3100 Series

DC Power Supply

Operation and Maintenance Manual

Model:

4025

REFERENCE ONLY

OBSOLETE SERIES, NO LONGER SUPPORTED

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WARNING

Hazardous voltages (greater than 50 volts) may be present when cover is removed and could cause injury to personnel. Authorized personnel only should remove cover.

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CHAPTER 1

DESCRIPTION OF EQUIPMENT

1-1. PURPOSE AND CAPABILITIES

The Power Ten, Inc. 3100-4025 power supply is a general purpose power supply designed specifically for laboratory test and systems applications requiring variable dc sources with good ripple and regulation characteristics. The 3100-4025 power supply is constant current/constant voltage power supplies with an automatic crossover feature. They provide up to 1000 watts of dc power over a wide range of voltage and current levels.

1-2. TECHNICAL CHARACTERISTICS

The physical, electrical and environmental characteristics for the 3100-4025 are listed in tables 1-1 and 1-2.

Table 1-1. 3100-4025 Technical Characteristics

PARAMETERS	SPECIFICATIONS
MODEL:	DC Output
4025	Volts: 0-40 Amps: 25
PHYSICAL CHARACTERISTICS:	
Width	19 in.
Depth	18.75 in.
Height	5.25 in.
Weight	25 lbs. (max)
ELECTRICAL CHARACTERISTICS:	
Input Power(std.)	
Voltage	103-127 V ac
Frequency	47 to 63 Hz
Phases	1 phase
Regulation (Line or Load)	
Voltage	Greater of 0.05% or 10 mV
Current	0.25% of Imax
Transient Response	A load step from 50% to 100% of full load will recover to within +/- 1% within 50 ms.
Stability	After warmup with constant line, load, temperature - CV Mode: +/- 0.1% of Vmax per 8 hours. CC Mode: +/- 0.03% of Imax
Remote Control	On/Off control via contact closure.

Table 1-1. 3100-4025 Technical Characteristics - Continued

PARAMETERS	SPECIFICATIONS
ELECTRICAL CHARACTERISTICS:	
Remote Programming	
Resistive:	
Constant Voltage (0-100%)	0 - 12K ohms
Constant Current (0-100%)	0 - 400 ohms
Voltage:	
Constant Voltage (0-100%)	0 - Vout(max) DC
Constant Current (0-100%)	0 - 100 mV
Current:	
Constant Voltage (0-100%)	0 - 3.333 mA
Constant Current (0-100%)	0 - 0.250 mA
Remote Sensing	Terminals provided to sense output voltage at point of load.
Noise and Ripple (RMS)	CV Mode: 0.225% of Vmax CC Mode: 0.225% of Imax
ENVIRONMENTAL CHARACTERISTICS:	
Temperature Coefficient	0.015%/deg. C of max. output voltage rating for voltage set point. 0.03%/deg. C of max. output current rating for current set point.
Ambient Temperature	
Operating	0 to 40 Degrees C. Derate output current specification linearly to 50% of Imax @ 70 degrees C.
Storage	-40 to 75 Degrees C
Cooling	Convection cooled

CHAPTER 2

INSTALLATION

2-1. INSPECTION

Inspect the shipping carton for possible damage before unpacking the unit. Carefully unpack the equipment. Save all packing materials until inspection is complete. Verify that all items listed on the packing slips have been received. Visually inspect all exterior surfaces for broken knobs, connectors or meters. Inspect for dented or damaged exterior surfaces. External damage may be an indication of internal damage. If any damage is evident, immediately contact the carrier that delivered the unit and submit a damage report. Failure to do so could invalidate future claims.

2-2. INPUT/OUTPUT CONNECTORS

Table 2-1 lists all external connectors for Series 3100-4025.

2-3. LOCATION AND MOUNTING

The 3100-4025 is intended for mounting in a standard 19-inch equipment rack. Four captive screws, two on each side of the front panel, are used to secure the unit in place. The unit is also suitable for workbench applications.

2-4. CHECKOUT AND PRELIMINARY ADJUSTMENTS

Follow the instructions in paragraph 3-2 for setup and operation of the equipment.

Table 2-1. 3100-4025 Input/Output Connectors

CONNECTOR	FUNCTION	CONNECTS TO
TB1-AC TB1-AC TB1-GND	Prime Power Input	103-127 V ac 47-63 Hz Power Source
Pos. Binding Post Neg. Binding Post GND Stud	Output Power	User Load(s)
TB2	Control Interface	See Table 3-2 For Description

CHAPTER 3

OPERATING INSTRUCTIONS

3-1. CONTROLS AND INDICATORS

Front panel controls and indicators for the 3100-4025 are identified in figure 3-1 with index numbers keyed to table 3-1. Table 3-1 provides a description of all operator controls and indicators.

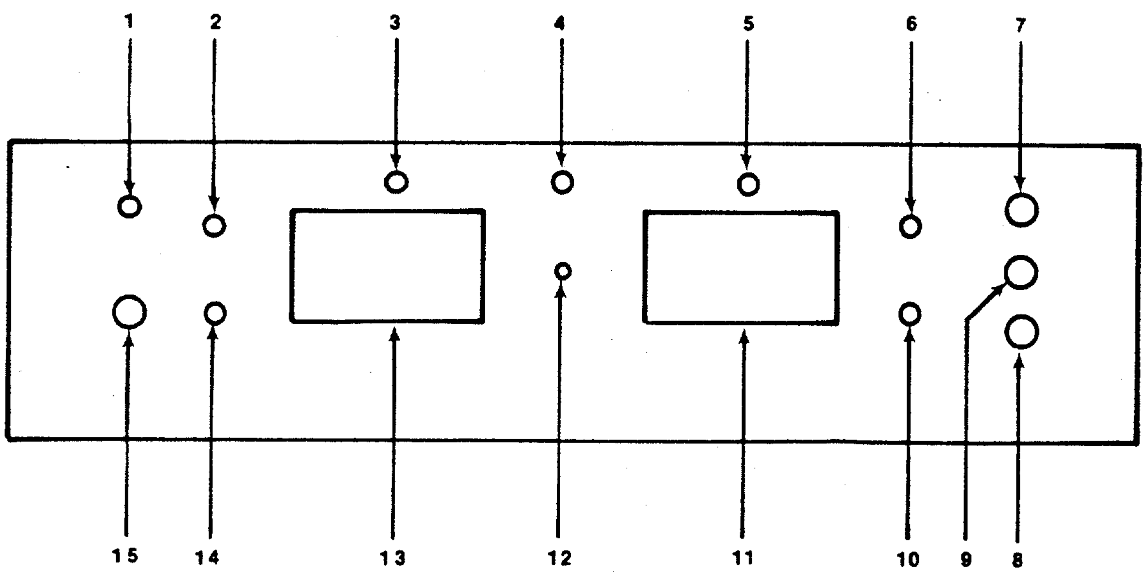

Figure 3-1. 3100-4025 Controls and Indicators

Table 3-1. 3100-4025 Controls and Indicators

FIGURE & INDEX NO	CONTROL/INDICATOR	FUNCTION
3-1		
-1	POWER ON Indicator	Indicates prime power is applied to power supply.
-2	COARSE Output Voltage Control	Adjusts voltage output relatively close to desired level.
-3	Voltage Mode Indicator	Indicates the power supply is operating in the voltage mode.
-4	OVERVOLTAGE Indicator	Indicates output voltage has exceeded preset level, and power supply output is turned off.
-5	Current Mode Indicator	Indicates the power supply is operating in the current mode.
-6	COARSE Output Current Control	Adjusts current output relatively close to desired level.
-7	Positive Output	Positive regulated output for driving user load.
-8	Chassis Ground	Connects internally to power supply chassis.
-9	Negative Output	Negative regulated output to connect to user load.
-10	FINE Output Current Control	Adjusts current output to a precise level.
-11	CURRENT Meter	Measures current output.
-12	Overvoltage Potentiometer	Adjusts overvoltage trip level
-13	VOLTAGE Meter	Measures voltage output.
-14	FINE output Voltage Control	Adjusts voltage output to a precise level.
-15	Circuit Breaker	Applies AC power to the power supply.

3-2. SETUP AND OPERATING INSTRUCTIONS

The following paragraphs provide setup and operating procedures for the 3100-4025.

The power supply may be configured via TB2 for different operating configurations: local and remote current programming, local and remote voltage programming, normal parallel, auto-parallel, normal series, and auto-series. The use and operating requirements of each configuration are provided in the following paragraphs. Reference table 3-2 for barrier strip TB2 designators and functions.

a. Local Operation. Units are shipped from the factory configured for local voltage/current control and local voltage sensing. This configuration is used for applications where the IR drop of the load wires is insufficient to degrade performance at the load. The strapping pattern is provided in figure 3-2. Prior to turning the unit on, rotate the voltage and current potentiometers (COARSE and FINE) fully counterclockwise (minimum output). Then switch the circuit breaker to the ON position and adjust the voltage and current to the desired output.

b. Remote Current Programming. The remote current programming configuration is used for applications that require the output current be programmed (controlled) from a remote source. An external resistance or external floating voltage source may be used for a programming device. When using remote current programming, a shielded, twisted pair hookup wire is recommended to prevent noise interference with programming signals.

(1) External Current Programming Using Resistance. The resistance coefficient for remote current programming is 400 ohms/100% rated output. The programming current from the current control programming terminal A3 is factory set for 0.250 milliampere. This yields a coefficient of 0.25% of rated output current per ohm. If multiple switches or relays are used to program different levels, make-before-break contacts are recommended. See figure 3-3A for strapping requirements.

(2) External Current Programming Using a Voltage Source. The voltage coefficient for remote current programming is as follows:

Programming Coefficient	Full Scale Rated Output
1 millivolt = 0.25 amps	100 mV

See Figure 3-3B for strapping requirements.

Table 3-2. Barrier Strip (TB2) Designators and Functions

TB2 DESIGNATOR	SCHEMATIC SYMBOL	FUNCTIONAL DESCRIPTION
1	V+	Positive output voltage for local voltage sensing.
2	VS+	Positive voltage sensing terminal.
3	Vprog.	3.333 milliamp current source for either local or remote voltage programming using resistance.
4	Vcont.	Voltage control input terminal.
5	Vset	Front panel voltage control potentiometers for local control.
6	VS-	Negative voltage sensing terminal.
7	V-	Negative output voltage for local voltage sensing.
8	Iprog.	0.250 milliamp current source for either local or remote current programming using resistance.
9	Icont.	Current control input terminal.
10	Iset	Front panel current control potentiometers for local control.
11	Imon -	Negative current monitor terminal. return for remote current programming resistor.
12	Imon +	0-5 VDC = 0-100% rated current. User positive current monitor terminal.
13	On/Off contact rtn	Control Circuit Common. Used with TB2-12 for current monitor and/or TB2-14 for remote on/off control return.
14	On/Off cntct ctrl	Remote on/off control using contacts of switch of relay.

c. Remote Voltage Programming. The remote voltage programming configuration is used for applications that require the output voltage be programmed (controlled) from a remote source. An external resistance or external floating voltage source may be used as a programming device. When using remote voltage programming, a shielded twisted pair hookup wire is recommended to prevent noise interference with programming signals.

(1) External Voltage Programming Using Resistance. The resistance coefficient for remote voltage programming is 12k ohms = 100% of rated output voltage. The programming current from terminal TB2-3 is factory set to 3.333 mA. If multiple switches or relays are used to program different levels, make-before-break contacts are recommended. See figure 3-4 for strapping requirements.

(2) External Voltage Programming. The voltage coefficient for external voltage programming is Vout(max) volts = 100% of rated output voltage. To program voltage slightly above the rated output will not damage the unit, but degraded performance may result. See figure 3-5 for strapping requirements.

g. Remote Sensing. In applications where the load is located some distance from the power supply or the voltage drop of the power output leads significantly interferes with load regulation, remote voltage sensing may be used. When remote sensing is used, voltage is regulated at the load versus the power supply output terminals. To connect the power supply for remote voltage sensing (see figure 3-6 for strapping requirements):

(1) Remove jumper between the positive sense terminal (TB2-2) and the positive output monitor terminal (TB2-1).

(2) Remove jumper between the negative sense terminal (TB2-6) and the negative output monitor terminal TB2-7.

(3) Connect sensing leads from the load positive to TB2-2 and the load negative to TB2-6. A shielded, twisted pair is recommended to avoid potential noise interference.

h. Remote Output On/Off Control. Remote on/off control may be accomplished by contact closure.

(1) Remote on/off by contact closure. See figure 3-7A for strapping requirements. Output is on when contacts are closed.

NOTE

> The following modes of operation are used for applications requiring greater output current or voltage than is available from a single power supply. To meet the requirements for greater output, two or more supplies may be connected in parallel.

i. Auto-Parallel Operation. In the auto-parallel mode of operation, a master/slave configuration is established.

CAUTION

When using two or more supplies in parallel, damage may occur to slave(s) crowbar circuits if slave overvoltage level set is not higher than the master overvoltage level set. To prevent damage, set all slave units overvoltage-set potentiometers fully clockwise and the master unit to the desired trip level. If overvoltage protection is not desired, set to trip at maximum rated voltage (less than fully clockwise).

To set up the auto-parallel mode of operation, connect all outputs in parallel to load. Connect jumper from master TB2-12 to slave TB2-9 and TB2-10. Remove jumper between slave TB2-8 and TB2-9. Rotate slave voltage control potentiometers to maximum and adjust current control potentiometers for balanced output currents during operation. Once adjusted, output currents will track automatically. If tracking is not close, perform the calibration procedures listed in chapter 5. See figure 3-8 for strapping requirements.

j. Auto-Series Operation. In the auto-series mode of operation, a master/slave configuration is established. With two or more supplies connected in series, one is established a master and the remaining units as slaves. The master supply must always be the most positive unit. When operating in the auto-series mode, voltage control potentiometer settings determine the percentage of total load voltage contribution by slave units. Current control potentiometers of the slave units are active and should be set to maximum clockwise position. See figure 3-9 for the strapping requirements.

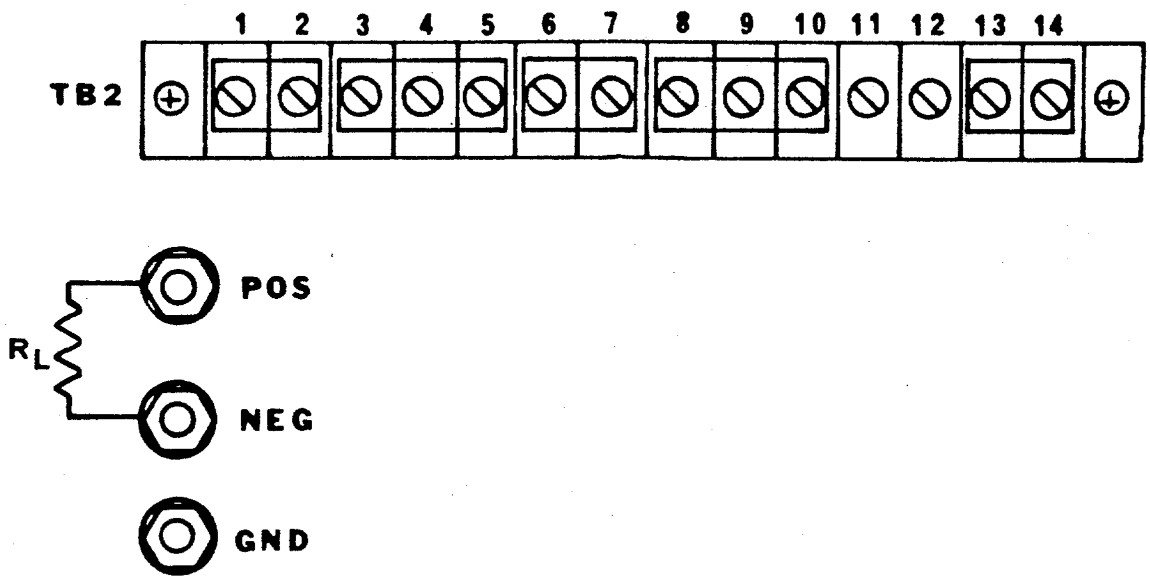

Figure 3-2. Normal Strapping Pattern

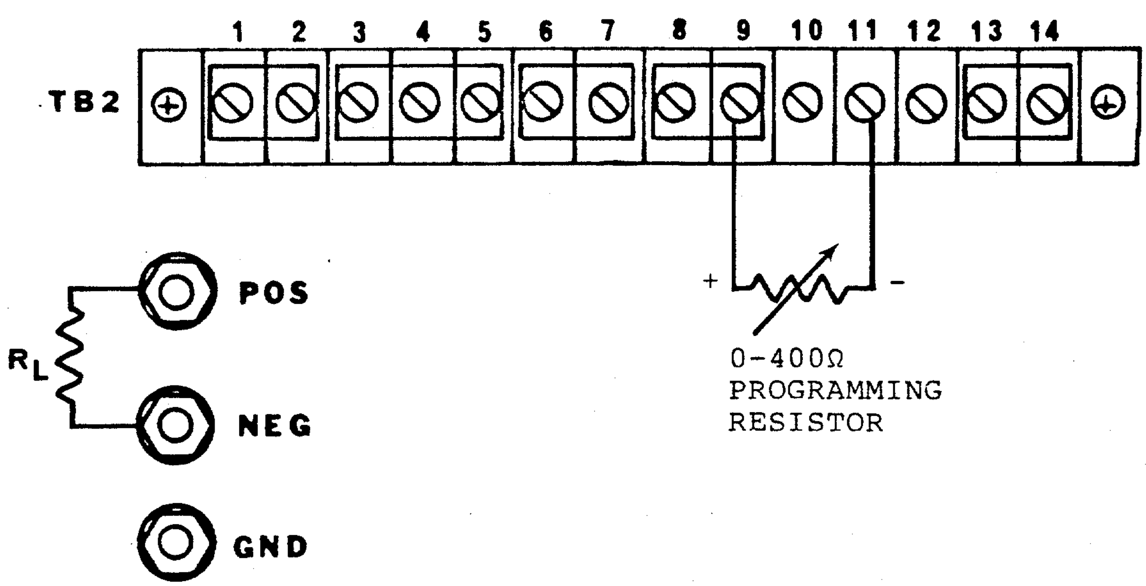

Figure 3-3A. Remote Resistance Programing of Output Current

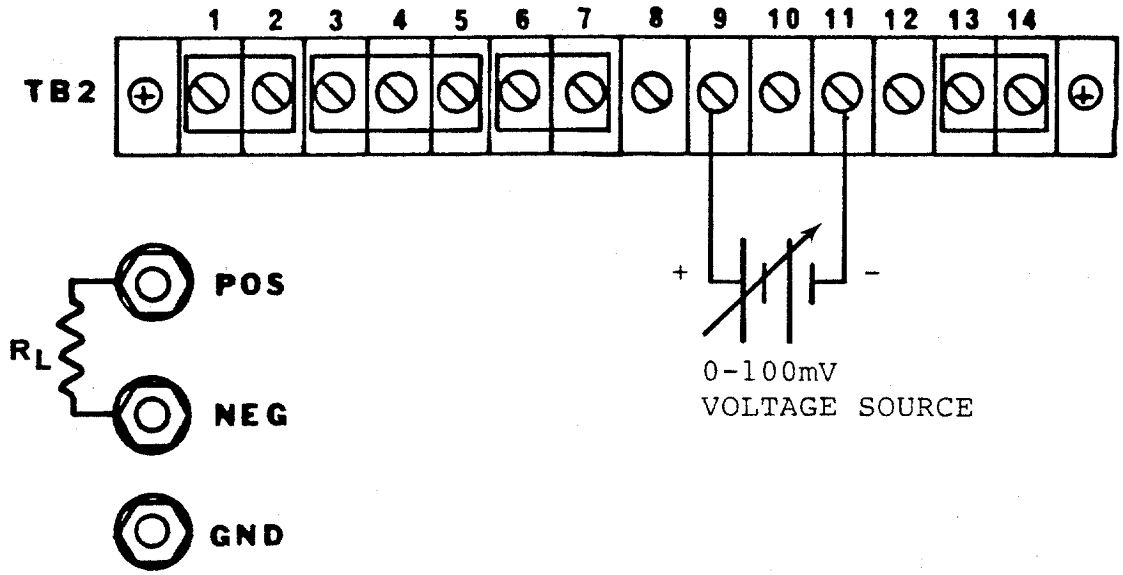

Figure 3-3B. Remote Voltage Programming of Output Current

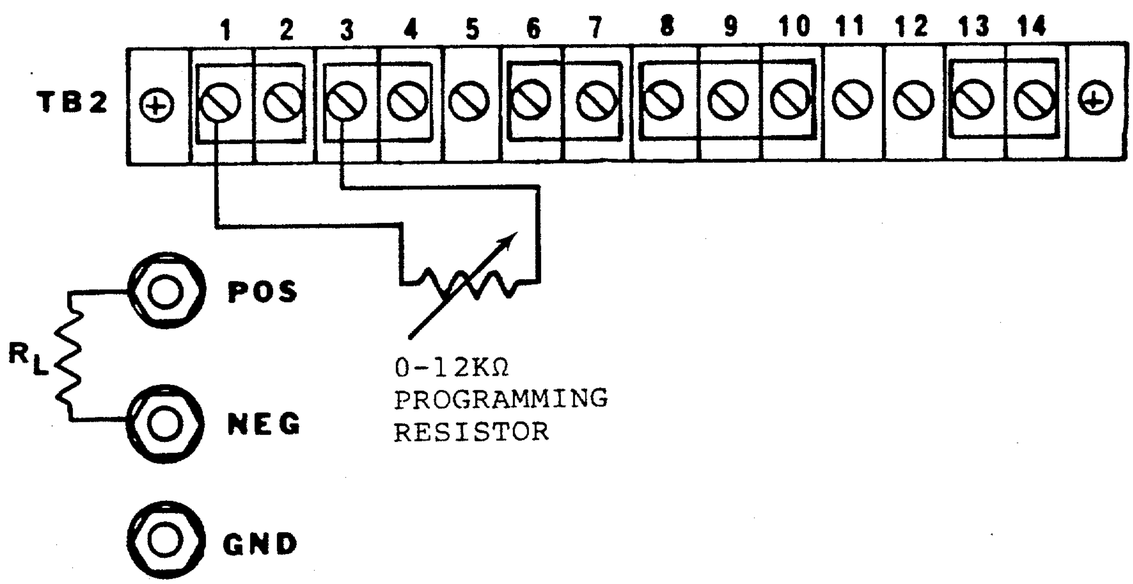

Figure 3-4. Remote Resistance Programming of Output Voltage

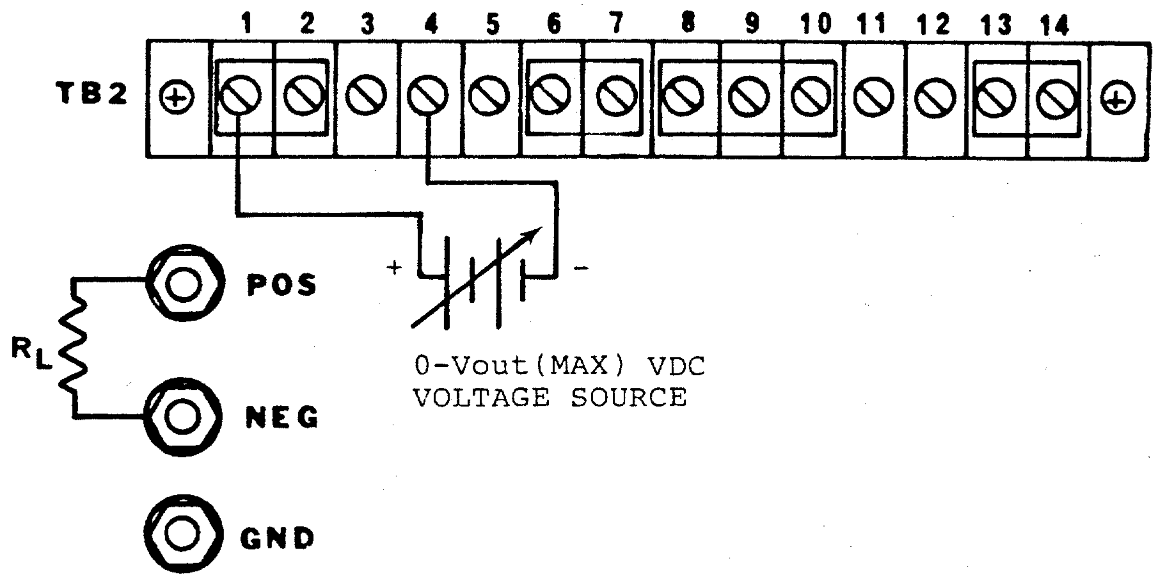

Figure 3-5. Remote Voltage Programming of Output Voltage

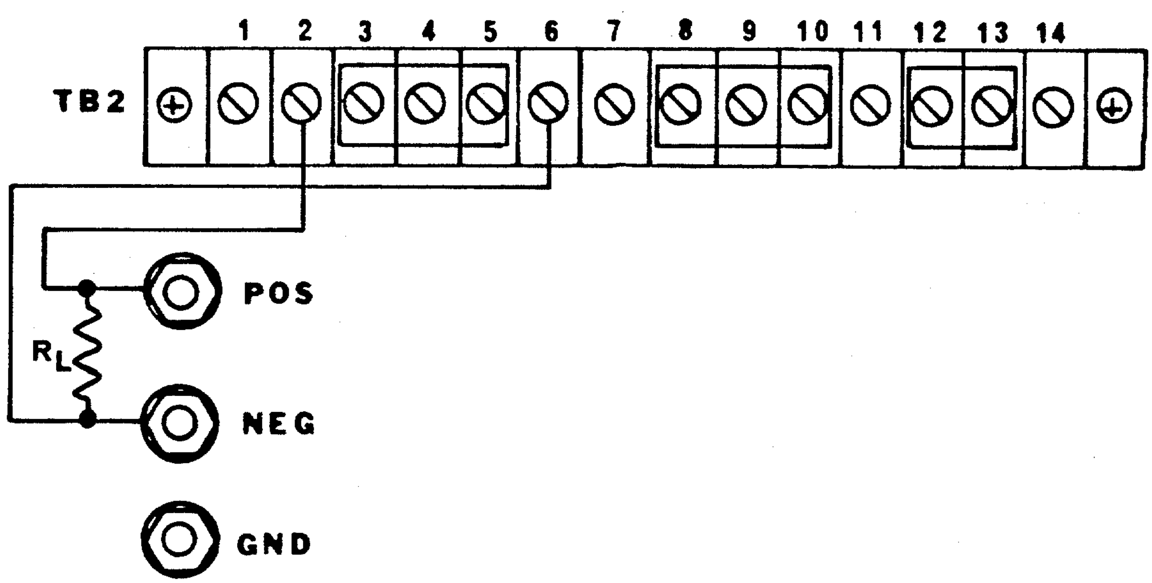

Figure 3-6. Remote Sensing Operation

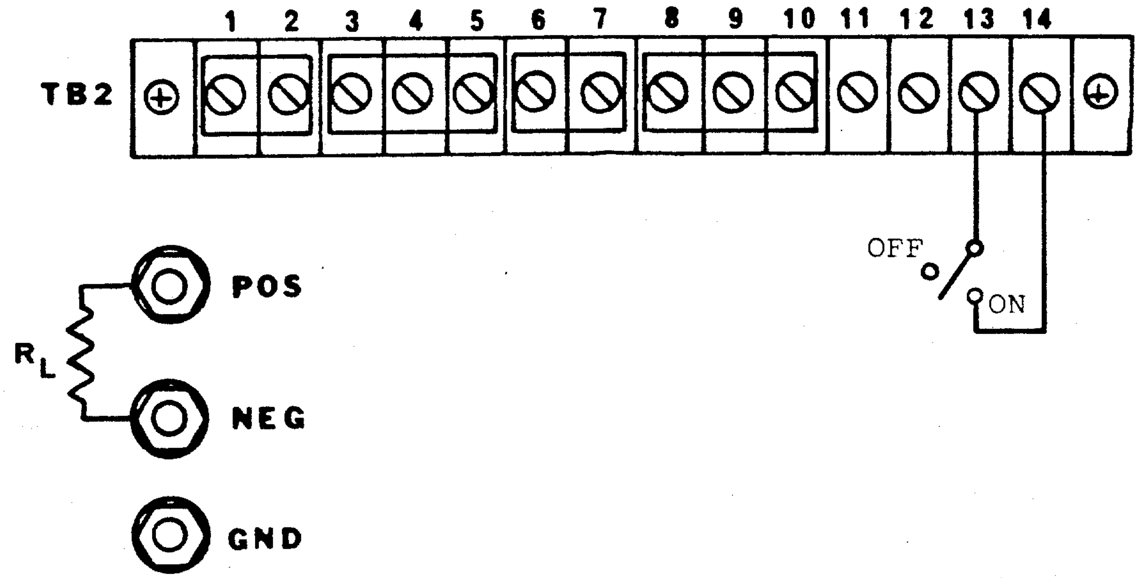

Figure 3-7. Remote On/Off Control by Contact Closure

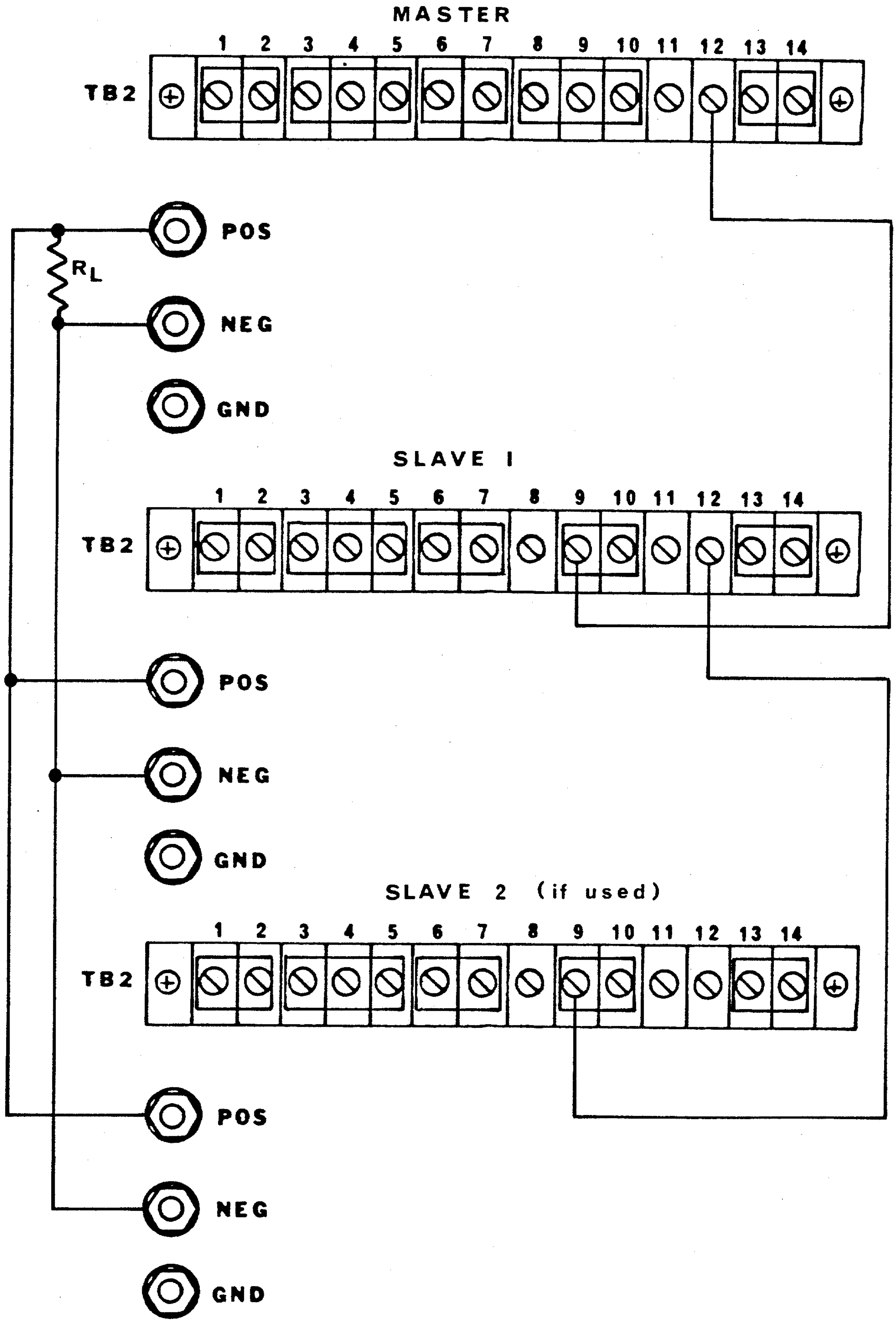

Figure 3-8. Auto-Parallel Operation

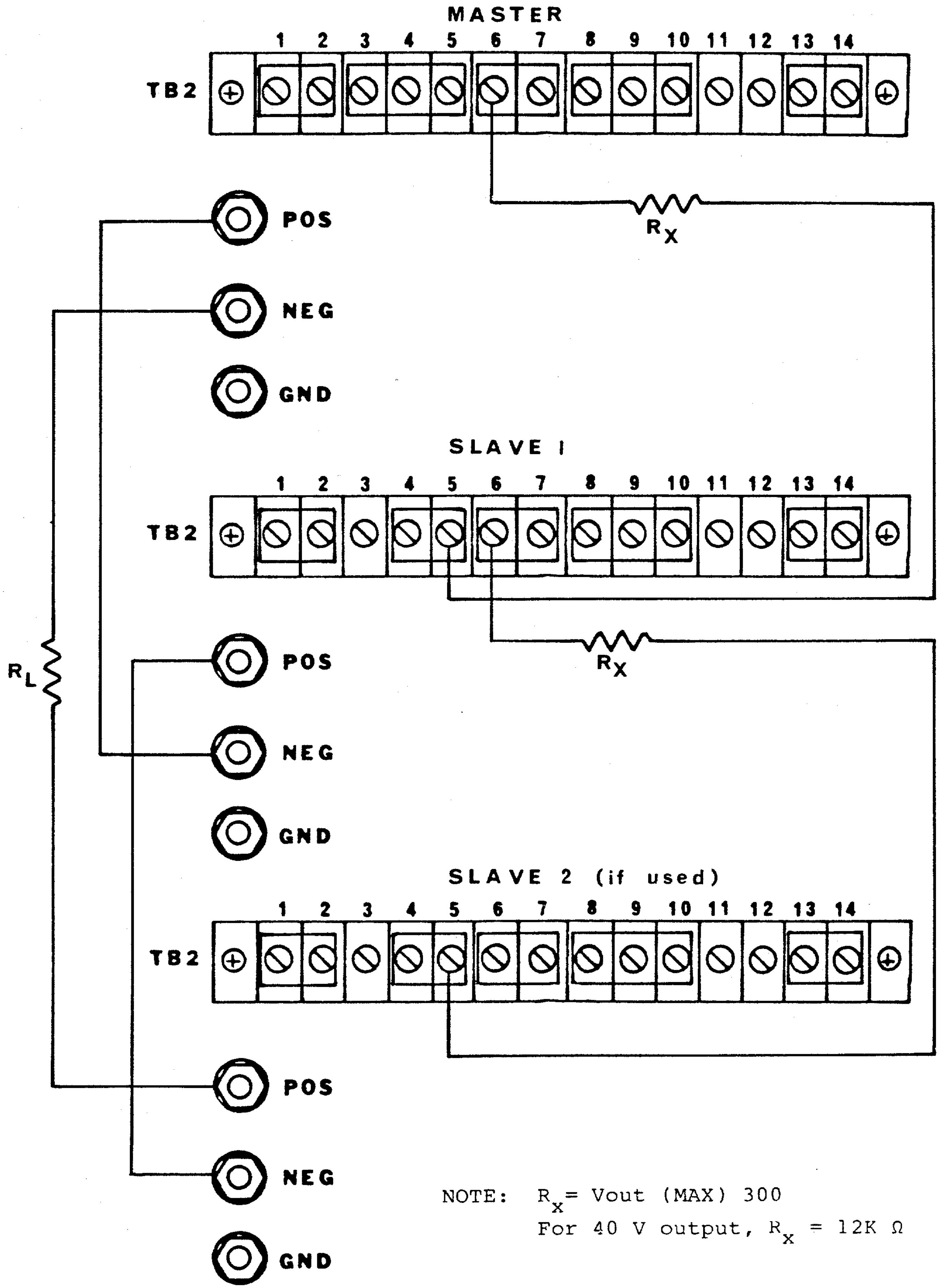

Figure 3-9. Auto-Series Operation

CHAPTER 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION

This chapter provides a circuit description of the 3100-4025 Power Supply. Reference schematics 10-001-043-90B and 10-010-066-90A.

4-2. GENERAL DESCRIPTION

The 3100-4025 Power Supply is an on-line switching power supply operating at 20 kHz. Regulation is attained by pulse-width modulation. A half-bridge configuration is used to generate 1 kW of load power.

4-3. DETAILED CIRCUIT DESCRIPTION

a. Input Power Distribution (Reference schematic 10-001-043-90B). Input 103-127 V ac is routed through EMI filter FL-1 and circuit breaker S1 to the circuit board through connector J2. This voltage is also applied to the primary of transformer T1.

b. Switching Regulator Operation (Reference schematic 10-010-066-90A).

(1) Unregulated DC Power Bus. The ac input voltage from J2 is connected to a voltage doubler consisting of BR2, C50-C55. This produces an unregulated dc voltage of about 300 volts for power conversion. R80 and R81 are surge limiters to reduce inrush current; R83 is a bleed resistor to discharge capacitors C50-C55.

(2) Power Conversion. Main power conversion is achieved using a half-bridge configuration consisting of power switch transistors Q13, Q14 and associated drive components. Operating at 20 kHz, transistors Q13 and Q14 turn on during alternate half cycles. The pulse-width modulated output provides primary drive for the power transformer T2.

Base drive and snubber circuits are identical for both transistors so only one will be described , Q13. Basedrive power is provided through transformer T3. T3 secondary provides a +5 V voltage and pin 7 during the Q13 switch "ON" period. This +5 V is routed through R89 and CR29 to the base of Q13. C62 provides a high peak current during Q13 turn-on to reduce the turn-on time and resulting switching losses. The -5 V from transformer T3 is coupled through CR31 to the base of Q13 to provide negative bias during the turn-off period. Diodes CR27 and CR29 comprise a Baker clamp to reduce Q13 storage time. C60 and R85 provide snubbing for Q13, which reduces power losses during turn-off.

(3) Power Rectifier/Filter. Input pulse-width modulated voltage is applied to power transformer T2. The secondary is full wave rectified by CR25 and CR26. Filtering is provided by L1, C48 and C49. R82 is a current shunt that provides output current sensing. The snubber R84 and C56 reduce spikes and ringing that result from switching.

(4) Bias Supplies. A nominal 32 volts ac is routed through J1-22, -23, -24. The center tap (J1-24) is connected to the power supply circuit common (negative power supply output). The ac inputs are rectified by BR1 and capacitively filtered by C27 and C28 to provide a nominal +/-16 volts dc to the +/-12 volt bias regulators. The positive 12 volt bias is regulated by U7 and filtered by C31 and C34. The negative 12 volt bias is regulated by U8 and filtered by C32 and C35.

(5) Pulse-width Modulator. The pulse-width modulator (PWM) U9, and its associated components described below, is the primary controlling circuit in the regulator. For a thorough understanding of internal circuits operations, reference the data sheet and applications notes on the SG2524 regulating PWM. The primary function in this power supply is to convert the differential analog inputs on pins 1 and 2 to a PWM signal on pins 11-12 and 13-14. The reference input pin 2 is derived from the reference output pin 16 and the voltage divider R73 and R74. The control (feedback) input is derived from error amplifiers U3, U4 and U5 through CR5, CR9 and CR6 respectively. Loop compensation is determined by C43 and RC feedback R71 and C42.

(6) Base Drive Amplifier. The following description of the power transistor base drive amplifier pertains to transformer T4 which drives power transistor Q14. The base drive to both transistors is identical, so to only one is described.

The PWM output of U9 consists of a transistor driver whose uncommitted collector and emitter appears on pins 11 and 12. CR21 and CR22 comprise a Baker clamp for positive drive transistor Q8 which reduces storage time and turn-off time. C44 assures proper negative bias for the switching transistor during turn-off. It is alternately charged by pull-down transistor Q11 through R75 and then discharged by pull-up transistor Q9 through the primary of T2.

(7) Deadband Control/Slow Start. A minimum blanking pulse (deadband control) of 4 microseconds is needed at output of PWM to assure that there is no possibility of having both power transistors on simultaneously during transitions. Simultaneous conduction can occur due to storage time of power switch transistor Q14.

Deadband control is accomplished by limiting the maximum swing of voltage at U9, pin 9. The emitter of Q10 assures that pin 9 can go only one diode drop above the base of Q10 which is determined by the voltage reference, pin 16, and voltage dividers R73 and R74.
Q2 is capable of overriding output of the PWM U9. It provides a place to place slow start circuitry. By adding C29 across Q2, a delay is

introduced when the power supply is initialized. When the base of Q2 becomes back biased, output voltage can rise only at a rate of the time constant determined by R52 and C29.

(8) Voltage Reference Circuit. The voltage reference circuit is an adjustable negative current source (current sink) which is set for 3.333 mA. This reference is routed to TB2-3 for local or remote voltage control via resistance. The circuit consists of Q1, precision reference VR1 , and associated components. VR1 sets a 6.2 volt reference across R6 and R7. The diode drop of CR2 cancels that of Q1 and provides temperature compensation. R7 adjusts the current source and is used for calibration.

(9) Current Reference Circuit. The current reference circuit is an adjustable current source which us set for 0.250 mA. This reference is routed to TB2-8 for local or remote control of current via resistance. The circuit consists of R24,R25 and U9. Pin 16 of U9 provides a precision +5 V reference voltage which is used with R24 and R25 to provide a current source. R24 adjusts the current source and is used for calibration.

(10) Voltage Control. Voltage control and error amplification are provided by U4 and associated components. The inverting input is connected to the negative regulated output through R30. The non-inverting input is connected to Vcont (TB2-4) through R29 and R32. Because the (-) inverting terminal is tied to the negative output, error-amplification is done with respect to this voltage. Error amplifier U4 amplifies any error signal and provides a control signal to the PWM through CR9 when the regulator is in voltage mode.

The lead network C17 and R31 provide loop compensation along with C13, C14 and R23. R27 is an offset adjustment for zero nulling. (See calibration procedures.)

(11) Current Control. Current control and error amplification are provided by U5 and associated components. Current control (local or remote) is routed from TB2-9 through R38 to the (-) inverting input of U5. The (+) non-inverting input is connected through R36 to Is(+), the positive sensing end of shunt resistor R82. When the voltage across R82 equals the voltage between Icont (TB2-9) and Is(-), U5 puts the regulator into constant current mode. The output of U5 provides a control signal to the PWM chip through CR6.

C18 and R37 are a lead network to provide loop compensation. C16 and C19 provide additional compensation. R33 is an offset adjustment for zero nulling. (See calibration procedure.)

(12) Current Limit. The current limit circuit consists of U3 and associated components. The (-) inverting input is connected through R19 to resistive divider R18 and R20. The divider is connected from the +5 V reference to Is(-), the negative sensing side of shunt resistor R82. The (+) non-inverting input of U3 is connected through R21 to Is(+), the positive sensing end of R82. When the voltage at Is(-) becomes sufficiently negative with respect to Is(+), the voltage

at the inverting input will equal the voltage at the non-inverting input causing U3 to put the regulator into constant current mode. The output of U3 provides a control signal to the PWM chip through CR5. The current limit circuit is only activated when the output current exceeds rated maximum by approximately 5%. The lead network of C12 and R22 along with C10 provide loop compensation.

(13) Current Monitor/Parallel Tracking Amplifier. The current monitor/parallel tracking amplifier consists of U2 and associated components. The primary purpose is to provide an output of 0 to 1 mA to TB2-12 (Imon+) corresponding to 0 to 100% of rated output current, when used in a parallel configuration. When not used for parallel operation, TB2-12 provides a 0 to 5 V dc monitor signal corresponding to 0 to 100% of rated output current. Both amplifier inputs are provided by current shunt R82. Gain is controlled by resistors R8 and R9 which are factory selected to provide 0 to 5 V dc for 0 to 100% current output at U2-6. This 0 to 5 V dc is routed through R34 to provide 0 to 1 mA, when used in the parallel configuration.

(14) Overvoltage Detector/Crowbar. The overvoltage detector/crowbar circuit consists of U6 (pins 12, 13, 14), Q5, SCR1, and associated components. The inverting input (pin 13) is connected to the wiper of the overvoltage set potentiometer R93 on the front panel through J1-17. The wiper provides an adjustable voltage to U6 (pin 13) that is compared to the voltage at U6 (pin 12). The voltage at U6 (pin 12) comes from a voltage divider that is connected across the output of the supply. If the voltage at U6 (pin 12) exceeds the voltage at pin 13, the output of U6 will go high and latch through R56 and Cr16. The high output of U6 turns off the PWM by turning on Q2 through R57. Also, Q5 is turned on; it lights the LED which indicates an overvoltage condition. Q5 also fires SCR1 when it turns on, bringing the regulator output voltage down quickly. C33 and C36 provide noise rejection to prevent false tripping of the circuit. R69 limits the peak current through SCR1 when the crowbar fires.

(15) Inrush Current Limiting. Inrush current limiting is provided by surge limiters R80 and R81. These devices are thermistors with a negative thermal coefficient. The type used have a cold resistance of about 2.5 ohms.

(16) Thermal Protection. Thermal protection is provided by U6 (pins 5, 6, 7) and associated components. R42 and R44 provide a 1.42 V reference voltage at U6 (pin 6). This voltage is compared to the voltage across the thermal sensor, R43, which is a positive temperature coefficient thermistor. When the voltage at pin 5 exceeds the voltage at pin 6, the output (pin 7) will go high. This turns on Q2 and shuts of the PWM. This condition only occurs when the heatsink temperature exceeds a safe level. R46 and CR13 provide thermal hysteresis of about five degrees centigrade.

(17) Bias Enable. The bias enable circuit prevents power supply operation if bias voltages become marginal, as would be the case during a brownout. U6 (pins 8, 9, 10) and resistors R40 and R41 form a comparator which uses the 5 volt reference of U9 to set the voltage

at U6 (pin 9). If the unregulated positive bias voltage goes below 15 volts, the comparator output (pin 8) will go high because the voltage at pin 9 will go below the voltage at pin 10. This turns on Q2 which shuts off the PWM.

(18) Bias Supplies. The regulator requires +/- 12 volt bias supplies for internal use. These are provided by BR1, U7, U8 and associated components. Transformer T1 provides 28 V ac (centered-tapped) to BR1 through J1 (pins 22, 23, 24).This is rectified by BR1 and filtered by C27 and C28. U7 and U8 provide regulated voltages of +12 volts and -12 volts respectively.

(19) Remote On/Off Output Control. Remote On/Off control of the regulator output may be implemented by switching or contact closure. A switch, relay contacts, or a semiconductor switch may be used to provide contact between TB2-13 and TB2-14. If a semiconductor switch is used, it must be capable of sinking about one milliamp from TB2-14 to TB2-13. Note that the regulator output is enabled when the switch is closed.

(20) Voltage/Current Mode Indicators. The indicators, LED 2 (voltage) and LED 3 (current) are driven by U1 (pin 14) and U1 (pin 1), respectively. Pins 2 and 12 of U1 are tied together and can be driven high by U4 through CR8, resulting in voltage mode being indicated. Pins 3 and 13 of U1 are tied together and can be driven high by either U3 through CR3 or U5 throughCR7. If either U3 or U5 drive pins 3 and 13 of U1 high, current will be indicated.

(21) Remote Interface. The remote interface is barrier strip TB2 with appropriate jumpers, which permit user selection of local/remote voltage or current control and local/remote voltage sensing. TB2 is accessible from the rear panel. See chapter 3 of the manual for local/remote control and sensing connections.

CHAPTER 5

MAINTENANCE AND CALIBRATION

5-1. INTRODUCTION

This chapter contains preventive and corrective maintenance information for the 3100-4025. To isolate defective components, use standard troubleshooting procedures in conjunction with the principles of operation in chapter 4, the list of materials information in chapter 6 and the schematics in chapter 7.

5-2. EQUIPMENT REQUIRED

Table 5-1 lists the test equipment required to perform maintenance on the 3100-4025. The recommended model or an equivalent may be used.

5-3. PREVENTIVE MAINTENANCE

Preventive maintenance for the 3100-4025 consists of scheduled inspection and cleaning.

a. Schedule. Table 5-2 lists the preventive maintenance routines and the recommended performance intervals.

b. Inspection. Table 5-3 lists the visual inspection checks to be performed. It also indicates the corrective action to be taken.

c. Cleaning. Cleaning requirements are based on the need established during inspection. If cleaning is required, follow the instruction listed in the corrective action column of table 5-3.

5-4. REPAIR

Repair of the 3100-4025 is performed by removing and replacing failed parts and components. Information required to order replacements is contained in chapter 6, List of Materials.

Table 5-1. Test Equipment Required

COMMON NAME	REQUIRED CAPABILITIES	RECOMMENDED MODEL
Digital Multimeters	ac and dc Ranges	Hewlett-Packard Model 3468A
Oscilloscope	Signal and Waveform Measurement	Tektronix 2215
Resistive Load	For Full Rated Output Voltage and Current of P.S. Model Type.	

Table 5-2. Preventive Maintenance Schedule

PREVENTIVE MAINTENANCE ROUTINE	RECOMMENDED PERFORMANCE INTERVAL
Inspection	Annual
Cleaning	As Required

Table 5-3. Inspection and Corrective Action

ITEM	INSPECT FOR	CORRECTIVE ACTION
Connector plugs and jacks	Looseness, bent or corroded contacts, damage or improper seating in mating connector	Clean contacts with solvent moistened cloth, soft bristle brush, small vacuum or low compressed air. Replace connectors damaged, deeply corroded, or improperly seated in mating connector.
Chassis, extruded heatsinks	Dirt and Corrosion	Clean with cloth moistened with soapy water.
Electrical Wiring	Broken, burned or pinched wire; frayed, worn or missing insulation	Repair or replace defective wires.
Soldering connections	Corrosion, loose, cracked, or dirty connections	Clean and resolder connections.
Dirt and moisture buildup	Short circuits, arcing, corrosion, overheating	Clean as required.
Front panel controls and meters	Dirt and corrosion	Clean with cloth moistened with soapy water. Use a Kimwipe tissue and GTC glass cleaning compound to clean the meter faces.

5-5. CALIBRATION AND ADJUSTMENTS

To perform the following calibration and adjustment procedures, the cover must be removed from the power supply. Because removal of the cover allows access to potentially hazardous power voltages (up to 300 V dc) and because of the importance of accurate readings to performance, only technically trained personnel should perform calibration procedures.

WARNING

> Hazardous voltages (up to 300 V dc) are present during equipment operations. Press switch to OFF position and disconnect power cord from power source. Allow a minimum of 3 minutes for discharge of storage capacitance before removing the cover or performing any maintenance function.

Reference assembly 10-010-066-90 while performing calibration procedures.

a. Voltage Reference. The voltage reference is provided by an adjustable current regulator Q1. To calibrate for the 3.333 mA programming coefficient (constant voltage) the following sequence is recommended.

(1) Remove all jumpers and external connections to TB2-3.

(2) Set current control potentiometers on front panel fully counterclockwise.

(3) Connect a precision digital multimeter (DMM) to TB1-3(+) with reference to TB2-13. Set DMM to DC milliamps and 20 milliamps range.

(4) Apply power to power supply.

(5) Adjust R7 for 3.333 milliamps on DMM.

(6) Remove power from power supply.

(7) Reconnect all jumpers/connections to TB2-3 as required for local or remote voltage control.

b. Current Reference.

(1) Remove jumper between TB2-9 and TB2-10.

(2) Connect a 402 ohm, 1% resistor between TB2-9 and TB2-11.

(3) Connect a resistive load to regulator output that is adequate to draw full rated current.

(4) Install a current shunt in line with the load.

(5) Turn power supply on.

(6) Adjust R24 so that power supply goes from voltage mode to current mode when load current reaches 25.1 amps.

(7) Turn power supply off.

(8) Remove resistor and reconnect jumper from TB2-9 to TB2-10.

c. Voltage Zero Calibration. The voltage control circuit (U4) zero is adjusted by R27. The following sequence is recommended.

(1) Connect jumper (short circuit) between TB2-2 and TB2-4.

(2) Connect resistive load and DMM across output terminals of power supply. Set DMM to read DC volts and approximately 200 millivolt range.

(3) Set current control potentiometers fully clockwise.

(4) Apply power to power supply.

(5) Adjust R27 until the power supply output voltage starts to increase in the normal polarity. Reverse adjustment direction of R27 until output voltage decreases to zero reading on the DMM, Do not continue adjustment once the output reads zero millivolts.

(6) Remove power from power supply.

(7) Remove resistive load and DMM from power supply output terminals.

(8) Remove jumper from TB2-2 and TB2-4.

d. Current Zero Calibration. The current control circuit (U5) zero is adjusted with R33. The following sequence is recommended.

(1) Connect a jumper (short circuit) between TB2-9 and TB2-11.

(2) Connect a resistive load and DMM across the output terminals of the power supply. Set DMM to read DC volts and approximately 200 millivolt range.

(3) Set voltage control potentiometers on front panel fully clockwise.

(4) Apply power to power supply.

(5) Adjust R33 until the power supply output voltage starts to increase in the normal polarity. Reverse adjustment direction of R33 until output voltage decreases to zero reading on the DMM. Do not continue adjustment when the output reads zero volts.

(6) Remove power from power supply.

(7) Remove resistive load and DMM from power supply output terminals.

(8) Remove jumper between TB2-9 and TB2-11.

e. Current Monitor/Parallel Tracking Amplifier Zero Calibration. The current monitor/parallel tracking amplifier zero is adjusted with R5 The following sequence is recommended.

(1) Connect a jumper (short circuit) between TB2-9 and TB2-11.

(2) Connect a resistive load across output terminals.

(3) Connect a DMM between TB2-12(+) and TB2-13(-). Set DMM to dc volts on 0.2 volt scale.

(4) Set front panel voltage and current control potentiometers fully counterclockwise.

(5) Apply power to power supply.

(6) Adjust R5 to 0.00 volts on DMM.

(7) Remove Power from power supply.

(8) Remove jumper between TB2-9 and TB2-11.

(9) Remove resistive load from power supply output terminals.

f. Meter Zero Calibration. The zero set for both voltage and current front panel meters is located on the panel meters and is accessible at the front panel. Zero adjustment should be completed only with the prime power removed.

g. Meter Full Scale Calibration. Full scale calibration is factory set by resistors R17 and R26. Adjustment of full scale deflection is normally not required, but can be done by changing these two resistors.

CHAPTER 6

LIST OF MATERIALS

6-1. INTRODUCTION

The repair parts list contains the major parts required to maintain the 3100-4025. To ensure accurate procurement of replacement parts, the information contained in the parts list columns must be used effectively. The following paragraphs describe the parts list format and include an explanation of the information presented in each of the columns.

The SEQ column contains the sequence number in ascending order. The REFERENCE column contains the reference designations of the electrical components. The DESCRIPTION column contains the standard identifying noun or item name. The ITEM column contains the part number Power Ten has assigned to items both purchased and Power Ten manufactured. The QUANTITY column contains the quantity for a unique configuration which is identified by a dash number.

CHAPTER 7

ILLUSTRATIONS

7-1. INTRODUCTION

This chapter contains the appropriate schematic drawings for your model of the 3100-4025.