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1800W | DATENBLATT GERÄTE

HERSTELLER Camtec Power Supply GmbH

PRODUKTSERIE GL1800-RM1800-Serie

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Wir freuen uns auf das Gespräch mit Ihnen.



IHR ANSPRECHPARTNER

Martin Sochor



+43 2236 42694-40



powersupply@ing-fischer.at



Ing. Erhard Fischer GmbH



Weissenbach 101 | AT-2371 Hinterbrühl



www.ing-fischer.at

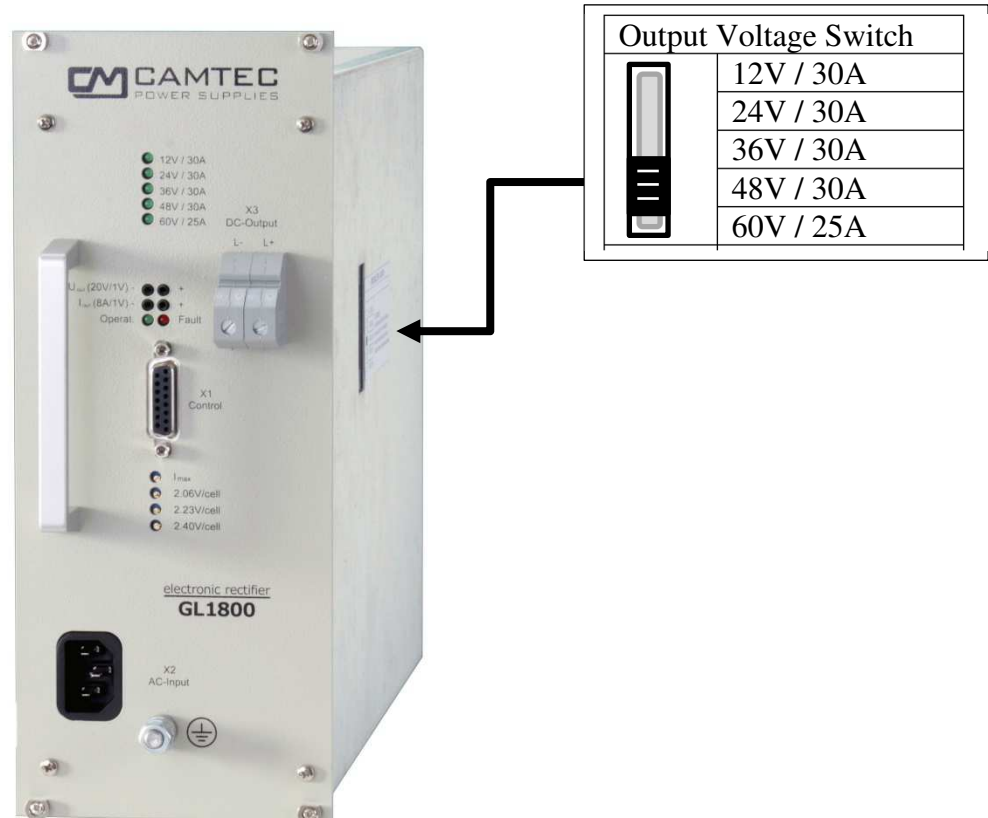


ING. ERHARD FISCHER GMBH

**Immer die passende Lösung für Industrie-
Stromversorgungen, Heizfolien & Messtechnik**

GL1800/RM1800 1800W Rectifier 230Vac

Battery Charger & Industrial Power, 19-Inch 6U/21TE, 16-2/3Hz, 47-63Hz



Specification:

- Selectable Output 12/24/36/48/60Vdc
- Precision set of cell voltage
- Precision set of current limiting
- C/V curve with no fold back
- External shutdown
- Boost Charging Mode / Float Charging Mode
- Electronic inrush current limiter 11Apeak
- N+1 parallel and redundant operation
- Precise dynamic response to load change
- Designed for long life under full stress
- Strong input filters and PFC $\lambda=1$
- Hold up time >40ms
- Overload and short circuit protected
- EMC/EMI EN55022 class B

Models	Selectable Output Voltage	Voltage setting	Output Current
GL1800	12Vdc	10.5 – 17.0 Vdc	30A
	24Vdc	21.0 – 34.0 Vdc	30A
	36Vdc	32.0 – 51.0 Vdc	30A
	48Vdc	41.0 – 68.0 Vdc	30A
	60Vdc	52.0 – 77.0 Vdc	25A



Technical Concept

The Camtec GL1800/RM1800 is a high precision and extremely robust charging rectifier for an upscale demand. By using the slide switch, it is possible to select the output of the device between 12/24/36/48/60Vdc. The slide switch is located on the right side of the unit to avoid unintentionally switch under operation. The GL1800/RM1800 is engineered and manufactured by CAMTEC in Germany. The design meets challenging applications like railway, complex drives, battery charging for DC-UPS, test-stands, machine-building and professional LED lighting. The power supply provides a low ripple-noise, a precise load-regulation and high efficiency of typical 90%. High-end long-life capacitors guarantee an extended hold-up-time of 40ms and an extraordinary lifetime of the power supply. The circuit design starts complex loads easily. The internal control circuit manages illegal operating conditions to prevent your system from damages. The device features active high input transients with suppressor diodes, X2-capacitors and varistors. All inputs, outputs and feature connections are galvanic isolated. The design rules set value on extended interference immunity and safety. The unit is designed in accordance to the EN60950-1, EN610101-1 and the EMC-compatibility to EN55022 class B. Our engineering design is made in accordance with the CSA22.2/UL61010 and the IEEE CB scheme rules.

Features

Design Conception

The GL1800 power supply realizes high power efficiency in a very robust housing. The CAMTEC philosophy is, to employ high-end low ESR ultra long-life capacitors where expedient to achieve a superior lifetime of the product. The GL1800 power supply is made for high reliable and demanding industrial applications, rail way, unbreakable power supply charger (DC-UPS), professional high-power lighting (floodlight, production hall) and for telecom & demanding IT applications.

Voltage Setting Potentiometer and Cell Voltage Settings

The GL1800 features 3 potentiometers to offer 3 different cell voltage settings. On the fly the operation of the unit can be selected over the interface between 2.06/2.23/2.40Vdc per cell. The output cell voltage limit can be independently adjusted with a 15-turns high precision potentiometer. The listed values are guaranteed by the factory. The tolerance of the upper margin is -0/+5%. The tolerance of the lower margin is -5%/+0%. The output voltages cover the typical cell voltage range of standard lead acid batteries.

Current Limiting

The DC current limiting can be set to a desired level below Cmax.

Boost and Float Charge Mode

The CPS-GL1800 offers a boost charge mode. On the fly the operation of the unit can be selected over the interface between 2.06/2.23/2.40Vdc per cell. Each of the cell voltages can be fine-tuned.

External Shutdown feature (SD)

The GL1800 has a shutdown contact.

Real Time Failure Monitoring

The GL1800/RM1800 monitors its operation conditions. All messages will be displayed over a galvanic isolated relay. The controller detects AC and DC low voltage, while the DC voltage failure depends on the operated voltage set point. Further the device features over temperature control, fan control on blockade/cable break, and an intermediate voltage control.

Fan Failure Monitoring

The rectifier has a built-in fan monitor on blockade or cable break. Each failure will apply a message to the failure relay.

Measuring the operating Current and the Voltage

For smart service demands the GL1800/RM1800 features a measuring point. It allows an easy check of the correct output DC voltage and the operating DC current. Such feature helps much to service the field while the device is built into a 19-Inch subrack.

Galvanic Isolation

The power supply is galvanic isolated between the input and the output. All features like Shut Down, Inhibit and the Power Good Relay are isolated from the DC-power outputs and control connections.

Thermal shutdown

The CPS-EC series is featured with a thermal overload shut down

Over Voltage Protection (OVP)

The CPS-EC series is featured with a voltage overload shut down

Short Circuit Protection

A continuous short circuit does not cause damage to the power supply. It recovers automatically and does not shut down while short circuit appears. The GL1800/RM1800 rectifier delivers constant current and zero output voltage.

Open Circuit Protection (OCP)

The device is continuously open circuit protected. The device delivers a stable output voltage and no current. If a load is immediately connected to the device, the power supply stabilizes within 1ms. It does not overshoot the output voltage.

Power Up Ramp

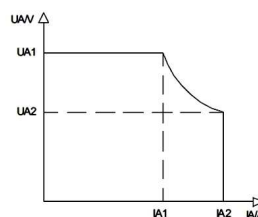
The device has a soft start ramp when powering up. The device does not either overshoot the voltage nor does the output flutter. The behaviour is independent from a load is connected or not.

Inrush Limiter

The power supply provides an electronic inrush current limiter that works absolute accurately with a low inrush of only 11Apeak/7.7Arms current value. The limiter works independent from the ambient temperature and its tolerance is only $\pm 10\%$.

Current Voltage Chart, CV & CC mode

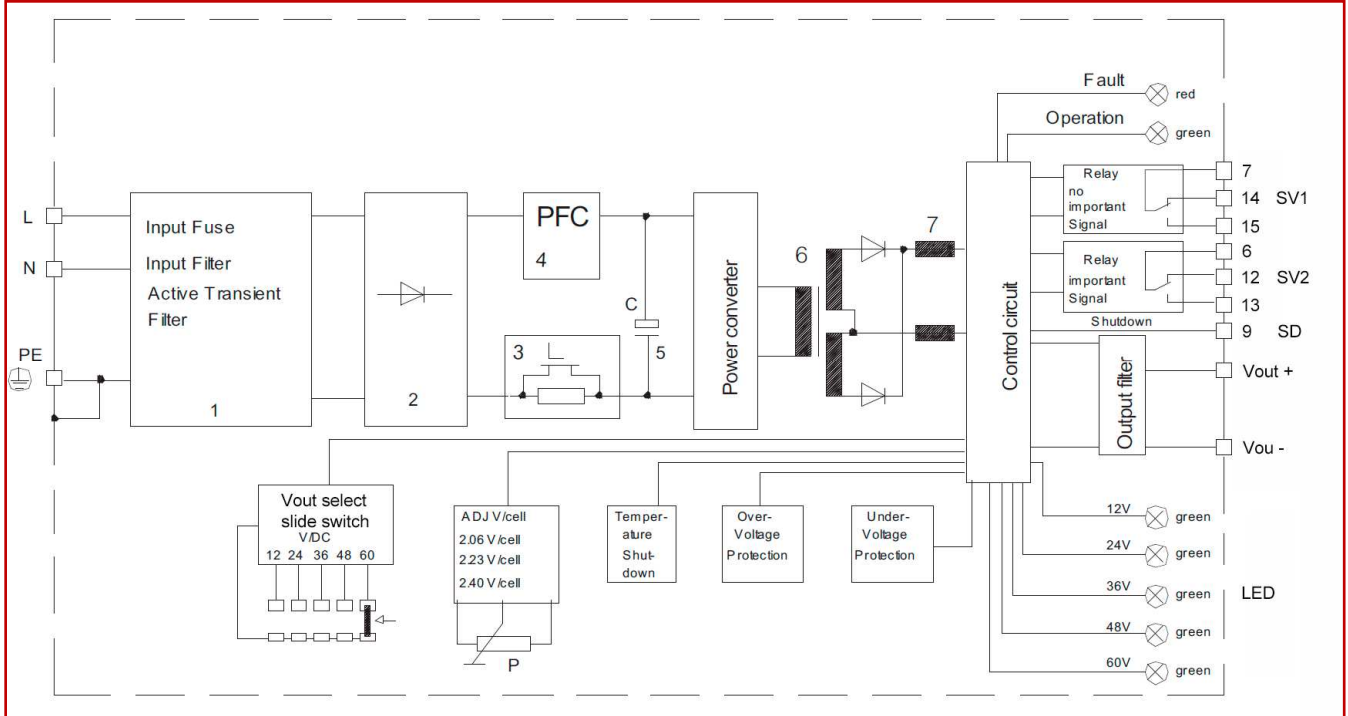
The GL1800 rectifier provides a perfect current voltage chart. It has no fold back or other abnormalities. The unit delivers a stable and constant current to the outputs. The device can be used either in the CV or in the CC mode (auto switch).



Technical Data Table

AC Input Range	184 – 265Vac, 16-2/3, 47 – 63Hz					
AC Input Nominal	220 – 240Vac, 16-2/3, 47 – 63Hz					
DC Input Range	250Vdc – 350Vdc					
AC Input Rating	230Vac <8.0A sinusoidal					
DC Input Rating	250Vdc<7.5A 350Vdc<5.0A					
The DC Output Voltage is selectable via a switch. The table shows the selectable pole voltages, the voltage set range depending on the selected pole voltage, the over voltage protection, the current with the adjustable current limiting and the ripple peak in mVpp @ 230Vac nominal load C/V characteristic DIN41773	Vout selector switch	Vset range	OVP	Cout	Cset range	Ripple Peak
	12Vdc	10.5-17.0Vdc	15.4Vdc	30A	18-30A	10mVpp
	24Vdc	21.0-34.0Vdc	31.0Vdc			
	36Vdc	32.0-51.0Vdc	46.0Vdc			
	48Vdc	41.0-68.0Vdc	60.0Vdc	25A	18-25A	
60Vdc	52.0-77.0Vdc	75.0Vdc				
Power	Max. 1800W continuous					
Potentiometer C/V Setting	15 turns high precision potentiometer, protective isolation ≤60Vdc					
Operation Failure Relay	Yes, change over contact to select between break / close indication, signalling contacts 80Vdc/1A					
Temperature Sense Function	External NTC control circuit required, see the chapter in this manual					
Remote Shutdown (SD)	Yes, protective isolation to the inputs and the output					
Accuracy	< ± 1.5% interface					
Load Regulation	< ± 0.05% 0-100%, 1ms					
Soft Start-up	100ms typical					
Start-up from Shutdown	5s max.					
Response to Load Change	<1ms 10-100%, 100-10%					
Base Load	None required (open circuit proof)					
Efficiency 230Vac	90%					
Short Circuit Protection	Continuous					
Open Circuit Proof	Continuous					
Temperature Control	Yes, thermal shutdown in a latch mode					
Hold Up Time	>40ms 230Vac					
Inrush Current ±10%	<7.7rms / <11Apeak (230Vac) active inrush current limiter					
MCB (Circuit Breaker)	10A type-B					
Cooling	Controlled fan from the manufacturer EBM Papst (Germany), Airflow = bottom to top blow					
Fan Failure Monitoring	Yes					
Ambient Operating Temp.	- 10°C...+50°C no derating					
Ambient Storage Temp.	- 40°C...+85°C					
Environment	Humidity 95% non-condensing @ 25°C ETS 300 019/class 3.2, climate class. 3k3, pollution rate II					
Altitude Operations	3000m (9842 ft.) above sea level					
ROHS standard	2011/65/EG & (EU)2015/863 confirmed					
REACH standard	EG No. 1907/2006 confirmed					
EMI	EN55022 conducted class B, radiated class B, EN61000-6-3					
EMS	EN61000-6-2					
Safety	EN61010-1, EN61010-2-201, EN62368-1, EN60950-1, EN60204-1					
Safety Class 1(A)	VDE0805, VDE0100					
Power Factor	Active PFC EN61000-3-2 factor λ=1.0					
Sophomoric Noise	< 2 mV, ETS 300 132-2/ITU-T					
Isolation Paths	> 8mm creepage distance & clearance paths					
Input to Output Isolation	4000Vac					
Input to Case Isolation	2500Vac					
Output to Case Isolation	500Vdc					
Meantime by Failure (MTBF)	450.000h (IEC61709)					
Meantime to Failure (MTTF)	167.312h (IEC61709)					
Dimensions (HxWxD)	6U/21TE (262x106x360mm) IP20 EN60529 case fit standard 19-inch 400mm subrack					
Weight	5800g					
AC Connector VDE0623	Female IEC60320:C13 male socket 10A/250Vac for female IEC60320:C14 plug 10A/250Vac					
DC Screw Terminals	Phoenix HDFK10, tightening torque 1.5 – 1.8 Nm Rigid cable 0.5 – 16mm² / AWG20 – AWG5, flexible cable 0.5 – 10mm² / AWG20 – AWG7					

Operation Manual and Technical Details



1) Active Transient Filter 2) Rectifier 3) Inrush Current Limiter 4) PFC 5) Load Capacitor 6) Transformer 7) Storage Choke

Connections

Feature	Technology	Details and Connections	Section	Information
Potentiometer Voltage	15 turns	High precision	2.06V/cell	Set voltage range and set-current range depends on selected Vout (see table p.5)
Potentiometer Voltage	15 turns	High precision float charging	2.23V/cell	
Potentiometer Voltage	15 turns	High precision boost charging	2.40V/cell	
Potentiometer Current	15 turns	High precision	Imax	
Voltage Monitor	Socket contact	Measuring point +/- socket	Vout 20V/1V	Relation 1V = 20V
Current Monitor	Socket contact	Measuring point +/- socket	Iout 8A/1V	Relation 1V = 8A
Shutdown	Contact	SUB-D15 female PIN09	X1 SD	(p.6)
Relay no important signal	Change-over	SUB-D15 female PIN07/14/15	X1 SV1	See relay signal table (p.6)
Relay important signal	Change-over	SUB-D15 female PIN09/12/13	X1 SV2	See relay signal table (p.6)
Operation Signal	-15Vdc	SUB-D15 female PIN11	X1 (11)	Reference to GND/L+
CCL1800 Charging Limiter	Contact	SUB-D15 female PIN04	X1	Separate device CCL1800 (p.5)
Output Voltage Selector	Slide switch	Select between 12/24/36/48/60Vdc	SWITCH	
Output Connection	Screw terminal	Phoenix Contact HDFK10	X3 Vout	
Input Connector Male	IEC socket	Schurter GSP1.850.1 10A/15A 250V	X2 Vac	
PE Protective Earth	M6 bolt	Redundant case earth	PE	

All potentiometers and all the inputs and the outputs of the analogue interface provide an isolation of 500Vdc to the output. Please note that the IEC-AC-Connector and the SUB-D-15p. connectors are not included

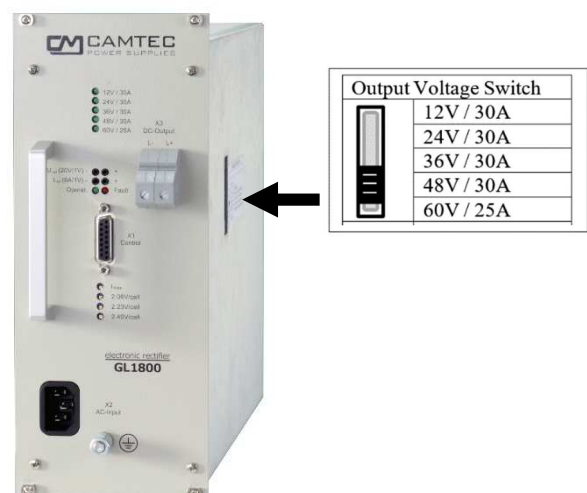
DC Voltage & DC Current setting table					
Rated DC Voltage	12Vdc (6 cells)	24Vdc (12 cells)	36Vdc (18 cells)	48Vdc (24 cells)	60Vdc (30 cells)
DC Voltage Setting Range 2.06V/cell	10.5 ... 17.0Vdc	21.0 ... 34Vdc	32.0 ... 51Vdc	41.0 ... 68.0Vdc	52.0 ... 77.0Vdc
DC Voltage Setting Range 2.23V/cell float charging	12.0 ... 15.5Vdc	24.0 ... 31Vdc	36.0 ... 46.0Vdc	48.0 ... 62.0Vdc	59.0 ... 77.0Vdc
DC Voltage Setting Range 2.40V/cell Boost charging	12.0 ... 15.5Vdc	24.0 ... 31Vdc	36.0 ... 46.0Vdc	48.0 ... 62.0Vdc	59.0 ... 77.0Vdc
DC Current Setting Range	18.0 ... 30.0A				18.0 ... 25.0A

The DC voltage and the current can be adjusted with a high precision 15 turn potentiometer with low temperature fading. The factory setting is 36Vdc (40.2Vdc preservation charging). We guarantee the above given set ranges with a tolerance of -5/0% for the lower margin and 0/+5% for the upper margin.

DC cell voltage setting indication:

While setting the outputs make sure the involved measuring equipment is ungrounded. It is demanded to use a separating transformer in front of the AC connection of an oscilloscope. Otherwise the GL1800/RM1800 could be damaged.

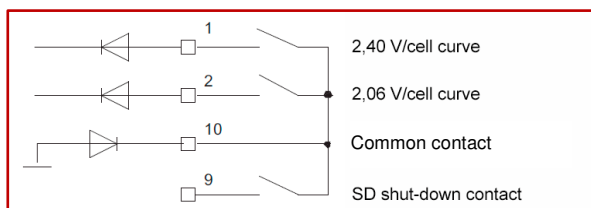
Select the output pole voltage with the slide switch located at the right of the power supply. The selected voltage will be indicated from the LEDs at the front plate of the device. The current limiting changes automatically. The idea of the location of the slide switch is to prevent inadvertent changes by the system owner. **Never change the output pole voltage while the device is connected to the AC or the outputs re connected to a DC battery!**



The output voltage can now be set in accordance to the battery cell voltage. The output current can be set to the desired level as well. Safety rules require to use an isolated screw driver for $\geq 60\text{Vdc}$ voltage setting.

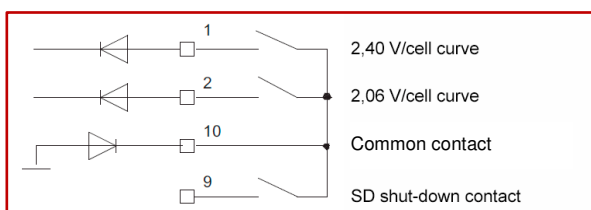
X1 SUB-D Shutdown contact (SD)

THE GL1800/RM1800 is featured with an external shutdown Contact. If the shutdown repeats the power supply starts with a delay. Using the soft-start the current and the voltage rises within 5s continuously to the default set values. The isolation between the SD contact and the DC-output is 500Vdc.



Boost Charging and float charging

The GL1800/RM1800 features a boost charge mode. The power supply delivers preservation / float charging when PIN2 of the connector X1 is enabled. Enabling PIN1 switches the rectifier into the boost charging mode. The maximum current limiting cannot be exceeded. The current limiting is depending from the selected output voltage. The boost charge is no power boost and it is recommended to set the current limiting potentiometer I_{max} to the equivalent value. Make sure that the opposite contact is always disabled when switching over between preservation charging and boost charging.

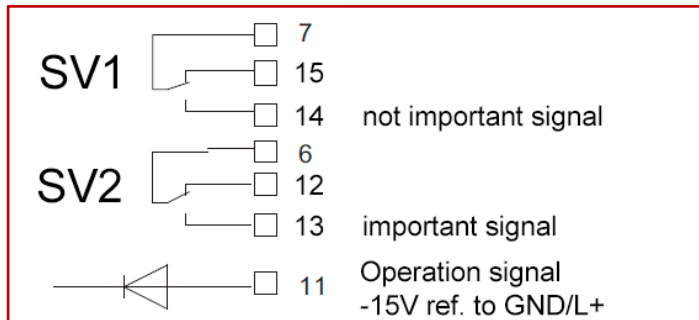


X1 SUB-D Power OK, Relay SV1 & SV2 indication

The below table of values shows the hysteresis of the lower and upper threshold margins where the POWER OK indication. The signalling contacts are capable of 80Vdc/1A.

WARNING! Regarding the DC-output voltage setting range it is important to consider that this data sheet shows the guaranteed values. In practice the setting range will be wider. The lower margin of the setting range can go below the DC-ok high margin of the power-ok indication. Make sure that the output voltage setting will properly stay above the DC ok high margin to avoid false messages from the relay.

Hysteresis & Threshold Margins								
Nominal [V]	DC-ok low		DC-ok high		Input ok low		Input ok high	
12V	>12.0Vdc		<15.6Vdc		155Vac		175Vac (the power supply unit starts at 175Vac)	
24V	>24.0Vdc		<31.2Vdc					
36V	>36.0dc		<46.8Vdc					
48V	>48.0dc		<60.0Vdc					
60V	>60.0Vdc		<75.0Vdc					
Relay Indications SUB-D (X1)								
Power Supply Status	Normal	AC-Fail	DC-Low	DC-High	Shut Down	Temperature	Fan	Internal Bus
Relay SV1 bridged contacts	7-15	7-14	7-14	7-14	7-14	7-14	7-14	1-14
Relay SV2 bridged contacts	6-12	6-13	6-12	6-13	6-12	6-13	6-12	6-13



The power ok relays SV1 and SV2 indicate the power supply operation condition. The relays have change over contacts to allow demanded system integration. The contacts are floating (no earth connection). The protective isolation is 500Vdc to the outputs and 4000Vac to the input. Considering the lower and the upper margin of the AC voltage detection it is to say that the unit starts at 155Vac. The relay SV2 indicates low battery. SV1 and SV2 both change over when the AC voltage fails.

PIN11 of the DUB-D connector (X1) delivers -15Vdc when the power supply unit is operating.

LED Signal Indication								
LED	Normal	AC-Fail	DC-Low	DC-High	Shut Down	Temperature	Fan	Internal Bus
12V/30A	ON	OFF	OFF	OFF	OFF	ON	ON	OFF
24V/30A	ON	OFF	OFF	OFF	OFF	ON	ON	OFF
36V/30A	ON	OFF	OFF	OFF	OFF	ON	ON	OFF
48V/30A	ON	OFF	OFF	OFF	OFF	ON	ON	OFF
60V/25A	ON	OFF	OFF	OFF	OFF	ON	ON	OFF
Operat.	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF
Fail (RED)	OFF	ON or OFF	ON	ON	ON	ON	ON	ON

Note: The LED indication is not lit when the power supply is switched off or has very low AC.

Monitor	Description	Function	Action
Internal Bus Failure	The internal bus voltage drops below 350Vdc	Locked shut down to prevent damages to the device	Return to service
AC Failure	The AC fail indicates a voltage below 155Vac	Shut down, auto recovery	Device restarts when AC returns to normal values. Power up time up to 5s.
Over Voltage	The OVP indicates that the output voltage exceeds 2.5V/cell for the 48V & 60V selection or 2.6V/cell for the other voltage selections	Locked shut down to prevent damages to the batteries	Check the load
Low Voltage	The LVP indicates that the output voltage drops below 1.9V/cell for the 48V & 60V selection or 2.0V/cell for the other voltage selections	Failure LED is lit, device continues operation	Check the load
Fan Failure	The fan indicates when either the fan is blocked or when the fan is disconnected	Failure LED is lit, device continues operation	Return to service
Temperature Failure	The temperature control indicates an over temperature from either the transformer or the internal coolers	Locked shut down to prevent damages to the device	Let the device cool down. Disable and then enable the AC voltage to restart the unit. Power up time up to 5s.

Measuring the Output Current and the Output Voltage (Vout 20V/1V, Iout 8A/1V)

The Output voltage and the output current can be checked. The power supply features test socket contacts at the front plate. The unit delivers a voltage output signal. For the output voltage the relation for the voltage is $1V_{\text{signal}} \approx 20V_{\text{output}}$ and for the current it is $1V_{\text{signal}} \approx 8A_{\text{output}}$.



Inrush Current Limiter

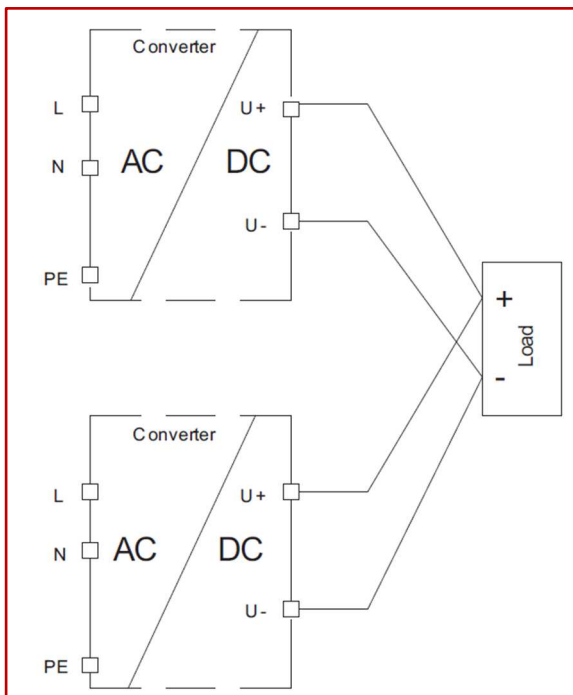
The unit is featured with an electronic inrush current limiter (ex. 230Vac = 7,7Arms / 11Apeak). The built-in circuit is a very precise limiter and no simple NTC thermistor solution. The circuit works with an accuracy of $\pm 10\%$. The accuracy is independent from the ambient temperature and from the number of switch-on sequences. The quickest recommended MCB is B-type 8A (230Vac). The smallest power relay or a contactor in front of the GL1800 must cope 11A peak current.

Parallel Operation & Decoupling

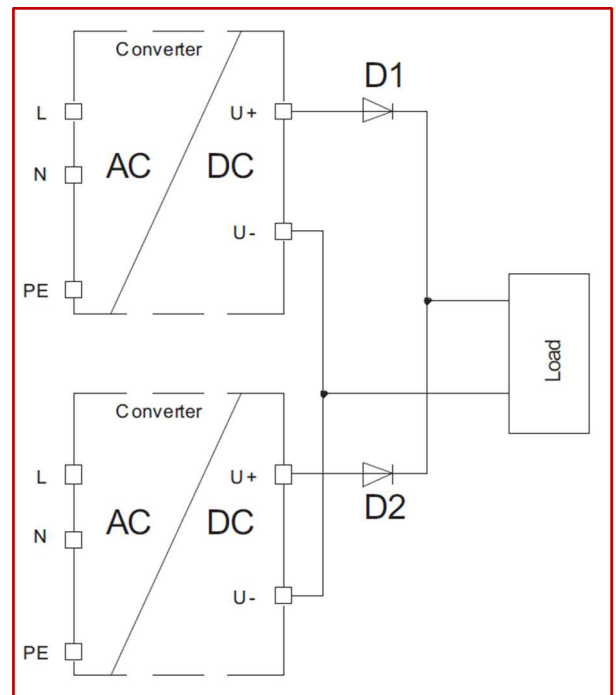
In order to increase the overall power of the power supply, two or more devices of the same model with the same output voltage may be operated in parallel. We recommend using a busbar for the DC power connector. Make sure that the cable lengths and cable cross-sections of all power supplies to the busbar or to the star point are identical. To avoid operation errors, select the line length from the neutral point or from the busbar to the load as short as possible and use the maximum possible conductor cross-section.

The GL1800 / RM1800 models have no internal O-ring diode for decoupling. It is possible to operate up to 35 power supplies in parallel.

The internal inrush current limiter of the GL1800 offers easy installation without having the problem of extreme high inrush current while operating the units in parallel. Find more details on page 7 of this manual.



Parallel Operation without decoupling



Parallel/Redundant Operation with decoupling

Connections

AC Main Input

IEC male plug in
connector IEC60529
IEC61140

DC Mains

DC + voltage / DC - voltage
Screw Terminal IEC60947-7-1 Phoenix HDFKV10
Rigid cable 0.5 – 16mm² / AWG20 – AWG5
Flexible cable 0.5 – 10mm² / AWG20 – AWG7
tightening torque 1.5 – 1.8 Nm

Interface

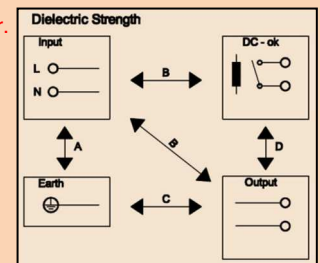
SUB-D 15 pole female DIN41652
IEC807-3

Safety Test

Type Test	T	A	B	C ¹⁾	D
Factory Test	60s	2500Vac	4000Vac	500Vdc	500Vdc
Field Test	5s	2000Vac	2000Vac	500Vdc	500Vdc
	2s	2000Vac	2000Vac	500Vdc	500Vdc

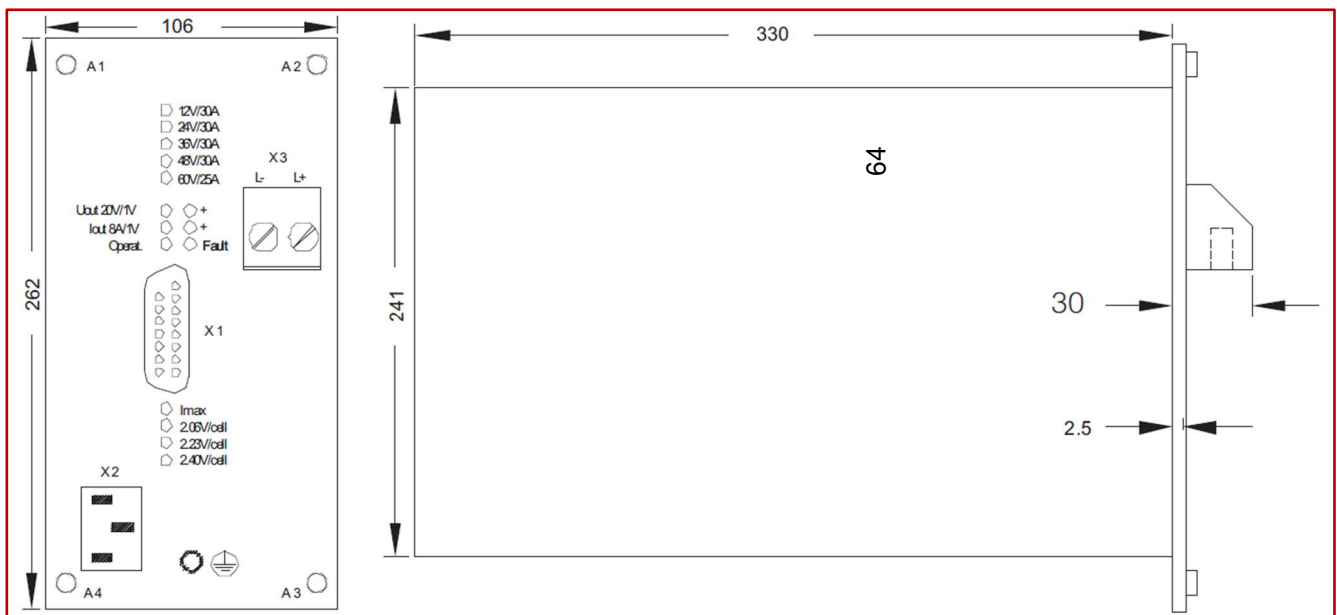
Type test and factory tests are
conducted by the manufacturer.
Do not repeat the test in field.
Field test rules:

- Use appropriate test equipment which apply the voltage with a slow ramp
- Connect L1 and N together, as well as all output poles
- Use only AC test-voltages with 50/60Hz. The output voltage is floating and has no ohmic reference to ground.
- When testing output voltages $\geq 60\text{Vdc}$ remain to safety rules.
Use only isolated screw drivers to adjust output voltages.



Mechanics & Installation Instructions

Stable metal/aluminium housing IP20. To allow adequate convection, a free air space of 50mm above the top and below the bottom of the device is required. The unit has a controlled fan at the bottom. Do not block the ventilation holes at the bottom and the top of the unit. Make sure that the fan cannot be blocked under operation. The GL1800 must be installed vertically so that the air flows through the fan from the bottom to the top of the device. It is not possible to operate the unit in another mounting position.



The GL1800 must be installed vertically so that the air flows through the fan from the bottom to the top of the device. It is not possible to operate the unit in another mounting position.

Trouble Shooting

Device delivers no DC voltage, LED is not lit, fan does not blow	Device powers up	Wait 5 seconds until the device is online
	Device does not power up	Reconnect AC plug and ensure that the AC voltage is available
	Shutdown enabled (SD)	Release shutdown
Device powers up and immediately goes into Failure Mode and shuts itself down (no output voltage)	Check if output voltage setting is too high	Lower output voltage
Device powers up and immediately goes into Failure Mode (output voltage enabled)	Overpower current limiting mode	Lower connected load
	Fan failure	Unblock fan
Device shuts down	The AC fail indicates a voltage below 155Vac	Device restarts when AC returns to normal values. Power up time up to 5s.
	The over voltage protection indicates that the output voltage exceeds 2.5V/cell for the 48V & 60V selection or 2.6V/cell for the other voltage selections => locked shut down	Disconnect the device. Check the load and the cabling. Switch the AC on when the failure has been found. Power up time up to 5s
Failure LED is lit, device continues operation	The low voltage protection indicates that the output voltage drops below 1.9V/cell for the 48V & 60V selection or 2.0V/cell for the other voltage selections	Disconnect the device. Check the load is too high. Check cabling. Switch the AC on when the failure has been found. Power up time up to 5s
	The fan indicates when either the fan is blocked or when the fan is disconnected	Resolve the blocking. In all other cases return to service
	The temperature control indicates an over temperature from either the transformer or the internal coolers => locked shut down	Let the device cool down. Disable and then enable the AC voltage to restart the unit. Power up time up to 5s.
	The internal bus voltage drops below 350Vdc => locked shut down	Never open or try to repair the unit. Inside are dangerous voltages that can cause electrical shock hazard. Return device to service

Safety regulations: Please read these instructions completely before using the equipment. Keep these instructions on to hand. The device may only be operated by trained specialist staff.

Installation:

- 1.) The device is designed for devices and systems that meet the standard requirements for hazardous voltages, power and fire prevention.
- 2.) Installation and service only by trained persons. The AC power must be switched off. The work is to be labeled; accidental reconnection of the system must be prevented.
- 3.) Opening the device, its modification, loosening bolts or operation outside the specified herein specification or in an unsuitable environment, has the immediate loss of warranty to follow. We disclaim any responsibility for any resulting damage to persons or things.
- 4.) Note: The device must not be operated without an upstream circuit breaker (CB). We recommend the use of B-Type 10A. It is prohibited to use the unit without PE. It may be necessary upstream device has a power switch.

Warning:

Non-compliance can result in fire and serious injury or death.

1. Do not operate without PE.
2. Before connecting the device to the AC, make wires free of voltage and assure accidentally switch on.
3. Allow neat and professional cabling.
4. Never open or try to repair the unit. Inside are dangerous voltages that can cause electrical shock hazard.
5. Avoid metal pieces or other conductive material to fall into the item.
6. Do not operate the device in damp or wet conditions.
7. Do not operate the unit under EX-conditions.



All parameters after 15 minutes of continuous operation at full load / 25°C / 230Vac 50/60Hz, unless otherwise indicated.