INSTRUCTION MANUAL

COM-PAK SERIES

REGULATED POWER SUPPLIES

LAMBDA ELECTRONICS CORP. COLLEGE POINT, NEW YORK

MODEL NO. C-281, C-281M

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SECTION I

GENERAL DESCRIPTION

A. Introduction

1. Purpose of Manual.

This manual contains all information necessary for installation, operation and maintenance of the Lambda COM-PAK Series regulated power supplies. It is recommended that the appropriate sections of this manual be carefully read prior to installation, operation or maintenance.

2. General Functions of the COM-PAK Series.

The COM-PAK Series is an outstanding achievement in the combination of performance, ultra-compactness and versatility in the field of regulated power supply design. The highly desirable electrical characteristics of good regulation, low noise and ripple are achieved with no sacrifice of compactness or durability. Rugged construction, conservative use of high-quality components and easy accessibility for service and maintenance make these units desirable for long service uses where reliability must be paired with performance. The compact packaging of these units enable them to be used under conditions of limited space where other power supplies of equivalent performance would be excluded. This is of particular advantage for use in computer equipment and other demanding applications. Other features of the series, unique in the field of power supply design, are described in detail in the following text.

3. Voltage Ranges of the COM-PAK Series.

The COM-PAK Series is divided into three voltage groups, each of which supplies regulated voltage over a range of 200 volts DC within the Series limits of 0 and 525 VDC. The "80" group, comprised of Models C-280, C-480, C-880 and C-1580 and their metered equivalents, is rated at 0 to 200 VDC output. The "81" group, comprised of Models C-281, C-481, C-881 and C-1581 and metered equivalents, is rated at 125 to 325 VDC output. The "82" group covers the rest of the range, 325 to 525 VDC output

The 200 VDC range of each power supply is covered in four continuously variable bands of 50 VDC. Voltage selection for each unit is accomplished by means of two voltage range switches and a vernier voltage control. Operation of these is described in Section III–OPERATION.

4. Current Ranges of the COM-PAK Series.

The units of the COM-PAK Series are grouped into several current ranges. Units of range 0 to 200 MA, 400 MA, 800 MA, 1500 MA etc. are presently available. Identification of the current capacity may be made by reference to the digit (or digits) preceding the digits 80, 81 or 82 of the model number. This digit (or digits) multiplied by 100 yields the current in milliamperes. For example, Model C-281 is a 200 MA supply while Model C-1581 is a 1.5 ampere supply.

5. Special Features.

a. Service Access

All routine service may be carried out with the unit in its operating position provided access to the rear of the unit is available. Access to the interior of units of the COM-PAK Series for purposes of service is easily afforded. The majority of internal connections, wiring and terminals is exposed by opening the tube deck (hinged rear panel).

b. Local Station or Remote Control Operation

All units of the COM-PAK Series incorporate means of remote on-off and vernier voltage control of the DC output in addition to normal local station operation. These units may thus be used in applications where the power supply must be in proximity to the units it energizes even though the operator must be stationed elsewhere. As supplied, each unit is wired for local station operation. The simple conversion to remote control operation is described in detail in Section II–INSTALLATION, Paragraph D.

c. Hermetically Sealed Components

All transformers and capacitors used in the COM-PAK Series are hermetically sealed units. Conservative design and utilization of all active components ensures long reliable service.

d. Advanced Packaging

The COM-PAK Series has been designed to provide maximum performance capability in units of extremely compact construction. A special feature of the COM-PAK Series is the minimal panel height which these power supplies occupy. A table is here given of model number, current rating and corresponding panel height of these units.

COM-PAK SERIES Model Number	Current Rating	Panel Height in Inches
C-280, C-281, C-282	200MA	5¼
C-480, C-481, C-482	400MA	5¼
C-880, C-881, C-882	800MA	7
C-1580, C-1581, C-1582	1500MA	8¾

Any unit of the COM-PAK Series will fit into a standard RETMA 19 inch relay rack or rack cabinet of 15 inch minimum depth. The packaging of the COM-PAK Series facilitates serviceability in its normal operating position. All tubes are replaceable from the rear of the unit and almost all components and accessories are accessible upon opening the rear tube deck.

An additional consideration in the packaging of the COM-PAK Series is the desirability of maximum ventilation. The COM-PAK series has been designed to facilitate thermal flow thus maintaining operating temperatures at a minimum.

e. *Transient-free Operation*

The COM-PAK Series of power supplies will operate within regulation specifications for unit step load current variations of O MA to rated full load and for unit step of full load to O MA. The output voltage will remain within specification limits for a 10 volt RMS increase or decrease in line voltage with the proviso that at all times the line voltage be within the range 105-125 VAC.

The wide dynamic operating range of the COM-PAK Series is especially applicable to computer work where a transient-free power source is often essential.

B. Electrical Specifications

1. DC Output.

a. *Ranges*

The following table gives the DC output voltage and current ranges of the various models of the COM-PAK Series:

MODELS	VOLTAGE RANGE	CURRENT RANGE
C-280, C-280M	0-200 VDC	0-200 MA
C-281, C-281M	125-325 VDC	0-200 MA
C-282, C-282M	325-525 VDC	0-200 MA
C-480, C-480M	0-200 VDC	0-400 MA
C-481, C-481M	125-325 VDC	0-400 MA
C-482, C-482M	325-525 VDC	0-400 MA
C-880, C-880M	0-200 VDC	0-800 MA
C-881, C-881M	125-325 VDC	0-800 MA
C-882, C-882M	325-525 VDC	0-800 MA
C-1580, C-1580M	0-200 VDC	0-1500 MA
C-1581, C-1581M	125-325 VDC	0-1500 MA
C-1582, C-1582M	325-525 VDC	0-1500 MA

Voltage range for each model is completely covered in four continuously variable bands as follows:

Models	
C-280, 480, 880, 1580	0-50 , 50-100, 100-150, 150-200
C-281, 481, 881, 1581	125-175, 175-225, 225-275, 275-325
C-282, 482, 882, 1582	325-375, 375-425, 425-475, 475-525

Current rating applies over entire voltage range.

b. *Regulation (Line)*

The output voltage will remain constant within 0.15% or 0.3 volt (whichever is greater) for any line voltage variation between 105 and 125 VAC for all units of the COM-PAK Series.

c. *Regulation (Load)*

The output voltage will remain constant within 0.25% or 0.5 volt (whichever is greater) for any load current variation from 0 to full load.

d. *Transient Response (Line)*

The output voltage will remain constant within line regulation specifications for a step-function line voltage change of +10 V RMS or −10 V RMS within the limits of 105-125 VAC.

e. *Transient Response (Load)*

The output voltage will remain constant within load regulation specifications for a step-function change from 0 to full load or full load to 0.

f. *Internal Impedance*

The impedances of the respective units of the COM-PAK Series are as follows:

C-200 Series	Less than 6 ohms
C-400 Series	Less than 3 ohms
C-800 Series	Less than 1.5 ohms
C-1500 Series	Less than 0.75 ohms

g. *Ripple and Noise*

The output voltage of all units of the COM-PAK Series has a ripple and noise content of less than 3 millivolts RMS.

h. *Polarity*

All units of the COM-PAK Series may be operated with either positive or negative output terminals grounded.

2. AC Output.

The AC output of the units of the COM-PAK Series is rated at 6.5 VAC (unregulated) at 115 VAC input under the following load current conditions:

C-200 Series	10 AMP
C-400 Series	15 AMP
C-800 Series	20 AMP
C-1500 Series	30 AMP

This voltage is as measured at the output terminals. Allowance has been made for a voltage drop of 0.2 VAC in the external wiring of a filament power load. This AC output power is electrically isolated and ungrounded.

3. AC Input.

All units of the COM-PAK Series require an AC input power source of 105 to 125 VAC, of frequency 50 to 400 CPS, single phase. Power consumption of all units is as follows:

MODELS	INPUT POWER
C-280	300 Watts
C-281	330 Watts
C-282	390 Watts
C-480	410 Watts
C-481	480 Watts
C-482	595 Watts
C-880	670 Watts
C-881	850 Watts
C-882	1070 Watts
C-1580	1180 Watts
C-1581	1420 Watts
C-1582	1850 Watts

(All outputs are loaded to full ratings and input at 125 VAC.)

4. Ambient Temperature and Duty Cycle.

All COM-PAK Series units are designed to operate continuously under full load and 125 VAC line conditions at ambient temperatures of up to 50°C(122°F).

5. Overload Protection.

a. External Overload Protection

All units are protected against external overloads by the AC and DC fuses located on the front panels. These fuses, of the time-lag cartridge type, are in holders which become illuminated upon fuse failure. Immediate warning of overload condition is thus given.

b. Internal Failure Protection

All units are protected against failure of internal components by fuses located on the tube deck. These fuses, of the time-lag cartridge type, are held in quick-removal half-turn holders.

6. Input and Output Connections.

A heavy-duty barrier terminal block is mounted on the rear of all units to serve as the power input and take-off point. All terminals are labeled and are of the screw-down type.

7. Controls

a. AC and DC Switches

These are to be found on the front panel of all units. The AC switch controls low-voltage filament power to all tubes inside the unit and also energizes the 6.5 VAC unregulated output. The DC switch controls the high-voltage circuits of the unit and causes the regulated DC output to appear at the output terminals.

b. DC Output Voltage Controls

The DC output voltage is controlled by means of two band switches and a vernier potentiometer. These are located on the tube deck of the unit.

8. Meters.

The regulated DC output voltage and the output current are indicated by the meters mounted upon the front panel of the metered models of the COM-PAK Series. These meters are of the 3½" rectangular type, and are rated at 2% of full scale accuracy.

9. Voltage Reference.

The voltage reference used on all units is the stable 5651 voltage reference tube. Use of this tube results in superior long-time voltage stability.

C. Physical Specifications

1. Mounting.

Panels of all units of the COM-PAK series have standard RETMA notching for standard 19" relay rack or cabinet mounting.

2. Dimensions.

C-200 Series	5 1/4" H x 19" W x 14 3/8" D
C-400 Series	5 1/4" H x 19" W x 14 3/8" D
C-800 Series	7" H x 19" W x 14 3/8" D
C-1500 Series	8 3/4" H x 19" W x 14 3/8" D

3. Weight.

C-200 Series	53 lb. Net	80 lb. Shipping Wt.
C-400 Series	53 lb. Net	80 lb. Shipping Wt.
C-800 Series	84 lb. Net	100 lb. Shipping Wt.
C-1500 Series	120 lb. Net	140 lb. Shipping Wt.

4. Finish.

Standard finish on all COM-PAK units is black ripple enamel.

D. Tube Complement

TUBE TYPE	MODEL											
	280	281	282	480	481	482	880	881	882	1580	1581	1582
5651	1	1	1	1	1	1	1	1	1	1	1	1
OB2	1			1	1	1	1	1	1	1	1	1
5R4-GYA			2									
5U4-GB	2	2										
5Y3-GT							1	1	1			
6X4	2			2	1	1	1			1		
6AQ5	1			1			1			1		
6L6-GB	3			5	6	6	10	12	12			
6W6-GT		6	6									
5881										19	20	20
12AX7	4	2	2	4	2	2	4	2	2	4	3	3

TUBE TYPE	FUNCTION
5651	Voltage Reference Standard Tube
OB2	Voltage Regulator Tube
5R4-GYA	Vacuum Rectifier Tube
5U4-GB	Vacuum Rectifier Tube
5Y3-GT	Vacuum Rectifier Tube
6X4	Vacuum Rectifier Tube
6AQ5	Series Control Tube
6L6-GB	Series Control Tube
6W6-GT	Series Control Tube
5881	Series Control Tube
12AX7	Voltage Amplifier Tube

SECTION II

INSTALLATION

A. Mechanical

All units of the COM-PAK Series are designed to fit standard 19" relay racks or cabinets. When mounted in position, sufficient room should be provided to the rear of the unit to permit opening the rear panel for purposes of service and inspection.

The front panel of all units is sturdily constructed. However, provision should be made to relieve the panel mounting screws of the weight of the unit. It is recommended that angle brackets be secured to the sides of the rack to support the weight of the unit. The front panel screws should serve merely to fix the power supply in its rack position.

B. Power Input Connections

All units of the COM-PAK Series operate from a power line source of 105-125 VAC, 50-400 CPS, single phase. Input power is applied to the terminals identified as 105-125 VAC. The terminal marked ⏚ (chassis ground) should be wired to the rack or cabinet ground, and this in turn connected to an earth ground.

C. Power Output Connection

Power output may be obtained from all units of the COM-PAK Series at the terminal block on the hinged tube deck of the chassis. A convenient way of connecting the unit to the equipment is by means of a fanning strip mounted at the end of the connecting cable. The connecting cable should pass through the slot in the chassis leg at the hinge. This avoids excessive flexure of the cable when the tube deck is opened.

Cable leads should be selected for current carrying capacity and for inherent voltage drop. The latter is a function of length, wire size and operating current. It is to be noted that this voltage drop will add to the regulation of the power supply and therefore should be minimized.

D. Conversion to Remote Control Operation

As supplied, all units of the COM-PAK Series are wired for local operation. In order to convert any COM-PAK unit to remote control operation, the following procedure is to be followed:

1. Remove terminal block cover exposing terminal block.
2. Remove all external wiring from terminals on which jumper bars are present.
3. Replace jumper bar across terminals marked "Remote DC Switch" with a remote SPST switch of appropriate power rating. See table for switch current rating.

SERIES	SWITCH CURRENT RATING
200 MA	3A
400 MA	6A
800 MA	10A
1500 MA	20A

4. Reconnect line input lead to line input terminal from which jumper bar was removed.
5. Replace jumper bar across terminals marked "Remote DC Vernier" with a remote 5,000 ohm 4 watt wirewound potentiometer. The potentiometer is wired as a rheostat so that resistance increases with clockwise rotation of the shaft. It is recommended that the two connecting wires be shielded.
6. Replace external wiring and terminal block cover.

SECTION III

OPERATION

SAFETY NOTICE

Dangerous voltages exist in this equipment. Observe the usual safety precautions when operating or servicing the equipment in order to avoid shock or injury.

A. Power Controls

1. "AC".

The AC power switch is located at the left side of the front panel. Placing the switch in the "ON" position will energize the internal filaments of the supply and cause power to appear at the 6.5 VAC terminals at the rear of the unit. Simultaneously, the "AC" light will glow. The AC power switch must be turned to "ON" to enable the DC switch to operate.

2. "DC".

Placing the DC switch in its "ON" position will cause DC output voltage to appear at the appropriate terminals at the rear of the chassis and cause the "DC" light to glow. It must be noted that for this function to be performed, the unit must be connected for local station operation *(See Paragraph C of this section)*, or else the remote DC power switch must be in its "ON" position.

B. Output Voltage Controls

1. General.

The output voltage controls are located on the tube deck of the unit to the left side as viewed from the rear. They consist of two range switches and one screwdriver slotted potentiometer labeled "DC VERNIER CONTROL". Note that under no circumstance is the potentiometer labeled "CALIB" (calibration) to be used to adjust output voltage. Setting of the calibration control is covered in SECTION IV – MAINTENANCE. By the proper use of these switches and the vernier control, any voltage within the specified voltage range of the unit is made available.

2. Principles of Bandswitches and Vernier Control.

All units of the COM-PAK Series cover a total voltage range of 200 VDC output. This is divided into four ranges of 50 VDC each, selected by means of two toggle bandswitches. A table is to be found on the tube deck above the output voltage controls which gives the voltage ranges and their respective switch positions. Within these ranges the exact voltage desired is set by adjusting the "DC VERNIER CONTROL". This control varies the output voltage over a a range in excess of 50 VDC.

To obtain any specific voltage the two bandswitches are placed in their proper positions and then the "DC VERNIER CONTROL" is rotated to yield the required voltage. As an example, consider the case of a Model C-1581 unit from which 200 VDC is desired. The following chart is noted on the tube deck:

RANGE VDC	SWITCH POSITION
125-175	B + D
175-225	A + D
225-275	B + C
275-325	A + C

The two switches are thus set in A + D positions, and the "DC VERNIER CONTROL" is adjusted so that 200 VDC output is obtained. A similar procedure is followed for any other desired voltage within the range of the unit.

C. Local Station or Remote Control Operation

All units of the COM-PAK Series can be readily adapted to remote control of the DC power output. As supplied, all units are wired for local station operation. For conversion to remote control operation, refer to Section II–INSTALLATION, Paragraph D.

The remote controls, consisting of an SPST toggle switch for DC power and a potentiometer for DC vernier voltage control, are electrically in series with the respective local station controls they supplant. Certain precautions must be observed. For remote operation the panel "DC" power switch must remain in the "ON" position. The tube deck "DC VERNIER CONTROL" must remain in its minimum resistance (extreme counterclockwise) position. Since there is no remote bandswitching, the desired range of output voltage must be chosen in advance, and the bandswitches placed in their appropriate positions. The remote potentiometer may then be used to adjust the output voltage over the desired range.

For remote operation of AC power, the "AC" switch is kept in the "ON" position, and the AC input power source turned on and off.

SECTION IV

MAINTENANCE

SAFETY NOTICE

Dangerous voltages exist in this equipment. Observe the usual safety precautions when operating or servicing the equipment in order to avoid shock or injury.

A. Introduction

Long trouble-free service is to be expected from Lambda power supplies. Neglecting the possibility of pliysical damage, any maintenance that may be required will result from overload of the power supply unit or the aging and failure of the vacuum tubes. In event of power supply failure or performance of a unit outside of the specified limits listed in the table of electrical specifications, refer to the chart *(Paragraph F of this section),* listing possible trouble symptoms, possible causes and remedial action to be taken for correction of the symptoms.

This chart has been prepared with reference to a block diagram of the power supply. The block diagram is to be found in SECTION V of this manual. For identification of the components described in the block diagram, reference should be made to the schematic diagram accompanying the block diagram. The schematic diagram contains the component number and abbreviated descriptions of the components. Thus the chart, the power supply block diagram, and the schematic diagram combine to aid effective maintenance and service of the power supply.

B. Service Access

The COM-PAK Series of power supplies are designed to permit normal maintenance and service of the unit while mounted in its operating position. Removal of the unit from its operating enclosure for general service is not required provided rear access to the unit exists. Opening the tube deck provides accessibility to almost all tiepoints and terminals of the power supply. The tube deck is locked in its operating position by quarter-turn fasteners. For purposes of service and maintenance the tube deck is kept open by means of the built-in door check. When locked the door check assumes a fully extended position. Reversal of the opening operation collapses the door check and the tube deck may then be closed and locked.

C. Tube Removal and Replacement

All tubes of the COM-PAK Series are secured to the tube deck by means of tube clamps or retainer tube shields. All of the miniature series tubes are secured by retainer tube shields. Removal of this type of tube is performed by depressing the tube shield, rotating it counter-clockwise, withdrawing the shield, and then extracting the tube from its socket. Upon reinsertion of the tube, the retainer shield is placed over the tube; it is depressed and then rotated clockwise.

Spring retainer clamps are used on all octal base type tubes. Tube removal is effected by depression of both sides of the clamp accompanied by withdrawal of the tube from the socket. Replacement of the tube requires only simple insertion into its socket.

D. Calibration Procedure

The calibration of any of the COM-PAK Series power supplies should be checked upon replacement of any of the voltage amplifier tubes or the voltage reference tube. This check is made as follows:

1. With AC and DC power switches in the "OFF" positions, the range switches on the tube deck are set to positions A + D.
2. The "DC VERNIER CONTROL" is set to its extreme counterclockwise position.
3. A voltage standard of one percent accuracy of calibration or better is connected between the –DC and +DC output terminals.
4. Throw AC and DC switches to the "ON" positions. The value measured on the standard should be between 3 and 5 volts below the rated lower value of the range. As an example, on Model C-281, the range A + D corresponds to 175 to 225 VDC. The unit would be properly calibrated if the voltage measured falls between 170 and 172 VDC.

If the voltage falls outside the specified limits, the following calibration procedure should be followed:

1. Remove cap nut from "CALIB" potentiometer.
2. With flat blade screw driver adjust "CALIB"

potentiometer so that output voltage is 3 to 5 VDC below minimum value of A + D range. Clockwise rotation of the potentiometer shaft results in increasing voltage; counterclockwise rotation of the potentiometer shaft results in decreasing voltage.

3. Seal the "CALIB" potentiometer with glyptal or equivalent cement. Replace the cap nut on the potentiometer.

4. The range switches and "DC VERNIER CONTROL" are then used to set the DC output voltage.

E. Use of Maintenance Chart and Diagrams

The first step in the utilization of the Maintenance Chart is the pin-pointing of the trouble symptoms that exist. Examples of possible symptoms are the following:

a. Absence of filament voltage accompanied by glowing "FIL" fuse holder.

b. Absence of DC output voltage accompanied by glowing of "DC" fuse holder.

c. Excessively high DC output voltage, high ripple, poor regulation.

A symptom defined as above guides the serviceman to the particular circuits involved in the failure.

For each trouble symptom given in the chart, causes and remedies are listed in order of probability of occurrence. The first listed cause and remedy for a particular symptom is the one of greatest probability; the last one listed is the one of minimum probability.

The schematic diagram contains voltage information which can be used to aid the service and maintenance procedure. The indicated values are average operating voltages of a properly functioning power supply. Operating conditions are as specified on the schematic diagram. Comparison of these voltages with voltages existing on the faulty unit may indicate cause of failure. A competent electronic technician may find this procedure more expeditious in locating the faulty circuit or component than that of following the detailed step by step procedure outlined in the maintenance chart. The use of the maintenance chart is recommended until such time as a familiarity with the equipment is obtained.

F. Maintenance Chart

TABULATION OF TROUBLE SYMPTOMS, PROBABLE CAUSES AND/OR REMEDIES

The following operating conditions are assumed to apply:

1. AC power of proper magnitude and frequency is present at input terminals.

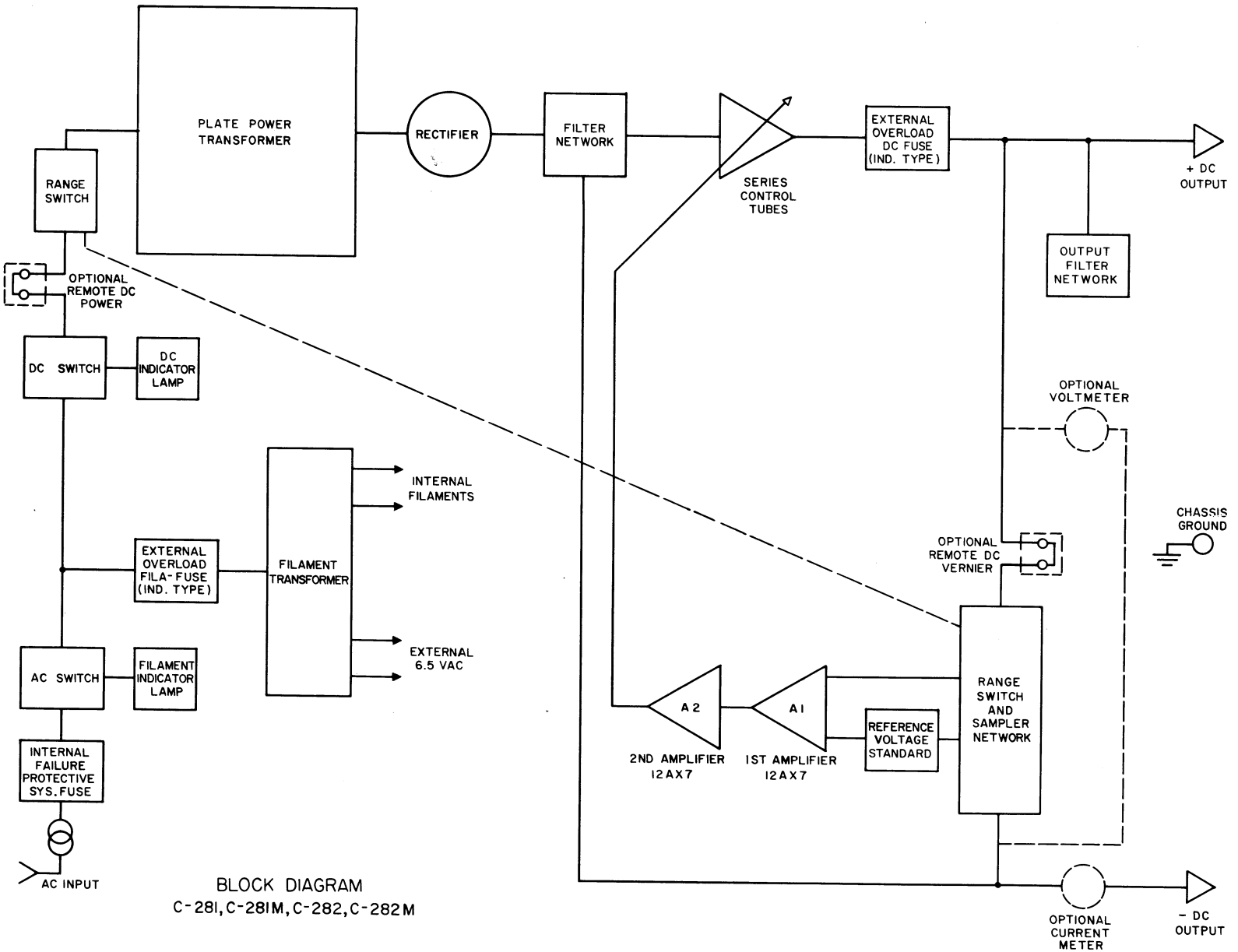
2. Either +DC or –DC terminal connected to chassis ground.

3. The unit is wired for local station operation. See Section III–OPERATION, Paragraph C.

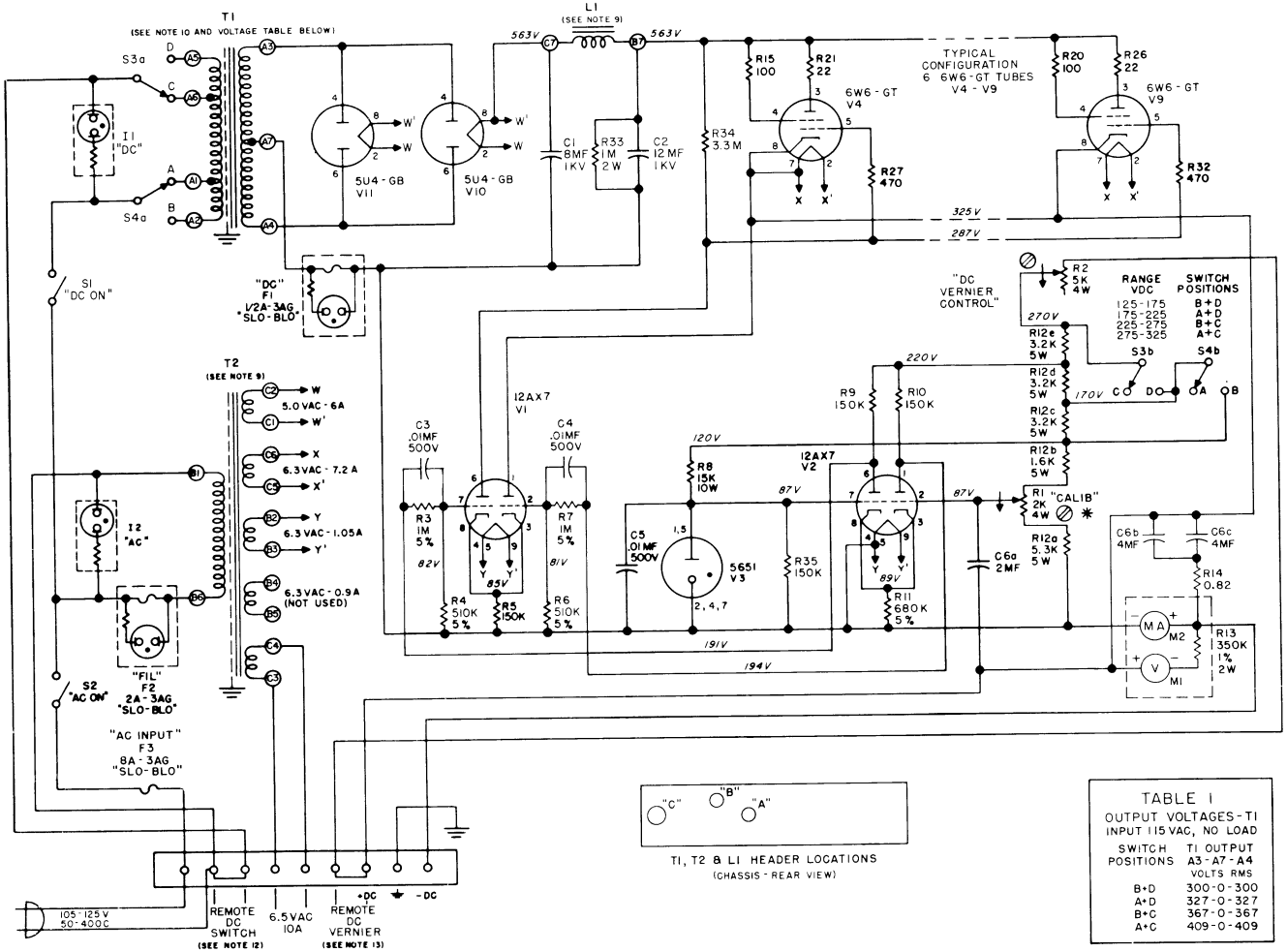
SYMPTOM	PROBABLE CAUSE AND/OR REMEDY
1. AC switch in "ON" position, no filament voltage, AC indicator lamp is off.	a) System fuse has burned out. Replace fuse, type 3AG SLO-BLO, of proper amperage. Check wiring for presence of short across input terminals if fuse burns out again. b) Defective AC switch
2. AC switch "ON", filament power present, AC lamp "ON". When DC switch is thrown to "ON" position, AC lamp is extinguished; no filament power.	This condition is restricted to Models C-281 and C-282 and metered equivalents. System fuse has burned out. Replace with type 3AG SLO-BLO fuse of proper amperage, after checking for the following as required: a) Defective vacuum tube rectifiers. b) Shorted capacitor in filter system. *NOTE:* The leakage resistance obtained from a simple resistance check of a capacitor is not necessarily an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which are low in value. Only a dead short is a true indication of a shorted capacitor. c) Defective DC switch. d) Shorted turn in plate transformer.
3. Red glow appears in "FIL" fuse holder on front panel. No filament voltage, AC indicator lamp is on.	Filament fuse has burned out. Replace fuse, type 3AG SLO-BLO of proper amperage, after checking for the following as required: a) Excessive AC external load. Remove external AC load. Check external AC load for short circuit or overload condition. Adjust for operation within specification limits. b) Short circuited tube filament or wiring. Check filament voltages at tube sockets with AC voltmeter. Refer to schematic diagram for pin numbers. For a nominal 115 VAC input,

	6.3 VAC should exist across filaments of all amplifier tubes, series control tubes, and 6.3 volt rectifier tubes. Five volts should exist across filaments of 5 volt rectifier tubes.
4. AC and DC switches in "ON" position, DC indicator lamp fails to glow. No DC voltage at output terminals.	a) In models other than C-281, C-282 and metered equivalents, plate power fuse has failed. Replace with a type 3AG SLO-BLO fuse of proper amperage after checking for the following as required: 1.1 Shorted capacitor in plate power system filter. 1.2 Defective rectifier in plate power circuit. Semiconductor rectifiers should have high back to forward resistance ratio. b) Defective DC switch. c) Shorted turn in plate transformer.
5. AC and DC switches in "ON" position, red glow appears in DC fuse holder on front panel.	DC fuse has burned out. Replace with type 3AG SLO-BLO fuse of proper amperage after checking the following as required: a) External DC overload. Remove external DC load and check resistance value for presence of overload or short circuit. b) Shorted output filter network capacitor. *(See note on capacitor leakage measurements under symptom 2).* c) On models other than C-281, C-282 and metered equivalents, check for a short circuit to –DC terminal anywhere in the auxiliary circuit screen supply. d) On 0-200 VDC models only, shorted semiconductor diode clamp.
6. AC and DC switches in "ON" and DC lamps "ON". No failure indication in front panel fuses. DC voltage at output terminals slightly greater than 0 VDC.	Can occur only on models other than C-281, C-282 and metered equivalents. Auxiliary supply fuse has burned out. Replace with type 3AG SLO-BLO fuse of proper amperage after checking for the following as required: a) Internal short in auxiliary supply circuit rectifier. b) Short in auxiliary supply circuit filter capacitor.
7. DC voltage at output terminals is excessively high. Poor regulation, excessive ripple voltage.	a) Short in a series control tube. Remove external DC load. Extract series control tubes one by one until DC voltage regains its proper operating value. Replace faulty tube. b) Defective 12AX7 first or second amplifier stage. Detect by substituting a good 12AX7 tube in respective amplifier stage. c) Defective 5651 voltage reference tube. Check visually for presence of orange glow within tube when DC power is on. Absence of glow is indicative of faulty tube. Alternatively, check for voltage drop of 85 to 90 volts across 5651 under operating conditions. If voltage is outside these limits, tube is faulty. For 0-200 VDC models, these additional conditions may occur within the bias supply. d) Bias supply fuse, 1/16 ampere 3AG SLO-BLO, has burned out. Replace after checking the following as required: 1.1) 6X4 bias rectifier tube gassy or shorted. 1.2) Shorted filter capacitor. 1.3) Shorted bias output network capacitor. e) Burned out 6X4 bias rectifier. f) Burned out 6AQ5(–A) series control tube. g) Shorted section 12AX7 first or second stage amplifier. h) Shorted feedback capacitor first amplifier stage.
8. Little apparent change in DC output voltage. High ripple and noise content, poor regulation.	Condition to be found only on models other than C-281, C-282 and metered equivalents. Defective 0B2 voltage regulator tube.
9. Random instability of DC output voltage. DC output voltage approximately correct. High noise level.	a) Defective 5651 voltage reference tube. b) Defective 0B2 voltage regulator tube.

10. DC output voltage abnormally low. Poor regulation, high ripple and noise.	a) Shorted section of 12AX7 in first or second amplifier stage. b) In models C-1581, C-1582 and metered equivalents, filament open in 12AX7 third amplifier stage. c) Shorted feedback capacitor in first amplifier stage. For 0-200 VDC models, these additional conditions may occur within the bias supply: d) Shorted 6AQ5(–A) series control tube. e) Defective 12AX7 first or second amplifier stage. f) Short in 12AX7 clamp section.
11. Poor regulation and high ripple at low line voltage, at upper end of each voltage range and at full load current.	a) Deterioration of several series control tubes. Detection of faulty tubes can be effected by measuring voltage drop across each 22 ohm plate resistor at low line voltage and maximum load. Faulty tubes will show low or zero voltage drop. Replacement of faulty tubes is required. It is recommended that entire set of series control tubes be checked and marginal tubes replaced to minimize probability of near future recurrence of condition. b) Defective semiconductor or vacuum rectifier in main supply. c) Defective rectifier in auxiliary circuit supply.
12. Poor line voltage regulation. Load regulation and ripple good.	Defective 12AX7 first amplifier stage in main and/or bias supply.
13. Poor regulation and high ripple at no load, at low voltage end of B + D band and high line voltage.	Poor cutoff characteristic of one or more series control tubes. Replace one by one until faulty tube or tubes are found.
For 0-200 VDC models only.	
14. Presence of negative voltage in excess of 10 to 15 VDC output when front panel DC fuse has burned out.	Defective semiconductor diode clamp.
15. Overvoltage surge upon application of AC and DC power.	Filament burnout in 12AX7 clamp section.



BLOCK DIAGRAM
C-281, C-281M, C-282, C-282M



T1, T2 & L1 HEADER LOCATIONS
(CHASSIS-REAR VIEW)

TABLE 1
OUTPUT VOLTAGES-T1
INPUT 115 VAC, NO LOAD

SWITCH POSITIONS	T1 OUTPUT A3-A7-A4 VOLTS RMS
B+D	300-0-300
A+D	327-0-327
B+C	367-0-367
A+C	409-0-409

NOTES

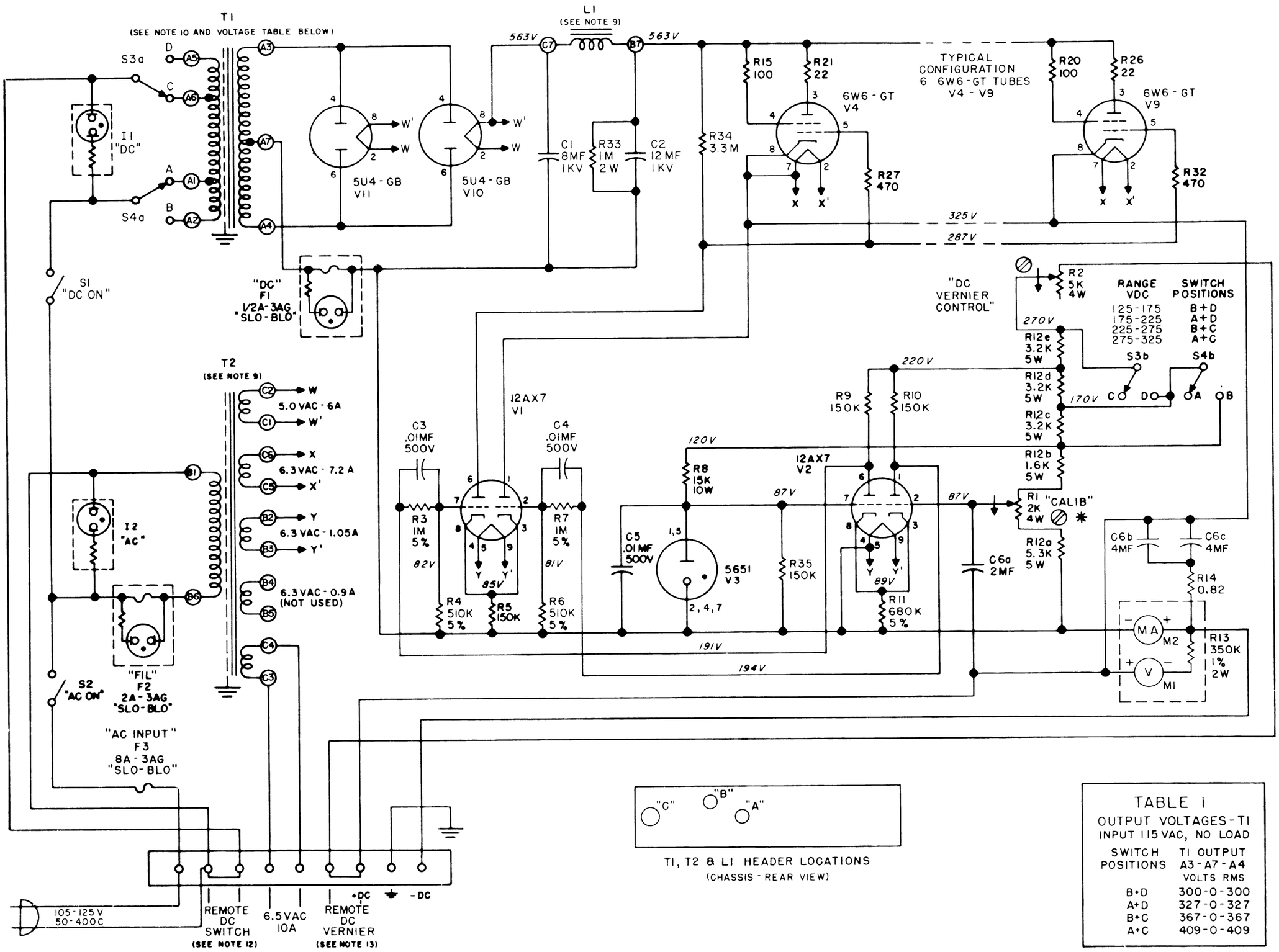
1. WATTAGE RATING OF RESISTORS: 1/2W, UNLESS OTHERWISE NOTED.
2. TOLERANCE OF RESISTORS: COMPOSITION ±10%, WIREWOUND ±5% UNLESS OTHERWISE NOTED.
3. CAPACITORS RATED AT 600VDC WORKING, UNLESS OTHERWISE NOTED.
4. TOLERANCE OF CAPACITORS: SINGLE SECTION ±10%, MULTIPLE SECTION -10%, +20%.
5. ↻ INDICATES CLOCKWISE ROTATION OF SHAFTS.
6. ⏚ INDICATES CONNECTION TO CHASSIS.
7. ⊘ INDICATES SCREWDRIVER SLOT.
8. * INDICATES FACTORY ADJUSTMENT. SEE INSTRUCTION MANUAL.
9. (A1) INDICATES TRANSFORMER TERMINAL.
10. T1, T2, L1 ARE PART OF HERMETICALLY SEALED ASSEMBLY, LAMBDA PART NO. AAR-40-056.
11. SWITCHES S3a, b; S4a, b ARE DPDT TOGGLE SWITCHES.
12. TO USE "REMOTE DC SWITCH": REMOVE JUMPER, CONNECT SWITCH BETWEEN TERMINALS.
13. TO USE "REMOTE DC VERNIER": TURN R2 MAXIMUM COUNTER-CLOCKWISE, REMOVE JUMPER, CONNECT WIREWOUND POTENTIOMETER (5000 OHM, 4 WATT) BETWEEN TERMINALS.

CONDITIONS OF VOLTAGE MEASUREMENT

A. INPUT: 115 VAC, 60 CPS.
B. OUTPUT VOLTAGE: 325 VDC
C. OUTPUT CURRENT: ZERO MA
D. INDICATED VOLTAGES ARE TYPICAL VALUES, AND ARE DC UNLESS OTHERWISE NOTED.
E. MEASUREMENTS MADE USING 20,000 OHMS/VOLT METER BETWEEN "-DC" TERMINAL AND INDICATED POINTS, UNLESS OTHERWISE NOTED.

SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY
MODEL C-281, C-281M
METERS INCLUDED IN "M" MODELS ONLY

LAMBDA
ELECTRONICS CORP.
COLLEGE POINT, NEW YORK



"C" "B" "A"

T1, T2 & L1 HEADER LOCATIONS
(CHASSIS - REAR VIEW)

TABLE 1
OUTPUT VOLTAGES - T1
INPUT 115 VAC, NO LOAD

SWITCH POSITIONS	T1 OUTPUT A3 - A7 - A4 VOLTS RMS
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A+D	327-0-327
B+C	367-0-367
A+C	409-0-409

NOTES

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SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY
MODEL C-281, C-281M
METERS INCLUDED IN "M" MODELS ONLY

LAMBDA
ELECTRONICS CORP.
COLLEGE POINT, NEW YORK

Edited by N7RHU NOT FOR SALE