VOICE 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 KS-20721, List 3 general purpose station couplers when used in Voice Connecting Arrangements (VCA) SU6AQ and STS. (Suffixes AV, QT, and VT have been deleted.)

1.02 This section is reissued to:

- Change conditions for use of the KS-20721, List 11 pulse corrector
- Add information on noise pickup (6.04)
- Add lead designations to Fig. 8
- Clarify 3.03
- Delete P and S options.

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 VCA to be used with his equipment.

1.05 If the customer wants a copy of the Technical Reference which covers any of the above VCAs, 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 VCAs. Only the features and options applying to the arrangements shown in Table A are covered.

1.08 ***Voice Connecting Arrangement SU6AQ:*** This connecting arrangement is typically used with customer-provided (CP) alarm systems and call diverters.

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

1.10 An associated 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, reference should be made to the SDs to determine the extent of the changes and the manner in which the section may be affected.

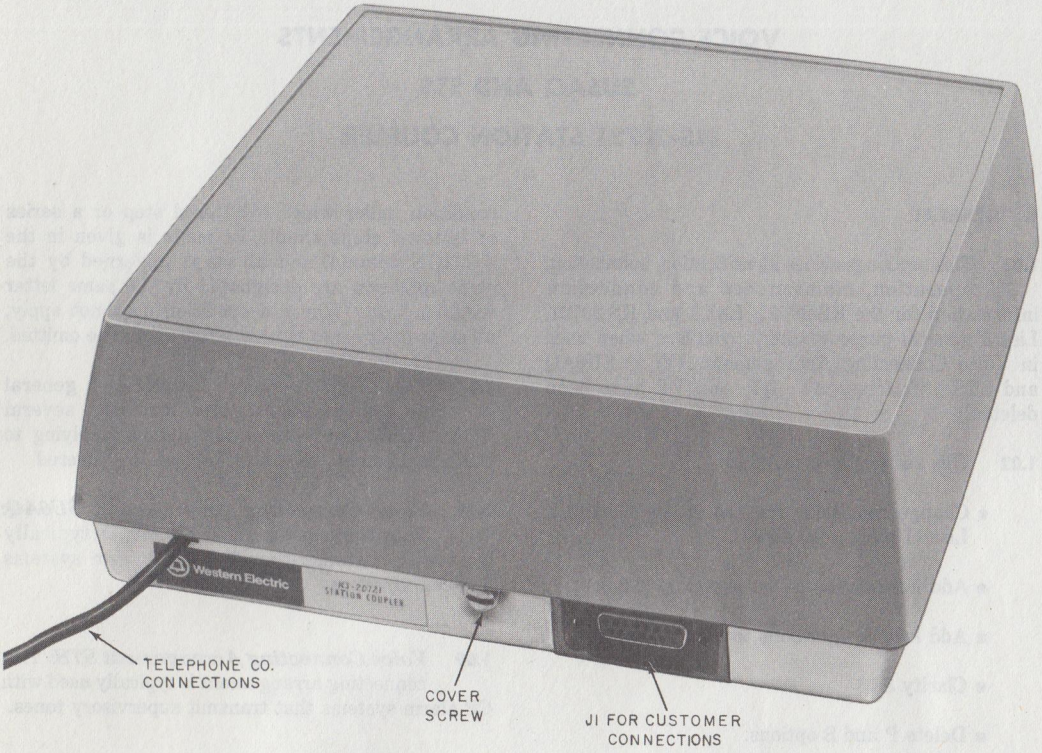


Fig. 1—KS-20721, List 1 or List 3 Station Coupler

TABLE A

OPTION TABLE

VOICE CONNECTING ARRANGEMENT	TYPICAL CUSTOMER-PROVIDED EQUIPMENT	KS-20721 STATION COUPLER LIST NUMBERS	WIRING OPTIONS‡
SU6AQ	Alarm Systems	List 1, 10†, 11†	Q,R,Z,V†
STS	Alarm System with Tone Signaling	List 3*, 11†	Q,R,T,Z,V†

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

†Telephone Company option. When pulse correction is required, install List 11, remove Q option, and connect V option.

‡Features described in Table C. Z option is factory-wired.

2. IDENTIFICATION

PURPOSE

- To provide facilities for connecting various types of customer-provided equipment (CPE) to the telephone line
- To limit excessive levels from CPE and to provide protection for personnel and facilities against hazardous voltages.

APPLICATION

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

ORDERING GUIDE

- Coupler, Station, KS-20721, L1 (Fig. 1 and 2)
- Coupler, Station, KS-20721, L3 (Fig. 1). The L3 consists of the following items which may be ordered separately and assembled in the field (see 2.03).

  Coupler, Station, KS-20721, L1

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

  Limiter, KS-20721, L13 (Fig. 4)
- Corrector, Pulse, KS-20721, L11 (Fig. 5, see 2.04).
- Set, Test, KS-20721, L15 (Fig. 6).
- Tool, KS-19192, L1 (not required on later model units which have slotted cover screws).
- Transformer, 2012B (one per coupler).
- Unit, Power, 19-Type (or equivalent, when required for multiple installations, see 6.03).

DESIGN FEATURES

2.01 Voice 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
- Talk battery to customer equipment
- AC or DC powered.

2.02 The KS-20721, List 1 station coupler (Fig. 2) is the basic unit designed to be field equipped with a KS-20721, List 10 hinge assembly for mounting any combination of the optional circuit packs (Fig. 3). The circuit packs are equipped with quick connect connectors for easy installation.

2.03 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.

2.04 The KS-20721, List 11 pulse corrector (Fig. 5) is not required for initial installations. It shall be used only after it has been determined that the dial pulses received from CPE meet all requirements specified in the Technical Reference and pulsing problems still exist. It should not be used to correct poor customer pulses. When adding the List 11 pulse corrector to the List 1 coupler, remove wiring option Q and provide option V as shown in Table B.

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.

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. 6).

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 station coupler shall be consistent with

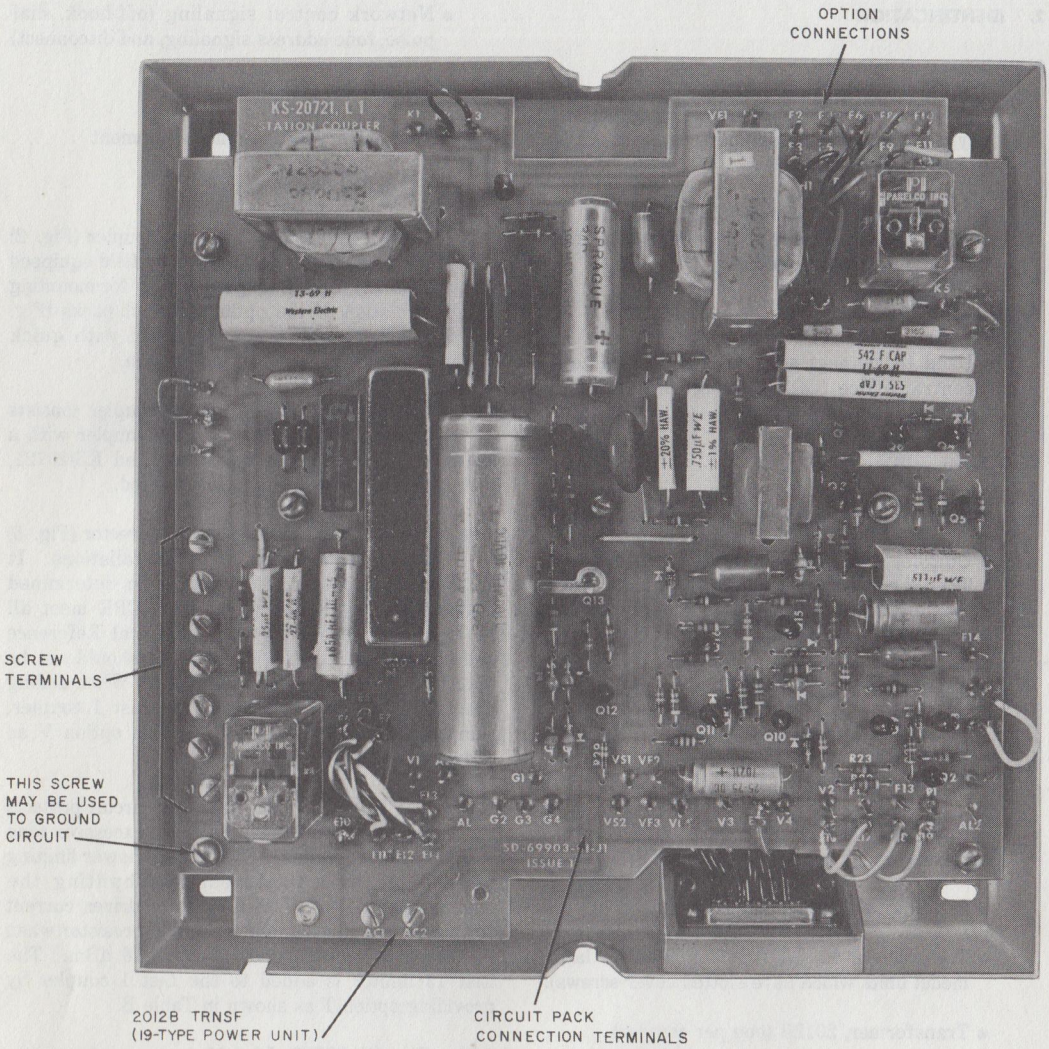


Fig. 2—KS-20721, List 1 Station Coupler, Cover Removed

standard practices. The installer should provide the necessary internal wiring options that are called for on the customer service order by uniform service order code (USOC) using Tables A and B. The features provided by the various options are explained in Table C. The KS-20721 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.)

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. The mating

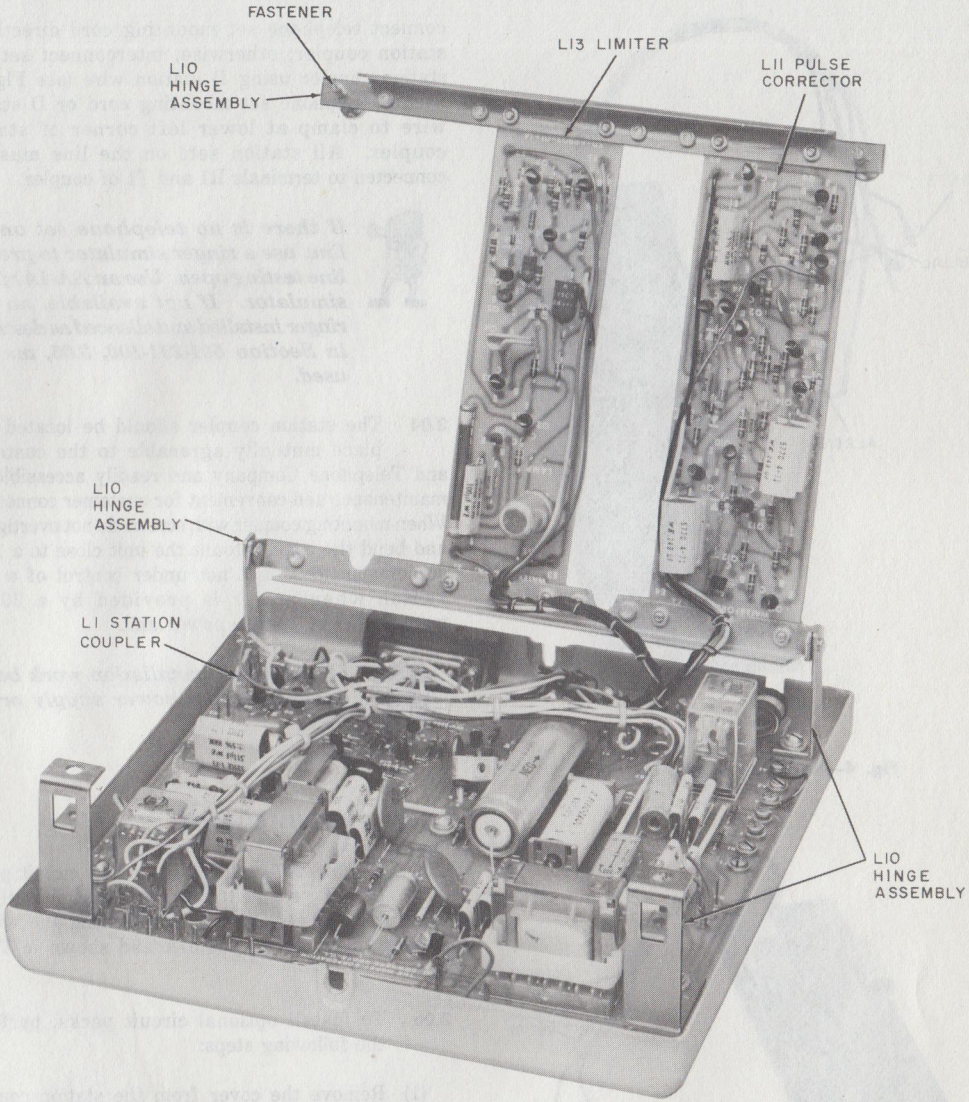


Fig. 3—KS-20721 Station Coupler Showing Optional Circuit Packs Mounted

plug (P1) is an ITT - Cannon Electric or Cinch Mfg. Co. No. DA-19603-403 plug with hood No. DA-51225-1 and is customer provided. Screw terminals on the left side of the printed circuit board 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 When using an associated Telephone Company telephone set, locate station coupler within five feet of the telephone set, if practical, and

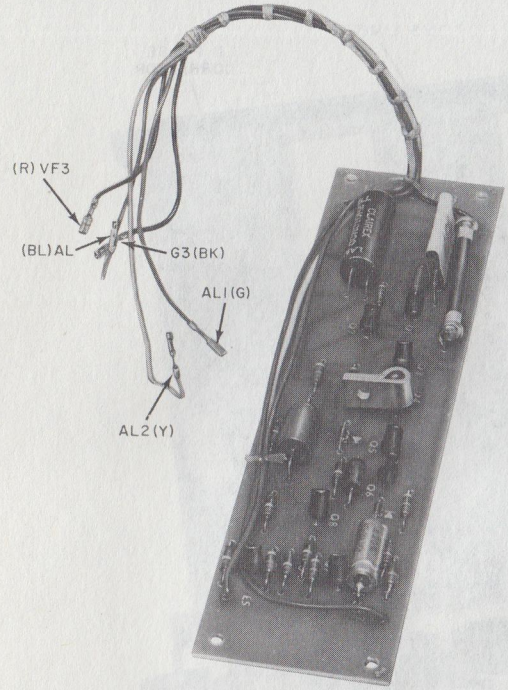


Fig. 4—KS-20721, List 13 Limiter

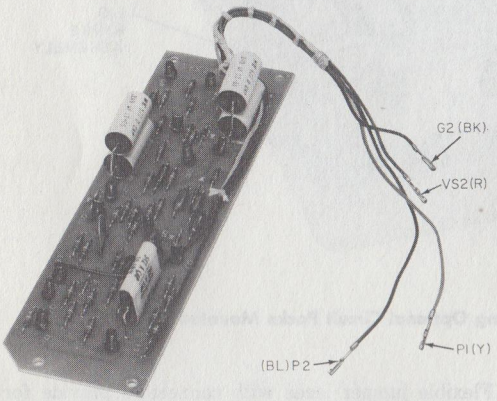


Fig. 5—KS-20721, List 11 Pulse Corrector

connect telephone set mounting cord directly to station coupler; otherwise, interconnect set and station coupler using D station wire (see Fig. 9). 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, 3.05, may be used.

3.04 The station coupler should be located in a place mutually agreeable to the customer and Telephone Company and readily accessible for maintenance and convenient for customer connection. 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.

CIRCUIT PACK INSTALLATION

3.05 The KS-20721, Lists 11 and 13 circuit packs (if not provided) may be added initially or to an existing installation by providing the wiring options called for in Table A and shown in Table B.

3.06 To install optional circuit packs, perform the following steps:

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

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

(3) The installer can mount the circuit packs 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

TABLE B

WIRING OPTIONS FOR FIELD INSTALLATION

OPTION LEAD		FROM TERMINAL ON L1†	TO TERMINAL ON L1 BOARD OPTIONS				
LOC	COLOR		Q	R	T	V	Z‡
LEADS ON L1 BOARD	G	N					N
	BL	K1					
	S	K4					
	O	F10					
	BR	F6					
	V	F4					
	BK	F5		F1			
	Y	P2	P2			P3	
	S*	F8					F8
	BL*	F7					F7
	W	M					
CIRCUIT PACKS	R				VF3	VS2	
	BK				G3	G2	
	Y				AL2	P1	
	BL				AL	P2	
	G				AL1		

*These leads originate from J1 connector.
†Store on these terminals when not is use.
‡This option factory-wired.

secure with four corner mounting screws furnished with circuit pack.

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

(5) Plug connecting leads from circuit packs into corresponding terminals on List 1 board per Table B and Fig. 4 and 5. 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.

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. (Fastener may break if turned counterclockwise.)

(7) Replace cover and fasten cover screws.

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

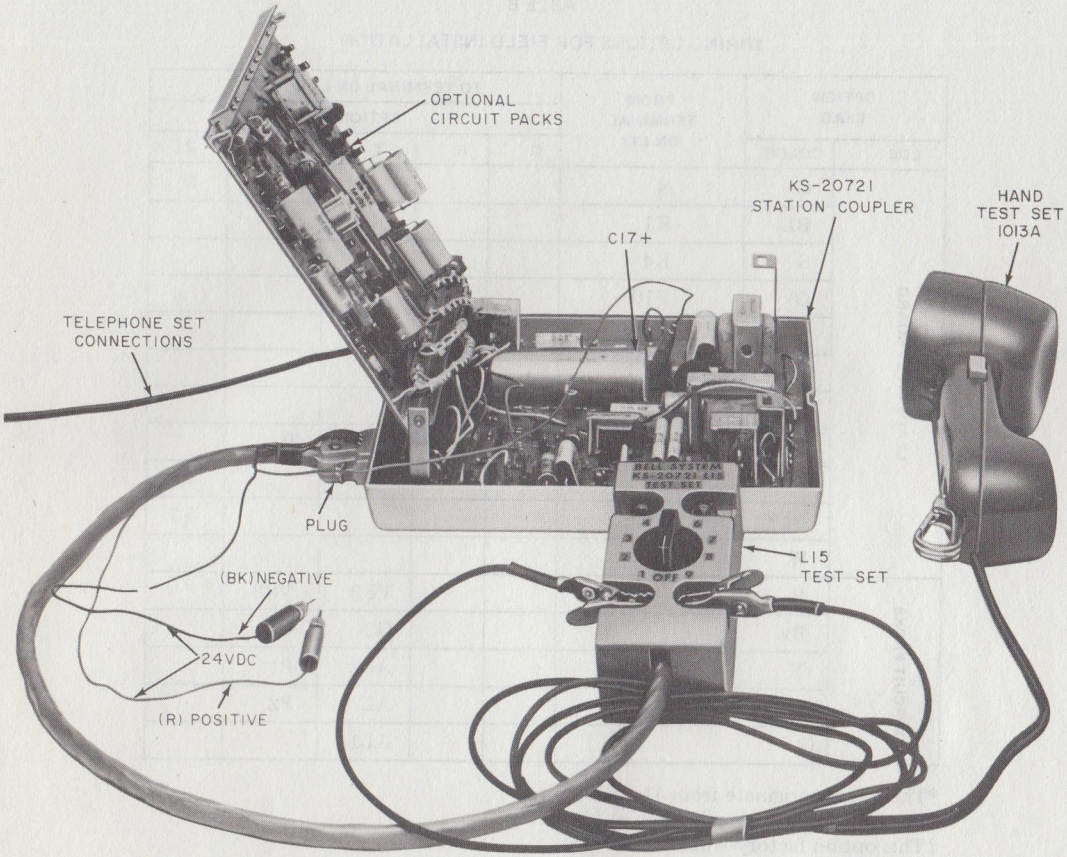


Fig. 6—KS-20721 Station Coupler With KS-20721, List 15 Test Set and 1013A Hand Test Set

4. OPERATION

GENERAL

4.01 The KS-20721, List 1 station coupler (Fig. 7) 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, and 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 OH1 and OH2. 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

TABLE C

WIRING OPTION FEATURES

OPTION	FEATURE
Q	Provides for direct control of line relay PR for dc pulse repeating without pulse correction.
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.
V	Adds List 11 circuit to provide dc pulse correction.
T	Adds List 13 circuit to provide AGC limiting when customer transmits end-to-end non-voice signals.

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:

(a) Closing leads OH1 and OH2

(b) Closing lead ANS to lead B1 momentarily (at least 1 second).

Performing (a) causes TR relay to operate causing line seizure, since PR relay was already operated by the ring detector. Performing (b) causes PR relay to stay operated and causes TR relay to operate. Telephone line current operates CPC relay which causes PR and TR relays to stay operated after lead ANS is disconnected from lead B1+. Any of the actions listed above will cause the coupler to terminate the telephone line and answer the incoming call. 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. When the ANS lead is closed to B1+ to answer the call, leads OH1 and OH2 must not be connected, and there should be no dc termination across CT and CR.

DISCONNECT INCOMING CALL

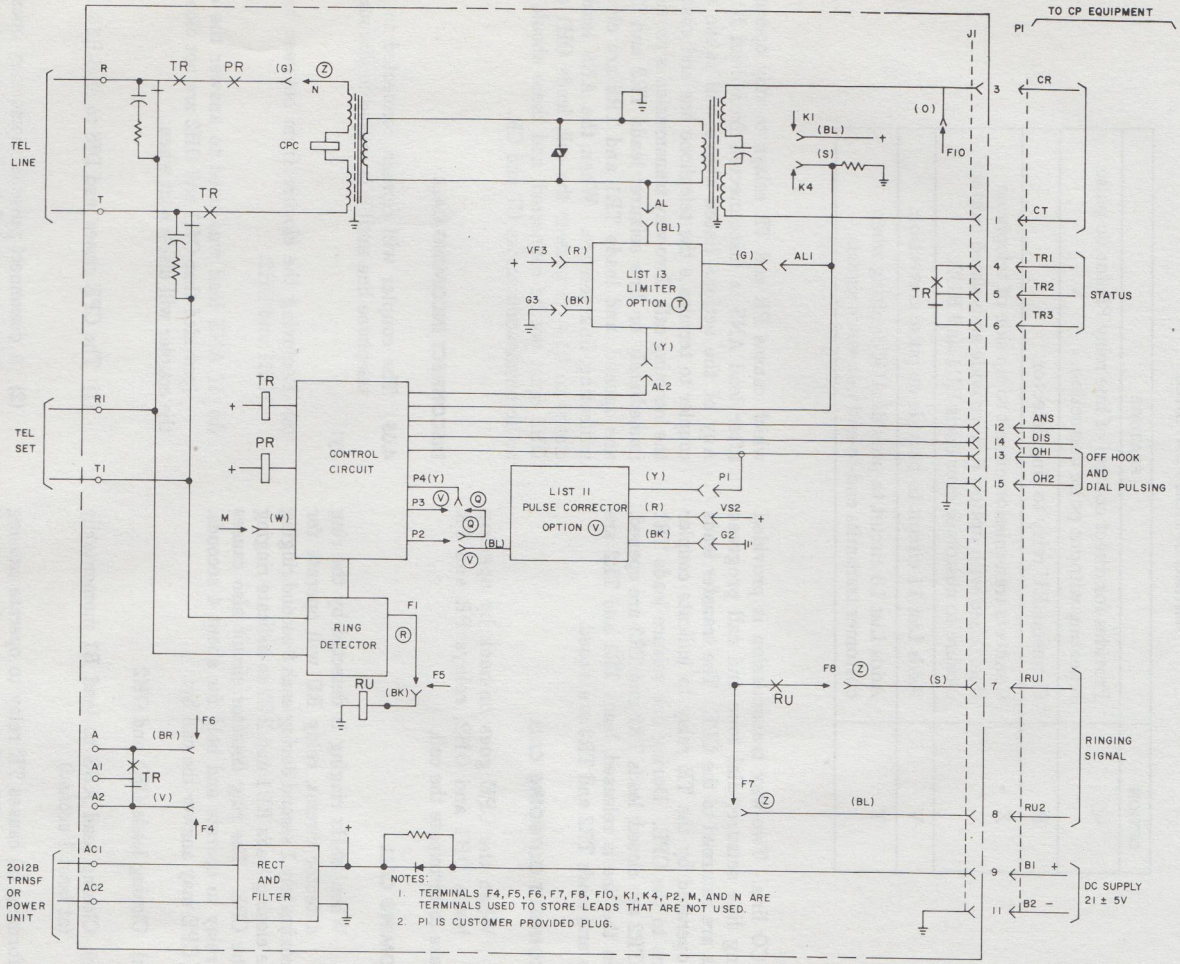
4.05 The coupler will remain connected to the telephone line until it is caused to disconnect by:

(a) Removing the closure from between leads OH1 and OH2.

(b) If ANS lead was used to answer the call (provided that OH1 and OH2 are not closed), the coupler will disconnect when:

(1) The CPE closes lead DIS to lead B2−.

(2) A disconnect pulse (a momentary open or battery reversal) is received from the CO where the design of the CO provides an open when calling party disconnects. Some COs give a momentary open only after time-out.



NOTES:
1. TERMINALS F4, F5, F6, F7, F8, F10, K1, K4, P2, M, AND N ARE TERMINALS USED TO STORE LEADS THAT ARE NOT USED.
2. P1 IS CUSTOMER PROVIDED PLUG.

Fig. 7 KS-20721 Station Coupler, Internal Wiring Options

Any of the actions described cause TR and PR relays to release disconnecting the coupler from the line.

LIST 15 TEST SET

4.06 The List 15 test set (Fig. 6 and 8) 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.
- 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. 9.)

5.02 After performing steps in 5.01, if trouble still exists, perform the following test.

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.

STEP	ACTION	VERIFICATION
1	Rotate selector switch on List 15 test set to OFF.	
2	Remove cover of station coupler using KS-19192, List 1 tool or screwdriver.	
3	Connect a 1013A (or equivalent) hand test set to terminals provided on test set (Fig. 6).	
4a	If coupler is normally powered by CPE— Use a 24V (KS-6571 or equivalent) battery and connect the pin-tipped red lead from the test set to +24V and black lead to −24V.	
5	Connect test set plug to receptacle on station coupler.	White lamp extinguished. Red lamp extinguished.

5.05 ***Tests—SU6AQ and STS***

STEP	ACTION	VERIFICATION
6	Connect alligator clip on wire coming from the test set plug to the positive (+) terminal of capacitor C17 in the station coupler (Fig. 8).	

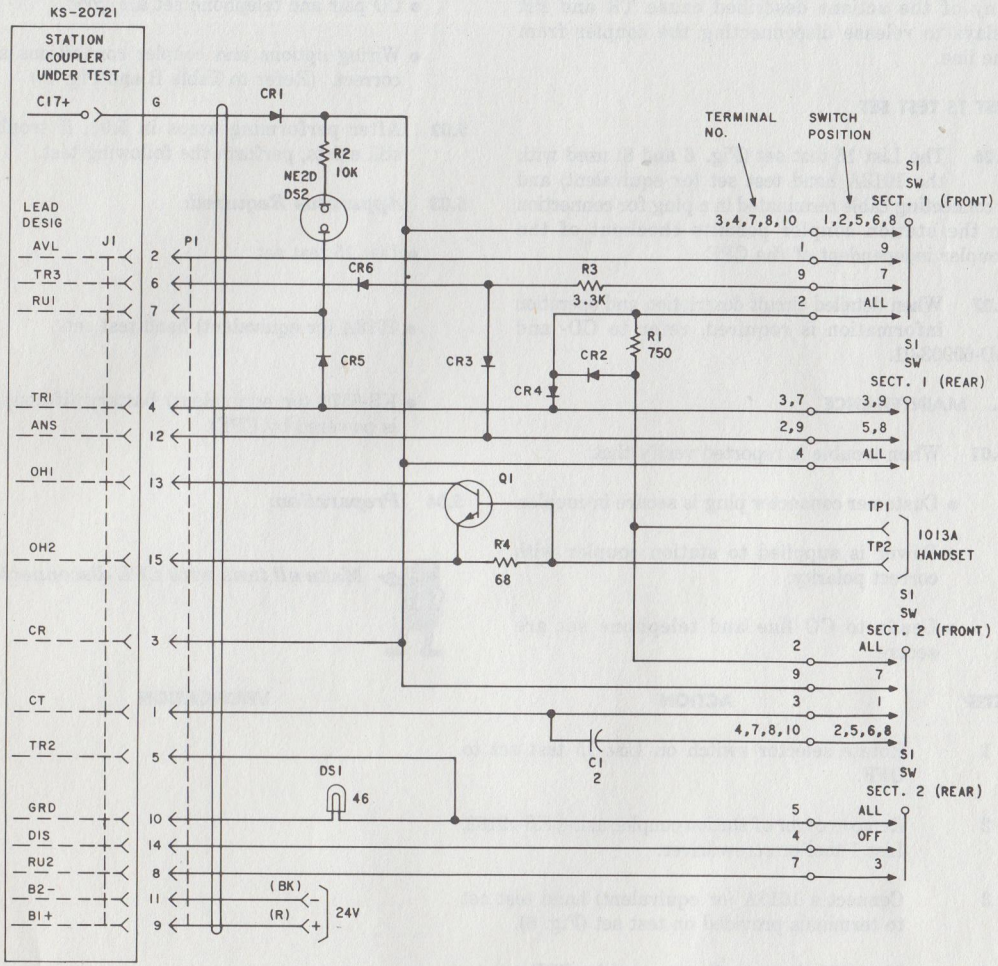
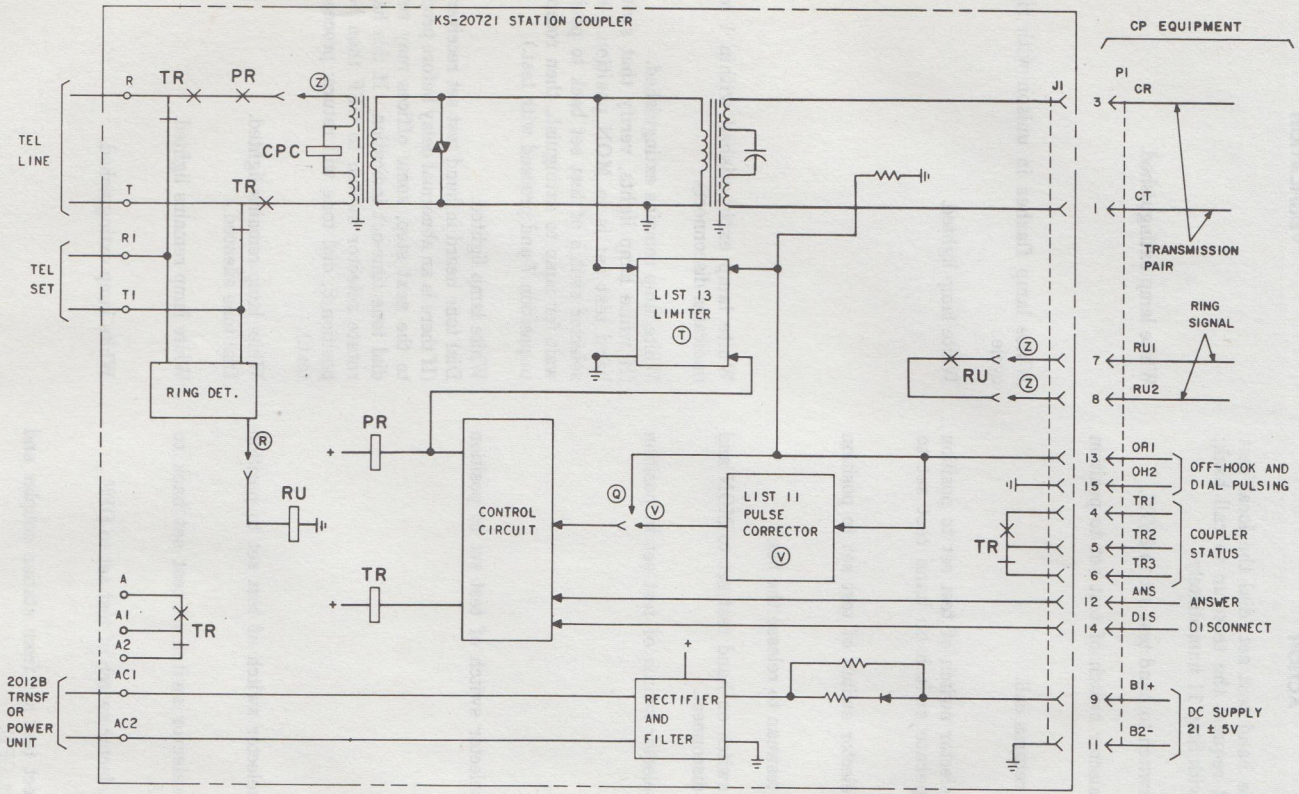


Fig. 8—KS-20721, List 15 Test Set Schematic

STEP	ACTION	VERIFICATION
7	Operate switch on hand test set to MON.	
8	Rotate selector switch of test set to position 2.	
9	Operate switch on hand test set to TALK.	White lamp lighted. Dial tone heard in hand test set receiver.

STEP	ACTION	VERIFICATION
10	Using the hand test set, dial the local test desk and request the testman to call back; proceed with Step 11 immediately.	
11	Operate switch to hand test set to MON.	White lamp extinguished.
12	Rotate selector switch of test set to position 3.	
13	Testman returns call.	White lamp flashes in unison with ringing cycle.
14	Rotate selector switch of test set to position 5 and operate switch on hand test set to TALK.	White lamp lighted.
15	Rotate selector switch of test set to position 6.	
16	Request testman to release the line.	
17	Operate switch on hand test set to MON and wait for disconnect.	White lamp extinguished within 1 minute (indicates disconnect).
18	Rotate selector switch of test set to position 7.	White lamp remains extinguished. (If white lamp lights, verify that switch on hand test set is in MON position. Rotate selector switch of test set back to position 6, wait for lamp to extinguish, then rotate back to position 7 and proceed with test.)
19	Rotate selector switch of test set to position 8.	White lamp lighted. Dial tone heard in hand test set receiver. (If there is an abnormal delay before proceeding to the next step, some offices may return a dial tone time-out indication. If this happens, rotate selector switch to OFF then back to position 8; dial tone will return; proceed with test.)
20	Rotate selector switch of test set to position 9.	White lamp remains lighted. Dial tone silenced.
21	Rotate selector switch of test set back to position 8.	White lamp remains lighted.
22	Rotate selector switch of test set to OFF.	White lamp extinguished.
23	Disconnect test set from station coupler and reconnect CPE.	



NOTES:

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

Fig. 9—KS-20721 Station Coupler, Simplified Schematic

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

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).

6. CONNECTIONS

6.01 Connections to the CPE are made through the 15-pin KS-19087, List 1 female connector on the coupler. The customer must furnish a suitable connecting cable equipped with a Cinch Manufacturing Co. or ITT Cannon Electric Co. No. DA-19603-403 plug with a DA-51225-1 hood (or equivalent).

6.02 Provide the correct wiring options from Table B, connect the CO line to screw terminals T and R and the 2012B power transformer (or 19-type power unit) leads to screw terminals AC1 and AC2, and all associated telephone sets to the screw terminals T1 and R1. If an associated telephone set is not used (and no telephone set is on line), connect a ringer simulator (see 3.03) to T1 and R1. Tighten all unused terminal screws.

6.03 A 2012B power transformer must not be used to supply more than one coupler. A suitable dc power supply (19-type or equivalent) may be used to supply multiple couplers (a maximum of ten couplers per 19-type power unit connected to the dc signal 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 power supply may be connected with either polarity to the AC1 and AC2 terminals. Do not ground either terminal of the power supply. Power supply current drain is 0.140 ampere maximum with all circuit packs in use. Initial surge current is 1 ampere and standby current is 0.012 ampere.

6.04 ◗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.◖

6.05 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 ±5 volts dc is connected to leads B1+ and B2− through plug (P1).