

R&R Technologies PS-1 Manual

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This manual is available in full color PDF format at
http://www.rnrtech.com/products/power_supplies/ps1-downloads.html

1.0 Introduction.



R&R Technologies unique PS-1 bench-top power supply design incorporates rechargeable batteries so that the supply may be used in a variety of situations not readily suitable to conventional bench-top supplies.

How often have you been developing a product which involves interfacing with a PC and reached the point in development where you need the product being developed next to the software/firmware development PC which is likely nowhere near the test bench?

How often have you been field testing a piece of equipment and wished you had a bench type power supply to power the unit being tested?

How often have you needed a power supply that is "truly" isolated from the power mains?

How often have you set up a "test" to run overnight, or even say for a couple of weeks and any power outage would cause the test to fail? In its normal state running from the wall transformer, the PS-1 has automatic input power fail protection.

The inclusion of the batteries means that now when you need a test bench power supply for some tests on a nearby (or remote) location, you can simply unplug the wall transformer charging the instrument, take it to the site needing power, use it, then bring it back and plug it back into the wall transformer.

The PS-1 features 1.2 to 15 Volts adjustable output at up to 1.00 Amps. There is an adjustable current limit/crowbar which shuts the supply off when exceeded.. This is adjustable in 10mA steps from 0.01 to 1.00 Amps. There is a single 3 digit LED display to show Output Voltage, Output Current, Input Voltage, or Current Limit setting. Charging/Operating voltage is supplied via a 24Vdc wall transformer. The PS-1 has an internal 18Vdc battery rated at 1.2Ahr. The PS-1 is a switching regulator design which reduces internal heat generation. When running on batteries, the PS-1 will typically supply 5.0 Volts at 1 Amp for about 3.5 Hours. Basically, the batteries when fully charged are capable of supplying 21.6 Watt-hours of energy. The switching supply converts at about 90% efficiency at heavier loads, which gives about 19 Watt-hours of usable energy.

2.0 Getting Started.

When you receive your PS-1 check it closely for damage..... It does have batteries inside which are quite heavy.

You should have received the following items:

- The PS-1 Power Supply.
- A 24Vdc Wall transformer.
- This instruction manual.

If all looks good then go ahead and power the unit up. Briefly press the On/Off button in the upper right corner of the instrument.



You should hear a series of ascending tones and the LED display should show dashes for about 2 seconds.



Then the display will show the last voltage output setting.

Now press the select button in the upper middle of the instrument (marked Sel/Reset). Each time you press this button, it will cycle the LED display showing Output Current, Input Voltage, Current Limit setting, then Output Voltage again.

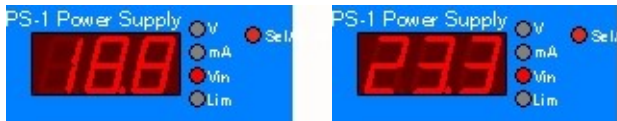


When you are displaying the Output voltage, you may adjust the output voltage with the knob in the center of the instrument. Clockwise increases it, counter-clockwise decreases it.

When you are displaying Output current, or Input Voltage, the adjustment knob has no effect.

When you are displaying the Current Limit setting, the adjustment knob will increase/decrease the desired current limit.

Next plug the supplied wall transformer into an appropriate wall outlet and plug the power plug into the PS-1. The power jack for the PS-1 is located in the lower right hand side of the instrument.. When you plug this transformer in, you should see the "charging" LED light up. If you are watching the Input voltage on the LED display, you will notice that it goes from about 18 Volts to about 23 Volts.

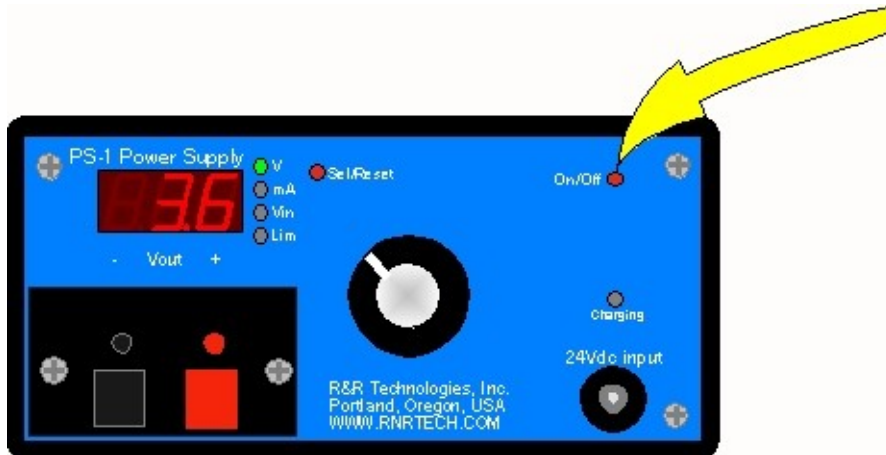


The next section will go into detail about the operations of the PS-1.

3.0 Controls and Operations.

This section describes the controls of the PS-1 and the operations of the PS-1.

3.1 Controls.



3.1.0 On/Off switch.

This switch is used to turn the instrument on if it is off and visa versa. If the instrument is off (display is blank) then briefly pressing and releasing this switch will power the instrument up. The PS-1 goes thru a power up sequence that lasts about 2 seconds.

This switch is also used to power the instrument up in a Calibration Mode. To do this, press and hold the switch until the display shows "CAL".



First the instrument will display dashes as it is performing it's power on sequence.



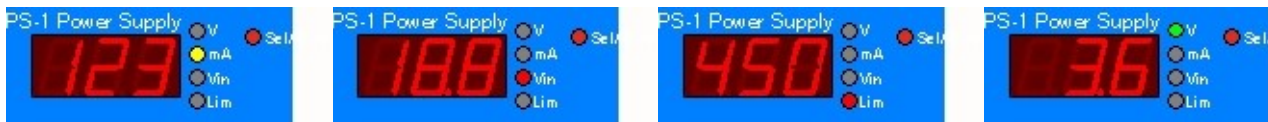
Then it will beep with ascending tones and display "CAL" on the display to indicate it has powered up in the calibrate mode.

Any time the instrument is powered up, briefly pressing the On/Off switch will power the instrument off. This is indicated with a descending series of tones and the display will go blank



3.1.1 Sel/Reset switch.

In Normal Mode this switch is used to cycle through the LED display modes. There are a series of indicator LEDs just to the left of this switch which indicate what the LED display is showing. Each press of this switch advances the display to the next item to be displayed (it cycles through Output Voltage, Output Current, Input Voltage and Current Limit setting).



When the PS-1 goes into current limit the display shows "CL" and the unit flashes and beeps, because the current limit was exceeded, this switch is used to restart the PS-1. Note that when the current limit is exceeded, the unit turns the switcher "off" and the PS-1 presents a high impedance on it's output pins.



In calibrate mode, this switch is used to select the measurement to be calibrated and then to record the new calibration setting (see Calibration Mode Operation).



3.1.2 Adjustment Knob.

In Normal Mode this knob is used to adjust the output voltage, or to set the current limit. The output voltage can only be adjusted when the LED display is showing the output voltage, likewise, the current limit can only be adjusted when the LED display is showing the current limit.

In Calibration Mode this knob adjusts the output voltage to achieve the desired calibration values (see Calibration Mode Operation).

3.1.3 Output Terminals.

The PS-1 features spring-loaded terminals for its output terminals. These allow easier connect/disconnects, and overall are much more convenient in a test environment. Pushing down on the spring lever allows you to insert stripped wire or a test lead into the connector. If you are using alligator clips, you can insert a small piece of wire to clip onto, or even better, you can insert a 3/4 inch 2-46 or 4-40 screw into the connector with the head sticking out, this makes an ideal post to clip onto. One big advantage to the spring-loaded clips is if you accidentally get caught in the leads coming from the PS-1, they rather gracefully slip out of the connector when yanked on.



3.1.4 Power Jack.

This jack is where the charging/operations power is applied to the instrument. It is located on the front panel so that the instrument can be removed from its nominal "permanent" place on the test bench without having to reach around to the back of the instrument to accomplish this. This instrument is designed to be removed from its nominal resting place on a frequent basis.

3.1.5 The Wall Transformer.

The wall transformer has been selected to be able to charge the battery and to operate the instrument to its full capacity. So even with a fully discharged battery, the PS-1 can operate at maximum ratings (15V and 1Amp) with the wall transformer plugged in. This is very important, you may have fully discharged the battery in field use and yet need full use of the supply when you return to the test bench, alternatively (possibly more likely) you have not kept the PS-1 charging even when on the bench and you all of a sudden need it at full power.



3.1.6 The "Charging" LED.

The "charging" LED is located just above the Power Jack. It will light up when the wall transformer is plugged in and the battery is being charged. One exception: When the batteries are fully charged and have reached their "float" potential, the LED will go out.

3.2 Operations.

3.2.0 The power-on sequence.

The PS-1 powers on through a controlled sequence to protect the instrument and the end user. For a normal power up, press the On/Off switch briefly.



supply.

First a series of ascending tones will indicate power is turning on, simultaneously, the display will display dashes. The PS-1 waits for measurement averages to settle, then attempts to turn on the switching



If all is successful, you will see the current Output voltage being displayed on the display.



Else, If the input voltage is too low (less than 15 Volts) the switcher will not be turned on, instead the display will blink, the beeper will beep, and the display will show "bLo" to indicate the battery needs charging.



when large capacitors may be present in the device being powered up.

Or, if a short or over-current condition is detected on the output while trying to power up the switcher, it will shut down the switcher and display "CL " while flashing the display and beeping. The PS-1 uses a "smart algorithm" based on the current limit setting to allow the instrument to power up gracefully even

To power the PS-1 up in the calibrate mode, press and hold the On/Off switch.



First the display will display dashes. Measurement averages are allowed to settle.



After about two seconds of holding the On/Off switch the display should show "CAL" and a series of ascending tones will indicate the unit is entering the calibrate mode. At this time you can release the On/Off switch.

3.2.1 Normal Mode Operation.

In the normal operating state of the instrument, after the power on sequence (see above) the display shows the current Output voltage.



In normal operation, the output voltage can be adjusted with the output adjustment knob over the range of 1.2 to 15.0 Volts.

If the Sel/Reset switch is momentarily pressed, advance LED display to next measurement to display.



If the display is showing (V) Output voltage then the output voltage may be adjusted with the output adjustment knob.

When the display is showing (mA) output current the adjustment knob is inactive.

When the display is showing (Vin) input voltage the adjustment knob is inactive.

When the display is showing (Lim) current limit, the adjustment knob is used to set the current limit.

If the On/Off switch is pressed at any time, the PS-1 turns off.

If while operating, the current limit is exceeded:

- The switcher is shut off.
- The display shows "CL".
- Blink the display.
- And beep the beeper.

This continues until the Sel/Reset switch is momentarily pressed, or the unit is powered off.

The current limit is a crowbar type which shuts off the output voltage upon being tripped, not a current limit type that just limits the current. The primary reason for this is to protect circuitry under power during development and testing where rapid shutdown is the surest way to prevent harming components.

3.2.2 Calibrate Mode Operation.

This is a special state of the instrument which allows calibration of the measurements being made. After the power on sequence (see above) the display shows "CAL".



There are two possible calibrations for the PS-1, the voltage measurements and the current measurements.

To start the calibration sequence, momentarily press the Sel/Reset switch.



First the unit will start with the voltage calibration. If you wish to bypass the voltage calibration just momentarily press the Sel/Reset switch and unit will go to the current calibration. Momentarily pressing the Sel/Reset switch again will go back to voltage calibration. The calibration mode can only be exited by momentarily pressing the On/Off and turning the PS-1 off.

To calibrate the voltage measurements, you will need a voltage measuring device that is at least accurate to 0.1%. Most 4 1/2 digit multimeters meet this standard. Attach the multimeter or other voltage measuring instrument on the output terminals. The voltage calibration is a two point calibration which involves setting two precise voltages.

With the display showing 2.00 Volts, adjust the output voltage to 2.000 Volts on the multimeter. Once the 2.000 Volts is reached, press and hold the Sel/Reset switch for about one-half second until you hear a beep. The display will now show 12.0 Volts.



With the display showing 12.0 Volts, adjust the output voltage to 12.000 Volts on the multimeter. Once the 12.000 Volts is reached, press and hold the Sel/Reset switch for about one-half second until you hear a beep. The display will now show 500mA. The voltage calibration is now done.



To calibrate the current, you will need to place a 500 mA load on the output terminals. A 5 to 20 Ohm resistor of appropriate wattage is recommended. Connect a multimeter in series with the load resistor.

- During calibrate the Current Limit setting is set for 1000mA. If the current limit is exceeded:
 - The switcher is shut off.
 - The display shows "CL ".
 - Blink the display.
 - And beep the beeper.
- This continues until the Sel/Reset switch is momentarily pressed.

With the display showing 500 mA, adjust the PS-1 output knob for 500.0 mA of current on the multimeter. Once the 500.0 mA is reached, press and hold the Sel/Reset switch for about on-half second until you hear a beep. The display will now show 2.00 Volts.

You can exit the calibrations as mentioned above at any time by powering down the PS-1.

4.0 Interface options.

There are currently two interface options for the PS-1, an RS-232 interface and a USB Interface. Both behave similarly and appear to your PC as COMx ports.

These interfaces will allow you to upgrade the PS-1 internal firmware via the serial ports using a special program. The interfaces also allow you to read the PS-1 settings, monitor the PS-1 measurements, and set the output voltage and current limit, with generic terminal programs.

If there are any PS-1 firmware updates, they will be available for download at http://www.rnrtech.com/products/power_supplies/ps1-downloads.html.

The settings and readings are implemented through a set of command statements. The PS-1 serial interface commands can be executed with Hyperterminal or an equivalent terminal program with the following settings:

Baud Rate:	115200
Data bits:	8
Stop bits:	1
Parity:	none
Handshake:	off

4.0.0 Command syntax.

The command syntax is:

@Cxxxx

where @	is the command start character.
C	is a single letter command.
xxxx	is zero to four argument characters.

Note! The commands do not need nor expect a return at the end of the command string.

4.0.1 The commands.

@A	Shows Output Voltage and Current Limit settings.
@C	Shows the output current measurement.
@L1000	Sets the current limit (range 0010 to 1000) milliamps.
@O1500	Sets the voltage output (range 0000 to 1500) Volts.
@S	Toggles the real-time streaming output of Output Voltage and Output Current measurements.
@V	Shows the output voltage measurement.
@I	Shows the input voltage measurement.
@H	Lists a short form help of the commands.

These commands can be hand entered on a generic terminal program like HyperTerminal.

4.1 The RS-232 Interface.

The RS-232 interface connects directly to a PC via one of its COM ports, utilizing a standard DB-9 serial cable. The interface DB-9 connector is located on the back panel of the PS-1.

4.2 The USB Interface.

The USB interface utilizes an FTDI USB-232 bridge device which with the proper drivers installed looks to Windows like a COM port. It is connected with a standard USB-A to USB-B cable. This interface does require a software driver which is available at http://www.rnrtech.com/products/power_supplies/ps1-downloads.html. The interface USB type B connector is located on the back panel of the PS-1.

5.0 Specifications.



Input Power:

Charging supply wall-type:	24Vdc - 700mA (or more)
Internal Batteries:	18Vdc nominal at 1.2Ahr capacity
Charge time to full capacity from discharged batteries:	8hrs
Battery organization:	12Vdc plus 6Vdc in series.

Output:

Regulator type:	Switching
Vout:	1.2Vdc to 15Vdc
Iout:	0 to 1000mA
Output ripple:	<10mV p-p
Load Regulation:	<1%

Battery operations:

Energy capacity (fully charged):	21.6 Watt-hrs.
Typical operating times on a fully charged battery:	
12.0Vdc @ 1Amp:	1.6hrs
5.0Vdc @ 1Amp:	3.5hrs
3.0Vdc @ 100mA:	36hrs
Any Vdc @ no load:	120hrs

Physical:

Dimensions:	5.1 x 2.3 x 6.0 in. , 13 x 6 x 15 cm
Weight:	2.6 lbs, 1.2 kg
Operating temperature range:	0 to 70 C
Display:	3 digit 7-segment LED
Indicators:	5 LEDs
Switches:	2 momentary, 1 rotary
Power Jack:	Coaxial 2.1mm pin
Output Terminals:	Spring loaded - quick connect