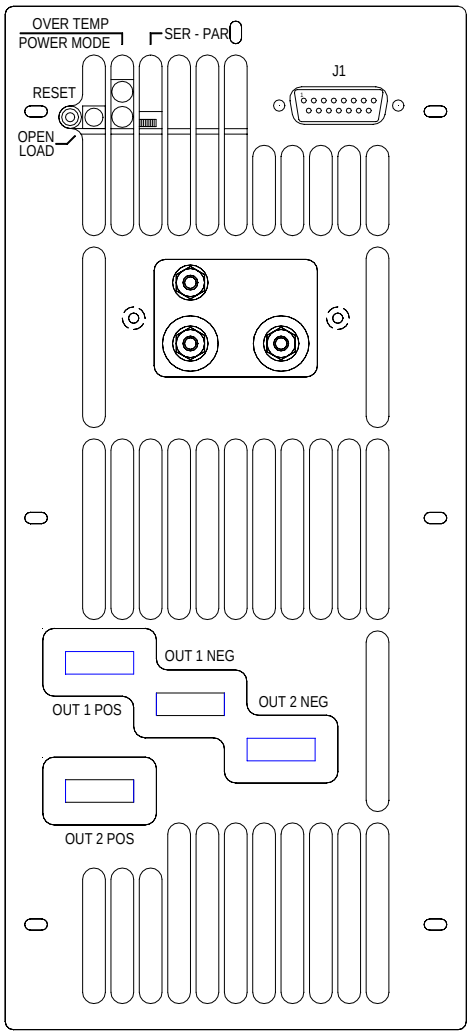
T3000

Thermal Power Supply



User's Manual

518-035 Revision A, Feb 2006

Preface

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SYCON INSTRUMENTS, INC.
Policy

Sycon Instruments, Inc. (Sycon) warrants that all electronic instrumentation equipment manufactured by Sycon shall be free from defects in materials and workmanship for a period of 2 years from date of shipment. Mechanical vacuum components such as feedthroughs, sensors, cables, and shutters shall be warranted for a period of six months from the date of shipment. For the duration of the warranty period Sycon will, at its option, either repair or replace any part which is defective in materials or workmanship without charge to the purchaser. The foregoing shall constitute the exclusive and sole remedy of the purchaser for any breach by Sycon of this warranty.

This warranty does not apply to any equipment which has not been used in accordance with the specifications recommended by Sycon for the proper and normal use of the equipment. Sycon shall not be liable under any circumstances for consequential or incidental damages in connection with, or arising out of the sale, performance, or use of, the equipment covered by this warranty.

This warranty is in lieu of all other warranties by Sycon, expressed or implied, including the implied warranty of merchantability, the implied warranty of fitness for a particular purpose, and warranty against infringement of any patent.

EQUIPMENT RETURN

Before returning any equipment to Sycon contact the Product Service Department in your area for instructions. Obtain a Return Authorization (**RA**) number and indicate this number on all shipping cartons and correspondence. Ship all items in suitable containers with adequate protection from outside damage.

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Section 1

Introduction – Description of Equipment

1.1 Purpose and Capabilities

The Sycon T3000 is designed specifically to power resistive evaporative sources used in the deposition of thin film coatings. It has been specified to cover the class of resistive load devices requiring low voltage and high current at power levels up to 3kW. The two output sections of the supply can be connected in parallel to provide up to 600 Amperes RMS in excess of 5 Volts, or in the series connected configuration, 300 Amperes RMS in excess of 10 Volts. This versatile output range covers a broad spectrum of thermal sources. T3000 power supplies can be connected in parallel to meet extremely high power requirements, (two units connected in parallel would provide up to 6kW load power.)

Several methods for controlling output power are available to the user. In the simplest arrangement, a user-supplied DC voltage is applied to control the output current to the load. A current feedback loop in the T3000 serves to stabilize output load current in proportion to this DC control voltage input.

The next level of sophistication is to use the T3000 in conjunction with the Sycon RS3000 controller. This unit allows the user to input desired current levels with corresponding rate of rise times to control load thermal stresses and to monitor set points and output power levels. The controller features automatic shutdown to govern over-temperature and open-load failure modes.

The T3000 is also directly compatible for use with industry standard thickness/rate controllers, such as the Sycon STC-200 or STC-2000 products. This configuration allows setting of specified deposition rates through automatic control of output power to the thermal source. STC PID control loop features govern deposition dynamics for these applications.

The most sophisticated configuration employs the T3000 with the RS3000 and STC-200 or STC-2000 products. This configuration allows setting of specified deposition rates through automatic control of output power to the thermal source, control of PID loop dynamics and provides set points and output power level as well as other monitoring and control functions.

1.2 Theory of Operation

The T3000 is a switch mode power supply (SMPS), which operates at a switching frequency of 250kHz. High frequency operation allows significant reduction in the size and weight of the magnetic components while maintaining high operating efficiency.

The SMPS converts 208/220 VAC single-phase line voltage to a line-isolated full-wave rectified 120-Hertz output waveform, which provides up to 3kW output power. Please note that the RMS value of a full-wave rectified sine wave is the same as that of the sine wave,

although it contains both DC and harmonics of line frequency. Therefore, the heating value in the load (the resistive deposition source) is the same whether the current is sine wave, rectified sine wave or a DC voltage all of equal RMS value.

The rectified line frequency was chosen as the output format because it offers an inherent unity power factor characteristic for the power supply. This comes about because power is being delivered to the resistive load throughout the 60-Hertz cycle of line frequency. Since conversion from line to output is performed at 250 kHz, there is insignificant phase shift introduced at the 60-Hertz line frequency. The net result is input line current that is, ideally, sinusoidal and essentially in-phase with the line voltage. This is the condition for near unity power factor.

1.3 Technical Characteristics

Table 1-1 Specifications

Output Power	3000 Watts
Parallel Output	5 Volts @ 600 Amps RMS
Series Output	10 Volts @ 300 Amps RMS
Input Voltage Range	180-264 VAC, Single Phase
Input Freq. Range	47 Hz to 63 Hz
Input Current	18 Amps @ 220 VAC
Efficiency	80% Full Load
Power Factor	>0.99 @ Full Load (TBD)
Total Harmonics	< 5% @ Full Load (TBD)
Input Control	0 to +10VDC Required For Controlling Output Current
Response Time	<100ms 250A to 500A Step Parallel Output[1]
Current Monitor	1 VDC = 100 Amps RMS For Parallel & 50 Amps For Series
Voltage Monitor	1 VDC = 1.5 Volt RMS Across Output Terminals
Protection	Over Temperature Shutdown
Size	11.4 in. H x 5.25 in. W x 12.9 in. D
Power Density	4 Watts per cubic inch
Weight	28 Pounds
Ambient Range	0^{o}C to +50^{o}C at full load
Cooling	Forced air, two internal fans
EMI	Designed to meet Conducted and Radiated EN55022
Safety	Designed to meet EN60950
Output Connectors	Flat bus bars with ¼" Bolt Hole for Lug Attachment
AC Input Wiring	2-Wire plus Ground with 8 – 32 lugs
I/O Connector	15-pin Dsub for control, monitoring and status signals
Power ON Indicator	Green LED: Flashing=Input Power ON, Steady=Output ON
Over Temperature	Red LED: Steady=Over Temp, Flashing=Ready for Reset
Open Load	Red LED: Steady=Open Load
Compatibility	Sycon Controller RS3000 &/or Rate Deposition Controllers

Footnote1; Response time is load dependent with lower resistance loads exhibiting faster response.

1.4 Output Characteristics

The purpose of this subsection is to provide guidelines for choosing between series or parallel output connections based on the load requirements of the thermal source being energized. Output voltage and current profiles vary in proportion to load resistance, up to maximum limits determined by the output circuit configuration. Figure 1-1 provides a guideline for choosing the appropriate output hookup configuration, based on the T3000 maximum output profile and the load requirements of the thermal source.

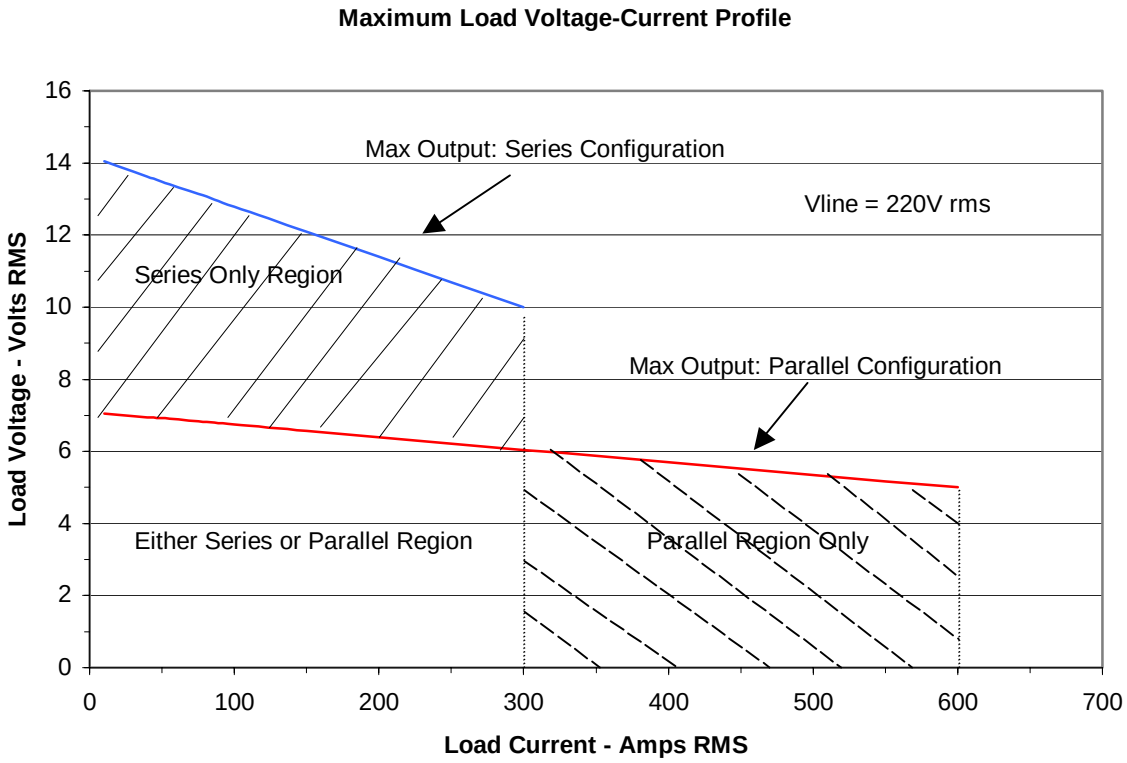


Figure 1-1 Maximum Voltage-Current Profile for Series and Parallel Hookup

Figure 1-1 is marked with regions which define when the series or parallel output configuration is appropriate. The maximum voltage-current rating of any given thermal source may be located as a point on the graph. The appropriate configuration(s) is determined by the location of this point.

For example, consider a commercially available thermal source rated at 521 ARMS and a corresponding voltage drop of 3.89 VRMS. This is a 2kW thermal source and falls in the area of the graph noted as “Parallel Only”.

By way of contrast, a thermal source rated at 742 Watts, which is specified by a voltage drop of 8.73 VRMS at 85 ARMS and falls in the “Series Only” region of the graph.

As a third example, consider a thermal source rated at about 365 Watts exhibiting a voltage drop of 1.34V at a maximum current of 273 Amperes. This falls in the region where either a series or parallel connection would work.

The above sample calculations assume that the voltage drop in the wires connecting to the T3000 is small in comparison to the voltage drop across the thermal source load. This condition is usually satisfied when the output wiring is properly sized for current carrying capacity.

Generally, where either a series or parallel option is available, the series configuration is recommended.

Section 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 damage. 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 2.2-1 lists all external connections for the T3000. An input and output connector description is provided in Table 2.2-2. For permanently connected equipment, a readily accessible safety switch shall be incorporated in the fixed AC wiring.

NOTICE
For proper connection to the mains, a 30-Amp circuit breaker or fuse is required in each AC line.

Table 2.2-1 T3000 External Connections

CONNECTOR	FUNCTION	CONNECTS TO
AC1 (See Figure 2.2-1) AC2 Frame Ground	Prime AC Power Input Single Phase	180-264 VAC 47-63 Hertz Power Source
Section 1 (See Figure 2.2-2) Positive Bus Bar Negative Bus Bar	Output Power	User Load (See Figure 2.2-3 for series or parallel connections)
Section 2 (See Figure 2.2-2) Positive Bus Bar Negative Bus Bar	Output Power	User Load
J1	Control Interface	See Table 3.2-1

Table 2.2-2 T3000 Connection Interface

Connector Function	Description
AC line connections & frame ground	8-32 Threaded Stand-off accepts #8 Ring terminal
Output Bus Bars	¼" bolt holes
J1 control interface	15 pin DB female (accepts 15 pin male matching connector on cable)

Figure 2.2-1 shows the location and connection configuration for the single AC line input (180-264 VAC). The AC wiring should be terminated with NO. 8 ring terminals and secured to the 8-32 male terminals on the T3000 with nut and lock-washer. A safety cover, with strain relief, covers the AC input connections.

CAUTION

Hazardous Voltages Present

TURN OFF THE INPUT AC POWER WITH THE SAFETY SWITCH BEFORE REMOVING THE T3000 PROTECTIVE COVER.

Figure 2.2-2 shows the location of the bus bars for the two output sections and defines the polarity relative to each other. Note that the Output-2 positive bus bar is common with the T3000 signal ground.

CAUTION

Hazardous Current Levels Possible

TURN OFF THE INPUT AC POWER WITH THE SAFETY SWITCH BEFORE CHANGING CONNECTIONS TO BUS BARS.

Figure 2.2-3 shows how the auxiliary C-shaped and flat bus bars are utilized to connect the two output sections of the T3000 in the parallel configuration. Cables to the thermal sources (usually the feedthrough terminals of the vacuum chamber) must be terminated in a suitably current rated solderless connector with a ¼-inch bolt hole for connection to the bus bars.

Figure 2.2-4 shows a similar arrangement for series connection of the two output sections using the auxiliary Z-shaped bus bar. Cable connection requirements must be consistent with current load requirements.

Also shown in Figure 2.2-4 is the location of the DB15 connector, which interfaces with the control cable from the RS3000 or other user specified control hardware.

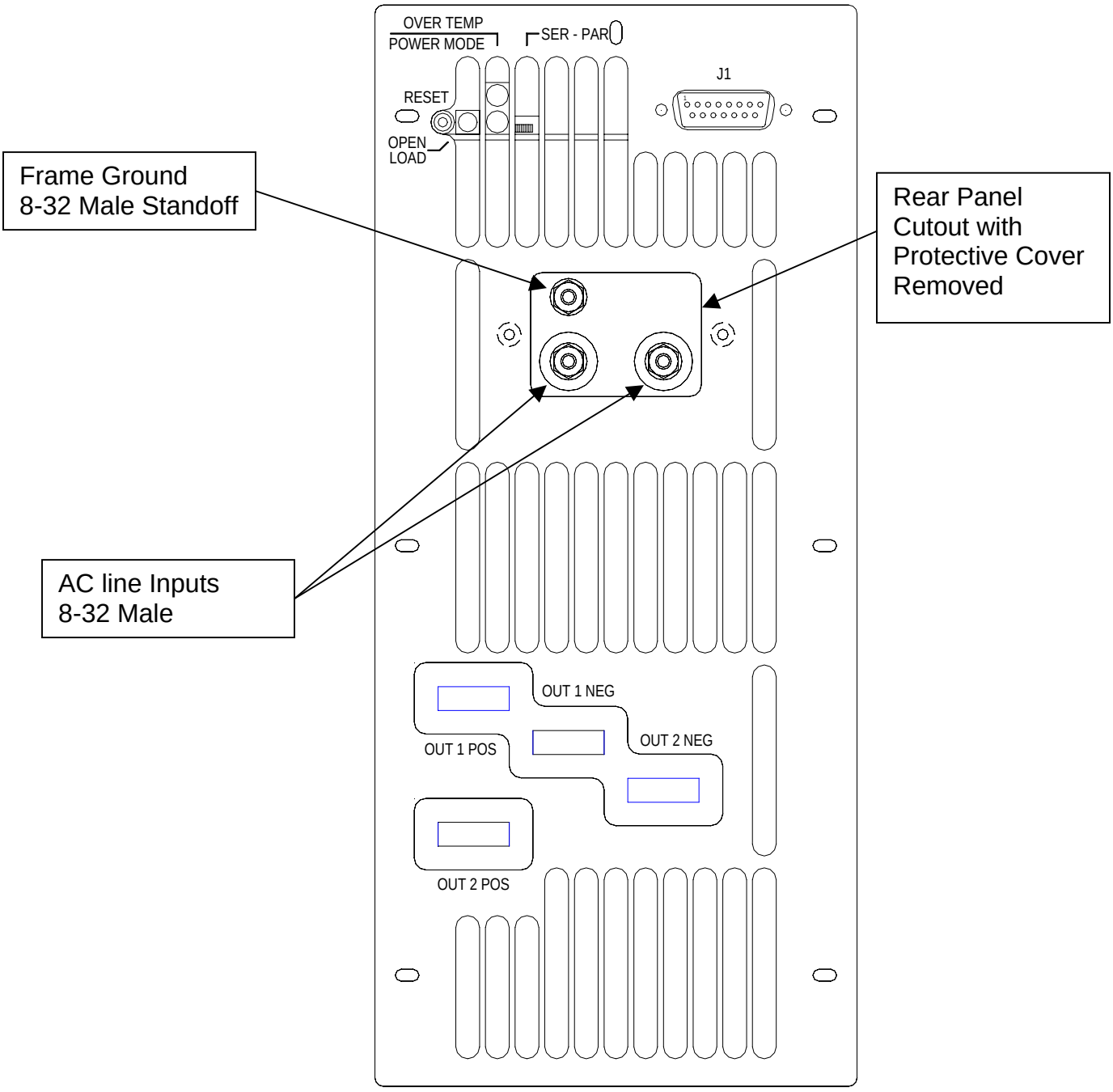


Figure 2.2-1 AC Line and Frame Ground Connections (Shown with safety cover removed to expose terminals)

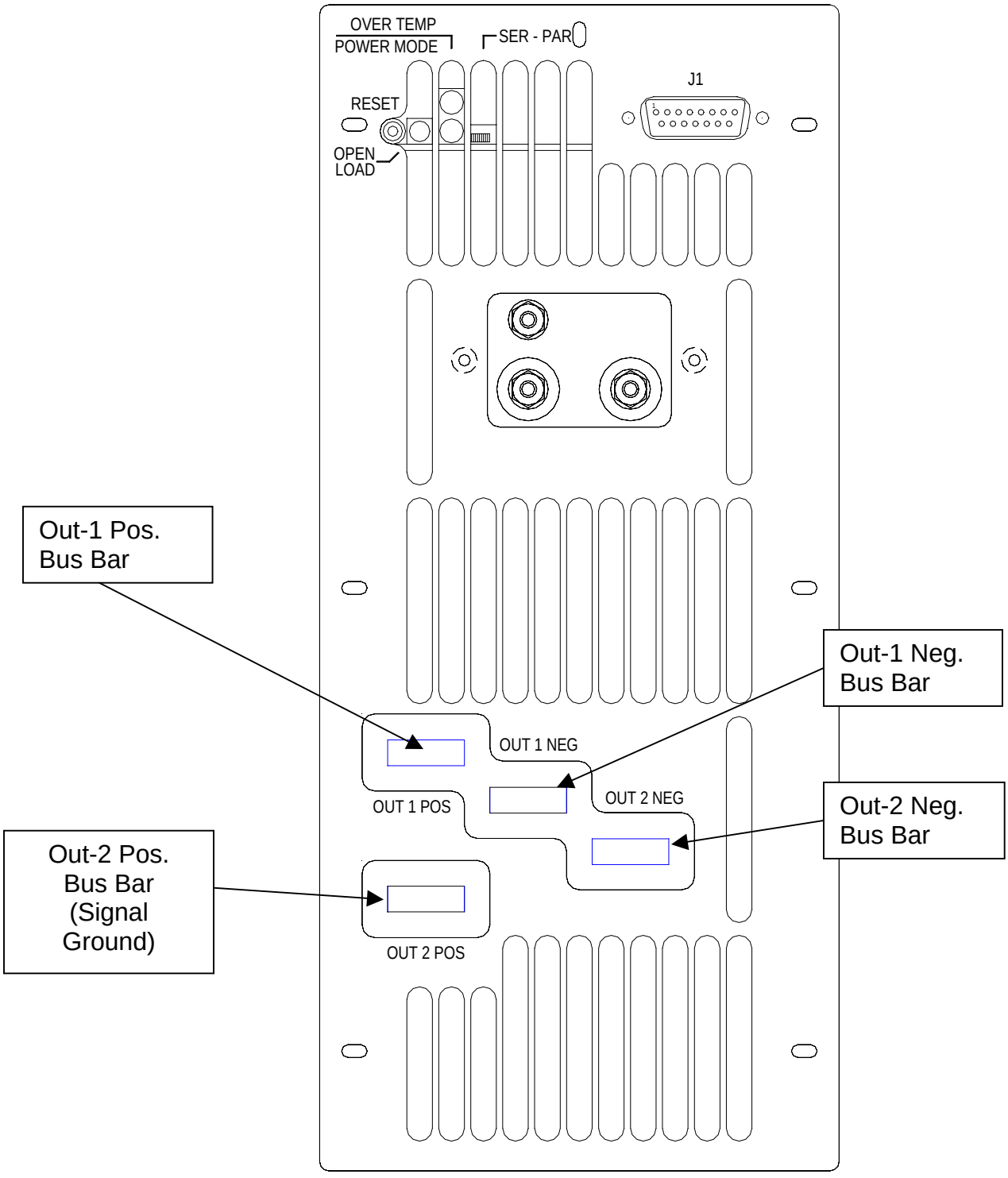


Figure 2.2-2 Bus Bar Identification For The Two Output Sections

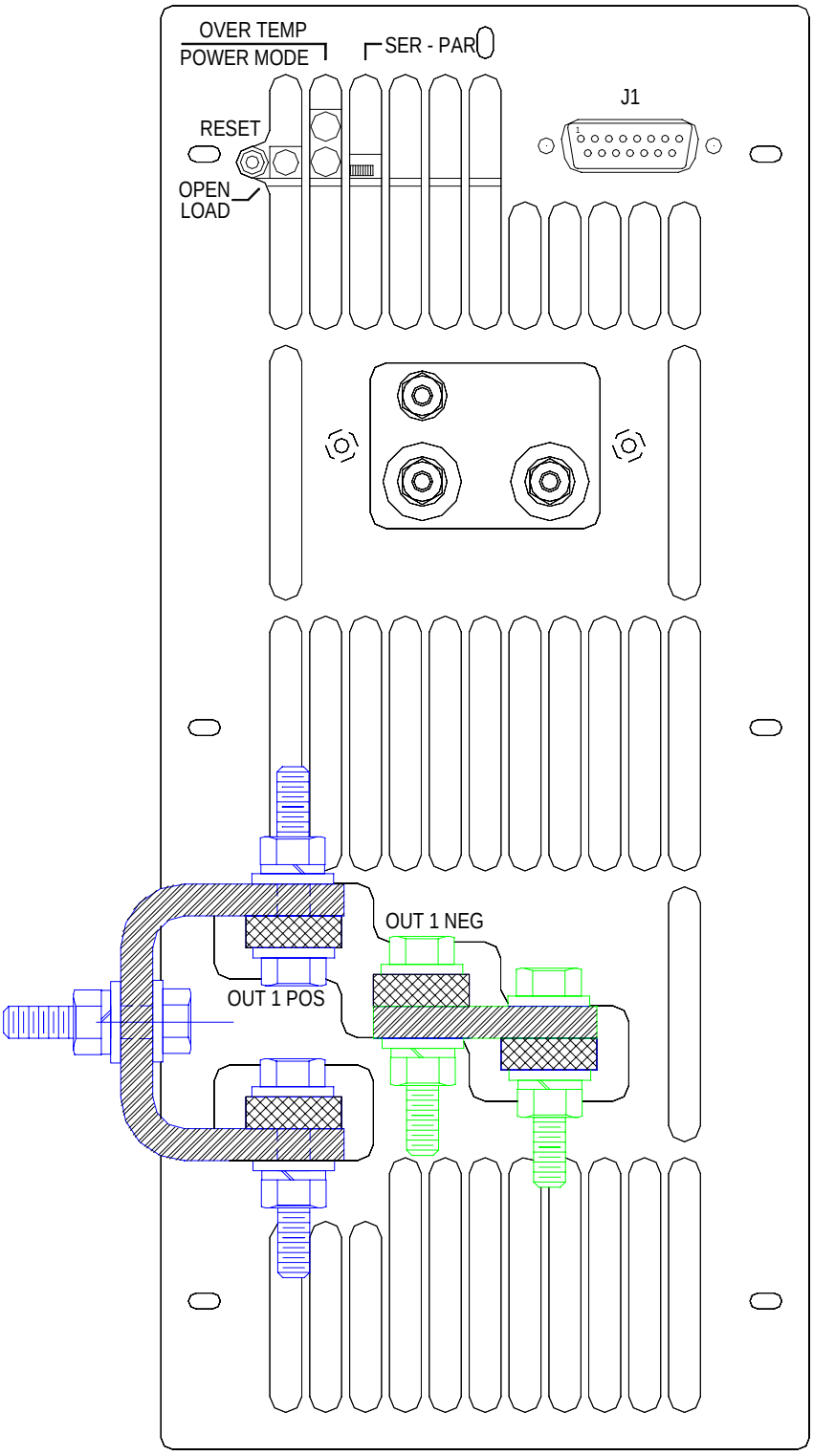


Figure 2.2-3 Bus Bar Jumpers Connect Two Output Sections In Parallel

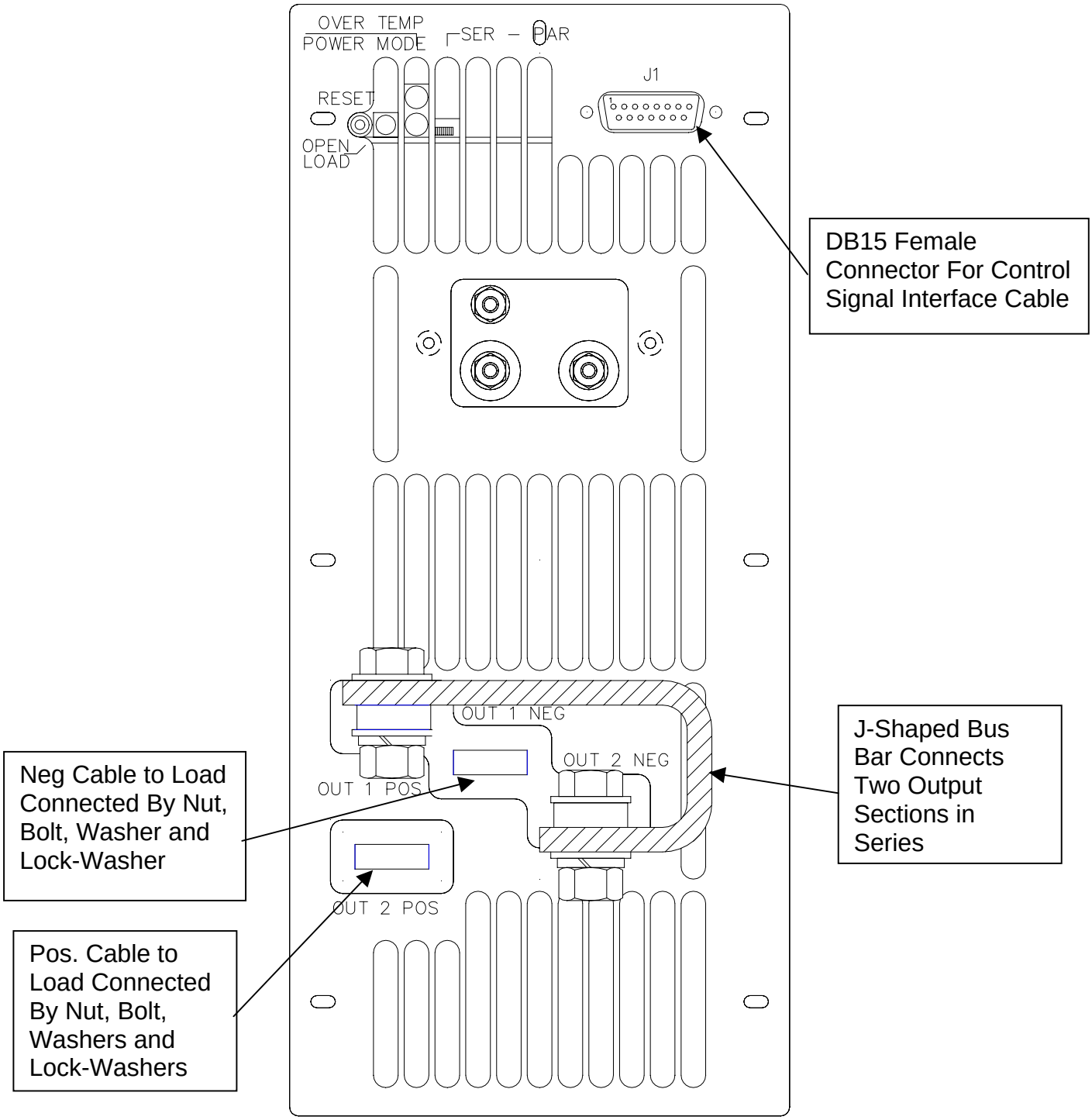


Figure 2.2-4 **J-Shaped Bus Bar Connects Two Supply Sections in Series**

2.3 Locations and Mounting

There are six #10-32 threaded mounting holes on each side of the T3000 that can be used for custom mounting the unit. It is recommended that the unit be located as close as possible to the vacuum chamber electrical feedthroughs, in order to minimize cable losses for the high current connections. Locations for these mounting holes are shown in the outline drawing of Figure 2.3-1.

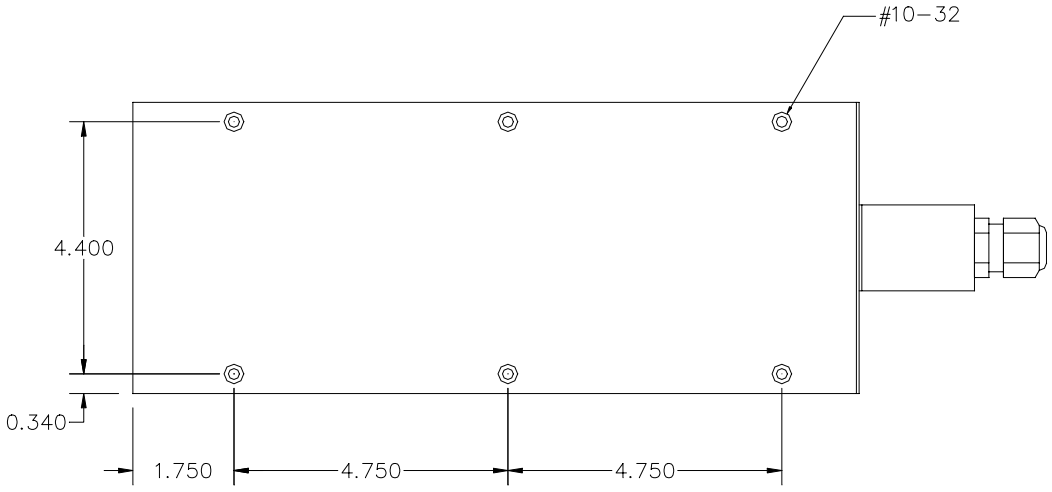


Figure 2.3-1 Location of Six Mounting Holes on T3000 Side Panels

The T3000 power supply and the RS3000 controller are also designed to mount in a standard 19.0-inch equipment rack using a custom front panel. The panel contains a power ON/OFF switch with a built-in circuit breaker. The panel and switch are available from Sycon Instruments. Four screws, two on each side of the front panel, should be used to secure the unit in place. Figure 2.3-2 shows the mechanical arrangement for side-by-side rack mounting of the two units.

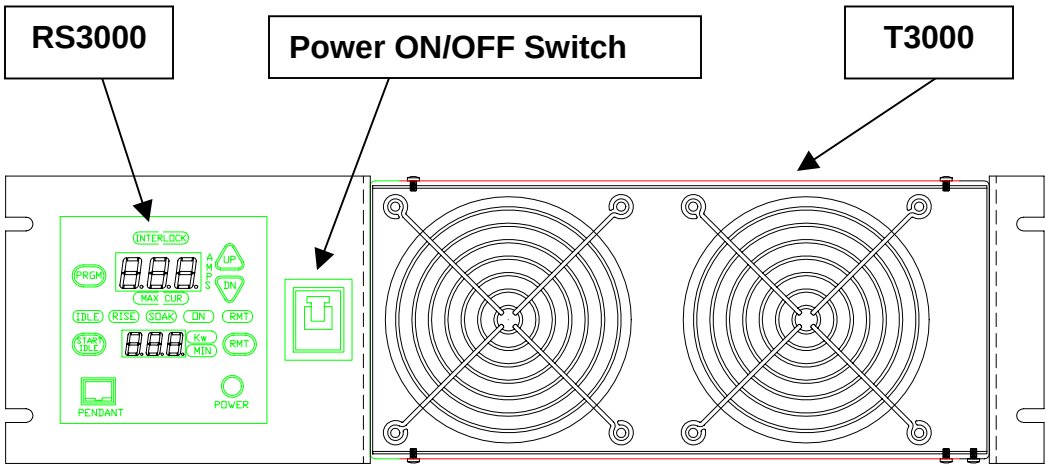


Figure 2.3-2 Side-By-Side19” Rack Mount Configuration

NOTICE
The front and rear of the unit should be free of obstructions to airflow. Proper ventilation must be maintained, regardless of mounting or orientation.

2.4 Wire Sizing

Care must be taken to properly size all conductors for the input and output of the power supply. Table 2.4-1 gives *minimum* recommended wire size for different current levels and operating temperatures. This table is derived from the National Electrical Code and is for reference only. Local laws and conditions may have different requirements. The table is for copper wire only.

Table 2.4-1 Minimum Wire Size Table

COPPER WIRE CURRENT CAPACITY Single wire in open air, ambient temperature 86°F			
Ampacities of Wire Types (w/ Temp Rating) @ 0-2000 Volts			
Wire Size AWG	TW UF (140°F)	FEPW, RH, RHW, THW, THWN, ZW, THHW, XHHW (167°F)	USE-2, XHH, XHHW, -2, TA, TBS, SA, SIS, FEP MI, RHW-2, THHN, ZW-2, THWN-2, FEPB, RHH, THHW, THW-2 (194°F)
0000	300	360	405
000	260	310	350
00	225	265	300
0	195	230	260
1	165	195	220
2	140	170	190
3	120	145	165
4	105	125	140

Ambient Ampacity Correction for above Wire types			
Temp °F	140 °F	167 °F	194 °F
96-104	0.82	0.88	0.91
105-113	0.71	0.82	0.87
114-122	0.58	0.75	0.82
123-131	0.41	0.67	0.76
132-140	- - -	0.58	0.71
141-158	- - -	0.35	0.58
159-176	- - -	- - -	0.41

2.5 Outline Drawings

Figure 2.5-1 shows the outline drawing for the T3000 power supply.

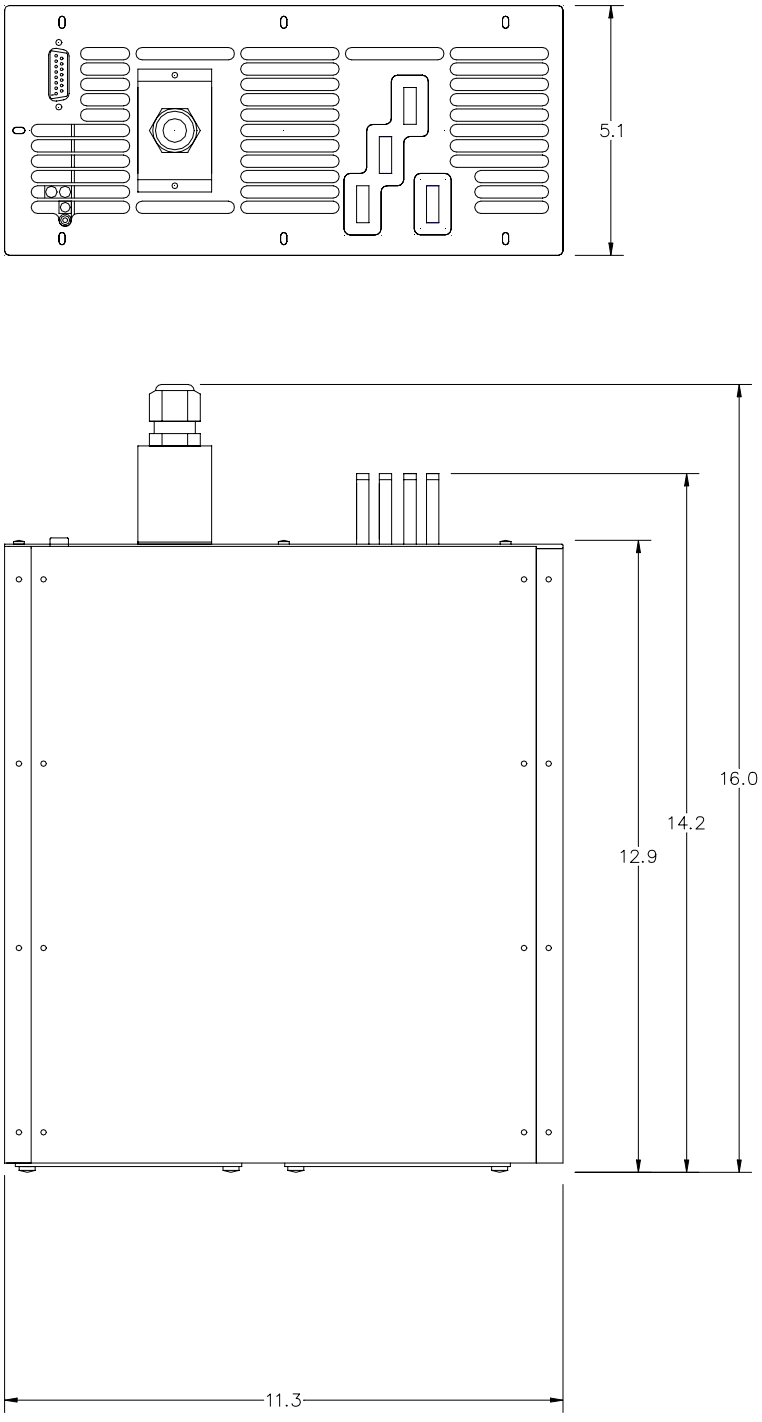


Figure 2.5-1 T3000 Case Outline Drawing

Section 3

Operating Instructions

3.1 Controls and Indicators

The T3000 has been designed with few user interface requirements, since primary usage will be in conjunction with the Sycon RS3000 controller and/or rate deposition controllers, such as the Sycon STC200 or STC2000. Stand-alone usage is also permissible and only requires a user supplied control voltage, 0 to +10 Volts, on J1 pin 7 with ground return on pins 3 and 11 and a external on/off switch between pins 13 and 11 on J1. The power supply has three LEDs which monitor operation, and a user accessible reset button to reestablish output power after fault removal. These items are beneficial for monitoring power supply operation in any usage configuration. The T3000 also has a Series/Parallel Mode Switch which is intended for use only in conjunction with the RS3000. These functions are delineated in Table 3.1-1.

Table 3.1-1 T3000 Indicator and Control Description

Indicator or Control Item	Usage Description
Green LED: Power Indicator	Blinks at a regular rate to indicate AC line power is ON and the supply is in a standby mode. When load power is enabled, by shorting J1-pin 13 to pin 3 or 11, the supply is in the active state and the LED emits a constant glow, provided no faults exist.
Red LED: Over-Temperature Fault	This LED will glow steadily when power supply internal temperatures are excessive, causing a safety shutdown of output power. (A primary cause could be airflow blockage due to improper installation of the power supply in the user environment). The LEDs will blink at a constant rate when the internal temperature has cooled to a safe operating point. The reset button can then restore T3000 operation.
Red LED: Open load condition	This LED will glow steadily when the load connection is open, a condition that causes the power supply to automatically shutdown.
Reset Button Switch: Primarily intended to allow recovery after an internal temperature fault	After cool-down, output power to the load can be reestablished with the reset button. It can also be used to verify the open load condition by attempting to recycle power to the load.
Series / Parallel Mode Switch: Intended for use only in conjunction with the RS3000	The position of this switch must be manually set to match the output configuration of the T3000. Switch position is decoded by the RS3000 Controller to set correct scale factors for each mode.

In addition, after AC line voltage is turned on, the green LED and the red over-temperature LED will blink sequentially once per second for eight seconds. The unique series of red and green blinks correspond to identify the version of firmware programmed in the unit. For example, a blinking sequence of R,R,R,R,R,R,G,G defines a particular firmware code. Sycon technical support

personnel may request this information, when service calls are made to the factory.

Table 3.1-2 summarizes the different modes associated with the three LED's.

Table 3.1-2 T3000 LED Mode Indication Summary

Start-up Timing Seconds	Power ON Indicator Green LED	Internal Over Temperature Red LED	Open Load Condition Red LED	Condition
0 to 1	Steady Glow	Steady Glow	Steady Glow	LED Checkout
1 to 9	Blink in sequence per version code		Steady Glow	Denotes Firmware Version
After Start Sequence is completed	Blink once/sec	Dark	Dark	Ready for output power Enable
	Steady Glow	Dark	Dark	Output Power Enabled - Operational
	Blink once/sec	Dark	Steady Glow	Open Load; Output Power Inhibited
	Blink once/sec	Steady Glow	Dark	Over Temp; Output Power Inhibited
	Blink once/sec	Blinks twice/sec	Dark	Cooled down; Ready for reset

Figure 3.1-1 shows the location of the three LEDs and push-button reset switch on the rear panel of the T3000.

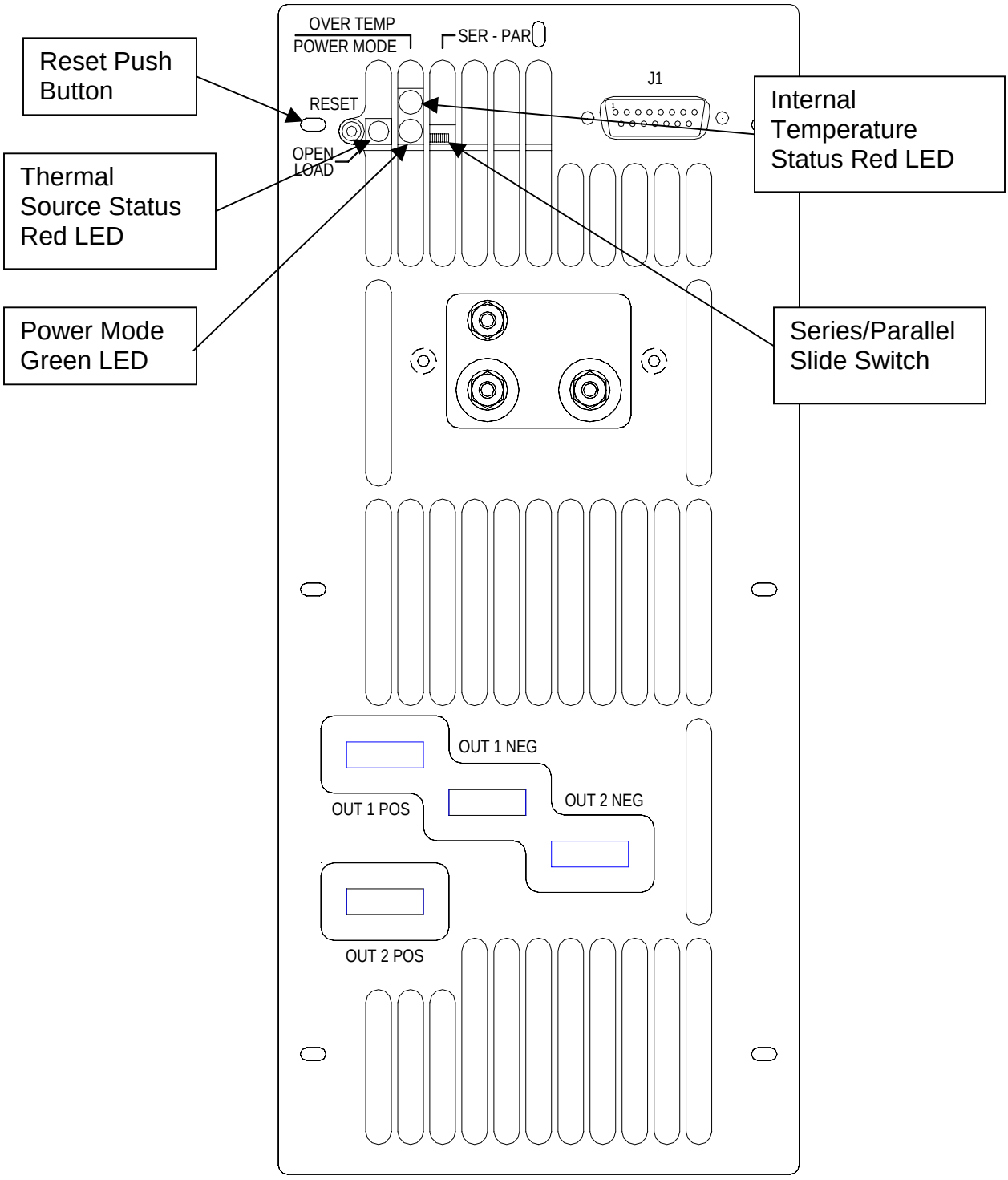


Figure 3.1-1 LED and Reset Button Location: Back Panel View

3.2 Basic Operation

The T3000 can be used in several control configurations as depicted by the block diagrams of Figure 3.2-1.

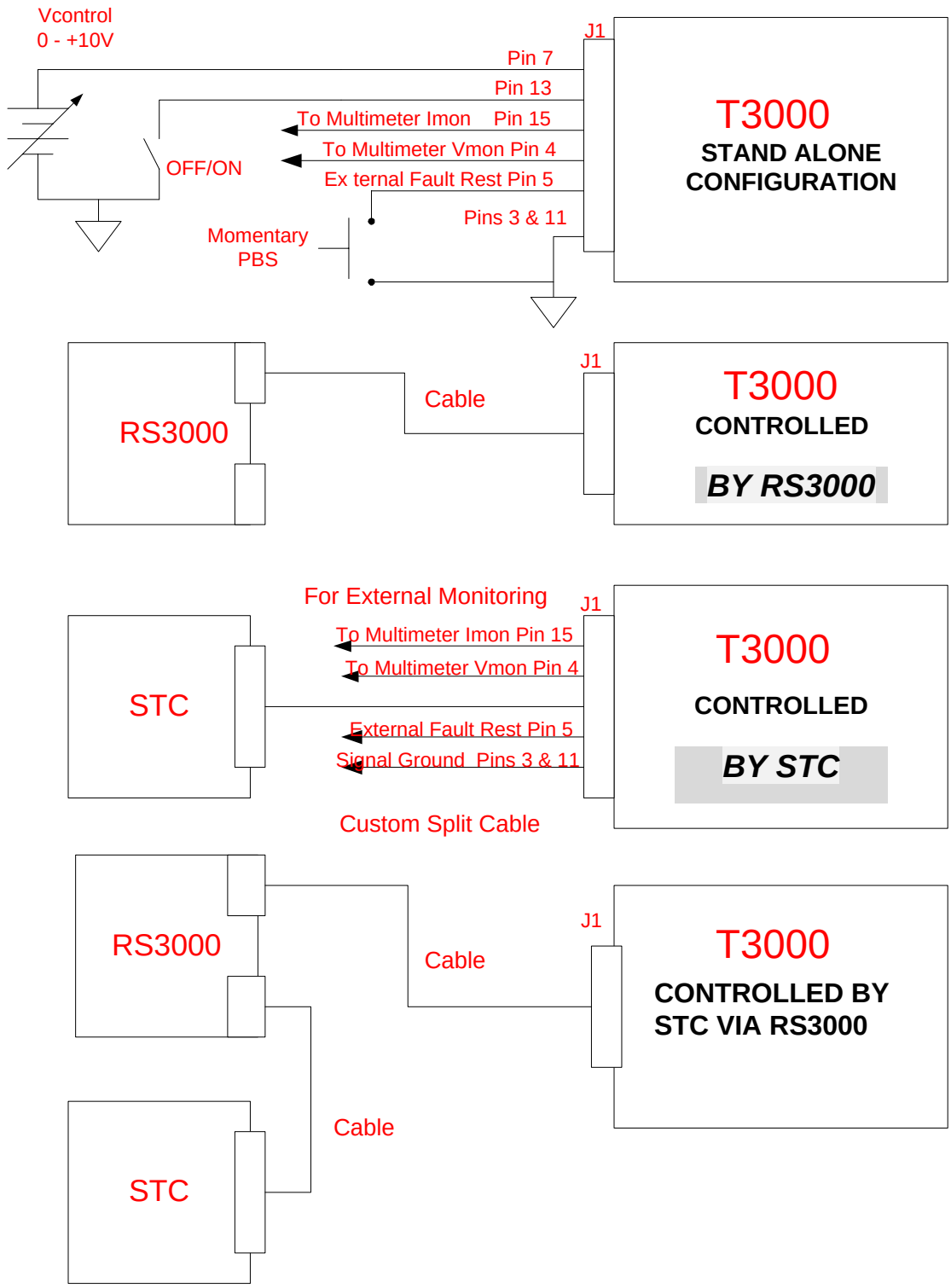


Figure 3.2-1 Various Methods For Controlling The T3000 Power Supply

Table 3.2-1 shows the function of each pin for connector J1 where control and monitor signals interface with the unit.

Table 3.2-1 T3000 Connector J1 Pin Assignments

PIN NUMBER	PIN FUNCTION
1	Open Boat Output High
2	+5 VDC Out
3	Signal Ground
4	Output Voltage Monitor 1VDC = 1.5VRMS
5	External Reset
6	No Connection
7	Current Set Point Control Voltage
8	No Connection
9	Over Temperature Output High
10	+5 VDC
11	Signal Ground
12	+ 12 VDC Out
13	Output Load Power On When Low
14	Series / Parallel Select
15	Current Monitor 1VDC =100ARMS Parallel; 50ARMS Series

Figure 3.2-1 shows the rudiments for controlling the T3000 output current via connections to J1. Table 3.2-1 shows other signals that are useful in the stand-alone configuration if it is desired to monitor output levels. For example, the DC voltage between pin 15 and ground (pins 3 and 11) is proportional to output RMS current in the load. For the parallel output connection the scale factor is 1 VDC equals 100 ARMS, and for the series-connected output, 1VDC equals 50 ARMS in the load. Similarly, the output voltage can be monitored at pin 4 where the scale factor is set to 1 VDC equals 1.5 VRMS across the output terminals. For example, to set the output current to 300 ARMS for a parallel load connection, the ON/OFF switch is set to the shorted position and the control voltage input on pin 7 is slowly adjusted until the pin 15 voltage is equal to 3 VDC, which corresponds to an output current of 300 ARMS into the load.

Operation of the T3000 with the RS3000 controller is covered in Section 4 of this manual. Use with a rate deposition controller, such as the STC200 or STC2000, is covered in manuals for those products. Note that the auxiliary monitor signals are available on connector J1 when used with a rate controller, but a custom cable would be required to split off the desired signals (see Figure 3.2-1). For applications requiring rate control, it is recommended that an RS3000 be used in conjunction with the rate deposition controller as it provides monitoring of set points, output power, temperature and open load faults, and provides a compatible interface to the T3000.

Section 4

Use of the T3000 with the RS-3000

4.1 Introduction

This chapter contains information on operating the T3000 power supply using an RS-3000 controller. The RS-3000 functions as a user interface for the T3000, and supplies the control voltages needed to operate the T3000. The RS-3000 also displays system faults with a combination of text messages on the displays, and/or indicator LEDs.

The RS-3000 can be controlled from the front panel, with a hand controller (or pendant), or via the back-panel RS-232 connection.

Programmable parameters include: Maximum current, current ramp time, ramp current, and beeper control.

For uses requiring PID control loop capability, a remote control unit (such as the STC-2000) can be connected to the RS-3000.

For operation of the T3000 and RS-3000 using a PC connected to the RS-232 port, see the RS-3000 manual.

4.2 Description

Dimensions: The RS-3000 is 3 $^{7/8}$ inches wide by 3 $^{3/4}$ inches high by 5 $^{5/8}$ inches deep. The unit is rack mountable next to the T3000 power supply.

Keys: There are six front panel keys used to program, change modes, and start or stop the unit.

STOP: Used to abort the current operation (switch the T3000 power output to zero) from Ramp, Manual or Remote mode.
START: Used to start Ramp mode or to switch from Ramp mode to Manual mode.
PRGM: Used to enter Program mode, step through the programmable parameters, and exit Program mode.
RMT: Used to toggle between Remote and Manual modes.
INC: Used to increase the value of the maximum current, ramp time (minutes) or ramp current, toggle the beeper on or off, and select baud rate.
DEC: Used to decrease the value of the maximum current, ramp time (minutes) or ramp current, toggle the beeper on or off, and select baud rate.

Displays: There are two 3-character displays. The larger display can show mode (such as “Off” or “Err”), ramp current, and current. The smaller display can show minutes and kilowatts. Error messages are shown on the smaller display.

Indicators: There are nine LED-illuminated indicators. Some indicators show the mode status:

PRGM (for program mode),
RMT (for remote mode), and
MAN (for manual mode).
CUR and MAX illuminated: Large display shows maximum current in Amps.
RAMP and MIN illuminated: Small display shows ramp time in minutes
RAMP and CUR illuminated: Large display shows ramp current in Amps.
Kw illuminated: Small display shows power output in kilowatts
INTERLOCK illuminated: There is a problem with the safety interlock that must be resolved in order to operate the T3000 power supply.

Hand Controller/Pendant: A pendant may be attached to the RS-3000 front panel. The pendant comes with a six foot long coiled cord. The pendant provides three keys for control of the unit: **INC**, **DEC** and **STOP**.

Interconnect Cables: A cable is provided to connect the RS-3000 to the T3000, using the 15-pin D-Sub connectors on the units. Additional cables are available to connect the RS-3000 to a Sycon controller or a PC.

Figure 4.2-2: RS-3000 Front Panel

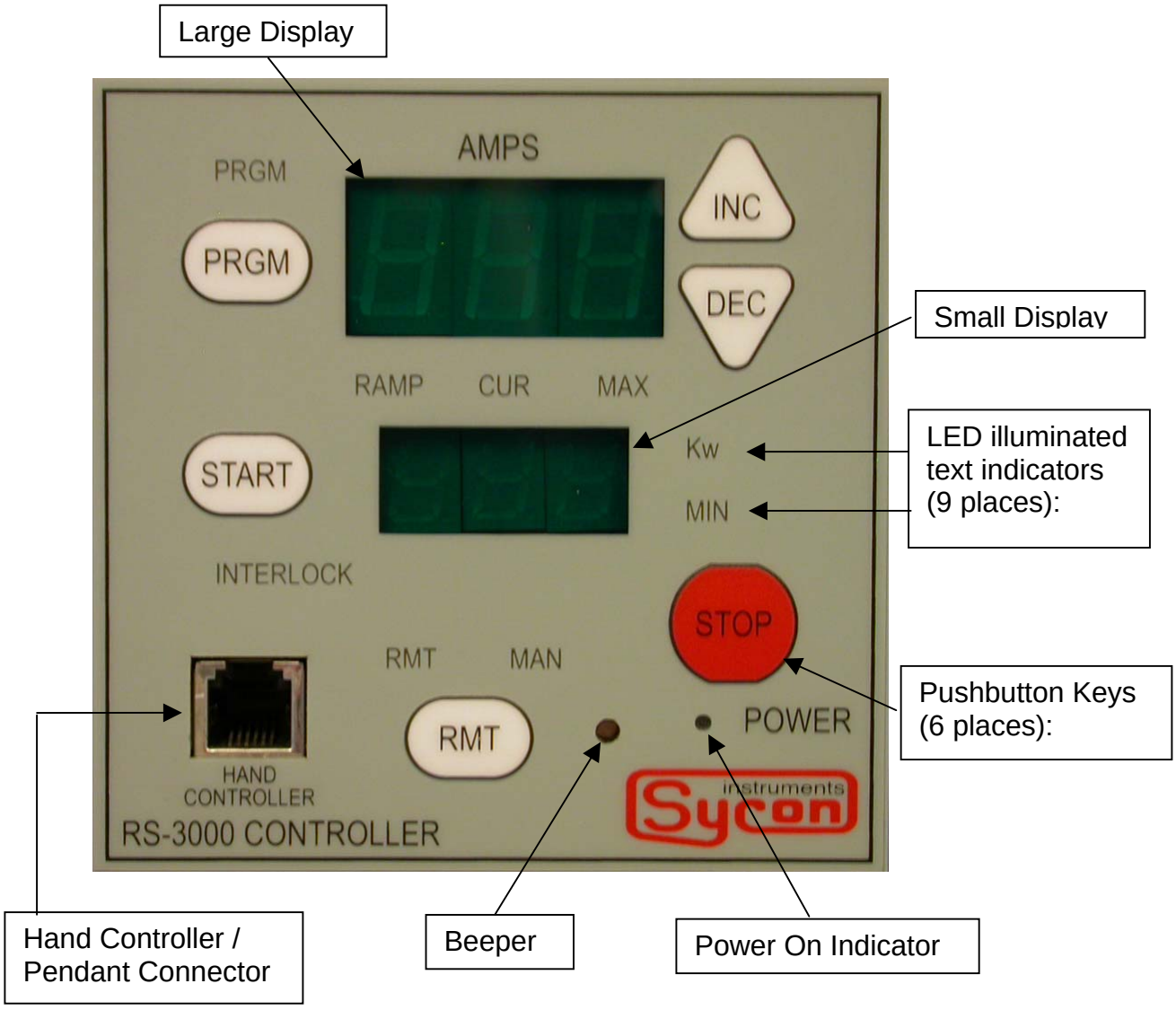
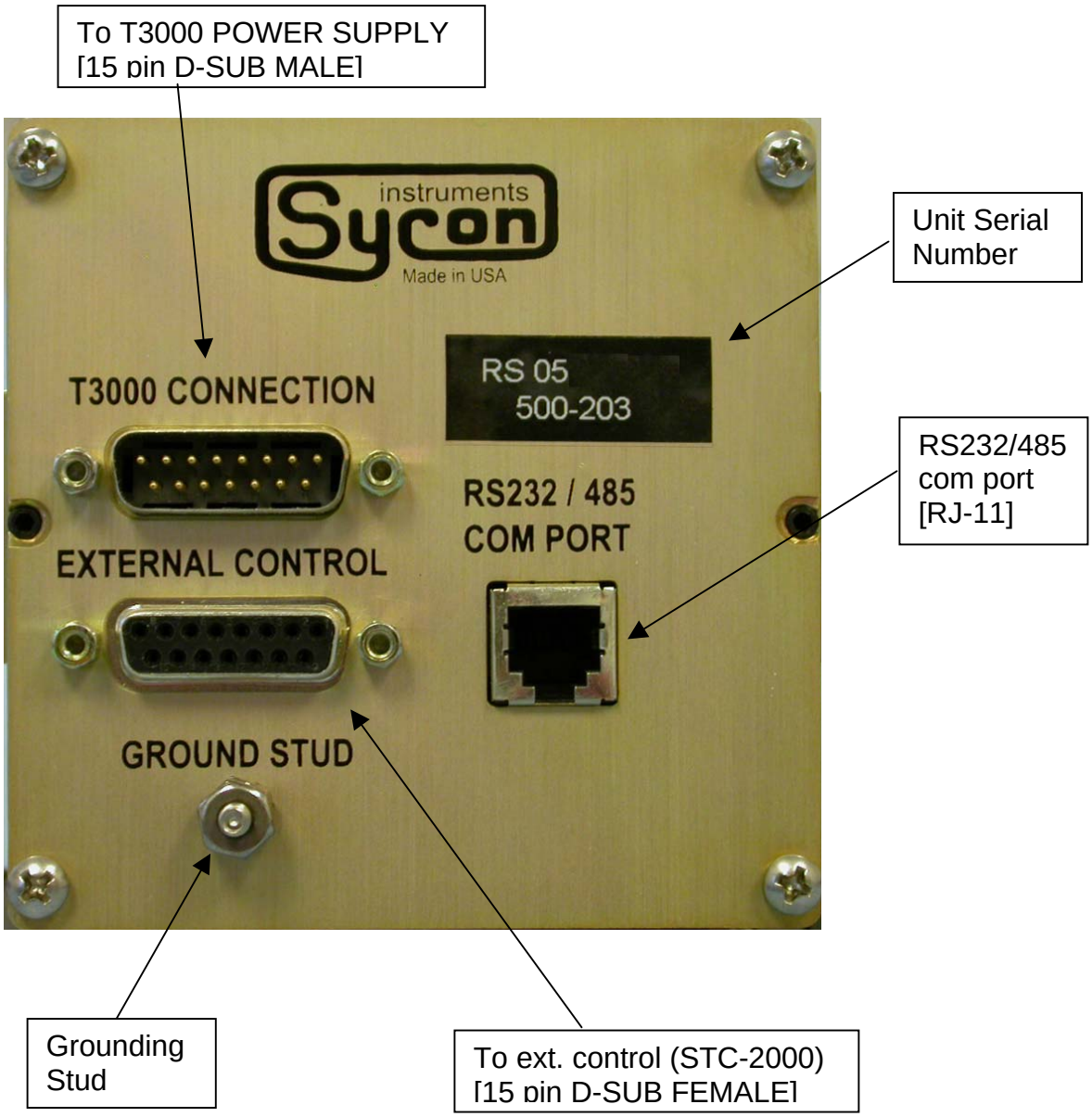


Figure 4.2-2 RS-3000 Back Panel



4.3 Basic Operation

Program Mode: The Program mode is used to program the parameters of the RS-3000. Press the **PRGM** key to enter the programmable parameter sequence. The **PRGM** LED will illuminate and flash while the RS-3000 is in Program mode.

Use the **INC** and **DEC** keys to adjust values for each parameter. Step through the parameters by pressing the **PRGM** key.

Current Maximum: Use the **INC** and **DEC** keys to adjust the maximum current value within a range of 0-600 Amps for parallel-wired outputs or 0-300 Amps for series-wired outputs.

Ramp Minutes: Use the **INC** and **DEC** keys to adjust the ramp time value within a range of 0.0-99.9 minutes.

Ramp Current: Use the **INC** and **DEC** keys to adjust the ramp current value within a range of 0-600 Amps for parallel-wired outputs or 0-300 Amps for series-wired outputs.

Beeper: Use the **INC** and **DEC** keys to toggle the beeper on or off.

Host Communication Baud Rate: Adjustments to this parameter are needed only if the RS-3000 is controlled using a PC. See the RS-3000 manual for further information.

Ramp Mode: The Ramp mode is used to ramp the power supply current up from zero to a preset level, and then hold at that level. Ramp mode is selected by entering a non-zero time in the “Ramp Minutes” parameter.

When the RS-3000 is running in Ramp mode, the small display shows time remaining, which counts down to zero, alternately with power supply output (in kilowatts.) The **Kw** indicator illuminates while the power value is displayed, and the **MIN** indicator illuminates while the time-remaining value is displayed. The large display shows ramp current.

When the RS-3000 finishes ramping it will automatically switch to Manual mode and maintain the current level until the **STOP** key is pressed. When Manual mode begins, the small display will switch to show time elapsed (counting up from zero).

The process may be stopped during Ramp or Manual mode by pressing the **STOP** key.

Manual Mode: The Manual mode allows manual control of the current level via the **INC** and **DEC** keys. Manual mode will be entered and the **MAN** LED indicator will illuminate when the **Start** key is pressed, if the value of the Ramp Minutes parameter is zero.

When the RS-3000 is running in Manual mode, the large display shows current in Amps. The small display shows time elapsed since the **Start** key was pressed alternately with

power supply output (in kilowatts.) The **Kw** indicator illuminates while the power value is displayed, and the **MIN** indicator illuminates while the elapsed-time value is displayed.

The process may be stopped during Manual mode by pressing the **STOP** key.

Remote Mode: The Remote mode allows control of the power supply output via a remote controller such as the Sycon Instruments STC-2000. See the RS-3000 manual for further information.

4.4 Error Conditions

The following messages and error indications may appear on the front panel of the RS-3000:

"**Interlock**" LED illuminated on front panel: This indicates that a problem exists with the interlock system which must be resolved before the T3000 cam be operated.

"**Err**" and "**Opn**" present on front panel displays: This indicates that an open boat condition exists which must be resolved before the T3000 can be operated.

"**Err**" and "**Hot**" present on front panel displays: This indicates that the T3000 power supply has overheated, and must cool before it can be operated.

"**Err**" and "**PrG**" present on front panel displays: This indicates a memory error, which can be cleared by pressing the "PGRM" key.

"**MAX**" LED indicator illuminated: This indicates that the output current has reached the maximum value.

Section 5

Calibration

5.1 Instructions

The T3000 power supply and companion RS3000 controller come factory-adjusted, and there is no user calibration required. If the unit fails to perform to specification, it must be returned to the factory for repair and/or adjustment.

NOTICE
Unauthorized adjustment of internal circuits will invalidate product warranty.

Section 6

Maintenance

6.1 Introduction

This chapter contains preventive maintenance information for the T3000.

WARNING

All maintenance that requires removal of the cover of the unit should only be done by properly trained and qualified personnel. Hazardous voltages exist inside the unit. Disconnect the supply from the input power before performing any maintenance. Service, fuse verification, and connection of wiring to the chassis must be accomplished at least five minutes after power has been removed via external means. All circuits and/or terminals to be touched must be safety grounded to the chassis.

6.2 Preventive Maintenance

Preventive maintenance for the T3000 consists of scheduled inspection and cleaning.

1. Schedule: Table 6-1 lists the preventive maintenance routines and the recommended performance intervals.
2. Inspection: Table 6-2 lists the visual inspection checks to be performed. It also indicates the corrective action to be taken.

Table 6-1 Preventive Maintenance Schedule

PREVENTIVE MAINTENANCE ROUTINE	RECOMMENDED PERFORMANCE INTERVAL
Inspection	Annual
Cleaning	As required

Table 6-2 Inspection and Corrective Action

ITEM	INSPECT FOR	CORRECTIVE ACTION
Connector plugs and buss bars	Loose, bent or corroded contacts and buss bars. Damage or improper seating in mating connector.	Clean contacts and buss bars with solvent moistened cloth, soft bristle brush, small vacuum or low compressed air.
Chassis, fans & extruded heatsinks	Dirt and corrosion	Replace damaged or corroded connectors.
External electrical wiring	Broken, burned or pinched wire. Frayed, worn or missing insulation	Clean with cloth moistened with soapy water.
External solder connections	Corrosion, loose, cracked, or dirty connections	Repair or replace defective wires.
Dirt and moisture buildup	Short circuits, arcing, corrosion, overheating	Clean and resolder connections.
T3000 enclosure	Dirt and corrosion	Clean as required with cloth moistened with soapy water.

6.3 Fuses

WARNING

Only properly trained and qualified personnel should remove the cover from the power supply. Service, fuse verification, and connection of wiring to the chassis must be accomplished at least five minutes after power has been removed via external means; all circuits and/or terminals to be touched must be safety grounded to the chassis.

The T3000 contain two time-delay ceramic ferrule fuses, F1 and F2, which have a current rating of 25 Amps and a voltage rating of 250 Volts. Use Cooper Bussmann type MDA-25A-R or equivalent.

Section 7

T3000 Configurations

This section provides a procedure for operation of the T3000 in various configurations. Please refer to the system diagram in Section 2.1-1.

7.1 T3000 Stand-Alone Configuration

1) Verify that the AC input power is disabled.

2) Connect the AC-In power cable to the T3000 as shown in Figure 2.2-1.

3) Connect the output buss bars for the desired configuration, series or parallel, as per Figures 2.2-3 or 2.2-4.

4) Connect the control cable to J1 as shown in Figure 3.2-1. (Note: Voltages measured on pins 5 and 14 are used as monitor points.)

5) Apply the AC power. The green LED should now “blink” indicating that AC power is applied to the T3000.

6) With 0 V applied to pin 7 of J1, close the Off/On switch. The green LED should now be on in a steady state which indicates that the T3000 is ready to supply current to the load.

7) Gradually apply the desired input voltage, 0 to +10 V, to pin 7 of J1. (Note: For the series mode, 1 volt in = 50 ARMS out while 1 volt in = 100 ARMS out for the parallel mode.)

8) When the operation is complete, turn off current to the load by opening the “On/Off” switch and apply 0 volts to pin 7 of J1. (Note: The operation can also be terminated by applying 0 volts to pin 7 and then opening the “On/Off” switch.

7.2 T3000 Controlled by RS3000

1) Verify that the AC input power is disabled.

2) Connect the AC-In power cable to the T3000 as shown in Figure 2.2-1.

3) Connect the output buss bars for the desired configuration, series or parallel, as per Figures 2.2-3 or 2.2-4.

4) Position the SER-PAR slide switch to coincide with the output buss bar configuration. (Note: Switch positioned to the left is for the Series configuration while switch positioned to the right is for the Parallel configuration,)

5) Connect the control cable to J1 as shown in Figure 3.2-1.

6) Verify that all of the interlocks to the RS300 are satisfied.

7) Apply the AC power. The green LED should now “blink” indicating that AC power is applied to the T3000.

8) Apply appropriate input parameters to the RS3000 as described in Section 7 and depress the Start control of the RS300. The green LED should now be on in a steady state mode that indicates that the T3000 is ready to supply current to the load. (Note: The RS3000 can be operated in the programmed or manual mode.) Refer to Section 7.X for description of RS3000 displays.

7.3 T3000 Controlled by STC

1) Verify that the AC input power is disabled.

2) Connect the AC-In power cable to the T3000 as shown in Figure 2.2-1.

3) Connect the output buss bars for the desired configuration, series or parallel, as per Figures 2.2-3 or 2.2-4.

4) Connect the control cable to J1 as shown in Figure 3.2-1. (Note: A custom split cable is required if voltages measured on pins 5 and 14 are used as monitor points.)

5) Apply the AC power. The green LED should now “blink” indicating that AC power is applied to the T3000.

6) Apply appropriate input parameters to the STC200 or STC2000, as described in their respective manuals, and start the process. The green LED should now be on in a steady state mode, indicating that the T3000 is ready to supply current to the load. (Note: Set STC output for the 0 to +10 V range).

7.4 T3000 Controlled by STC via RS3000

1) Verify that the AC input power is disabled.

2) Connect the AC-In power cable to the T3000 as shown in Figure 2.2-1.

3) Connect the output buss bars for the desired configuration (Series or Parallel), per Figures 2.2-3 or 2.2-4.

4) Position the SER-PAR slide switch to coincide with the output buss bar configuration. (Note: Switch positioned to the left is for the Series configuration while switch positioned to the right is for the Parallel configuration,)

5) Connect the control cable from the RS3000 to J1 as shown in Figure 3.2-1.

6) Connect the cable from the STC output to JX of the RS3000.

7) Apply the AC power. The green LED should now “blink” indicating that AC power is applied to the T3000.

8) Apply appropriate input parameters to the STC200 or STC2000, as described in their respective manuals, and start the process. The green LED should now be on in a steady state mode, indicating that the T3000 is ready to supply current to the load. (Note: Set STC output for the 0 to +10 V range).

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