

PocketPower25 Manual and Specifications

PRELIMINARY

By Versalent 10-5-20

General Description:

PocketPower25 (PP25) is a USB-only, pocket-sized adjustable power source that can be used for any production/demo/test environment that requires a highly controlled power source in the lower power range. Because it is small and lightweight it makes mobile power convenient. It consists of two separate sections. The first is a switching pre-regulator that generates the needed 25 volts which is well above the 5V delivered by USB, and also provides power efficiency. The second section is a linear output stage which provides for very precise voltage and current control from 0 to full scale. The two combine to deliver efficient power with excellent control. Since USB power is limited, PocketPower25 is limited to those applications (1.75 watt across the 0 to +/- 25V range). That means low output voltages provide up to 350mA while the higher voltage outputs provide < 100mA. See specification chart that follows.

PocketPower25 output is NOT isolated from the USB ground, so separate models are offered for positive and negative outputs (supplies cannot be 'stacked'). The PP25P outputs 0 to +25V volts while the PP25N outputs 0 to -25 volts. At power-up the control software identifies the model(s) connected and displays each PP25P in purple/yellow colors, and each PP25N in blue/orange colors. Up to 12 small device-control frames can appear on-screen at one time to manage that many PocketPowers. In addition, each unit can be assigned a name which is associated with its unique serial number. Their unique identities allows the software to store a 'configuration' so that a system of multiple supplies gets reconfigured identically even if USB cables are switched, or other USB devices are added/removed causing the host to enumerate* them differently.

Detailed Description:

PocketPower25 is small at 2.25" X 2.4" X 1" and 3 oz. It connects to a USB 1,2,3 port using a standard micro-USB connector, and provides output power through a 3.5mm barrel jack. LEDs on the top panel show applied power (GREEN) , and current-limit status (RED). On-screen displays also show these indicators as well as voltage and current-limit settings, and the actual measured voltage and current outputs of the supply. These values are also available via the DLL should you want to integrate operation into your own applications.

*USB enumeration is the process of initializing devices and assigning them a host port

PocketPower25 contains no knobs or dials -- it is fully controlled through its USB connection in conjunction with the provided software application/DLL. As with any bench-type supply, there are two sets of voltage/current values of importance. The first are the set-values for the voltage output and the current-limit. The second are the actual values which are monitored and displayed. The actual voltage should be the same as the set value (within tolerances) unless current-limiting occurs. And the actual current should generally be less than current-limit setting unless in current-limiting. PocketPower software provides both sets of values on-screen in a small frame so you can visually monitor the state of power being delivered just as with a standard bench supply. Voltage can be set from between 0 to +/- 25.00 volts in 10mv increments, and current-limiting is set from 0 to 350mA in 2mA increments. PocketPower output is limited to 1.75W* output, so the maximum current limit setting is dependent on the output voltage setting. Maximum current-limit setting = $1.75W / (\text{Output Voltage Setting})$

Some selected voltage outputs and associated maximum current-limit settings:

Output Voltage Setting	Max Current Limit Setting
25.00V	70mA
20.00V	86mA
10.00V	174mA
0 to 5.00V	350mA

Software Features:

The PocketPower application can automatically detect each PP25P and PP25N device connected with the click of a menu item, or PP25 devices can be manually added/deleted again using a menu item on the application window. Each device gets a small control-frame within the application window and 1 to 12 control frames can appear on-screen at a time to control up to 12 PocketPowers. [Most desktop computers offer approximately 6 USB ports (laptops offer fewer) capable of the 500mA needed to power a PP25P/N. You can expand your port count with hubs, but they must be powered hubs since unpowered hub ports cannot deliver the required 500mA per port.]

Initially all control-frames show Connection Status as NOT CONNECTED and the frames are grayed/disabled. The Connect All application menu item will connect each frame to its PP25 using its serial number/name association, then enable the frame and change its Connection status to CONNECTED. At this point they are ready to operate.

*USB provides a minimum of 4.75V @ 500mA = 2.375W

Within each PP25 control frame are:

- 1) Voltage Setting field You can enter from 0.00 to +/- 25.00 (volts)
- 2) Current Limit field .. You can enter from 0.00 to 1.75W/Voltage Setting (mA)
- 3) SET button .. sends the two settings to the attached/connected PP25P/N
- 4) Measured Output Voltage (XX.XX Volts not editable)
- 5) Measured Output Current (XXX mA not editable)
- 6) Current Limit Status (**ACTIVE** or inactive .. not editable). ACTIVE means that the supply has reached its maximum allowed current output and has switched to regulating output current instead of output voltage (so output voltage may be reduced). Inactive means that the maximum allowed output current has not been reached.
- 7) Connect and Disconnect menu items which allow you to individually connect or disconnect communications to a particular PP25. If you unplug a USB cable during operation, that PP25 will get disconnected. If you re-plug it, you will have to click the Connect item to resume operation of that supply.
- 8) Device Identity (a device serial number and/or assigned name)

Each PP25 control frame also contains menu items to control data logging, and to define a device name. Names are associated with device serial numbers on the back of each unit and it is easier to manage multiple supplies when they have names like '6V LASER SUPPLY' rather than 8 digit serials.

Configuration Files:

The Save Configuration application window menu item stores your setup in a .cfg file for later recall. This saves several items to allow a quick restoration of your system restoration:

1. The number of PocketPower's in your configuration (so the number of control-frames to display).
2. Any names that you have assigned to those PocketPowers so that the control-frames display the text name/description of the power supply.
3. Your default on-connect settings. PocketPower devices power-up, and by default 'connect' with voltage and current limit settings of 0 to protect load devices. If you save output settings in the configuration, then these will be restored when the device reconnects.
4. Relative screen locations of each PocketPower control frame so that the ordering of the supplies on-screen remains the same.

Loading a previously saved configuration allows you to instantly resume operation in exactly the same state as when you saved this configuration, with no settings required. Notice that you can name the same PP25 differently for each saved configuration. The identification scheme based on unit serial numbers ensures that your configurations always arrange themselves with the same control frame operating the same supply, even if USB cables are plugged in differently, or USB devices are added or removed from the host as described previously.

When devices are connected the type of supply PP25P/N is auto-detected. Frame colors change depending on the type of supply found. PP25P supplies have an on-screen purple/yellow pallet while PP25N supplies have a blue/orange pallet to match the pallets used on the device labels to aid organization (important if you have 3+ PocketPowers connected).

Execute Profile Feature:

During testing it is sometimes necessary to change the supply value(s) for specific tests, or within processes either quickly, or on a slow ramp etc. The PocketPower application offers a means to do this without the complications of writing your own control software by simply creating a text file which defines output settings and time entries. This profile can then be executed unattended (with logging on if desired). The text file format is simple, and a separate document <https://www.versalent.biz/manuals/PocketPowerProfiling.htm> describes this in detail. Basically the file consists of unit-identification (by name or serial number) followed on the same line by a date-time followed by an output-voltage, then by a current limit value. Date-time can be (A)bsolute or (R)elative to starting time, so the profile can begin execution now or at any time in the future, and a REPEAT(xx) function can be used with (R)elative commands to create a repeating set of supply voltages to be generated.

Pocket Power Specifications:

Output Voltage:

PP25P: 0 to +25.00V DC non-isolated 25mv resolution (1001 steps of 25mv each)

PP25N: 0 to -25V DC non-isolated 25mv resolution (1001 steps of -25mv each)

Output Voltage Accuracy:

PP25P & PP25N: < 0.5% of setting +/- 20mv

Load Regulation: < 0.1% No load to full load

Output Noise:

< 7mV rms

USB Power Port Regulation:

This replaces the typical 'line regulation' specification since power is derived from USB.

< 0.1% Output variation with full +/- 5% allowable USB voltage variation

Step Change Response Time:

Typical 100ms maximum. This specification represents the combination of the response times of the switcher pre-regulator and the linear control loop response time.

Current-Limit Response Time:

< 10ms for control loop response. [Note that the output capacitance of the supply is 10uf, so an instantaneous change in load (such as a short circuit from a high voltage output) can cause an initial current spike considerably greater than the current limit setting during the 10ms response time.]

Tracking Accuracy:

The tracking features allows multiple supplies to 'follow' each other. Since tracking supplies each have the same tolerances as their parent , supplies will track their parent's command values to within the same accuracy specifications. And if SUPPLY#3 tracks SUPPLY#2 which tracks SUPPLY #1, SUPPLY#3 will track SUPPLY#1 to within the same accuracy specifications. There are no 'cumulative tracking errors' because tracking is based on each supply's commanded values which are exact, and not their measured values which contain tolerance errors. [There is no limit to the tracking hierarchy .. i.e. with 6 supplies in a chain, each can track a parent up to the 'top level supply'. Top to bottom tracking causes no cumulative accuracy errors.]

Reliability:

Multiple levels of protection are implemented in PocketPower25 as shown below so although PocketPower is tiny, it is electrically rugged , self-protecting and reliable.

The first level is not actually for protection of PocketPower25, but protects the USB port to which it is connected:

1. USB ports (prior to USB 3) are limited to delivering a maximum of 500mA to a USB device (after the device has been enumerated – connected and initialized). And prior to enumeration they are limited to 100mA. PocketPower25 monitors and controls its own current usage, providing input current limiting set to 100mA prior to USB enumeration, then switching to 500mA after

enumeration is complete. This current-limiting is completely separate from PocketPower25's adjustable output current limiting, and basically applies a 'throttle' to PocketPower's switching pre-regulator to limit initial inrush/stabilization currents that switching supplies typically draw. Pre-regulator 'soft-start' is also implemented to help keep initial currents within USB compliance, but the input current-limiter guarantees that the device does not exceed USB power delivery specifications at any time during operation.

Protection levels 2 – 5 protect PocketPower25 from damage :

2. The switching pre-regulator contains its own internal current limits and thermal shutdown which activate if the pre-regulator is over-stressed or over heated.
3. PocketPower's control software does not allow output voltage/current settings which would exceed its 1.75W output power. This protects the pre-regulator as well as the linear output stage.
4. PocketPower's control software uses the measured output voltage and current to compute the power dissipated by the output stage and automatically reduces the pre-regulator voltage if necessary to protect itself. For instance, if the output is shorted to ground, the pre-regulator output will be automatically reduced to protect the output stage from overheating.
5. Thermal protection of the output stage also shuts down PocketPower's output if the temperature of the output stage exceeds a reasonable limit. This is implemented completely in hardware and could activate if the control software is terminated after PocketPower's output is set and it is delivering power. In this case the #4 above software power limiting is no longer in effect and load changes could force PocketPower's output stage into excessive dissipation. This final fail-safe protection is not dependent on the control software being active, or valid load conditions being maintained. Note that PocketPower does NOT stop delivering power if the PocketPower application is stopped – devices do not require a connection to the application in order to continue operating at their last settings.

Manual Version/Date	Description of Changes
10/5/20	Release of PRELIMINARY manual

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