Power Supply System ~ Telecom

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User's Guide

Flatpack2 Rectifiers

Flatpack2 DC Power Supply Systems

350002.013

NS-EN ISO 14001 Certified
Certificate No:
11276-2007-AE-NOR-NA

NS-EN ISO 9001 Certified
Certificate No:
4072-2007-AQ-NOR-NA

Safety Precautions

- ☑ The equipment described in this manual must only be operated by Eltek Valere personnel or by persons who have attended a suitable Eltek Valere training course
- ☑ The equipment represents an energy hazard and failure to observe this could cause terminal injury and invalidate our warranty
- ☑ There are hazardous voltages inside the power system. As the modules incorporate large charged capacitors, it is dangerous to work inside the system even if the mains supply is disconnected
- ☑ Products into which our components are incorporated have to comply with a number of requirements. Installation is to be in accordance with the recommendations herein
- ☑ Please read the manual carefully before using the equipment

350002.013 Issue 6.1, 2008 November

Published 2008-11-25

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1. Introduction

The *Flatpack2* rectifier module is a powerful and cost-effective power supply used in Eltek Valere's *Flatpack2* DC power system.

About this Guide

This booklet provides users of Flatpack2 DC power systems with the required information to install and operate the Flatpack2 rectifier modules. The booklet also presents the rectifier's technical specifications, such as input voltage range, output power, operating temperature range, etc.

Read also the generic and site specific documentation that was delivered with your Flatpack2 DC power system.

For detailed functionality description, browse and search through PowerSuite Online Help.

System Diagram — Flatpack2 DC Power System

The *Flatpack2* rectifier modules are the building blocks of *Flatpack2 PS* systems, see Figure 1. The *Smartpack* controller monitors and controls the whole system, and serves as the local user interface between you and the system. The *PowerSuite* application enables you to configure and operate system from a personal computer.

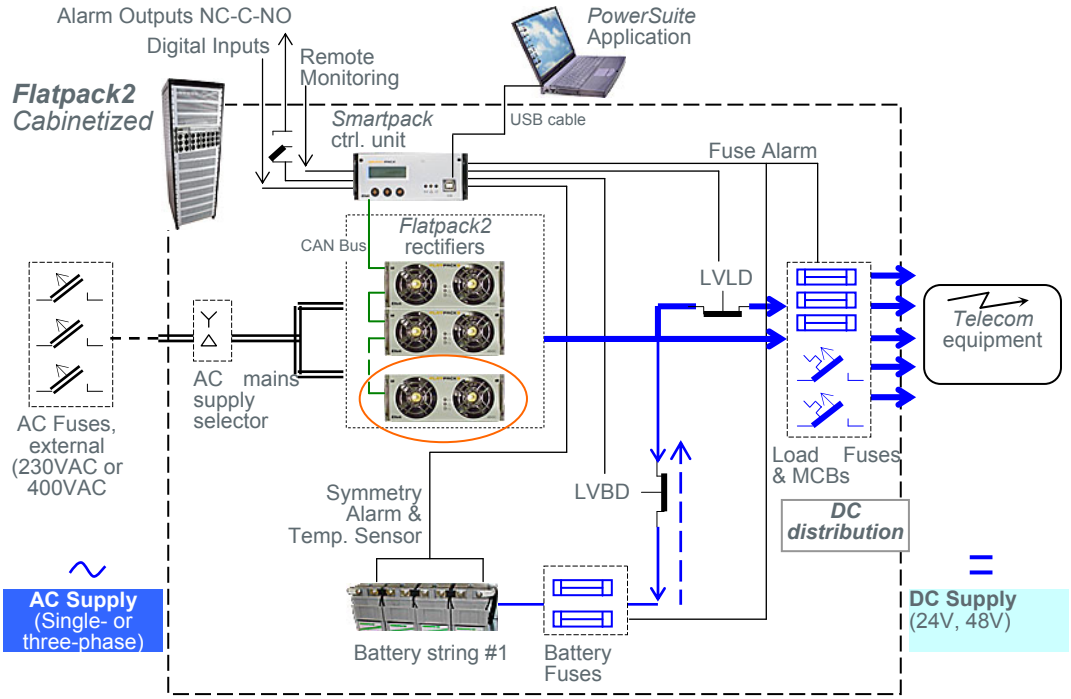


Figure 1 Example of a typical Flatpack2 PS *system for DC power supply of telecom equipment. The system is fed from an external AC mains supply, and consists of rectifiers in power shelves, a control unit and DC distribution unit. Battery banks, LVD contactors, etc. are typically also a part of the system.*

2. Flatpack2 Rectifier

The *Flatpack2* rectifier module is a hot-pluggable, digitally controlled switch mode power supply. The module is designed for battery charging and supplying of high quality DC power to telecom equipment and similar applications.

The rectifier works in stand-alone mode or in parallel with other rectifiers, then communicating via CAN bus with the system's *Smartpack* controller and other connected rectifiers. *Flatpack2* DC power systems are implemented by mounting the rectifiers in 23" or 19" power shelves (4 rectifiers across or 2 *Flatpack2* Dual across).

A wide range of features are implemented in the *Flatpack2* rectifier, as mentioned below.

Key Features

Flatpack2 HE rectifier

Flatpack2 rectifier

Flatpack2 rectifier Dual

- ✓ **Highest efficiency in minimum space**
  Resonant topology makes the module efficiency industry leading, and contributes to the rectifier's ultra compact dimensions.
  Specially, the Flatpack2 HE rectifier stands out with 96.5% efficiency.
- ✓ **Digital controllers**
  Primary and secondary controls are digitalized, enabling excellent monitoring and control characteristics. Also, the number of components has been reduced by 40% compared to previous rectifier generation - for highly reliable, long life, trouble free DC power systems.
- ✓ **Heat management**
  Front-to-back and back-to-front air flow modules, with chassis-integrated heat sinks, gives the module the most suitable working environment and no limitations in the scalability of the desired system solution.
- ✓ **CAN bus networked**
  The *Flatpack2* rectifier is connected in a CAN bus network for communication with the controller and other rectifiers.
- ✓ **Unique connection**
  A true plug-and-play connection system: reducing time-to-install related cost.
- ✓ **Global approvals**
  Flatpack2 is CE marked, UL recognized and NEBS certified for world wide installation.

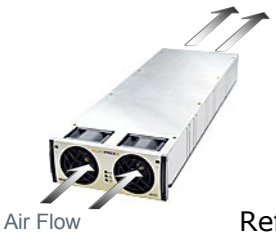
Typical Applications

Wireless, fiber and fixed line communication
Today's communications demand state-of-the-art, cost efficient and compact DC power systems. *Flatpack2* rectifiers deliver industry leading power density and superb reliability at lowest lifetime cost.

Broadband and network access
Increasing network speed demands flexible and expandable DC power solutions. The *Flatpack2* rectifier is your key building block for future needs.

Module Options

The *Flatpack2* rectifier is available in various options, offering different performance characteristics.



Heat Management ~ Front-to-Back Air Flow

Flatpack2 Rectifier 24V, 2000W

Refer to chapter "Specifications Flatpack2 Rectifier 24V, 2000W" on page 11.

Flatpack2 Rectifier 24V, 2000W NiCd - (Nickel-Cadmium)

This rectifier's output voltage window is optimized for charging nickel-cadmium batteries.

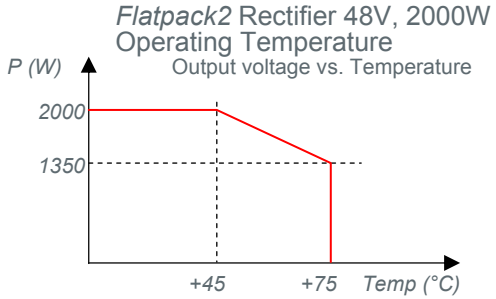
Refer to chapter "Specifications Flatpack2 Rectifier 24V, 2000W NiCd" on page 12.

Flatpack2 Rectifier 48V, 1800W

Refer to chapter "Specifications Flatpack2 Rectifier 48V, 1800W" on page 13

Flatpack2 Rectifier 48V, 2000W

Refer to chapter "Specifications Flatpack2 Rectifier 48V, 2000W" on page 14



Flatpack2 Rectifier 48V, 3000W

Flatpack2 DC power systems are implemented by mounting the rectifiers in dedicated 4AC High Current power shelves.

Refer to chapter "Specifications Flatpack2 Rectifier 48V, 3000W" on page 15.

Air Flow

Flatpack2 Rectifier 24V, 4000W Dual

Flatpack2 DC power systems are implemented by mounting the rectifiers in 19" power shelves, 2 rectifiers across.

Refer to chapter "Specifications Flatpack2 Rectifier 24V, 4000W Dual" on page 17.

Flatpack2 Rectifier 48V, 4000W Dual

For a description, refer to chapter "*Flatpack2* Rectifier 24V, 4000W Dual", page 7. For technical data read chapter "Specifications Flatpack2 Rectifier 48V, 4000W Dual", page 16.

Flatpack2 Rectifier 48V, 2000W HE - (High Efficiency)

The most efficient rectifier in the industry!

The combination of innovative design, efficiency and reliability makes the Flatpack2 HE rectifier stands out. With an efficiency of up to 96.5%, the losses have been reduced by 50% compared to the current industry standard.

Also, the Flatpack2 HE rectifier has an extremely high efficiency at low load, which historically has been a drawback with most modern soft switching technologies.

Refer to chapter "Specifications Flatpack2 Rectifier 48V, 2000W HE" on page 18.

Flatpack2 Rectifier 24V, 1800W HE - (High Efficiency)

For a description, refer to chapter "*Flatpack2* Rectifier 48V, 2000W HE - (High Efficiency)", page 7. For technical data, read chapter "Specifications Flatpack2 Rectifier 24V, 1800W HE", page 19.

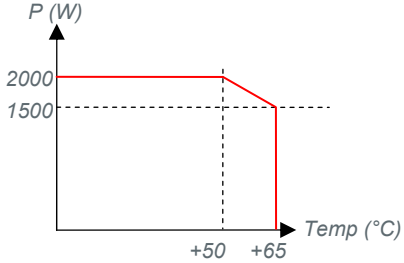
Heat Management ~ Back-to-Front Air Flow

Air Flow

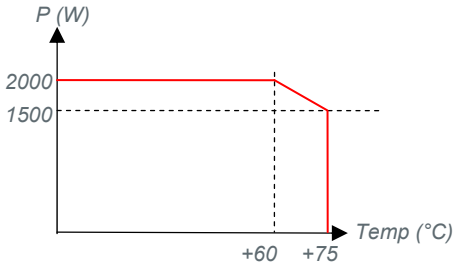
Flatpack2 Rectifier 48V, 2000W BF and 48V, 2000W BF HT

Refer to chapter "Specifications Flatpack2 Rectifier 48V, 2000W" on page 14

The technical specifications for I: "Flatpack2 Rectifier 48V, 2000W", II: "Flatpack2 Rectifier 48V, 2000W BF" and III: "Flatpack2 Rectifier 48V, 2000W BF HT" are the same, except for the operating temperatures, which are: I: (see page 14), II: —40 C to +65°C (—40°F to +149°F) and III: —40 C to +75°C (—40°F to +167°F).



***Flatpack2* Rectifier 48V, 2000W BF**
Operating Temperature
Output voltage vs. Temperature



***Flatpack2* Rectifier 48V, 2000W BF HT**
Operating Temperature
Output voltage vs. Temperature

3. Installation of *Flatpack2 Rectifiers*

Safety Precautions

Get acquantied with the satety precautions on page 2, before installing or handling the equipment.

CAUTION: Double Pole / Neutral Fusing. There is a Mains fuse in each line.

Mounting and Removing Rectifiers

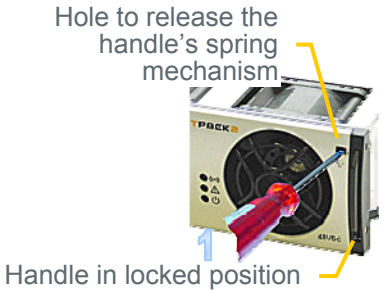
The Flatpack2 rectifiers incorporate handles that serve both to lock the modules into position and to pull them out of their housings.

Device hazard

CAUTION: The rectifiers may be warm, but **do not hand-carry** them by their handles. **Open the handles before inserting** them into the power shelves (hot-pluggable).

Mount **blind panels** in unused module locations.

Electric shock



Mounting the *Flatpack2* rectifier (hot-pluggable)

1. **Open the handles**
   (insert a screwdriver into the holes to release the spring mechanism)
2. **Insert the module** fully into the power shelf
3. **Lock the handles**
   (push the handles up into their housings (locked position), so that the module is securely locked)

Removing the *Flatpack2* rectifier

1. **Open the handles**
   (insert a screwdriver into the holes to release the spring mechanism)
2. **Remove the module**
   (use both handles to pull the module loose from the connector; support from underneath)

Figure 2 Flatpack2 rectifiers's locking mechanism

Device hazard

CAUTION: Do not relocate **already hot-plugged rectifiers** to other positions in the power shelf.
New *Flatpack2* rectifiers must be hot-plugged in the power shelf, one at time, starting with position 1, 2, 3 and so on. This is usually performed before shipment of the system. Read your system's quick start guide for more information.

WARNING: To replace installed rectifiers with new ones, remove the installed rectifiers and wait for the controller to notify communication error with the extracted rectifiers. Push the new rectifiers firmly inwards — one module at a time, allowing a 2s delay — to plug them in the power shelf. Start with the shelf position with lowest ID number. Lock their handles.

Removing Blind Panels

Release the panel's upper left and right corners by inserting a small screwdriver into the panel's upper left gap, and carefully press down and out to release the locking tabs. Repeat on the upper right gap. Refer to the *Flatpack2* system's quick start guide for more information.

Connections

All connections are implemented by inserting the *Flatpack2* module fully into the power shelf, thus plugging the rectifier to the self's back wiring card (hot-pluggable).

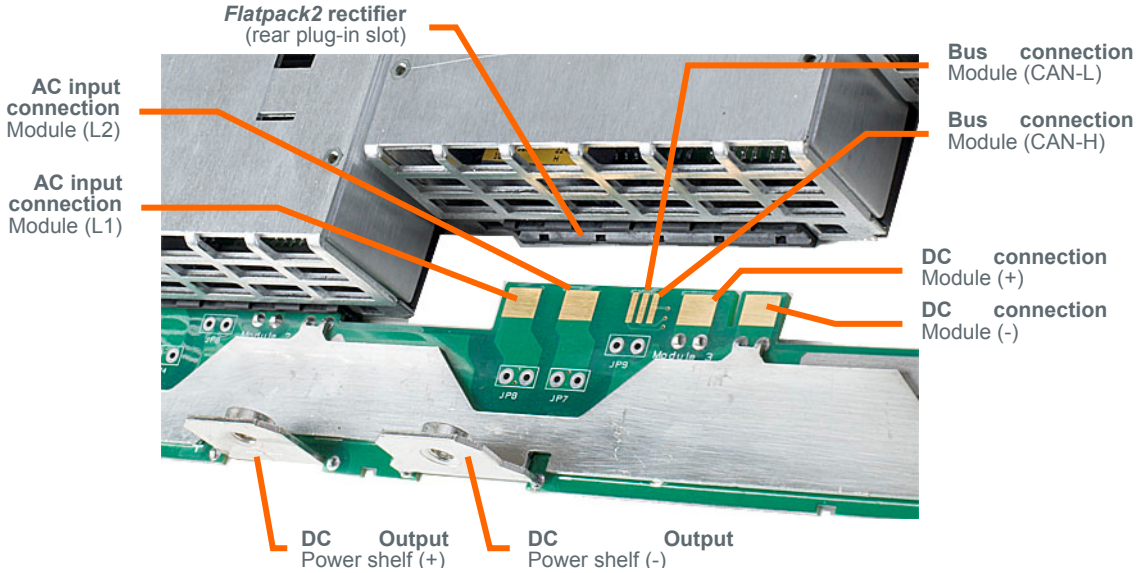


Figure 3 Flatpack2 module's rear plug-in connections to power shelf's back wiring card

For details about other power shelf signals, type of power shelf, etc., please read the system's generic and specific documentation, or contact your dealer or Eltek Valere representative.

CAN Bus Addressing (plug-and-play)

When a *Flatpack2* rectifier is hot-plugged in the power shelf the first time, the *Smartpack* controller automatically assigns the rectifier with the next available ID number (CAN bus address). The rectifier will retain its ID (and serial number), even after removing and reinserting it in the power shelf.

The rectifiers' IDs are assigned from 1 and upwards. When a module is plugged in, the *Smartpack* controller automatically increases the number of communicating rectifiers in the CAN network.

Correct Rectifier Position in Power Shelves

Flatpack2 DC power systems are usually shipped from factory with the rectifier modules already installed in the correct position in the power shelves, with respect to their CAN bus address or ID number.

This relationship is very important for the correct monitoring of the mains three phases, as the *Smartpack* controller always uses rectifier ID 01, 02 and 03 to monitor mains phase L1, L2 and L3 respectively. If these rectifiers malfunction, rectifier ID 04, 05 and 06 will automatically take over.

For example: accidentally inserting a rectifier with ID 02 in a power shelf position internally connected to mains phase L1, will cause the controller to monitor L1 "thinking" it monitors L2.

Firmware Upgrade of the Rectifier Modules

Please, contact Eltek Valere Service Dep. if you need to upgrade the rectifiers' firmware.

4. Operation

The *Flatpack2* Rectifier Module is designed for parallel operation in a system. The front panel LEDs provides information about the rectifier status and CAN bus activity.

Front Panel Interface

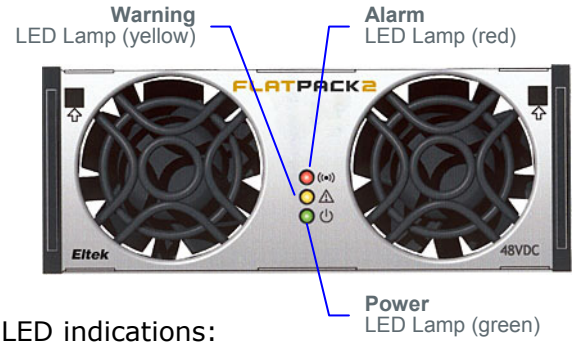


Figure 4 Example of a Flatpack2 Rectifier Module's front panel

The *Flatpack2* Rectifier Module has the following LED indications:

- "Power" (green) indicates that the power supply is OFF, ON and communicating
- "Alarm" (red) indicates an alarm situation
- "Warning" (yellow) indicates an abnormal situation

LED Indicators

The following events will activate the *Flatpack2* rectifier's front LEDs:

LED	Status	Description
Power (green)	ON	Rectifier is powered
	Flashing	*Smartpack* controller accessing information on the rectifier
	OFF	Mains are unavailable
Warning (yellow)	ON	▪ Rectifier is in Derating Mode (reduced output power) due to high internal temperature, or low input voltage, or fan failure ▪ The remote Battery Current Limit is activated ▪ AC input voltage is out of range ▪ Rectifier in stand-alone mode (or loss of communication with the *Smartpack* controller
	Flashing	Rectifier is in Over-voltage Protection Mode (AC input)
	OFF	No abnormal situation is present
Alarm (red)	ON	▪ Rectifier is in Shut-down Mode due to low mains, or high internal temperature, or high output voltage ▪ Internal rectifier failure (malfunction) ▪ Fan failure (single or double fan malfunction) ▪ Low output voltage ▪ CAN bus failure
	OFF	No alarm situation is present

Refer also to chapter "Technical Specifications", page 11.

5. Technical Specifications

Specifications Flatpack2 Rectifier 24V, 2000W

AC Input	
Voltage	85-290 VAC (Nominal 176 – 275 VAC)
Frequency	44 to 66Hz
Maximum Current	13.0 A_{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 290 VAC

DC Output	
Voltage	26.7 VDC (adj. range: 21.0-29.0 VDC)
Output Power	○ 2000 W at nominal input ○ 1800 W at nominal input above 28.0 VDC
Maximum Current	84.0 Amps at 24 VDC and nominal input
Current Sharing	±5% of maximum current from 10% to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 21 VDC at 1000W load
Ripple and Noise	< 100 mV peak to peak, 30 MHz bandwidth < 0.96 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Blocking diode ○ Short circuit proof ○ High temperature protection

Other Specifications	
Efficiency	Typical 89%
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure, one or two fans. ○ Low voltage alarm at 21.0V ○ CAN bus failure
Warnings:	○ Low temperature shutdown ○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at overvoltage ○ Loss of CAN communication with control unit, stand alone mode
Operating temp	-40 to +75°C (-40 to +167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	2 fans (front to back airflow)
Fan Speed	Temperature and load regulated
MTBF	> 240, 000 hours Telcordia SR-332 Issue I, method III (a) ($T_{ambient}$: 25°C)
Acoustic Noise	< 65dBA at nominal input and 70% load ($T_{ambient}$ < 30°C)
Humidity	○ Operating: 5% to 95% RH non-condensing ○ Storage: 0% to 99% RH non-condensing
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13”)
Weight	1.9 kg (3.97 lbs)

Applicable Standards	
Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 (telecommunication network) EN 61000-6-4 (emission, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-1 (immunity, light industry) Telcordia NEBS GR1089 CORE
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2 ETSI EN 300 132-2 Telcordia NEBS GR63 CORE Zone 4 RoHS compliant

Specifications are subject to change without notice 241115.200.DS3 v2

Specifications Flatpack2 Rectifier 24V, 2000W NiCd

AC Input

Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	44 to 66Hz
Maximum Current	12.5 A_{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output

Voltage	○ Adjustable range: 21.5-36.0 VDC ○ Default voltage: 26.7 VDC
Output Power	2000 W at nominal input
Maximum Current	70.0 Amps at 29 VDC and nominal input
Current Sharing	±5% of maximum current from 10% to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 21.5 VDC at 1500W load
Ripple and Noise	< 100 mV peak to peak, 30 MHz bandwidth < 0.96 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Fuse on output ○ Short circuit proof ○ High temperature protection

Other Specifications

Efficiency	Typical 91%
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure, one or two fans. ○ Low voltage alarm at 21.0V ○ CAN bus failure
Warnings:	○ Low temperature shutdown ○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at overvoltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	2 fans (front to back airflow)
Fan Speed	Temperature and load regulated
MTBF	> 200, 000 hours Telcordia SR-332 Issue I, method III (a) ($T_{ambient}$: 25°C)
Acoustic Noise	< 65dBA at nominal input and 70% load ($T_{ambient}$ < 30°C)
Humidity	○ Operating: 5% to 95% RH non-condensing ○ Storage: 0% to 99% RH non-condensing
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13”)
Weight	1.9 kg (3.97 lbs)

Applicable Standards

Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 (telecommunication network) EN 61000-6-4 (emission, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-1 (immunity, light industry) Telcordia NEBS GR1089 CORE
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2 ETSI EN 300 132-2 Telcordia NEBS GR63 CORE Zone 4 RoHS compliant

Specifications are subject to change without notice 241115.250.DS3 v2

Specifications Flatpack2 Rectifier 48V, 1800W

AC Input

Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	10.7 Arms maximum at nominal input and full load
Power Factor	> 0.99 at 20% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output

Voltage	53.5 VDC (adj. range: 43.5-57.6 VDC)
Output Power	1800 W at nominal input
Maximum Current	37.5 Amps at 48 VDC and nominal input
Current Sharing	±5% of maximum current from 10% to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 43.5 VDC at 1500W load
Ripple and Noise	○ < 100 mV peak to peak, ○ 30 MHz bandwidth ○ < 0.96 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Blocking diode ○ Short circuit proof ○ High temperature protection

Other Specifications

Efficiency	Typical 92%, min. 91% at 40-90% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure, one or two fans. ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at overvoltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +70°C (-40 to +158°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	2 fans (front to back airflow)
Fan Speed	Temperature and load regulated
MTBF	> 405, 000 hours Telcordia SR-332 Issue I, method III (a) (Tambient : 25°C)
Acoustic Noise	< 50dBA at nominal input and 70% load (Tambient < 30°C)
Humidity	Operating: 5% to 95% RH non-condensing Storage: 0% to 99% RH non-condensing
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13”)
Weight	1.8 kg (3.97 lbs)

Applicable Standards

Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 (telecommunication network) EN 61000-6-4 (emission, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-1 (immunity, light industry) Telcordia NEBS GR1089 CORE
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2 ETSI EN 300 132-2 Telcordia NEBS GR63 CORE Zone 4 RoHS compliant

Specifications are subject to change without notice 241115.001.DS3 v8

Specifications Flatpack2 Rectifier 48V, 2000W

AC Input

Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	12.5 Arms maximum at nominal input and full load
Power Factor	> 0.99 at 20% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output

Voltage	53.5 VDC (adj. range: 43.5-57.6 VDC)
Output Power	2000 W at nominal input
Maximum Current	41.7 Amps at 48 VDC and nominal input
Current Sharing	±5% of maximum current from 10% to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 43.5 VDC at 1500W load
Ripple and Noise	○ < 100 mV peak to peak, ○ 30 MHz bandwidth ○ < 0.96 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Blocking diode ○ Short circuit proof ○ High temperature protection

Other Specifications

Efficiency	Typical 92%, min. 91% at 40-90% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure, one or two fans. ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	○ Low temperature shutdown ○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at overvoltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +158°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	2 fans (front to back airflow)
Fan Speed	Temperature and current regulated
MTBF	> 350, 000 hours Telcordia SR-332 Issue I, method III (a) (Tambient : 25°C)
Acoustic Noise	< 55dBA at nominal input and full load (Tambient < 30°C)
Humidity	Operating: 5% to 95% RH non-condensing Storage: 0% to 99% RH non-condensing
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13”)
Weight	1.9 kg (4.19lbs)

Applicable Standards

Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 (telecommunication network) EN 61000-6-1 (immunity, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-4 (emission, industry) Telcordia NEBS GR1089 CORE
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2 (-1, -2, -3) ETSI EN 300 132-2 Telcordia NEBS GR63 CORE Zone 4 RoHS compliant

Specifications are subject to change without notice 241115.100.DS3 v4

Specifications Flatpack2 Rectifier 48V, 3000W

AC Input

Voltage	85-300 VAC (Nominal 176 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	19.2 A_{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output

Voltage	53.5 VDC (adj. range: 43.5-58.0 VDC)
Output Power	3000 W within nominal input range, linear derating to 1380 W at 85 VAC
Maximum Current	62.5 Amps at 48 VDC and nominal input
Current Sharing	±5% of maximum current from 10% to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 10ms; output voltage> 43.5 VDC at full load
Ripple and Noise	○ < 100 mV peak to peak, 30 MHz bandwidth ○ < 2.0 mV_{rms} psophometric
Output Protection	○ Over-voltage shutdown ○ Output fuse ○ Short circuit proof ○ High temperature protection

Other Specifications

Efficiency	Typical 93%, min. 92% at 25-100% load
Isolation	○ 3.0 KVAC – input and output ○ 1.5 KVAC – input earth ○ 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Over-voltage shutdown on output ○ Fan failure, one or two fans. ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	○ Low temperature shutdown ○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at over-voltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: Rectifier failure ○ Yellow LED: Rectifier warning
Operating temp	-40 to +75°C (-40 to +158°F), linear derating from +45°C to 2130W at +75°C
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	2 fans (front to back airflow)
Fan Speed	Temperature and current regulated
MTBF	> 300, 000 hours Telcordia SR-332 Issue I, method III (a) ($T_{ambient}$: 25°C)
Acoustic Noise	< 65dBA at nominal input and full load ($T_{ambient}$ < 30°C)
Humidity	Operating: 5% to 95% RH non-condensing Storage: 0% to 99% RH non-condensing Conformal coating on PCB
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13”)
Weight	1.9 kg (4.19lbs)

Applicable Standards

Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2	
EMC	EN61000-6-1 EN61000-6-2 EN61000-6-3 EN61000-6-4	EMC, Immunity, Light industry EMC, Immunity, Industry EMC, Emission, Light industry (with additional filtering in power shelf) EMC, Emission, Industry
Mains Harmonics	EN61000-3-2	
Environment	ETSI EN 300 019-2 ETSI EN 300 132-2 RoHS	

Specifications are subject to change without notice 241119.100.DS3 –v2

Specifications *Flatpack2* Rectifier 48V, 4000W Dual

AC Input	
Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	25 Arms maximum at nominal input and full load
Power Factor	> 0.99 at 20% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output	
Voltage	53.5 VDC (adj. range: 43.5-57.6 VDC)
Output Power	4000 W at nominal input
Maximum Current	74.8 Amps at 53.5 VDC and nominal input
Current Sharing	±3% of maximum current from 10% to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 43.5 VDC at 3000W load
Ripple and Noise	○ < 100 mV peak to peak, ○ 30 MHz bandwith ○ < 0.96 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Blocking diode ○ Short circuit proof ○ High temperature protection

Other Specifications	
Efficiency	Typical 92%, min. 91% at 40-90% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure, one or two fans. ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	○ Low temperature shutdown ○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at overvoltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +158°F), derating above +45°C (+113°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	4 fans (front to back airflow)
Fan Speed	Temperature and current regulated
MTBF	> 150, 000 hours Telcordia SR-332 Issue I, method III (a) (Tambient : 25°C)
Acoustic Noise	< 55dBA at nominal input and full load (Tambient < 30°C)
Humidity	Operating: 5% to 95% RH non-condensing Storage: 0% to 99% RH non-condensing
Dimensions	218 x 41.5 x 327mm (wxhxd) (8.5 x 1.69 x 13”)
Weight	3.8 kg (8.4lbs)

Applicable Standards	
Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 (telecommunication network) EN 61000-6-1 (immunity, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-4 (emission, industry)
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2 (-1, -2, -3) ETSI EN 300 132-2 RoHS compliant

Specifications are subject to change without notice 241115.500.DS3 v3

Specifications *Flatpack2* Rectifier 24V, 4000W Dual

AC Input	
Voltage	85-290 VAC (Nominal 176 – 275 VAC)
Frequency	44 to 66Hz
Maximum Current	25 Arms maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 290 VAC

DC Output	
Voltage	26.7 VDC (adj. range: 21.0-29.0 VDC)
Output Power	4000 W at nominal input, derating linear below 176VAC
Maximum Current	150.0 Amps at 26.7 VDC and nominal input
Current Sharing	±5% of maximum current from 10% to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 21 VDC at 2000W load
Ripple and Noise	< 100 mV peak to peak < 0.96 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Blocking diode ○ Short circuit proof ○ High temperature protection

Other Specifications	
Efficiency	Typical 89%
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure, one or two fans. ○ Low voltage alarm at 21.0V
Warnings:	○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at over voltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +167°F), derating above +45°C (+113°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	4 fans (front to back airflow)
Fan Speed	Temperature and load regulated
MTBF	> 100, 000 hours Telcordia SR-332 Issue I, method III (a)
Acoustic Noise	< 65dBA at nominal input and 70% load (Tambient < 30°C)
Humidity	○ Operating: 5% to 95% RH non-condensing ○ Storage: 0% to 99% RH non-condensing
Dimensions	189 x 41.5 x 327mm (wxhxd) (8.5 x 1.69 x 13”)
Weight	3.8 kg (8.4 lbs)

Applicable Standards	
Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 (telecommunication network) EN 61000-6-4 (emission, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-1 (immunity, light industry)
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2 ETSI EN 300 132-2 RoHS compliant

Specifications are subject to change without notice 241115.400.DS3 v2

Specifications Flatpack2 Rectifier 48V, 2000W HE

AC Input

Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	11.6 A_{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output

Voltage	53.5 VDC (adj. range: 43.5-57.6 VDC)
Output Power	2000 W at nominal input
Maximum Current	41.7 Amps at 48 VDC and nominal input
Current Sharing	±5% of maximum current from 10 to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 43.5 VDC at 1500W load
Ripple and Noise	○ < 250 mV peak to peak, ○ 30 MHz bandwidth ○ < 2 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Hot plug-in - Inrush current limiting ○ Short circuit proof ○ High temperature protection

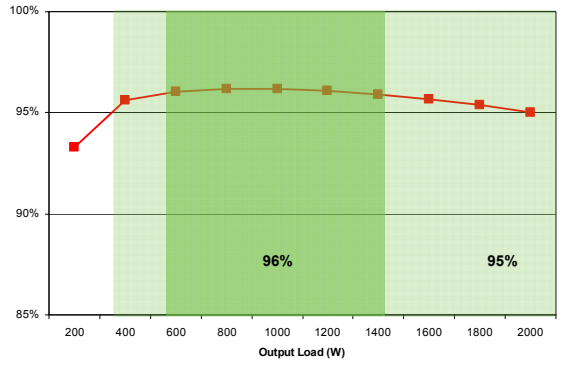
Other Specifications

Efficiency	>96% at 30-70% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	○ Low temperature shutdown ○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at overvoltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	Fan (front to back airflow)
Fan Speed	Temperature and current regulated
MTBF	> 350, 000 hours Telcordia SR-332 Issue I, method III (a) ($T_{ambient}$:25°C)
Acoustic Noise	< 20dBA at nominal input and full load ($T_{ambient}$<= 25°C) < 56dBA at nominal input and full load ($T_{ambient}$ > 40°C)
Humidity	Operating: 5% to 95% RH non-condensing Storage: 0% to 99% RH non-condensing
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13”)
Weight	1.950 kg (4.3lbs)

Applicable Standards

Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 EN 61000-6-1 (immunity, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-4 (emission, industry) Telcordia NEBS GR1089 CORE
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2-1 Class 1.2 ETSI EN 300 019-2-2 Class 2.3 ETSI EN 300 019-2-3 Class 3.2 ETSI EN 300 132-2 Telcordia NEBS GR63 CORE Zone 4 RoHS compliant

Efficiency



Specifications are subject to change without notice

241115.105.DS3 – v8

Specifications Flatpack2 Rectifier 24V, 1800W HE

AC Input

Voltage	85-300 VAC (Nominal 176 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	11.25 A_{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output

Voltage	26.7 VDC (adj. range: 21.7-28.8 VDC)
Output Power	1800 W at nominal input
Maximum Current	75 Amps at 24 VDC and nominal input
Current Sharing	±5% of maximum current from 10 to 100% load
Static voltage regulation	±0.5% from 10% to 100% load
Dynamic voltage regulation	±5.0% for 10-90% or 90-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 21 VDC at 1000W load
Ripple and Noise	○ < 250 mV peak to peak, ○ 30 MHz bandwidth ○ < 2 mV rms psophometric
Output Protection	○ Overvoltage shutdown ○ Hot plug-in - Inrush current limiting ○ Short circuit proof ○ High temperature protection

Applicable Standards

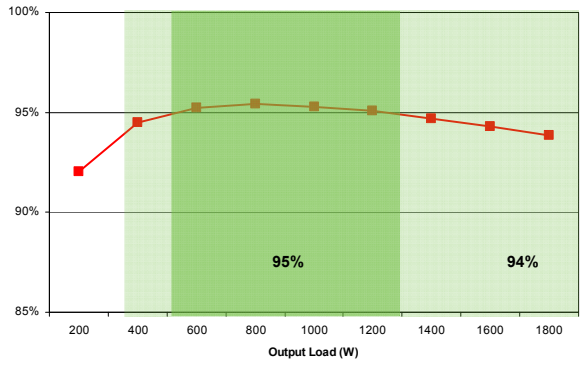
Electrical safety	IEC 60950-1 UL 60950-1 CSA 22.2
EMC	ETSI EN 300 386 V.1.3.2 EN 61000-6-1 (immunity, light industry) EN 61000-6-2 (immunity, industry) EN 61000-6-3 (emission, light industry) EN 61000-6-4 (emission, industry) Telcordia NEBS GR1089 CORE
Mains Harmonics	EN 61000-3-2
Environment	ETSI EN 300 019-2-1 Class 1.2 ETSI EN 300 019-2-2 Class 2.3 ETSI EN 300 019-2-3 Class 3.2 ETSI EN 300 132-2 Telcordia NEBS GR63 CORE Zone 4 RoHS compliant

Specifications are subject to change without notice

Other Specifications

Efficiency	>95% at 30-70% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm at 21.5V ○ CAN bus failure
Warnings:	○ Low temperature shutdown ○ Rectifier in power derate mode ○ Remote battery current limit activated ○ Input voltage out of range, flashing at overvoltage ○ Loss of CAN communication with control unit, stand alone mode
Visual indications	○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	Fan (front to back airflow)
Fan Speed	Temperature and current regulated
MTBF	> 300, 000 hours Telcordia SR-332 Issue I, method III (a) ($T_{ambient}$:25°C)
Acoustic Noise	< 40dBA at nominal input and full load ($T_{ambient}$ < 25°C) < 58dBA at nominal input and full load ($T_{ambient}$ > 40°C)
Humidity	Operating: 5% to 95% RH non-condensing Storage: 0% to 99% RH non-condensing
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13”)
Weight	1.950 kg (4.3lbs)

Efficiency



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