DESCRIPTIONS

1500W, AC-DC Converter

RoHS

Report Report

UL60601-1 EN62368-1 BS EN62368-1

FEATURES

- Wide input voltage range 85 - 264VAC or 120 - 370VDC
- Accepts AC or DC input (dual-use of same terminal)
- Built-in active PFC function
- Operating ambient temperature range: -40℃ to +70℃
- High reliability, efficiency up to 94%
- Output short circuit, 5s constant-current, over-voltage,
- over-temperature protection
- Support 3+1 parallel redundancy, current sharing
- Operating up to 5000m altitude
- Fan speed automatic adjustable
- Comply with IEC/UL62368, IEC60601, IEC60335, GB4943

APPLICATIONS

- Industrial control
- LED
- street light control
- electricity
- Security
- Telecommunications
- Medical
- smart home

Selection Guide

Certification	Part No*	Output Power (W)	Nominal Output Voltage and Current (Vo/Io)		OUTPUT VOLTAGE ADJUSTABLE RANGE (V) VO1	Efficiency at 230VAC (%) Typ.	Capacitive Load (uF) Max.	
			VO1/IO1	VO2/IO2			VO1	VO2
EN/BS EN	AEF1500-2B-12	1510	12V/125A	5V/2A	12-14.4	92	40000	1000
	AEF1500-2B-15	1510	15V/100A		15-18.0	92	20000	
UL/EN/ BS EN	AEF1500-2B-24	1510	24V/62.5A		24-28.8	94	10000	
EN/BS EN	AEF1500-2B-27	1522	27V/56A		27-32.4	94	8000	
EN/ BS EN/UL	AEF1500-2B-36	1522	36V/42A		36-43.2	94	6000	
EN/BS EN	AEF1500-2B-48	1546	48V/32A		48-56.0	94	4000	
	AEF1500-2B-54	1522	54V/28A		54-58.0	94	3000	

Note: 1. *Use suffix "QQ" for both sides conformal coating.

2. *Before powering on the product, please confirm whether the control signal connection terminal (CN7) Pin6 (PS_ON) and Pin7 (GND) short-circuit jumper cap are

connected (Factory comes with short-circuit jumper cap). If not, the product without output. When the control signal connection terminal (CN7) of the product are external connected as a whole, please ensure that Pin6 and Pin7(or Pin14) are short-circuit connected. Please refer toAEF1500-2B-xx (-QQ) Series Power Supply Application Notes: 2.10 Remote control.

3. *When using the current sharing function for all models, do not directly increase the load on the system beyond the rated load of a single prototype when the power is turned on for the first time.

4. *The product picture is for reference only, for details, please refer to the actual product.

Specifications

Product Specifications	Item	Operating Conditions		Min.	Typ.	Max.	Unit
Input Specifications	Input Voltage Range	Rated input		100	--	240	VAC
		AC input		85	--	264	
		DC input		120	--	370	VDC
	Input Voltage Frequency			47	--	63	Hz
	Input Current	115VAC		--	--	15.5	A
		230VAC		--	--	8	
	Inrush Current	115VAC	Cold start	--	3.7	20	
		230VAC		--	6.5	40	
	Power Factor	115VAC	Room-temperature, full load	PF≥0.99			
		230VAC		PF≥0.95			
	Leakage Current	240VAC	Earth leakage current	< 0.5mA			
			Touch current	< 0.1mA			
	Hot Plug			Unavailable			
Output Specifications	Output Voltage Accuracy	Full load range	Vo1	--	±1.0	--	%
			Vo2	--	±2.0	--	
	Line Regulation	Rated load	Vo1	--	±0.5	--	
			Vo2	--	±1.0	--	
	Load Regulation	0%-100% load	Vo1	--	±0.5	--	
			Vo2	--	±3.0	--	
	Ripple & Noise*	20MHz bandwidth (peak-to-peak value)	Vo1:12V/15V/24V/27V	--	--	150	mV
			Vo1: 36V/48V	--	--	200	
			Vo1: 54V	--	--	250	
			Vo2: 5V	--	--	100	
	Hold-up Time	Full input voltage		12	--	--	ms
	Short Circuit Protection*	Recovery time <5s after the short circuit disappear		Hiccup, self-recover			
	Constant Current Protection*	230VAC		Constant current limit, output voltage turn off after 5s, self-recover			
	Over-voltage Protection	12V		≤16.5V	Output voltage turn off, re-power & PS_ON on for recover		
		15V		≤25.0V			
		24V		≤33.0V			
		27V		≤35.0V			
		36V		≤48.0V			
		48V		≤60.0V			
		54V		≤63.0V			

	Over-temperature Protection		Over-temperature protection activation	--	--	70	℃
			Over-temperature protection deactivation	50	--	--	
	Minimum Load			0	--	--	%
	Dynamic Minimum Load			10	--	--	
	Fan		The fan speed is linearly adjusted and determined by the output power and output voltage together				
General Specifications	Isolation Test	Input - output	Electric strength test for 1min., leakage current <10mA	4000	--	--	VAC
		Input - ⏚		2000	--	--	
		Output - ⏚		1500	--	--	
	Insulation Resistance	Input - output	Environment temperature: 25±5℃ Relative humidity: <95%RH, non-condensing Testing voltage: 500VDC	100	--	--	MΩ
		Input - ⏚		100	--	--	
		Output - ⏚		100	--	--	
	Operating Temperature			-40	--	+70	℃
	Storage Temperature			-40	--	+85	
	Storage Humidity		Non-condensing	10	--	95	%RH
	Operating Humidity			20	--	90	
	Switching Frequency		PFC @ rated output	--	65	--	kHz
			LLC @ rated output	--	85	--	
	Power Derating		Operating temperature derating: 12V/15V, -40℃ to -30℃	5	--	--	%/℃
			-30℃ to +45℃	0	--	--	
			+45℃ to +70℃	1.6	--	--	
			Operating temperature derating: 24V/27V/36V/48V/54V, -40℃ to -30℃	5	--	--	
			-30℃ to +50℃	0	--	--	
			+50℃ to +70℃	2	--	--	
			Input voltage derating: 85VAC - 100VAC	2	--	--	%/VAC
			120VDC - 200VDC	0.875	--	--	%/VDC
	Safety Class			CLASS I			
	Isolation Level	Input - output		2 × MOPP			
		Input - ⏚		1 × MOPP			
		Output - ⏚		1 × MOPP			
	MTBF		MIL-HDBK-217F@25℃	≥250,000 h			
Mechanical Specifications	Case Material		SUS 304				
	Dimensions		250.00mm x 127.00mm x 40.50mm				
	Weight		1800g (Typ.)				
	Cooling Method		25CFM				

Note:1. *The "Tip and barrel method" is used for ripple and noise test, output parallel 47uF electrolytic capacitor and 0.1uF ceramic capacitor, please refer to Enclosed Switching Power Supply Application Notes for specific information;

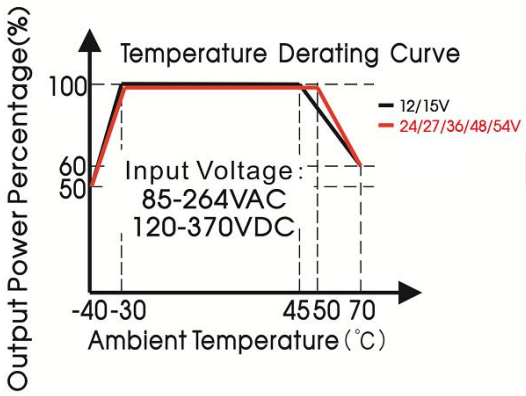
2.*Over current protection is realized in constant current mode, see section 2.6 of the application manual below;
3.*For auxiliary short-circuit mode, refer to section 2.7 of the application manual below;
4.Cooling method and power derating refer to typical characteristic curves.

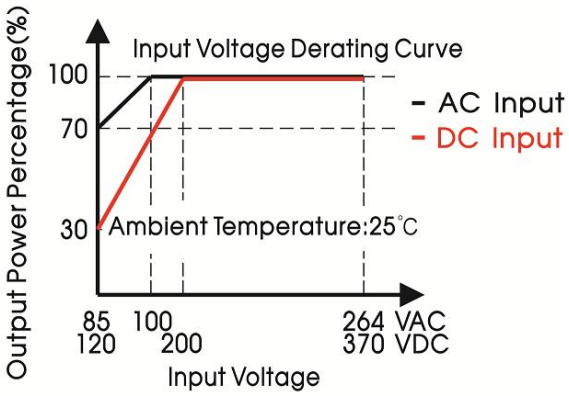
Electromagnetic Compatibility (EMC)

Electromagnetic Compatibility (EMC)	Emissions (EMI)	CE	CISPR32/EN55032 CLASS B	
		RE	CISPR32/EN55032 CLASS B	
		Harmonic current	EN61000-3-2 CLASS A	
	Immunity (EMS)	ESD	IEC/EN61000-4-2 Contact ±8KV/Air ±15KV	perf. Criteria B
		RS	IEC/EN61000-4-3 10V/m	perf. Criteria A
		EFT	IEC/EN61000-4-4 ±4KV, (5 or 100)kHz	perf. Criteria B
		Surge*	IEC/EN61000-4-5 line to line ±2KV/line to ground ±4KV	perf. Criteria B
		CS	IEC/EN61000-4-6 10Vr.m.s	perf. Criteria A
		Voltage dips, short Interruptions and voltage variations	IEC/EN61000-4-11 0%, 70%	perf. Criteria B

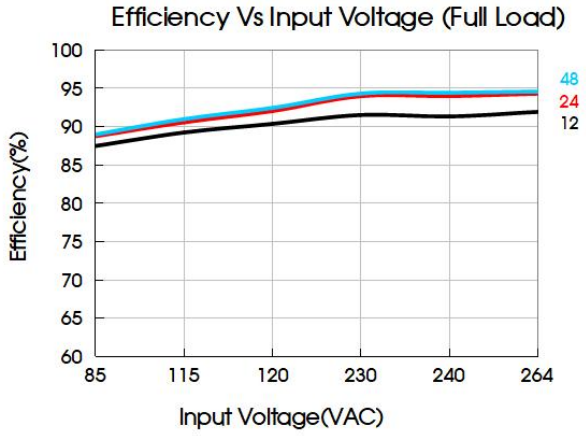
Note: *Un is the maximum input nominal voltage.

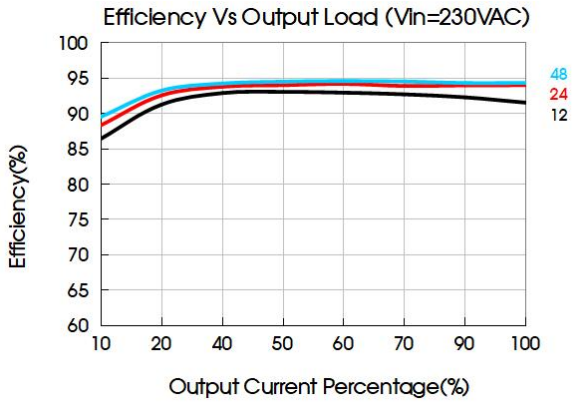
Characteristic Curve



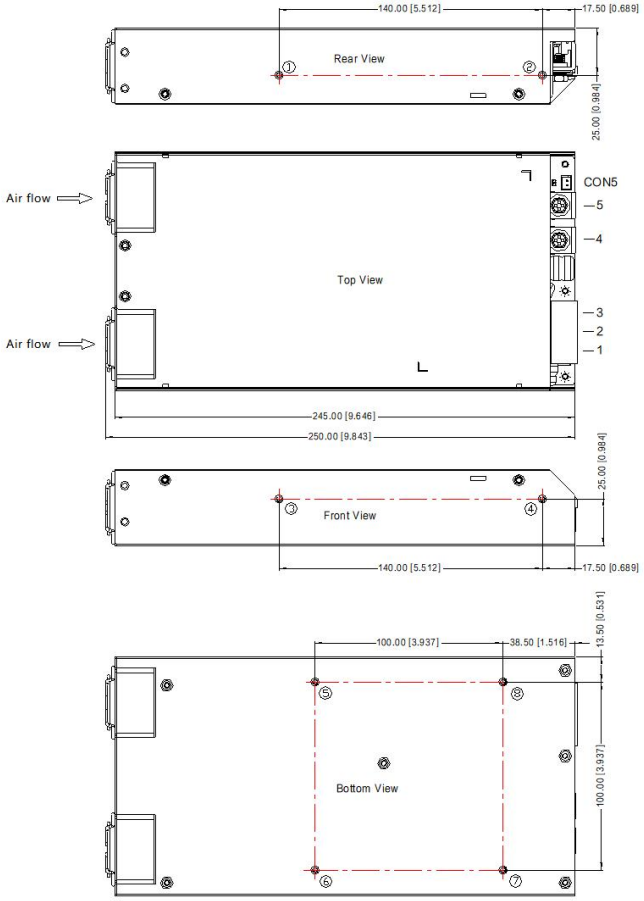


Note: With an AC input voltage between 85 - 100VAC and a DC input between 120 - 200VDC the output power must be derated as per the temperature derating curves.



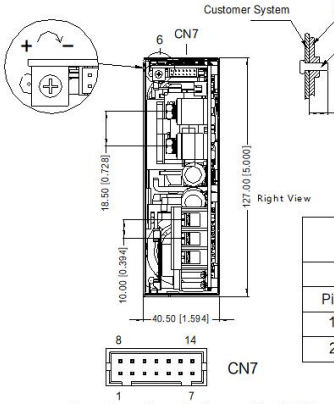


Dimensions and Recommended



THIRD ANGLE PROJECTION

Position	Screw Spec.	Length of locking screw L(Max)	Torque(Max)
① – ⑧	M3	3mm	0.4N · m



Pin-Out	
Pin	Mark
1	AC(L)
2	AC(N)
3	⏚
4	-Vo Main output
5	+Vo Main output
6	ADJ Output adjustable resistor

CON5 (Auxiliary output)

Pin-Out		Customer Connector
Pin	Mark	
1	-S	Connector: XHS2.5-2Y (KANGDAO) or equivalent Terminal: XH2.5-TE (KANGDAO) or equivalent
2	+S	

Precautions: The product comes with a 2-PIN jumper cap accessory, which is only for temporary commissioning, For long-term use, please choose PAA-047 **(Optional Accessory)**

Pin-Out				Customer Connector
Pin	Mark	Pin	Mark	
1	VS+	8	VS-	Connector: JST PHDR-14VS or equivalent Terminal: JST SPHD-002T-P0.5 or CPJ-010(Optional Accessory) or equivalent
2	CURRENT SHARE	9	ADDRESS0	
3	DC_OK	10	ADDRESS1	
4	SCL	11	ADDRESS2	
5	SDA	12	RXD	
6	PS_ON	13	TXD	
7	GND	14	GND	

Note:
Unit: mm[inch]
Pin1, 2, 3 wire range: 22-12AWG
Pin1, 2, 3 connector tightening torque: M4, 0.9N · m(Max)
Pin4, 5 connector tightening torque: M5, 2.3N · m(Max)
General tolerances: ± 1.00[± 0.039]

Note:1. Pin 12, 13 of CN7 are reserved and have no actual function.

2. The bottom mounting hole of AMF1500 series products is based on the output side, which is compatible with our AMF1000 series products.

3. AMF1500 series products can be used with adapter plate: Compatible with the installation mode of mainstream 1500W products in the market. Please consult FAE for EMC test operation instructions.

Note:

1. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity <75%RH with nominal input voltage and rated output load;
2. The room temperature derating of 5℃/1000m is needed for operating altitude greater than 2000m;
3. All index testing methods in this datasheet are based on our company corporate standards;
4. Products are related to laws and regulations: see "Features" and "EMC";
5. The out case needs to be connected to PE (⏚) of system when the terminal equipment in operating;
6. products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units;
7. The power supply is considered a component which will be installed into a terminal equipment. All EMC tests should be confirmed with the final equipment;
8. In the appearance dimension drawing, ±Vo represents the main output, ±S represents the auxiliary output, and the auxiliary output can be selected by the customer, which has no effect on the main output.

AEF1500-2B-xx(-QQ) Power Supply Application Note

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MiDAS

1. Overview

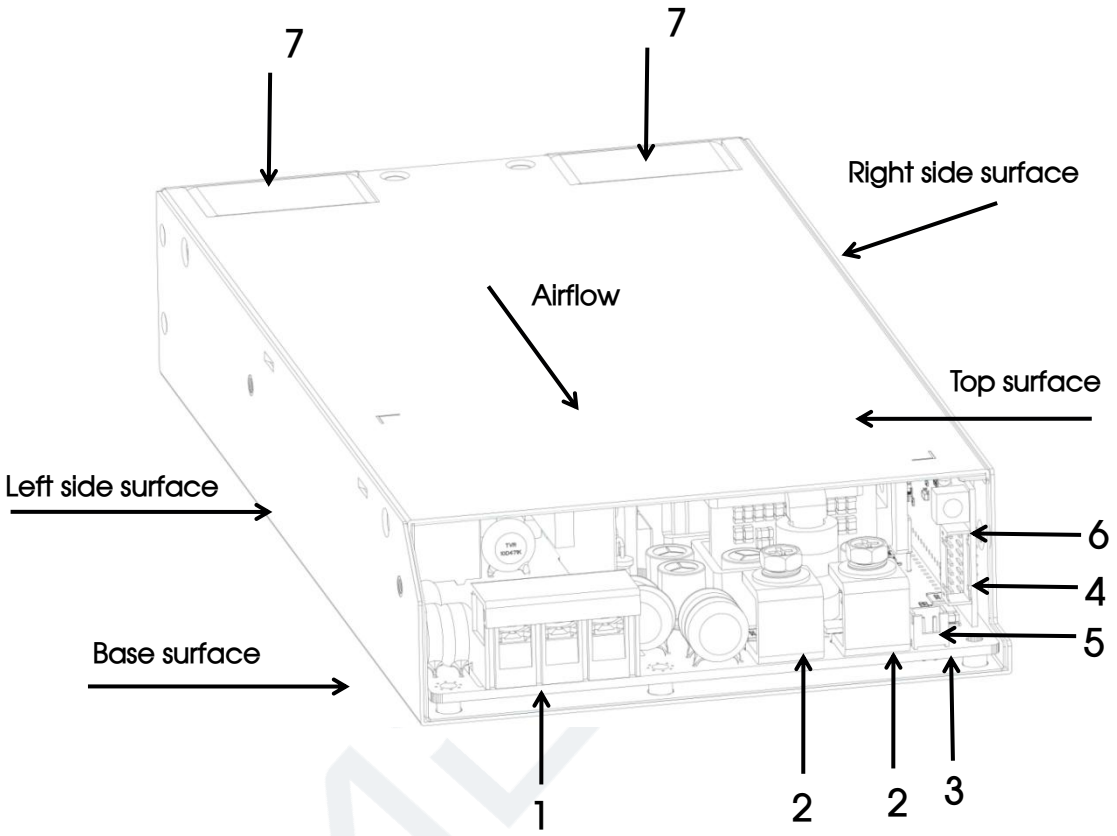


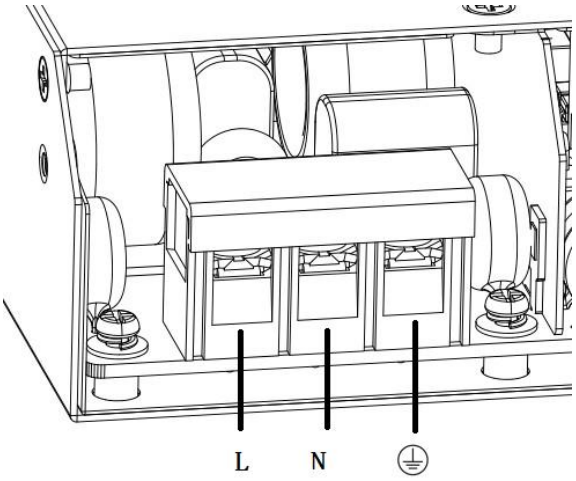
Fig. 1: Appearance information of *AEF1500-2B-xx(-QQ)*

Overview description:

1. AC/DC input terminal (J1)
2. DC main output terminal (J2, J3)
3. Auxiliary road output terminal (CON5)
4. Signal connection press the terminal (CN7)
5. Green and red status display LED lights
6. Output voltage regulation resistor
7. Fans

1.1 AC/DC input terminal block (J1)

The input terminal J1, as a standard 3-pin fence welding terminal with upper cover, the center spacing of the pins is 10mm.



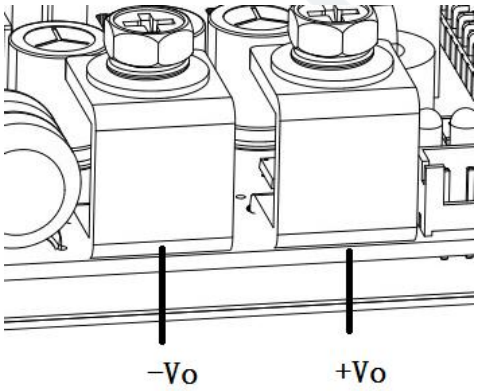
Pin	Features
L	Line (Phase)
N	Neutral
⏚	Ground/Earth

Wire size: 12-22AWG

Torque: 1.2N·m (max)

1.2 Main DC output terminal (J2, J3)

The output terminal uses two standard screw lock type metal terminals, the pin spacing between each is 18mm.

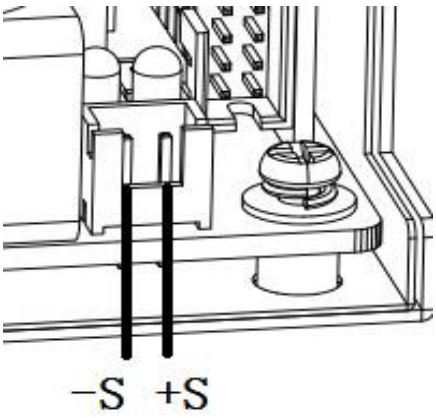


Pin	Features
+Vo	Main output +
-Vo	Main output -

Torque: 2.3N·m

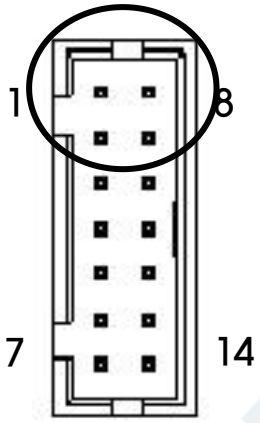
1.3 Auxiliary DC output terminal (CON5)

The auxiliary output terminal with a standard terminal of 2.5mm pitch.



Pin	Function
-S	Auxiliary DC output -
+S	Auxiliary DC output +

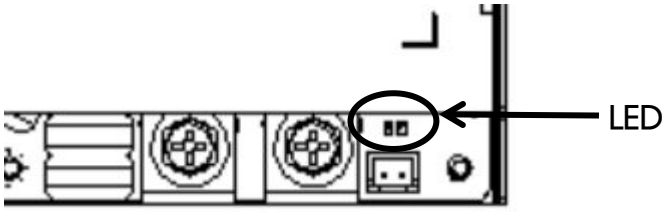
1.4 Signal port (CN7)



Pin	Label	Features
1	VS+	Remote compensation positive terminal
2	CURRENT SHARE	Current sharing bus
3	DC_OK	DC_OK Signal
4	SCL	I2C communication line
5	SDA	I2C communication line
6	PS_ON	Remote control signal
7	GND	Signal terminal reference ground
8	VS-	Remote compensation negative terminal
9	ADDRESS0	ADDRESS code 0
10	ADDRESS1	ADDRESS code 1
11	ADDRESS2	ADDRESS code 2
12	RXD	Serial communication
13	TXD	Serial communication
14	GND	Signal terminal reference ground

Note: The reference ground of all pins on the signal terminal is pin7 and pin14.

1.5 Green and red status display LED lights

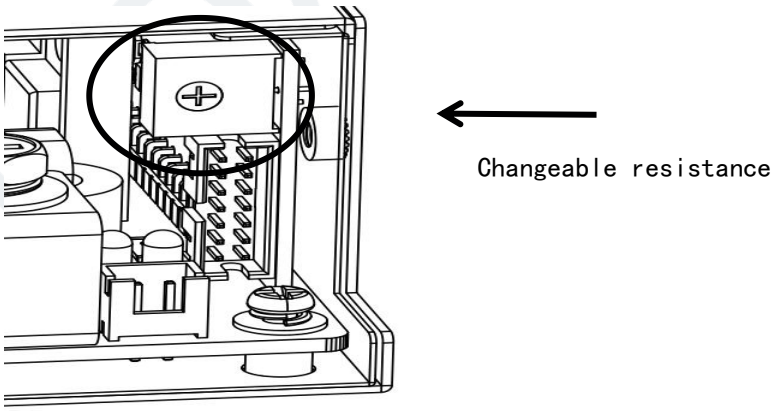


Two kinds of LED lights indicate difference working states of the power supply:

Green LED	Red LED	Status
ON	OFF	Normal work
OFF	ON	Main or auxiliary road alarm
OFF	OFF	No input

1.6 Output voltage adjustment knob

Turn counterclockwise to increase output voltage



Model	Rated Output Voltage	Adjustable Range Of Output Voltage
AEF1500-2B-12	12V	12 - 14.4V
AEF1500-2B-15	15V	15 - 18.0V
AEF1500-2B-24	24V	24 - 28.8V
AEF1500-2B-27	27V	27 - 32.4V
AEF1500-2B-36	36V	36 - 43.2V
AEF1500-2B-48	48V	48 - 56.0V
AEF1500-2B-54	54V	54 - 58.0V

2. Function Manual

2.1 Input requirements

The AC input voltage and DC input voltage must be within the defined voltage range (refer to data-sheet), otherwise the power supply may not work properly or even malfunction. The internal L and N line of the power module have been connected in series with a 250V 25A fuse. For better protection, it is recommended that customers use a circuit breaker not greater than 25A (Non-mandatory requirement).

2.2 Output requirements

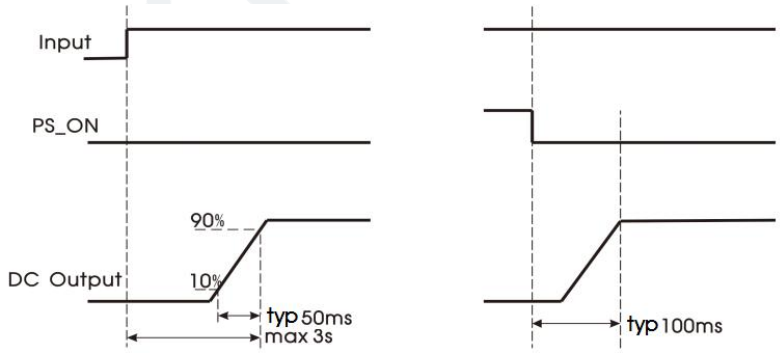
Main output

At any voltage value, the maximum output current and power must not exceed the rated/specified value. The output current must not exceed the maximum output current value.

Auxiliary output

The auxiliary circuit supports a maximum current of 2A.

2.3 Start-up timing



Item	Operating Conditions		Min.	Typ.	Max.	Unit
Power-off Hold Time	Room temperature, full load	115VAC	12	--	--	ms
		230VAC	12	--	--	
Start Delay Time	230VAC, full load, 25℃		--	--	3	s

2.4 Fan speed control

Fan speed is determined by output power and output voltage at the same time, refer to the following curve for fan speed change.

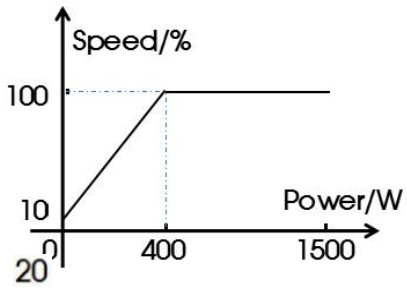


Fig.1

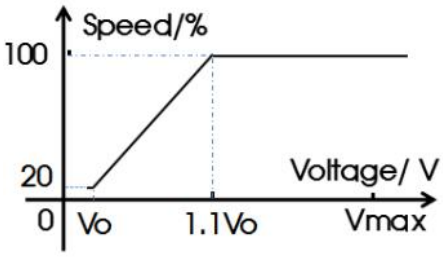


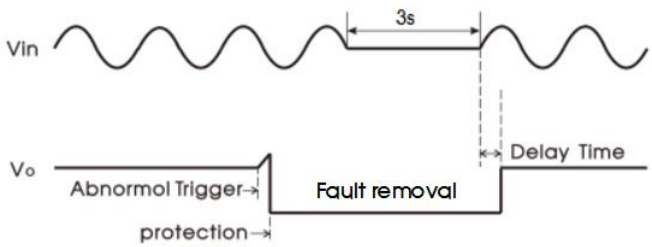
Fig.2

Vo：Rated output voltage

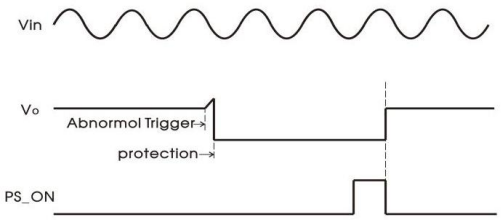
2.5 Output over-voltage protection (OVP)

Main output

The over-voltage protection function is to close the main output when the output voltage reaches the protection voltage value. When the main circuit over-voltage protection occurs, the main circuit output voltage of the module will be shut off, and the auxiliary circuit output will not be affected. The main circuit output can be restored after disconnecting the input power for at least 3 seconds.



In addition, it can be quickly restarted by the PS_ON signal:



Auxiliary output

When the auxiliary circuit voltage reaches 6.3VDC (maximum value), the auxiliary output will be in hiccup status, and the main output voltage turn off until the auxiliary output returns to normal after the fault is eliminated.

2.6 Output constant-current protection (OCP)

① Main circuit overcurrent

If in CC load mode, when the current exceeds the constant current point, the output enters hiccup mode; when the over current state is released, the output returns to normal.

If in CR/CV load mode, the relationship among output current, voltage and resistance in shown in the following curve:

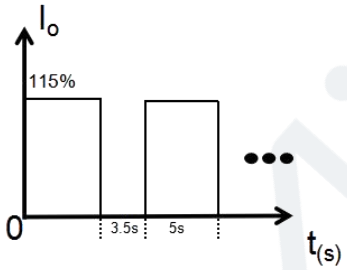


Fig.1

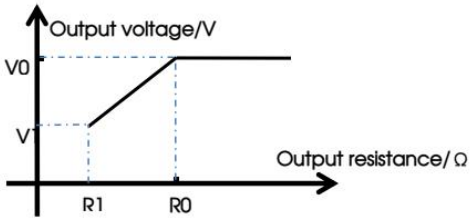


Fig.2

When the product enters the constant current state, the output state circulates as shown in Fig.1, working for 5S and protecting for 3.5S, until the constant current state is released.

In that above Fig.2 the slope corresponding to section R1-R2 is the output current corresponding to constant current. Generally, $V_1 \cong 75\%V_0$.

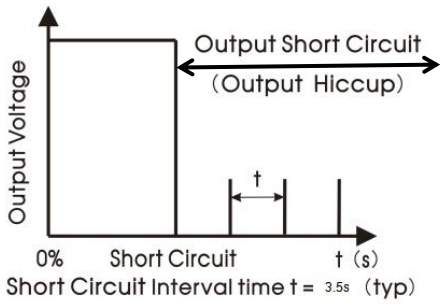
② Auxiliary circuit overcurrent

When the auxiliary output current exceeds 120% (typ.) of the rated current, turn off the main output. After the overflows state is removed, the main route automatically recovers output after restart.

2.7 Output short circuit protection (SCP)

When the output is short-circuited, the power output in hiccup with interval 3.5s. After the short-circuit is removed, the power module will automatically return to normal, and the auxiliary output will not be affected.

When the auxiliary circuit output is short-circuited, the main circuit without output.



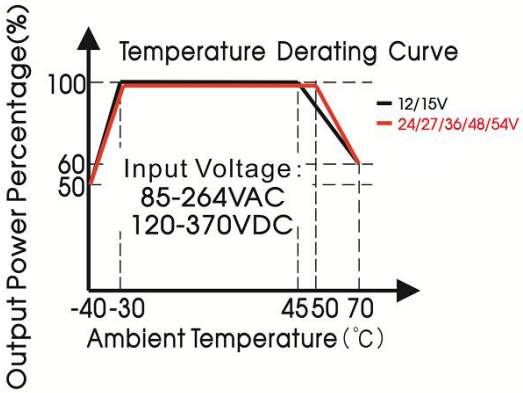
2.8 Over-temperature protection (OTP)

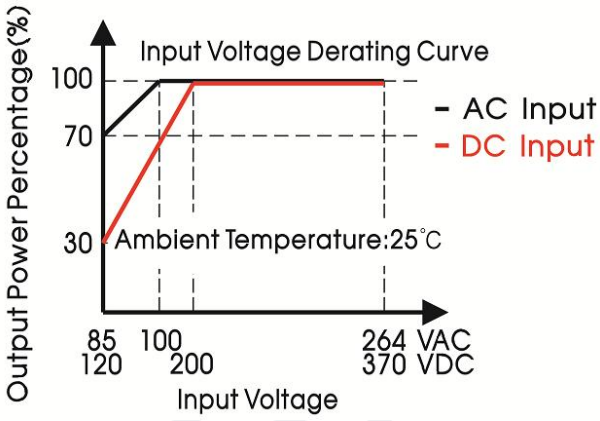
When the ambient temperature of the power supply exceeds the rated temperature for a period of time, the power supply will be turned off and the power supply will resume normal operation after the ambient temperature drops to the set value.

2.9 Output power derating

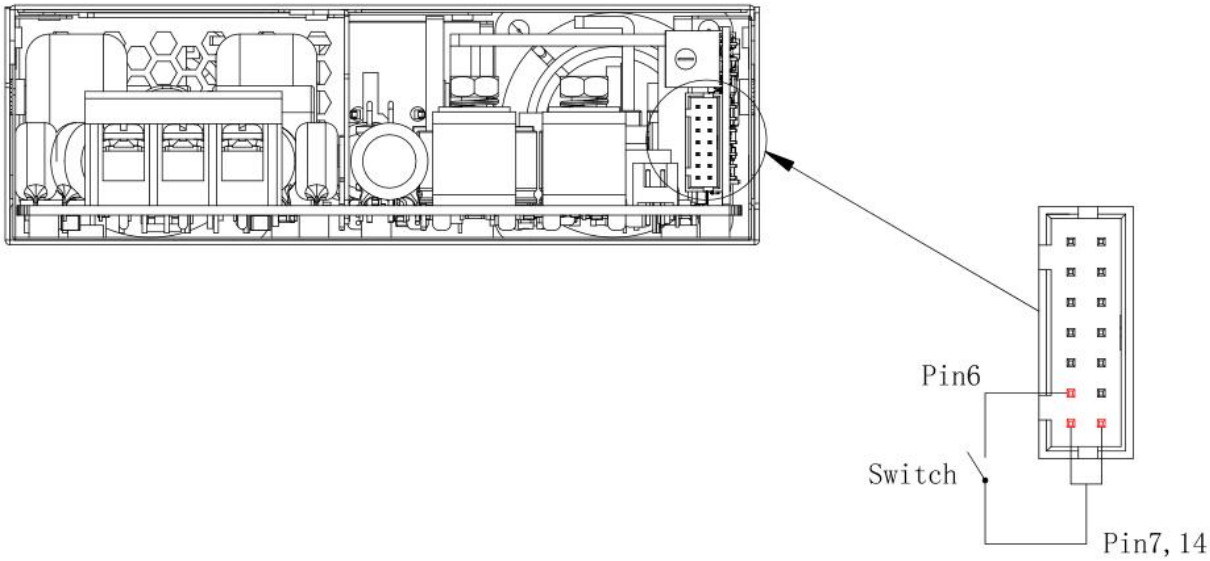
When the input voltage is greater than 100VAC (or 200VDC), only need to derate according to the temperature derating curve.

When the input voltage is lower than 100VAC (or 200VDC), the output power will be derated according to the following input voltage derating curve after temperature derating.





2.10 Remote control



PS_ON (Pin6) and GND (Pin7or Pin14)	Output Status
Short-Circuit	Output on
Pin floating	Output off

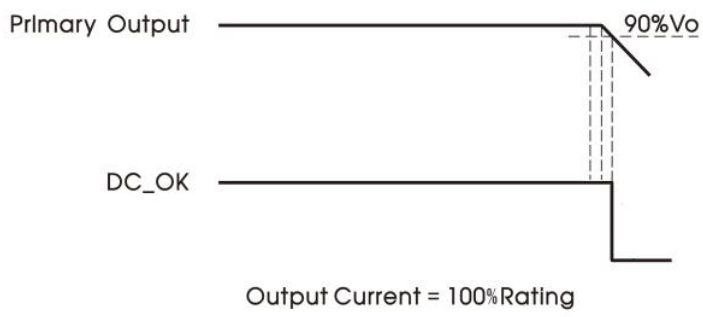
If the input terminal of the power module has been connected to a power source, the PS_ON signal pin can be used to control the on and off of the main output, and the PS_ON signal does not affect the output voltage of the auxiliary circuit.

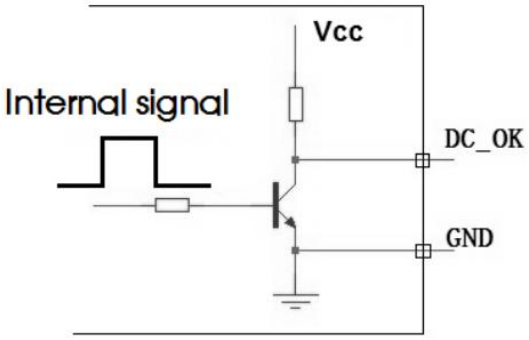
Note: The internal PS_ON input impedance of the module is 5.1K.

2.11 DC_OK signal

The DC_OK signal is used to monitor whether the power supply is working normally, and the signal is at Pin3 of the signal terminal CN7.

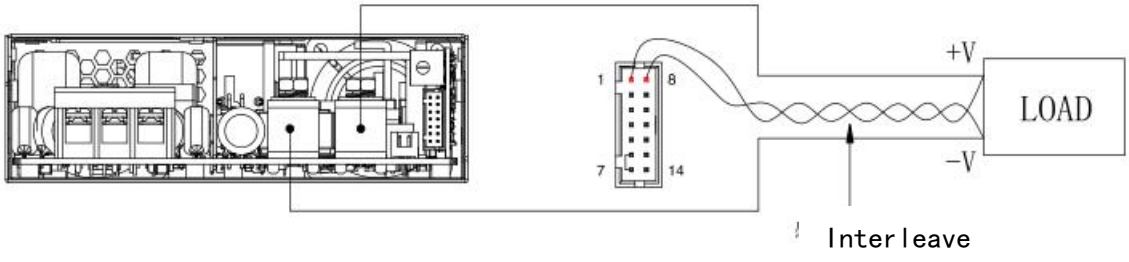
Note: When the DC_OK signal is connected to the external circuit, the impedance of the external external circuit (i.e. between Pin3 and Pin7 or Pin14 of CN7) is not less than 10kΩ.





DC_OK (Pin3) and GND (Pin7 or Pin14)	Output State
2.5 - 5V	Output on
0 - 0.5V	Output off

2.12 Remote compensation



Note:

1. Vs+ and Vs- cannot be shorted or reversed, otherwise the power module will be damaged.

2. Before powering on the product, please confirm whether the control signal connection terminal (CN7) Pin6 (PS_ON) and Pin7 (GND) short-circuit jumper cap are connected. If not, the product without output. When the control signal connection terminal (CN7) of the product are external connected as a whole, please ensure that Pin6 and Pin7 (or Pin14) are short-circuit connected.

3. Pin 1 and pin 8 of the signal terminal CN7 can compensate the voltage drop on the output cable.

4. The remote compensation circuit can compensate up to 200mV cable voltage drop. This voltage includes the sum of the cable drop connected to the output positive terminal and the output negative terminal.

5. If you need to use the remote compensation function, the signal pin needs to be connected with the load end with a twisted pair cable.

2.13 Parallel operation

2.13.1 Redundancy

The power module output can be connected in parallel to achieve redundancy, thereby improving system reliability. The maximum power of the redundant system needs to be derated to ensure that the redundant system can still meet the rated load requirements when a power supply module fails. The current common practice is to construct a redundant system by the N+1 method, that is, N+1 power supplies are connected in parallel, to support the maximum load current N*Iomax, where Iomax is the rated output

current of each power supply. For example, the rated output current of each power supply is 40A, and 3+1 units are connected in parallel to construct a 3*40A=120A redundant system.

The power module supports 3+1 parallel redundant operation.

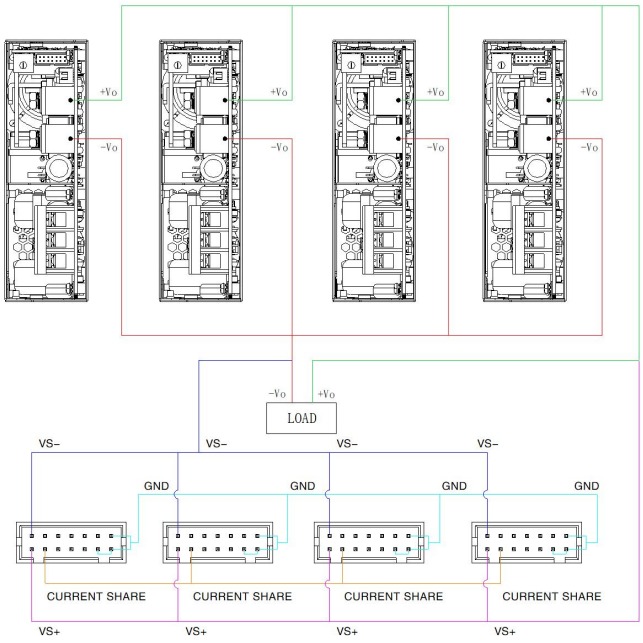
The ORing circuit is used inside the power module, and when any one of the power modules in the parallel fails, it will not affect the work of other power modules.

When used in parallel, the maximum load current cannot exceed the maximum output current of a single power supply module, otherwise the whole parallel power supply module will not start normally.

2.13.2 Current sharing

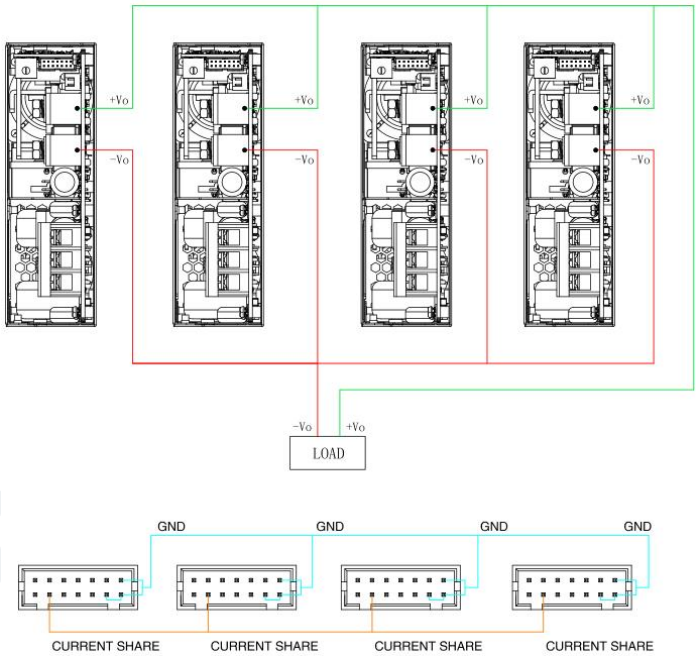
Method 1: Current sharing bus and remote compensation lines are both connected.

For load line loss ≤ 200mV, and the output voltage difference of each single module ≤ 50mV, this type of connection is recommended to obtain a better line-end output voltage and current sharing effect.



Method 2: Only the current sharing bus is connected, and the remote compensation is not connected.

For the load line loss ≥ 200mV, or the output voltage difference of each single module cannot or does not need to be accurately adjusted to ≤ 50mV, this type of connection is recommended to obtain a better current sharing effect of the parallel machine. In the same way, when the load loss is unknown or the current sharing fails to meet the specifications under the first connection method, it is recommended to replace it with this connected method. The wiring method of the current sharing function is shown in the figure below:



Note: 1. When using in parallel, the number of parallel modules cannot exceed 4.

2. Before powering on the product, please confirm whether the control signal connection terminal (CN7) Pin6 (PS_ON) and Pin7 (GND) short-circuit jumper cap are connected. If not, the product without output. When the control signal connection terminal (CN7) of the product are external connected as a whole, please ensure that Pin6 and Pin7 (or Pin14) are short-circuit connected. We have PAA-047 jumper terminals for sale.

Please refer to AEF1500-2B-xx(-QQ) Series Power Supply Application Notes: 2.10 Remote control.

When power modules work in parallel, there is an internal active current sharing circuit to ensure that the current between each module is balanced.

The active current sharing circuit adopts the automatic master-slave current sharing method. Each power module has a current sharing bus signal (CURRENT SHARE BUS). When working in parallel, the current sharing bus of all power modules must be connected together. The current-sharing bus signal is located at pin 2 of CN7.

The output voltage of each power module will affect the current sharing accuracy. The output voltage of the power module is the rated voltage ±50mV. In practical applications, if the output voltage value needs to be adjusted, the output voltage of all parallel power supply modules needs to be adjusted

to the same voltage. The recommended voltage range: target voltage value ±50mV

After the output load of each power module is greater than 50% of the rated load, the current sharing accuracy should be ±5%. The current sharing calculation formula is:

$$\text{Current sharing accuracy} = \frac{Io\max - Io\min}{Io\max} * 100\%$$

Iomax: the maximum output current value in parallel power supply modules.

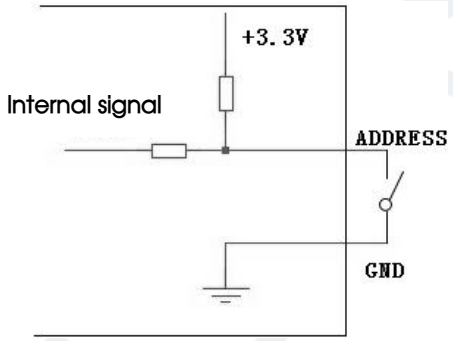
Iomin: the minimum output current value in parallel power supply modules.

2.14 I2C communication address

In the parallel system, if you need to identify the power module information, you need to set the I2C communication address for each parallel power module, and exchange data with the host computer through I2C. The setting of the communication address is determined by pins 9, 10 and 11 of the signal terminal CN7. When these three pins are short-circuited with pin 7 or 14 of CN7, it will be low level (L, voltage

range: 0 - 1.31V). When disconnected, it is high level (H, voltage range: 1.99V - 3.3V). The specific address number is shown in the table below:

ADDRESS 2	ADDRESS 1	ADDRESS 0	Address number
L	L	L	0
L	L	H	1
L	H	L	2
L	H	H	3
H	L	L	4
H	L	H	5
H	H	L	6
H	H	H	7



The internal pull-up resistance value of the power module is 10kΩ, and the external impedance can be matched according to the actual application to meet the high and low voltage range.

3. Installation requirements

3.1 Safety introduction

Warning: Risk of electric shock

During high voltage operating

- The power supply module is disconnected from the input DC or the AC power and placed for at least one minute before starting to operate it.
- When installing the input wire to the power module, please connect the ground terminal first, and then connect the L line and the N line.

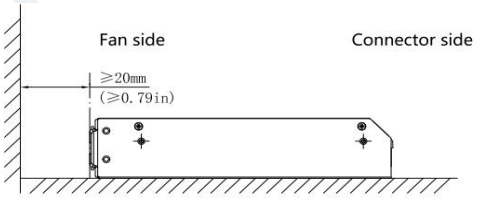
- When removing the input wire, please remove the L wire and the N wire first, and then remove the ground wire.
- When disassembling, make sure that no objects fall into the power module.
- Pay attention to high temperature.
- After the power module is working in a high temperature environment, wait for its shell to cool down before operating.
- This product needs to be installed by professionals and needs to be used with other equipment.

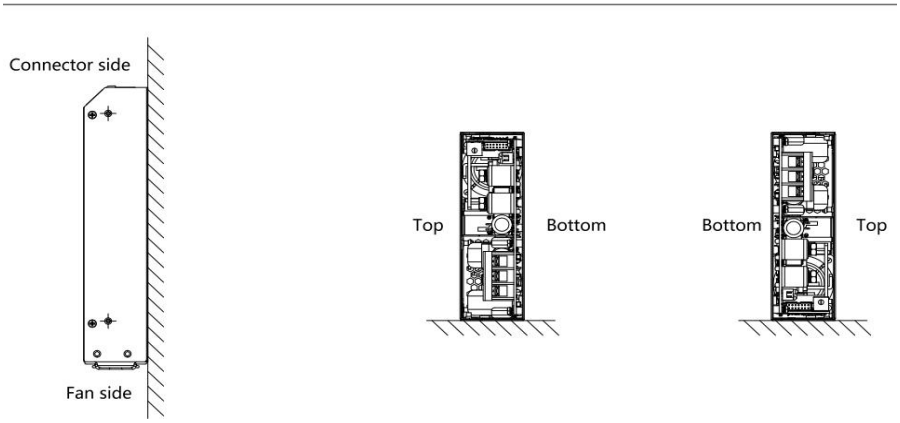
3.2 Safety requirements

When installing, pay attention to the primary side and the protective ground, the creep distance and the electrical clearance of the primary side and the secondary side refer to EN60601-1.

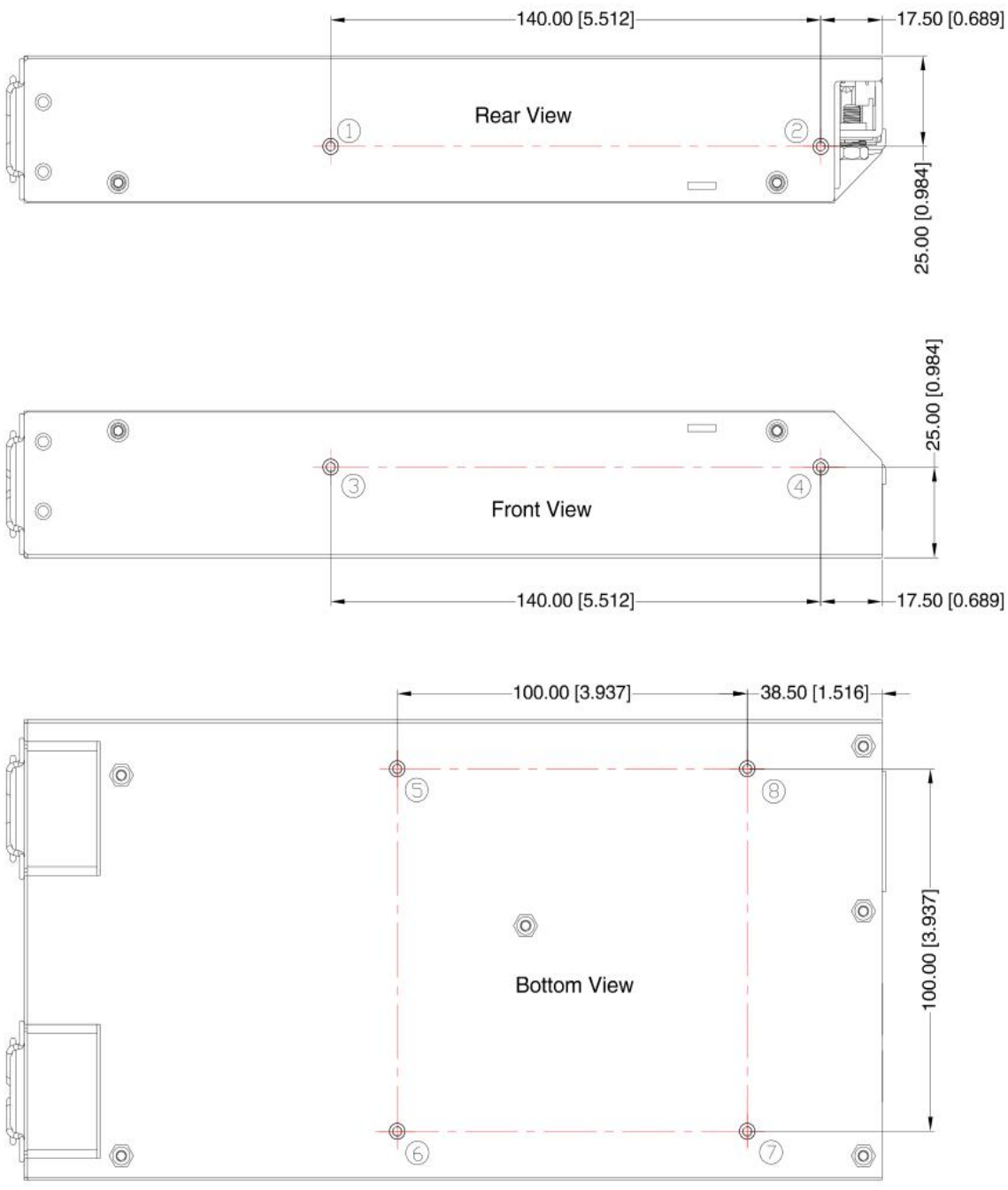
3.3 Installation method

Standard mounting orientation:





Position of mounting holes:



Note: The fan panel cannot be blocked by other objects, and a distance of at least 20mm must be maintained, otherwise it will affect the heat dissipation and performance of the power module.

4. Communication protocol

The AEF1500-2B-xx(-QQ) series power modules support standard communication protocols and manage and monitor the power modules through I2C bus.

Command	Command Name	Access Type	Data	Data Format	Description
0x9A	PMB_MFR_MODEL	Block Read	32	ASCII	Product model
0x8B	PMB_READ_VOUT	Read Word	2	Direct	Main circuit output voltage (10mV)
0x8C	PMB_READ_IOUT	Read Word	2	Direct	Main output current (10mV)
0x96	PMB_READ_POUT	Read Word	2	Direct	Main output power (10mV)
0xC4	PMB_MFR_AUX_VOUT	Read Word	2	Direct	Auxiliary output Voltage (10mV)
0xC5	PMB_MFR_AUX_IOUT	Read Word	2	Direct	Auxiliary output current (10mV)
0xC7	PMB_MFR_FAULT_BIT	Read Word	2	Bit Field	Fault status word

Describe Of Fault Status Through PMB_MFR_FAULT_BIT	
Bit Segment	**Description**
BIT: 0	0: Fan 1 normal 1: Fan 1 fault
BIT: 1	0: Fan 2 normal 1: Fan 2 fault
BIT: 2	0: Auxiliary output normal 1: Auxiliary output abnormal
BIT: 3	0: No over-voltage in main circuit 1: Over-voltage in main circuit

BIT: 4	0: No under-voltage in main circuit 1: Under-voltage in main circuit
BIT: 5	0: No level 1 over-current in main circuit 1: Level 1 over-current in main circuit
BIT: 6	0: No level 2 over-current in main circuit 1: level 2 over-current in main circuit
BIT: 7	0: No level 1 over-load in main circuit 1: Level 1 over-load in main circuit
BIT: 8	0: No level 2 over-load in main circuit 1: Level 2 over-load in main circuit
BIT: 9	0: No level 3 over-load in main circuit 1: Level 3 over-load in main circuit
BIT: 10	0: Normal temperature 1: Over-temperature and over-load
BIT: 11	0: No short circuit in main circuit 1: Short circuit in main circuit
BIT: 12	0: No hardware over-voltage in main circuit 1: Main circuit hardware over-voltage fault
BIT: 13	0: No hardware under-voltage in main circuit 1: Main circuit hardware under-voltage fault
BIT: 14	0: Pre-charge normal 1: Pre-charge fault
BIT: 15	0: PFC soft start normal 1: PFC soft start fault