AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - LIMITED ABSORPTION

SPHEREA
PUISSANCE PLUS

PERFORMANCES

- High accuracy
- High stability
- Fast transients
- High inrush current facilities
- Wide bandwidth
- Very low distortion
- Quadrant changes without transition
- Very low output impedance

RS232

APPLICATIONS

- 3 insulated outputs
- AC, AC+DC, DC
- Avionic network 300-800-1200Hz
- Industrial networks 50-60 Hz
- LVDC and HVDC grids
- Tests in accordance with ABD100.1.8 / MIL-STD-704
- Disturbed networks
- AC or DC motor simulation
- Non-linear loads
- Harmonics generation

DESCRIPTION

- PA-3X7000 is a voltage amplifier “4 quadrants” three phases AC, AC+DC or DC. Its high electrical performance allows to test or simulate all kinds of generators or loads.

- The linear technology used for these amplifiers allows:
  - A high dynamic, a very low distortion on a wide frequency range and a large bandwidth,
  - To provide power peaks up to 4 times its rated power,
  - An easy integration for “Real-Time” or “Power Hardware In the Loop” applications with simulators,
  - A power factor between +1 (source mode) and -1 (sink mode).

- PUISSANCE+ amplifiers are operating in voltage regulation or in current regulation:
  - For each phase, an analog input receives a “pilot” signal whose amplitude is 0~±10 V peak (7.07 VRMS), coming from amplifier internal synthetizer or from an external synthetizer,
  - After insulation, the equipment amplifies this signal depending on the selected range, with a very short propagation delay,
  - On all our amplifiers, insulated analog outputs, two per phase, return images of voltage and current at the output of the equipment with amplitude 0~±10 V peak.

- Its remote control by protocol TCP/IP on Ethernet or SCPI on link RS232 allows its easy integration into an automatic test system.

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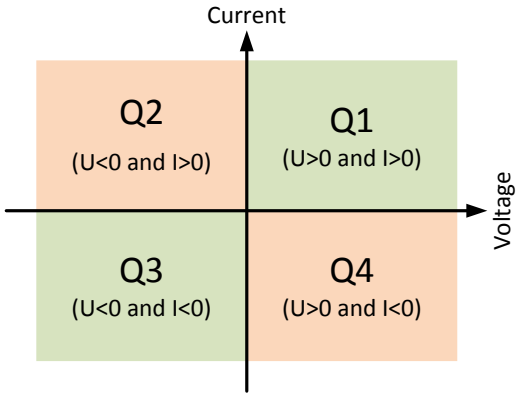
"4 QUADRANTS" OPERATION

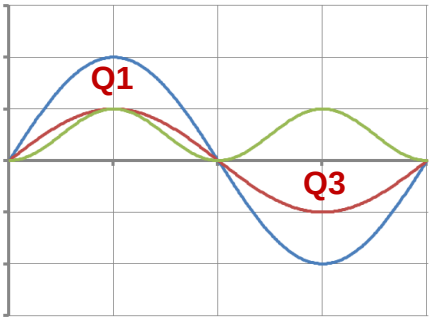
When amplifiers operate in voltage regulation with current limitation, in case of temporary overload the voltage decreases to limit the current.

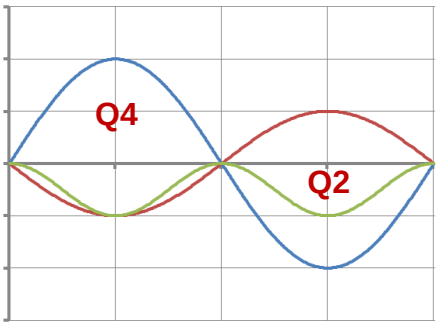
In "Q1" and "Q3" areas, the amplifier behaves in "GENERATOR or SOURCE": the instantaneous power is positive.

In "Q2" and "Q4" areas, the amplifier behaves in "ABSORBER or SINK": the instantaneous power is negative.



On a time scale, with voltage in Blue trace, current in Red trace, power in Green trace:



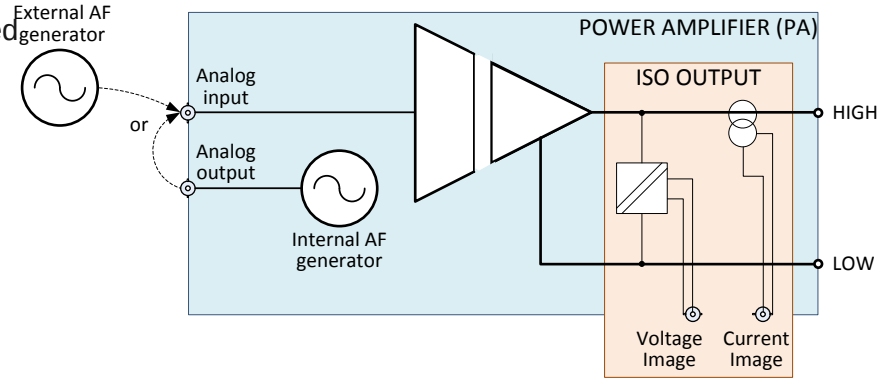


INTERNAL CONSTITUTION

PA-3x7000 amplifier is composed of three identical amplifiers of 7 kVA each.

Each amplifier is electrically insulated from the two others.

Each amplifier includes:
- one AF generator,
- one analog input,
- one power output,
- two outputs "Image"



The internal AF generator can generate AC or DC pilot signal. In AC sine and customized waveforms can be used. In AC dephasing can also be programmed.

The outputs "Voltage Image" and "Current Image" are insulated from power outputs.

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BANDWIDTH “small signals”

Blue trace:

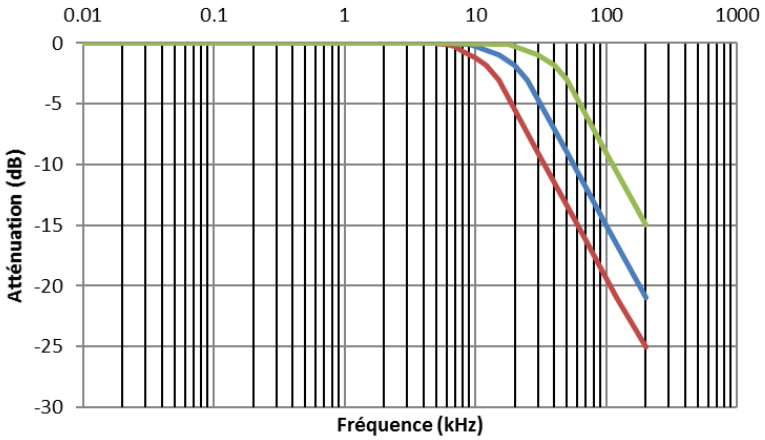
In voltage regulation bandwidth at -3dB is 25 kHz.

Green trace:

In voltage regulation, with “PA-3X7K-BW” option, bandwidth at -3dB is increased to 50 kHz.

Red trace:

In current regulation, with “PA-3X7K-RI” option, bandwidth in current at -3dB is 15 kHz.



RISE TIME, FALL TIME AND TRANSFER TIME

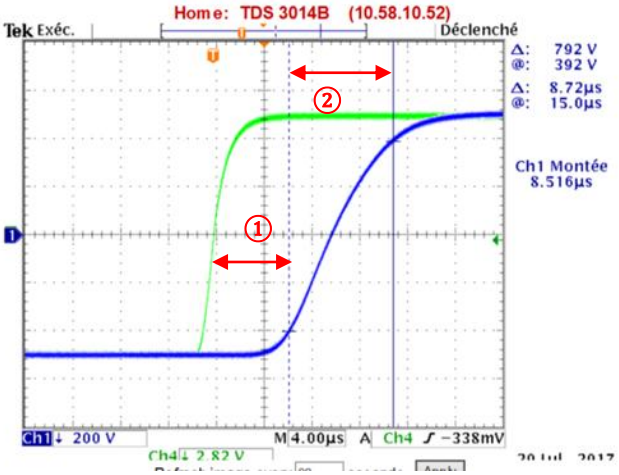
Theses measurement must be done using a square pilot signal.

Regarding the range in use:

- Rise time 10% - 90%: ≤ 20 µs
- Fall time 90% - 10%: ≤ 20 µs
- Transfer time: ≤ 20 µs

Example of measurements using the range 400V on an amplifier:

- ① Transfer time: 7.2µs
- ② Rise time: 8.5µs



AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - LIMITED ABSORPTION

OUTPUT FEATURES

POWER OUTPUTS	Power						
	Rated power per phase	7 000VA					
	Rated power total	21 000VA					
	AC ranges	130V / 200V / 260V / 400V					
	DC ranges	180V / 280V / 360V / 560 V / 720V / 1120V					
	Output type	Direct (without transformer)					
	Voltage and current in AC	Ranges					
		130V	200V	260V	400V		
	AC voltage (VRMS)	0-130	0-200	0-260	0-400		
	Permanent AC current “In” (ARMS)	0-54	0-36	0-28	0-18		
	Maximum peak current (3xIn < 5 s)	162	108	84	54		
	Voltage and current in DC	Ranges					
		180V	280V	360V	560V	720V	1120V
	DC voltage (VDC)	±180	±280	±360	±560	±720	±1120
	Permanent DC current “In” (ADC)	±54	±36	±54	±36	±28	±18
	Maximum peak current (3xIn < 5 s)	162	108	162	108	84	54
	Voltage accuracy						
	Typical	0,1% of range + 0,1% of programmed value					
	Resolution	12 bits					
	Current accuracy						
	Typical	0,1% of range + 0,1% of programmed value					
	Resolution	12 bits					
	Voltage distortion at full output 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 current variation from 0 to 100%						
	Max	< 0,1% of rated voltage					
	Noise						
	Max RMS	0,02% of rated voltage					
	Max peak to peak	0,3% of rated voltage					
	Internal AF generator						
	Frequency	DC or 40 Hz to 10 kHz - Resolution 0.1 Hz					
	Dephasing	± 360° - Resolution 0.1°					
	Bandwidth						
	Full scale	DC – 5 kHz					
	Small signals at -3 dB	25 kHz					
	Variation with a square signal pilot						
	Rise time 10% / 90%	< 20 µs					
	Fall time 10% / 90%	< 20 µs					
	Transfer time	< 20 µs					
	Transition from Q1 to Q4	< 10µs					
	Variation according temperature						
	Typical	50 ppm/°C					
	Max	100 ppm/°C					
	Stability after 15 minutes of operation						
	Max	< 0,05% of rated voltage					
	Insulation of the outputs versus case ground						
	Measurement at 500 VDC	> 100 MΩ					

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MAINS

MAINS	Mains network	
	Number of phases	3 Phases + Earth without Neutral
	Voltage (-10% +6%)	400 VRMS
	Frequency	47 - 63 Hz
	Mains current at full output power	
	Max per phase (ARMS)	45
	Protection	Magneto thermal breaker
	Inrush current	Limited to 2 x Max current
	Dielectric strength of the mains input versus the output connected to the case ground	
	Measurement at 2500VRMS / 50Hz	Current < 10 mA

LOW VOLTAGE INPUTS AND OUTPUTS, MEASUREMENTS

INPUTS	Input signal amplitude	
	Insulation	> 10 MΩ (1)
	Voltage for full output scale	7,07 VRMS / ± 10V peak
	Max. voltage	± 15 V peak
	Input impedance	10 kΩ
	Input signal frequency	
	Fundamental	DC – 5kHz
	Harmonics (small signals)	Max 50 kHz
	Digital inputs (4 inputs)	
	Type	DC 0-24V
	“Low” level	< 5V
	“High” level	> 11 V
	Input impedance	10 kΩ

OUTPUTS	Images (2)	
	Voltage image accuracy	1 VRMS for 83,3 VRMS
	Current image accuracy	1 VRMS for 15,56 ARMS
	Connectors	BNC sockets
	Accuracy of the measurements displayed on the touch screen	
	Voltage measurement	0,3% of range + 0,3% of measure
	Current measurement	0,3% of range + 0,3% of measure

1) The analog inputs are insulated from power outputs.
2) The analog images are insulated from power outputs.

MECHANICAL AND ENVIRONMENTAL

MECANICHAL AND ENVIRONMENTAL	Metallic parts treatment	
	Frame	Aluminum painted RAL7021
	Sides and rear panels	Aluminum painted RAL7035
	Dimensions and weight	
	Width	800 mm
	Depth (connectors excluded)	800 mm
	Height	1950 mm (38U) on wheels with brake
	Weight	550 kg
	Handling	
	Wheels	Four wheels 125 mm with brakes
	Temperature and humidity	
	Storage temperature	-10°C à +85°C
	Operating temperature	+0°C à +50°C
	Relative humidity	10% - 90% non-condensing
	Sound level (fans at full speed)	
	Measured at 1 m of front panel	< 70 dBA
	Marking	
	Marking	CE
	Index of 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.

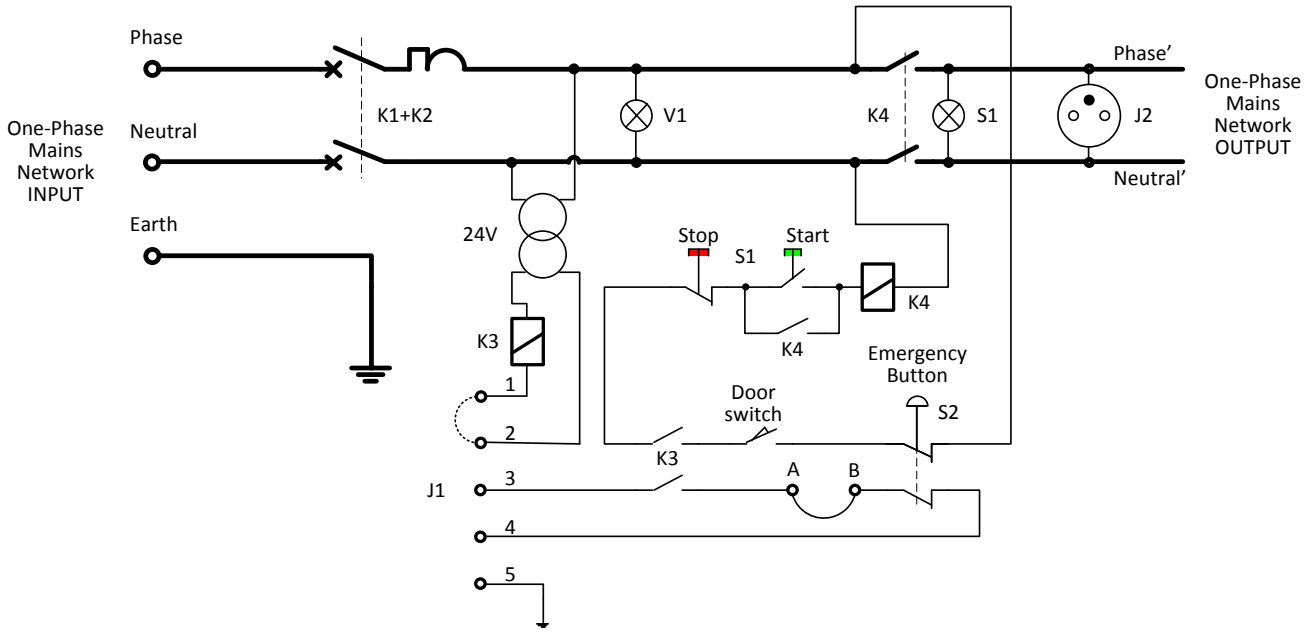
Against overtemperature: automatic output switch-off

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.

EMERGENCY MANAGEMENT

Used in all our power racks, the « auxiliary line module » is installed on front panel and insures:

- The magnetothermal and differential protection of the one-phase mains network,
- ON / OFF function of the cabinet
- Emergency buttons management.



The 30 mA magnetothermal and differential breaker « K1+K2 » insures cabinet protection White light “V1” is ON when power is ON.

Powered at 24 VRMS, relay “K3” is closed if a link is made between pins 1 and 2 of “J1” connector, using a strap or using an external emergency button.

Relay “K4” insures output power on. Its command includes:

- Emergency button “S2” installed on front panel of the module,
- A “Normally Open” contact closed when the rear door of the cabinet is closed,
- A “Normally Open” contact of relay “K3”,
- A “Normally Closed” contact of Start/Stop button “S1”,
- A “Normally Open” contact od Start/Stop button “S1” a maintaining contact of relay “K4”.

Between pins 3 and 4 of “J1” connector is available the status of the cabinet:

- Contact type is Normally Open
- Max switchable current is 1 ARMS at 48 VRMS

The link is closed if “K3” relay is closed and emergency button not pushed. In some cases, an optional switch can be installed between A and B pins, instead of the strap, to create a specific output function.

PERMANENT OPERATION IN LVAC

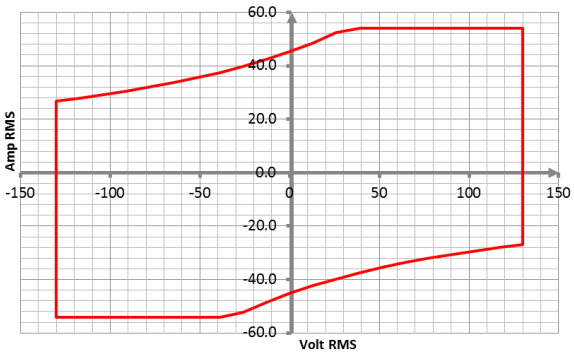
Connection **IN PARALLEL** of amplifiers outputs is not allowed: two voltage sources cannot be connected without specific equipment.

Connection **IN SERIES** of amplifiers outputs is not allowed even if they use the same pilot signal on their inputs.

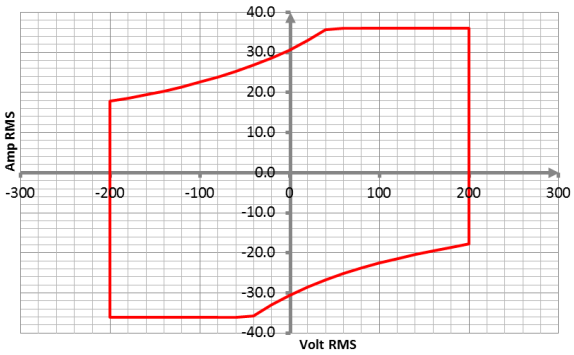
These diagrams explain relation between current and voltage for a power factor of 1 (SOURCE) and -1 (SINK).

Continuous operation is allowed “inside” diagrams. In generation or absorption limitations are due to the heating of the power transistors.
Operation “outside” diagrams will result in:

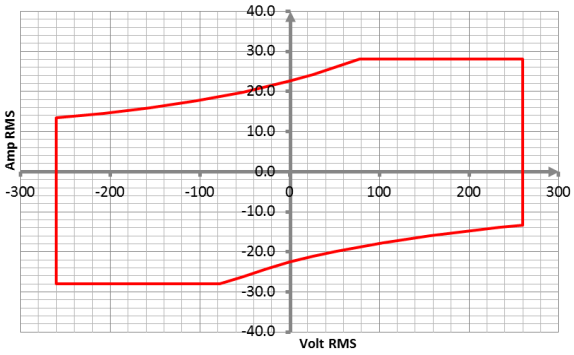
- an immediate switch-off by over-current protection if current is above the limits
- a break after a delay by thermal protection in case of overheating of the power parts.



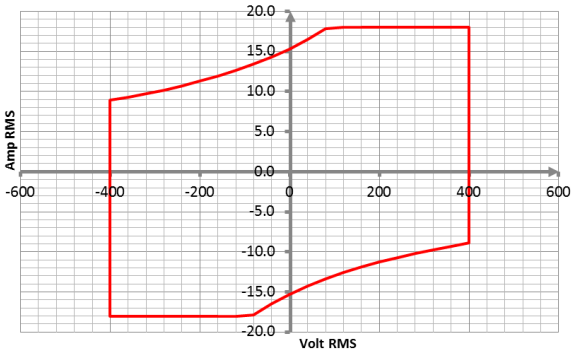
RANGE 130V-54A



RANGE 200V-36A



RANGE 260V-28A



RANGE 400V-18A

PERMANENT OPERATION IN LVDC

Connection **IN PARALLEL** of amplifiers outputs is not allowed: two voltage sources cannot be connected without specific equipment.

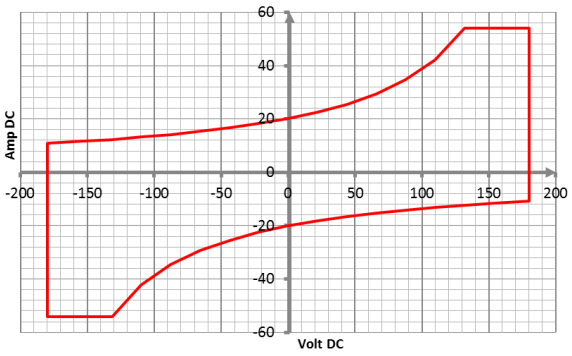
Connection **IN SERIES** of amplifiers outputs is **NOT RECOMMENDED**. To use amplifiers in higher voltage ranges, specific HVDC ranges have been created (see on next page).

These diagrams explain relation between current and voltage for an operation in GENERATION and in ABSORPTION.

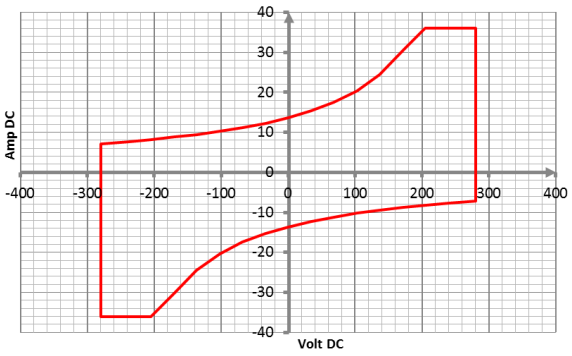
Continuous operation is allowed “inside” diagrams. In generation or absorption limitations are due to the heating of the power transistors.

Operation “outside” diagrams will result in:

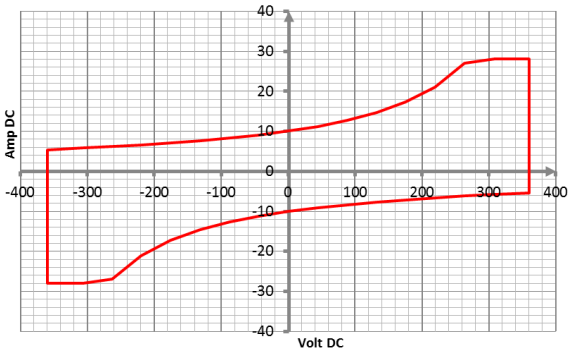
- an immediate switch-off by over-current protection if current is above the limits
- a break after a delay by thermal protection in case of overheating of the power parts.



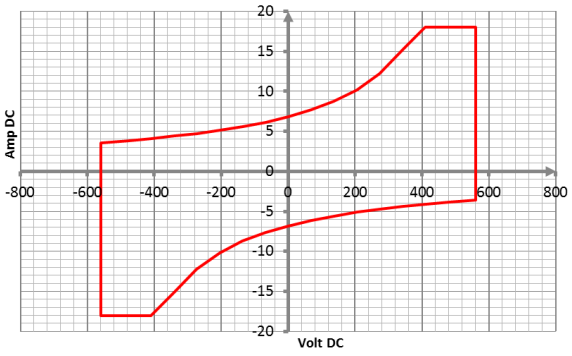
RANGE 180V-54A



RANGE 280V-36A



RANGE 360V-28A

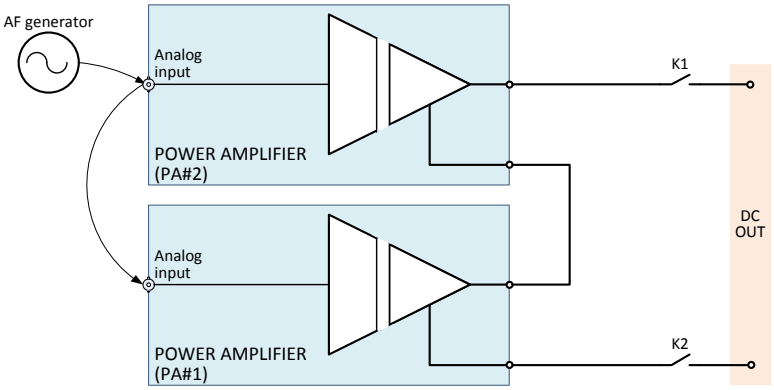


RANGE 560V-18A

AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - LIMITED ABSORPTION

PERMANENT OPERATION IN HVDC

To make safe operation of amplifiers in HVDC, a specific output has been cabled on a specific terminal distinct from AC output terminals. For that, amplifiers “PA#1” and “PA#2” are coupled in series using adapted relays. Third amplifier “PA#3” is not used.



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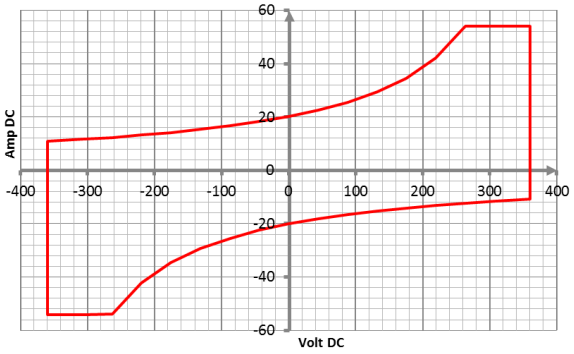
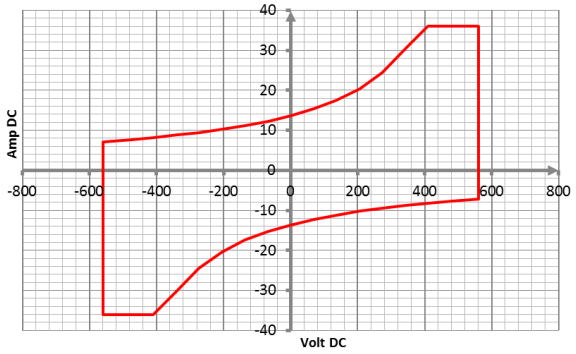
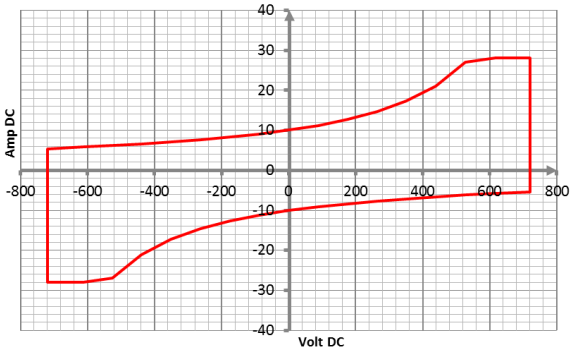


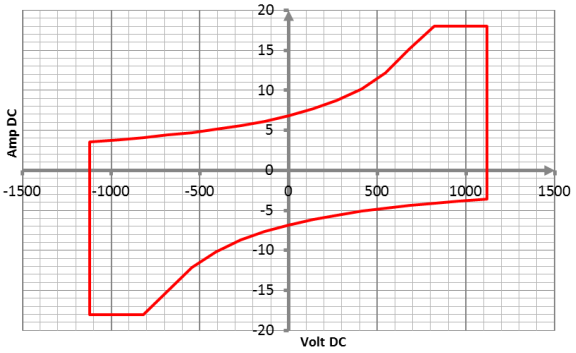
RANGE 360V-54A



RANGE 560V-36A



RANGE 720V-28A



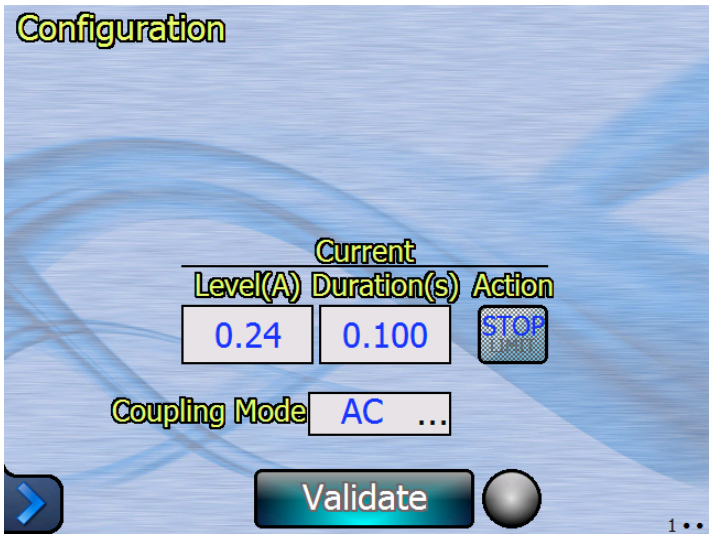
RANGE 1120V-18A

LOCAL OR REMOTE CONTROL

Managed by a Control board with a touch screen, the amplifier has two operating modes:

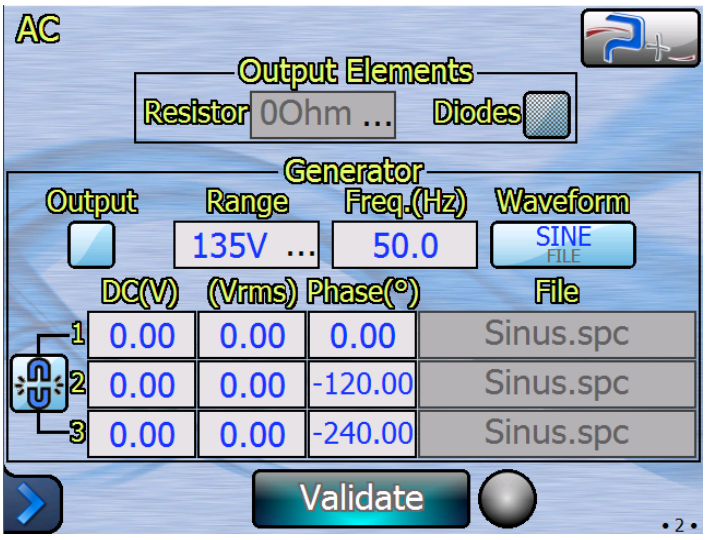
- **Local control:** The control device equipped with a graphical touch screen disposed in front panel gives access to all the control functions and the display of the measures.
- **Remote control:** The control device has one TCP/IP Ethernet link and two serial links, RS232 and RS485, for a control through a remote PC.

LOCAL CONTROL ON TOUCH SCREEN

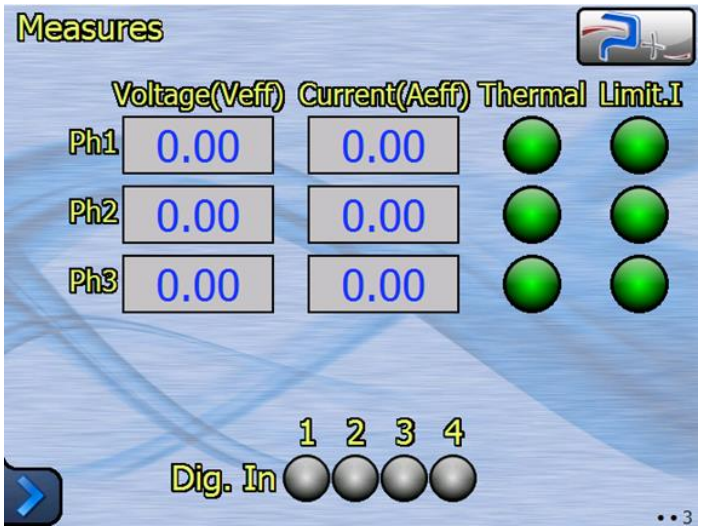


A first screen is for current limitation programming in amplitude and duration.

On the main screen, graphical objects like boxes, input boxes and dropdowns are to set it up.



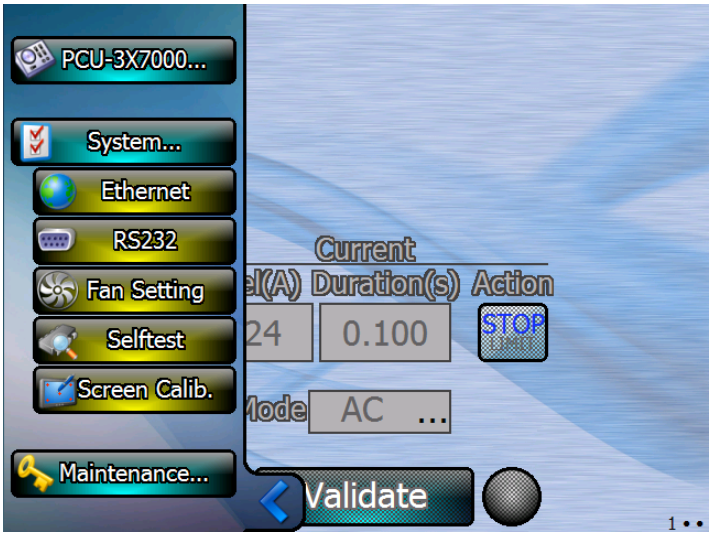
AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - LIMITED ABSORPTION



On the measurements screen, fields return the instantaneous values of voltage and current.

LEDs indicate status: thermal fault, overcurrent detected...

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



ORDER INFORMATION

PA-3x7000-AC/DC-400V-54A-4G-<options>
Amplifier 3x7000 VA with limited absorption

AVAILABLE OPTIONS (to order separately)

PA-3X7K-BW	bandwidth small signals increased from 25 kHz to 50 kHz
PA-3X7K-RI	amplifier can be used in in voltage and in current regulation
PA-3X7K-MAINS	modification of mains input for a 200 VRMS between phases network

Specification may change without notice

Head office: 500 avenue du Danemark 82000 Montauban France. Tel: +33 (0)5.63.02.14.21 contact@puissanceplus.com www.puissanceplus.com
Entzheim site: 7 allée de l'Europe 67960 Entzheim France. Tel: +33 (0)3.88.10.30.40 contact@electrona.fr www.electrona.fr

AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

SPHEREA
PUISSANCE PLUS

PERFORMANCES

- High accuracy
- High stability
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CE RS232

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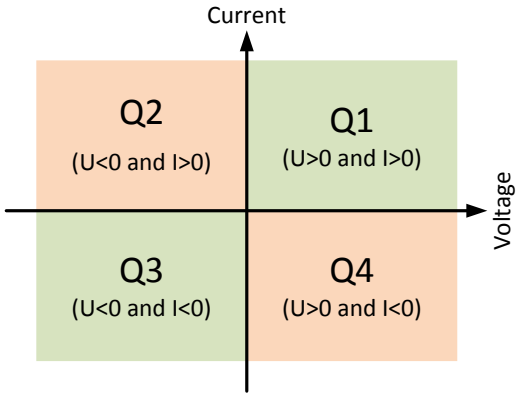
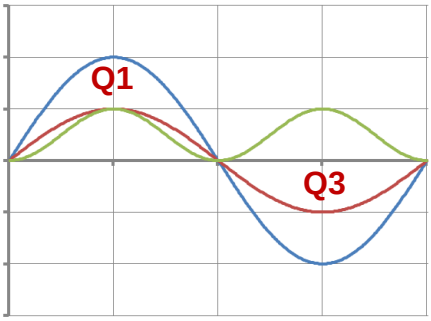
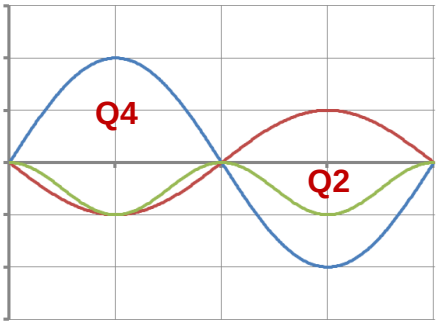


On a time scale, with voltage in Blue trace, current in Red trace, power in Green trace:



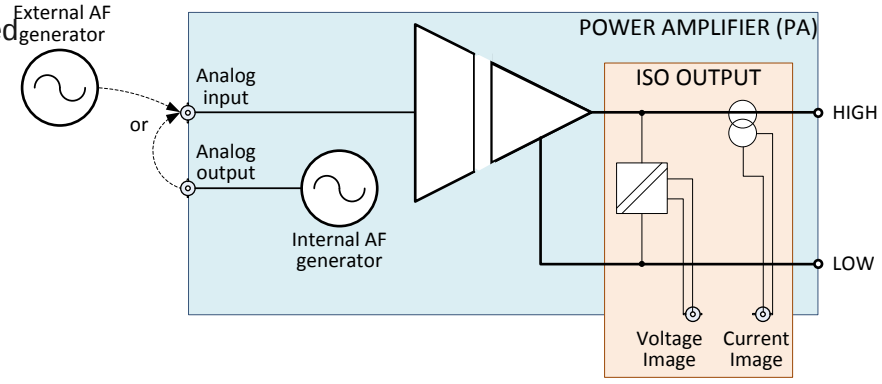


INTERNAL CONSTITUTION

PA-3x7000 amplifier is composed of three identical amplifiers of 7 kVA each.

Each amplifier is electrically insulated from the two others.

Each amplifier includes:
- one AF generator,
- one analog input,
- one power output,
- two outputs "Image"



The internal AF generator can generate AC or DC pilot signal. In AC sine and customized waveforms can be used. In AC dephasing can also be programmed.

The outputs "Voltage Image" and "Current Image" are insulated from power outputs.

AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

BANDWIDTH “small signals”

Blue trace:

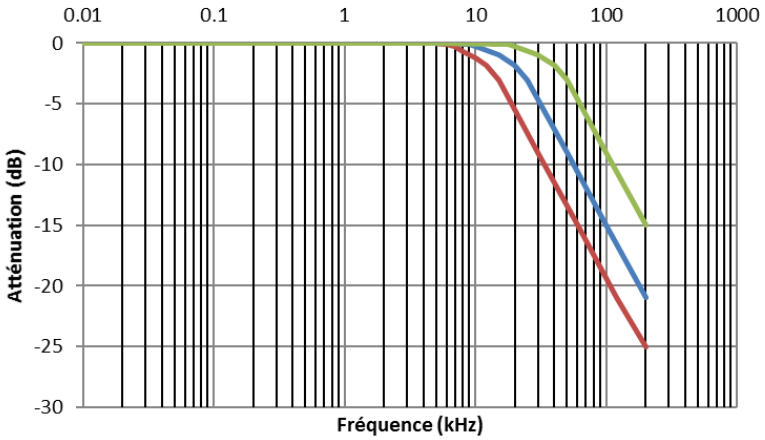
In voltage regulation bandwidth at -3dB is 25 kHz.

Green trace:

In voltage regulation, with “PA-3X7K-BW” option, bandwidth at -3dB is increased to 50 kHz.

Red trace:

In current regulation, with “PA-3X7K-RI” option, bandwidth in current at -3dB is 15 kHz.



RISE TIME, FALL TIME AND TRANSFER TIME

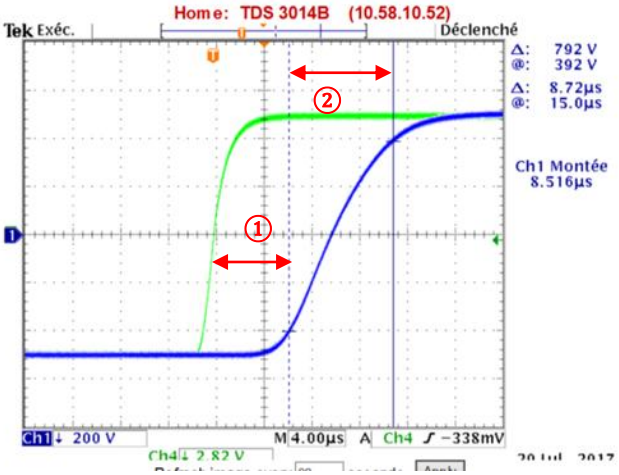
Theses measurement must be done using a square pilot signal.

Regarding the range in use:

- Rise time 10% - 90%: ≤ 20 µs
- Fall time 90% - 10%: ≤ 20 µs
- Transfer time: ≤ 20 µs

Example of measurements using the range 400V on an amplifier:

- ① Transfer time: 7.2µs
- ② Rise time: 8.5µs



AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

OUTPUT FEATURES

POWER OUTPUTS

Power						
Rated power per phase	7 000VA					
Rated power total	21 000VA					
AC ranges	130V / 200V / 260V / 400V					
DC ranges	180V / 280V / 360V / 560 V / 720V / 1120V					
Output type	Direct (without transformer)					
Voltage and current in AC	Ranges					
	130V	200V	260V	400V		
AC voltage (VRMS)	0-130	0-200	0-260	0-400		
Permanent AC current “In” (ARMS)	0-54	0-36	0-28	0-18		
Maximum peak current (3xIn < 5 s)	162	108	84	54		
Voltage and current in DC	Ranges					
	180V	280V	360V	560V	720V	1120V
DC voltage (VDC)	±180	±280	±360	±560	±720	±1120
Permanent DC current “In” (ADC)	±54	±36	±54	±36	±28	±18
Maximum peak current (3xIn < 5 s)	162	108	162	108	84	54
Voltage accuracy						
Typical	0,1% of range + 0,1% of programmed value					
Resolution	12 bits					
Current accuracy						
Typical	0,1% of range + 0,1% of programmed value					
Resolution	12 bits					
Voltage distortion at full output 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 current variation from 0 to 100%						
Max	< 0,1% of rated voltage					
Noise						
Max RMS	0,02% of rated voltage					
Max peak to peak	0,3% of rated voltage					
Internal AF generator						
Frequency	DC or 40 Hz to 10 kHz - Resolution 0.1 Hz					
Dephasing	± 360° - Resolution 0.1°					
Bandwidth						
Full scale	DC – 5 kHz					
Small signals at -3 dB	25 kHz					
Variation with a square signal pilot						
Rise time 10% / 90%	< 20 µs					
Fall time 10% / 90%	< 20 µs					
Transfer time	< 20 µs					
Transition from Q1 to Q4	< 10µs					
Variation according temperature						
Typical	50 ppm/°C					
Max	100 ppm/°C					
Stability after 15 minutes of operation						
Max	< 0,05% of rated voltage					
Insulation of the outputs versus case ground						
Measurement at 500 VDC	> 100 MΩ					

AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

MAINS

MAINS	Mains network	
	Number of phases	3 Phases + Earth without Neutral
	Voltage (-10% +6%)	400 VRMS
	Frequency	47 - 63 Hz
	Mains current at full output power	
	Max per phase (ARMS)	45
	Protection	Magneto thermal breaker
	Inrush current	Limited to 2 x Max current
	Dielectric strength of the mains input versus the output connected to the case ground	
	Measurement at 2500VRMS / 50Hz	Current < 10 mA

LOW VOLTAGE INPUTS AND OUTPUTS, MEASUREMENTS

INPUTS	Input signal amplitude	
	Insulation	> 10 MΩ (1)
	Voltage for full output scale	7,07 VRMS / ± 10V peak
	Max. voltage	± 15 V peak
	Input impedance	10 kΩ
	Input signal frequency	
	Fundamental	DC – 5kHz
	Harmonics (small signals)	Max 50 kHz
	Digital inputs (4 inputs)	
	Type	DC 0-24V
	“Low” level	< 5V
	“High” level	> 11 V
	Input impedance	10 kΩ

OUTPUTS	Images (2)	
	Voltage image accuracy	1 VRMS for 83,3 VRMS
	Current image accuracy	1 VRMS for 15,56 ARMS
	Connectors	BNC sockets
	Accuracy of the measurements displayed on the touch screen	
	Voltage measurement	0,3% of range + 0,3% of measure
	Current measurement	0,3% of range + 0,3% of measure

1) The analog inputs are insulated from power outputs.
2) The analog images are insulated from power outputs.

MECHANICAL AND ENVIRONMENTAL

MECANICHAL AND ENVIRONMENTAL	Metallic parts treatment	
	Frame	Aluminum painted RAL7021
	Sides and rear panels	Aluminum painted RAL7035
	Dimensions and weight	
	Width	800 mm
	Depth (connectors excluded)	800 mm
	Height	2230 mm (43U) on wheels with brake
	Weight	715 kg
	Handling	
	Wheels	Four wheels 125 mm with brakes
	Temperature and humidity	
	Storage temperature	-10°C à +85°C
	Operating temperature	+0°C à +50°C
	Relative humidity	10% - 90% non-condensing
	Sound level (fans at full speed)	
	Measured at 1 m of front panel	< 70 dBA
	Marking	
	Marking	CE
	Index of 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.

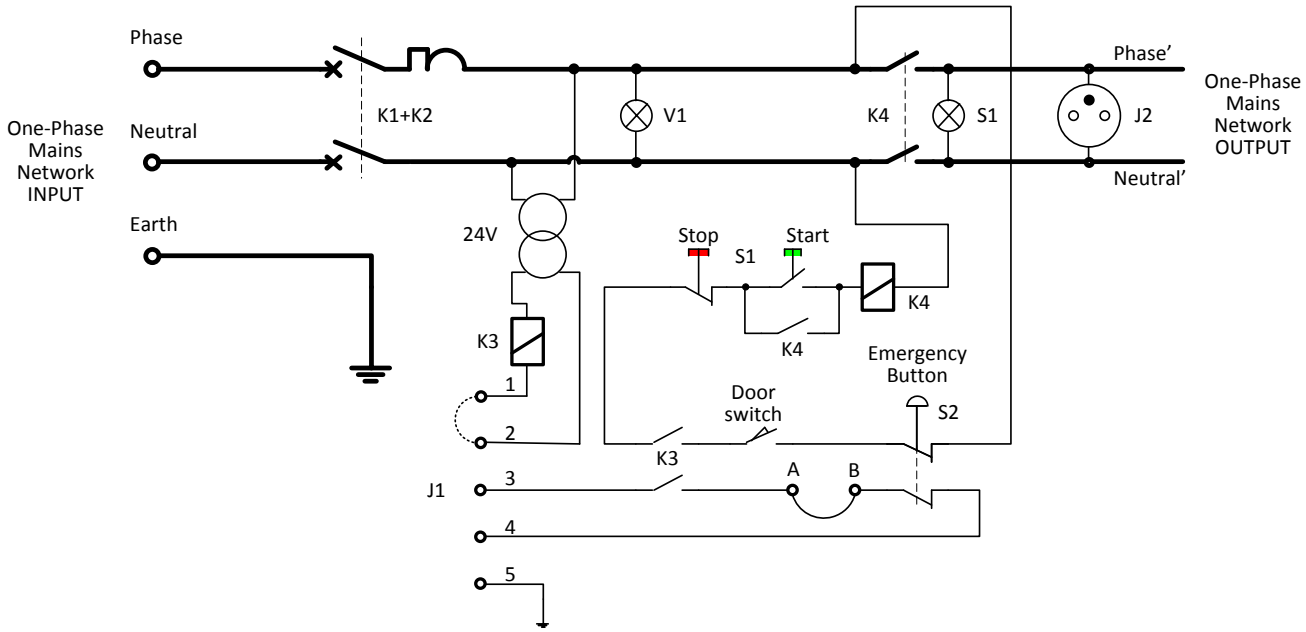
Against overtemperature: automatic output switch-off

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.

EMERGENCY MANAGEMENT

Used in all our power racks, the « auxiliary line module » is installed on front panel and insures:

- The magnetothermal and differential protection of the one-phase mains network,
- ON / OFF function of the cabinet
- Emergency buttons management.



The 30 mA magnetothermal and differential breaker « K1+K2 » insures cabinet protection White light “V1” is ON when power is ON.

Powered at 24 VRMS, relay “K3” is closed if a link is made between pins 1 and 2 of “J1” connector, using a strap or using an external emergency button.

Relay “K4” insures output power on. Its command includes:

- Emergency button “S2” installed on front panel of the module,
- A “Normally Open” contact closed when the rear door of the cabinet is closed,
- A “Normally Open” contact of relay “K3”,
- A “Normally Closed” contact of Start/Stop button “S1”,
- A “Normally Open” contact od Start/Stop button “S1” a maintaining contact of relay “K4”.

Between pins 3 and 4 of “J1” connector is available the status of the cabinet:

- Contact type is Normally Open
- Max switchable current is 1 ARMS at 48 VRMS

The link is closed if “K3” relay is closed and emergency button not pushed. In some cases, an optional switch can be installed between A and B pins, instead of the strap, to create a specific output function.

PERMANENT OPERATION IN LVAC (resistive load unused)

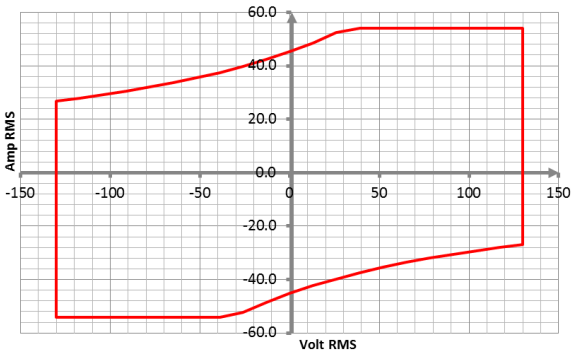
Connection **IN PARALLEL** of amplifiers outputs is not allowed: two voltage sources cannot be connected without specific equipment.

Connection **IN SERIES** of amplifiers outputs is not allowed even if they use the same pilot signal on their inputs.

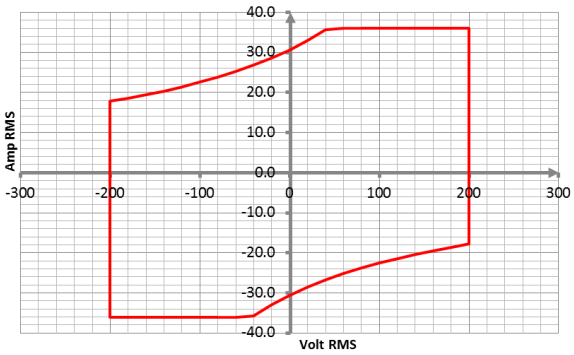
These diagrams explain relation between current and voltage for a power factor of 1 (SOURCE) and -1 (SINK).

Continuous operation is allowed “inside” diagrams. In generation or absorption limitations are due to the heating of the power transistors.
Operation “outside” diagrams will result in:

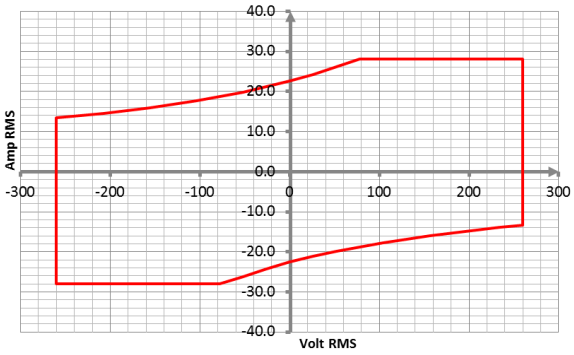
- an immediate switch-off by over-current protection if current is above the limits
- a break after a delay by thermal protection in case of overheating of the power parts.



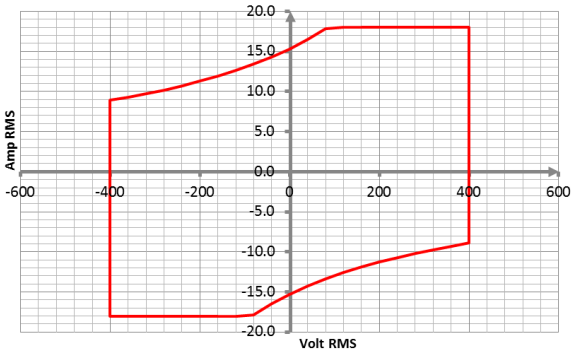
RANGE 130V-54A



RANGE 200V-36A



RANGE 260V-28A



RANGE 400V-18A

AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

PERMANENT OPERATION IN LVDC (resistive load unused)

Connection **IN PARALLEL** of amplifiers outputs is not allowed: two voltage sources cannot be connected without specific equipment.

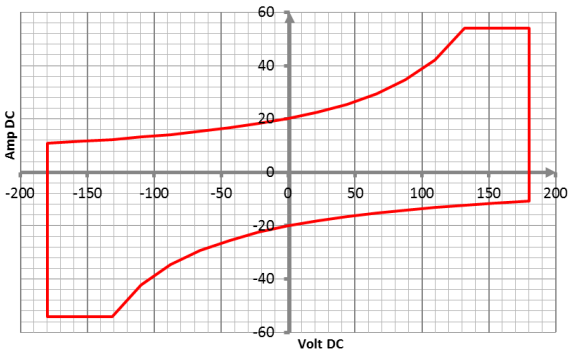
Connection **IN SERIES** of amplifiers outputs is **NOT RECOMMENDED**. To use amplifiers in higher voltage ranges, specific HVDC ranges have been created (see on next page).

These diagrams explain relation between current and voltage for an operation in GENERATION and in ABSORPTION.

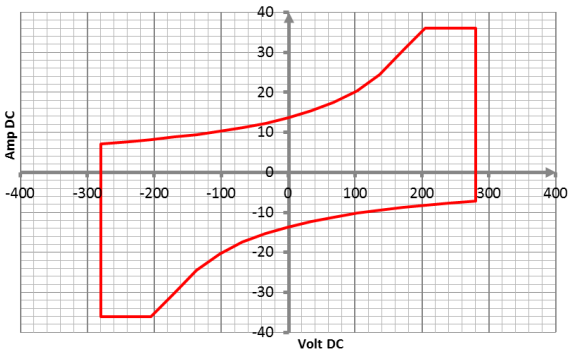
Continuous operation is allowed “inside” diagrams. In generation or absorption limitations are due to the heating of the power transistors.

Operation “outside” diagrams will result in:

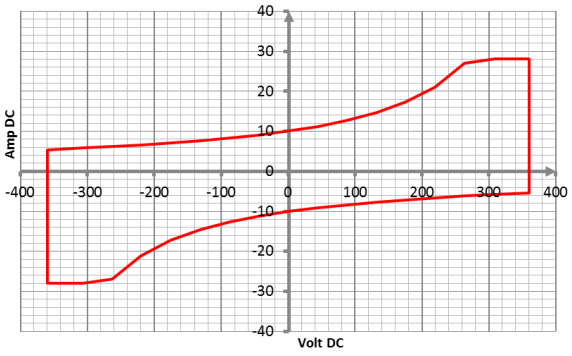
- an immediate switch-off by over-current protection if current is above the limits
- a break after a delay by thermal protection in case of overheating of the power parts.



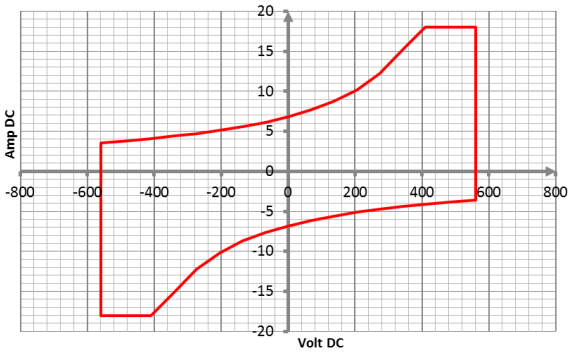
RANGE 180V-54A



RANGE 280V-36A



RANGE 360V-28A

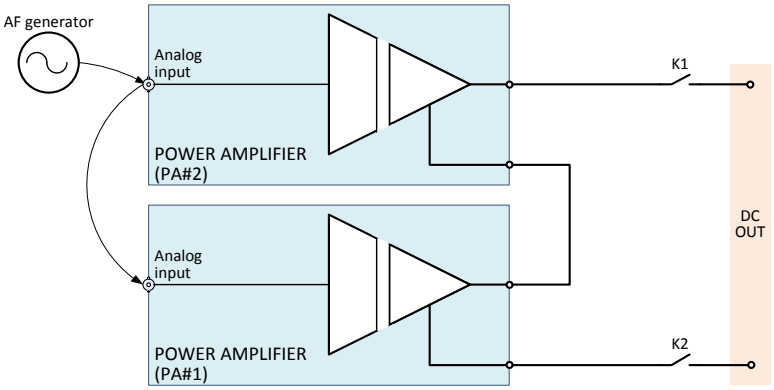


RANGE 560V-18A

AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

PERMANENT OPERATION IN HVDC (resistive load unused)

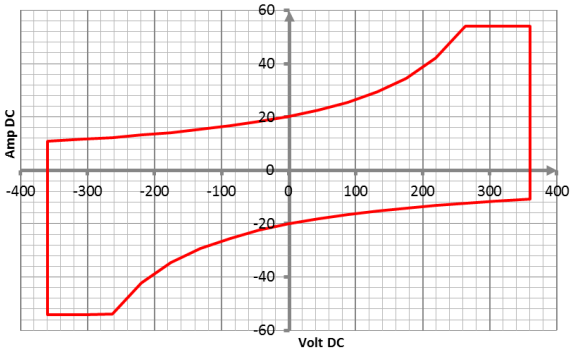
To make safe operation of amplifiers in HVDC, a specific output has been cabled on a specific terminal distinct from AC output terminals. For that, amplifiers “PA#1” and “PA#2” are coupled in series using adapted relays. Third amplifier “PA#3” is not used.



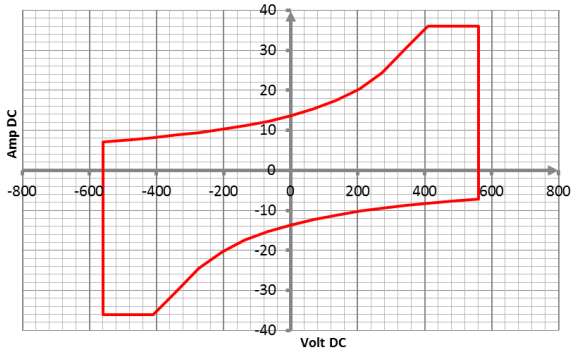
These diagrams explain relation between current and voltage for an operation in GENERATION and in ABSORPTION. Continuous operation is allowed “inside” diagrams. In generation or absorption limitations are due to the heating of the power transistors.

Operation “outside” diagrams will result in:

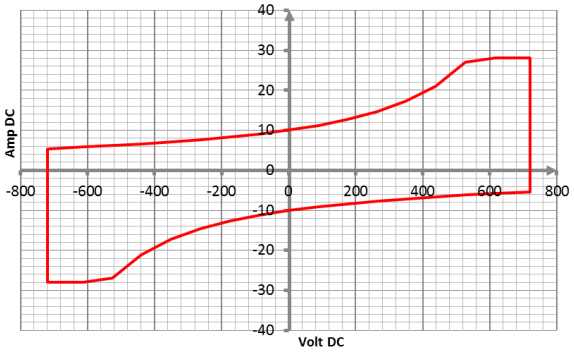
- an immediate switch-off by over-current protection if current is above the limits
- a break after a delay by thermal protection in case of overheating of the power parts.



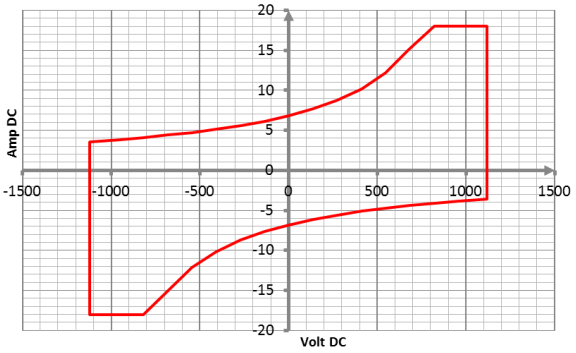
RANGE 360V-54A



RANGE 560V-36A



RANGE 720V-28A

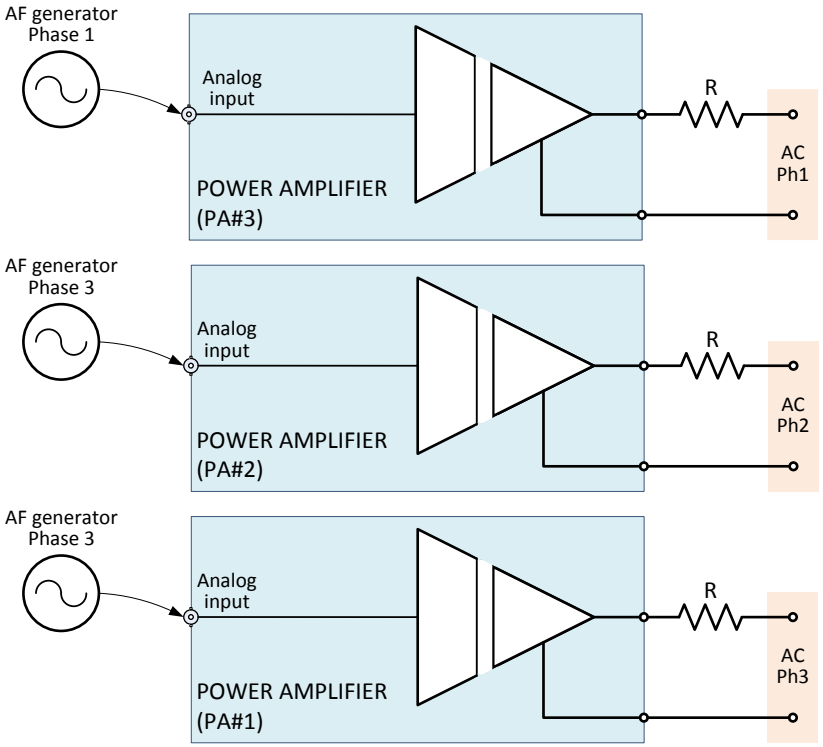


RANGE 1120V-18A

OPERATION IN LVAC WITH "RESISTIVE LOAD" (resistive load used)

The resistive load increases absorption capacity in quadrants "Q2" or "Q4" (see diagram explaining quadrants in page 5 of this document).

The general diagram in AC is:



Resistor "R" can have two different values:

- 8 ohms (current limited to 28 ARMS)
- 32 ohms (current limited to 18 ARMS)

In range "130V", resistors are not used because the current limitation at 28 ARMS is the same when resistors are unused.

In range "200V", only "8 ohms" value is available because voltage drop should be too high using "32 ohms" resistor.

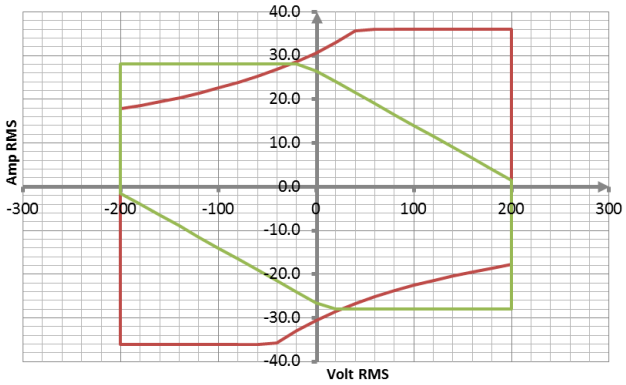
In ranges "260V" and "400V", "8 ohms" and "32 ohms" values are available.

AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

OPERATION IN RANGE “200V”

Red trace = without resistive load
Green trace = with resistive load 8 ohms

In range “200V”, use of resistive load brings an additional absorption from 30% in the quadrants “Q2” and “Q4” to reach 28 ARMS.

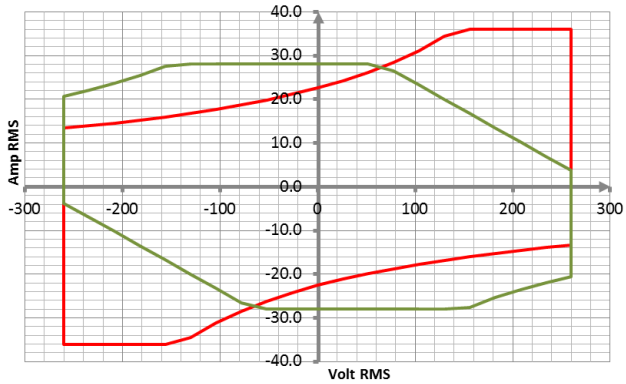


OPERATION IN RANGE “260V”

Red trace = without resistive load
Green trace = with resistive load 8 ohms

In range “260V”, use of resistive load allows absorption of 100% for a voltage between 0 and 160 VRMS in the quadrants “Q2” and “Q4”.

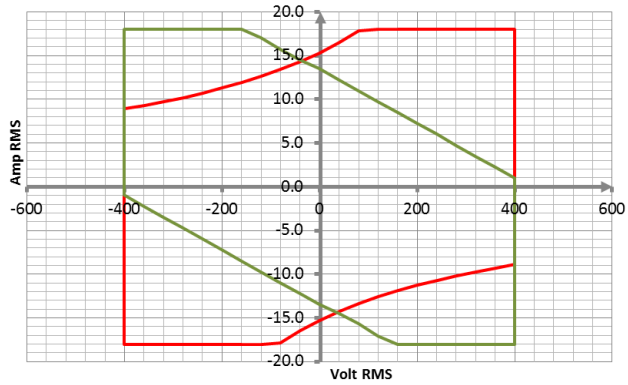
Erreur courant max 28A sur courbe rouge



OPERATION IN RANGE “400V”

Red trace = without resistive load
Green trace = with resistive load 32 ohms

In range “260V”, use of resistive load allows absorption of 100% for a voltage between 160 and 400 VRMS in the quadrants “Q2” and “Q4”.



OPERATION IN LVDC WITH "RESISTIVE LOAD" (resistive load used)

Resistor "R" can have two different values:

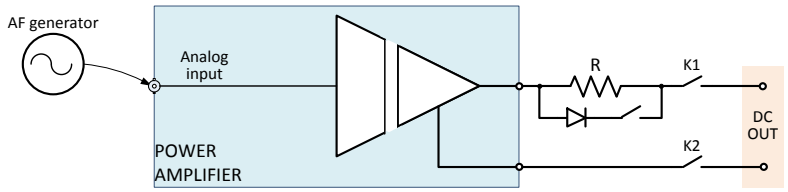
- 8 ohms (current limited to 28 ADC),
- 32 ohms (current limited to 18 ADC).

The diode makes it possible to avoid a voltage drop in generation of positive voltage.

In ranges:

- "180V-54A",
- "280V-36A",

only "8 ohms" value is available.



In ranges:

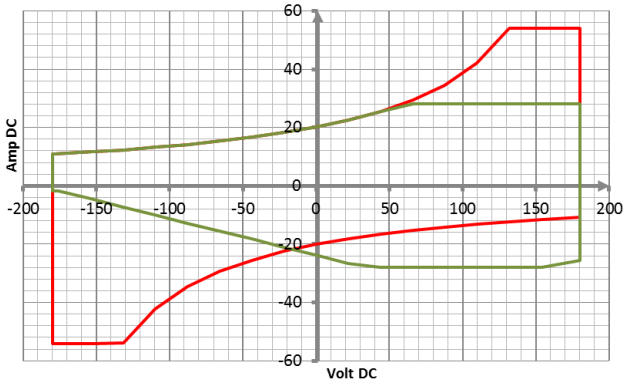
- "360V-28A",
- "560V-18A",

"8 ohms" and "32 ohms" are available.

OPERATION IN RANGE "180V-54A"

Red trace = without resistive load
Green trace = with resistive load 8 ohms

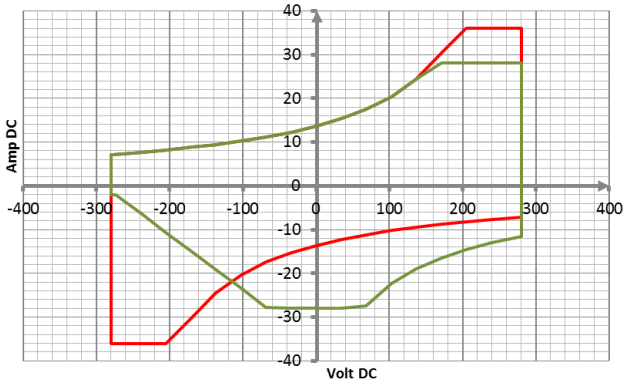
In range "180V-54A", use of resistive load allows absorption of 28 ADC for a voltage between 40 and 150 VDC in quadrant "Q4".



OPERATION IN RANGE "280V-36A"

Red trace = without resistive load
Green trace = with resistive load 8 ohms

In range "280V-36A", use of resistive load allows absorption of 28 ADC for a voltage between -60 and +60 VDC in quadrants "Q3" and "Q4".

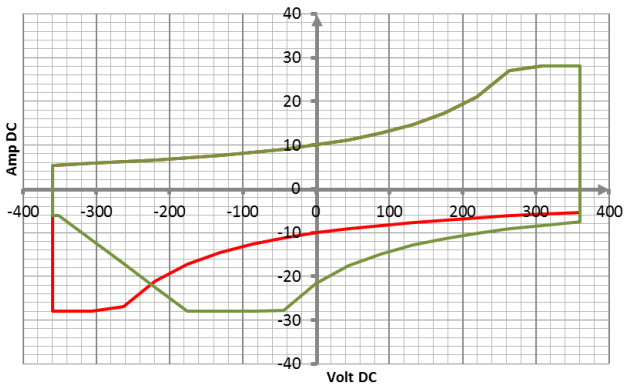


AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

OPERATION IN RANGE “360V-28A”

Red trace = without resistive load
Green trace = with resistive load 8 ohms

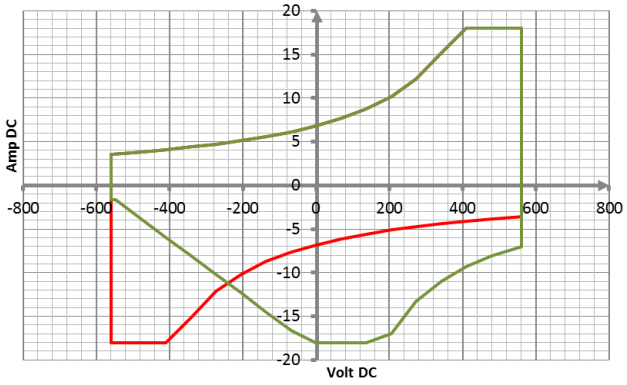
In range “360V-28A”, use of resistive load allows generation of 100% for a voltage between 50 and 180 VDC in quadrant “Q3”.



OPERATION IN RANGE “560V-18A”

Red trace = without resistive load
Green trace = with resistive load 32 ohms

In range “560V-18A”, use of resistive load doubles absorption in quadrant “Q4”.



OPERATION IN HVDC WITH "RESISTIVE LOAD" (resistive load used)

Resistor "R" can have two different values:

- 8 ohms (current limited to 28 ADC),
- 32 ohms (current limited to 18 ADC).

The diode makes it possible to avoid a voltage drop in generation of positive voltage.

In ranges:

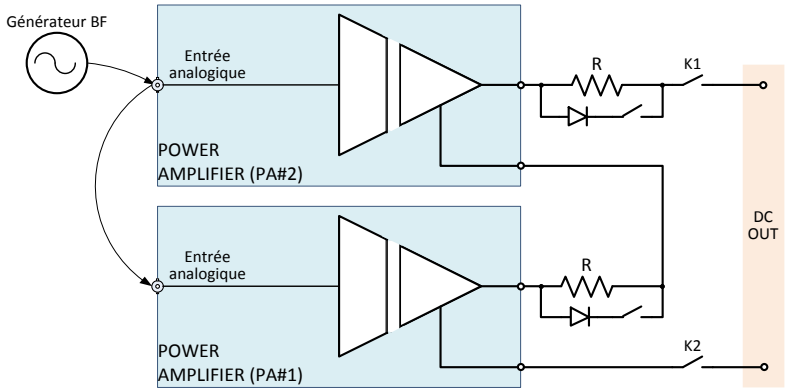
- "360V-54A",
- "560V-36A",

only "8 ohms" value is available.

In ranges:

- "720V-28A",
- "1120V-18A",

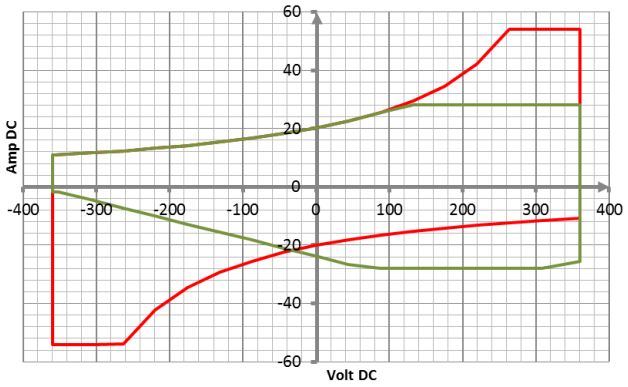
"8 ohms" and "32 ohms" are available.



OPERATION IN RANGE "360V-54A"

Red trace = without resistive load
Green trace = with resistive load 8 ohms

In range "360V-54A", use of resistive load allows absorption of 28 ADC for a voltage between 80 and 300 VDC in quadrant "Q4".

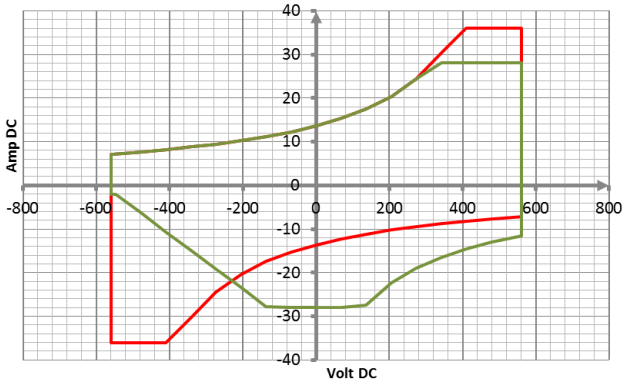


AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION

OPERATION IN RANGE “560V-36A”

Red trace = without resistive load
Green trace = with resistive load 8 ohms

In range “560V-36A”, use of resistive load allows absorption of 28 ADC for a voltage between -120 and +120 VDC in quadrants “Q3” and “Q4”.

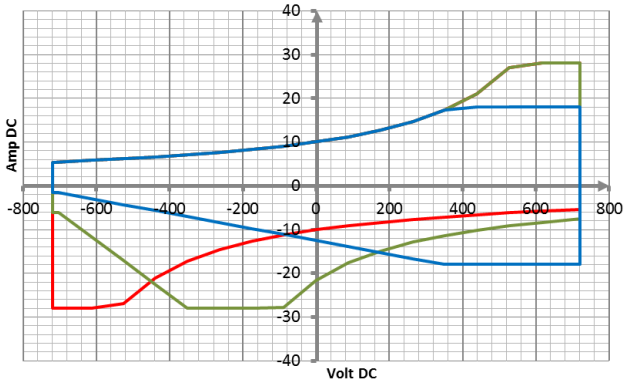


OPERATION IN RANGE “720V-28A”

Red trace = without resistive load
Green trace = with resistive load 8 ohms
Blue trace = with resistive load 32 ohms

In range “720V-28A”, use of value of “8 ohms” of resistive load modifies generation area in quadrant “Q3”.

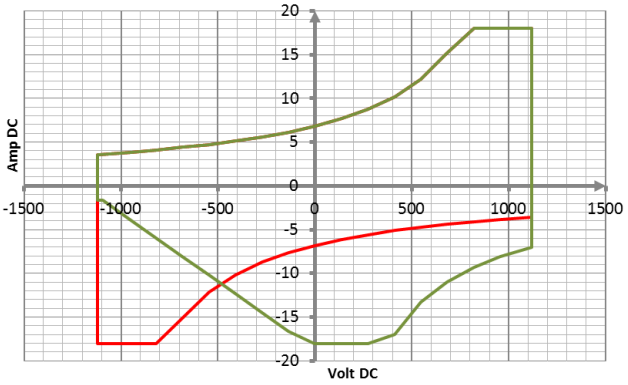
Use of value of “32 ohms” of resistive load doubles absorption in quadrant “Q4”.



OPERATION IN RANGE “1120V-18A”

Red trace = without resistive load
Green trace = with resistive load 32 ohms

In range “1120V-18A”, use of resistive load doubles absorption in quadrant “Q4”.

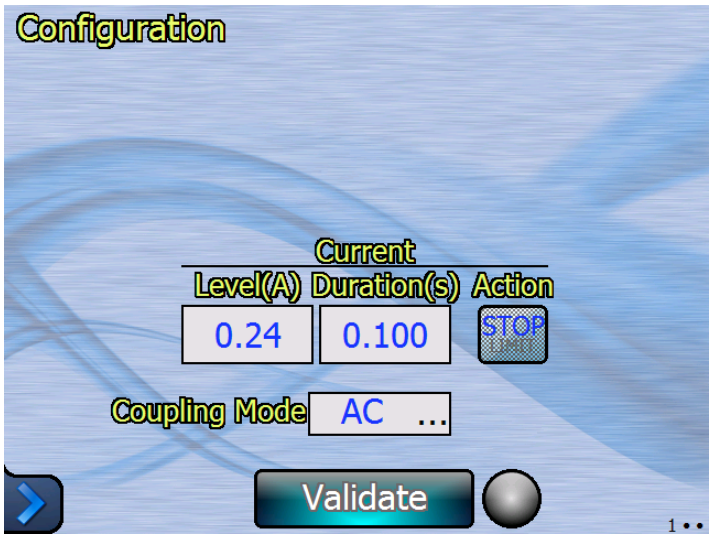


LOCAL OR REMOTE CONTROL

Managed by a Control board with a touch screen, the amplifier has two operating modes:

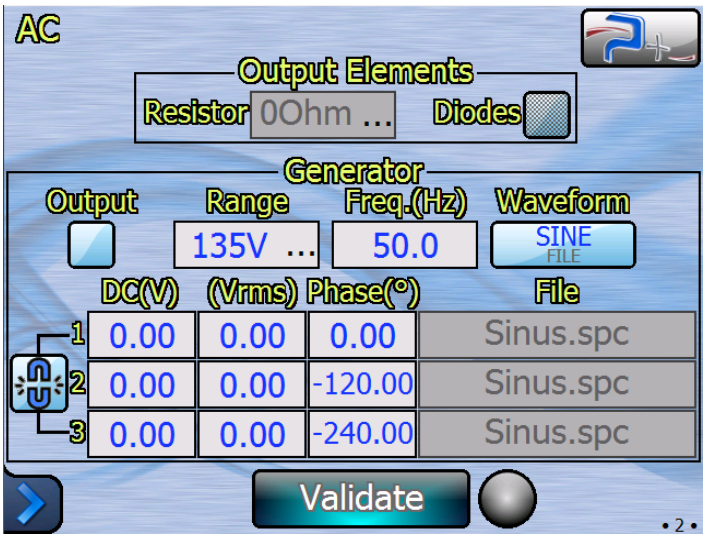
- **Local control:** The control device equipped with a graphical touch screen disposed in front panel gives access to all the control functions and the display of the measures.
- **Remote control:** The control device has one TCP/IP Ethernet link and two serial links, RS232 and RS485, for a control through a remote PC.

LOCAL CONTROL ON TOUCH SCREEN

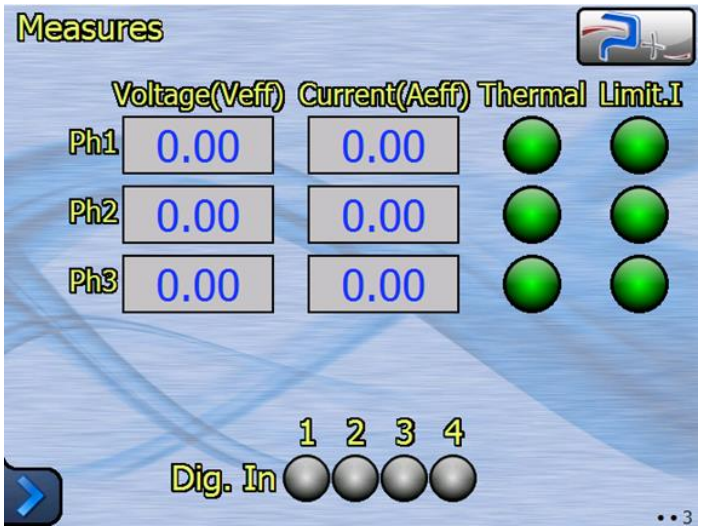


A first screen is for current limitation programming in amplitude and duration.

On the main screen, graphical objects like boxes, input boxes and dropdowns are to set it up.



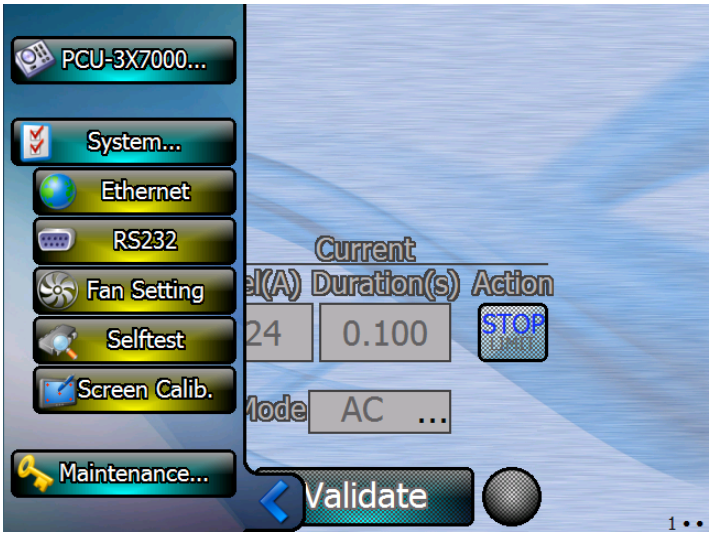
AC DC 4Q POWER AMPLIFIER
3x7kVA - 4 RANGES - FULL ABSORPTION



On the measurements screen, fields return the instantaneous values of voltage and current.

LEDs indicate status: thermal fault, overcurrent detected...

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



ORDER INFORMATION

PA-3x7000-AC/DC-400V-54A-4G-PR-<options>
Amplifier 3x7000 VA including resistors for full absorption

AVAILABLE OPTIONS (to order separately)

PA-3X7K-BW	bandwidth small signals increased from 25 kHz to 50 kHz
PA-3X7K-CP	amplifier can be used as a passive load AC or DC load
PA-3X7K-RI	amplifier can be used in in voltage and in current regulation
PA-3X7K-MAINS	modification of mains input for a 200 VRMS between phases network

Specification may change without notice

Head office: 500 avenue du Danemark 82000 Montauban France Tel: +33 (0)5.63.02.14.21 contact@puissanceplus.com www.puissanceplus.com
Entzheim site: 7 allée de l'Europe 67960 Entzheim France Tel: +33 (0)3.88.10.30.40 contact@electrona.fr www.electrona.fr