

Engineered Products

DIVISION OF

Acme Electric Corporation

PS² L - 1500

ELECTRONIC LOAD

OPERATION and CALIBRATION MANUAL

OPERATING MANUAL CONTENT

Section I

Operating Instructions

Section II

Calibrating Instructions

HOME FILE

THIS UNIT IS CAPABLE OF

1500 WATTS MAXIMUM

MAXIMUM VOLTAGE 60 VOLTS

MAXIMUM CURRENT 150 AMPS

WARNING

THIS UNIT IS CAPABLE OF GOING HIGHER

MAKE SURE THIS UNIT IS ADJUSTED

PROPERLY WHEN IN USE

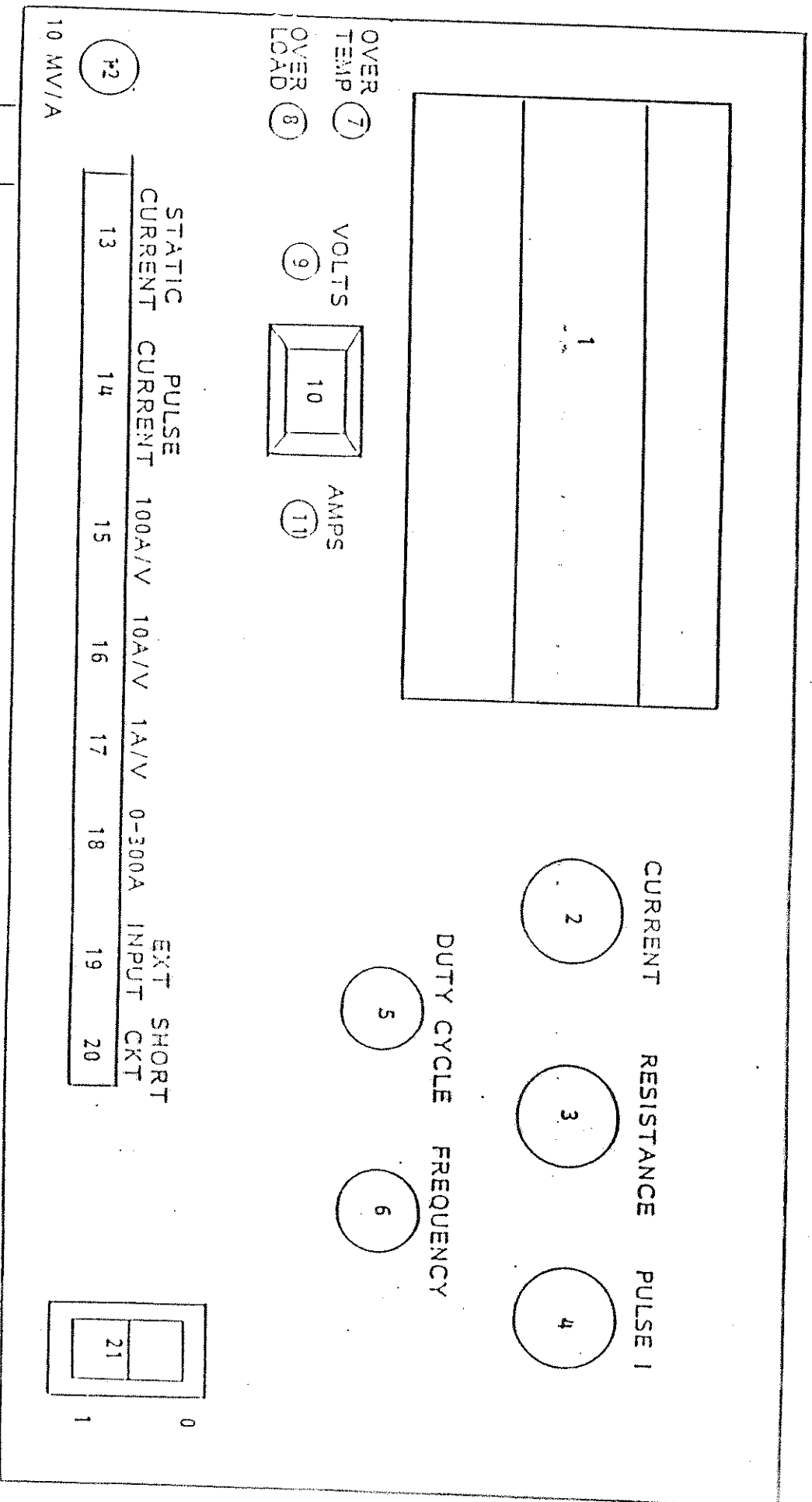
SECTION I - OPERATING MANUAL

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FOREWORD

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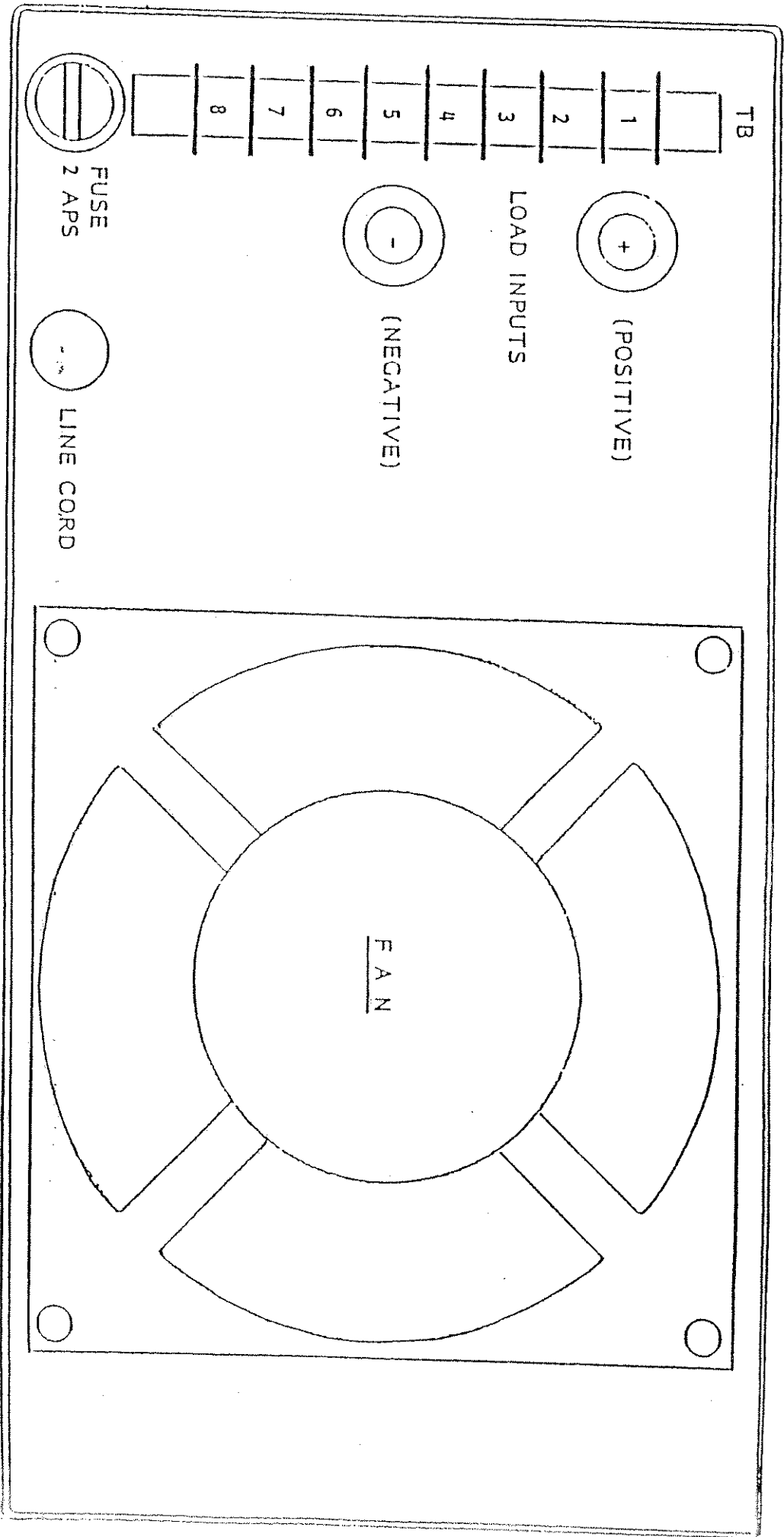
THE INFORMATION AND SPECIFICATIONS CONTAINED HEREIN ARE SUBJECT TO CHANGE WITHOUT NOTICE.



FRONT PANEL LAY-OUT - FIGURE 1

OPERATION CONTROLS

ITEM #	DESCRIPTION	OPERATION
1	DC AMMETER DC VOLTMETER	Indicates current being drawn by the load Indicates voltage being sensed by the load
2	CURRENT	Sets amplitude of current in constant current mode
3	RESISTANCE	Sets amplitude of resistance in constant resistance mode
4	PULSE I	Sets dynamic pulsed current amplitude
5	DUTY CYCLE	Sets dynamic pulsed current duty factor
6	FREQUENCY	Sets dynamic pulsed current repetition rate
7	SHUTDOWN INDICATOR	Lights up when load is in shutdown mode due to overpower or overtemperature
8	OVERLOAD INDICATOR	Lights up when load is near an overpower condition (approx. 1700 Watts)
9	VOLTMETER INDICATOR	Lights up when Digital Meter is in Voltmeter mode
10	AMMETER/VOLTMETER SELECTOR SWITCH	Used to switch Digital Meter function to Ammeter or Voltmeter mode
11	AMMETER INDICATOR	Lights up when Digital Meter is in Ammeter Mode
12	10 MV/A OUTPUT	External load current monitoring output
13	STATIC CURRENT	Enables/Disables static and dynamic load current
14	PULSE CURRENT	Enables/Disables dynamic load function
15	100 A/V	Scales static resistance control to 100 A/V
16	10 A/V	Scales static resistance control to 10 A/V
17	1 A/V	Scales static resistance control to 1 A/V
18	0-300 A	Enables/Disables constant current mode of 0 to 300 Amps
19	EXT. INPUT	Enables/Disables external inputs
20	SHORT CIRCUIT	Energizes short circuit relay
21	AC POWER SWITCH	Turns load "ON" or "OFF"



BACK PANEL LAY-OUT - FIGURE II

REAR VIEW

TERMINAL BLOCK (TABLE II)

1	Constant Resistance
2	Buffer Out
3	Constant Current
4	V Out
5	EXT Mod Input
6	Common
7	Common
8	Short Circuit

REMOTE PROGRAMMING CONNECTIONS (TABLE III)

CONSTANT CURRENT 0 - 10 V INPUT	CONSTANT RESISTANCE MODE
Connect 2 & 3 Together	Connect 1 & 2 Together
Control Input 5 (+) 6(-)	R_{prog} 4 to 5
SHORT CIRCUIT (EXTERNAL) 8 (+) 7 (-) Active low Internal pull up to +15 Volt @ 15mA Maximum	

1. GENERAL OPERATION

The PS2L 1500 load is a solid state programmable electronic load. It is versatile and can test virtually any power supply. The PS2L 1500 load can dissipate up to 1500 watts continuous, 1800 watts total with a 50% duty cycle above 1500 watts of continuous DC power with an input voltage range of 1.5 volts to 30 volts DC.

It provides static testing in either constant current or constant resistance mode and dynamic testing using a constant current pulsed load. The PS2L 1500 load has constant current capability of 0 to 300 Amps and three (3) constant resistance ranges of 0 to 1, 0 to 10, and 0 to 100 Amps per volt.

The PS2L 1500 load can be set for Constant Current, Constant Resistance, or Pulse modes or any combination of the three modes, which may be set from the front panel. The PS2L 1500 load can be remotely programmed by either Resistance or Voltage programming through the back panel terminal block.

The PS2L 1500 load has full four digit display for voltage and current, true short circuit test, air cooling, scope outputs for sampling, overvoltage protection, electronic circuit which limits power dissipation, reverse polarity protection, and automatic shut down on overtemperature.

2. CONSTANT CURRENT MODE

The PS2L 1500 load will accept inputs as low as 1.5 volts, thus it can be used to test power supplies for ECL logic. In addition, the PS2L 1500 load can be connected in series with a power supply to create a Constant Current source. It can also act as a Constant Current discharge to test batteries and capacitor banks. It will also test DC voltage regulators. The following procedures should be followed in the Constant Current mode:

- A. Connect the power supply to be tested to the rear terminal of the PS2L 1500 load. Verify that the correct polarity has been observed.
- B. Turn the PS2L 1500 load "ON/OFF" power switch to the "ON" position. Turn on the PSUT.
- C. Depress 0 - 300 Amp operation selector switch on the front panel.
- D. Set the Static Current Control fully Counter Clockwise.
- E. Depress the front panel Static Current Switch.
- F. Adjust Current Control for desired load current.

3. CONSTANT RESISTANCE MODE

The Constant Resistance mode allows the PS2L 1500 load to test power supplies designed with fold-back current limiting. The PS2L 1500 load provides the Constant Resistance for start up. Once the power supply has reached full voltage, the PS2L 1500 load can be switched to any other mode. The following procedures should be used in the Constant Resistance mode:

- A. Connect the power supply to be tested to the rear terminals of the PS2L 1500 load. Verify that the correct polarity has been observed.
- B. Turn the PS2L 1500 load "ON/OFF" power switch to the "ON" position. Turn on the PSUT.
- C. Use the operation selector switches to select 100 A/V (Amps per Volts), 10 A/V or the .1 A/V range.
- D. Adjust Resistance Control full counter clockwise.
- E. Depress the Current Static Switch to the "ON" position.
- F. Adjust the Resistance Control to the desired current level as indicated on the front panel digital display.

4. PULSE OPERATION

The load capability of the PS2L 1500 load is continuously variable from 0 to 300 Amps. The PS2L 1500 load may be pulsed with an adjustable duty factor of 0 to 100% at a repetition rate between 1 second and 2 milliseconds. The pulse load is added to, though independent of, the static load (i.e.: changing either one does not alter the setting of the other). The following procedures should be used for pulse operation:

- A. Connect the power supply to be tested to the rear terminals of the PS2L 1500 load. Verify that the correct polarity has been observed.
- B. Select either the 100 A/V, 10 A/V, 1 A/V range of 0-300 Amp.
- C. Set the pulse current control fully counter clockwise and the pulse duty cycle control fully clockwise.
- D. Turn the "ON/OFF" switch to the "ON" position.
- E. Set the Current and Resistance controls fully counter clockwise.
- F. Turn on PSUT.
- G. Turn the Current or Resistance controls for the desired current level as indicated by the front panel digital display.
- H. Depress the Pulse Current Selection Switch.
- I. Adjust the Pulse Current Control to the desired upper limit.

NOTE: With the Pulse Duty Factor Control fully clockwise, the Pulse Duty Factor is 100% (i.e.: T_{on} is equal to T). The scope connector located on the front panel may be used to observe the pulse operation of the PS2L 1500 load. The output of the connector is 10 MV/A. If no scope is available, the front panel digital meter may be used to determine what the pulse duty factor will be.

$$I_m = I_s + \frac{T_{on}}{T} (I_p)$$

Where: I_m = Load Meter Reading

I_s = Static Current

I_p = Pulse Current

T_{on} = Pulse Duration

T = Time Between Pulses

NOTE: The actual time for T_{on} or T is not required, only the ratio, which is the desired duty cycle, to determine the specific digital meter reading.

5. SHORT CIRCUIT TEST

The PS2L 1500 load has a true short circuit capability that will display a direct readout of short circuit current on the digital meter. Depress the short circuit control on the front panel of the PS2L 1500 load. An internal relay is closed, which puts a true short circuit on the power supply under test with the meter switch set on Amps.

The digital meter will display the short circuit of the supply under test.

6. EXTERNAL VOLTAGE PROGRAMMING

The remote programming for Constant Current Mode uses an external 0 to 10 Volt source to control the electronic load input sink current. When the front panel switch is set to the external programming mode and the back panel terminal block is jumpered for constant current mode, a zero (0) to ten (10) volt input to the remote programming terminal will produce a zero (0) to three hundred (300) amperes load sink current.

FOR EXAMPLE: IF A ONE (1) VOLT INPUT IS SUPPLIED TO THE REMOTE PROGRAMMING TERMINAL, THE LOAD WILL SINK THIRTY (30) AMPERES FROM THE UNIT UNDER TEST.

This control voltage input to the load can be derived from some external voltage source or it can be derived from the output voltage of the unit under test. If an external voltage source is used, the Load will act in the Constant Current mode in that, whatever the voltage applied to the Load DC power input terminals, the load current will be constant. If the control voltage is derived from the output of the unit under test, the load current to the unit under test will be proportional to the output voltage.

The MAXIMUM allowable input voltage to the remote programming terminal is twelve (12) volts. The nominal input impedance is 590 Ohm. The suggested connector for terminal strip are #6 Spade or Ring Crimp terminals.

7. EXTERNAL PROGRAMMING

The external programming for Constant Resistance Mode, only, uses an external programming resistor as follows:

R_1 = Desired Load Resistance in Ohms.

R_p = External Programming Resistor in Ohms.

$$R_p = (R_1 \times 59000) - 590$$

$$0.01 \text{ Ohm} \leq R_1 \leq \infty$$

The back panel terminal block is to be jumpered for Constant Resistance Mode and the programming resistor connected to the proper terminals.

NOTE: See Table IV for programming resistor locator

PROGRAMING RESISTOR LOCATOR

LOAD RESISTANCE (Ohms)	0.005	0.050	0.500	5.000
PROG RESISTANCE (K-Ohms)	0.000	2.360	28.91	294.00
LOAD RESISTANCE (Ohms)	0.010	0.100	1.000	10.000
PROG RESISTANCE (K-Ohms)	0.000	5.310	58.41	589.00
LOAD RESISTANCE (Ohms)	0.015	0.150	1.500	15.000
PROG RESISTANCE (K-Ohms)	0.295	8.260	87.91	884.00
LOAD RESISTANCE (Ohms)	0.020	0.200	2.000	20.000
PROG RESISTANCE (K-Ohms)	0.590	11.210	117.410	1,179.00
LOAD RESISTANCE (Ohms)	0.025	0.250	2.500	25.000
PROG RESISTANCE (K-Ohms)	0.885	14.160	146.910	1,474.00
LOAD RESISTANCE (Ohms)	0.030	0.300	3.000	30.000
PROG RESISTANCE (K-Ohms)	1.180	17.110	176.410	1,769.00
LOAD RESISTANCE (Ohms)	0.035	0.350	3.500	35.000
PROG RESISTANCE (K-Ohms)	1.475	20.060	205.910	2,064.00
LOAD RESISTANCE (Ohms)	0.040	0.400	4.000	40.000
PROG RESISTANCE (K-Ohms)	1.770	23.010	235.410	2,359.00
LOAD RESISTANCE (Ohms)	0.045	0.450	4.500	45.000
PROG RESISTANCE (K-Ohms)	2.065	25.960	264.91	2,654.00
LOAD RESISTANCE (Ohms)	0.050	0.500	5.000	50.000
PROG RESISTANCE (K-Ohms)	2.360	28.910	294.410	2,949.00
LOAD RESISTANCE (Ohms)	0.055	0.550	5.500	55.000
PROG RESISTANCE (K-Ohms)	2.655	31.860	323.910	3,244.00
LOAD RESISTANCE (Ohms)	0.060	0.600	6.000	60.000
PROG RESISTANCE (K-Ohms)	2.950	34.810	353.41	3,539.00
LOAD RESISTANCE (Ohms)	0.065	0.650	6.500	65.000
PROG RESISTANCE (K-Ohms)	3.245	37.760	382.910	3,834.00
LOAD RESISTANCE (Ohms)	0.070	0.700	7.000	70.000
PROG RESISTANCE (K-Ohms)	3.540	40.710	412.410	4,129.00
LOAD RESISTANCE (Ohms)	0.075	0.750	7.500	75.000
PROG RESISTANCE (K-Ohms)	3.835	43.660	441.910	4,424.00
LOAD RESISTANCE (Ohms)	0.080	0.800	8.000	80.000
PROG RESISTANCE (K-Ohms)	4.130	46.610	471.41	4,719.00
LOAD RESISTANCE (Ohms)	0.085	0.850	8.500	85.000
PROG RESISTANCE (K-Ohms)	4.425	49.560	500.91	5,014.00
LOAD RESISTANCE (Ohms)	0.090	0.900	9.000	90.000
PROG RESISTANCE (K-Ohms)	4.720	52.510	530.41	5,309.00
LOAD RESISTANCE (Ohms)	0.095	0.950	9.500	95.000
PROG RESISTANCE (K-Ohms)	5.015	55.460	559.91	5,604.00

8. SPECIFICATIONS FOR THE PS2L 1500 LOAD

POWER REQUIREMENTS:

AC Input 110 VAC/1 Amp
220 VAC/.5 Amps
43 to 63 Hz

MAXIMUM LOADING POWER:
1500 Watts

MAXIMUM LOAD VOLTAGE:
30 VDC

STATIC MODE:
Constant Current or Constant
Resistance.

CURRENT RIPPLE:
0 to less than 0.1 Amp peak to peak

DYNAMIC LOAD RESPONSE TIME:
1 Micro second per Amp or 150 Micro
second, whichever is greater.

SENSING:
Local voltage sensing is standard.

REMOTE PROGRAMING:
0 to 10 Volts for Constant Current
Mode. Option for Constant
Resistance Mode. Option for Short
circuit.

VOLTMETER:
0-60.00 V $\pm 1\%$

FRONT PANEL INDICATORS:
Voltmeter/Ammeter - Over
temperature LED - Overvoltage
LED - Voltmeter/Ammeter Indicator
lights.

CAUTION: AFTER ANY THERMAL SHUTDOWN, OPERATOR MUST TURN THE LOAD
OFF TO RESET THE LOAD BACK TO NORMAL OPERATION.
RE-ENERGIZE THE LOAD AND ALLOW THE UNIT TO RUN WITHOUT
CURRENT BEING DRAWN: THIS WILL ALLOW THE UNIT TO COOL
OFF BEFORE RESUMING OPERATION.

PROTECTION CIRCUITS:

Electronic circuit limits power dissipation. PS2L 1500 load will shut down in the event of an overvoltage. This condition will occur at approximately 36V (± 4 Volts). Thermal breakers shut off loads in the event of an overtemperature condition. Reverse polarity is protected.

CURRENT SIGNAL OUTPUT:

Voltage is proportional to current provided.
10 millivolts per Amp. $\pm 0.1\%$

FRONT PANEL CONTROLS:

Power "ON/OFF" - Load "ON/OFF"
Mode Selection Switches for Pulse
Current "ON/OFF" - Range Selector
switches for 1, 10, 100 A/V, and
0-300 Amp. Vernier Controls for
greater accuracy - Pulse Current
Control - Static Current Control -
Pulse Repetition Control - Mode Selection
Switch for Ammeter/Voltmeter.

REAR PANEL:

AC Power Connector - AC Input Fuse
Positive and Negative bus terminals
Remote Programing terminals - Fan.

AMMETER:

0-300 A $\pm 1\%$

CALIBRATION PERIOD:

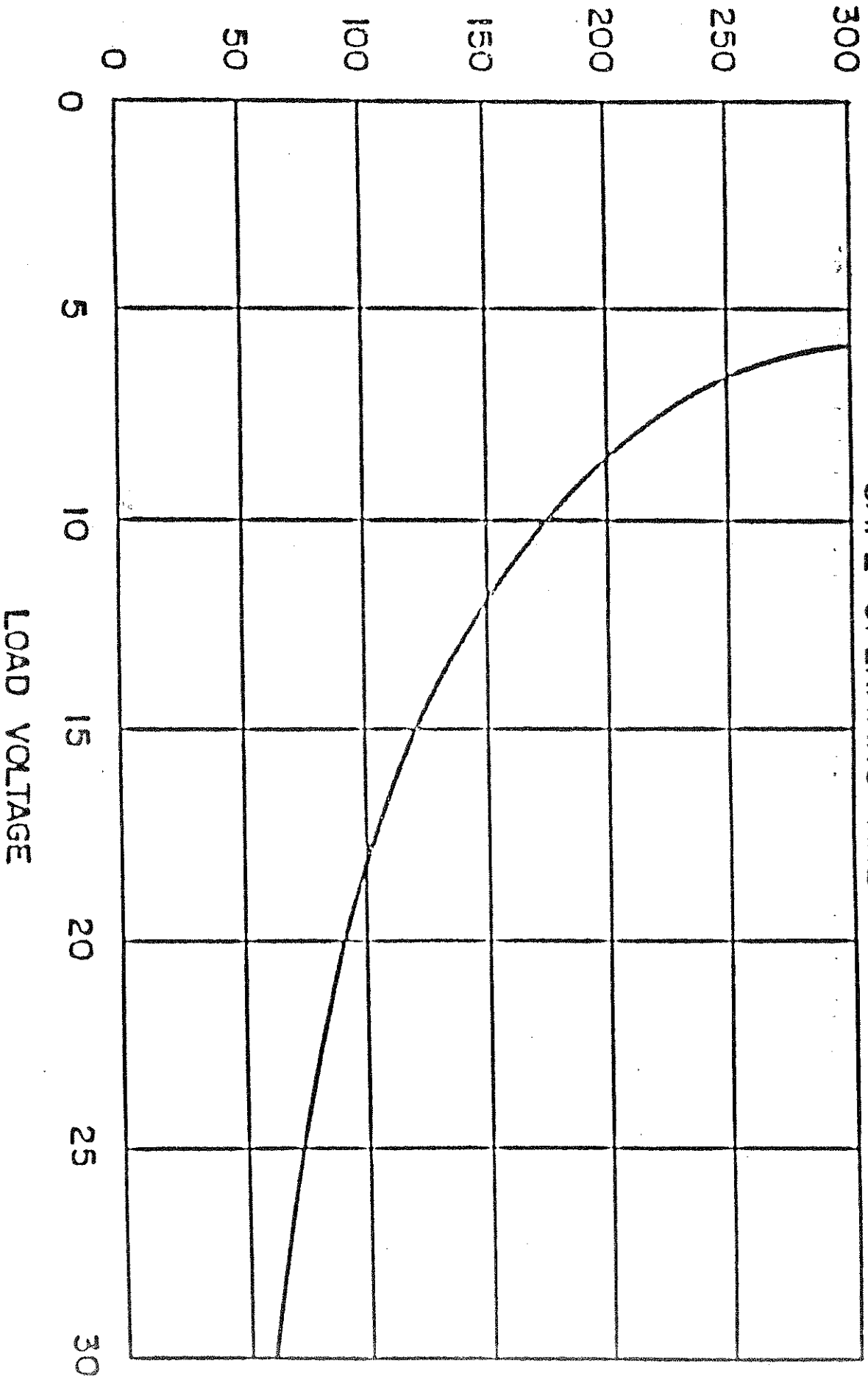
One (1) year after delivery.
Every six (6) months thereafter.

PULSE REPETITION RATE:

9 Hz to 1,750 Hz.

DC CURRENT MAXIMUM

SAFE OPERATING AREA OF PS²L-1500



FOR PULSE CURRENT APPLICATION ONLY!

CAUTION! CAUTION! CAUTION!

ALL LEADS FROM THE UNIT UNDER TEST TO THE PS²L 1500 LOAD MUST BE TWISTED PAIR (APPROXIMATELY 2 to 3 TURN PER INCH). THIS SUGGESTS 14 AWG WIRE AND ENOUGH TWISTED PAIRS TO MEET REQUIRED CURRENT APPLICATION. IN CASES WHERE EXCESSIVELY LONG LEADS FOR LOAD CONNECTIONS ARE TO BE USED, FAILURE TO ADHERE TO THE APPLICATION STATED ABOVE WILL INCREASE THE RISK OF DAMAGING THE PS²L 1500 LOAD DUE TO EXCESSIVE INDUCTANCE.

IF YOUR LEAD LENGTH IS TO EXCEED FIVE (5) FEET, PLEASE CONSULT WITH MANUFACTURER. FAILURE TO ABIDE BY THIS INSTRUCTION MAY VOID YOUR WARRANTY.

FOR LARGER VA APPLICATIONS

FOR HIGHER CURRENT APPLICATION WHERE TWO OR MORE PS²L 1500 LOADS ARE OPERATED IN PARALLEL, EACH LOAD MUST BE INDIVIDUALLY FUSED!!!

WARRANTY

All Acme PS2L Electronic Loads are guaranteed against defects in material and workmanship for a period of one (1) year, providing the units have been operated within published electrical specifications; have not been damaged by misuse, improper operation, or accident; have not been modified or altered (as determined by Acme Electric). Units must be returned prepaid to the factory, Cuba, NY, after receipt of an RMA (Return Material Authorization) from Acme Sales Department (716-968-2400).

Acme Electric Inc. limits its obligation under this warranty solely to the repair or replacement of any unit returned during the period covered by the warranty. Acme Electric Inc. warrants out-of-warranty repaired units for a period of ninety (90) days from return to customer.

Acme Electric Inc. assumes no liabilities for consequential damages of any kind through the use or misuse of the product by the purchaser or others. No other obligations or liabilities are expressed or implied.

SECTION II - CALIBRATING INSTRUCTIONS

<u>PAGE</u>	<u>SUBJECT</u>
1	Equipment Required for Calibration
2	Calibration Procedural Steps
3	Full Scale Adjustment Procedures
4	P.C.B. Lay-Out (Figure 2)

CALIBRATION PROCEDURES

1. EQUIPMENT REQUIRED FOR CALIBRATION

- A. DVM 4½ Digits (5½ preferred) .2 V to 100 V Range - 1 MegOhms Input Impedance.
- B. 300 Amps/50mVolt Calibrated Shunt ($\pm 0.25\%$).
- C. External Power Supply - 2 Volt (minimum) - 300 Amps.
- D. Scope Probe (x 1).
- E. BNC to Banana Plug adapter (for scope probe to DVM) Pomona #1269.

2. CALIBRATION PROCEDURAL STEPS

- A. Energize the Load and allow 20 to 30 minutes for warm up.
- B. Remove cover.
- C. Remove the meter from the face plate and allow the meter to hang freely out of the front panel.
- D. Perform the "zero-null" as follows:
 1. Attach a hard short across the Load (+) and (-) studs (this can be done by slipping a screwdriver between the two metal bussbars on which the solenoids are attached to.)
 2. Set all controls COUNTER-CLOCKWISE and all switches should be out with the exception of the "STATIC CURRENT" switch, which should be engaged.
 3. Attach the scope lead to the DVM with the BNC adapter.
 4. Attach the scope ground to the regulator tab in the upper right hand corner of the P.C. Board.
 5. Attach the scope lead to TP1 (U1-7) and adjust R-8 for NULL.
 6. Attach the scope lead to TP10 (U3-6) and adjust R-61 for NULL.
 7. Engage the 100 A/V switch in.
 8. Attach the scope lead to TP10 (U3-6) and adjust R-66 for NULL.
 9. If a lot of adjustment was needed, please repeat the above procedures.
 10. Remove the short from previously installed position and go on to "FULL SCALE ADJUSTMENT" PROCEDURES".

3. FULL SCALE ADJUSTMENT PROCEDURES (for 300 Amp full scale)

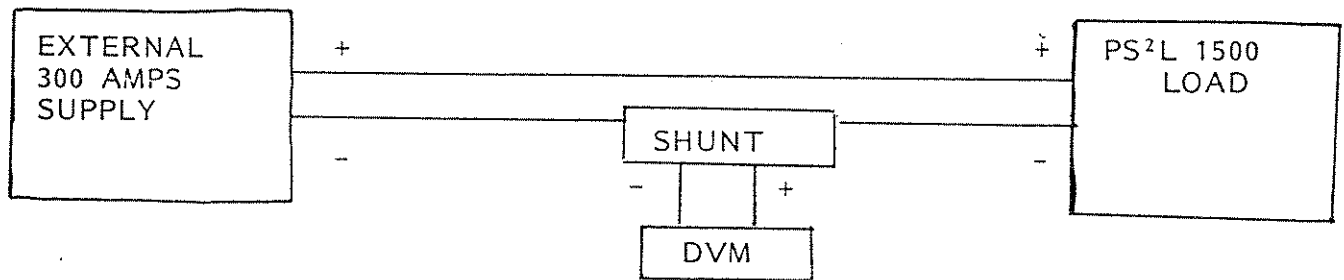


FIGURE 1

- A) Attach the equipment as shown in figure 1.
- B) All front panel controls set to full COUNTER-CLOCKWISE and all switches should be disengaged with the exception of the "STATIC CURRENT" and "CONSTANT CURRENT" switches which should be engaged.
- C) Turn on external power supply and adjust the load for a displayed reading of 300 Amps. on the Load using the Current Control.
- D) Adjust R-12 so that the displayed shunt reading is the same as the Load's reading of 300 Amps.
- E) Check "ZERO" of the Load by turning all current controls COUNTER-CLOCKWISE and observing 0 Amps on the shunt DVM. If Load shows any current draw, adjust R-61 Clockwise VERY slowly for 0.0 reading on the shunt DVM.
- F) Remove power from the Load and disconnect the cables from the Load.
- G) Try all switches to ascertain that "ZERO" has been calibrated. Re-insert DPM meter back into the Load and secure in place.

When all of the above has been completed, the Load has been calibrated. Replace and secure Load cover prior to usage.

- TP1 = Instrumentation Amp. output (U1)
- TP2 = Voltage Amp. output
- TP3 = Ground
- TP4 = Multiplier output
- TP5 = Pulse output
- TP6 = +15 VDC
- TP7 = +10 VDC Ref
- TP8 = Current Amp. output
- TP9 = -15 VDC
- TP10 = Mixer U12 output
- TP11 = +24 VDC

ELOAD CONTROL DB-1015 REV B.

DI-BAR ELECTRONICS INC.

SILKSCREEN
DI-BAR ELECTRONICS
ELOAD BOARD

