PROTECTIVE CONNECTING ARRANGEMENTS CDQ4W AND CDQ4X

1. GENERAL

1.01 This section provides identification, installation, method of operation, maintenance, and connecting information for Protective Connecting Arrangements (PCA) CDQ4W and CDQ4X (Fig. 1 and 2). These PCAs provide for the connection of 2-way dial repeating tie trunks between a customer-provided (CP) switching system and a Bell System PBX or Centrex system. They present a 4-wire transmission interface with channel signaling provided by the telephone company between Bell System 4-wire facilities and the CP equipment (CPE). PCA CDQ4W is used with CP trunks designed for a dry contact type signaling interface. PCA CDQ4X is used with CP trunks designed for an E and M type signaling interface. PCA CDQ4W consists of an interconnecting unit (IU) J53050C, List 1 (MD) or List 3 (Fig. 3); DX signaling unit J98605AJ; 44V4A intermediate repeater shelf J98615AH, List 2, equipped with plug-in components; and KS-15620, List 22 rectifier. PCA CDQ4X uses the same equipment as CDQ4W with the exception of the J53050C IU which is a List 2 (Fig. 4) instead of a List 1 or 3.

> ***Note:*** An X76090 loop-back panel may be provided at the customer's premises to facilitate testing the connecting arrangement from the serving central office.

1.02 This section is reissued to:

- Include coverage of the J98605AJ DX signaling unit which replaces the J98605AG, now rated MD. (Information required for maintenance of existing installations using the J98605AG has been retained.)
- Rate the J53050C, List 1 IU MD.
- Include information on the KS-15620, List 22 rectifier which replaces the KS-15620, List 14, now rated MD.
- Add current drain information.
- Replace the term Voice Connecting Arrangement (VCA) with Protective Connecting Arrangement (PCA).
- Add post-installation tests.
- Expand maintenance information.
- Remove KS-20944 protector from Design Features.

1.03 If the customer wants a copy of the Technical Reference which covers this interface specification, 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 drawings:

CD-1E206, Issue 1, Appendix 3B, and SD-1E206, Issue 4B (J53050C, L1 and L3 IU)

CD-1E254, Issue 1 and SD-1E254, Issue 1 (J53050C, L2 IU)

CD-97047, Issue 5D, Appendix 2D, and SD-97047, Issue 16D (44V4A Repeater)

J98605AJ-1, Issue 8 and SD-1C363, Issue 4B (J98605AJ DX Signaling Unit)

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

2. IDENTIFICATION

PURPOSE

- To provide a 4-wire voice connection between a CP PBX and Bell System tie line facilities
- To provide dry contact type signaling or E and M signaling to and from CPE

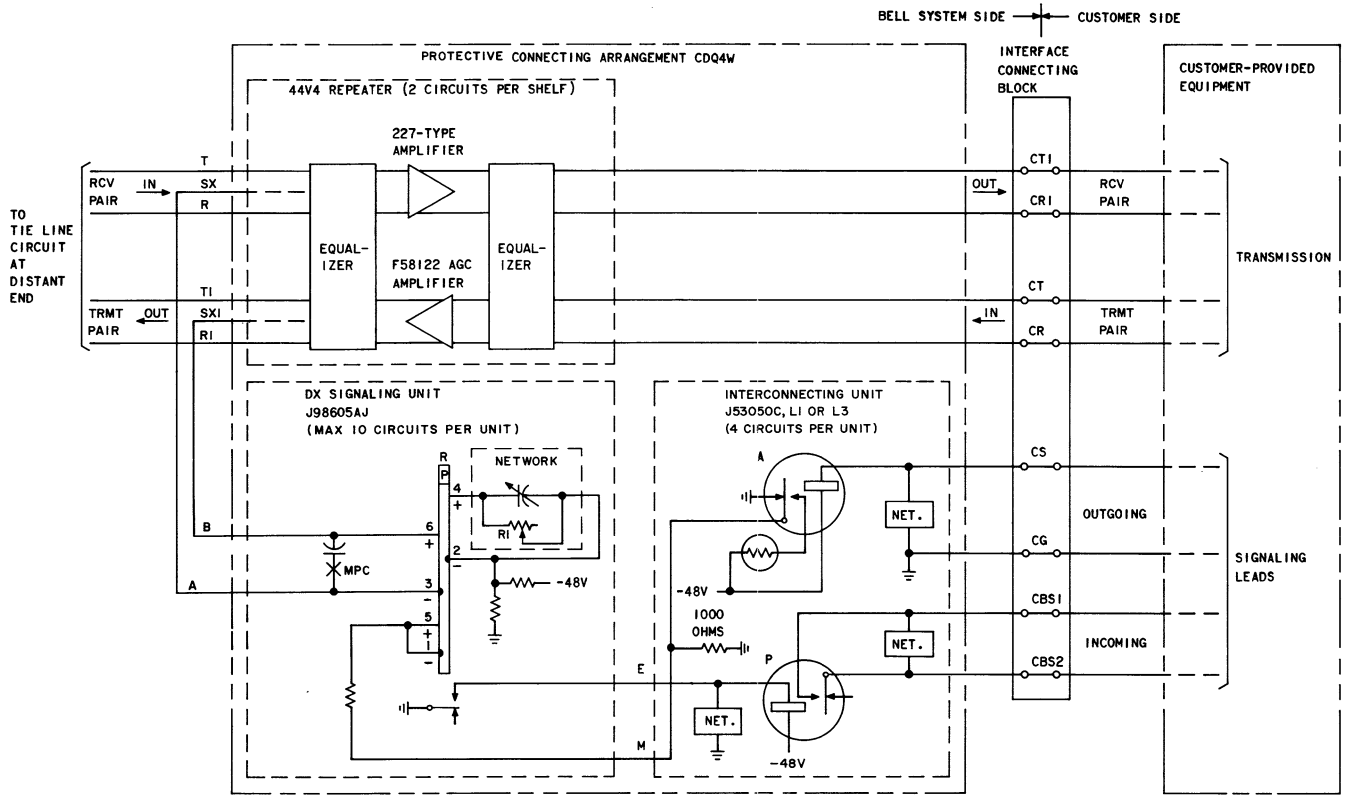


Fig. 1—Simplified Schematic—PCA CDQ4W

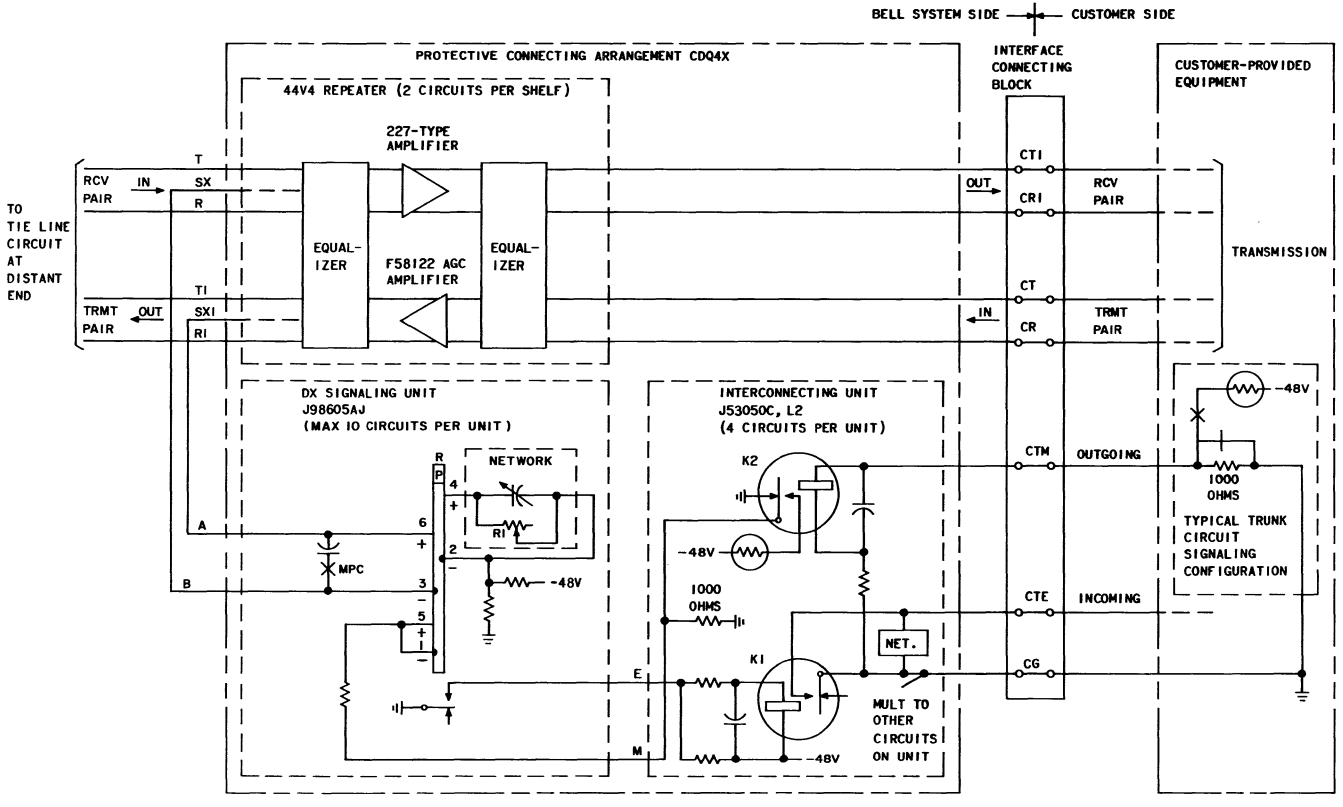


Fig. 2—Simplified Schematic—PCA CDQ4X

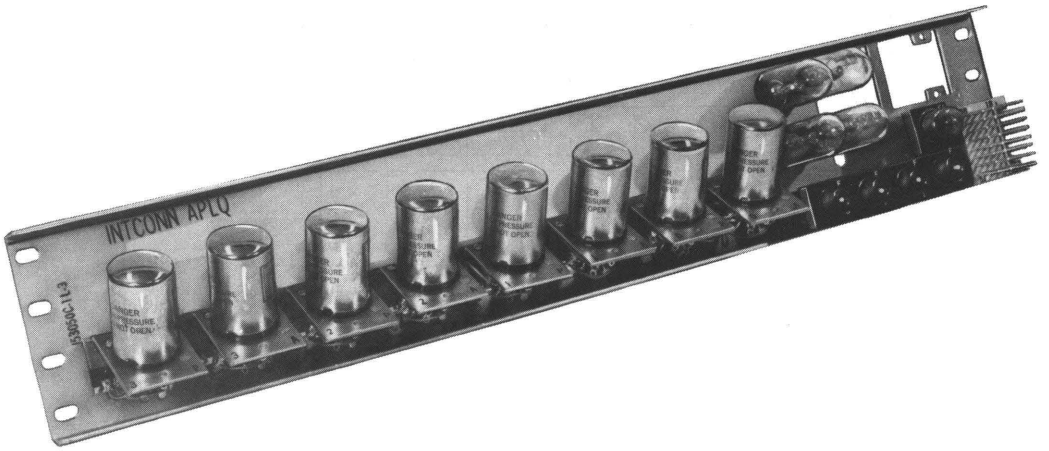


Fig. 3—J53050C, List 3 IU

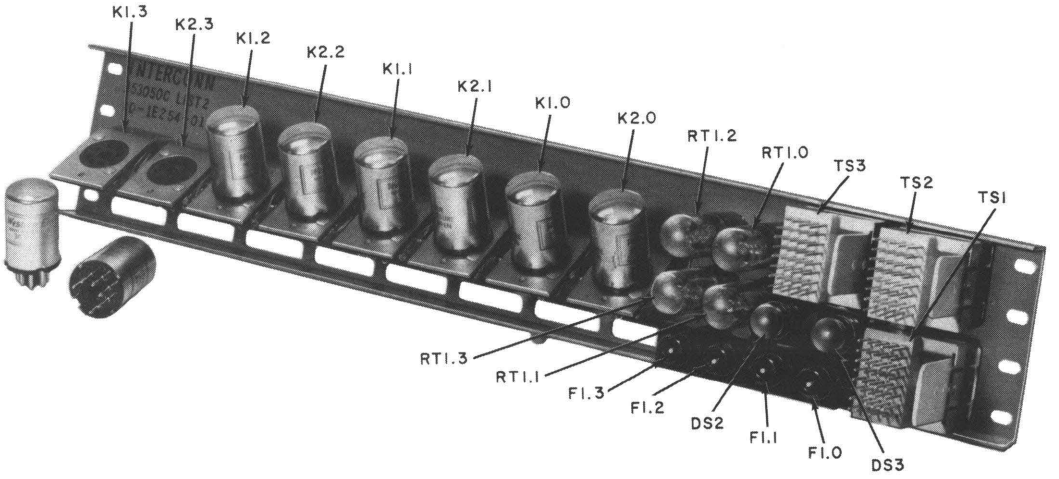


Fig. 4—J53050C, List 2 IU

- To limit excessive levels from CPE, to provide protection for telephone company personnel against hazardous voltages, to insure longitudinal balance, and to repeat network control signaling.

ORDERING GUIDE

- Unit, Interconnecting, J53050C, List 1 (MD) or List 3—for PCA CDQ4W. Each unit provides four signal isolation (applique) circuits.

- Unit, Interconnecting, J53050C, List 2—for PCA CDQ4X. Each unit provides four signal isolation (applique) circuits.

- Unit, Signaling DX, J98605AJ—order both List 1 and List A to get a mounting assembly with wiring and connectors for ten circuits; order required number of 334A relays separately, one per tie trunk circuit being served.

- Shelf, Repeater, Intermediate 44V4A, J98615AH, List 2—each shelf provides two circuits.

Note: For plug-in components, refer to Section 852-307-101. When automatic control of signal power level is required, order F58122 automatic gain control (AGC) amplifier for use in the ***transmitting leg from the CPE to Bell System facilities*** instead of the standard 227-type amplifier shown in Section 852-307-101 (see Fig. 1 and 2).

Associated Apparatus (Order Separately)

- Rectifier, List 22, KS-15620 (2 amperes at −48 volts).

Note: This rectifier meets acceptable noise requirements as explained under Power Supplies in Section 332-104-102. Other rectifiers may be used when specified by local engineering. Typical current drain for a single CDQ4W arrangement is 0.169 ampere; for a single CDQ4X, 0.212 ampere. Be sure that rectifier capacity is adequate for the number of PCAs installed.

- Adapter, Group 33, ED-90273-70 (two required)—for mounting 19-inch rectifier on relay rack.

- Cord, Power, KS-14532

  List 1—10 ft.

  List 2—2 ft.

  List 3—15 ft.

  List 4—20 ft.

  List 5—25 ft.

- Cable, Wiring, "D" Inside, 16-pair or equivalent—for cabling from connecting arrangement to interface connecting block.

- Block, Connecting, 66M1-50 (Fig. 5 and 6).

Note: Other types of blocks may be used when specified by local engineering.

- Clip, Bridging, B (25 per pkg).

- Block, Connecting, 66 Type—for connecting telephone company facilities.

- Panel, Loop-Back, X76090 (optional).

Note: The loop-back panel mounts on a standard 23-inch relay rack. Four circuits are provided per panel; one panel is required for each two 44V4A repeater panels. Power must be provided from a local −48 volt source with a local fusing arrangement.

- Protector, List 2, KS-20944 (optional)—***must*** be provided when CP power supply is used to power the PCAs. See Fig. 11 and 12.

- Block, Connecting, 66C1-16 or equivalent—for providing distribution of power when KS-20944 protector is used between CP power supply and ***more than one*** connecting arrangement of any type. See Fig. 13.

Note: The cumulative current drain of all the connecting arrangements connected to a KS-20944 protector must not exceed the maximum current rating of the protector. For instance, if the maximum current drain

for one connecting arrangement is 1.0 ampere and the maximum current rating of a KS-20944, List 2 protector is 15 amperes, no more than 15 connecting arrangements may be connected to the protector (this example is for illustrative purposes only).

- Wire, AM, 14 gauge, paired, red and black, P-384614 or equivalent—for cabling from the KS-20944 protector to the 66C1-16 connecting block. See Fig. 13.

Replaceable Components

- Fuses, 70A (1-1/3 amp) (J53050C IU)
- Plug-in components of 44V4A repeater
- Relays, 303E (J53050C, List 1 [MD] and List 3 IU) or 303K (J53050C, List 2 IU)
- Relays, 334A (J98605AJ DX Signaling Unit).

DESIGN FEATURES

44V4A Repeater Shelf

- Mounts on standard 23-inch relay rack on 1-3/4 inch centers.
- Two repeater circuits per shelf.
- Each circuit provides a 4-wire voiceband transmission path (voice coupler) to and from the CP equipment.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.
- Typical current drain per circuit: 0.036 ampere.

J98605AJ DX Signaling Unit

- Mounts on standard 23-inch relay rack
- Up to ten circuits per unit
- Provides DX signaling to the distant end
- Provides loop-strapping options
- Typical current drain per circuit: 0.061 ampere.

J53050C, List 1 (MD) or List 3 Interconnecting Unit

- Mounts on standard 23-inch relay rack.
- Four signal isolation (applique) circuits per unit.
- Lists 1 and 3 are electrically the same with the exception that List 3 is equipped with four fuses (one per circuit); List 1 was manufactured prior to January 1971.
- Converts standard Bell System E lead signaling to a dry contact closure.
- Converts CP dry contact closure to standard Bell System M lead signaling.
- Provides dc isolation of the signaling leads between the CP equipment and the DX signaling unit.
- Typical current drain per circuit: 0.072 ampere.

J53050C, List 2 Interconnecting Unit

- Mounts on standard 23-inch relay rack
- Four signal isolation (applique) circuits per unit
- Accepts ground and battery supervisory signals over M lead from CP equipment
- Provides closure (to ground) and open supervisory signals over E lead to CP equipment
- Provides dc isolation of the signaling leads between the CP equipment and the DX signaling unit
- Typical current drain per circuit: 0.115 ampere.

3. INSTALLATION

3.01 Locate the PCAs in an area free of dampness and excessive dust or dirt with adequate room for access to front and rear of equipment

and connecting blocks. The associated equipment typically mounts on a standard 23-inch relay rack (see Fig. 7).

3.02 Wire the equipment as shown in Fig. 9 and 10. Mount the interface connecting block in a position that will facilitate testing between it and the PCA equipment. Use the 16-pair "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the block. Stencil trunk number and lead designations on designation strip (see Fig. 5 and 6). Make DX signaling unit adjustments as given in 3.03. Install the proper plug-in components in the 44V4A repeater. (When the AGC amplifier is used, see 7.02 for adjustment procedures.) Apply power as shown in Fig. 9 and 10. Before installing bridging clips on the block to connect Bell System wiring to CP wiring, perform the appropriate quick test in 3.08 to determine if each PCA operates properly. If it does not, recheck installation and connections; if necessary, perform the maintenance procedures in Part 5 of this practice.

3.03 ***DX Signaling Unit Adjustments (J98605AJ) (Fig. 1, 2, and 8)***

(a) Adjust network resistor R1 to equal the simplex loop resistance (one half the resistance of one pair of the 4-wire facility), $\pm$125 ohms. When adjusting R1, be sure that at least one of the network capacitance screw switches (C1, C2, C3) is open (up). Using an ohmmeter, measure the resistance of R1 across test points TP1 and TP3 with the signaling circuit (334A relay) removed from its socket.

(b) It is desirable to have a 4 microfarad (μf) capacitor across the A and B leads. If the external circuit (the repeater) does not provide this, close the MPC screw switch on the signaling circuit to insert its 4 μf capacitor. In no case should the A-B capacitance exceed 4 μf; therefore, if the external circuit has a capacitor of more or less than 4 μf, disconnect it before connecting the 4 μf capacitor of the signaling circuit. To properly match the A-B capacitance of 4 μf, the signaling circuit network capacitance should be 6 μf (C1 and C2 closed). Refer to the SD-1C363-01 for more information on these adjustments.

Power Requirements

3.04 If Bell System power source is used to power the connecting arrangement, the customer must provide a 117V 60-Hz power outlet within power cord length of the customer-designated mounting location of the connecting arrangement (see ORDERING GUIDE for cord lengths).

3.05 The power outlet supplying connecting arrangement(s) must not be under control of a switch and should be on a separately fused power circuit to prevent accidental loss of ac line voltage. Where local instructions permit, secure the power cord to the outlet with a power cord plug retainer assembly.

3.06 Refer to appropriate sections in Division 167 for proper grounding of power plants.

3.07 ***KS-20944 Protector (Fig. 11 and 12):*** When a CP power source is used to power the connecting arrangement, a KS-20944 protector must be provided between the CP power source and the connecting arrangement. Mount the KS-20944 protector on a wall or suitable flat surface near the interface connecting block. Use the AM-type, 14-gauge wire or equivalent to make connections from the protector to the 66C1-16 connecting block. Terminate one end of the wiring to the screw terminals (term. $-$ and $+$) of the load terminal strip provided on the protector. Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 13; using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 13, depending on the number of connecting arrangements provided. Use "D" inside wire cable or equivalent to make connections from the quick-connect terminals in columns A, B, and C of the connecting block to the battery, and ground terminals on the connecting arrangements. The customer must connect his power supply to the red (GRD) and black (-V) wires extending from the protector.

Warning: The circuit breaker switch removes voltage from the load (Bell System) side of the protector only; voltage will be present on the upper terminals of the circuit breaker inside the box as soon as customer power is connected.

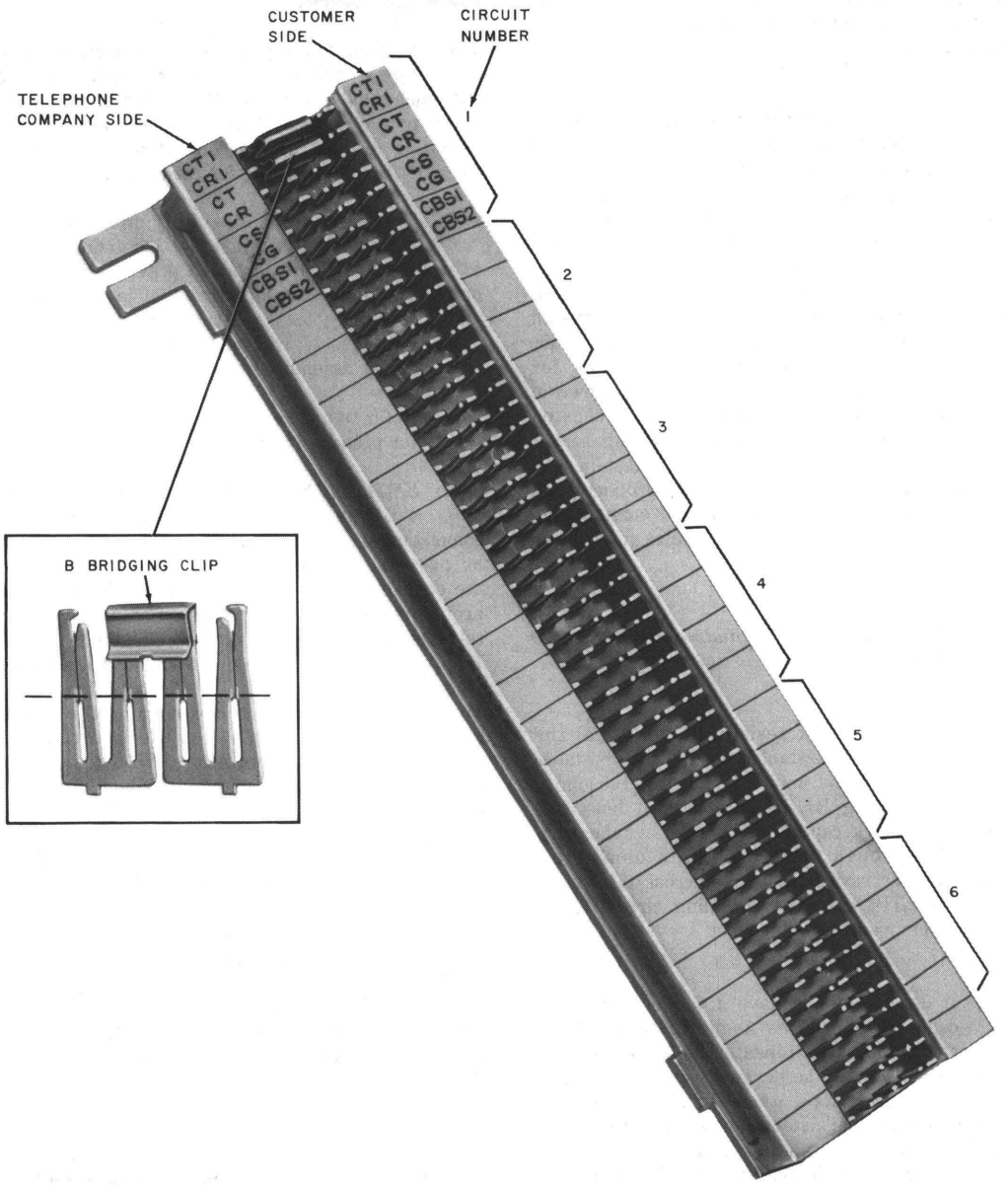


Fig. 5—Typical Interface Connecting Block—PCA CDQ4W

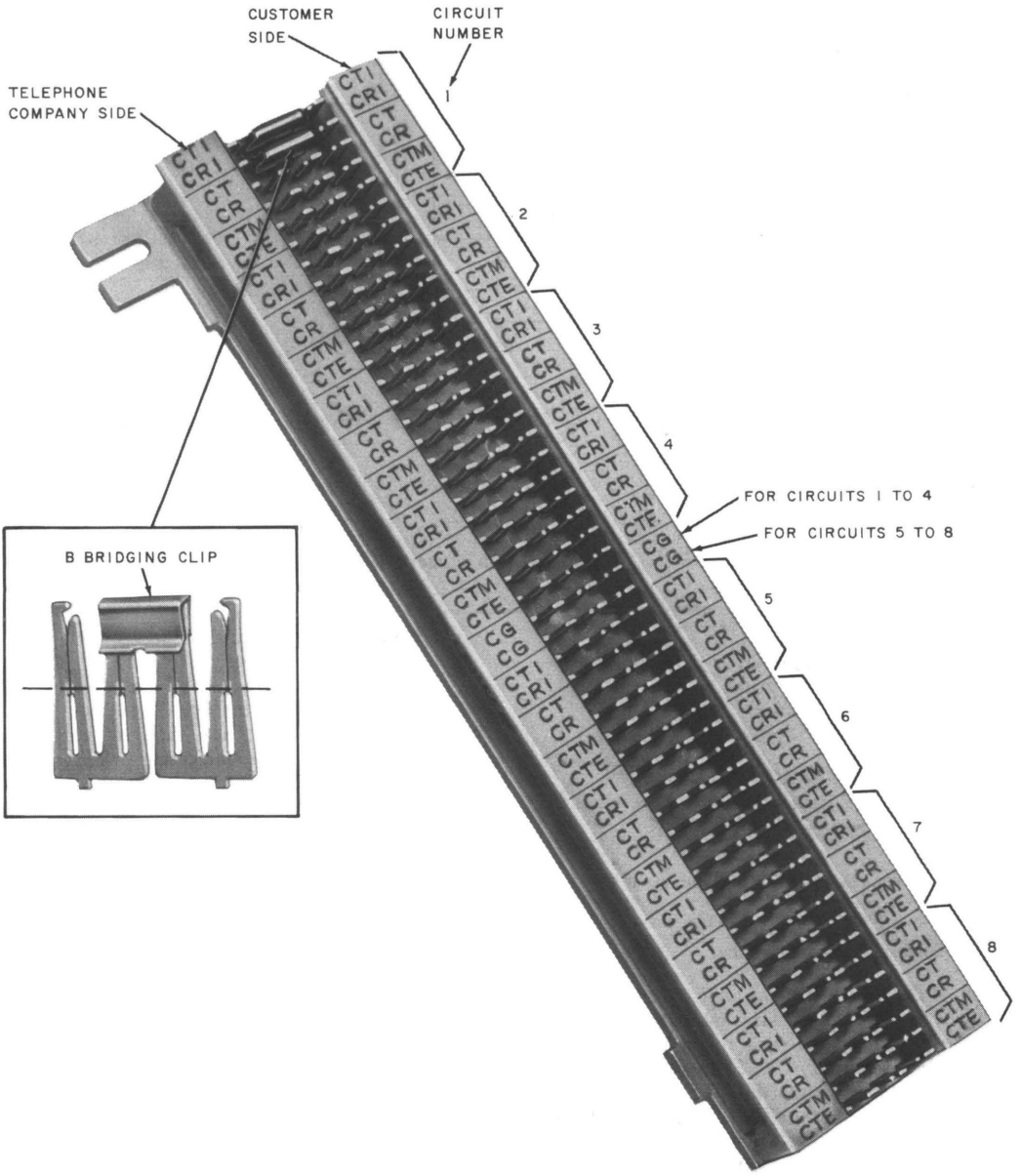


Fig. 6—Typical Interface Connecting Block—PCA CDQ4X

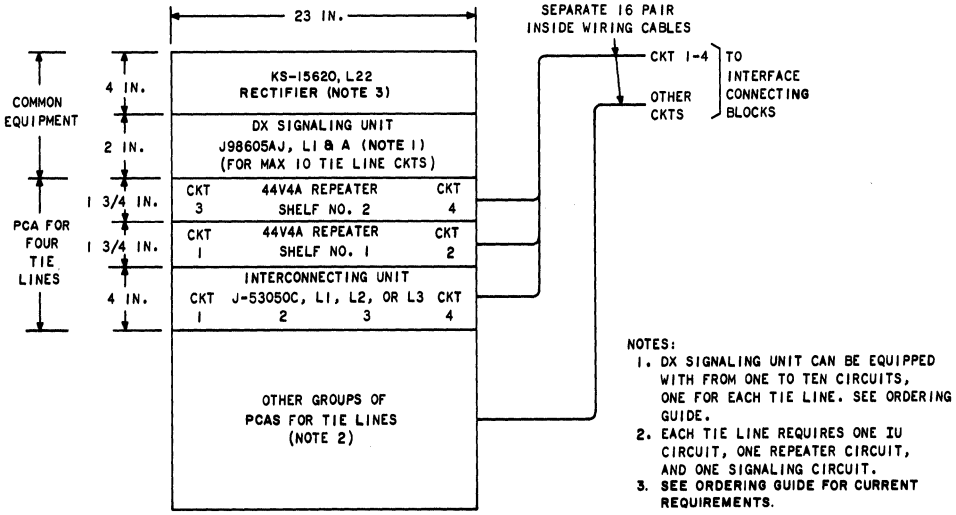


Fig. 7—Typical Rack Mounting—PCA CDQ4W or CDQ4X, Front View

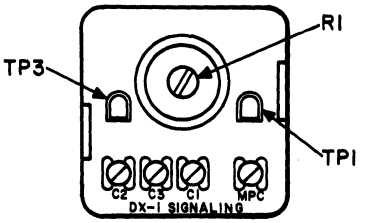


Fig. 8—334A Relay, End View

3.08 *Post-Installation Tests*

(a) ***PCA CDQ4W (Fig. 1):*** At the telephone company side of the interface connecting block, connect a 4-wire telephone, such as a 500AD, to the CT, CR, CT1, and CR1 leads; a 1013A handset across the CS and CG leads; and an 81A test set across the CBS1 and CBS2 leads. Connect talk battery from the −48 volt supply through a 500-ohm resistor to CR and ground to CT. (A 2A or 31A KTU can be used for battery feed instead of the resistor; refer to Section 518-112-421 for connections.) With the 1013A in the TALK mode, dial the distant end while monitoring on the 500AD. The distant end should answer, and satisfactory transmission should be possible using the 500AD. Ask the distant end to call you back. Put the 1013A in the MON mode and the 500AD on-hook. When the distant end calls back, the 81A (in the "C" position) should buzz, indicating closure on the CBS1 and CBS2 leads. Use the 500AD to tell the distant end that the test is complete. Restore the circuit to normal.

(b) ***PCA CDQ4X (Fig. 2):*** Same as for CDQ4W except 1013A handset is connected between CTM lead and −48 volts, 81A test set is connected across CTE and CG leads, and ground is connected to CG.

4. METHOD OF OPERATION

4.01 *Incoming Call—PCA CDQ4W (Fig. 1)*

(a) An incoming call from the distant PBX unbalances the DX signaling circuit causing R relay to operate which places a ground on the E lead, causing P relay to operate in the signal isolation (applique) circuit. P relay closes a contact toward the CP equipment across leads CBS1 and CBS2. The CP equipment must respond to this seizure by connecting dial pulse

receiving equipment to those leads and returning dial tone, if provided, to the distant PBX over leads CT and CR to indicate readiness to receive dial pulses.

(b) When dial pulses have been received, the CP equipment may transmit answer supervision to the distant PBX by placing a closure across leads CS and CG. This operates the A relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit, which repeats the answer supervision to the distant tie trunk circuit.

(c) The 44V4A repeater provides a 4-wire transmission path to the CP equipment.

4.02 ***Outgoing Call—PCA CDQ4W (Fig. 1)***

(a) The CP equipment seizes the tie trunk by placing a closure across leads CS and CG. The closure across CS, CG operates the A relay in the signal isolation circuit which in turn places battery on the M lead to the DX signaling circuit. The DX circuit unbalances the signaling circuit and gives a seizure indication at the distant PBX; the distant PBX returns dial tone, if provided, over leads CT1 and CR1. The CP equipment then outpulses the digits over the CS, CG leads which are repeated to the distant PBX.

(b) If the distant tie trunk circuit receives the answer supervision signal from its associated PBX, it unbalances the near end DX circuit causing the R relay to operate, which in turn operates the P relay in the signal isolation circuit in the same manner as an incoming call. The resulting contact closure repeats the answer supervision to the CP equipment.

(c) The 44V4A repeater provides a 4-wire transmission path to the distant end.

4.03 ***Disconnect—PCA CDQ4W (Fig. 1)***

(a) When the customer at the near end goes on-hook first, the CP equipment removes the contact closure across leads CS, CG which releases the A relay. The A relay released removes battery from the M lead toward the signaling circuit. The signaling circuit subsequently transmits a disconnect signal to the distant PBX. When the distant end goes on-hook, a disconnect signal is returned to the near end DX signaling circuit; the DX circuit removes ground from the E lead which in turn causes the P relay in the signal isolation circuit to release, removing the closure across leads CBS1, CBS2 toward the CP equipment and restoring the connecting arrangement to the idle condition.

(b) When the customer at the distant end goes on-hook first, the signaling circuit removes ground from the E lead toward the signal isolation circuit causing the P relay to release. P relay released removes the contact closure across leads CBS1, CBS2 toward the CP equipment. The CP equipment subsequently removes the contact closure across leads CS, CG which releases the A relay in the signal isolation circuit. Release of the A relay removes battery from the M lead toward the signaling circuit and restores the connecting arrangement to the idle condition.

4.04 ***Incoming Call—PCA CDQ4X (Fig. 2)***

(a) An incoming call from the distant PBX unbalances the DX signaling circuit causing R relay to operate which places a ground on the E lead toward the signal isolation circuit. E lead grounded operates K1 relay in the signal isolation circuit which closes a contact toward the near end CP equipment across leads CTE, CG. The CP equipment must respond to this seizure by connecting dial pulse receiving equipment to these leads and returning dial tone, if provided, to the distant PBX over leads CT and CR to indicate readiness to receive dial pulses.

(b) Dial pulses from the distant end are recognized by the DX signaling circuit and repeated to the signal isolation circuit by alternately opening and closing the E lead. Relay K1 in the signal isolation circuit repeats dial pulses to the CP equipment over lead CTE.

(c) When dial pulses have been received, the CP equipment may transmit answer supervision to the distant PBX by placing battery (−48 volts) on the CTM lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit, which repeats the answer supervision to the distant tie trunk.

(d) The 44V4A repeater provides a 4-wire transmission path to the CP equipment.

4.05 ***Outgoing Call—PCA CDQ4X (Fig. 2)***

(a) The CP equipment seizes the tie trunk by placing battery on the CTM lead. This operates the K2 relay in the signal isolation circuit, which in turn places battery on the M lead to the DX signaling circuit. The DX circuit unbalances the signaling circuit at the distant PBX; the distant PBX returns dial tone, if provided, over leads CT1 and CR1. The CP equipment then outpulses the digits over lead CTM, which are repeated to the distant PBX.

(b) If the distant tie trunk receives the answer supervision signal from its associated PBX, it unbalances the near end DX circuit causing the R relay to operate, which in turn operates K1 relay in the signal isolation circuit in the same manner as an incoming call. The resulting K1 contact closure repeats the answer supervision to the CP equipment by grounding the CTE lead.

(c) The 44V4A repeater provides a 4-wire transmission path to the distant end.

4.06 ***Disconnect—PCA CDQ4X (Fig. 2)***

(a) When the customer at the near-end CP equipment goes on-hook first, the CP equipment removes battery from lead CTM which releases the K2 relay in the signal isolation circuit. The K2 relay released removes battery from the M lead toward the signaling circuit. The signaling circuit subsequently transmits a disconnect signal to the distant PBX. When the distant end goes on-hook, a disconnect signal is returned to the near end DX signaling circuit; the DX circuit removes ground from the E lead, which in turn causes the K1 relay in the signal isolation circuit to release, removing ground from lead CTE toward the CP equipment and restoring the connecting arrangement to the idle condition.

(b) When the distant end goes on-hook first, the signaling circuit removes ground from the E lead toward the signal isolation circuit, causing the K1 relay to release, removing ground from lead CTE toward the CP equipment. The CP equipment subsequently removes battery from lead CTM which releases the K2 relay in the signal isolation circuit. Relay K2 released removes battery from the M lead toward the signaling circuit and restores the connecting arrangement to the idle condition.

5. MAINTENANCE

5.01 Where there is an indication of trouble in the connecting arrangement(s), the circuit at fault must be opened at the interface connecting block to verify in which direction the trouble exists. The circuit can be opened at the connecting block by removing the B bridging clip associated with each lead.

5.02 Precautions should be taken when performing tests to avoid adversely affecting service to the customer. Local instructions should be followed with reference to notifying the customer before performing the tests.

Note: In no case should the CPE be used to perform end-to-end tests.

5.03 The repairman should first check the PCA for blown fuses, loose or broken wires and connectors, adequate battery and ground, and verify that the CO cable pairs are good. Any defects found should be repaired and tested before the equipment is reconnected to the customer's facility. If the trouble persists, continue with the trouble-shooting procedures described below.

5.04 Perform the post-installation tests described in 3.08 to determine if there is trouble in the PCA or the telephone company 4-wire facilities behind the PCA. If the tests in 3.08 can be completed successfully, and the areas checked in 5.03 are satisfactory, then the trouble is probably in the CPE.

5.05 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 BSP 660-101-312 entitled Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).

Do not attempt any tests or repairs to the customer-provided equipment.

5.06 If the trouble appears to be in the telephone company 4-wire facilities remote from the

PCA, follow local practices to have them tested and repaired. If the PCA appears to be at fault, test the circuits which are most likely to be involved, based on the results of the test in 5.04. Faulty transmission probably points to the repeater as the source of trouble. Signaling difficulties are most likely to be caused by a defective J53050C IU or DX signaling unit plug-in relay. If CP power is being used, check the protector. When the faulty circuit is found, replace components or the entire unit, as necessary, or move leads to an idle circuit if one is available.

5.07 ***Apparatus Required to Perform Tests***

(a) Test cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord), one KS-6278 connecting clip, and one 411B (test pick) tool (for connecting battery to alarm bar of 70-type fuses).

Note: To connect battery to the alarm bar of 70-type fuses mounted in a 21A fuse block, insert the tip of the 411B tool (attached to the 1W13B cord) into the aperture provided in the fuse block cover and touch the alarm bar.

(b) Volt-ohm-meter capable of measuring −48 volts and 1000 ohms.

(c) Two clip leads, one of sufficient length to reach from the interface connecting block to the connecting arrangement.

5.08 ***Tests—J53050C, List 1 (MD) or List 3 Interconnecting Unit***

(a) Using 893 cord, connect battery to alarm bar of fuse(s) on interconnecting unit—fuse alarm lamp should light.

(b) Open all eight leads of the circuit under test at the interface connecting block. Remove leads E and M from the DX signaling unit. Connect lead CG to lead E. The P relay should operate, indicated by closure across leads CBS1 and CBS2 (zero resistance). If P relay does not operate, replace it with a relay known to be good; if P relay still does not operate, check for faulty D1 diode or open on leads CBS1, CBS2, CG, or E.

(c) Connect lead CG to lead CS. The A relay should operate, indicated by battery (−48 volts) present on lead M. If A relay does not operate, replace it with a relay known to be good; if battery still is not present on lead M, measure the resistance from lead M to ground. If resistance measures zero, check for faulty D2 diode; if resistance measures 1000 ohms, check for faulty RT resistance lamp or open on lead CG, CS, or M.

(d) On completion of tests, reconnect leads E and M to the DX signaling unit and replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.09 ***Tests—J53050C, List 2 Interconnecting Unit***

(a) Make fuse alarm test as shown in 5.08 (a).

(b) Open all seven leads of the circuit under test at the interface connecting block. Remove leads E and M from the DX signaling unit. Apply battery (−48 volts) to lead CTM and ground to lead CG. K2 relay should operate, indicated by battery (−48 volts) present on lead M. If K2 relay does not operate, replace it with a relay known to be good; if battery still is not present on lead M, measure the resistance from lead M to ground. If resistance measures zero, check for open on lead CTM, CG or M; if resistance measures 1000 ohms, check for faulty RT1 resistance lamp.

(c) Connect lead E to frame ground. K1 relay should operate, indicated by a closure across leads CG and CTE (zero resistance). If K1 relay does not operate, replace it with a relay known to be good; if K1 relay still does not operate, check for open on leads CTE, CG, or E.

(d) On completion of tests, reconnect leads E and M to the DX signaling unit and replace the B bridging clips at the interface connecting block associated with the circuit under test.

5.10 ***Tests—J98605AJ DX Signaling Unit:***

(a) Remove the 334A relay in the faulty PCA from its connector to perform tests. It is not a repairable item and will be replaced if defective.

(b) Verify the adjustments described in 3.03 and correct any discrepancies.

(c) Return the 334A relay to its connector in the signaling unit. If the trouble has not been cleared, replace the relay. (Perform 3.03 adjustments on any new relays before installing.)

5.11 ***Tests—J98605AG (MD) DX Signaling Unit:*** If the circuit malfunction is isolated to this unit, the entire unit must be replaced (unless an unused circuit is available).

5.12 ***Tests—44V4A Repeater:*** If the CO cable pairs are verified to be good and transmission trouble is still present, the repeater may be defective. The amplifiers, terminal sets, and equalizer are plug-in units which may be adjusted or removed and replaced individually to localize the fault. Refer to the practices listed in 5.15 for additional information. Alignment procedures for the F58122 AGC amplifier, when used with the 44V4A repeater, is covered in Part 7.

5.13 ***Tests—KS-20944 Protector (Fig. 11 and 12):*** If circuit breaker switches are tripped (in the ***off*** position), return them to the ***on*** position; if the circuit breaker switches cannot be operated to the ***on*** position, perform tests as follows:

(a) Disconnect telephone company-provided wiring from terminals 1 and 2 (− and +) of the load terminal strip on the protector under test. If the circuit breaker switches remain in the ***on*** position when operated, the trouble is in the telephone company-provided equipment. Check the proper polarity of the telephone company-provided leads at terminals 1 and 2 (− and +) of the load terminal strip on the protector; ascertain that the circuits connected to the protector do not exceed the current rating of the protector.

(b) If the trouble is not in the telephone company side, check the type, amount, and polarity of the CP voltage present on the leads provided for customer termination at the protector; this voltage should meet the specifications shown in Fig. 12.

5.14 After tests have been completed and defective equipment repaired or replaced, repeat the post-installation tests in 3.08 to determine that the PCA is operating correctly. If it is, restore all circuits to normal and close the connections between telephone company equipment and CPE.

5.15 When detailed maintenance information is required, refer to the following:

44V4A Repeater

- CD- and SD-97047-01
- Section 179-100-303
- Section 852-307-101
- Section 332-106-101.

359-Type Equalizer

- Sections 332-116-101 through 332-116-113.

227-Type Amplifier

- Section 024-140-101.

DX Signaling Circuit

- CD- and SD-95487-01 (for J98605AG)
- CD- and SD-1C363-01 (for J98605AJ)
- Section 179-100-309
- Section 859-501-101.

Signal Isolation (Applique) Circuit

- CD- and SD-1E206-01 (for Lists 1 or 3)
- CD- and SD-1E254-01 (for List 2).

KS-20944 Protector

- Section 463-300-109.

6. CONNECTIONS

6.01 For connecting information, refer to Fig. 1, 2, 9, 10, 12, and 13.

7. F58122 AUTOMATIC GAIN CONTROL (AGC) AMPLIFIER

7.01 ***Physical and Electrical Characteristics***

(a) The F58122 AGC amplifier is identical in size and connections to the 227-type amplifier used in the 44V4A repeater shelf; it is used to limit the inband signal power in the transmitting leg from CP facilities to Bell System facilities.

(b) The gain of the F58122 AGC amplifier is continuously adjustable from −10 dB to +25 dB. The ability to insert loss is necessary when interfacing with a +7 transmission level point (TLP) transmit leg from CP facilities. The clamped output power of the amplifier is adjustable from −20 dBm to 0 dBm.

(c) The F58122 amplifier is normally adjusted to clamp at a power level 13 dB below the TLP. When the output side of the amplifier is at the 0 TLP, the minimum protection criteria permits an inband 3-second average output power of −13 dBm. If the input signal to the amplifier should be increased to a level that produces an instantaneous signal greater than −7 dBm at the output of the amplifier, the AGC action of the amplifier changes the output to −7 dBm after 20 milliseconds and then to −13 dBm after a time interval varying from 300 to 500 milliseconds. When the input level to the amplifier is such that the output level of the amplifier is between −7 and −13 dBm, the AGC action of the amplifier changes the output level to −13 dBm after a time interval varying from 0.3 to 3 seconds.

7.02 ***Adjustments:*** Gain adjustments are made by means of the LEV ADJ control (R3) and switch S1 (see Fig. 14). The combined setting of these two controls provides a range of −10 to +25 dB gain. The setting of the AGC ADJ control (R20) determines the points at which clamping of the amplifier output begins. The range of the AGC ADJ control is from 0 to −20 dBm. Before making adjustments, refer to circuit order card to determine the TLP at the input and output of the amplifier. With an input signal 10 dB below the input TLP of the amplifier, the amplifier gain must be adjusted (using LEV ADJ and S1 as required) to provide an output level which is 10 dB below the output TLP of the amplifier. The AGC ADJ control must then be adjusted to reduce the output of the amplifier by 3 dB (13 dB below output TLP). The following example shows the method of adjusting F58122 AGC amplifier for a typical input and output TLP:

Example:

(a) Assume that the circuit order card shows an input TLP of −4 and an output TLP of +4.

(b) Set switch S1 to the counterclockwise position (when more than 10 dB of gain is required, set S1 to clockwise position) and LEV ADJ control (R3) to the +8 position; set the AGC ADJ control (R20) fully clockwise to the 0 dBm position. This provides an amplifier gain of +8 dB, the amount of gain required to raise the TLP from −4 to +4.

(c) Adjust the oscillator test level of a 21A transmission measuring set (TMS), or equivalent, to −14 dBm at 1000 Hz (10 dB below input TLP).

(d) Connect the OSC jack of the 21A TMS to the amplifier input (AMPL IN jack on the 44V4A repeater associated with the AGC amplifier). Connect the DET jack of the 21A TMS to the amplifier output (AMPL OUT jack on the 44V4A repeater associated with the AGC amplifier).

(e) Adjust the LEV ADJ control on the AGC amplifier for a detector reading of −6 dBm on the 21A TMS (10 dB below output TLP).

(f) ***Slowly adjust*** the AGC ADJ control on the AGC amplifier in a counterclockwise direction until a detector reading of −9 dBm is obtained on the 21A TMS (13 dB below output TLP). Because of long time constants, this adjustment must be made by turning the AGC ADJ ***slowly*** while noting the change in the detector reading.

(g) The amplifier is now adjusted to clamp the output power to a level 13 dB below the TLP (−9 dBm at +4 TLP).

(h) Reduce the oscillator test level of the 21A TMS by 5 dB (15 dB below input TLP); the detector reading should drop by 2 dB (15 dB below output TLP). This checks the limiting action of the amplifier.

(i) Disconnect the 21A TMS from the 44V4A repeater.

(j) Use the preceding method and refer to Fig. 14 to adjust the AGC amplifier for other TLPs.

The AGC action of the amplifier will make it impossible to measure the overall loss of the circuit using test levels that exceed 13 dB below the TLP. It is suggested that loss measurements from the customer equipment to another location be conducted at a test level of 13 dB below TLP. To minimize the possibility of a misunderstanding, it is imperative that each individual involved with testing the circuit understands that a reduced test level is being used. Some testboards and VF patch bays are not equipped to send reduced test levels. Higher test levels may be used to test those portions or directions of the circuit in which an AGC amplifier (F58122) is not used.

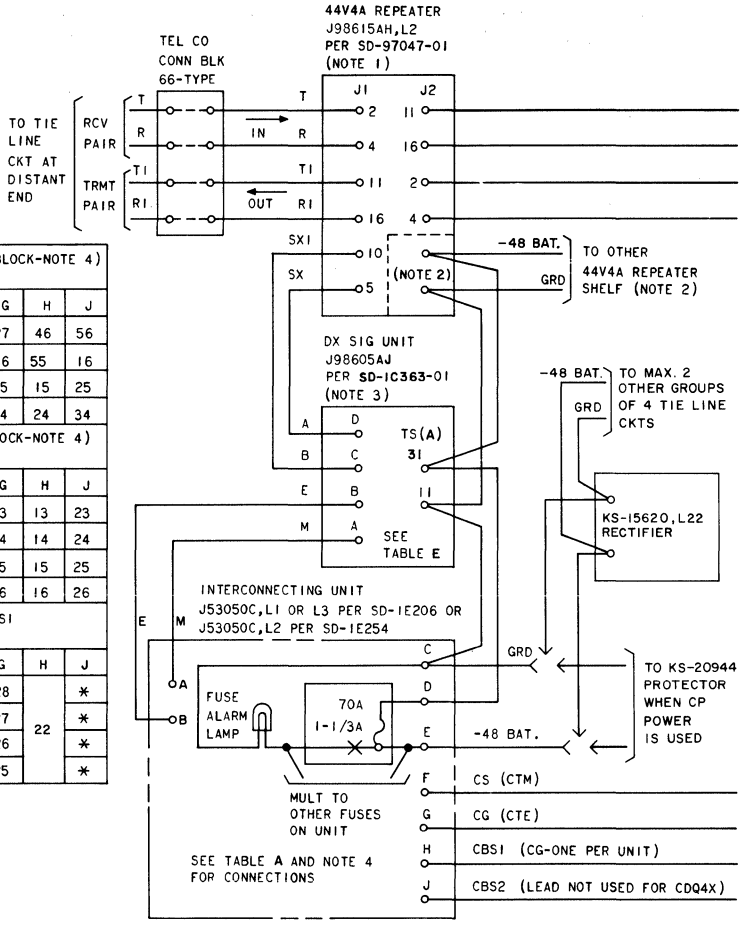


TABLE A

CKT NO.	TERMINALS ON J53050C,L3 (D5A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
0	48	58	51	14	11	17	27	46	56
1	28	38				26	36	55	16
2	57	18				35	45	15	25
3	37	47				44	54	24	34
CKT NO.	TERMINALS ON J53050C,L1 (D3A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
1	17	27	11	32	41	33	43	13	23
2	37	47				34	44	14	24
3	18	28				35	45	15	25
4	38	48				36	46	16	26
CKT NO.	TERMINALS ON J53050C,LIST 2 - TS1 PCA CDQ4X								
	A	B	C	D	E	F	G	H	J
0	48	58	52	18	11	38	28	22	*
1	47	57				37	27		*
2	46	56				36	26		*
3	45	55				35	25		*

* NO CONNECTION REQUIRED FOR CDQ4X

TABLE B

STRAPS ON J53050C,LIST 2					
TS1		TS2		TS3	
FROM	TO	FROM	TO	FROM	TO
54	53	58	28	58	28
44	53	48	38	48	38
34	14	38	57	38	57
24	14	47	37	47	37
11	21	27	46	27	46
21	31	17	56	17	56
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	11	41	11
		31	21	31	21

NOTES:

1. EACH 44V4A REPEATER SHELF HAS FACILITIES FOR 2 CIRCUITS.SHOWN ARE THE CONNECTIONS FOR 1 CIRCUIT. CONNECTIONS FOR OTHER 3 CIRCUITS ARE IDENTICAL AS SHOWN, EXCEPT FOR BATTERY AND GROUND CONNECTIONS, WHICH ARE EXPLAINED IN NOTE 2. FOR ALIGNMENT PROCEDURES FOLLOW EXISTING PRACTICES AND PART 7.
2. VIEWING THE 44V4A REPEATER SHELF FROM THE BACK, CONNECT BATTERY TO THE FIRST STANDOFF ON THE LEFT AND GROUND TO TERMINAL 15 OF J4 LOCATED ON THE LEFT. BATTERY AND GROUND IS FACTORY WIRED TO OTHER CIRCUIT ON THE SAME SHELF.
3. REFER TO SD-1C363-01 FOR NETWORK RESISTANCE AND CAPACITANCE ADJUSTMENTS AND FOR USE OF CAPACITOR ACROSS A AND B LEADS.
4. J53050C,LIST 3 INTERCONNECTING UNITS ARE EQUIPPED WITH A D5A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE FIRST PART OF TABLE A. J53050C, LIST 1 INTERCONNECTING UNITS ARE EQUIPPED WITH A D3A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE SECOND PART OF TABLE A. CONNECTIONS FOR J53050C,LIST 2 INTERCONNECTING UNITS(CDQ4X) ARE SHOWN IN THE LAST PART OF TABLE A.LEAD DESIGNATIONS IN PARENTHESES APPLY TO LIST 2.STRAPS MUST BE PROVIDED ON THE LIST 2 INTERCONNECTING UNIT AS SHOWN IN TABLE B.

Fig. 9—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AJ (Sheet 1 of 2)

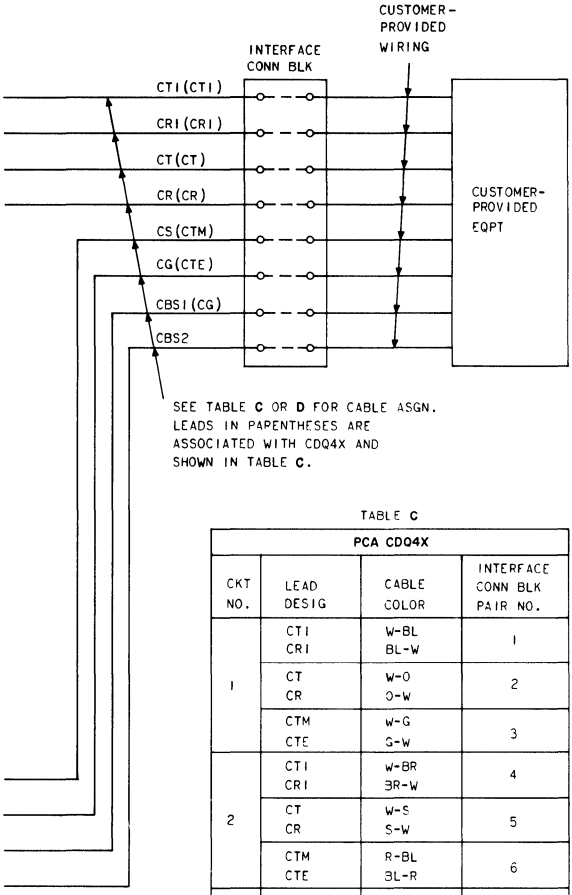


TABLE C

PCA CDQ4X			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CTI CRI	W-BL BL-W	1
	CT CR	W-O O-W	2
	CTM CTE	W-G G-W	3
2	CTI CRI	W-BR BR-W	4
	CT CR	W-S S-W	5
	CTM CTE	R-BL BL-R	6
3	CTI CRI	R-O O-R	7
	CT CR	R-G G-R	8
	CTM CTE	R-BR BR-R	9
4	CTI CRI	R-S S-R	10
	CT CR	BK-BL BL-BK	11
	CTM CTE	BK-O O-BK	12
1-4	CG	BK-G	13
5-8	CG*	G-BK	

* USE G-BK LEAD FOR CG LEAD ON SECOND GROUP OF FOUR CIRCUITS TO PREVENT SPLITTING PAIRS (SEE FIG. 3)

TABLE D

PCA CDQ4W			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CTI CRI	W-BL BL-W	1
	CT CR	W-O O-W	2
	CS CG	W-G G-W	3
	CBSI CBS2	W-BR BR-W	4
2	CTI CRI	W-S S-W	5
	CT CR	R-BL BL-R	6
	CS CG	R-O O-R	7
	CBSI CBS2	R-G G-R	8
3	CTI CRI	R-BR BR-R	9
	CT CR	R-S S-R	10
	CS CG	BK-BL BL-BK	11
	CBSI CBS2	BK-O O-BK	12
4	CTI CRI	BK-G G-BK	13
	CT CR	BK-BR BR-BK	14
	CS CG	BK-S S-BK	15
	CBSI CBS2	Y-BL BL-Y	16

TABLE E

CKT. NO.	TERMINALS ON TS(A) OF J98605AJ				TERMINALS ON TS(B) OF J98605AJ			
	A	B	C	D	A	B	C	D
1	47	28	38	48				
2	36	17	27	37				
3	25	45	16	26				
4	14	34	44	15				
5	42	23	33	43				
6					47	28	38	48
7					36	17	27	37
8					25	45	16	26
9					14	34	44	15
10					42	23	33	43

THIS TABLE SHOWS CONNECTIONS FOR FULLY EQUIPPED SIGNALING UNIT. SELECT ONE CIRCUIT FOR EACH TIE LINE.

Fig. 9—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AJ (Sheet 2 of 2)

TABLE A

CKT NO.	TERMINALS ON TS(E) OF J98605AG (MD)			
	A	B	C	D
1	28	38	48	58
2	27	37	47	57
3	26	36	46	56
4	25	35	45	55

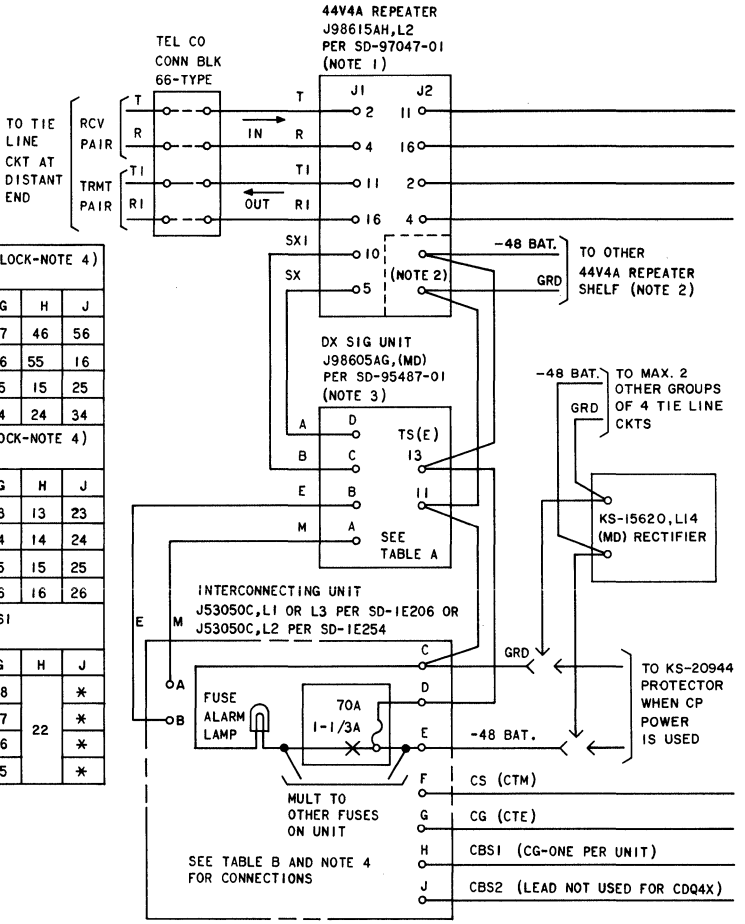
TABLE B

CKT NO.	TERMINALS ON J53050C,L3 (D5A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
0	48	58	51	14	11	17	27	46	56
1	28	38				26	36	55	16
2	57	18				35	45	15	25
3	37	47				44	54	24	34
CKT NO.	TERMINALS ON J53050C,L1 (D3A BLOCK-NOTE 4) PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
1	17	27	11	32	41	33	43	13	23
2	37	47				34	44	14	24
3	18	28				35	45	15	25
4	38	48				36	46	16	26
CKT NO.	TERMINALS ON J53050C,LIST 2 - TS1 PCA CDQ4W								
	A	B	C	D	E	F	G	H	J
0	48	58	52	18	11	38	28	22	*
1	47	57				37	27		*
2	46	56				36	26		*
3	45	55				35	25		*

* NO CONNECTION REQUIRED FOR CDQ4X

TABLE C

STRAPS ON J53050C,LIST 2					
TS1		TS2		TS3	
FROM	TO	FROM	TO	FROM	TO
54	53	58	28	58	28
44	53	48	38	48	38
34	14	38	57	38	57
24	14	47	37	47	37
11	21	27	46	27	46
21	31	17	56	17	56
31	41	23	42	23	42
		13	52	13	52
		52	22	52	22
		12	51	12	51
		41	11	41	11
		31	21	31	21



NOTES:

1. EACH 44V4A REPEATER SHELF HAS FACILITIES FOR 2 CIRCUITS.SHOWN ARE THE CONNECTIONS FOR 1 CIRCUIT. CONNECTIONS FOR OTHER 3 CIRCUITS ARE IDENTICAL AS SHOWN, EXCEPT FOR BATTERY AND GROUND CONNECTIONS, WHICH ARE EXPLAINED IN NOTE 2. FOR ALIGNMENT PROCEDURES FOLLOW EXISTING PRACTICES AND PART 7.
2. VIEWING THE 44V4A REPEATER SHELF FROM THE BACK, CONNECT BATTERY TO THE FIRST STANDOFF ON THE LEFT AND GROUND TO TERMINAL I5 OF J4 LOCATED ON THE LEFT. BATTERY AND GROUND IS FACTORY WIRED TO OTHER CIRCUIT ON THE SAME SHELF.
3. REFER TO SD-95487-01, SHEET 4 (FIG. 4), AND SHEET 6 (FIG. 55) FOR STRAPPING OF A2, B2, C2, AND D2 LEADS (G, H, J, AND K OPTIONS).
4. J53050C,LIST 3 INTERCONNECTING UNITS ARE EQUIPPED WITH A D5A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE FIRST PART OF TABLE B. J53050C, LIST 1 INTERCONNECTING UNITS ARE EQUIPPED WITH A D3A TERMINAL STRIP; CONNECTIONS TO THESE UNITS ARE SHOWN IN THE SECOND PART OF TABLE B. CONNECTIONS FOR J53050C,LIST 2 INTERCONNECTING UNITS(CDQ4X) ARE SHOWN IN THE LAST PART OF TABLE B.LEAD DESIGNATIONS IN PARENTHESES APPLY TO LIST 2.STRAPS MUST BE PROVIDED ON THE LIST 2 INTERCONNECTING UNIT AS SHOWN IN TABLE C.

Fig. 10—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AG (MD) (Sheet 1 of 2)

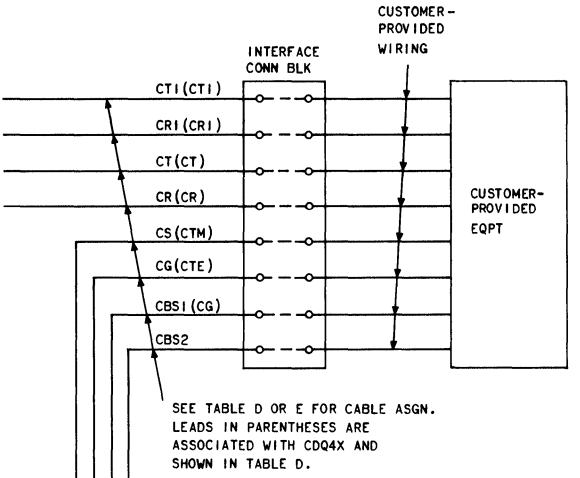


TABLE D

PCA CDQ4W			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CTI CRI	W-BL BL-W	1
	CT CR	W-O O-W	2
	CTM CTE	W-G G-W	3
2	CTI CRI	W-BR BR-W	4
	CT CR	W-S S-W	5
	CTM CTE	R-BL BL-R	6
3	CTI CRI	R-O O-R	7
	CT CR	R-G G-R	8
	CTM CTE	R-BR BR-R	9
4	CTI CRI	R-S S-R	10
	CT CR	BK-BL BL-BK	11
	CTM CTE	BK-O O-BK	12
1-4	CG	BK-G	13
5-8	CG*	G-BK	

TABLE E

PCA CDQ4W			
CKT NO.	LEAD DESIG	CABLE COLOR	INTERFACE CONN BLK PAIR NO.
1	CTI CRI	W-BL BL-W	1
	CT CR	W-O O-W	2
	CS CG	W-G G-W	3
	CBSI CBS2	W-BR BR-W	4
2	CTI CRI	W-S S-W	5
	CT CR	R-BL BL-R	6
	CS CG	R-O O-R	7
	CBSI CBS2	R-G G-R	8
3	CTI CRI	R-BR BR-R	9
	CT CR	R-S S-R	10
	CS CG	BK-BL BL-BK	11
	CBSI CBS2	BK-O O-BK	12
4	CTI CRI	BK-G G-BK	13
	CT CR	BK-BR BR-BK	14
	CS CG	BK-S S-BK	15
	CBSI CBS2	Y-BL BL-Y	16

* USE G-BK LEAD FOR CG LEAD ON SECOND GROUP OF FOUR CIRCUITS TO PREVENT SPLITTING PAIRS(SEE FIG. 3)

Fig. 10—Connections for Four Trunks—PCA CDQ4W or CDQ4X Using DX Signaling Unit J98605AG (MD) (Sheet 2 of 2)

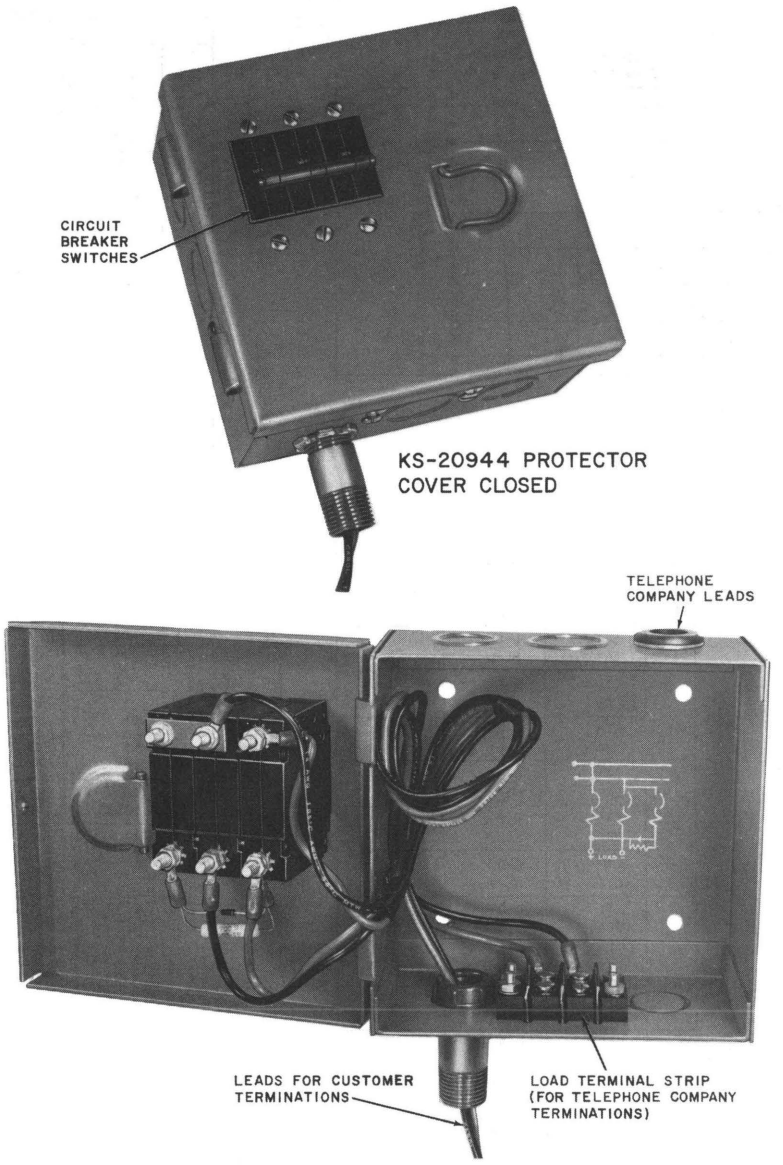
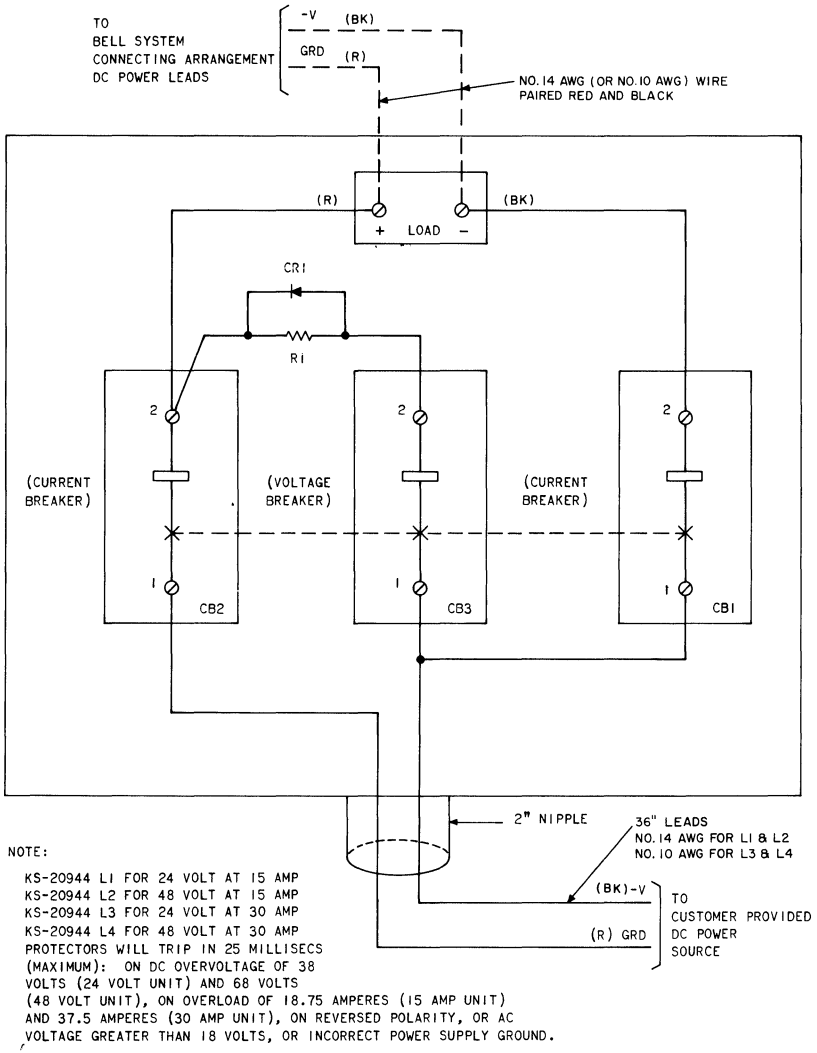


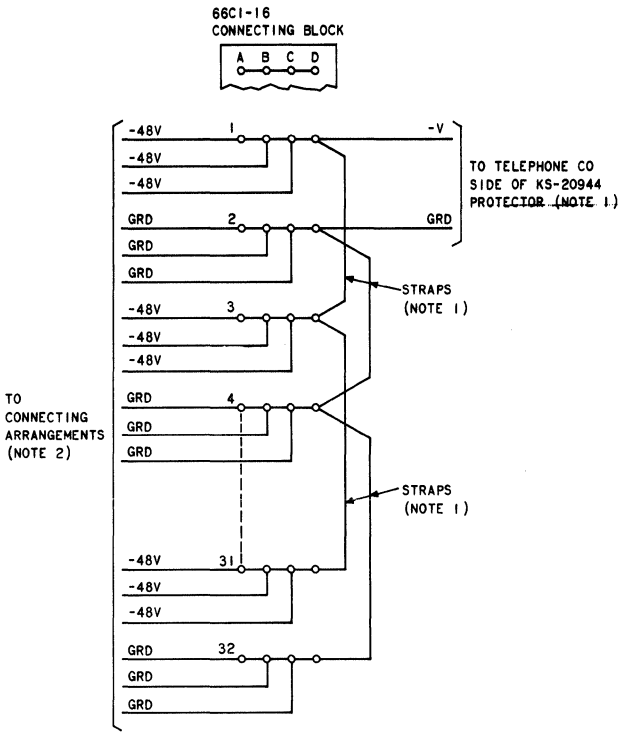
Fig. 11—KS-20944 Protector



NOTE:

KS-20944 L1 FOR 24 VOLT AT 15 AMP
KS-20944 L2 FOR 48 VOLT AT 15 AMP
KS-20944 L3 FOR 24 VOLT AT 30 AMP
KS-20944 L4 FOR 48 VOLT AT 30 AMP
PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM): ON DC OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS (48 VOLT UNIT), ON OVERLOAD OF 18.75 AMPERES (15 AMP UNIT) AND 37.5 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT POWER SUPPLY GROUND.

Fig. 12—Schematic—KS-20944 Protector



NOTES:

1. USE 14-GAUGE WIRE TO CONNECT FROM KS-20944 PROTECTOR TO CONNECTING BLOCK; PROVIDE MULTIPLE STRAPS AS DETERMINED BY NUMBER OF CONNECTING ARRANGEMENTS TO BE CONNECTED TO. USE SOLDER TO MAKE THE CONNECTION OF THE 14-GAUGE WIRE AND STRAPS TO THE CONNECTING BLOCK.
2. USE "D" INSIDE WIRE OR EQUIVALENT TO MAKE CONNECTIONS FROM CONNECTING BLOCK TO CONNECTING ARRANGEMENTS.. EACH CONNECTING BLOCK PROVIDES MEANS FOR CONNECTING TO 48 CIRCUITS, HOWEVER, DO NOT EXCEED THE MAXIMUM CURRENT RATING OF THE KS-20944 PROTECTOR.

Fig. 13—Typical Power Distribution Connections Between KS-20944 Protector and PCAs

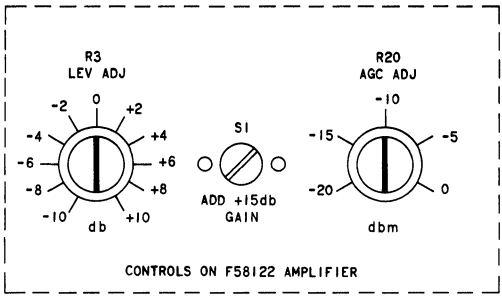


Fig. 14—Adjustment Controls—F58122 Automatic Gain Control Amplifier