4Q POWER AMPLIFIER
AC - DC - SINGLE-PHASE - 6000VA

SPHEREA
PUISSANCE PLUS

APPLICATIONS

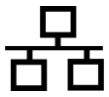
- AC or DC network simulation
- Motor emulation / AC-AC AC-DC or DC-DC converters
- Solar array simulation

PERFORMANCES

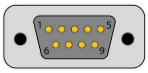
- One insulated output:
  - From mains
  - From analog inputs
- Generation and absorption AC, AC+DC, DC
- Fast transients < 10 µs
- Quadrant changes without transition
- High inrush current facilities (4 x I_n)
- Includes an AF synthetizer from DC to 5 kHz
- Wide bandwidth > 25 kHz at -3dB
- Very low distortion < 0.3%
- Very low output impedance
- Low noise S/B > 70 dB
- High accuracy < 0.2%
- High stability < 0.1%
- Can be installed in a bench with 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~±10 V (7.07 VRMS) coming from internal synthetizer or from an external synthetizer,
- Two analog outputs insulated from power output return images of voltage and current with amplitude 0~±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.

CE

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ISO 9001 BUREAU VERITAS Certification

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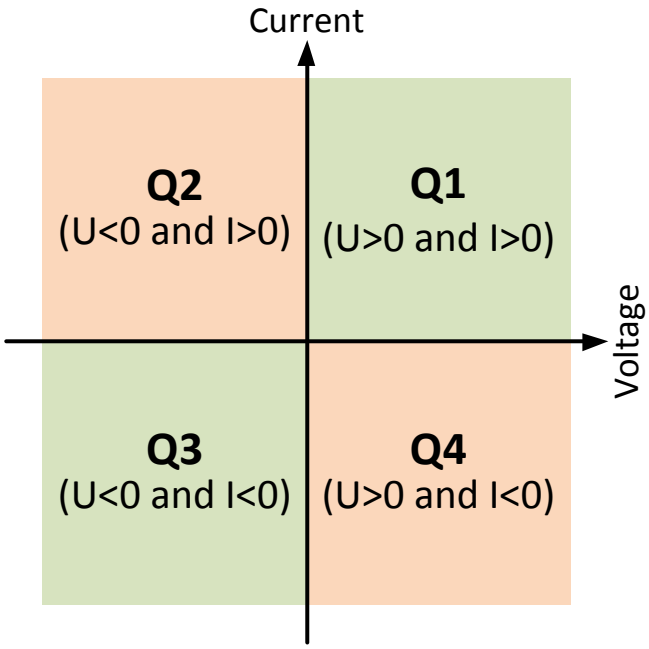
PERMANENT OPERATING AREAS

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.

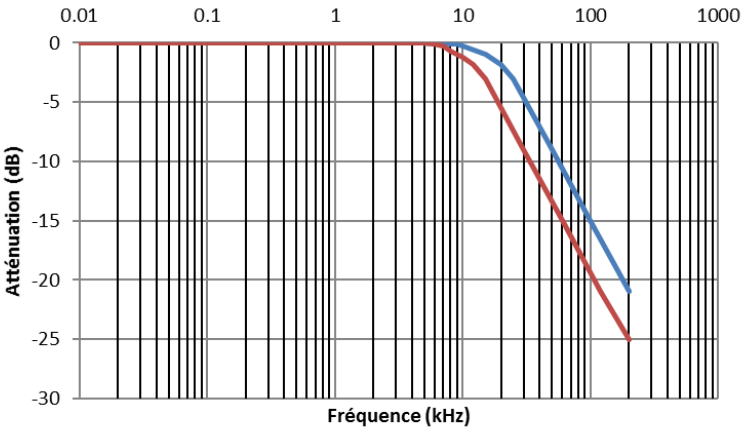
BANDWIDTH “small signals »

Blue trace:

In voltage regulation, the bandwidth at -3dB is 25 kHz.

Red trace:

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



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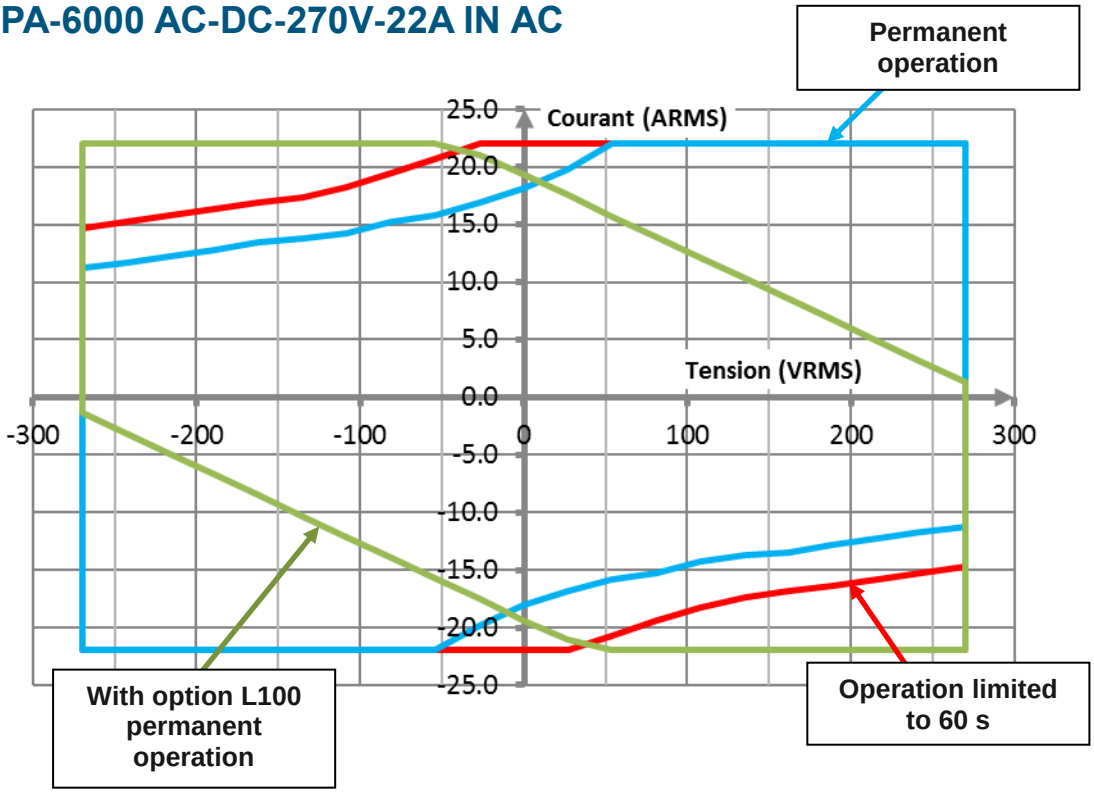
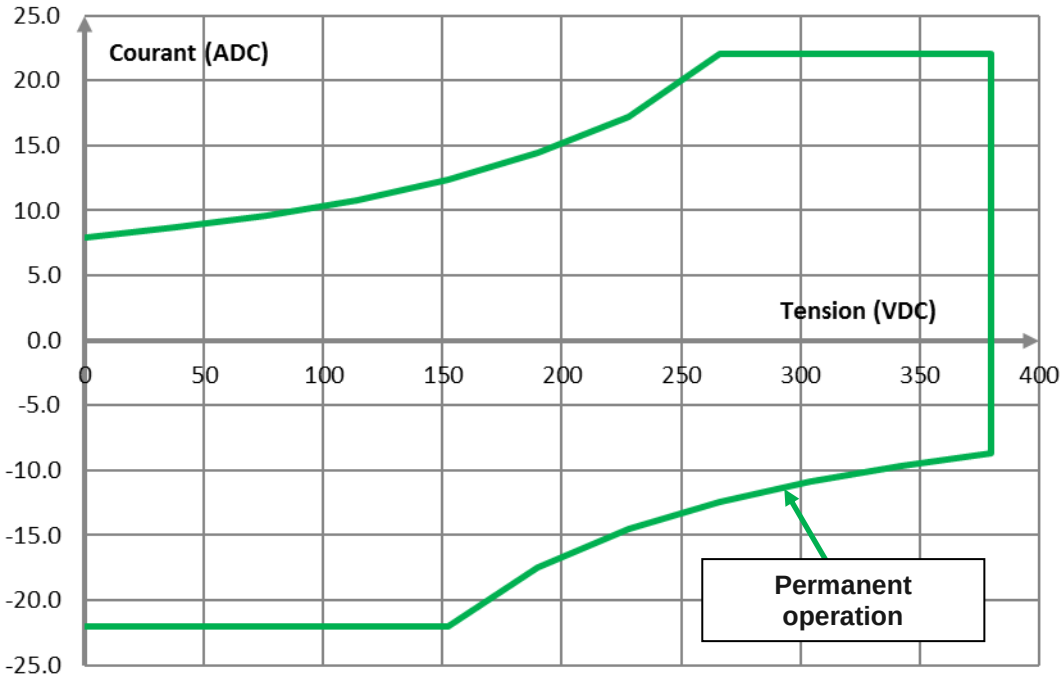
MODEL PA-6000 AC-DC-270V-22A IN AC



MODEL PA-6000 AC-DC-270V-22A IN DC



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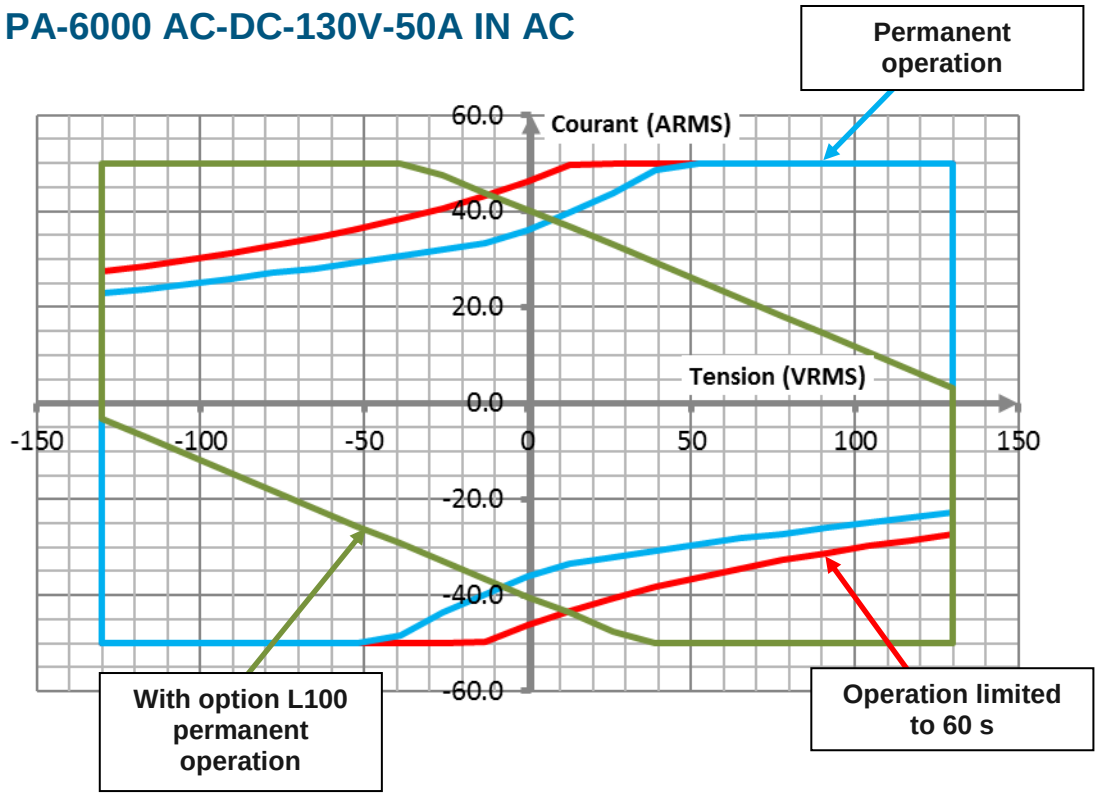
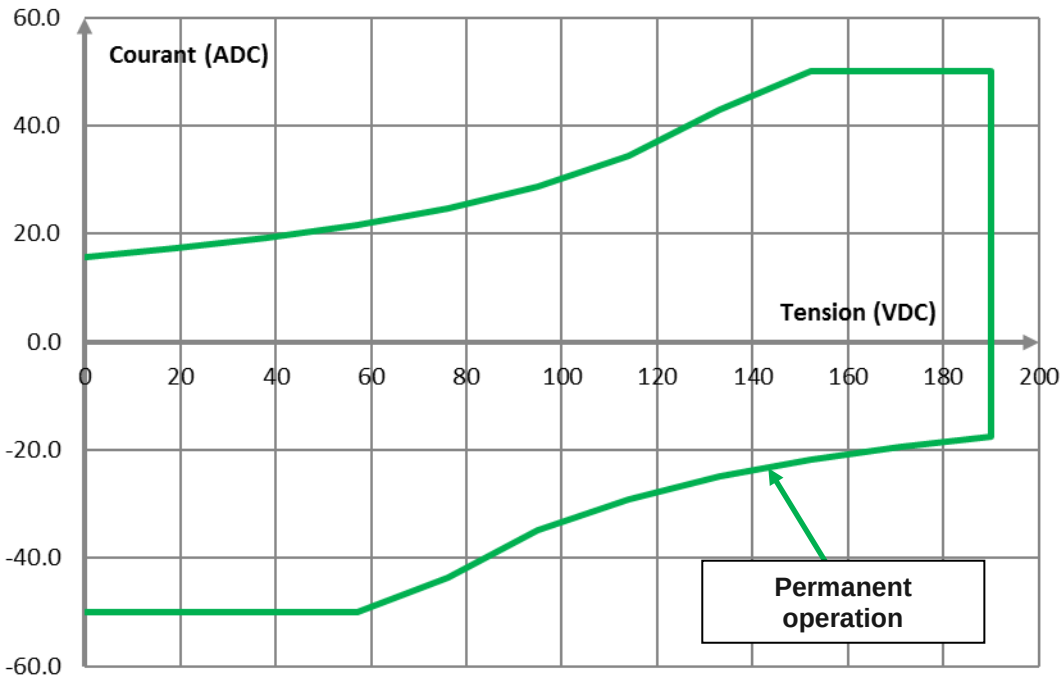
MODÈL PA-6000 AC-DC-130V-50A IN AC



MODEL PA-6000 AC-DC-130V-50A IN DC



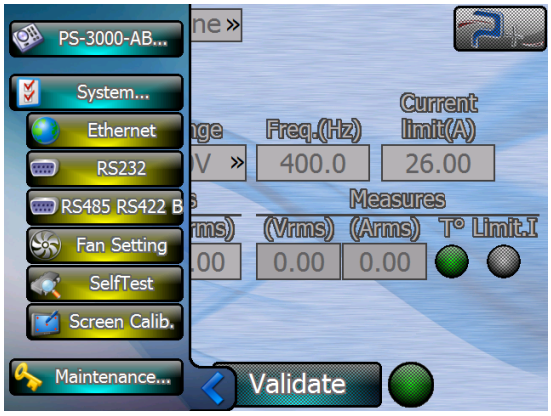
LOCAL OR REMOTE CONTROL

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”.

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FEATURES OF THE AMPLIFIERS

OUTPUT: POWER		
Power		
Rated power	6000 VA (1)	
Regulation		
Modes	Voltage (U) and Current (I)	
Ranges	One	
Performances in AC	PA-6000-130V-50A	PA-6000-270V-22A
Voltage Ph-N (VRMS)	0~130	0~270
Current per phase (ARMS)	0~50	0~22
Peak current (A peak) (2)	100	50
Performances in DC	PA-6000-130V-50A	PA-6000-270V-22A
Voltage (VDC)	0~±190	0~±380
Current (ADC)	0~±50	0~±22
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	

Notes:

(1) Using voltage regulation, it is possible to connect up to three amplifiers in-series to increase output voltage.
Using current regulation, it is possible to connect up to three amplifiers in parallel to increase output current.

(2) Duration of peak current is limited to 100 ms.

OUTPUT: TIME AND FREQUENCY	
Bandwidth	
Full scale (3)	DC – 5 kHz / 10 kHz
Small signals at -3 dB	25 kHz
Variation time of full scale using a square pilot signal	
Rise time 10% / 90%	< 10 µs (voltage regulation) < 100 µs (current regulation)
Fall time 10% / 90%	< 10 µs (voltage regulation) < 100 µs (current regulation)
Transfer time	< 10 µs (voltage regulation) < 100 µs (current regulation)
Transition from Q1 to Q4	< 10µs

Notes:

(3) 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%:

a. To 110 VRMS for an amplifier in range 130V,
b. To 220 VRMS for an amplifier in range 260V.

OUTPUT: IMAGES AND MEASURES	
Images outputs (3)	
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:

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

INPUT: AMPLITUDE AND FREQUENCY	
Input signal amplitude (external generator)	
Insulation (4)	> 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

Notes:

(5) “Pilot” analog input is insulated from power outputs.

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MAINS POWER SUPPLY	
Mains network	
Number of phases	Three-Phase + Neutral + Earth
Voltage	400 VRMS ±10%
Frequency	47 - 63 Hz
Input current	
Max at full output power	13 ARMS per phase
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 panel	Aluminum painted RAL7021
Rear panel	Aluminum anodized black
Dimensions and weight	
Width	483 mm (19 inches)
Depth	600 mm
Height	355 mm (8U)
Weight	120 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

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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-6000-AC-DC-130V-50A-UI

Amplifier 6000 VA: max voltage 130 VRMS, max current 50 ARMS
Using Voltage or Current regulation

PA-6000-AC-DC-270V-22A-UI

Amplifier 6000 VA: max voltage 270 VRMS, max current 22 ARMS
Using Voltage or Current regulation

AVAILABLE OPTIONS (to order separately)

PA-RC-SPECIAL RANGE: special ranges, please consult us

PA-RC-BAIE: installation in a bench height 29U (1570 MM) equipped with wheels (installation without any cabling)

PA-RC-L100: set of resistors connected between the user output and the power amplifier. It allows to reach 100% absorption. This option includes installation in a small rack height 29U (1570 mm) with START / STOP buttons and emergency stop management.

DELIVERIES

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

Specification may change without notice