

DM APS/xxx 3-phase power systems

ONE APS 4-QUADRANT VOLTAGE / CURRENT AMPLIFIER PER PHASE



Fig. 1: 4-quadrant amplifier system DM APS/60000

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
German. Lloyd

Operating modes:

THREE PHASE MODE

The three APS amplifiers are used for generating a three phase network system, either as a star connection with neutral or as a delta connection without neutral.

SINGLE PHASE PARALLEL MODE

The three amplifiers are set to parallel mode – thus having three times higher output power and output current capability with the option parallel connection an easy change between three phase and parallel mode is possible. Additionally the paralleled system has a common output panel with higher power capability in parallel mode.

SERIAL MODE

Two of the amplifiers are set in serial connection. This enables the system to double the output voltage capability and keep the nominal output power and peak current capability.

ANTI-SERIAL MODE

Two of the amplifiers are set to anti-serial connection. This operating mode is used for generating high DC voltages with positive and negative voltages. One APS is the positive side, the second one is the negative side.

VOLTAGE AND CURRENT MODE OPERATION REFERENCE SOURCE FOR ALL APPLICATIONS

TOUCHSCREEN USER INTERFACE

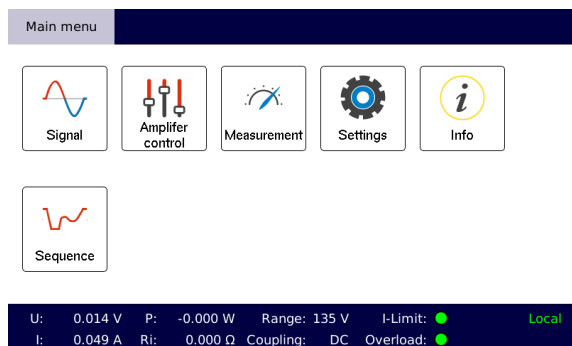


Fig. 6: Main menu

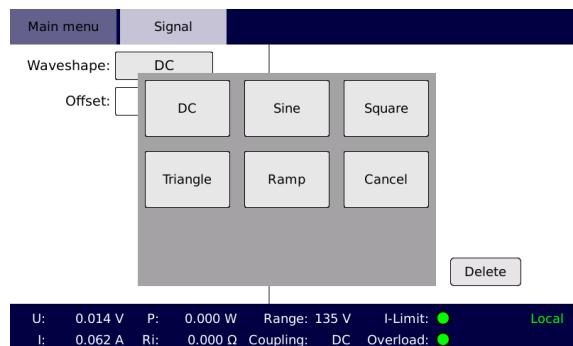


Fig. 7: Selection of the output signal waveshape

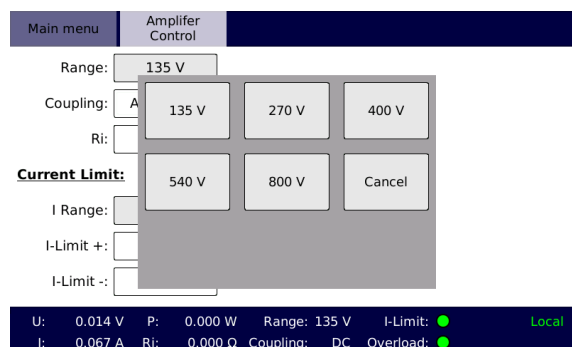


Fig. 8: Selection of the output voltage range

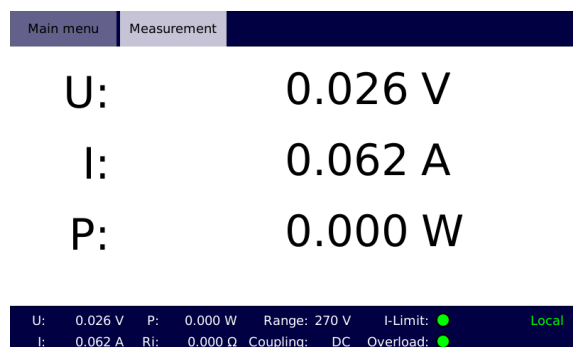


Fig. 9: Measurement unit display

TECHNICAL DATA - GENERAL

		DM APS/xxx series			
Nominal voltage ranges¹⁾	AC (DC)	135V _{rms} (±191V _{DC}) / 240V _{rms} (±339V _{DC}) / 270V _{rms} (±382V _{DC}) / 300V _{rms} (±424V _{DC})			
Load regulation		Range	DC ... 450Hz	450Hz ... 5kHz	5kHz ... 10kHz
		135V _{rms}	0.4%	5.0%	15.0%
		240V _{rms}	0.2%	2.5%	8.0%
		270V _{rms}	0.2%	1.0%	5.0%
		300V _{rms}	0.2%	1.0%	5.0%
Stability (1h)		gain: <0.1% / offset: <0.02% of range value at constant load and temperature			
Line regulation		<1.5×10 ⁻⁴ per 10V line-voltage change			
Ripple (< 1 MHz)		< 100mV _{rms}			
Frequency bandwidth		large signal: DC ... 10kHz (-3dB) small signal (10%): DC ... 50kHz (-3dB)			
Slew rate		>52V/μs (rise time <5μs at 230V _{rms} according to IEC/EN 61000-4-11, max over-undershoot 5%)			
Harmonic distortion (max.)		Range	DC ... 450Hz	450Hz ... 5kHz	5kHz ... 10kHz
		135V _{rms}	0.3%	3.0%	5.0%
		240V _{rms}	0.2%	2.0%	3.0%
		270V _{rms}	0.1%	1.0%	2.5%
		300V _{rms}	0.1%	1.0%	2.5%
Floating output		max. voltage between earth and the amplifier's ground output: <300V _{rms}			
Internal resistance compensation		<8V _p (ground and each phase line)			
Protection circuits		overload / short circuit / over temperature			
External input	<i>Max. voltage</i>	0 ... V _{ExtMax} (V _{ExtMax} is adjustable between ±2V _p ... ±25V _p)			
	<i>Impedance</i>	approx. 10kΩ			
	<i>Delay time</i>	Signal delay between amplifier's external input and amplifier's output <5μs			
Interface		Ethernet 100MBit			
Internal oscillator unit		One unit per phase			
	<i>Type</i>	4-channel synthesizer			
	<i>Wave forms</i>	DC, sine, square, triangle, ramp, arbitrary			
	<i>Amplitude resolution</i>	17Bit			
	<i>Frequency range</i>	DC ... 1MHz			
	<i>Frequency resolution</i>	1μHz			
	<i>Frequency accuracy</i>	25ppm			
	<i>Phase range</i>	0° ... 360°			
	<i>Phase resolution</i>	0.001°			
	<i>Memory depth</i>	1MSample			
	<i>Synthesizer functions</i>	ADD, AM, FM, PM, PWM			
	<i>Sequence memory</i>	1024 steps			

Internal control unit		One unit per phase			
Display		7.0" Touchscreen (17.8cm, resolution 800x480)			
Sequencer		Integrated sequences: amplitude pulse, frequency pulse (lin/log) User defined sequences memory			
User interface		Touchscreen / front-panel button / incremental encoder			
Digital I/O		8 digital inputs: +5V _{DC} ... +24V _{DC} 8 digital outputs: +5V _{DC} (internal V _{CC}), I _L =40mA (external V _{CC} input: +5V _{DC} ... +24V _{DC} , I _L =500mA)			
Digital instrument		One instrument per phase			
	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	10Hz ... 45Hz	5kHz ... 15kHz	15kHz ... 30kHz
		45Hz ... 450Hz	450Hz ... 5kHz	5kHz ... 15kHz	15kHz ... 30kHz
		0.1 + 0.02	0.2 + 0.2	0.4 + 0.4	0.8 + 0.8
	Current measurement ranges	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}			
	Current accuracy	± (% of measured value + % of current measurement range value)			
		DC	10Hz ... 45Hz	5kHz ... 15kHz	15kHz ... 30kHz
		45Hz ... 450Hz	450Hz ... 5kHz	5kHz ... 15kHz	15kHz ... 30kHz
		0.2 + 0.04	0.4 + 0.4	0.8 + 0.8	1.6 + 1.6
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 frequency		± (% of measured value + % of voltage measurement range value + error(sf))			
voltage monitor		DC	10Hz ... 45Hz	5kHz ... 15kHz	15kHz ... 30kHz
		45Hz ... 450Hz	450Hz ... 5kHz	5kHz ... 15kHz	15kHz ... 30kHz
		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		>1MOhm			
Withstand voltage		>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			

Remarks:

- 1) 240V_{rms} range not available at DM APS 1000
- 2) See application note: "Technical information monitoring unit"
- 3) At cosine phi = 1

TECHNICAL DATA – DM APS/ 3000 / 7500 / 15000

		DM APS/3000	DM APS/7500	DM APS/15000
Power AC	- continuous	3000VA	7500VA	15000VA
	- approx. 1h ³⁾	4500VA	11250VA	22500VA
Power DC	- continuous	3000W	7500W	15000W
	- approx. 1h	4500W	11250W	22500W
Short-time power		6000VA	15000VA	30000VA
Peak current per phase		26.4A _p	88A _p	176A _p
Peak current in parallel mode		79.2A _p	264A _p	528A _p

TECHNICAL DATA – DM APS/ 22500 / 30000 / 45000

		DM APS/22500	DM APS/30000	DM APS/45000
Power AC	- continuous	22500VA	30000VA	45000VA
	- approx. 1h ³⁾	33750VA	45000VA	67500VA
Power DC	- continuous	22500W	30000W	45000W
	- approx. 1h	33750W	45000W	67500W
Short-time power		45000VA	60000VA	90000VA
Peak current per phase		264A _p	440A _p	616A _p
Peak current in parallel mode		792A _p	1320A _p	1848A _p

TECHNICAL DATA – APS/ 60000 / 75000 / 90000

		DM APS/60000	DM APS/75000	DM APS/90000
Power AC	- continuous	60000VA	75000VA	90000VA
	- approx. 1h ³⁾	90000VA	112500VA	135000VA
Power DC	- continuous	60000W	75000W	90000W
	- approx. 1h	90000W	112500W	135000W
Short-time power		120000VA	150000VA	180000VA
Peak current		880A _p	1056A _p	1150A _p
Peak current in parallel mode		2640A _p	3168A _p	3450A _p

TECHNICAL DATA – DM APS 120000 / 150000 / 180000

		DM APS/120000	DM APS/150000	DM APS/180000
Power AC	- continuous	120000VA	150000VA	180000VA
	- approx. 1h ³⁾	180000VA	225000VA	270000VA
Power DC	- continuous	120000W	150000W	180000W
	- approx. 1h	180000W	225000W	270000W
Short-time power		240000VA	300000VA	360000VA
Peak current		1760A _p	2112A _p	2300A _p
Peak current in parallel mode		5280A _p	6336A _p	6900A _p

APS SERIES ADD-ONS AND OPTIONS

Options				
OPT.05	U/I monitor	Galvanically isolated BNC plugs for monitoring voltage and current (includes OPT.14)		
NTD.11.33	Additional voltage range	0 ... 33V _{rms} ($\pm 47V_{DC}$)		
NTD.11.36	Additional voltage range	0 ... 36V _{rms} ($\pm 51V_{DC}$)		
NTD.11.56	Additional voltage range	0 ... 56V _{rms} ($\pm 79V_{DC}$)		
NTD.11.60	Additional voltage range	0 ... 60V _{rms} ($\pm 85V_{DC}$)		
NTD.11.150	Additional voltage range	0 ... 150V _{rms} ($\pm 212V_{DC}$)		
NTD.11.570DC	Additional DC-voltage range	0 ... +570V _{DC}		
NTD.11.630DC	Additional DC-voltage range	0 ... +630V _{DC}		
NTD.11.800DC	Additional DC-voltage range	0 ... +800V _{DC}		
OPT.13.30	Special frequency range	DC ... 30kHz (-3dB)		
OPT.14	External input	0 ... V _{ExtMax} (adjustable between $\pm 2V_p$... $\pm 25V_p$) OPT.14 includes a digital input filter: type Bessel or Butterworth, order 1 ... 6 (adjustable) Filter frequency selectable 100Hz ... 10MHz		
NTD.18	Special line voltage	available on request in the range of 110V _{rms} ... 300V _{rms}		
OPT.21	Common output	Common output plugs for parallel operation		
OPT.24	Programmable internal impedance	Model	Ri max. (Ohm)	Li max. (mH)
		APS 1000	30000	400
		APS 2500	9000	120
		APS 5000	4500	60
		APS 7500	3000	40
		APS 10000	1800	24
		APS 15000	1286	17
		APS 20000	900	12
		APS 25000	750	10
		APS 30000	643	9
		APS 40000	450	6
		APS 50000	375	5
		APS 60000	321	4
OPT.25	Constant current mode			
OPT.30	Optical link	Optical interface to real time simulator LC duplex interface / Aurora 8B/10B protocol / 2Gb/s data rate		
UT.540.C	Voltage transformer	Output voltages 400V _{rms} / 540V _{rms} Other voltages on request		



EMV/D 22500/APS



DM 22500/APS