powerbox
Powering Progress

Operation and installation manual

PB256-CML series

DC uninterruptible power supplies



256-1602 ISSUE X5

Important safety advice and warnings

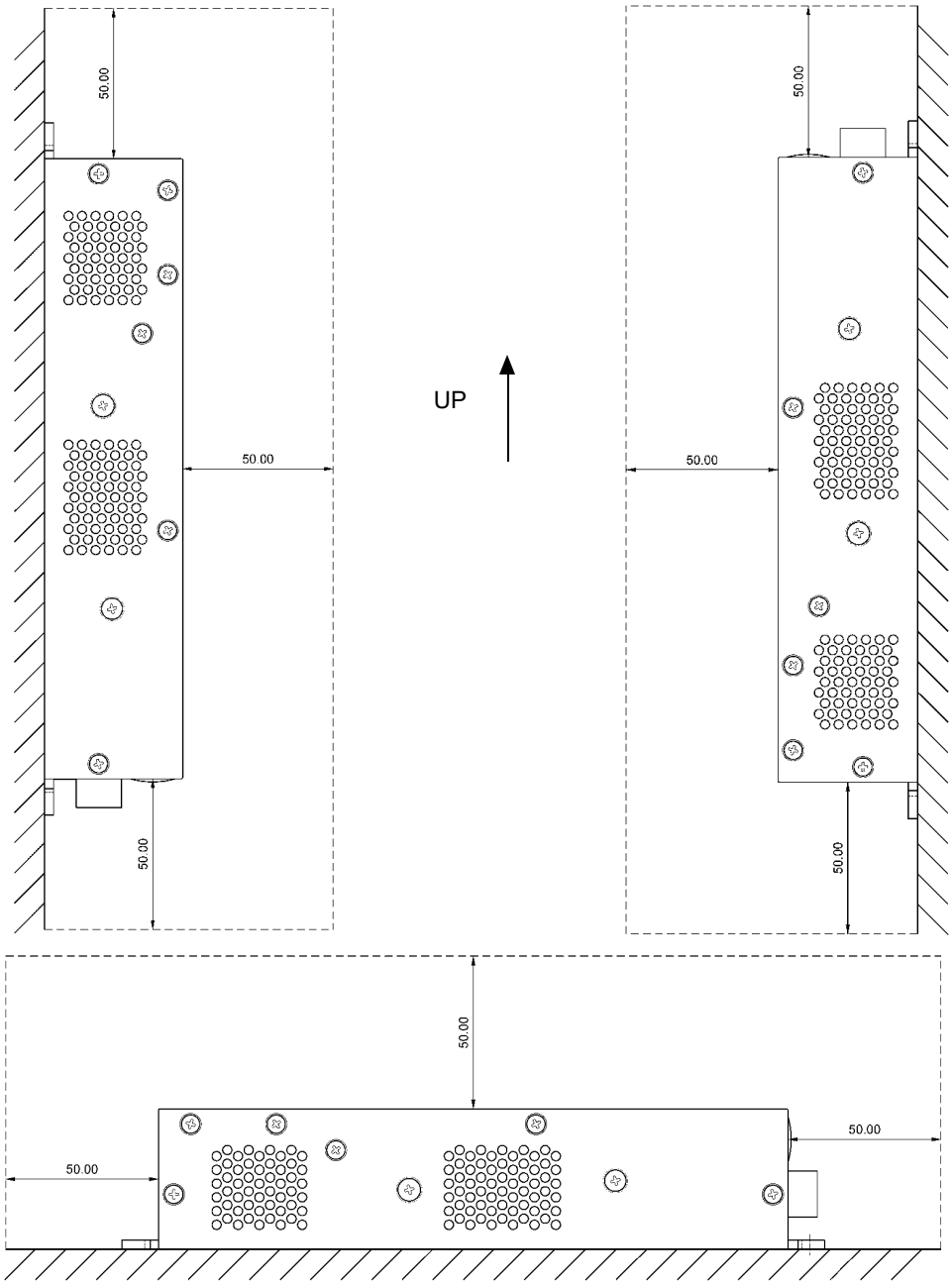
Please read carefully and understand this manual before using this product.

- This DC Uninterruptible Power Supply (DC UPS) uses an external battery to back up its DC output when AC mains power fails. This battery is to be connected to the BATT +/- terminals.
- The external battery must be a valve-regulated (AGM or gel) lead-acid battery or a flooded lead-acid battery.
- Model PB256-1210CML uses an external 12V lead-acid battery (6 x 2Vcells) with total capacity (C20) between 5Ah and 100Ah, typically 10Ah to 20Ah.
- Model PB256-2405CML uses an external 24V lead-acid battery (12 x 2V cells) with total capacity (C20) between 5Ah and 50Ah, typically 5Ah to 10Ah.
- Larger capacity batteries than those listed above can be accommodated; however, the battery charging time will be longer.
- **WARNING: Do not charge non-rechargeable batteries with this product.**
- This DC UPS is not designed for charging automotive batteries or for installation in caravans or similar vehicles.
- Explosive gases may be released by the external battery during charging. This battery must be placed in a well-ventilated area.
- Whenever AC mains is present, this DC UPS will charge the external battery automatically. Charging current is controlled by an internal constant current limiter. This charging current limit is set at the factory to 2A (PB256-1210CML) and 1A (PB256-2405CML). Refer to your battery manufacturer's specifications for the appropriate battery charging current limit. Alternate battery charging currents are available, but need to be specified at time of order. Contact Powerbox.
- This DC UPS is designed for indoor use only and must never be exposed to water, rain or any liquids.
- This DC UPS is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the DC UPS by a person responsible for their safety. Children should be supervised to ensure that they do not play with the DC UPS.
- If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.

Important installation requirements

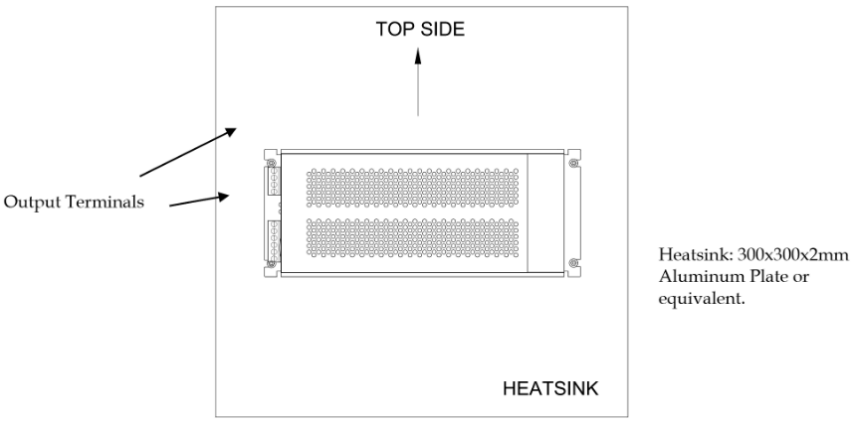
- The PB256-CML DC UPS is designed to be mounted to a flat metal surface in either the horizontal or vertical plane using M4 or equivalent fasteners on 220 x 73mm centers. Refer to the mechanical outline diagram at the end of this manual.
- As shown in Figure 1, the DC UPS can be mounted either horizontally or in the shown vertical orientations without any additional protection. Clearance of 50mm must be provided on all sides to ensure proper cooling and reliable operation.

FIGURE 1: PB256 MOUNTING ORIENTATIONS



- If the DC UPS is to be mounted in any other orientation, a non-combustible fire barrier must be mounted below the unit or the unit must be installed inside a separate fire enclosure complying with AS/NZS62368.1 Clause 6.4.7 or 6.4.8 or equivalent.
- To operate at its maximum rated output power (load plus battery charging) of 138W (13.8Vdc/10A: PB256-1210CML; 27.6Vdc/5A: PB256-2405CML), the DC UPS must be attached to a heatsink with thermal resistance equal to or better than a 300x300x2mm Aluminium plate with free airflow. The mounting surface must be flat to within ±0.1mm. Thermally conductive compound (Electrolube HTC35SL or equivalent) must be spread liberally across this interface to ensure low thermal resistance. The unit must be mounted in the vertical plane as shown below.

FIGURE 2: PB256 HEATSINKING



- If the DC UPS is not attached to a heatsink as described above, it can only be operated to a maximum output power (load plus battery charging) of 110W (13.8Vdc/8A: PB256-1210CML; 27.6Vdc/4A: PB256-2405CML).
- The maximum output power from the DC UPS must be derated based upon the ambient air temperature around it. Refer to Figure 4 “PB256 Derating Curves”. If the DC UPS is installed inside another enclosure, this is the air temperature inside the enclosure around the DC UPS.
- If the DC UPS is installed inside another enclosure:
  - This enclosure must be made of metal.
  - The DC UPS must be mounted vertically.
  - The DC UPS should be mounted to one of the surfaces of the enclosure so that this surface is a heatsink for it.
  - If this surface is not equivalent to the heatsink specified above (ie. equivalent thermal resistance), the DC UPS may only operate to a maximum output power (load plus battery charging) of 110W (13.8Vdc/8A: PB256-1210CML; 27.6Vdc/4A: PB256-2405CML).
  - There must be at least 50mm free air clearance from the sides and top of the DC UPS to any surface of the enclosure or to any other objects inside the enclosure that may impede cooling airflow.
  - Ventilation holes must be provided in the enclosure to ensure free flow of cooling air around the DC UPS and to keep the air temperature around it within its derating curves. As a minimum, at least 200cm^2 of open ventilation area (individual hole area x number of holes) must be installed above the DC UPS and at least 200cm^2 of open ventilation area must be installed below the DC UPS. The diameter of individual ventilation holes must be at least 5mm to ensure unimpeded airflow.
  - If other power-dissipating equipment is installed inside the enclosure, these ventilation areas must be increased as required to maintain the air temperature around the DC UPS within its derating curves.
  - The air temperature inside the enclosure should be checked under operation to ensure that it is within the DC UPS’s derating curves.

- In all installations, the DC UPS is to be connected to the AC mains power via the provided supply cord which is to be plugged into an earthed 10A socket outlet compliant with AS/NZS 3112.
- In all installations, including when the DC UPS is installed inside another enclosure, it must be possible to disconnect the DC UPS from the AC mains power by unplugging the provided supply cord plug from the mains socket outlet.
- It is recommended that batteries be installed according to AS 2676.1:2020 or AS 2676.2:2020. For installations using PB256-2405CML, with battery capacity greater than 10Ah, this is mandatory. In particular, one or both of the battery leads must be protected against overcurrent by a fuse or circuit breaker located close to the battery. Refer to Figure 3. If the positive terminal of the battery is solidly earthed, then a fuse or circuit breaker is only required in the negative terminal. If neither terminal of the battery is earthed, then a fuse or circuit breaker is required in both terminals. It is recommended that the negative terminal of the battery not be earthed. These protective devices must be sized to interrupt the short circuit current of the battery.
- Connections from the DC UPS to the load and to the battery are made via LOAD+/- and BATT+/- terminals. This is a pluggable screw terminal block which is suitable for up to 2.5mm^2 wire. This terminal block must not be unplugged under load. Disconnect the AC mains supply and all loads from the DC UPS before unplugging this terminal block.
- The cables between the battery and the DC UPS, battery fuses or circuit breaker, must be able to withstand the prospective short-circuit current which the battery is able to deliver for a period of at least 1 second.
- Observe the polarity of the battery when connecting it to the DC UPS. Reversed battery polarity will blow an internal protection fuse and can damage the DC UPS.
- When initially powering the DC UPS after installation, follow the procedure in “Commissioning”.

Features and operation

The PB256-CML series is a family of 13.8Vdc and 27.6Vdc 138W off-line DC uninterruptible power supplies which operate from 210-240Vac mains power. When connected to a lead-acid battery, these units provide uninterrupted power to a DC load in the event of a mains failure.

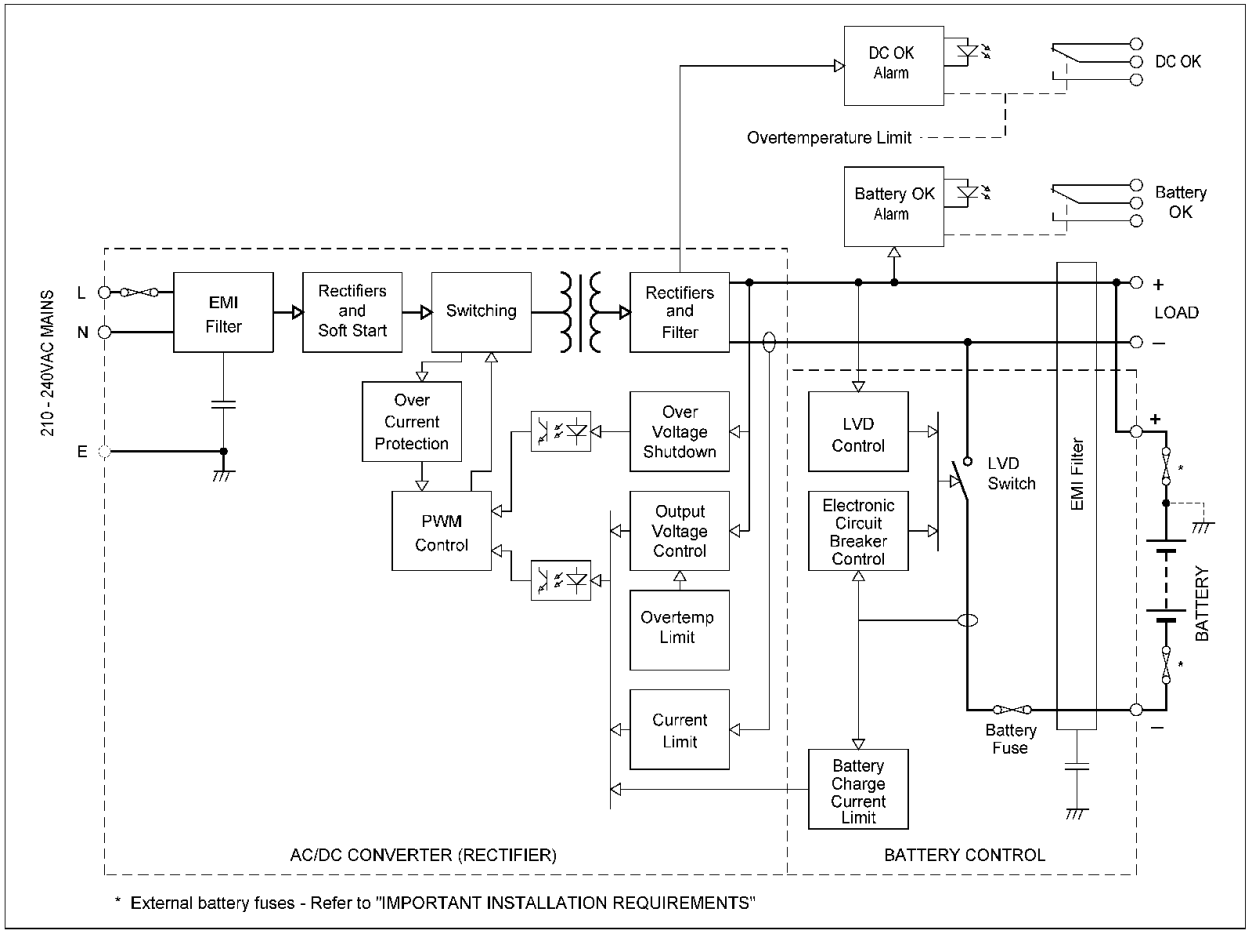
The PB256-CML contains a two-step current limited float charger, battery charge current limiting, a battery low voltage disconnect switch and DC OK (mains/rectifier) and Battery OK alarms. It employs high efficiency switching technology which makes it suitable for powering a broad range of loads such as communication equipment, control equipment and alarm systems. Also, due to its very low output noise, it is suitable for powering sensitive loads such as radio equipment.

The PB256-CML is available in a chassis mount enclosure. An external heatsink is required for operation at rated output power. All models employ natural convection cooling.

Figure 3 is a block diagram of the PB256-CML which details its various functions as follows.

- A high efficiency switching AC/DC converter (rectifier) provides 13.8Vdc/10A or 27.6Vdc/5A directly to the load and to charge the battery. This converter provides a constant output voltage and a constant current limit. Latching output overvoltage shutdown and autoresetting overtemperature protection are also included.
- The battery is connected across the output of the AC/DC converter via an electronic low voltage disconnect switch (LVD switch) in the negative lead. As a result, the output and battery voltage are essentially equal and the battery is available to supply the load the instant when AC mains power fails. Also, the output voltage follows the battery voltage as the battery charges.

FIGURE 3: PB256 BLOCK DIAGRAM



- The PB256-CML operates as a two-step charger. If the battery is discharged and mains voltage is applied, the PB256-CML provides constant current to the battery. Once the battery voltage has risen to the float voltage, the AC/DC converter operates as a constant voltage charger.
- Battery charging current is controlled by its own constant current limiter. This circuit reduces the AC/DC converter output to control the charging current into the battery only. This current limiter has no effect on the output current available to the load from the AC/DC converter.
- The unit is protected against battery reverse polarity by an internal battery fuse in series with the battery negative terminal.
- To protect the battery against overdischarge, the electronic LVD switch disconnects the negative load terminal from the battery negative terminal when the battery voltage drops below 1.8V/cell (10.8V or 21.6V). This switch is automatically reset on reapplication of mains power. For this switch to operate correctly, the battery negative and load negative must not be connected together outside of the PB256-CML.
- The LVD switch also operates as an electronic circuit breaker for the battery. This protects the load wiring against overcurrents or accidental short circuits. The circuit breaker trips in less than 2ms for short duration current surges of greater than typically 350% of the AC/DC converter output current rating and in less than 300ms for overcurrents greater than typically 150% of the AC/DC converter output rating.
- If the ambient temperature is too high for the output power being drawn from the rectifier or if there is insufficient cooling airflow, overtemperature limit reduces the total output power ensuring that maximum internal air temperature is not exceeded. If the maximum internal temperature is exceeded, the rectifier shuts down. This shutdown automatically resets when the internal temperature returns to a normal level.
- Two alarms with separate voltage-free changeover contacts and green LED's are provided.
  - **DC OK** indicates loss of mains power, failure of the off-line AC/DC converter, or tripping of the overtemperature limit.
  - **BATTERY OK** is a battery low voltage alarm when AC mains power is OFF indicating that the battery is becoming discharged. This alarm is also asserted when AC mains power is applied if the internal battery fuse has failed.

Model summary and ratings

PB256 Ordering Information

PB256	-1210	CML	-
1	2	3	4

1 Series name

2 Output Voltage
1210: 13.8Vdc
2405: 27.6Vdc

3. Enclosure
CML: chassis mount

4. Options (Multiple options can be specified)
Options must be specified at time of order. Contact Powerbox

-T: Battery temperature sensor with 2 meter cable

-T0.5: Battery temperature sensor with 0.5 meter cable

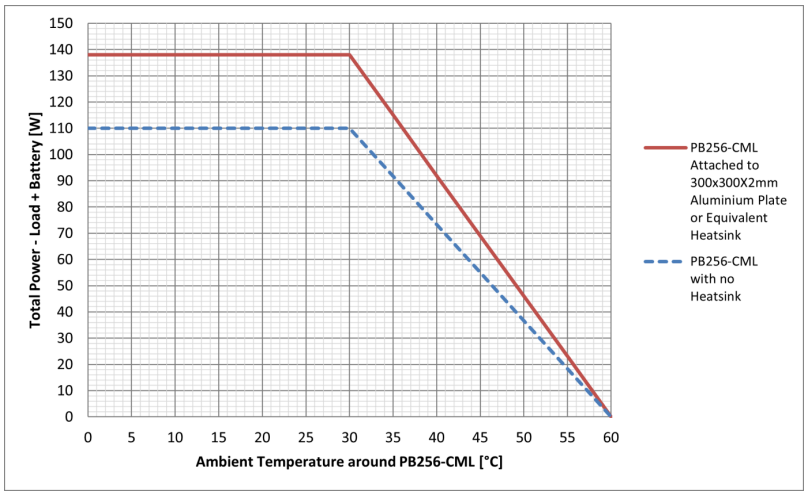
-CC: Conformal coating

-##A: Non standard battery charging current limit, if different from default. (## = Current limit in Amperes)

MODEL	PB256-1210CML	PB256-2405CML
Output Power	138W: Attached to a 300x300x2mm Al plate or equivalent heatsink. See derating curves below	138W: Attached to a 300x300x2mm Al plate or equivalent heatsink. See derating curves below
Output Voltage	13.8Vdc	27.6Vdc
Total Output Current	10.0A	5.0A
Load Current	10.0A	5.0A
Battery Voltage	13.8Vdc Float (12V battery)	27.6Vdc Float (24V battery)
Battery Charging Current Limit	2.0A	1.0A
Size	230 x 93 x 46mm (L x W x H)	
Weight	850g	

Derating Curves

FIGURE 4: PB256 DERATING CURVES



Sizing Example

The sum of the battery charge current limit and the load current must be kept less than or equal to the rated output current of the DC UPS at the required maximum ambient temperature.

For example: An installation must supply a 13.8V load of 4A and charge a 20Ah backup battery in a maximum ambient temperature of 40°C. The DC UPS is mounted to a heatsink equivalent to a 300x300x2mm Aluminium plate in free air. The battery charging current limit of 2A is suitable for the battery capacity (0.1C). The sum of the load current and battery charging current limit is 4A +2A = 6A. Multiplying by the float voltage gives a maximum output power of 13.8V x 6A = 82.8W. Referring to the derating curves, model PB256-1210CML attached to an equivalent heatsink has a maximum rated output power of 92W at 40°C so it is suitable for this application.

Commissioning

1. Connect the battery and ensure that the external battery fuse in the negative battery lead is not installed. Ensure that all loads are either disconnected or are switched off. If a DC distribution board is being used, this disconnection can be done by removing the fuses in the distribution board.
2. Apply 210-240Vac mains voltage to the input.
3. Measure the voltage at the LOAD terminals. This voltage should be either 13.8Vdc or 27.6Vdc.
4. Measure the voltage drop across the fuse holder in the negative battery lead. This voltage should be less than ±2.5Vdc for PB256-1210CML and less than ±5Vdc for PB256-2405CML. If the voltage is above this limit, either the battery polarity is reversed, the wrong voltage battery is installed, or there are problems with the battery wiring. Correct these issues before proceeding.
5. Install the fuse in the battery negative lead.
6. Measure the voltage across the battery. This should gradually rise indicating that the battery is charging.
7. Confirm that both LED's on the DC UPS are ON indicating no alarms.
8. Turn on loads or connect loads to the unit. If a DC distribution board is being used, this connection can be done by installing the fuses on this distribution board. Note that the pluggable output connector on the DC UPS must not be used to make this connection when output voltage is present on the DC UPS. If a DC distribution board is not used, if the fuses on the DC distribution board cannot be removed, or if there is no load switch, before connecting the load the system must be shut down by disconnecting the fuse in the battery negative lead and turning off the AC mains power. After connecting the load, install the fuse in the battery negative lead and turn on the AC mains power to start up the DC UPS.

Specifications

MODEL			PB256-1210CML	PB256-2405CML
INPUT	VOLTAGE [V]		210-240 Vac 1ø	
	CURRENT [A]		1.4 max.	
	FREQUENCY [Hz]		50/60 (45 - 65)	
	EFFICIENCY [%]		80 typ.	
	INRUSH CURRENT [A]		15 max. (cold start)	
OUTPUT (AC Mains Operation)	VOLTAGE [VDC][*1]		13.8	27.6
	OUTPUT POWER [W][*3]		138	138
	TOTAL OUTPUT CURRENT [A][*2]		10.0	5.0
	LOAD CURRENT [A]		10.0	5.0
	AC/DC CONVERTER CURRENT LIMIT	> LVD Volts	Constant current: 12.5A typical	Constant current: 6.25A typical
		< LVD Volts	Foldback & hiccup	
	BATTERY CHARGING CURRENT LIMIT [A][*4]		2.0	1.0
	LINE REGULATION [%]		0.2 typ.	
	LOAD REGULATION [%]		2.0 typ.	
	RIPPLE [mVp-p][*5]		25 max.	45 max.
	NOISE [mVp-p][*5]		25 max.	45 max.
	OVERVOLTAGE SHUTDOWN [V]		15.5 - 19.5 (Latching)	31.5 - 39 (Latching)
	LOAD SHORT CIRCUIT PROTECTION		Indefinite (Autoresetting)	
	BATTERY CHARGER SHORT CIRCUIT PROTECTION		Indefinite (Autoresetting)	
	OVERTEMPERATURE PROTECTION		Rectifier maximum temperature limiter reduces rectifier output power. Extreme overtemperature causes rectifier shutdown (Autoresetting).	
OUTPUT (Battery Operation)	VOLTAGE DROP – BATTERY TO LOAD [V]		0.4 typ.	0.2 typ.
	LOW VOLTAGE DISCONNECT [V]		10.8 typ.	21.6 typ.
	LOAD OVERLOAD PROTECTION		Battery Electronic Circuit Breaker	
	BATTERY REVERSE POLARITY PROTECTION		Internal Fuse	
DISPLAYS AND ALARMS	DC OK		LED (Green) ON=OK, Voltage-free Changeover Contact (32V, 1A) Alarm on loss of mains, failure of AC/DC converter or tripping of overtemperature limit.	
	BATTERY OK		LED (Green) ON=OK, Voltage-free Changeover Contact (32V, 1A) Alarm on battery low voltage (AC mains voltage OFF), or on failure of battery fuse (AC mains voltage ON).	
	BATTERY LOW ALARM VOLTAGE (Falling) [V]		11.3	22.6
ISOLATION	INPUT TO OUTPUT		4242 VDC, 1 minute	
	INPUT TO GROUND		2121 VDC, 1 minute	
	OUTPUT TO GROUND		707 VDC, 1 minute	
	ALARMS TO OUTPUT AND GROUND		707 VDC, 1 minute	
STANDARDS	SAFETY		AS/NZS 61558.1/.2.16	
		Short Circuit Protection	SMPS incorporating a short-circuit-proof safety-isolating transformer	
		Electric Shock Protection	Class I	
		Overvoltage Category	II	
		Pollution Degree	2	
	EMC	RF Emissions	AS/NZS CISPR11 Group1, Class B	
		Harmonic Current	AS/NZS 61000.3.2	
MECHANICAL AND ENVIRONMENT	OPERATING TEMP AND HUMIDITY[*3]		0 to 60°C, 5 to 90%RH (Non condensing) (Refer to DERATING CURVES)	
	CASE SIZE / WEIGHT		230 x 93 x 46mm (LxWxH) / 850g	
	ENVIRONMENT		For indoor use only	
	COOLING METHOD		Natural Convection	
	PROTECTION INDEX		IP20	
	AC MAINS CABLE		250Vac, 10A, AS/NZS 3112, AS/NZS 60227.5, AS/NZS 60320.1 C13 2m approved cable included with unit.	

*1 **WARNING: Do not apply voltages higher than the output voltage to the unit output or serious damage to the unit can occur!**

*2 Sum of load + battery charging current; example, 2A charging + 8A load = 10A

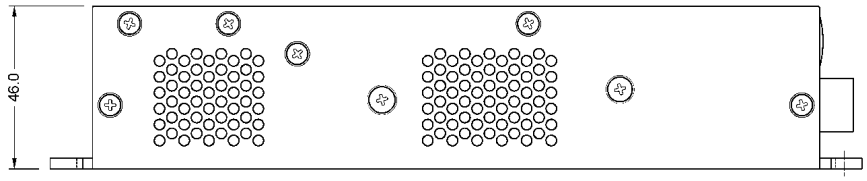
*3 To operate at maximum rated output power, these models must be attached to a heatsink (300 x 300 x 2mm Aluminium plate or equivalent heatsink).

*4 This feature limits battery charging current but not load current. Other battery charging currents are available. Contact Powerbox.

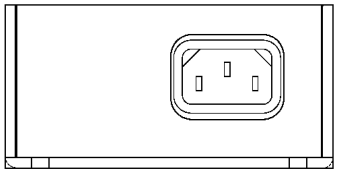
*5 Using a 20MHz oscilloscope at the output terminals.

Mechanical outline

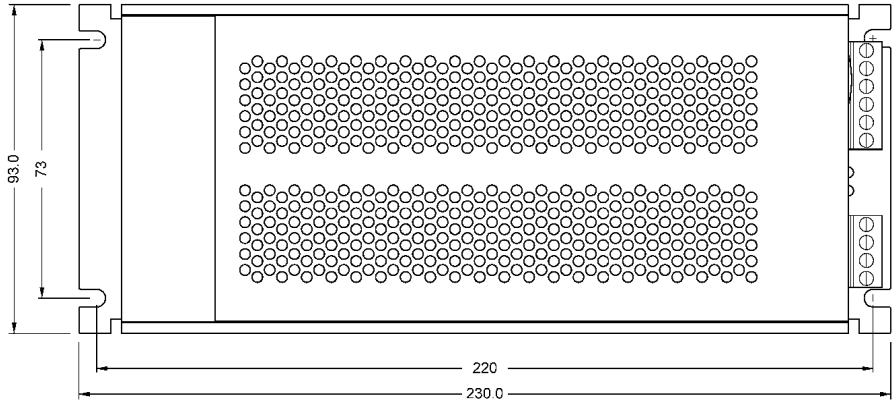
Front View



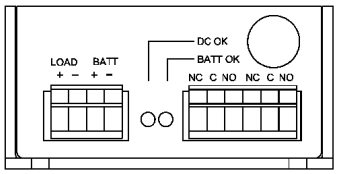
Left Side View



Top View



Right Side View



NOTES:

1. Mounting Centres: 220 x 73mm, Suitable for M4 Hardware
2. AC Mains: 10A Class 1 IEC 60320-1 C14 Appliance Inlet
3. Output and Battery: 4W Pluggable Screw Terminal Block Suitable for up to 2.5 sq. mm wire.
4. Alarms: 6W Pluggable Screw Terminal Block Suitable for up to 2.5 sq. mm wire.

powerbox
Powering Progress

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