

ACS series of 4-quadrant amplifiers

4-QUADRANT CURRENT AMPLIFIER



Fig. 1: 4-quadrant amplifier ACS 500/LV

The relating applications:

Automated testing of circuit breakers, fuses and relays, coils and measuring transformers, capacitors and terminal blocks

Testing and calibration of power analyzers and powermeters

The adjustable and desired output current is automatically regulated and stabilized according to the user's preferences. The only limitation is the amplifier's performance characteristic.

- ✓ Low harmonic distortion - even under very non-linear load conditions
- ✓ Operates from DC up to 1kHz large signal bandwidth (-3dB)
- ✓ Integrated 4-channel signal synthesizer for arbitrary waveform generation and integrated waveform storage capability
- ✓ High output current accuracy and stability, high short-time current capability
- ✓ Extended synchronization possibilities (e.g. 3 x current + 3 x voltage sources)
- ✓ Modular system concept –
basic amplifier unit can be combined with various transformer units for perfectly adapted current ranges
- ✓ Remote control interface (Ethernet, Digital I/O) and optical link for easy PHIL interface
- ✓ Voltage limitation adjustable
- ✓ Touch panel operation 7" (800x480)

CURRENT SOURCE FOR ALL APPLICATIONS

**CURRENT AMPLIFIER SYSTEM CONSISTING OF
ACS AMPLIFIER, MATCHING TRANSFORMER, SECONDARY SIDE MEASUREMENT
COMMON OUTPUT PANEL**

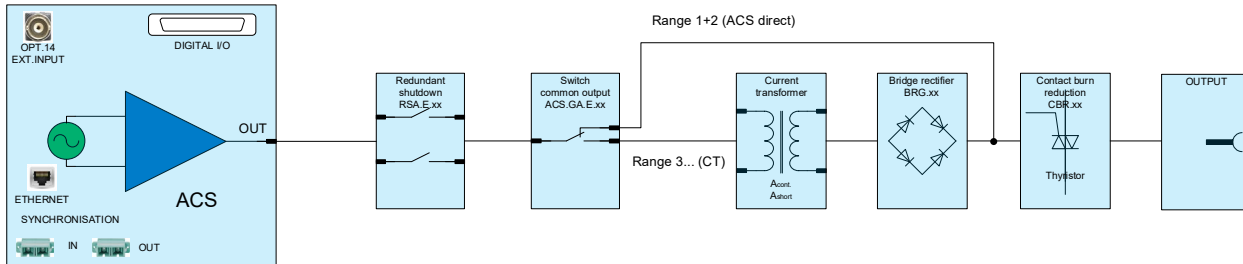


Fig. 2: Schematic overview of current amplifier system



Fig. 2: ACS 9000 including current transformer unit ITS 9000

ACS CURRENT AND OVERLOAD CHARACTERISTIC

Fig. 4: AC current overload capability

Short time AC peak current capability of the ACS series amplifier in dependency of the time duration of the pulse current

e.g.
for 10sec pulse duration 2.5 times the nominal current
for 50ms pulse duration 5 times the nominal current

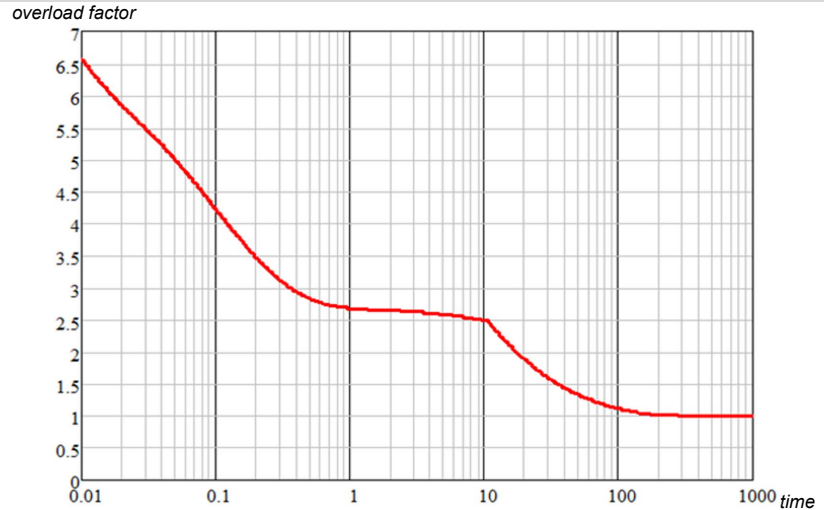


Fig. 5: DC current overload capability

Short time DC peak current capability of the ACS series amplifier in dependency of the time duration of the pulse current

e.g.
for 10sec 1.9 times the nominal current
for 50ms 4.8 times the nominal current

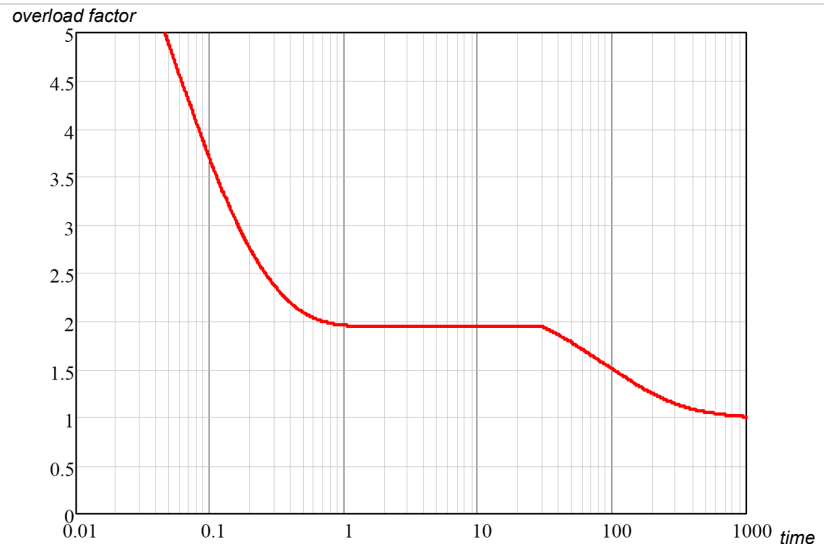
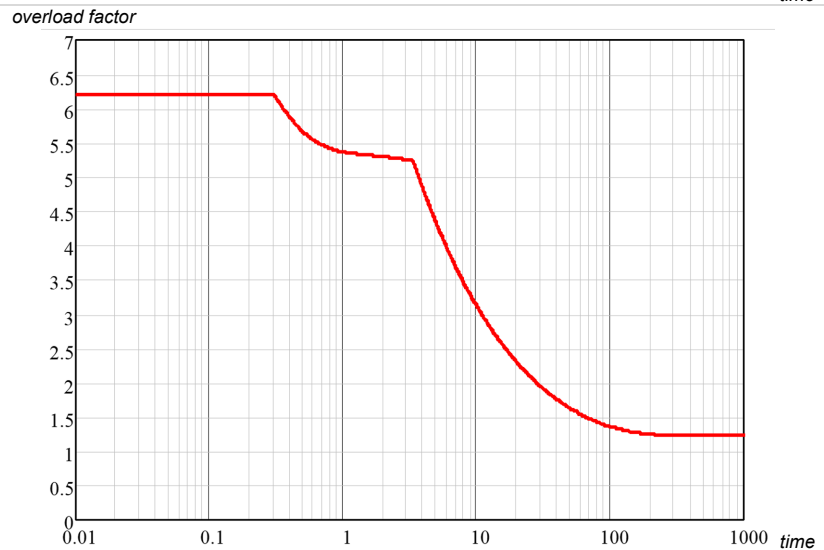


Fig. 6: AC current overload capability with optional ranges

Short time AC peak current capability of the ACS series amplifier in dependency of the time duration of the pulse current operating in one of the optional ranges 36V/56V (option NT.36 or NT.56)

e.g.
for 10sec 3.2 times the nominal current
for 50ms 6.2 times the nominal current



TECHNICAL DATA - GENERAL

		ACS series			
Nominal voltage ranges		135V _{rms} (±191V _{DC}) / 270V _{rms} (±382V _{DC})			
Load regulation short circuit up to nominal load cos phi=1		45Hz ... 65Hz 0.2%	65Hz ... 450Hz 0.5%	450Hz ... 1kHz 1%	
Stability (1h) of output current		gain: <0.1% / offset: <0.02% of nominal current at constant load and temperature			
Frequency bandwidth		large signal: DC ... 1kHz (-3dB)			
Harmonic distortion (at nominal current)		45 ... 65Hz 0.3%	65Hz ... 1kHz 1.5%		
Floating output		max. voltage between earth and the amplifier's ground output: <300V _{rms}			
Protection circuits		overcurrent / overload / overtemperature			
External input (optionally)	Max. voltage	0 ... V _{ExtMax} (V _{ExtMax} is adjustable between ±2V _p ... ±25V _p)			
	Impedance	approx. 10kΩ			
	Delay time	Signal delay between amplifier's external input and amplifier's output <5μs			
Interface		Ethernet 100MBit			
Internal oscillator unit					
	Wave forms	DC, sine, square, triangle, ramp, arbitrary			
	Amplitude resolution	17Bit			
	Frequency range	DC ... 1MHz			
	Frequency resolution	1μHz			
	Frequency accuracy	25ppm			
	Phase range	0° ... 360°			
	Phase resolution	0.001°			
	Memory depth	1MSample			
	Synthesizer functions	ADD, AM, FM, PM, PWM			
	Sequence memory	1024 steps			
Internal control unit					
Monitoring unit ²⁾		voltage		current	
Max. output		±10V _p			
Scaling factor 'sf' (adjustable)		sf: 0.2 ... 1000		sf: 0.1 ... 1000	
Bandwidth		300kHz		200kHz	
Monitoring accuracy		± (% of measured value + % of voltage measurement range value + error(sf))			
frequency		DC	10Hz ... 45Hz	5kHz ... 15kHz	15kHz ... 30kHz
		45Hz ... 450Hz	450Hz ... 5kHz		
voltage monitor		0.12 + 0.02 + 2mV*sf	0.3 + 0.2 + 2mV*sf	0.7 + 0.4 + 2.2mV*sf	1.4 + 0.8 + 2.3mV*sf
current monitor		0.22 + 0.04 + 2mA*sf	0.5 + 0.4 + 2mA*sf	1.1 + 0.8 + 2.2mA*sf	2.2 + 1.6 + 2.3mA*sf
Noise of ADC measurement		<20mV _{rms} (DC ... 300kHz)		<1.5mA _{rms} (DC ... 300kHz)	
Noise DAC output		<0.2mV _{rms} (DC ... 300kHz)			
Delay time		<1μs			
Output impedance		470hm			
Isolation		earth / remaining electronics / each other			
Protection		short circuit			

Insulation resistance	>1MΩ
Withstand voltage 10s	2000V _{DC}
Ambient temperature	0°C up to 40°C
Relative Humidity (non-condensing)	max. 80% for temperatures <31°C, decreasing linearly to 50% at 40°C
System of protection	IP20
Display	7.0" Touchscreen (17.8cm, resolution 800x480)
Sequencer	Integrated sequences User defined sequences memory
User interface	Touchscreen / front-panel button / incremental encoder
Digital I/O	8 digital inputs: +5VDC ... +24VDC 8 digital outputs: +5VDC (internal VCC), IL=40mA (external VCC input: +5VDC ... +24VDC, IL=500mA)

Digital instrument						
	Voltage measurement ranges	112.5V _p / 225V _p / 450V _p / 900V _p (auto ranging)				
	Voltage accuracy	± (% of measured value + % of voltage measurement range value)				
		DC 45Hz ... 450Hz 0.1 + 0.02		10Hz ... 45Hz 450Hz ... 5kHz 0.2 + 0.2		
	Current measurement ranges [A _p]	depending on peak current of the amplifier other measurement ranges on request				
		ACS	range 1	range 2	range 3	range 4
		500	3	6	12	26.4
		700	5	10	20	44
		1500	10	20	40	88
		3000	20	40	80	176
		4000	30	60	120	264
		6000	50	100	200	440
		7500	60	120	240	528
		9000	70	140	280	616
		12000	100	200	400	880
		15000	120	240	480	1056
		18000	140	280	560	1150
		24000	200	400	800	1760
		30000	240	480	960	2112
		36000	280	560	1120	2300
	Current accuracy	± (% of measured value + % of current measurement range value)				
		DC 45Hz ... 450Hz 0.2 + 0.04		10Hz ... 45Hz 450Hz ... 5kHz 0.4 + 0.4		

TECHNICAL DATA – ACS series

	ACS 500	ACS 700	ACS 1500
Continuous power AC(DC)	500 VA(W)	700 VA(W)	1500 VA(W)
Peak current	26.4A _p	44A _p	88A _p
Continuous current			
@135V _{rms} / ±191V _{DC}	3.3A _{rms} / 2.3A _{DC}	4.7A _{rms} / 3.3A _{DC}	10A _{rms} / 7.1A _{DC}
@270V _{rms} / ±382V _{DC}	1.9A _{rms} / 1.3A _{DC}	2.6A _{rms} / 1.8A _{DC}	5.6A _{rms} / 4A _{DC}
Power Supply (±10%, 50/60Hz)	230V Schuko	230V Schuko	230V/400V CEE
Protection	16A	16A	3 x 16A
	ACS 3000	ACS 4000	
Continuous power AC(DC)	3000 VA(W)	4000 VA(W)	
Peak current	176A _p	264A _p	
Continuous current			
@135V _{rms} / ±191V _{DC}	20A _{rms} / 14A _{DC}	27A _{rms} / 19A _{DC}	
@270V _{rms} / ±382V _{DC}	11A _{rms} / 7.8A _{DC}	15A _{rms} / 10.6A _{DC}	
Power Supply (±10%, 50/60Hz)		230V/400V CEE	
Protection	3 x 32A	3 x 40A	
	ACS 6000	ACS 7500	ACS 9000
Continuous power AC(DC)	6000 VA(W)	7500 VA(W)	9000 VA(W)
Peak current	440A _p	528A _p	616A _p
Continuous current			
@135V _{rms} / ±191V _{DC}	40A _{rms} / 28A _{DC}	50A _{rms} / 35A _{DC}	60A _{rms} / 42A _{DC}
@270V _{rms} / ±382V _{DC}	22A _{rms} / 15A _{DC}	28A _{rms} / 20A _{DC}	33A _{rms} / 23A _{DC}
Power Supply (±10%, 50/60Hz)		230V/400V CEE	
Protection	3 x 63A	3 x 80A	3 x 100A
	ACS 12000	ACS 15000	ACS 18000
Continuous power AC(DC)	12000 VA(W)	15000 VA(W)	18000 VA(W)
Peak current	880A _p	1056A _p	1150A _p
Continuous current			
@135V _{rms} / ±191V _{DC}	80A _{rms} / 56A _{DC}	100A _{rms} / 71A _{DC}	120A _{rms} / 85A _{DC}
@270V _{rms} / ±382V _{DC}	44A _{rms} / 31A _{DC}	56A _{rms} / 40A _{DC}	67A _{rms} / 47A _{DC}
Power Supply (±10%, 50/60Hz)		230V/400V	
Protection	3 x 130A	3 x 160A	3 x 200A
	ACS 24000	ACS 30000	ACS 36000
Continuous power AC(DC)	24000 VA(W)	30000 VA(W)	36000 VA(W)
Peak current	1760A _p	2112A _p	2300A _p
Continuous current			
@135V _{rms} / ±191V _{DC}	160A _{rms} / 113A _{DC}	200A _{rms} / 141A _{DC}	240A _{rms} / 170A _{DC}
@270V _{rms} / ±382V _{DC}	89A _{rms} / 63A _{DC}	110A _{rms} / 78A _{DC}	130A _{rms} / 92A _{DC}
Power Supply (±10%, 50/60Hz)		230V/400V	
Protection	3 x 130A	3 x 160A	3 x 200A

ACS SERIES ADD-ONS AND OPTIONS

NT.36	36V _{rms} range	
NT.56	56V _{rms} range	
OPT.05	U/I monitor	Galvanically isolated BNC plugs for monitoring voltage and current (includes OPT.14)
OPT.14	External input	0 ... V _{Ext max} V _{Ext max} is adjustable between $\pm 2V_p$... $\pm 25V_p$ OPT.14 includes a digital low pass input filter Type Bessel or Butterworth, order 1 ... 6 (adjustable) Filter frequency selectable 100Hz ... 10MHz
OPT.30	Optical link	Optical interface to real time simulator LC duplex interface / Aurora 8B/10B protocol / 2Gb/s data rate
ACS.GA	Common output	Common output for amplifier and current transformer
STMB.S.	Shunt measurement	Current measurement via shunt resistor
STMB.L.	LEM measurement	Current measurement via integrated LEM module (wiring)
STMB.L2.	LEM measurement	Current measurement via additional LEM module (module plus wiring)

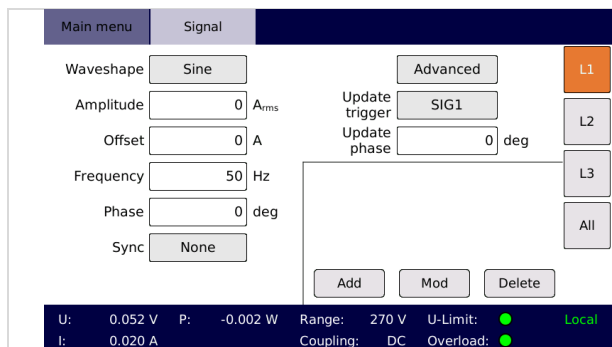


Fig. 7: Screenshot basic signal settings

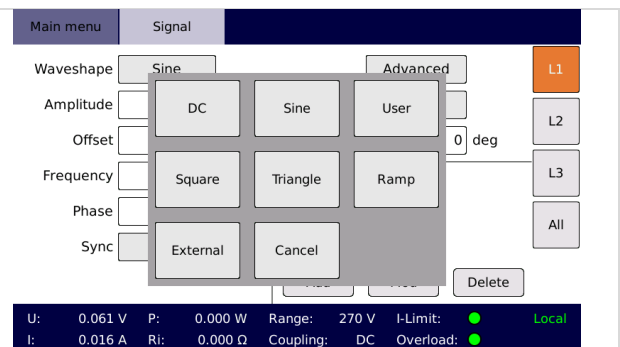


Fig. 8: Screenshot wavseshape selection

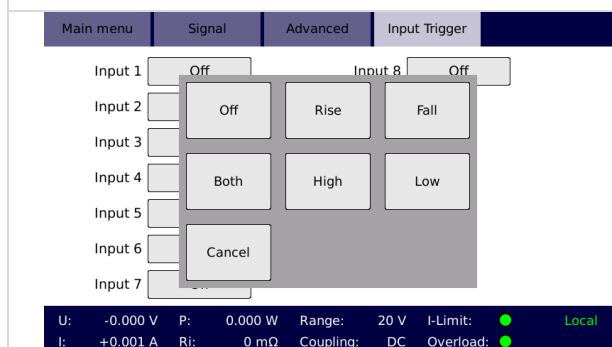


Fig. 9: Screenshot input trigger

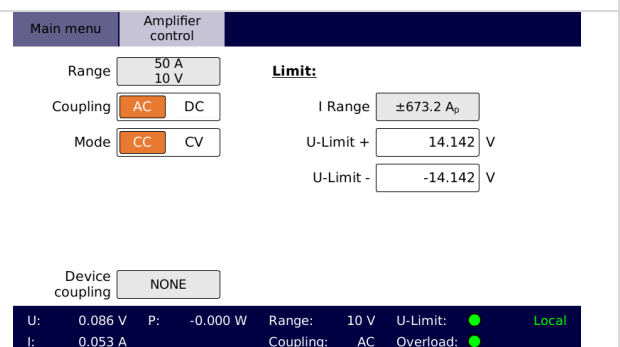


Fig. 10: Screenshot amplifier control