

Anex

FSP Technology Inc. Hydro Ti Pro 1000W

Lab ID#: FS10002101
 Receipt Date: Dec 9, 2022
 Test Date: Dec 19, 2022

Report: 22PS2101A
 Report Date: Dec 19, 2022

DUT INFORMATION

Brand	FSP Technology Inc.
Manufacturer (OEM)	FSP
Series	Hydro Ti Pro
Model Number	HTI-1000M
Serial Number	S2161030025
DUT Notes	

DUT SPECIFICATIONS

Rated Voltage (Vrms)	100-240
Rated Current (Arms)	13-6
Rated Frequency (Hz)	50-60
Rated Power (W)	1000
Type	ATX12V
Cooling	135mm Fluid Dynamic Bearing Fan (MGA13512XF-A25)
Semi-Passive Operation	✓ (selectable)
Cable Design	Fully Modular

TEST EQUIPMENT

Electronic Loads	Chroma 63601-5 x2 Chroma 63600-2 63640-80-80 x10 63610-80-20
AC Sources	Chroma 6530, APM SP300VAC4000W-P
Power Analyzers	RS HMC8015, N4L PPA1530, N4L PPA5530
Oscilloscopes	Picoscope 4444, Rigol DS7014, Siglent SDS2104X PLUS
Sound Analyzer	Bruel & Kjaer 2270 G4
Microphone	Bruel & Kjaer Type 4955-A
Temperature Logger	Picoscope TC-08
Tachometer	UNI-T UT372
Multimeters	Keysight 34465A, Keithley 2015 - THD
UPS	FSP Champ Tower 3kVA, CyberPower OLS3000E 3kVA
Isolation Transformer	4kVA

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RESULTS

Temperature Range (°C /°F)	30-32 / 86-89.6
ErP Lot 3/6 Ready	✓
(EU) No 617/2013 Compliance	✓
ALPM (Alternative Low Power Mode) compatible	✓
ATX 3.0 Ready	✓

115V

Average Efficiency	92.235%
Efficiency With 10W (≤500W) or 2% (>500W)	74.077
Average Efficiency 5VSB	80.409%
Standby Power Consumption (W)	0.0756000
Average PF	0.993
Avg Noise Output	12.65 dB(A)
Efficiency Rating (ETA)	TITANIUM
Noise Rating (LAMBDA)	A++

230V

Average Efficiency	93.950%
Average Efficiency 5VSB	78.929%
Standby Power Consumption (W)	0.1218000
Average PF	0.968
Avg Noise Output	14.69 dB(A)
Efficiency Rating (ETA)	TITANIUM
Noise Rating (LAMBDA)	A++

POWER SPECIFICATIONS

Rail		3.3V	5V	12V	5VSB	-12V
Max. Power	Amps	20	20	83.33	3	0.3
	Watts	120		1000	15	3.6
Total Max. Power (W)		1000				

HOLD-UP TIME & POWER OK SIGNAL (230V)

Hold-Up Time (ms)	27.1
AC Loss to PWR_OK Hold Up Time (ms)	23.3
PWR_OK Inactive to DC Loss Delay (ms)	3.8

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CABLES AND CONNECTORS

Modular Cables

Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (600mm)	1	1	16-22AWG	Yes
4+4 pin EPS12V (700mm)	2	2	16AWG	No
6+2 pin PCIe (650mm)	3	3	16AWG	No
6+2 pin PCIe (650mm+150mm)	2	4	16-18AWG	No
12+4 pin PCIe (700mm) (600W)	1	1	16-24AWG	No
SATA (500mm+150mm+150mm+150mm)	2	8	18AWG	No
SATA (500mm+150mm) / 4 pin Molex (+150mm+100mm)	1	2 / 2	18AWG	No
SATA (500mm+150mm) / 4 pin Molex (+150mm) / FDD (+150mm)	1	2 / 1 / 1	18-22AWG	No

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General Data	
Manufacturer (OEM)	FSP
PCB Type	Double Sided
Primary Side	
Transient Filter	2x Y caps, 2x SMD Y caps, 3x X caps, 1x CM choke, 1x DM choke, 1x MOV
Inrush Protection	1x NTC Thermistor SCK205R0 (5 Ohm) & Relay
Standby Rectifier Diodes	4x On Semiconductor S1M (1000V, 1A @ 100°C)
Bridge Rectifier MOSFETs	4x STMicroelectronics STB57N65M5 (650V, 26.5A @ 100°C, Rds(on): 0.0630hm)
APFC MOSFETs	2x Infineon IPA60R099C7 (600V, 8A @ 100°C, Rds(on): 0.0990hm)
APFC Boost Diode	2x Infineon IDH08G65C6 (650V, 8A @ 145°C)
Bulk Cap(s)	1x Nippon Chemi-Con (450V, 680uF, 2,000h @ 105°C, KMZ) & 1x Nippon Chemi-Con (450V, 330uF, 2,000h @ 105°C, KMR)
Main Switchers	4x Alpha & Omega AOTF160A60L (600V, 15A @ 100°C, Rds(on): 0.0160hm)
Driver ICs	2x Novosense NSi6602
APFC Controller	Infineon ICE2PCS02G
Resonant Controller	Champion CM6901T2X
Topology	Primary side: Bridgeless, APFC, Full-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	
+12V MOSFETs	6x Toshiba TPHP8504PL (40V, 150A, Rds(on): 0.85mOhm)
5V & 3.3V	DC-DC Converters: 6x Infineon BSC0901NS (30V, 94A @ 100°C, Rds(on): 1.9mOhm) PWM Controller(s): ANPEC APW7159C
Filtering Capacitors	Electrolytic: 5x Nippon Chemi-Con (1-5,000h @ 105°C, KZE), 4x Rubycon (6-10,000h @ 105°C, ZLH), 1x Rubycon (1-5,000h @ 105°C, ZL) Polymer: 21x United Chemi-Con, 19x NIC, 4x FPCAP
Supervisor IC	Weltrend WT7527RA (OVP, UVP, OCP, SCP, PG)
Fan Controller	APW9010
Fan Model	Protechnic Electric MGA13512XF-A25 (135mm, 12V, 0.38A, Fluid Dynamic Bearing Fan)
5VSB Circuit	
Rectifier	1x Nexperia PSMN2R0-30YLD FET (30V, 100A, Rds(on): 20hm), 1x P15L50N5 SBR (50V, 15A) & 1x CET CEB04N7G FET (700V, 4A, Rds(on): 3.30hm)
Standby PWM Controller	GR8837CCG

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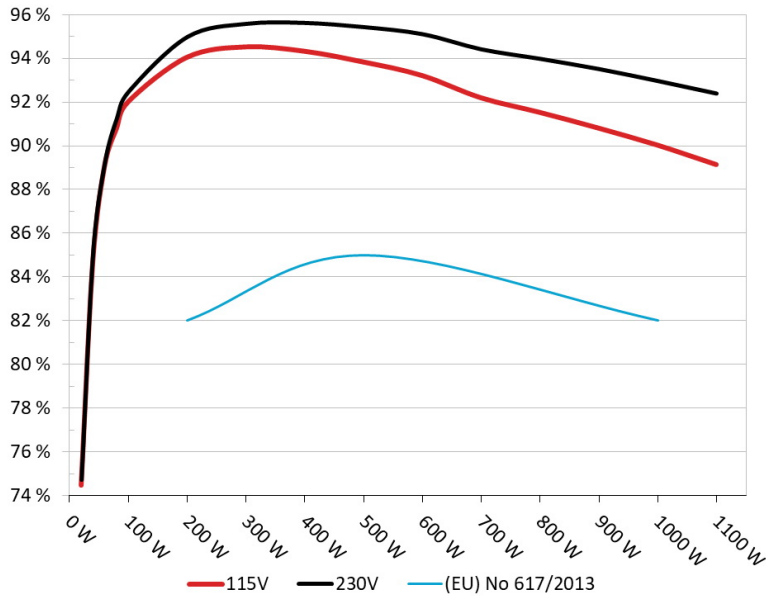
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EFFICIENCY UNDER HIGH AMBIENT TEMPERATURE

Efficiency: FSP Hydro Ti Pro 1000W

Ambient: 37°C - 47°C (98.6°F - 116.6°F)



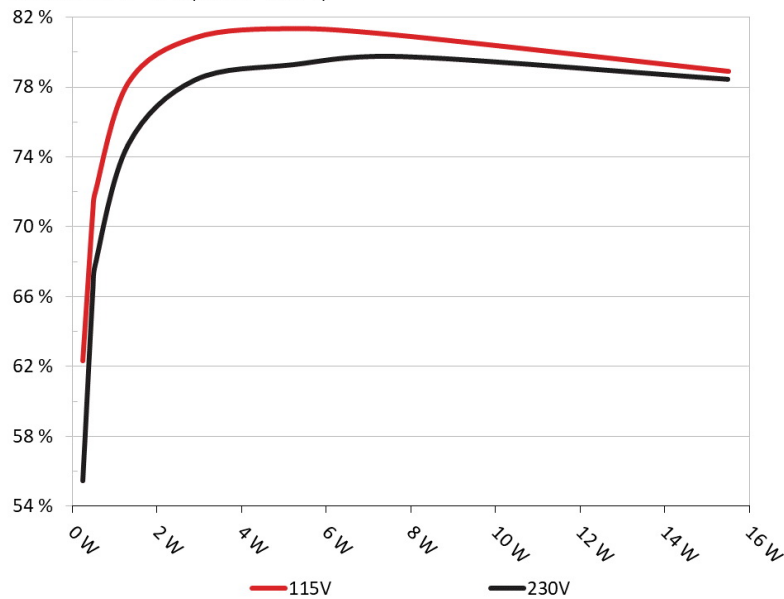
INFO

The PSU's efficiency under high ambient temperatures with 115V and 230V input. For this graph the results of the 10-110% load regulation table are used

5VSB EFFICIENCY

5VSB Efficiency: FSP Hydro Ti Pro 1000W

Ambient: 34°C - 36°C (93.2°F - 96.8°F)



INFO

This graph depicts the efficiency levels of the 5VSB rail with 115V and 230V input

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FSP Technology Inc. Hydro Ti Pro 1000W

5VSB EFFICIENCY -115V (ERP LOT 3/6 & CEC)

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.236W	62.809%	0.04
	5.248V	0.378W		114.85V
2	0.09A	0.472W	71.385%	0.069
	5.247V	0.661W		114.84V
3	0.55A	2.879W	81.334%	0.28
	5.236V	3.54W		114.85V
4	1A	5.224W	81.863%	0.378
	5.225V	6.381W		114.84V
5	1.5A	7.817W	81.451%	0.432
	5.212V	9.596W		114.84V
6	2.999A	15.507W	79.412%	0.495
	5.171V	19.528W		114.85V

5VSB EFFICIENCY -230V (ERP LOT 3/6 & CEC)

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.236W	55.95%	0.013
	5.248V	0.423W		229.89V
2	0.09A	0.472W	66.83%	0.022
	5.247V	0.706W		229.89V
3	0.55A	2.879W	78.876%	0.11
	5.235V	3.647W		229.89V
4	1A	5.222W	79.766%	0.182
	5.223V	6.548W		229.89V
5	1.5A	7.814W	80.224%	0.244
	5.21V	9.74W		229.89V
6	2.999A	15.497W	78.928%	0.355
	5.167V	19.635W		229.89V

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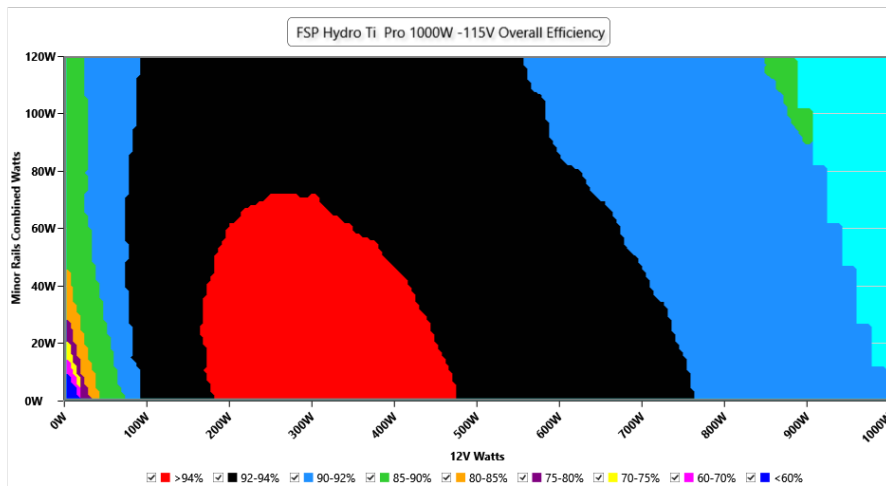
115V

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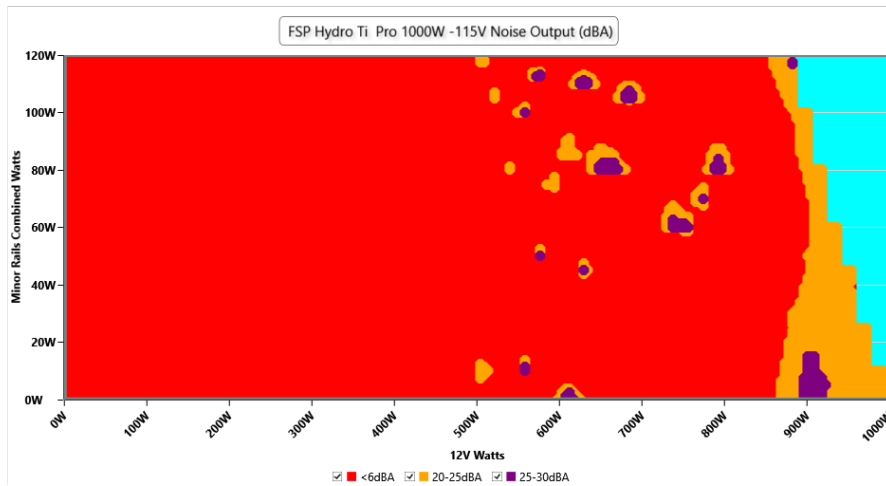
EFFICIENCY GRAPH 115V



INFO

This graph depicts the PSU's efficiency throughout its entire operational range. For the generation of the efficiency and noise graphs we set our loaders to auto mode through our custom-made software before trying thousands of possible load combinations

NOISE GRAPH 115V



INFO

The PSU's noise in its entire operational range and under 30-32 °C ambient is depicted in this graph. The X axis represents the load on the +12V rail(s) while the Y axis is the load on the minor rails

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VAMPIRE POWER -115V

Detailed Results

	Average	Min	Limit Min	Max	Limit Max	Result
Mains Voltage RMS:	114.86 V	114.81 V	113.85 V	114.89 V	116.15 V	PASS
Mains Frequency:	60.00 Hz	60.00 Hz	59.40 Hz	60.02 Hz	60.60 Hz	PASS
Mains Voltage CF:	1.416	1.416	1.340	1.418	1.490	PASS
Mains Voltage THD:	0.17 %	0.13 %	N/A	0.24 %	2.00 %	PASS
Real Power:	0.076 W	0.038 W	N/A	0.108 W	N/A	N/A
Apparent Power:	9.472 W	8.985 W	N/A	9.793 W	N/A	N/A
Power Factor:	0.007	N/A	N/A	N/A	N/A	N/A

INFO

This graph is generated by the PPA Standby Power Analysis software which takes full control of the power analyzer during the whole procedure. This application features all of the EN50564 & IEC62301 test limits for standby power software testing

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10-110% LOAD TESTS 115V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
10%	6.450A	1.923A	1.96A	0.97A	99.984	92.009%	0	<6.0	44.43°C	0.982
	12.153V	5.199V	3.366V	5.151V	108.668				40.01°C	114.83V
20%	13.915A	2.89A	2.947A	1.169A	199.912	94.038%	0	<6.0	45.51°C	0.991
	12.146V	5.19V	3.359V	5.134V	212.585				40.6°C	114.8V
30%	21.738A	3.376A	3.444A	1.368A	299.939	94.513%	0	<6.0	46.79°C	0.995
	12.139V	5.183V	3.353V	5.118V	317.354				41.53°C	114.78V
40%	29.513A	3.864A	3.943A	1.568A	399.281	94.314%	0	<6.0	47.61°C	0.996
	12.133V	5.176V	3.347V	5.102V	423.352				41.87°C	114.76V
50%	36.983A	4.836A	4.938A	1.77A	499.014	93.827%	0	<6.0	48.29°C	0.997
	12.127V	5.169V	3.341V	5.085V	531.836				42.19°C	114.72V
60%	44.525A	5.811A	5.937A	1.973A	599.546	93.205%	0	<6.0	49.49°C	0.997
	12.122V	5.163V	3.335V	5.069V	643.253				42.9°C	114.7V
70%	52.018A	6.791A	6.942A	2.177A	699.27	92.19%	689	<6.0	43.64°C	0.997
	12.114V	5.154V	3.328V	5.05V	758.499				50.71°C	114.68V
80%	59.574A	7.773A	7.945A	2.281A	799.253	91.523%	746	19.7	43.9°C	0.997
	12.109V	5.147V	3.321V	5.038V	873.288				51.95°C	114.65V
90%	67.472A	8.266A	8.443A	2.387A	899.009	90.806%	1122	34.0	44.2°C	0.996
	12.103V	5.139V	3.314V	5.025V	990.03				53.23°C	114.63V
100%	75.180A	8.766A	8.974A	3.008A	999.013	90.029%	1464	41.4	45.19°C	0.996
	12.096V	5.132V	3.308V	4.985V	1109.659				55.22°C	114.59V
110%	82.834A	9.758A	10.084A	3.013A	1099.649	89.136%	1803	46.8	47.35°C	0.995
	12.089V	5.123V	3.3V	4.976V	1233.669				58.26°C	114.56V
CL1	0.113A	13.938A	14.241A	0A	121.247	88.879%	0	<6.0	48.99°C	0.985
	12.153V	5.179V	3.348V	5.197V	136.42				43.69°C	114.81V
CL2	0.113A	19.265A	0A	0A	101.367	88.022%	0	<6.0	49.86°C	0.983
	12.158V	5.191V	3.356V	5.216V	115.161				42.76°C	114.82V
CL3	0.113A	0A	19.635A	0A	67.353	83.552%	0	<6.0	51.83°C	0.971
	12.156V	5.197V	3.36V	5.196V	80.611				42.65°C	114.83V
CL4	82.601A	0A	0A	0.001A	999.671	90.506%	1226	36.5	44.64°C	0.996
	12.102V	5.152V	3.322V	5.151V	1104.544				55.5°C	114.59V

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20-80W LOAD TESTS 115V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
20W	1.220A	0.481A	0.49A	0.193A	19.987	74.485%	0	<6.0	40.17°C	0.857
	12.156V	5.201V	3.369V	5.191V	26.833				37.1°C	114.84V
40W	2.688A	0.673A	0.686A	0.289A	39.986	84.794%	0	<6.0	41.29°C	0.935
	12.155V	5.199V	3.367V	5.185V	47.156				38.01°C	114.84V
60W	4.156A	0.866A	0.882A	0.386A	59.985	89.116%	0	<6.0	42.49°C	0.963
	12.153V	5.198V	3.366V	5.179V	67.31				38.72°C	114.84V
80W	5.621A	1.058A	1.079A	0.483A	79.936	90.787%	0	<6.0	43.44°C	0.976
	12.152V	5.197V	3.365V	5.173V	88.046				39.43°C	114.83V

RIPPLE MEASUREMENTS 115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	5.90mV	4.47mV	15.22mV	10.68mV	Pass
20% Load	7.72mV	4.93mV	14.31mV	10.47mV	Pass
30% Load	9.55mV	5.03mV	16.79mV	11.08mV	Pass
40% Load	11.77mV	5.44mV	16.48mV	12.40mV	Pass
50% Load	12.84mV	5.95mV	7.79mV	12.19mV	Pass
60% Load	14.41mV	5.99mV	8.80mV	12.70mV	Pass
70% Load	11.01mV	6.96mV	18.91mV	13.56mV	Pass
80% Load	11.80mV	6.76mV	17.59mV	13.41mV	Pass
90% Load	12.91mV	7.07mV	10.82mV	14.17mV	Pass
100% Load	19.74mV	9.47mV	11.90mV	16.62mV	Pass
110% Load	21.34mV	9.35mV	14.51mV	16.16mV	Pass
Crossload1	9.62mV	6.50mV	7.71mV	11.78mV	Pass
Crossload2	5.95mV	6.56mV	6.67mV	11.33mV	Pass
Crossload3	5.06mV	7.17mV	15.72mV	10.78mV	Pass
Crossload4	19.33mV	8.32mV	11.45mV	16.39mV	Pass

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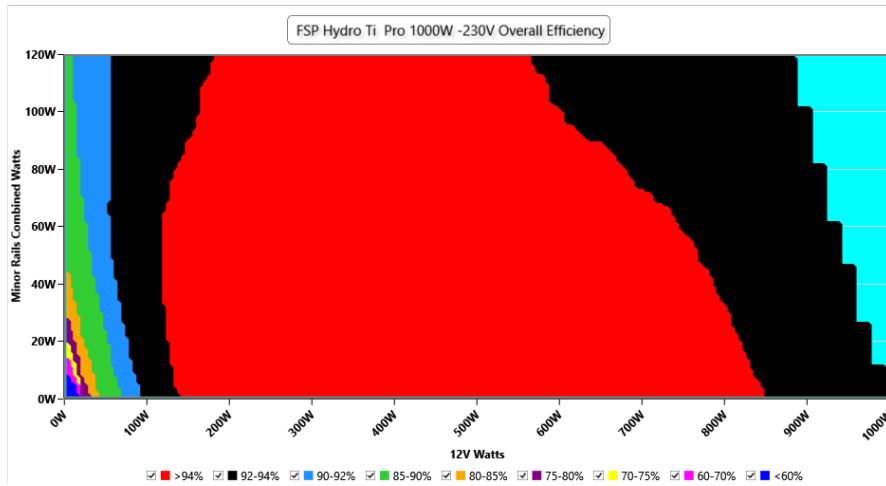
230V

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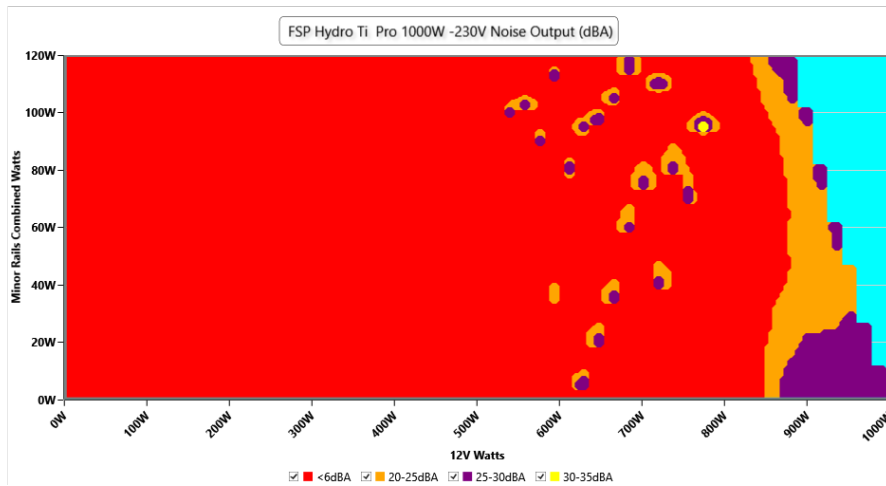
EFFICIENCY GRAPH 230V



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NOISE GRAPH 230V



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VAMPIRE POWER -230V

Detailed Results

	Average	Min	Limit Min	Max	Limit Max	Result
Mains Voltage RMS:	229.88 V	229.84 V	227.70 V	229.93 V	232.30 V	PASS
Mains Frequency:	50.00 Hz	50.00 Hz	49.50 Hz	50.01 Hz	50.50 Hz	PASS
Mains Voltage CF:	1.415	1.415	1.340	1.416	1.490	PASS
Mains Voltage THD:	0.13 %	0.11 %	N/A	0.20 %	2.00 %	PASS
Real Power:	0.122 W	0.045 W	N/A	0.202 W	N/A	N/A
Apparent Power:	31.424 W	31.022 W	N/A	31.770 W	N/A	N/A
Power Factor:	0.004	N/A	N/A	N/A	N/A	N/A

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10-110% LOAD TESTS 230V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
10%	6.448A	1.924A	1.961A	0.971A	99.991	92.48%	0	<6.0	44.42°C	0.882
	12.156V	5.198V	3.365V	5.15V	108.124				40.1°C	229.89V
20%	13.914A	2.891A	2.948A	1.169A	199.934	94.986%	0	<6.0	45.23°C	0.957
	12.149V	5.19V	3.359V	5.133V	210.488				40.54°C	229.87V
30%	21.735A	3.377A	3.445A	1.368A	299.973	95.586%	0	<6.0	46.86°C	0.975
	12.143V	5.183V	3.353V	5.116V	313.823				41.57°C	229.86V
40%	29.516A	3.864A	3.944A	1.569A	399.408	95.627%	0	<6.0	47.55°C	0.982
	12.136V	5.177V	3.347V	5.1V	417.674				41.92°C	229.85V
50%	36.984A	4.837A	4.94A	1.77A	499.133	95.438%	0	<6.0	48.59°C	0.983
	12.130V	5.17V	3.34V	5.084V	522.993				42.5°C	229.84V
60%	44.523A	5.811A	5.938A	1.973A	599.633	95.114%	0	<6.0	49.57°C	0.984
	12.125V	5.164V	3.334V	5.068V	630.432				42.91°C	229.83V
70%	52.007A	6.788A	6.941A	2.176A	699.327	94.422%	664	<6.0	43.3°C	0.986
	12.118V	5.157V	3.328V	5.052V	740.645				50.35°C	229.81V
80%	59.579A	7.773A	7.946A	2.282A	799.294	93.987%	666	<6.0	43.41°C	0.987
	12.109V	5.147V	3.32V	5.038V	850.425				51.59°C	229.8V
90%	67.475A	8.267A	8.444A	2.387A	899.032	93.523%	984	30.3	44.16°C	0.987
	12.102V	5.139V	3.314V	5.025V	961.293				53.25°C	229.79V
100%	75.183A	8.767A	8.975A	3.009A	999.029	92.976%	1354	39.2	45.11°C	0.986
	12.096V	5.131V	3.307V	4.984V	1074.505				55.14°C	229.78V
110%	82.836A	9.758A	10.085A	3.013A	1099.636	92.398%	1747	46.6	46.52°C	0.986
	12.088V	5.122V	3.3V	4.976V	1190.12				57.45°C	229.76V
CL1	0.113A	13.942A	14.244A	0A	121.248	89.672%	0	<6.0	47.19°C	0.916
	12.151V	5.177V	3.348V	5.196V	135.199				41.66°C	229.88V
CL2	0.113A	19.271A	0A	0A	101.367	88.687%	0	<6.0	49.89°C	0.892
	12.158V	5.189V	3.355V	5.215V	114.296				42.83°C	229.89V
CL3	0.113A	0A	19.638A	0A	67.353	84.168%	0	<6.0	53.76°C	0.823
	12.156V	5.196V	3.36V	5.195V	80.025				44.73°C	229.89V
CL4	82.586A	0A	0A	0.001A	999.634	93.435%	1184	35.5	45.17°C	0.986
	12.104V	5.154V	3.323V	5.153V	1069.875				55.98°C	229.77V

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Anex

FSP Technology Inc. Hydro Ti Pro 1000W

20-80W LOAD TESTS 230V

Test	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
20W	1.220A	0.48A	0.489A	0.192A	19.992	74.731%	0	<6.0	40.21°C	0.492
	12.166V	5.206V	3.371V	5.196V	26.751				37.1°C	229.9V
40W	2.687A	0.673A	0.685A	0.289A	39.987	85.199%	0	<6.0	40.83°C	0.665
	12.163V	5.204V	3.369V	5.189V	46.934				37.51°C	229.89V
60W	4.154A	0.865A	0.882A	0.386A	59.985	89.255%	0	<6.0	41.54°C	0.777
	12.161V	5.202V	3.368V	5.182V	67.207				38.01°C	229.89V
80W	5.618A	1.058A	1.078A	0.483A	79.941	91.254%	0	<6.0	42.95°C	0.842
	12.159V	5.2V	3.367V	5.176V	87.602				39.1°C	229.89V

RIPPLE MEASUREMENTS 230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	4.98mV	4.62mV	4.85mV	10.88mV	Pass
20% Load	14.18mV	5.39mV	14.05mV	14.47mV	Pass
30% Load	9.90mV	5.39mV	5.91mV	12.20mV	Pass
40% Load	15.85mV	5.13mV	12.74mV	14.82mV	Pass
50% Load	13.62mV	5.69mV	16.38mV	12.75mV	Pass
60% Load	15.54mV	6.45mV	15.88mV	15.23mV	Pass
70% Load	13.16mV	6.91mV	14.81mV	14.62mV	Pass
80% Load	16.32mV	6.76mV	16.13mV	15.74mV	Pass
90% Load	11.14mV	7.07mV	11.27mV	13.41mV	Pass
100% Load	16.82mV	9.39mV	12.81mV	16.40mV	Pass
110% Load	18.17mV	9.42mV	14.10mV	16.89mV	Pass
Crossload1	9.44mV	7.06mV	7.85mV	12.59mV	Pass
Crossload2	5.29mV	6.60mV	6.47mV	11.74mV	Pass
Crossload3	4.86mV	5.54mV	7.18mV	10.83mV	Pass
Crossload4	16.83mV	8.76mV	11.98mV	15.52mV	Pass

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Anex

FSP Technology Inc. Hydro Ti Pro 1000W



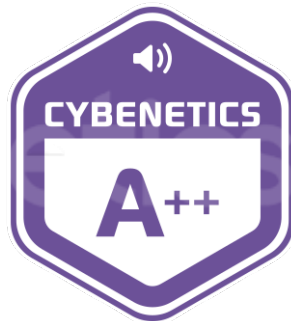
Top side



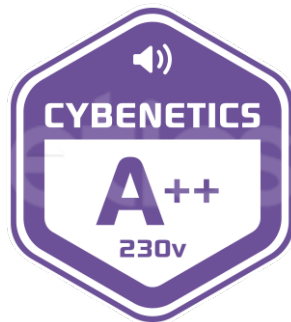
AC Input		100-240V~ 13-6A 50-60Hz			
交流輸入 / 交流輸入 / 정격입력		(Only for China Korea 日本 中国 韩国 台湾)			
DC Output		200-240V~ 6A 50-60Hz			
直流輸出 / 直流輸出		(Only for China Korea 日本 中国 韩国 台湾)			
	+3.3V	+5V	+12V	-12V	+5Vsb
Max Output Current	20A	20A	83.33A	0.3A	3A
最大電流 / 最大電流 / 정격출력					
Max Combined Power	120W		1000W	18.6W	
最大功率 / 最大功率					
Total Power	1000W				
額定功率 / 額定功率					

Power specifications label

CERTIFICATIONS 115V



CERTIFICATIONS 230V



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