# PROTECTIVE CONNECTING ARRANGEMENTS

# SU6AQ AND STS

# KS-20721 STATION COUPLER

## 1. GENERAL

**1.01** This section provides identification, installation, operation, maintenance and connection information for the KS-20721, List 1 and List 3 general purpose station couplers which are used to connect customer-provided (CP) alarm systems in Protective Connecting Arrangements (PCA) SU6AQ and STS. (Suffixes AV, QT, and VT have been deleted.)

**1.02** This section is reissued to:

- Rate KS-20721, List 11 pulse corrector MD and remove references to its use
- Revise Tables A, B, and C
- Change Fig. 3, 5, 6, 7, and 8
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA)
- Add current drain requirements to 3.09.

**1.03** The KS-20721 station coupler (Fig. 1) is used to provide services similar to those provided by the KS-20008 control unit (MD) and the KS-20445, List 1 control unit for alarm systems. However, the plug and wiring connections may be different and substitution should not be made without customer approval.

**1.04** The customer should be informed by the manufacturer or supplier of the equipment of the proper PCA to be used with his equipment.

**1.05** If the customer wants a copy of the Technical Reference which covers any of the above PCAs, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

**1.06** ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 5 of this section indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

**1.07** The KS-20721 station coupler is a general purpose station coupler used with several PCAs. Only the features and options applying to the arrangements shown in Table A are covered. Avoid alteration of the PCA to provide services other than design intent.

**1.08** ***Protective Connecting Arrangement SU6AQ:*** This connecting arrangement is intended to connect customer-provided equipment (CPE) capable of either originating or receiving calls, or both, and typically providing alarm systems to the telecommunication network.

**1.09** ***Protective Connecting Arrangement STS:*** This connecting arrangement is typically used with CP alarm systems that transmit supervisory tones.

**1.10** An associated telephone company telephone set may make a normal outgoing call with any of the arrangements if the station coupler is not in operation.

**1.11** The KS-20721, List 15 test set may be used to test the station coupler.

**1.12** This issue of the section is based on the following drawing:

SD-69903-01, Issue 5B—KS-20721 Station Coupler

If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing,

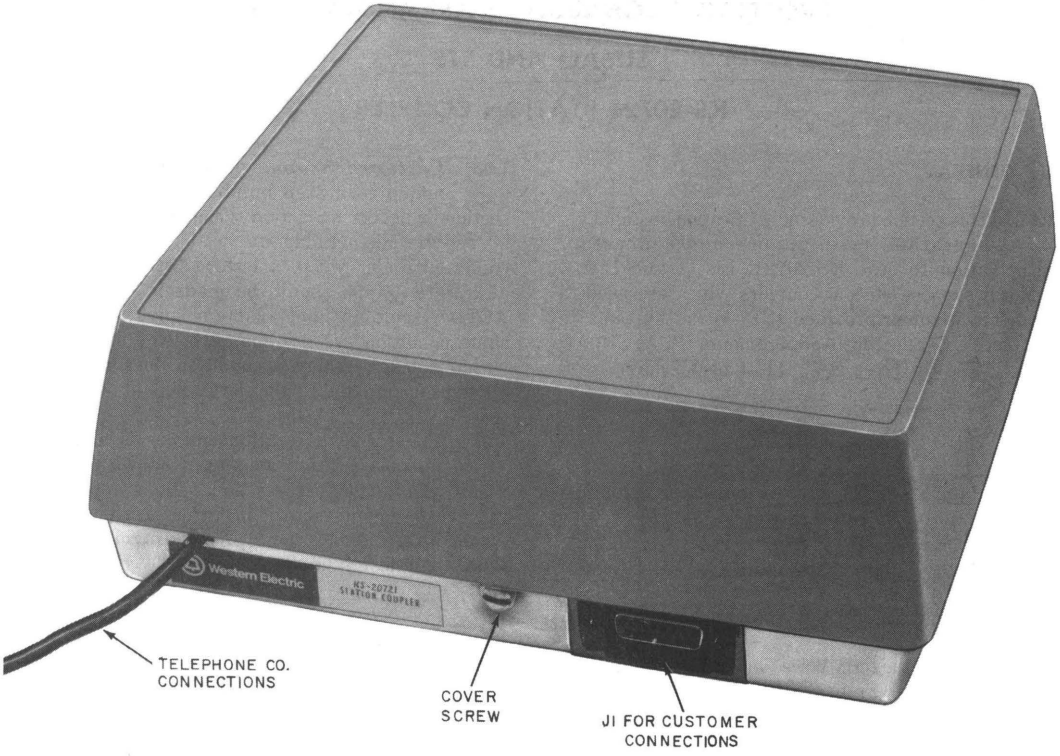



**Fig. 1—KS-20721, List 1 or List 3 Station Coupler**

**TABLE A**

**OPTION TABLE §**

| PROTECTIVE CONNECTING ARRANGEMENT | TYPICAL CUSTOMER PROVIDED EQUIPMENT | KS-20721 STATION COUPLER LIST NO. | REQUIRED WIRING OPTIONS* |
|---|---|---|---|
| SU6AQ | Alarm Systems | List 1 | Q‡, R, Z‡ |
| STS | Alarm System With Tone Signaling | List 3† | Q‡, R, T, Z‡ |

* Features described in Table C.

† List 3 consists of Lists 1, 10, and 13.

‡ Options Q and Z are factory-wired.

§ Never provide more than required wiring options.

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 various types of CPE to the telephone line
- To limit excessive levels from CPE, to provide protection for telephone company personnel and facilities against hazardous voltages, to insure longitudinal balance, and to provide for network control signaling.

### APPLICATION

- Used to connect a CP alarm system to a central office (CO) exchange line or PBX station line.

### ORDERING GUIDE

*Basic Units*

- Coupler, Station, KS-20721, L1 (Fig. 1 and 2). Used for PCA SU6AQ.
- Coupler, Station, KS-20721, L3 (Fig. 3). Used for PCA STS. The L3 comes factory-wired with the three units listed below. These three units may also be ordered separately and assembled in the field. (See 2.03 and 2.04.)

  Coupler, Station, KS-20721, L1

  Assembly, Hinge, KS-20721, L10 (Fig. 3)

  Limiter, KS-20721, L13 (Fig. 4)

**2.01** If coupler is to be powered by telephone company, provide:

- Transformer, 2012B (one per coupler)

  or

- Unit, Power, 19-type (or equivalent dc supply) when required for multiple coupler installations—see 3.09.

*Associated Apparatus*

- Set, Test, KS-20721, L15 (Fig. 5)—see 2.06.
- Set, Test, Hand, 1013A (or equivalent).
- Battery, KS-6571 (or equivalent)—required for testing if coupler is powered by CPE.
- Tool, KS-19192, L1 (not required on later model units which have slotted screws).

### DESIGN FEATURES

**2.02** Protective Connecting Arrangements SU6AQ and STS provide the following features:

- DC isolation and high-voltage surge protection
- 20-Hz ringing detection
- Network control signaling (off-hook, dial pulse, tone address signaling, and disconnect)
- 2-way voice transmission
- AC or DC powered
- Can be powered by either telephone company or CP power supply.

**2.03** The KS-20721, List 1 station coupler (Fig. 2) is the basic unit which can be field equipped with a KS-20721, List 10 hinge assembly for mounting the optional circuit pack (Fig. 3). The circuit pack is equipped with quick connectors for easy installation.

**2.04** The KS-20721, List 3 station coupler consists of a KS-20721, List 1 station coupler with a KS-20721, List 10 hinge assembly and KS-20721, List 13 limiter (Fig. 4), factory-installed.

**2.05** The KS-20721, List 13 limiter circuit protects the telephone facilities from excessive tone signal levels from the CPE. Average power limiting is achieved by a photoresistor shunting the transmission path. A level detector drives current through the lamp controlling the photoresistor when the signal amplitude goes above −10 dBm. The List 13 limiter is added to the List 1 coupler by providing option T as shown in Table B.

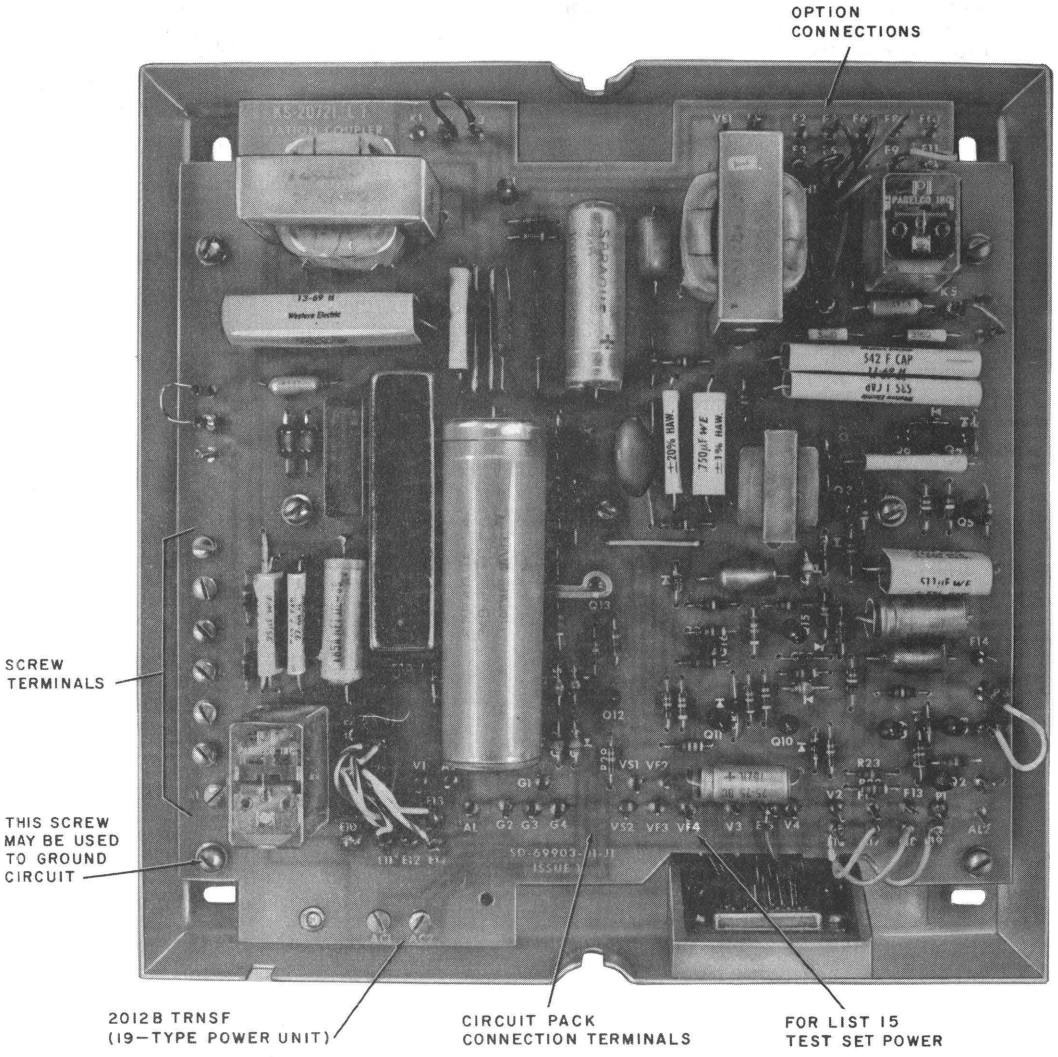



**Fig. 2—KS-20721, List 1 Station Coupler, Cover Removed, Used With PCA SU6AQ**

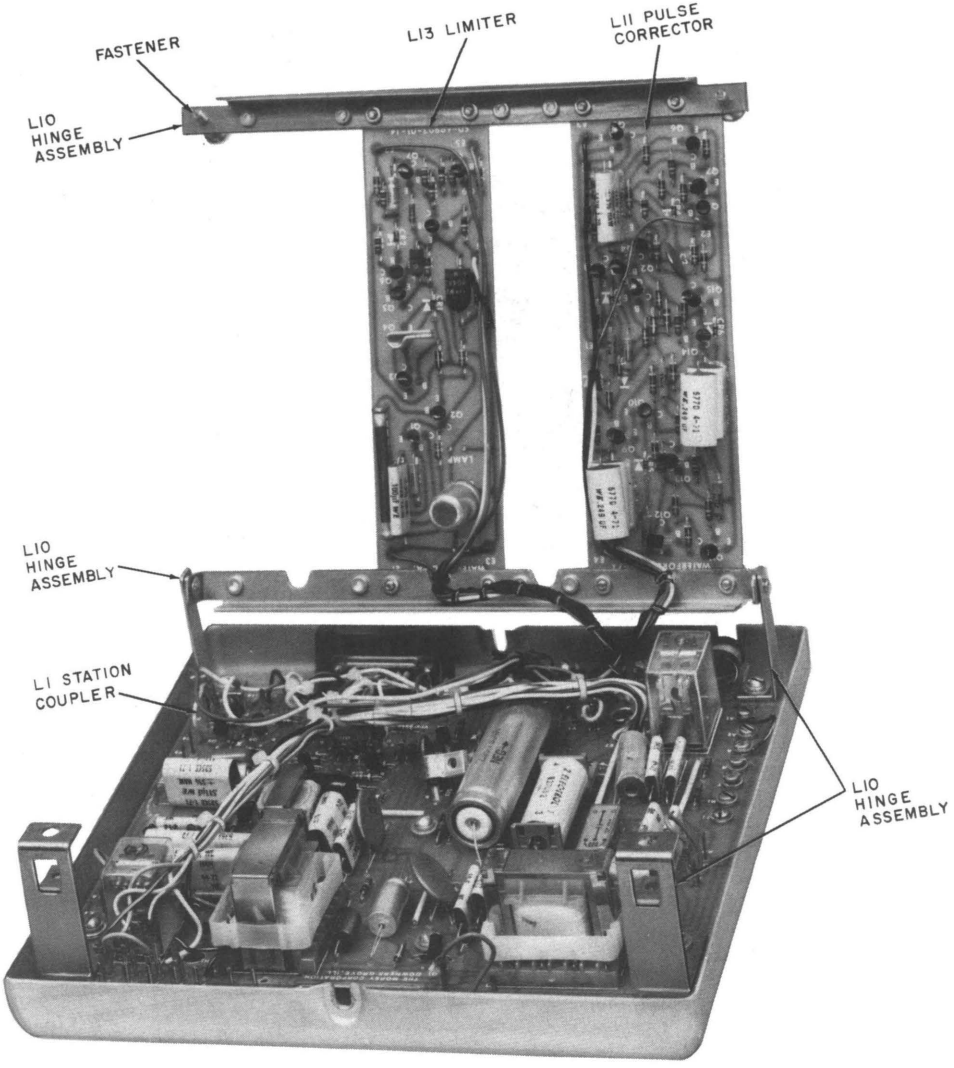



Fig. 3—KS-20721, List 3 Station Coupler Used With PCA STS

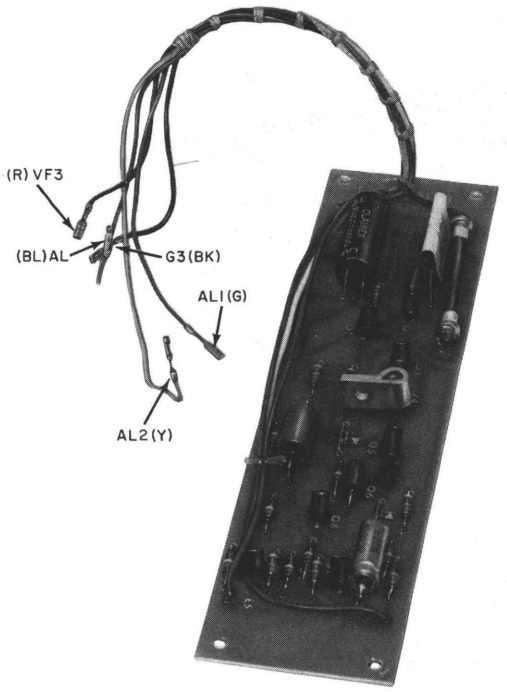



**Fig. 4—KS-20721, List 13 Limiter**

**2.06** The KS-20721, List 15 test set plugs into the connector on the station coupler and is used with a 1013A hand test set (or equivalent) to test the operation of the coupler independent of the CPE (Fig. 5).

## 3. INSTALLATION—KS-20721, LISTS 1 and 3 STATION COUPLERS (Refer to wiring options shown in Table A and connections in Table B)

**3.01** The location and method of installing the KS-20721 station coupler shall be consistent with standard practices. The station coupler is designed for wall or shelf mounting, weighs 4 lbs, measures approximately 9 inches square by 3 inches deep, and has a metal base with plastic cover. (Cover screws require KS-19192, List 1 tool for early models, screwdriver for later models, and may be changed by the installer.)


***Early models had special quarter-turn fasteners, current models have conventional captive screws which fasten clockwise and release when turned counterclockwise. On early models, turn fasteners clockwise only to open or close. Fasteners may break if turned counterclockwise.***

**3.02** A 15-pin connector (J1, Fig. 1) is located on the base of the unit to connect the transmission path and control leads to the CPE by means of a CP cable equipped with an ITT-Cannon Electric or Cinch Manufacturing Company plug No. DA-19603-403 (P1) with hood No. DA-51225-1. Screw terminals on the left side of the printed circuit board (Fig. 2) provide connections to the CO line, telephone set, and 2012B power transformer (or power supply). Flexible jumper leads with connectors provide for installation options.

**3.03** The station coupler should be located in a place mutually agreeable to the customer and telephone company, readily accessible for maintenance, and convenient for customer connection. When associated with a telephone company telephone set, the coupler should be within 5 feet of the telephone set, if practical. When mounting coupler with screws, do not overtighten and bend the base. Mount the unit close to a 115V ac convenience outlet not under control of a wall switch when power is provided by a 2012B transformer or 19-type power unit.


***Complete all installation work before connecting the power supply or the CPE.***

**3.04** ▶***Options:*** Provide the wiring options given in Table A. The features provided by these options are explained in Table C. These are the only options which are to be provided. Wire the options by moving the flexible jumper leads with connectors to the terminals given in Table B. Verify that the unused leads are stored on the proper terminals given in Table B. For PCA STS, if the KS-20721 List 13 is to be field-installed, proceed with the circuit pack installation procedures given below.◀

**TABLE B**

**WIRING OPTIONS FOR FIELD INSTALLATIONS**

| OPTION LEAD | | FROM TERMINAL ON L1† | TO TERMINAL ON L1 BOARD | | | |
|---|---|---|---|---|---|---|
| | | | OPTIONS | | | |
| LOC | COLOR | | Q‡ | R | T | Z‡ |
| LEADS ON L1 BOARD | G | N | | | | N |
| | BL | K1 | | | | |
| | S | K4 | | | | |
| | O | F10 | | | | |
| | BR | F6 | | | | |
| | V | F4 | | | | |
| | BK | F5 | | F1 | | |
| | Y | P2 | P2 | | | |
| | S* | F8 | | | | F8 |
| | BL* | F7 | | | | F7 |
| | W | M | | | | |
| LIST 13 LIMITER | R | | | | VF3 | |
| | BK | | | | G3 | |
| | Y | | | | AL2 | |
| | BL | | | | AL | |
| | G | | | | AL1 | |

* These leads originate from J-1 connector.

† Verify that leads are stored on these terminals when not in use.

‡ Options Q and Z are factory-wired.

**CIRCUIT PACK INSTALLATION (PCA STS)**

**3.05** For those installations for PCA STS where the KS-20721 List 3 with the factory-installed KS-20721 List 13 circuit pack is not used, the KS-20721 List 13 must be added to a KS-20721 List 1. To add this circuit pack, perform the following steps:

(1) Remove the cover from the station coupler using the KS-19192, List 1 tool or screwdriver.

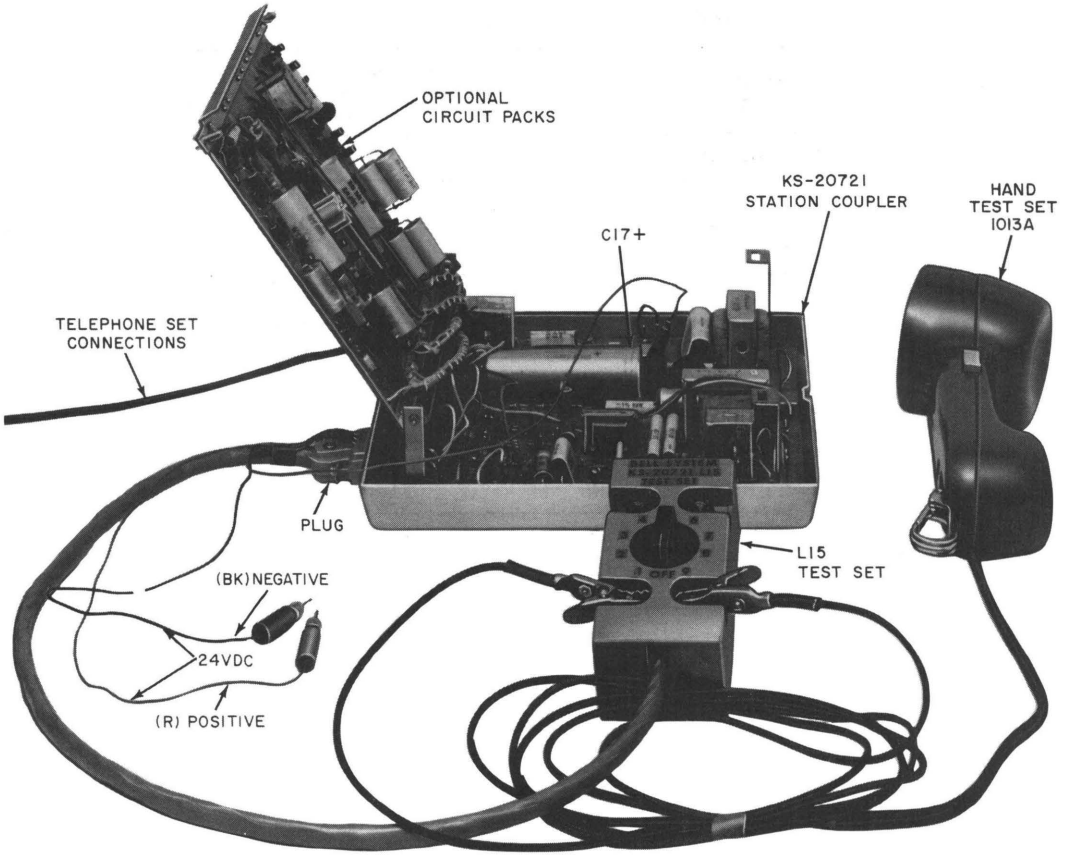



**Fig. 5—KS-20721, List 3 Station Coupler With KS-20721, List 15 Test Set and 1013A Hand Test Set**

(2) Attach KS-20721, List 10 hinge assembly to the four corner screws mounting the List 1 board. Refer to Fig. 3.

(3) Mount the circuit pack on the internal mounting frame formed by the hinge assembly. Place board in correct position on frame (refer to Fig. 3 or cover label) and secure with four corner mounting screws furnished with circuit pack.

(4) Connect the flexible jumper leads on List 1 board to provide the required options called for in Table A by using the connecting information given in Table B. (See 3.04.)

(5) Provide option T by plugging the connecting leads from circuit pack into corresponding terminals on List 1 board per Table B and Fig. 4. Dress leads to avoid interference with boards and cover and secure leads with cable clamp provided.

(6) Close hinge assembly and fasten the two top corner fasteners.

**TABLE C**

**WIRING OPTION FEATURES**

| OPTION | FEATURE |
|---|---|
| Q | Provides for direct control of line relay PR for dc pulse repeating. |
| R | Connects RU relay to ring detector. |
| Z | Connects transmission circuit to tip side of telephone line. Used with option R to provide an isolated contact closure to customer over leads RU1 and RU2. |
| T | Adds list 13 circuit to provide AGC limiting when customer transmits end-to-end nonvoice signals. |

## CONNECTIONS

**3.06** If an associated telephone company telephone is used, connect telephone set mounting cord directly to station coupler; otherwise, interconnect set and station coupler using D station wire (see Fig. 8). Secure telephone set mounting cord or D station wire to clamp at lower left corner of station coupler. All station sets on the line must be connected to terminals R1 and T1 of coupler.


***If there is no telephone set on the line, use a ringer simulator to prevent line testing open. Use an AA-1A ringer simulator. If not available, an E1C ringer installed and silenced as described in Section 501-251-100 may be used.***

**3.07** Connect the CO line to screw terminals T and R. Lightly tighten all unused terminal screws.

## POWER

**3.08** Power for the coupler may be supplied by either the telephone company or the customer. If power is supplied by the telephone company, either a 2012B transformer or suitable dc supply (19-type or equivalent) may be used.

**3.09** A 2012B power transformer must not be used to supply more than one coupler. A suitable dc power supply (19C2 or equivalent) may be used to supply multiple couplers (a maximum of ten couplers per 19C2 power unit connected to the dc signal [20-26V dc] terminals). The dc power supply should be of the current limiting type, or it should be connected through a 20-ohm, 1-watt resistor to provide current limiting. The input power terminals, AC1 and AC2, may be connected to either the ac output of a single 2012B power transformer or to the dc signal terminals of a 19-type power unit, with either polarity. The internal bridge rectifier will apply the correct polarity to the station coupler. Do not ground either terminal of the power supply. The power supply current drain of the basic coupler (List 1), used with the PCA SU6AQ, is .060 ampere operating current, .012 ampere standby current, and 1 ampere initial surge. The current drain of the coupler (List 3) with the List 13 limiter, used with the PCA STS, is .150 ampere operating current, .015 ampere standby current, and 1 ampere initial surge.

**3.10** Line noise pickup, cross-talk, etc, may occur between units connected to a common power supply. When this occurs, it may be cleared by grounding the housing of each station coupler. The circuit board mounting screw below terminal A1 may be used for grounding the circuit.

**3.11** When power is supplied by a 2012B transformer (or 19-type power unit), a current limited, positive dc voltage source is provided to the customer on lead B1+ (ground return on lead B2−) furnishing a charging current of approximately 2.5 milliamperes which may be used to keep a CP rechargeable battery (18V, 150 to 500 ma) charged during normal operation to provide power when commercial power fails. If the customer furnishes power, 21 $\pm$5 volts dc is connected to leads B1+ and B2− through plug (P1).

**3.12** After installation is completed, perform operational tests given in Part 5 to check for proper operation before CPE is connected.

# 4. OPERATION

## GENERAL

**4.01** The KS-20721, List 1 station coupler (Fig. 6) consists of a 20-Hz ringing signal detector operating ringup (RU) relay, a supervisory control circuit operating line transfer (TR) relay, dial pulsing (PR) relay, CPC relay, a transmission circuit

consisting of two transformers in tandem, a peak voltage limiter, and a power supply rectifier and filter circuit.

## OUTGOING CALL

**4.02** When the customer goes off-hook, the CPE provides a contact closure to the off-hook leads 0H1 and 0H2. After a 1-second delay, during which time the coupler will terminate a call originated from a phone connected to T1 and R1, the coupler will seize the telephone line and complete the 2-way transmission path. The closure between leads OH1 and OH2 must be maintained for the duration of the call except during dial pulsing. The CPE maintains the closure until dial tone is returned before transmitting dial pulses. The List 1 coupler repeats dial pulses through PR relay to the CO line. Two-way transmission is provided during line seizure; dial tone and call progress tones are returned to the CPE. The transfer leads are operated by the TR relay to indicate coupler status to the CPE. During line seizure leads TR1 and TR2 are closed; leads TR2 and TR3 are opened. When the line is released, leads TR1 and TR2 are open and leads TR2 and TR3 are closed.

### Disconnect Outgoing Call

**4.03** When the CPE goes on-hook by opening leads OH1 and OH2, relays PR and TR release to terminate the call.

## INCOMING CALL

**4.04** When 20-Hz ringing is detected by the ring detector circuit, relay RU will operate for approximately 1 second during each 2-second ringing cycle closing leads RU1 and RU2 to indicate ringing to the CPE. The ring detector circuit also causes PR relay to operate and hold for about 4 seconds. The CPE may answer the call by closing (and maintaining a closure) between leads OH1 and OH2.

This causes TR relay to operate causing line seizure, since PR relay was already operated by the ring detector. Two-way transmission is provided immediately on line seizure; leads TR2 and TR3 are opened, and leads TR1 and TR2 are closed indicating line seizure.

### Disconnect Incoming Call

**4.05** The coupler will remain connected to the telephone line until it is caused to disconnect by removing the closure between leads OH1 and OH2. This causes TR and PR relays to release, disconnecting the coupler from the line.

## LIST 15 TEST SET

**4.06** The List 15 test set (Fig. 5 and 7), used with the 1013A hand test set (or equivalent) and a connecting cable terminated in a plug for connection to the station coupler, permits checkout of the coupler independent of the CPE.

**4.07** When detailed circuit description and operation information is required, refer to CD- and SD-69903-01.

## 5. MAINTENANCE

**5.01** When trouble is reported verify that:

- Customer connector plug is secure in coupler.
- Power is supplied to station coupler with correct polarity, if supplied from CPE.
- Leads to CO line and telephone set are secure.
- CO pair and telephone set are good.
- Wiring options and coupler connections are correct. (Refer to Table B and Fig. 8.)

**5.02** After performing steps in 5.01, if trouble still exists, perform test described in 5.05.

**5.03** ***Apparatus Required:***

- List 15 test set
- 1013A (or equivalent) hand test set
- KS-6571 (or equivalent) battery (if coupler is powered by CPE).

**5.04** ***Preparation:***


***Make all tests with CPE disconnected.***

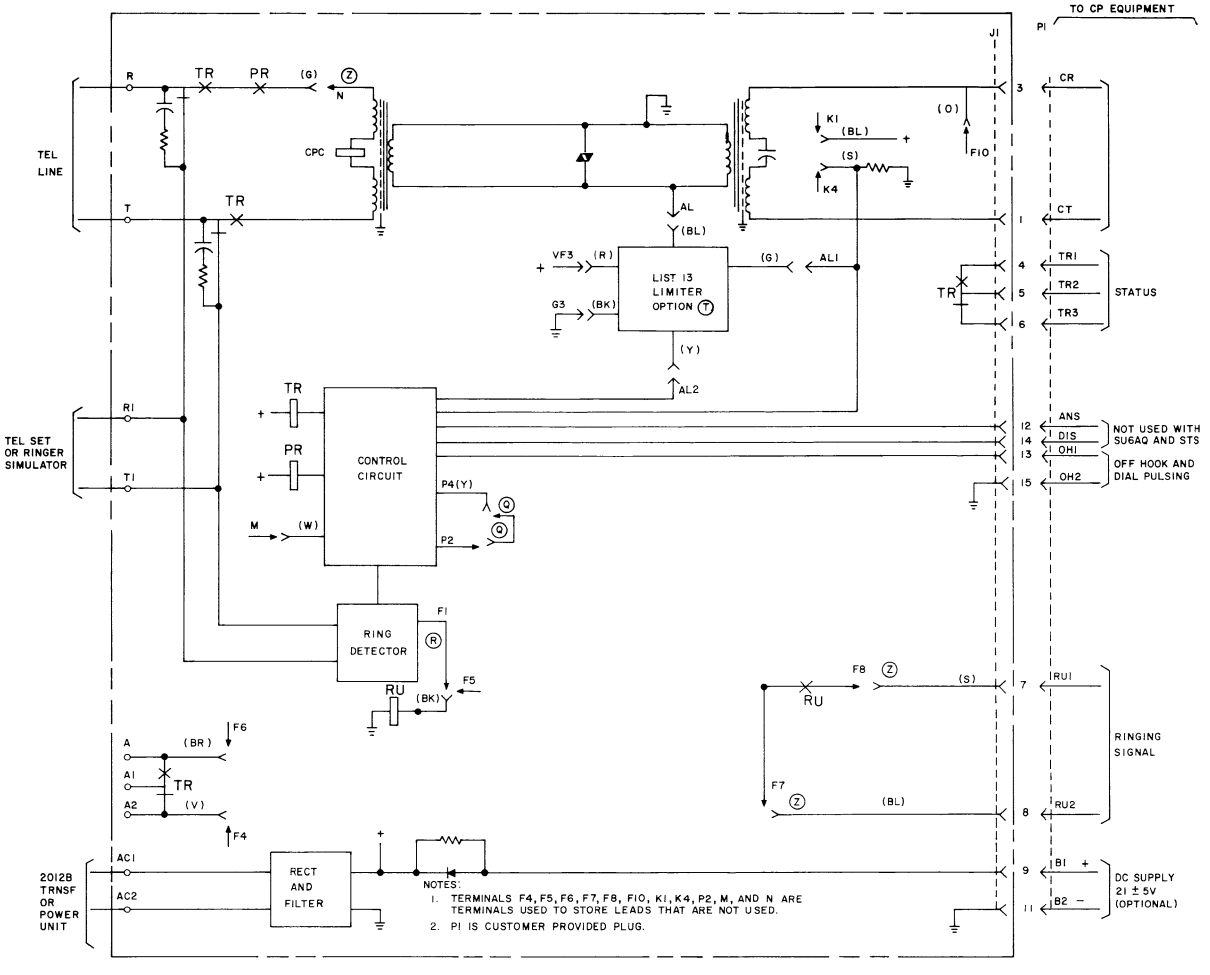



**Fig. 6—KS-20721 Station Coupler, Internal Wiring Options**

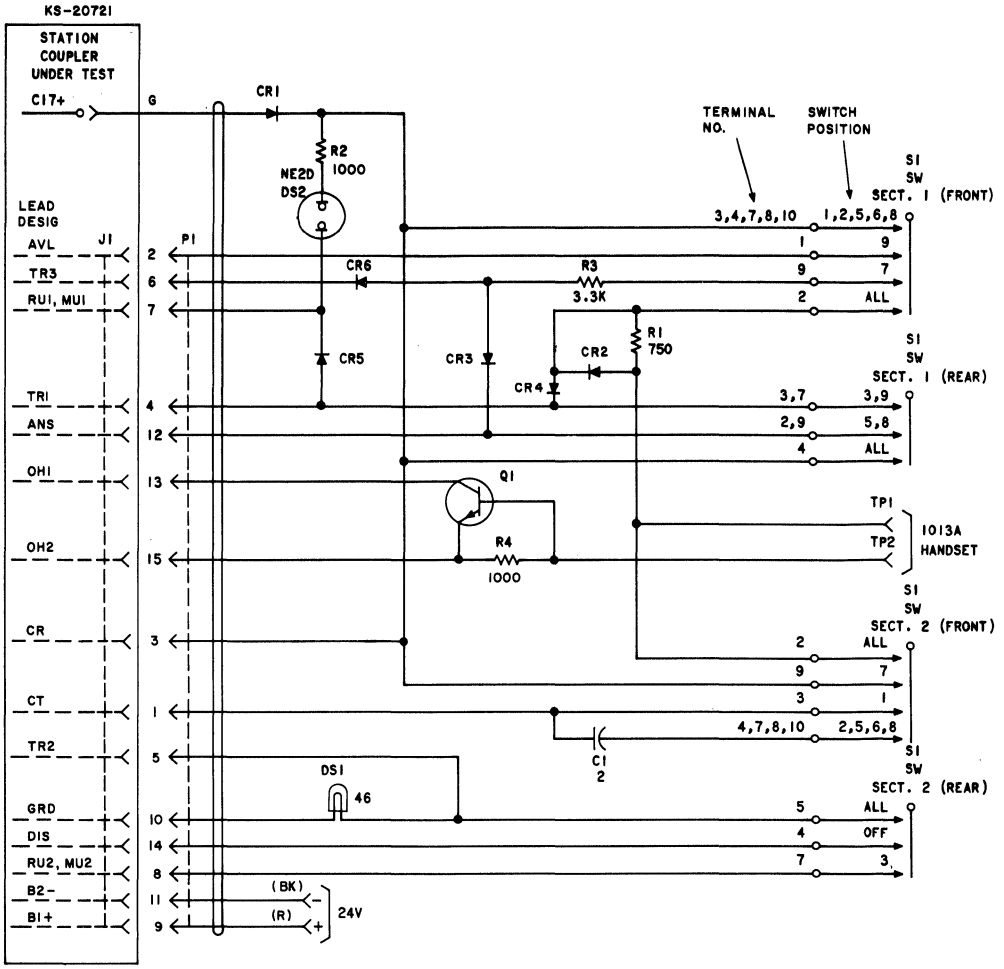



**Fig. 7—KS-20721, List 15 Test Set Schematic**

| STEP | ACTION | VERIFICATION |
|---|---|---|
| 1 | Remove cover of station coupler using KS-19192, List 1 tool or screwdriver. | |
| 2 | Rotate selector switch on List 15 test set to position 7. | |
| 3a | If coupler is normally powered by CPE—<br>Use a 24V (KS-6571 or equivalent) battery | White lamp extinguished.<br>Red lamp extinguished. |

| STEP | ACTION | VERIFICATION |
|---|---|---|
| | and connect the pin-tipped red lead from the test set to +24V and black lead to −24V. | |

**5.05** ***Tests—SU6AQ and STS***

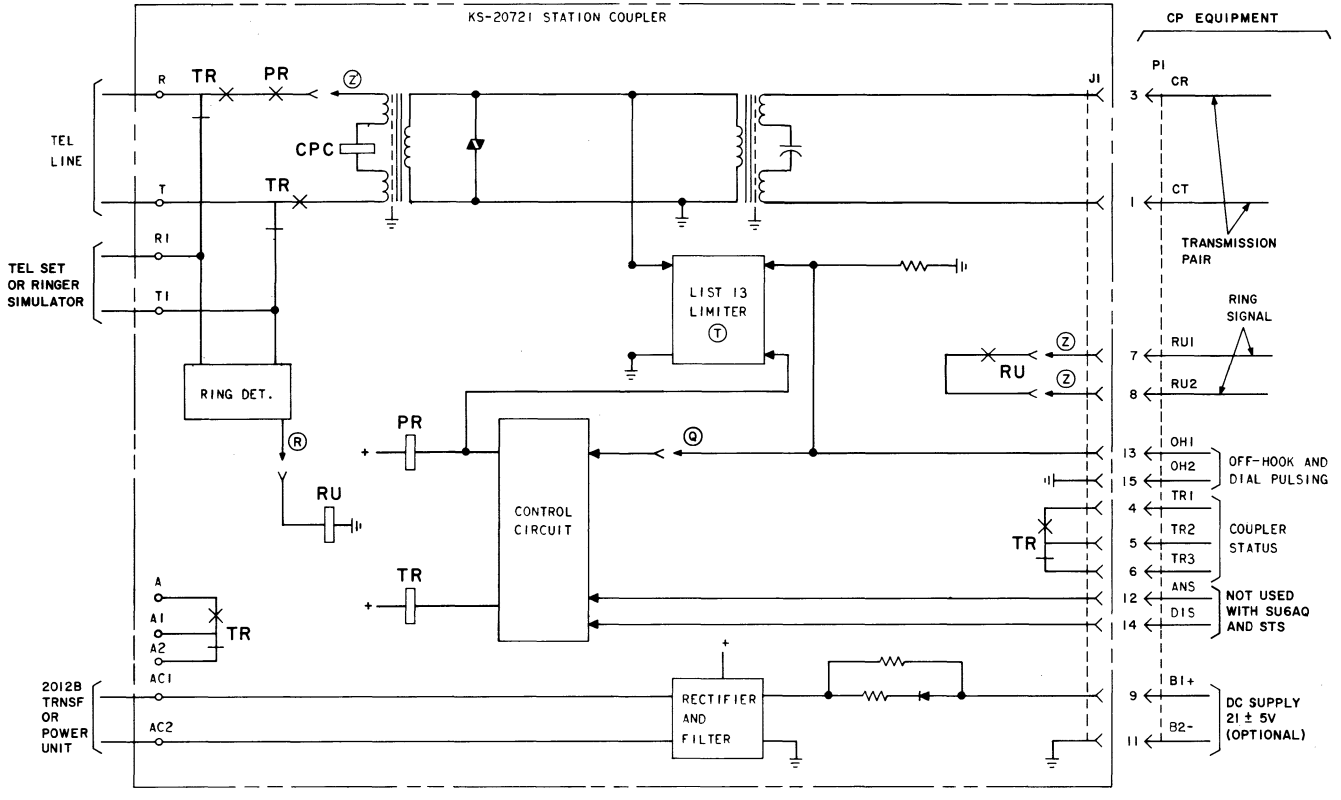
| STEP | ACTION | VERIFICATION |
|---|---|---|
| 4 | Connect test set plug to receptacle on station coupler and connect alligator clip on wire coming from test set plug to terminal VF4 in the station coupler (Fig. 5). | White lamp extinguished. |
| 5 | Rotate selector switch of test set to position 8. | White lamp lighted. |
| 6 | Rotate selector switch to OFF. | White lamp extinguished. |
| 7 | Operate switch on 1013A hand test set to TALK and connect its leads to the terminals provided on the List 15 (Fig. 5). | White lamp lighted. |
| 8 | Rotate selector switch to position 1. | Dial tone heard in hand test set receiver. |
| 9 | Using the hand test set, dial the local test desk and request the testman to call back. Proceed immediately to step 10. | |
| 10 | Rotate test set switch to position 3. | White lamp extinguished. |
| 11 | Testman returns call. | White lamp flashes in unison with ringing cycle. |
| 12 | Rotate test set switch to position 1 and answer call on 1013A. | White lamp lighted. |
| 13 | Rotate test set switch to OFF. | White lamp extinguished. |
| 14 | Disconnect test set from station coupler, replace cover, and reconnect CPE. | |

**5.06** If coupler does not meet the above tests, replace coupler and/or circuit pack.

**5.07** If the tests are satisfactory, remove all test connections to restore circuit to normal and follow local reporting procedures for CP trouble.


***Do not attempt any test or repair to the CPE.***

**5.08** When in the repairman's judgment 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 Section 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).




NOTES:

1. CIRCLED LETTERS (Z), (T), ETC DENOTE WIRING OPTIONS
2. P1 IS CUSTOMER PROVIDED PLUG.

**Fig. 8—KS-20721 Station Coupler, Simplified Schematic**