PROTECTIVE CONNECTING ARRANGEMENTS C1V, RCX, AND GC2

1. GENERAL

1.01 This section provides identification, installation, operation, maintenance and connection information for Protective Connecting Arrangements (PCA) C1V, RCX, and GC2. These connecting arrangements are used to indicate the dc supervisory and ringing condition of a telephone company central office (CO) line in the telecommunications network or tie line to customer-provided equipment (CPE).

1.02 This section is reissued to:

- Add two new tie line arrangements for PCA RCX (Fig. 11F and 11G)
- Change title of section
- Change Fig. 2 and 11.

1.03 If the customer wants a copy of the Technical Reference which covers these interface specifications, he should contact the local Telephone Company Business Office or the Marketing Representative.

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

SD-69633-01, Issue 7D—117A Interconnecting Unit and Protective Connecting Arrangement RCX, C1V, and GC2

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

A. PURPOSE

- PCA C1V using an 18D KTU provides a contact closure over leads CBS1 and CBS2 toward the CPE when the PBX or CO line is seized and maintains closure until the line becomes idle.
- PCA RCX using a 117A IU provides a contact closure over leads CDP1 and CDP2 toward the CPE when the PBX or CO line is seized. This contact closure opens with each dial pulse, and the contacts open when the line becomes idle.
- PCA C1V and RCX may be used together to provide both of the features explained above.
- PCA GC2 using a 15D KTU provides a contact closure over leads C1 and C2 toward the CPE when ringing is present on the line.

B. ORDERING GUIDE

Note: Equipment for these connecting arrangements may be mounted on existing relay racks or in equipment cabinets provided there is available space.

PCA C1V (Fig. 1)

- Unit, Telephone, Key, 18D
- Box, Apparatus, ▶105C◀
- Backboard, KS-5796, L7, L8, or L9 (if required)
- Block, Connecting, 66M1-50 (Fig. 2)
- Clip, Bridging, B
- Capacitor, KS-19524, L9, 60 μF, or equivalent (one per 18D KTU), required to prevent longitudinal imbalance.

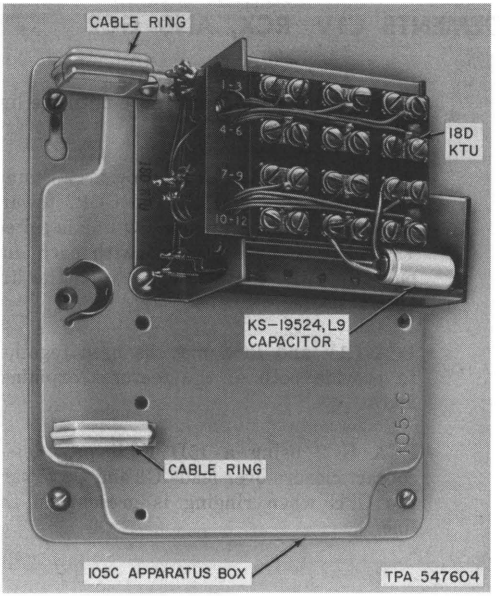


Fig. 1—Protective Connecting Arrangement C1V

PCA RCX (Fig. 3 and 4)

- Unit, Interconnecting, 117A—each unit provides four circuits when equipped with 303F relays (unit is shipped with ***one*** 303F relay provided)
- Relay, 303F—one per line as required
- Mounting, Apparatus, 15A—one per three 117A IUs
- Backboard, 173A
- Cover, 116A—includes two ◗811910082◖ (P-19A008) cover supports and screws that attach to the 15A apparatus mounting to support the cover
- Block, Connecting, 66M1-50 (Fig. 2)
- Clip, Bridging, B.

Associated Equipment for PCA RCX Only (Order Separately)

- Unit, Telephone, Key, 227B—one per three lines (Fig. 11C only)
- ◗Unit, Telephone, Key, 17B—one per line (Fig. 11F only)◖
- Unit, Telephone, Key, 25B—one per three lines (Fig. 11D and H only)
- Bracket, ◗813722048 (P-37B204)◖ —one per two ◗17B◖ or 25B KTUs
- Capacitor, KS-19524, L9, 60 μF—one per 25B KTU (required to prevent longitudinal imbalance)
- ◗Diode, 521D—one per Fig. 11G only.◖

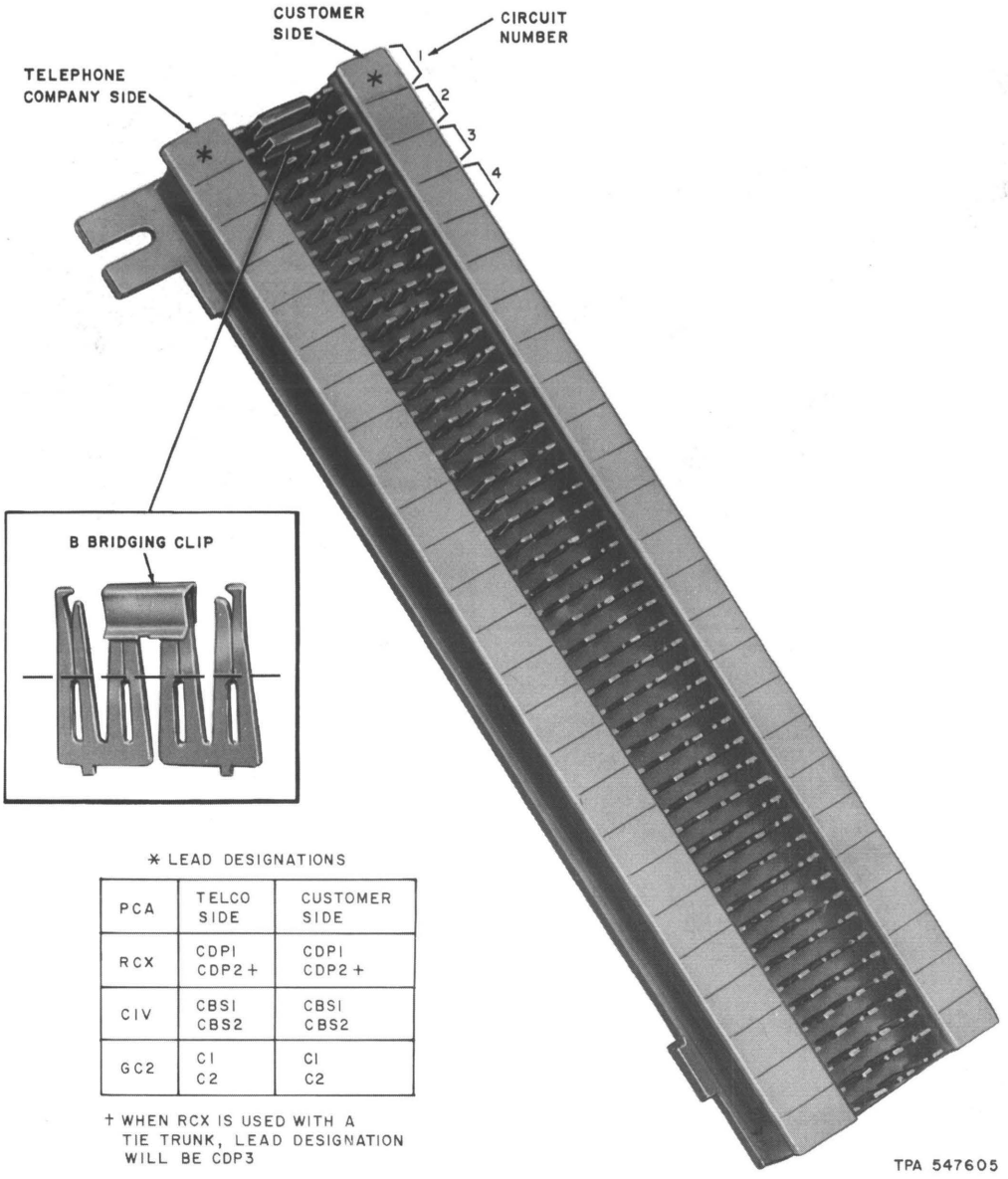
PCA GC2 (Fig. 5)

- Unit, Telephone, Key, 15D
- Box, Apparatus, ◗105C◖
- Backboard, KS-5796, L7, L8, or L9 (if required)
- Block, Connecting, 66M1-50 (Fig. 2)
- Clip, Bridging, B.

C. DESIGN FEATURES

PCA C1V

- Uses an 18D KTU.
- Screw terminals on front.
- The 105C apparatus box consists of a metal base with cover, cable rings, and dust guard. It will hold two 18D KTUs.
- Approximate dimensions of apparatus box: 7-1/2 inches high by 7 inches wide by 3-1/2 inches deep.
- B relay may follow dial pulses; SR relay not affected by dial pulses.



* LEAD DESIGNATIONS

PCA	TELCO SIDE	CUSTOMER SIDE
RCX	CDP1 CDP2+	CDP1 CDP2+
CIV	CBS1 CBS2	CBS1 CBS2
GC2	C1 C2	C1 C2

+ WHEN RCX IS USED WITH A TIE TRUNK, LEAD DESIGNATION WILL BE CDP3

Fig. 2—66M1-50 Interface Connecting Block

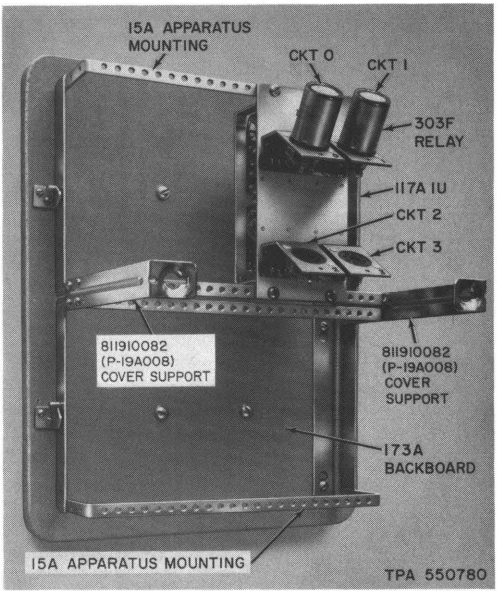


Fig. 3—Protective Connecting Arrangement RCX

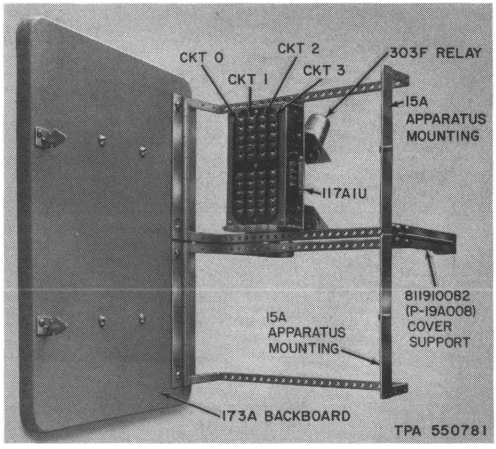


Fig. 4—Protective Connecting Arrangement RCX (Rear View)

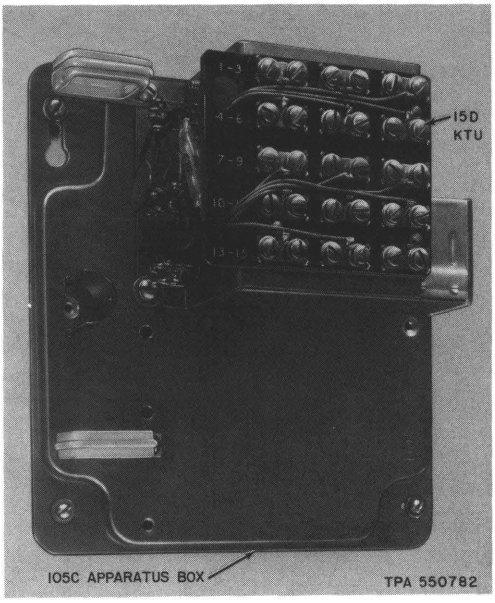


Fig. 5—Protective Connecting Arrangement GC2

PCA RCX

- Uses a 117A IU.
- Screw terminals on rear.
- 15A apparatus mounting will hold three 117A IUs (Fig. 3), or three 227B KTUs (Fig. 6), or four 25B KTUs mounted on two ◗813722048◖ (P-37B204) brackets.
- Approximate dimensions of mounting: 16-1/2 inches by 13 inches by 9 inches (with cover in place).
- 173A backboard mounts two 15A apparatus mountings.
- 116A cover encloses two 15A apparatus mountings—includes two ◗811910082◖ (P-19A008) cover supports and mounting screws.
- 117A IU is nonpolarized and contains four circuits for four 303F plug-in relays.

- DP relay is operated in the idle condition, except when connected to a tie trunk as shown in Fig. 11E only.

- DP relay follows dial pulses and ringing.

PCA GC2

- Uses a 15D KTU.

- Screw terminals on front.

- The 105C apparatus box consists of a metal base with cover, cable rings, and dust guard. It will hold two 15D KTUs.

- Approximate dimensions of apparatus box: 7-1/2 inches high by 7 inches wide by 3-1/2 inches deep.

- R relay operated by ringing voltage.

- Provides a contact closure toward the CPE over leads C1 and C2 when ringing is present on the line.

3. INSTALLATION

3.01 Refer to the following sections for detailed information on associated apparatus:

- Backboards—463-130-100

- Connecting blocks—461-604-102

- Apparatus mountings and apparatus boxes—463-140-100.

PCA C1V

3.02 The 105C apparatus box mounts on any flat surface. A backboard is not required except on damp surfaces or to facilitate mounting. A KS-5796, List 7, List 8, or List 9 backboard may be used to mount the 105C box, when required.

3.03 Connect the KS-19524, List 9, 60 μF capacitor between terminals 9 and 11 of the 18D KTU.

3.04 Mount the 18D KTU in the 105C apparatus mounting and make connections as shown in Fig. 8.

3.05 Perform tests in Part 5 after installation and connections have been completed.

PCA RCX

3.06 Attach the 173A backboard to the wall. Fasten the 15A apparatus mounting to the backboard and install the 117A IU(s) on the 15A apparatus mounting. The 117A IU may also be mounted on 23-inch relay racks with 67B mounting bars. Make connections as shown in Fig. 9.

3.07 When PCA RCX is used with ground start CO trunks associated with a 700-type PBX, mount an auxiliary 227B KTU on a 15A apparatus mounting (Fig. 6) or 23-inch relay rack with 67B mounting bars. Make connections as shown in Fig. 12.

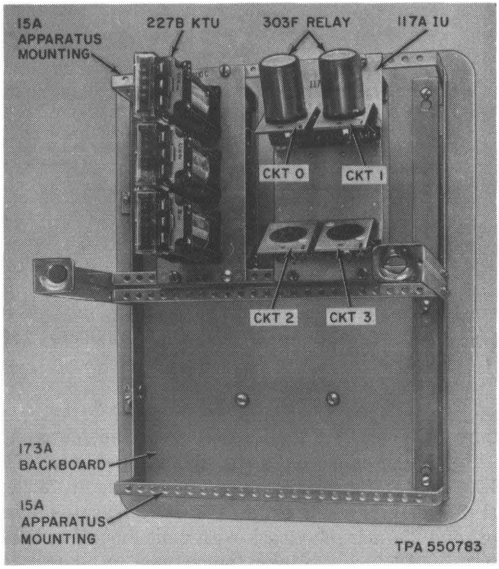


Fig. 6—15A Apparatus Mounting With 117A IU and Auxiliary 227B KTU

3.08 When PCA RCX is used with ground start CO trunks associated with an 800-type PBX, mount an auxiliary 25B KTU on a 15A apparatus mounting with an 813722048 (P-37B204) bracket, or in a 105C apparatus box (Fig. 7), or on a 23-inch

relay rack with bent mounting bars per ED-69143-70. Connect the KS-19524, List 9, 60 μF capacitor between terminals 2 and 11 on the 25B KTU (see Fig. 7). Make connections as shown in Fig. 13.

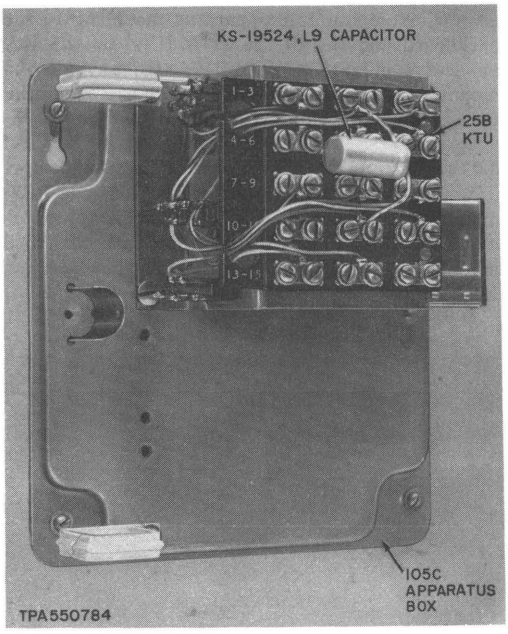


Fig. 7—105C Apparatus Box With Auxiliary 25B KTU

3.09 When PCA RCX is used to provide outgoing supervision on a tie trunk, mount a 17B KTU on a 15A apparatus mounting with an 813722048 (P-37B204) bracket, or in a 105C apparatus box, or on a 23-inch relay rack with bent mounting bars per ED-69143-70. Make connections as shown in Fig. 11F.

3.10 Perform tests in Part 5 after installation and connections have been completed.

PCA GC2

3.11 The 105C apparatus box mounts on any flat surface. A backboard is not required except on damp surfaces or to facilitate mounting. A KS-5796, List 7, List 8, or List 9 backboard may be used to mount the 105C box, when required.

3.12 Mount the 15D KTU in the 105C apparatus mounting and make connections as shown in Fig. 10.

3.13 Perform tests in Part 5 after installation and connections have been completed.

4. OPERATION

4.01 ***PCA C1V (Fig. 8):*** This service requires an 18D KTU only. On seizure of the CO line by the telephone company station or PBX, B relay operates from CO line current. The B relay operated operates SR relay which provides a contact closure toward the CPE over leads CBS1 and CBS2. The SR relay (slow release) maintains the CBS1-CBS2 closure, while the B relay may follow dial pulses from the CO line. When the line is idle, both relays release.

4.02 ***PCA RCX:*** This arrangement is intended to provide an indication to CPE of outgoing calls and the digits dialed (rotary). In some applications of this arrangement, however, a ringing and/or off-hook indication will be present during incoming calls. For this reason, an explanation of the circuit operation on incoming calls is included for each application of the arrangement.

(a) ***Loop Start CO Trunks, PBX Lines, or CO Lines (Fig. 9, 11A or 11B):*** In this application the DP relay of the 117A IU is bridged directly across the tip and ring and held operated by CO battery and ground. The DP relay operated opens the CDP1 and CDP2 leads toward the CPE which indicates that the line is in an idle condition. When the station goes off-hook, the DP relay is shunted which causes it to release and provide a contact closure between the CDP1 and CDP2 leads toward the CPE to indicate line seizure. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On incoming calls, depending on the ringing signal, the DP relay may or may not operate and release in unison with the ringing cycle, but the contact between the CDP1 and CDP2 leads toward the

CPE will be closed when the call is answered (off-hook indication).

(b) ***Ground Start CO Trunk on 700-Type PBX (Fig. 11C):*** In this application an auxiliary 227B KTU is used to connect the 117A IU across tip and ring of the CO line. When the line is seized, the ground contact closure on the B or SR lead from the PBX trunk operates the CA1 relay in the 227B KTU. The CA1 relay operated closes a contact between the CDP1 and CDP2 leads towards the CPE to indicate line seizure, and another contact connects the 117A IU across tip and ring of the CO line. The DP relay in the 117A IU remains released due to the shunting effect of the off-hook station. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call the DP relay may or may not operate and release in unison with the ringing cycle, but the contact between the CDP1 and CDP2 leads toward the CPE will be closed when the call is answered (off-hook indication).

(c) ***Ground Start CO Trunk on 800-Type PBX (Fig. 11D):*** In this application an auxiliary 25B KTU is used to connect the 117A IU across tip and ring of the CO line. When the station goes off-hook, the line current operates the L2 relay in the 25B KTU. The L2 relay operated provides a contact closure to operate the CT relay. CT relay operated provides a contact closure between leads CDP1 and CDP2 toward the CPE to indicate line seizure, and another contact closure bridges the 117A IU across tip and ring of the CO line. The DP relay in the 117A IU remains released due to the shunting effect of the off-hook station. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call the contact between the CDP1 and CDP2 leads toward the CPE will close when the call is answered (off-hook indication).

(d) ***Tie Trunk With E and M or DX Signaling (Fig. 11E):*** In this application the DP relay of the 117A IU is operated by a ground contact closure in the tie trunk. When the station goes off-hook, the dial pulsing contact in the tie trunk is closed operating the DP relay. The DP relay operated closes the contact between the CDP1 and CDP3 leads towards the CPE indicating line seizure. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP3 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call, there will not be a closure between the CDP1 and CDP3 leads toward the CPE until the call is answered by the PBX attendant.

(e) ♦***Tie Trunk—Outgoing Calls (Fig. 11F):*** This application requires a 17B KTU to connect the 117A IU across the tip and ring of the tie trunk. When the tie trunk is seized at PBX(A) on an outgoing call, the tie trunk supplies a ground to operate relay SW from PBX or local battery. Make contacts on relay SW connect relay DP in the 117A IU across the tie trunk circuit and provide a closure across CDP1 and CDP2 toward the CPE to indicate seizure. Relay DP does not operate due to the shunt of the off-hook station. When the station dials, relay DP follows the dial pulses to open and close the CDP1 and CDP2 contacts. When the station goes on-hook, the SW and DP relays release, removing the closure toward the CPE. On an incoming call, the closure between CDP1 and CDP2 occurs when the call is answered (off-hook indication).

Note: Unwanted pulses in addition to dial pulse information may appear on leads CDP1 and CDP2 during call process, depending on the associated PBX.

(f) ***Tie Trunk—Incoming Call (Fig. 11G):*** In an idle trunk condition, relay DP will be operated from the PBX battery on the tip and ring opening CDP1 and CDP2 to the CPE. When the trunk is seized on an incoming call, the tie trunk circuit (A) shunts relay DP which releases, providing a closure on CDP1 and CDP2 as a seizure indication. Relay DP will follow dial pulses from the distant end which opens and closes CDP1 and CDP2.

Note: Unwanted pulses in addition to dial pulse information may appear on leads CDP1 and CDP2 during call process, depending on the associated PBX.♦

(g) ***Station Line From 800-Type PBX (Fig. 11H):*** In this application an auxiliary 25B KTU is used to connect the 117A IU across tip and ring of the station. When the station goes off-hook, the line current operates the L2 relay in the 25B KTU. The L2 relay operated provides a contact closure to operate the CT relay. CT relay operated provides a contact closure between leads CDP1 and CDP2 toward the CPE to indicate line seizure, and another contact closure bridges the 117A IU across tip and ring of the station line. The DP relay in the 117A IU remains released due to the shunting effect of the off-hook station. As the station dials, the DP relay operates and releases to open and close the contact between the CDP1 and CDP2 leads toward the CPE to indicate digits dialed. The contact closure toward the CPE will open when the line becomes idle. On an incoming call the contact between the CDP1 and CDP2 leads toward the CPE will close when the call is answered (off-hook indication).

4.03 ***PCA GC2 (Fig. 10):*** This service requires a 15D KTU bridged across the CO or PBX line. R relay operates from ac ringing voltage and is not affected by the dc line voltage. When ringing voltage is on the line, the R relay will operate and provide a contact closure across the C1 and C2 leads toward the CPE. The R relay contact opens when ringing voltage ceases.

5. MAINTENANCE

5.01 Check CO pair and for blown fuses, loose or broken connections.

5.02 Open the leads to the circuit under test by removing the B bridging clips or wire straps at the 66M1-50 interface connecting block. Make all test connections on the telephone company side of the block. Perform the following tests:

(a) ***PCA C1V (Fig. 8):*** Connect an 81A or KS-16990, List 1 test set across terminals CBS1 and CBS2. Set the test set to the continuity position (continuity should not be indicated). At the connecting arrangement, connect a 1013A (or equivalent) hand test set across the T and R leads to the telephone company station or PBX. Push the TALK-MON switch of the hand test set to the TALK position. Dial tone should be heard, and the B and SR relays should operate and close the contact to terminals CBS1 and CBS2. The 81A or KS-16990, List 1 test set should indicate continuity. Dial "O" using the 1013A (or equivalent) hand test set. The 81A or KS-16990, List 1 test set should continue to indicate continuity while dialing. Remove the 1013A (or equivalent) hand test set, and the relays will release opening the leads to terminals CBS1 and CBS2.

(b) ***PCA RCX (Fig. 9):*** Connect an 81A or KS-16990, List 1 test set across the CDP1 and CDP2 terminals. Set the test set to the continuity position (continuity should not be indicated). At the connecting arrangement, connect a 1013A (or equivalent) hand test set across the T and R leads to the telephone company station or PBX. Push the TALK-MON switch of the hand test set to the TALK position. Dial tone should be heard and continuity shown at the CDP1 and CDP2 terminals. Dial "O" using the 1013A (or equivalent) hand test set. The 81A or KS-16990, List 1 test set should follow dial pulses. Remove the 1013A (or equivalent) hand test set, and the test set connected across the CDP1 and CDP2 leads should indicate open.

(c) ***PCA GC2 (Fig. 10):*** Connect an 81A or KS-16990, List 1 test set across the C1 and C2 terminals. Set the test set to the continuity position (continuity should not be indicated). At the connecting arrangement, connect a 1013A (or equivalent) hand test set across the T and R leads to the telephone company station. Push the TALK-MON switch of the hand test set to the TALK position. Dial tone should be heard and an open circuit indicated at C1 and C2 terminals. Dial the test desk and arrange to have ringing voltage applied to the line. Push the TALK-MON switch of hand test set to MON. The test set connected to the C1 and C2 terminals should indicate continuity during ringing.

Warning: Hold hand test set away from ear while ringing current is applied.

5.03 If the test results described are not obtained check wiring, battery, and ground to unit. If battery and ground are present and wiring is correct, replace the 18D KTU, 117A IU, or 15D KTU, and retest.

5.04 If test results are satisfactory, restore circuit to normal by removing all test connections,

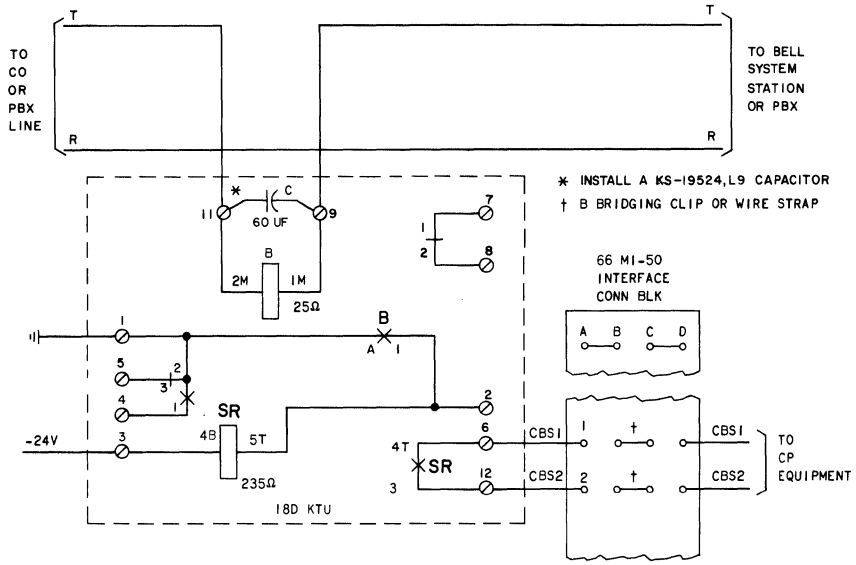


Fig. 8—Protective Connecting Arrangement C1V—Schematic

and replace the B bridging clips or wire straps on the 66M1-50 interface connecting block.

Do not attempt any tests or repairs to the CPE.

5.05 When trouble is suspected 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 Service With Customer-Provided Equipment (CPE).

6. CONNECTIONS

Based on a maximum of 100 feet of 24-gauge conductor loop between the IU and the interface connecting block, the associated telephone company wiring will have a nominal 5-ohm dc resistance with the contacts closed.

6.01 For PCA C1V, refer to Fig. 1, 2, and 8.

6.02 For PCA RCX with loop start, refer to Fig. 2, 9, 11A, and 11B.

6.03 For PCA RCX with ground start CO trunk (700-type PBX), refer to Fig. 2, 9, 11C, and 12.

6.04 For PCA RCX with ground start CO trunk (800-type PBX), refer to Fig. 2, 9, 11D, and 13.

6.05 For PCA RCX with tie trunks or CO trunk with E and M signaling, refer to Fig. 2, 9, and 11E.

6.06 ▶For PCA RCX with dial repeating tie trunks, refer to Fig. 2, 9, and 11F or 11G.◀

6.07 For PCA RCX with station line from an 800-type PBX, refer to Fig. 2, 4, 7, 9, 11H, and 13.

6.08 For PCA GC2, refer to Fig. 2, 5, and 10.

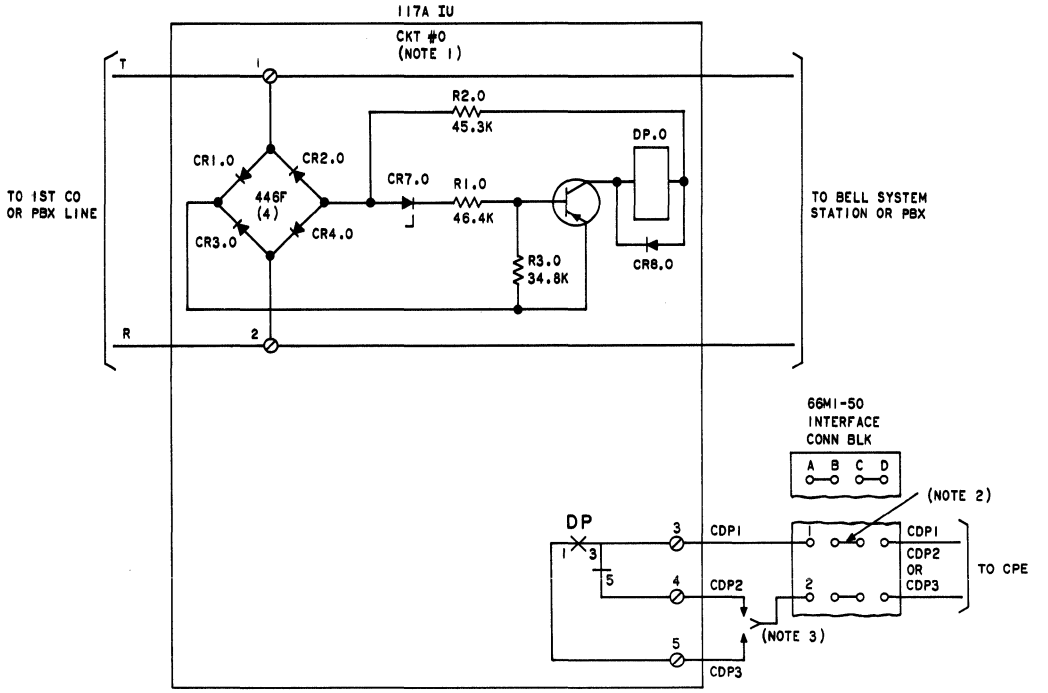


TABLE A

CONNECTIONS TO SCREW TERMINALS ON 117A IU					
CKT NO.	LEAD DESIGNATIONS				
	T	R	CDP1	CDP2	CDP3
0	1	2	3	4	5
1	11	12	13	14	15
2	21	22	23	24	25
3	31	32	33	34	35

NOTES:

1. 117A IU PROVIDES FOUR CIRCUITS WHEN EQUIPPED WITH FOUR 303F PLUG-IN RELAYS. SEE TABLE A FOR ASSOCIATED CIRCUIT AND TERMINAL NUMBERS.
2. B BRIDGING CLIP OR WIRE STRAP.
3. USE LEAD CDP3 ONLY WHEN RCX IS USED WITH A TIE TRUNK ARRANGEMENT AS SHOWN IN FIG. 11E. USE LEAD CDP2 IN ALL OTHER ARRANGEMENTS.

Fig. 9—Protective Connecting Arrangement RCX—Schematic

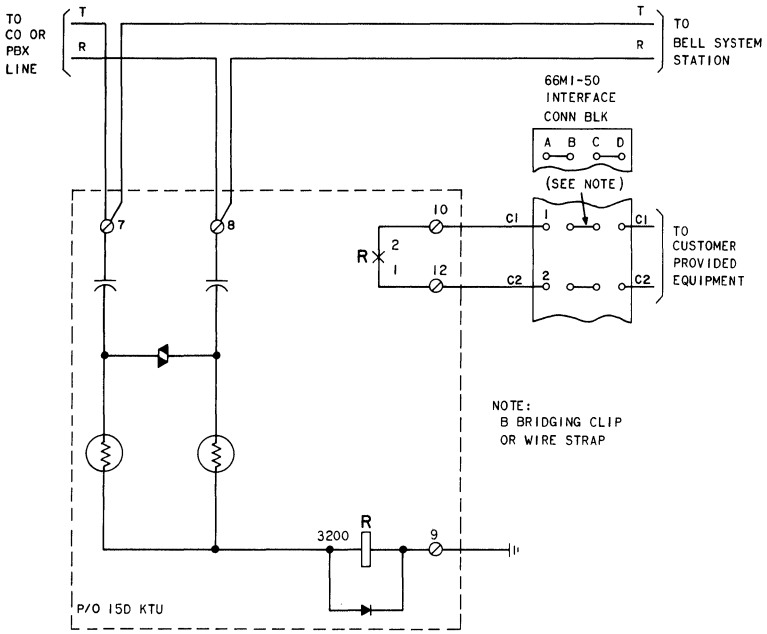
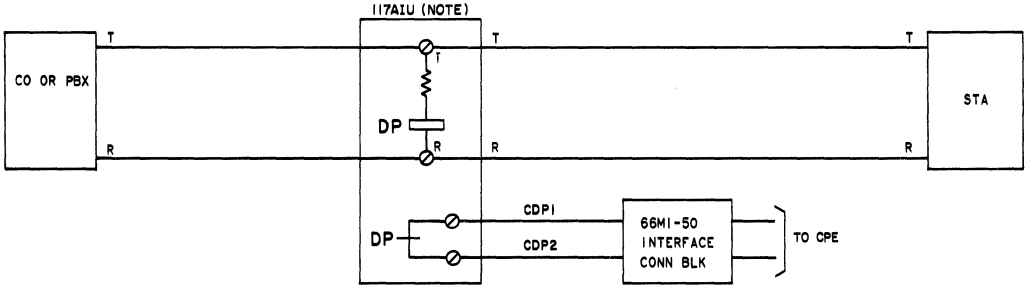
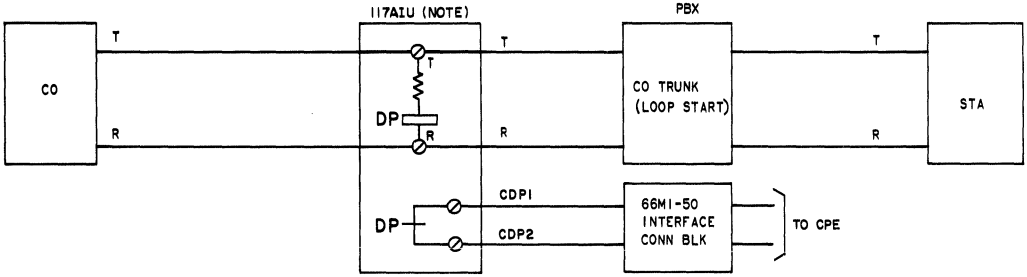


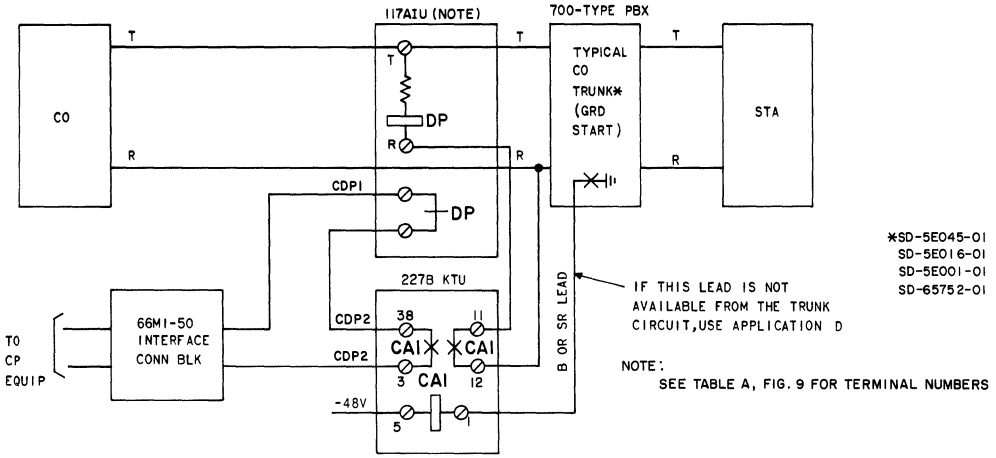
Fig. 10—Protective Connecting Arrangement GC2—Schematic



A. RCX WITH CO OR PBX LINE

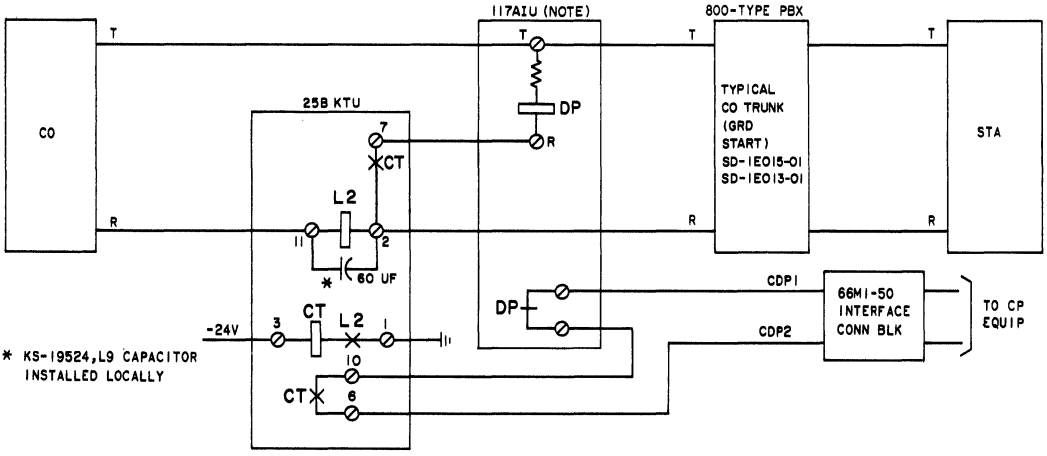


B. RCX WITH LOOP START CO TRUNK

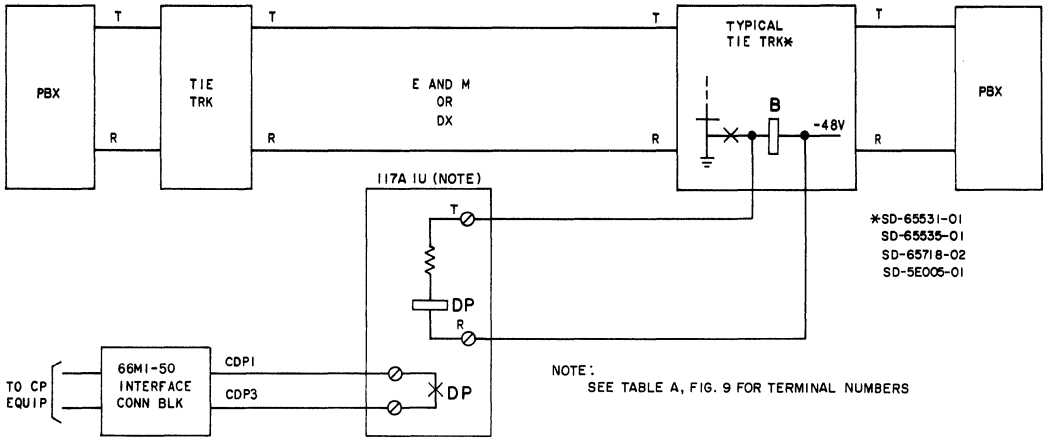


C. RCX WITH GROUND START CO TRUNK (700-TYPE PBX)

Fig. 11—Protective Connecting Arrangement RCX—Typical Circuit Applications (Sheet 1 of 3)

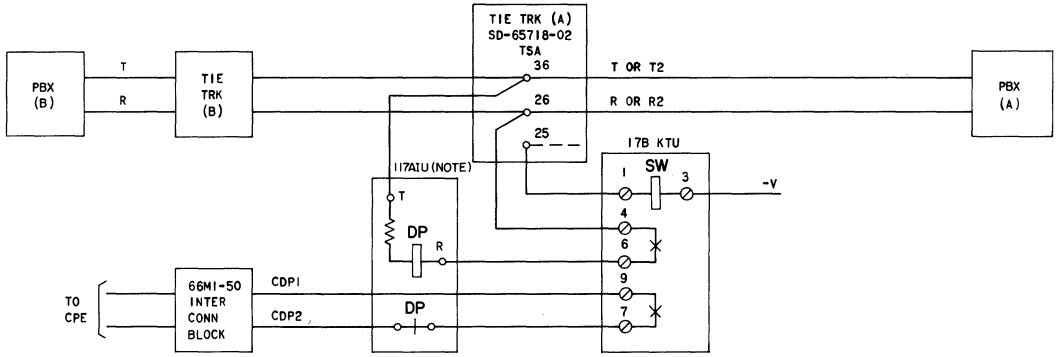


D. RCX WITH GROUND START CO TRUNK (800-TYPE PBX)

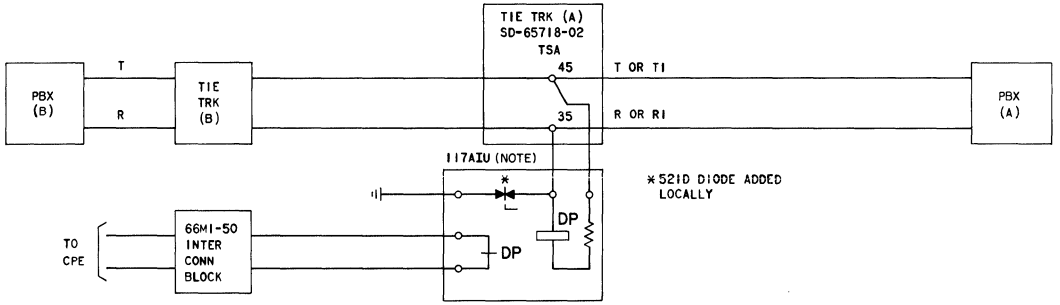


E. RCX WITH TIE TRUNK

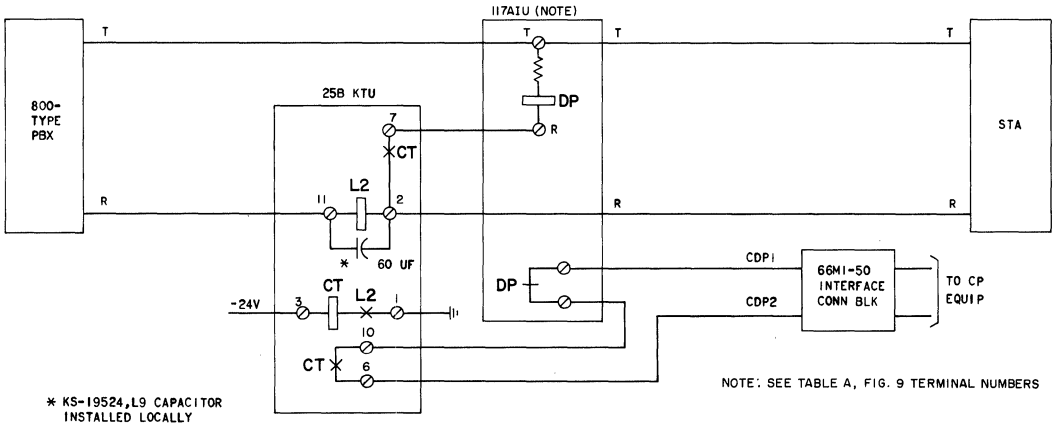
Fig. 11—Protective Connecting Arrangement RCX—Typical Circuit Applications (Sheet 2 of 3)



F. RCX WITH TIE TRUNK - OUTGOING CALLS



G. RCX WITH TIE TRUNK - INCOMING CALLS



H. RCX WITH STATION LINE FROM 800-TYPE PBX

Fig. 11—Protective Connecting Arrangement RCX—Typical Circuit Applications (Sheet 3 of 3)

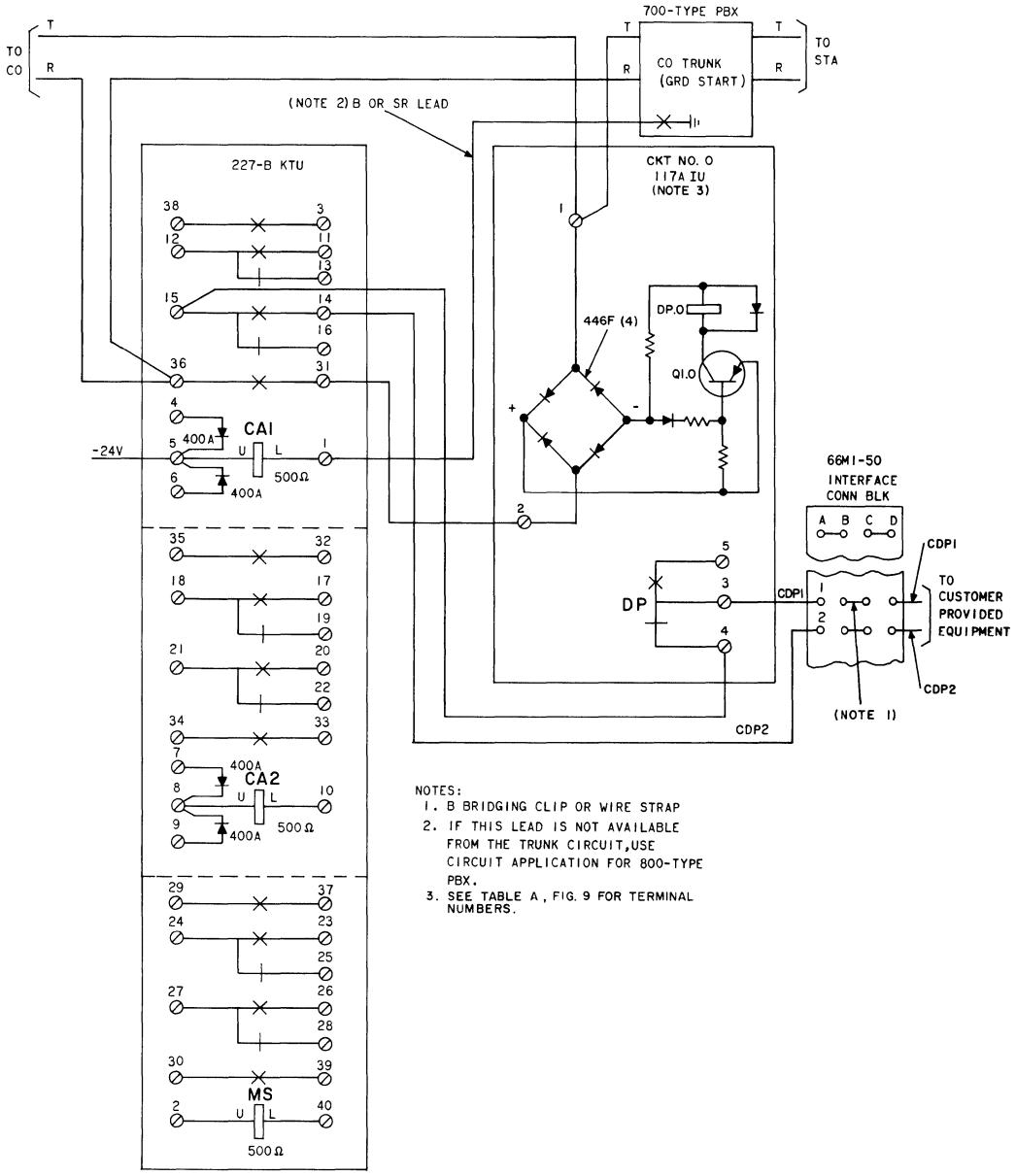
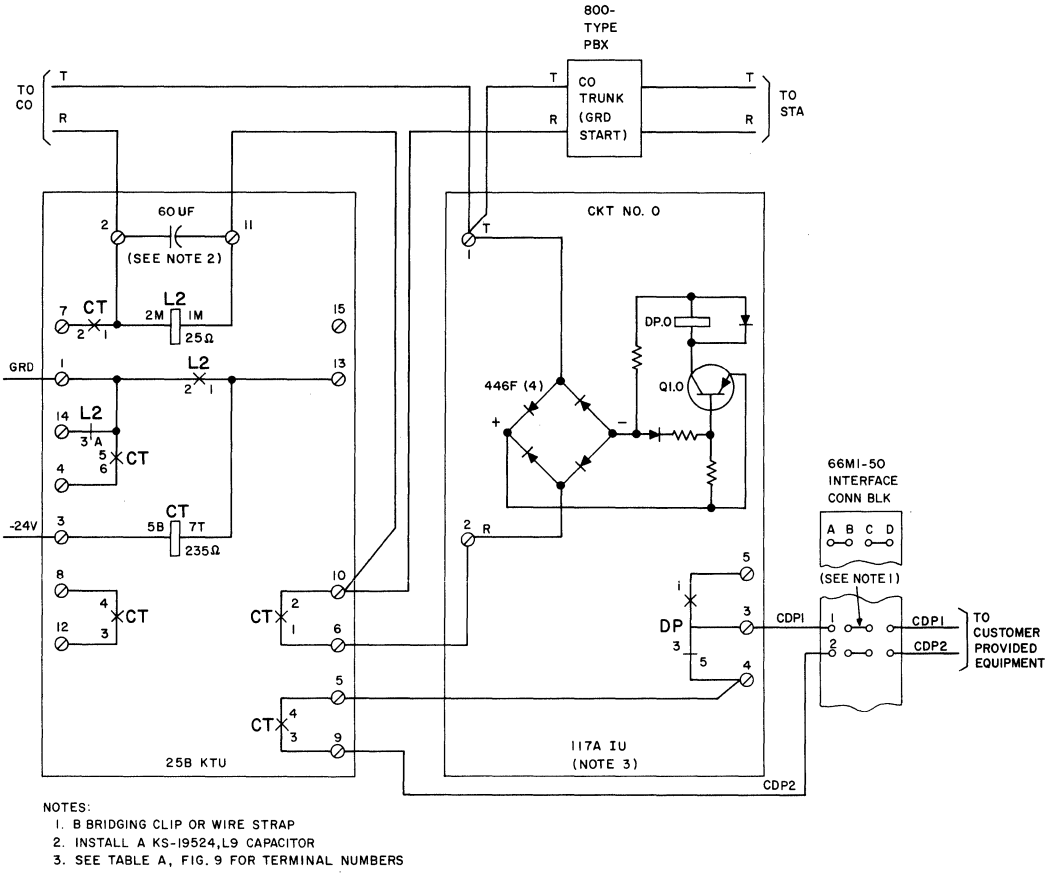


Fig. 12—Protective Connecting Arrangement RCX for Ground Start CO Trunks Associated With 700-Type PBX



NOTES:
1. B BRIDGING CLIP OR WIRE STRAP
2. INSTALL A KS-19524,L9 CAPACITOR
3. SEE TABLE A, FIG. 9 FOR TERMINAL NUMBERS

Fig. 13—Protective Connecting Arrangement RCX for Ground Start CO Trunks Associated With 800-Type PBX