

APS series of 4-quadrant amplifiers

4-QUADRANT VOLTAGE / CURRENT AMPLIFIER



4-quadrant amplifier APS 1000

- ✓ Very high peak-load ability (up to 2 ... 3 ms)
- ✓ Very low internal resistance
- ✓ Very fast slew rate > 52 V/μs (rise time < 5 μs at 230 V acc. IEC/EN 61000-4-11)
- ✓ Extremely low harmonic distortion - even under very non-linear load conditions
- ✓ Operates from DC up to 10 kHz large signal bandwidth (-3 dB) - optional up to 30 kHz
- ✓ Small signal bandwidth up to 50 kHz
- ✓ High long-term overload characteristic (up to 1 hour)
- ✓ High short-term overload characteristic (up to 2 minutes)
- ✓ Constant voltage (CV) or constant current (CC) operation mode
- ✓ Multi-source operation modes: parallel / serial
- ✓ Optical link for easy PHIL interface
- ✓ Internal oscilloscope
- ✓ Amplifier control via webinterface and interface commands
- ✓ Test and evaluation software available

The relating standards:*

IEC/EN 61000-3-2
 IEC/EN 61000-3-3
 IEC/EN 61000-3-11
 IEC/EN 61000-3-12
 IEC/EN 60146-1-1
 IEC/EN 61000-2-2
 IEC/EN 61000-4-8
 IEC/EN 61000-4-11
 IEC/EN 61000-4-13
 IEC/EN 61000-4-14
 IEC/EN 61000-4-17
 IEC/EN 61000-4-27
 IEC/EN 61000-4-28
 IEC/EN 61000-4-29
 IEC/EN 61000-4-34
 IEC/EN 61131-2
 IEC/EN 61496-1
 IEC/EN 61800-3
 IEC/EN 62040-2
 RTCA DO-160
 SEMI F47-0706
 IEC TR 61547-1
 German. Lloyd

** The APS series of amplifiers can be used for certain tests within these standards. Additional equipment might be required. For detailed information, please contact sales@spitzenberger.de.*

VOLTAGE AND CURRENT MODE OPERATION
 REFERENCE SOURCE FOR ALL APPLICATIONS



Very fast rise and fall time

Due to the very fast slew rate of $> 52 \text{ V}/\mu\text{s}$ the APS is fully compliant according to the requirements of IEC/EN 61000-4-11 in practice.

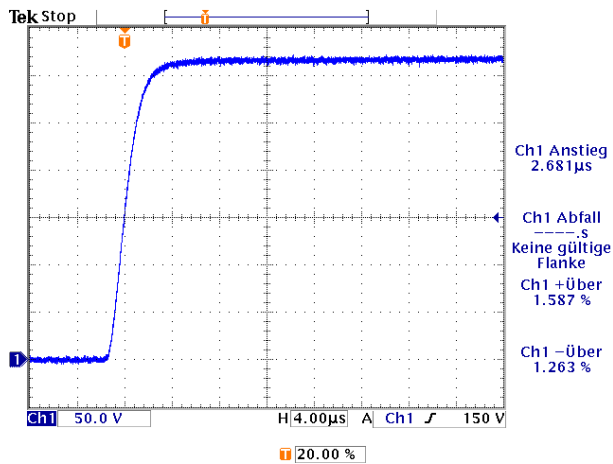


Fig. 1: Rise time of the output voltage

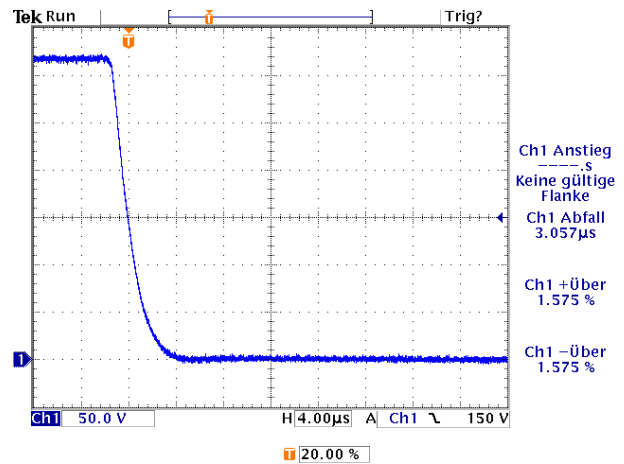


Fig. 2: Fall time of the output voltage

Peak inrush current

High peak inrush current capability of 500 A and 1000 A as required by IEC/EN 61000-4-11 and IEC/EN 61000-4-34.

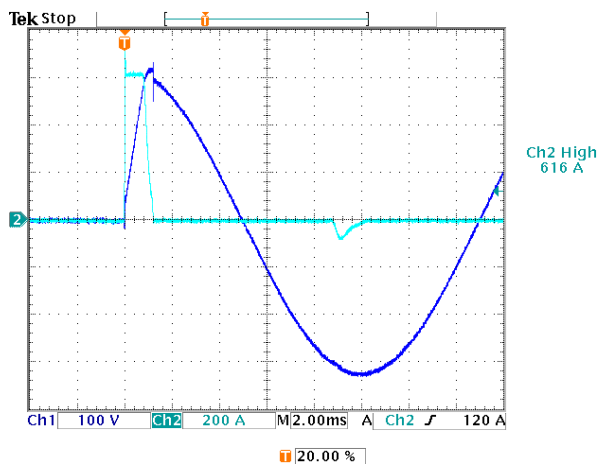


Fig. 3: Inrush current APS 15000

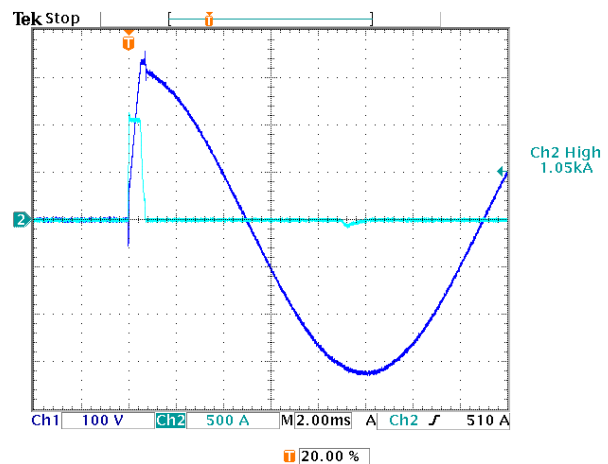


Fig. 4: Inrush current APS 25000

Extremely high loadability

150 % of rating is available in case of a load power factor 1. Amplifier stability is absolutely assured when operating with either inductive or capacitive loads.

The sink mode power capability is approx. 30 % of the source mode capability.

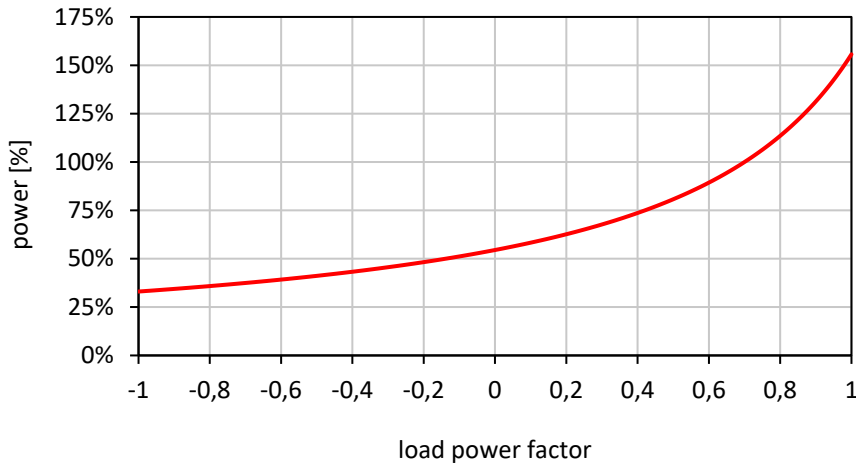


Fig. 5: APS performance characteristic

Extremely low harmonic distortion

The voltage harmonics of the 4-quadrant amplifiers APS series are extremely low. At no load condition the voltage harmonics are typically smaller by a factor of 100 than the limit values permitted by IEC 61000-3-2. The very low internal resistance means that the limit values are not exceeded even under very non-linear load conditions.

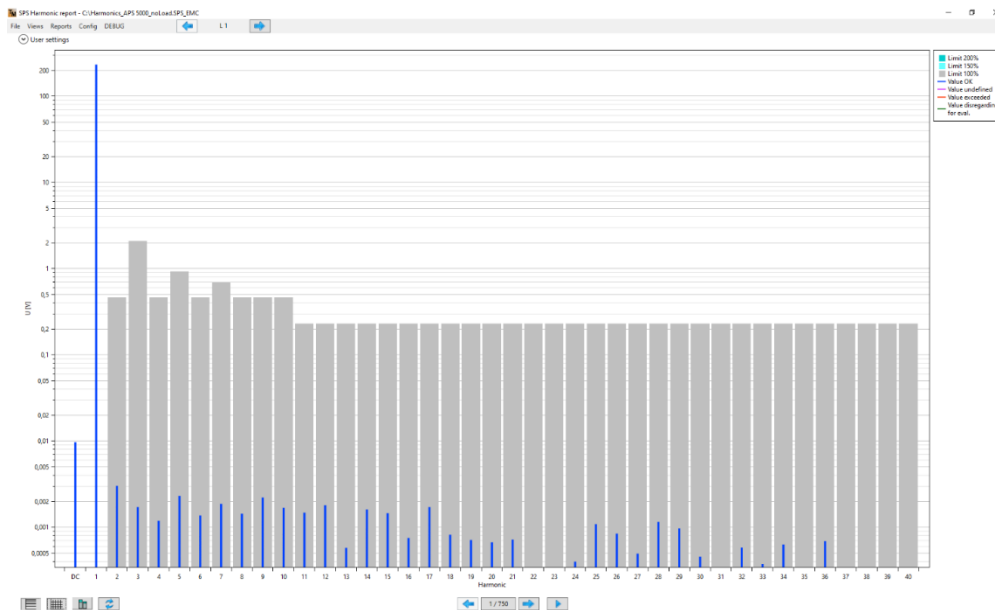


Fig. 6: Voltage harmonics of APS 5000 (no load condition)

Wide range of applications for power amplifiers APS series

The 4-quadrant amplifiers APS series can be used for many other tests in addition to grid simulation. Due to the high large signal bandwidth, components can also be tested with up to 30 kHz at full amplitude.

With the same power amplifier, however, pure DC voltages or mixed signals (ripple on DC) can also be output, so that both low-voltage and high-voltage vehicle electrical systems can be simulated.

PHIL (Power Hardware In the Loop)

Due to the low delay between the set point value and the output signal, the 4-quadrant amplifier APS series is very well suited for stable and accurate PHIL simulations. The optical interface to real time simulator reduces the delay time and accuracy losses compared to the analogue control.

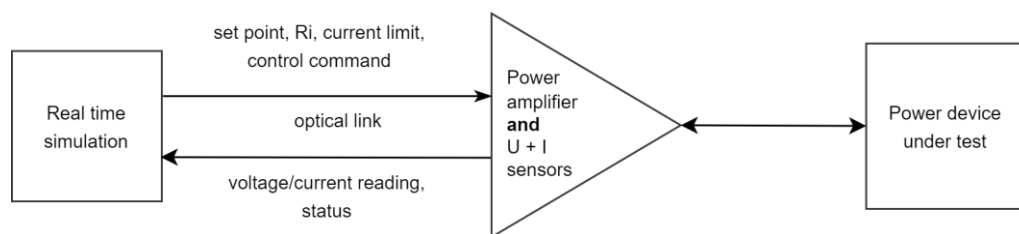


Fig. 7: PHIL application

TOUCHSCREEN USER INTERFACE

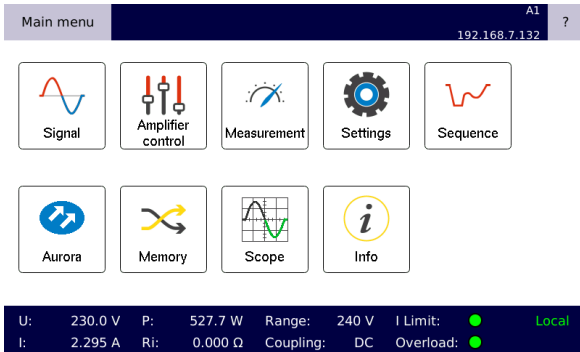


Fig. 8: Main menu

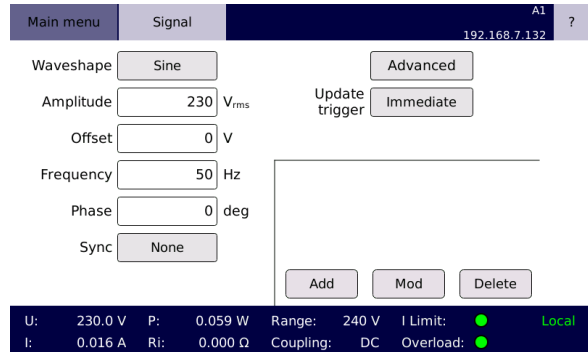


Fig. 9: Signal settings

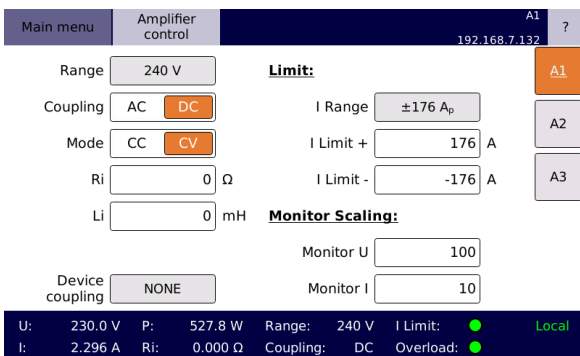


Fig. 10: Amplifier control

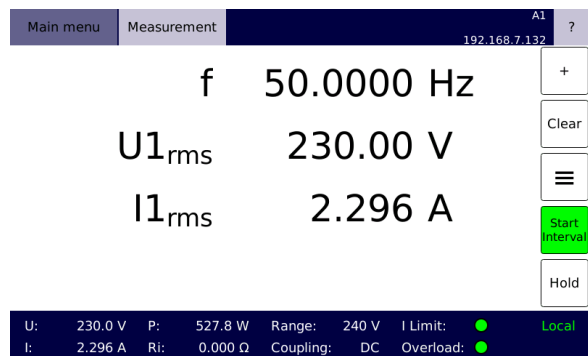


Fig. 11: Measurement

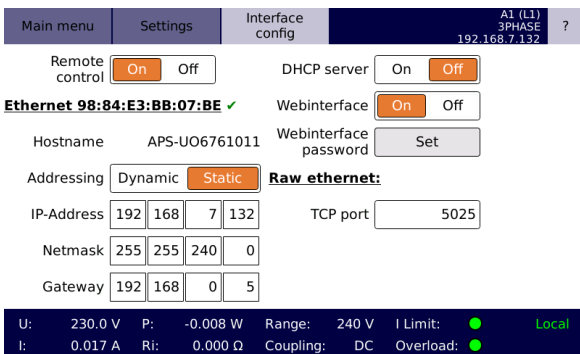


Fig. 12: Interface configuration

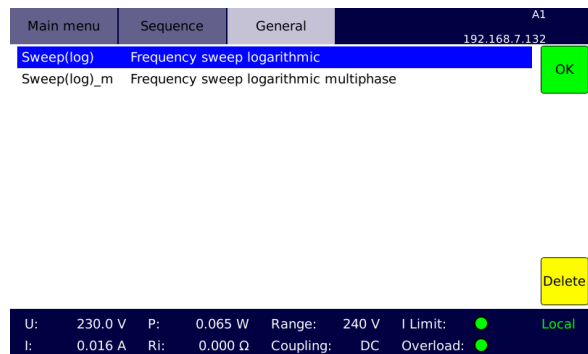


Fig. 13: Sequence menu

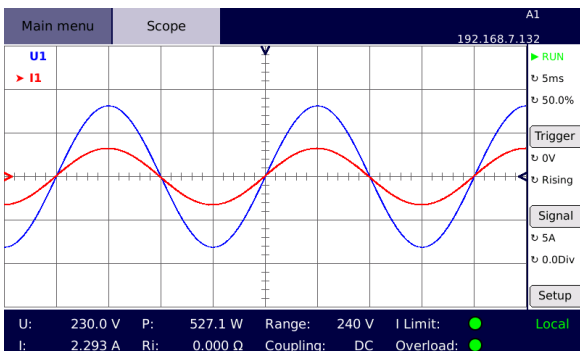


Fig. 14: Internal oscilloscope

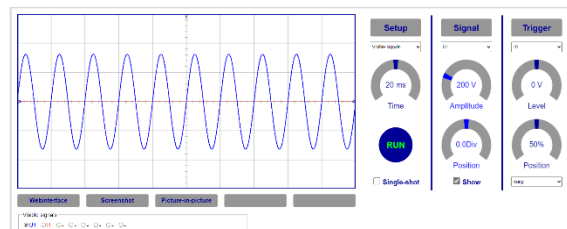


Fig. 15: Web oscilloscope

SOFTWARE CONTROL

SPS TestManager

- ✓ Test and evaluation software for fully compliant emission and immunity tests
- ✓ Automated test run of various IEC and automotive standards

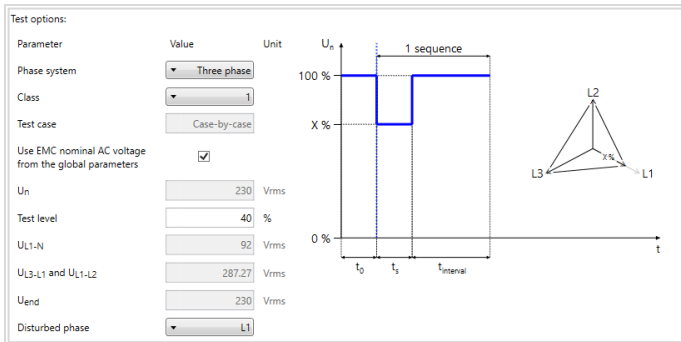


Fig. 16: SPS TestManager software

SPS SystemControl

- ✓ Simulation and control software for arbitrary waveforms, voltage and frequency variations
- ✓ Generation of user defined sequences
- ✓ Sequence preview graph

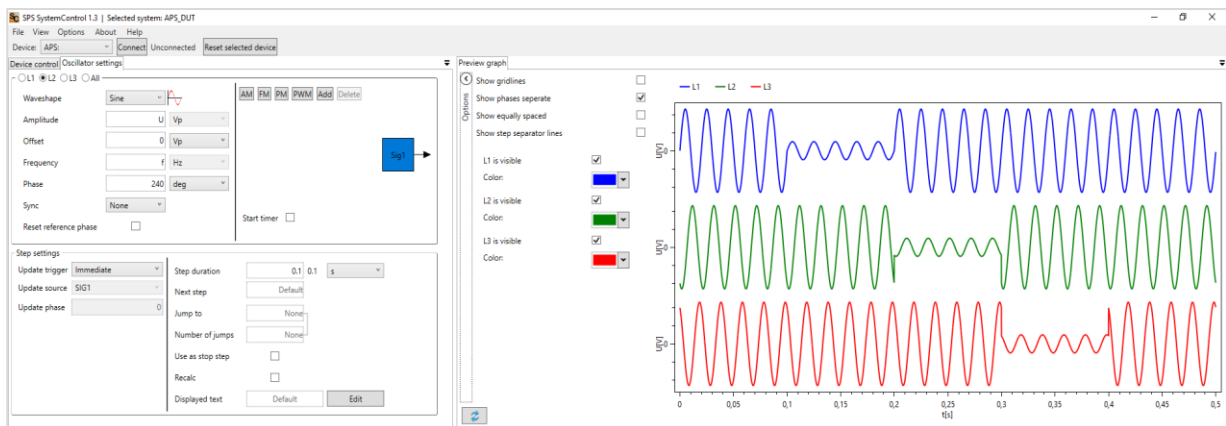


Fig. 17: SPS SystemControl software

Command interface

- ✓ Easily integrate the device into your own software applications
- ✓ Remote control commands are based on the SCPI standard

Webinterface

- ✓ Monitor and control the connected device via a web browser
- ✓ Oscilloscope function

TECHNICAL DATA - GENERAL

		APS series				
Nominal voltage ranges <i>RMS (DC)</i>		135 V (±191 V) 240 V (±339 V) 270 V (±382 V) 300 V (±424 V)				
		Note: - APS 100: only one range available (either 135 V or 300 V) - APS 1000 / APS 1250: 240 V range not available				
Load regulation	Range (RMS)	DC ... 450 Hz	450 Hz ...	5 kHz ...	10 kHz ...	
			5 kHz	10 kHz	30 kHz	
	135 V	0.4 %	5.0 %	15.0 %	25.0 %	
	240 V	0.2 %	2.5 %	8.0 %	15.0 %	
	270 V	0.2 %	1.0 %	5.0 %	10.0 %	
300 V	0.2 %	1.0 %	5.0 %	10.0 %		
Stability (1 h)	gain: < 0.1 % / offset: < 0.02 % of range end value at constant load and temperature					
Line regulation	< 1.5 x 10 ⁻⁴ per 10 V line-voltage change					
RMS noise at output	< 100 mV (< 1 MHz)					
Frequency bandwidth	large signal: DC ... 10 kHz (-3 dB) small signal (10 %): DC ... 50 kHz (-3 dB)					
Slew rate	> 52 V/μs (rise time < 5 μs at 230 V (RMS) according to IEC/EN 61000-4-11) 5 % max. over-/undershoot					
Harmonic distortion (max.)	Range (RMS)	DC ... 450 Hz	450 Hz ...	5 kHz ...	10 kHz ...	
			5 kHz	10 kHz	30 kHz	
	135 V	0.3 %	3.0 %	5.0 %	7.0 %	
	240 V	0.2 %	2.0 %	3.0 %	6.0 %	
	270 V	0.1 %	1.0 %	2.5 %	5.0 %	
300 V	0.1 %	1.0 %	2.5 %	5.0 %		
Internal resistance compensation	< 8 V peak (ground and each phase line)					
Protection circuits	overload / short circuit / overtemperature					
Floating output	max. voltage between earth and the amplifier's ground output: < 300 V (RMS)					
External input <i>(optional)</i>	<i>Max. peak voltage</i>	0 ... U _{ExtMax} (U _{ExtMax} is adjustable between ±2 V ... ±25 V)				
	<i>Input impedance</i>	approx. 10 kΩ				
	<i>Delay time</i>	signal delay between amplifier's external input and amplifier's output < 5 μs				
Internal oscillator unit						
	<i>Type</i>	4-channel synthesiser				
	<i>Wave forms</i>	DC, sine, square, triangle, ramp, arbitrary				
	<i>Amplitude resolution</i>	17 Bit				
	<i>Frequency range</i>	DC ... 1 MHz				
	<i>Frequency resolution</i>	1 μHz				
	<i>Frequency accuracy</i>	25 ppm				
	<i>Phase range</i>	0° ... 360°				
	<i>Phase resolution</i>	0.001°				
	<i>Memory depth</i>	1 MSample				
	<i>Synthesiser functions</i>	ADD, AM, FM, PM, PWM				
	<i>Sequence memory</i>	1024 steps				

TECHNICAL DATA - GENERAL

		APS series			
Internal control unit					
	<i>Display</i>	7.0" touchscreen (17.8 cm, resolution 800 x 480)			
	<i>Sequencer</i>	user defined sequences memory			
	<i>User interface</i>	touchscreen / front panel button / incremental encoder webinterface			
	<i>Digital I/O (optional)</i>	8 digital DC inputs: U = +5 V ... +24 V 8 digital DC outputs: U = +5 V (internal U _{CC}), I _L = 40 mA (external DC input U _{CC} : +5 V ... +24 V, I _L = 250 mA)			
Measurement					
	<i>Peak voltage measurement ranges</i>	112.5 V / 225 V / 450 V / 900 V (auto ranging)			
	<i>Current measurement ranges</i>	depending on peak current of the amplifier range 1: $\frac{I_{peak}}{8.8}$ range 2: $\frac{I_{peak}}{4.4}$ range 3: $\frac{I_{peak}}{2.2}$ range 4: I _{peak}			
	<i>Measurement accuracy</i>	± (% of measured value + % of measurement range value)			
	<i>Frequency</i>	DC 45 Hz ... 450 Hz	10 Hz ... 45 Hz 450 Hz ... 5 kHz	5 kHz ... 15 kHz	15 kHz ... 30 kHz
	<i>Voltage accuracy</i>	0.1 + 0.02	0.2 + 0.2	0.4 + 0.4	0.8 + 0.8
	<i>Current accuracy</i>	0.2 + 0.04	0.4 + 0.4	0.8 + 0.8	1.6 + 1.6
Monitoring unit (optional)		voltage		current	
	<i>Max. peak output</i>	±10 V			
	<i>Scaling factor 'sf' (adjustable)</i>	sf: 0.2 ... 1000		sf: 0.1 ... 1000	
	<i>Bandwidth</i>	300 kHz		200 kHz	
	<i>Monitoring accuracy</i>	± (% of measured value + % of measurement range value + error(sf))			
	<i>Frequency</i>	DC 45 Hz ... 450 Hz	10 Hz ... 45 Hz 450 Hz ... 5 kHz	5 kHz ... 15 kHz	15 kHz ... 30 kHz
	<i>Voltage monitor accuracy</i>	0.12 + 0.02 + 2 mV * sf	0.3 + 0.2 + 2 mV * sf	0.7 + 0.4 + 2.2 mV * sf	1.4 + 0.8 + 2.3 mV * sf
	<i>Current monitor accuracy</i>	0.22 + 0.04 + 2 mA * sf	0.5 + 0.4 + 2 mA * sf	1.1 + 0.8 + 2.2 mA * sf	2.2 + 1.6 + 2.3 mA * sf
	<i>Noise of ADC measurement (RMS)</i>	< 20 mV (DC ... 300 kHz)		< 1.5 mA (DC ... 300 kHz)	
	<i>Noise DAC output (RMS)</i>	< 0.2 mV (DC ... 300 kHz)			
	<i>Delay time</i>	< 1 μs			
	<i>Output impedance</i>	47 Ω			
	<i>Isolation</i>	earth / remaining electronics / each other			
	<i>Protection</i>	short circuit			

TECHNICAL DATA - GENERAL

		APS series			
Programmable internal impedance (optional)					
	<i>Accuracy real (0 ... 5 % of adjustment range)</i>	±(1 % of adjusted value + $\Delta R_{\text{absolute}}$)			
	<i>Accuracy inductive (0 ... 5 % of adjustment range)</i>	±(2 % of adjusted value + $\Delta L_{\text{absolute}}$)			
		Adjustment range real	Adjustment range inductive	$\Delta R_{\text{absolute}}$	$\Delta L_{\text{absolute}}$
	<i>APS 100</i>	0 Ω ... 120000 Ω	0 mH ... 1600 mH	104 m Ω	532 μ H
	<i>APS 1000</i>	0 Ω ... 30000 Ω	0 mH ... 400 mH	26 m Ω	133 μ H
	<i>APS 1250</i>	0 Ω ... 18000 Ω	0 mH ... 240 mH	16 m Ω	80 μ H
	<i>APS 2500</i>	0 Ω ... 9000 Ω	0 mH ... 120 mH	8 m Ω	40 μ H
	<i>APS 5000</i>	0 Ω ... 4500 Ω	0 mH ... 60 mH	4 m Ω	20 μ H
	<i>APS 7500</i>	0 Ω ... 3000 Ω	0 mH ... 40 mH	2.6 m Ω	13.3 μ H
	<i>APS 10000</i>	0 Ω ... 1800 Ω	0 mH ... 24 mH	1.6 m Ω	8 μ H
	<i>APS 12500</i>	0 Ω ... 1500 Ω	0 mH ... 20 mH	1.3 m Ω	7 μ H
	<i>APS 15000</i>	0 Ω ... 1286 Ω	0 mH ... 17 mH	1 m Ω	6 μ H
	<i>APS 20000</i>	0 Ω ... 900 Ω	0 mH ... 12 mH	1 m Ω	5 μ H
	<i>APS 25000</i>	0 Ω ... 750 Ω	0 mH ... 10 mH	1 m Ω	5 μ H
	<i>APS 30000</i>	0 Ω ... 643 Ω	0 mH ... 9 mH	1 m Ω	5 μ H
	<i>APS 40000</i>	0 Ω ... 450 Ω	0 mH ... 6 mH	1 m Ω	5 μ H
	<i>APS 50000</i>	0 Ω ... 375 Ω	0 mH ... 5 mH	1 m Ω	5 μ H
	<i>APS 60000</i>	0 Ω ... 321 Ω	0 mH ... 4 mH	1 m Ω	5 μ H
Interface	Ethernet 100 Mbit/s (HiSLIP SCPI) USB 2.0 Host				
Synchronisation bus (multiple devices)	device synchronisation and internal communication optical fibre, LC duplex: - synchronised sequence start - parallel operation - only one ethernet connection required				
Insulation resistance	> 1 M Ω				
Peak withstand voltage (max. 10 s, output to earth)	> 2000 V				
Cooling	temperature-controlled forced air cooling				
Ambient temperature	+10 °C up to +40 °C				
Storage temperature	-25 °C up to +60 °C				
Relative humidity	non condensing, max. 80 % for temperature < 31 °C, decreasing linearly to 50 % at 40 °C				
Ingress protection	IP20				

TECHNICAL DATA – APS series

		APS 100	APS 1000	APS 1250
Power AC	<i>continuous</i>	100 VA	1000 VA	1250 VA
	<i>approx. 1 h ¹⁾</i>	150 VA	1500 VA	1875 VA
Power DC	<i>continuous</i>	100 W	1000 W	1250 W
	<i>approx. 1 h</i>	150 W	1500 W	1875 W
Short-time power		200 VA	2000 VA	2500 VA
Peak current		6.6 A	26.4 A	44 A
Power supply ($\pm 10\%$, 50/60 Hz)		230 V	230 V	230 V
Line protection, connection	<i>NT</i>	4 A, Schuko	16 A, Schuko	16 A, Schuko
	<i>or NT/D</i>	-	-	-
Housing		plug-in unit or rack, light grey (RAL 7035)		
	<i>Amplifier approx. dimensions (H x W x D)</i>	1/2 19", 4 U 178 x 222 x 450 mm	19", 4 U 178 x 483 x 650 mm	19", 4 U 178 x 483 x 700 mm
	<i>Power supply NT approx. dimensions (H x W x D)</i>	included -	included -	included -
	<i>Power supply NT/D approx. dimensions (H x W x D)</i>	-	-	-
Weight	<i>Amplifier (approx.)</i>	16 kg	58 kg	55 kg
	<i>Power supply NT (approx.)</i>	-	-	-
	<i>Power supply NT/D (approx.)</i>	-	-	-

TECHNICAL DATA – APS series

		APS 2500	APS 5000	APS 7500
Power AC	<i>continuous</i>	2500 VA	5000 VA	7500 VA
	<i>approx. 1 h ¹⁾</i>	3750 VA	7500 VA	11250 VA
Power DC	<i>continuous</i>	2500 W	5000 W	7500 W
	<i>approx. 1 h</i>	3750 W	7500 W	11250 W
Short-time power		5000 VA	10000 VA	15000 VA
Peak current		88 A	176 A	264 A
Power supply ($\pm 10\%$, 50/60 Hz)		230 V / 400 V		
Line protection, connection	<i>NT</i>	3 x 16 A, CEE	3 x 20 A, CEE	3 x 32 A, CEE
	<i>or NT/D</i>	3 x 32 A, CEE	3 x 63 A, CEE	3 x 100 A, CEE
Housing		plug-in unit or rack, light grey (RAL7035)		
	<i>Amplifier approx. dimensions (H x W x D)</i>	19", 5 U 222 x 483 x 650 mm	19", 7 U 311 x 483 x 650 mm	19", 10 U 444 x 483 x 650 mm
	<i>Power supply NT approx. dimensions (H x W x D)</i>	19", 5 U 222 x 483 x 650 mm	19", 5 U 222 x 483 x 650 mm	19", 10 U 444 x 483 x 650 mm
	<i>Power supply NT/D approx. dimensions (H x W x D)</i>	19", 10 U 444 x 483 x 650 mm	19", 12 U 533 x 483 x 650 mm	19", 22 U 978 x 600 x 850 mm
Weight	<i>Amplifier (approx.)</i>	36 kg	55 kg	66 kg
	<i>Power supply NT (approx.)</i>	90 kg	120 kg	180 kg
	<i>Power supply NT/D (approx.)</i>	180 kg	285 kg	430 kg

TECHNICAL DATA – APS series

		APS 10000	APS 12500	APS 15000
Power AC	<i>continuous</i>	10000 VA	12500 VA	15000 VA
	<i>approx. 1 h ¹⁾</i>	15000 VA	18750 VA	22500 VA
Power DC	<i>continuous</i>	10000 W	12500 W	15000 W
	<i>approx. 1 h</i>	15000 W	18750 W	22500 W
Short-time power		20000 VA	25000 VA	30000 VA
Peak current		440 A	528 A	616 A
Power supply ($\pm 10\%$, 50/60 Hz)		230 V / 400 V		
Line protection, connection	<i>NT</i>	3 x 40 A, CEE	3 x 50 A, CEE	3 x 63 A, CEE
	<i>or NT/D</i>	3 x 125 A, CEE	3 x 150 A, terminal box	-
Housing		plug-in unit or rack, light grey (RAL7035)		
	<i>Amplifier approx. dimensions (H x W x D)</i>	19", 17 U 755 x 483 x 650 mm	19", 20 U 888 x 483 x 650 mm	19", 23 U 1022 x 483 x 650 mm
	<i>Power supply NT approx. dimensions (H x W x D)</i>	19", 12 U 533 x 483 x 650 mm	19", 12 U 533 x 483 x 650 mm	19", 12 U 533 x 483 x 650 mm
	<i>Power supply NT/D approx. dimensions (H x W x D)</i>	19", 22 U 978 x 600 x 1050 mm	19", 22 U 978 x 600 x 1050 mm	-
Weight	<i>Amplifier (approx.)</i>	110 kg	122 kg	135 kg
	<i>Power supply NT (approx.)</i>	240 kg	285 kg	285 kg
	<i>Power supply NT/D (approx.)</i>	550 kg	750 kg, incl. rack	-

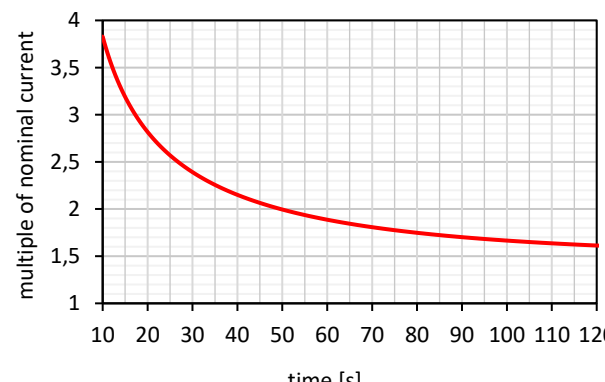
TECHNICAL DATA – APS series

		APS 20000	APS 25000	APS 30000
Power AC	<i>continuous</i>	20000 VA	25000 VA	30000 VA
	<i>approx. 1 h ¹⁾</i>	30000 VA	37500 VA	45000 VA
Power DC	<i>continuous</i>	20000 W	25000 W	30000 W
	<i>approx. 1 h</i>	30000 W	37500 W	45000 W
Short-time power		40000 VA	50000 VA	60000 VA
Peak current		880 A	1056 A	1150 A
Power supply ($\pm 10\%$, 50/60 Hz)		230 V / 400 V		
Line protection, connection	<i>NT</i>	3 x 80 A, CEE	-	3 x 125 A, CEE
	<i>or NT/D</i>	3 x 250 A, terminal box	3 x 300 A, terminal box	3 x 375 A, terminal box
Housing		plug-in unit or rack, light grey (RAL7035)		
	<i>Amplifier approx. dimensions (H x W x D)</i>	19", 33 U 1467 x 600 x 1050 mm	19", 39 U 1733 x 600 x 1050 mm	19", 46 U 2044 x 600 x 1050 mm
	<i>Power supply NT approx. dimensions (H x W x D)</i>	19", 22 U 978 x 600 x 1050 mm	-	19", 22 U 978 x 600 x 1050 mm
	<i>Power supply NT/D approx. dimensions (H x W x D)</i>	27", 42 U 1866 x 800 x 1050 mm	27", 42 U 1866 x 800 x 1050 mm	27", 46 U 2044 x 800 x 1050 mm
Weight	<i>Amplifier (approx.)</i>	220 kg	250 kg	460 kg, incl. rack
	<i>Power supply NT (approx.)</i>	360 kg		770 kg, incl. rack
	<i>Power supply NT/D (approx.)</i>	950 kg, incl. rack	1140 kg, incl. rack	1560 kg, incl. rack

TECHNICAL DATA – APS series

		APS 40000	APS 50000	APS 60000
Power AC	<i>continuous</i>	40000 VA	50000 VA	60000 VA
	<i>approx. 1 h ¹⁾</i>	60000 VA	75000 VA	90000 VA
Power DC	<i>continuous</i>	40000 W	50000 W	60000 W
	<i>approx. 1 h</i>	60000 W	75000 W	90000 W
Short-time power		80000 VA	100000 VA	120000 VA
Peak current		1760 A	2112 A	2300 A
Power supply ($\pm 10\%$, 50/60 Hz)		230 V / 400 V		
Line protection, connection		NT or NT/D	3 x 160 A, terminal box -	3 x 200 A, terminal box -
Housing		rack, light grey (RAL7035)		
	<i>Amplifier approx. dimensions (H x W x D)</i>	19", 2 x 33 U 1467 x 1200 x 1050 mm	19", 2 x 39 U 1733 x 1200 x 1050 mm	19", 2 x 46 U 2044 x 1200 x 1050 mm
	<i>Power supply NT approx. dimensions (H x W x D)</i>	19", 37 U 1644 x 600 x 1050 mm	19", 42 U 1866 x 600 x 1050 mm	19", 46 U 2044 x 800 x 1050 mm
	<i>Power supply NT/D approx. dimensions (H x W x D)</i>	-	-	-
Weight	<i>Amplifier (approx.) Power supply NT (approx.) Power supply NT/D (approx.)</i>	on request	on request	on request

OPTIONS AND ACCESSORIES

Options		
OPT.01	IEEE488	Not in combination with OPT.02 ²⁾
OPT.02	RS232	Not in combination with OPT.01 ²⁾
OPT.05	U/I monitor	Galvanically isolated voltage and current measurement outputs accessible via BNC sockets (includes OPT.14) ²⁾
OPT.MS	Mains synchronisation	Output signal can be synchronised with mains
NT.11.33	Additional voltage range RMS (DC)	0 ... 33 V (± 47 V) ²⁾³⁾
NT.11.36	Additional voltage range RMS (DC)	0 ... 36 V (± 51 V) ²⁾⁴⁾
NT.11.56	Additional voltage range RMS (DC)	0 ... 56 V (± 79 V) ²⁾⁴⁾
NT.11.60	Additional voltage range RMS (DC)	0 ... 60 V (± 85 V) ²⁾⁴⁾
NT.11.150	Additional voltage range RMS (DC)	0 ... 150 V (± 212 V) ²⁾
NT.11.570DC	Additional voltage range DC	0 ... +570 V ²⁾
NT.11.630DC	Additional voltage range DC	0 ... +630 V ²⁾
OPT.13.30	Special frequency range	DC ... 30 kHz (-3 dB)
OPT.14	External input	0 ... U_{ExtMax} U_{ExtMax} peak is adjustable between ± 2 V ... ± 25 V OPT.14 includes a digital input filter: type Bessel or Butterworth, order 1 ... 6 (adjustable) Filter frequency selectable 100 Hz ... 10 MHz ²⁾
NT.18	Special RMS line voltage	Available on request in the range of 110 V ... 300 V
OPT.21	Common output	Common output plugs for parallel operation
OPT.24	Programmable internal impedance	R_i and L_i internally programmable
OPT.25	Constant current mode	
OPT.30	Optical link	Optical interface to real time simulator LC duplex interface / Aurora 8B/10B protocol / 2 Gb/s data rate
STMB	Additional current measurement ranges	range 5: $\frac{I_{peak}}{140.8}$, range 6: $\frac{I_{peak}}{70.4}$, range 7: $\frac{I_{peak}}{35.2}$, range 8: $\frac{I_{peak}}{17.6}$
UT.540.C	Voltage transformer	Output voltages (RMS) 400 V / 540 V (f: 45 Hz ... 5 kHz (-3dB)) Other voltages and frequency ranges on request  Fig. 18: Maximum short-time current of transformer

Remarks:

- 1) At $\cos \varphi = 1$
- 2) Not available for APS 100
- 3) Not available for APS 1000
- 4) Only one of these options available for APS 1000

DM xxx/APS Three-phase mains simulation system

MULTIPLE AMPLIFIER CONNECTION



3-phase mains simulation system DM 22500/APS

DEVICE SYNCHRONISATION

The APS series amplifiers can be operated in single mode and in serial or parallel mode. An internal optical fibre interface allows to synchronise the amplifiers and enables data exchange. The webinterface of the first amplifier can be used to access all connected amplifiers. The device synchronisation supports:

- Synchronised sequence start
- Multi-phase operation
- Only one ethernet connection required

OPERATION MODES

Three-phase mode

Three APS amplifiers are used to generate a three-phase system in a star connection. This allows operation of EUT with or without neutral conductor.

Parallel mode

The APS amplifiers are connected in parallel. This configuration is used to increase the output current and output power capability.

Serial mode

The APS amplifiers are connected in serial. This configuration is used to increase the output voltage and output power capability. This mode requires two amplifiers with independent grounds. (Which is not fulfilled if two amplifiers share a common power supply.)

Anti-serial mode

Two amplifiers use a common ground. The EUT has to be connected between the two amplifier outputs. The second amplifier is automatically controlled to the inverse voltage of the first amplifier's voltage. The set point voltage is automatically split into two parts. The voltage set point of the second amplifier will be inverted. This configuration is used to increase the output voltage and output power capability.

TECHNICAL DATA – DM xxx/APS series

		DM 300/APS	DM 3000/APS	DM 3750/APS
Power AC	<i>continuous</i>	300 VA	3000 VA	3750 VA
	<i>approx. 1h ¹⁾</i>	450 VA	4500 VA	5625 VA
Power DC	<i>continuous</i>	300 W	3000 W	3750 W
	<i>approx. 1h</i>	450 W	4500 W	5625 W
Short-time power		600 VA	6000 VA	7500 VA
Peak current per phase		6.6 A	26.4 A	44 A
Peak current in parallel mode		19.8 A	79.2 A	132 A
System components		3 x APS 100	3 x APS 1000	3 x APS 1250

TECHNICAL DATA – DM xxx/APS series

		DM 7500/APS	DM 15000/APS	DM 22500/APS
Power AC	<i>continuous</i>	7500 VA	15000 VA	22500 VA
	<i>approx. 1h ¹⁾</i>	11250 VA	22500 VA	33750 VA
Power DC	<i>continuous</i>	7500 W	15000 W	22500 W
	<i>approx. 1h</i>	11250 W	22500 W	33750 W
Short-time power		15000 VA	30000 VA	45000 VA
Peak current per phase		88 A	176 A	264 A
Peak current in parallel mode		264 A	528 A	792 A
System components		3 x APS 2500	3 x APS 5000	3 x APS 7500

TECHNICAL DATA – DM xxx/APS series

		DM 30000/APS	DM 37500/APS	DM 45000/APS
Power AC	<i>continuous</i>	30000 VA	37500 VA	45000 VA
	<i>approx. 1h ¹⁾</i>	45000 VA	56250 VA	67500 VA
Power DC	<i>continuous</i>	30000 W	37500 W	45000 W
	<i>approx. 1h</i>	45000 W	56250 W	67500 W
Short-time power		60000 VA	75000 VA	90000 VA
Peak current per phase		440 A	528 A	616 A
Peak current in parallel mode		1320 A	1584 A	1848 A
System components		3 x APS 10000	3 x APS 12500	3 x APS 15000

TECHNICAL DATA – DM xxx/APS series

		DM 60000/APS	DM 75000/APS	DM 90000/APS
Power AC	<i>continuous</i>	60000 VA	75000 VA	90000 VA
	<i>approx. 1h ¹⁾</i>	90000 VA	112500 VA	135000 VA
Power DC	<i>continuous</i>	60000 W	75000 W	90000 W
	<i>approx. 1h</i>	90000 W	112500 W	135000 W
Short-time power		120000 VA	150000 VA	180000 VA
Peak current per phase		880 A	1056 A	1150 A
Peak current in parallel mode		2640 A	3168 A	3450 A
System components		3 x APS 20000	3 x APS 25000	3 x APS 30000

TECHNICAL DATA – DM xxx/APS series

		DM 120000/APS	DM 150000/APS	DM 180000/APS
Power AC	<i>continuous approx. 1h ¹⁾</i>	120000 VA 180000 VA	150000 VA 225000 VA	180000 VA 270000 VA
Power DC	<i>continuous approx. 1h</i>	120000 W 180000 W	150000 W 225000 W	180000 W 270000 W
Short-time power		240000 VA	300000 VA	360000 VA
Peak current per phase		1760 A	2112 A	2300 A
Peak current in parallel mode		5280 A	6336 A	6900 A
System components		3 x APS 40000	3 x APS 50000	3 x APS 60000