PAC460D1212-CE
PSU Technical Manual V1.0

AC-DC PSU	90 - 264 V AC Input	12 V DC/12 V_{SB} DC Output	460 W Power

NOTE

1. **EPW460-12 A** on the label of the module is the internal model used by the manufacturer.
2. The figures provided in this document are for reference only.

Description

The PAC460D1212-CE converts an AC input of 90 V to 264 V AC into 12 V DC/460 W output and 12 V_{SB} DC/24 W output. It provides PSMI communication ports, communicates with and sends the electronic serial numbers to the host to facilitate the monitoring and management. It also supports N+1 (N ≤ 3) redundancy.

Applications

- Servers/Storages

P	AC	460	D	1212	-	C	E
1	2	3	4	5		6	7

1 — Embedded Power
2 — AC/DC
3 — Output power: 460 W
4 — Double outputs
5 — Output voltage: 12 V DC, 12 V_{SB} DC
6 — With case
7 — Extractor fan

Features

- Input voltage range: 90 - 264 V AC
- Output power: 460 W
- 80 PLUS certified “Platinum” efficiency: 94% (V_{in} = 230 V AC; 12 V/20 A; 12 V_{SB}/1 A; without fan)
- Depth x Width x Height: 196.5 mm x 86.4 mm x 40.5 mm (7.74 in. x 3.40 in. x 1.59 in.)
- Weight: about 1 kg
- Hot-plug capable
- Power grid: 220 V AC single-phase
- Support 240HVDC
- N+1 (N ≤ 3) redundancy is supported
- With speed-controllable fan
- Support input undervoltage, overvoltage , overcurrent, short circuit protection
- Support output overcurrent, overvoltage, short circuit protection
- Support overtemperature protection
- PSMI communication interface for controlling, programming and monitoring
- Meet UL, TUV, CB,CE, CCC certification for AC
- Meet UL, TUV, CCC,CB certification for 240HVDC
- Meet RoHS 6 requirement

Electrical Specifications

Conditions: T_A = 25°C (77°F), V_{in} = 220 V AC, unless otherwise notes.

Parameter	Output	Min.	Typ.	Max.	Units	Notes & Conditions
Environmental characteristics						
Operating temperature	-	-5	25	55	°C	Able to start up with power module at -20°C.
Storage temperature	-	-40	25	85	°C	-
Relative humidity	-	5	-	95	%	Non-condensing
Altitude range	-	-60	-	3000	m	CCC certification: 2000 m
Input characteristics						
AC input voltage range	-	90	220	264	V AC	-
240HVDC input voltage range	-	192	240	288	V DC	The live wire and neutral wire can be reversely connected to the PSU without affecting its running.
Frequency	-	45	50/60	65	Hz	-
Input current	-	-	-	6	A	V_{in} = 100 V AC - 240 V AC, 100% load
Power factor	-	0.97	-	-	-	V_{in} < 230 V AC, 100% load
	-	0.98	-	-	-	V_{in} = 230 V AC, 100% load
	-	0.95	-	-	-	V_{in} = 230 V AC, 50% load
	-	0.90	-	-	-	V_{in} = 230 V AC, 20% load
Input inrush current	-	-	-	-	A	V_{in} = 264 V AC, 100% load; Meet ETSI300132-3
Standby power consumption①	-	-	1.0	1.0	W	Condition: 12 V output shut down; 12 V_{SB} output shut down; fan off
	-	-	5.0	5.0	W	Condition: 12 V output shut down; 12 V_{SB}/0 A, The fan operate at minimum speed.
	-	-	7.0	7.0	W	Condition: 12 V / 0 A, 12 V_{SB} / 0 A, The fan operate at minimum speed.
Output characteristics						
Output power	12 V	-	460	-	W	Fan-cooled. The PSU automatically adjusts the fan speed.
	12 V_{SB}	-	24	-	W	
Output voltage set point	12 V	12.27	12.30	12.33	V DC	Condition: V_{in} = 220 V AC; 12 V/1 A, 12 V_{SB}/0.1 A
	12 V_{SB}	11.85	12.20	12.35	V DC	

Notes1:
Typical Test Conditions: V_{in} = 115 V
Maximum Test Conditions: V_{in} = 230 V

Electrical Specifications

Conditions: T_A = 25°C (77°F), V_{in} = 220 V AC, unless otherwise notes.

Parameter	Output	Min.	Typ.	Max.	Units	Notes & Conditions
Output characteristics						
Output voltage range	12 V	11.85	12.30	12.45	V DC	-
	12 V_{SB}	11.40	12.00	12.60	V DC	
Output current	12 V	1.0	-	38.3	A	12 V_{SB} remains functional at a 2.5 A output current.
	12 V_{SB}	0.1	-	2	A	
Output ripple and noise (peak to peak)	12 V	-	-	120	mV	Oscilloscope bandwidth: 20 MHz; Tested with a 0.1 µF ceramic (metalized film) capacitor and two 33 µF tantalum capacitor connected to the output terminal.
	12 V_{SB}	-	-	120	mV	
Dynamic overshoot amplitude	12 V	-5	-	5	%	Current change rate: 0.5 A/µs, T = 10 ms; Load: 25% - 50% - 25%; 50% - 75% - 50%; Tested with a 2200 µF capacitor connected to the output terminal.
	12 V_{SB}	-10	-	10	%	Current change rate: 0.5 A/µs, T = 10 ms; Current: 0.1 A - 2 A; Tested with a 270 µF capacitor connected to the output terminal.
Instantaneous transient overshoot amplitude	12 V	-5	-	5	%	Current change rate: 0.1 A/µs, Load: 65% - 130% - 65%, T: 1s - 10 ms - 1s
Overshoot at turn on/turn off	All	-5	-	5	%	-
Current share unbalance	12 V	-5	-	5	%	Every module should be loaded at least 50% of its maximum load. 12V_{SB}: No current sharing
Current sharing bus voltage	12 V	3.23	3.33	3.43	V	12 V current sharing bus voltage; V_{in} = 220 V AC, 100% load
Temperature coefficient	All	-0.2	-	0.2	%/°C	Rated output voltage and current; T_A = -5°C to +55°C (23°F to 131°F)
External capacitance	12 V	2200	-	22000	µF	The whole range of V_{in} , load
	12 V_{SB}	200	-	1000	µF	
Hot-plug voltage	12 V	11.6	-	12.6	V	Condition: Hot-plug speed 0.5 m/s ≤ V ≤ 1 m/s The system voltage cannot exceed the maximum voltage of the PSU.
	12 V_{SB}	11.4	-	12.6	V	
Control Signal Characteristic						
PSON voltage Low level High level	All	 0 2.0		 0.8 3.5	 V V	Low level effective

Electrical Specifications

Conditions: T_A = 25°C (77°F), V_{in} = 220 V AC, unless otherwise notes.

Parameter	Output	Min.	Typ.	Max.	Units	Notes & Conditions
Control Signal Characteristic						
PSON current Low level High level	All	1.0 -	- -	- -	mA mA	-
PSON timing Rising time Falling time	All	- -	- -	200 200	µs µs	-
PSOK voltage Low level Intermediate level High level	12 V	0 2.0 3.0	- - -	0.6 2.5 3.5	V V V	High level effective
PSOK current Low level Intermediate level High level	12 V	0.1 200 1.0	- -	- -	mA µA mA	-
PSOK timing Rising time Falling time	12 V	- -	- -	200 200	µs µs	-
PS_INTERRUPT voltage Low level High level	All	0 4.7	- -	0.6 5.0	V V	High level effective
PS_INTERRUPT current Low level High level	All	0.1 -	- -	- -	mA mA	-
PS_INTERRUPT timing Rising time Falling time	All	- -	- -	200 200	µs µs	-
PRESENT# voltage Low level Left open	12 V	350 150	- 250	- -	mV mV	Low level effective
PRESENT# current Low level High level	12 V	- -	- -	1.0 -	mA mA	-
PRESENT# timing Rising time Falling time	12 V	- -	- -	200 200	µs µs	-

Electrical Specifications

Conditions: T_A = 25°C (77°F), V_{in} = 220 V AC, unless otherwise notes.

Parameter	Output	Min.	Typ.	Max.	Units	Notes & Conditions
Efficiency						
100% load	All	91.0	-	-	%	V_{in} = 230 V AC; 12 V/38.3 A; 12 V_{SB}/2 A; Power consumption of fans not included.
50% load	All	94.0	-	-	%	V_{in} = 230 V AC; 12 V/20 A; 12 V_{SB}/1 A; Power consumption of fans not included.
20% load	All	90.0	-	-	%	V_{in} = 230 V AC; 12 V/8 A; 12 V_{SB}/0.4 A; Power consumption of fans not included.
Protection characteristics						
Input undervoltage protection Protection threshold Recovery threshold	-	 - -	 - -	 84 89	 V AC V AC	Hysteresis ≥ 5 V; Self-recovery
Input overvoltage protection Protection threshold Recovery threshold	-	 280 275	 - -	 - -	 V AC V AC	Hysteresis ≥ 5 V; Self-recovery
240HVDC input undervoltage Protection threshold Recovery threshold	-	 - -	 - -	 185 190	 V DC V DC	Hysteresis ≥ 5 V; Self-recovery
240HVDC input overvoltage Protection threshold Recovery threshold	-	 320 315	 - -	 - -	 V DC V DC	Hysteresis ≥ 5 V; Self-recovery
Output overvoltage protection	12 V	13.0	-	15.0	V	Latch off
	12 V_{SB}	13.0	-	15.0	V	Self-recovery
Output overcurrent protection	12 V	43	-	53	A	Latch off
	12 V_{SB}	2.5	-	3.0	A	Hiccup mode
Output short circuit protection	12 V_{SB}	2.5	-	3.0	A	Hiccup mode
Overtemperature protection	12 V	55	-	-	°C	Self-recovery
Reliability characteristics						
Mean time between failures (MTBF)	All	-	250,000	-	hours	Telcordia SR332; V_{in} = 220 V AC; 100% load; T_A = 25°C (77°F)

Specifications are subject to change without notice.

Characteristic Curves

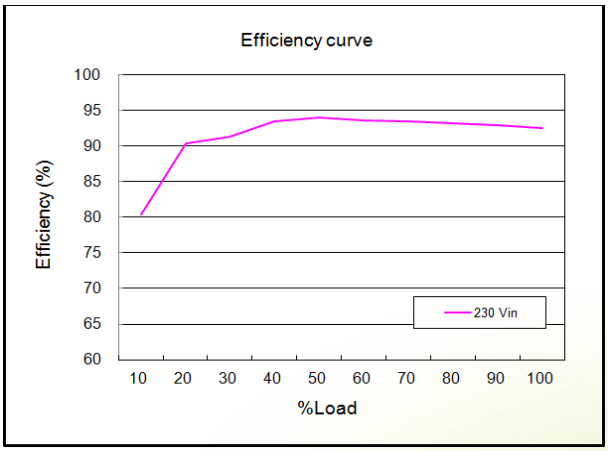

Figure 1: Efficiency (T_A = 25°C [77°F])

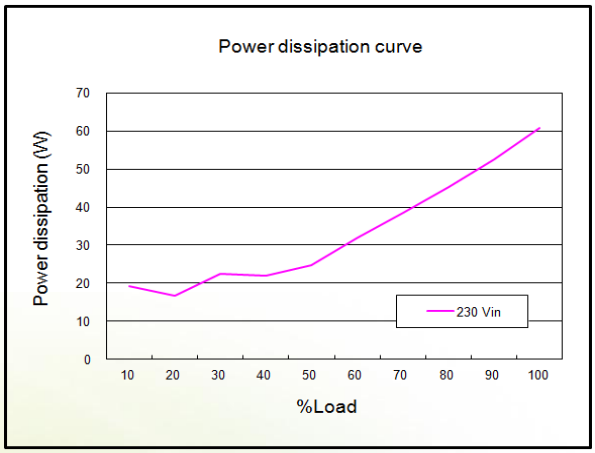

Figure 2: Power dissipation curve

Control Signal

PSON

The PSON is an internally pulled-up (3.3 V) input signal to enable/disable the 12 V output. This active-low pin is also used to clear any latched fault condition.

PSON	12 V Output Voltage
Low level	On
High level/left open	Off

The configuration diagram of PSON is shown in Figure 3:

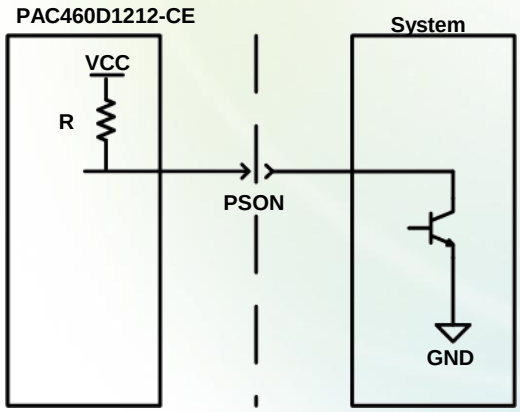

Figure 3: Configuration diagram of PSON

PSOK

PSOK is an signal to indicate that the 12 V output is within the regulation limits of the power supply. The configuration diagram of PSOK is shown in Figure 4:

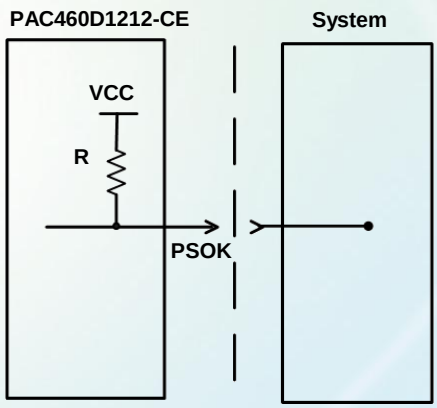

Figure 4: Configuration diagram of PSOK

Control Signal

About the detail of PSOK logic is as following:

PSOK	12 V output voltage
High level	12 V output: normal (V_{out} > 11.6 V)
Intermediate level	AC input: abnormal 12 V output: normal
Low level	12 V output: abnormal (The 12 V output is less than 11.4 V , or greater than the output voltage protection point)

PS_INTERRUPT

The low active open collector signal indicates that the power supply is experiencing a problem, warning or fault that the system agent should investigate. PS_INTERRUPT will be low if one of the following situations occurs:

- Abnormal input
- Abnormal output (including the abnormal output of 12 V_{SB} and the absence of the 12 V output caused by Present#)
- Overtemperature

After the fault condition is removed, the PS_INTERRUPT will be high level. The logic about PS_INTERRUPT is as following:

PS_INTERRUPT	PAC460D1212-CE
Low level	Abnormal
High level	Normal

The configuration diagram of PS_INTERRUPT is shown in Figure 5:

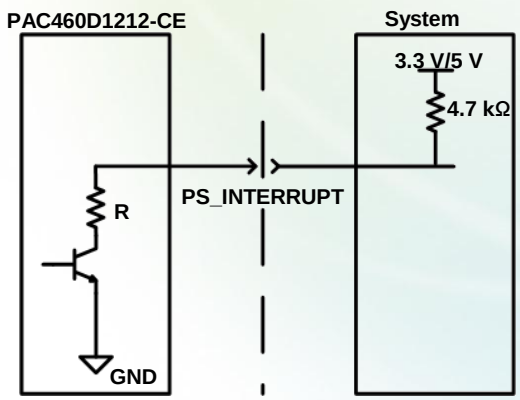

Figure 5: Configuration diagram of PS_INTERRUPT

PRESENT#

The PRESENT# is used to indicate to a power distribution unit controller that a supply is plugged in and help to implement the PSU hot-plug. The PRESENT# input is active-low and is located on a recessed pin on the connector and is used to disconnect the main output as soon as the power supply is being plugged out.

This signal controls only the output of the 12 V and cannot control the 12 V_{SB}.

The configuration diagram of PRESENT# is shown in Figure 6:

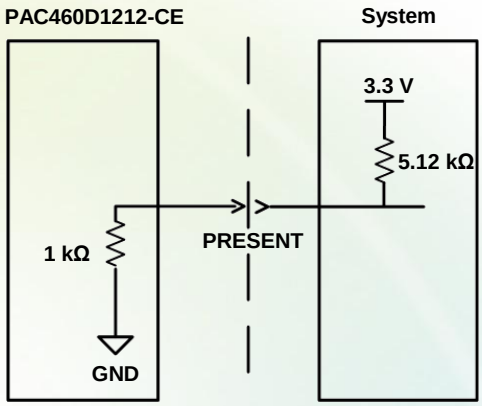

Figure 6: Configuration diagram of PRESENT

The logic of PRESENT# is as following:

PRESENT#	Connect to the system
Low level	Yes
Left open	No

Turn On/Turn Off Timing

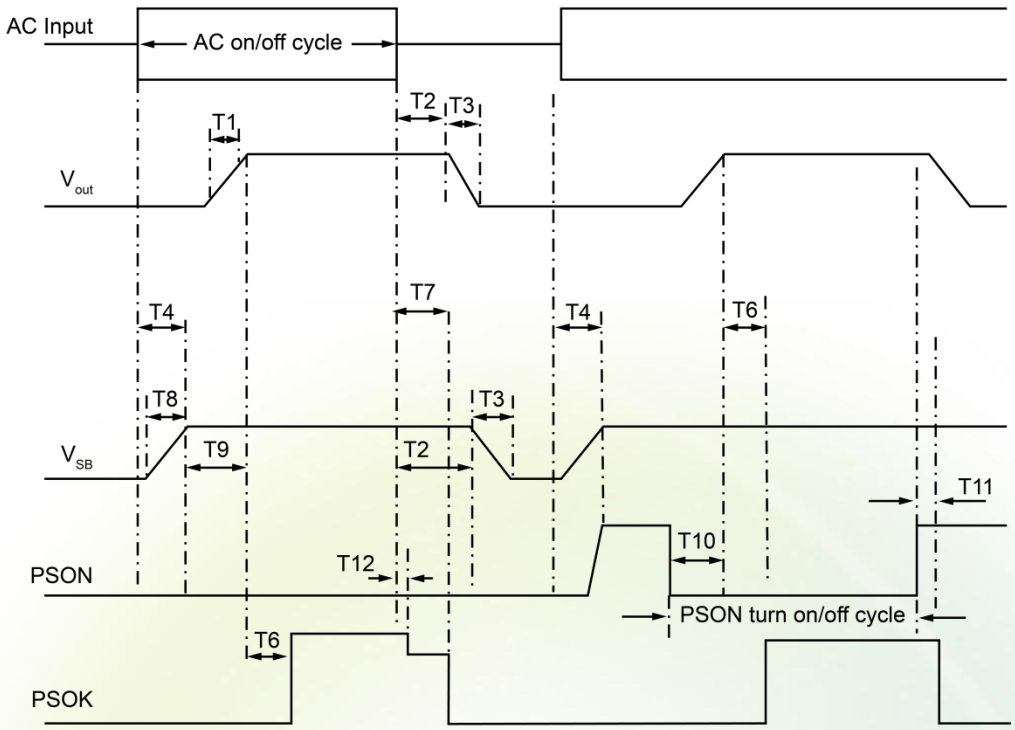

Figure 7: Turn on/turn off timing

Label	Description	Min.	Max.	Unit
T1	Time for the voltages of 12 V route rising from 10%V_{out} to 90%V_{out}.	1	30	ms
T2	Hold up time (AC input off to V_{out} =11.85 V DC [12 V output]). Condition: 12 V/460 W, 12 V_{SB}/24 W	10	-	ms
	Hold up time (AC input off to V_{out} =11.85 V DC [12 V output]). Condition: 12 V/230 W, 12 V_{SB}/12 W	20	-	ms
	Hold up time (AC input off to V_{out} =11.85 V DC [12 V output]). Condition: 12 V/115 W, 12 V_{SB}/6 W	30	-	ms
	Hold up time (AC input off to V_{out} =11.85 V DC [12 V output]). Condition: 12 V/57.5 W, 12 V_{SB}/3 W	40	-	ms
T3	Time for the output voltage dropping from 90% of regulated voltage to 0.3 V (12 V/1 A, 12 V_{SB}/0.1 A) after the power input disconnects.	-	500	ms
T4	Time for 12 V_{SB} output voltage to increase to 90% of the rated voltage when the AC input is resumed in case of a power failure lasting more than 10s.	0	2000	ms
T6	Duration from the time the 12 V route reach a regulated voltage to the time the PSOK is normally displayed.	50	100	ms

Table 1: Turn on/turn off timing demands

Turn On/Turn Off Timing

Label	Description	Min.	Max.	Unit
T7	Duration from the time the AC outage starts to the time the PSOK becomes low level. Test condition: 12 V/460 W.	10	-	ms
	Duration from the time the AC outage starts to the time the PSOK becomes low level. Test condition: 12 V/230 W.	20	-	ms
	Duration from the time the AC outage starts to the time the PSOK becomes low level. Test condition: 12 V/115 W.	30	-	ms
	Duration from the time the AC outage starts to the time the PSOK becomes low level. Test condition: 12 V/57.5 W.	40	-	ms
T8	Time for the 12 V_{SB} route rising from 0 V to 12 V.	-	30	ms
T9	Time from when the 12 V_{SB} route reaches the regulated voltage to when the 12 V route reaches the regulated voltages when the PSU starts and the PSON is low level.	50	300	ms
T10	Time from when the PSON signal becomes low level to when both the 12 V routes reach a regulated voltage (tested 5s after the AC input is stable).	10	30	ms
T11	Delay time from PSON high to PSOK low.	-	50	ms
T12	Time from when the PSOK signal becomes intermediate level after the power input disconnects.	0	4	ms

Table 1: Turn on/turn off timing demands

Typical Waveforms

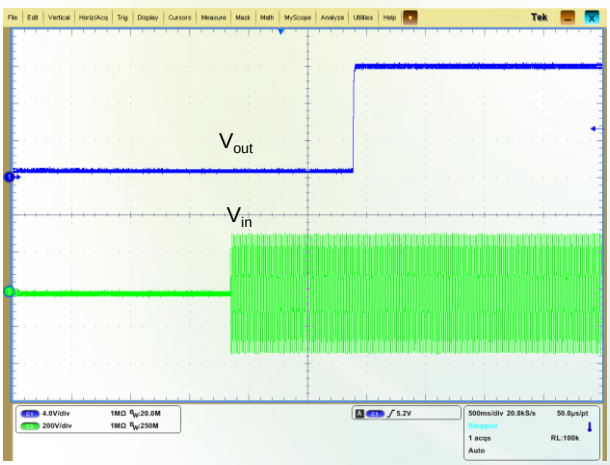

Figure 8: Turn-On AC line (100% load, 12 V, 500 ms/div)

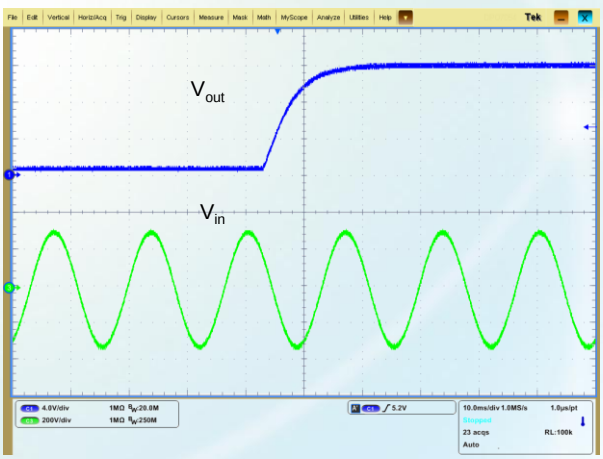

Figure 9: Turn-On AC line (100% load, 12 V, 10 ms/div)

Typical Waveforms

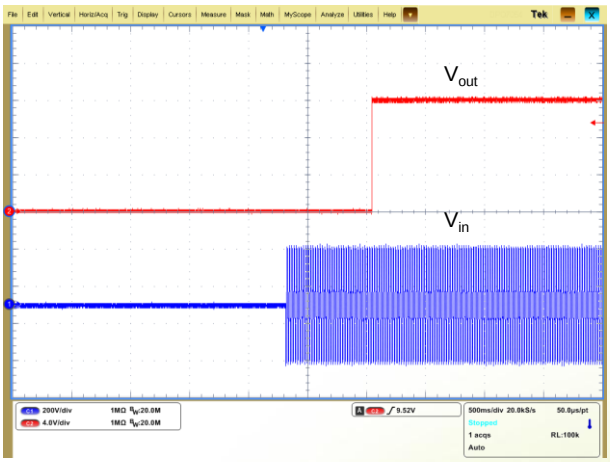

Figure 10: Turn-On AC line (100% load, 12 V_{SB}, 500 ms/div)

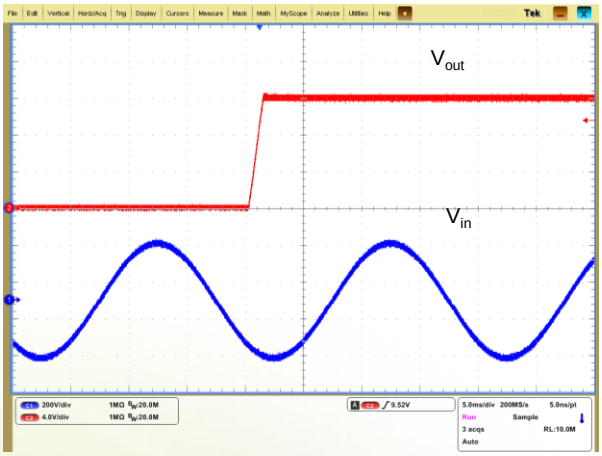

Figure 11: Turn-On AC line (100% load, 12 V_{SB}, 5 ms/div)

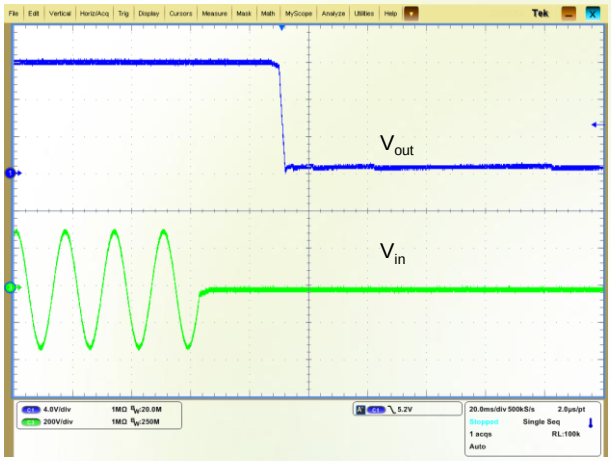

Figure 12: Turn-Off AC line (100% load, 12 V, 20 ms/div)

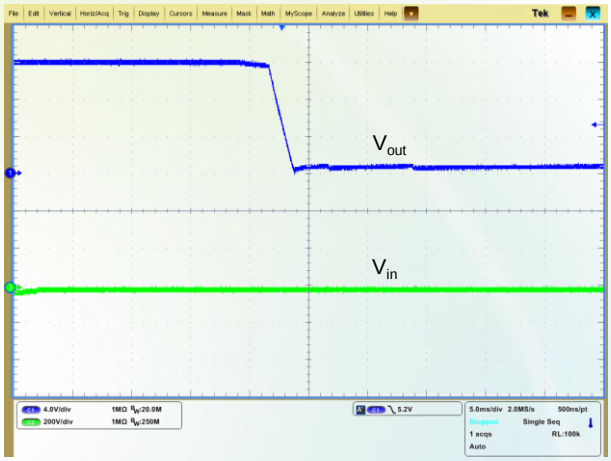

Figure 13: Turn-Off AC line (100% load, 12 V, 5 ms/div)

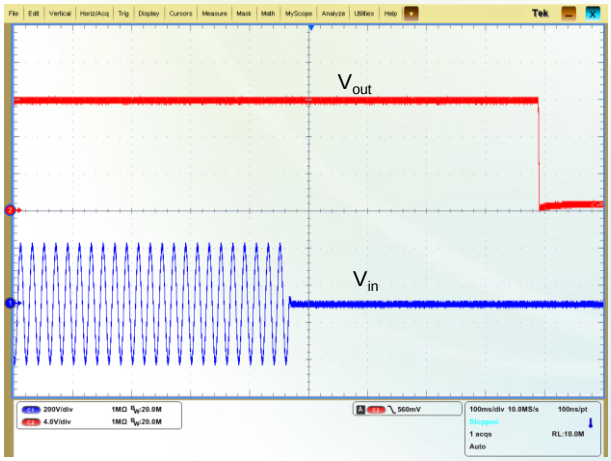

Figure 14: Turn-Off AC line (100% load, 12 V_{SB}, 100 ms/div)

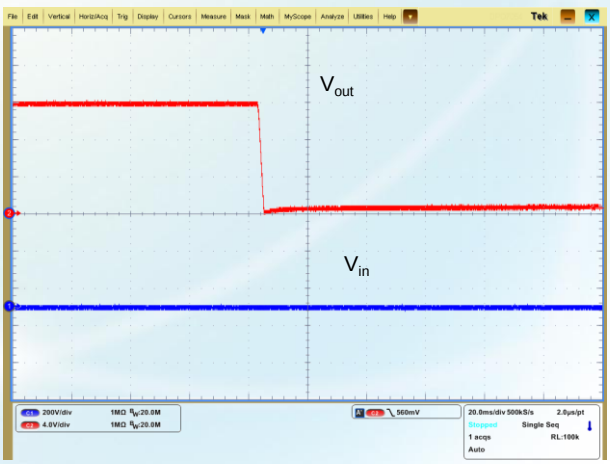

Figure 15: Turn-Off AC line (100% load, 12 V_{SB}, 20 ms/div)

Typical Waveforms

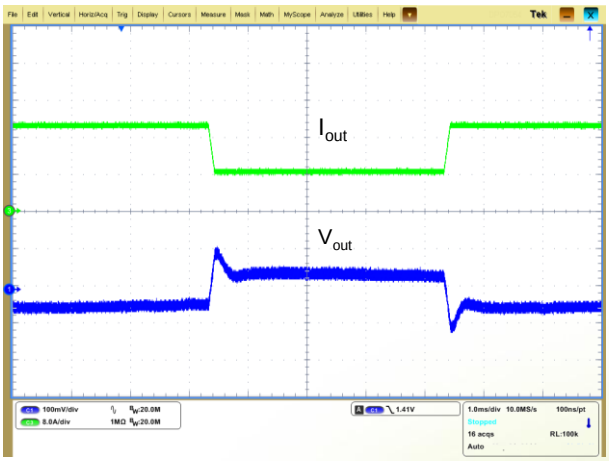

Figure 16: Output voltage dynamic response (12 V, Load: 25% - 50% - 25%, 0.5 A/μs)

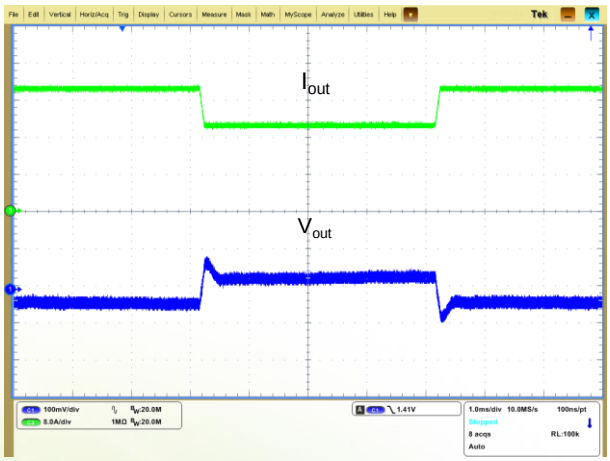

Figure 17: Output voltage dynamic response (12 V, Load: 50% - 75% - 50%, 0.5 A/μs)

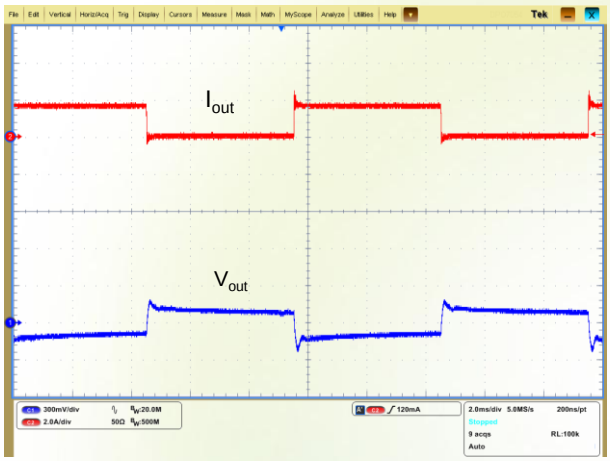

Figure 18: Output voltage dynamic response (12 V_{SB}, Load: 5% - 100% - 5%, 0.5 A/μs)

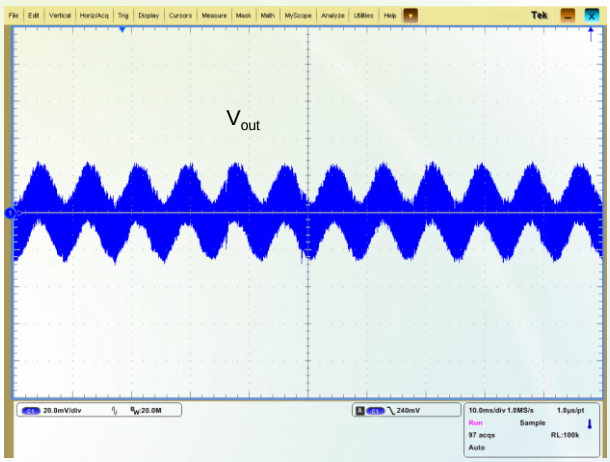

Figure 19: Output voltage ripple (V_{in} = 220 V, 12 V, I_{out} = 38.3 A)

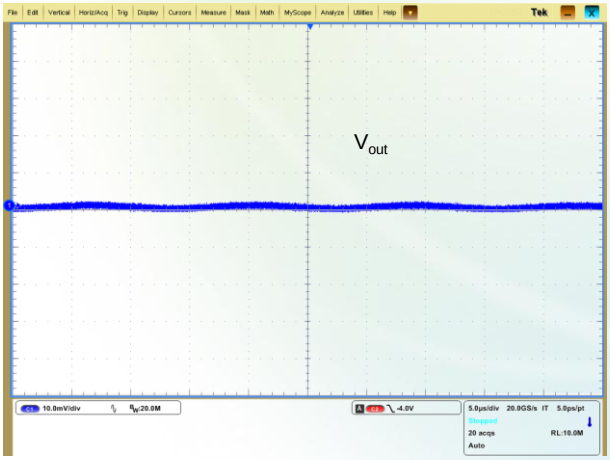

Figure 20: Output voltage ripple (V_{in} = 220 V, 12 V_{SB}, I_{out} = 2 A)

Internal Cooling Fans

The power supply to the fans follows the following modes:

1. The fan control circuit and the I2C single chip work properly only when the 12 V main circuit after the oring diode has a normal output voltage.
2. When the input cable is disconnected, the fan feeds from the system, the fan can operate at minimum speed.
3. When the 12 V_{SB} is normal and the 12 V output voltage is shut down, the fan can operate at minimum speed. If the PSU enters the standby mode, the 12 V&12 V_{SB} and the fan all shut down.
4. When the fan becomes faulty, the 12 V output voltage will be shut down. After the fan resumes, the 12 V output resumes.
5. If one of the paralleled PAC460D1212-CEs has no output while the communication remains normal, the fan can operate at minimum speed.

Power supply will power for the internal fans. It contains fan speed control circuits to vary the fan speed. Figure 21 shows the detail about the wind tunnel.

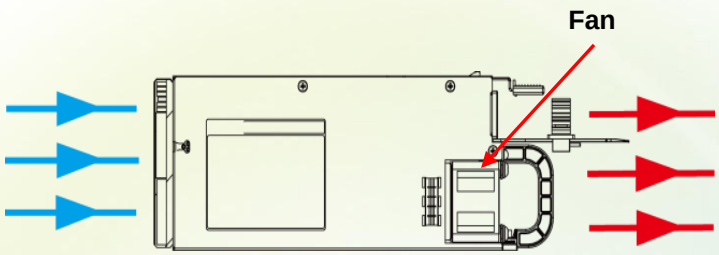

Figure 21: Wind tunnel

Noise of the PSU should meet the following requirements:

Air Intake Vent Temperature	Typical noise	Maximum noise	Test Method
25°C	55 dB	60 dB	Tested 1 m away from the PSU, at 100% load.
25°C	42 dB	45 dB	Tested 1 m away from the PSU, at 50% load.
Remark: The noise sensor should face the air exhaust vent of the fan.			

Load Sharing

Up to four PAC460D1212-CEs can be paralleled for redundant configurations. The I-MON signal is the current balancing signal of the 12 V. All the I-MON pins need to be interconnected in order to activate the sharing function.
For details about the current sharing parameters, see the ***Output characteristics***.

Protection Characteristic

Relationship of 12 V and 12 V_{SB}

1. When input overvoltage/undervoltage occurs, the 12 V is shut down while 12 V_{SB} work properly.
2. The output overcurrent or short circuit protection, output overvoltage protection, and overtemperature protection of the 12 V will not affect the normal output of the 12 V_{SB}.
3. If the output overcurrent or short circuit protection, output overvoltage protection, and overtemperature protection of the 12 V_{SB} occur, the output of the 12 V is shut down.

Input Undervoltage Protection

The PSU will shut down after the input voltage drops below the undervoltage protection threshold for shutdown. The PSU will start to work again after the input voltage reaches the input undervoltage recovery threshold for startup.

Input Overvoltage Protection

The PSU will shut down after the input voltage exceeds the overvoltage protection threshold for shutdown. The PSU will start to work again after the input voltage reaches the input overvoltage recovery threshold for startup.

Output Overvoltage Protection

●V_{out} = 12 V
When the output voltage exceeds the output overvoltage protection threshold, the PSU will enter a latch off mode. The latch can be cleared by toggling the PSON signal or by an AC input re-cycle. The delay time from AC off to AC on should be less than 5s. If the static overvoltage exceeds the output overvoltage threshold for 1 to 2 seconds, protection should be triggered. The upper voltage threshold cannot exceed 15 V.

●V_{out} = 12 V_{SB}
When the output voltage exceeds the output overvoltage protection threshold, the PSU will enter a hiccup mode. When the fault condition is removed, the converter will automatically restart.

Output Overcurrent Protection

●V_{out} = 12 V
When the output current exceeds the output overcurrent protection threshold, the PSU will enter a latch off mode. The output overcurrent protection/short circuit protection protects the PSU by maintaining a constant current for at least 2s before the PSU locks out. The latch can be cleared by toggling the PSON signal or by an AC input re-cycle. The delay time from PSON high to PSON low should be more than 2s. The delay time from AC off to AC on should be less than 5s.
The transient maximum output power at 49.7 A is not affected by the output overcurrent or short circuit protection.

●V_{out} = 12 V_{SB}
When the output current exceeds the output overcurrent protection threshold, the PSU will enter a hiccup mode. When the fault condition is removed, the converter will automatically restart.

Overtemperature Protection

The power supply is protected against over temperature conditions caused by overload, loss of fan cooling or excessively high ambient temperature. When the ambient temperature exceeds 55°C, the overtemperature protection is triggered and the PSU output is disconnected. When the ambient temperature returns to normal, the PSU automatically recovers.

Mechanical Dimension

Unit of measurement: mm (in.) All tolerance refers to “x. ±0.5; .x ±0.3; .xx ±0.15; ANG ±1” except especial declaration.

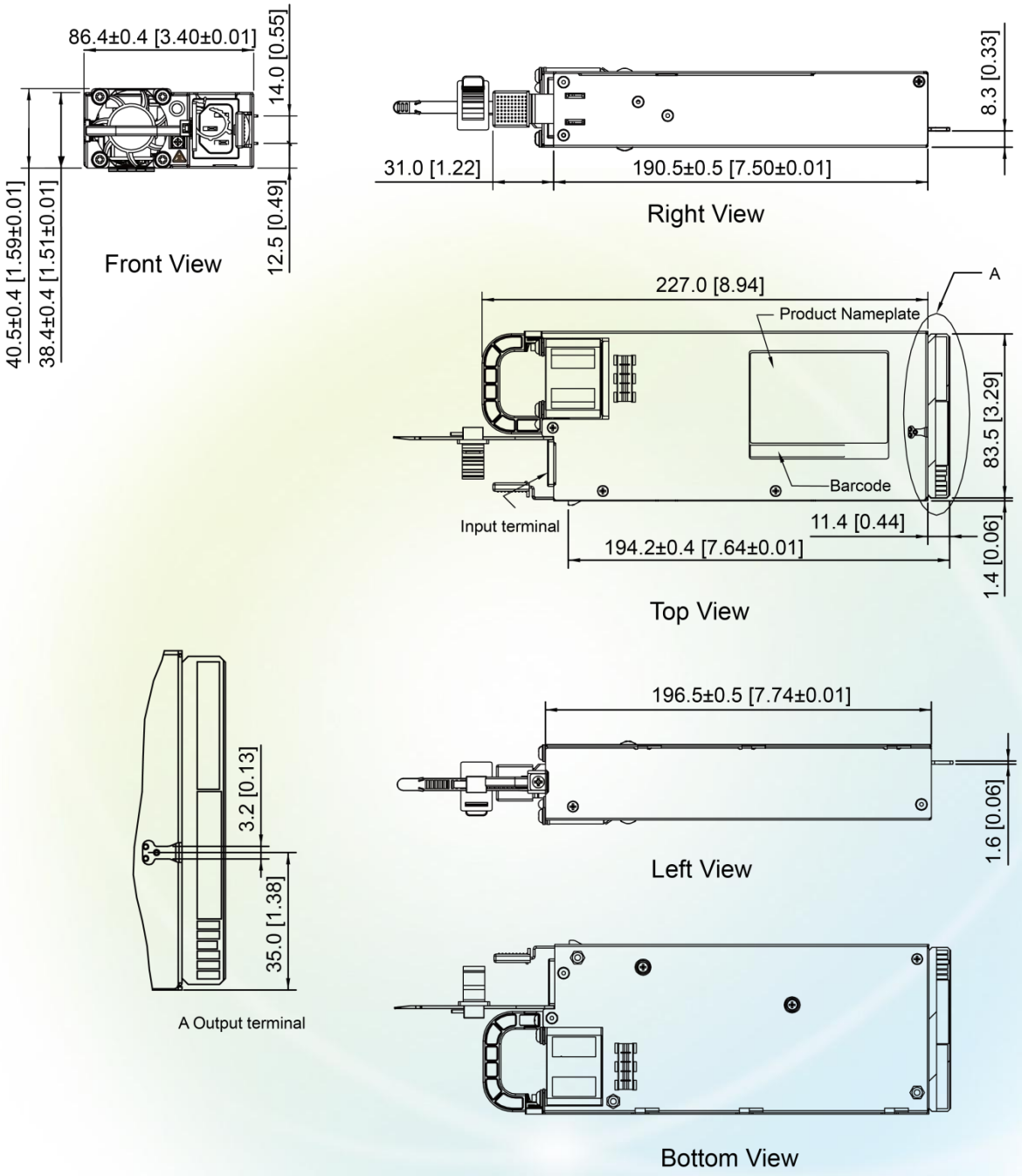

Figure 22: Mechanical dimension

Interface Description

The output connector connects the power as well as the signal to the system or the power backplane board.

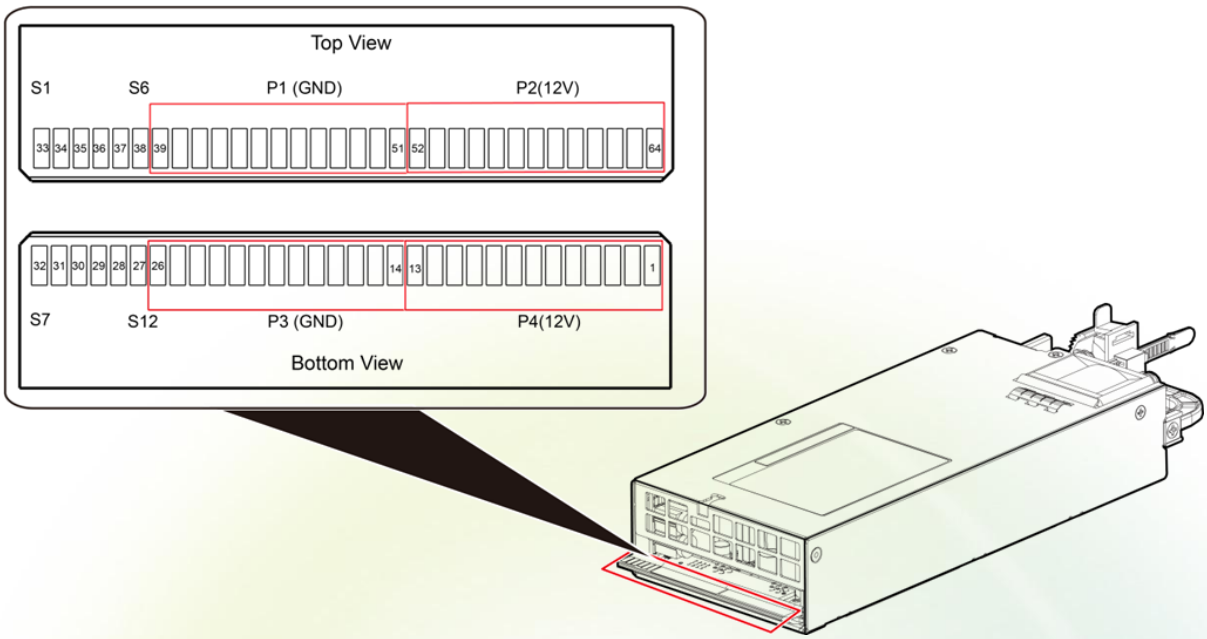

Figure 23: Rear panel

Pin Definition Of Output Socket

Pin	Definition	Description
P4(01 -13), P2(52 – 64)	12 V	Output: 12 V DC
P3(14 – 26), P1(39 – 51)	GND	12 V&12 V_{SB} Power GND
S12(27)	A2	I2C address
S11(28)	A1	I2C address
S10(29)	A0	I2C address
S9(30)	GND	I2C signal GND
S8(31)	SDA	I2C data signal
S7(32)	SCL	I2C clock signal
S1(33)	PSON	Power supply on/off control signal

Pin Definition Of Output Socket

Pin	Definition	Description
S2(34)	I-MON	12 V DC load sharing
S3(35)	PSOK	Signal indicating the normal status of the 12 V outputs
S4(36)	PRESENT#	Power supply module present (short pin)
S5(37)	12 V_{SB}	Standby output: 12 V_{SB} DC
S6(38)	PS_INTERRUPT	I2C interruption signal

Indicator And Alarm

Indicator	Color	Status	Description
Power indicator	Green	Steady green	The input and outputs of the main and standby circuits are normal.
		Off	1.No AC input 2. Input overvoltage, Input undervoltage, Power not present 3. Power abnormal

Monitor And Communication

The main controller monitors and controls a maximum of 4 PSUs, reads and writes the electronic labels and the faulty records over a standard I2C port. As long as the standby or 12 V supplies power to the PSU, the PSU can communicate with the system regardless of AC input.
Addresses A2, A1 and A0 allocate addresses to the PSU. If the signal is connected to the GND, the address is 0. If the signal is left open, the address is 1. The I2C address of the PSU is A2, A1, and A0 from high to low. See the following table for details.

PSU A2/A1/A0	0/0/0	0/0/1	0/1/0	0/1/1	1/0/0	1/0/1	1/1/0	1/1/1
EEPROM	0xA0	0xA2	0xA4	0xA6	0xA8	0xAA	0xAC	0xAE
MCU	0xB0	0xB2	0xB4	0xB6	0xB8	0xBA	0xBC	0xBE

The PAC460D1212-CE develops the following monitoring functions and faults detection functions:

Monitoring functions:

- Input voltage
- Input current
- Input power
- Output voltage
- Output current
- Output power
- Output voltage set point

Faults detection functions:

- Reports alarms for input under/overvoltage protection
- Reports alarms for output overvoltage
- Reports alarms for fan faults
- Reports alarms for overtemperature
- Reports alarms for output overcurrent, and short circuits

Appendix B describe the FRU data to be stored in power supply EEPROM by vendor. For more information, please refer to ***Appendix A PSMI Communication***.

Safety Precautions

You are advised to provide two power inputs for the system. Power configuration in N+1 (N ≤ 3) mode is preferred. The following figure shows the power configuration in 1+1 mode and 2+2 mode.

- Configure a circuit breaker (with a rated current not less than 16 A) for each PSU.
- The rated current of the upstream circuit breaker for each power input is recommended to be not less than 32 A.
- The PSU should be properly grounded. Otherwise, it will be damaged due to a lightning strike.

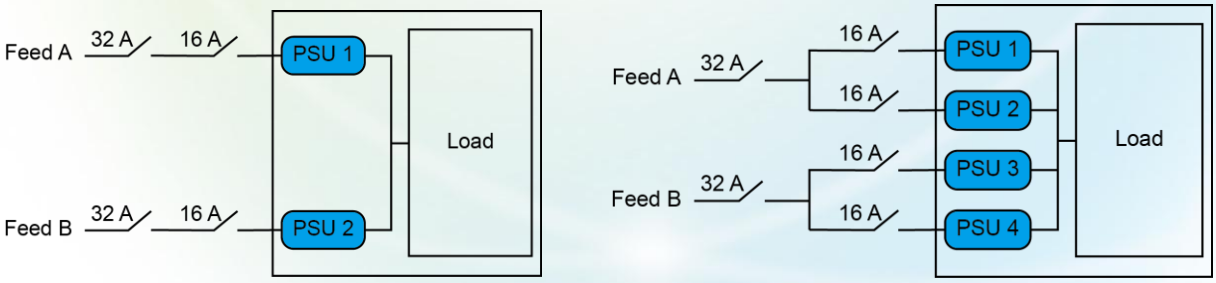

Figure 24: Application configuration in system (Left: 1+1 mode; Right: 2+2 mode)

Appendix A PSMI Communication

Parameter	Register address	Description
Power alarm Register	0x04	Alarm information, such as fan fault, power input disconnection, overtemperature, overvoltage, overcurrent, PSU failure.
Air intake vent temperature T1	0x1A	PSU air intake vent temperature
Communication model Register	0x98	Set to return to 0, indicating the PSMI protocol.
Output voltage Register	0x0E	12 V output voltage
Output current Register	0x10	12 V output current
Input voltage Register	0x08	Power Module Input voltage
Input power Register	0x0C	Power Module Input Power
Output power Register	0x12	12 V output power
Fan 1 speed Register	0x1E	Fan speed
Version Register	0x00	bit 3~0: Power Hardware version, 0 stands for A, 1 stands for B, 2 stands for C, and the rest goes on in similar fashion. bit 7~4: Unified communications bit 11~8: Power Software minor release bit 15~12: Power Software major release
Power Type Register	0x02	Bit C~B: If the input is AC current, 00 (AC) is sent. If the input is 240 HVDC, 10 (240 V DC) is sent. 00 represents AC, 01 represents 48 V DC,10 represents 240 V DC,11 represents 380 V DC Bit D: 1 Bit E-F: 0

Appendix A PSMI Communication

Power alarm register (0x04)								
Bit#	7	6	5	4	3	2	1	0
Access	RO	RO	RO	RO	RO	RO	RO	RO
Default Value	0	-	0	-	-	-	-	-
Definition	FAN2 FAILURE	FAN1 FAILURE	RESERVED	INPUTLOSS	OT	OC	OV	FAILURE
Bit#	F	E	D	C	B	A	9	8
Access	RO	RO	RO	RO	RO	RO	RO	RO
Default Value	0	0	0	0	0	0	0	0
Definition	RESERVED							

Bit	Description	Remark
F~8	Reserved bit, which returns to 0 after reading the signal.	-
7	Reserved bit, which returns to 0 after reading the signal.	-
6	FAN1 0b = FAN1 OK 1b = No output, because Fan1 failure	-
5	Reserved bit, which returns to 0 after reading the signal.	-
4	INPUT LOSS 0b = Power input voltage 1b = No input	Input: AC Input; DC Input
3	Overtemperature 0b = Power normal 1b = Overtemperature protection; Shut down.	After the overtemperature alarm is cleared, the OT bit is cleared.
2	Overcurrent 0b = Power normal 1b = Output overcurrent protection; Latch off.	After the PSON resumes, this bit is cleared.
1	Overvoltage 0b = Power normal 1b = Output overvoltage protection; Latch off.	After the PSON resumes, this bit is cleared.
0	Failure 0b = Power normal 1b = Power abnormal: input normal, PSON normal, DC output abnormal	When the PSU fails, and the active event is not the same as the previously stored event, record the active event. When the PSU and the DC output resume, the alarm of failed PSU is cleared.

Appendix B FRU Descriptions

Offset (Bytes)	**Value** (Decimal)	**Definition** (Remarks)	**Offset** (Bytes)	**Value** (Decimal)	**Definition** (Remarks)
0 to 7		**Common Header, 8 Bytes**	29 to 36	050	FRU File ID: “MM/DD/YY"
0 to 7	001	Format Version Number		050	
	000	Internal Use Area Offset		047	
	000	Chassis Info Area Offset		049	
	001	Board Info Area Offset		052	
	005	Product Info Area Offset	37	193	End Tag
	014	Multi Record Area Offset	38	000	PAD
	000	PAD (reserved) Default value is 0	39	088	Zero checksum Shall be calculated at the time of manufacturing.
	235	Zero Check Sum			
8 to 39		**Board Info Area, 32 Bytes**	**40 to 111**		**Product Info Area, 72 Bytes**
8	001	Format Version Number	40	001	Product Info Area Format Version
9	004	Board Info Area Length	41	009	Product Info Area Length in multiples of 8 Bytes
10	025	Language Code(English)			
11 to13	014	Number of minutes from 0:00 hrs 1/1/96 to build date. LSB first . Shall be calculated at the time of manufacturing. Default date is 05/28/07. Default date shall indicate that the Mfg. date was not programmed correctly by the power supply vendor.	42	025	Language (English)
	138		43	197	Manufacturer Name Type/Length (0C5H) = Type “ASCII+LATIN1” 5 Bytes
	147		44 to 48	072	Manufacturer Name 5 byte sequence Vendor Name: HUAWE In Decimal = 072, 085, 065, 087, 069 In Hex = 48H, 55H,41H, 57H, 45H Vendor specific information
14	192	BOARD MANUFACTURER NAME LENGTH/byte [8-bit ASCII / 00h]		085	
				065	
				087	
				069	
15	192	BOARD PRODUCT NAME LENGTH/ byte [8-bit ASCII / 00h]	49	218	Product Name Type/Length (DAH) = Type “ASCII+LATIN1” 26 Bytes.
16	192	BOARD SERIAL NUMBER TYPE LENGTH/byte [8-bit ASCII / 00h]	50 to 75	072	26 Byte sequence Product Name: HUAWE 460 W PLATINUM PS In Decimal = 072, 085, 065, 087, 069, 032, 052, 054, 048, 087, 032, 080, 076, 065, 084, 073, 078, 085, 077, 032, 080, 083, 032, 032, 032, 032 In Hex = 48H, 55H, 41H ,57H, 45H, 20H, 34H, 36H, 30H, 57H, 20H, 50H, 4CH, 41H, 54H, 49H, 4EH, 55H, 4DH, 20H, 50H, 53H, 20H, 20H, 20H, 20H
				085	
17	202	Product Spare Part Number type/length		065	
18 to 27	032	Specified 10-Byte Sequence Product Spare Part Number: “ ” In Decimal = 032, 032, 032, 032, 032, 032, 032, 032, 032, 032 In Hex = 20H, 20H, 20H, 20H, 20H, 20H, 20H, 20H, 20H, 20H,		087	
	032			069	
	032			032	
	032			052	
	032			054	
	032			048	
	032			087	
	032			032	
	032			080	
	032			076	
28	200	FRU File ID type/length [8-bit ASCII / 8] (Used as FRU version)		065	
				084	
29 to 36	048			073	
	053			078	
	047			085	

Appendix B FRU Descriptions

Offset (Bytes)	Value (Decimal)	Definition (Remarks)	Offset (Bytes)	Value (Decimal)	Definition (Remarks)
50 to 75	077	-	99 to104	000	Shall be added at the time of manufacturing
	032			000	
	080			002	
	083		105	000	Asset Tag Default Value is 0
	032		106	000	FRU File ID Type/Length [not used]
	032		107	193	End Tag In Decimal: 193 In Hex: 0C1H
	032		108 to 110	000	PAD
	032			000	
76	202	Product Option Kit Number(Product Part/Model Number) Type/Length (0CAH) = Type “ASCII+LATIN1” 10 Bytes		000	
			111	186	Zero Check Sum Shall be calculated at the time of manufacturing.
			112 to 199		**Multi Record Area, 88 Bytes**
77 to 86	048	Specified 10-Byte Sequence Product Part/Model Number: “02310XSE ” In Decimal = 048, 050, 051, 049, 048, 088, 083, 069, 032, 032 In Hex = 30H, 32H, 33H, 31H, 30H, 58H, 53H, 45H, 20H, 20H	**112 to 116**		**Power Supply Record Header**
	050		112 to 116	000	Record type = 000 for Power supply
	051			002	End of List /Record Format Version Number
	049			024	Record Length of Power Supply Record
	048			239	Record CHECKSUM of Power Supply Record (Zero CHECKSUM)
	088			247	Header CHECKSUM of Power Supply Record Header (Zero CHECKSUM)
	083				
	069				
	032				
	032		**117 to 140**		**Power Supply Record**
87	194	Product Version - Type/Length (0C2H) = Type “ASCII+LATIN1” 2 Bytes	117 to 118	204	Overall Capacity of the Power Supply, 460 W = 01CCH 2 Bytes Sequence In Decimal = 204, 001 In Hex = CCH, 01H
88 to 89	048	Specified 2-Byte Sequence Production level start at “01” In Decimal = 048, 049 In Hex = 30H, 31H		001	
	049		119 to 120	040	Peak VA, 552 W = 0228H 2 Bytes Sequence In Decimal = 040, 002 In Hex = 28H, 02H
90	206	Product Serial Number Type/Length (0CEH) = Type “ASCII+LATIN1” 14 Bytes.		002	
			121	030	Inrush Current, A In Decimal = 030 In Hex = 1EH
91 to 94	048	Product Part/Model Number: “0XSE In Decimal = 048, 088, 083 069 In Hex = 30H, 58H, 53H, 45H	122	005	Inrush Interval, 5 ms In Decimal = 005 In Hex = 05H
	088		123 to 124	040	Low End Input Voltage Range 1 (10 mV), 9000 = 2328H 2 Bytes Sequence In Decimal = 040, 035 In Hex = 28H, 23H
	083			035	
	069		125 to 126	144	High End Input Voltage Range 1 (10 mV), 13200 = 3390H 2 Bytes Sequence In Decimal = 144, 051 In Hex = 90H, 33H
95 to 96	068	Unique Sequence Identifier; Specified 2 Bytes Sequence for Supplier		051	
	048				
97 to 98	069	Unique Sequence Identifier; Specified 2 Bytes Sequence for Year of production			
	053				
99 to104	000	Unique Sequence Identifier Specified 6 Bytes Sequence for Serial Number	127 to 128	080	Low End Input Voltage Range 2 (10 mV), 18000 = 4650H
	000				
	000				

Appendix B FRU Descriptions

Offset (Bytes)	Value (Decimal)	Definition (Remarks)
127 to 128	070	2 Bytes Sequence In Decimal = 080, 070 In Hex = 50H, 46H
129 to 130	032	High End Input Voltage Range 2 (10 mV), 26400= 6720H 2 Bytes Sequence In Decimal = 032, 103 In Hex = 20H, 67H
	103	
131	047	Low End Input Frequency Range, 47 Hz = 2FH
132	063	High End Input Frequency Range, 63 Hz = 3FH
133	010	AC Dropout Tolerance in ms, 10 ms = 0AH
134	026	Binary Flags, 1 indicates function supported and a 0 indicates function not supported. Bits 7-5: RESERVED, WRITE AS 000B Bit 4: Tachometer Pulses Per Rotation / Predictive Fail Polarity BIT = 1 Bit 3: Hot Swap / Redundancy Support BIT = 1 Bit 2: Auto switch Support BIT = 0 Bit 1: Power Factor Correction Support BIT = 1 Bit 0: Predictive Fail Support BIT = 0 In Decimal = 026 In Hex = 1AH
135 to 136	040	Peak Wattage Capacity and Holdup Time, 552 W= 0228H; 1 Second = 01H Bits 15 - 12: Holdup Time in Seconds 01 Second = 01H Bits 11 - 0: Peak Capacity in Watts 552 W = 0228H 2 Bytes sequence: In Decimal: 040, 018 In Hex: 28H, 12H
	018	
137 to 139	000	Combined Wattage, None. Byte 1: 000 = 00H Bits 7 - 4: 0000B Bits 3 - 0: 0000B Byte 2 and Byte 3: 00H, 00H 3 Bytes Sequence In Decimal = 000, 000, 000 In Hex = 00H, 00H, 00H
	000	
	000	
140	000	Predictive Fail Tachometer Lower Threshold, Not Applicable. Predictive Failure is not Supported
141 to 145		**12 V DC Output Record Header**
141 to 145	001	Record type = 01 for DC Output Record
	002	End of List /Record Format Version . Number for 12 V DC Output Record
141 to 145	013	Record Length of 12 V DC Output Record
	209	Record CHECKSUM of 12 V DC Output Record (Zero CHECKSUM)
	031	Header CHECKSUM of 12 V DC Output Record Header (Zero CHECKSUM)
146 to 158		**12 V Output Record**
146	001	Output Information, 001 = 01H Bit 7: Standby Information = 0B Bits 6-4: Reserved, Write as 000B Bits 3-0: Output Number 10 = 001B In Decimal = 001 In Hex = 01H
147 to 148	206	Nominal Voltage (10 mV), 1230 = 04CEH 2 Bytes Sequence In Decimal = 206, 004 In Hex = CEH, 04H
	004	
149 to 150	136	Maximum Negative Voltage Deviation (10mV), 1160 = 0488H 2 Bytes Sequence In Decimal = 136, 004 In Hex = 88H, 04H
	004	
151 to 152	236	Maximum Positive Voltage Deviation (10 mV), 1260 = 04ECH 2 Bytes Sequence In Decimal = 236, 004 In Hex = ECH, 04H
	004	
153 to 154	120	Ripple and Noise pk-pk 10 Hz to 30 MHz (mV), 120 = 0078H 2 Bytes Sequence In Decimal = 120, 000 In Hex = 78H, 00H
	000	
155 to 156	100	Minimum Current Draw (10 mA; 1/10 IPMI spec value), 100 = 0064H 2 Bytes Sequence In Decimal = 100, 000 In Hex = 64H, 00H
	000	
157 to 158	246	Maximum Current Draw (10 mA; 1/10 IPMI spec value), 3830.01 = 0EF6H 2 Bytes Sequence In Decimal: 246,014 In Hex: F6H, 0EH
	014	
159 to 163		**12 V_{SB} Output Record Header**
159 to 163	001	Record type = 01 for DC Output Record
	002	End of List /Record Format Version Number for 12 V_{SB} Output Record
	013	Record Length of 12 V_{SB} Output Record
	239	Record CHECKSUM of 12 V_{SB} Output Record (Zero CHECKSUM)
	001	Header CHECKSUM of 12 V_{SB} Output Record Header (Zero CHECKSUM)

Appendix B FRU Descriptions

Offset (Bytes)	Value (Decimal)	Definition (Remarks)
164 to 176		**12 V_{SB} Output Record**
164	130	Output Information, 130 = 82H Bit 7: Standby Information = 1B Bits 6-4: Reserved, Write as 000B Bits 3-0: Output Number 2 = 010B
165 to 166	176	Nominal Voltage (10mV), 1200 = 04B0H 2 Bytes Sequence In Decimal = 176, 004 In Hex = B0H, 04H
	004	
167 to 168	056	Maximum Negative Voltage Deviation (10 mV), 1080 = 0438H 2 Bytes Sequence In Decimal = 056, 004 In Hex = 38H, 04H
	004	
169 to 170	040	Maximum Positive Voltage Deviation (10 mV), 1320 = 0528H 2 Bytes Sequence In Decimal = 040, 005 In Hex = 28H, 05H
	005	
171 to 172	120	Ripple and Noise pk-pk 10 Hz to 30 MHz (mV), 120 = 0078H 2 Bytes Sequence In Decimal = 120, 000 In Hex = 78H, 00H
	000	
173 to 174	000	Minimum Current Draw (10 mA; 1/10 IPMI spec value), 0 = 0000H 2 Bytes Sequence In Decimal = 000, 000 In Hex = 00H, 00H
	000	
175 to 176	250	Maximum Current Draw (10 mA; 1/10 IPMI spec value), 250 = 00FAH 2 Bytes Sequence In Decimal = 250, 000 In Hex = FAH, 00H
	000	
177 to 181		**OEM Record Header**
177 to 181	208	Record type = 208 for PS OEM Record
	130	End of List /Record Format Version Number for OEM Record
	018	Record Length of OEM Record
	100	Record CHECKSUM of OEM Record (Zero CHECKSUM)
	056	Header CHECKSUM of OEM Record Header (Zero CHECKSUM)
182 to 199		**OEM Record**
182 to 184	011	OEM ID, ID is 11 (LSB first) 3 Bytes Sequence In Decimal = 011, 000, 000 In Hex = 0BH, 00H, 00H
	000	
	000	
185	003	Multi Record Sub-Type: 03 Power Supply Low Line Characteristics, PS feature Set, and PS Identifier.
186 to 187	204	Low Line Overall Capacity of the Power Supply, 460 W = 01CCH 2 Bytes Sequence In Decimal = 204, 001 In Hex = CCH, 01H
	001	
188 to 189	040	Low Line Peak Wattage Capacity and Holdup Time, 552 W = 0228H; 1 Seconds = 01H Bits 15-12: Holdup Time in Seconds 1 Seconds = 01H Bits 11- 0: Peak Capacity in Watts 552 W = 0228H 2 Bytes sequence: In Decimal: 040, 018 In Hex: 28H, 12H
	018	
190	128	PS Feature Class: 128 In Decimal: 128 In Hex: 80H
191	199	PS Identifier Input (Bit 7-Bit 6): 00 stands for DC, 10 stands for AC, 11 stands for AC or 240DC PS ID (Bits 5- 0): 000111b (0b for DC input, 1b for AC) In Decimal: 199 In Hex: C7H
192 to 197	000	Reserved. Default Value is 0
	000	
	000	
	000	
	000	
	000	
198 to 199	032	OEM Name, " " 2 Bytes Sequence In Decimal = 032, 032 In Hex = 20H,20H
	032	
200 to 204		**PS Diagnostic Record Header**
200 to 204	208	Record type = 208 for PS Diagnostic Record
	002	End of List /Record Format Version Number for PS Diagnostic Record
	051	Record Length of PS Diagnostic Record
	176	Record CHECKSUM of PS Diagnostic Record (Zero CHECKSUM)
	075	Header CHECKSUM of PS Diagnostic Record Header (Zero CHECKSUM)
205 to 255		**PS Diagnostic Record**
205 to 208	000	ID Number
	000	
	000	
	000	
209 to 224	000	Serial Number
	000	
	000	
	000	

Appendix B FRU Descriptions

Offset (Bytes)	**Value** (Decimal)	**Definition** (Remarks)	**Offset** (Bytes)	**Value** (Decimal)	**Definition** (Remarks)
209 to 224	000	Serial Number	235	000	Input Voltage MSB
	000		236	000	Input Current LSB
	000		237	000	Input Current MSB
	000		238	000	Output Voltage LSB
	000		239	000	Output Voltage MSB
	000		240	000	Output Current LSB
	000		241	000	Output Current MSB
	000		242	000	T1 Temperature LSB
	000		243	000	T1 Temperature MSB
	000		244	000	T2 Temperature LSB
	000		245	000	T2 Temperature MSB
	000		246	000	F1 Speed LSB
225	000	Total Runtime LSB	247	000	F1 Speed MSB
226	000	Total Runtime Byte #2	248	000	Peak Input Current LSB
227	000	Total Runtime MSB	249	000	Peak Input Current MSB
228	000	PS Status LSB	250	000	Peak Output Current LSB
229	000	PS Status MSB	251	000	Peak Output Current MSB
230	000	Shutdown Event LSB	252	000	PS Control LSB
231	000	Shutdown Event MSB	253	000	PS Control MSB
232	000	Warning Event LSB	254	000	PAD
233	000	Warning Event MSB	255	080	ASCII "P" = Programmed at factory
234	000	Input Voltage LSB			

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