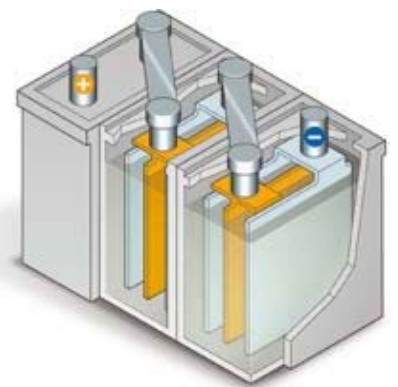




**BP••••**

Battery chargers



Technical addendum

[www.cretechnology.com](http://www.cretechnology.com)



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## DOCUMENT CONTROL

Version	Date	Details
A	Dec. 23 <sup>rd</sup> , 2014	First publication
B	April 27 <sup>th</sup> , 2015	Adding of BP+ range. More on IEC61010-1. Corrections on FAULT relays (text, photos and diagrams). Corrections on derating temperature of BP0524M & BP1012M.
C	March 12 <sup>th</sup> , 2017	Modification BP+ range → 305 V <sub>AC</sub>

This document is intended to help understand our Product information and technical documentations, and make informed choices. It starts with installation hints.

## 1 COMMON FEATURES

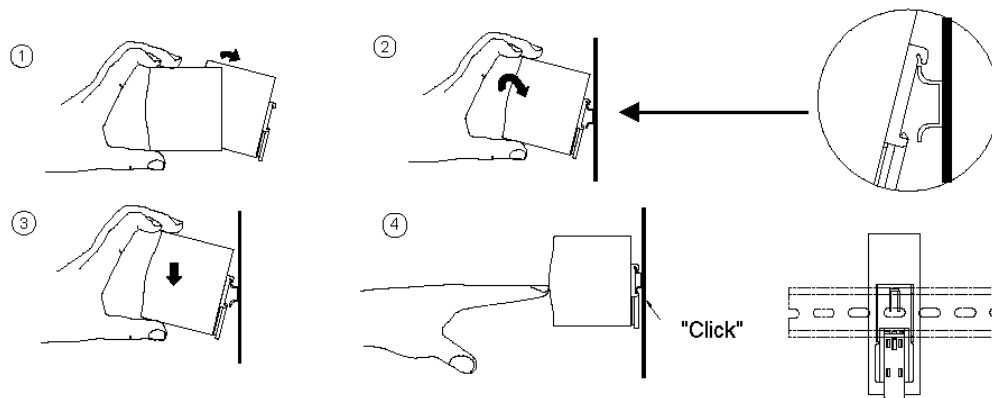
### 1.1 Mounting

Only install the charger in a pollution degree 2 environment (dry, well-ventilated locations).

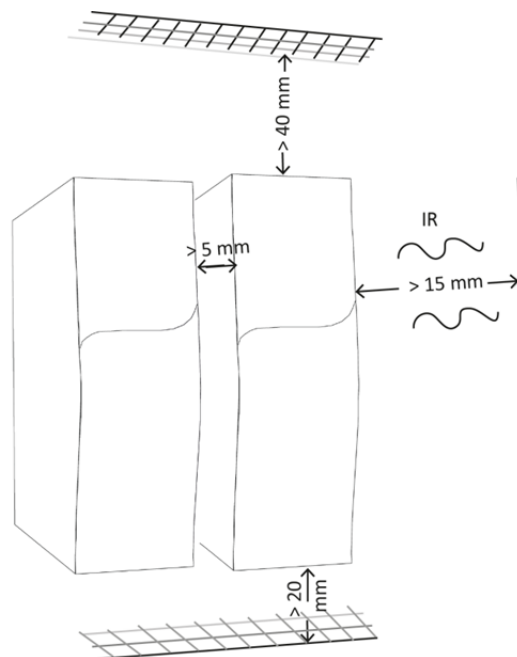
Hang the charger vertically with the input terminal strip at the bottom.

To fasten the charger on the  $\Omega 35$  DIN rail (7.5 or 15):

1. Tilt the charger slightly rearwards
2. Fit the charger over top hat rail
3. Slide it downward until it hits the stop
4. Press against the bottom for locking
5. Shake the charger slightly to check the locking action

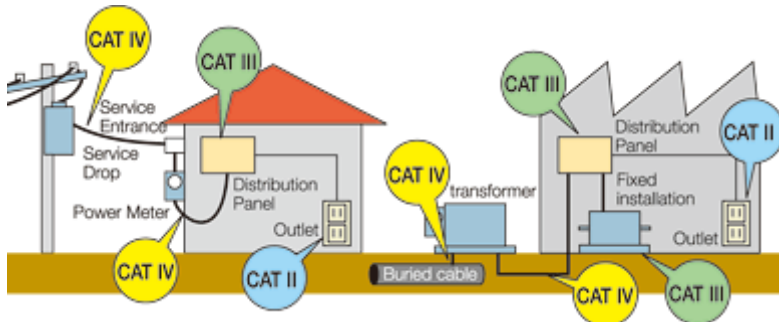


Clearances are recommended around a charger, when it is permanently at full power, especially if it is adjacent to a heat source:

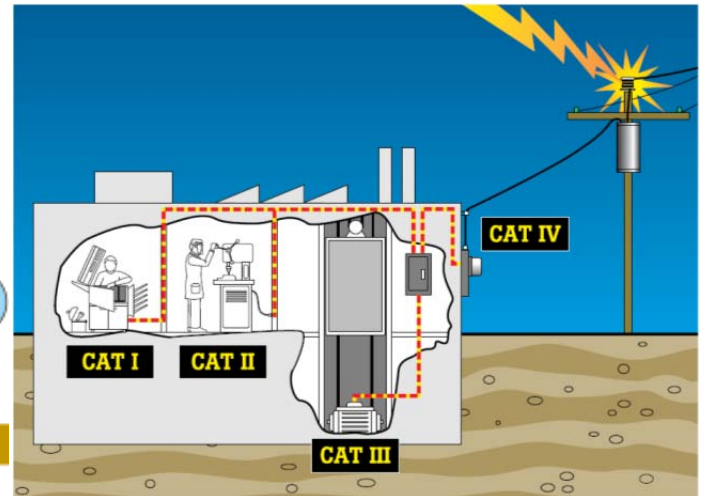


Derogation: DIN modules with diode or fuse. See further.

By design our chargers are category II regarding the installation. As illustrated for home and factory, the risk of electrical shock is higher upstream in the distribution system, especially if the location is lightning-prone:



Categories according to IEC61010-1



CAT II: all outlets at more than 10m from CAT III or 20m from CAT IV

If the category III or IV is required, a surge protection device must be added. Ask our customer service for advice.

## 1.2 Definitions

The individual technical documentations specify various characteristics, such as



- **Charger inrush current:** at power-on, a large pulse current is draft from the AC source for half to 1 cycle (1/100 ...1/50 ms in 50Hz). As a result, avoid recycling the power several times in a row. Besides, if several chargers are turned on at once, the high current may trip a protection; we recommend phasing in the starts
- **Setup time:** lead time after source connection
- **Rise time:** time for the output voltage to get steady
- **Hold-up time:** time when the nominal output voltage is still present after source loss
- **Temperature coefficient:** used to compensate the influence of temperature
- **Leakage current:** see the captions of the diagram blocks further (BP, BP+ and BPR B ranges)
- **Charger efficiency:** ratio of total power delivered by the charger to input power; it differs from 1 because of dissipation inside the charger
- **Battery capacity:** total charge the battery can store. The battery can deliver an energy (Wh) = average voltage x total charge (Ah). Rule of thumb: select a charger whose output current equals total charge/10 (C-rate = 0.1xC corresponding to slow charger)
- **Charger float voltage:** charge voltage at full charge

## 1.3 Safety issues

⚠ DANGER	
	<b>HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH</b>
	<ul style="list-style-type: none"> <li>▪ The unit must only be installed and serviced by qualified electrical personnel</li> <li>▪ Apply appropriate personal protective equipment (PPE), follow safe electrical work practices</li> <li>▪ Turn off power before installing or removing fuses, and before installing the unit</li> <li>▪ Use a properly rated voltage sensing device to confirm the power is off</li> <li>▪ Do not use renewable link fuses in fused switch</li> </ul>
	<b>Failure to follow these instructions will result in death or serious injury</b>

Connect the protective earth to ground. Isolate the charger from the AC source, before connecting or disconnecting a battery. Do not open the charger.

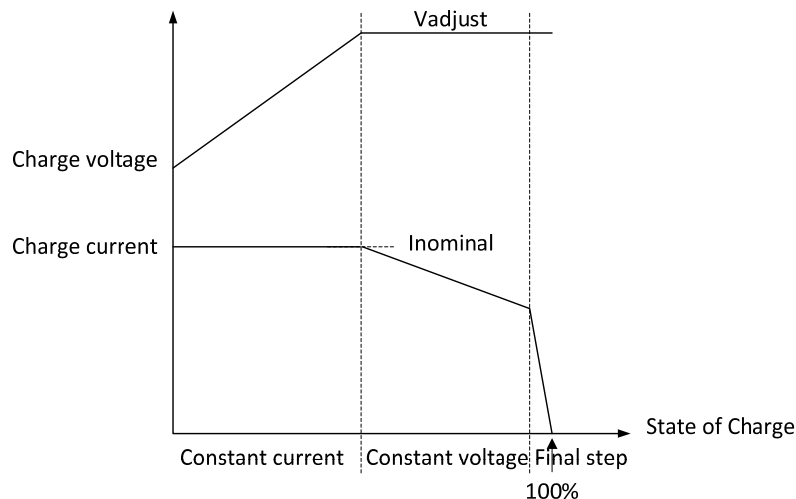
Never charge a frozen battery. Due to a charge imbalance risk, avoid charging batteries in parallel.

<b>⚠ WARNING</b>	
<b>HAZARD OF BURN &amp; FIRE</b>	
	Do not touch the unit in operation and shortly after disconnection
	Risk of fire and short circuit. Protect the openings from foreign objects or dripping liquids
<b>Failure to follow these instructions may result in serious injury</b>	

#### 1.4 Charge curve

The charge takes place as follows:

- I constant, U increases to reach the nominal power
- I decreases
- I decreases rapidly to 0



Note: in the flat sections, the curve may feature a slight slope due to temperature drifts.

For several types of battery and two nominal voltages, the following table shows the recommended Float and Boost voltages ( $V_{boost}$  is 4 ... 5% above  $V_{float}$ ). You can take either voltage for  $V_{adjust}$ , but  $V_{float}$  is preferred if the battery remains connected after full charge is reached.

Battery rated voltage	NiCd		Gel /Lead-acid	
	$V_{float}$	$V_{boost}$	$V_{float}$	$V_{boost}$
12V	13.2V	13.8V	13.7V	14.2V
24V	26.4V	27.6V	27.4V	28.4V

This table is given for information only; check with the battery manufacturer.

To function as a "float charger" which senses the reduction in charging current and reduces the charging voltage, implement a boost strategy with a BPR B charger (see *BPRB range/Overview*); an external logic must remove the boost on time.

When the battery is used in a standby operation, such as the start of a diesel generator, the charge time does not matter a lot. It depends on the C-rate. During normal operation, the battery is at full capacity and the battery charger is used to maintain the float voltage of the battery.

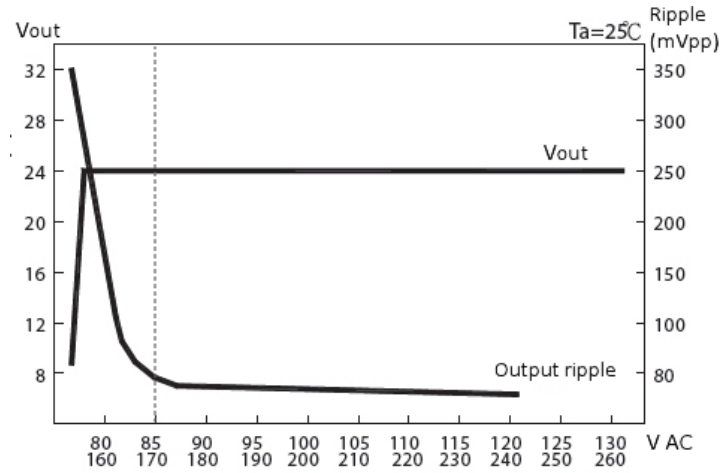
The battery is only drained when the generator starts. As the generator has a DC charging alternator fitted, the battery is quickly recharged when the generator is running. If the generator stops before the battery is fully recharged, the charger continues to recharge the battery until it is fully charged.

## 1.5 Derating

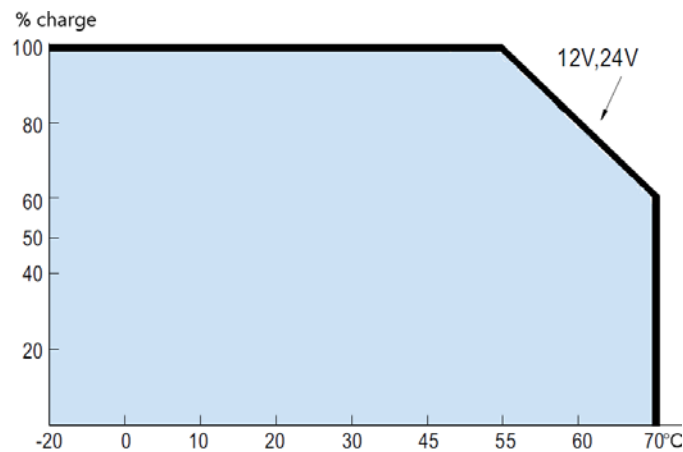
The performance might downgrade beyond the specified limits in the technical documentations:

- AC voltage below lower limit:

Example: BP0524M (the AC voltage limit is 85V or 170V depending on the position of a switch)



- Temperatures above the limits:



NOTE General outlines are shown here. To see the accurate curves, refer to the specific *Product information*.

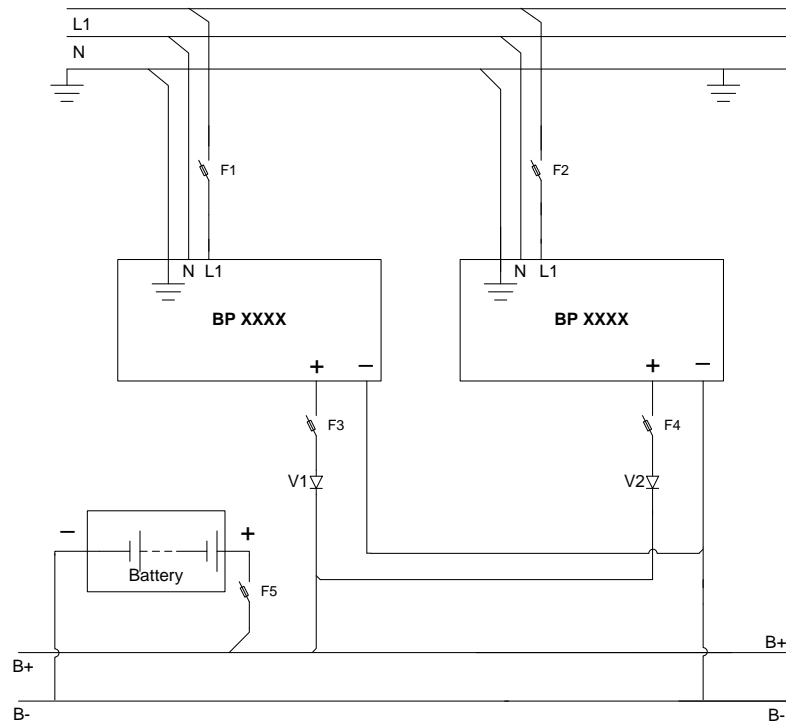


## 1.6 Paralleling chargers

For a better availability or to increase the output currents, it is advised to parallelize several chargers.

Except for BP+ range (where the diode is built in), Schottky diodes must be installed so that there is no reverse current and harmonics do not add. Redundancy is also possible.

The diode SBX 2550 is connected between the terminals of a DIN terminal module. The kit includes the module and the diode. The chargers are hooked up as follows (in this case, AC inputs are L1-N):



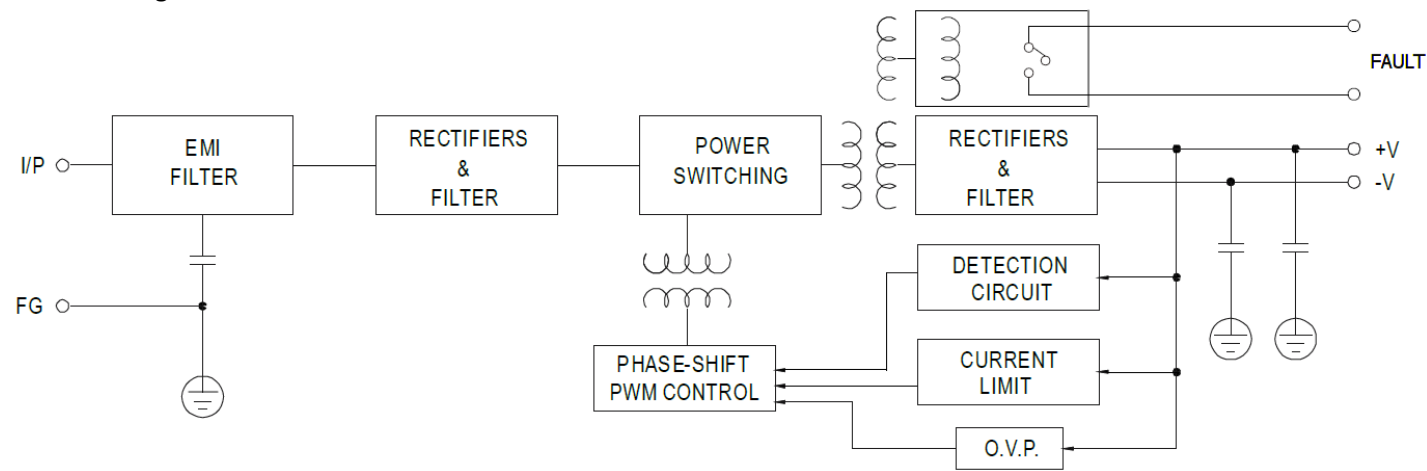
For an optimal charge:

1. Adjust to identical voltages on both chargers (at mid-run typically)
2. Connect the battery to be charged
3. Measure the current delivered by each charger
4. Increase the voltage of the charger that delivers fewer current or decrease the one of the other while keeping the correct voltage between the battery lugs; however, there is no warranty of currents balance.

As a battery is connected downstream, the diode causes a voltage drop (typically 0.3V).

2      **BPR (COMPACT) RANGE**

Diagram block:



I/P = Input, FG = Front Ground, OVP = Over Voltage Protection  
A DC OK isolated relay output is activated in event of any fault. It is an NO contact.

2.1      **Protections**

A Schottky diode must be installed on the output (positive terminal) to prevent reverse power in the case the battery has a higher voltage.  
It might result from a power outage: then the relay opens, the led goes off (unless there is no diode). The battery higher voltage might also be due to the charge by a charge alternator of a generator.

Internal protections:

- Overcurrent: constant current limiting. The charger provides constant current even when the protection circuit is triggered; the current is clipped, until the peak disappears
- Short circuit: the output voltage drops; DC OK: led goes off, and the relay trips; automatic restart
- Overvoltage (e.g. if the connection to the battery is cut): in this event, no current is delivered; DC OK: led remains on, and relay does not trip (if the diode is installed). The charger restarts automatically
- Undervoltage: the relay trips until the dip disappears (above 10Vdc for BPR 0324S)

**WARNING**

**THE CHARGER HAS NO FUSE ON THE OUTPUT**

Install a fuse on the positive output

**Failure to follow this instruction may damage the charger**

BPR	0324S	0512S
Recommended fuse rating	5A	7.5A

The led is still on and the relay circuit remains closed.

Example of installation (the fuse and fuse module on the right are NOT provided):



In this example, the diode is connected to the module on the right, but it can also span across the two smaller modules.

**AC side:** install a fuse or a breaker on the input. The AC currents, and inrush currents in cold start, show in the data sheets. We suggest the following:

	BPR	0324S / 0512S
Anti-surge fuse		T2.5A/L250V
Circuit-breaker C16. Max. count of chargers is		4

2.2 Connections

Recommended wires: made of copper, they must withstand temperatures of at least 80°C (e.g., UL1007).

Cross-section and tightening torque for terminals:

	BPR	0324S / 0512S
Cross-section		0.75 mm² (AWG18)
Tightening torque		50 N.m (4.4 lb-in)

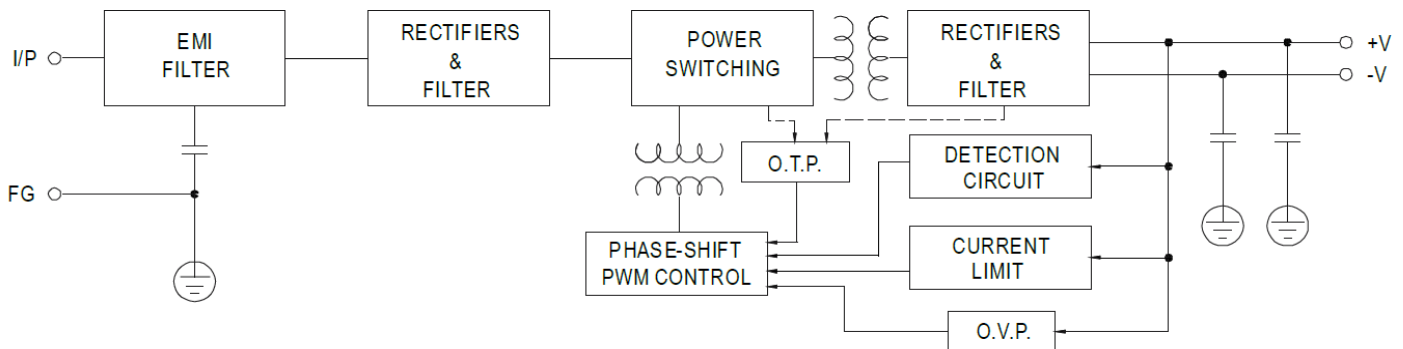
Make sure that all strands of each stranded wire enter the connection terminal and the screw terminals are securely fixed to prevent poor contact.

### 2.3 Comparison of the various models

		Unit	BPR 0324S	BPR 0512S
<b>Output</b>	Current – rated/max	A	2.5	5
	Voltage – rated	V <sub>DC</sub>	24	12
	Voltage – adjust range	V <sub>DC</sub>	24 ... 30	12 ... 15
	Rated power	W	60	60
	Hold-up time	ms	50 @230V <sub>AC</sub> , 20 @115V <sub>AC</sub>	
<b>Input</b>	Voltage range	V	85 ... 264V <sub>AC</sub> , 120 ... 370V <sub>DC</sub>	
	Frequency range	Hz	47 ... 63	
	Current	A	1.8A @115V <sub>AC</sub> , 1A @230V <sub>AC</sub>	
	Inrush current (typ.)	A	Cold start 30A @115V <sub>AC</sub> , 60A @230V <sub>AC</sub>	
	Leakage current	mA	<1mA @240V <sub>AC</sub>	
<b>Efficiency</b>	typical, @ rated current	–	88%	86%
<b>Protection</b>	Overcurrent	%	105 ... 150%	
	Short-circuit	–	Yes	Yes
	Overvoltage	V	31.2 ... 36	15.6 ... 18
	Over temperature	°C	110±5	105±5
<b>Functions</b>	Breaking power DC OK	V	30V, 1A resistive load	
<b>Temperature</b>	Working derate @higher	°C	–20 ... 55 ... 70	–25 ... 55 ... 70
	Working humidity	%RH	20 ... 90, non condensing	
	Storage	°C	–40 ... 85, 10 ... 95 %RH	
	Coefficient	%/°C	±0.03 @0 ... 50°C	
<b>WxHxD</b>		mm	40 x 90 x 100	
<b>Weight</b>		kg	0.33	
<b>MTBF</b>	MIL-HDBK217F @25°C	khour	299.2	
<b>Vibrations</b>	10 min/cycle, 60 min		Component: 2G @10...500Hz 3 axes. Mounting clip compliant with IEC60068-2.6	
<b>Isolation</b>	@500 VDC 25°C 70%RH	MΩ	>100 between input, output and front ground	
<b>Max voltage</b>		V <sub>AC</sub>	3kV betw. Input & output 1.5kV betw. Input & ground, 0.5 kV betw. output & ground	

### 3 BP RANGE

Diagram block:



I/P = Input, FG = Front Ground

OVP = Over Voltage Protection

OTP = Over Temperature Protection by temperature switch (detection on one or both sides of the transformer)

Leakage current: the Y capacitors between I/P and FG cause some leakage current flow from line or neutral to the case; the leakage current to the case is not dangerous. A proper connection to ground discharges the case.

#### 3.1 Protections

A Schottky diode must be installed on the output (positive terminal) to prevent reverse power in the case the battery has a higher voltage (due to input outage [the led goes off unless there is no diode], or due to the charge alternator of a generator).

Internal protections (the front led DC OK goes off; additionally BP 4024T lights a red led ALARM):

- Overcurrent: constant current limiting. The charger provides constant current even when the protection circuit is triggered; the current is clipped, until the peak disappears
- Short circuit: the output voltage drops; automatic restart
- Overvoltage (e.g. if the connection to the battery is cut): in this event, no current is delivered; the led is still on. The charger restarts automatically (if the diode is installed)
- Over temperature: the voltage is not delivered anymore until the fault disappears.

OTP (Refer to block diagram)	BP 2024M	BP 2024T	BP 4024T
Air detection			
Upstream detection on heat sink of power transistor (TSW)	x	x	x
Downstream detection on heat sink of power diode (TSW2)			x

<b>⚠ WARNING</b>			
<b>THE CHARGER REQUIRES A FUSE ON THE OUTPUT</b>			
Install a fuse on the positive output			
<b>Failure to follow this instruction may damage the charger</b>			
	BP 2024M	BP 2024T	BP 4024T
Recommended fuse rating	25A/30A	25A/30A	50A

The DC OK led is still on.

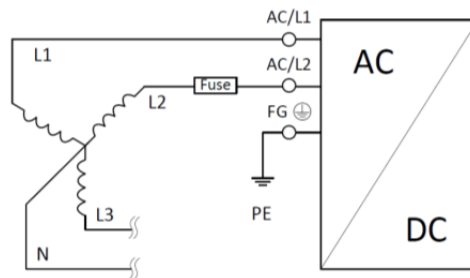
**AC side:** insert a breaker or fuse. The AC currents, and inrush currents in cold start, show in the data sheets. We suggest the following:

BP	2024M	2024T	4024T
Anti-surge fuse	T15A/H250V	F6.3A/L250V	F6.3A/L250V
Circuit-breaker C16 Max. count of chargers is	3	3	2

Dual phase input in Wye connection: use of only two phases

BP	2024M	2024T	4024T
Connections	L-N	L1-L2, L2-L3, or L3-L1	L1-L3
Note	Phase to phase is forbidden	Output current derated by 20%	

Example for BP 2024T:



### 3.2 Connections

Recommended wires: made of copper, they must withstand temperatures of at least 80°C (e.g., UL1007), and have cross-sections as follows:

BP	2024M/T	4024T
Rated current (A)	20	40
Cross-section (mm <sup>2</sup> )	2.5	4
Cross-section (AWG)	12	11

Make sure that all strands of each stranded wire enter the terminal connection and the screw terminals are securely fixed to prevent poor contact.

Recommended screwdriver: 4mm, slotted type

Tightening torques of terminal screws:

BP	2024M/T	4024T
AC inputs	50 N.m (4.4 lb-in)	100 N.m (9 lb-in)
DC outputs	78 N.m (7 lb-in)	

### 3.3 Power factor

The power switching generates harmonics and the capacitors do not absorb currents in phase with the source.

Use BP2024M when the power factor is a concern: BP 2024M features a passive PFC function (low-frequency filter between rectifiers and power switching). This results in fewer harmonics and compliance with EN 61000-3-2 standard. The efficiency is higher.

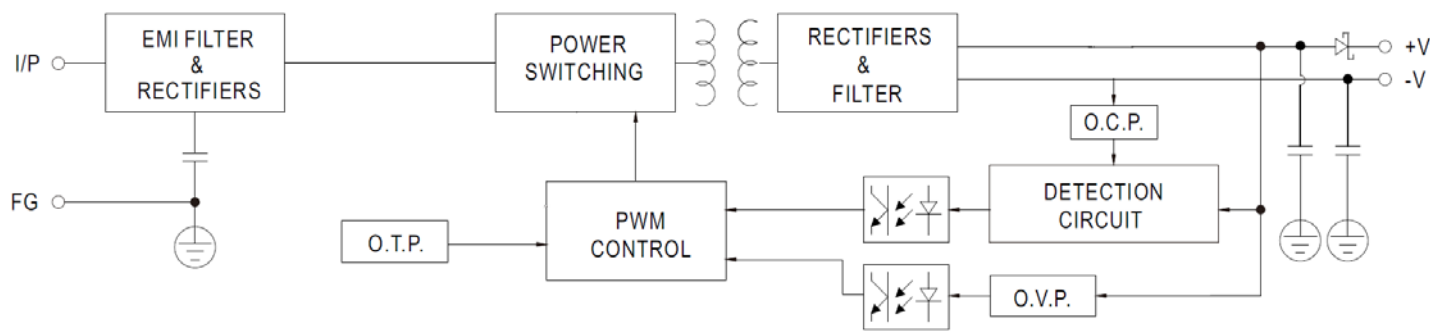
### 3.4 Comparison of the various models

		Unit	BP 2024M	BP2024T	BP 4024T
<b>Output</b>	Current – rated/max	A	20	20	40
	Voltage – rated	V <sub>DC</sub>	24	24	24
	Voltage – adjust range	V <sub>DC</sub>	24 ... 28	24 ... 28	24 ... 28
	Rated power	W	480	480	960
	Hold-up time	ms	16 @230V <sub>AC</sub>	16 @400V <sub>AC</sub> 35 @500V <sub>AC</sub>	14 @400V <sub>AC</sub> 30 @500V <sub>AC</sub>
	Voltage total tolerance	%	±1.0	±1.0	±1.0
<b>Input</b>	Voltage range	V <sub>AC</sub>	180...264V	340 ... 550V <sub>AC</sub>	340 ... 550V <sub>AC</sub>
	Frequency range	Hz	47 ... 63	47 ... 63	47 ... 63
	Current	A	4 @230V <sub>AC</sub>	1,7 @400V <sub>AC</sub> 1,3 @500V <sub>AC</sub>	2 @400V <sub>AC</sub> 1,6 @500V <sub>AC</sub>
	Inrush current (typ.) Cold start	A	40 @230V <sub>AC</sub>	50	50
	Leakage current	mA	<3,5mA @240V <sub>AC</sub>	<3,5mA @530V <sub>AC</sub>	<3,5mA @530V <sub>AC</sub>
	Power factor (typ.)	none	≥ 0,7		
<b>Efficiency</b>	Typical,@ rated current	–	89 %	89 %	91 %
<b>Protection</b>	Overcurrent	%power	105 ... 150 %	105 ... 150 %	105 ... 125 %
	Short-circuit	–	Yes	Yes	Yes
	Overvoltage	V	30 ... 36	30 ... 36	30 ... 36
	Over temperature	°C		100±5	100±5
<b>Temperature</b>	Working derate @higher	°C	-20...50...70	-20...50...70	-20 ...45...60
	Working humidity	%RH	20 ... 90, non condensing	20 ... 90, non condensing	20 ... 90, non condensing
	Storage	°C	-20 ... 85°C, 10 ... 95 %HR	-40 ... 85°C, 10 ... 95 %HR	-40 ... 85°C, 10 ... 95 %HR
	Coefficient	%/°C	±0.03 @0 ... 50°C	±0.03 @0 ... 50°C	±0.03 @0 ... 50°C
<b>WxHxD</b>		mm	125,5 (227) x 125,2 x 100	227 (276) x 125,2 x 100	227 (276) x 125,2 x 100
<b>Weight</b>		kg	2,4	2,5	3,3
<b>MTBF</b>	MIL-HDBK217F @25°C	khour	180,9	91,9	122,5
<b>Vibrations</b>	10 min/cycle, 60 min		Component: 2G @10...500Hz 3 axes. Mounting clip compliant with IEC60068-2.6		
<b>Isolation</b>	@500 V <sub>DC</sub> 25°C 70%RH	MΩ	>100 between input, output and front ground		
<b>Max voltage</b>		V <sub>AC</sub>	3kV betw. Input & output 1.5kV* betw. Input & ground, 0.5 kV betw. output & ground		

\* 2 kV for BP 4024T

4 BP+ 305 RANGE

Diagram block:



I/P = Input, FG = Front Ground

OCP = Over Current Protection

OVP = Over Voltage Protection

OTP = Over Temperature Protection by temperature switch (sensor in air)

Leakage current: the Y capacitors between I/P and FG cause some leakage current flow from line or neutral to the case; the leakage current to the case is not dangerous. A proper connection to ground discharges the case.

4.1 Protections

The **integral** Schottky diode prevents reverse power in the case the battery has a higher voltage (due to input outage [the led goes off], or due to the charge alternator of a generator).

Internal protections (the front led DC OK goes off):

- Overcurrent: constant current limiting. The charger provides constant current even when the protection circuit is triggered; the current is clipped, until the peak disappears
- Short circuit: the output voltage drops immediately; automatic restart
- Overvoltage (e.g. if the connection to the battery is cut): the diode limits the voltage
- Over temperature (detection in air): the voltage is not delivered anymore. Cycle the power.

Undervoltage on output: from 2Vdc, the led turns off. Cycle the power.

**WARNING**

**THE CHARGER REQUIRES A FUSE ON THE OUTPUT**

Install a fuse on the positive output

**Failure to follow this instruction may damage the charger**

BP+	0512M - 305	0324M - 305	1012M - 305	0524M - 305	1024M - 305
Recommended fuse rating	7.5A	5A	15A	7.5A	15A

The DC OK led is still on.



**AC side:** insert a breaker or fuse. The AC currents, and inrush currents in cold start, show in the technical documentations. We suggest the following:

BP+	0512M - 305	0324M - 305	1012M - 305	0524M - 305	1024M - 305
Anti-surge fuse	T3.15A/L250V		T4A/L250V		
Circuit-breaker C16 Max. count of chargers is	6		5		

## 4.2 Connections

Recommended wires: made of copper, they must withstand temperatures of at least 80°C (e.g., UL1007), and have cross-sections as follows:

BP+	0512M - 305	0324M - 305	1012M - 305	0524M - 305	1024M - 305
Rated current (A)	5	3	10	5	10
Cross-section (mm <sup>2</sup> )	0.75	0.75	1.3	0.75	1,3
Cross-section (AWG)	18	18	16	18	16

Make sure that all strands of each stranded wire enter the terminal connection and the screw terminals are securely fixed to prevent poor contact.

Recommended screwdriver: 3mm, slotted type

Tightening torques of terminal screws:

BP+	0512M-305 and 0324M-305	1012M-305 and 0524M-305	1024M-305
AC inputs	68 N.m (6 lb-in)	100 N.m (9 lb-in)	100 N.m (9 lb-in)
DC outputs	68 N.m (6 lb-in)	100 N.m (9 lb-in)	100 N.m (9 lb-in)

### 4.3 Comparison of the various models

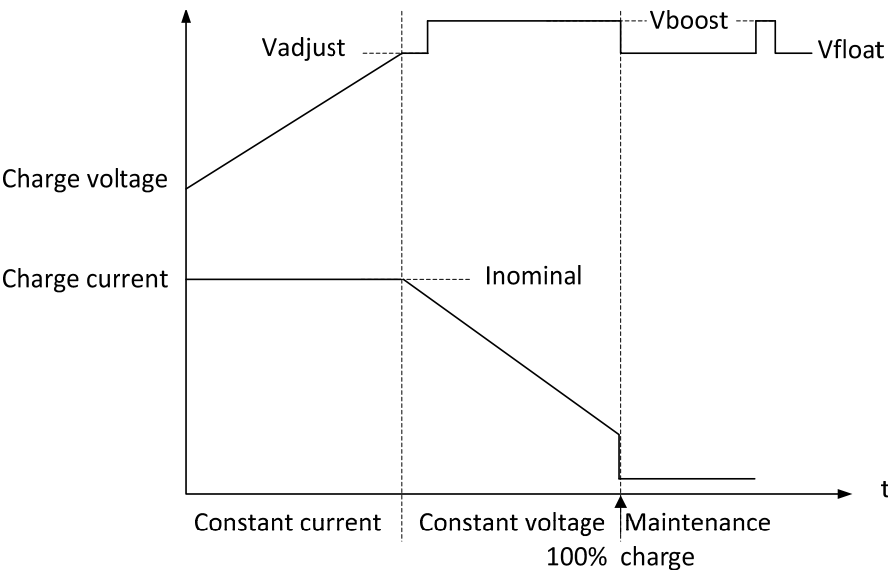
Refer to the *Product information*.

		BP+ 0512M - 305	BP+ 0324M - 305	BP+ 1012M - 305	BP+ 0524M - 305	BP+ 1024M - 305
OUTPUT	DC VOLTAGE	12V	24V	12V	24V	24V
	RATED CURRENT	5A	3A	10A	5A	10A
	CURRENT RANGE	0 ~ 5A	0 ~ 3A	0 ~ 10A	0 ~ 5A	0 ~ 10A
	RATED POWER	75 W	75 W	120 W	120 W	240 W
	RIPPLE & NOISE (Max.)	100mVp-p	120mVp-p	100mVp-p	120mVp-p	150mVp-p
	VOLTAGE ADJ. RANGE (by default)	12 ~ 14V (13.2V)	24 ~ 28V (26.4V)	12 ~ 14V (13.2V)	24 ~ 28V (26.4V)	24 ~ 28V (26.4V)
	LINE REGULATION	(+/-) 0.5%				
	LOAD REGULATION	(+/-) 1.0%				
	SETUP, RISE TIME	1500ms, 60ms/230V <sub>AC</sub> 3000ms, 60ms/115V <sub>AC</sub> at full load				
	HOLD UP TIME (Typ.)	16ms/230V <sub>AC</sub> 12ms/115V <sub>AC</sub> at full load				
INFORMATION	Please adjust output voltage required with the potentiometer according to the battery charger					
INPUT	VOLTAGE RANGE	90 ~ 305V <sub>AC</sub> 127 ~ 370V <sub>DC</sub>				
	FREQUENCY RANGE	47 ~ 63Hz				
	EFFICIENCY (Typ.)	83%	87%	84%	87%	87%
	AC CURRENT (Typ.)	1.6A/115V <sub>AC</sub> / 0.9A/230V <sub>AC</sub> 1.6A/115V <sub>AC</sub> / 0.9A/230V <sub>AC</sub> 2.65A/115V <sub>AC</sub> / 1.45A/230V <sub>AC</sub> 2.65A/115V <sub>AC</sub> / 1.45A/230V <sub>AC</sub> 2.8A/115V <sub>AC</sub> / 1.4A/230V <sub>AC</sub>				
	INRUSH CURRENT (Typ.)	20A/115V <sub>AC</sub> 35A/230V <sub>AC</sub>				
	LEAKAGE CURRENT	<1mA / 240V <sub>AC</sub>				
PROTECTION	OVERLOAD	105 ~ 130% rated output power Protection type: constant current limiting with auto-recovery after fault condition is removed				
	OVER VOLTAGE	14 ~ 17V    29 ~ 33V    14 ~ 17V    29 ~ 33V    29 ~ 33V Protection type: shut down o/p voltage, re-power on to recover				
	OVER TEMPERATURE	110°C (+/- 5°C) Protection type: shut down o/p voltage, re-power on to recover				
ENVIRONMENT	WORKING TEMPERATURE	(-)20 ~ (+)70°C (Refer to output load derating curve)				
	WORKING HUMIDITY	20 ~ 95% RH non condensing				
	STORAGE TEMP, HUMIDITY	(-)40 ~ (+)85°C, 10 ~ 95% RH				
	TEMP. COEFFICIENT	(+/-)0.03%/°C (0 ~ 50°C)				
	VIBRATION	Component: 10 ~ 500Hz, 2G 10min./1cycle, period for 60min. each along X, Y, Z axes ; Mounting: Compliance with IEC60068-2-6				
SAFETY & EMC	WITHSTAND VOLTAGE	I/P-O/P:3KV <sub>AC</sub> I/P-FG:1.5KV <sub>AC</sub> O/P-FG:0.5KV <sub>AC</sub>				
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:>100M Ohm / 500V <sub>DC</sub> / 25°C / 70% RH				
	EMI CONDUCTION & RADIATION	Compliance with EN55011, EN55022 (CISPR22), EN61204-3 Class B				
	HARMONIC CURRENT	Compliance with EN61000-3-2,-3				
	EMI IMMUNITY	Compliance with EN61000-4-2, 3, 4, 5, 6, 8, 11, ENV50204, EN55024, EN61000-6-2, EN61204-3, heavy industry level, criteria A				
OTHERS	MTBF	486Khrs min    MIL-HDBK-217F (25°C)			456Khrs min    MIL-HDBK-217F (25°C)	
	DIMENSION (W x H x D)	32 x 125.2 x 102mm	32 x 125.2 x 102mm	40 x 125.2 x 113.5mm	40 x 125.2 x 113.5mm	63 x 125.2 x 113.5mm
	PACKING	0.51kg	0.51kg	0.57kg	0.57kg	1kg
NOTES	All parameters NOT specially mentioned are measured at 230V <sub>AC</sub> input, rated load and 25°C of ambient temperature.					
	Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair wire terminated with a 0.1 uF & 47 uF parallel capacitor.					
	The battery charger is considered a component which will be installed into final equipment. The final equipment must be re-confirmed that it still meets EMC directives					
	Installation clearances: 40mm on top, 20mm on bottom, 5mm on the left and right side are recommended when loaded permanently with full power. In case the adjacent device is a heat source, 15mm clearance is recommended.					
	Derating may be needed under low input voltage and extreme temperature. For 115V, please check the derating curve.					

5 BPR B RANGE

5.1 Overview

This range provides boost capability for quick charging of depleted batteries and maintenance (equalization of Pb-acid cells). This range features a small case width.



For two types of battery and two nominal voltages, the following table shows the recommended Float and Boost voltages (Vboost is 4 ... 5% above Vfloat):

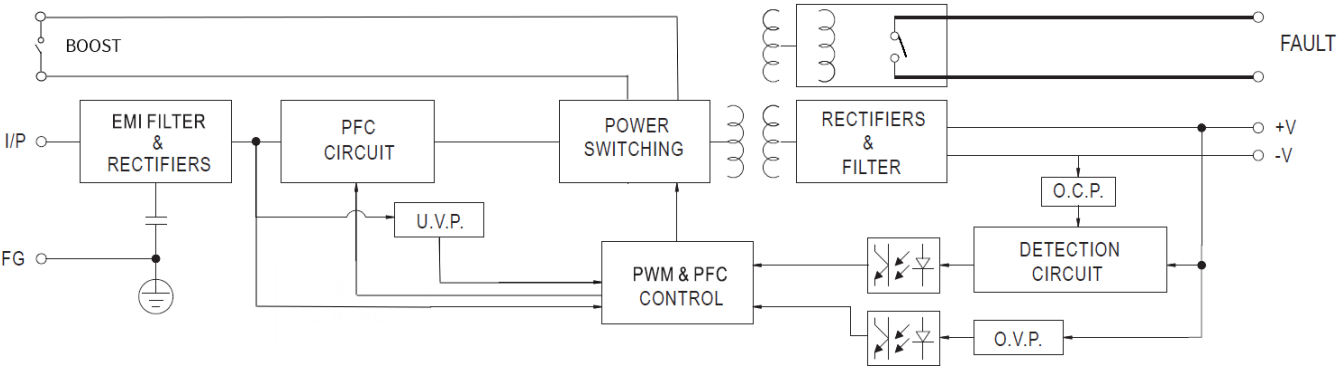
Battery rated voltage	NiCd		Gel /Lead-acid	
	Vfloat	Vboost	Vfloat	Vboost
12V	13.2V	13.8V	13.7V	14.2V
24V	26.4V	27.6V	27.4V	28.4V

This table is given for information only; check with the battery manufacturer. From Vboost, calculate  $V_{adjust} = V_{boost} / 1.04$  (it should be close to Vfloat) and adjust the charger accordingly.

Diagram blocks:

BPR B 0524M and 1012M: the diagram block is similar to the one of BPR (with downstream OTP).

BPR B 1024M and 2024M include in addition a dual-stage active PFC to offer a high power factor:



PFC = Power Factor Control

OCP = Over Current Protection

OVP = Over Voltage Protection, UVP = Under Voltage Protection

OTP = Over Temperature Protection (not depicted) by upstream temperature switch (TSW): detection on heat sink of power transistor

## 5.2 Protections

A Schottky diode must be installed on the output (positive terminal) to prevent reverse power in the case the battery has a higher voltage (due to input outage, or due to the charge alternator of a generator).

Internal protections:

- Overcurrent: constant current limiting. The charger provides constant current even when the protection circuit is triggered; the current is clipped, until the peak disappears
- Short circuit: the output voltage drops; FAULT relay trips; automatic restart
- Overvoltage (e.g. if the connection to the battery is cut): in this event, no current is delivered; FAULT relay does not trip. To restart the charger, disconnect and reconnect the input
- Undervoltage: if the rectified input voltage is below a threshold, a protection is triggered (UVP of 1024M & 2024M): FAULT relay trips. If output voltage drops, the relay trips also
- Over temperature: the relay trips; the voltage is not delivered anymore until the fault disappears

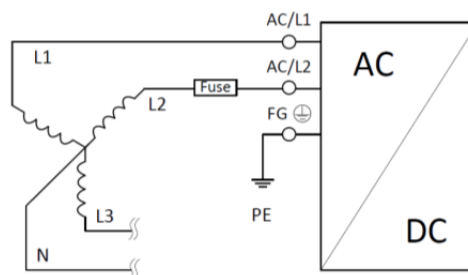
<b>⚠ WARNING</b>	
<b>THE CHARGER REQUIRES A FUSE ON THE OUTPUT</b>	
Install a fuse on the positive output	
<b>Failure to follow this instructions may damage the charger</b>	

BPR B	0524M	1012M	1024M	2024M
Recommended fuse rating	7.5A	15A	15A	25A/30A

The DC OK isolated relay output is activated in event of any fault.

**AC side:** insert a breaker or fuse (if in Wye connection, on L2 as illustrated). The AC currents, and inrush currents in cold start, show in the data sheets. We suggest the following ratings:

BPR B	0524M ,1012M, 1024M	2024M
Fuse	T4A/H250V	T6.3A/H250V
Circuit-breaker - C16 curve	10 ... 20A	



### 5.3 BPR B connections

#### POWER and GROUND

Recommended wires: made of copper, they must withstand temperatures of at least 80°C (e.g., UL1007), and have cross-sections as follows:

BPR B	0524M	1012M and 1024M	2024M
Rated current +30% (A)	6.5	13	22
Cross-section (mm <sup>2</sup> )	1	1.5	4
Cross-section (AWG)	16	14	10

Make sure that all strands of each stranded wire enter the terminal connection and the screw terminals are securely fixed to prevent poor contact. BPR B 1024M and BPR B 2024M feature two outputs; use both to prevent too much current stress on a single one.

STATUS and COMMAND: 0.5mm<sup>2</sup> (AWG22)

Recommended screwdrivers: 3mm, slotted type, with tightening torques that follow for terminal screws:

BPR B	0524M and 1012M	1024M and 2024M
AC inputs	50 N.m (4.4 lb-in)	100 N.m (9 lb-in)
DC outputs	78 N.m (7 lb-in)	

### 5.4 Operation

The boost can be activated:

- Manually through a button on another module
- Or automatically by an external PLC

The module/PLC is connected to the charger through a 2-pin block; a cord with two 30 cm (1') wires and a male terminal block is provided together with the charger.

Procedure:

1. Connect the charger signals (status and boost command) to the module/PLC
2. Connect the AC input
3. Adjust the output voltage
4. Connect the battery
5. If the boost is manually operated, press the button whenever required.

## 5.5 Comparison of the various models

		Unit	BPRB 0524M	BPRB 1012M	BPRB 1024M	BPRB 2024M
Output	Current – rated/max	A	5	10	10	20
	Voltage – rated	V <sub>DC</sub>	24	12	24	24
	Voltage – adjust range	V <sub>DC</sub>	24 ... 29	12 ... 15	24 ... 28	24 ... 28
	Voltage – boost	V <sub>DC</sub>	When contact is closed, V <sub>adjusted</sub> ± 4 ... 5%			
	Rated power	W	120	120	240	480
	Hold-up time	ms	50 @400V <sub>AC</sub> , 10 @230V <sub>AC</sub>		18 @400V <sub>AC</sub> , 18@230V <sub>AC</sub>	18 @400V <sub>AC</sub> , 16 @230V <sub>AC</sub>
	Voltage total tolerance	%	±1.0	±1.5	±1.0	±1.5
Input	Voltage range	V <sub>AC</sub>	180 ... 550V <sub>AC</sub> , the max. charge is derated under 200V <sub>AC</sub>			
	Frequency range	Hz	47 ... 63			
	Current	A	0.6A @400V <sub>AC</sub> , 1.25 @230V <sub>AC</sub>		1A @400V <sub>AC</sub> , 2 @230V <sub>AC</sub>	1.6A @400V <sub>AC</sub> , 4 @230V <sub>AC</sub>
	Inrush current (typ.)	A	Cold start: 50A			
	Leakage current	mA	<3.5mA @530V <sub>AC</sub>			
	Power factor (typ.)	none			>0.84 @400V <sub>AC</sub> >0.84 @230V <sub>AC</sub>	>0.84 @400V <sub>AC</sub> >0.84 @230V <sub>AC</sub>
Efficiency	typical,@ rated current	–	90%@400V <sub>AC</sub>	88%@400V <sub>AC</sub>	90.5%	91%
Protection	Overcurrent	%power	105 ... 130%	105 ... 130%	105 ... 150%	105 ... 130%
	Short-circuit	–	Yes	Yes	Yes	Yes
	Overvoltage	V	31 ... 37	16 ... 18	31 ... 38	31 ... 38
	Over temperature	°C	110±5	105±5	90±5	95±5
Functions	Breaking power FAULT	V	30V / 1A resistive load			
	Boost input		2-pin keyed front socket, module and cord (30 cm/1') are provided			
Temperature	Working derate @higher	°C	-25 ... 60 ... 70	-25 ... 50 ... 70	-30 ... 60 ... 70	-30 ... 50 ... 70
	Working humidity	%RH	20 ... 90, non condensing		20 ... 95, non condensing	
	Storage	°C	-40 ... 85°C, 10 ... 95%RH			
	Coefficient	%/°C	±0.03 @0 ... 50°C			
WxHxD		mm	40 x 125.2 x 113.5		63 x 125.2 x 113.5	85.5 x 125.2 x 128.5
Weight		kg	0.65		1.06	1.7
MTBF	MIL-HDBK217F @25°C	khour	268		141.1	112.8
Vibrations	10 min/cycle, 60 min		Component: 2G @10...500Hz 3axes. Mounting clip compliant with IEC60068-2.6			
Isolation	@500 V <sub>DC</sub> 25°C 70%RH	MΩ	>100 between input, output and front ground			
Max voltage		V <sub>AC</sub>	3k betw. Input & output 2k betw. Input & ground, 0.5 k betw. output & ground/ FAULT			

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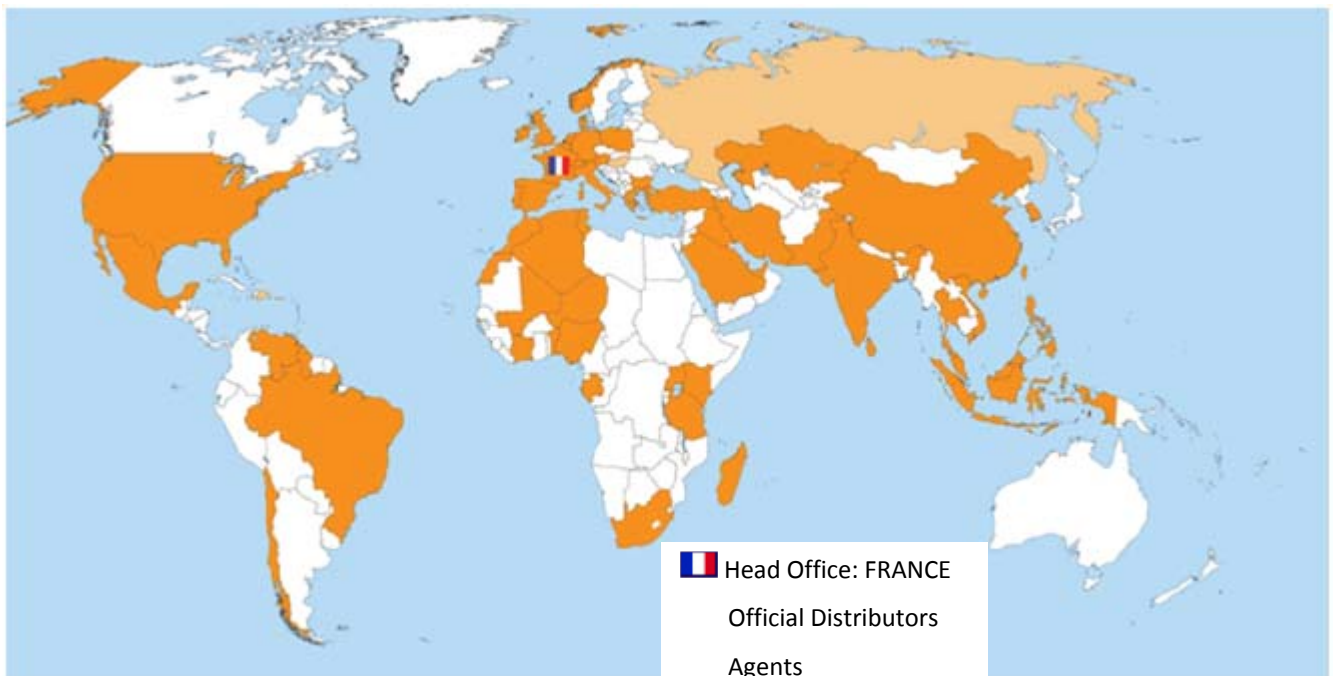
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