MPE-1500CM

Single Output, 1500W Compact, Enclosed AC/DC Power Supplies

Key Features:

- 1,500W Output Power
- Universal 85-264 VAC In
- UL 60601 Approved
- Over Current Protection
- Over Voltage Protection
- Built-In Active PFC
- Meets EN 55032 B
- Efficiency to 94%
- Built-In DC Fans
- AC or DC Input
- Reinforced Insulation

c UL us

CE

UK CA

RoHS

MicroPower Direct
46 Eastman Street
Unit 1
Easton, MA 02375
USA

T: (781) 344-8226
F: (781) 344-8481
E: sales@micropowerdirect.com
W: www.micropowerdirect.com

MPD MICROPOWER DIRECT

Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input

Parameter	Conditions		Min.	Typ.	Max.	Units
Input Voltage Range	Rated Input		100		240	VAC
	AC Input		85		264	
	DC Input		120		370	VDC
Input Frequency			47		63	Hz
Input Current	See Model Selection Guide					
Leakage Current	240 VAC	Earth Current			0.5	mA
		Touch Current			0.1	
Power Factor	Full Load	115 VAC	0.99			---
		230 VAC	0.95			
Inrush Current, Cold Start		115 VAC		3.7	20	A Pk
		230 VAC		6.5	40	

Output

Parameter	Conditions		Min.	Typ.	Max.	Units
Output Voltage Accuracy	Main Output			±1.0		%
	Auxiliary Output			±2.0		
Line Regulation, At Rated Load	Main Output			±0.5		%
	Auxiliary Output			±1.0		
Load Regulation, 0 - 100% Load	Main Output			±0.5		%
	Auxiliary Output			±3.0		
Ripple & Noise (20 MHz), See Note 2	Main Output	12/15/24/27V			150	mV p-p
		36/48V			200	
		54V			250	
	Auxiliary Output	5V			100	
Hold-Up Time	Full input voltage		12			ms
Standby Power Consumption	115 VAC			3.5		W
	230 VAC			4.5		
Temperature Derating	12/15 V	-40°C to -30°C	5			%/°C
		-30°C to + 45°C	0			
		+45°C to +70°C	1.6			
	Other Models	-40°C to -30°C	5			
		-30°C to + 50°C	0			
		+50°C to +70°C	2			
Input Voltage Derating	85 - 100 VAC		2			%/VAC
	120 - 200 VDC		0.875			%/VDC
Over Current Protection	Constant current limit, output voltage turn off after 5s, self-recovery					
Constant Current Protection	230 VAC		Constant current limit, output voltage turn off after 5s, self-recovery			
Short Circuit Protection, See Note 3	Continuous (Autorecovery)					

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage, See Note 4	Input to Output	4,000			VAC
	Input to Ground	2,000			
	Output to Ground	1,500			
Isolation Resistance	See Note 5	100			MΩ
Isolation Level	Input to Output		2 x MOPP		
	Input to Ground		1 x MOPP		
	Output to Ground		1 x MOPP		
Switching Frequency	PFC Circuit		65		kHz
	LLC Circuit		85		

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40		+70	°C
Storage Temperature Range		-40		+85	°C
Over Temperature Protection	Activation			+70	°C
	Deactivation	+50			
Cooling	Forced Air Convection (25CFM) (See Derating Curves)				
Operating Humidity	Non-Condensing	20		90	%RH
Storage Humidity		10		95	

Physical

Size	9.84 x 5.00 x 1.59 in. (See Mechanical Drawing on Page 5)
Weight	63.49 oz (1.8kg) (See Mechanical Drawing on Page 5)
Case Material	SUS 304
Conformal Coating, See Note 9	Option Available For Use In Harsh Environments

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	250			kHours
Safety Standards	See Model Selection Guide				
Safety Class	Class I				

Model Selection Guide

UL	Model Number		Input Current (A Max) 115 VAC	Input Current (A Max) 230 VAC	Output Voltage (VDC)	Output Adjust Range (VDC)	Output Current (A) Rated	Output Current (A) % Min.	Output Power (W)	Over Voltage Protection (VDC) See Note 6	Max Output Capacitance (μF)	Efficiency (%, Typ)
	MPE-1500CM-12	Main	15.5	8	12	12 - 14.4	125	0	1510	16.5	40000	92
		Aux			5	-	2		10	7	1000	
	MPE-1500CM-15	Main	15.5	8	15	15 - 18	100	0	1510	25	20000	92
		Aux			5	-	2		10	7	1000	
▪	MPE-1500CM-24	Main	15.5	8	24	24 - 28.8	62.5	0	1510	33	10000	94
		Aux			5	-	2		10	7	1000	
	MPE-1500CM-27	Main	15.5	8	27	27 - 32.4	56	0	1522	35	8000	94
		Aux			5	-	2		10	7	1000	
▪	MPE-1500CM-36	Main	15.5	8	36	36 - 43.2	42	0	1522	48	6000	94
		Aux			5	-	2		10	7	1000	
	MPE-1500CM-48	Main	15.5	8	48	48 - 56	32	0	1546	60	4000	94
		Aux			5	-	2		10	7	1000	
	MPE-1500CM-54	Main	15.5	8	54	54 - 58	28	0	1522	63	3000	94
		Aux			5	-	2		10	7	1000	
	* MPE-1500CMU-24, -36 have UL 60601 recognition (UL certificate). Contact factory for safety standard status of other models.											

Notes:

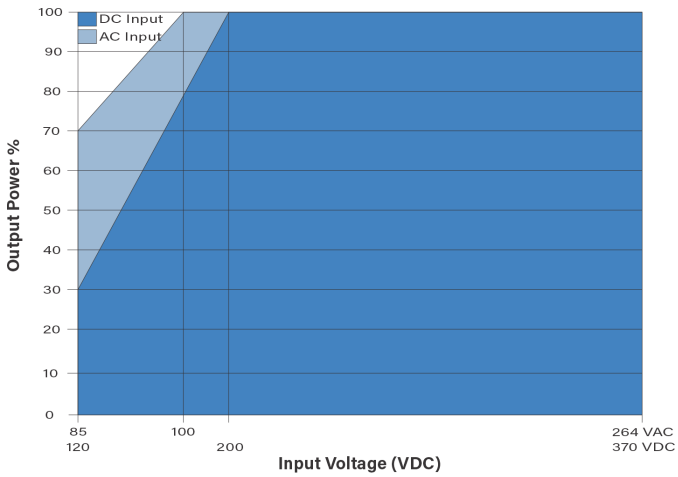
1. Before applying power to the unit, confirm that pin 6 (PS ON) and pin 7 (GND) on the control signal connection terminal are connected (see page 5). If not, the unit will not turn on. Contact the factory for more information.
2. Output ripple is measured at 20 MHz bandwidth using 0.1 μF and 47 μF capacitors connected in parallel as close to the power supply terminals as possible.
3. Output short circuit protection is provided by a "hiccup mode" circuit. The unit recovers <5 seconds after the fault condition is removed.
4. Input-output and input-ground isolation are tested for 60 seconds with a leakage current of <10 mA.
5. Insulation resistance is given for input - output, input - ground and output - ground. It is tested at 500 VDC and 25±5°C with 95%RH non-condensing humidity.
6. After an overvoltage fault the unit must be power recycled (or the PS ON signal must be used to recover.
7. All units include an on-board slow blow fuse.
8. During CE/RE testing a magnetic bead (nickel-zinc ferrite) should be coupled with the output load line. The power supply is considered a component of the system during such testing. All items are tested on a metal plate and should be combined with the final equipment for EMC confirmation. Call the factory for more information.
9. For use in harsh environments such as exposure to a salt or chemical spray or high humidity the unit is available conformaly coated.
10. When using the current sharing function for all models, the load added to the system cannot exceed the rated load of a single unit when the initial power is turned on.
11. A room temperature derating of 5°C/1000m is needed for operating alititude greater than 2000m.
12. The output voltage can be adjusting by the ADJ knob. Turn clockwise to decrease and counterclockwise to increase.

Function Specifications

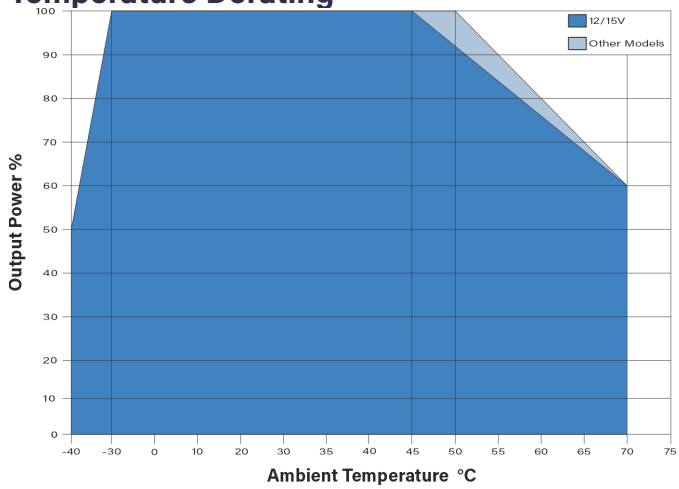
Function	Operating Conditions		Min	Typ	Max	Unit
Remote Control	Input V Range	Turn On V (CN7 pin 6 and CN7 pin7/14 are short)			0.5	V
	Load Range	Turn Off V (CN7 pin 6 and CN7 pin 7/14 are open)	2.0		5.0	
DC OK Signal	Input V Range	Power On	2.5		5.0	V
	Load Range	Power Off	0		0.5	
Oring	Supports direct parallel use. Acheives 3+1 parallel redundancy					
Current Share Acc.	See Note 10			±5		%
LED Signal	Indicates Main Output Status	Normal Output	Steady Green			
		Abnormal Output Protected	Steady Red			
		Power Off (AC without Input)	Turned Off			
Remote Sense	Total compensation voltage (+Vs/-Vs shorted to +Vo/-Vo)			200		mV
SDA, SCL			Internal 2.4 k pull up resistor to internal 3.3V			

For Conformal Coating, add the suffix "CC" to the part number:
(i.e. **MPE-1500CM-24-CC**)

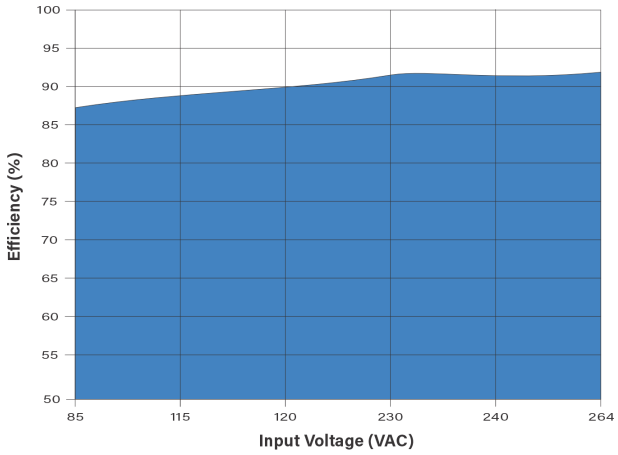
Input Voltage Derating



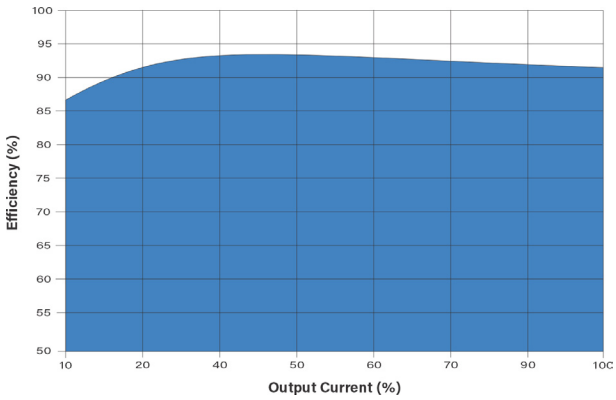
Temperature Derating



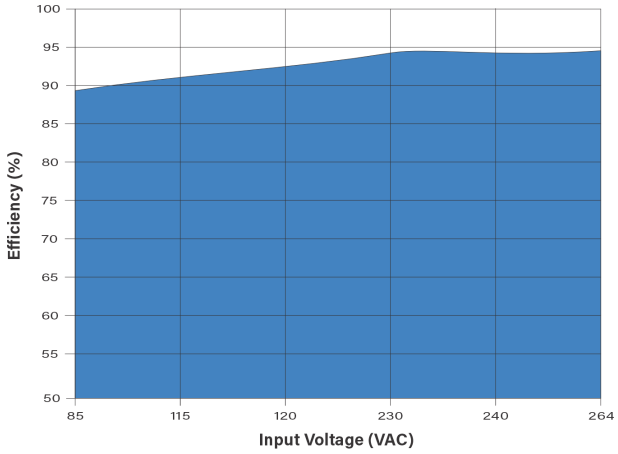
Efficiency vs Input Voltage: 12 VOUT



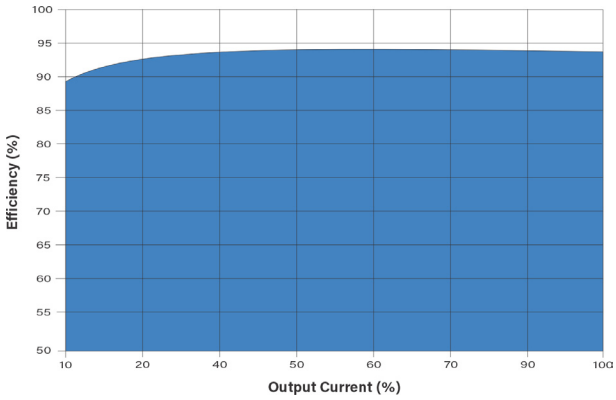
Efficiency vs Output Load: 12 VOUT



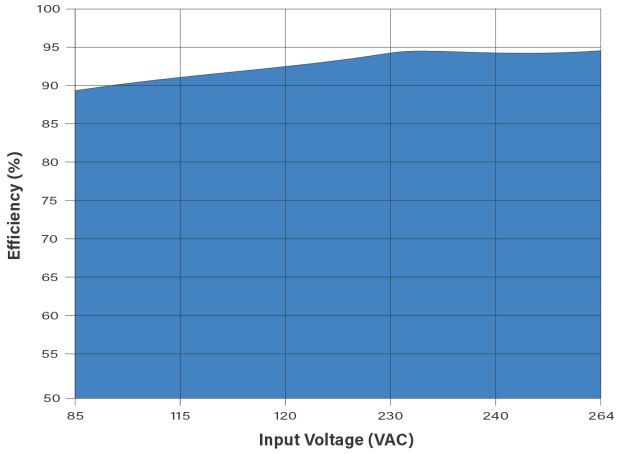
Efficiency vs Input Voltage: 24 VOUT



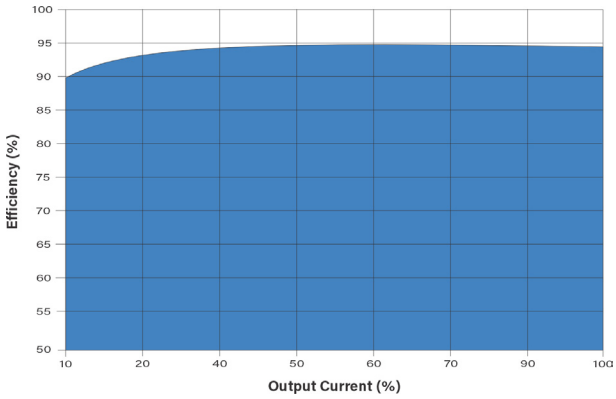
Efficiency vs Output Load: 24 VOUT



Efficiency vs Input Voltage: 48 VOUT



Efficiency vs Output Load: 48 VOUT



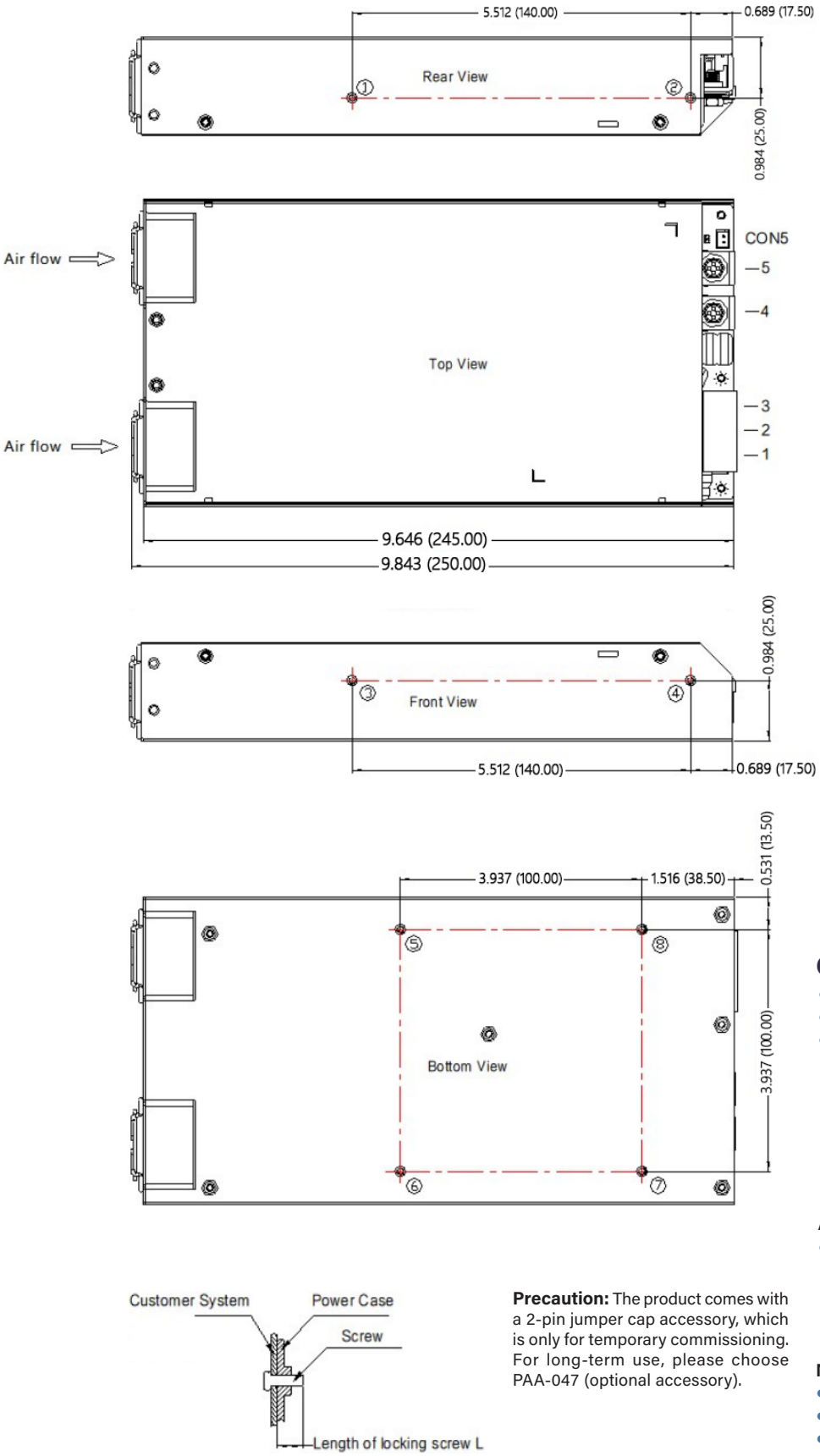
EMC

Parameter	Standard	Criteria	Level
Radiated Emissions	CISPR 32/EN 55032		Class B
Conducted Emissions	CISPR 32/EN 55032		Class B
Harmonic Current	EN 61000-3-2		Class A
ESD	EN 61000-4-2	B	±8 KV Contact
			±15 KV Air
RS	EN 61000-4-3	A	10V/m
EFT	EN 61000-4-4	B	±4 kV
Surge	EN 61000-4-5	B	±2 KV L-L
			±4 KV L-G
CS	EN 61000-4-6	A	10 Vrms
Voltage Dips	EN 61000-4-11	B	0%, 70%

MPD has a very wide range of high performance AC/DC power supplies ranging from 600W UChannel units to 1W units in miniature Single-In-Line (SIP) packages. All are designed and certified to international safety and EMC/EMI standards.
We have AC/DC supplies approved for use in medical equipment, DIN rail supplies, "Green" energy supplies and constant power supplies.
We also offer a wide variety of DC/DC converters, POL regulators and IGBT drivers. All products are available with short lead times. Call today for complete information or product samples. Or go to our website:

WWW.MICROPOWERDIRECT.COM

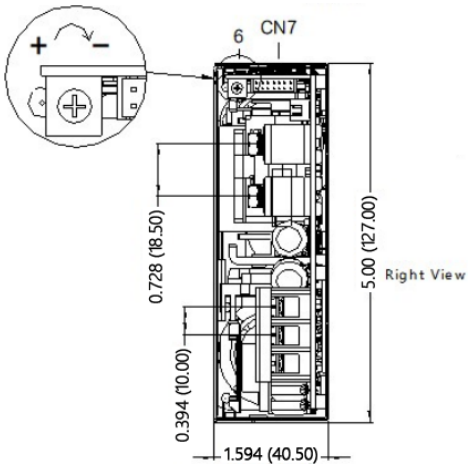
Mechanical Dimensions

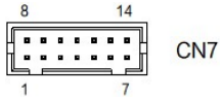


Precaution: The product comes with a 2-pin jumper cap accessory, which is only for temporary commissioning. For long-term use, please choose PAA-047 (optional accessory).

Case Connections

Position	Screw	Max L	Max Torque
1 - 8	M3	3 mm	0.4N•m





Function Connector (CN7):

- JST PHDR-14VS or Equivalent
  Mating Terminal SPHD-002T-P0.5

Term.	Function
1	VS+
2	Current Share
3	DC OK
4	SCL
5	SDA
6	PS ON
7	GND

Term.	Function
8	VS-
9	ADDRESS0
10	ADDRESS1
11	ADDRESS2
12	RXD
13	TXD
14	GND

Connections

- Wire range - 22 -12 AWG
- Pin 1, 2, 3 Tightening Torque: M4, 0.9 N•m
- Pin 4, 5 Tightening Torque: M5, 2.3N•m

Pin	Function
1	AC-Line
2	AC-Neutral
3	Ground
4	-VOUT
5	+VOUT
6	Output Adj

Auxilliary Output Connector (CN5):

- Mating Harness Attached

Pin	Function	Connector
1	-S	Connector: XH2.5-2Y (KAN-GDAO) or equivalent
2	+S	Terminal: XH2.5-TE (KANG-DAO) or equivalent

Notes:

- All dimensions are typical in inches (mm)
- General tolerances: ±0.039 (±1.00)
- Weight: 63.49 oz (1.8 kg)

MPD: Eastman Street, Unit 1, Easton, MA 02375 • Tel: (781)-344-8226 • Fax: (781)-344-8481 • E-Mail: sales@micropowerdirect.com

MPE-1500CM Power Supply Application Notes

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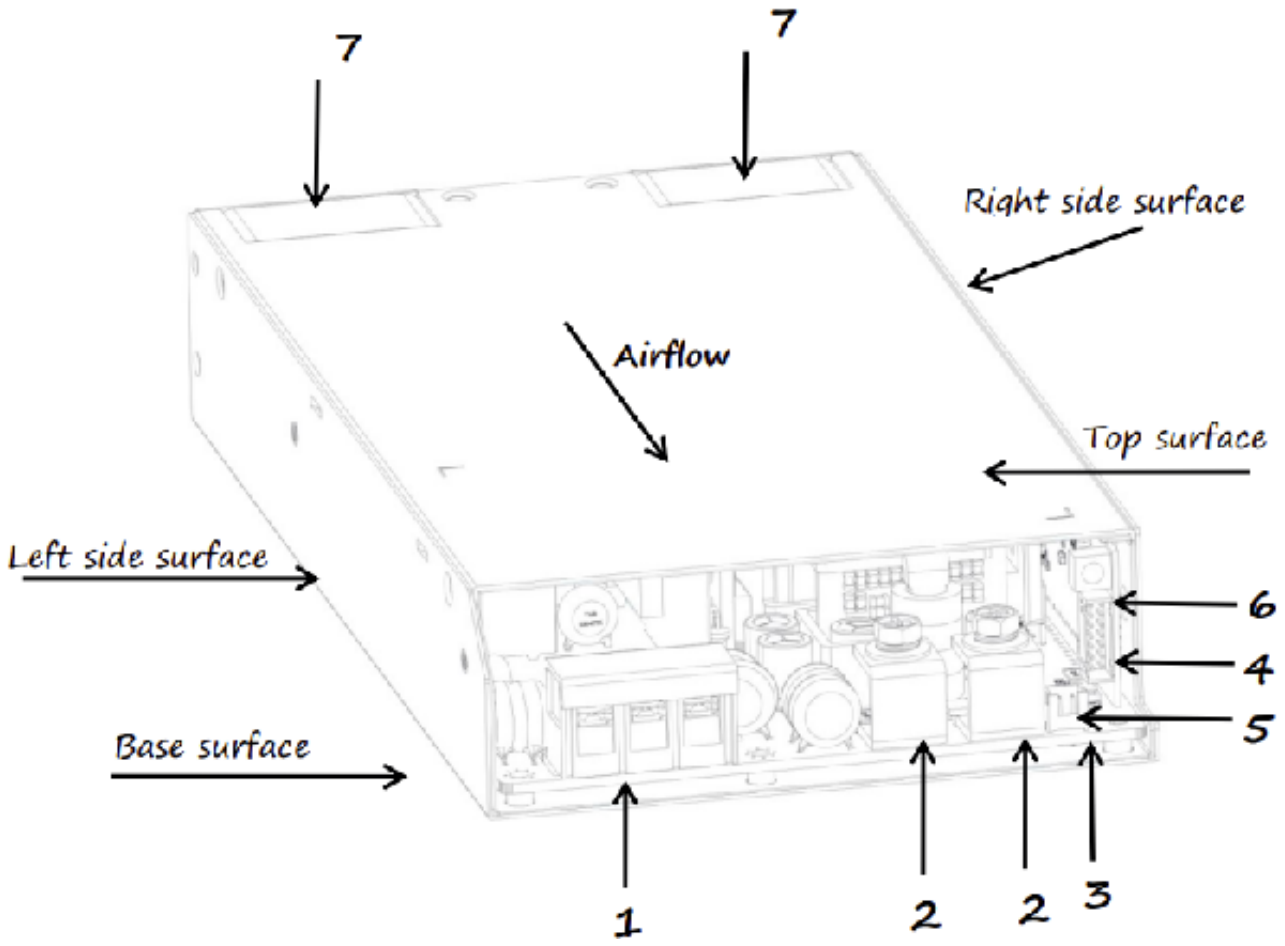
Overview

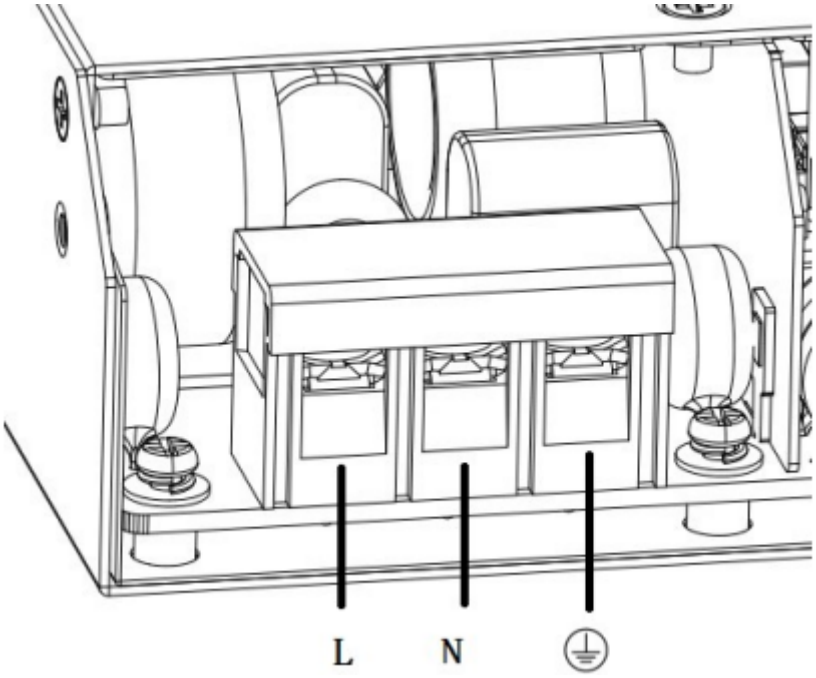


Overview description:

1. AC/DC input terminal (J1)
2. DC main output terminal (J2, J3)
3. Auxiliary road output terminal (CN5)
4. Signal connection press the terminal (CN7)
5. Green and red 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 spacing of the pins is 10mm.



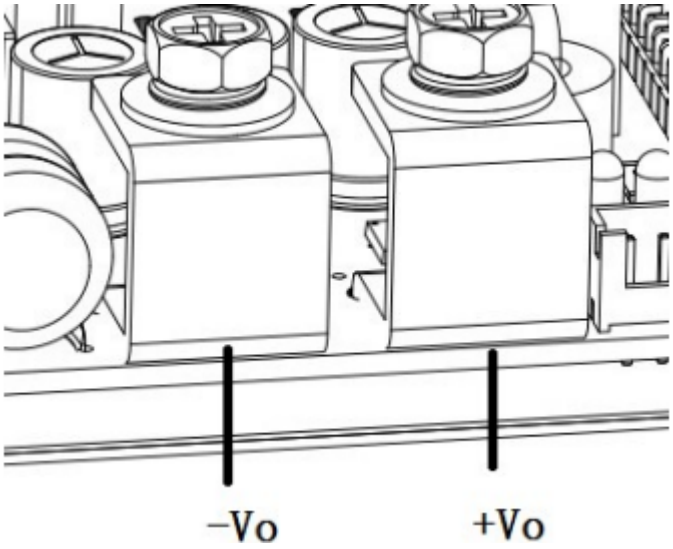
Pin	Features
L	Line (Phase)
N	Neutral
GND	Ground/Earth

Wire size: 12-22AWG

Torque: 1.2N

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.

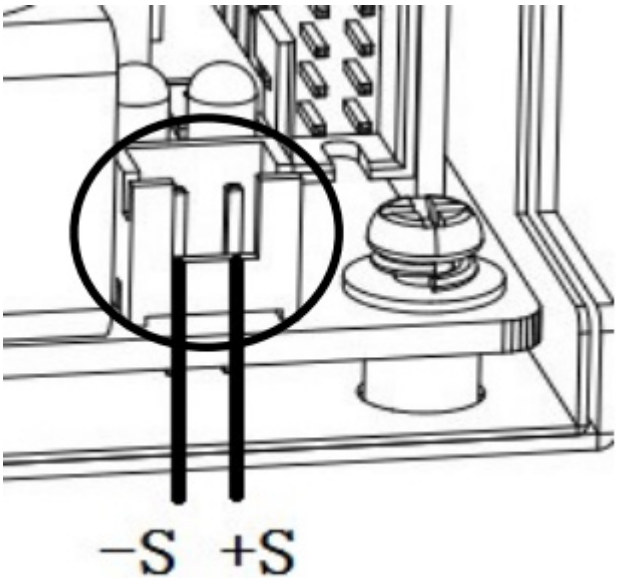


Pin	Features
+Vo	Main Output +
-Vo	Main Output -

Torque: 2.3N • m

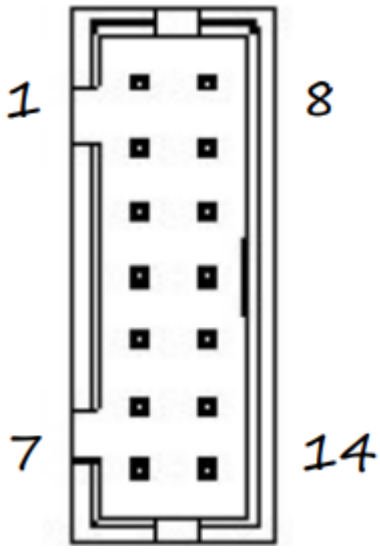
1.3 Auxiliary DC Output Terminal (CON5)

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



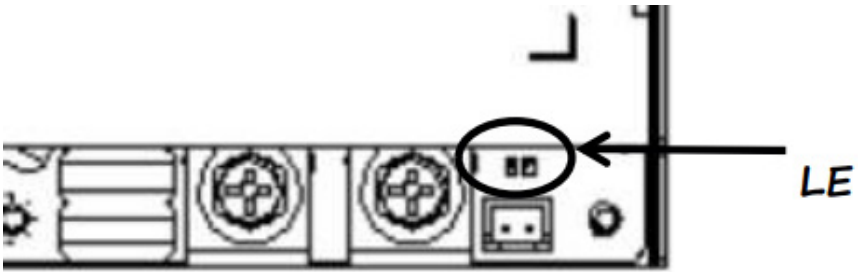
Pin	Features
-S	Auxiliary DC Output -
+S	Auxiliary DC Output +

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 communucation
14	GND	Signal terminal reference ground

1.5 Green and Red Status Display LED Lights

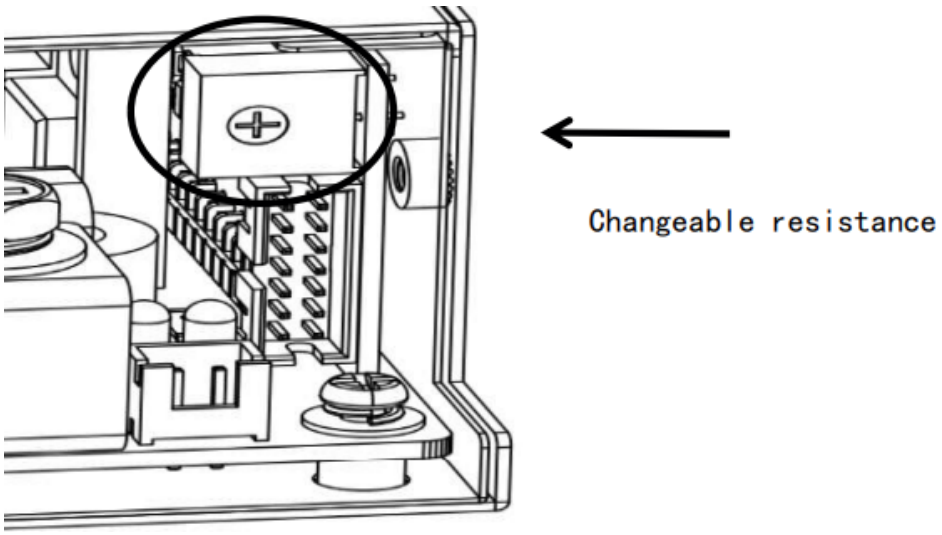


Two kinds of LED lights indicate different working states of the power supply:

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 (V)	Adjustable Output Voltage Range (V)
MPE-1500CM-12	12	12 - 14.4
MPE-1500CM-15	15	15 - 18
MPE-1500CM-24	24	24 - 28.8
MPE-1500CM-27	27	27 - 32.4
MPE-1500CM-36	36	36 - 43.2
MPE-1500CM-48	48	48 - 56
MPE-1500CM-54	54	54 - 58

2. Function Manual

2.1 Input Requirements

The AC input voltage and DC input voltage must be within the defined voltage range (refer to the datasheet), otherwise the power supply may not work properly or even malfunction. The internal L and N line of the power supply 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

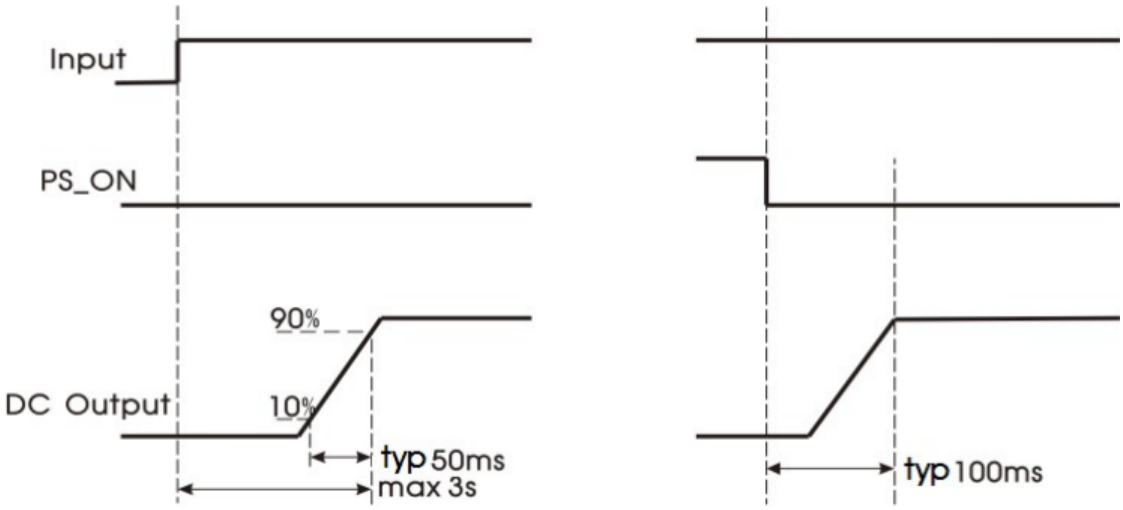
Main Output

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.

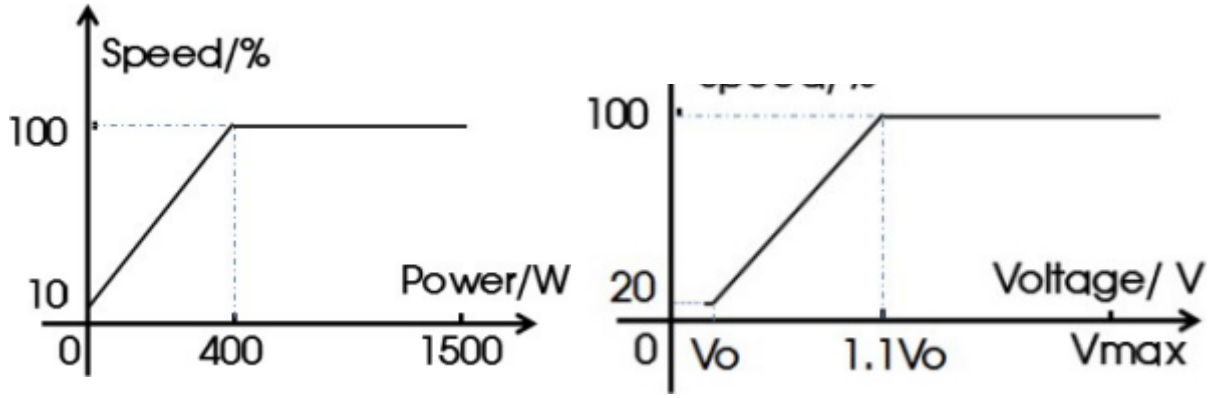
2.3 Start-Up Timing



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

2.4 Fan Speed Control

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

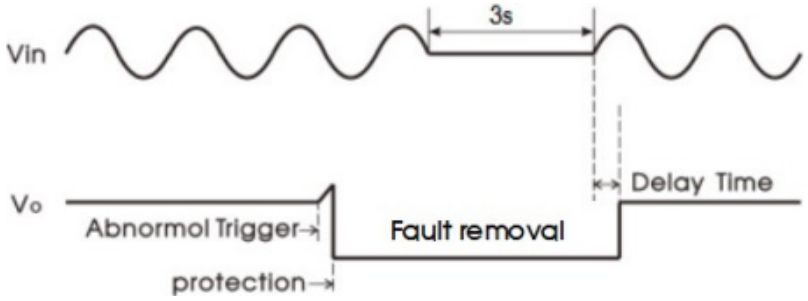


Vo: Rated output voltage

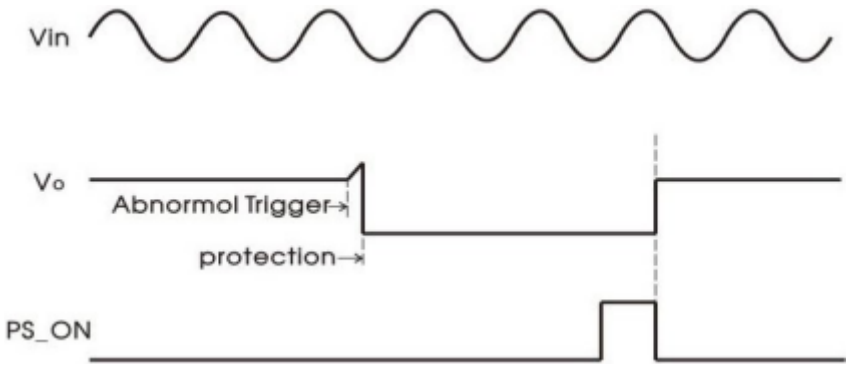
2.5 Output Over Voltage Protection (OVP)

Main Output

The over voltage protection function is used to close the main output when the outut 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 auxi8liary circuit voltage reaches 6.3VDC (maximum value), the auxiliary output will be in hiccup status, and the main output voltage turns off until the auxiliary output returns to normal after the fault is eliminated.

2.6 Output Constant Current Protection (OCP)

Main Curcuit 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 the output current, voltage and resistance is shown in the following curve:

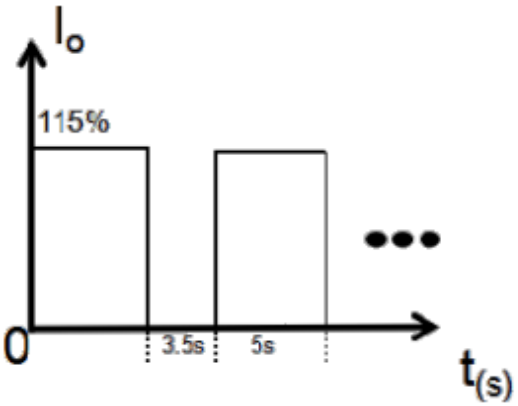


Fig. 1

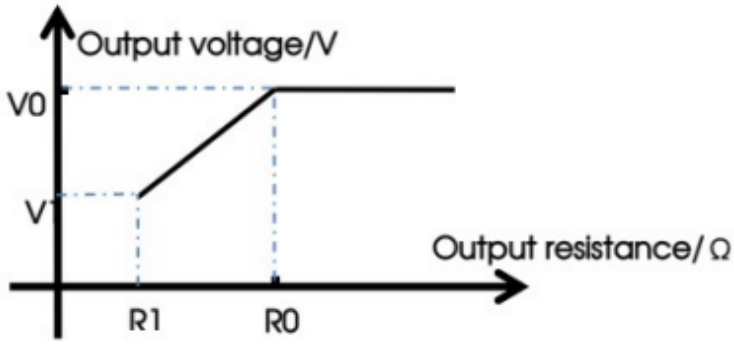


Fig. 2

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

In Fig. 2 above, the slope corresponding to section R1 - R2 is the output current corresponding to constant current. Generally, $V1 \cong 75\% V0$.

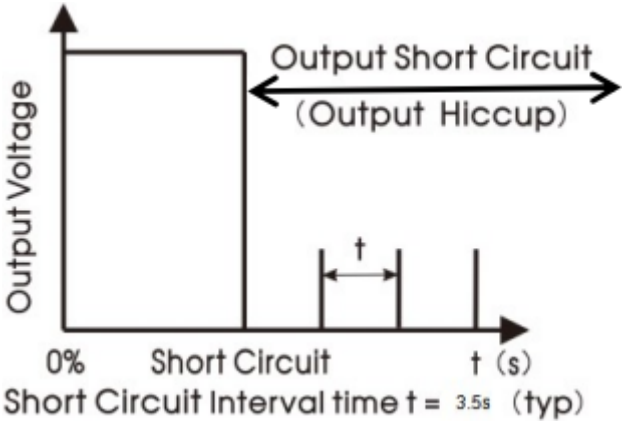
Auxiliary Circuit Overcurrent

When the auxiliary output current exceeds 120% (typ.) of the rated current, turn off the main output. After the overflow 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 is in hiccup mode with inteval 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 has no output.



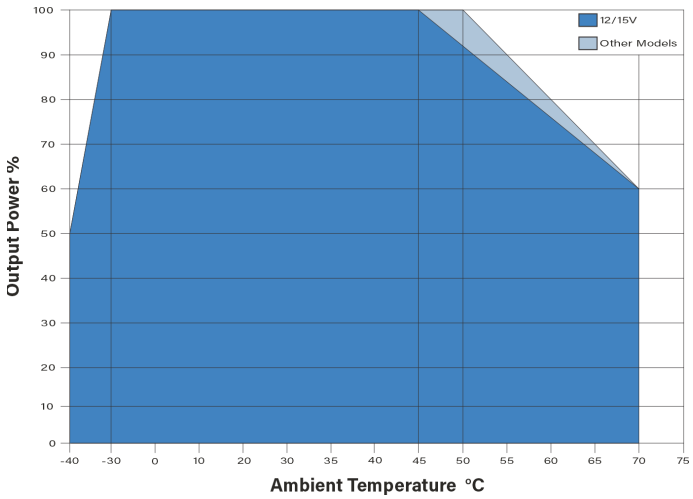
2.8 Over Temperature Protection (OTP)

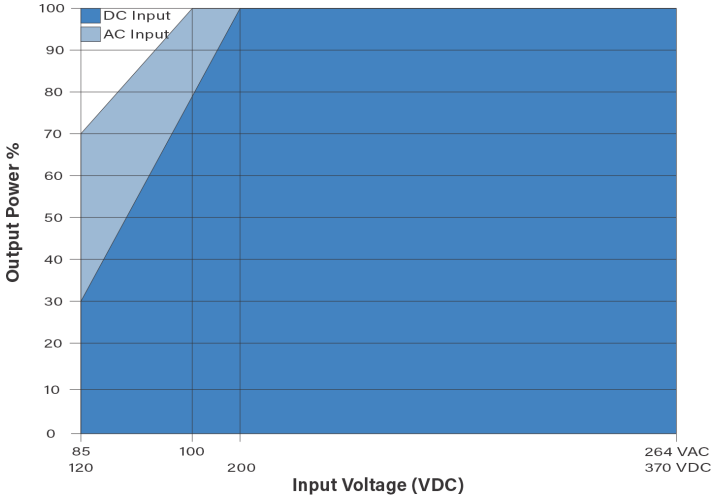
When the ambient temperature of the power supply exceeds the rated temperature for a period of time, the power supply will be turned off and will resume normal operation after the ambient temperature drops to the set value.

2.9 Output Power Derating

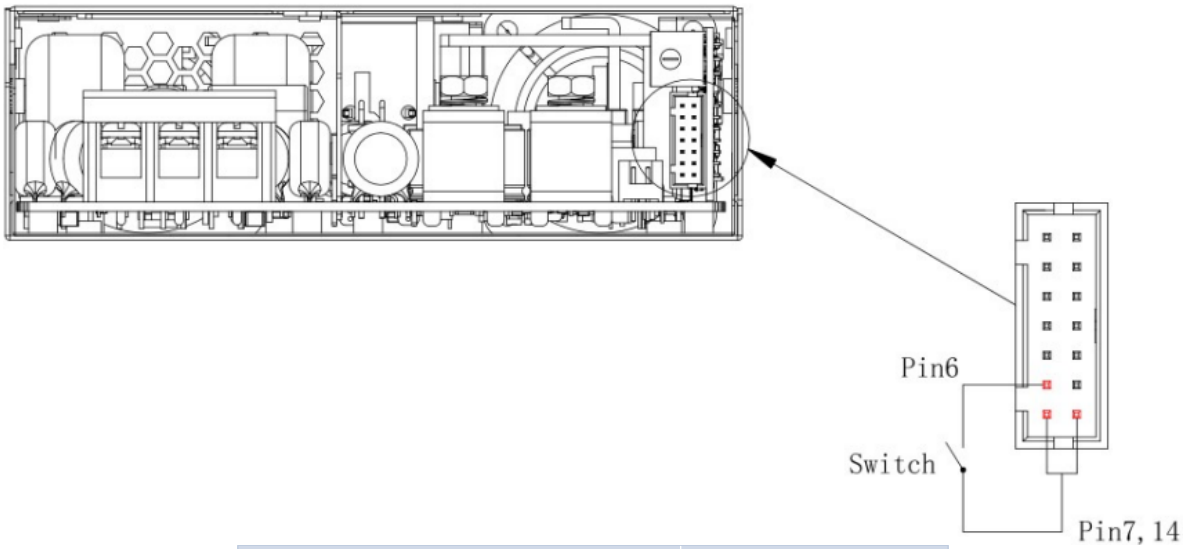
When the input voltage is greater than 100VAC (or 200VDC), it is only needed to derate according to the temperature derating curve.

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 (Pin 6) and GND (Pin 7 or Pin 14)	Output Status
Short-Circuit	Output on
Pin Floating	Output off

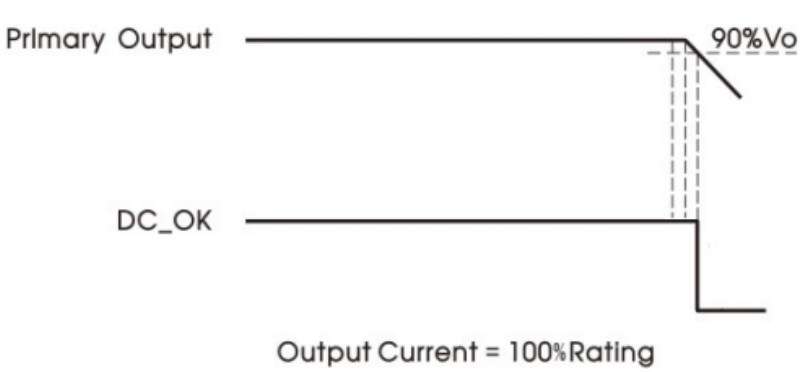
If the input terminal of the power module has been connected to a power source, the PS ON signal pin can ve used to control the on and off of the main output, and the PS ON signal does not affect the output voltage of the auxiliary circuit.

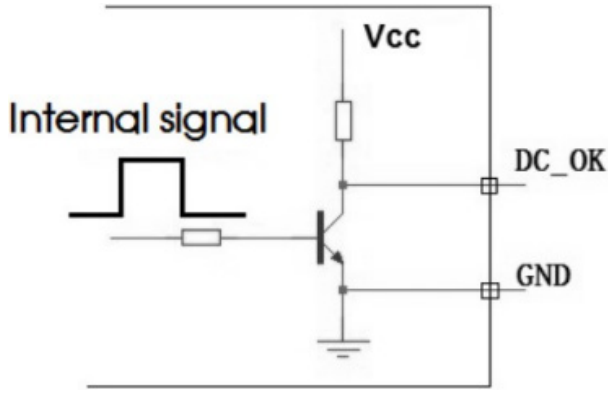
Note: The internal PS ON imput impedance of the module is 5.1K.

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 Pin 3 of the signal terminal CN7.

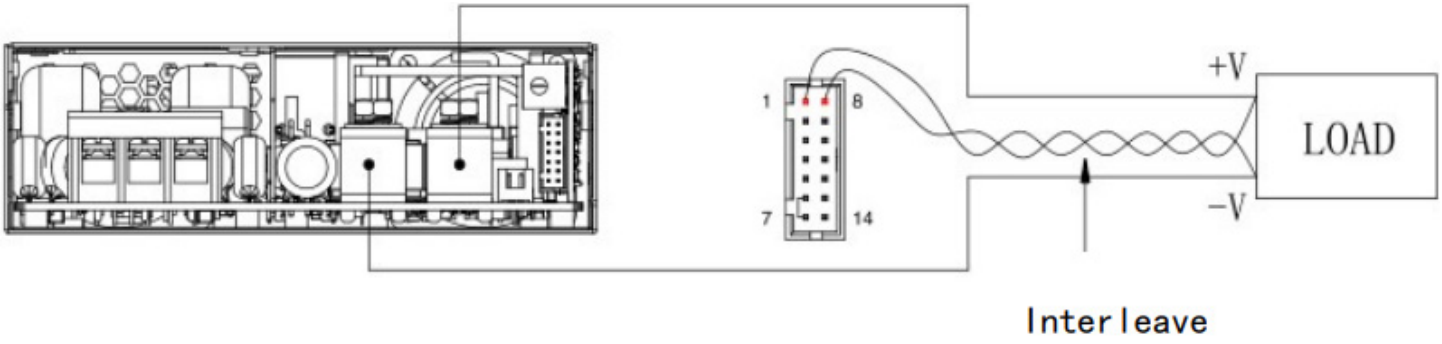
Note: When the DC OK signal is connected to the external circuit, the impedance of the external circuit (i.e. betwen Pin 3 and Pin 7 or Pin 14 of CN7) is no less than 10kΩ.





DC OK (Pin 3) and GND (Pin 7 or Pin 14)	Output Status
2.5 - 5V	Output on
0 - 0.5V	Output off

2.12 Remote Compensation



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) Pin 6 (PS ON) and Pin 7 (GND) short-circuit jumper cap are connected. If not, the product has no output. When the control signal connection terminal (CN7) of the product is externally connected as a whole, please ensure that Pin 6 and Pin 7 (or Pin 14) 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 ahieve redundancy, therby 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 connecte din parallel, to support the maximum load current N * *Io*max, where *Io*max is the rated output current of each power supply. For example, the rated output current of each power suply 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 operation.

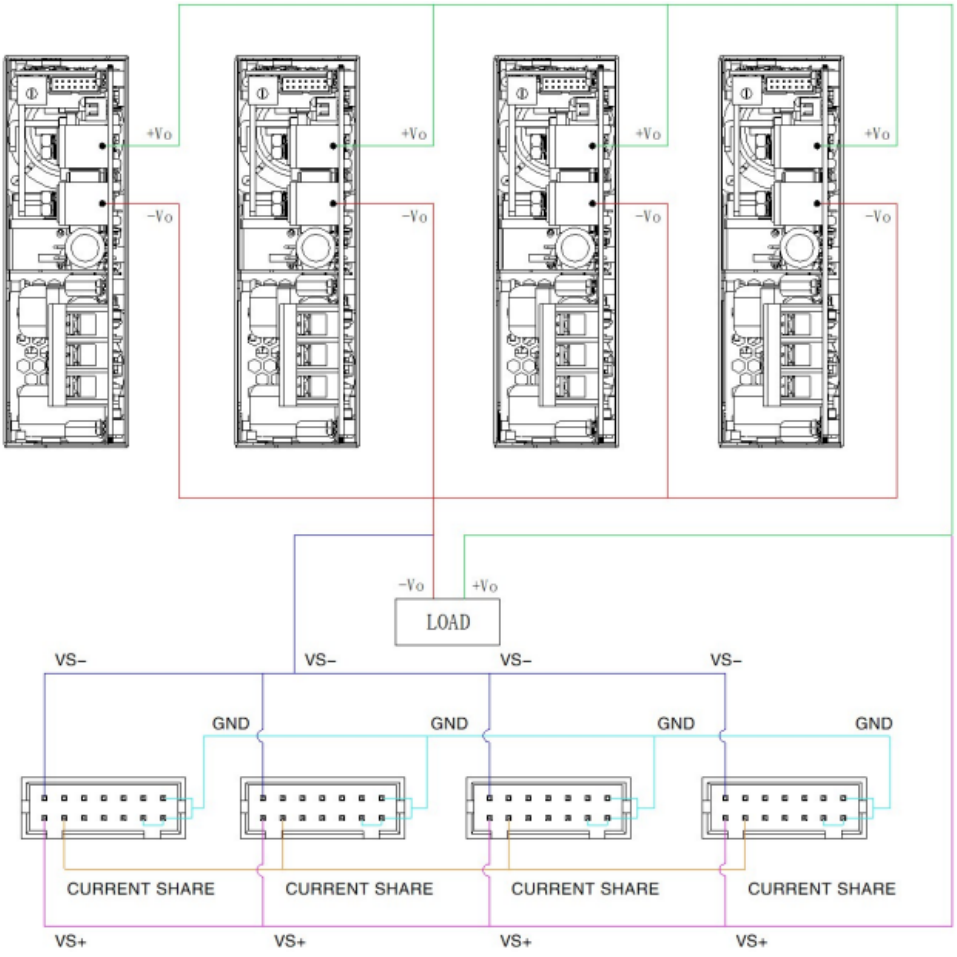
The Oring circuit is used inside the power module, and when any one of the power modules in the parallel fails, it will not affect the work of the other power modules.

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

2.13.2 Current Sharing

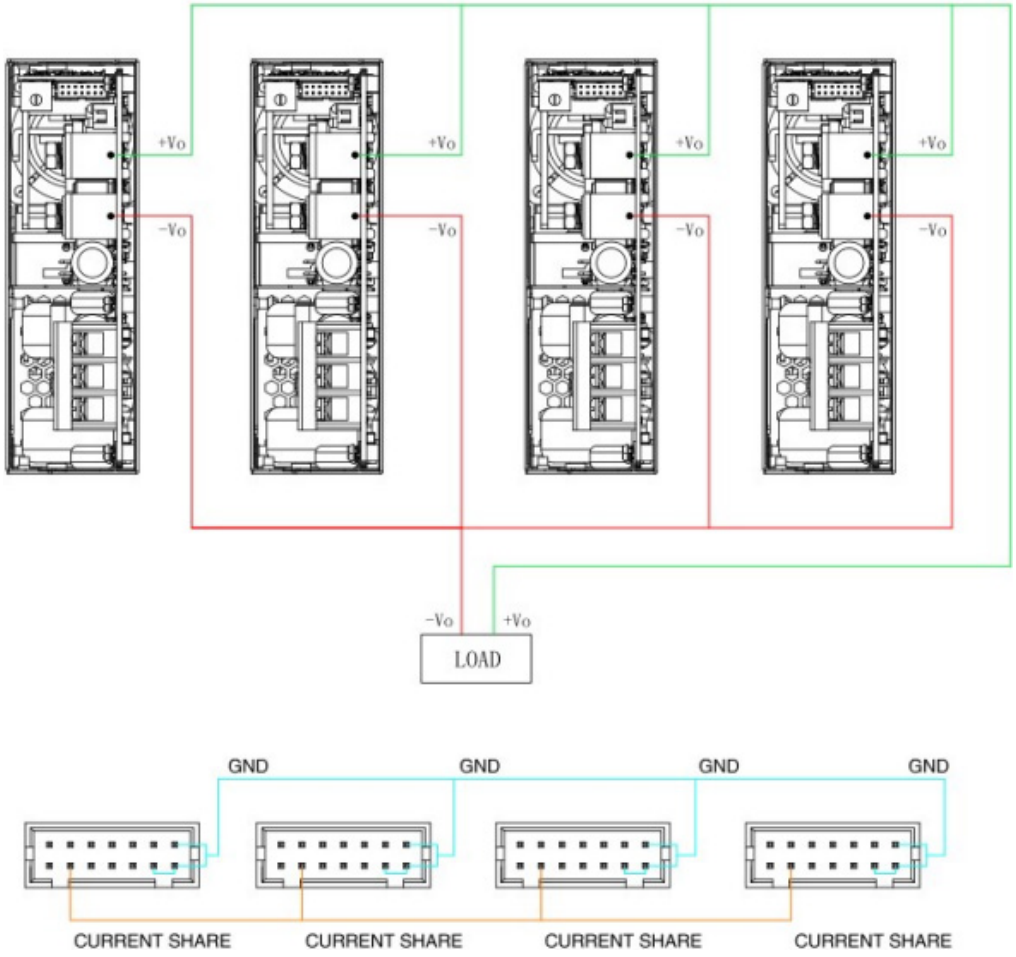
Method 1: Current sharing bus and remote compensation lines are both connected.

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 bus 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 thesame way, when the load loss is unknown or meets the specifications under the first connection method, it is recommended to replace it with this connection method. The wiring method of the current sharing function is shown 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 Pin 6 (PS ON) and Pin 7 (GND) short-circuit jumper cap are connected If not, the product has no output. When the control signal connection terminal (CN7) of the product is externally connected as a whole, please ensure that Pin 6 and Pin 7 (or Pin 14) are short-circuit connected. Please refer to the application note 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 curent sharing circuit adopts the automatic master-slave current sharing method. Each 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 neds to be adjusted, the output voltage of all parallel power supply modules needs to be adjusted to the same voltage. The recomended voltage range is: Target Voltage Value ±50mV.

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

Current Sharing Accuracy = ((*Io*max - *Io*min) / Iomax) * 100%

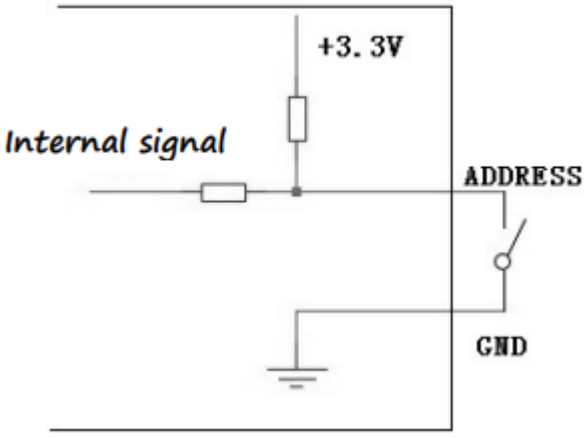
*Io*max: the maximum output current value in parallel power supply modules.

*Io*min: 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 1.99 - 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 Information

Warning: Risk of electric shock

During high voltage operation

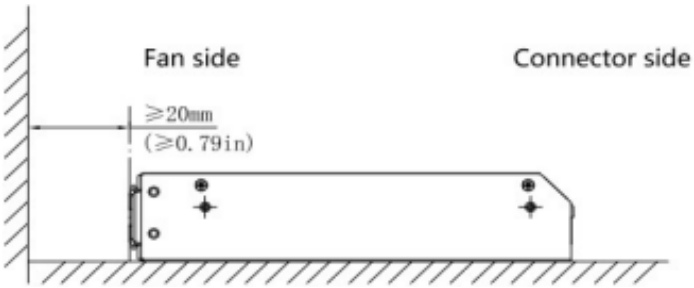
- The power supply module is disconnected from the input DC or the AC power and replaced for at least one minute before starting to operate it.
- When installing the input wire to the power module, please connect the ground terminal first, and then the N line.
- When removing the input wire, please remove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

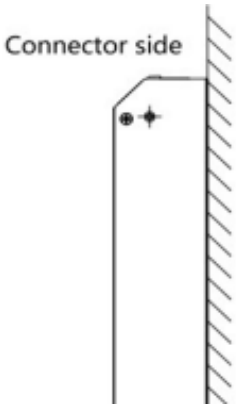
3.2 Safety Requirements

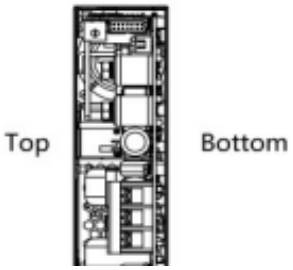
When installing, pay attention to the primary side and the protective ground, the creep distance and the eletrical clearance of the primary side and the secondary side. Refer to EN60601-1.

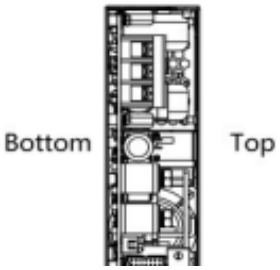
3.3 Installation Method

Standard mounting orientation:

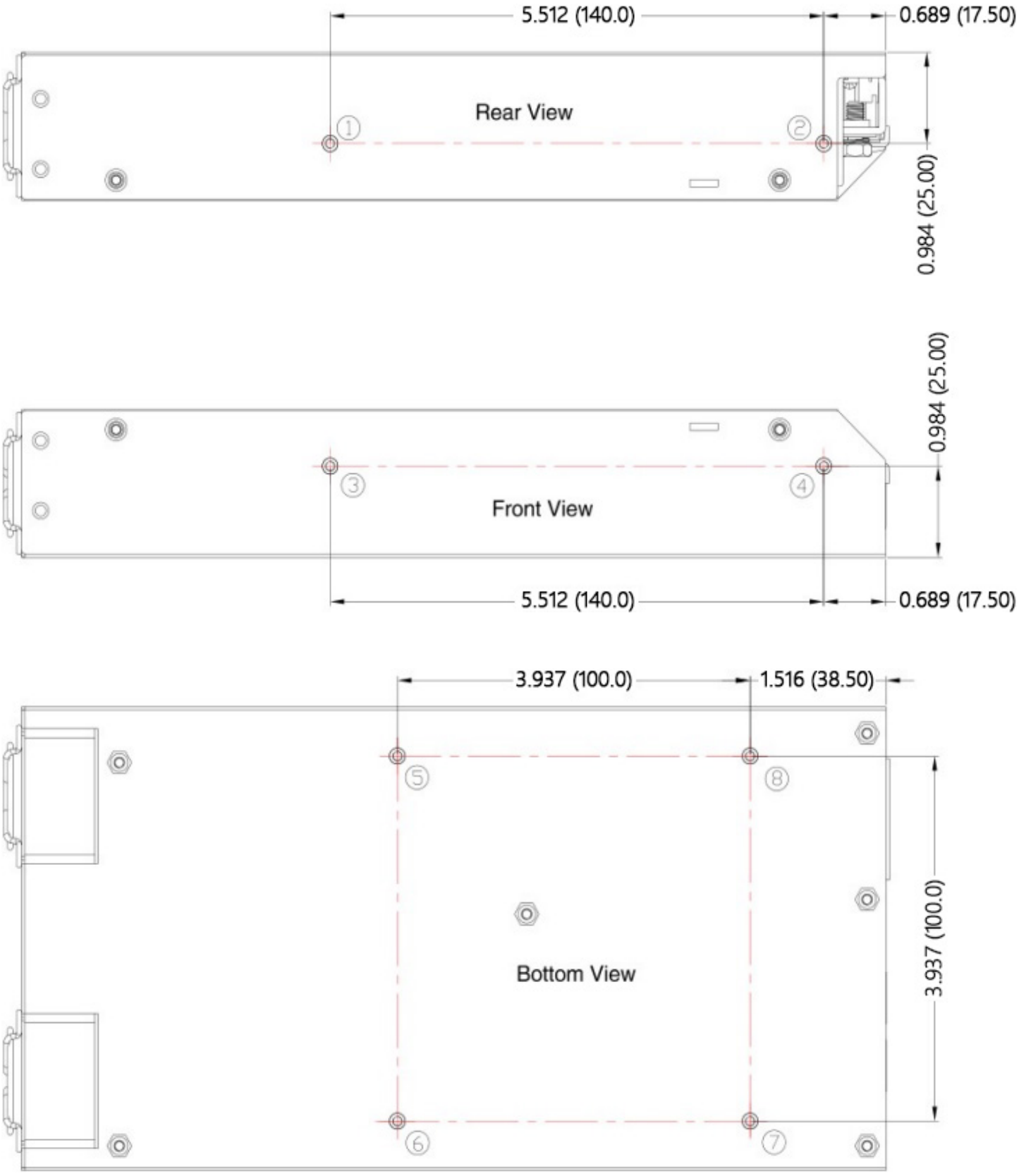








Position of mounting holes:



4. Communication Protocol

The MPE-1500CM series power modules support standard communication protocols and manage and monitor the power modules through the 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

Description 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 man 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