

# Functional Description

## Rectifier DPR 1200B-48





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## 1 DOCUMENT INFORMATION

### 1.1 Version control

<b>Document number</b>	<b>Document description</b>	
-	Functional Description, Rectifier DPR 1200B-48	
<b>Previous version</b>	<b>Description of changes</b>	
31.05.2004	Product picture & Mechanical drawing updated	
	<b>Controlled by</b>	<b>Date</b>
	Hans-Peter Glauser	08.10.2004

<b>Approved by</b>	<b>Date</b>
Hans-Peter Glauser	08.10.2004

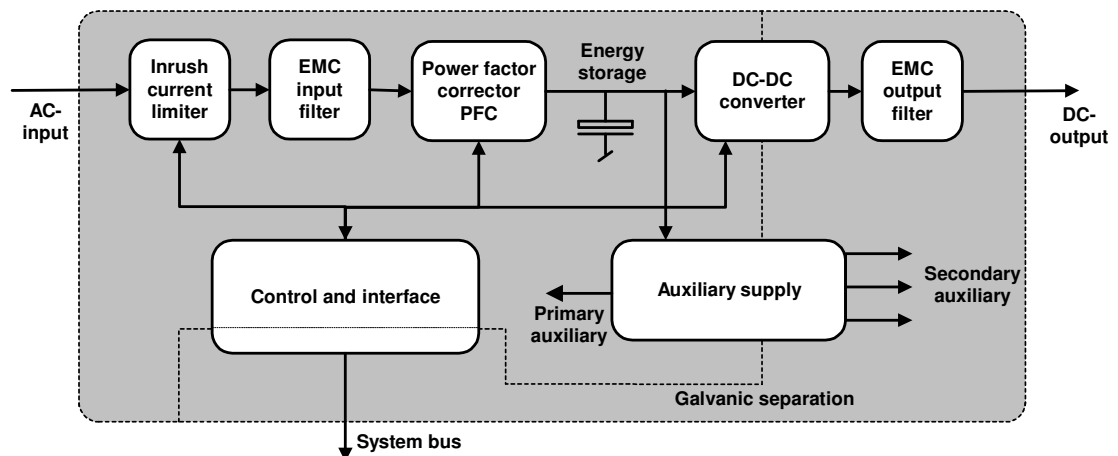
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### 3 FUNCTIONAL DESCRIPTION

The rectifier contains two stages of high frequency power converter:

The power factor corrector (PFC) has a boost topology with a switching frequency of 120 kHz. It is responsible for the power factor and harmonic content of the input current. The DC-DC converter has a phase shifted full bridge topology with a switching frequency of 140 kHz. It is responsible for galvanic isolation and power conversion to the DC output. The control and interface circuit controls and protects the rectifier during all operation conditions appearing in a power system. The EMC filters guarantee the required standards.



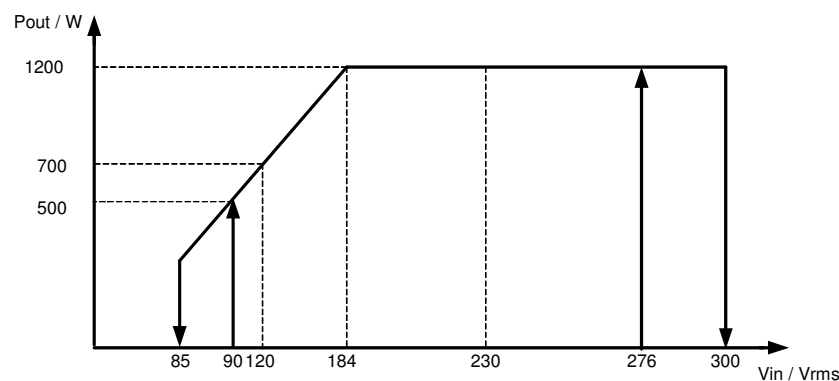
**Figure 1. Block diagram.**

#### 3.1 Input voltage range

If the input voltage exceeds the limits of the input voltage range the rectifier is shut off. The rectifier will restart automatically as soon as the input voltage returns into the specified input voltage range. At low input voltages, an output power derating is enabled to limit the input current to acceptable values.

For AC mains voltage in the range of 276V to 300V, the power factor corrector (PFC) stage is self protecting and the input current shape is not sinusoidal.

Input voltage range: Refer to «Generic installation manual for power systems» for further guidelines about AC overvoltage and transient overvoltage protection.



**Warning!** Do not operate the device without a transient protection described in «Generic installation manual for power systems»

**Warning!** Ensure in the installation that the Neutral will never be disconnected before the supplying AC lines.

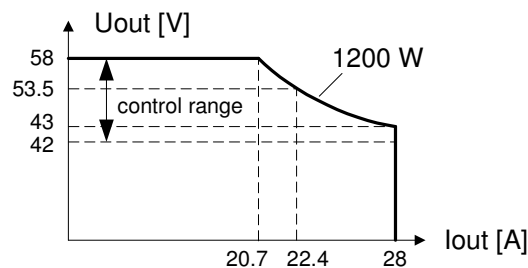
**Warning!** Ensure in the installation that the supplying AC lines will be never connected before the Neutral.

### 3.2 Inrush current limitation

When the rectifier is first connected to the mains, the energy storage capacitors are charged via resistors. As soon as a certain voltage limit is reached, these resistors are short-circuited, the rectifier starts up and delivers output power.

### 3.3 Output characteristic

The rectifier has a constant output power characteristic to meet the demand of optimal use of the power supply to electronic constant power loads. The result is a constant recharging current to the battery after a mains outage, and a better use of rectifier efficiency.



**Figure 2. The output characteristic.**

### 3.4 Output voltage

The factory setting is defined for flooded battery types: 53.5 V. If a controller with voltage programming function is used, it can remotely adjust the rectifier output voltage to different values via analogue signal interface or digital interface.

### 3.5 Output current

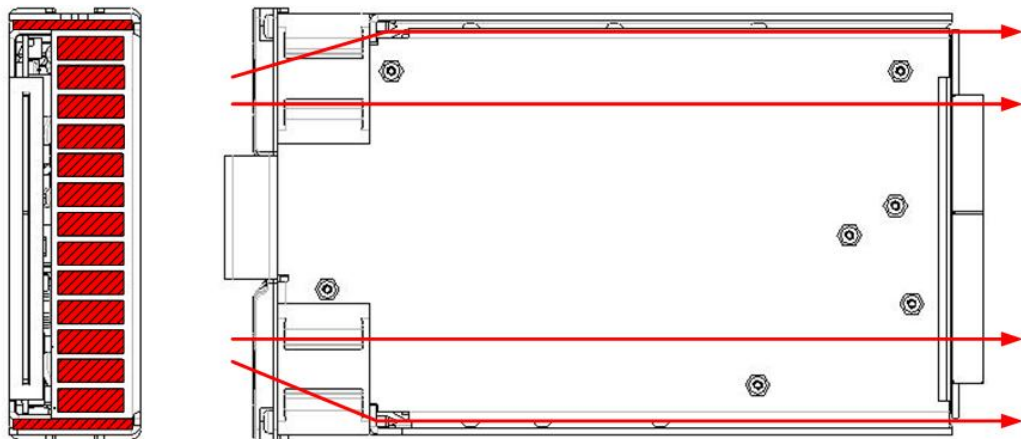
The factory setting for the output current limit is 28 A<sub>DC</sub>.

### 3.6 Cooling

The device is fan cooled.

**Warning!** The air flow must not be restricted!

**Warning!** Apply always blank panels for empty rectifier slots to avoid wrong air circulation inside the system!



Shadowed area: air outlet at the rear

**Figure 3. Air flow**

### 3.7 Overvoltage protection OVP

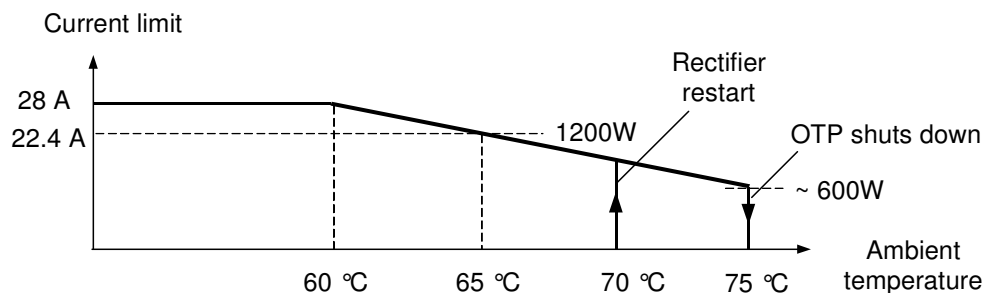
The rectifier is equipped with a selective over voltage protection, that shuts down the rectifier in case of output voltage exceeding an internally set limit. The protection is combined with a current measuring condition to achieve selectivity between parallel rectifiers; only the «guilty» rectifier will be shut down. The factory setting is 59 V. Reset of OVP shut down can be done by disconnecting the mains supply voltage for approx. 2 seconds.

### 3.8 Thermal management

The rectifier is protected in case of abnormal environment conditions, interrupted air flow and fan failure. Therefore two thermal sensors are integrated:

Sensor	Monitoring	Function
Reference sensor	Combination of heat sink / fresh air temperature	Controls the over - temperature protection (OTP) characteristic.
Protection sensor	Main transformer temperature	Detects interrupted air flow and fan failure.

The thermal management (reference sensor) reduces the output current in order to limit internal temperature according the characteristic below:



**Figure 4. Thermal management of the rectifier.**

The thermal management (protection sensor) protects the rectifier against interrupted air flow and fan failure. During these conditions, the rectifier is shut down as soon as the internal temperature reaches a critical value. After several unsuccessful restart attempts the rectifier remains shut down and generates an alarm.

### 3.9 Load sharing

The rectifier is equipped with an active load sharing function that ensures equal load on parallel rectifiers. The function uses the signal interface bus between rectifiers. This function does not require any other external unit outside rectifiers.

### 3.10 Rectifier enable

The rectifier is enabled by external connection to support the hot pluggable feature:  
Rectifier enable: Pins S10/S22 – S3/S15 connected  
Remark: This connection is a connection on the standard backplane.

### 3.11 Precharge

The rectifier module is hot pluggable. Pushing the rectifier into the cabinet connects leading precharge contacts first to precharge the DC output capacitors. The lagging output power contacts are connected with a delay.

### 3.12 Configuration

In systems without controller or with PSC 200 / PSC 1000 the rectifier operates with the factory-set standard configuration; in systems with PSC 3 controller the configuration is automatically done upon inserting the rectifier module.

The push button «Config» has two assigned functions:

- In system configurations with PSC 3, for the physical position numbering within a system. Refer to PSC 3 manual.
- To reset configuration to default factory settings. Press button until LED «Com» starts blinking (10 sec. approx.)

### 3.13 Enhanced rectifier supervision and control functions

In systems with PSC 3 controller applying digital communication, the following data and appropriate functions are available.

#### 3.13.1 Manufacturing data

This data is stored at production. It can be transmitted to the PSC 3 upon request:

- SAP serial no. / SAP part no.
- SW / HW version no.
- User specific data (like user serial no.)

#### 3.13.2 Configuration data

This data is stored in the PSC 3 and in the rectifier module. It is downloaded at the first system start or after a configuration change only:

- Nominal output voltage
- Output current limitation

- Output power limitation
- Maximum output voltage / current / power at start up
- Start up delay, limit time
- Low input voltage for shut down / mains failure detection
- Low input voltage for start up.

### 3.13.3 Commands / control data

The following commands are transmitted from the PSC 3 to the rectifier upon request by the operator or by controller function:

- Start / stop rectifier
- Reset OVP

The following control data is transmitted from the PSC 3 to the rectifier periodically:

- Output voltage (VPGM)
- Output current limit / output power limit

### 3.13.4 Information data

The rectifier calculates following data and transmits it upon request:

- Total operating time

The following data is transmitted by the rectifier periodically:

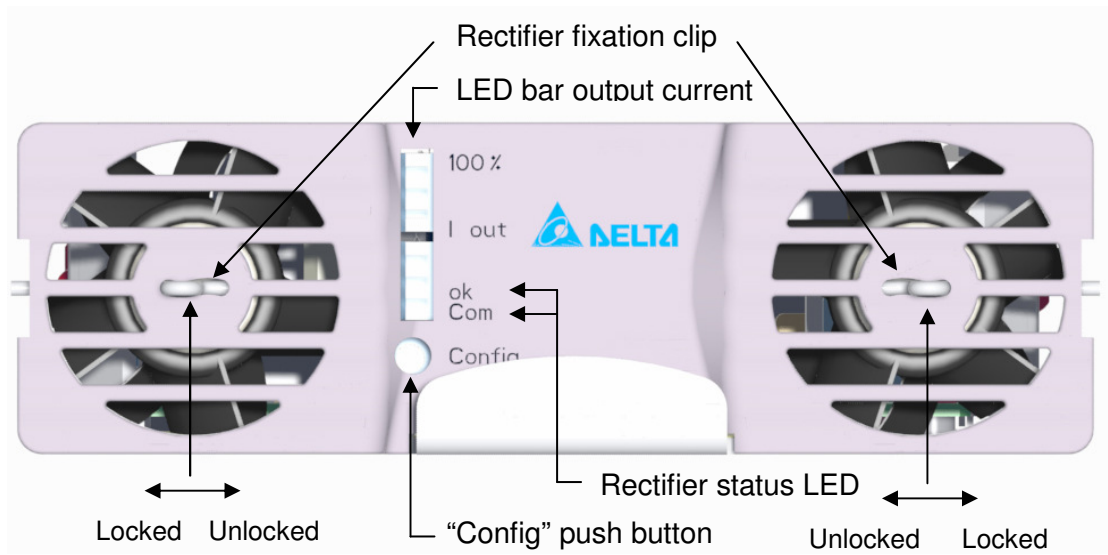
- Rectifier status (Power off, Remote off, AC failure, Rectifier mode, Deration of output power caused by output power / output current / high temperature / low input voltage, fan status, over-temperature / over-voltage protection status).
- Rectifier data (output voltage, output current).

### 3.13.5 Measurements

Following data is transmitted upon request from the PSC 3 only:

- AC input voltage
- Internal temperatures

## 4 FRONT ELEMENTS



**Figure 5. Front panel of DPR 1200B-48 rectifier.**

### 4.1 Rectifier status indications

LED «ok» turns off and an alarm is given if:

- Input connection is missing
- OVP / OTP shutdown procedure is activated or a fan failure is detected. The details are indicated by the means of a flashing LED in the LED bar.
- Load sharing is not working correctly
- The output fuse is blown
- The rectifier is faulty.
- SW download with PSC3

LED «ok» blinks (200ms on / 200ms off) and an alarm is given if:

- The rectifier is faulty due to regulation failure

LED «ok» flashes (20ms on / 1000ms off) and an alarm is given if:

- Input voltage out of range, but auxiliary supply is still working
- Rectifier not enabled (refer to section 3.10 )
- Rectifier off, controlled by PSC 3

LED «Com» is lit if the device communicates with the PSC 3 controller via IMBUS.

LED «Com» turns off if:

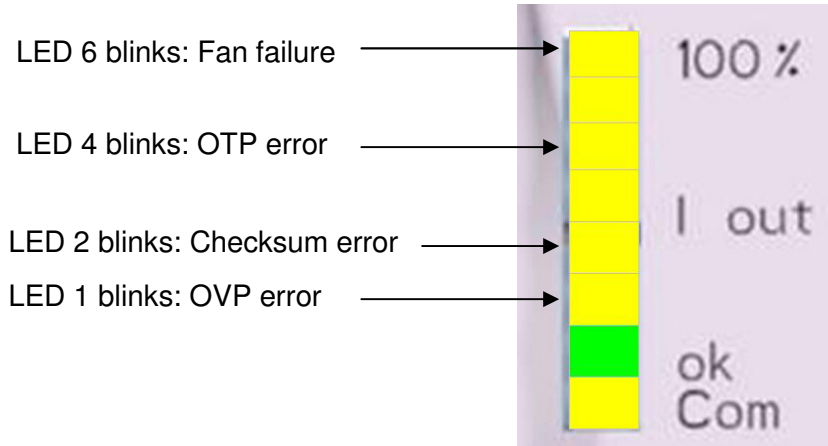
- No PSC 3 communicating with the rectifier
- Error in IMBUS cabling or wrong bus termination

LED «Com» blinks if:

- At start up of the rectifier during configuration process of the interface

- Reset to default rectifier settings (see sec. 4.2 )

LED bar blinks if:



#### 4.2 Push button «Config»

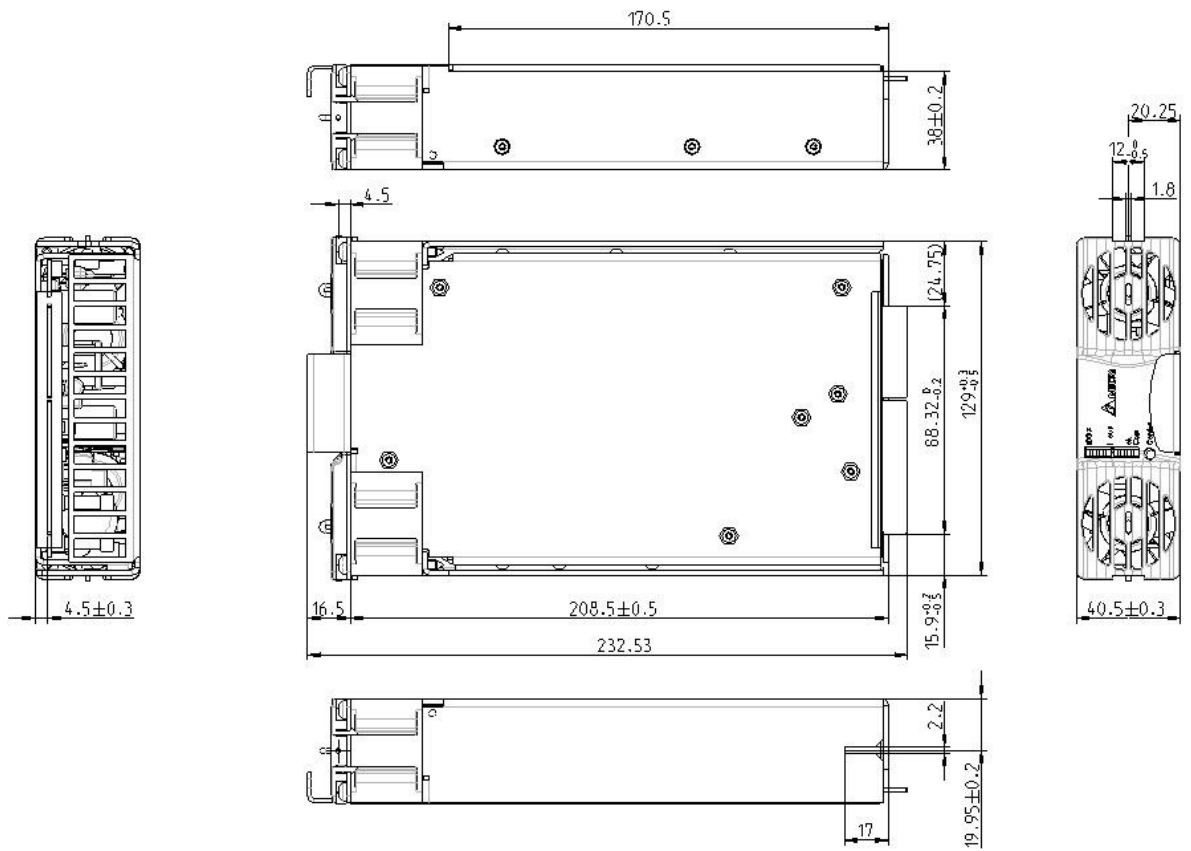
The push button «Config» has the following function:

- To reset the rectifier configuration to default factory settings. Press button until LED «Com» starts blinking (10 sec. approx.)

#### 4.3 Rectifier fixation

The rectifier can be fixed in a shelf by moving the clip into outside (locked) position. To unlock the rectifier in a shelf, the clip must be moved into inside position. Special fixation support must be provided in the shelf to ensure the rectifier fixation.

**5 MECHANICAL DIMENSIONS**



**Figure 6. Mechanical dimensions of the DPR 1200B-48 rectifier.**

Remark: The drawing indicates the nominal design dimensions.

## 6 INSTALLATION

### 6.1 Mechanical

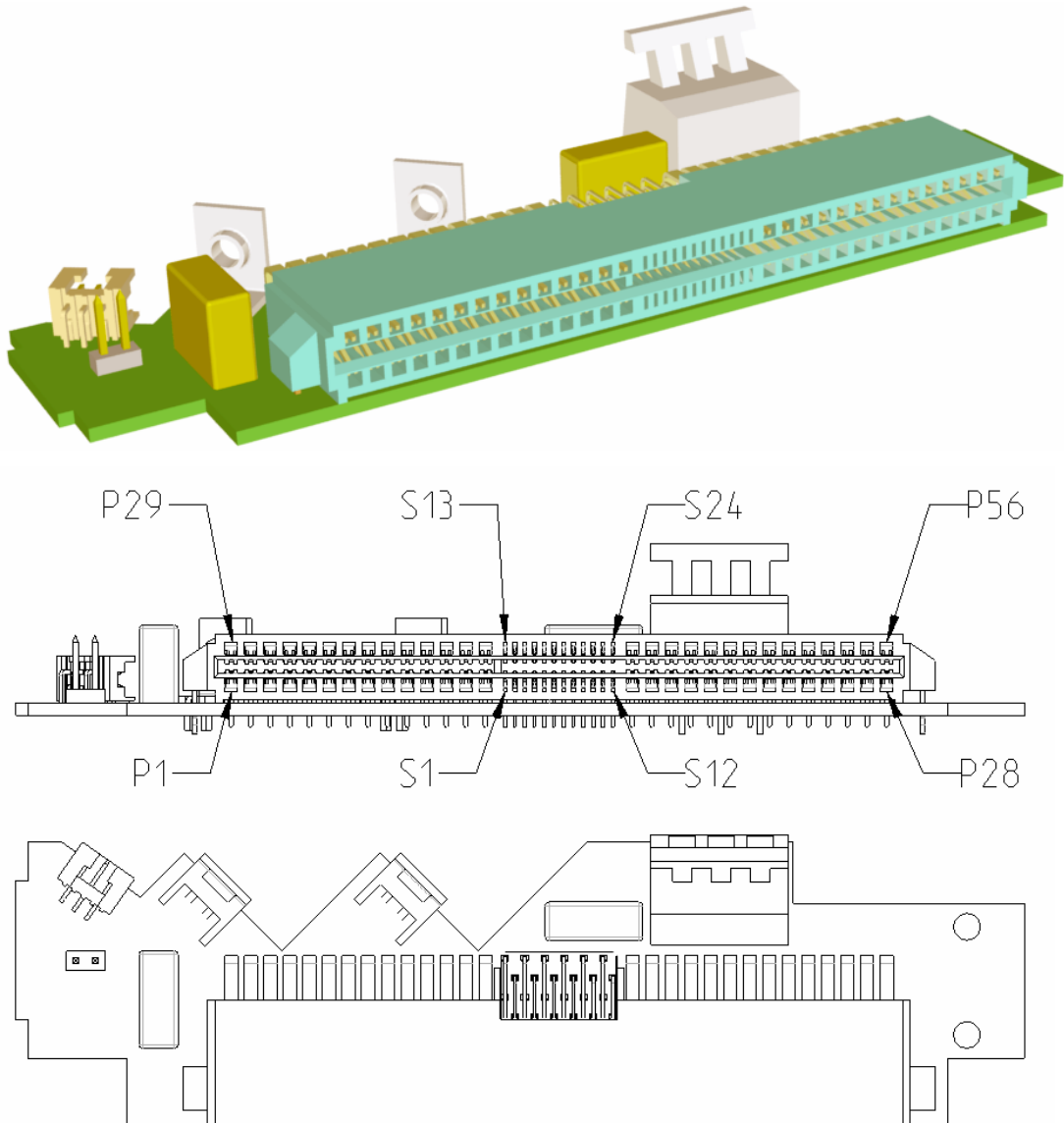
The rectifier is mounted in the rack and fixed with two interlocks integrated into the front panel.

### 6.2 Electrical connections

The rectifier has a 'golden finger' connector located on the backside. This fits to a combined power header located on the backplane (FCI P/N 10028886-003A).

The system bus is daisy-chained from rectifier to rectifier and to the controller (if such is used in the system). It is a one to one connection.

Signals on backplane connector:



P1-P7	VOUT+	DC output
P29-35	VOUT+	DC output
P8-14	VOUT-	DC output
P36-42	VOUT-	DC output
S1+13	PRECHARGE	Precharge for output capacitor refer to Sec. Precharge
S2+14	NC	Reserved for other applications
S3+15	OFF-RETURN	Reference ground for signal 'OFF'
S4+16	RFA	PSC 1000: Rectifier failure
S5+17	LS_BUS	Load sharing bus refer to Sec. Load sharing
S6+18	VPGM	PSC 1000: output voltage programming
S7+19	GND_SYS	Reference ground for PSC 1000 and load sharing
S8+20	CAN_H	PSC 3: IMBUS connection
S9+21	CAN_L	PSC 3: IMBUS connection
S10+22	OFF	Rectifier enable, reference ground 'OFF-RETURN', refer to Sec. Rectifier enable
S11+23	NC	Reserved for other applications
S12+24	NC	Reserved for other applications
P15-17	PE	AC mains, PE terminal
P43-45	PE	AC mains, PE terminal
P20-23	N	AC mains, N terminal
P48-51	N	AC mains, N terminal
P25-28	L	AC mains, L terminal
P53-56	L	AC mains, L terminal

For system side you can use the connector with the FCI ordering part number 10028886-003A (vertical PCB version) or the Delta standard backplane (DES p/n D0106218). Do not use right angle version connectors (see chapter Cooling).

**Warning!** Operate the device only with connected PE.

## 7 SYSTEM INTEGRATION

For system integration following aspects have to be considered (s. appropriate paragraphs):

- «Rectifier enable»
- «Precharge»
- «Cooling»
- «Rectifier »

Special care has to be taken selecting the pre – fuse. The fuse in the AC distribution must be selective against the protection applied in the device (see Section «Safety»).

Refer to «Generic installation manual for power systems» for further guidelines about the system integration.

### 7.1 Accessories

Different backplane solutions are available for vertical or horizontal rectifier system integration.

### 7.2 Commissioning

- Place rectifier in its rack position. This contact AC, DC and system bus.
- Check LED «ok».
- For systems with PSC 3 only: Check LED «Com»

### 7.3 Troubleshooting

The following instructions can be helpful in case of a rectifier alarm to find out whether a rectifier is faulty or the failure is outside the rectifier module. Internal failures can only be repaired in a Delta factory, so the rectifier module must be replaced in the system with a new unit.

Standard troubleshooting - LED «ok» is off and an alarm is given:

Mains voltage is missing:	Check mains fuse breaker in system
OVP is activated:	Reset OVP by pulling out the rectifier for approx. 2 seconds
OTP is activated:	Check air flow at front and behind the shelf, clean air filter on system
Fan failure, air flow blocked:	Check air flow at front and behind the shelf, clean air filter on system, check fans
Rectifier is faulty:	Replace rectifier module

Systems with PSC 3 and digital communication: additional trouble shooting:

COM-LED off or blinking:	Communication failed. Check bus cable to PSC 3. Check correct IMBUS termination.
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If nothing helps, pull out the rectifier for 1 minute to reset the rectifier completely.

## **8      RECTIFIER REPLACEMENT IN A RUNNING SYSTEM**

- Step 1.    Remove rectifier module
- Step 2.    Place new rectifier into its rack position
- Step 3.    Check system (controller) for alarms.

## 9 TECHNICAL SPECIFICATIONS

### General

Efficiency	≥ 91 %
Losses, max.	135 W
Safety	EN 60 950, class I UL 60 950 CAN / CSA – C22.2
EMI, radiated	EN 55 022, class B
Compliant with	EN 300 386-2
Cooling	Fan cooled
Power density	1100 W / l, 18 W / in <sup>3</sup>
Acoustic noise	48dB(A)

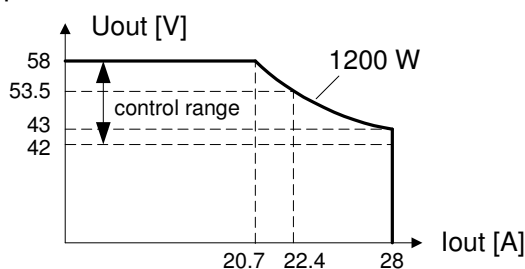
### Input

Voltage range	88 ... 300 V <sub>rms</sub>
Volt. range, red. power	88 ... 184 V <sub>rms</sub>
Volt. range, no PFC	276 ... 300 V <sub>rms</sub>
Inrush current	10.6 A <sub>peak</sub>
Current maximum	7.5 A <sub>rms</sub>
Line current	Meets IEC 1000-3-2
Harmonic distort. THD	< 5 %
Power factor	~ 1.0
EMI, conducted	EN 55 022, class B
Mains connector	Rear side
Input protection	Internal fuse 2 x 10 A
Input switch	None

### Output

Voltage, nominal	53.5 V <sub>dc</sub>
Voltage adjust range	42 ... 58 V <sub>dc</sub>
Voltage error, static	± 250 mV <sub>dc</sub>
Overvoltage protection	59 V ± 1 V
Ripple + spikes	≤ 100 mV <sub>p-p</sub>
Psophometric noise	≤ 1.0 mV <sub>rms</sub> (weighted)
EMI, conducted	EN 55 022, class A
Current limit, nominal	28 A <sub>dc</sub>
Limit adjustment range	0 ... 28 A <sub>dc</sub>
Load sharing	< ± 2 A <sub>dc</sub>
Power limit	1200 W, fixed
Output connector	Rear side
Output protection	Internal fuse 40 A

Output characteristic:



### User interface

Output current display	LED bar
Status indication	LED «ok» LED «OVP»* LED «Overtemp»* LED «Fan failure»*

\* Status indication integrated in the LED bar

### Power system controller

PSC 1000	Voltage programming Rectifier fail alarm
PSC 3	Voltage programming Curr. limit progr. Power limit progr. Rectifier fail alarm Rectifier start up Rectifier on/off

### Mechanics

Width, overall	40.8 mm (1U)
Height, overall	132 mm (3U)
Depth, overall	232.5 mm
Weight	1.25 kg

### Environment

Ambient temperature	-25 ... + 75 °C
Reduced power	65 ... + 75 °C
Relative humidity	95 % max, non cond.

### Accessories

Single backplane	P/N: D0106218
Triple backplane	P/N: D0112006
Blank panel	P/N: D0112127