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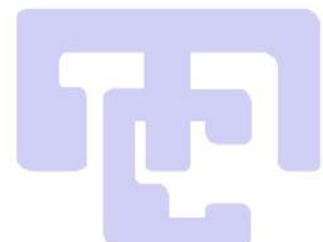
Designed and Manufactured in Australia

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www.cmtechnology.com.au

Tel: + 61 2 9764 6550

Emergency Vehicle Battery Manager PS4012 and PS 2024



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These products are designed as on vehicle battery chargers and battery charge state monitors. While the vehicle is at its base or station, the charger is connected to the AC mains supply. An ignition interlock relay on the charger prevents starting the vehicle when the AC mains are on. The charger first applies a fast charge to bring the battery up to nominal capacity and then applies a trickle charge to maintain that state. The charger cannot overcharge or cause loss of electrolyte like simple automotive chargers do.

Should the mains fail for an extended period, as can happen in rural locations, the manager monitors the battery condition for a low battery state. The charger sounds an audible warning and closes a relay contact pair that can be used to warn remotely of this state, for example by a radio link.

When the vehicle is required, the 240 is unplugged and the vehicle can be driven away to the emergency site. Here the battery drain can be considerable when work lights, hazard lights and radio loads are considered. The manager monitors the battery condition and sounds an audible warning and closes a relay contact pair that can be used to warn operators to start the main vehicle engine to recharge the battery with the vehicle alternator.

1.0: General Information:

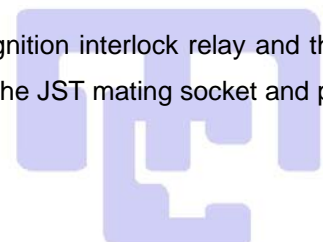
The products consist of a black anodized custom-made aluminum case 255 mm long and 190 mm wide by 115mm high. Laser cut stainless steel ends are fixed to the case. The ends are pre-cut with 6 by 6mm mounting holes. The charger must be mounted with the air vent holes clear, and in free air circulation, but it can be mounted in any position.

2.0: Mounting:

These products are not waterproof. They should be mounted in a vented, waterproof equipment locker, or in the crew cab itself. Do not mount in engine bays or next to exhaust stacks that radiate heat.

The 240-volt AC mains input socket is supplied with a matching plug and socket that should be connected to a caravan type inlet on the vehicle body. Use of an earth current circuit breaker is strongly recommended on the supply circuit. An independent connection to earth is provided below the IEC power inlet. It is connected to separately ground the case if required.

The output to the battery is by two stainless steel 8mm front panel bolts. The ignition interlock relay and the alarm contact pair use a 4 pin JST locking type connector, also mounted on the front. The JST mating socket and pins, two 8mm solder lugs and brass washers are provided.



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Two suitable spanners should be used when tightening the terminal securing nut and the locknut holding the terminal assembly(s) into the charger.

The mounting base is predrilled with 6 by 6mm holes. The charger is fan cooled and must be mounted with all the air vent holes clear and with unrestricted air circulation available. Care must be taken that loose equipment and clothing cannot ever stop the airflow

3.0: Electrical Specification:

The chargers are switch mode forward converters of the constant current mode type. Each is power factor corrected, with input inrush current limiting. They operate first at a constant current to bring the battery up to its charged state, and then operate at a constant voltage to trickle charge the battery. This constant voltage point is very precise so the battery cannot "boil" or lose electrolyte as happens with simple automotive chargers. The charger can therefore be left permanently connected to the battery. They have a number of built in microprocessor controlled alarm features. (See "Alarms").

3.1: Voltage and Current Ratings

- PS4012 13.9 V at 40 amps
- PS2024 27.8 V at 20 amps


These are the factory set points for voltage, measured at 1-ampere load. They can be factory trimmed with an internal preset.

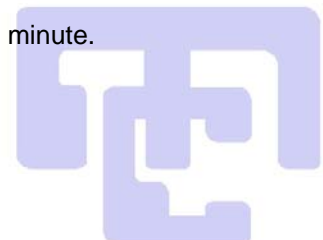
3.2: Input Voltage

The input range is 240 V AC +/- 10%. The input frequency can be from 40 to 400 Hertz. The input is fused and switched with an IEC type socket, and transients are clamped. An earthing bolt is attached to the rear, and a spare mains fuse is located inside the IEC assembly.

- The Mains isolation is

Input to output:	3500 V AC for 1 minute.
Input to case:	3500 V AC for 1 minute.
- EMI Approvals:

The products carry the "Ctick" mark. 





3.3: Voltage and Current Metering

The Output Voltage regulation with both loads (10% to 90%) and mains input are:

- Regulation <3% typical.

3.4: Voltage and Current Metering

Both the voltage and current provided by the chargers are metered on front panel mounted LCD 3 and a half digit panel meters. Allowance must be made for circuit drops in the wiring when measuring the battery volts however.

3.5: Standing Loads and Charging a Battery aswell

It is suggested that the standing load on the charger be less than 75% of its current rating to keep the recharge time within reasonable bounds. Therefore 15 amps maximum on the 20 amp PS2024, for example.

3.6: Ignition Interlock

A relay shuts to provide a closed floating contact pair when the 240V mains are applied. The pair should be used to shut an interlock relay on the vehicle ignition to stop it being driven away with the 240 still connected.

3.7: Reverse Polarity Protection

If a charged battery should be reverse polarity connected to the charger, the PS1012 and PS824 protect themselves by blowing an easily replaced front panel accessed blade fuse. A Red "Polarity" LED is lit and an internal audible alert sounds.

3.8: Low Voltage Warning

The manager's microprocessor monitors the battery condition and sounds an audible warning and closes a relay contact pair that can be used to warn operators via an external horn to start the main engine to recharge the battery. The detection circuits have software time delays to eliminate short transient dips and hysteresis to stop hunting. Once the battery terminal voltage comes up, the alarm condition is cleared automatically.

- Threshold

PS4012	11.5 volts
PS2024	22 volts
- Contact Rating

10 amps

- Alarm pulses.





3.9: Using Alarm Contacts

The floating alarm contacts can be used in many ways. One way is to warn of the low battery state on the vehicle when it is at the emergency site. The contacts shut and operate a warning siren or strobe before the battery is unable to start the vehicle.

Another use would be in remote locations, for example Country Fire Service garages. Here if the power fails for some time and the site is un-manned, the contacts could be used to activate a remote telephone dialer, operate a CB, or again trip an alarm sound or light.

3.10: Alarm Summary

- AC ON when the 240 V mains is first connected to the charger the internal audible alarm gives 4 short beeps to show all is well. When the charger is off the contacts are open. When the AC mains is turned on the contacts close.
- Battery Low. The alarm sounds and the alarm contacts shut. This happens when the battery voltage drops to

PS4012	< 10.5volts
PS2024	< 20 volts
- Polarity Wrong. The PS4012 and PS2024 protect themselves by blowing a front panel blade type fuse. A Red "Polarity" LED is lit. There is an audible alert.





2.5: Reverse Polarity Protection:

The supplies are input diode isolated. They are not affected by indefinite reverse power within the input voltage limits 0 to 150 V DC. (0 to 55V DC PSTR 24) Normal operation is restored immediately upon the correct application of power. Under reverse power, no output voltage is present. The reverse polarity is indicated by a RED daylight visible high brightness LED labeled "POLARITY". Correct polarity DC is shown by a GREEN high brightness "xxx V DC" LED, both adjacent to the input DC CR socket.

2.6: Output Voltage:

2.61:Nominal:

The nominal output voltage is 13.8 V DC at 16 amps. Other voltages on request. Output voltage present is shown by a GREEN high brightness LED, "12 V", adjacent to the output DC CIR sockets.

2.62: Regulation:

When measured at the back of the output connector (i.e.. not including drops in the output plug itself), the regulation is:

- Over load 0-16 amps (input nominal) < +/- 1%
- Over Input Range (Load 16 amps) < +/- 1%
- Over Temperature (Input Nominal, Load 16 amps) < +/- 1%

2.7: Output Current:

The rated output is **16 amps rms, maximum continuous at 60 Celsius**. The supply has a constant current type of limiting behavior, and allows parallel connection & redundant operation. The **current limit** is 22 amps. The supply is limited by its passive (no fans) heat sink. The supply can be short circuited. The "rms" figure allows duty cycle ratings e.g.:

- 22 Amps for 1minute, 12 Amps for 4 minutes cyclic duty at 60°C
- At 50 C, the available current is 20 amps in a free air flow of > 1m/sec

2.8: Output Voltage Ripple & Transients:

The output voltage ripple and transients are less than 100mV for any load.

2.9: Output Noise:

The output noise under all load conditions is <100 mV peak , DC to 100 MHz.





2.10: Over Voltage Protection:

The output is disconnected if it should exceed an internal preset for 1mS.



Over Volts disconnect 14.9 VDC +/- 3% (Hysteresis 0.6 Volt DC)

No fuses are used. The output cannot reverse under any condition.

2.11: Current Limiting:

The supplies do not require a load for proper operation. The outputs are current limited electronically. No fuses are used. Disconnection and Re-connection of the load during operation will not damage the supplies.

2.12: Parallel Operation:

The supplies are designed for parallel operation, either for load sharing or redundant operation techniques.

2.13: Efficiency:

The efficiency at 16 amps (75% load) is >80% (83% typical PSTR 24 &74 84% PSTR 110)

2.14: Cooling:

The unit is convection cooled. Provision for free air circulation around the inner case (~110 mm deep) should be made, as up to 70 watts can be dissipated at maximum load. 1 metre/sec of air flow should be provided.

The supply should not be used in a confined space that is not fully ventilated.

2.15: MTBF:

The unit is manufactured using only well specified and qualified components. In particular, the electrolytics are IEC 384-4, long life grade, climatic category IEC 68 (-40 +85) with a life in excess of 60,000 hours at a 60 Celsius ambient and full ripple current. Infant mortality is eliminated with a full load burn in at final test (8Hrs) before dispatch. The MTBF is **predicted** at > 60, 000 hours in normal service.

2.16: Temperature Rating:

The power supplies are specified for operation from -10 to +60°C.





2.17: Options:

Series Type "PSTRxxF" has the options:

- Input Ripple filter for high ripple (>5%) DC sources.
- Power good (13.8+/- %5) floating contact set

3.0: Equipment Mechanical Specification:

3.1: General:

The power supplies are designed and manufactured with the rigors of railway application in mind. The major components like electrolytics have multiple terminations into the printed circuit board, which itself is made of 70 micron (twice normal), through hole plated, tinned fibre glass. Critical joints are bolted for extra strength and other components supported with Loctite 480 adhesive. The PCB is also conformal coated to stabilize the minor components and for dust protection. All components mount to the PCB. There are no looms other than short jumper wires from the PCB and soldered to the CIR in-out connectors. The wires used are silicone insulated high temperature grade. The power supplies consist of a 19 inch standard rack mount, extruded aluminium front panel assembly anodized black. To this is bolted a removable inner safety case that is made from laser cut stainless steel. All parts mount to a single PCB screwed at many places to the front panel. A back screen printed lexan label covers the annunciator LEDs, effectively sealing the front panel. The supply is mounted to the rack with 4 front panel screws. All electrolytics are mechanically clamped to the frame independent of the PCB mounts.

3.2: Mechanical Stability:

To provide an independent assessment of the product, the mechanical stability of the unit was tested by the Philips NATA laboratory for the Freight Rail Corporation project. The tests comprised a vibration test at the resonance frequency to the test specifications for Railway based electronic equipment and dust penetration tests to IP50.

3.3: Maintainability and Warranty:

The supplies are manufactured from discrete components soldered to a double sided through hole plated PCB. Complete parts lists (with suppliers), circuit diagrams, overlays, descriptions of operation and calibration details are included in the purchase price.

Within warranty (12 months) return to factory freight paid applies. The unit will be returned freight paid. Outside warranty, the units can be returned freight paid to the factory for maintenance for a fixed fee + freight (if the unit is in good mechanical condition)



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3.4: Revision Notes:

Rev. 1.0 December 1992	Initial Release
Rev. 1.1 March 1993	Increase Efficiency to >80% due to 3F3 ferrites being available.
Rev 1.2 June 1993	Modified mechanical design. Type 24 added. Maintainability spec added
Rev 1.3 February 1994	Add Operation & Calibration Description to full specification.
Rev 1.4 March 1994	Tidy up. PSTR24 18 now 21V note qualifying this.
Rev 1.5 February 1995	Include new graphics
Rev 2.0 July 1996	Improved PSTR24 at 15 V. Add duty cycle or "rms" to current limit
Rev 2.1 Sept 2001	Improved graphics
Rev 2.2 July 2003	Include Telstra (1996) 48 V variant in main spec.



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