

Read this first!

Before operating this unit please read this manual thoroughly and retain this manual for future reference! This device may only be installed and put into operation by qualified personnel. If damage or malfunction should occur during operation, immediately turn power off and send unit to the factory for inspection. The unit does not contain serviceable parts. The tripping of an internal fuse is caused by an internal defect. The information presented in this document is believed to be accurate and reliable and may change without notice.

Intended Use: This power supply is designed for installation in an enclosure and is intended for general use such as in industrial control, office, communication, and instrumentation equipment. Do not use this device in equipment, where malfunction may cause severe personal injury or threaten human life.



WARNING

Risk of electrical shock, fire, personal injury or death.

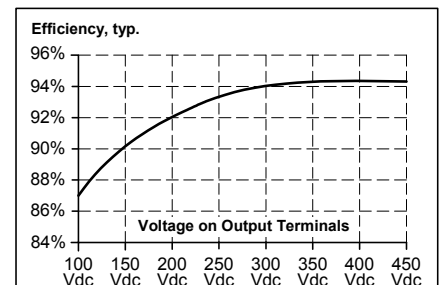
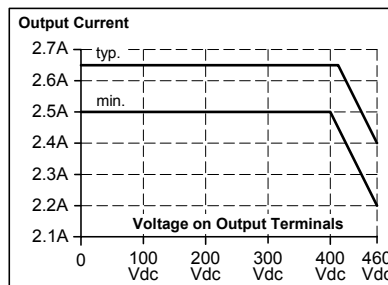
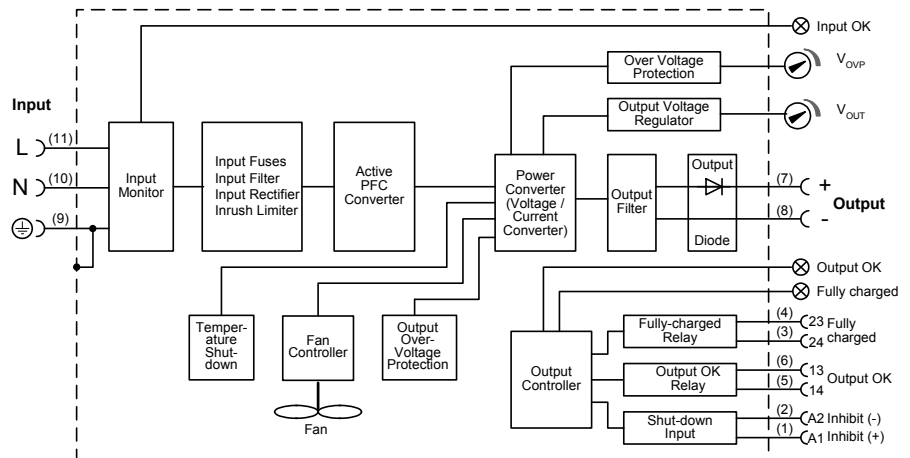
- 1) Do not use the power supply without proper grounding (Protective Earth).
- 2) Turn power off before working on the device. Protect against inadvertent re-powering.
- 3) Make sure that the wiring is correct by following all local and national codes.
- 4) Do not modify or repair the unit.
- 5) Do not open the unit as high voltages are present inside.
- 6) Use caution to prevent any foreign objects from entering the housing.
- 7) Do not use in wet locations or in areas where moisture or condensation can be expected.
- 8) Do not touch during power-on, and immediately after power-off. Hot surfaces may cause burns.

Functional Description:

This power supply can be used as a regular power supply with an adjustable output voltage between 360V and 460V or as a charger for EDLC-capacitors (electrical double layer capacitors commonly known as Ultracaps, Supercaps or Greencaps). The charging method is a constant current – constant voltage characteristic followed by a float charging mode. The output is protected with a serial diode to avoid return currents from the capacitors. A redundant control circuit monitors the end-of-charge voltage and switches the unit off in case of high voltage. After such an event, automatic start attempts occur until the failure is cleared. Due to the internal fan which starts running when necessary, the unit can be used in any mounting orientation and at altitudes as high as 6000m. Furthermore, the wide operational temperature range from -40°C to +65°C, the low weight of only 2.3kg and the small size of only 310 x 154 x 80mm (LxWxH) allows for many types of applications. A galvanically isolated inhibit input stops the charging mode and the "Fully-Charged" and an "Output-OK" relay contacts allow a remote monitoring of the unit.

Performance Data:

Input Voltage AC 220-240V -20%/+10% (176 to 264Vac)
 Turn-on Voltage typ. 164Vac
 Shut-down Voltage typ. 151Vac
 Input Current typ. 5.2A (at 230Vac, 1000W output power)
 Input Frequency 50-60Hz ±6%
 Power Factor > 0.9
 Inrush Current < 10A peak (active limited)
Output voltage 360-460Vdc
 Factory setting: 410Vdc
 min. 2.5A at 400Vdc
 Output Current
 Ripple-Voltage - typ. 6Vpp , max. 10Vpp (without connected capacitor bank)
 - negligible (with connected capacitor bank)
 Ripple Current typ. 150mApp , max. 300mApp (during charging)
 Return Current Max. 1mA (discharge current when charger is off)
 Efficiency typ. 94.4 %
 Full-load Losses typ. 60W (output: 400Vdc, 2.6A)
 No-load Losses typ. 12 W at 360Vdc output voltage
 typ. 13 W at 400Vdc output voltage
 typ. 15 W at 460Vdc output voltage
 Dimensions 310 x 158 x 80mm (L x W x H)
 Weight 2.3kg / 5lb
 Temp. Range -40°C to +65°C (operational)
 -55°C to +85°C (storage)
 Humidity 10 – 90% r.H.
 Do not energize while condensation is present
 Altitude 0 to 6000m above sea level
 Shock 20g 11ms, 3 bumps per direction (18 in total)
 30g 6ms, 3 bumps per direction (18 in total)
 Vibration 2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g



Protection Features:

The output is short-circuit, overload and no-load proof. After removing the fault, an auto-restart will be performed.

Over-temperature protection:

A temperature sensor monitors the internal temperature of a semiconductor. If the temperature rises above a certain level, the fan will be turned on. If the temperature keeps rising, the output will switch off in order to protect the charger. The output will automatically turn on again as soon as the temperature decreases by 5°C. The "Output-OK" LED will be off and the "Output-OK" contact will be open when the over-temperature protection is active.

Output over-voltage protection (OVP) circuit:

In case of an internal power supply defect, a redundant circuit limits the maximum voltage on the output terminals. If the fault has not removed within 2.5s, the "Output-OK" LED will be turned off and the "Output-OK" contact will open.

Overload and short-circuit protection:

An overload or short circuit on the output will be recognized by the slew-rate of the voltage change on the output. If the output does not reach typ. 40Vdc within 130s after starting to charge, the charger will stop and will make a pause of 110s before a new charging cycle starts. These cycles continue until the fault has been removed.

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North America	PULS in St. Charles / Chicago	+1 630 587 9780	www.pulspower.us
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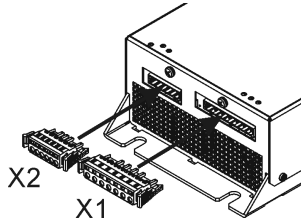
Terminals and Wiring

Two self-locking plug-connectors (X1, X2) with spring-clamp connection points. Use appropriate copper cables that are designed for the required operating temperature. Follow national installation codes and regulations! Ensure that all strands of a stranded wire enter the terminal connection!

Allowed wire sizes	0.08 - 2.5 mm ² (solid)
	0.08 - 2.5 mm ² (fine-stranded)
	0.25 - 1.5 mm ² (fine-stranded with ferrule and plastic collar)
	0.25 - 2.5 mm ² (fine-stranded with ferrule, without plastic collar)
	28 - 12 AWG
Recom. stripping length:	8 - 9mm (0.31 - 0.35in)

Pin assignment:

X1: Power Connector	X2: Signal Connector
1 Vout (+)	1 Inhibit (+)
2 not used	2 Inhibit (-)
3 Vout (-)	3 Fully charged contact
4 not used	4 Fully charged contact
5 PE	5 Output-OK contact
6 N	6 Output-OK contact
7 L	



Isolation and Dielectric Strength

The output is floating and has no ohmic connection to the ground. Type and factory tests are conducted by the manufacturer. The test duration is 60s for type tests and 5s for the factory tests. Field tests may be conducted in the field using an appropriate test equipment which applies the voltage with a slow ramp (2s up and 2s down). Prior to the field test connect all input-terminals together as well as all output poles. When testing, set the cut-off current settings of the test equipment to a value larger or equal than 10mA. Optionally, a DC test voltage can be applied too. In such cases, multiply the AC test voltages with the factor 1.41. The test duration for field tests should not exceed 10s, since every high-pot test adds extraordinary stress to the unit.

	Type- and Factory tests			Field tests		
	Output	PE	Signal Pins	Output	PE	Signal Pins
Input	2.5kVac	2.5kVac	3kVac	2kVac	2kVac	2.5kVac
Output	-	2.5kVac	3kVac	-	2kVac	2.5kVac
PE	-	-	500Vac	-	-	500Vac

Procedure for Setting the End-of-Charge Voltage and the OVP Level

OVP voltage: The OVP voltage (Output over-voltage protection) automatically adjusts to 10V higher than the end-of-charge voltage after following the procedure for setting the end-of-charge voltage. To test the OVP level tune the end-of charge-voltage potentiometer clockwise until the "Fully Charged" LED starts flashing. This indicates the OVP level.

End-of-Charge voltage: Setting the end-of-charge voltage shall be done in a laboratory. The output shall be open (not loaded, no capacitor needed). The output voltage (end-of-charge voltage) shall be measured with a digital voltmeter. Factory setting of the end-of-charge voltage is 410Vdc and the OVP level is 10V higher. Changing of these values can be done according to the following examples:

Example 1: Setting the end-of-charge voltage to 420V and OVP to 430V

Step 1: Push the "OVP disable / enable" button to disable the OVP. The red LED will start and keep flashing for two minutes. For this period of time the end-of-charge voltage can be set without triggering the OVP. Ensure that the unit is not in OVP mode before starting with step 1.

Step 2: Set the end-of-charge voltage to 420V

Step 3: Push the "OVP disable / enable" button again to set the OVP voltage 10V higher than the end-of-charge voltage(= 430Vdc). Red LED will go off.

Example 2: Setting the end-of-charge voltage to 430V and OVP to 450V

Step 1: Push the "OVP disable / enable" button to disable the OVP. The red LED will start and keep flashing for two minutes. For this period of time the end-of-charge voltage can be set without triggering the OVP.

Step 2: Set the end-of-charge voltage to 440V

Step 3: Push the "OVP disable / enable" button again to set the OVP voltage 10V higher than the end-of-charge voltage(= 450Vdc). Red LED will go off.

Step 4: Set the end-of-charge voltage to 430V (without pushing the button)

CE Marking

CE mark is in conformance with EMC directive 2004/108/EC, the low-voltage directive (LVD) 2006/95/EC and the RoHS directive 2011/65/EU.

EMC Immunity: EN 61000-6-1, EN 61000-6-2

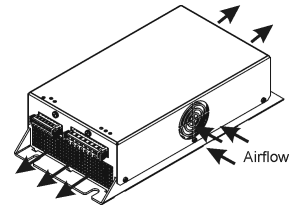
EMC Emission EN 61000-6-3, EN 61000-3-2, FCC Part 15 Class B

Input Fuses

Internal input fuse included, not user accessible. The unit is tested and approved for branch circuits up to 32A (IEC) or 30A (UL). An external protection is only required if the supplying branch has an ampacity greater than this, however, in some countries local regulations might apply. Check local codes and requirements. If an external fuse is necessary or utilized, use a minimum value of 10A B or 8A C-characteristic breaker to avoid nuisance tripping of the circuit breaker.

Cooling

The charger has a temperature controlled fan included, which makes the unit suitable for any mounting orientation and also suitable for applications where the heat cannot be transferred through the base plate of the unit. The fan will only run if needed during high temperatures. The fan will also run for 8 seconds after applying sufficient input voltage. This allows to check the function of the fan. Furthermore, the fan will run approximately every three hours for a short time to avoid a stiffness of the fan after long breaks and to extend the life of the fan.



Signals, LEDs

Inhibit Input: A signal voltage of at least 18V on the inhibit input terminal stops the charging mode. Safety features are not included. The input is galvanically isolated by an optocoupler.

Output-OK Relay Contact: This relay contact closes when the charger works properly and no internal faults or abnormal conditions are present. The contact is open when the inhibit input is active, the over-temperature protection is activated, during overload or short-circuit conditions or when the over-voltage protection circuit has triggered.

Fully-charged Relay Contact: This relay contact closes (normally-open-contact) when the end-of-charge voltage is achieved.

Contact ratings: max. 30Vdc, 0.5A resistive load min. 1mA at 5Vdc (minimum permissible load)

Input-OK LED: This green LED is on, when input voltage is higher than 150Vac.

Output-OK LED: This green LED is synchronized with the Output-OK relay contact. The LED is on when the relay contact is closed.

Fully-charged LED: This green LED is off during charging and is on when the end-of-charge voltage is achieved. The LED is flashing when the unit enters the over-voltage protection level area (charger has switched off and makes start-up attempts).

LEDs Pattern

	Input-OK	Output-OK	Fully charged
Capacitors in charging mode	ON	ON	OFF
Capacitors fully charged	ON	ON	ON
Inhibit input activated	ON	OFF	OFF (***)
Capacitor does not permit charging	ON	130s ON, 110s OFF	OFF
No capacitor connected	ON	ON	ON
Over-temperature shut-down (OTP)	ON	OFF	****)
Over-voltage protection activated (OVP)	ON	OFF **)	flashing
Input voltage < 150V	OFF	OFF	OFF

Relay Contacts Pattern

	Output-OK *)	Fully charged
Capacitors in charging mode	closed	open
Capacitors fully charged	closed	closed
Inhibit input activated	open	open (***)
Capacitor does not permit charging	130s closed, 110s open	open
No capacitor connected	closed	closed
Over-temperature shut-down (OTP)	open	****)
Over-voltage protection activated (OVP)	open **)	closed
Input voltage < 150V	open	open

*) The Output-OK contact is synchronized with the Output-OK LED.

**) Short single pulses will be suppressed in order to avoid a false triggering of the OVP.

***) Delayed by a couple of seconds

****) According to the state-of-charge

