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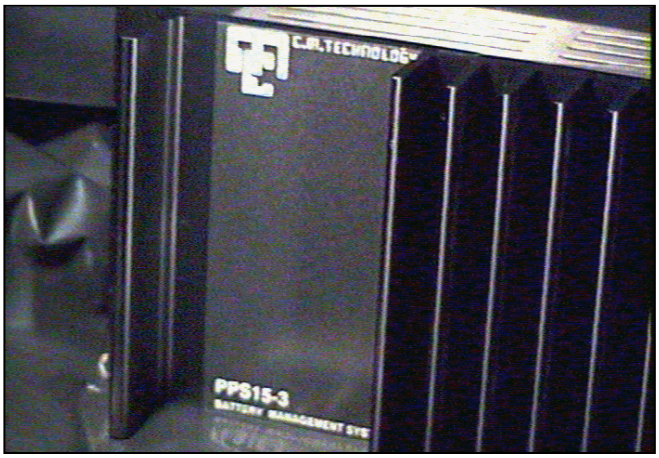
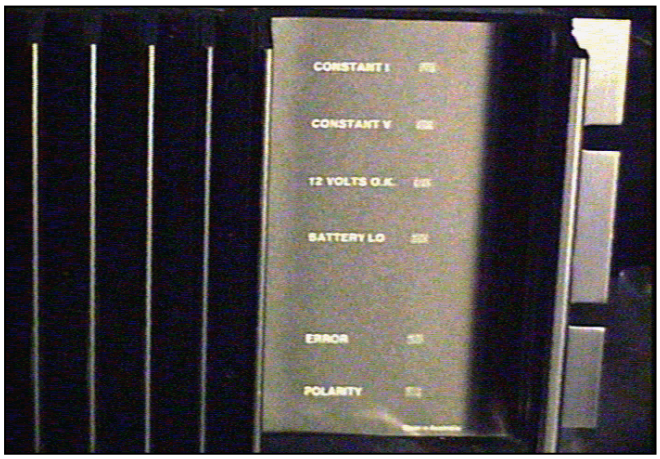
PRODUCT DATASHEET

Rev. A1
Tel: +61 (2) 9764 5655

PPS15





3 RU 230/110V AC to 13.8 VDC POWER SUPPLY

WITH BATTERY MANAGER OPTION

A Caspian Technology Company

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Introduction:

The PPS15-3 is a 13.8 volt 15 amp transformer isolated switch mode down converter designed to be used either as a stand alone supply or as a float style battery backed up supply when a lead acid battery is connected to its battery terminals.

The PPS15-3 was designed for wide mains voltage swings (240 ±20%) or (110+/- 10%) and high temperatures and vibration. The supply is rated at 60° C and has been NATA tested at 70° C at full load at 280 volt mains. It was originally designed for railway trackside applications where such conditions apply. It is very suitable for applications where the mains supply is poorly regulated, and temperatures can be extreme. Models available are:

- Input Voltage 240 AC RMS or 110 AC RMS
- Output Current 15 amps DC out
- Output Voltage 13.8 V (all models).

1.0: Operation Principles:

1.1: Stand alone supply

The PPS15-3 is constant voltage, constant current supply. When no battery is connected, the output voltage stays constant at 13.8 volts (adjustable) until the current limit (15 amps) is exceeded. The PPS15-3 does not require a battery to be connected for normal operation and provides clean DC.

1.2: Backed up supply

If a suitable back up battery is connected, the supply will run at its current limit until the battery is charged, that is until the constant voltage set point is reached. The current is shared between the communications load and the battery at all times, to a total of 15 amps. When the battery is charged, the PPS15-3 stays at this set point (13.8 volts and adjustable), supplying the load current and a small trickle charge to the battery.

Front panel LED indicators show the status of the supply and battery. When the battery is on charge the “CONSTANT I “LED is on. Within 0.1 Volt of the set point, the “CONSTANT V” LED comes on. The rate of rise of the terminal voltage on Lead Acid batteries is quite fast once they near full charge, so the LEDs form a reasonably accurate state of charge indicator in this mode.

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1.3: Battery is protected

To avoid completely flattening the battery when the ac mains fail for extended periods, the PPS15-3 isolates the load when the battery voltage (as seen at the PPS15-3) drops to 11 volts. Approximately 1 volt of hysteresis is used to stop the disconnect function hunting. When the battery is disconnected in this way, a red “BATTERY LO” LED is lit. When the mains returns, the battery voltage rises rapidly to 12 volts, the load is reconnected automatically, and the 15 amps of available current is shared between the load and battery. A “12 VOLTS OK” Led is lit. The terminal voltage rises to the set point (13.8 volts) when the battery is charged. At this point the supply goes into constant voltage mode, and the current to the battery drops off and a small trickle charge is left.

1.4: Load is completely protected

Should the PPS15-3 fail and present an overvoltage condition (> 15 volts for 100uS), an independent MOSFET overvoltage isolation switch isolates both battery and load from the supply, and a red “ERROR” LED is turned on. In the event that this overvoltage is just a transient condition, the PPS15-3 resets automatically.

Should a charged back-up battery be connected with reverse polarity, the power supply and its load are disconnected automatically by a MOSFET switch, and a red “POLARITY” LED is connected. The PPS15-3 resets automatically when the polarity is correct. This function operates even if load and battery connections are interchanged.

2.0: Recharge Time

The time to charge a battery depends upon the average draw from the load, the battery capacity, and the current limit of the PPS15-3. Suppose that the average continuous base station draw is 10 amps, and then 5 amps (15 amps minus 10) is available on average to charge the battery. A 55 AH battery would then take about 12 hours to recover.

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3.0: Mechanical

The 19 inch rack mount (3RU) case is manufactured from custom extruded aluminum, anodized black. (see drawing appended). All major components mount to the front panel, which forms the heatsink. The PCB is 70 micron copper (2x normal), secured with press fitted standoffs in many places to the heatsink. The main electrolytic have multiple terminations to the PCB, and heavy parts like Ferrites are bolted to the PCB, while other parts are supported with Loctite 480 adhesive.

The rear safety cover is made of laser cut stainless steel vented to allow full air flow. The PPS15-3 is convection cooled, and provision must be made for clear air flow around the product, as some 75 watts are lost as heat at full load.

The dress labels are back screen printed polycarbonate that is strongly resistant to mechanical damage. The annunciator LEDS shine through this.

Height	3RU	132 mm
Depth	70 mm behind panel, plus 25mm sockets etc.	
Width	19" rack	432 mm

Weight	7 Kg approx.
Mounting	4 screws, rack mount

4.0: Temperature and product life

The design ambient is -10º to +60º C. The product has been tested at 15 amps and 280 volt mains for 15 hours in a 70º C ambient, and passes with all components within their published operating maximum temperatures. (Freight Rail Corp test requirement)

At a 20º C ambient, the heatsink rises < 20º C in still air at 15 amps load and 240 V mains input. Free air flow is required around the product, and any enclosure must be designed to lose 75 watts to free air.

At 70º C and full load, the electrolytics used have a typical design life of >7000 hours (case temp 83º C IEC 384-4 part). This rises to >140,000 hours at a 40º C continuous ambient.

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5.0: Reliability

The PPS15-3 is manufactured using only well specified and qualified high grade commercial parts. In particular, the electrolytics are IEC 384-4 long life grade with a life exceeding 140,000 hours at 40º C continuous. C.M. Technology burns in all products to eliminate turn on failures. The MTBF is calculated to be >60000 hours at 50º C.

6.0: Maintainability & Warranty

The PPS15-3 is manufactured from discrete components soldered to a double sided, through hole plated solder masked 70 micron PCB. Complete parts lists, circuit diagrams, PCB overlays and a description of the circuit operation are included in the purchase price.

7.0: General Specification

Mains Input (50-60Hertz)	240 ± 20% (110V available)
Mains Isolation	toroidal transformer to AS3108 E.T.S.A. APPROVAL No CS/1083/S.COMPLIES WITH AS3108-1990, & AS3193-1990
Nominal Output Voltage (1 amp)	13.80V adjustable
Regulation (nominal mains 1-15 amps)	<250 mV
Constant Current Point	15 amp (20 amp) -0/+0.6 amp
Hum, Noise & Ripple (15 A , 20 MHz BW)	< 100mV pp < 15 mV rms
Over Volts Lockout	> 15.5 V ± 0.4 V
Battery Disconnect	< 11.2 V ± 0.4 V
Reverse Polarity protection	Absolute
Alarms	(Optional) Floating contacts for AC Ok and DC good window, +11.4 to+14.8 V DC.
Temperature	-10º C to 70º C at 15 amps
Expected Life (40º C ambient, full load)	>15 years
MTBF (calculated)	>60,000 Hours @ 50º C

RFI (generated and immunity)

Test Standard Report No M51138X E.M.C.Technologies P/L. as PPS15-3

EN55022 (CISPR 22 :1994)

EN50082-1 :1992

IEC 801-2 :1991

IEC 801-3 :1984

IEC 801-4 :1988

N 2672

AUSTEL Certified Component No. A96/PS/0096

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8.0: Connections

The battery and load have separate positive and negative Anderson Power Pole connectors. The alarm terminals are via a 4 pole screw terminal connector. All are mounted upon the back panel.

The mains input are an IEC fuse switch assembly, UL recognized. A spare fuse, (UL recognized) is contained in the input socket. Three MOVs (UL recognized) clip transients, and RFI is rejected by a DELTA mains filter. (UL recognized.). Mains isolation is by a conventional 50/60 Hz iron core toroidal transformer to AS3108 (E.T.S.A. approval CS/1083/S, PPS20 complies with AS3108-1990, & AS3193-1990). This configuration gives excellent immunity from mains induced transients found in remote locations.

9.0: System earth bolt (option)

An M6 bolt is mounted to the case at the point of entry of the IEC mains input.

10.0: Principles of Operation

The PPS15-3 is a constant current, constant voltage D.C. supply. The output voltage stays constant (within the limits of regulation) until the current limit of 15 or 20 amps is reached. The supply then goes into constant current. This provides a simple means of floating a lead acid battery if required. The operation of the supply does not require the battery to be present.

10.1: Down Converter

The main input is transient clipped by 3 MOV's (R41-43, Circuit Diagram PPS153-2.sch appended). A Heineman fuse (3ag) switch assembly is used to isolate the mains. The fuse is removed by twisting the input toggle.

A Delta RFI filter provides ~ 40 dB extra RFI filtering upon the input. The main is then transformed down to 22 Volts by the mains toroid T6. The output is rectified (Bridge D27) and then filtered by C29 & C30. High frequency inductor L2 provides further RF rejection.
The resulting 32 volts DC is chopped at 100 Khz by MOSFET Q6, and flywheel diode D24, and then filtered by L1 and C16 to produce 13.8 volts DC on C16. Regulation is achieved by altering the mark space ratio of the control signal via U5, the SMPS controller.

10.2: Current and Voltage Settings

The voltage setting is via 20 turn pot R33 (“SET VOLTS” on the PCB), which is available through the mesh of the safety case. It is used to set the constant voltage point, or the end point for the battery charging voltage. This is factory set at 13.75 volts. This pot adjusts the voltage feedback to U5, and is compared with the reference voltage (5.00 volts) generated by U5.

The current in the down converter is sensed by current transformer T5, rectified by D25, and then a portion set by 20 turn pot R39 (“SET AMPS” on the PCB) is sent to U5 for cycle by cycle current limiting. This limit is set to be 15 amps in the factory. The current pulses are integrated by L1 & C15 to make DC. This represents the constant current that is then shared between the battery and the load.

10.3: Charge State indication

The state of charge is indicated by the move from constant voltage (operation at the set point voltage) to constant current (battery terminal volts at less than the set point). This is detected by comparator U6 that compares the reference voltage on pin 18, U5 to the output. The output of U6 drives two high brightness LEDS, D20 and 21 to show the state of charge. Transistors Q8, Q9 isolate this function when the main is not on.

10.4: Over voltage protection

Both LOAD and BATTERY terminals are switched via MOSFETS Q1 and Q3 respectively. The gates of these transistors are fed from a 24 volt charge pump, consisting of U2, diodes D3, D4 and capacitors C2 and C14. A comparator, U3, compares a separate precision reference D18, and the rail. If it should exceed 15.5 volts, the gate drive is removed and the outputs go open. LED D5 lights (“ERROR”). If this overvoltage was just a transient, then the drive is re-applied.

10.5: Under voltage

In battery back up, the life of the battery is reduced if it is taken below 11 volts. The precision reference D18 and comparator U1 form a Schmitt Trigger with 1 volt hysteris. In operation, tripping U1 (battery <11.0 volts) removes the gate drive from Q1 and thus removes the load. The “BATTERY LO” led is lit. Hysterisis in the Schmitt means that the load is not re-connected until the battery reaches 12 volts. This happens almost immediately when the mains comes on, as the battery is in a (relatively) high impedance state at this time.

10.6: Upside Down

Both the PPS15-3 and the load are protected by Q1 and Q3 from an upside down connection of a battery to either of the LOAD or BATTERY terminals. The battery cannot be reverse charged either. Under these conditions the “POLARITY” LED is lit, and no power is available to the load. This protection circuit operates with or without mains being on.