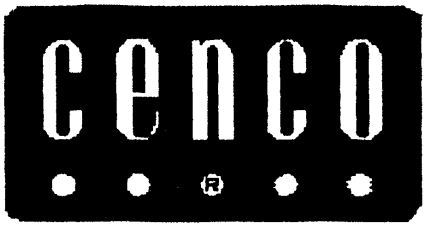


INSTRUCTION MANUAL

For

Multi Output Power Supply

CENCO CATALOG # 31384

Introduction

This Power Supply is designed to operate demonstration vacuum tubes and e/m of the electron apparatus of various designs. It contains four separate power supplies that are isolated from each other and ground, so they can be connected as needed for the particular apparatus. The high voltage supply can be set from 0-500 Vdc at 10 mA by a high voltage transistor connected as an emitter follower. The base current of the transistor is limited to provide output current limiting, as a protection against accidental short circuits. The bias supply is a similar circuit adjustable from 0-80Vdc at 10 mA. These supplies have less than 5% ripple. The filament supply provides 1/2/3/4/5/6 Vac at 2A. Finally, there is a supply to provide current for the Helmholtz coils on the e/m apparatus, which is adjustable from 0-20 Vdc at a maximum current of 5 A with a 1% ripple. The duty cycle for this supply is limited to 50% at maximum current to prevent overheating of the power supply and the Helmholtz coils.

The front panel has a 500V moving coil voltmeter which is switch selectable to monitor the high voltage or the bias voltage. There is a 5 A moving coil ammeter to measure the output of the high current supply. The outputs of the high voltage and bias supplies are provided on color-coded 4 mm banana jacks while the filament supplies are connected to four banana jacks. The high current supply has two color-coded five way binding posts. Connection to the line is made with a three-wire grounded line cord and plug for use on 120 Vac 60 Hz power. The high current power supply is protected by a thermal circuit breaker while the other supplies are protected by a fuse.

Operation

1. Connect the power supply to a three-wire grounding outlet. Three-wire to two-wire adapters are not satisfactory, unless the ground lead is connected by a #14 AWG wire to a cold water pipe with a sturdy clamp.

High Voltage and Bias Supplies

2. With no connection made to the jacks, turn on the power supply. One of the pilot lights beside the "Voltage Monitor" selector switch will be alight indicating which supply is connected to the meter. Move the switch to the left to read the high voltage supply. Rotate the left-most knob on the panel clockwise and observe the change in the output

voltage. The high voltage supply can be adjusted through the range 0-500 Vdc at full current. At low currents the voltage will go much higher than 500Vdc. Make the voltage adjustment with the load connected and return the voltage to zero before removing the load.

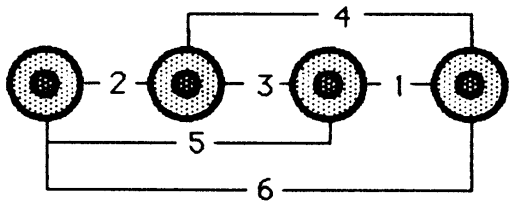
Rotate the knob counterclockwise and the voltage will drop to 0. Care should be taken to be sure the meter is connected to the supply that is being adjusted to avoid an accidental over-voltage condition at the load.

3. Switch the selector to the bias supply and repeat the test using the center knob on the panel to adjust the voltage. The bias supply has a voltage range of 0-80 Vdc. Rotate the knob counterclockwise to return the output to 0.

BE SURE OF THE VOLTAGE AND CURRENT LIMITATIONS OF THE APPARATUS BEFORE CONNECTING IT TO THIS POWER SUPPLY.

Filament Supplies

4. The filament voltage is selected by choosing the correct pair of jacks. The graphics on the panel indicate the voltage between the jack pairs.



FILAMENT SUPPLY
VOLTS AC
2 A MAX.

Voltages between 1 and 6 in 1 V steps are available. Connect the tube filament to the correct pair of jacks. This supply is not connected to any of the other supplies or ground. Best operation of a vacuum tube sometimes requires that one side of the filament be grounded. If this is required, it should be done externally with a jumper cable.

The filament voltage outputs are rated at full load current. At lower currents, the output voltage will be higher than indicated on the panel. Since most vacuum tubes draw much less than the 2 A rating, the supply voltage will be high. This is undesirable, for excessive filament voltage greatly reduces the life of these expensive tubes. Often, running the filament at a little less than rated voltage has no effect on the experiment but increases the tube life considerably. It is suggested that the tube be connected to 1 V less than its rating unless the manufacturer specifically warns against it. If in doubt at all, confirm the filament voltage with an ac voltmeter before operating the vacuum tube for extended periods.

5. Confirm the connections are to the correct voltage, and turn on the power supply. The tube filament should light. In some vacuum tubes, neither the filament nor the glow from it are visible. Generally this is not the case, and correct filament operation can be confirmed visually.

6. Turn off the supply while the remaining connections are made.

Helmholtz Coil Supply

This supply delivers up to 100 W and is adjustable from 0-5A. The design of this supply uses a phase controlled triac to adjust the power input to a full wave dc supply. The transformer output is full wave rectified and filtered, with the final output stage being an active filter to reduce the ripple at 5 A output to <70 mV. This type of regulator has low internal power dissipation. The duration of use at full power is determined by transformer heating. The output is rated for a 50% duty cycle, i.e.,10 minutes "on" followed by 10 minutes "off" at full load. At 2.5 A output, the supply can be used continuously.

7. Connect the Helmholtz coils to the binding posts on the right hand side of the panel. The polarity of the current will determine the polarity of the magnetic field, so it is important to make the connections correctly. It is usually impossible to tell in advance which way is correct. The easiest thing to do is to try one alternative and see if the beam deflection is correct. When the correct connection is found, mark the terminals for next time.

8. Turn on the power supply and adjust the knob on the right until the meter indicates the desired current. Remember the duty cycle limitation on the output. When the connections are correct, return the knob to its counterclockwise limit.

9. Turn off the supply while the remaining connections are made.

Starting the Experiment

10. Rotate the high voltage and bias controls to their counterclockwise limits. Connect the supplies to the apparatus. The high voltage is connected to the plate or accelerating electrodes, while the bias connects to one of the grids or focussing electrodes.

It may be desirable to monitor the plate or bias current to make sure it is within the tube ratings. Both of the supplies are current limited. If they go into current limit, the voltage adjustment is disabled, so the supplies may appear to be malfunctioning. As soon as the excessive load is removed, normal operation will resume. This condition is difficult to interpret without measuring the output current on a milliammeter.

11. A jumper lead will be required to connect the bias supply to the plate supply. It will go from the black lead on the high voltage supply to the black or the red lead of the bias supply; to the black if the bias is positive and to the red if the bias is negative. Check with the apparatus manual to see which alternative is required.

12. Make a final check of all leads to see that they reach to intended jacks. If a lead is to be changed, make sure that the power is off before making it. After turning off the supply, observe the panel meter to see that the high voltage capacitor has discharged to zero.

THE VOLTAGE PRODUCED IN THIS POWER SUPPLY CAN BE DANGEROUS IF CARELESSLY HANDLED. ENSURE YOUR SAFETY BY FOLLOWING RESPONSIBLE LABORATORY PROCEDURES.

13. When everything is correct, verify that the control knobs are all at their counterclockwise limits. Turn on the supply. The tube filaments will light, as you have seen before.

14. Wait 30 s or so for the filament to reach normal temperature before adjusting the plate and bias supplies.

The remaining instructions depend upon the apparatus being used. They should be taken from the instruction manual for the apparatus. For convenience, the remaining steps that are generally applicable are given here. If there appears to be a conflict with the instructions for the apparatus, use the apparatus instructions.

15. Switch the meter to the bias supply and adjust it to the required value. If the bias is low (10 V or so), it may be desirable to use an external voltmeter to help set the correct value. Generally, this is not necessary since the bias adjustment is usually not critical. Use your judgement.

16. Switch the meter selector switch to the left, and adjust the plate supply. Observe the restrictions of the apparatus. If the plate voltage should not exceed 300 V, don't set it any higher. You may be able to see the electron beam in the tube at this point, depending upon the apparatus.

17. Turn the coil supply up to 1 A and observe the direction of beam deflection. If it is backwards, turn the coil current to zero and reverse the coil leads. Some versions of the e/m apparatus use both coil polarities to double the beam deflection. In that case, either polarity is just as useful to start.

18. Turn up the coil current and make the required measurement. Return the current to zero between measurements. Observe the current limitations of the particular coil set you are using.

Operation at high currents is limited by transformer heating and is protected by a thermal circuit breaker. Operation of the thermal protection is indicated by the pilot light over the current adjustment knob. If this light goes on, the current adjustment knob should be returned to its counterclockwise limit. This will prevent excess current being delivered when the breaker is reset. If the 50% duty cycle is observed, the breaker should not trip out. If the breaker does trip, it can be reset by pushing in the small black button which is mounted just above the line cord on the side of the case. The breaker will not reset until it has cooled down, which may take a few minutes.

There is no interaction between the coil current setting and the high and bias voltage supplies, because they use separate transformers. There is some interaction between the filament supply and the high and bias voltage supplies. This is usually inconsequential since the tube needs both to operate. Nevertheless, check the high and bias voltages and reset if necessary before taking a measurement.

WRJB-January 1987

Specifications

High Voltage

Voltage	0 - 500 Vdc adjusted by a high voltage transistor connected as an emitter follower.
Current	10 mA continuous. Supply is current limited.
Ripple	<1% rms at 5 mA.

Bias Supply

Voltage	0 - 80 Vdc adjusted by an emitter follower transistor.
Current	10 mA continuous. Supply is current limited.
Ripple	< 1% rms at 5 mA.

Filament Supply

Voltage	1 to 6 Vac in 1 V steps. Voltage is somewhat higher at < 2 A loads. Voltage selected from a tapped transformer connected to five 4 mm banana jacks.
Current	2 A continuous.

Specifications (Continued)

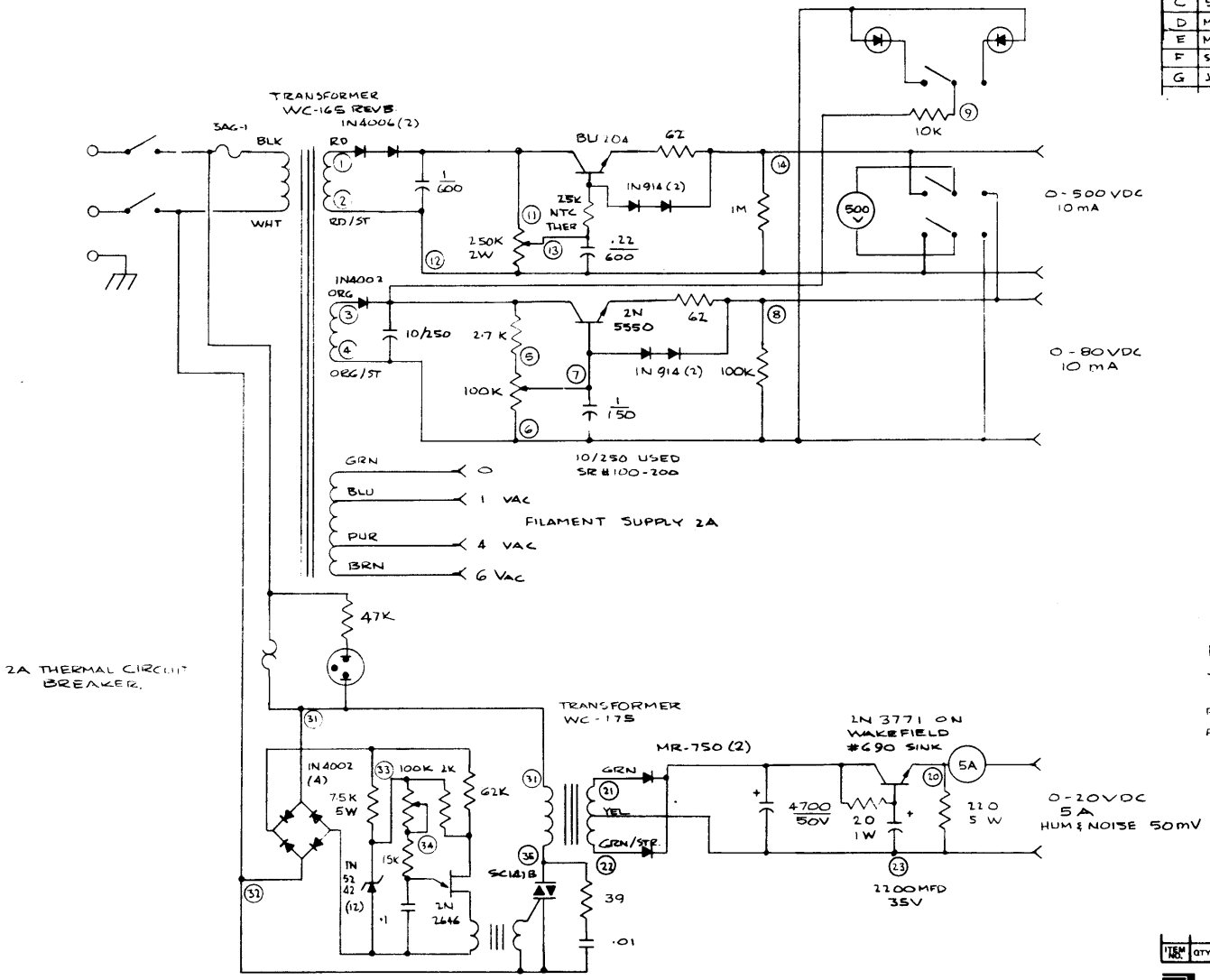
High Current Supply

Current	Adjustable 0 - 5 A to a 4 ohm load.
Duty Cycle	50% at 5 A (10 m on/10 m off) Continuous at <2.5A.
Ripple	<1% or 70 mV whichever is greater.

General

Controls	Control knobs for the three adjustable power supplies. "On-Off" rocker switch. Slide switch to select HV or bias supply for meter readout.
Meters	500 Vdc 2% accurate. 5 Adc 2% accurate. Both meters moving coil type.
Indicators	Two LED pilot lights indicating which power supply is connected to the voltmeter. Neon pilot indicating circuit breaker is tripped.
Overload Protection	2 A thermal circuit breaker protecting the high current supply. 1 A fuse wired internally protecting other circuits.
Line Voltage	117 Vac ± 10% 60 Hz 1.6 A
Dimensions	26 W x 21 D x 10 H cm
Weight	4.4 kg net

REV	DATE	DESCRIPTION
C	SEPT. 17, 1985	HIGH CURRENT SUPPLY R'PLD
D	MAY 12, 1986	FUSING CHANGED HV DIODE DOUB.
E	MAY 13, 1986	TRIAC CONTROL CHANGED
F	SEP 24, 1986	FILAMENT WINDINGS CORRECTED
G	JAN 6, 1987	PRODUCTION CHANGES



REDRAWN AS REV. C 9/17/85
THIS REVISION STARTS AT S.R. 100

REVISION D STARTS AT S.R. 134
REVISION E STARTS AT S.R. 200

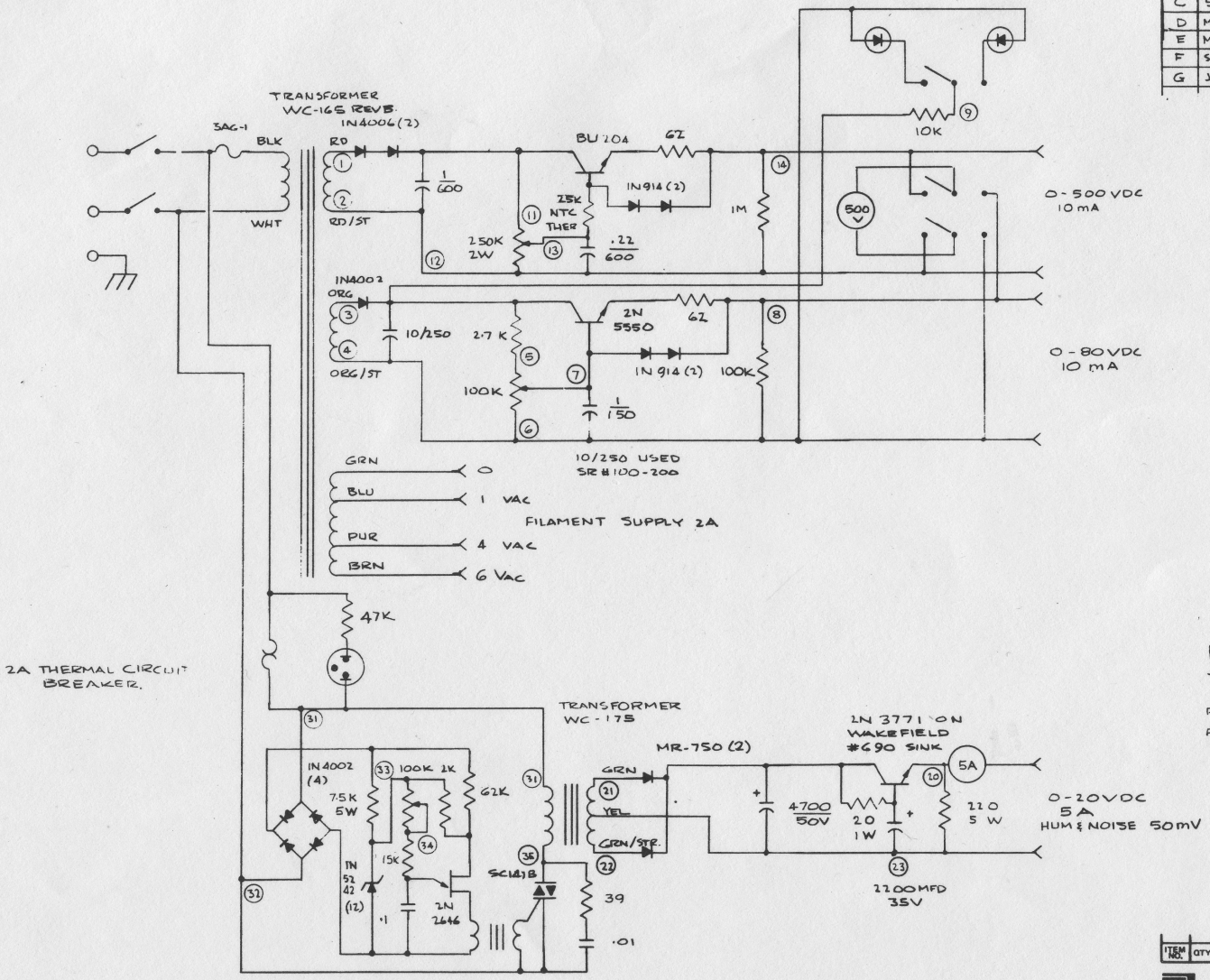
ITEM NO.	QTY.	PART NO.	DESCRIPTION

DAEDALON CORPORATION
POST OFFICE BOX 2028 SALEM, MASSACHUSETTS 01970-6228 (617) 744-5310

SCHEMATIC - MULTI OUTPUT POWER SUPPLY
CV-25

MAT'L.	SCALE	DR'N BY WMS	DATE 9/17/85
	DO NOT SCALE THIS DRAWING	CHK'D BY	DATE
FINISH	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON DECIMALS ANGLES .xx ± .x ± .xxx ± UNLESS OTHERWISE SPECIFIED ✓ ALL OVER	APP'D BY	DATE
		DWG. NO.	WC-144

REV	DATE	DESCRIPTION
C	SEPT. 17, 1985	HIGH CURRENT SUPPLY R'PLD
D	MAY 13, 1986	FUSING CHANGED HV DIODE DOUB.
E	MAY 13, 1986	TRIAC CONTROL CHANGED
F	SEP 24, 1986	FILAMENT WINDINGS CORRECTED
G	JAN 6, 1987	PRODUCTION CHANGES



REDRAWN AS REV. C 9/17/85
THIS REVISION STARTS AT S.R. 100

REVISION D STARTS AT S.R. 134
REVISION E STARTS AT S.R. 200

ITEM NO.	QTY.	PART NO.	DESCRIPTION

DAEDALON CORPORATION
POST OFFICE BOX 2028 SALEM, MASSACHUSETTS 01970-6228 (617) 744-5310

SCHEMATIC - MULTI OUTPUT POWER SUPPLY
CV-25

MATL.	SCALE	DR'N BY WRJ B	DATE 9/17/85
	DO NOT SCALE THIS DRAWING	CHK'D BY	DATE
FINISH	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON DECIMALS ANGLES .xx ± .xxx ± UNLESS OTHERWISE SPECIFIED ✓ ALL OVER	APP'D BY	DATE
		DWG. NO.	WC-144