

Inline PSU Tester

Users Guide

Model PM123 Rev 1



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Introduction

The PSU Tester can be used to diagnose and troubleshoot your desktop power supply. With the PSU Tester, you can:

- Check power supply voltages are within the approved limits.
- Record the minimum and maximum of voltage and current for each voltage rail.
- Measure the exact power drawn from each voltage rail.
- Measure the total power drawn from the power supply.
- Test for ripple on main voltage rails ⁽¹⁾.
- Measure and check Power-on Time (T1), Rise Time (T2), PWR_OK delay (T3) and Power-down warning (T6) and check them against the specification.
- Measure the minimum slew rate on main voltage rails ⁽¹⁾ during power up.
- Check that the turn-on slope of main voltage rails ⁽¹⁾ is positive during power up (smooth power up).
- Check power sequencing is correct

1. Main voltage rails are +12V1DC, +12V2DC (12V CPU), +5VDC and +3.3VDC

Warnings – Important – Please read.



Do not skip this step. Safety should be your primary concern during a power supply test with a PSU tester.

- Remove anything conductive from your hands (e.g. metal rings, watches, or bracelets) before testing a PSU or working inside your computer.
- Only use the original cables that comes with the tester. The PCIe cable that comes with the tester, is not a standard cable and is custom-made for the tester. Using other cables could lead to short circuit between the voltage rails.
- **Make sure all the cables are fully inserted.** A loose connection introduces more electrical resistance which can lead to melting of the wires under high load (or even a fire).
- In the case of a dramatic failure of the device under test, you may see smoke coming from the power supply or inside the case or smell a burning. In this case unplug the power supply from the **wall**. Do not touch the PSU or the PSU Tester in such circumstances.
- Always have someone monitor the testing in case the device under test suddenly fails. Do not start a test and walk away.
- If the PSU Tester is inline (connected to both power supply and motherboard), do not power up using the keypad on the tester. Instead, use the PC power button. This is just a precaution against poor engineered power supplies that do not meet ATX standards and can prevent a short on the PS_ON line.
- In standalone mode the tester will dissipate 4Watts of power (in order to place a test load on the PSU). This can result in the base of the tester becoming warm to touch after a short period of time. The tester will automatically terminate testing after 1 minute to avoid overheating.

Background

A power supply unit (or PSU) converts mains AC to low-voltage regulated DC power for the internal components of a computer. The PSU normally supplies +3.3 V, +5 V, and +12 V and -12V to a PC. Older systems (before Pentium 4 and Athlon XP platforms) were designed to draw most power from 5 V and 3.3 V rails, while the newer machines draw most of their power from the 12 V rail. The -12 V supply is primarily used to provide the negative supply voltage for RS-232 ports and is also used by one pin on conventional PCI slots to provide a reference voltage for some models of sound cards.

ATX and ATX12V standards

ATX (Advanced Technology eXtended) is a motherboard and power supply configuration specification developed by Intel in 1995. The specification defines the key mechanical dimensions, mounting point, I/O panel, power and connector interfaces between a computer case, a motherboard and a power supply. There is also another specification called ATX12V which only describes the PSU.

Major changes in ATX/ATX12V revisions

ATX Version	Introduction date	Main changes from previous version
ATX	1995	<ul style="list-style-type: none">- Created 20 pin main power cable- Included 4 pin peripheral power cable- Included floppy power cable
ATX12V 1.0	2000	<ul style="list-style-type: none">- Added 4 pin 12V power cable. Older computers put most of their load on 3.3 and 5 volts. As time passed, computers drew more and more of their load from 12V.- Added 6 pin auxiliary power cable. It was added to provide extra wattage to motherboards for 3.3 and 5 volts.- Increased 12V output power
ATX12V 1.3	2003	<ul style="list-style-type: none">- Added SATA power cable- Made -5V rail optional- Increased 12V output power
ATX12V 2.0	2003	<ul style="list-style-type: none">- Changed to 24 pin main power cable. The 24-pin main power connector was added in ATX12V 2.0 to provide extra power needed by PCI Express slots. The older 20 pin main power cable only has one 12V line.- Removed 6 pin auxiliary power cable- Added 20A current limit to rails- Increased 12V output power- Reduced 3.3V and 5V output power

Table 1

As of now, the latest version is ATX12V v2.4, published in April 2013.

PSU Cables

Typically, power supplies have the following connectors:

- Motherboard power cable: This is the cable that goes to the motherboard to provide it with power. The connector has either 20 or 24 pins. The older 20 pin main power cable only has one 12V line. The new 24 pin connector added one line apiece for ground, 3.3, 5, and 12V. Many power supplies come with a 20+4 pin cable which is compatible with both 20 and 24 pin motherboards.

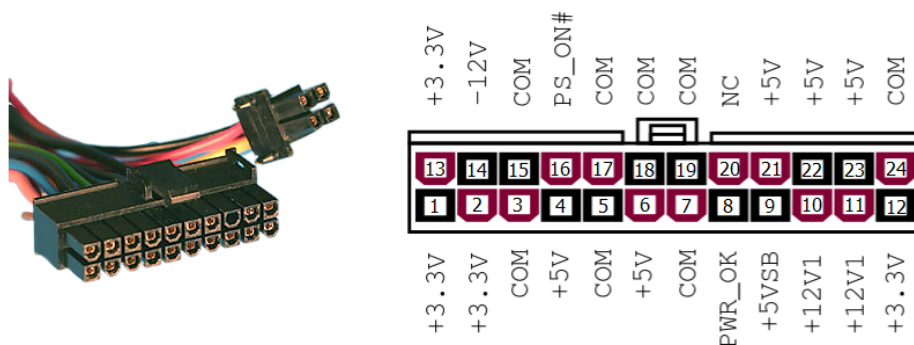


Figure 1: 24-pin connector

Color	Signal	Pin	Pin	Signal	Color
Orange	+3.3 V	1	13	+3.3 V	Orange
				+3.3 V sense	Brown
Orange	+3.3 V	2	14	-12 V	Blue
Black	Ground	3	15	Ground	Black
Red	+5 V	4	16	Power on	Green
Black	Ground	5	17	Ground	Black
Red	+5 V	6	18	Ground	Black
Black	Ground	7	19	Ground	Black
Grey	Power good	8	20	Reserved	None
Purple	+5 V standby	9	21	+5 V	Red
Yellow	+12 V	10	22	+5 V	Red
Yellow	+12 V	11	23	+5 V	Red
Orange	+3.3 V	12	24	Ground	Black

Table 2: 24-pin motherboard power connector pinout

- CPU power cable: This is the cable that goes to the motherboard to provide power to CPU. The connector has either 4 or 8 pins. The older 4 pin CPU power cable only has two 12V line. The new 4+4 pin connector added two more 12V lines. Many power supplies come with a 4+4 cable which is compatible with both 4 and 8 pin motherboards.



Figure 2: 8-pin CPU power connector

Color	Signal	Pin	Pin	Signal	Color
Black	Ground	1	5	+12 V	Yellow
Black	Ground	2	6	+12 V	Yellow
Black	Ground	3	7	+12 V	Yellow
Black	Ground	4	8	+12 V	Yellow

Table 3: 8-pin CPU power connector pinout

- PCI Express power cable: This is the cable that goes to the PCI Express cards (e.g. graphic cards). Some graphic cards have 6 pin PCI Express power connectors and others have 8 pin connectors. Many power supplies come with a 6+2 PCI Express power cable which is compatible with both kinds of graphic cards. The 6+2 PCI Express power cable is made up of two pieces: a 6-pin piece, and a 2-pin piece.



Figure 3: 8-pin PCI Express connector

Color	Signal	Pin	Pin	Signal	Color
Yellow	+12 V	1	5	Ground	Black
Yellow	+12 V	2	6	Ground	Black
Yellow	+12 V	3	7	Ground	Black
Black	Ground	4	8	Ground	Black

Table 4: 8-pin PCI Express connector pinout

- SATA power cable: This is the cable that goes to the hard drives.

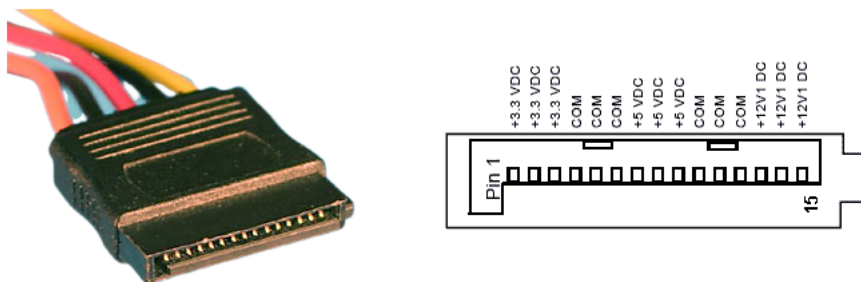


Figure 4: 15-pin SATA connector

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Signal	+3.3 V			Ground			+5 V			Ground			+12 V		

Table 5: 15-pin SATA connector pinout

DC Regulation range

The DC output voltages shall remain within the regulation ranges shown in Table 1.

PSU Output line	Range	Min.	Nom.	Max.	Unit
+12V1DC	±5%	+11.40	+12.00	+12.60	Volts
+12V2DC (12V CPU)	±5%	+11.40	+12.00	+12.60	Volts
+5V	±5%	+4.75	+5.00	+5.25	Volts
+3.3VDC	±5%	+3.14	+3.30	+3.47	Volts
-12VDC	±10%	-10.80	-12.00	-13.20	Volts
+5VSB	±5%	+4.75	+5.00	+5.25	Volts

Table 6

Output Ripple/Noise

The output ripple/noise requirements listed in Table 2.

Output	Max. Ripple & Noise (mVpp)
+12V1DC	120
+12V2DC (12V CPU)	120
+5VDC	50
+3.3VDC	50
-12VDC	120
+5VSB	50

Table 7

mVpp = Millivolts peak to peak

Timings

Below you can see the timing diagram for the power good signal as available on the ATX12V specification. “VAC” is the input alternating voltage, i.e., the voltage from the wall. PS_ON# is the “power on” signal (i.e., you pushed the “standby” button from the computer case). “O/P’s” stand for “operating points.” And PWR_OK is the power good signal.

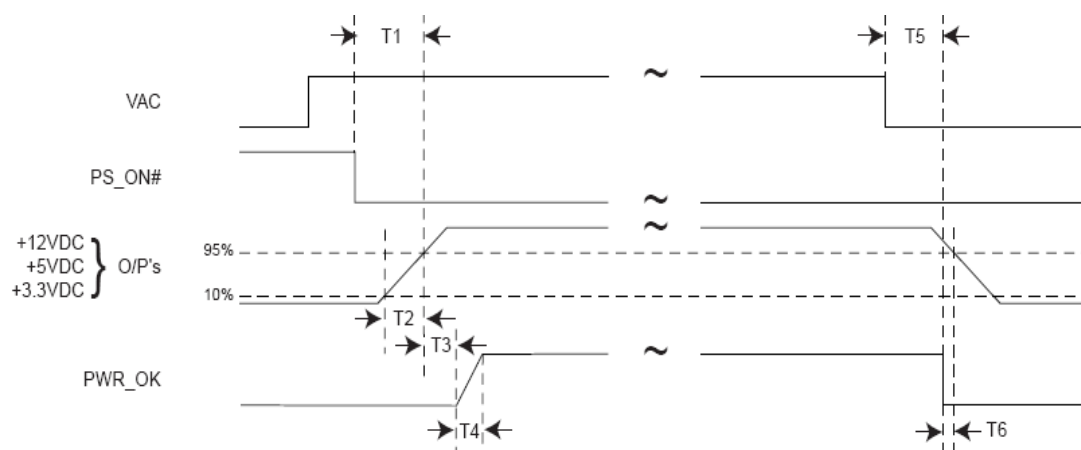


Figure 5

Power-on Time (T1): The power-on time is defined as the time from when PS_ON# is pulled low to when the +12VDC, +5VDC, and +3.3VDC outputs are within the regulation ranges. The power-on time shall be less than 500 ms ($T1 < 500 \text{ ms}$).

Rise Time (T2): The output voltages shall rise from $\leq 10\%$ of nominal to within the regulation ranges within 0.1 ms to 20 ms ($0.1 \text{ ms} \leq T2 \leq 20 \text{ ms}$).

PWR_OK delay (T3): PWR_OK is a “power good” signal. It should be asserted high by the power supply to indicate that the +12VDC, +5VDC, and +3.3VDC outputs are above the under-voltage thresholds. The PWR_OK time shall be asserted high within 300ms to 500ms after outputs are above the under-voltage thresholds ($300 \text{ ms} < T3 < 500 \text{ ms}$).

Power-down warning (T6): During power-down, the PWR_OK signal should be asserted low at least 1ms before the +12VDC, +5VDC, and +3.3VDC outputs reach their under-voltage thresholds ($T6 \geq 1 \text{ ms}$).

Ramp up

There must be a smooth and continuous ramp of each DC output voltage from 10% to 90% of its final set-point within the regulation band. The smooth turn-on requires that, during the 10% to 90% portion of the rise time, the slope of the turn-on waveform must be positive. The tester monitors the slope and report it as “Positive Slope”. Also, for any 5ms segment of the 10% to 90% risetime waveform, a straight line drawn between the end points of the waveform segment must have a slope $\geq [V_{\text{out, nominal}} / 20] \text{ V/ms}$. The tester measures the minimum slope across all 5ms segments during power-up and displays it as “T2 Min Slew Rate”.

Output	T2 Min Slew Rate (V/ms)
+12V1	0.6
+5V	0.25
+3.3V	0.165
+12V2 (12V CPU)	0.6

Table 8

Power sequencing

The +12 VDC and +5 VDC output levels must always be equal to or greater than the +3.3 output during power-up and normal operation. The time between the +12VDC or +5VDC output reaching its minimum in-regulation level and +3.3VDC reaching its minimum in-regulation level must be ≤ 20 ms. The PSU Tester checks the timing sequencing and report it as “T SEQ”.

Efficiency

80 Plus (trademarked 80 PLUS) is a voluntary certification program intended to promote efficient energy use in computer power supply units (PSUs). It certifies products that have more than 80% energy efficiency at 20%, 50% and 100% of rated load, and a power factor of 0.9 or greater at 100% load. Such PSUs waste 20% or less electric energy as heat at the specified load levels, reducing electricity use and bills compared to less efficient PSUs.

80 Plus test type ^[4]	115 V internal non-redundant				230 V internal redundant				230 V EU internal non-redundant			
Percentage of rated load	10%	20%	50%	100%	10%	20%	50%	100%	10%	20%	50%	100%
80 Plus		80%	80%	80%						82%	85%	82%
80 Plus Bronze		82%	85%	82%		81%	85%	81%		85%	88%	85%
80 Plus Silver		85%	88%	85%		85%	89%	85%		87%	90%	87%
80 Plus Gold		87%	90%	87%		88%	92%	88%		90%	92%	89%
80 Plus Platinum		90%	92%	89%		90%	94%	91%		92%	94%	90%
80 Plus Titanium	90%	92%	94%	90%	90%	94%	96%	91%	90%	94%	96%	94%

Table 9: Efficiency level certifications

Device Operation

A failing power supply can often be at the root of problems you might not expect, like random lockups, spontaneous reboots, and even some serious error messages. The PassMark PSU Tester is designed to quickly test a PC power supply.

Configurations

The tester can be used in two different configurations. Standalone and Inline configurations are explained below.

Standalone

In this configuration, the PSU Tester is only connected to a PSU (i.e. it is not connected to a motherboard). This configuration is recommended for the production line testing or when the PC doesn't boot.

STAND-ALONE MODE

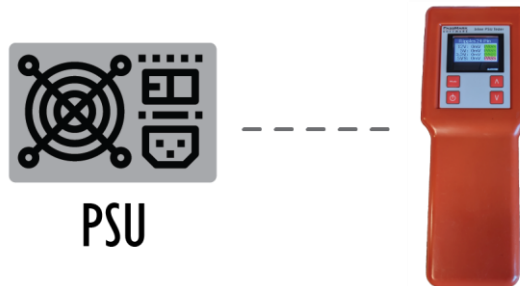


Figure 6

Inline

The PSU Tester is connected to a power supply and a motherboard. The inline mode is more likely to reveal the root cause of more complicated issues such as random lockups, spontaneous reboots and peripheral failure. Using Inline mode will also result in the PSU being placed under much higher load. In addition to voltage and timing measurement, the current drawn from each voltage rail is also measured in this configuration.

INLINE MODE



Figure 7

The PSU Tester can be connected to a computer via a USB port. Using the monitoring software, you can see all the voltages, currents and timings in one window and you

can control the tester from the software. Moreover, the software allows you to save all the measurements in a .txt file.

INLINE MODE WITH MONITORING

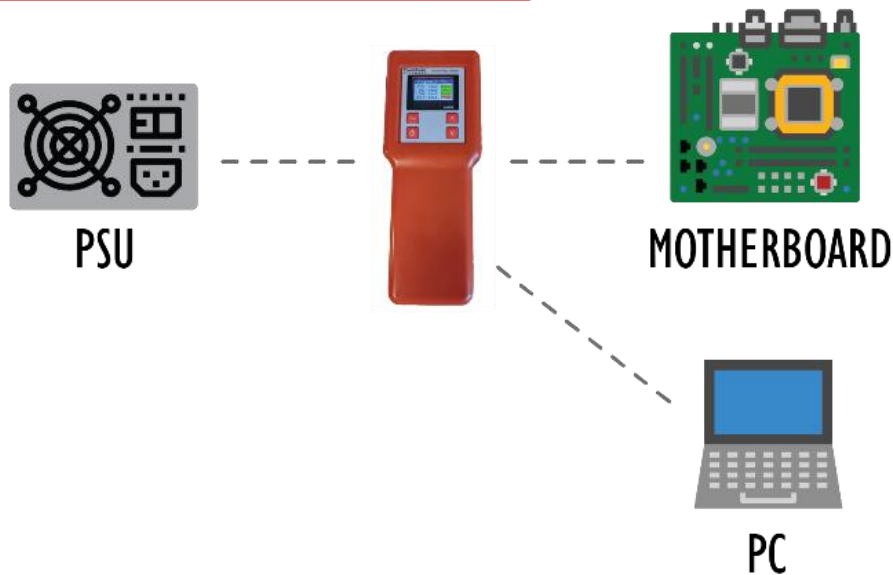


Figure 8

LCD Display

The PassMark PSU Tester features a built-in 1.8" TFT LCD display to show voltage, current, ripple and power for each voltage rail. The default screen when a device is connected to a PSU is shown below.

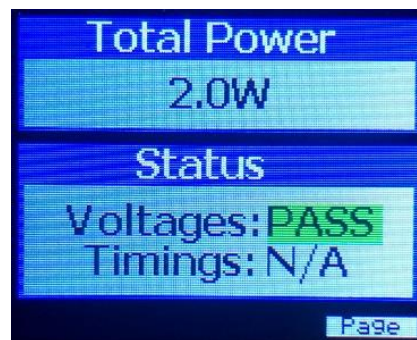


Figure 9

Total Power: Total power drawn by the tester or motherboard.

Voltages: Shows "PASS" when all voltages within the regulation ranges.

Timings: Shows "PASS" when all timings are met. "N/A" means some of the timings are not yet measured. Timings are calculated during power-up and power-down process, so if it shows "N/A", that means one or two power cycles are required to calculate the timings.

The background colour of PASS/FAIL messages can be green, red, light red and yellow. Each colour has a different meaning which are explained below:

PASS means voltage is currently within the approved limits and never been outside the specifications.

PASS means voltage is currently within the approved limits, but an over-voltage was detected previously.

PASS means voltage is currently within the approved limits, but an under-voltage was detected previously.

FAIL means voltage is outside the approved limits.

Keypad

The Tester has a membrane keypad with four keys.

Power On/Off button: This button forces a power-up by asserting the PS_ON pin to logic low (PS_ON is active low). Please note that this button shouldn't be used when the PSU Tester is in inline configuration. Instead, the PC should be turned on/off using the "standby" button from the computer case.

Up (Page Up) and Down (Page Down) buttons: These two buttons are used to navigate between different pages. The pages are listed below:

- **Default Page:** Displays the total power as well as the voltages and currents status.
- **Voltage 24-Pin:** This page displays the voltage for each rail on the 24-Pin connector (i.e. +12V1DC, +5VDC, +3.3VDC, +5 VDCSB and -12VDC).
- **Voltage CPU and PCIe:** This page displays the +12V2DC (+12V CPU) voltage on the 8-Pin CPU and the +12V PCIe on the 6-Pin PCIe connectors.
- **Voltage SATA:** This page shows the voltage for each rail on the 15-Pin SATA connector (i.e. +12VDC, +5VDC, +3.3VDC). Please note that the tester doesn't measure the actual voltages on the SATA connector, instead it displays the voltage on +12V1DC, +5VDC, +3.3VDC as these rails are almost always connected to SATA voltage rails.
- **Ripple 24-Pin:** This page displays the ripple in millivolts on +12V1DC, +5VDC, +3.3VDC and +12V2DC (+12V CPU).
- **Timings (T1, T2, T3 and T6):** This page shows the timings for +12V1DC, +5VDC, +3.3VDC and +12V2DC (+12V CPU).
- **T2 Min Slew Rate:** This page displays the minimum slew rates across all 5 ms segments during power-up for +12V1DC, +5 VDC, +3.3VDC and 12V2DC (+12V CPU).
- **Turn-on slope:** If there was a negative slope during power-up on +12V1DC, +5VDC, +3.3VDC and +12V2DC (+12V CPU) rails, this page will show a Fail.
- **Power Sequencing:** The +12VDC and +5VDC output levels must always be equal to or greater than the +3.3VDC output during power-up and normal operation. If this criterion fails, the 'V' column shows a red circle. Also, the time between the +12 VDC or +5VDC output reaching its minimum in-regulation level and +3.3VDC reaching its minimum in-regulation level must be ≤ 20 ms. If this criterion fails, the 'T' column shows a red circle.

Mode: This button allows to change the mode of details on each page. Pressing this button on a page, allows you to see more details. Using this button, you can change the mode from Voltage to Current or Power while in a Voltage page or you can see the timing values while in Timing page.

Page	Mode 1	Mode 2	Mode 3	Mode 4
Total Power 47.8W Status Voltages: PASS Timings: PASS				
Voltage 24-Pin 12V:12.15V PASS 5V:5.08V PASS 3.3V:3.31V PASS 5VS:5.07V PASS 12V2:12.4V PASS	Current 24-Pin 12V:0.7A 5V:1.8A 3.3V:0.9A 5VS:0.3A 12V:N/A	Power 24-Pin 12V:11.9W 5V:8.1W 3.3V:2.4W 5VS:1.8W 12V:N/A		
Voltage CPU 12V:12.16V PASS Voltage PCIe 12V:12.16V PASS	Current CPU 12V:1.4A Current PCIe 12V:0.5A	Power CPU 12V:16.4W Power PCIe 12V:5.7W		
Voltage SATA 12V:12.15V PASS 5V:5.08V PASS 3.3V:3.31V PASS	Current SATA 12V:0.0A 5V:0.2A 3.3V:0.0A	Power SATA 12V:0.0W 5V:0.5W 3.3V:0.0W		
Ripple 24-Pin 12V: 35mV PASS 5V: 24mV PASS 3.3V: 13mV PASS 12V2: 43mV PASS				
Timings T 1 2 3 6 12V1: ●●●●● 5V: ●●●●● 3.3V: ●●●●● 12V2: ●●●●● PWR_OK:367ms	T1 - Power ON 12V1: 54ms PASS 5V: 65ms PASS 3.3V: 67ms PASS 12V2: 54ms PASS	T2 - Rise Time 12V1: 3ms PASS 5V: 7ms PASS 3.3V: 7ms PASS 12V2: 3ms PASS	T3 - PWR OK 12V1:313ms PASS 5V:302ms PASS 3.3V:300ms PASS 12V2:313ms PASS	T6 - DC Loss delay 12V1: 9ms PASS 5V: 19ms PASS 3.3V: 6ms PASS 12V2: 9ms PASS
T2 Min Slew Rate 12V1: 3.7V/ms ● 5V: 0.7V/ms ● 3.3V: 0.4V/ms ● 12V2: 3.7V/ms ●				
Turn-on Slope 12V1: PASS 5V: PASS 3.3V: PASS 12V2: PASS				
Power Sequencing V Seq: PASS T Seq: PASS				

Table 10

Input and output connectors

The tester has four inputs and four outputs terminals. The input terminals marked with “In” suffix should be connected to PSU. The output terminals which are only used in inline configuration are marked with “Out” suffix and should be connected to motherboard. The “SATA In” input is a bit tricky as the orientation of the SATA cable is important. Make sure the pins inside the SATA connector make electrical contact with the pads on the PCB, otherwise the hard drive won’t work.

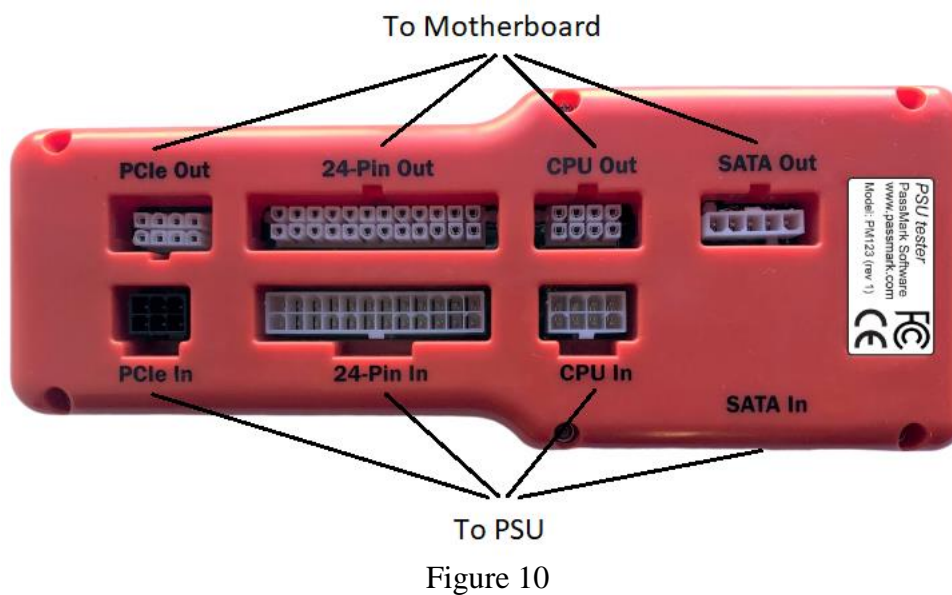


Figure 10

Cables

Each tester comes with 5 cables:

- A USB 2.0 A to B cable for connecting the tester to PC.



Figure 11

- A 24Pin female to 20+4Pin male for connecting the “24-Pin Out” terminal to motherboard.



Figure 12

- An EPS 8Pin female to 4+4Pin for connecting the “CPU Out” terminal to motherboard.



Figure 13

- An EPS 8Pin female to 6+2Pin Male for connecting the “PCIe Out” terminal to motherboard.



Figure 14

- A 5Pin to dual SATA 15Pin female for connecting the “SATA Out” terminal to external hard drives.



Figure 15

How to Test a power supply unit

Standalone mode

1. For your safety, first turn off the power supply by setting the I/O switch on the back panel to the “O” stand.
2. Disconnect all peripherals and devices from the power supply.
3. Connect the 24-pin, 8-pin connector and 6-pin cables of the PSU to the corresponding ‘In’ terminals of the PSU Tester. Note that some power supplies have 8-pin (6+2Pin detachable) PCIe cable. In this case detach the extra 2 pins and connect the 6-pin side.
4. Plug the AC power cord into the main.
5. Turn on the power supply by setting the I/O switch on the back panel to the “I” stand.
6. Press and hold the power button on the PSU tester for 3 seconds until the display shows “Power ON”.
7. Using the Up/Down buttons you can navigate between pages to check the voltages and timings. By pressing the mode button, you can switch between voltage, current and power modes or you can see the timing values.
8. If the monitoring port is connected, you can run the monitoring software and check the PSU parameters from the software as well.

Inline Mode

1. First turn off the power supply by setting the I/O switch on the back panel to the “O” stand.
2. Disconnect all peripherals and devices from the power supply and connect the 24-pin, 8-pin connector and 6-pin cables of the PSU to the corresponding ‘In’ terminals of the PSU Tester. Note that some power supplies have 8-pin (6+2Pin detachable) PCIe cable. In this case detach the extra 2 pins and connect the 6-pin side.
3. Now use the PSU Tester cables to connect “Out” terminals to the motherboard and PC peripherals (e.g. hard drive and graphic card).
4. Plug the AC power cord into the main
5. Turn on the power supply by setting the I/O switch on the back panel to the “I” stand.
6. Turn on the machine using the “standby” button from the computer case.
7. Using the Up/Down buttons you can navigate between pages to check the voltages and timings. By pressing the mode button, you can switch between voltage, current and power modes or you can see the timing values.
8. If the monitoring port is connected, you can run the monitoring software and check the PSU parameters from the software as well.
9. You can run BurnInTest during inline testing to ramp up power usage by the motherboard and place more load on PSU.

Monitoring Software

The main PSUTest application window is divided into 4 sections: Select COM Port, PSU Statistics, Overall Status, and control buttons.

Main Window



Figure 16

The main screen contains the following features and options:

Device

COM Port: The PSU Tester appears as a Virtual COM port when connected to PC. You can determine the Virtual COM Port by opening the Device Manager and looking for USB Serial Device (COM #) or STMicroelectronics Virtual COM Port (COM #).

PSU Statistics

This section displays voltage, current, power, ripple and timing for each voltage rail. A green background for a field means the value is within the acceptable range and a red background means the value is outside the valid range. A grey background indicates that the measurement is not yet completed, and one or two power cycles are required for the value to be calculated. 'N/A' means that the measurement is not available.

Overall Status

This section shows Power Status, Total Power and the status of Voltages and Currents.

Control Buttons

Power ON/OFF: This button forces a PSU to power up/down. Do not use this button when the tester is in inline configuration. Instead, use the “standby” button from the computer case.

Clear Log: The monitoring software records all voltages in the system memory at intervals set in the configuration window. This button can be used to erase all the previous records.

Save Log: Using this button, you can save the log into comma-separated values format (CSV) file.

Reset Min/Max: This button resets the minimum and maximum values for voltages and currents.

Save Report: Using this button, you can save all the PSU statistics in a .txt file.

Configuration Window

The following options appear in the configuration window:

Connected Cables: This allows you to specify which cables are connected so that the unavailable voltages will be excluded from the PASS/FAIL criteria.

Compliance Mode: This option allows the user to select the compliance mode. In the “Strict” mode, all voltages and timings are checked against the specification and any out of range value will result in a FAIL message. In the “Loose” mode the criterial for PASS will be loosened to allow an easier PASS when important values are within the range. Table below summarizes the differences between the “Strict” and “Loose” modes.

	Strict	Loose
DC Regulation range for 12V1, 12V2, 5V and 3.3V rails	10%	10%
DC Regulation range for -12V rail	10%	15%
T2 Min Slew Rate	According to the specification	Not Checked
Power Sequencing	According to the specification	Only when 12V and 5V are above 500mV

Table 11

Buzzer Mode: This option allows the user to specify the conditions at which the buzzer should alarm the user. Table below summarizes the different modes.

Mode	Description
Fatal Errors	Buzzer makes sound when voltages are outside specification or PWR_OK signal is not asserted by the PSU.
Compliance	Buzzer makes sound when any of voltages or timings are outside their approved limits.
Off	Buzzer is always off.

Table 12

Log Intervals: This allows to specify the time intervals for samples in the log file.

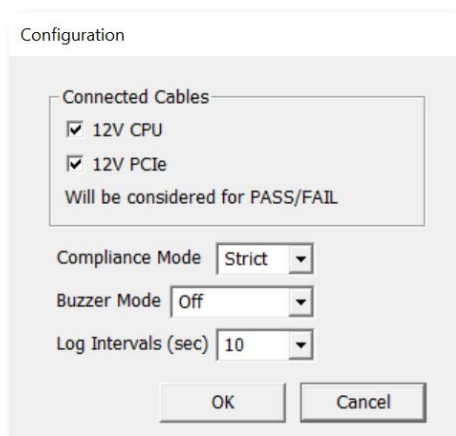


Figure 17

Calibration Window

The unit should provide accurate measurements out of the box, with its default calibration. Typical default accuracy is around 1% for voltage readings, 4% for small currents and 2% for larger current measurements. So, for most uses, further calibration is not required.

However, for experienced users with suitable 3rd party equipment, calibration can be performed to improve the voltage & current measurement accuracy.

To calibrate, two known voltages/loads should be applied for each rail. The applied voltage/load should be measured by a high-end multimeter and is called “Applied Value”. The PSU Tester also software records its own measurement, known as the “Measured Value” and finds the gain and offset required to map this value to the expected value. It is recommended to turn off the buzzer from the configuration window as some of the sample points are outside the ATX specification and will cause the buzzer to stay on during calibration.

Calibration

Voltage/Current: Voltage +12V1

Reset calibration

Reset all calibration data

Turn On (No Load)

Calibration Date - Constants

Last Calibration Date: N/A

Gain: N/A

Offset: N/A

☒ Allow user to specify the sample points

	To be applied	Measured	
Point 1:	1200		Read
Point 2:	12000		Read

Calibrate

Cancel OK

Figure 18

Voltage measurement calibration:

- Open the calibration window.
- From the dropdown list, select the voltage rail that should be calibrated.
- Click “Reset calibration data” to erase all previous calibration data.
- Apply an external voltage equal or close to Point 1. If you can’t apply the exact voltage, activate the “Allow user to specify the sample points” option, which allows you to specify the exact applied voltage.
- Click “Read” button for the Point 1.
- Apply an external voltage equal or close to Point 2. Again, if you can’t apply the exact voltage, activate the “Allow user to specify the sample points” option, which allows you to specify the exact applied voltage.
- Click “Read” button for the Point 2.
- Click “Calibrate”.

Current measurement calibration:

- Open the calibration window.
- From the dropdown list, select the current that should be calibrated.
- Connect the input voltage for the selected current to a low noise external power source. This can be a high-end PSU as well. Click “Turn On (No Load)” to power up the PSU and deactivate the internal passive loads. This step is required even if an external source is used.
- Click “Reset calibration data” to erase all previous calibration data.
- Apply an external load equal or close to Point 1. If you can’t apply the exact load, activate the “Allow user to specify the sample points” option, which allows you to specify the exact applied load.
- Click “Read” button for the Point 1.
- Apply an external load equal or close to Point 2. Again, if you can’t apply the exact load, activate the “Allow user to specify the sample points” option, which allows you to specify the exact applied load.
- Click “Read” button for the Point 2.
- Click Calibrate.

Driver Installation

Starting from Windows 10, the STSW-STM32102 driver is no more adequate and the usage of the native inbox driver (Microsoft driver) is recommended. For other operating systems please follow the below procedure.

Windows Installation (Win7 & Win10)

Step1 – connect the device

With the computer turned on and running, connect the PSU Tester to the USB port on the computer to be tested. The device LCD should turn on and display the default screen.

Step 2 – Install the device driver

Download the latest driver from the following address and extract the package.

<https://www.passmark.com/products/psu-tester/download.php>

The STSW-STM32102 software package contains four installation files based on the various versions of the Microsoft® operating system. Run the setup file according to

the version of your operating system. E.g. run
'CP_V1.5.0_Setup_W7_x64_64bits.exe' if you have a 64-bit version of Windows 7
installed on your computer.

Technical Specification

CPU	ARM Cortex M4
Memory	32KB RAM, 128K Flash
User Interface	1.8" TFT LCD 128X64 Pixels + Membrane Keypad
Standards	ATX12V
Connectors	24-Pin In, 8-Pin CPU In, 6-Pin PCIe In, SATA In, 24-Pin Out, 8-Pin CPU Out, 6-Pin PCIe Out, SATA Out
Internal load	Internal load (1Watt) on +12V1DC, +12V2DC, +5VDC and +3.3VDC voltage rails. Active only when the PSU tester is in standalone mode (Disable in Inline mode).
Measurement	<p>Voltages: +12V1DC, +12V2DC (12V CPU), +5VDC, +3.3VDC, +5VSB, -12VDC, +12VDC PCIe</p> <p>Currents: +12V1DC, +12V2DC (12V CPU), +5VDC, +3.3VDC, +5VSB, +12VDC PCIe, +12VDC SATA, +5VDC SATA. +3.3VDC SATA</p> <p>Ripple: +12V1DC, +12V2DC (12V CPU), +5VDC, +3.3VDC</p> <p>Timings: Power-on Time (T1), Rise Time (T2), PWR_OK delay (T3) and Power-down warning (T6)</p> <p>Minimum slew rate and Ramp up: Check smooth and continuous ramp up of +12V1DC, +12V2DC (12V CPU), +5VDC, +3.3VDC.</p> <p>Power Sequencing: Check +12VDC and +5VDC against +3.3VDC during power up to ensure they are equal to or greater than the +3.3VDC.</p>
Voltage Measurement Range	+12V: 0 to +14.7V, Resolution: 3.5mV +5V: 0 to +6.6V, Resolution: 1.6mV +3.3V: 0 to +4.5V, Resolution: 1.1mV -12V: -15V to +3.3V, Resolution: 4.4mV
Maximum inline current	+12V1DC: 25A +12V2DC (12V CPU): 50A +5VDC: 30A

	+3.3VDC: 30A +5VSB: 8A +12VDC PCIe: 30A +12VDC SATA: 5.5A +5VDC SATA: 5.5A +3.3VDC SATA: 5.5A
Operational Voltage	5V via USB port or the +5V on the 24-Pin connector
Operational Current	200mA
Measurement Error (A)	±4% before calibration, 1.5% after calibration (Note 1)
Measurement Error (V)	±1% before calibration, 0.25% after calibration (Note 1)
Case	High impact ABS plastic
Size	225mm x 85mm x 30mm (8.8 x 3.3 x 1.2 inches)
Weight	240g (8.4 oz)
Safety Protections	Over voltage protection +12V: protected up to 22V +5V: protected up to 10V +3.3V: protected up to 6.5V
Storage Temperature	-30 °C to + 80 °C
Usage Temperature	0 °C to + 40 °C
Part number	PM123
RoHS (Lead free)	Yes

Table 13

1. Calibration service is available upon request for an additional fee. Calibration can also be done by the user if they have a high-end multimeter and a programmable load tester.

The PSU Tester firmware is software upgradeable in the field.

The specifications above are for the PassMark Inline PSU Tester hardware revision 001.

Software Compatibility

Window 7, 8, 10 are supported.

Windows: PSUTest software is required for Windows. Both 32bit and 64bit Windows drivers are available.

Troubleshooting

Symptom: No display after connecting the USB cable

The tester takes its power from the Analysis port. There is most likely a fault with the cable or computer.

Symptom: Power, but no Found New Hardware window

The basic USB device enumeration process could not be completed. This could be a fault in the Windows O/S installation or with the USB hardware in the computer.

Some real-world faulty power supply tests

Antec EA-550 GREEN



This is a 550 Watt 80 Plus Bronze Certified power supply.

Claimed power specifications:

Rail		+3.3V	+5V	+12V1	+12V2	-12V	+5VSB
Max. Power	Amps	20A	18A	30A	30A	0.3A	2.5A
	Watts	66W	90W	360W	360W	3.6W	12.5W
Total Max. Power (W)		550W					

Table 14

Test Results:

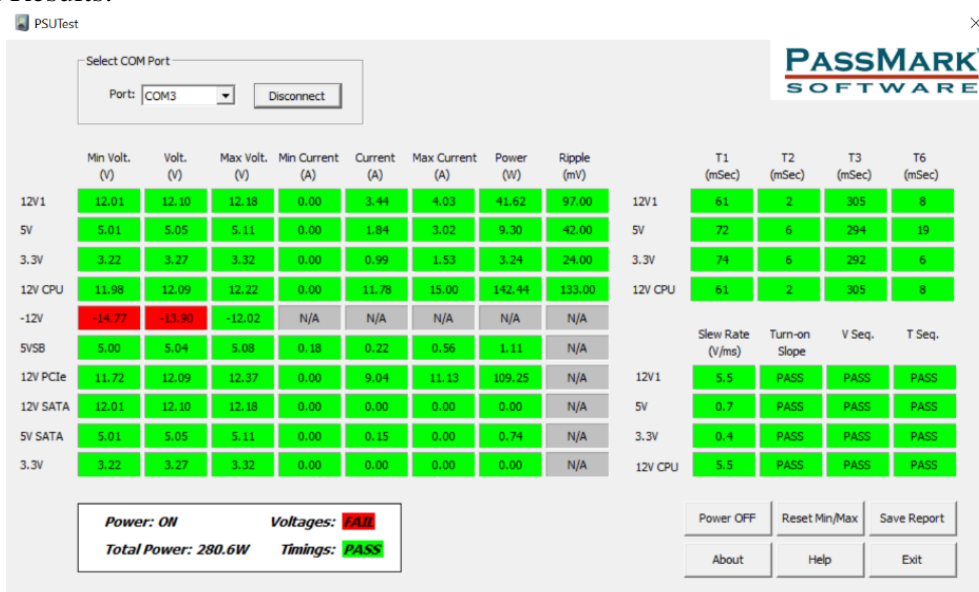


Figure 19

- Voltages were within the specification except for the -12V rail which went outside approved limits when the PSU was under load. The -12V rail is not used very often, especially in new motherboards. There are three type of devices on old motherboards that require -12V which are RS232/RS485 ports without build-in circuitry for generating the negative voltage, (mini-)PCI slots and some PCI sound-cards. These are starting to become very rare, therefore this failure alone is not enough to render this PSU as faulty or not usable.

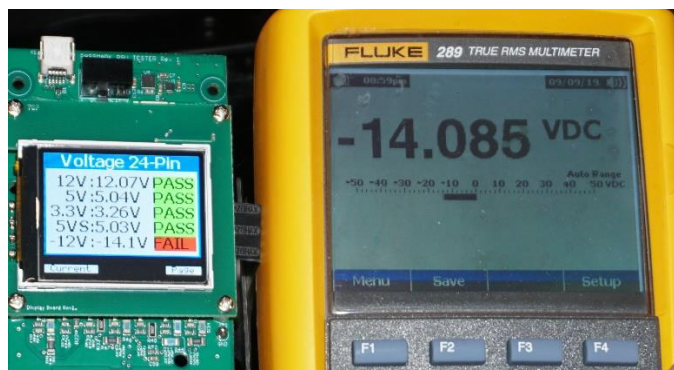


Figure 20

- Efficiency: Using BurnInTest, we put system under load by running the following tests.

Test load 1: CPU (General purpose instructions, 5 Threads)

Test load 2: CPU (General purpose instructions, 11 Threads) and 3D Graphics test (window size 640x400 pixels)

Mode	Output Power	Load	Input Power	Efficiency
Idle	49W	9%	65W	75%
Load 1	110W	20%	133W	82%
Load 2	279W	51%	319W	87%

Table 15

The efficiency measurements confirm that the PSU meets the 80 Plus Bronze efficiency requirements at 20% and 50% loads.

Antec NeoECO 520C



This is a 520 Watt 80 Plus Bronze Certified power supply.

Claimed power specifications:

Rail		+3.3V	+5V	+12V	-12V	+5VSB
Max.	Amps	24A	24A	40A	0.8A	2.5A
Power	Watts	79.2W	120W	480W	9.6W	12.5W
Total Max. Power (W)		520W				

Table 16

Test Results:

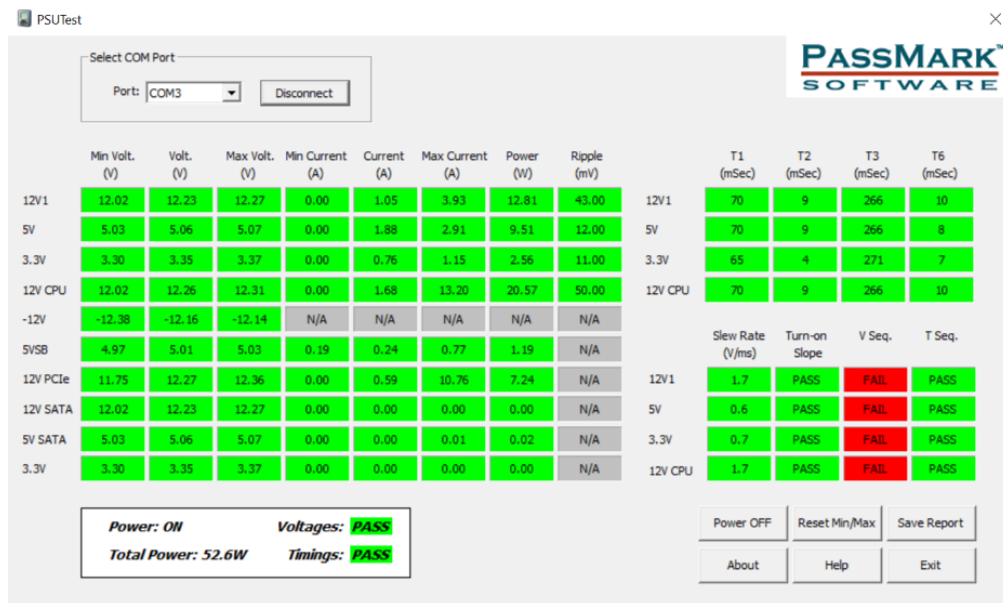


Figure 21

- Failed to meet the power sequencing criteria (V column showed a red circle). This was confirmed by looking at 5V and 3.3V rails by an oscilloscope. As you can see in the below screenshot, the 5V rail was greater than 3.3V for the first 500 microseconds. However, this is not a big issue as the voltage difference is small (<300mV) and the duration is very short (400 microseconds). This failure alone is not enough to render this PSU as faulty or not usable.

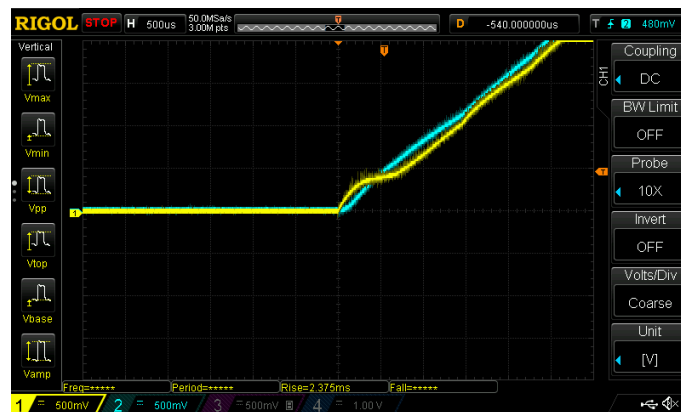


Figure 22

- All voltages were within the specification under different loads (Tested at no load, 20% and 50% loads).
- Efficiency: Using BurnInTest, we put system under load by running a combination of tests simultaneously.
Test load 1: CPU (General purpose instructions, 4 Threads)
Test load 2: CPU (General purpose instructions, 8 Threads) and 3D Graphics test (window size 640x400 pixels)

Mode	Output Power	Load	Input Power	Efficiency
Idle	49W	9%	66W	74%
Load 1	104W	20%	126W	82%
Load 2	259W	50%	301W	86%

Table 17

The efficiency measurements confirm that the PSU meets the 80 Plus Bronze efficiency requirements at 20% and 50% loads.

Seasonic SSR-360GP Active PFC F3



This is a 360 Watt 80 Plus Gold Certified power supply.

Claimed power specifications:

Rail		+3.3V	+5V	+12V	-12V	+5VSB
Max. Power	Amps	12A	16A	30A	0.3A	2A
	Watts	39.6W	80W	360W	3.6W	10W
Total Max. Power (W)		360W				

Table 18

Test Results:



Figure 23

- Voltages were within the specification except for the -12V rail which went outside approved limits when the PSU was under a heavy load (>300W). The -12V rail is not used very often, especially in new motherboards. There are three type of devices on old motherboards that require -12V which are RS232/RS485 ports without build-in circuitry for generating the negative voltage, (mini-)PCI slots and

some PCI sound-cards. These are starting to become very rare, therefore this failure alone is not enough to render this PSU as faulty or not usable.

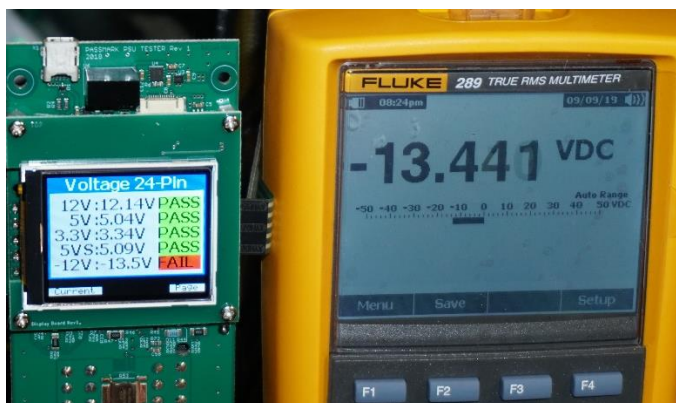


Figure 24

- Efficiency: Using BurnInTest, we put system under load by running a combination of tests simultaneously.
 Test load 1: CPU (General purpose instructions, 1 Threads)
 Test load 2: CPU (General purpose instructions, 2 Threads) and 3D Graphics test (window size 320x200 pixels)
 Test load 3: CPU (Max heat, 16 Threads) and 3D Graphics test (window size 640x480 pixels)

Mode	Output Power	Load	Input Power	Efficiency
Idle	51W	14%	65W	78%
Load 1	76W	21%	91W	83%
Load 2	182W	50%	203W	90%
Load 3	325W	90%	361W	90%

Table 19

The PSU does not meet the 80 Plus Gold efficiency requirements. Expected efficiency at gold level at 20% and 50% load are 88% and 92% respectively.

Seasonic SSR-650RM Active PFC F3



This is a 650 Watt 80 Plus Gold Certified power supply.

Claimed power specifications:

Rail		+3.3V	+5V	+12V	-12V	+5VSB
Max. Power	Amps	20A	20A	54A	0.3A	2.5A
	Watts	66W	100W	648W	3.6W	12.5W
Total Max. Power (W)		650W				

Table 20

Test Results:



Figure 25

- T2 Min Slew Rate for the 12V1 and 12V2 voltage rails failed to meet the criteria. This is confirmed by looking at the 12V rail by an oscilloscope. As you can see the area marked with red colour has a slew rate less than 0.6V/msec.

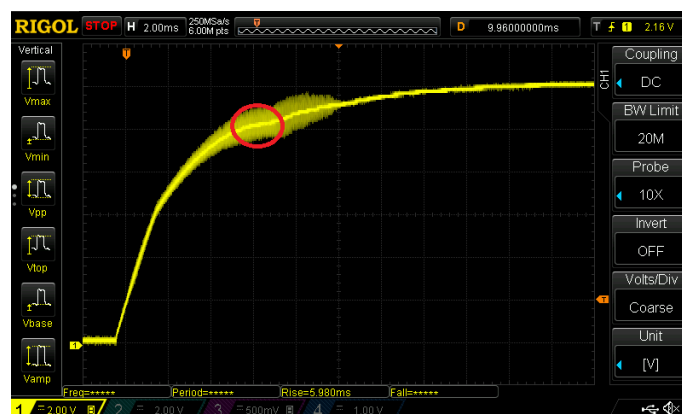


Figure 26

- Voltages were within the specification except for the -12V rail which went outside approved limits when the PSU was under a heavy load (>300W).
- Efficiency: Using BurnInTest, we put system under load by running a combination of tests simultaneously.
Test load 1: CPU (General purpose instructions, 7 Threads)
Test load 2: CPU (Maximum heat, 12 Threads) and 3D Graphics test (window size 1024x768 pixels)

Mode	Output Power	Load	Input Power	Efficiency
Idle	50W	8%	66W	76%
Load 1	138W	21%	156W	88%
Load 2	327W	50%	360W	92%

Table 21

The efficiency measurements confirm that the PSU meets the 80 Plus Gold efficiency requirements at 20% and 50% loads.

OCZ600MXSP



This is a 600 Watt 80 Plus Bronze Certified power supply.

Claimed power specifications:

Rail		+3.3V	+5V	+12V1	+12V2	-12V	+5VSB
Max. Power	Amps	25A	25A	25A	25A	0.3A	2.5A
	Watts	150W		504W		3.6W	12.5W
Total Max. Power (W)		600W					

Table 22

Test Results:

- The PSU failed to assert the PWR_OK to high level. Therefore, the PSU Tester reported T3 as N/A (not available). A few seconds later we noticed smoke and burning smell from the PSU, and we immediately turned it off from the wall. This PSU was being used for a few years and was replaced as the PC used to shut down after a few minutes.



Figure 27

Disclaimer

This product is not warranted nor intended to be used for medical, life support, lifesaving, critical control or safety applications, unless pursuant to an express written agreement with PassMark Software. Furthermore, PassMark Software does not authorize this product for use as critical components in life-support systems where a malfunction or failure may reasonably be expected to result in significant injury to the user. The inclusion of this PassMark Software product in life-support systems application implies that the manufacturer assumes all risk of such use and in doing so indemnifies PassMark Software against all charges.