

**SEE ADDENDUM**

## VOICE CONNECTING ARRANGEMENT C232W

### 1. GENERAL

SD-69613-01, Issue 2B

**1.01** This section provides identification, installation, operation, maintenance, and connecting information for Voice Connecting Arrangement C232W. The equipment used to implement Voice Connecting Arrangement C232W is determined by the requirements of the specific installation (see Table A and Part 2, ORDERING GUIDE and DESIGN FEATURES). This arrangement provides a 2-wire voiceband only connection, without signaling, between customer-provided (CP) equipment and Bell System 2-wire or 4-wire facilities. This arrangement does not provide dc continuity between the CP equipment and the Bell System facility, and does not pass 20-Hz ringing. The customer is expected to provide inband signaling when using this connecting arrangement.

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.

**1.02** This section is reissued to include information on the KS-20944 protector, to add Fig. 6, 7, and 8, and to change Fig. 4 and 5.

**1.04** If the customer wants a copy of the Technical Reference which covers this interface specification, the customer should contact the local Telephone Company Business Office or the Marketing Representative.

**1.03** This issue of the section is based on the following drawings:

SD-1E207-01, Issue 1

### 2. IDENTIFICATION

#### PURPOSE

- To provide a voiceband only connection between CP 2-wire equipment and Bell System 2-wire or 4-wire facilities
- To provide longitudinal isolation
- To limit excessive levels from CP equipment and to provide protection for personnel against hazardous voltages.

**TABLE A**

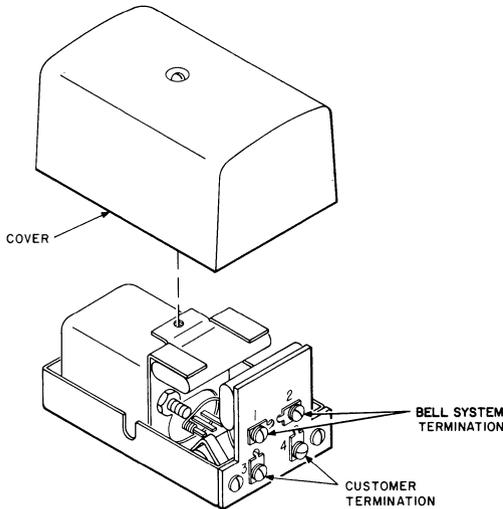
BELL SYSTEM FACILITY	EQUIPMENT REQUIRED	NO. OF CKTS. PER UNIT	TYPE OF MOUNTING
2-Wire	31B-49 Voice Coupler	1	Backboard or Flat Surface
	J53050D,L1 Interconn. Unit	4	23-Inch Relay Rack
	Protected Repeat Coil (Locally Engineered)	1	Locally Engineered
4-Wire	J98615BA, L1 Repeater Unit	1	16C or 31A App. Mtg.
	J98615BJ,L2 Repeater Shelf		23-Inch Relay Rack

**ORDERING GUIDE**

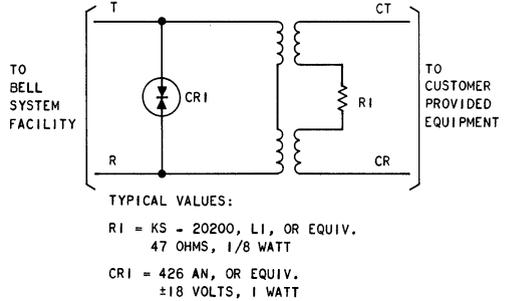
- J53050D, List 1 Interconnecting Unit, for use with 2-wire facilities—each unit provides four voice coupler circuits.
- Coupler, Voice, 31B-49, (Fig. 1) for use with 2-wire facilities—provides one voice coupler circuit per unit.

**Note:** A protected repeat coil (Fig. 2) may be used with 2-wire facilities if local requirements permit. Local engineering must specify repeat coil to be used and provide values and details for modification.

- J98615BJ, List 2, 24V4C Terminal Repeater Shelf or J98615BA, List 1, 24V4B Terminal Repeater Mounting Unit, for use with 4-wire facilities. Each unit provides one voice coupler circuit (the transmission characteristics of the J98615BJ, List 2 and the J98615BA, List 1 are identical; mounting requirements determine which repeater should be used).



**Fig. 1—31B Voice Coupler**



**Fig. 2—Typical Protected Repeat Coil—Locally Engineered**

**Note:** For plug-in components refer to Section AB24.100.01; when automatic control of signal power level is required, order F58122 automatic gain control (AGC) amplifier for use in the *transmitting leg from the CP equipment to Bell System facilities* instead of the standard 227-type amplifier shown in Section AB24.100.01 (Fig. 5).

**Associated Apparatus (Order Separately)**

- KS-15620, List 14 Rectifier or equivalent (to provide -48 volts to 24V4 repeaters when required).

**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.

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

- KS-14532 Power Cord

List 1—10 ft.

List 2—2 ft.

List 3—15 ft.

List 4—20 ft.

List 5—25 ft.

- Cable, Wiring, "D" inside, or equivalent (for cabling from connecting arrangement to interface connecting block).
- Block, Connecting, 66M1-50 (Fig. 3).

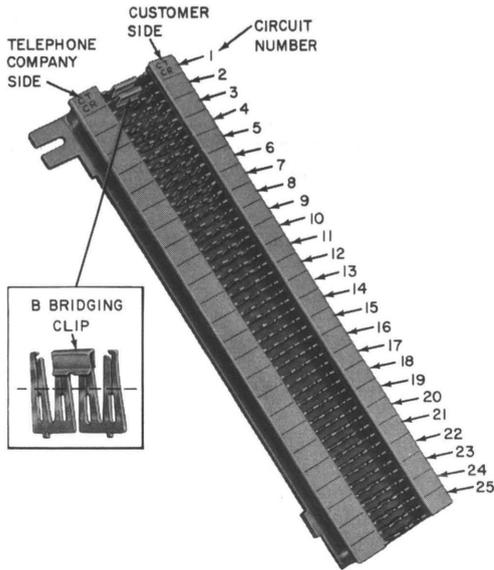


Fig. 3—Typical Interface Connecting Block

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

- Clip, Bridging, B (25 per pkg).
- KS-20944, List 2 Protector (Optional—**must** be provided when CP power supply is used)—see Fig. 6 and 7.
- 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. 8).

**Note:** The cumulative current drain of 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. 8).

### Replaceable Components

- Plug in components of 24V4 repeater.

### DESIGN FEATURES

#### J53050D, List 1 Interconnecting Unit

- Mounts on standard 23-inch relay rack.
- Four circuits per unit on 2-inch by 23-inch mounting plate.
- Each circuit provides a 2-wire voiceband transmission path (voice coupler) to and from the CP equipment.
- Provides impedance match of either 600 ohms to 600 ohms (option Z) or 900 ohms to 600 ohms (option Y).
- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.

#### 31B Voice Coupler

- Approximate dimensions 4 inches long by 2-3/4 inches wide by 2 inches high.
- Mounts on backboard or any flat surface.
- Each unit provides one 2-wire voiceband transmission path to and from the CP equipment.
- Connects directly to CP equipment without use of interface connecting block (Fig. 4).
- Provides 1:1 impedance match.

- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.

#### **24V4C Repeater Shelf**

- Mounts on standard 23-inch relay rack on 1-3/4 inch centers.
- One repeater circuit per shelf.
- Each circuit provides a 2-wire to 4-wire voiceband transmission path (voice coupler) from the CP equipment to Bell System facilities and a 4-wire to 2-wire voiceband transmission path from Bell System facilities to the CP equipment.
- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.

#### **24V4B Repeater Unit**

- Mounts in key unit apparatus mountings such as the 16C or 31A.
- One repeater circuit per unit.
- Each circuit provides a 2-wire to 4-wire voiceband transmission path (voice coupler) from the CP equipment to Bell System facilities and a 4-wire to 2-wire voiceband transmission path from Bell System facilities to the CP equipment.
- Provides transformer isolation and hazardous voltage protection between CP equipment and Bell System facilities.
- Limits the inband signal power applied to Bell System facilities when equipped with F58122 AGC amplifier.

#### **◆KS-20944, List 2 Protector (Fig. 6 and 7)**

- Components are mounted in a 5-1/2 by 4-1/2 by 3-1/2 inch box with hinged cover, designed to mount on a wall or any flat surface.

- Provides screw terminals inside of box for connection to Bell System equipment.
- Provides two external 14-gauge color-coded leads for connection to CP power source ([R] GRD, [BK] – V).
- Provides current and voltage limiting between Bell System equipment and CP power source.
- Protector circuit breakers trip in 25 milliseconds on overvoltage, current overload, reversed voltage polarity, improper grounding, or ac voltage from CP power source as follows:
  - (a) Overvoltage of 68 volts dc
  - (b) Current overload of 18 amperes
  - (c) Reversed dc polarity
  - (d) Improper ground
  - (e) AC voltage greater than 18 volts.
- Protector circuit breaker switch provides a means for removing CP power from Bell System interconnecting equipment.

**Caution:** *The circuit breaker switch removes voltage from the load (Bell System) side of the protector only; voltage will still be present on terminals and components inside the protector box.*

- Provides hazardous voltage protection between CP power source and Bell System equipment.◆

### **3. INSTALLATION**

**3.01** Locate the voice connecting arrangements 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 24V4C and the J53050D typically mount on a 23-inch relay rack, the 24V4B mounts in a key unit apparatus mounting, and the 31B voice coupler mounts on a backboard or any flat surface.

**3.02** Use "D" inside wiring cable or equivalent to terminate the leads associated with the CP equipment on the interface connecting block.

Stencil trunk number and lead designations on interface connecting block designation strip (Fig. 3). When 31B voice couplers are used, make connections directly to the screw terminals on the coupler (Fig. 1).

**3.03** When required, 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).

**3.04** 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.

**3.05** Refer to the appropriate section in Division 167 for proper grounding of power plants.

#### ▶KS-20944 PROTECTOR

**3.06** When 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 (see Fig. 7). Solder the other end of the wiring to terminals in column D of the connecting block as shown in Fig. 8; using the 14-gauge wire, solder the multiple straps to the terminals in column D of the connecting block as shown in Fig. 8, 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.▶

#### 4. OPERATION

##### 4.01 *Incoming Call:*

- (a) When 2-wire facilities are used, the J53050D interconnecting unit (voice coupler circuit), the 31B voice coupler, or the locally modified

repeat coil provides a 2-wire transmission path from Bell System facilities to the CP equipment.

- (b) When 4-wire facilities are used, the 24V4C repeater or the 24V4B repeater provides a 4-wire to 2-wire transmission path from Bell System facilities to the CP equipment.

##### 4.02 *Outgoing Call:*

- (a) When 2-wire facilities are used, the J53050D interconnecting unit (voice coupler circuit), the 31B voice coupler, or the locally modified repeat coil provides a 2-wire transmission path from the CP equipment to Bell System facilities.
- (b) When 4-wire facilities are used, the 24V4C repeater or the 24V4B repeater provides a 2-wire to 4-wire transmission path from the CP equipment to Bell System facilities.

#### 5. MAINTENANCE

**5.01** When 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.

**5.03 *Tests—J53050D List 1 Interconnecting Unit:*** Perform normal circuit order transmission tests. The insertion loss of the interconnecting unit is a nominal 1 dB at 1000 Hz.

**5.04 *Tests—31B Voice Coupler:*** Perform normal circuit order transmission tests. The insertion loss of the voice coupler is a nominal 0.6 dB at 1000 Hz.

**5.05** For maintenance and tests on the 24V4B repeater or the 24V4C repeater, refer to existing practices. Alignment procedures for the F58122 AGC amplifier, when used with the 24V4 repeater, are described in Part 7.

**5.06 Tests—KS-20944 Protector (Fig. 6 and 7):**

If circuit breaker switches are tripped (in the **off** position) return them to the **on** position; if 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 for 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. 7.4



**Do not attempt any tests or repairs to the CP equipment.**

- 5.07** When detailed maintenance information is required, refer to the following:

**24V4C Repeater**

CD- and SD-97047-01

Section 179-100-303

Section AB 24.100.01

Section 332-105-103.

**24V4B Repeater**

CD- and SD-99739-01

Section 179-100-303

Section AB 24.100.01

Section 332-105-102.

**359-Type Equalizer**

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

**227-Type Amplifier**

Section 024-140-101.

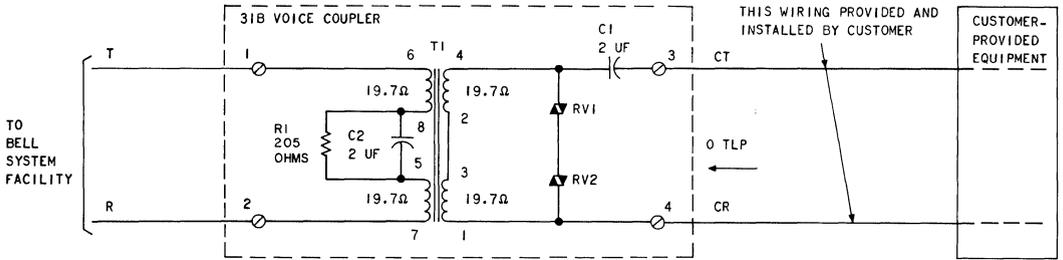
**6. CONNECTIONS**

- 6.01** For connecting information refer to Fig. 4, 5, 7, and 8.

**7. F58122 AUTOMATIC GAIN CONTROL 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 24V4 repeater. 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 switches S1 (Fig. 9). The combined setting of these two controls provides a range of –10 to +25 dB



A. TYPICAL VOICE CONNECTING ARRANGEMENT C232W USING 31B VOICE COUPLER

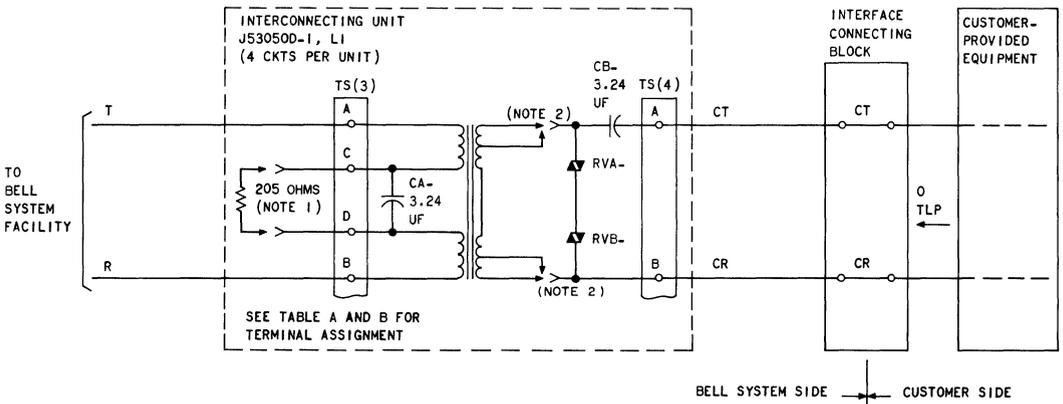


TABLE A

CKT NO.	TERMINALS ON J53050D, L1							
	TS(3)				TS(4)			
	A	B	C	D	A	B	C	D
1	11	14	13	12	14	16		
2	15	18	17	16	24	26		
3	21	24	23	22	34	36		
4	25	28	27	26	44	46		

TABLE B

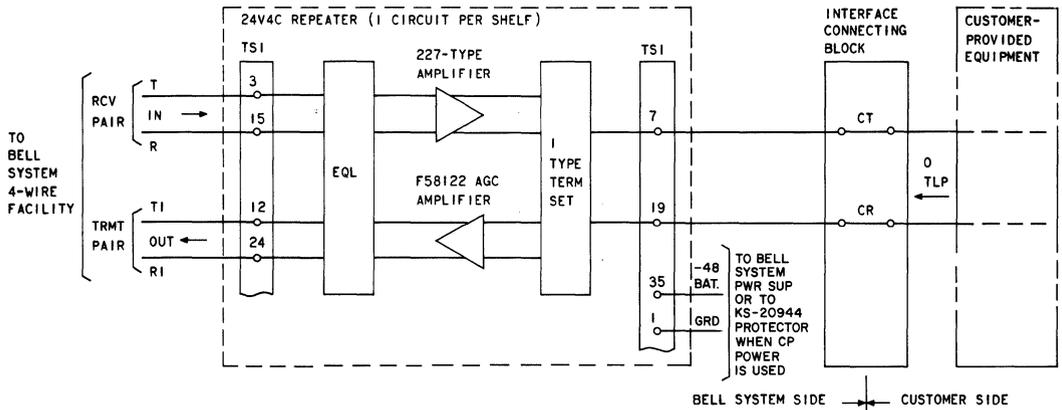
CKT. NO.	STRAPS ON J53050D, L1 TS(4) - (NOTE 2)			
	OPTION Y		OPTION Z	
	FROM	TO	FROM	TO
1	17	16	15	16
	11	12	13	12
2	27	26	25	26
	21	22	23	22
3	37	36	35	36
	31	32	33	32
4	47	46	45	46
	41	42	43	42

NOTES:

1. PROVIDE RESISTORS ON TS(3) AS SHOWN, KS-20289, L2A, OR EQUIV, IF REQUIRED FOR CIRCUIT CONTINUITY. SEE TABLE A FOR TERMINAL NUMBER ASSIGNMENT.
2. WHEN CP EQUIPMENT TO BELL SYSTEM IMPEDANCE IS 600 OHMS TO 600 OHMS PROVIDE STRAPS ON TS(4) FOR OPTION Z; WHEN CP EQUIPMENT IMPEDANCE IS 600 OHMS AND BELL SYSTEM IMPEDANCE IS 900 OHMS, PROVIDE STRAPS ON TS(4) FOR OPTION Y (SEE TABLE B).

B. TYPICAL VOICE CONNECTING ARRANGEMENT C232W USING J53050D, L1 INTERCONNECTING UNIT

Fig. 4—Connections-Voice Connecting Arrangement C232W, 2-Wire Facility



A. TYPICAL VOICE CONNECTING ARRANGEMENT C232W USING 24V4C REPEATER SHELF

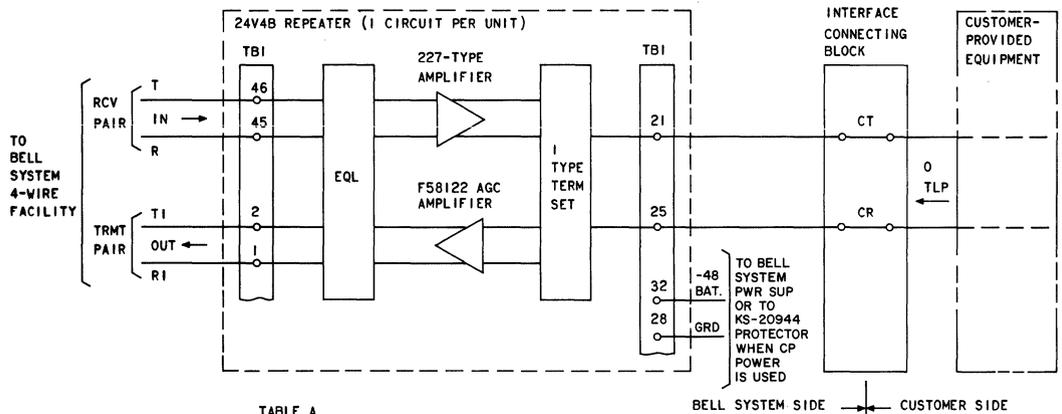


TABLE A

ON TBI-STRAP	
FROM	TO
3	4
7	8
14	15
18	19
35	36
43	44
47	48

NOTE:

WHEN 24V4B REPEATER IS USED  
PROVIDE STRAPS AS SHOWN IN TABLE A.

B. TYPICAL VOICE CONNECTING ARRANGEMENT C232W- USING 24V4B REPEATER UNIT

Fig. 5—Connections—Voice Connecting Arrangement C232W, 4-Wire Facility

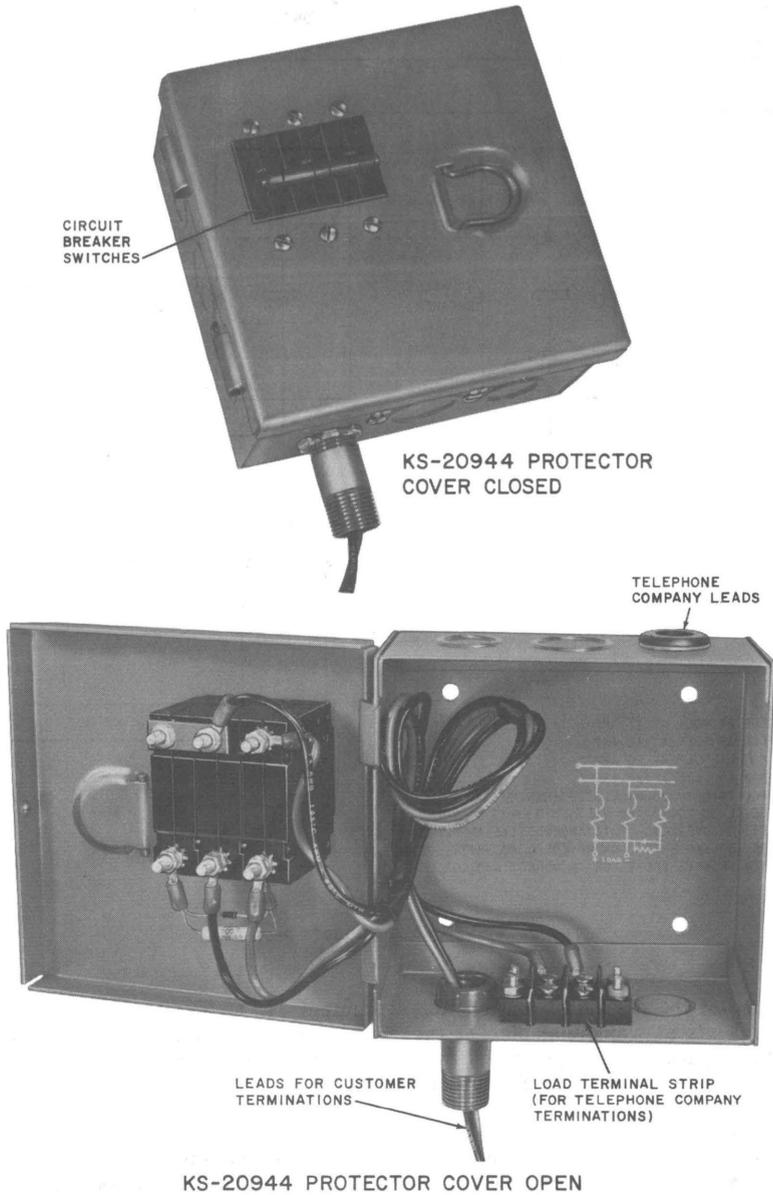
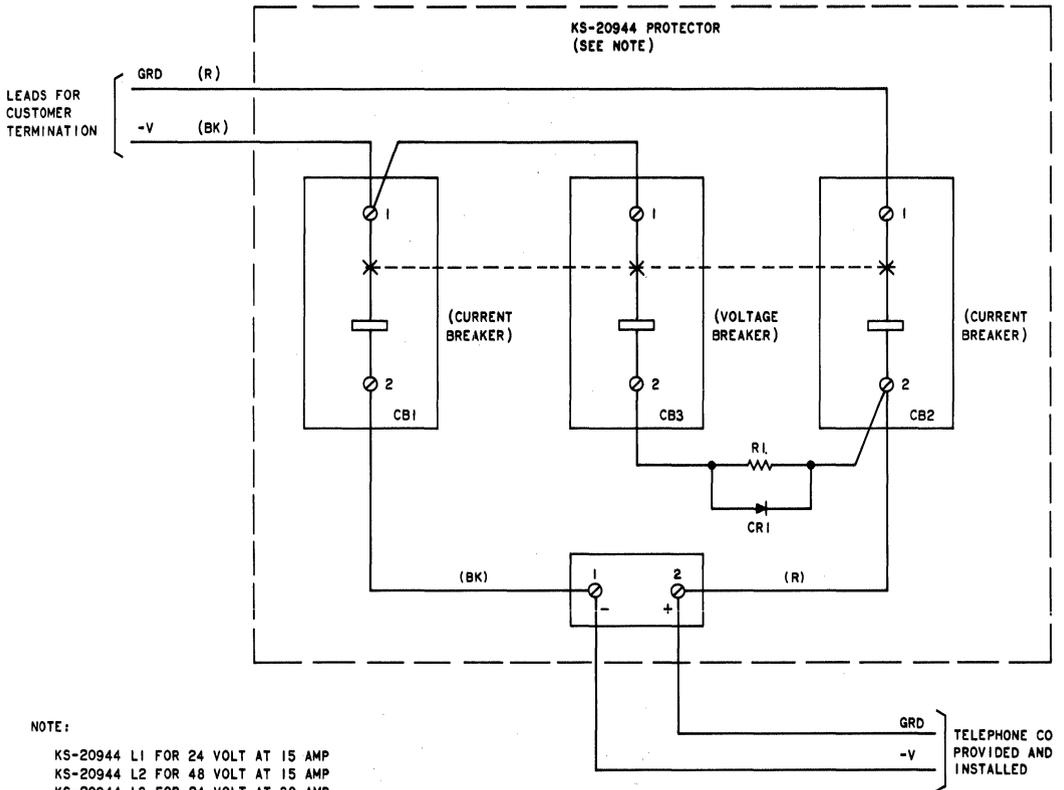


Fig. 6—KS-20944 Protector



## 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  
 K2-20944 L4 FOR 48 VOLT AT 30 AMP  
 PROTECTORS WILL TRIP IN 25 MILLISECS (MAXIMUM):  
 ON OVERVOLTAGE OF 38 VOLTS (24 VOLT UNIT) AND 68 VOLTS  
 (48 VOLT UNIT), ON OVERLOAD OF 18 AMPERES (15 AMP UNIT)  
 AND 36 AMPERES (30 AMP UNIT), ON REVERSED POLARITY, OR AC  
 VOLTAGE GREATER THAN 18 VOLTS, OR INCORRECT GRD.

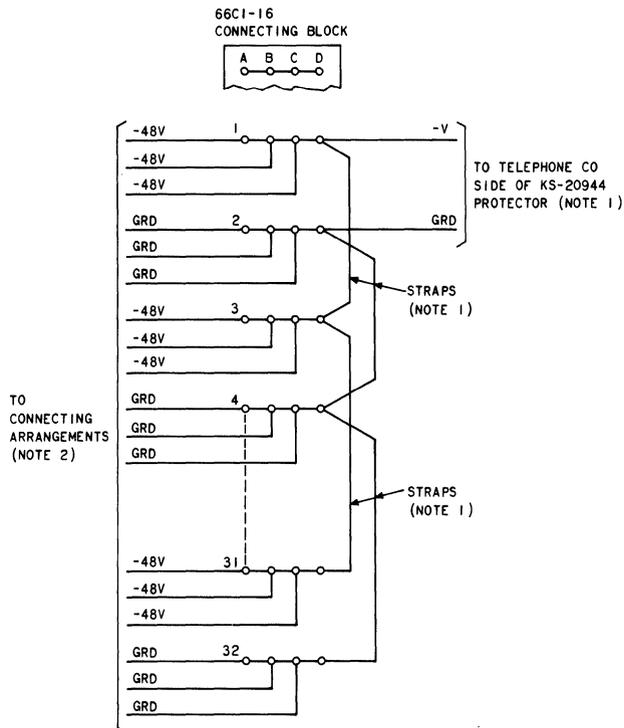
Fig. 7—Schematic—KS-20944 Protector

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 the 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



## 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. 8—Typical Power Distribution Connections Between KS-20944 Protector and Connecting Arrangements**

(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).

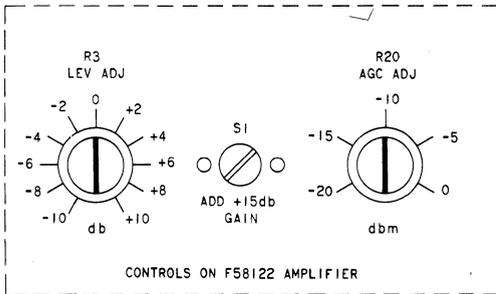
(d) Connect the OSC jack of the 21A TMS to the amplifier input (AMPL IN jack on the 24V4 repeater associated with the AGC amplifier). Connect the DET jack of the 21A TMS to the

amplifier output (AMPL OUT jack on the 24V4 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 24V4 repeater.
- (j) Use the preceding method and refer to Fig. 9 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.*



**Fig. 9—Adjustment Controls on F58122 Automatic Gain Control Amplifier**