

1. Introduction

1.1 Scope

This specification defines the performance and characteristic for the model of AP-1U60P868 power supply.

1.2 General Description

AP- 1U serials is switching power supply, with a 1U form factor, +5V standby voltage, remote on/off, dual line input capability.

2. AC Input

2.1 Voltage Range

Voltage range: 100VACmin ~ 264VACmax

Active PFC Version

2.2 Frequency Range

Frequency range: 47Hz – 63Hz

2.3 Input Current

2.3.1 Steady-state Current

Maximum current at 110 VAC (RMS): 9.0A

Maximum current at 240 VAC (RMS): 4.5 A

2.3.2 Cold Start Inrush Current

Maximum inrush current at 115VAC: 50A

Maximum inrush current at 230 VAC: 100A

* Measured at 25°C ambient cold start.

2.3.3 Power Factor Correction (PFC)

AP- 1U serials is facilitated with the universal input active PFC with the PF value near 1 at full load.

115V (Nominal) Operation

PFC reaches 95.0% at 115V, 60Hz, under full output loading in accordance with the EN 61000-3-2, class D standards.

230V (Nominal) Operation

PFC reaches 95.0% at 230V, 50Hz, under full output loading in accordance with the EN 61000-3-2, class D standards.

2.4.4 Input Over current Protection

The power supply is equipped with a non-reset-able fuse on the AC input to limit power consumption on a failure within the power supply module.

Input Fuse Rating:

Voltage	250 V
Current	12 A

2.4.5 Withstand Voltage

The power supply is capable of withstanding a maximum 1800vac potential between the input and ground for a period of 1 minute.

2.4.6 Catastrophic Failure Protection

If a component failure occurs, the power supply will not exhibit any of the following: * Flame

- * Excessive smoke
- * Charred PCB
- * Fused PCB conductor
- * Startling noise
- * Emission of molten material

3. DC Output

3.1 Output Voltage

Table 1 below summarizes the minimum DC output voltages and associated power requirements for each output.

AP- 1U60P868

Parameter	Min (A)	Nom.	Max (A)	Peak (A)	Unit
+3.3V	0.3	-	18		Amps
+5V	0.5	-	20		Amps
+12V1	0.3	-	24	28	Amps
+12V2	0.3	-	24	28	Amps
-12V	0	-	0.5		Amps
-5V	0	-	0.3		Amps
+5Vsb	0	-	2.5		Amps

Table 1. DC Output Specifications Notes:

- (1) The maximum continuous total DC outputs power shall not exceed 600W.
- (2) The maximum continuous load on +5V and +3.3V outputs shall not exceed 120W.
- (3) The +12V1 and +12V2 total output shall not exceed 45A.

3.2 Output Regulation

The DC voltage outputs will stay within the regulation band as measured at the terminal outputs due to any combination of the following conditions:

- * Input voltage fluctuations
- * Specified load range
- * Centering
- * Specified environmental conditions
- * Changing load steps

3.2.1 Output voltage load regulation

The following table summarizes the allowable output voltage tolerances for each output rail.

DC Nominal Output	Output Voltage Tolerance
+12V1&2 DC	±5%
+5V DC	±5%
+3.3V DC	±5%
-12V & -5V DC	±10%
+5VSB	±5%

Table 2. DC Output Tolerance Specifications

3.2.2 Output Voltage Line Regulation

The following table specifies line regulation as measured from minimum to maximum load including the transient response requirements as detailed in this document.

DC Nominal Output	Output Voltage Tolerance
+12V _{1&2} DC	±1%
+5V DC	±1%
+3.3V DC	±1%
-12V DC/-5VDC	±1%
+5V SB	±1%

Table 3. DC Output Tolerance Specifications

3.2.3 Cross Regulation

The power supply DC outputs perform within all line and load specifications regardless of the static or transient loads on any of the outputs.

3.3 Efficiency

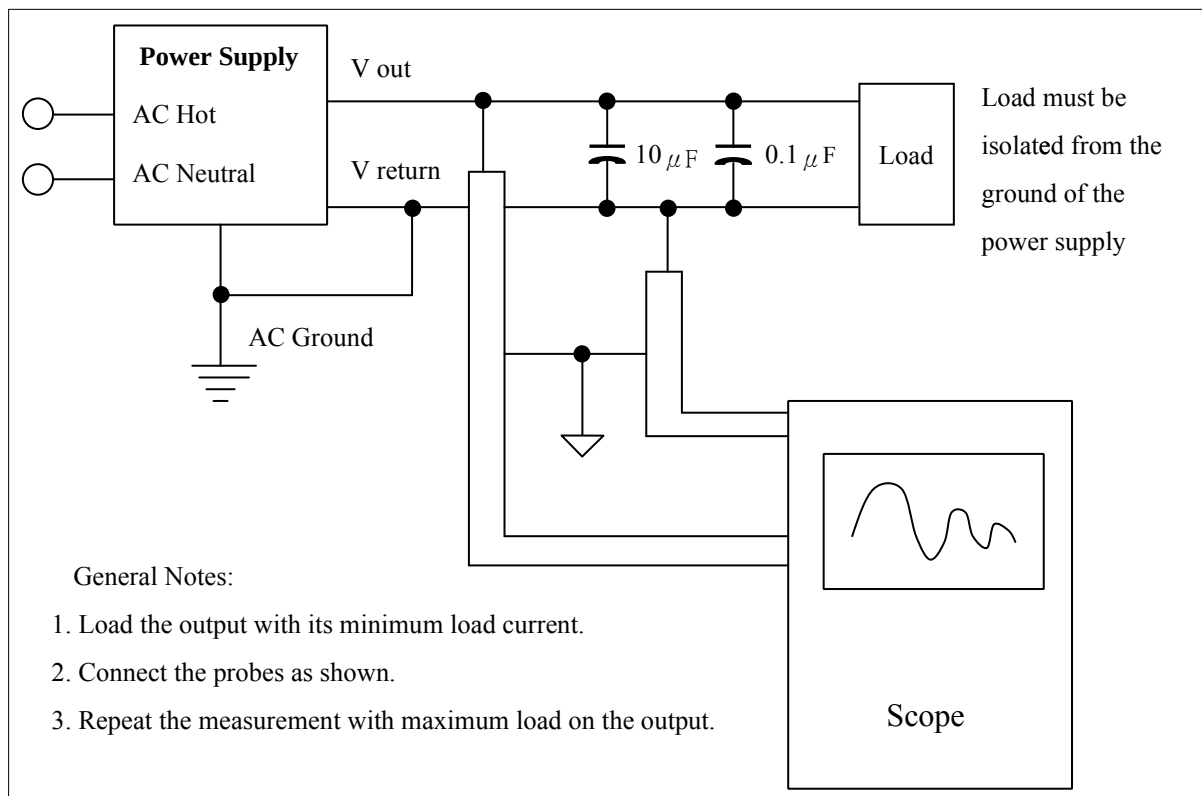
≥ 80% minimum at 115VAC, at full load.

3.4 Output Periodic and Random Deviation (PARD)

There are two types of noise (PARD) specifications to be considered on the power supply; Common Mode and Differential Mode. Common mode is referred to as noise that is common between the specified voltage output and the associated ground line. Differential mode refers to noise that is only measured on the specified DC voltage output. In either case, noise is within the frequency range of 10 Hz – 20MHz and specifications are rated over the full output range for the power supply. Tables 4 provide the details for this specification.

DC Output	Ripple and Noise
+12V _{1&2} DC	≤ 120mv(pk-pk)
+5V DC	≤ 50mv(pk-pk)
+3.3V DC	≤ 50mv(pk-pk)
-12V DC/-5VDC	≤ 120mv(pk-pk)
+5V SB	≤ 50mv(pk-pk)

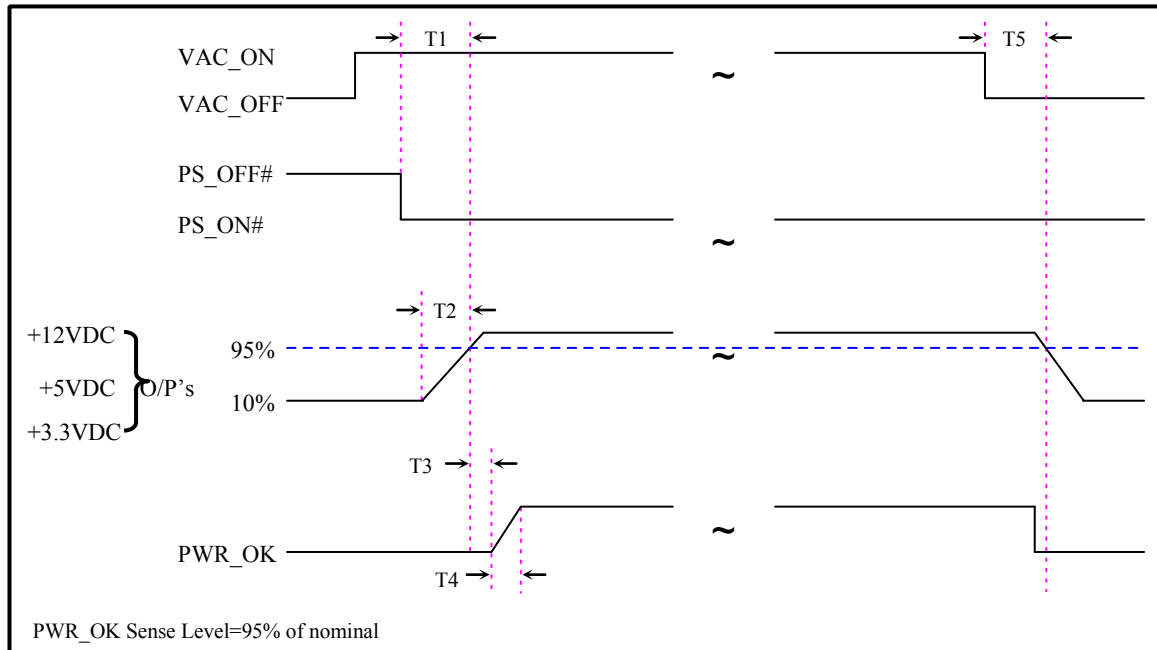
Table 4. DC Output Periodic And Random Deviation (PARD)



3.5 Voltage Hold-up Time

All output will stay within regulation for at least 17ms after an AC line voltage failure is detected at nominal line (115VAC or 230VAC) under 80% full load condition.

3.7 Timing / Housekeeping / Control



< 500mS	T1 : Power-On Time
0.1mS <= T2 <= 20mS	T2 : Rise Time
100mS < T3 < 500mS	T3 : PWR_OK Delay
T4 <= 100uS	T4 : PWR_OK Rise Time
T5 >=17mS	T5 : AC Loss to PWR_OK Hold-up Time

Figure 1

Power Supply Timing

3.7.1 PWR_OK

The power supply accepts a logic collector level which will disable/enable all the output voltages. As the logic level is low, output voltages are enabling; As the logic level is high, output voltages are disable. The definition of logic low/high level is as:

High Level: 2.50V ~ 5.25V while sourcing 0.4mA maximum

Low Level: 0.0V ~ 0.50V while sinking 5.0mA maximum

3.7.2 PS_ON# Signal

The power supply provides an internal pull-up to TTL high. The power supply also provides debounce circuitry on PS_ON# to prevent it from oscillating on/off at startup when activated by a mechanical switch. The DC output enable circuitry is SELV-complaint.

	Min.	Max.
V _{IL} , Input Low Voltage	0.0V	0.8V
V _{IL} , Input Low Current (V _{in} = 0.4 V)		-1.6mA
V _{IH} , Input High Voltage (I _{in} = -200 μ A)	2.0V	
V _{IH} , open circuit, I _{in} = 0		5.25V

Table 8. PS_ON# Signal Characteristics

3.7.3 +5VSB

The +5VSB is capable of delivering a maximum of 3.5 Amps at +5V $\pm$ 5% to external circuit. The power supply +5VSB is with over current protection.

3.7.4 5vsb Power-on Time

The +5VSB has a power-on time of two seconds maximum after application of valid AC voltages. (Figure 1)

3.7.5 Output Rise time

The output voltages rise from 10% of nominal to within the regulation ranges within 0.1ms to 20ms (Figure 1)

3.7.6 Overshoot at Turn-on / Turn-off

Any overshoot at turn on or turn off is under 10% of the nominal DC output voltage with further stipulation that all DC outputs are within their specified DC voltage ranges before the generation of the power good signal. Additionally, no voltage may undershoot or overshoot once the power good signal has been asserted.

3.7.7 Reset after Shutdown

The power supply latches into a shutdown state because of a fault condition on its outputs, the power supply returns to normal operating after the fault has been removed and the PS_ON# (or AC input) has been cycled OFF/ON.

3.8 Output Protection

Each DC output is protected from over voltage, over current and short circuit. The following sections include the details for these protection mechanisms.

3.8.1 Over Current Protection

The power supply DC outputs are protected from supplying output current above the maximum ratings. With the exception of the 5VSB output, all DC outputs (+12V1/+12V2/+5V/+3.3V) are latched off in the event of an over-current event on the DC outputs.

In the event of a short circuit on any output, except the 5VSB rail, all outputs are disabled and remain disabled until the power supply is powered off back on. The 5VSB rail will recover when removal of the short circuit condition.

3.8.2 Over Voltage Protection

The over voltage sense circuitry and reference reside in packages that are separate and distinct from the regulator control circuitry and reference. No single point fault is able to cause a sustained over voltage condition on any or all outputs. The power supply provides latch-mode over voltage protection defined as:

- +5V output is between 5.8V to 6.3V

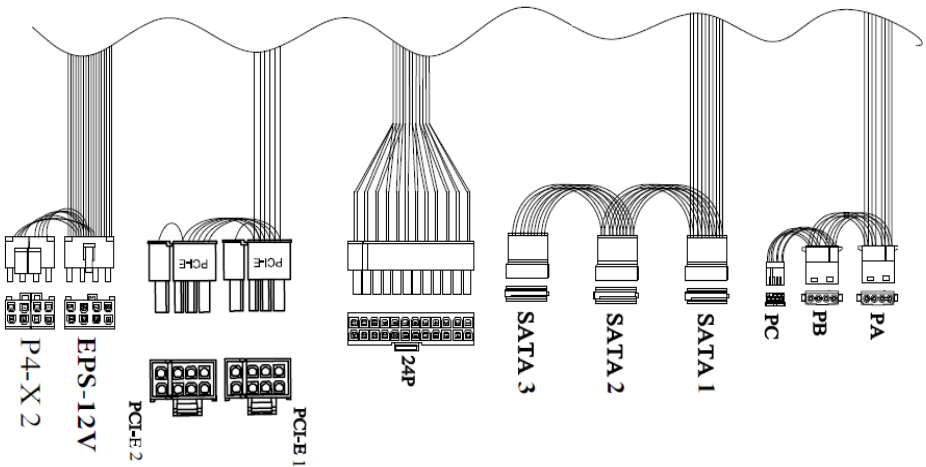
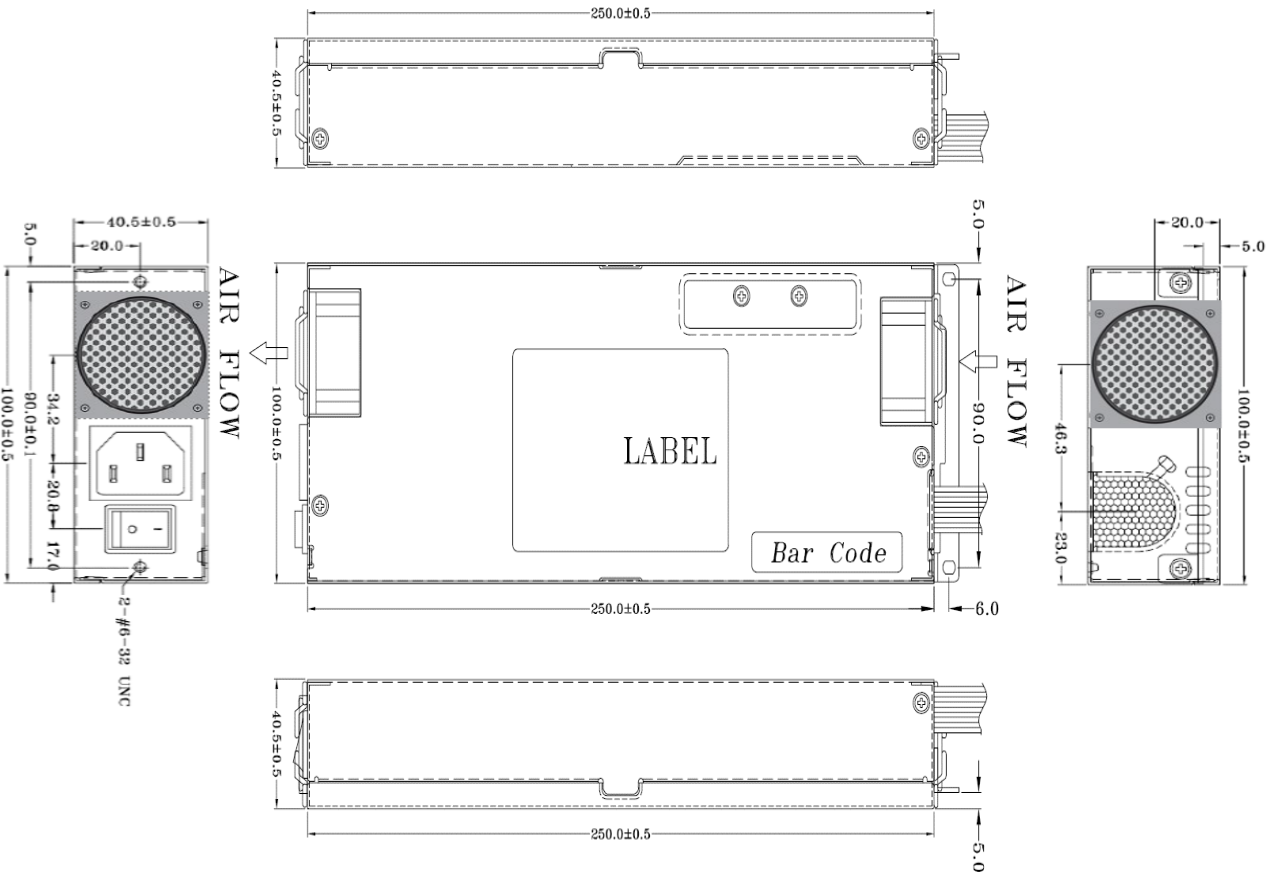
- +12V output is between 13.5V to 16.0V

- +3.3V output is between 3.6V to 4.2V

3.8.3 Short Circuit Protection

The power supply DC outputs are protected from damage due to faults, when any output shorts to ground. In the event of a short circuit on any output, all outputs shall be disabled and remain disabled until the power supply is powered off and back on.

The 5VSB rail will recover when removal of the short circuit condition.



REF ID	PIN NO	SIGNAL	WIRE COLOR	SAUGER	CONNECTOR TYPE	CABLE LENGTH
24P	1	+3.3VDC	Orange	18	Molex 39-01-2240	400 mm
	2	+3.3VDC	Orange	18		
	3	GND	Black	18		
	4	+5VDC	Red	18		
	5	+5VDC	Red	18		
	6	+5VDC	Red	18		
	7	GND	Black	18		
	8	PG	Gray	18		
	9	+5VSB	Yellow	18		
	10	+12VDC	Yellow	18		
	11	+12VDC	Yellow	18		
	12	+3.3VDC	Orange	18		
	13	+3.3VDC	Orange	18		
	14	-12VDC	Blue	18		
	15	GND	Black	18		
	16	PG-ON	Black	18		
	17	PG-ON	Black	18		
	18	GND	Black	18		
	19	GND	Black	18		
	20	-5VDC	White	18		
	21	+5VDC	Red	18		
	22	+5VDC	Red	18		
	23	+5VDC	Red	18		
	24	GND	Black	18		
PA	1	+12VDC	Yellow	18	AMP 1-480424-0	350 mm
	2	GND	Black	18		
PB	1	+4VDC	Red	18	AMP 1-480424-0	150 mm
	2	+2VDC	Yellow	18		
PC	1	GND	Black	18	AMP 171822-4	150 mm
	2	GND	Black	18		
SATA 1	1	+12VDC	Yellow	18	Molex SD-67582-001	350mm
	2	+12VDC	Yellow	18		
SATA 2	1	+12VDC	Yellow	18	Molex SD-67582-001	150 mm
	2	GND	Black	18		
SATA 3	1	+12VDC	Yellow	18	Molex SD-67582-001	150 mm
	2	GND	Black	18		
PCI-E 1	1	+12VDC	Yellow	18	Molex 39-01-2060	350 mm
	2	+12VDC	Yellow	18		
PCI-E 2	1	+12VDC	Yellow	18	Molex 39-01-2060	150 mm
	2	GND	Black	18		
EPS-12V	1	+12VDC	Yellow	18	Molex 39-01-2080	350 mm
	2	GND	Black	18		
P4	1	+12VDC	Yellow	18	Molex 39-01-2040	150mm
	2	GND	Black	18		

Model : AP-1U60P868

4.2 Environmental

4.2.1 Environmental (Operating)

Temperature: 0°C to 40°C

Humidity: 20% to 80%

Relative Humidity (non-condensing)

Altitude: -61meters to +3,048 meters

4.2.2 Environmental (Non-Operating)

Temperature: -25°C to 85°C

Humidity: 10% to 90%

Relative Humidity (non-condensing)

Altitude: -61meters to +15,244 meters

4.3 Fan Control Function (Optional)

In order to prolong the fan's life cycle, the power supply is facilitated with a Thermostatic circuitry to control the fan speed under the power supply Operating temperature and loading.

4.4 Reliability

The power supply reliability is based on the calculation with the Part-Stress Analysis method of MIL-HDBK-217F using the quality factors listed in MIL-HDBK-217F. under the following conditions:

- Full-rated load
- 120VAC input
- Ground begins
- 25°C ambient

4.5 MTBF MTBF (mean time between failures) Calculation

The demonstrated MTBF shall be 100,000 hours of continuous operation at 25°C, full load, 80% confidence limit and nominal line. The MTBF of the power supply be calculated in accordance with MIL-HDBK-217F. The DC FAN is not included.

4.6 Safety / Agency Approval

UL 1950

IEC 950

TUV/UL IEC 62368-1:2014

CE EN 61000-3-2, EN 61000-3-3

EN 55032, EN55035

FCC Part 15, Class B

CISPR Class B

4.7 Warranty:

3-Year Manufacture Limited Warranty.