

## 50-TYPE RECORDER CONNECTORS

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### 1. GENERAL

**1.01** This section covers the 50-type recorder connectors designed for use on premises where customers are to use voice recorders on subscriber lines or other facilities which may be switched to the general message telephone exchange and toll services. This revision of Issue 1 includes additional information on transmission characteristics and notes minor circuit changes made in the equipment to improve performance. Also included is the information contained in the previous associated addendum.

**1.02** The functions of the recorder connectors are as follows:

- (a) To provide a suitable method of associating customer-owned recording equipment with telephone company facilities, including protection against excessive voltages or service impairments.
- (b) To provide a warning tone to *notify the distant party* when a voice recorder is being used. *The tone level to the line was selected by test to accomplish this function even on the longer connections.*

**1.03** The recorder connectors discussed in this section are intended for the following different types of applications:

- (a) Installation on a particular subscriber line on which a voice recorder is to be used.
- (b) Connection to a key telephone set of a 1A key telephone system in such a manner as

to permit the use of a recorder with any one of the lines to which the set has access.

(c) Installation at PBXs, turrets, or other switching equipment where an attendant may cut in a recorder.

(d) Special installations to permit any one of several stations on the same premises to have access to a single recorder merely by the operation of a key at the station.

(e) Portable assemblies, each consisting of a recorder connector on a mounting board and terminated in a cord and plug. These are for recorder salesmen, and their purpose is to expedite demonstrations of voice recorders. Prior to the use of this portable plug-ended equipment, associated jack arrangements are installed temporarily at the customers' premises where the voice recorders are to be demonstrated. In other respects, these installations are similar to those noted in (a), as the demonstration unit would be associated with a single line.

(f) Installations of recorder connectors on telephone company premises for the purpose of demonstrating the tone to customers and telephone company employees.

**1.04** Other types of installations may, of course, develop, and a number of special local arrangements may be required by customers under unusual conditions. When considering such cases, it is important to make certain that, on message connections, the tone warning signal will be transmitted to both local and remote stations and that the telephone service is not impaired or excessive voltages introduced.

### 2. DESCRIPTION

**2.01 General:** As shown in Figures 1 and 2, the 50-type recorder connector consists of an assembly of electronic apparatus mounted on a black enameled base approximately 9-5/8 by 7-1/8 inches, with a removable black enameled metal cover approximately 4 inches deep. A beige-gray wrinkle enamel finish is planned for future production

of the 50B recorder connectors. The base is arranged for wall or desk mounting and is provided with one hole and three slots to take No. 8 wood screws. The removable cover provides access to the unit for installation and maintenance purposes. A terminal strip provides for installation connections to the telephone line and the local station, terminals R and T for the telephone line, terminals R1 and T1 for connections to the local station, and terminal G for connection to the telephone ground. A 147A or 165A backboard may be used for mounting any of the 50-type recorder connectors for portable use.

**2.02** The appearance, mounting, size, and facilities for connecting the telephone line, local subscriber's subset, and voice recorder are essentially the same for all the recorder connectors described in this section with the exception of the finish on new production 50B recorder connectors mentioned in 2.01.

**2.03 50A Recorder Connector:** The 50A recorder connector is an ac-dc unit designed to give long service without replacing vacuum tubes by virtue of utilizing two Western Electric 407A vacuum tubes. The life of these tubes under design conditions of use for the 50A recorder connector is approximately 20,000 hours. This unit is, therefore, particularly suitable for installations where an exceptional amount of service is required. The 50A recorder connector is shown in Fig. 1.

**2.04 50AA Recorder Connector:** The 50AA recorder connector is identical to the 50A recorder connector except that, to achieve economy in cost, two 12AX7 vacuum tubes of outside manufacture are used. The life of the 12AX7 tubes under design conditions of use for the 50AA recorder connector is approximately 500 hours. Experience has indicated that the service life of the 12AX7 vacuum tube may be several times the design life under normal operating conditions. In addition, since the height of the 12AX7 vacuum tube is greater than the 407A vacuum tube, the cover of the 50AA recorder connector is 1/8 inch greater in height than the initial production of 1100 50A recorder connectors. All future production of 50-type recorder connectors will incorporate the same sized cover used for the 50AA recorder connector.

**2.05 Modified 50AA Recorder Connector:** The 50AA recorder connector may be modified

to utilize Western Electric 407A vacuum tubes (by means of minor wiring changes) and thus to provide the service capabilities of the 50A recorder connector. Also, the equipment may be modified to include improved hybrid coil balancing networks and a warning tone characteristic similar to the 50B recorder connector as discussed in 3.11 and 3.12. At the telephone companies' request, these modifications will be made in the Distributing House Repair Shops of the Western Electric Company.

**2.06 50B Recorder Connector:** The 50B recorder connector is a 50- to 60-cycle ac only operated unit. It meets the performance requirements of the 50A and 50AA recorder connectors but differs in economy of design based on experience with the design of the 50A and 50AA units. The ac operation permits operation of the filaments of two 6SN7GT vacuum tubes, which are commercial radio receiver-type tubes of outside manufacture, on a voltage basis, and a design life of 2500 to 4000 hours is thereby obtained. Under normal operating conditions, this vacuum tube life expectancy will be exceeded. For long life, commercial vacuum tubes of the "red base" type coded 5692 may be used with a design life of 10,000 hours. The 50B recorder connector is shown in Fig. 2.

**2.07 Connecting Arrangements:** A Cannon SK-M7-32S male receptacle provides an outlet for connection to the voice recorder and power supply by means of a female connector and cord (not a part of the recorder connector unit). The Cannon receptacle provides for power intake of 105 to 130 volts dc or ac 25 to 60 cycles, a shielded pair for the voice connection to the voice recorder, and a control pair.

**2.08** Power must be supplied to the recorder connector, and the control switch must be operated to close the plate circuit before the recorder can be connected to the telephone circuit and the tone started. The plug, cord, and connection to power supply and recorder are to be supplied by the customer. The recorder manufacturers may produce several different arrangements to do this.

- (a) The connector may be patched to the recorder and provision made in the recorder for (1) switching on power and closing the control circuit simultaneously or (2) same as (1) plus a standby position. In the standby position, power would be supplied the connector but the control circuit would be open.

(b) The connector may be patched through a "Y" cord to a power outlet and to the recorder, possibly with cord switches in either or both the power and control circuits. Arrangements of this type might be adopted to avoid recorder modifications.

Whatever method is employed, the connecting arrangements should be such that the plate circuit is closed and the tone started *only* if the recorder is actually being used to record a telephone conversation. This is particularly important where the installation is at a party line station since improper connecting arrangements might result in the tone being applied to the line and interfering with the other stations even though the recorder is not being used for telephone recording.

**2.09** Several cords of commercial manufacture will probably be available for use by the recorder manufacturing companies in making connections by means of a Cannon SK-M7-21C 1/2-inch plug to the 50-type recorder connector. One such cord, manufactured by the Whitney-Blake Company, is designated by them as the SRC-6 cable and is available through the Graybar Electric Company.

**2.10 Warm-Up Time:** The 50A Recorder Connector requires about one minute to operate after the power is connected. For the 50AA and 50B units, the interval is between 20 and 30 seconds.

### 3. TRANSMISSION CHARACTERISTICS AND CIRCUIT DESCRIPTION

**3.01 50A and 50AA Recorder Connectors:** The transmission circuits of the 50A and 50AA recorder connectors are shown in Figures 3 and 4, respectively. The vacuum tube V1 and its associated circuits provide for the generation of a 1400-cycle ( $\pm 1$  percent) tone, the duration and decay characteristics of the tone and the repetition interval. The first half of V1, in conjunction with transformer T1, forms a Hartley-type self-blocking oscillator whose cathode resistors R2 (and also R16 in the 50AA), grid resistors R3 and R15, and grid capacitor C3 are of such values that grid current biases this half of the tube to cutoff after an active interval of approximately 0.4 second and repeats at intervals of approximately  $15 \pm 3$  seconds.

**3.02** The second half of V1 is connected as a diode to rectify part of the oscillator voltage and charges the capacitor C7 through the resistor R8 (and also R13 in the 50AA). The first half of vacuum tube V2 is the warning tone amplifier. This section of the tube is normally self-biased, but the charging of capacitor C7 applies a negative bias to the grid which increases beyond the cutoff value. This reduces the gain of the tube and causes the warning tone to decay at the rate of approximately 10 db in the first 0.2 second. The output of the tube is connected to the line through the transformer T2. The two-element resistance-capacitance network associated with T2 is so adjusted that the level of the tone delivered to the local telephone set is lower than that delivered to the line, thereby limiting the tone to the local receiver to a tolerable level. The tone level on the line is about  $-4$  vu. The tone level into the local set is substantially less. Available test data indicate the range is from  $-9$  vu to  $-19$  vu. The insertion loss of the 50A and 50AA recorder connectors is about 1 db.

**3.03** The hybrid coil T3 is used to derive the recorder connection and is arranged to reduce the difference in level between the speech from the local station and from the distant station by about 10 db. The circuit, including the warning tone rejection filter, reduces the level of tone introduced into a 600-ohm recorder input connection to approximately  $-35$  vu to  $-45$  vu. This suppression is provided so that the tone will not reduce the gain of the recorder amplifier by operating its automatic volume control, thereby avoiding possible loss of a syllable or two during the recovery of the AVC circuit. The transformer T4 provides for electrical isolation between the recorder and the telephone facilities. By means of the amplifier derived from the other half of V2, the speech level incoming from a distant point is about 5 db less in a 600-ohm recorder connection than at the local telephone set. This amplifier also functions as a relay in the recorder input circuit, since connection to the telephone line is completed only when plate power is applied to vacuum tube V2. Also, since the vacuum tube filaments are in series, opening of the oscillator tube filament will disable V2 and prevent transmission of speech to the message recorder.

**3.04 50B Recorder Connector:** The transmission circuit of the 50B recorder connector is shown in Fig. 5. As in the case of the 50A and

50AA recorder connectors, one half of vacuum tube V1 and its associated circuits provide for the generation of a 1400-cycle ( $\pm 1$  percent) tone every  $15 \pm 3$  seconds. This is a Hartley self-blocking type of oscillator whose cathode resistor R2, grid resistor R3, and grid capacitor C3 control the duration of the tone as well as the repetition interval. At the start of oscillation, grid current charges capacitor C3 through the cathode resistor R2 until the tube is self-biased to cutoff. The period of oscillation or tone duration is approximately 0.2 second and is determined by the time constant of R2C3. The tube remains cutoff until C3 can discharge sufficiently through R3. This discharge time or repetition interval of  $15 \pm 3$  seconds is determined by the time constant of R3C3. The resultant 1400-cycle tone, whose envelope is a square-topped pulse in contrast to the logarithmic decay type of tone in the 50A and 50AA recorder connectors, is fed directly to one half of vacuum tube V2 where it is amplified and transmitted to the line through transformer T2. Omission of the decay feature of the warning tone permits the use of the other half of vacuum tube V1 as a diode rectifier for the "B" voltage and also reduces the harmonics of the warning tone to such an extent that the 2800-cycle filter, provided in the 50A and 50AA units, is eliminated in the 50B recorder connector circuit.

**3.05** As in the case of the 50A and 50AA units, the transformer, or hybrid coil T2 and its associated resistance-capacitance network, is so arranged that the level of the tone delivered to the local telephone set is lower than that delivered to the line. However, an improved three-element network (excluding the dc blocking capacitor C2.1) is provided in the 50B recorder connector with a resultant improvement in the amount of tone suppression. The tone level on the line is about  $-5$  vu while the tone level into the local set may be expected to range from about  $-5$  vu to  $-20$  vu, depending upon the degree of balance between the hybrid circuit and the line impedance seen by the recorder connector. The insertion loss of the 50B recorder connector is about 1 db.

**3.06** The hybrid coil T3 and its associated three-element resistance-capacitance network (excluding the dc blocking capacitor C2.2) are used to derive the recorder connection and are arranged to reduce the difference in level between the speech from the local station and from the distant station by about 20 db. This reduction in speech level

difference will also depend upon line impedance conditions which will usually vary for different types of connections.

**3.07** While the three-element hybrid networks are designed to provide optimum balance over a wide range of line impedances, their effectiveness in reducing the tone level to the local subset and recorder, as well as reducing the speech level difference, is less on very short loops (under about 3000 feet), particularly when loaded trunks are involved. Improvements by one of the following two alternatives may be effected in some instances.

- (a) In the case of installations on short loops, capacitors C9 and C5 may be removed from the networks.
- (b) For installations on long loops, such as those over 10,000 feet, resistors R4 and R11 may be shorted.

However, it is expected that the standard three-element networks will be generally satisfactory and only in rare cases will these minor adjustments be necessary.

**3.08** In order to further reduce the level of the warning tone to the recorder, beyond that obtained from T2, so that it does not noticeably interfere with the intelligibility of the recorded speech, the sharply tuned (1400 cycles) rejection filter FL1 is inserted in the output circuit of T3. The tone introduced into the 600-ohm recorder input is thus reduced to approximately  $-30$  to  $-50$  vu. One half of vacuum tube V2 serves the dual purpose of amplifying the signal to the recorder and acting as a relay in the recorder input circuit, since connection to the telephone line is completed only when the plate power is applied to this tube through the control switch, which is usually associated with the external recorder equipment.

**3.09** The filaments of the vacuum tubes in the 50B unit are in parallel in order to obtain increased tube life. This arrangement has not eliminated the safety feature of disabling the recorder connector in the event only one tube fails. If V1 fails, the "B" voltage is lost; if V2 fails, the transmission path to the recorder is disabled.

**3.10** Isolation from the power line, made possible by the use of the power transformer, eliminates longitudinal noise arising from direct

connection to the power line as required in the 50A and 50AA recorder connectors. Elimination of this source of noise has permitted the omission of the double electrostatic shields in T3 and T4 and the omission of all shields in T2.

**3.11 *Modified 50AA Recorder Connector:*** As mentioned in 2.05, arrangements have been made with the Western Electric Distributing House Repair Shops to modify 50AA recorder connectors where an additional reduction in the level of the warning tone to the local telephone receiver or to the customer-owned recorder appears desirable. Two basic circuit changes will be incorporated in the modified equipments. These are (1) a change in the oscillator circuit to eliminate the logarithmic decay characteristic from the warning tone and (2) a change in the two hybrid networks to improve the balance between the hybrid circuits and the wide range of line impedance conditions encountered.

**3.12** Figure 6 shows the modified circuit of the 50AA recorder connector. With regard to the tone levels and characteristics, as well as the general transmission features, this modified equipment is similar to the 50B recorder connector previously described. It was anticipated that these modified equipments would be installed on a replacement basis only in those cases where there was an indicated need. However, with the availability of the 50B recorder connector having similar performance characteristics, the need for the modified 50AA recorder connector may be limited to a very few installations in dc areas only.

**3.13 *Transmission Performance Considerations:***

The 50-type recorder connectors described in this section have been designed to meet the requirements set forth by the FCC for the recording of telephone conversations and to provide satisfactory arrangements for coupling customer-owned voice recorders to telephone lines. The general performance of the recorder connectors will be subject to the manner in which they are connected into the telephone facilities and to the types of telephone facilities and connections encountered.

**3.14** As noted in the previous paragraphs, a single balancing network has been provided for each of the two hybrid circuits. The performance of these hybrid arrangements is dependent upon the degree of balance between the hybrid circuit and the line impedance as seen by the recorder connector. The line impedance will, of course,

vary for different installations and for different types of connections. Because of these varying conditions, the performance of the recorder connectors (particularly with regard to the level of the warning tone to the local receiver and recorder, as well as the difference in level of local speech versus distant speech as applied to the recorder) may also vary considerably.

**3.15** Also in this connection, it should be realized that the design of the recorder connector requires that it be connected in series with the line circuit. It will not function properly if used in a bridged or monitoring condition. The use of a bridged connection will, of course, result in a recording in which there is no equalization of the speech levels of the local and distant parties of the monitored circuit. Also, the level of the warning tone to the line being monitored will vary and will usually be several db lower than the normal level. The most important point is that the level of the warning tone to the local monitored telephone station will usually be considerably higher than normal and that the interference to transmission is likely to be serious for the type of communications involved. The combination of these several factors would probably result in customer dissatisfaction. Therefore, where a single recorder connector is to be used on more than one line or to be associated with standard monitoring facilities, switching arrangements will be necessary for inserting the recorder connector into the several lines involved.

**3.16** The recorder connectors have been designed to operate into a recorder load of approximately 600 ohms and, for correct operation, the load should not differ greatly from this value. It may be necessary, therefore, for the customer to provide matching facilities, either by means of a resistor or transformer, for recorders of the high-impedance type to make the load on the recorder connector approximately 600 ohms in order to insure optimum performance.

**3.17 *Noise Considerations:*** Provision is incorporated to meet the compression requirements of the message recorder which, in some cases, may have up to 50-db compression. To accomplish this, the maximum noise due to the use of the recorder connector is maintained below a maximum of -60 dbm at the message recorder connecting receptacle "voice" terminals when terminated in 600 ohms.

**3.18** Provision is made for longitudinal suppression, such that noise originating in the message recorder or power source due to various possible grounding conditions of the power source or recorder, is not transmitted to the telephone line or local subscriber's station. In addition, provision is incorporated to suppress transmission of longitudinal noise to the message recorder.

**3.19** After the first few units of the 50A and 50AA recorder connector were produced, a minor factory modification was made to reduce unbalances and the consequent possibility of objectionable noise when installations were made on lines having appreciable noise to ground. Since a comparatively small number of recorder connectors were manufactured prior to this change, few troubles from unbalances are expected to arise. However, should such noise conditions be encountered, the recorder connector should be checked to determine whether this modification has been incorporated.

**3.20** The modification consists of a simple wiring change on the terminal strip and involves transferring the transformer shield connection from terminal "G" to terminal "R1". In a few of the early 50A recorder connectors, there were two such wires, both of which should be transferred to "R1". These wires are not readily traced, but the only wire which should remain on terminal "G" is that connected to the chassis and which is easily identified. This modification removes the ground on the shields of the two hybrid coils and connects the shields to the ring side of the line.

#### **4. SPECIAL APPLICATION CONSIDERATIONS**

**4.01** *Installations in dc Areas:* Because the 50B recorder connector, which is ac operated only, costs considerably less than the ac-dc units, it was planned that only a sufficient number of the latter would be manufactured to take care of the ultimate requirements in dc areas, including, of course, the portable assemblies for recorder salesmen. The initial production of 50A and 50AA types was to be used generally for all applications until the 50B type was available. Since the 50B is now available and since all future production will be of this type, it will be necessary for the companies to conserve some of the ac-dc units for dc applications in each area. Similarly, on subsequent removals of recorder connectors from service, it will be desirable to place a sufficient number of

the ac-dc types in the supply stock to take care of the future needs in dc areas, as well as some additional units required for recorder salesmen.

**4.02** *Installations on Private Lines:* Recorder connectors, which include a warning tone, are not required on private line telephone circuits not switched to the general exchange or toll systems. Very few recorder installations of this type have been made and most of these are on facilities leased to the Civil Aeronautics Administration. In these, the recorders are associated with the attendant's telephone set rather than with the line. For installations on the line proper, it has been the practice to bridge the recorder on the line through a suitable transformer installed by the telephone company, the transformer being selected to limit the bridged loss and to provide adequate protection. This procedure might be followed or, if desirable, a hybrid coil of the type used in the 50-type recorder connectors could be employed. The latter would have the advantage of reducing level differences between the local and remote stations which may be important in some circumstances.

**4.03** *Installations for Telephone Company Demonstrations:* In the case of installations on telephone company premises, to permit demonstration of the tone, it will be necessary to provide suitable arrangements for connecting power to the recorder connector and to start and stop the tone. The preferable arrangement depends upon the type of demonstration. As indicated in Figures 3 through 6, terminals 1 and 6 should be connected to the power supply and this may be done through a conventional power cord terminated in a Cannon SK-M7-21C 1/2-inch plug. Terminals 2 and 7 also must be short-circuited to operate the connector. Where appropriate, this could be done within the unit and the power cord used to start and stop the recorder connector, a switch being included in the cord if necessary. In other instances, where it is desirable to demonstrate the recorder without the delay in warming up, the power might be connected continuously and a control switch wired through the Cannon plug to terminals 2 and 7.

**4.04** *Requests for Improved Telephone Facilities:* Experience with voice recorders (on private lines) indicates that where unsatisfactory recordings are frequently obtained, the customer may, in some instances, request transmission improvements of the telephone facilities. The quality of recordings

depends, of course, upon: (a) the performance of the telephone facilities, (b) the manner in which the parties speak and use the telephone instrumentalities, and (c) the performance of the voice recorder (including reproduction). The telephone facilities used in message connections provide a grade of transmission suitable for telephone communication, taking into account the manner in which the subscribers use the instruments, and their talking habits in conveying information to each other. It does not follow that even perfect recordings of such conversations will be completely intelligible to a third party transcribing it. Also, there will probably be a number of different types of recorders

of varying quality and maintenance will vary considerably. It can not, of course, be expected that all customers using recorders will appreciate these considerations and will understand that the objective and responsibility of the telephone companies is to provide good telephone transmission at a reasonable cost, and that the customer's additional objective of obtaining good recordings is not within the control of the telephone company. However, when complaints are received, it might, of course, be advisable to check the facilities to be sure that the transmission is satisfactory for telephone service.

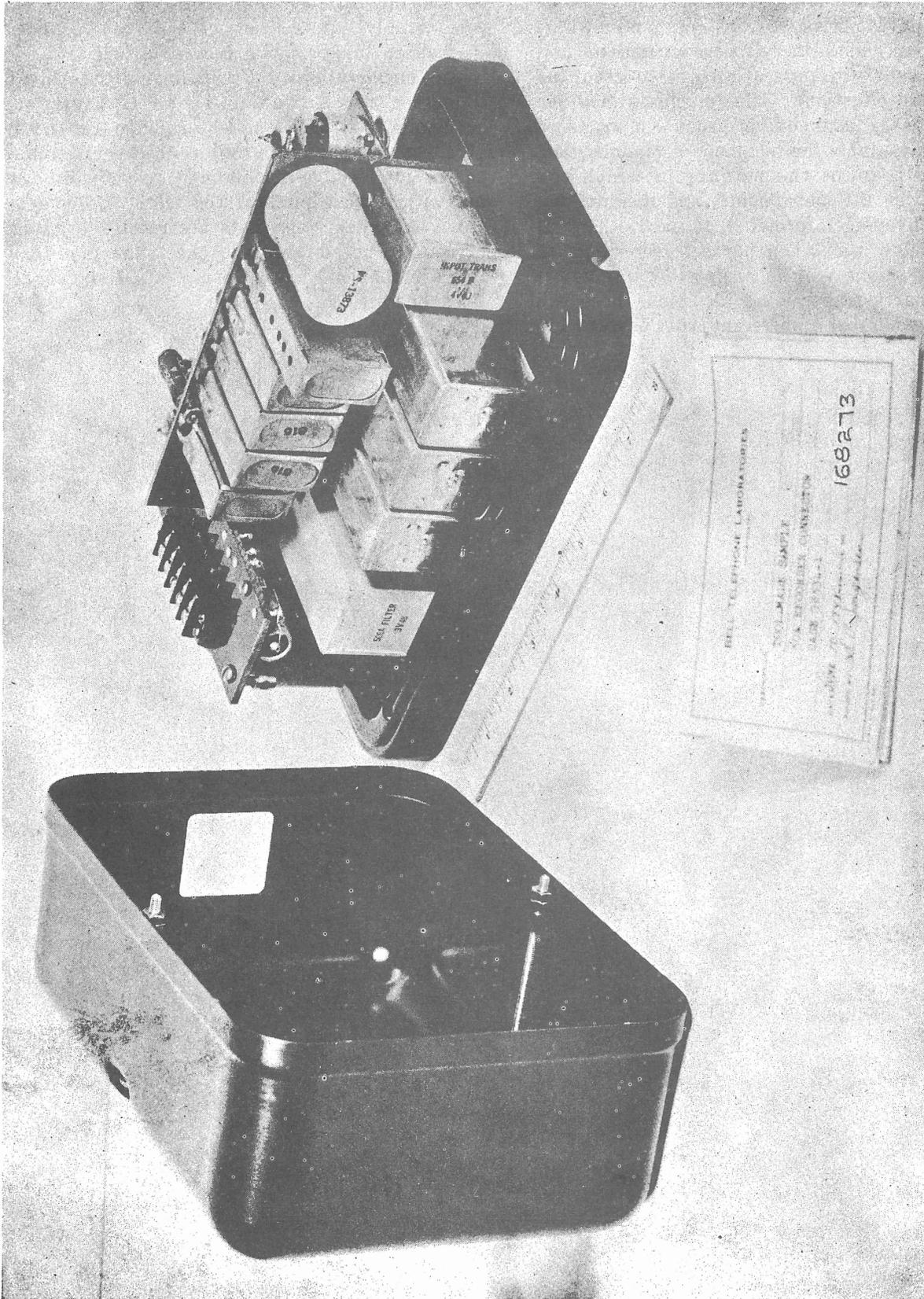


Fig. 1—50A Recorder Connector

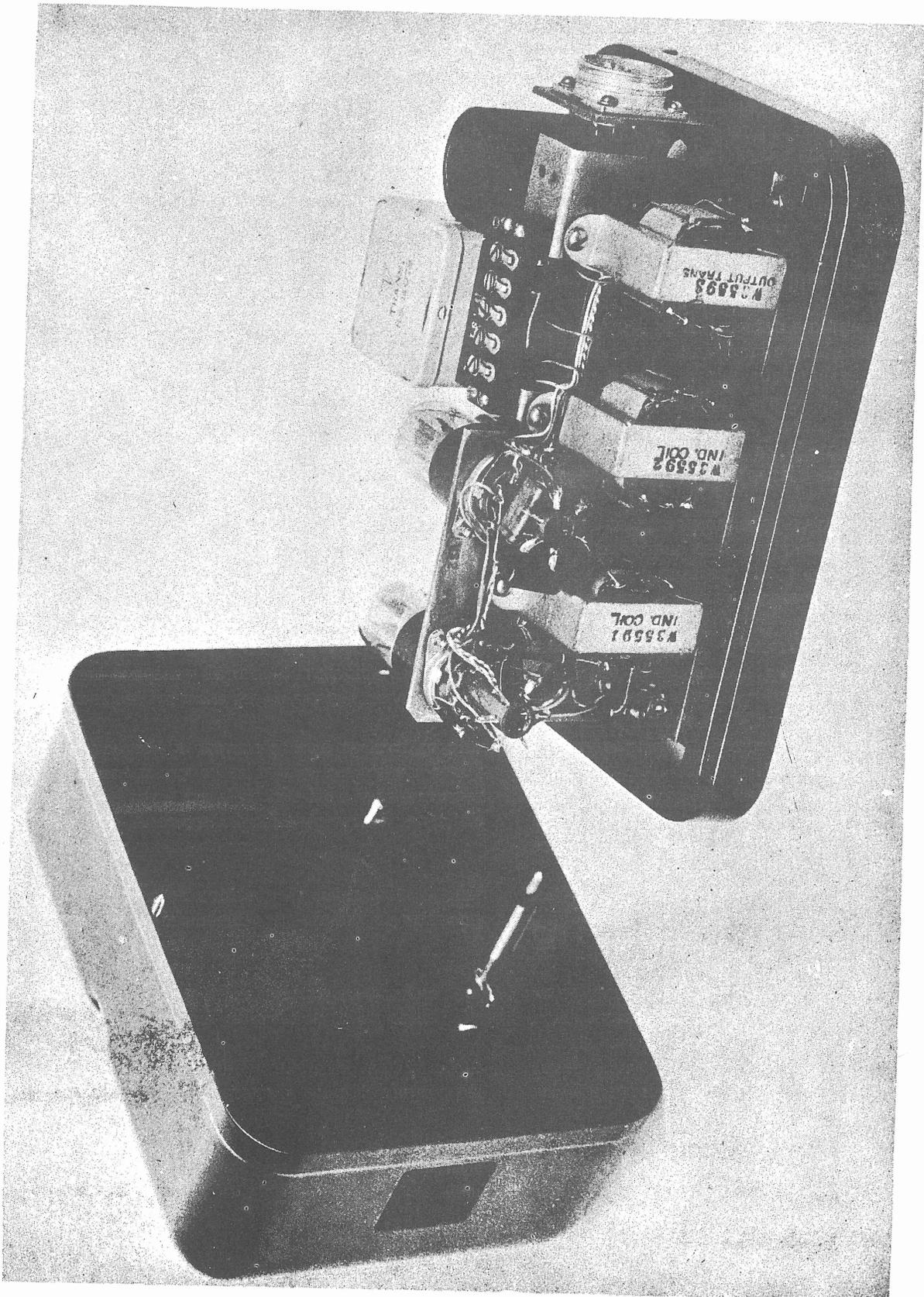
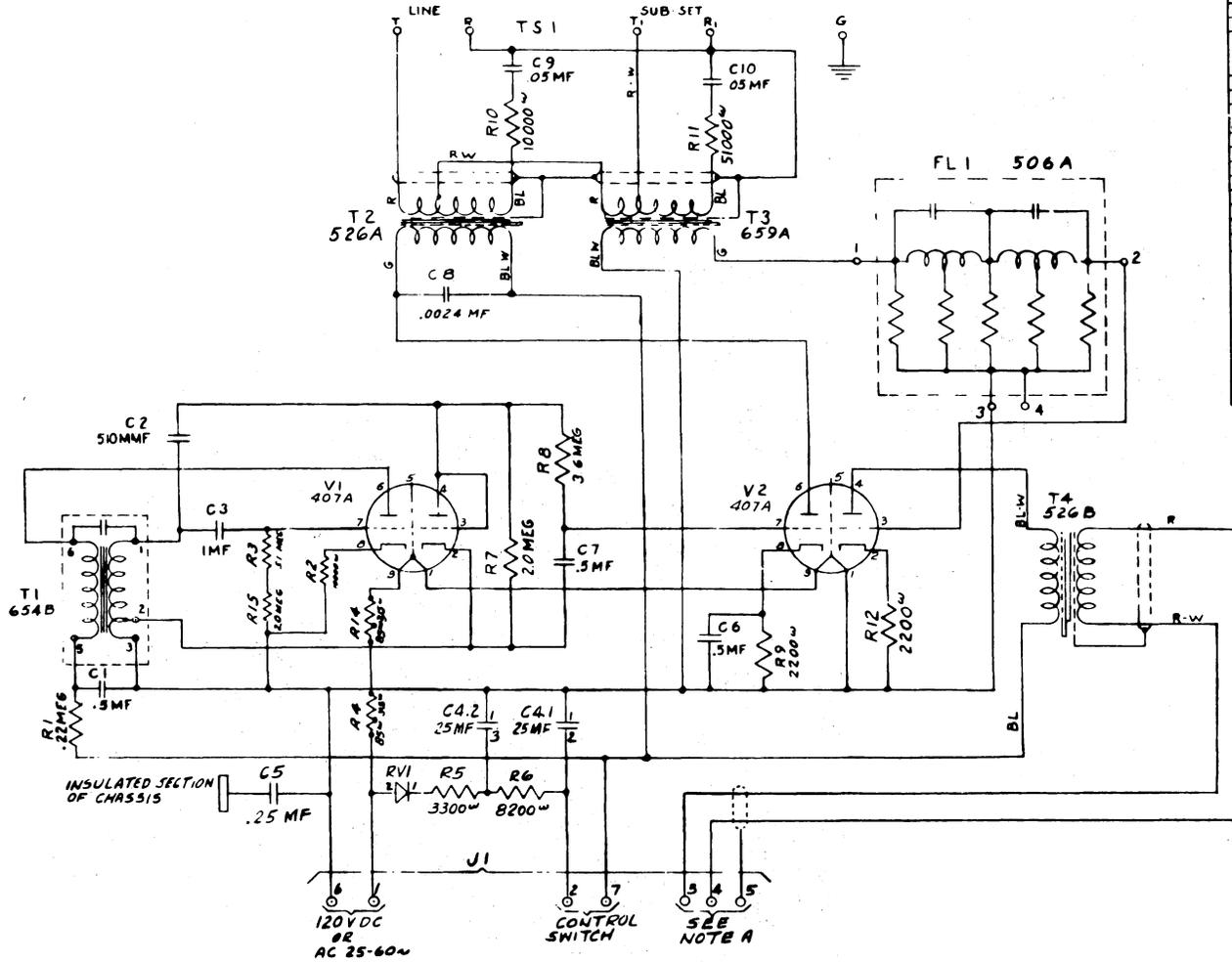


Fig. 2—50B Recorder Connector

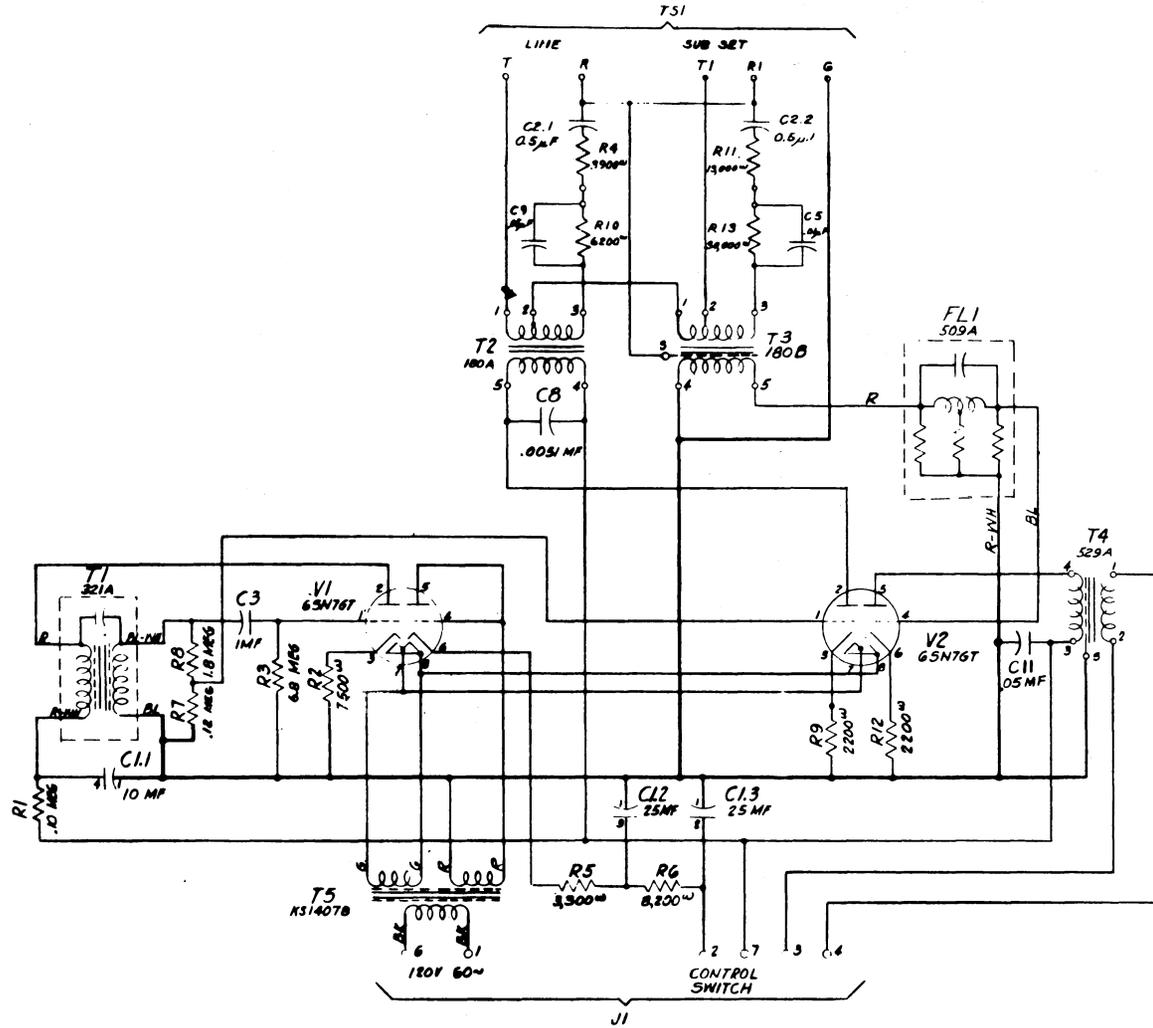


OPERATING VOLTAGES	
BETWEEN POINT LISTED BELOW AND TERMINAL 6 OF J1	MEASURED WITH DC VOLTMETER HAVING IMPEDANCE OF 10 MEGOHMS
TERMINAL 3 of V1	-0.3 -20*
TERMINAL 6 of V1	100 TO 80 50*
TERMINAL 7 of V1	VOLTAGE VARIES BETWEEN -30 AND -5 DURING 15 SECOND TIMING INTERVAL
TERMINAL 8 of V1	0 3.2*
TERMINAL 5 of T1	100 TO 80 50*
JUNCTION OF RVI & R5	118 TO 110
TERMINAL 3 of C9	112 TO 102
TERMINAL 2 of C9	102 TO 90
TERMINAL 2 of V2	2.9 TO 2.5
TERMINAL 4 of V2	100 TO 86
TERMINAL 6 of V2	101 TO 87
TERMINAL 7 of V2	-8 TO -0.6
TERMINAL A of V2	0 TO 2
*VOLTAGES OBTAINED WHEN OSCILLATOR IS ACTIVE	
NOTE: THE ABOVE VOLTAGES ARE TYPICAL AVERAGE VALUES OBTAINED WITH TERMINALS 2 AND 7 OF J1 STRAPPED AND 120 VOLTS, 60 CYCLES, APPLIED TO TERMINALS 1 AND 6. WHERE A RANGE OF VOLTAGES IS SHOWN, THE VALUES ARE VARIATIONS WHICH OCCUR BETWEEN ACTIVE PERIODS OF THE OSCILLATOR.	

NOTE:  
 A: WITH UNBALANCED CIRCUITS TERM. 3 SHOULD BE SIGNAL GROUND AND TERM. 5 MAY BE CONNECTED TO TERM. 3 OR GROUND.

Fig. 3—50A Recorder Connector



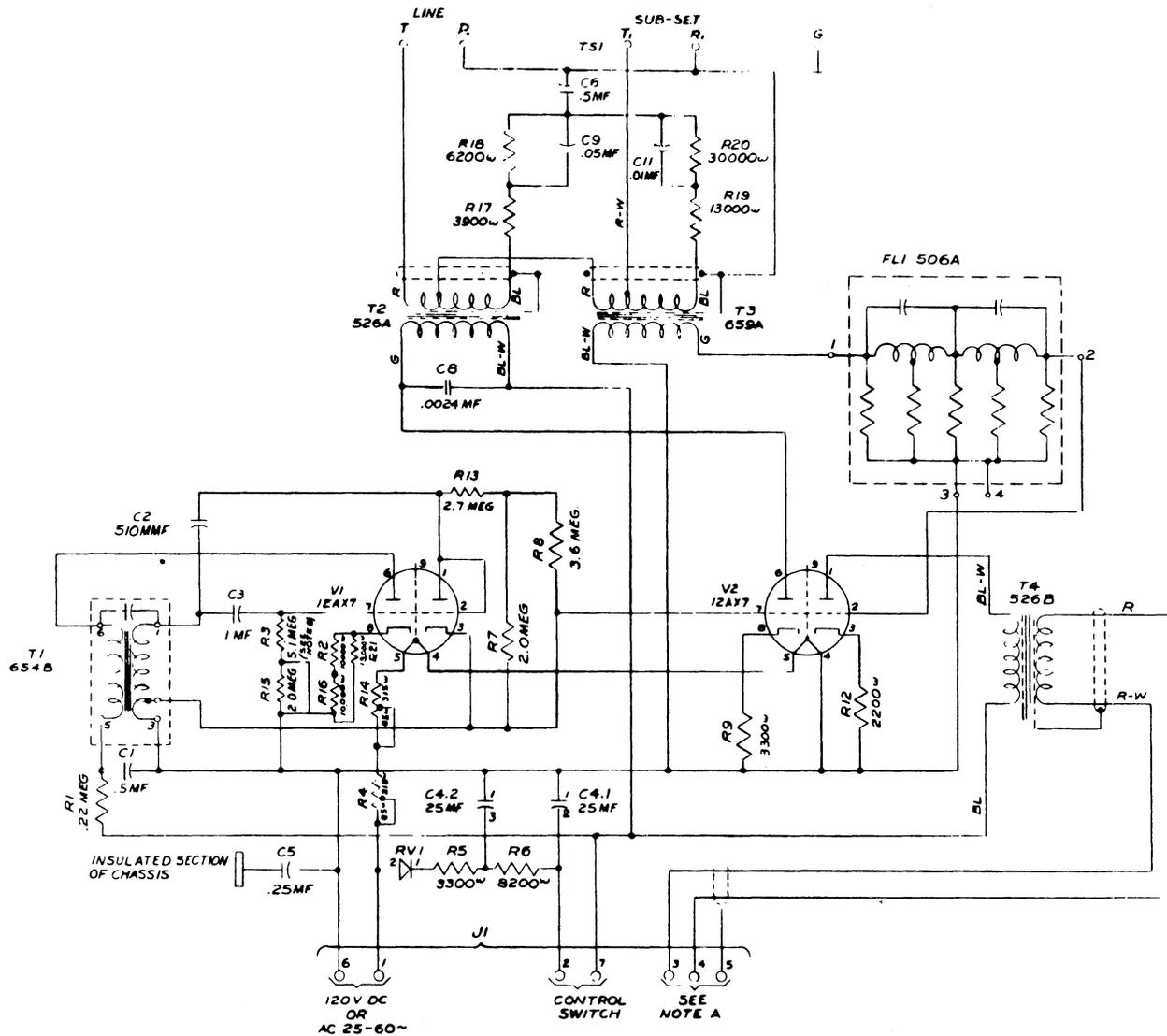


OPERATING VOLTAGES		
VOLTAGES		
BETWEEN POINT LISTED BELOW AND TERMINAL 5*	D C MEASURED WITH VOLT-METER HAVING AN IMPEDANCE OF 10 MEG OHMS	A C MEASURED WITH VOLT-METER HAVING AN IMPEDANCE OF MINIMUM 1 MEG.
JUNCTION OF R1 & R-1NH LEAD FROM T1	.92	.77*
TERMINAL 2 OF V1	.82	.77*
" 3 " "	0	.55*
" 4 " "		120
" 6 " "	115	
JUNCTION OF R5 & R6	105	
TERMINAL 2 OF U1	.84	
" 3 " V2	3.1	
" 6 " "	3.2	
" 2 " "	83.5	
" 5 " "	83.5	
" 4 " T2	.84	
" 1 " V1	VOLTAGE VARIES BETWEEN -35 & -6.5 DURING 15 SECOND TIMING INTERVAL	

\* VOLTAGES OBTAINED WHEN OSCILLATOR IS ACTIVE

NOTE: THE ABOVE VOLTAGES ARE TYPICAL AVERAGE VALUES OBTAINED WITH TERMINALS 2 & 7 OF J1 STRAPPED AND 120 VOLTS, 60 CYCLES, APPLIED TO TERMINALS 1 & 6

Fig. 5—50B Recorder Connector



OPERATING VOLTAGES	
BETWEEN POINT LISTED BELOW AND TERMINAL 6 (IF V1)	MEASURED WITH DC VOLT METER HAVING IMPEDANCE OF 10 MEGOHMS
TERMINAL 1 OF V1	-0.9
TERMINAL 6 OF V1	-4.0*
TERMINAL 7 OF V1	VOLTAGE VARIES BETWEEN -35 AND -2 DURING 15 SECOND TIMING INTERVAL
TERMINAL 8 OF V1	0
TERMINAL 5 OF T1	127 TO 119
JUNCTION OF R8 AND R13	-0.3
JUNCTION OF RV1 & R5	134 TO 130
TERMINAL 3 OF C4	133 TO 128
TERMINAL 2 OF C4	129 TO 120
TERMINAL 1 OF V2	129 TO 120
TERMINAL 3 OF V2	1.1 TO 1.0
TERMINAL 6 OF V2	129 TO 120
TERMINAL 7 OF V2	-5.0 TO -0.2
TERMINAL 8 OF V2	0 TO 0.8

\*VOLTAGES OBTAINED WHEN OSCILLATOR IS ACTIVE

NOTE: THE ABOVE VOLTAGES ARE TYPICAL AVERAGE VALUES OBTAINED WITH TERMINALS 2 & 7 OF V1 STRAPPED AND 120 VOLTS 60 CYCLES APPLIED TO TERMINALS 1 AND 6, WHERE A RANGE OF VOLTAGES IS SHOWN THE VALUES ARE VARIATIONS WHICH OCCUR BETWEEN ACTIVE PERIODS OF THE OSCILLATOR.

- NOTE:
- WITH UNBALANCED CIRCUITS TERMINAL 3 SHOULD BE SIGNAL GROUND AND TERMINAL 5 MAY BE CONNECTED TO TERMINAL 3 OR GROUND.
  - ON SOME OF THESE RECORDER CONNECTORS R3 IS 5.6 INSTEAD OF 5.1 MEGOHMS.

THIS DRAWING SHOWS MODIFICATIONS WHICH HAVE BEEN INCORPORATED IN THE 50AA RECORDER CONNECTOR SHOWN SCHEMATICALLY ON LA77622B. THE MODIFICATIONS INCLUDE THE REPLACEMENT OF THE TWO ELEMENT BALANCING NETWORKS WITH THREE ELEMENT NETWORKS AND THE ELIMINATION OF THE WARNING TUBE SLOW DECAY FEATURE.

Fig. 6—Modified 50AA Recorder Connector