

## DC Sources LAB/SMSL 1,2 – 5 kW with integrated load | voltage-controlled for 2-quadrant operation



 19" x 2 U x 440 mm

## DC Sources LAB/HPL 5 – 10 kW with integrated load | voltage-controlled for 2-quadrant operation



 19" x 3 U x 620 mm

### OVERVIEW

- From 1.2 kW to 5 kW
- Output voltages up to 600 V
- Output currents up to 500 A
- Compact design
- Quiet operation, ensuring that it is pleasant to work within the vicinity of the unit
- Very easy to control via front panel
- Information via graphic display
- Constant voltage, current, resistance, power operation and simulation of PV arrays
- With integrated load; 300 – 2,000 W voltage-controlled for 2-quadrant operation
- Create any type of voltage or current curve via memory card or digital interface (sequential operation)
- Script operation, in conjunction with the Datalog function, enables an independent stand-alone test field to be set up
- Standard integrated ATI 5/10 galvanically isolated analogue interface: 0 – 5 V or 0 – 10 V (user selectable) and RS232, soft interlock
- Digital interfaces IEEE488, RS485, USB and LAN (optional)
- SD card slot (optional)
- Filter functions which can be adjusted for analogue interface
- Voltage rise time and current rise time (U and I slopes) are adjustable
- U<sub>max</sub> and I<sub>max</sub> can be set by the user in order to limit output voltage or output current
- A switch-off time can be set for the unit once the start button has been pressed
- Create U/I output characteristics which can be saved (e.g. for PV-Sim, shading)
- Datalog function: Current operating values are saved to the memory card at adjustable time intervals
- Protective functions for OVP, OTP, UVP, OCP
- Special versions available on request

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## PRODUCT EXAMPLES LAB/SMSL

Type	Power W	Voltage V	Current A	Dimensions
LAB/SMSL 115	1.200	0 – 15	0 – 80	19" x 2 U x 440 mm
LAB/SMSL 135	1.200	0 – 35	0 – 35	19" x 2 U x 440 mm
LAB/SMSL 145	1.200	0 – 45	0 – 30	19" x 2 U x 440 mm
LAB/SMSL 170	1.200	0 – 70	0 – 20	19" x 2 U x 440 mm
LAB/SMSL 1150	1.200	0 – 150	0 – 8	19" x 2 U x 440 mm
LAB/SMSL 1300	1.200	0 – 300	0 – 4	19" x 2 U x 440 mm
LAB/SMSL 1600	1.200	0 – 600	0 – 2	19" x 2 U x 440 mm
LAB/SMSL 215	2.400	0 – 15	0 – 160	19" x 2 U x 440 mm
LAB/SMSL 235	2.400	0 – 35	0 – 68	19" x 2 U x 440 mm
LAB/SMSL 245	2.400	0 – 45	0 – 53	19" x 2 U x 440 mm
LAB/SMSL 270	2.400	0 – 70	0 – 34	19" x 2 U x 440 mm
LAB/SMSL 2150	2.400	0 – 150	0 – 16	19" x 2 U x 440 mm
LAB/SMSL 2300	2.400	0 – 300	0 – 8	19" x 2 U x 440 mm
LAB/SMSL 2600	2.400	0 – 600	0 – 4	19" x 2 U x 440 mm
LAB/SMSL 315	3.000	0 – 15	0 – 200	19" x 2 U x 440 mm
LAB/SMSL 335	3.000	0 – 35	0 – 90	19" x 2 U x 440 mm
LAB/SMSL 345	3.000	0 – 45	0 – 70	19" x 2 U x 440 mm
LAB/SMSL 370	3.000	0 – 70	0 – 45	19" x 2 U x 440 mm
LAB/SMSL 3100	3.000	0 – 100	0 – 30	19" x 2 U x 440 mm
LAB/SMSL 3150	3.000	0 – 150	0 – 20	19" x 2 U x 440 mm
LAB/SMSL 3300	3.000	0 – 300	0 – 10	19" x 2 U x 440 mm
LAB/SMSL 3600	3.000	0 – 600	0 – 5	19" x 2 U x 440 mm
LAB/SMSL 420	4.000	0 – 20	0 – 200	19" x 2 U x 440 mm
LAB/SMSL 435	4.000	0 – 35	0 – 115	19" x 2 U x 440 mm
LAB/SMSL 445	4.000	0 – 45	0 – 90	19" x 2 U x 440 mm
LAB/SMSL 470	4.000	0 – 70	0 – 60	19" x 2 U x 440 mm
LAB/SMSL 4100	4.000	0 – 100	0 – 40	19" x 2 U x 440 mm
LAB/SMSL 4150	4.000	0 – 150	0 – 30	19" x 2 U x 440 mm
LAB/SMSL 4300	4.000	0 – 300	0 – 15	19" x 2 U x 440 mm
LAB/SMSL 4600	4.000	0 – 600	0 – 7	19" x 2 U x 440 mm
LAB/SMSL 525	5.000	0 – 25	0 – 200	19" x 2 U x 440 mm
LAB/SMSL 535	5.000	0 – 35	0 – 150	19" x 2 U x 440 mm
LAB/SMSL 545	5.000	0 – 45	0 – 120	19" x 2 U x 440 mm
LAB/SMSL 570	5.000	0 – 70	0 – 75	19" x 2 U x 440 mm
LAB/SMSL 5100	5.000	0 – 100	0 – 50	19" x 2 U x 440 mm
LAB/SMSL 5150	5.000	0 – 150	0 – 35	19" x 2 U x 440 mm
LAB/SMSL 5300	5.000	0 – 300	0 – 17	19" x 2 U x 440 mm
LAB/SMSL 5600	5.000	0 – 600	0 – 8,5	19" x 2 U x 440 mm

Other versions on request

## PRODUCT EXAMPLES LAB/HPL

Type	Power W	Voltage V	Current A	Dimensions
LAB/HPL 520	5.000	0 – 20	0 – 250	19" x 3 U x 620 mm
LAB/HPL 540	5.000	0 – 40	0 – 125	19" x 3 U x 620 mm
LAB/HPL 580	5.000	0 – 80	0 – 65	19" x 3 U x 620 mm
LAB/HPL 5100	5.000	0 – 100	0 – 50	19" x 3 U x 620 mm
LAB/HPL 5150	5.000	0 – 150	0 – 35	19" x 3 U x 620 mm
LAB/HPL 5300	5.000	0 – 300	0 – 17	19" x 3 U x 620 mm
LAB/HPL 5600	5.000	0 – 600	0 – 8.5	19" x 3 U x 620 mm
LAB/HPL 1020	10.000	0 – 20	0 – 500	19" x 3 U x 620 mm
LAB/HPL 1040	10.000	0 – 40	0 – 250	19" x 3 U x 620 mm
LAB/HPL 1080	10.000	0 – 80	0 – 125	19" x 3 U x 620 mm
LAB/HPL 10100	10.000	0 – 100	0 – 100	19" x 3 U x 620 mm
LAB/HPL 10150	10.000	0 – 150	0 – 70	19" x 3 U x 620 mm
LAB/HPL 10300	10.000	0 – 300	0 – 34	19" x 3 U x 620 mm
LAB/HPL 10600	10.000	0 – 600	0 – 17	19" x 3 U x 620 mm

Other versions on request

## MODEL NUMBER DESCRIPTION

LAB /	HPL	5	150 / 3P400	LAN	Kfz 12	Mod
DC-Source	Series	Output power	Output voltage Input voltage description	Interface option	Process option	Modification

## OPTIONS

Appendix	Description
../230	230 / 207 – 253 VAC Input
../3P208	3 x 208 / 187 – 229 VAC Input
../3P400	3 x 400 / 360 – 440 VAC Input
../3P440	3 x 440 / 396 – 484 VAC Input
../3P480	3 x 480 / 432 – 528 VAC Input
../400Hz	400 Hz Input
../DC	250...750 VDC Input
../LT IEEE	IEEE488 Interface
../LTRS485	RS485 Interface
../LAN	LAN Interface
../USB	USB Interface
../KFZ12	Preselected Start-up Curve 12 V
../KFZ24	Preselected Start-up Curve 24 V
../OPT	Predefined Output characteristic
../SD	SD Card Slot

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## LINE INPUT

Device power	LAB/HPL					
	LAB/SMSL					
	1.2 kW	2.4 kW	3 kW	4 kW	5 kW	10 kW
Connection	3 wire (1P+N+E) / 5 wire (3P+N+E)					
Input 1P/230	1 x 230 Vac (207 – 253 Vac 47 – 63Hz)					
Input 3P/200	3 x 200 Vac (180 – 220 Vac 47 – 63Hz)					
Input 3P/208	3 x 208 Vac (187 – 229 Vac 47 – 63Hz)					
Input 3P/400	3 x 400 Vac (360 – 440 Vac 47 – 63Hz)					
Input 3P/440	3 x 440 Vac (396 – 484 Vac 47 – 63Hz)					
Input 3P/480	3 x 480 Vac (432 – 528 Vac 47 – 63Hz)					
Max.allowed non symmetry (3P-System)	< 3 %					
Input current 1P/230 Modell <sup>1,2</sup>	15	18	22	28	33	–
Input current 3P/200 Modell <sup>1,2</sup>	9.5	11.5	15	20	25	50
Input current 3P/208 Modell <sup>1,2</sup>	9	11	14	19	23	46
Input current 3P/400 Modell <sup>1,2</sup>	4.5	5.5	7.5	10	11.5	22.9
Input current 3P/440 Modell <sup>1,2</sup>	4	5	7	9	11	21
Input current 3P/480 Modell <sup>1,2</sup>	3.5	4.5	6.5	8	10	19.5
Inrush transient current <sup>2</sup>	< 25	< 25	< 25	< 25	< 25	< 51
Normalinal current internal Fuse 3P/400 Modell	15 A	15 A	15 A	15 A	15 A	30 A
Recommended supply breaker 3P/400 Modell (value and curve)	16 A Type D/K	16 A Type D/K	16 A Type D/K	16 A Type D/K	16 A Type D/K	32 A Type D/K
Leakage current	< 35 mA					
cos phi	> 0.7					
Harmonic content <sup>3</sup>	50 Hz = 72 %   100 Hz = 2 %   150 Hz = 0.9 % 200 Hz = 0.1 %   250 Hz = 11 %   350 Hz = 0.6 %					
Efficiency Type	94 %					

<sup>1</sup> For nominal current and nominal voltage

<sup>2</sup> For nominal input voltage

<sup>3</sup> Total harmonic distortion input current ((%)/lin)

<sup>4</sup> 500 A is the maximum possible current for an 10 kW Unit

<sup>5</sup> If the ripple is not specified, the maximum allowed ripple is 0.2 % of F.S.

<sup>6</sup> The measurement of the peak peak ripple is strongly dependent of the measurement setup

<sup>7</sup> The given accuracy is also all interfaces valid

<sup>8</sup> Notices: The relative accuracy will not change.

Only the absolute value will be change because the nominal Values of the "unit" are change

<sup>9</sup> A higher number is possible, ask the manufacturer

<sup>11</sup> The ripple measurement methode of ET System is specifid at application note : ET Ripple-Spec

<sup>12</sup> Ther ripple specification are reservation to change on the part of manufacturer

<sup>13</sup> Device Is at the moment only avalibale with highspped output (Low output cap)

<sup>14</sup> Not as standard unit available

## OUTPUT

	LAB/HPL															
	LAB/SMSL															
Control quality	Static Regulation	±0,1 % F.S.														
	Line Regulation voltage	± 0,02 % F.S.														
	Line Regulation current	± 0,02 % F.S.														
	Load Regulation voltage	± 0,05 % F.S. ± 2 mV														
	Load Regulation current	± 0,05 % F.S. ± 20 mA														
	Dynamic Responce Time @ Load Step 10 – 90 %	< 30 ms														
Output current	Output voltage	15	20	25	35	40	45	50	60	70	80	100	150	300	600	
	SMSL: 1,2 kW Unit	80	60	48	34,29	30	26,67	24	20	17,14	15	12	8	4	2	
	SMSL: 2,4 kW Unit	160	120	96	68,57	60	53,33	48	40	34,29	30	24	16	8	4	
	SMSL: 3 kW Unit	200	150	120	85,71	75	66,67	60	50	42,86	37,50	30	20	10	5	
	SMSL: 4 kW Unit	250	200	160	114,29	100	88,89	80	66,67	57,14	50	40	26,67	13,33	6,67	
	SMSL/HPL: 5 kW Unit	x	250	200	142,86	125	111,11	100	83,33	71,43	62,50	50	33,33	16,67	8,33	
	HPL: 10 kW Unit	x	500	460	285	250	222	200	167	143	120	100	70	34	17	
	Other combinations of voltage and current also possible, ask the manufactory															
	Basic calculation of possible combinations are:															
	Pout = Vout x Iout   Pmax for one unit 10 kW   Vmax = 600 V   Cmax = 500 A each 10 kW															
Rippel and Noise <sup>1)</sup>	Voltage Ripple (p-p) 20 MHz	40 <sup>12</sup>	80 <sup>12</sup>	80 <sup>12</sup>	80 <sup>12</sup>	140 <sup>12</sup>	140 <sup>12</sup>	140 <sup>12</sup>	140 <sup>12</sup>	140 <sup>12</sup>	140 <sup>12</sup>	140 <sup>12</sup>	900 <sup>12</sup>	900 <sup>12</sup>	900 <sup>12</sup>	
	Voltage Ripple (p-p) 300 kHz	15 <sup>12</sup>	35 <sup>12</sup>	35 <sup>12</sup>	35 <sup>12</sup>	60 <sup>12</sup>	60 <sup>12</sup>	60 <sup>12</sup>	60 <sup>12</sup>	60 <sup>12</sup>	60 <sup>12</sup>	60 <sup>12</sup>	400 <sup>12</sup>	400 <sup>12</sup>	400 <sup>12</sup>	
	Voltage Ripple (rms) <sup>5</sup> mV 20 MHz	15	35	35	35	60	60	60	60	60	60	60	400	400	400	
	Voltage Ripple (rms) <sup>5</sup> mV 300 kHz	10 <sup>12</sup>	25 <sup>12</sup>	25 <sup>12</sup>	25 <sup>12</sup>	40 <sup>12</sup>	40 <sup>12</sup>	40 <sup>12</sup>	40 <sup>12</sup>	40 <sup>12</sup>	40 <sup>12</sup>	40 <sup>12</sup>	300 <sup>12</sup>	300 <sup>12</sup>	300 <sup>12</sup>	
	Current Ripple (p-p)	< 0.5 % of F.S.														
	Current Ripple (rms)	< 0.4 % of F.S.														
Isolation	Primary / Secondary	3.000 VAC														
	DC-Output / Earth	500 VDC										2.000 VDC				
	Primary / Earth	2.150 VDC														
Output speed	Rise Time, Full load	6 ms	6 ms	6 ms	6 ms	12 ms	12 ms	12 ms	12 ms	12 ms	20 ms	20 ms	20 ms	20 ms	20 ms	
	Rise Time, No load	5 ms	5 ms	5 ms	5 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	
	Fall Time, Full Load	15 ms	15 ms	15 ms	15 ms	20 ms	20 ms	20 ms	20 ms	20 ms	20 ms	20 ms	40 ms	40 ms	50 ms	
	Fall Time, No Load	5 s to get below 50 V														
Accuracy	Rel. Accuracy ± <sup>7</sup>															
	Voltage [V] 0,25	0,038	0,050	0,063	0,088	0,100	0,113	0,125	0,150	0,175	0,200	0,250	0,375	0,750	1,500	
	Current [A] 0,4	1,000	1,000	0,800	0,571	0,500	0,444	0,400	0,333	0,286	0,250	0,200	0,133	0,067	0,033	
	Relative Accuracy for Sens Operation (worst case) [%] <sup>7</sup>															
	Voltage [V] 0,5	0,075	0,100	0,125	0,175	0,200	0,225	0,250	0,300	0,350	0,400	0,500	0,750	1,500	3,000	
	Max. Sens Voltage over nominal Voltage <sup>7</sup>	± 1 % of F.S.														
Max. Sens voltage inside the nominal voltage range <sup>7</sup>	5 % of F.S. (if higher voltage is needed ask manufactory)															

## OUTPUT

	LAB/HPL													
	LAB/SMSL													
	15	20	25	35	40	45	50	60	70	80	100	150	300	600
Output voltage														
Resolution voltage	20 V – 99,99 V										100 V – 999,9 V			
Display														
Current Setting resolution	00.00										000.0			
Single & M/S-Serial-Mode														
Current Setting resolution	N x 00.01										N x 000.1			
M/S-Parallel Mode														
Resolution current	0,000 A – 9,999 A				10,00 A – 99,99 A						100,0 A – 999,9 A			
Display														
Maximum continuous power @ Tamb. = 50°C	LAB/SMSL 1,2 – 5 kW: 300 – 600 W LAB/HPL 5 – 10 kW: 300 – 2.000 W													
Maximum sink current	Iout max of the Device													
Protection	PL (Power is limited by digital frontpanel control) OTP (Over temperature protect by the frontpane) Fan is linear controlled by an Temp.-Sensor													
Responce time <sup>16</sup>	< 20 ms													
Voltage threshold above which the load is applied	Voltage Set Value +100 mV ±10 mV													
Output Voltage [V]	15	20	25	35	40	45	50	60	70	80	100	150	300	600
Programming	45 ms	45 ms	45 ms	45 ms	60 ms	60 ms	60 ms	60 ms	60 ms	60 ms	60 ms	120 ms	120 ms	150 ms
Down Speed @ No Load														
OVP	Over Voltage Protection: is adjustable between 0 % and 120 % of Voltage full range													
OCP	Over Current Protection: is realised by the current setpoint, the output current can not go over the set output current													
OTP	Over Temperature Protection: if the internal heat sink tempearture is go above 90°C the device will automatical shut down													
UVLO	Under Voltage Lock out: if set limit reach device shut down													
UI-MODE	Voltage and Current Operation Mode: Voltage and current are setable													
UIP-MODE	Power Limit Mode: A Powerlimit is setable													
UIR-MODE	Output Resistor Mode: A Output resistor is setable between [Rmax=Vout_max/Iout_max] and [Rmin=Rmax X 0.1]													
PV-SIM-MODE	Photovoltaic Simulation Mode: Simulation of a PV-Cell is possible!													
SLOPE-FUNCTION	Adjustable Slope for current and Voltage: Range-Minimum 1 A/s resp. 1 V/s   Range-Maximum is 30 ms to Vmax resp. Imax													
AI-FILTER	Adjustable filter function for Analoginterface Setvalues. Avergare time is adjustable between approximate 0 s to 80 s 0=0 s; 2=15 ms; 3=30 ms; 4=60 ms; 5=125 ms; 6=250 ms; 7=500 ms; 8=1 s; 9=2 s; 10=3 s; 11=5 s; 12=10 s; 13=20 s; 14=40 s; 15=80 s													
t-ENABLE	Adjustable on time for the device after press the start button (standby). Time is adjustable between 1 s and 65000 s													

## INTERFACE

### Analog Interface

Digital outputs (CV, Standby, Error)	Output type: Open collector with pull-up resistor 10 k $\Omega$ after +5 V Isinkmax: 50 mA
Digital inputs (Ext. Control, Standby)	Input resistance: 47 k $\Omega$ Maximum input voltage: 50 V High level: Uin > 2 V Low level: Uin < 0.8 V
Analog outputs (Xmon)	Output resistance: 100 $\Omega$ Minimum permissible load resistance: 2 k $\Omega$ Minimum load resistance for 0.1 % accuracy: 100 k $\Omega$
Analog inputs (Xset)	Input resistance: 1 M $\Omega$ Maximum permissible input voltage: 25 V
Reference voltage	Reference voltage Uref: 10 V $\pm$ 10 mV Output resistance: < 10 $\Omega$ Maximum output current: 10 mA (not short-circuit-proof)
5 V – supply voltage	Output voltage: 5 V $\pm$ 300 mV Maximum output current: 50 mA (not short-circuit-proof)
Programming Response Time	< 10 ms

### RS232

Signal inputs (Rx, D, CTS)	Maximum input voltage: $\pm$ 25 V Input resistance: 5 k $\Omega$ (Type) Switching thresholds: UH < -3 V, UL > +3 V
Signal outputs (Tx, D, RTS)	Output voltage (at RL > 3 k $\Omega$ ): min $\pm$ 5 V, Type $\pm$ 9 V, max $\pm$ 10 V Output resistance: < 300 $\Omega$ ; Short circuit current: Type $\pm$ 10 mA

### RS485

Maximum input voltage	$\pm$ 5 V
Input resistance	> 12 k $\Omega$
Output current	$\pm$ 60 mA Max
High level	Ud > 0.2 V
Low level	Ud < -0.2 V

### EMC AND SAFETY STANDARDS

Safety standard	EN 60950
Emission	EN 61000-6-4:2007
Immunity	EN 61000-6-2:2005
Measurement, control- and laboratory equipment	EN 61010-1:2010

### AMBIENT CONDITIONS

Cooling	Fans
Operating temperature	0 – 50°C
Operating temperature	-20°C – 70°C
Humidity	< 80 %
Operating height	< 2.000 m
Weight / Dimension LAB/SMSL 1,2 – 5 kW	14 – 19 kg / 19" x 2 U x 440 mm
Weight / Dimension LAB/HPL 5 kW	19 kg / 19" x 3 U x 620 mm
Weight / Dimension LAB/HPL 10 kW	27 kg / 19" x 3 U x 620 mm
FAN Volume	42 – 43 dB