



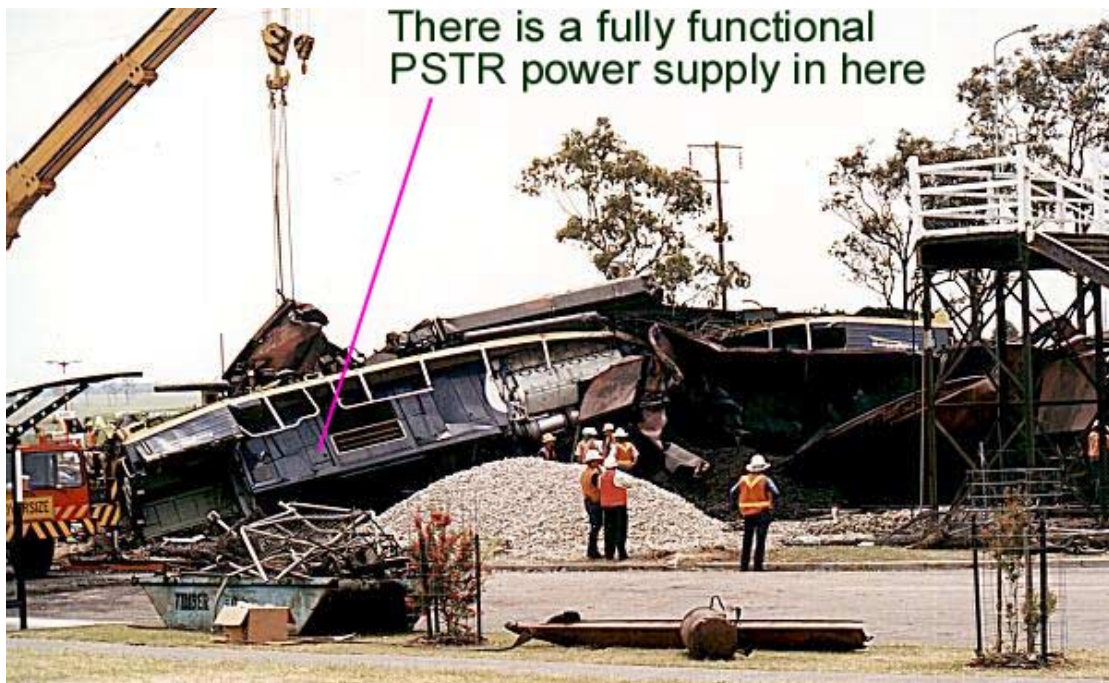
On Time, On Spec, On Budget

Fanden Pty Ltd
ACN 093 030 356
ABN 23 093 030 356
PO Box 498
Baulkham Hills NSW 1755
phone: 02 9639 6238
fax: 02 9639 7462
email: sales@fanden.com.au
web: www.fanden.com.au

ref: PSTRINFO

PSTR110, 74 & 24 DC-DC CONVERTER

(the power supply with ~\$12M of vibration & shock "testing")



original photo by David Johnson 25 Oct 1997
used with permission.



Unit with rear cover removed showing
mechanical bracing of major components

| | |
|---|---|
| General Information..... | 3 |
| Type Definition..... | 3 |
| Equipment Dimensions and Mounting | 3 |
| Australian Content | 3 |
| Transient Protection | 4 |
| Input – Output Voltage Isolation | 4 |
| Input Noise Immunity | 4 |
| Reverse Polarity Protection..... | 4 |
| Regulation | 4 |
| Output Current | 4 |
| Output Voltage Ripple and Transients..... | 5 |
| Output Noise | 5 |
| Over Voltage Protection | 5 |
| Current Limiting | 5 |
| Parallel Operation | 5 |
| Efficiency | 5 |
| Cooling..... | 5 |
| MTBF..... | 5 |
| Temperature Rating | 5 |
| Options | 6 |
| Equipment Mechanical Specification | 6 |
| General..... | 6 |
| Mechanical Stability | 6 |
| Reliability & Maintainability..... | 6 |

TYPE 24, 74 & 110 TELECOMMUNICATION POWER SUPPLIES FOR RAILWAY APPLICATIONS

General Information

The PSTR24, 74 & 110 Telecommunications Power Supplies are DC to DC Converters designed to provide an isolated, regulated, over voltage & transient protected 13.8 Volt source for radio and other equipment that is to be powered from the train DC supply.

These supplies feature a 22 Amp maximum current with an excellent 1% overall voltage regulation and high energy conversion efficiency. They feature 1,000 volts input to output isolation and internationally acceptable levels (AS3548) of conducted RFI. The units are standard 19" rack mounting (3 RU), convection cooled and designed for high electrical and mechanical reliability (MTBF > 60,000 hours) with an operating temperature range of -10°C to + 60°C. The supplies are widely used within the Australian railway system.

Type Definition

The power supply type required depends on the nominal DC input voltage:

| Nominal Vin | Vin min | Vin max | low input voltage ripple | high input voltage ripple |
|-------------|---------|---------|--------------------------|---------------------------|
| 24 | 15 | 32 | PSTR24 | PSTR24F |
| 74 | 55 | 100 | PSTR74 | PSTR74F |
| 110 or 120 | 70 | 150 | PSTR110 | PSTR110F |

the only difference in these products is in the main high frequency ferrite power transformer, the lexan front label and some MOSFets. All other parts are common to the range thus minimising spare parts requirements. The 'F' variant includes a robust input filter to protect against high locomotive auxiliary supply ripple levels on locomotives having auxiliary alternators including some locomotive fault conditions.

Equipment Dimensions and Mounting

The power supplies are designed for standard 19 inch rack mounting. The internal case is approx 110 mm deep and is of laser cut stainless steel construction. The extruded aluminium front is fitted with two carry handles and is anodised black. The various warning LEDs shine through a back screen printed lexan front panel which carries the type number and the Litton CIR series power connectors¹. The unit is secured with only 4 front panel screws. **Note: free air circulation is required around the internal case as up to 70 Watts has to be dissipated by the unit at maximum load.** A convective or other air flow of > 1 Metre/Sec should be supplied. An external circuit breaker should be fitted on the input circuit as no internal fuses are used. The front panel forms part of the heatsink.

Australian Content

The power supplies are designed and manufactured in Australia from Australian sourced materials where that is possible. The Australian content is > 80% and the units qualify for the Australian made symbol.

¹ mating connectors and alternate connector types may be supplied on request.

Transient Protection

these supplies are not susceptible to voltage spikes applied to the input terminals with the following characteristics:

Peak Voltage 5,000 Volts (7,000 Volts by request)

Rise Time < 0.1 microseconds

Fall Time to 2,000 Volts 160 microseconds, RC type time constant

Energy in spike < 100 Joules

Input – Output Voltage Isolation

Both input and output terminals float with respect to the metal case which is grounded.

isolation input to case > 1000 V RMS AC 50 Hz for 1 minute

isolation output to case > 1000 V RMS AC 50 Hz for 1 minute

isolation input to output > 1000 V RMS AC 50 Hz for 1 minute

Input Noise Immunity

Power supply operation is not affected by the application of 200 mV RMS (50 Ohms source) at any frequency from DC to 50 MHz. A multi pole input EMC / EMI filter is used.

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 55 V DC for PSTR24).

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 labelled 'POLARITY'. Correct DC is shown by a GREEN high brightness 'xxx V DC' LED, both adjacent to the input DC CIR socket.

Output Voltage

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.

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 range (input nominal, load 16 Amps) < +/- 1%

Output Current

The rated output is **16 Amps RMS maximum continuous at 60 °C (20A at 50°C)**.

The supply has a constant current type of limiting behaviour and allows parallel

operation and redundant operation. **The current limit is 22 Amps.** The supply is limited by its passive (no fans) heatsink. The supply can be short circuited. The RMS figure allows duty cycle ratings e.g.: 22 Amps for 1 minute, 14 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.

Output Voltage Ripple and Transients

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

Output Noise

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

Over Voltage Protection

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

Over Volts disconnect: 14.9 V DC +/- 3% (hystereses 0.6 V DC).

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

Current Limiting

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

Parallel Operation

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

Efficiency

The efficiency at 16 Amps (75% load) is > 80% (83% typical PSTR24 & 74, 84% PSTR110).

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

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 IEC68 (-40°C to +85°C) with a life in excess of 60,000 hours at 60°C ambient and full ripple current. Infant mortality is eliminated with a full load burn in at final test (8 hours) before dispatch. The MTBF is **predicted** at > 60,000 hours in normal service.

Temperature Rating

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

Options

Series Type PSTRXX[YY][F] has the options:

- input ripple filter for high ripple (> 5%) DC sources = type 'F'
- power good (13.8 +/- 5%) floating contact set

Equipment Mechanical Specification

General

The PSTR series power supplies are designed and manufactured with the rigours of railway locomotive applications 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 are supported with Loctite 480 adhesive. The PCB is also conformally 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 silicon insulated high temperature grade. The power supplies consist of a 19 inch standard rack mount, extruded aluminium front panel assembly anodised 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 black silk screen printed lexan label covers the enunciator LEDs effectively sealing the 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.

Mechanical Stability

To provide an independent assessment of the product, the mechanical and thermal stability of the unit was extensively tested by the Philips NATA laboratory for the Freight Rail Corporation Train Radio Project². Although not exactly a 'recommended test' we are also quite pleased that three (out of three) power supplies survived the Beresfield collision which caused locomotives 8219, 8246 & 8247 to be written off³.



Our cover photo by David Johnson shows 8219 upside-down in the wreckage as cranes work to clear the line (used with permission).

Reliability & Maintainability

The supplies are manufactured from discrete components soldered to a through hole plated PCB. In the last 9 years of locomotive operations using this power supply the modal cause of product failure has been high pressure detergent washing and flooding. The MTBF is **predicted** at > 60,000 hours in normal service.

² 16 hours of slow sweep vibration (amplitude in mm = 25 / freq²) and mechanical resonance testing to SRA / Freight Rail specs, 16 hours under full load at 70°C and cycling between -10 & +70°C.

³ despite this impressive result Fanden does not warrant that PSTR power supplies will survive similarly destructive rail accidents in future.