RS-3000

Power Supply Controller

AMPS

PRGM

INC

DEC

RAMP   CUR   MAX

START

Kw

MIN

INTERLOCK

STOP

RMT   MAN

○

○ POWER

RMT

HAND
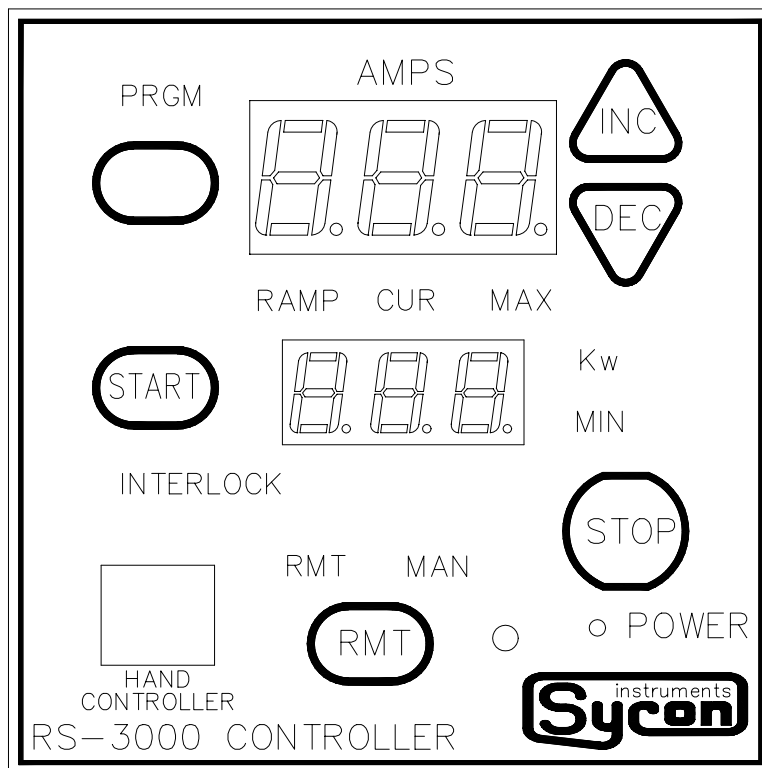CONTROLLER

Sycon instruments

RS–3000 CONTROLLER

User's Manual

Warranty

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.

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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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Description of Equipment

The RS-3000 functions as a user interface for the T3000 resistive power supply, and supplies the control voltages needed to operate the T3000. The RS-3000 also displays system faults in text message form or by 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, beeper control, and communication settings (mode, speed).

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

large 3 character display

small 3 character display

LED illuminated text indicators (9 places): PRGM, RAMP, CUR, MAX, Kw, MIN, INTERLOCK, RMT, MAN

Pushbutton Keys (6 places): PRGM, INC, DEC, START, RMT, STOP

HAND CONTROLLER / PENDANT CONNECTOR [RJ-11]

BEEPER

POWER ON INDICATOR

Figure 1-1   RS-3000 Front Panel

To T3000 POWER
SUPPLY
[15 pin D-SUB MALE]

RS232/485
com port
[RJ-11]

Grounding
Stud

To ext. control (STC-
2000)
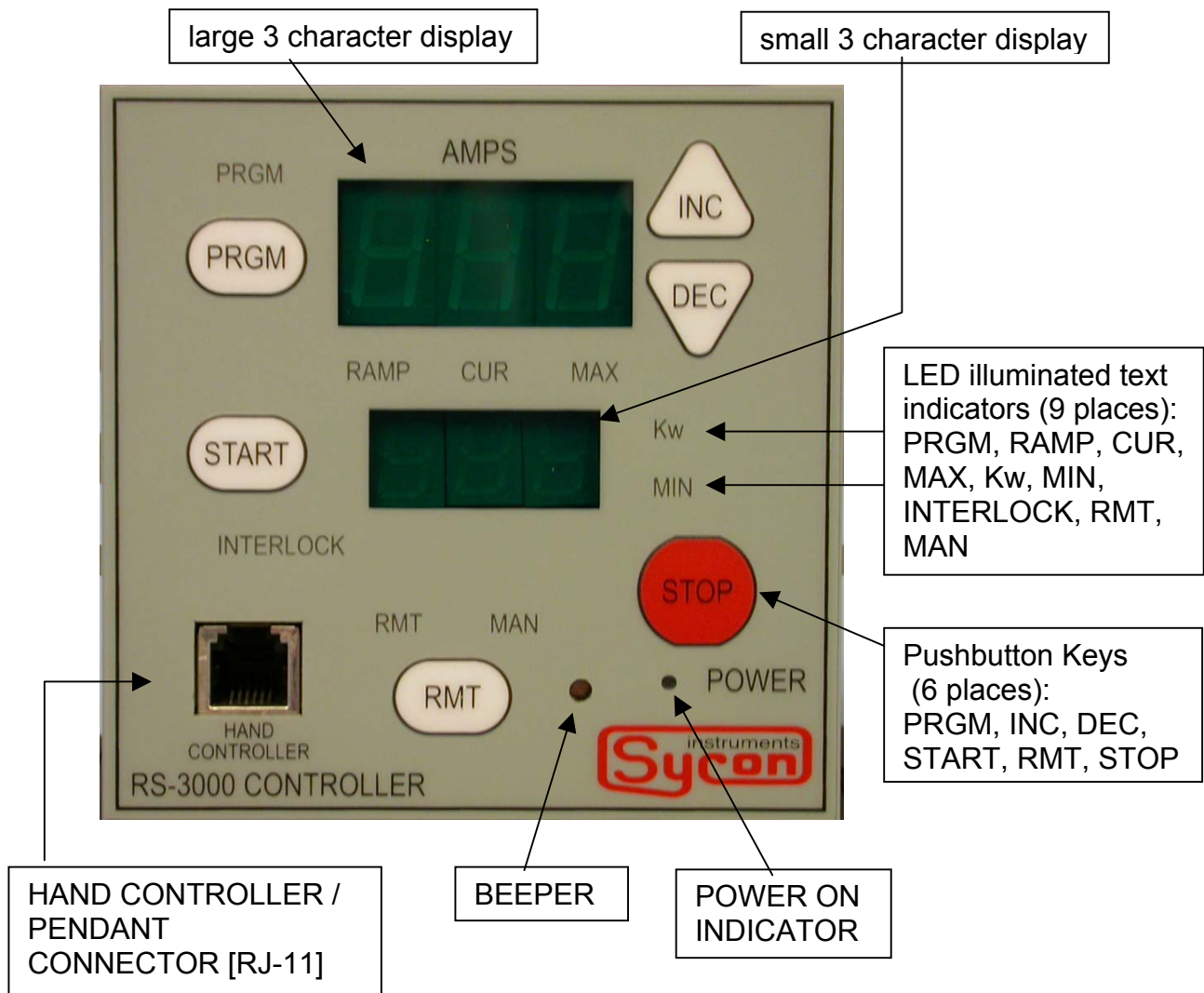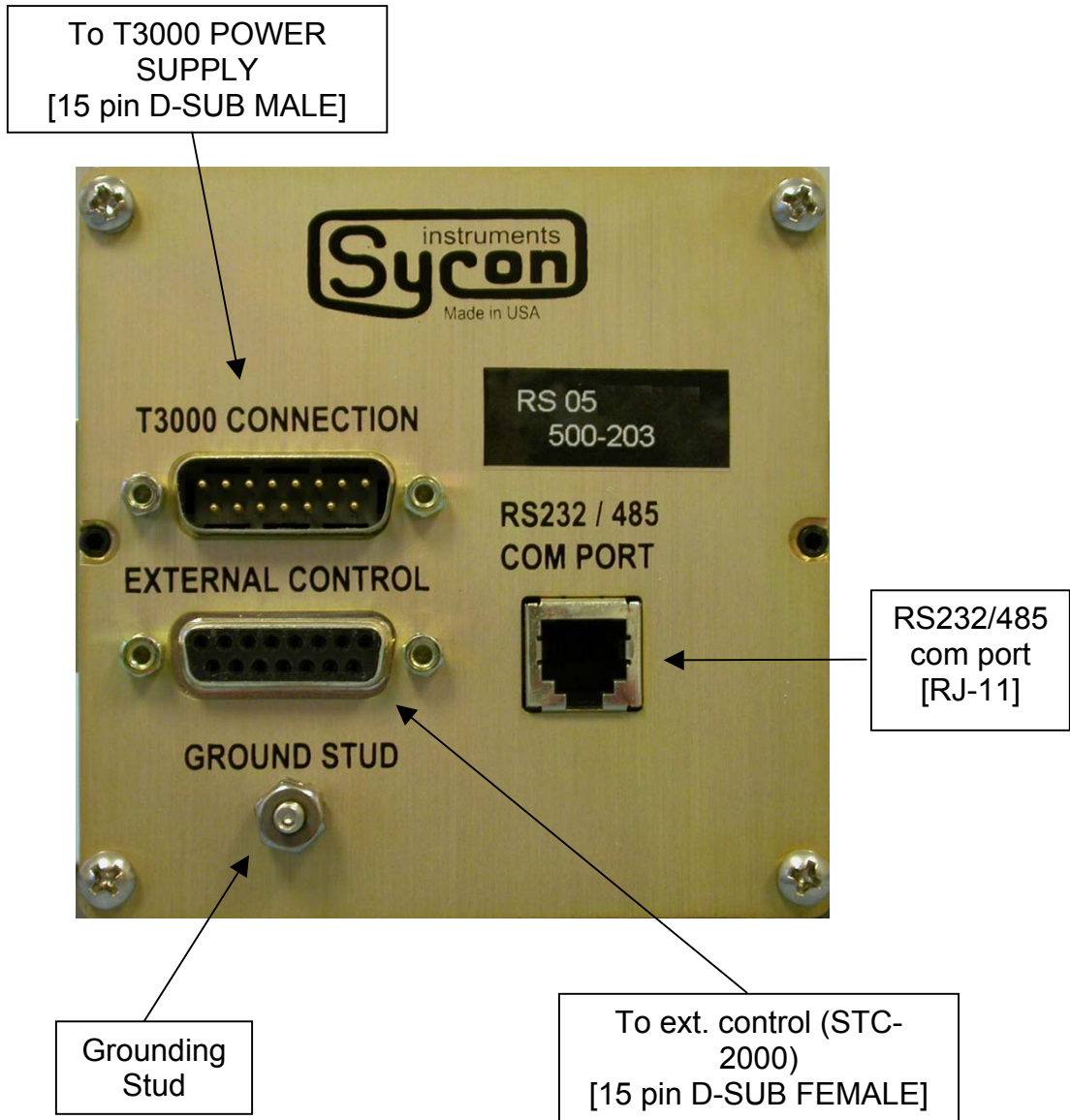[15 pin D-SUB FEMALE]

Figure 1-2   RS-3000 Back Panel

Connections

There is a **15 pin d-sub male** connector at the back of the unit that is used to connect to the T3000 power supply.

The RS-3000 is powered by the T3000 power supply.

There is a **15 pin d-sub female** connector at the back of the unit that is used to connect the RS-3000 unit to a more sophisticated control unit (such as the STC-2000).

There is a **6 pin modular** connector (RJ-11) at the **back** of the unit for RS232/485 communication. This allows remote control of the RS-3000 by a PC.

There is a **6 pin modular** connector (RJ-11) at the **front** of the unit for a hand controller. The standard hand controller cord length is 6 feet when the coiled cord is fully extended.

Front Panel Interface

There are **6 front panel keys** that are used to program the unit, change modes, and start/stop the unit.

There are two **3 character displays**.
The **larger display** is located near the top of the front panel.
The **smaller display** is located near the center of the front panel.

The **larger display** can show: mode (such as O.F.F. or Err), ramp current, and current.
  If problems occur, an **Err**or message is indicated by the letters Err appearing in the larger display.
  In program mode (current or new values can be seen or set): max current, ramp current, beeper [on/off], speed, and address.

The **smaller display** can show: minutes and kilowatts
  If problems occur, an error message is shown on the smaller display.
  Examples are: Opn (for open boat) or Hot (for power supply over temperature condition).
  In program mode (existing or new values can be seen or set): ramp minutes, [beeper] on/off, etc.

There are **9 LED illuminated indicators**. Some indicators show the mode status: **PRGM** (for program mode), **RMT** (for remote mode), and **MAN** (for manual mode). Other indicators are associated with and show the value type of the data shown on the displays. For example, with the first press of the program key (PRGM) the large display shows a value, and the CUR and MAX LED indicators are illuminated. This indicates that the value shown on the large display is the *maximum current*. With the second press of the program

key (PRGM) the large display is blanked while the small display shows a value. The LED indicators that are illuminated now include the RAMP and MIN LEDs. This indicates that the value shown on the small display is the *ramp minutes*. With the third press of the program key (PRGM) the small display is blanked while the large display shows a value. The LED indicators that are illuminated now include the RAMP and CUR LEDs. This indicates that the value shown on the large display is the *ramp current*. In these cases, the INC and DEC keys are used to set the values as needed. The program (PRGM) key sequences through the programmable elements with each subsequent press until all elements have been shown. In the programming mode, the program mode LED is illuminated and flashing. When the program mode LED turns off the last of the programmable elements is no longer shown and displays revert to the mode context from which the program mode was launched.

Specifics

3.1   Program mode

Press **PGRM key** to enter the programmable parameter sequence.
The **PGRM LED** illuminates and flashes to indicate activity within the programming mode.
All programmable elements are modified by pressing the **INC** and **DEC** keys.

Table 3-1   Programmable Elements

Programmable element	Where shown	LED indicators/display	Sequence element no.
maximum current	large display	CUR, MAX	1 (see descriptions below)
ramp minutes	small display	RAMP, MIN	2
ramp current	large display	RAMP, CUR	3
beeper (on/off)	small display	text *bpr* (large display)	4
comm. speed	small display	text *Spd* (large)	5
address	small display	text *Adr* (large)	6

Maximum current: The INC/DEC keys increment and decrement through a sequence of number values in the range of 0-600 Amps (parallel wired outputs) or 0-300 Amps (series wired outputs).

Ramp minutes: The INC/DEC keys increment and decrement through a sequence of number values in the range of 0.0-99.9 minutes.

Ramp current: The INC/DEC keys increment and decrement through a sequence of number values in the range of 0-600 Amps (parallel wired outputs) or 0-300 Amps (series wired outputs).

Beeper on/off: The INC/DEC keys toggle between the values of on and off.

Communication speed: The INC/DEC keys increment and decrement through a sequence of number values: 9600 baud, 38400 baud, and 115000 baud.

Address: The INC/DEC keys increment and decrement through a sequence of number values in the range of 0-9. RS232 is address 0 (hex address 0X10), and RS485 are addresses 1-9 (hex addresses X52 – X5A).

All of the above elements are saved in non-volatile memory. To purge and set NV memory to factory default values, press PRGM/DEC/RMT keys on power up (text message appears to indicate default successful).

3.2   Manual mode

Whether the RS-3000 is in *manual mode* or *ramp mode* is determined by the programmable value of *ramp minutes*. If *ramp minutes* is at zero, that is, 0.0, then *manual*

mode will be entered when the start key is pressed. This is confirmed by the illumination of the MAN LED indicator.

In the manual mode, the AMPS value shown in the large display can be varied using the INC and DEC keys on the front panel or pendant. The AMPS value displayed is the basis for what is requested from the power supply. Meanwhile, the small display alternately shows Kilowatts and minutes. The Kilowatts value is the power being expended at the supply output. The time value is the elapsed time from the press of the start key. The Kilowatts and time values are differentiated by the illumination of either the Kw or MIN LEDs. Pressing the stop key ends the manual mode which is confirmed by the display of the text O.F.F. in the large display. The pendant stop key is equivalent to the front panel stop key. Pressing the stop key places the RS-3000 into a quiescent state where the power output ON/OFF signal to the T3000 is set to OFF (see section 10.1, pin 13) and the RS-3000 analog output to control the T3000 power output is set to zero (see section 10.1, pin 7).

3.3   Ramp mode

Whether the RS-3000 is in *manual mode* or *ramp mode* is determined by the value of *ramp minutes*. If *ramp minutes* is at a non-zero value, that is, any value but 0.0, then *ramp mode* will be entered when the start key is pressed. This is confirmed by the fact that the MIN value is counting down and that the MAN LED is not illuminated. Ramp mode does not have a specific LED indicator.

In the ramp mode, the AMPS value shown in the large display changes based on the programmed values of ramp current and ramp minutes. The AMPS value displayed is the basis for what is requested from the power supply. Meanwhile, the small display alternately shows Kilowatts and minutes. The Kilowatts value is the power being expended at the supply output. The time value is the remaining time until ramping terminates at the desired current. The Kilowatts and time values are differentiated by the illumination of either the Kw or MIN LEDs. Pressing the stop key ends the ramp mode which is confirmed by the display of the text O.F.F. in the large display. If the stop key is not pressed, the MINutes value will count down to zero (while the power ramps up to the programmed value) and then the unit will automatically go into the manual mode after zero minutes remaining has been achieved. When in the manual mode the MINutes time will advance indefinitely at the last power level set during the ramp mode.

Pressing the stop key during the RAMP mode or in the subsequent Manual mode, places the RS-3000 into a quiescent state where the power output ON/OFF signal to the T3000 is set to OFF (see section 10.1, pin 13) and the RS-3000 analog output to control the T3000 power output is set to zero (see section 10.1, pin 7).

3.4   Remote mode

This mode uses a remote controller (such as the STC-2000) to control the power supply output.

Pressing the RMT key puts the unit into the remote mode. This is confirmed by the illumination of the RMT LED. Pressing the RMT key again takes the unit out of the remote

mode. During the remote mode, only Kilowatts and AMPS are shown. The stop key on the front panel or pendant can also be used to cancel the remote mode.
The connection to the RS-3000 from the remote controller is through a 15 pin female D-SUB connector on the back panel.

3.5   Error/problem Conditions

3.5.1 Interlock: is indicated by the illumination of the INTERLOCK LED on the front panel. This indicates that continuity of the interlock system is open. The T3000 power supply will not be controlled until this condition has been satisfied with a digital low or ground (see section 3.6.10.2, pin# 3).

3.5.2 Open boat: indicated on the large and small displays in terse text as Err Opn (error open). Indicates an open boat. This condition must be sensed after power is applied and therefore a reset on the power supply can take a while to re-sense the open boat condition. The T3000 power supply will not be controlled until this condition has been satisfied with a digital low or ground (see section 3.6.10.1, pin# 1).

3.5.3 Over temperature: indicated on large and small displays in terse text as Err Hot (error hot). Indicates an over temperature condition within the power supply. This condition is sensed immediately and will not allow a reset on the power supply to properly reset until the temperature has returned to a normal temperature range. The T3000 power supply will not be controlled until this condition has been satisfied with a digital low or ground (see section 3.6.10.1, pin# 9).

3.5.4 OOP: when indicated on both the large and small displays, this means that the system has encountered a microcontroller induced reset from which it has recovered. Condition indicates possible memory or microcontroller failures.

3.5.5 Err/PrG: indication for NV mem default due to error. This error condition can be cleared by pressing the PRGM key.

3.5.5 Current maximum: when the requested current reaches the maximum value, the MAX LED indicator blinks.

3.6   Hardware Specifics

3.6.1 Size:
3 $^{7/8}$ inches wide X 3 $^{3/4}$ inches high X 5 $^{5/8}$ inches deep.
Rack mountable next to the T3000 power supply

3.6.2 Weight:
1.1 pounds

3.6.3 Voltage / Current requirements:
800 mA (290 mA quiescent in O.F.F. mode) for +5 VDC,

2 mA for +12 VDC (use Sycon approved power supply only)

3.6.4 Beeper:
Audible (when enabled) in the 80-90 decibel range @ ~2.5 KHz

3.6.5 Case:
Aluminum with a grounding stud which is common to all connector shields. Shield/case ground is interconnected to RS-3000 digital ground within the product with a 1kΩ resistor.

3.6.6 Hand controller/pendant:
Has a 6 ft. coiled cord. Has an RJ-11 connector at one end and at the other end, a module having 3 keys for remote useage of front panel keys: INCrement(↑), DECrement (↓) and STOP. This assembly is supplied by Sycon Instruments. Connects to RJ-11 connector on the front panel.

3.6.7 Communications cable (optional):
A six ft. coiled cord terminated with an RJ-11 at one end (mates with RS-3000 back panel connector [RJ-11]) and a 9 pin female D-SUB at the other (RS232/485 port). This assembly is supplied by Sycon Instruments. Used to interconnect the RS-3000 control unit with an RS232/485 port such as, what may be found on a PC. Using communication software on the PC, the RS-3000 can be controlled as if by front panel controls and interrogated as if observing the displays and LEDS.

3.6.8 RS-3000/T3000 Interconnect cable:
A 3 ft. or 6 ft. cable assembly, wired straight-through (that is, pin 1 to pin 1, pin 2 to pin 2, etc.) terminated at the RS-3000 side with a 15 pin female D-sub and with a 15 pin male D-Sub connector at the T3000 side. This assembly is supplied by Sycon Instruments. It is used to interconnect the T3000 power supply and the RS-3000 control unit (*T3000 control* connector).

3.6.9 RS-3000/STC-2002 Interconnect cable:
A 6 ft. cable assembly terminated at the RS-3000 side with 15 pin male D-SUB connector and with a 15 pin female D-SUB connector on the T3000 side. It is interconnected from the RS-3000 *external control* connector to the STC-2000A/STC2002 *control outputs* connector.

3.6.10 Description of the RS-3000 I/O:

Table 3-2   Back-panel 15-pin D-sub Male Pin Descriptions

PIN NUMBER	DESCRIPTION of Connector Labeled *T3000 Control*	I/O direction
1	When this line is high, the RS-3000 will indicate an Open Boat failure	Input w/ pull-up
2	Along with pin 10, this line provides the RS-3000 with +5 VDC power	Input power
3	Along with pin 11, this line provides the RS-3000 with digital ground	Input power
4	Monitors the voltage output from the T3000 power supply (1 VDC = 1.5 VRMS)	Input
5	Alternative to T3000 Reset button (falling edge, not level sensitive)	Output w/ pull-up
6	For future use, not implemented in software.	Input
7	A control voltage from the RS-3000 used to set the output amperage of the T3000 (see note[1])	Output
8	Not connected	N. A.
9	When this line is high, the RS-3000 will indicate an Over Temperature failure	Input w/ pull-up
10	Along with pin 2, this line provides the RS-3000 with +5 VDC power	Input power
11	Along with pin 3, this line provides the RS-3000 with digital ground	Input power
12	This line provides the RS-3000 with +12 VDC power	Input power
13	A digital control voltage from the RS-3000 used to switch the T3000 power supply output ON (w/ a digital low) or OFF (w/ a digital high)	Output w/ pull-up
14	This line tells the RS-3000 how to interpret the T3000 data: as series wired or parallel wired. Digital high = series, digital low = parallel.	Input w/ pull-up
15	Monitors the amperage output of the T3000 (1 VDC = 100 Amps RMS when parallel wired / 50 Amps RMS when series wired	Input

Note[1]: 10 VDC = 600 AMPs parallel wired [or 300 AMPs series] and has a linear relationship down to zero except for a small value range between zero volts and a small fraction of a volt where AMPs will remain at zero.

Table 3-3   Back-panel 15-pin D-sub Female Pin Descriptions

PIN NUMBER	DESCRIPTION of Connector Labeled *External Control*	I/O Direction
1	Analog ground of the RS-3000 presented to remote controller (used with *Voltage control [pin #9]*)	ground pass thru
2	Along with pin 10, this line presents the RS-3000 digital ground to the remote controller	ground pass thru
3	Interlock status indication: grounded (to pin 2) or digital low = satisfied, open or digital high = interlock error (indicated by front panel LED)	Input w/ pull-up
4	Process abort (digital low = process abort)	Input w/ pull-up
5	Process START event (digital falling edge = START event)	Input w/ pull-up
6	Fault reset (digital falling edge = reset event)	Input w/ pull-up
7	Remote out (digital high = remote enabled)	Output w/ pull-up
8	Ready (digital high = ready enabled)	Output w/ pull-up
9	Voltage control (remote voltage control, via RS-3000, of the T3000)	Input
10	Along with pin 2, this line presents the RS-3000 digital ground to the remote controller	ground pass thru
11	Process timer reset (digital falling edge = reset event)	Input w/ pull-up
12	Process STOP event (digital falling edge = STOP event)	Input w/ pull-up
13	Remote/Local START mode	Input w/ pull-up
14	Busy (digital high = active)	Output w/ pull-up
15	Fault (digital high = active)	Output w/ pull-up

Section 4

Specifics

4.1   Events and modes

Various events cause mode changes. Events can include: elapsed time decremented to zero, amperage reaching a programmed value, an over-temperature condition, an open boat condition, loss of interlock continuity, or user interaction with front panel or pendant keys.

Following are specific events and their effects on the various modes.

Table 4-1   Manual Mode

Event	From	To	Description
START key	O.F.F. mode	MAN mode	Starts Manual mode if *user programmed* ramp minutes equals zero. MAN indicator is illuminated. The large display shows requested current from the T3000. The INC and DEC keys are used to change the requested value that is displayed. The pendant arrow keys provide this same function. The small display shows alternating minute and kilowatt values. Minute and kilowatt values can be differentiated by the illumination of the Kw and MIN indicators and by the position of the decimal point (x.xx=Kw format / xx.x=MIN format). In Manual mode, the time counts up, measuring elapsed time. Upon entry into the Manual mode, previous elapsed time values, if any, are reset to zero.
INC + DEC	MAN mode minutes > 0	MAN mode minutes = 0	Elapsed time can be reset to zero by pressing both the INC and DEC keys simultaneously. The pendant arrow keys provide this same function.
INC	MAN mode AMPs [*value*]	MAN mode AMPs [*value*]+1	Amperage requested can be incremented by pressing the INC key. The pendant arrow up key provides this same function. (Large display labeled AMPS)
DEC	MAN mode AMPs [*value*]	MAN mode AMPs [*value*]-1	Amperage requested can be decremented by pressing the DEC key. The pendant arrow down key provides this same function. (Large display labeled AMPS)
STOP	MAN mode	O.F.F. mode	Ends Manual mode. The pendant STOP key provides this same function.
err: open boat	MAN mode	O.F.F. mode	Error ends Manual mode.
err: hot	MAN mode	O.F.F. mode	Error ends Manual mode.
INTERLOCK	MAN mode	O.F.F. mode	Interlock at logical high ends Manual mode.

Table 4-2   Ramp Mode

Event	From	To	Description
START key	O.F.F. mode	RAMP mode	Starts Ramp mode if *user programmed* ramp minutes does **not** equal zero. The large display shows requested current from the T3000. The requested current value is based upon the user programmed values of *Ramp current* and *Ramp minutes*. The *Ramp current* is divided across the *Ramp minutes* and is distributed in a linear progression increasing from zero to the user programmed value of *Ramp current* just as the *Ramp minutes* value is reached. For example, at 25% of elapsed time, the current request will be at 25% of the programmed value of *Ramp current.* The small display shows alternating minute and kilowatt values. Minute and kilowatt values can be differentiated by the illumination of the Kw and MIN indicators and by the position of the decimal point (x.xx=Kw format / xx.x=MIN format). Upon entry into the Ramp mode, the time counts down from the user programmed value of *Ramp minutes*, measuring remaining time until zero is reached.
Ramp minutes=0	RAMP mode	MAN mode	Ends Ramp mode and automatically starts the Manual mode (see Manual mode START).
STOP key	RAMP mode	O.F.F. mode	Ends Ramp mode. The pendant STOP key provides this same function.
START key	RAMP mode	MAN mode	Ends Ramp mode and automatically starts the Manual mode (see Manual mode START) retaining the last current value held in the Ramp mode.
Err: open boat	RAMP mode	O.F.F. mode	Error ends RAMP mode.
Err: hot	"	O.F.F. mode	"
INTERLOCK	RAMP mode	O.F.F. mode	Interlock at logical high ends RAMP mode.

Table 4-3   Remote Mode

Event	From	To	Description
RMT key	O.F.F. mode	REMOTE mode	Starts Remote mode. RS-3000 needs to be connected to an STC-2000 or equivalent. The large display shows current and the small display shows kilowatts. The RMT indicator is illuminated.
RMT key	REMOTE mode	MAN mode	Toggles Remote mode off and automatically starts the Manual mode (see Manual mode START) retaining the last current value held in the Remote mode. As previously described for the START key event entering Manual mode, the large display shows current and the small display alternates between showing kilowatts and minutes. The RMT indicator is now off and the MAN indicator is illuminated.
STOP key	REMOTE mode	O.F.F. mode	Ends Remote mode. The pendant STOP key provides this same function.

Table 4-4   Program Mode

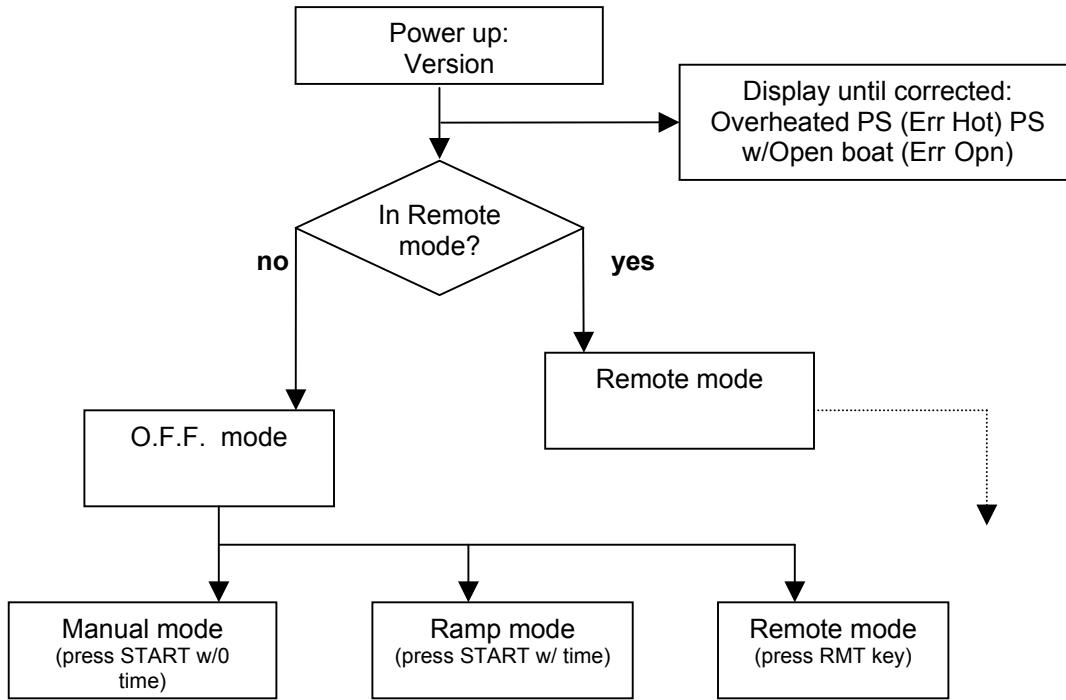| Event	From	To	Description
PRGM key	*any* mode (except the PRGM mode)	PRGM mode	Starts Program mode. The PRGM indicator blinks while in the Program mode. The first in a sequence of six user programmable parameters is shown (that of maximum current). The INC/DEC keys provide the means to make a value change.
PRGM key	PRGM mode	PRGM mode	For the 2nd press of the PRGM key while in the Program sequence, *Ramp minutes* can be altered by the INC/DEC keys (range is 0-99.9 minutes). For the 3rd press of the PRGM key while in the Program sequence, *Ramp current* can be altered by the INC/DEC keys (range is 0-600 Amps). For the 4th press of the PRGM key while in the Program sequence, *beeper configuration* can be altered by the INC/DEC keys (select: ON or OFF). For the 5th press of the PRGM key while in the Program sequence, *communication speed* can be configured by the INC/DEC keys (9.6, 38.4 or 115 kbaud). For the 6th press of the PRGM key while in the Program sequence, *address* can be configured by the INC/DEC keys (0-9). The 7th press of the PRGM key while in the Program sequence, terminates the PRGM mode and the PRGM indicator ceases to blink. Parameters are saved immediately as they are entered (there is no *quit without saving*). If there is a lack of activity for 30 seconds during the programming sequence, the programming mode will auto-terminate.

```
        ┌──────────────────┐
        │   Power up:       │
        │   Version         │
        └────────┬─────────┘                ┌────────────────────────────┐
                 │                           │ Display until corrected:    │
                 │──────────────────────────▶│ Overheated PS (Err Hot) PS │
                 ▼                           │ w/Open boat (Err Opn)       │
          ╱────────────╲                     └────────────────────────────┘
         ╱  In Remote   ╲
  no    ╱    mode?        ╲   yes
        ╲               ╱
         ╲             ╱
          ╲───────────╱
     │                      │
     ▼                      ▼
┌──────────────┐    ┌──────────────────┐
│ O.F.F. mode  │    │  Remote mode     │
└──────┬───────┘    └──────────────────┘
```

Manual mode
(press START w/0 time)

Ramp mode
(press START w/ time)

Remote mode
(press RMT key)

Figure 4-1   Mode Navigation

always accessible
(press PRGM key)

Program mode

(PRGM LED illuminates)

INC/DEC — Max power — (press PRGM key)

(press PRGM key) — Ramp time — INC/DEC

INC/DEC — Ramp Current — (press PRGM key)

(press PRGM key) — Beeper functionality — INC/DEC

INC/DEC — Comm. speed — (press PRGM key)

JM 17JAN2002

Comm. Address

(press PRGM key)
To exit Program mode
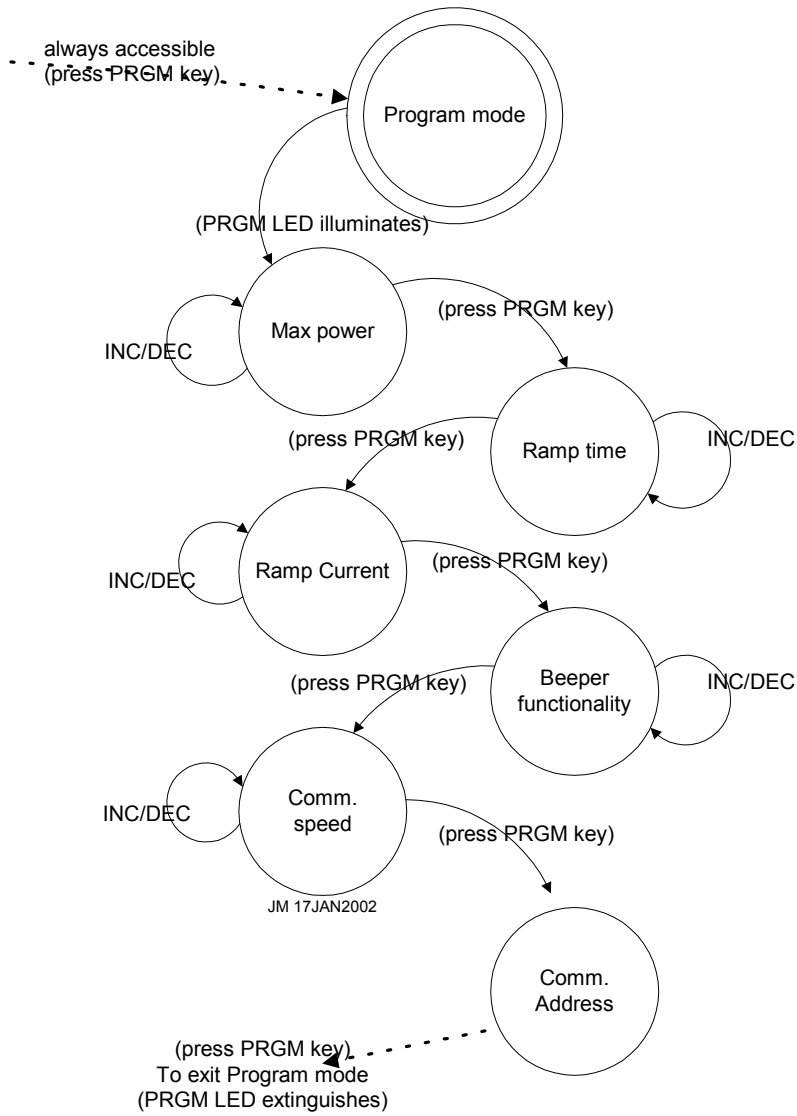(PRGM LED extinguishes)

Figure 4-2   Program Mode Navigation

Service

The unit is best opened by removing the 4 back panel screws then the four connector securing hardware (capturing) standoffs. Remove back panel. Remove top by sliding it rearward. Slide main board rearward to remove (note connection to front panel board) or service the fuses or jumpers without removing main board. Take care not to touch electronic devices or circuitry such that a high voltage discharge path from your finger may develop and destroy components.

There are 2 socketed internal fuses. One for VCC (labeled *F1*) and the other for +12 volts (labeled *F2*).

The RS-3000 power-on event sequence is as follows. The green power LED is illuminated. Next, the unit momentarily illuminates all LEDs and display segments. Then it momentarily displays its software version number (large display) and 300 (T3000 wired in series) or 600 (T3000 wired in parallel) in the small display. If the number displayed does not match the actual configuration, check the wiring select switch on the T3000. If there are no error conditions, the RS-3000 will display 0.F.F. in the large display.

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