

User's Guide

Flatpack2 Rectifiers



Flatpack2 DC Power Supply Systems

Information in this document is subject to change without notice and does not represent a commitment on the part of *Eltek Valere*.

No part of this document may be reproduced or transmitted in any form or by any means — electronic or mechanical, including photocopying and recording — for any purpose without the explicit written permission of *Eltek Valere*.

Copyright ©: *Eltek Valere*, 2010



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 7.0, 2010 Sep

Published 2010-09-07

Mafe

Table of Contents

1. Introduction	4
About this Guide	4
System Diagrams — Flatpack2 DC Power Systems	4
Flatpack2 PS System ~ Telecom	4
Flatpack2 PS System ~ Hybrid Solar	5
Flatpack2 PS System ~ Industrial.....	6
2. Flatpack2 Rectifier	7
Key Features.....	7
Typical Applications	7
Module Options	8
Heat Management ~ Front-to-Back Air Flow	8
Flatpack2 Rectifier 24V, 2000W	8
Flatpack2 Rectifier 24V, 2000W WOR	8
Flatpack2 Rectifier 24V, 1800W HE	9
Flatpack2 Rectifier 48V, 1800W	9
Flatpack2 Rectifier 48V, 2000W	9
Flatpack2 Rectifier 48V, 3000W	9
Flatpack2 Rectifier 48V, 2000W HE	9
Flatpack2 Rectifier 48V, 3000W HE	10
Flatpack2 Rectifier 48-60V, 2000W HE	10
Flatpack2 Solar Charger 48V, 1500W HE – (Solar)	10
Flatpack2 Rectifier 110VDC, 2000W HE WOR - (Industrial).....	11
Flatpack2 Rectifier 220VDC, 2000W HE WOR - (Industrial).....	11
Heat Management ~ Back-to-Front Air Flow	12
Flatpack2 Rectifier 48V, 2000W BF	12
Flatpack2 Rectifier 48V, 2000W HE, BF	12
3. Installation of Flatpack2 Rectifiers	13
Safety Precautions.....	13
Mounting and Removing Rectifiers	13
Removing Blind Panels	13
Connections	14
CAN Bus Addressing (plug-and-play)	14
Correct Rectifier Position in Power Shelves	14
Firmware Upgrade of the Rectifier Modules	14
4. Operation	15
Front Panel Interface	15
LED Indicators	15
5. Technical Specifications	16
Specifications Flatpack2 Rectifier 24V, 2000W	16
Specifications Flatpack2 Rectifier 24V, 2000W WOR.....	17
Specifications Flatpack2 Rectifier 24V, 1800W HE	18
Specifications Flatpack2 Rectifier 48V, 1800W	19
Specifications Flatpack2 Rectifier 48V, 2000W	20
Specifications Flatpack2 Rectifier 48V, 3000W	21
Specifications Flatpack2 Rectifier 48V, 2000W HE	22
Specifications Flatpack2 Rectifier 48V, 3000W HE	23
Specifications Flatpack2 Rectifier 48-60V, 2000W HE	24
Specifications Flatpack2 Solar Charger 48V, 1500W HE – (Solar)	25
Specifications Flatpack2 Rectifier 110VDC, 2000W HE WOR - (Industrial)	26
Specifications Flatpack2 Rectifier 220VDC, 2000W HE WOR - (Industrial)	27
Specifications Flatpack2 Rectifier 48V, 2000W HE, BF.....	28

1. Introduction

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

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 rectifiers' 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 WebPower or PowerSuite Online Help.

System Diagrams — Flatpack2 DC Power Systems

The *Flatpack2* modules are the building blocks of *Flatpack2 PS* systems, used for DC power supply of telecom and industrial equipment, in grid-fed sites or hybrid solar sites.

Flatpack2 PS System ~ Telecom

The example in Figure 1 represents 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 controller and DC distribution unit. Battery banks, LVD contactors, etc. are typically also a part of the system. The system controller monitors the whole system, and serves as the local user interface. You can configure the system from a standard web browser, or installing the *PowerSuite* application in a computer.

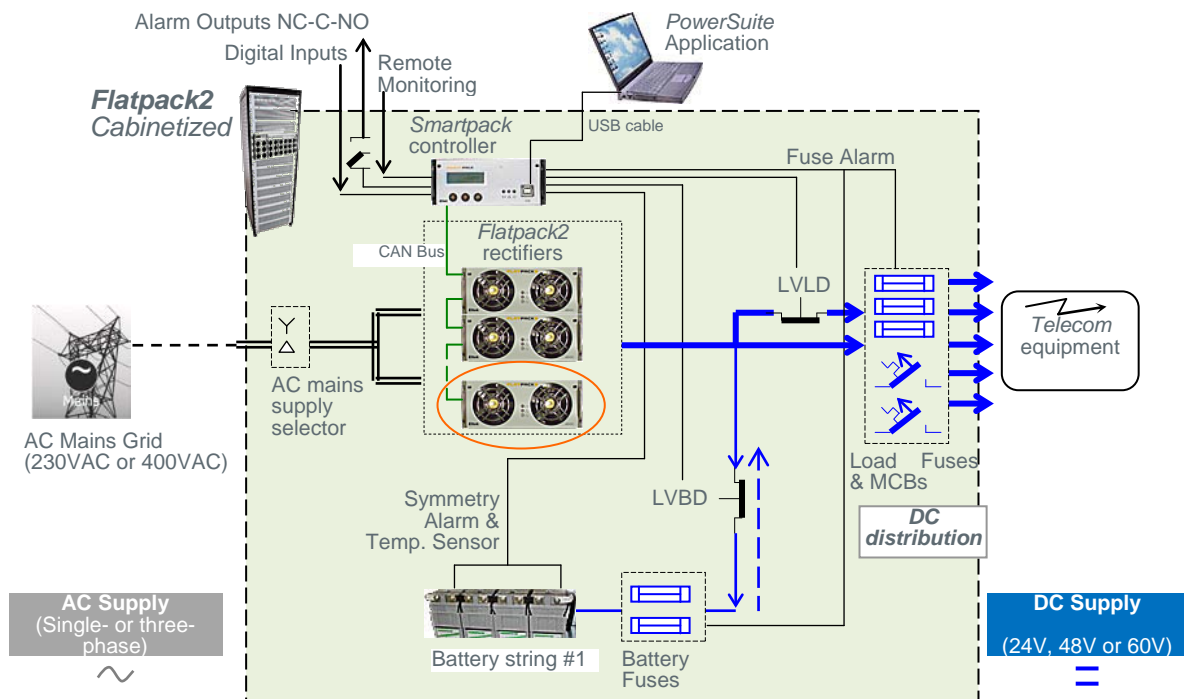


Figure 1 Typical *Flatpack2 PS* system for DC power supply of telecom equipment

Flatpack2 PS System ~ Hybrid Solar

The example in Figure 2 represents a typical hybrid, solar *Flatpack2* PS system for DC power supply of telecom and industrial equipment.

The system is fed from strings of solar panels (DC feed), and uses a diesel generator as AC feed backup at night and during cloudy days, thus ensuring extra battery charging. Extra AC feed backup can also be supplied by wind turbines or from the Mains grid.

The hybrid, solar system consists of paralleled solar chargers and rectifiers in power shelves, *Smartpack2*-based system controllers and DC distribution unit. Battery banks, LVD contactors, etc. are typically also a part of the system.

The *Smartpack2 Master* controller serves as the local user interface, while the *Smartpack2 Basic* controller monitors the system's internal wiring. The *I/O Monitor2* CAN node provides the system with input monitoring and output controlling signals.

You can configure the system from a standard web browser, via *WebPower*, or installing the *PowerSuite* application in a computer.

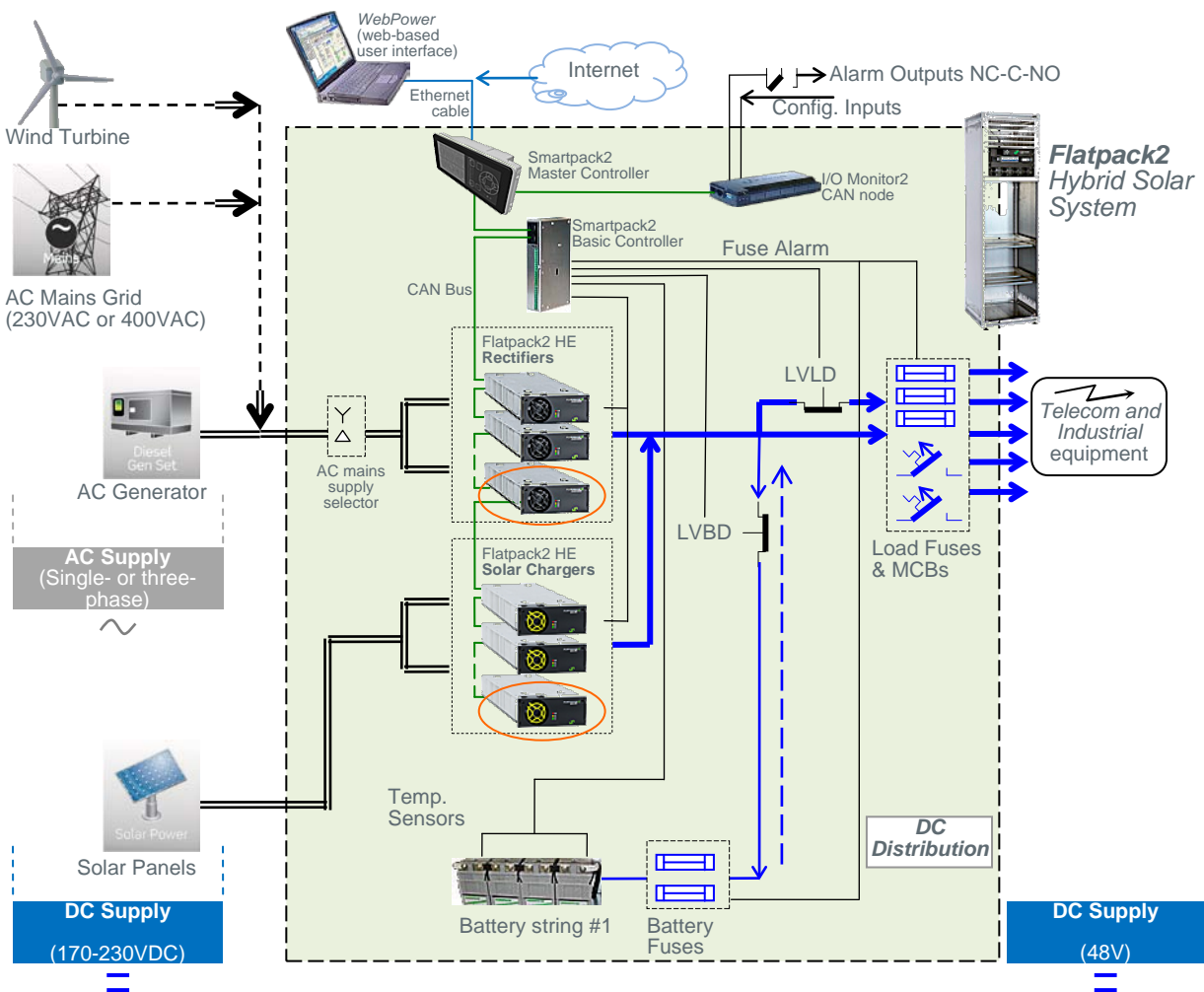


Figure 2 Typical hybrid, solar Flatpack2 PS system for DC power supply of telecom or industrial equipment

Flatpack2 PS System ~ Industrial

The example in Figure 3 represents a typical *Flatpack2* PS system for DC power supply of industrial equipment, in all areas of the industry, power generation and distribution.

The system is fed from an external AC mains supply, and consists of rectifiers in power shelves, a system controller and DC distribution unit. Battery banks, LVD contactors, etc. are typically also a part of the system.

The system controller monitors the whole system, and serves as the local user interface. You can configure the system from computer, installing the *MMT* application.

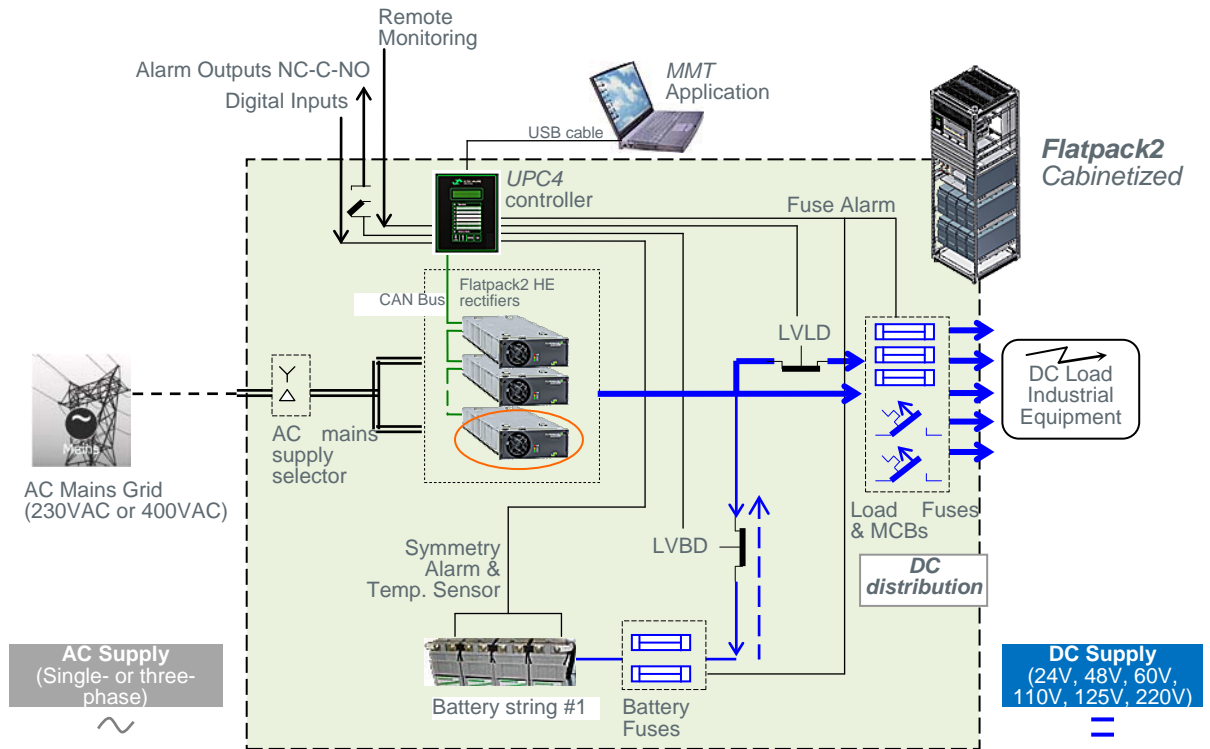


Figure 3 Typical Flatpack2 PS system for DC power supply of industrial equipment

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, industrial, solar hybrid 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 main controller and other connected rectifiers. *Flatpack2* DC power systems are implemented by mounting the rectifiers in 23" or 19" power shelves (4 rectifiers across).

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

Key Features

- ✓ **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 worldwide installation

Flatpack2 HE rectifier



Flatpack2 rectifier



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.

Industrial and Solar Hybrid sites

Also appropriate for power supply facilities with or without battery in all areas of industry, power generation and power distribution. The solar charger option is suitable for any telecom site with autonomous (solar only) or hybrid solar power.

Module Options

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

Flatpack2 Module Options ~ Overview	
241115.200	Flatpack2 Rectifier 24V, 2000W
241115.250	Flatpack2 Rectifier 24V, 2000W WOR
241115.205	Flatpack2 Rectifier 24V, 1800W HE
241115.001	Flatpack2 Rectifier 48V, 1800W
241115.100	Flatpack2 Rectifier 48V, 2000W
241119.100	Flatpack2 Rectifier 48V, 3000W
241115.105	Flatpack2 Rectifier 48V, 2000W HE
241119.105	Flatpack2 Rectifier 48V, 3000W HE
241115.705	Flatpack2 Rectifier 48-60V, 2000W HE
241115.650	Flatpack2 Solar Charger 48V, 1500W HE - (Solar)
241115.805	Flatpack2 Rectifier 110VDC, 2000W HE WOR - (Industrial)
241115.815	Flatpack2 Rectifier 220VDC, 2000W HE WOR - (Industrial)
241115.110	Flatpack2 Rectifier 48V, 2000W BF
241115.115	Flatpack2 Rectifier 48V, 2000W HE, BF



CAUTION:

Never install *Flatpack2* rectifiers in power shelves with **different output voltage than the rectifier's**. The rectifier's output voltage and the power system's output voltage must always be the same.



Heat Management ~ Front-to-Back Air Flow

The following *Flatpack2* rectifier options are always to be installed in power systems designed for Front-to-Back Air Flow heat management.



CAUTION:

Do **not install** rectifiers with **Back-to-Front heat management** in power systems designed for Front-to-Back heat management; otherwise the product guaranty becomes invalidated.

Flatpack2 Rectifier 24V, 2000W

Part number 241115.200. Refer to chapter "Specifications Flatpack2 Rectifier 24V, 2000W" on page 16.

Flatpack2 Rectifier 24V, 2000W WOR

Part number 241115.250. This rectifier's Wide Output voltage Range is optimized for charging any type of batteries.

Refer to chapter "Specifications Flatpack2 Rectifier 24V, 2000W WOR" on page 17.



Flatpack2 Rectifier 24V, 1800W HE

Part number 241115.205. For a description, refer to chapter "Flatpack2 Rectifier 48V, 2000W HE", page 9. For technical data, read chapter "Specifications Flatpack2 Rectifier 24V, 1800W HE", page 18.

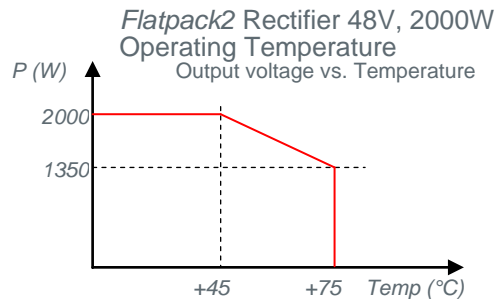


Flatpack2 Rectifier 48V, 1800W

Part number 241115.001. Refer to chapter "Specifications Flatpack2 Rectifier 48V, 1800W" on page 19

Flatpack2 Rectifier 48V, 2000W

Part number 241115.100. Refer to chapter "Specifications Flatpack2 Rectifier 48V, 2000W" on page 20



Flatpack2 Rectifier 48V, 3000W

Part number 241119.100. Flatpack2 DC power systems using these modules are implemented by mounting the rectifiers in dedicated High Current racks (4AC-HC-3kW Power Shelves, Part 222058).

Refer to chapter "Specifications Flatpack2 Rectifier 48V, 3000W" on page 21.



CAUTION: Do not install 3kW rectifiers in power systems implemented with 2kW power racks (4AC Power Shelves or 2AC Power Shelves); otherwise the product warranty becomes invalidated.

Flatpack2 Rectifier 48V, 2000W HE

Part number 241115.105. The combination of innovative design, efficiency and reliability makes the Flatpack2 HE rectifier stand 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 22.



Flatpack2 Rectifier 48V, 3000W HE



Part number 241119.105. Flatpack2 DC power systems using these modules are implemented by mounting the rectifiers in dedicated High Current racks (4AC-HC-3kW Power Shelves, Part 222058) or in High Current & Voltage racks (4AC-HC-HVDC Power Shelves, Part 268035).

Refer to chapters “Flatpack2 Rectifier 48V, 2000W HE”, page 9, for the High Efficiency feature, and to “Specifications Flatpack2 Rectifier 48V, 3000W HE”, page 23.



CAUTION: Do not install 3kW rectifiers in power systems implemented with 2kW power racks (4AC Power Shelves or 2AC Power Shelves); otherwise the product guaranty becomes invalidated.

Flatpack2 Rectifier 48-60V, 2000W HE



Part number 241115.705. In addition to the High Efficiency feature — refer to chapter “Flatpack2 Rectifier 48V, 2000W HE”, page 9 — the rectifier’s Wide DC Output Range (WOR) enables support for battery banks of both NiCd and Pb. From the controller, you can configure from 38 to 40 cells in NiCd battery banks, and 24 or 30 cells in Pb battery banks.

The module will detect and auto-adjust its voltage mode at start up.

For technical data, read chapter “Specifications Flatpack2 Rectifier 48-60V, 2000W HE” page 24.

Flatpack2 Solar Charger 48V, 1500W HE – (Solar)



Part number 241115.650. With the Maximum Peak Power Tracking (MPPT) algorithm ensuring close to 100% panel utilization and efficiency up to 96.5%, the galvanic isolated solar charger sets new standards for renewable power in totally green telecom sites.

The charger uses a digitalized advanced control algorithm that finds the solar panel voltage that generates the maximum power independent of sun availability. The charging is continuous according to performance profile for panels. In addition to finding the profiles peak power a full scan is performed at a fixed interval to stay on peak even with panel failures and major shadings. This gives close to 100% panel utilization.

The Flatpack2 HE SOLAR charger is suitable for any telecom site with autonomous (solar only) or hybrid solar power.

It can be used in parallel with any other Flatpack2 rectifiers (front-to-back air flow systems only) fed by generator or unreliable mains, on hybrid sites.

Solar chargers must be mounted in dedicated solar power shelves with correct DC input feeding, see Figure 2, page 5.

Refer to chapter “Specifications Flatpack2 Solar Charger 48V, 1500W HE – (Solar)” on page 25.

Flatpack2 Rectifier 110VDC, 2000W HE WOR - (Industrial)

Part number 241115.805. High efficiency rectifier for DC power supply facilities with or without battery in all areas of industry, power generation and power distribution.

With efficiency up to 94.4%, the losses have been reduced by 50% compared to the current industry standard.

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

The wide DC output range (WOR) can be used in both 110VDC and 125VDC systems, and is suitable for charging both NiCd and lead acid battery banks. For NiCd battery banks the any number cells from 84 to 105 are fully supported.

The “Flatpack2 Rectifier 110VDC, 2000W HE WOR” is only to be used in Smartpack2-based or UPC4-based power systems.

The rectifiers are to be mounted in dedicated High Current & Voltage racks (4AC-HC-HVDC Power Shelves, Part 268035).



Flatpack2 Rectifier 220VDC, 2000W HE WOR - (Industrial)

Part number 241115.815. High efficiency rectifier for DC power supply facilities with or without battery in all areas of industry, power generation and power distribution.

With efficiency up to 95.3%, the losses have been reduced by 50% compared to the current industry standard.

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

The wide DC output range (WOR) is suitable for charging both NiCd and lead acid battery banks. For NiCd battery banks the any number cells from 170 to 180 are fully supported.

The “Flatpack2 Rectifier 220VDC, 2000W HE WOR” is only to be used in UPC4-based power systems.

The rectifiers are to be mounted in dedicated High Current & Voltage racks (4AC-HC-HVDC Power Shelves, Part 268035).





Heat Management ~ Back-to-Front Air Flow

The following *Flatpack2* rectifier options are always to be installed in power systems designed for Back-to-Front Air Flow heat management.



CAUTION:
Do **not install** rectifiers with **Front-to-Back heat management** in power systems designed for Back-to-Front heat management; otherwise the product guaranty becomes invalidated.

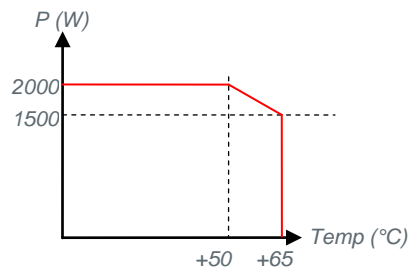
Flatpack2 Rectifier 48V, 2000W BF

Part number 241115.110

The technical specifications for “Flatpack2 Rectifier 48V, 2000W BF” are the same as for “Flatpack2 Rectifier 48V, 2000W”, except for their heat management and operating temperatures, which are:

- “Flatpack2 Rectifier 48V, 2000W”
Heat management: Front-to-Back Air Flow
Operating Temperature: (see page 20)
- “Flatpack2 Rectifier 48V, 2000W BF”
Heat management: Back-to-Front Air Flow
Operating Temperature:
—40 C to +65°C (—40°F to +149°F)

Fan direction icon:
counterclockwise



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

For other specifications, refer to chapter “Specifications Flatpack2 Rectifier 48V, 2000W” on page 20

Fan direction icon:
counterclockwise



Flatpack2 Rectifier 48V, 2000W HE, BF

Part number 241115.115. Refer to chapter “Specifications *Flatpack2* Rectifier 48V, 2000W HE, BF” on page 28.

3. Installation of *Flatpack2* Rectifiers

Safety Precautions

Get acquainted with the safety 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.

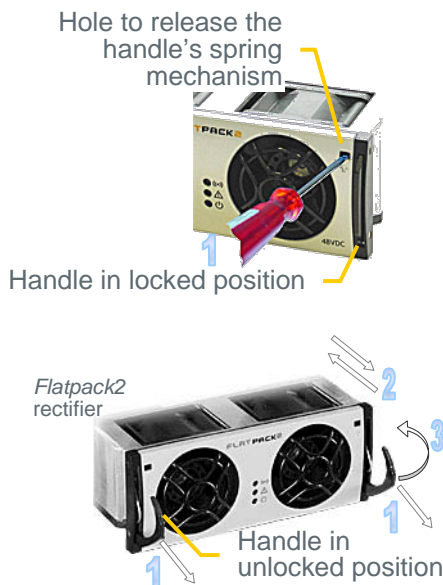


CAUTION: The rectifiers may be warm, but **do not hand-carry** them by their handles. **Open the handles before inserting** them into the power shelves (hot-pluggable).

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 4 *Flatpack2* rectifiers's locking mechanism



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 a 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).

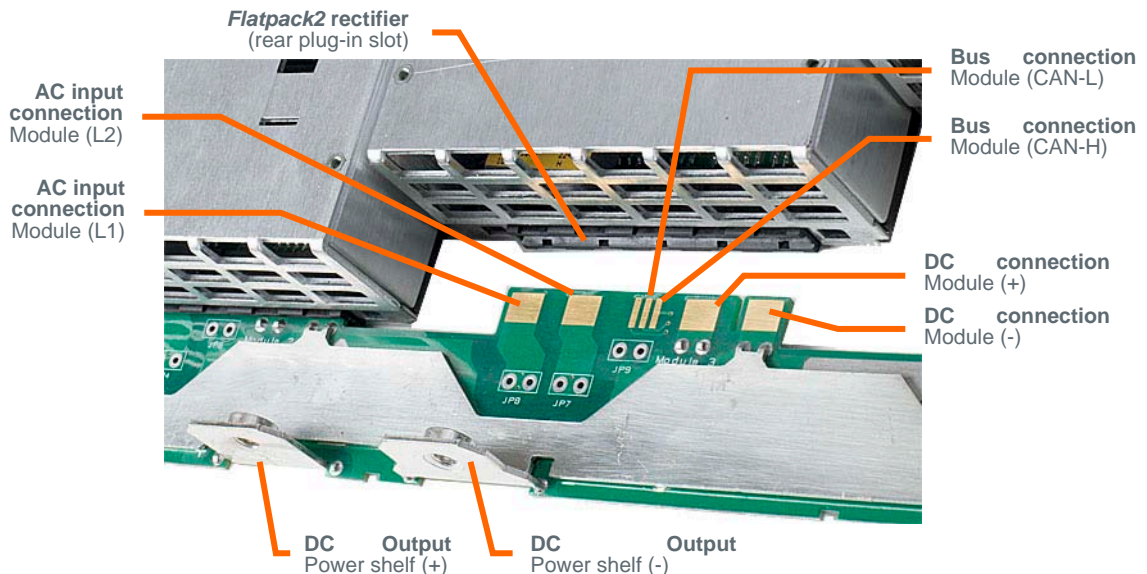


Figure 5 *Flatpack2* module's rear plug-in connections to power shelf's back wiring card

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 system's main 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 system's main 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 system's main 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

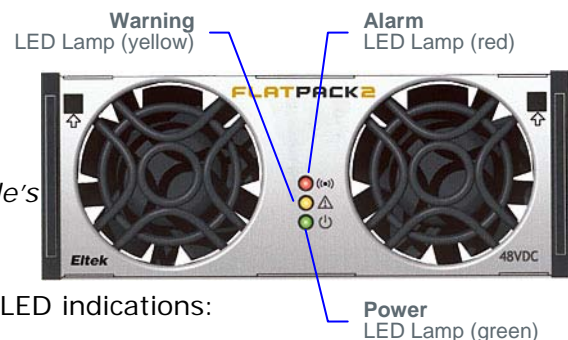


Figure 6 Example of a Flatpack2 Rectifier Module's

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 OFF	System controller accessing information on the rectifier Mains are unavailable
Warning (yellow)	ON	<ul style="list-style-type: none"> ▪ 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 system's main controller)
	Flashing OFF	Rectifier is in Over-voltage Protection Mode (AC input) No abnormal situation is present
Alarm (red)	ON	<ul style="list-style-type: none"> ▪ 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 16.

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	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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:	<ul style="list-style-type: none"> ○ 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:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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 WOR

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: 21.5-36.0VDC 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 v3

Specifications Flatpack2 Rectifier 24V, 1800W HE

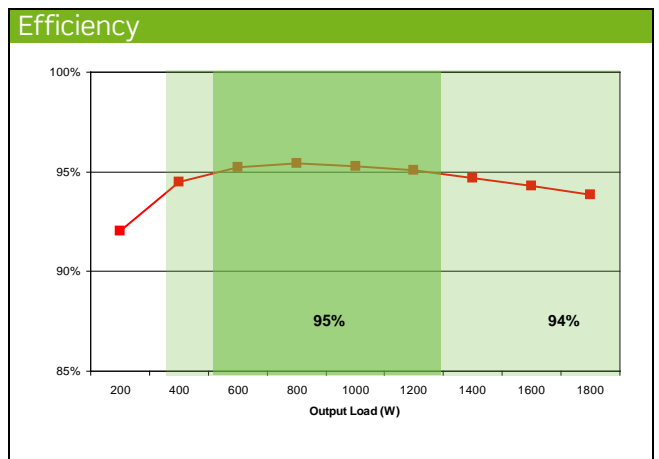
AC Input	
Voltage	85-300 VAC (Nominal 176 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	11.25 A _{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	<ul style="list-style-type: none"> ○ Varistors for transient protection ○ Mains fuse in both lines ○ 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	<ul style="list-style-type: none"> ○ < 250 mV peak to peak, ○ 30 MHz bandwidth ○ < 2 mV rms psophometric
Output Protection	<ul style="list-style-type: none"> ○ 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:	<ul style="list-style-type: none"> ○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm at 21.5V ○ CAN bus failure
Warnings:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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)



241115.205.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	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ < 100 mV peak to peak, ○ 30 MHz bandwidth ○ < 0.96 mV rms psophometric
Output Protection	<ul style="list-style-type: none"> ○ 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:	<ul style="list-style-type: none"> ○ 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:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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	
AC Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	12.5 A _{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
DC Voltage	120-275VDC (Rated 140 – 250VDC)
Input Protection	Varistors for transient protection Mains fuse in both lines Disconnect above 300 VAC

DC Output	
Voltage	53.5VDC (adj. range: 43.5-57.6VDC)
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) (T _{ambient} : 25°C)
Acoustic Noise	< 55dBA 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
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 – v6

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	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ < 100 mV peak to peak, 30 MHz bandwidth ○ < 2.0 mV_{rms} psophometric
Output Protection	<ul style="list-style-type: none"> ○ Over-voltage shutdown ○ Output fuse ○ Short circuit proof ○ High temperature protection

Other Specifications	
Efficiency	Typical 93%, min. 92% at 25-100% load
Isolation	<ul style="list-style-type: none"> ○ 3.0 KVAC – input and output ○ 1.5 KVAC – input earth ○ 0.5 KVDC – output earth
Alarms:	<ul style="list-style-type: none"> ○ 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:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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 EMC, Immunity, Light industry EN61000-6-2 EMC, Immunity, Industry EN61000-6-3 EMC, Emission, Light industry (with additional filtering in power shelf) EN61000-6-4 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, 2000W HE

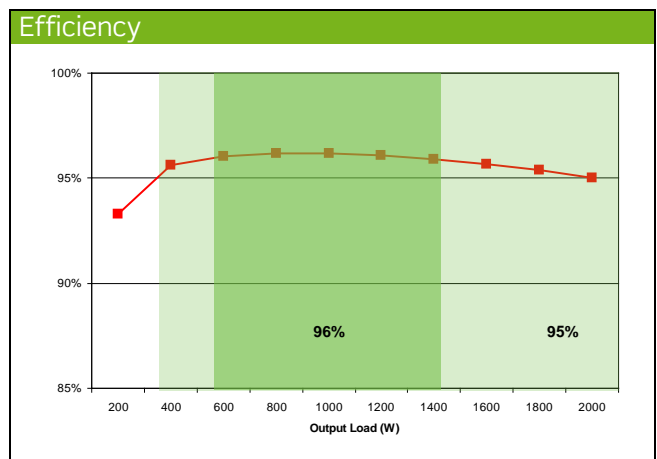
AC Input	
Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	11.6 A _{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	<ul style="list-style-type: none"> ○ Varistors for transient protection ○ Mains fuse in both lines ○ 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	<ul style="list-style-type: none"> ○ < 100 mV peak to peak, ○ 30 MHz bandwidth ○ < 2 mV rms psophometric
Output Protection	<ul style="list-style-type: none"> ○ 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	>96% at 30-70% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	<ul style="list-style-type: none"> ○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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)



241115.105.DS3 - v9

Specifications Flatpack2 Rectifier 48V, 3000W HE

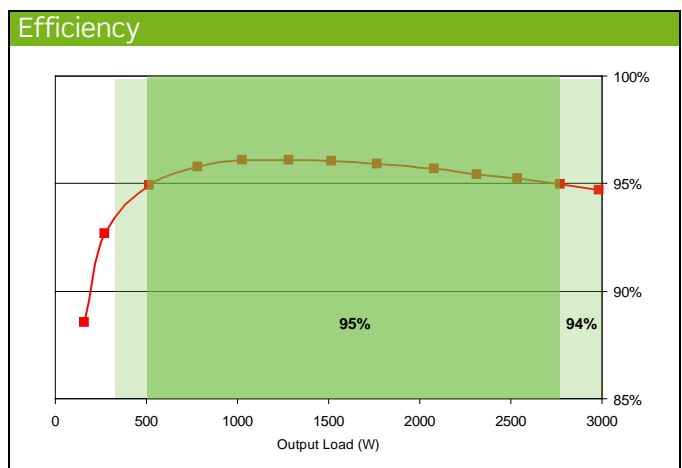
AC Input	
Voltage	85-300 VAC (Nominal 176 – 277 VAC)
Frequency	45 to 66Hz
Maximum Current	19.2 A _{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	<ul style="list-style-type: none"> ○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output	
Voltage	53.5 VDC (adj. range: 43.2-57.6 VDC)
Output Power	3000 W within nominal input, linear derating linear to 1380W 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	> 20ms; output voltage > 43.5 VDC at 1500W load
Ripple and Noise	<ul style="list-style-type: none"> ○ < 150 mV peak to peak, ○ 30 MHz bandwidth ○ < 2 mV rms psophometric
Output Protection	<ul style="list-style-type: none"> ○ Overvoltage shutdown ○ Hot plug-in - Inrush current limiting ○ Fuse ○ 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.1.3.3 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	>95.5% at 25-75% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	<ul style="list-style-type: none"> ○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm ○ CAN bus failure
Warnings:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +167°F), derating output power linear to 2100W at +75°C
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	Fan (front to back airflow)
Fan Speed	Temperature and output 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)



241119.105.DS3 - v2

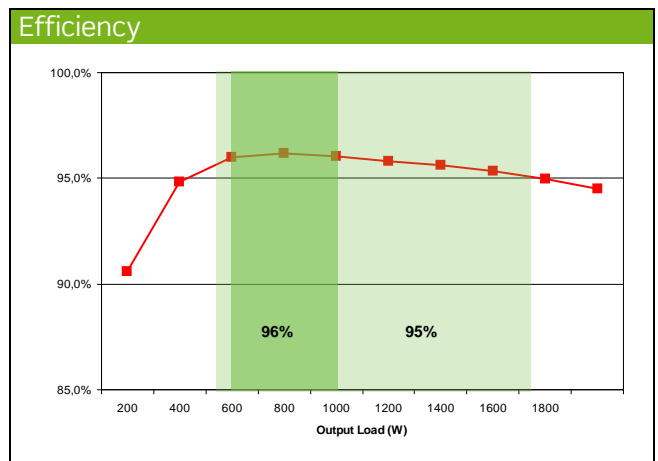
Specifications Flatpack2 Rectifier 48-60V, 2000W HE

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
THD	< 5 % at nominal input and full load
Input Protection	Varistors for transient protection Mains fuse in both lines Disconnect above 300 VAC

DC Output	
Voltage	Default: 53.5 VDC (48V mode) 67 VDC in (60V mode)
Pb batteries (48V or 60V)	Float/Boost charge: 2.0 – 2.4VDC/cell Standby/Test: 1.75 – 2.0VDC/cell
NiCd batteries (48V)	Float charge: 1.40 – 1.45 VDC/cell Boost charge: 1.45 – 1.70 VDC/cell Standby/Test: 1.05 – 1.2 VDC/cell
No of cells configurable in controller	NiCd: 38 - 40 Pb: 24 or 30
Output Power	<ul style="list-style-type: none"> o 2000W at nominal input, derating linear below 185VAC to 850W at 85VAC o Constant Power: 48V – 72V o Constant Current: 0 – 48V
Maximum Current	41.6 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	±4.0% for 10-50% or 50-10% load variation, regulation time < 200ms
Hold up time	> 20ms; output voltage > 53.5 VDC at 1500W load
Ripple and Noise	<ul style="list-style-type: none"> o < 150 mV peak to peak, 30 MHz bandwidth o < 2 mVrms psophometric
Output Protection	Overvoltage shutdown Hot plug-in Output fuse 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)
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 RoHS compliant

Other Specifications	
Efficiency	>95% at 30-70% load
Isolation	3.0 KVAC – input - output 1.5 KVAC – input earth 1.0 KVDC – output earth
Alarms:	Low mains shutdown High temperature shutdown Rectifier Failure Overvoltage shutdown on output Fan failure Low voltage alarm CAN bus failure Low temperature shutdown
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 +75°C (-40 to +167°F), derating above +45°C (+113°F) to 1350W at +75°C (+167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	Fan (front to back airflow)
Fan Speed	Temperature and load regulated
MTBF	> 350, 000 hours Telcordia SR-332 Issue I, method III (a) (T _{ambient} : 25°C)
Acoustic Noise	< 52dBA 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
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13")
Weight	1.950 kg (4.3lbs)



241115.705.DS3 – v2

Specifications are subject to change without notice

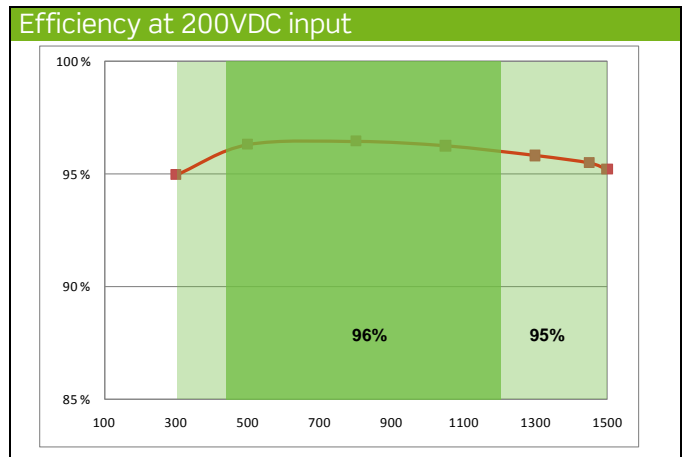
Specifications Flatpack2 Solar Charger 48V, 1500W HE – (Solar)

Input	
Voltage	Nominal: 170 – 230 VDC Tolerances: 85-265 VDC
Start-up voltage	150VDC
Maximum Current	9.5 A _{rms} maximum at nominal input and full load 10 A _{rms} maximum at 85VDC and full load
Input Protection	<ul style="list-style-type: none"> ○ Varistors for transient protection ○ Fuse in both lines ○ Reverse polarity

Output	
Voltage	<ul style="list-style-type: none"> ○ Default: 53.5 VDC ○ Float/Boost: 48 – 57.6 VDC ○ Stand by/Test: 43.5-48 VDC <p>For input voltages > 230VDC output stand by/test voltage is limited</p>
Maximum Output Power	<ul style="list-style-type: none"> ○ 1500 W, derating below 170V input ○ 800W at 85V input
Maximum Current	31.3 Amps at 48 VDC
Current Sharing	Passive, to optimize the power available from each string of solar panels
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
Ripple and Noise*	<ul style="list-style-type: none"> ○ < 250 mV peak to peak, ○ 30 MHz bandwidth ○ < 2 mV rms psophometric
Output Protection	<ul style="list-style-type: none"> ○ Overvoltage shutdown ○ Hot plug-in - Inrush current limiting ○ Short circuit proof ○ High temperature protection
* Based on power supplied not limited by solar panels	

Other Specifications	
Efficiency	>96% at 30-80% load and 200VDC input
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	<ul style="list-style-type: none"> ○ High temperature shutdown ○ Charger Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	<ul style="list-style-type: none"> ○ Low input voltage ○ Low temperature shutdown ○ Charger 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	<ul style="list-style-type: none"> ○ Green LED: ON, no faults ○ Red LED: charger failure ○ Yellow LED : charger warning
Operating temp	-40 to +75°C (-40 to +167°F), derating linear above +55°C (+131°F) to 1200W at +75°C (+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	<ul style="list-style-type: none"> < 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)
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 RoHS compliant



Specifications are subject to change without notice

241115.650.DS3 – v2

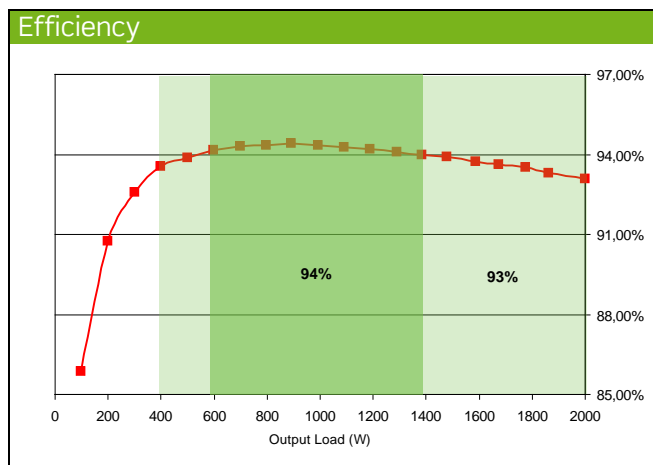
Specifications *Flatpack2* Rectifier 110VDC, 2000W HE WOR - (Industrial)

AC Input	
Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	11.9 A _{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
THD	< 5 % at nominal input and full load
Input Protection	<ul style="list-style-type: none"> o Varistors for transient protection o Mains fuse in both lines o Disconnect above 300 VAC

DC Output (floating)	
Voltage Adjustable	Default: 122.56 VDC (without controller) Range: 89.2-171.6 VDC
NiCd batteries	Float charge: 1.40 – 1.45 VDC/cell Boost charge: 1.45 – 1.70 VDC/cell Standby/Test: 1.05 – 1.2 VDC/cell No of cells configurable in controller Min: 85 / Max: 104
Output Power	2000 W at nominal input, derating linear below 185VAC to 850W at 85VAC Constant Power > 120V > Constant Current
Maximum Current	16.8 Amps at 120 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 10-80% or 80-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 89 VDC at 1500W load
Ripple and Noise	< 500 mV peak to peak, 30 MHz bandwidth
Output Protection	<ul style="list-style-type: none"> o Overvoltage shutdown o Hot plug-in o OR-ing diode o Short circuit proof o High temperature protection

Other Specifications	
Efficiency	>94% at 30-70% load
Isolation	3.0 KVAC – input to output 1.5 KVAC – input to earth 1.5 KVDC – output to earth 3.0 KVAC – CAN to primary 3.0 KVAC – CAN to secondary
Alarms:	<ul style="list-style-type: none"> o Low mains shutdown o High temperature shutdown o Rectifier Failure o Overvoltage shutdown on output o Fan failure o Low voltage alarm o CAN bus failure
Warnings:	<ul style="list-style-type: none"> o Low temperature shutdown o Rectifier in power derate mode o Remote battery current limit activated o Input voltage out of range, flashing at overvoltage o Loss of CAN communication with control unit, stand alone mode
Visual indications	<ul style="list-style-type: none"> o Green LED: ON, no faults o Red LED: rectifier failure o Yellow LED : rectifier warning
Operating temp	-40 to +75°C (-40 to +167°F), derating above +55°C (+131°F) to 1350W at +75°C (+167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	Fan (front to back airflow)
Fan Speed	Temperature and load regulated
MTBF	> 391, 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)

Applicable Standards	
Electrical safety	IEC 60950-1 /UL 60950-1 / CSA 22.2
EMC	ETSI EN 300 386 V.1.4.1 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) EN 61000-6-5 (immunity, power station and substation)
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 RoHS compliant



241115.805.DS3 – v2

Specifications are subject to change without notice

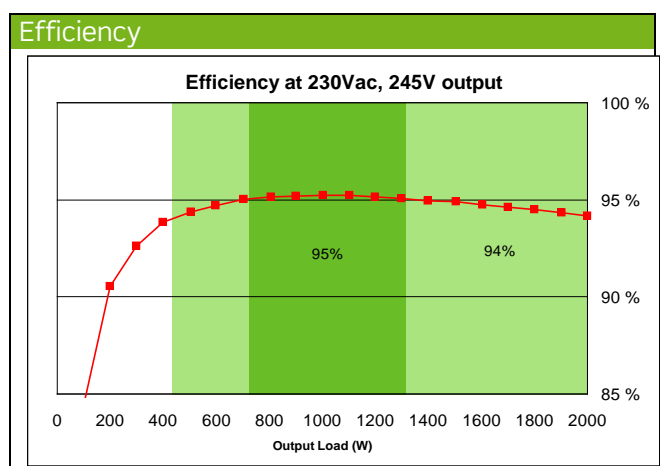
Specifications *Flatpack2* Rectifier 220VDC, 2000W HE WOR - (Industrial)

AC Input	
Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	11.9 A _{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
THD	< 5 % at nominal input and full load
Input Protection	<ul style="list-style-type: none"> ○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output (floating)	
Voltage Adjustable	Default: 245.3 VDC (without controller) Range: 178.5-297 VDC
NiCd batteries	Float charge: 1.40 – 1.45 VDC/cell Boost charge: 1.45 – 1.70 VDC/cell Standby/Test: 1.05 – 1.2 VDC/cell No of cells configurable in controller Min: 170 / Max: 180
Output Power	2000 W at nominal input, derating linear below 185VAC to 850W at 85VAC Constant Power > 220V > Constant Current
Maximum Current	9.16 Amps at 220 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 10-80% or 80-10% load variation, regulation time < 50ms
Hold up time	> 20ms; output voltage > 178 VDC at 1500W load
Ripple and Noise	< 1000 mV peak to peak, 30 MHz bandwidth
Output Protection	<ul style="list-style-type: none"> ○ Overvoltage shutdown ○ Hot plug-in ○ OR-ing diode ○ 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.1.4.1 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) EN 61000-6-5 (immunity, power station and substation)
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 RoHS compliant

Other Specifications	
Efficiency	>95% at 35-65% load
Isolation	3.0 KVAC – input to output 1.5 KVAC – input to earth 1.5 KVDC – output to earth 3.0 KVAC – CAN to primary 3.0 KVAC – CAN to secondary
Alarms:	<ul style="list-style-type: none"> ○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm ○ CAN bus failure
Warnings:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ 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 +55°C (+131°F) to 1350W at +75°C (+167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	Fan (front to back airflow)
Fan Speed	Temperature and load regulated
MTBF	> 459, 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)



241115.815.DS3 – v2

Specifications are subject to change without notice

Specifications *Flatpack2* Rectifier 48V, 2000W HE, BF

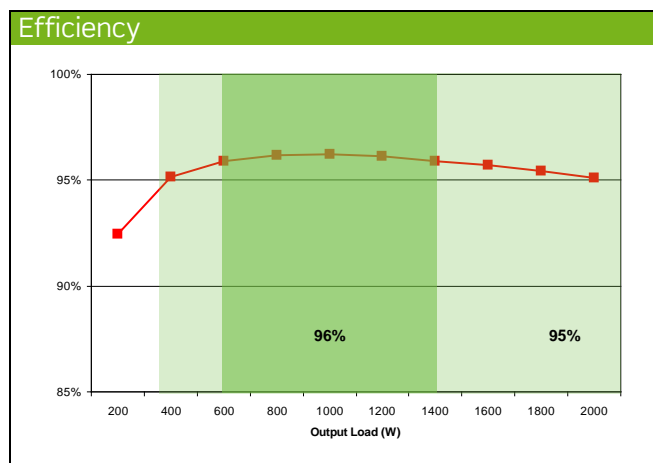
AC Input	
Voltage	85-300 VAC (Nominal 185 – 275 VAC)
Frequency	45 to 66Hz
Maximum Current	11.6 A _{rms} maximum at nominal input and full load
Power Factor	> 0.99 at 50% load or more
Input Protection	<ul style="list-style-type: none"> ○ Varistors for transient protection ○ Mains fuse in both lines ○ Disconnect above 300 VAC

DC Output	
Voltage	53.5 VDC (adj. range: 43.5-57.6 VDC)
Output Power	2000 W at nominal input, derating linear below 185 VAC to 850W at 85 VAC
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	<ul style="list-style-type: none"> ○ < 250 mV peak to peak, 30 MHz bandwidth ○ < 2 mV rms psophometric
Output Protection	<ul style="list-style-type: none"> ○ 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	>96% at 35-60% load
Isolation	3.0 KVAC – input and output 1.5 KVAC – input earth 0.5 KVDC – output earth
Alarms:	<ul style="list-style-type: none"> ○ Low mains shutdown ○ High temperature shutdown ○ Rectifier Failure ○ Overvoltage shutdown on output ○ Fan failure ○ Low voltage alarm at 43.5V ○ CAN bus failure
Warnings:	<ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ○ Green LED: ON, no faults ○ Red LED: rectifier failure ○ Yellow LED : rectifier warning
Operating temp	-40 to +80°C (-40 to +167°F), derating linear above +60°C (+142°F) to 1350W at +80°C (+167°F)
Storage temp	-40 to +85°C (-40 to +185°F)
Cooling	Fan (back to front 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	< 45dBA 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
Dimensions	109 x 41.5 x 327mm (wxhxd) (4.25 x 1.69 x 13")
Weight	1.950 kg (4.3lbs)



241115.115.DS3 – v1

