



APPLICATIONS

- AC or DC grids simulation
- Motor emulation / AC-AC AC-DC or DC-DC converters
- Solar array simulation

PERFORMANCES

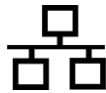
- One insulated output:
 - From mains
 - From analog input
- Generation and absorption AC, AC+DC, DC
- **Fast transients** < 10 μ s
- Quadrant changes without transition
- High inrush current facilities ($4 \times I_n$)
- Includes an AF synthesizer from DC to 5 kHz
- **Wide bandwidth** > 50 kHz at -3dB
- Very low distortion < 0.3%
- Very low output impedance
- Low noise S/B > 70 dB
- High accuracy < 0.2%
- High stability < 0.1%
- Includes an On-Off and emergency management



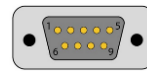
Non-contractual picture



TOUCHSCREEN



ETHERNET



RS232

DESCRIPTION

One-phase amplifier is a real “4 quadrants” power amplifier operating in voltage regulation or in current regulation:

- Its analog input receives a “pilot” signal whose amplitude is $0 \sim \pm 10$ V (7.07 VRMS) coming from internal synthesizer or from an external synthesizer / emulator,
- Two analog outputs insulated from power output return images of voltage and current with amplitude $0 \sim \pm 10$ V peak.

The linear technology used for these amplifiers allows:

- To provide power peaks up to 4 times its nominal power during 20 ms,
- An easy integration for “Real-Time” or “Power Hardware In the Loop” applications with simulators,
- An instantaneous quadrant changes from operation as generator, power factor +1, to operation as a load, power factor -1.

Entirely self-sufficient with its local control on touchscreen, they can be controlled remotely from a supervisor system via an Ethernet or RS232 link for easy integration in a complex test system.

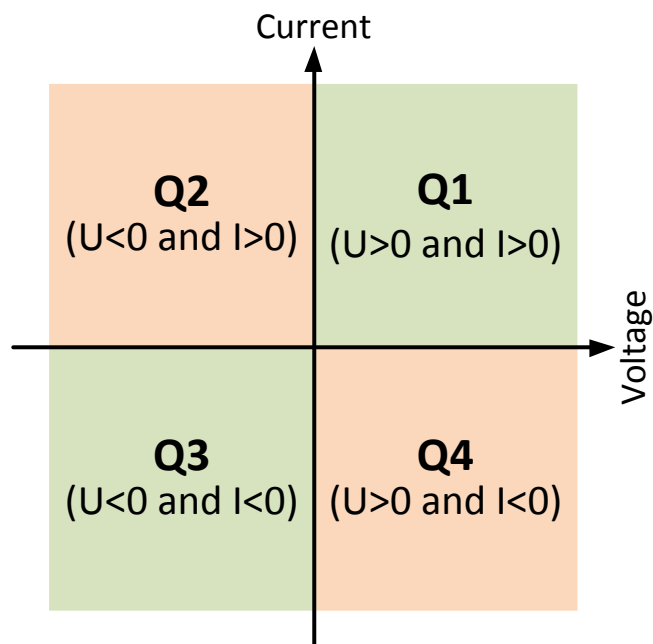


PERMANENT OPERATING AREAS

Following diagrams explain the relationship between the current and the voltage in the different quadrants, for each phase, in AC and then in DC. X-axis explain the voltage, Y-axis explain the current.

Continuous operation is allowed “insides areas” curves. Limitations are due to the heating of the power transistors. Operation “outside areas” will result in:

- An immediate switch-off by over-current protection if current is above the limits,
- A break after a delay by thermal protection in case of overheating of the power parts.



When amplifier is working as an absorber in AC, permanent current is around 40% of rated current of selected range. It can be upgraded to 100% using “PA-RC-L100” option.

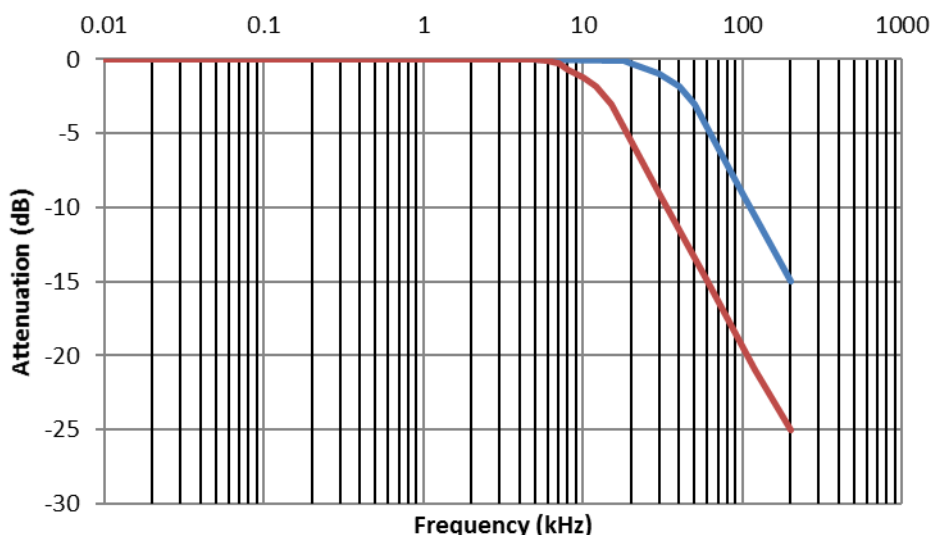
BANDWIDTH “small signals »

Blue trace:

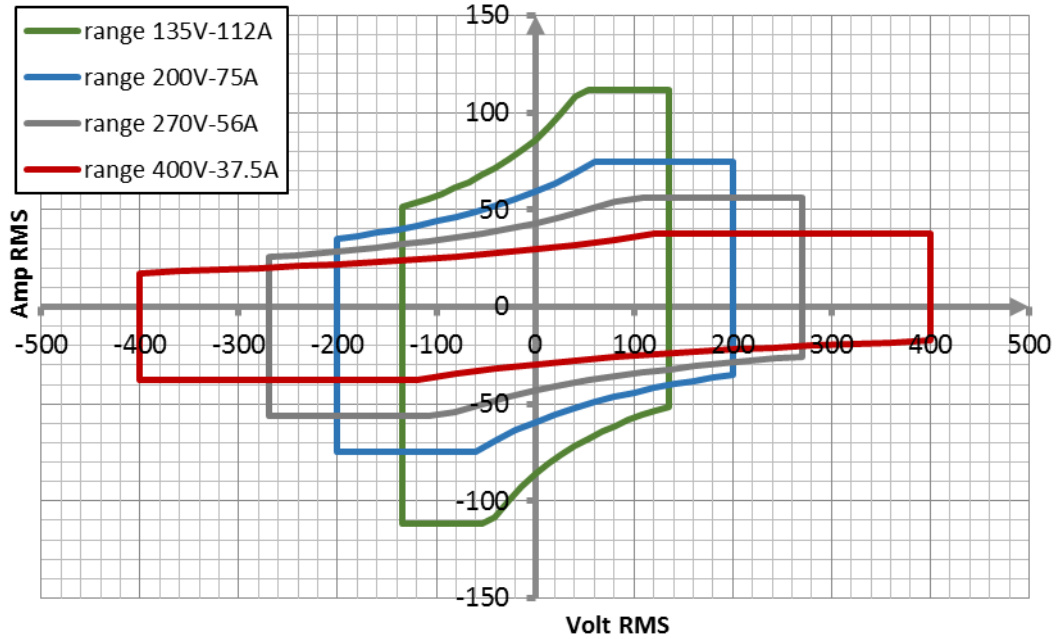
In voltage regulation, the bandwidth at -3dB is 50 kHz.

Red trace:

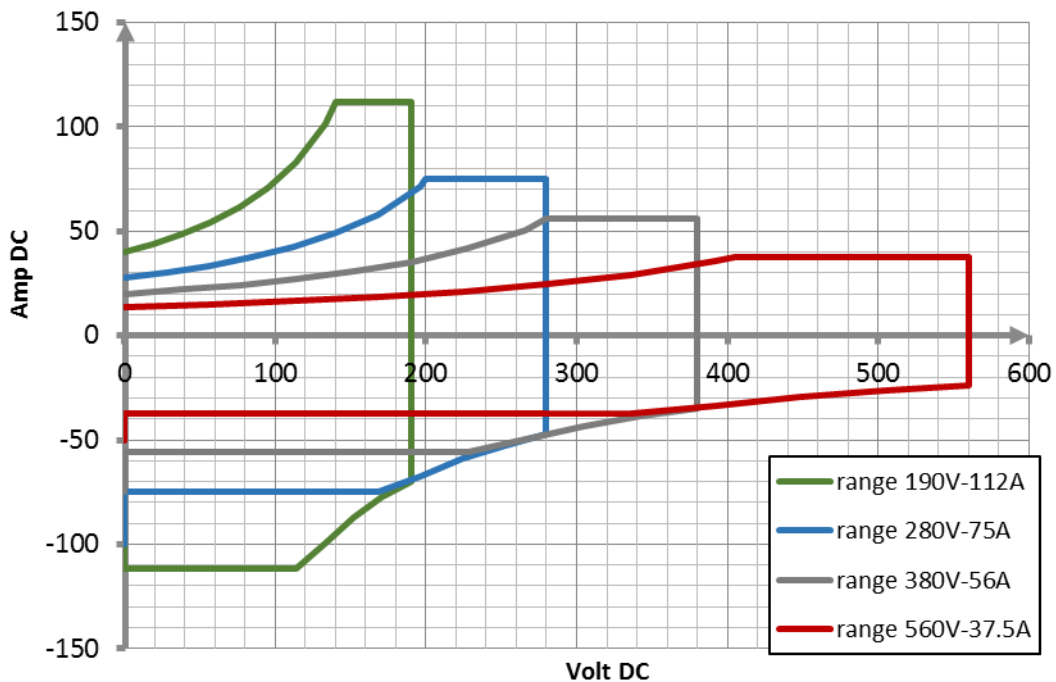
In current regulation, the bandwidth at -3dB is 15 kHz.



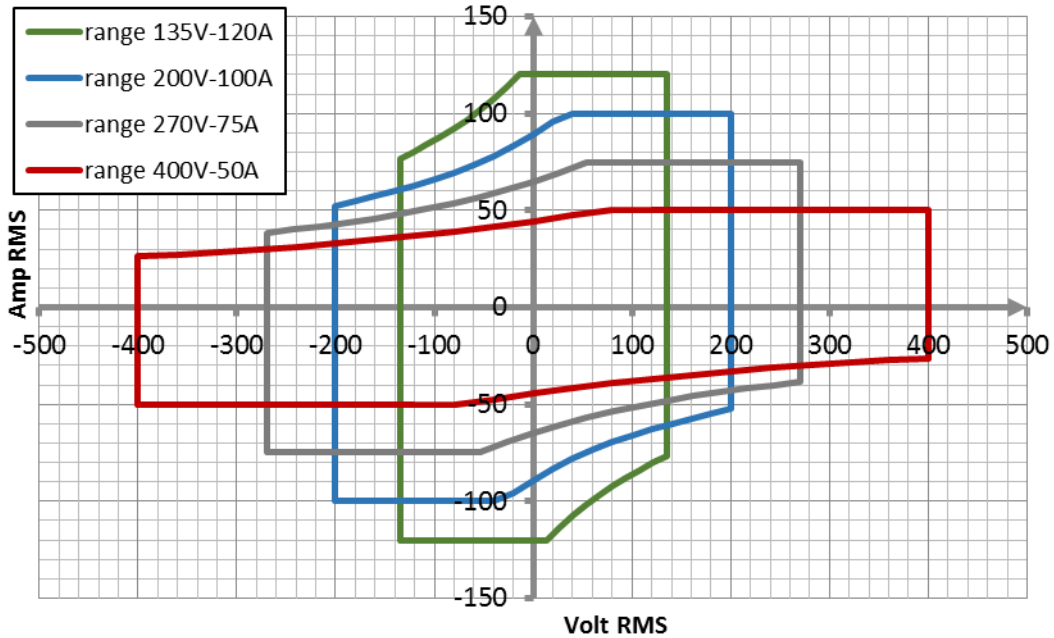
MODEL PA-15000 AC-DC-400V-112A IN AC



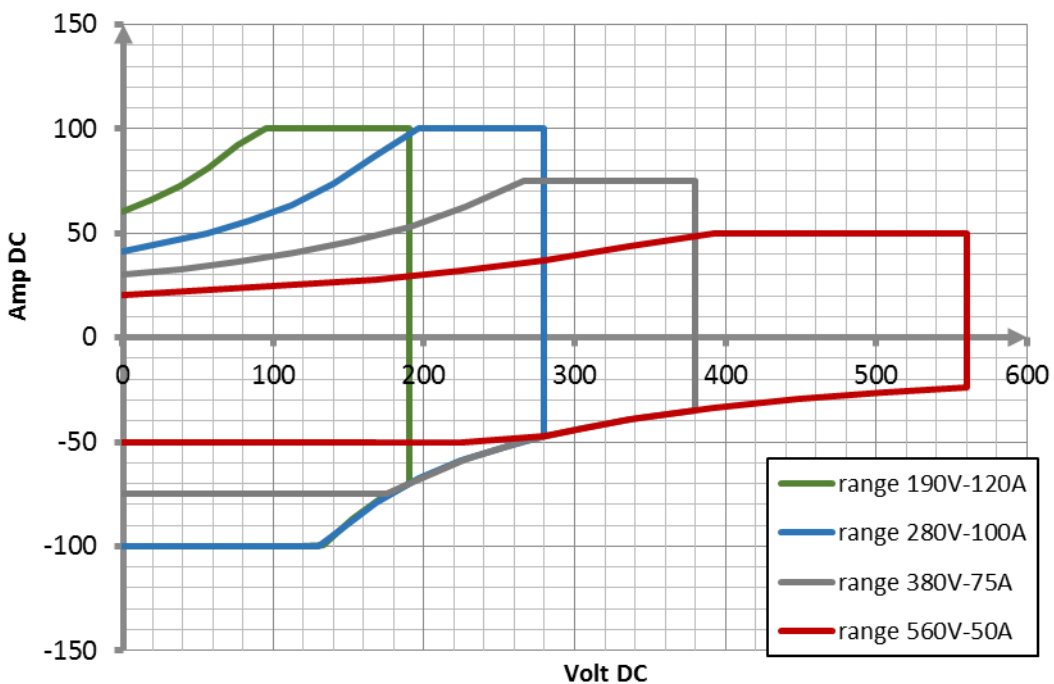
MODEL PA-15000 AC-DC-400V-112A IN DC



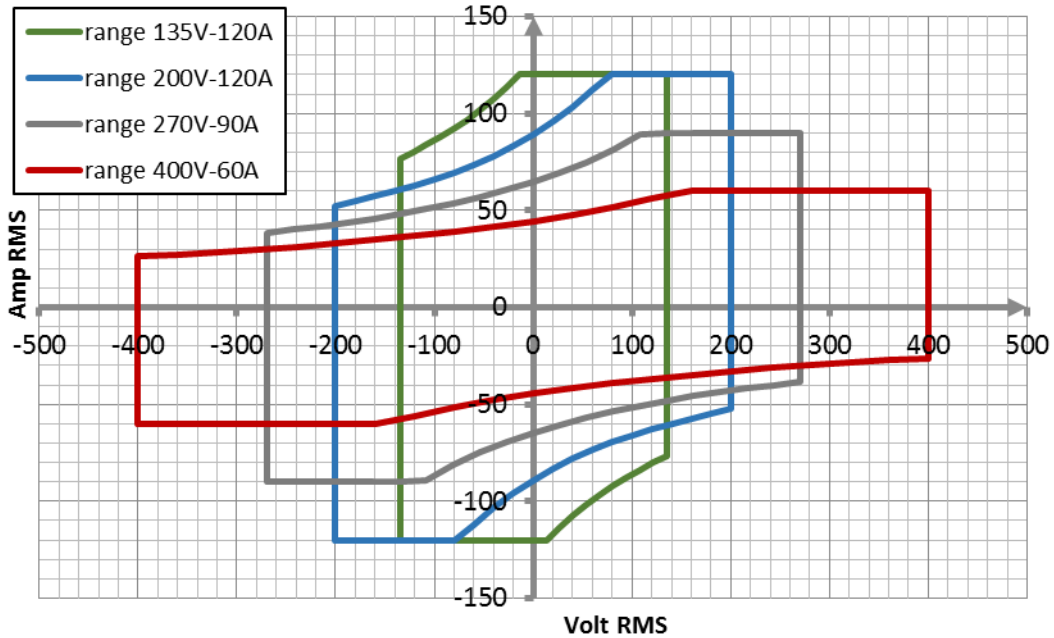
MODEL PA-20000 AC-DC-400V-120A IN AC



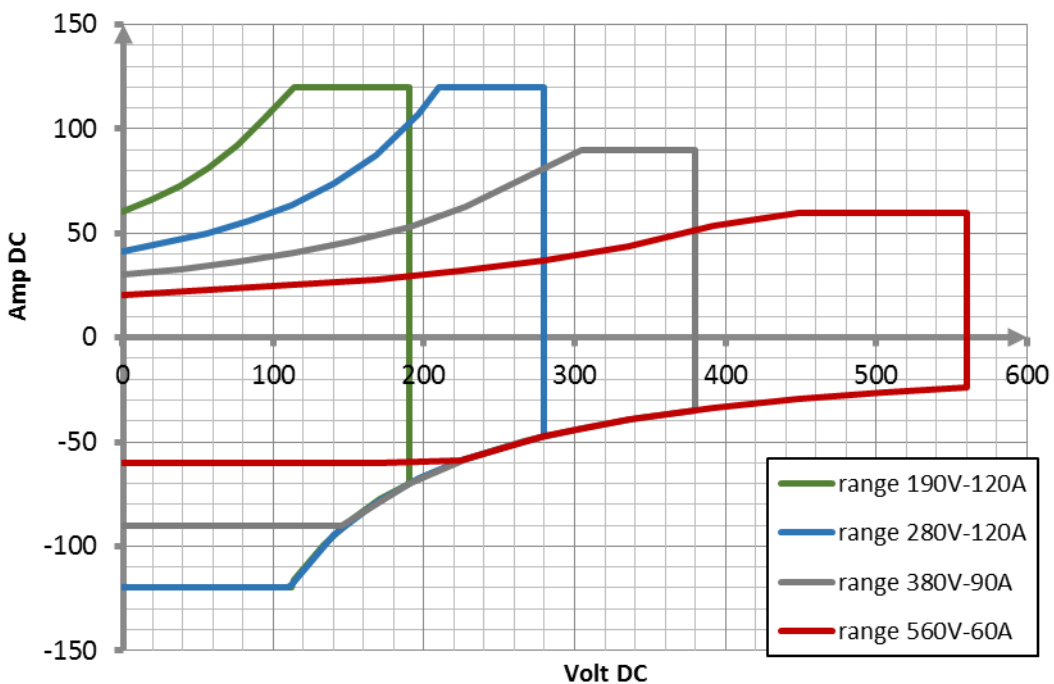
MODEL PA-20000 AC-DC-400V-120A IN DC



MODEL PA-24000 AC-DC-400V-120A IN AC



MODEL PA-24000 AC-DC-400V-120A IN AC



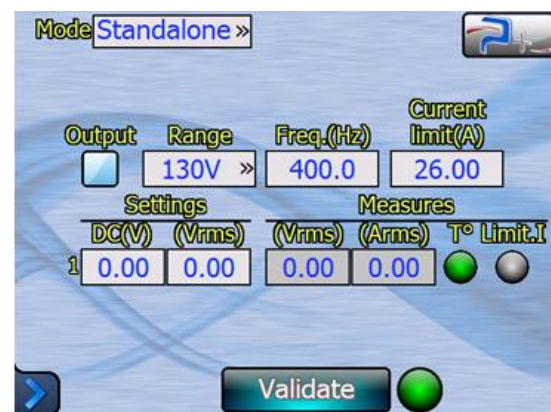
LOCAL OR REMOTE CONTROL

Managed by a Control board, the amplifiers have two operating modes:

- **Local control:** The control device equipped with a graphical touch screen disposed in front panel gives access to all the control functions and the display of the measures.
- **Remote control:** The control device has one TCP/IP Ethernet link and a serial link RS232 for a control through a remote PC. Control can be done either using PUISSANCE+ OPS3 software (not supplied), either directly via instructions TCP/IP or RS232 using customer software.

LOCAL CONTROL OF A ONE-PHASE AMPLIFIER

Commands and the display of the measures and the status of the amplifiers are grouped on the touch screen.



Other screens are to set up communications links or for the management of variable speed fans.

Used alone, amplifier is configured in “standalone” mode. When connecting three amplifiers in Star, it is possible to create a three-phase amplifier. In this case, first amplifier is configured as “Master”, the two others as “Slaves”.

FEATURES OF THE AMPLIFIERS

OUTPUT: POWER	
Power	
Rated power	15 000, 20 000 or 24 000 VA
Regulation	
Output	Direct (without transformer)
Modes	Voltage (U)
Ranges	Four on each model

OUTPUT: RANGES IN AC			
Range 0~135V	PA-15000	PA-20000	PA-24000
Voltage Ph-N (VRMS)	0~135		
Current per phase (ARMS)	0~112	0~120	0~120
Range 0~200V	PA-15000	PA-20000	PA-24000
Range Ph-N (VRMS)	0~200		
Current per phase (ARMS)	0~75	0~100	0~120
Range 0~270V	PA-15000	PA-20000	PA-24000
Range Ph-N (VRMS)	0~270		
Current per phase (ARMS)	0~56	0~75	0~90
Range 0~400V	PA-15000	PA-20000	PA-24000
Range Ph-N (VRMS)	0~400		
Current per phase (ARMS)	0~37.5	0~50	0~60

OUTPUT: RANGES IN DC			
Range 0~190V	PA-15000	PA-20000	PA-24000
Voltage (VDC)	0~190		
Current per phase (ADC)	0~112	0~120	0~120
Range 0~280V	PA-15000	PA-20000	PA-24000
Range (VDC)	0~280		
Current per phase (ADC)	0~75	0~100	0~120
Range 0~380V	PA-15000	PA-20000	PA-24000
Range (VDC)	0~380		
Current per phase (ADC)	0~56	0~75	0~90
Range 0~560V	PA-15000	PA-20000	PA-24000
Range (VDC)	0~560		
Current per phase (ADC)	0~37.5	0~50	0~60

OUTPUT: ACCURACY, RESOLUTION, STABILITY	
Voltage and current regulation	
Accuracy	0.1% of full scale + 0.1% of programmed value
Resolution	12 bits
Voltage distortion at full power	
Typical	< 0.3%
Max	< 0.7%
Voltage regulation for a mains variation of +6% -10%	
Max	< 0.1% of rated voltage
Voltage regulation for a variation of 0 to 100% of the output current	
Max	< 0.1% of rated voltage
Noise	
Max RMS	0.02% of rated voltage
Max peak to peak	0.3% of rated voltage
Variation regarding temperature	
Typical	50 ppm/°C
Max	100 ppm/°C
Stability after 15 minutes of operation	
Max	< 0.05% of rated voltage
Insulation of output versus case ground	
Measured at 500 VDC	> 100 MΩ

OUTPUT: TIME AND FREQUENCY	
Bandwidth	
Full scale (1)	DC – 5 kHz / 10 kHz
Small signals at -3 dB	50 kHz
Variation time of full scale using a square pilot signal	
Rise time 10% / 90%	< 10 μs
Fall time 10% / 90%	< 10 μs
Transfer time	< 10 μs
Transition from Q1 to Q4	< 10μs

Notes:

- (1) Amplifiers are able to generate a signal at 5 kHz at full scale on all the voltage range. At 10 kHz, amplitude is reduced of around 15%:

OUTPUT: IMAGES AND MEASURES	
Images outputs (2)	
Voltage image	7 VRMS for full scale on output
Current image	5 VRMS for full scale on output
Typical accuracy of measurement on touchscreen	
Voltage measure	0.3% of range + 0.3% of measured value
Current measure	0.3% of range + 0.3% of measured value

Notes:

- (2) Analog outputs “Image” are insulated of power outputs.

INPUT: AMPLITUDE AND FREQUENCY	
Input signal amplitude (external generator)	
Insulation (3)	> 10 MΩ
Voltage (full output scale)	7,07 VRMS / ± 10V peak
Max voltage	± 15 V peak
Input impedance	10 kΩ
Input signal frequency	
Fundamental	DC to 10 kHz
Harmonics (small signals)	Max 50 kHz
Internal AF generator (4)	
Frequency	DC and 40 to 10 kHz
Resolution	0.1 Hz
Waveforms	Sine, DC, harmonics up to rank 500, CSV files, AC+DC...

Notes:

- (3) “Pilot” analog input is insulated from power outputs.
 (4) When used in a Three-Phase system, “Master” amplifier generates pilot signals for the three phases. In this case it is possible to program dephasing between phases from -360 to +360° with a resolution of 0.1°.



MAINS POWER SUPPLY			
Mains network			
Number of phases	Three-Phase + Earth (without Neutral)		
Voltage	400 VRMS \pm 10%		
Frequency	47 - 63 Hz		
Input current	PA-15000	PA-20000	PA-24000
Max / phase at full output power	35 ARMS	45 ARMS	55 ARMS
Protection	Magneto-thermal breaker		
Inrush current	Limited to 2 x max current		
Dielectric strength mains input versus outputs connected to case ground			
Measured at 2500 VRMS / 50Hz	Current < 10 mA		

MECANICAL AND ENVIRONMENTAL			
Material and surface treatment			
Front panels and frame	Aluminum painted RAL7021		
Slides and rear panel	Aluminum painted RAL7021		
Dimensions			
Width	800 mm		
Depth	800 mm		
Height	1950 mm (38U)		
Weight	PA-15000	PA-20000	PA-24000
Weight	600 kg	650 kg	650 kg
Temperature and humidity			
Stockage temperature	-10°C à +85°C		
Operation temperature	+0°C à +40°C		
Humidity	10% - 90% non-condensing		
Noise (fans at full speed)			
Measured at 1 m	< 70 dBA		
Marking			
Marking	CE		
Protection	IP20		

PROTECTIONS

Against overload: current limitation

Amplifiers in linear technology can generate up to four times their rated power during short time. They are using voltage regulation with current limitation: if current is higher than programmed value, a timer starts. At the end of a programmable time between 0.1 and 5 seconds, output voltage decreases to limit current to the programmed value.

Against short-circuit on output: automatic output switch-off

Output is switched off on all phases et must be reactivated using touchscreen or an external command.

Against overtemperature: automatic output switch-off

A temperature sensor is installed on each power part. It switches off outputs of the three phases in case of overheating. After cooling, output must be reactivated using touchscreen or an external command.

ORDER INFORMATION

PA-15000-AC-DC-400V-112A-4G

Amplifier 15 000 VA: four ranges in AC and four ranges in DC
Using Voltage regulation

PA-20000-AC-DC-400V-120A-4G

Amplifier 20 000 VA: four ranges in AC and four ranges in DC
Using Voltage regulation

PA-24000-AC-DC-400V-120A-4G

Amplifier 24 000 VA: four ranges in AC and four ranges in DC
Using Voltage regulation

AVAILABLE OPTIONS (to order separately)

PA-AC-ACQ add a power analyzer

It allows measurements of frequency, voltage, current, power, distortion and a frequential analysis (Fourier Form Transform).

PA-AC-MAINS customized mains input

Modification of mains input to use amplifier on 115V LN (200V LL) mains

PA-AC-L100 resistive load

A resistor is inserted between output of the amplifier and use. It increases absorption capability.

PA-AC-RI current regulation

Add a current regulation in addition of voltage regulation

PA-AC-SPECIAL OUTPUT RANGE special voltage or current ranges

Please consult us

DELIVERIES

Amplifier is delivered with its user manual, its performances list (acceptance test report), its UE declaration.

Specification may change without notice