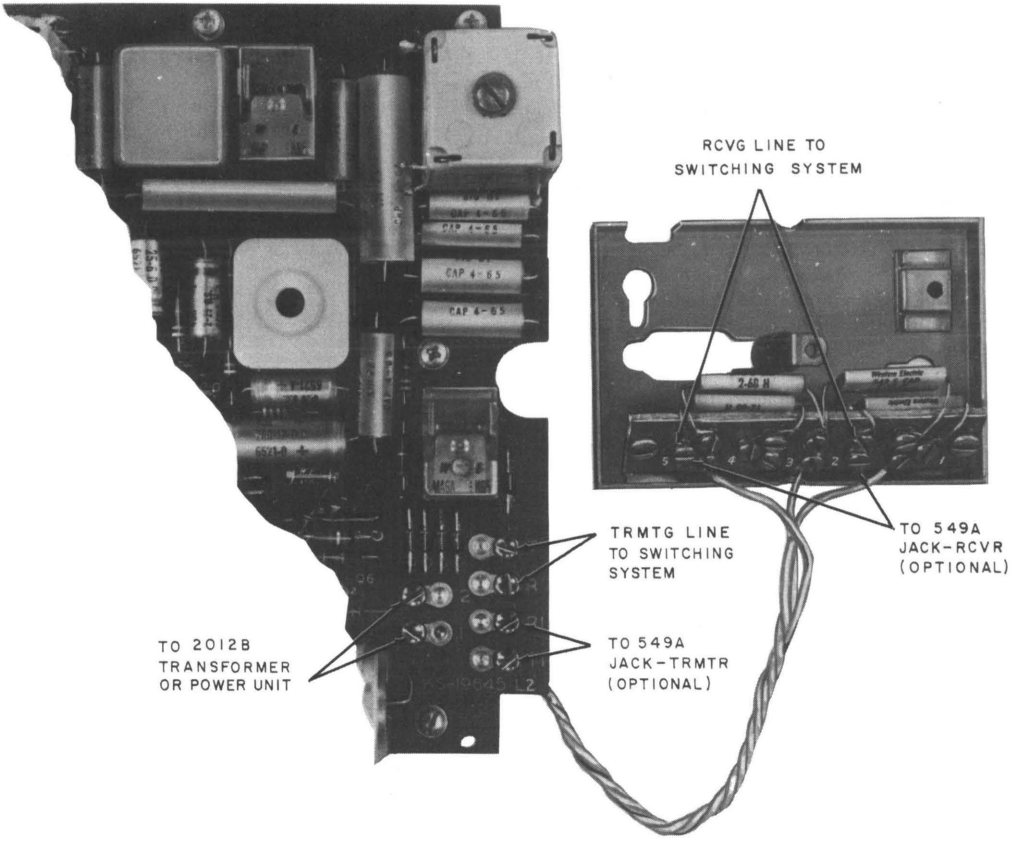


Fig. 3—KS-19645, List 4 Recorder Connector Modified For 4-Wire Use

- 1A, 1A1, or 1A2 Key Telephone System lines
- PBX switchboard attendant circuits (RCZ only)
- 100- and 101-type key equipment (RCZ only)
- PBX trunks (RTT and RC1 only)
- 4-wire circuits.

Recording on 4-wire circuits is on the receive side only. Transmit speech is recorded only when a sidetone circuit is provided as part of the 4-wire telephone circuit. This should be kept in mind when answering trouble reports and before replacing the recorder connector as being defective.

2.05 All new installations must use a 44A connecting block for the customer interface. For KS-19645, List 2 (MD) recorder connectors

currently in stock, the addition of the 44A connecting block can be accomplished by ordering a KS-19645, List 12 interconnecting cable. The KS-19645, List 6 (MD) recorder connector consists of a KS-19645, List 2 recorder connector factory-equipped with a KS-19645, List 12 interconnecting cable.◀

RESTRICTIONS FOR PCA RCZ

2.06 When a voice recorder is used on a telephone line, adequate notice must be given to both parties that their conversation is being recorded. This notice is provided by a recorder connector (PCA RCZ) which automatically produces a warning tone (beep) repeated at approximately 15-second intervals.

2.07 ▶The FCC has made two exceptions to the requirement for a tone warning: (1) for FCC licensed broadcasters when recording 2-way conversations for broadcast purposes; (2) for the U.S. Secret Service when involved with the President of the United States, his immediate family, or the White House grounds.

Where telephone service is used only in intrastate applications, other exceptions may be available for other emergency agencies such as municipal police or fire departments. When a service order is issued to disconnect the "beep-tone" on connecting arrangements, a service order remarks notation will be sufficient (eg, disconnect "beep tone" or reinstall RCZ without "beep tone").◀

Obtain approval from your supervisor before installing any recorder connector without warning tone (beep) unless specified on service order.

▶ORDERING GUIDE

All new installations must use a 44A connecting block for the customer interface.

(a) ***Basic Units:***

RCZ

- Connector, Recorder, KS-19645, List 4

or

- Connector, Recorder, KS-19645, List 6 (MD) (see 2.05)

RTT

- Connector, Recorder, KS-19645, List 4 "DR" modified tone per BSRS 455.205

or

- Connector, Recorder, KS-19645, List 6 (MD) "DR" modified tone per BSRS 455.205 (see 2.05)

RC1

- Connector, Recorder, KS-19645, List 4 (or List 6 MD) "RC1" modified tone per BSRS 455.205 (see 2.03 for List 4 and 2.05 for List 6)

4-Wire Service

- Connector, Recorder, KS-19645, List 4 "4-W" modified for 4-wire per BSRS 455.205

or

- Connector, Recorder, KS-19645, List 6 (MD) "4-W" modified for 4-wire per BSRS 455.205 (see 2.05)

(b) ***Associated Apparatus or Equipment (order separately)***

- Block, Connecting, 44A
- Transformer, 2012B-49 (Light Olive Gray or -50 Ivory), or
- Unit, Power, 19-Type (or equivalent, if required for multiple recorders—see 6.04)

(c) ***Optional Apparatus or Equipment (order separately if needed)***

- Adjuster, KS-19355, List 1 (used for adjusting inductor List 5)
- Backboard, KS-5796, List 7 (used to mount recorder connector on irregular wall surfaces)
- Capacitor, KS-13814, List 7 (three required—used to reduce radio interference)

Note: Additional apparatus may be required as a special assembly depending upon the specific use of recorder connector as shown in Table A. This apparatus may be determined from the figure references shown in Table A and from the following information:

- Multistation Circuit*, consisting of:

  Mounting, Apparatus, 15A (one each) Typical

  Cover, 116A (one per two 15A) Typical

  Unit, Telephone Key, 229B (one each per station)

  Unit, Telephone Key, 227B (one per three 229B KTUs)

  Unit, Telephone Key, 241B (one each)

  Diode, 400A (or equivalent—one per 227B KTU)

- Recorder Start Circuit, consisting of:

  Relay, KS-16626, List 12

- Inductor, 1542A (two required—used to reduce radio interference)

- Jack, 549A (used to connect modified 4-wire recorder connector to optional telephone or customer equipment)

- Network, KS-19645, List 11 (used to reduce line and background noise, Fig. 4).

* Components must be ordered separately and field-installed as required. Refer to Section 463-140-100 for apparatus mountings and covers.

(d) ***Replaceable Components***

- Cable, Interconnecting, KS-19645, List 12◀

DESIGN FEATURES

▶KS-19645, List 4 Recorder Connector, Unmodified (Fig. 1 and 2), and KS-19645, List 6 (MD) Recorder Connector, Unmodified◀

- Provide a high-impedance bridging connection to the station line. Not applicable for trunk service.

- Amplify audio transmission from the telephone line to the CP recorder with an option of automatic volume control (AVC) (wiring option Y).

- Generate a beep tone (wiring option X) at approximately 15-second intervals.

- Operate from 18 volts ac supplied from a separate 2012B transformer or from 24 volts dc when power is provided by a 19-type power unit (or equivalent).

- Have screw terminals for connecting the telephone line, the associated telephone set or line circuit, and the 2012B transformer.

- Provide 22 volts dc potential across interface leads ST1 and ST2 which may be used for start signal, if desired.

- Are designed for vertical mounting.

- Weigh approximately 4 pounds each.

- Measure 6-7/8 inches wide by 7-3/8 inches high and 3-3/8 inches deep.

- Suitable for stations equipped for TOUCH-TONE® dialing.

- Generate beep tone at a reduced level of −15 dBm to eliminate interference with TOUCH-TONE receivers.

- Delay the start of beep tone by 15 seconds to allow TOUCH-TONE calling without beep tone interference.

- ▶Five screw terminals replace the SK-M7/5-32S jack of the List 2 (MD) and are designated C3, C4, C2, C7, and G for ground. The screw terminals are connected to a 44A interface connecting block using inside wire (List 4 only).

- Consist of KS-19645, List 2 plus KS-19645, List 12 interconnecting cable. The cable is connected to a 44A interface connecting block (List 6 only).◀

→TABLE A←

SELECTION OF APPARATUS

TYPE OF SERVICE	SPECIFIC USE OF RECORDER CONNECTOR	TYPE TELEPHONE EQUIPMENT	FIG. NO. PER INSTALLATION	FIG. NO. PER STATION
RCZ	With voice recorder on individual CO or PBX line	500- or 2500-series telephone set	8, 27*	12
	With voice recorder to record on all lines terminated in *one* key set of 1A, 1A1, or 1A2 Key Telephone System	560-, 1560-, or 2600-series telephone set	8, 27*	13
		830-, 831-, 2830-, 2831-type telephone sets	8, 27*	17
		832-, 833-, 2832-, 2833-type telephone sets	8, 27*	18
		6040G key	8, 27*	23
	With voice recorder to record on all lines terminated in *two or more* key sets of 1A, 1A1, or 1A2 Key Telephone System	560-, 1560, 2500-series telephone set	8, 25†, 26, 27*	13, 24
		830-, 831-, 2830-, 2831-type telephone sets	8, 25†, 26, 27*	17, 24
		832-, 833-, 2832-, 2833-type telephone sets	8, 25†, 26, 27*	18, 24
	With voice recorder to record on all lines terminated in *one* attendant position	100- or 101-type key equipment position	8, 27*	19
		630- or 2630-type telephone set	8, 27*	14, 15, 16
	With voice recorder to record on all lines terminated in *two or more* attendant positions	100- or 101-type key equipment position	8, 25†, 26, 27*	18, 24
		630- or 2630-type telephone set		14, 15, 16
	With voice recorder on cord-type PBX (permanent installation)	Cord-type PBX attendant position	8, 25†, 27*	20, 21, 22‡
	With voice recorder on attendant position circuit, manual start provided	Cord-type PBX attendant position	8, 27*	21, 22‡
	With voice recorder on 4-wire line	Customer operated attendant consoles	11	
RTT	With CP timer as tone generator on telephone lines	300-, 500-, or 2500 series telephone sets or PBX	9	
RC1			10	

* Use Fig. 27 only when KS-19645, List 11 network is required for noise suppression.
† Use Fig. 25 when automatic start and stop of recorder is required.
‡ Fig. 22 provides connections for the 608-type PBX, but is typical of other PBXs.

KS-19645, List 4 ▶and List 6 (MD)◀ Recorder Connectors Modified for 440-Hz and for Use With a CP Call Duration Timer (PCA RTT, Fig. 1 and 2)

- Identified by "DR" stamped on the upper right-hand corner of the nameplate.
- Used as a customer-controlled tone generator—***not*** as a voice recorder connector.
- ▶Indicates telephone off-hook by contact closure between interface leads OH1 and OH2.◀
- Begins generating beep tone on the line shortly after receiving start signal from CP timer.
- Generates one 440-Hz beep tone lasting 1/2-second every 15 seconds as long as signal is provided by CP timer.
- ▶Tone is transmitted to both local and distant parties.◀
- Modified at the Distributing House per BSRS 455.205.

KS-19645, List 4 ▶and List 6 (MD)◀ Recorder Connectors Modified for "RC1" and for Use With a CP Call Duration Timer (PCA RC1, Fig. 1 and 2)

- Identified by "RC1" stamped on the upper right-hand corner of the nameplate and the lower right-hand corner of the printed circuit board.
- Used as a customer-controlled tone generator—***not*** as a voice recorder connector.
- Indicates telephone off-hook by voltage change across interface leads ST1 and ST2.
- Begins generating beep tone on the line shortly after receiving signal from CP timer.
- Generates a single 1400-Hz beep tone lasting approximately 1/2-second every 15 seconds as long as signal is provided by CP timer.
- ▶Generates tone to be heard by local party only.◀
- Modified at the Distributing House per BSRS 455.205. Recorder connectors, modified prior to April 1972, delay tone 15 seconds after signal by CP timer.

KS-19645, List 4 ▶and List 6 (MD)◀ Recorder Connectors Modified for 4-Wire Use (Fig. 3)

- Identified by "4-W" stamped on the upper right-hand corner of the nameplate.
- Provide an externally mounted unit which contains the connector terminals required for 4-Wire Switching System use.
- ▶Delay the start of beep tone approximately 15 seconds after ST1 and ST2 leads are closed at CP recorder; associated telephone set may be off hook.◀
- Modified at the Distributing House per BSRS 455.205.

KS-19645, List 11 Network (Fig. 4)

- Used if the telephone set associated with the recorder connector is in an acoustically noisy location so that the background noise being recorded does not reach an objectionable level during lulls in conversation. Under normal noise conditions, the hybrid-coil effect of the network is not needed. Also, the network is not intended to be used to correct noisy telephone lines.
- Reduces the near-end level and effect of room noise by approximately 15 dB at a sacrifice of approximately 3.5 dB insertion loss for the far-end talker.
- Provides an improvement of approximately 11.5 dB in signal-to-noise ratio of voice transmission from the far end.

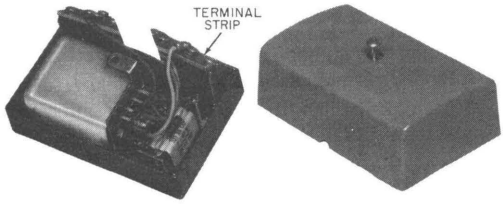


Fig. 4—KS-19645, List 11 Network

3. INSTALLATION

All new installations must use a 44A connecting block for the customer interface (see 2.05).

3.01 The location and method of installing the recorder connector shall be consistent with standard practices.

Connect KS-19645 recorder couplers to commercial power after all other installation work has been completed. The power cord shall not be passed through holes in walls or fastened to walls.

3.02 Determine that a solid vertical surface is available for the recorder connector and the 44A connecting block as close to the customer's equipment as possible. A solid surface is essential to prevent false relay operation.

3.03 Make certain the customer has an unused 115-volt ac outlet ***not*** under control of a wall switch for the power supply. When using standard inside wire, the distance between the transformer (or power unit) and recorder connector should not exceed 100 feet.

3.04 Install the KS-19645 type recorder connectors as follows:

(1) Remove cover.

(2) When installing a KS-19645, L1 (MD) or L2 (MD) recorder connector, position the recorder connector vertically so that the SK-M7/5-32S jack is at the bottom of the unit. When installing a List 4, position the recorder connector so the screw terminals are at the bottom of the unit (see Fig. 2).

(3) Secure unit to wall using appropriate fasteners for the type of wall surface. If necessary, use a KS-5796, List 7 backboard (see Ordering Guide). For installation of backboards, refer to Section 463-130-100 entitled Backboards, Identification and Installation.

(4) If installing a recorder connector modified for 4-wire use, mount the separate connector enclosure on the wall within the limits of the wiring furnished with the two units (Fig. 3).

(5) Run inside wiring for 2012B transformer (or 19-type power unit, or equivalent) to recorder connector.

(6) Connect CO lines (Fig. 2) or switching system lines (Fig. 3), and transformer leads. Terminate the mounting cord of the telephone set, if used, at the recorder connector or run additional wire to desired location. If needed, wire four leads to the 549A jack (Fig. 3). See Part 6.

(7) If the KS-19645, List 11 network (Fig. 4) is required, place it on a desk or fasten it to the wall. Wire the terminal strip as described in Part 6. Inside wire or cord may enter from the top or bottom.

(8) When installing KS-19645, L4 recorder connector, use approximately 20 inches of inside wire to connect recorder connector to 44A connecting block. Terminate inside wire on terminal strip as shown in Fig. 8 for RCZ, Fig. 9 for RTT, or Fig. 10 for RC1.

(9) After terminating inside wire on 44A connecting block, install straps (furnished with the unit) on the 44A connecting block as shown in Fig. 30.

(10) When installing a KS-19645, List 6 (MD) recorder connector, connect the KS-19645, List 12 interconnecting cable to the Cannon plug on the bottom of the recorder connector.

(11) When installing the KS-19645, List 6 (MD) recorder connector, terminate the other end of the List 12 cable and install straps on 44A connecting block as shown in Fig. 31.

(12) Select options as listed below.

RC1, RTT

No options required.

RCZ and 4-Wire Service

(a) All units are manufactured with option Y, AVC, installed (Fig. 2). AVC equalizes the level of speech between the recording station

and the distant station but does not affect the level on line. If the customer does not desire this feature or in 4-wire service, AVC may be disabled.

(b) To disable AVC, remove wire strap from terminals 5 and 6 (option Y) and turn the amplifier gain potentiometer R9 (Fig. 2) fully counterclockwise.

(c) To reactivate AVC, install wire strap between terminals 5 and 6 (option Y) and turn the amplifier gain potentiometer R9 (Fig. 2) clockwise to a point midway between numbers 2 and 3.

(d) The index for the potentiometer is the flat black part of the shaft end (Fig. 2).

(e) All units are manufactured with option X (terminals 3 and 4 strapped) beep tone installed (Fig. 2). Since the removal of this option disables the warning beep tone, ***do not remove it without permission from your supervisor,*** or unless it is specified on service order.

(f) If the customer desires beep tone to be recorded on his tape, turn the tuning slug of inductor L5 (Fig. 2) with a KS-19355, List 1 adjuster until a suitable beep tone level is produced across pins 3 and 4 of connector (Fig. 5).

Caution: To prevent damaging the tuning slug, do not use a screwdriver to adjust inductor L5.

(13) Make adjustments and checks as outlined in Part 5.

(14) Replace cover.

(15) The customer's wiring terminates on screw terminals 1, 4, 6, and 9 of the 44A connecting block as shown in Fig. 30.◀

4. OPERATION

4.01 ***KS-19645, List 1 (MD), List 2 (MD), ▶List 6 (MD),◀ and List 4 Recorder Connectors (RCZ):*** Indicate off-hook condition of associated telephone set by a voltage change from 0 volts to 22 volts dc on leads ST1 and ST2. Generate 1400-Hz beep tone ▶after approximately 15 seconds◀ and bridge leads TT and TR to the line when ST1 and ST2 leads are closed at the customer's recorder.

4.02 ***KS-19645 DR Recorder Connector Modified for 440-Hz (RTT) and for Use With CP Call Duration Timer:*** Indicates off-hook condition of associated telephone equipment by a contact closure between (screw terminals C2 and C3) leads OH1 and OH2. Generates 440-Hz beep tone shortly after associated telephone equipment is off-hook and the ST1 and ST2 leads are closed at the customer's timer.

4.03 ***KS-19645 RC1 Recorder Connector Modified Tone and for Use With CP Call Duration Timer:*** Indicates off-hook condition of associated telephone equipment by a voltage change from 0 volts dc to 22 volts on leads ST1 and ST2. Generates 1400-Hz beep tone immediately and every 15 seconds thereafter when associated telephone set is off-hook and the ST1 and ST2 leads are closed at the customer's timer.

4.04 ***KS-19645, List 2 (MD), ▶List 6 (MD),◀ and List 4 (4-W) Recorder Connectors Modified for 4-Wire Use:*** Generate 1400-Hz beep tone ▶approximately 15 seconds after the◀ ST1 and ST2 leads are closed at the CP recorder even if the customer's associated telephone equipment is not off-hook.

4.05 In the event of a commercial power failure, KS-19645 type recorder connector will not operate.

4.06 When the recorder connector is used to connect more than one station to the CP voice recorder, a multistation circuit is required. The basic circuit is shown in Fig. 26. The 229B and 227B KTUs function as a line circuit to connect the station to the recorder connector, and the 241B KTU functions as a lockout circuit by removing −24 volts from lead A to prevent other line circuits from operating. The pushbutton at each station is pushed to operate and pushed to release the recorder. When the pushbutton is first closed, the 227B relay operates and provides ground to operate relay AW which locks. The 227B relay and AW operated provide ground to operate relay A which locks under control of AW. The A relay operated removes battery from the 227B KTU which slowly releases. Release of the pushbutton removes shunt from the AZ relay which operates under control of AW and removes battery from

→TABLE C←

LINE, STATION, AND WIRING CONNECTION—KS-19645, LIST 2 (MD), LIST 6 (MD), OR LIST 4 RECORDER CONNECTOR MODIFIED FOR 4-WIRE USE (RCZ)

FUNCTION	DESIGNATION	TERMINALS ON:	
		PRINTED CIRCUIT BOARD	EXTERNAL TERMINAL STRIP
Line to 4-Wire Switching System (transmit)	TT	T	
	TR	R	
Line to 4-Wire Switching System (receive)	RT		2
	RR		4
To Telephone Set or Customer Equipment — TRMTR (optional)	T1	T1	
	R1	R1	
To Telephone Set or Customer Equipment — RCVR (optional)	T		2
	R		4
To 2012B Transformer or Power Unit	1 2	1 2	
Disable AVC	Remove wiring Option Y	Remove strap from 5 to 6	
Disable Beep Tone*	Remove wiring Option X	Remove strap from 3 to 4	
Line to 4-Wire Switching System (provides dc current)	Remove wiring Option Z	Cut two red jumpers adjacent to OH relay	

* Obtain supervisory permission before disabling beep tone unless specified on service order.

other circuits. The telephone set is now connected to the recorder through the A relay. The second operation of the pushbutton shunts relay AW which releases, and relay AZ stays operated through pushbutton ground; when the pushbutton is released, it releases AZ relay. AZ relay released removes ground from the A relay which releases and disconnects the recorder connector, removes lamp voltage, and stops the CP recorder.

4.07 For information on suppression of radio frequency interference (RFI) and noise, see 5.08 and 5.09.

4.08 Refer to CD- and SD-99414-01 for additional information on operation of KS-19645 type recorder connectors.

5. MAINTENANCE

▶KS-19645, List 1 (MD), List 2 (MD), List 6 (MD) or List 4 Recorder Connectors◀

5.01 ▶The primary difference between KS-19645, List 2 (MD) and KS-19645, List 4 or List 6 (MD) is the customer interface. For the List 2 the customer must have a Cannon SK-M7-21C-1/2 plug; while for the Lists 4 and 6, the customer must connect to a 44A connecting block.

5.02 Before checking operation, make certain that:

- ***For List 2 Only***—the customer's plug is wired as shown in Fig. 5, 6, or 7 (wiring the plug is the customer's responsibility).
- ***For Lists 4 and 6 Only***—The customer's wiring is properly terminated on the 44A connecting block as shown in Fig. 30 or 31.
- Connections and options are as required and as shown in Table B, C, D, or E.
- AC voltage (or dc voltage if powered by power unit) is present on screw terminals 1 and 2 of recorder connector.
- Telephone line is good.

5.03 To determine whether the recorder connector operates properly, perform the steps outlined below.

5.04 ***Unmodified and 4-Wire Modified Units (RCZ):***

(1) Disconnect plug from customer's equipment (List 2 only).

(2) Disconnect customer's leads from 44A connecting block (Lists 4 and 6).

(3) Connect a voltmeter across pins 2 and 7 in connector on unit (List 2 only). Zero volts should be indicated for unmodified units. (A nominal 22 volts should be indicated for 4-wire modified units.)

(4) Connect a voltmeter across screws 2 and 8 on 44A connecting block (Lists 4 and 6). Zero volts should be indicated for unmodified units. (A nominal 22 volts should be indicated for 4-wire modified units.)

(5) Go off-hook on the telephone associated with the recorder connector. (A nominal 22 volts should be indicated on the voltmeter.) If no voltage is present, recorder connector is defective and should be replaced.

(6) Establish a call to the local test desk or a nearby station.

(7) Remove voltmeter and strap pins 2 and 7 in connector on unit (List 2 only).

(8) Remove voltmeter and strap screws 2 and 8 on 44A connecting block (Lists 4 and 6).

(9) One 1400-Hz beep tone should be heard about every 15 seconds (except when X option is removed).

> ***Note:*** On TOUCH-TONE service installations, to avoid interference, make certain that the first beep tone from a List 2, 4, or 6 unit occurs no earlier than 15 seconds after the associated set goes off-hook. If no beep tone is heard (except when X option is removed), recorder connector is defective and should be replaced.

(10) Connect 1013A hand test (or equivalent) set across pins 3 and 4 of connector on unit (List 2 only).

(11) Connect 1013A hand test set (or equivalent) across screws 3 and 7 of 44A connecting block (Lists 4 and 6).

(12) Voice transmission from local test desk or nearby station should be heard in hand test set. Beep tone should be heard at very low level but should not be noticeable when normal speech signals are present (see 3.04[12][f]). If beep and voice transmission are not heard in hand test set receiver, recorder connector is defective and should be replaced.

(13) If tests are satisfactory, remove all test connections and reconnect customer's plug (List 2) or leads (List 4 or 6).

Recording on 4-wire is on the receive side only. Transmit speech is recorded only when a sidetone circuit is provided as a part of the 4-wire telephone circuit. This should be kept in mind when answering trouble reports and before replacing the recorder connector as being defective.

(14) When, in the judgment of repair personnel, the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

Do not attempt any tests or repairs on the CPE.

5.05 ***Modified 440-Hz (DR) Units (RTT):***

(1) Disconnect plug from customer's equipment (List 2 only).

(2) Disconnect customer's leads from 44A connecting blocks (Lists 4 and 6).

(3) Connect an ohmmeter or buzzer across pins 2 and 3 of connector on unit (List 2 only). Open circuit should be indicated.

(4) Connect an ohmmeter or buzzer across screws 7 and 8 on 44A connecting block (Lists 4 and 6). Open circuit should be indicated.

(5) Go off-hook with associated telephone set or seize WATS line. Continuity should be indicated by ohmmeter or buzzer. If no continuity is indicated, recorder connector is defective and should be replaced.

(6) Establish a call to nearby station, if possible, or to local test desk.

(7) Strap pins 5 and 7 in connector on unit (List 2 only).

(8) Strap screws 2 and 3 on 44A connecting block (Lists 4 and 6).

(9) 440-Hz beep tone should be heard by test desk and in local telephone set about every 15 seconds. If beep tone is not heard, recorder connector is defective and should be replaced.

(10) If tests are satisfactory, remove all test connections and reconnect customer's plug (List 2) or leads (List 4 or 6).

(11) When, in the judgment of repair personnel, the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

Do not attempt any tests or repairs on the CPE.

5.06 ***Modified Tone Units (RC1):***

(1) Disconnect plug from customer's equipment (List 2 only).

(2) Disconnect customer's leads from 44A connecting block (Lists 4 and 6).

(3) Connect a voltmeter across pins 2 and 7 of the connector on the unit (List 2 only). Zero volts should be indicated.

(4) Connect a voltmeter across screws 2 and 8 of the 44A connecting block (Lists 4 and 6). Zero volts should be indicated.

(5) Go off-hook with the associated telephone set or seize the WATS line. (A nominal 22 volts should be indicated on the voltmeter.) If no voltage is present, recorder connector is defective and should be replaced.

(6) Establish a call to the local test desk or a nearby station.

(7) Strap pins 2 and 7 of the connector (List 2 only). One 1400-Hz beep tone should be heard about every 15 seconds on the associated telephone set.

(8) Strap screws 2 and 8 on the 44A connecting block. One 1400-Hz beep tone should be heard about every 15 seconds on the associated telephone set.

(9) If beep tone is not heard, recorder connector is defective and should be replaced.

(10) At the test desk or nearby station, the 1400-Hz beep tone should not be noticeable.

(11) If tests are satisfactory, remove all test connections and reconnect customer's plug (List 2) or leads (List 4 or 6).

(12) When in the judgment of repair personnel the trouble is located in the CPE, the Repair Service Bureau should be notified so that proper Maintenance of Service Charge billing can be initiated as outlined in BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

Do not attempt any tests or repairs on the CPE.

5.07 To prevent trouble reports of constant beep tone on older models of List 1 recorder connector, disconnect, insulate, and store the lead on pin 5 on J1 (Cannon connector).◀

5.08 ***Radio Frequency Interference:*** RFI may occur at locations near radio transmitters. Because the normal gain of the unit is 25 dB, radio signals demodulated in associated telephone equipment or cables, or in the unit itself, may be amplified to objectionable levels. Should this occur, proceed with following steps until RFI ceases or reduces to a tolerable level.

(1) Connect three KS-13814, List 7 capacitors across the terminals of the unit as shown in Fig. 28.

(2) Connect two 1542A inductors as shown in Fig. 29.

(3) Add suppression devices to associated telephone sets.

Noise Suppression

5.09 Background noise at the local station may rise to objectionable levels on the line during lulls in conversation. When this occurs, install a KS-19645, List 11 network as shown in Fig. 27. If line noise pickup due to RFI common power supply, crosstalk, etc, is objectionable, ground the chassis of the recorder connector. Connect the ground wire to the cable clamp screw ▶for Lists 2 and 6 and to screw labeled G for List 4 (see Fig. 2, 27, and 28).◀

5.10 Noise in the output of the recorder connector, which occurs during the periods that relay BT is operated, may be caused by high-level longitudinal signals on the telephone line. This type of longitudinal induced noise is caused by the capacitance between ground and the transmission leads connecting terminals T1 and R1 (on the KS-19645) to the associated telephone set. Capacitance to ground can be minimized by locating the KS-19645 as close as possible to the telephone set. In the case of key telephones where capacitance between the transmission pair and ground is increased by the presence of other leads in the same cable which connect to grounded control circuits or lamp supplies, a separate cable may be used for the transmission pair to reduce capacitance to ground. When these suggested rearrangements of station wiring cannot be provided or do not provide sufficient noise reduction, a 285A inductor or 101-type protector should be installed between the telephone line and terminals T and R on the KS-19645 to suppress the longitudinal signals.

6. CONNECTIONS

6.01 Tables B, C, D, and E show line and station connections made on terminals of the unit.

6.02 Table A shows the selection of apparatus. Refer to Ordering Guide and figures as indicated in the table.

Protective Connecting Arrangements RTT (RTS) and RC1 (RC2) are not permitted on Centrex CO trunk applications.

6.03 For a functional schematic and circuit description of KS-19645 recorder connectors, see CD- and SD-99414-01.

6.04 A suitable dc power supply such as the 19-type may be used to supply multiple recorder connectors. ***Do not use a 2012B transformer for more than one KS-19645 recorder connector installation.*** The dc power supply should be of the current limiting type, or it should be connected through a 20-ohm, 1-watt resistor (a separate resistor for each coupler) to provide current limiting. The power supply may be connected with either polarity to terminals 1 and 2 of the recorder connector. Do not ground either terminal of the power supply. Power supply current drain is 0.070 ampere per recorder connector in operation and 0.010 ampere in the standby condition. The initial surge current is 1.0 ampere.

6.05 A multistation application of PCA RCZ is shown in Fig. 26. In this arrangement, one modified 241B KTU is required per arrangement and one 229B and 1/3 227B KTUs are required per station. A protective connecting arrangement for three stations would require one each 241B and 227B KTUs and three 229B KTUs. Additional stations would require one 229B KTU per station and one 227B KTU for each three or less stations. Provide a nonlocking pushbutton for each station and a lamp indicator per station with all lamps connected in multiple (Fig. 24). Automatic start-stop of the CP recorder may be direct or by control relay (Fig. 25) as required.

6.06 ***Connection Index:***

Table B—Line, Station, and Wiring Connections—KS-19645, List 1 (MD), List 2 (MD), List 6 (MD), or List 4, and Modified 440-Hz Recorder Connectors (RTT)

Table C—Line, Station, and Wiring Connections—KS-19645, List 2 (MD), List 6 (MD), or List 4 (4-W) Recorder Connector Modified for 4-Wire Use (RCZ)

Table D—Line, Station, and Wiring Connections—KS-19645, List 2 (MD), List 6 (MD), or List 4 Modified Tone Recorder Connector (RC1)

Table E—Line, Station, and Wiring Option Connections—KS-19645, List 2 (MD), List 6 (MD), or List 4 Recorder Connector Unmodified for RCZ

Fig. 5—Connections for Customer's SK-M7-21C-1/2 Plug from Voice Recorder (RCZ and 4-Wire Circuits) to KS-19645, List 2 Recorder Connector

Fig. 6—Connections for Customer's SK-M7-21C-1/2 Plug from Timer (RTT) to KS-19645, List 2 Recorder Connector

Fig. 7—Connections for Customer's SK-M7-21C-1/2 Plug from Timer (RC1) to KS-19645, List 2 Recorder Connector

Fig. 8—Connections for KS-19645, List 4 Recorder Connector and CP Recorder (RCZ)

Fig. 9—Connections for KS-19645, List 4 "DR" Recorder Connector (RTT)

Fig. 10—Connections for KS-19645, List 4 Recorder Connector (RC1)

Fig. 11—Connections for KS-19645, List 4 "4W" Recorder Connector (RCZ)

Fig. 12—Connections Using 500- or 2500-Series Telephone Sets (RCZ)

Fig. 13—Record on All Lines Terminated in 560-, 1560-, or 2560-Series Key Telephone Sets (RCZ Application)

Fig. 14—Record on All Lines Terminated in 630-, 631-, 636-, 637-, 2636-, and

2637-Type Key Telephone Sets (RCZ Application)

Fig. 15—Record on All Lines Terminated in 634-, 635-, 2634-, and 2635-Type Key Telephone Sets (RCZ Application)

Fig. 16—Record on All Lines Terminated in 630DA-, 631DA-, 2630DA-, and 2631DA-Type Key Telephone Sets (RCZ Application)

Fig. 17—Record on All Lines Terminated in 830-, 831-, 2830-, and 2831-Type Key Telephone Sets (RCZ Application)

Fig. 18—Record on all Lines Terminated in 832-, 2832-, 833-, and 2833-Type Key Telephone Sets (RCZ Application)

Fig. 19—Connections and Modifications Using 100- or 101-Type Key Units (RCZ Application)

Fig. 20—Connections to Attendant Telephone Circuit for Cord-Type PBX (RCZ Application)

Fig. 21—Connections to Attendant Telephone Circuit for 552- or 605-Type PBX (RCZ)

Fig. 22—Connections to Attendant Telephone Circuit for 608-Type PBX (RCZ Application)

Fig. 23—Connections Using 6040G Key (RCZ Application)

Fig. 24—Key and Lamp Circuit (RCZ Multistation Application)

Fig. 25—Recorder Start Circuit* (RCZ Multistation Application)

Fig. 26—Multistation Circuit* (RCZ Application)

Fig. 27—Connections Using KS-19645, List 11 Network (RCZ Application)

Fig. 28—Connections Using KS-19645, List 7 Capacitors (RCZ Application)

Fig. 29—Connections Using 1542A Inductors (RCZ Application)

Fig. 30—Connection of Inside Wire from KS-19645, List 4 Recorder Connector to 44A Connecting Block

Fig. 31—Connections for KS-19645, List 6 Recorder Connector to 44A Connecting Block

*Circuits must be field assembled, installed and connected. See Ordering Guide.

→TABLE B←

LINE, STATION, AND WIRING CONNECTIONS KS-19645, LIST 1 (MD), LIST 2 (MD), LIST 6 (MD), OR LIST 4, AND MODIFIED 440-HZ RECORDER CONNECTORS (RTT)

FUNCTION	DESIGNATION	TERMINALS ON PRINTED CIRCUIT BOARD
Line to CO	T	T
	R	R
2012B Transformer or Power Unit	1	1
	2	2
To Telephone Set, PBX, and/ or Key System	T	T1
	R	R1

→TABLE C←

LINE, STATION, AND WIRING CONNECTION—KS-19645, LIST 2 (MD), LIST 6 (MD), OR LIST 4 RECORDER CONNECTOR MODIFIED FOR 4-WIRE USED (RCZ)

FUNCTION	DESIGNATION	TERMINALS ON:	
		PRINTED CIRCUIT BOARD	EXTERNAL TERMINAL STRIP
Line to 4-Wire Switching System (Transmit)	TT	T	
	TR	R	
Line to 4-Wire Switching System (Receive)	RT		2
	RR		4
To Telephone Set or Customer Equipment-- TRMTR (Optional)	T1	T1	
	R1	R1	
To Telephone Set or Customer Equipment-- RCVR (Optional)	T		2
	R		4
To 2012B Transformer or Power Unit	1 2	1 2	

→TABLE D←

LINE, STATION, AND WIRING CONNECTIONS KS-19645, LIST 2 (MD), LIST 6 (MD), OR LIST 4 MODIFIED TONE RECORDER CONNECTOR (RC1)

FUNCTION	DESIGNATION	TERMINALS ON PRINTED CIRCUIT BOARD
Line to CO	T	T1
	R	R1
2012B Transformer or Power Unit	1	1
	2	2
To Telephone Set, PBX, and/ or Key System	T	T
	R	R

◆TABLE E◆

LINE, STATION, AND WIRING OPTION CONNECTIONS KS-19645, LIST 2 (MD), LIST 6 (MD), OR LIST 4 RECORDER CONNECTOR UNMODIFIED FOR RCZ

FUNCTION	DESIGNATION	TERMINALS ON PRINTED CIRCUIT BOARD
Line to CO	T	T
	R	R
2012B Transformer or Power Unit	1	1
	2	2
To Telephone Set, PBX, and/ or Key System	T	T1
	R	R1
Disable AVC	Remove wiring option Y	Remove strap from 5 to 6
Disable Beep Tone*	Remove wiring option X	Remove strap from 3 to 4

* Obtain supervisory permission before disabling beep tone or see service order.

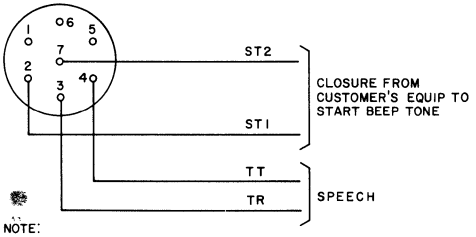


Fig. 5—Connections for Customer's SK-M7-21C-1/2 Plug From Voice Recorder (RCZ and 4-Wire Circuits) to KS-19645, List 2 (MD) Recorder Connector

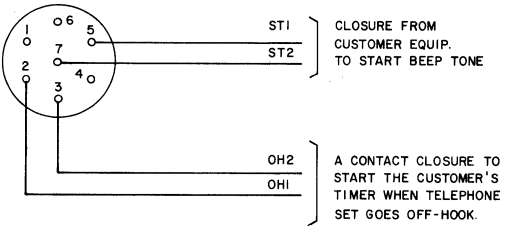


Fig. 6—Connections for Customer's SK-M7-21C-1/2 Plug From Timer (RTT) to KS-19645, List 2 (MD) Recorder Connector

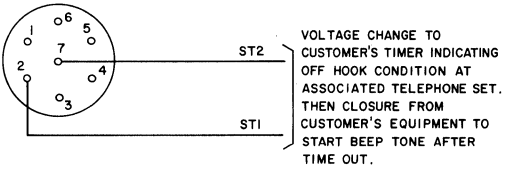


Fig. 7—Connections for Customer's SK-M7-21C-1/2 Plug From Timer (RC1) to KS-19645, List 2 (MD) Recorder Connector

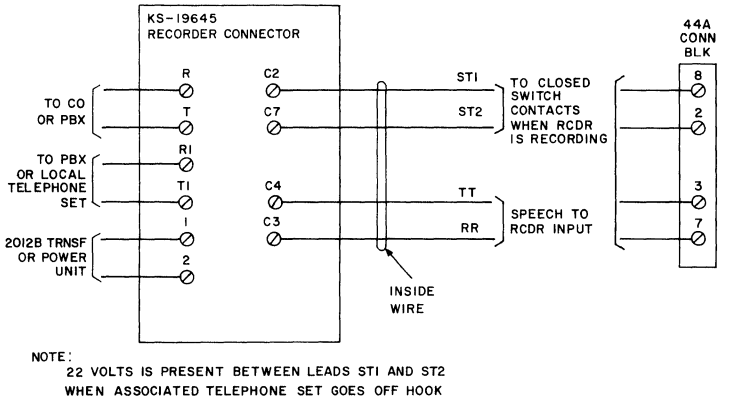


Fig. 8—Connections for KS-19645, List 4 Recorder Connector and CP Recorder (RCZ)

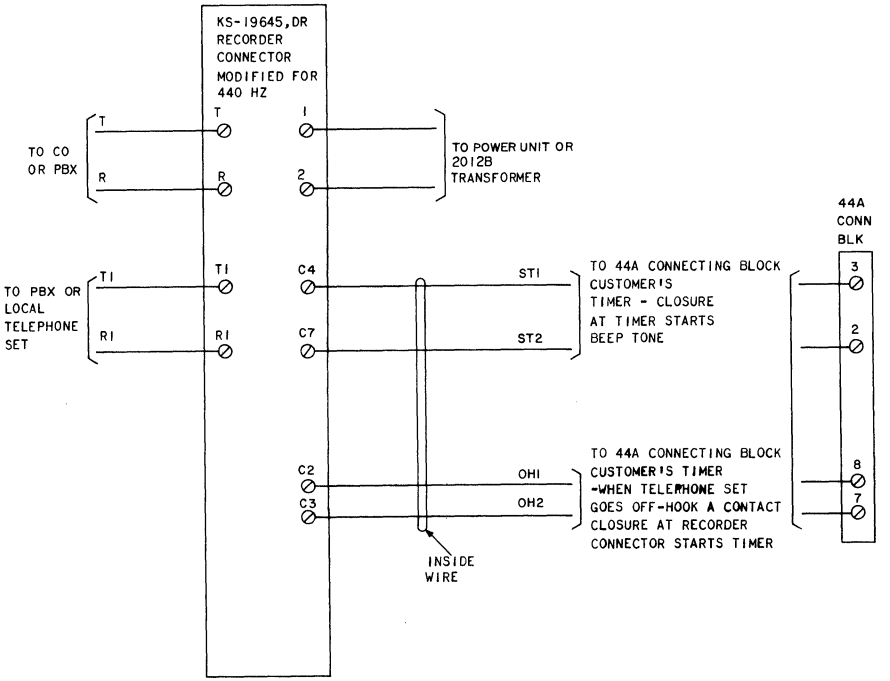


Fig. 9—Connections for KS-19645, List 4 "DR" Recorder Connector (RTT)

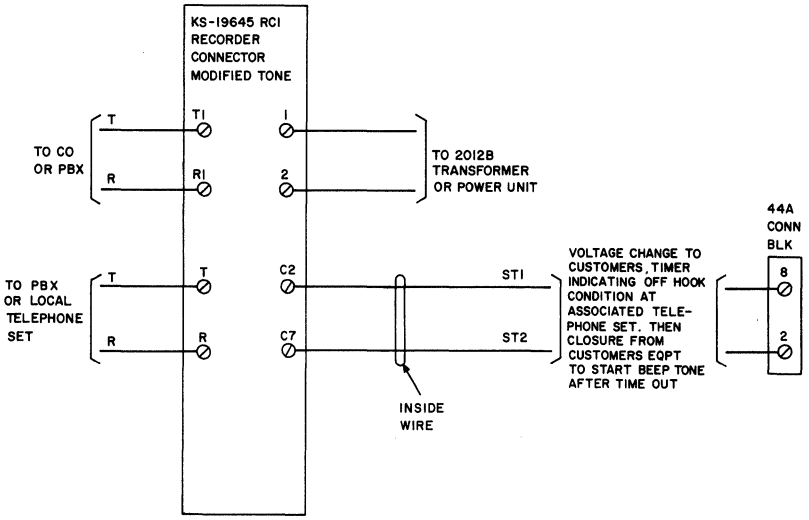


Fig. 10—Connections for KS-19645, List 4 "RC1" Recorder Connector (RC1)

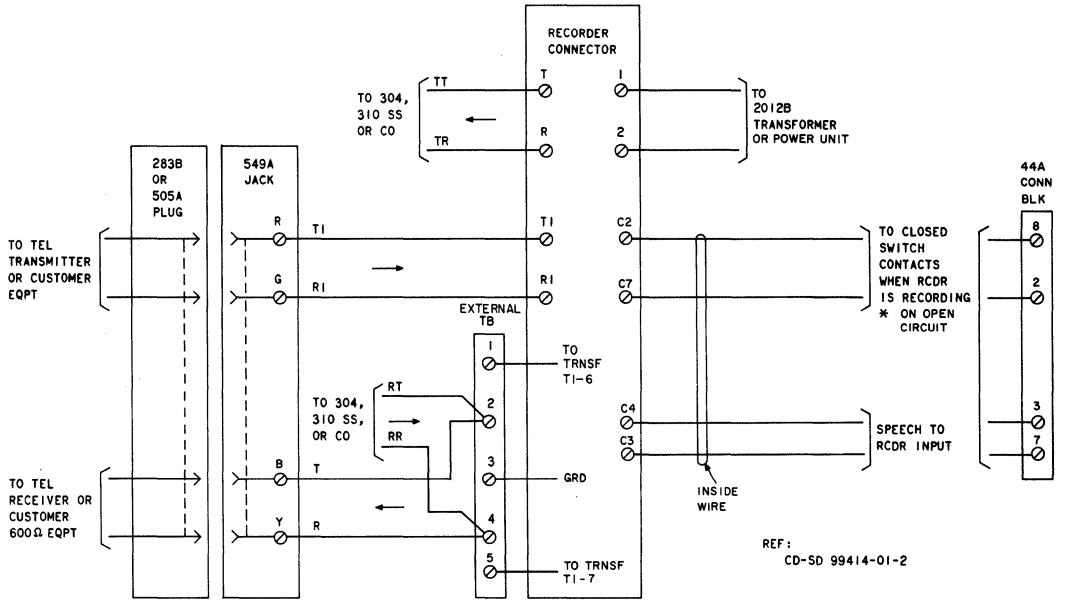


Fig. 11—Connections for KS-19645, List 4 "4W" Recorder Connector (RCZ)

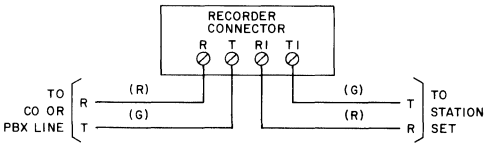


Fig. 12—Connections Using 500- or 2500-Series Telephone Sets (RCZ)

WIRE OR LEAD	565GK		1565GK, 2565GK		565HK		1565HK, 2565HK		565LK		1565LK, 2565LK	
	REMOVE FROM	CONN TO	REMOVE FROM	CONN TO	REMOVE FROM	CONN TO	REMOVE FROM	CONN TO	REMOVE FROM	CONN TO	REMOVE FROM	CONN TO
(G) KEY LEAD	F	ET	L2	ET	F	ET	L2	ET	F	ET	L2	ET
(G) [S-Y] LINE SWITCH	N	EB	9*	EB	9*	EB	9*	EB	9*	EB	9*	EB
ADD STRAPS		F TO EH * 9 TO ER		F TO EH * 9 TO ER		F TO EH * 9 TO ER		F TO EH * 9 TO ER		F TO EH * 9 TO ER		F TO EH * 9 TO ER

* TERMINAL N IF SET IS MODIFIED FOR 1A KTS

NOTE:
THIS IS A TYPICAL EXAMPLE USING 565 HK KEY TELEPHONE SET. REFER TO PARTICULAR TELEPHONE SET CONNECTIONS TO DETERMINE EQUIVALENT TERMINALS. USE EXCLUSION TYPE SETS TO PROVIDE SUFFICIENT CORD CONDUCTORS AND CONNECTION POINTS. EXCLUSION FEATURE CANNOT BE USED WITH THIS ARRANGEMENT IF 3-TYPE SPEAKERPHONE IS PROVIDED, MOVE (G-V) MTG CORD LEAD TO TERM. EB ALSO.

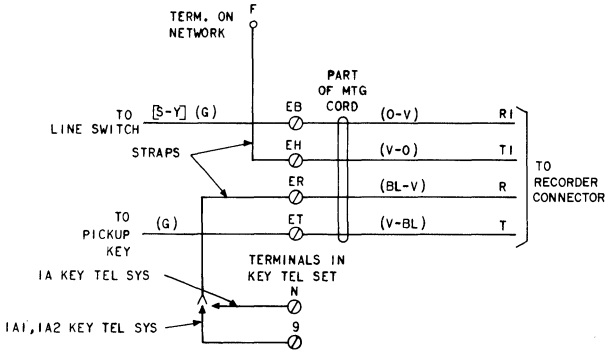
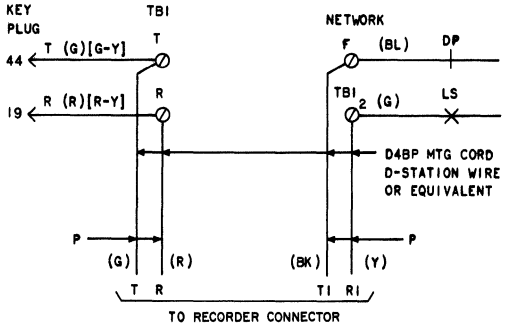


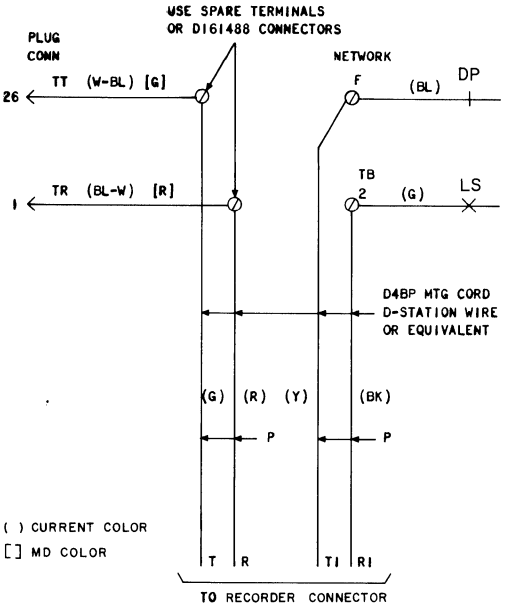
Fig. 13—Record on All Lines Terminated in 560-, 1560-, or 2560-Series Key Telephone Sets (RCZ Application)



NOTE:
CONNECTIONS SHOWN ARE FOR 630 OR 631 TYPE TELEPHONE SET. REFER TO PARTICULAR TELEPHONE SET CONNECTIONS TO DETERMINE EQUIVALENT TERMINALS.

WIRE OR LEAD	630, 631, 636, 637		2636 2637	
	REMOVE FROM	CONNECT TO	REMOVE FROM	CONNECT TO
(V-BL)	F AND T	STORE	4 AND T	STORE
(BL-V)	2 AND R	STORE	2 AND R	STORE
(G) MTG CORD LEAD	—	T ON TBI	—	T ON TBI
(R) MTG CORD LEAD	—	R ON TBI	—	R ON TBI
(BK) MTG CORD LEAD	—	F ON NET	—	4 ON TBI
(Y) MTG CORD LEAD	—	2 ON TBI	—	2 ON TBI

Fig. 14—Record on All Lines Terminated in 630-, 631-, 636-, 637-, 2636-, and 2637-Type Key Telephone Sets (RCZ Application)

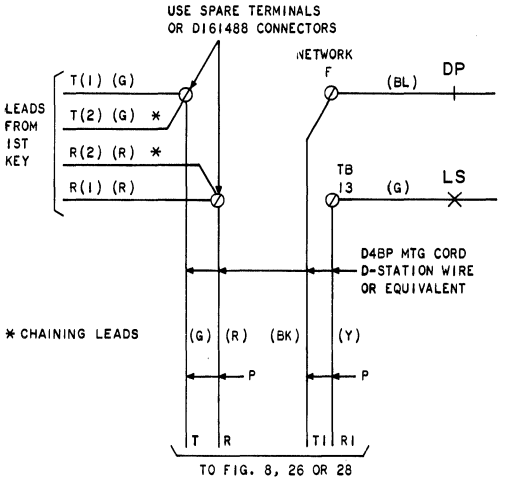


NOTE:
CONNECTIONS SHOWN ARE FOR 634 OR 635 TYPE TELEPHONE SET. REFER TO PARTICULAR TELEPHONE SET CONNECTIONS TO DETERMINE EQUIVALENT TERMINALS.

WIRE OR LEAD	634D, 635D 2634, 2635		634DA, 635DA		2634DA, 2635DA	
	REMOVE FROM	CONNECT TO	REMOVE FROM	CONNECT TO	REMOVE FROM	CONNECT TO
(W-BL)TT	F ON NET	* (G) MTG CORD	F ON NET	* (G)MTG CORD	L2 ON NET	* (G)MTG CORD
(BL-W)TR	2 ON TB	* (R)MTG CORD	I3 ON TB	* (R)MTG CORD	I3 ON TB	* (R)MTG CORD
(Y)MTG CORD LEAD	—	F ON NET	—	F ON NET	—	L2 ON NET
(BK)MTG CORD LEAD	—	2 ON TB	—	I3 ON TB	—	I3 ON TB

* USE D161488 CONNECTORS OR SPARE TERMINALS.

Fig. 15—Record on All Lines Terminated in 634-, 635-, 2634-, and 2635-Type Key Telephone Sets (RCZ Application)

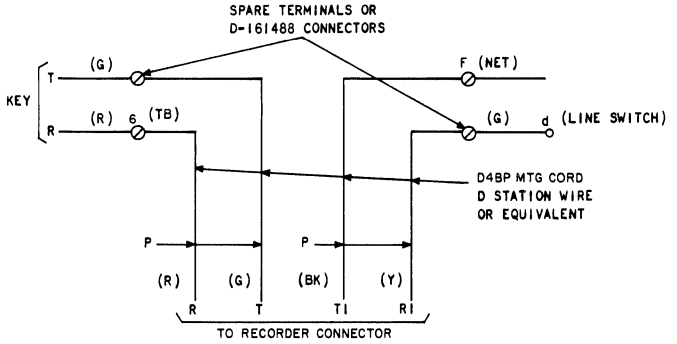


NOTE:
CONNECTIONS SHOWN ARE FOR 630DA OR 631DA TYPE TELEPHONE SET. REFER TO PARTICULAR TELEPHONE SET CONNECTIONS TO DETERMINE EQUIVALENT TERMINALS. CHAINING T AND R LEADS FROM FIRST KEY MUST BE MOVED TO SAME POINT AS T(1) AND R(1) LEADS.

WIRE OR LEAD	630DA, 631DA		2630DA, 2631DA	
	REMOVE FROM	CONNECT TO	REMOVE FROM	CONNECT TO
(G) T(1) T(2)	F ON NET	(G)* MTG CORD	12 ON TB	(G)* MTG CORD
(R) R(1) R(2)	13 ON TB	(R)* MTG CORD	13 ON TB	(R)* MTG CORD
(BK) MTG CORD LEAD	—	F ON NET	—	12 ON TB
(Y) MTG CORD LEAD	—	13 ON TB	—	13 ON TB

* USE D161488 CONNECTORS OR SPARE TERMINALS

Fig. 16—Record on All Lines Terminated in 630DA-, 631DA-, 2630DA-, and 2631DA-Type Key Telephone Sets (RCZ Application)

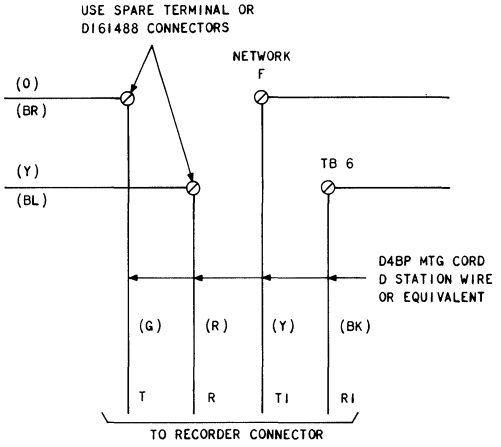


NOTE:
CONNECTIONS SHOWN ARE FOR 830-TYPE KEY TELEPHONE SET, REFER TO PARTICULAR TELEPHONE SET CONNECTIONS FOR EQUIVALENT TERMINALS.

WIRE OR LEAD	830		831		2830, 2831	
	REMOVE FROM	CONNECT TO	REMOVE FROM	CONNECT TO	REMOVE FROM	CONNECT TO
(G) KEY LEAD	F (NET)	(G) * MTG CORD	—	—	—	—
(G) LINE SWITCH	6 (TB)	(Y) * MTG CORD	6 (TB)	(Y) * MTG CORD	6 (TB)	(Y) X MTG CORD
(G) 353CA DIAL	—	—	—	—	8 (TB)	(BK) X MTG CORD
(R) MTG CORD	—	6 (TB)	—	6 (TB)	—	6 (TB)
(BK) MTG CORD	—	F (NET)	—	F (NET)	—	—
(G) MTG CORD	—	—	—	8 (TB)	—	8 (TB)
(G) WIRE	—	—	F AND 8	STORE	—	—

* USE SPARE TERMINAL OR D-161488 CONNECTOR

Fig. 17—Record on All Lines Terminated in 830-, 831-, 2830-, and 2831-Type Key Telephone Sets (RCZ Application)



WIRE	832, 2832 833, 2833		REMARKS
	REMOVE FROM	CONNECT TO	
O	F OF NET	* (G) MTG CORD	MOVE (O) TEL SET LEAD WHEN TEL SET NOT EQUIPPED WITH PRIVACY FEATURE
BR	F OF NET	* (G) MTG CORD	MOVE (BR) LEAD OF PRIVACY BOARD WHEN TEL SET IS EQUIPPED WITH PRIVACY FEATURE
Y	6 ON TB	* (R) MTG CORD	MOVE (Y) TEL SET LEAD WHEN TEL SET NOT EQUIPPED WITH PRIVACY FEATURE
BL	6 ON TB	* (R) MTG CORD	MOVE (BL) LEAD OF PRIVACY BOARD WHEN TEL SET IS EQUIPPED WITH PRIVACY FEATURE

* USE D161488 CONNECTORS OR SPARE TERMINAL

Fig. 18—Record on All Lines Terminated in 832-, 2832-, 833-, and 2833-Type Key Telephone Sets (RCZ Application)

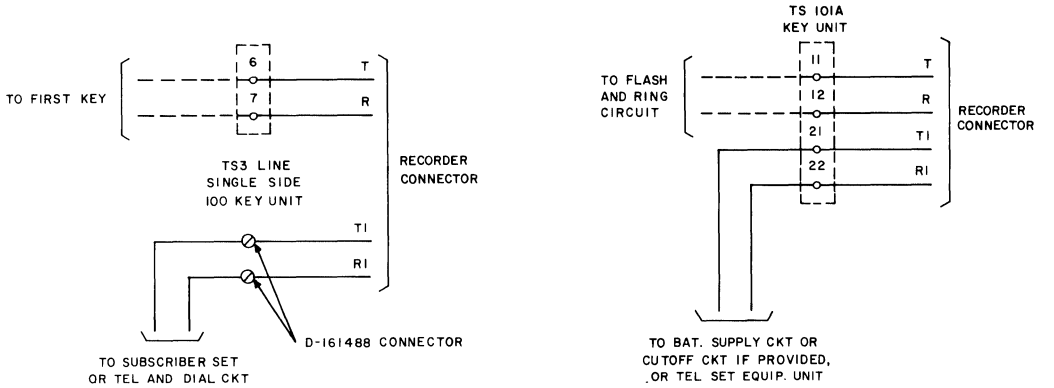
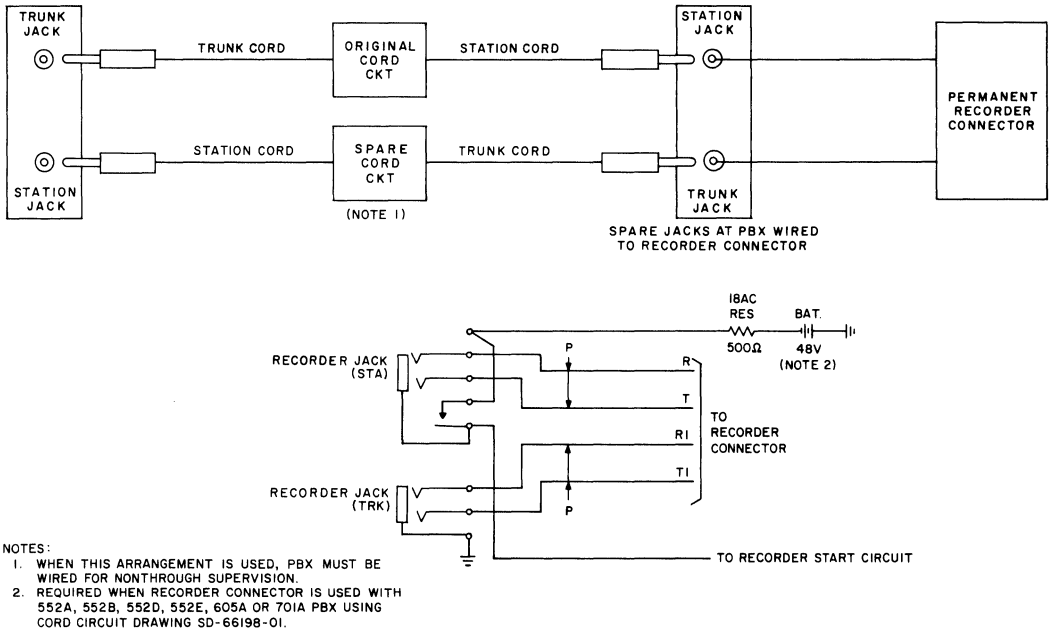


Fig. 19—Connections and Modifications Using 100- or 101-Type Key Units (RCZ Application)



NOTES:
1. WHEN THIS ARRANGEMENT IS USED, PBX MUST BE WIRED FOR NONTHROUGH SUPERVISION.
2. REQUIRED WHEN RECORDER CONNECTOR IS USED WITH 552A, 552B, 552D, 552E, 605A OR 701A PBX USING CORD CIRCUIT DRAWING SD-66198-01.

Fig. 20—Connections to Attendant Telephone Circuit for Cord-Type PBX (RCZ Application)

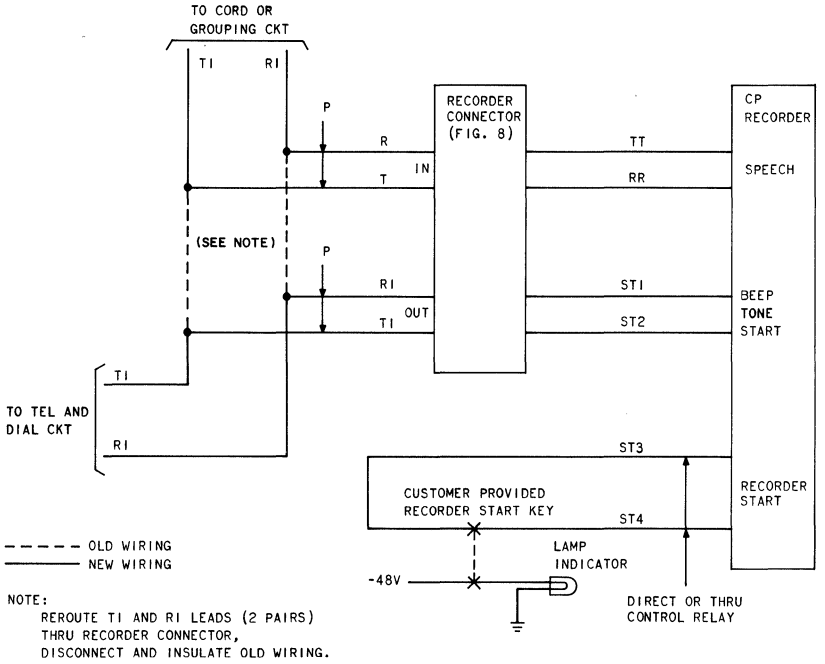


Fig. 21—Connections to Attendant Telephone Circuit for 552- or 605-Type PBX (RCZ Application)

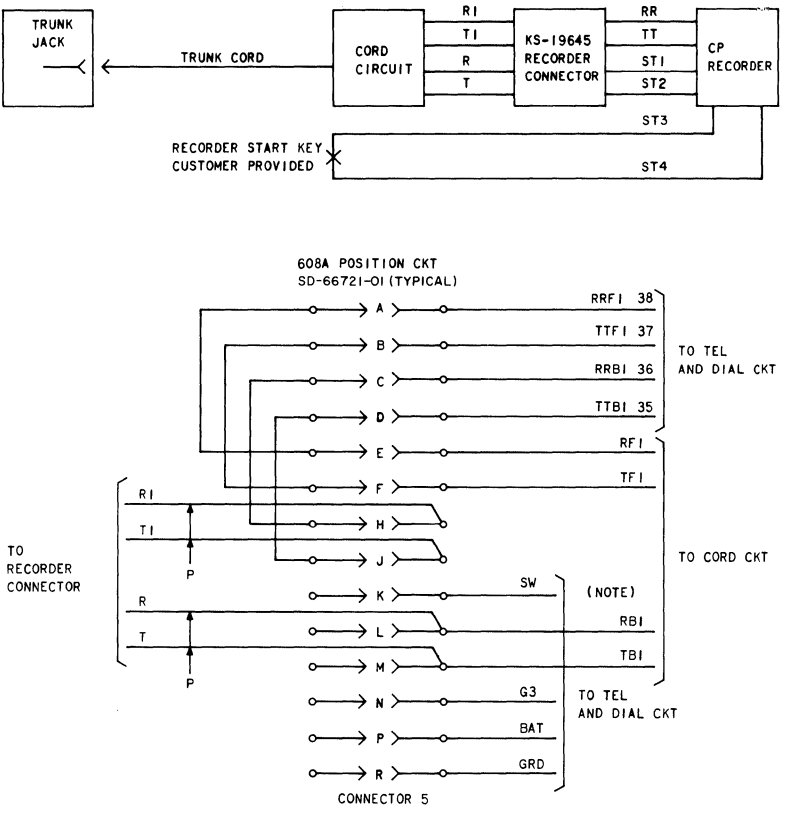


Fig. 22—Connections to Attendant Telephone Circuit for 608-Type PBX (RCZ Application)

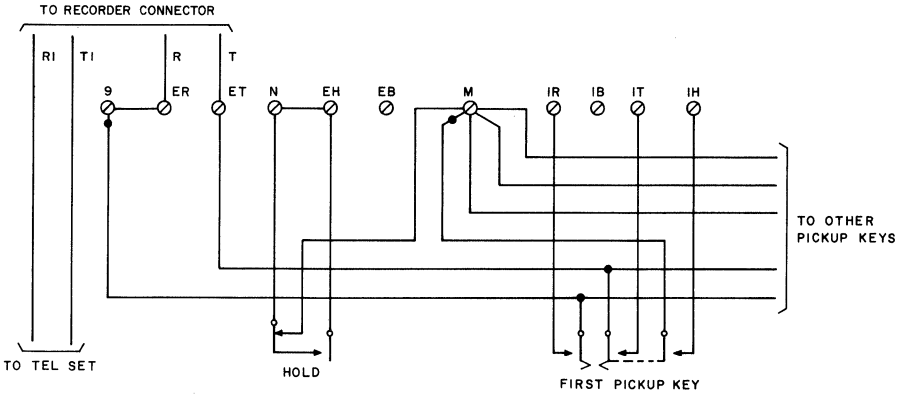


Fig. 23—Connections Using 6040G Key (RCZ Application)

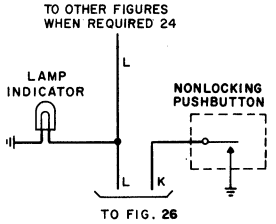


Fig. 24—Key and Lamp Circuit (RCZ Multistation Application)

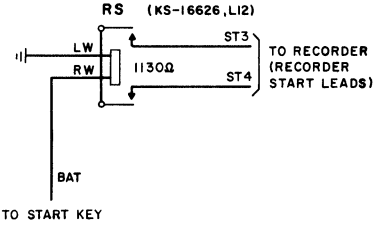


Fig. 25—Recorder Start Circuit (RCZ Application)

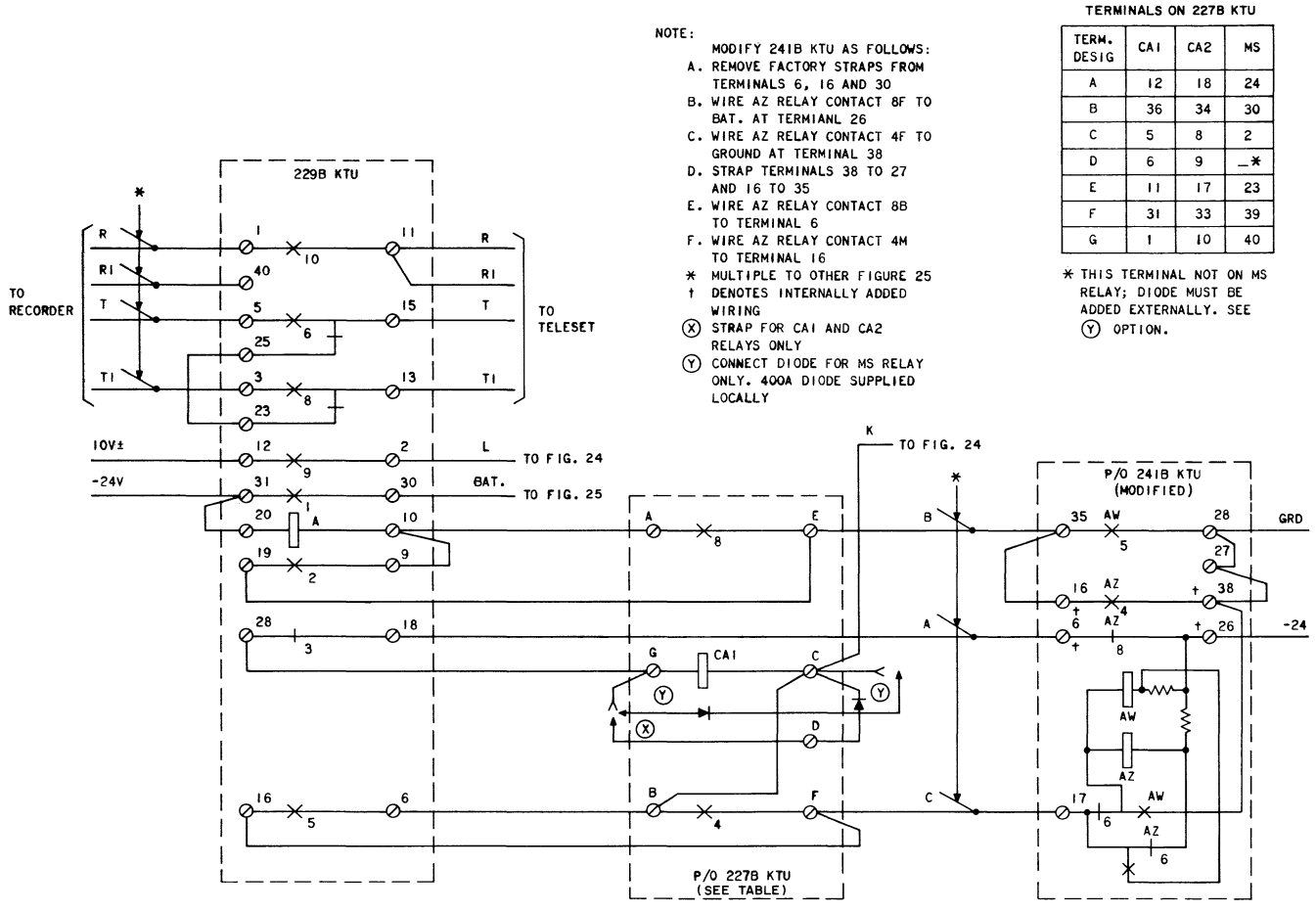


Fig. 26—Multistation Circuit (RCZ Application)

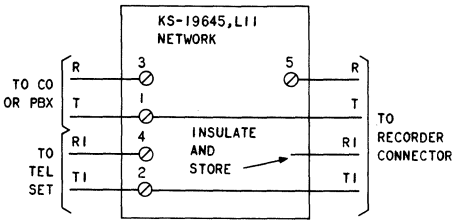


Fig. 27—Connections Using KS-19645, List 11 Network (RCZ Application)

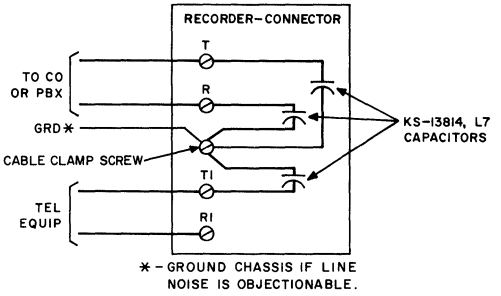
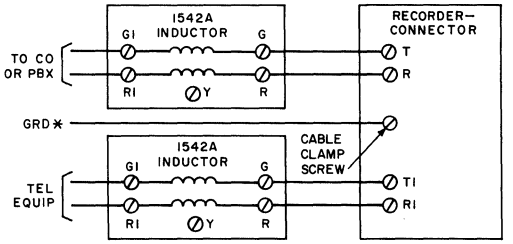


Fig. 28—Connections Using KS-13814, List 7 Capacitors (RCZ Application)



NOTE:
CAPACITORS MAY ALSO BE ADDED IN SAME MANNER AS SHOWN IN FIG. 28 TO OBTAIN ADDITIONAL SUPPRESSION.

* - GROUND CHASSIS IF LINE NOISE IS OBJECTIONABLE.

Fig. 29—Connections Using 1542A Inductors (RCZ Application)

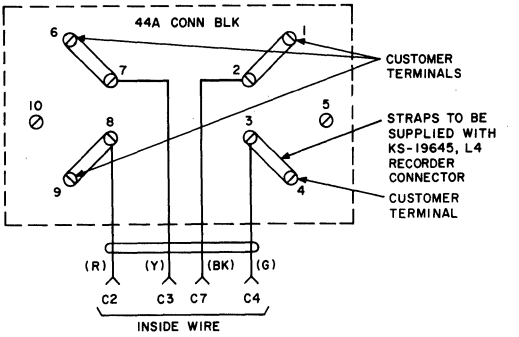


Fig. 30—Connection of Inside Wire From KS-19645, List 4 Recorder Connector to 44A Connecting Block

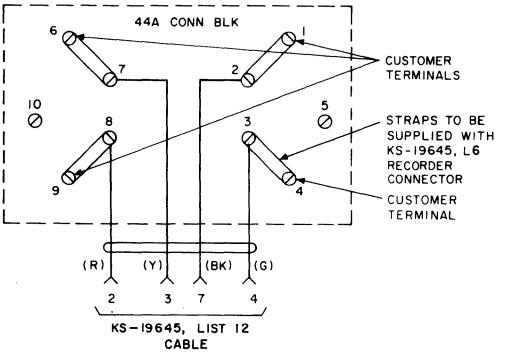


Fig. 31—Connection of KS-19645, List 12 Cable From the KS-19645, List 6 Recorder Connector to the 44A Connecting Block