



MP450,650,1K0 Instruction Manual

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0. Introduction

Modular Series are switching power supplies with modular design that consist of two stages: front-end PFC and output modules. Using ZVS (Zero Voltage Switching) technology to realize the power factor correction, the line input is rectified into high DC voltage (around 390VDC) by the front-end PFC stage, and then the DC output modules will transfer the operating voltage into all kinds of DC output voltages. Right now we offer four categories totally 35 different kinds of models - 75W(MS-75), 150W(MS-150), 300W(MS-300) single output modules and 100W(MD-100) dual output modules - to fulfill all kinds of applications.

1. Order Information

1.1 Explanation for Encoding

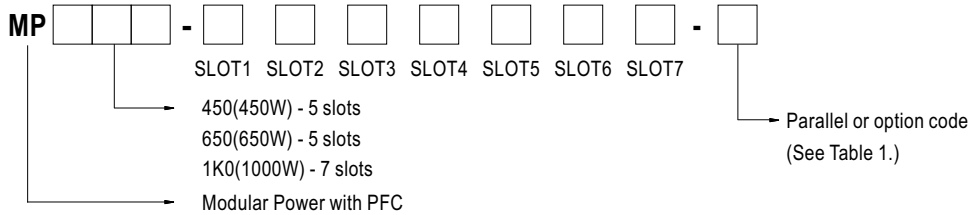
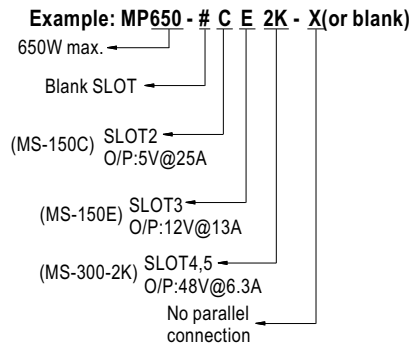
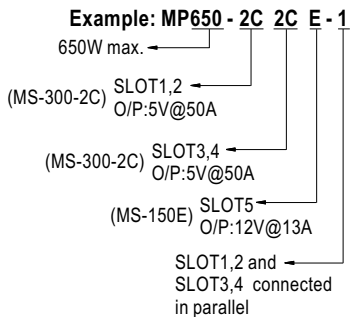


Table 1. Parallel code(MS-300 only)

Code	SLOT1	SLOT2	SLOT3	SLOT4	SLOT5	SLOT6	SLOT7
X						----	----
1	○		○			----	----
2		○		○		----	----
3			○		○		
4				○			○
5	○		○		○		
6		○		○			○

※Code X,1,2 for MP450,MP650

※Code X,1,2,3,4,5,6 for MP1K0



1.2 Notes on Encoding

- Please map out output modules that need to be connected in series or parallel at adjoining slots.
- Total wattage usage of all output modules should be less than the rated power of front-end PFC stage.

1.3 Marking

- Please refer to the marking on the safety label in front of the machine before using it.

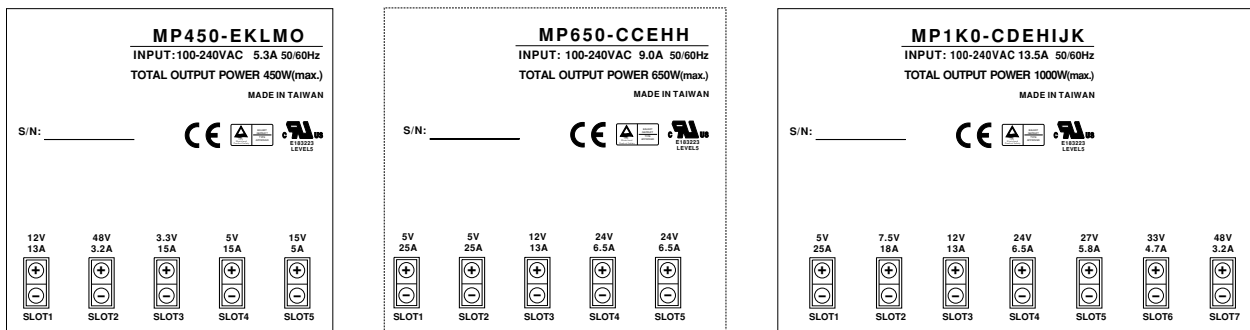


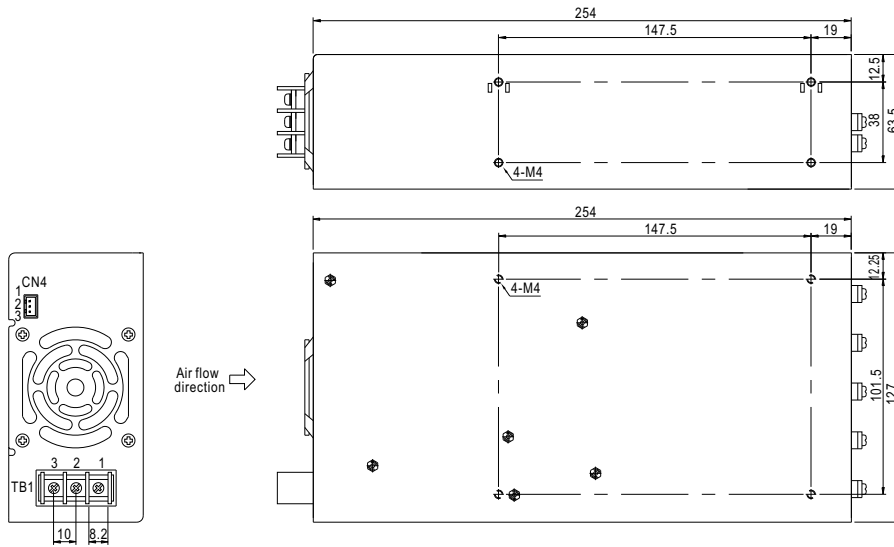
Figure 1-1 Safety labels

2. Mechanical Specification and Output Terminals

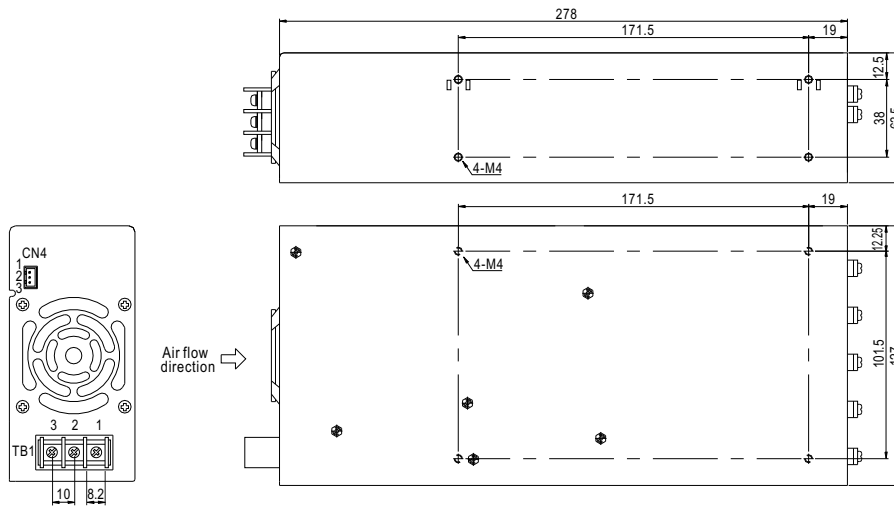
2.1 Mechanism of the Whole Power System

©MP450

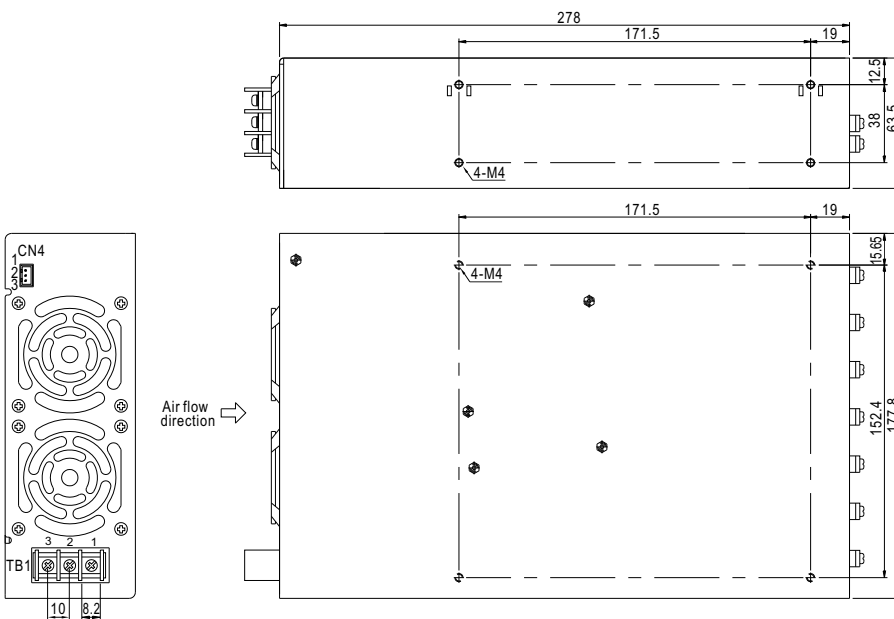
Unit:mm



©MP650



©MP1K0



TB1 (PFC-450/650/1K0)

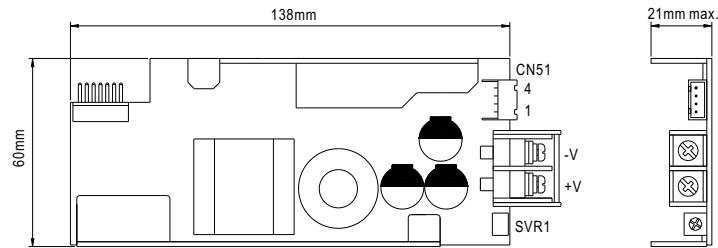
Pin No.	Assignment
1	AC/L
2	AC/N
3	FG \perp

CN4 (PFC-450/650/1K0) : JST B3B-XH or equivalent

Pin No.	Assignment	Mating Housing	Terminal
1	+RC: +Remote ON/OFF	JST XHP or equivalent	JST SXH-001T-P0.6 or equivalent
2	-RC: -Remote ON/OFF		
3	VCC: 12V/0.1A auxiliary output		

2.2 Mechanism of Output Modules

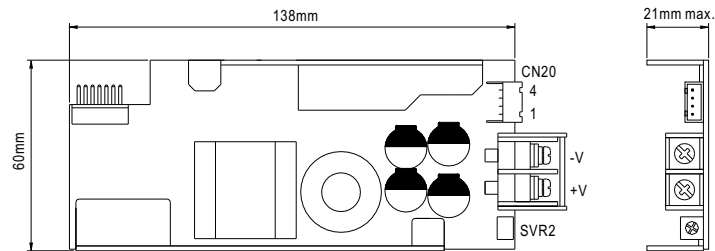
©MS-75



Output Connector(CN51) : JST B4B-XH or equivalent

Pin No.	Assignment	Mating Housing	Terminal
1	+S: +Remote sensing	JST XHP or equivalent	JST SXH-001T-P0.6 or equivalent
2	-S: -Remote sensing		
3	+RC: +Remote ON/OFF		
4	-RC: -Remote ON/OFF		

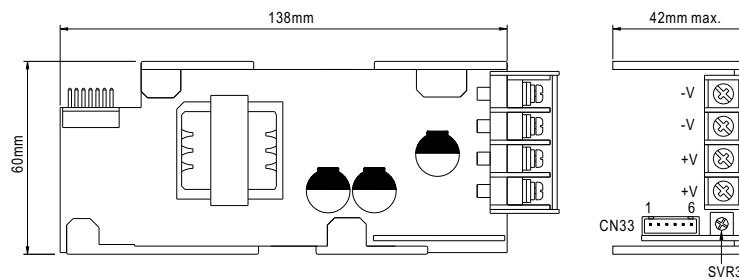
©MS-150



Output Connector(CN20) : JST B4B-XH or equivalent

Pin No.	Assignment	Mating Housing	Terminal
1	+S: +Remote sensing	JST XHP or equivalent	JST SXH-001T-P0.6 or equivalent
2	-S: -Remote sensing		
3	+RC: +Remote ON/OFF		
4	-RC: -Remote ON/OFF		

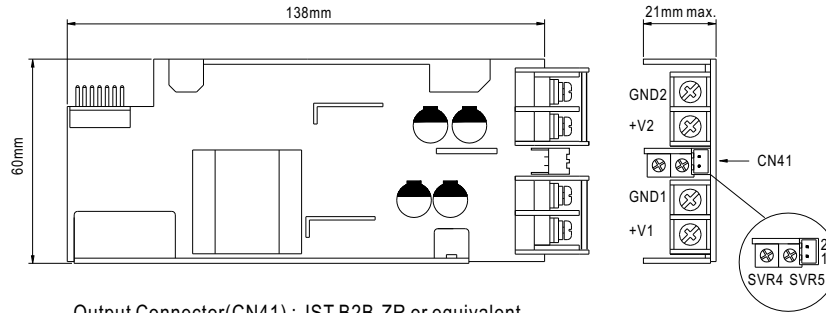
©MS-300



Output Connector(CN33) : JST B6B-XH or equivalent

Pin No.	Assignment	Mating Housing	Terminal
1	+S: +Remote sensing	JST XHP or equivalent	JST SXH-001T-P0.6 or equivalent
2	-S: -Remote sensing		
3	+RC: +Remote ON/OFF		
4	-RC: -Remote ON/OFF		
5	P: Current sharing		
6	G: GND		

©MD-100



Output Connector(CN41) : JST B2B-ZR or equivalent

Pin No.	Assignment	Mating Housing	Terminal
1	+RC	JST ZHR-2	JST SZH-002T-P0.5
2	-RC	or equivalent	or equivalent

- NOTE: 1.Remote ON/OFF of CN4 turn ON/OFF the entire power system
 2.Remote ON/OFF of CN20,CN33,CN41,CN51 turn ON/OFF the individual output module
 3.SVR1-5: DC output voltage adjustment(SVR4 for CH2 of MD-100,SVR5 for CH1 of MD-100)

3. Functions

3.1 Input Voltage Range

- ⊙Nominal input voltage range is AC 85~264V or DC 120~370V.
- ⊙To insure proper operation, AC input should be within the pre-specified range. The wrong input will cause the power supply to operate improperly, lose the PFC function or even be damaged.
- ⊙Since the Modular Series have built-in active PFC circuit, there will be lower efficiency and output derating is required when operating at lower input voltage (<100VAC).

3.2 Inrush Current Limiting

- ⊙Built-in inrush current limiting circuit.
- ⊙The external switch, if needed, should have a current rating exceeding the maximum inrush current.
- ⊙ Since the inrush current limiting circuit mainly consists of thermistor and relay, after turning off the power supply, a 10 second cool down period is recommended before turning it back on. Inrush current will be much higher than the specified value if input thermistor is not allowed sufficient time to cool down.

3.3 Output Voltage Adjustment Range

- ⊙Minor adjustments can be made to the output voltage of all channels by using a potentiometer. Turning clockwise will increase output voltage and counterclockwise will decrease output voltage.
- ⊙When the output is tuned to a higher voltage, please notice that the load current should be decreased accordingly. The output wattage of each module should not exceed its rated value under any circumstances.

3.4 Short Circuit Protection & Over Current Protection (O.C.P.)

- ⊙Built-in short circuit and over current protection function in each output module. O.C.P. comes into effect at >116% of output rated current and the output module will automatically recover once the over current condition is removed. (MS-75/150/300 are constant current type while MD-100 is shut-off type)

3.5 Over Voltage Protection (O.V.P.)

- ⊙Built-in over voltage protection circuit for each output channel.
- ⊙The O.V.P. triggering points are different for different output modules. Please refer to the specification sheet for details.
- ⊙The output module shuts down when O.V.P. is triggered. To restart power supply, please switch off V_{AC} first and then wait for 10 seconds before switching it back on.

3.6 Over Temperature Protection (O.T.P.)

- ⊙Built-in 2 sets of over temperature protection circuit. When the internal temperature exceeds the threshold value, the power supply will shut down automatically. You should switch off V_{AC} and remove all possible causes of overheating, and then let the power supply cool down to normal working temperature (needs about 10 minutes~1hour) before turning it back on.

3.7 Fan Alarm

- ⊙Built-in fan malfunction protection circuit. When the DC fan stop operating (fan lock, wire broken, or connector loosed), all output modules will be shut down. Please switch off V_{AC} and send back to our local distributor or MEAN WELL for repair.

3.8 Remote Sense - Output Modules

- ⊙Built-in remote sense circuit in MS-75, MS-150, and MS-300.
- ⊙When using this function, the sensing wires should either be twisted or shielded to prevent external noise interference. (refer to figure 3-1)
- ⊙When Remote Sense is not in use, +S should be shorted to +V and -S to -V. Or +S and -S can be left unconnected.
- ⊙The voltage drop across the output wires must be limited to less than 0.5V. Also heavy wires with adequate current rating should be used between +V/-V and the load. Please firmly connect the output wires to prevent them from losing, or the power supply may be out of order.
- ⊙If long sensing wires are necessary, then Noise Filtering Capacitors C1,C2 and C3 need to be added as figure 3-1.
- ⊙The power supply unit may become unstable due to the difference in wire impedance and load current. The addition of C1, C2, C3 and R1 shown in figure 3-1 may help improve output voltage stability. Please contact MEAN WELL for more detail specification of these components.

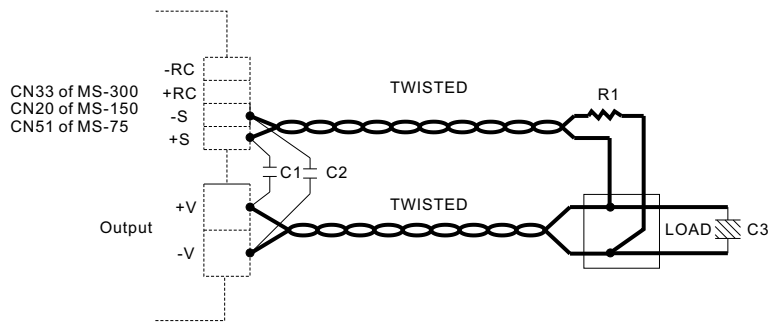


Figure 3-1 Connection for using the remote sense function

3.9 Auxiliary Output

⊙ Built-in 12V/0.1A auxiliary output that can be used as the voltage source of remote ON/OFF control application for individual output modules or the whole modular system. Please refer to figure 3-2 and 3-3 for wiring methods.

3.10 Remote ON/OFF Control - Whole Power System

- ⊙ Built-in remote ON/OFF control circuit for the whole power system.
- ⊙ The remote control circuit (+RC and -RC) has electric isolation from V_{in} and V_{out} .
- ⊙ When there's a 4~12V voltage difference or open circuit between +RC & -RC, the whole power system will be turned off. The power supply will be turned on if the voltage difference between +RC & -RC is less than 0.8V or short circuit. (The whole power system will have no output if the shorting connector is not assembled between +RC & -RC on CN4.)
- ⊙ The auxiliary output on the power supply can be used as the external control source of the remote ON/OFF control function. Please refer to figure 3.2 for connecting methods.

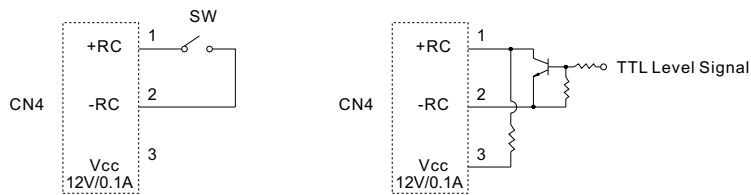


Figure 3-2 Connection for the remote ON/OFF control function of the whole power system

3.11 Remote ON/OFF Control - Output Modules

- ⊙ Built-in remote ON/OFF control circuit for each output module. All output modules can be turned ON/OFF independently by using the remote ON/OFF control function.
- ⊙ The remote control circuit (+RC and -RC) has electric isolation from V_{in} and V_{out} .
- ⊙ When there's a 4~12V voltage difference between +RC & -RC, the output module will be turned off. The power supply will be turned on if the voltage difference between +RC & -RC is less than 0.8V or open circuit.
- ⊙ The auxiliary output on the power supply can be used as the external control source of the remote ON/OFF control function on each output module. Please refer to figure 3.3 for connecting methods.

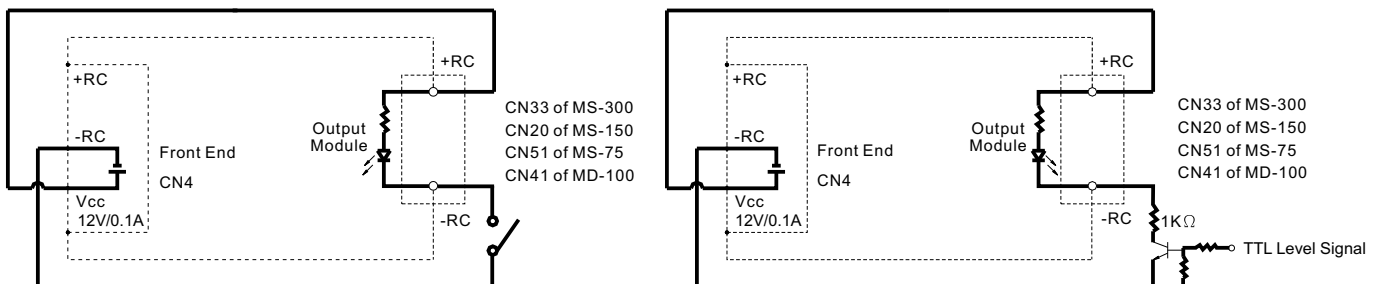


Figure 3-3 Connection for the remote ON/OFF control function of output modules

3.12 Parallel Operation

- ⊙ Only the MS-300 series is allowed to work in parallel.
- ⊙ Only same output modules adjoining one another inside the same power supply are recommended to connect in parallel.
- ⊙ The recommended number of output modules that can be connected in parallel is 3 units maximum for MS-300 and the total output current should not exceed 90% of the sum of rated currents.

For example: MP650-2C2CO-1

Parallel code "1" means that the two MS-300-2C(5V/50A) located at SLOT 1,2 & SLOT 3,4 should be connected in parallel and the maximum output current is 90A $[(50A+50A)*0.9]$.

- ⊙ Please adjust the output voltages to the required value before wiring the output modules. The voltage difference among output modules should be minimized that less than $\pm 3\%$ is required.
- ⊙ All wirings should be properly connected before turning on. The power supply can not be hot swapped.
- ⊙ Please connect the output terminal of each output module in parallel first and then connect to the load as shown in Figure 3-4.
Don't connect to the load separately.
- ⊙ Please connect the +S,-S,P and G of each output module in parallel as well.

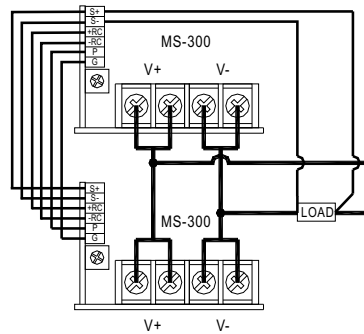


Figure 3-4 Operating in parallel connection

3.13 Series Operation

- ⊙ Higher output voltage can be acquired by using MS-75, MS-150, or MS-300 in series connection.
- ⊙ Only output modules with the same output wattage and adjoining one another are recommended to connect in series.
- ⊙ Output current for series connection should not exceed the smallest rated current of all series connecting modules.
- ⊙ The difference in rise times of individual output module will lead to steps/stairs like turn on.
- ⊙ The output voltage after series connection should be less than 60Vdc [the requirement of SELV(Safety Extra Low Voltage) of IEC60950-1].

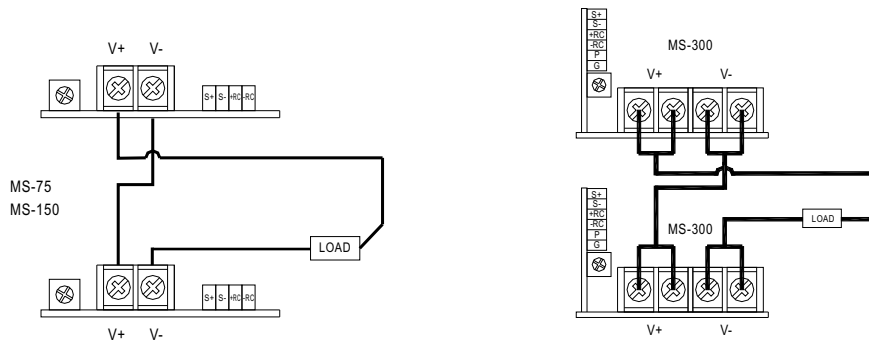


Figure 3-5 Operating in series connection

4. Notes On Operation

4.1 Requirement for Assembly

- ⊙ Based on safety considerations, the assembly task should be executed in factories certified by the safety organizations and should be authorized by MEAN WELL in advance as well.

4.2 Installation Method

- ⊙ The assembly diagram of the PFC front-end and output modules is shown in Figure 4-1.

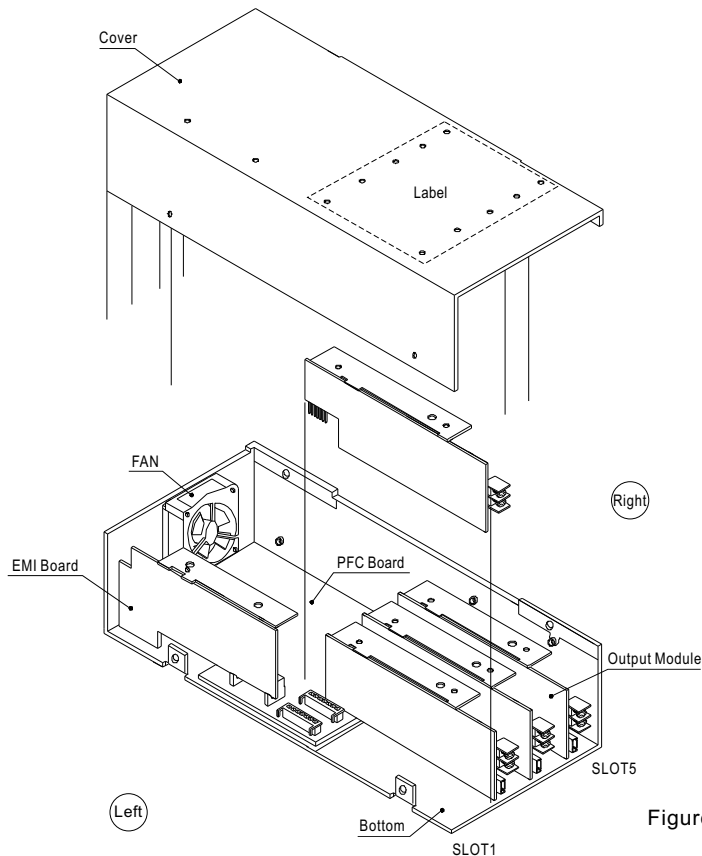


Figure 4-1 System assembly diagram

- ⊙ This is a power supply with built-in DC fan and please make sure that the ventilation is not blocked. It is suggested that there should be no barriers within 10cm of the ventilating holes.
- ⊙ The power supply unit should be mounted on a holding rack for extra support as shown in Figure 4-2.

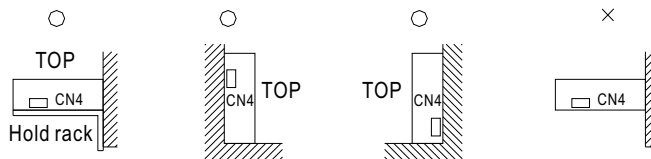


Figure 4-2 Mounting alternatives

- ⊙ In order to maintain a safe isolation distance from internal components, please use screws with length less than 6mm measured from the case as shown in Figure 4-3.

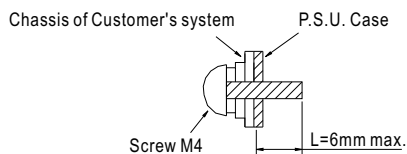


Figure 4-3 Mounting screw

4.3 Derating

- ⊙ The Modular Series consists of PFC front-end and output modules. The electrical specification of each output module should be carefully checked before operating and the total output power of all modules that is actually used should be less than the rated power of its PFC front-end.
- ⊙ Output load derating is required for proper operation in high ambient temperature or at low AC input. Please refer to the output derating curves of MP450, MP650, and MP1K0 shown in Figure 4-4.

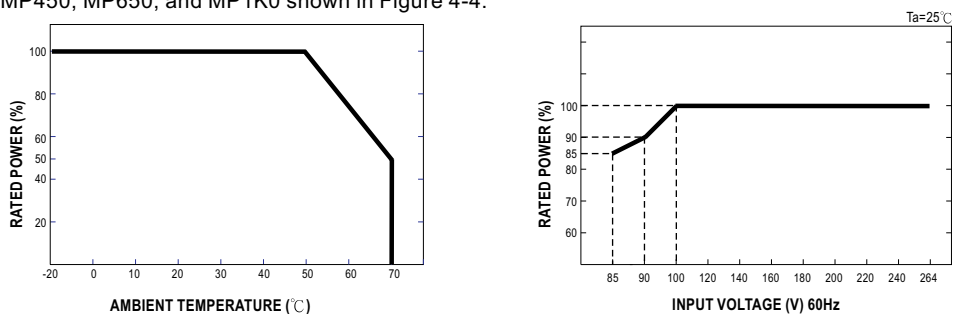


Figure 4-4 Output derating curves for Modular Series

5. Specification

5.1 Front End

MODEL		PFC-450		PFC-650		PFC-1000	
INPUT	VOLTAGE RANGE	85 ~ 264VAC	120 ~370VDC	85 ~ 264VAC	120 ~370VDC	85 ~ 264VAC	120 ~370VDC
	FREQUENCY RANGE	47 ~ 63Hz		47 ~ 63Hz		47 ~ 63Hz	
	POWER FACTOR	PF>0.95/230VAC PF>0.98/115VAC at full load					
	EFFICIENCY <small>Note.1</small>	80% typ.		85% typ.		78% typ.	
	AC CURRENT	5A/115VAC	2.5A/230VAC	9A/115VAC	4.5A/230VAC	13.5A/115VAC	6.7A/230VAC
	INRUSH CURRENT	20A/115VAC	40A/230VAC	20A/115VAC	40A/230VAC	20A/115VAC	40A/230VAC
	LEAKAGE CURRENT	<1mA/240VAC		<1mA/240VAC		<1mA/240VAC	
OUTPUT	TOTAL OUTPUT POWER	450W max.		650W max.		1000W max.	
PROTECTION	OVER TEMPERATURE	Thermal switch detect on the heatsink of power MOSFET Protection type : Shut down o/p voltage, recovers automatically after temperature goes down					
	FAN ALARM	Output shutdown when FAN is malfunction					
FUNCTION	REMOTE CONTROL	RC+/RC-: 0 ~ 0.8V or Short, Power ON		RC+/RC-: 4 ~ 12V or Open, Power OFF			
	AUXILIARY POWER(AUX)	12V@0.1A(only for Remote ON/OFF)					
	REMOTE INHIBIT CONTROL	On individual output module RC+/RC-: 0 ~ 0.8V or OPEN, POWER ON		RC+/RC-: 4 ~ 12V POWER OFF			
ENVIRONMENT	WORKING TEMP.	-20 ~ +70°C (Refer to output load derating curve)					
	WORKING HUMIDITY	20 ~ 90% RH non-condensing					
	STORAGE TEMP., HUMIDITY	-40 ~ +85°C, 10 ~ 95% RH					
	TEMP. COEFFICIENT	±0.03%/°C (0 ~ 50°C)					
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes					
SAFETY & EMC <small>(Note 5)</small>	SAFETY STANDARDS	UL60950-1, TUV EN60950-1 Approved					
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC					
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms/500VDC					
	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22) Class B					
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3					
	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN55024, Light industry level, criteria A					
OTHERS	MTBF	K hrs min. MIL-HDBK-217F (25°C)		K hrs min. MIL-HDBK-217F (25°C)		K hrs min. MIL-HDBK-217F (25°C)	
	DIMENSION	254*127*63.5mm (L*W*H)		278*127*63.5mm (L*W*H)		278*177.8*63.5mm (L*W*H)	
	PACKING	Kg		2.16Kg; 6pcs / 14Kg / 1.34CUFT		Kg	

5.2 Output Module

©1 SLOT Single Output (150W):MS-150

	OUTPUT VOLTAGE CODE	MS-150A	MS-150B	MS-150C	MS-150D	MS-150E	MS-150F	MS-150G	MS-150H	MS-150I	MS-150J	MS-150K	
OUTPUT (MS-150)	DC VOLTAGE	2V	3.3V	5V	7.5V	12V	15V	18V	24V	27V	33V	48V	
	RATED CURRENT	25A	25A	25A	18A	13A	10A	8.5A	6.5A	5.8A	4.7A	3.2A	
	CURRENT RANGE	0 ~ 25A	0 ~ 25A	0 ~ 25A	0 ~ 18A	0 ~ 13A	0 ~ 10A	0 ~ 8.5A	0 ~ 6.5A	0 ~ 5.8A	0 ~ 4.7A	0 ~ 3.2A	
	PEAK LOAD <small>Note.4</small>	30A	30A	30A	20.7A	15A	11.5A	9.8A	7.5A	6.7A	5.4A	3.68A	
	RATED POWER	50W	82.5W	125W	135W	156W	150W	153W	156W	156.6W	155.1W	153.6W	
	RIPPLE & NOISE (max.) <small>Note.2</small>	50mVp-p	80mVp-p	80mVp-p	100mVp-p	150mVp-p	150mVp-p	150mVp-p	150mVp-p	150mVp-p	150mVp-p	250mVp-p	250mVp-p
	VOLTAGE ADJ. RANGE	1.6 ~ 2.6V	2.6 ~ 4V	4 ~ 6V	6 ~ 9V	9 ~ 13.2V	13.2 ~ 16.8V	16.8 ~ 20V	20 ~ 26.4V	25 ~ 31V	30 ~ 40V	40 ~ 53V	
	VOLTAGE TOLERANCE <small>Note.3</small>	±3.0%	±2.0%	±2.0%	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	
	LINE REGULATION	±0.5%	±0.5%	±0.5%	±0.5%	±0.3%	±0.3%	±0.3%	±0.2%	±0.2%	±0.2%	±0.2%	
	LOAD REGULATION	±2.0%	±1.0%	±1.0%	±1.0%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	
	SETUP, RISE, HOLD TIME	1500ms, 50ms, 20ms at full load											
PROTECTION	OVER LOAD	121 ~ 150% rated output power			116 ~ 150% rated output power								
		Protection type : Constant current limiting, recovers automatically after fault condition is removed											
	OVER VOLTAGE	3 ~ 4V	4.1 ~ 5V	6.1 ~ 7.5V	9.1 ~ 11.2V	13.3 ~ 18V	16.9 ~ 22V	20.1 ~ 26V	26.5 ~ 35V	31.1 ~ 39V	40.1 ~ 48V	53.1 ~ 60V	
	Protection type : Shut down o/p voltage, re-power on to recover												

◎2 SLOT Single Output (300W):MS-300

OUTPUT (MS-300)	OUTPUT VOLTAGE CODE	MS-300-2A	MS-300-2B	MS-300-2C	MS-300-2D	MS-300-2E	MS-300-2F	MS-300-2G	MS-300-2H	MS-300-2I	MS-300-2J	MS-300-2K
	DC VOLTAGE	2V	3.3V	5V	7.5V	12V	15V	18V	24V	27V	33V	48V
	RATED CURRENT	50A	50A	50A	40A	25A	20A	16.7A	12.5A	11.2A	9.1A	6.3A
	CURRENT RANGE	0 ~ 50A	0 ~ 50A	0 ~ 50A	0 ~ 40A	0 ~ 25A	0 ~ 20A	0 ~ 16.7A	0 ~ 12.5A	0 ~ 11.2A	0 ~ 9.1A	0 ~ 6.3A
	PEAK LOAD Note.4	57.5A	57.5A	57.5A	46A	29A	23A	19.2A	14.4A	12.9A	10.5A	7.2A
	RATED POWER	100W	165W	250W	300W	300W	300W	300.6W	300W	302.4W	300.3W	302.4W
	RIPPLE & NOISE (max.) Note.2	80mVp-p	80mVp-p	80mVp-p	100mVp-p	150mVp-p	150mVp-p	150mVp-p	150mVp-p	200mVp-p	250mVp-p	300mVp-p
	VOLTAGE ADJ. RANGE	1.6 ~ 2.6V	2.6 ~ 4V	4 ~ 6V	6 ~ 9V	9 ~ 13.2V	13.2 ~ 16.8V	16.8 ~ 20V	20 ~ 26.4V	25 ~ 31V	30 ~ 40V	40 ~ 53V
	VOLTAGE TOLERANCE Note.3	±3.0%	±2.0%	±2.0%	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION	±0.5%	±0.5%	±0.5%	±0.5%	±0.3%	±0.3%	±0.3%	±0.2%	±0.2%	±0.2%	±0.2%
LOAD REGULATION	±2.0%	±1.0%	±1.0%	±1.0%	±0.5%	±0.5%	±0.5%	±1.0%	±1.0%	±1.0%	±1.0%	
SETUP, RISE, HOLD TIME	1500ms, 50ms, 20ms at full load											
PROTECTION	OVER LOAD	116 ~ 150% rated output power Protection type : Constant current limiting, recovers automatically after fault condition is removed										
	OVER VOLTAGE	3 ~ 4V	4.1 ~ 5V	6.1 ~ 7.5V	9.1 ~ 11.2V	13.3 ~ 18V	16.9 ~ 22V	20.1 ~ 26V	26.5 ~ 35V	31.1 ~ 39V	40.1 ~ 48V	53.1 ~ 60V
		Protection type : Shut down o/p voltage, re-power on to recover										

◎1 SLOT Single Output (75W):MS-75

OUTPUT (MS-75)	OUTPUT VOLTAGE CODE	MS-75L	MS-75M	MS-75N	MS-75O	MS-75P	MS-75Q
	DC VOLTAGE	3.3V	5V	12V	15V	24V	48V
	RATED CURRENT	15A	15A	6.3A	5A	3.2A	1.6A
	CURRENT RANGE	0 ~ 15A	0 ~ 15A	0 ~ 6.3A	0 ~ 5A	0 ~ 3.2A	0 ~ 1.6A
	PEAK LOAD Note.4	17.3A	17.3A	7.3A	5.8A	3.7A	1.8A
	RATED POWER	49.5W	75W	75.6W	75W	76.8W	76.8W
	RIPPLE & NOISE (max.) Note.2	80mVp-p	80mVp-p	150mVp-p	150mVp-p	150mVp-p	250mVp-p
	VOLTAGE ADJ. RANGE	2.6 ~ 4V	4 ~ 6V	9 ~ 13.2V	13.2 ~ 16.8V	20 ~ 26.4V	40 ~ 53V
	VOLTAGE TOLERANCE Note.3	±2.0%	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION	±0.5%	±0.5%	±0.3%	±0.3%	±0.2%	±0.2%
LOAD REGULATION	±1.0%	±1.0%	±0.5%	±0.5%	±0.5%	±0.5%	
SETUP, RISE, HOLD TIME	1500ms, 50ms, 20ms at full load						
PROTECTION	OVER LOAD	116 ~ 150% rated output power Protection type : Constant current limiting, recovers automatically after fault condition is removed					
	OVER VOLTAGE	4.1 ~ 5V	6.1 ~ 7.5V	13.3 ~ 18V	16.9 ~ 22V	26.5 ~ 35V	53.1 ~ 60V
		Protection type : Shut down o/p voltage, re-power on to recover					

◎1 SLOT Isolated Dual Output (100W):MD-100

OUTPUT (MD-100)	OUTPUT VOLTAGE CODE	MD-100R		MD-100S		MD-100T		MD-100U		MD-100V		MD-100W		MD-100X	
	DC VOLTAGE	5V	5V	5V	12V	5V	15V	24V	5V	24V	12V	12V	12V	15V	15V
	RATED CURRENT	10A	8A	10A	4.2A	10A	3.4A	2.5A	8A	2.5A	3.4A	5A	3.4A	4A	2.7A
	CURRENT RANGE	2 ~ 10A	0 ~ 8A	2 ~ 10A	0 ~ 5.8A	2 ~ 10A	0 ~ 4.7A	0.5 ~ 3A	0 ~ 10A	0.6 ~ 3A	0 ~ 4.7A	1 ~ 5A	0 ~ 5.8A	1 ~ 4.7A	0 ~ 4.7A
	RATED POWER Note.6	90W		100.4W		101W		100W		100.8W		100.8W		100.5W	
	RIPPLE & NOISE (max.) Note.2	100mVp-p	100mVp-p	100mVp-p	150mVp-p	100mVp-p	150mVp-p	200mVp-p	100mVp-p	240mVp-p	120mVp-p	120mVp-p	120mVp-p	150mVp-p	150mVp-p
	VOLTAGE ADJ. RANGE	4.75 ~ 5.5V	4.75 ~ 5.5V	4.75 ~ 5.5V	11.4 ~ 13.2V	4.75 ~ 5.5V	14.2 ~ 16.5V	22.8 ~ 26.4V	4.75 ~ 5.5V	22.8 ~ 26.4V	11.4 ~ 13.2V	11.4 ~ 13.2V	11.4 ~ 13.2V	14.2 ~ 16.5V	14.2 ~ 16.5V
	VOLTAGE TOLERANCE Note.3	±3.0%	±3.0%	±3.0%	±3.0%	±3.0%	±3.0%	±3.0%	±3.0%	±2.0%	±3.0%	±2.0%	±3.0%	±2.0%	±3.0%
	LINE REGULATION	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±0.5%	±1.0%	±0.5%	±1.0%	±0.5%	±1.0%
	LOAD REGULATION	±2.0%	±2.0%	±2.0%	±2.0%	±2.0%	±2.0%	±2.0%	±2.0%	±1.0%	±2.0%	±1.0%	±2.0%	±1.0%	±2.0%
SETUP, RISE, HOLD TIME	1500ms, 50ms, 20ms at full load														
PROTECTION	OVER LOAD	116 ~ 150% rated output power Protection type : Shut down o/p voltage, re-power on to recover													
	OVER VOLTAGE	5.6 ~ 7.2V	5.6 ~ 7.2V	5.6 ~ 7.2V	13.3 ~ 17V	5.6 ~ 7.2V	16.6 ~ 22V	26.5 ~ 34V	5.6 ~ 7.2V	26.5 ~ 34V	13.3 ~ 17V	13.3 ~ 17V	13.3 ~ 17V	16.6 ~ 22V	16.6 ~ 22V
		Protection type : Shut down o/p voltage, re-power on to recover													

NOTE	<ol style="list-style-type: none"> The value changed by installing different output models. The efficiency and MTBF in specification means output modules are composed by below five modules. 5V(Voltage code C)*2, 12V(Voltage code E)*1, 24V(Voltage code H)*2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor. Tolerance : includes set up tolerance, line regulation and load regulation. 35% Duty cycle maximum within every 10 seconds. Average output power should not exceed the rated power. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. If the output voltage adjust to higher level, the rated current should be derated to meet the total rated power for both outputs(For MD-100 only).
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