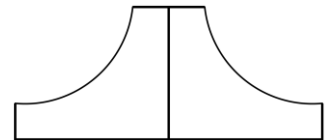




## SM15K - Series 15kW DC POWER SUPPLIES

### Bi-Directional - Constant Power

Models	Voltage range	Current range
SM 70-CP-450	0 - 70 V	-450 - 450 A
SM 210-CP-150	0 - 210 V	-150 - 150 A
SM 500-CP-90	0 - 500 V	-90 - 90 A
SM 1500-CP-30	0 - 1500 V	-30 - 30 A



### Features

- Bi-Directional power supply, standard 15kW Source & Sink
- Flexible output with constant power characteristic
- Power Regeneration Technology: sink power is not dissipated but fed back into the grid
- Designed for long life at continuous full power
- Excellent dynamic response to load changes, digital controlled with the possibility to adapt to the type of load
- Very low heat dissipation, efficiency 95% or more
- Protected against all overload and short circuit conditions

### Functionalities

- Operation on a wide range of three phase AC input voltages
- Standard Ethernet & Web interface
- EMC surpasses CE requirements: low emission & high immunity
- Low audible noise: temperature controlled cooling fans
- Durable digital encoders for voltage & current adjustment and menu operation
- Large user display, menu driven operations

		SM70-CP-450	SM210-CP-150	SM500-CP-90	SM1500-CP-30
<b>DC Power terminals</b>					
voltage range		0 - 70 V	0 - 210 V	0 - 500 V	0 - 1500 V
current range		-450 - 450 A	-150 - 150 A	-90 - 90 A	-30 - 30 A
Absolute maximum Sink voltage		≤ 74 V	≤ 220 V	≤ 525 V	≤ 1575 V
<b>Warning!</b> Higher voltages will damage the unit!					
Minimum Sink Voltage @ var. sink current:		1.2 V @ -450 A 0.8 V @ -215 A 0.8 V @ -45 A	3.0 V @ -150 A 1.5 V @ -75 A 1.5 V @ -15 A	5.5 V @ -90 A 3.0 V @ -30 A 1.0 V @ -10 A	16.0 V @ -30 A 7.0 V @ -10 A 2.0 V @ -3 A
Note that unit switches automatically between Source <-> Sink.					
<b>AC Input</b>					
3 phase, 48 - 62 Hz				342 - 528 V	
rated voltage range				380 - 480 V	
rated frequency				50 / 60 Hz	
rated current				maximum 27 A	
current (400 V / 3 ph, 15kW)				23 A	
power factor, 15kW, 7.5kW				0.996 / 0.988	
internal fuses				30 AT	
standby input power ( $V_o=I_o=0$ )				96 W	
standby input power ( $V_o=V_{max}$ )				180 W	
<b>Efficiency (Sink &amp; Source mode):</b>					
400 V AC, 3 ph input,					
15 kW, $I_{out}=100\%$				95 %	
15 kW, $U_{out}=100\%$				96 %	
<b>Regulation</b>					
Load 0 - 100%	<b>CV</b>	6 mV	5 mV	4 mV	10 mV
Line 342 - 528 V AC	<b>CV</b>	< 1 mV	< 1 mV	< 1 mV	< 1 mV
(external voltage sense)					
Load 0 - 100%	<b>CC</b>	35 mA	12 mA	8 mA	2 mA
Line 342 - 528 V AC	<b>CC</b>	4 mA	3 mA	1 mA	1 mA
(internal voltage sense, after warm up)					
<b>Ripple + noise (CC-ripple at full load)</b>					
Source mode:		33 V / 450 A	100 V / 150 A	167 V / 90 A	500 V / 30 A
rms (BW=300 kHz)	<b>CV</b>	10 mV	30 mV	10 mV	25 mV
p-p (BW=20 MHz)	<b>CV</b>	60 mV	150 mV	55 mV	150 mV
rms (BW=300 kHz)	<b>CC</b>	100 mA	t.b.d.	45 mA	12 mA
p-p (BW=20 MHz)	<b>CC</b>	-	-	200 mA	70 mA
Source mode:		70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1500 V / 10 A
rms (BW=300 kHz)	<b>CV</b>	10 mV	20 mV	25mV	35mV
p-p (BW=20 MHz)	<b>CV</b>	60 mV	125 mV	115mV	250mV
rms (BW=300 kHz)	<b>CC</b>	100 mA	t.b.d.	45 mA	5 mA
p-p (BW=20 MHz)	<b>CC</b>	-	-	200 mA	25 mA
Sink mode:		33 V / 450 A	100 V / 150 A	167 V / 90 A	500 V / 30 A
rms (BW=300 kHz)	<b>CV</b>	8 mV	30 mV	7 mV	15 mV
p-p (BW=20 MHz)	<b>CV</b>	50 mV	150 mV	35 mV	130 mV
rms (BW=300 kHz)	<b>CC</b>	100 mA	t.b.d.	45 mA	10 mA
p-p (BW=20 MHz)	<b>CC</b>	-	-	200 mA	60 mA
Sink mode:		70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1500 V / 10 A
rms (BW=300 kHz)	<b>CV</b>	8 mV	20 mV	10 mV	25 mV
p-p (BW=20 MHz)	<b>CV</b>	50 mV	125 mV	50 mV	200 mV
rms (BW=300 kHz)	<b>CC</b>	100 mA	t.b.d.	90 mA	3 mA
p-p (BW=20 MHz)	<b>CC</b>	-	-	320 mA	12 mA
<b>Programming &amp; monitoring</b>					
<b>accuracy (excluding INT MOD ANA)</b>					
Voltage				± 0.08%	
Current				± 0.15%	
<b>Temp. coeff., per °C</b>	<b>CV</b>			20.10 <sup>-6</sup>	
	<b>CC</b>			50.10 <sup>-6</sup>	
<b>Stability</b> <sup>1</sup>					
after 1 hr warm-up, during 8 hrs	<b>CV</b>			50.10 <sup>-6</sup>	
	<b>CC</b>			80.10 <sup>-6</sup>	
t <sub>amb</sub> = 25 ± 1 °C, V <sub>in</sub> = 400 VAC (internal voltage sensing for CC-stab.)					

Notes: 1. Measured at full load. 2. Signal latency depends on the interface used &amp; data traffic.

3. See "Safety Instructions"

<b>Programming speed</b> <sup>2</sup> <i>Note: Values on resistive load, unit in CV-mode. With other load, or in CC-mode, values can be longer.</i>	<b>SM70-CP-450</b>	<b>SM210-CP-150</b>	<b>SM500-CP-90</b>	<b>SM1500-CP-30</b>
<b>Rise time (10 - 90%)</b> output voltage step time, (load = 15 kW) time, (load = 1500 W)	0 → 33 V 2.2 ms 1.5 ms	0 → 100 V 1.6 ms 1.3 ms	0 → 167 V 1.5 ms 1 ms	0 → 500 V 1.5 ms 1 ms
output voltage step time, (load = 15 kW) time, (load = 1500 W)	0 → 70 V 5.5 ms 3.5 ms	0 → 210 V 3 ms 2.7 ms	0 → 500 V 4.5 ms 3.5 ms	0 → 1500 V 4.5 ms 3.5 ms
<b>Fall time (90 - 10%)</b> output voltage step time, (load = 15 kW) time, (load = 1500 W)	33 → 0 V 1.5 ms 1.5 ms	100 → 0 V 1.3 ms 1.3 ms	167 → 0 V 0.8 ms 0.9 ms	500 → 0 V 0.8 ms 0.9 ms
output voltage step time, (load = 15 kW) time, (load = 1500 W)	70 → 0 V 2.6 ms 3.5 ms	210 → 0 V 2.5 ms 2.5 ms	500 → 0 V 2.5 ms 3.5 ms	1500 → 0 V 2.8 ms 3.5 ms
<b>DC Output Capacitance</b> X-capacitors (typical) Y-capacitors (typical)	22000 µF 950 nF	1170 µF 950 nF	560 µF 145 nF	58 µF 145 nF

	<b>SM70-CP-450</b>	<b>SM210-CP-150</b>	<b>SM500-CP-90</b>	<b>SM1500-CP-30</b>
<b>Recovery time</b> output voltage recovery within di/dt of load step time, @ 50 - 100% load step max. deviation	33 V, 225 → 450 A 100 mV 5 A/µs 100 µs 0.8 V	100 V, 75 → 150 A 500 mV 2.4 A/µs 100 µs 1.4 V	167 V, 45 → 90 A 750 mV 0.8 A/µs 100 µs 2.8 V	500 V, 15 → 30 A 2.8 V 0.25 A/µs 100 µs 9.0 V
output voltage recovery within di/dt of load step time, @ 50 - 100% load step max. deviation	70 V, 112 → 215 A 100 mV 2 A/µs 100 µs 0.3 V	210V, 36 → 72 A 250 mV 1.15 A/µs 100 µs 0.75 V	500 V, 15 → 30 A 500 mV 0.25 A/µs 150 µs 1.2 V	1500 V, 5 → 10 A 1.2 V 0.085 A/µs 150 µs 3.5 V
<i>Note: Values are with Local Sensing. With Remote Sensing + long cables, values can be different.</i>				
<b>Pulsating load</b> max. tolerable AC component of load current f > 1 kHz f < 1 kHz	60 Arms 450 Apeak	15 Arms 150 Apeak	15 Arms 90 Apeak	5 Arms 30 Apeak

<b>Insulation</b> AC power terminals / DC pwr terminals creepage / clearance AC power terminals / case DC power terminals / case	3750 Vrms (1 min.) 8 mm 2500 Vrms 1000 V DC <sup>3</sup>	3750 Vrms (1 min.) 8 mm 2500 Vrms 1500 V DC <sup>3</sup>
<b>Safety</b>	EN 60950 / EN 61010	
<b>EMC Generic Emission Generic Immunity</b>	EN 61326-1, class B equipment (for use in domestic establishments) EN 61326-1, equipment for use in industrial and domestic establishments	
<b>Operating Temperature at full load</b>	-20 to +50 °C derate output to 75% at 60 °C	
<b>Humidity</b>	maximum 95% RH, non condensing, up to 40 °C maximum 75% RH, non condensing, up to 50 °C	
<b>Storage temperature</b>	-40 to +85 °C	
<b>Thermal protection</b>	output shuts down in case of insufficient cooling	
<b>MTBF</b>	500 000 hrs	

	<b>SM70-CP-450</b>	<b>SM210-CP-150</b>	<b>SM500-CP-90</b>	<b>SM1500-CP-30</b>
<b>Hold-Up time</b> (@ 400 VAC input) V <sub>out</sub> = 100%, P <sub>out</sub> = 15 kW I <sub>out</sub> = 100%, P <sub>out</sub> = 15 kW V <sub>out</sub> = 100%, P <sub>out</sub> = 7.5 kW	10 ms 10 ms 25 ms	10 ms 10 ms 20 ms	15 ms 15 ms 35 ms	15 ms 15 ms 35 ms
<b>Turn on delay after mains switch on</b>	2.5 s			
<b>Inrush current</b>	23 A			

Notes: 1. Measured at full load. 2. Signal latency depends on the interface used & data traffic.

3. See "Safety Instructions"

	SM 70-CP-450	SM 210-CP-150	SM 500-CP-90	SM 1500-CP-30
<b>Series operation</b> max. total voltage	Not possible	Not possible	750V* 1000V**	Not possible
Master / Slave operation			maximum 6 units <sup>3</sup>  *) units delivered before Q4 / 2018 **) units delivered Q4 / 2018 or newer Contact factory for upgrading to enable 1000V series operation for older units.	
<b>Parallel operation</b> Master / Slave operation	maximum 60 units			
<b>Remote sensing</b> max. voltage drop per load lead	default 1 V, can be set to 10 V			
<b>Limits</b> Voltage adjust range Current adjust range Power adjust range Voltage OverLoad level Voltage Self-Protection level	0 - 101 % 0 - 101 % 0 - 101 % 102.5 % - unit will continue to operate (OL-indication in display) 105 % - output is automatically disabled (PROT-indication in display)			
<b>Potentiometers</b> front panel control with knobs resolution	15 bits			
<b>Meters</b> scale voltage scale current scale power accuracy read output	4 digit 0.00 - 70.00 V - 450.0 - 450.0 A - 15000 - 15000 W 0.2% + 2 digit	4 digit 0.0 - 210.0 V - 150.0 - 150.0 A - 15000 - 15000 W 0.2% + 2 digit	4 digit 0.0 - 500.0 V - 90.0 - 90.0 A - 15000 - 15000 W 0.2% + 2 digit	4 digit 0 - 1500 V - 30.00 - 30.00 A - 15000 - 15000 W 0.2% + 2 digit

<b>Mounting</b>	stacking of units allowed, air flow is from left to right			
<b>AC Terminals (CON A)</b>	screw terminals for wire 4 mm <sup>2</sup> , 3 phase + earth (no neutral)			
<b>DC Terminals (CON B1 &amp; B2)</b>	M12 bolts	M8 bolts		
<b>Programming connectors (LAN)</b>	standard with RJ45-connector for Ethernet at rear panel			
<b>Interlock (CON F)</b>	input for contact at rear panel			
<b>Cooling</b> audio noise level  air flow	low noise blower, fan speed adapts to temperature of internal system ca. 50 dBA at full load, 25 °C ambient temperature, 1 m distance ca. 65 dBA at full load, 50 °C ambient temperature, 1 m distance From left to right			
<b>Enclosure</b> degree of protection	IP20			
<b>Dimensions</b> front panel: h x w behind front panel: h x w x d	132 x 483 mm (19", 3 U) 128 x 448 x 591 mm (excluding feet) no extra depth is required with optional interfaces assembled			
<b>Weight</b>	27 kg			

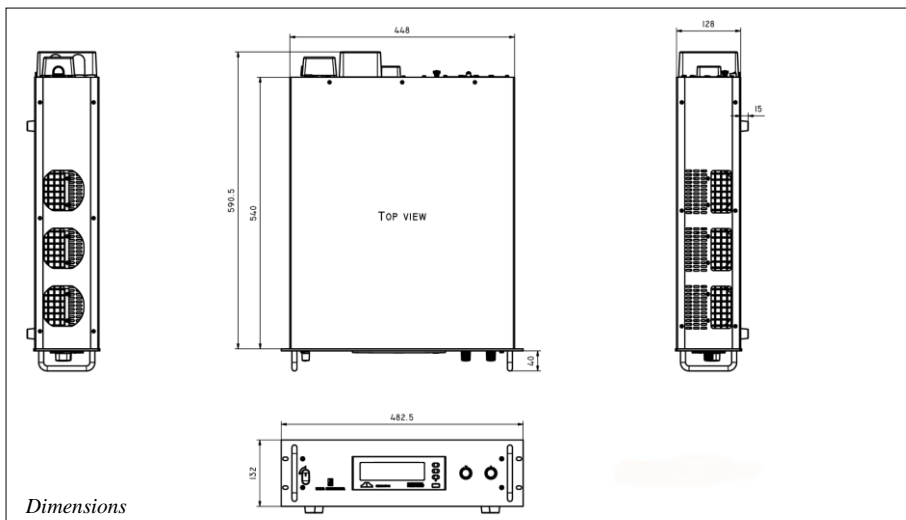
CV = Constant Voltage  
 CC = Constant Current  
 CP = Constant Power

Specifications measured at  
 $t_{amb} = 25 \pm 5 \text{ }^\circ\text{C}$  and  $V_{in} = 400 \text{ VAC}$ ,  
 50 Hz unless otherwise noted.

The information in this document is  
 subject to change without notice.

Notes:

1. Measured at full load.
2. Signal latency depends on the interface used and data traffic.
3. See safety Instructions in the operating manual.



## Typical Applications

- Solar inverter testing, PV-Simulation
- Car testing systems
- ATE in industrial production lines
- Plasma chambers
- Automotive battery simulations
- Controlled battery (dis)charging
- Lasers
- Sustainable energy
- Driving PWM-Controlled DC motors
- Accurate current sources
- Aerospace and military equipment

## Standard Features



### Bi-Directional Two-Quadrant Output

Full power Bi-Directional two quadrant operation maintains the DC output voltage constant whether the output power is positive or negative. Ideal for PWM-speed controlled DC-Motors and ATE systems.



### Digital CV-, CC- and CP-Settings

Reliable, long-life digital encoders are implemented at the front panel. Includes total front panel lock (also for CV- / CC-knobs) and a coarse or fine pitch adjustment depending on the turning speed.



### Sequencer

Arbitrary Waveform generator or standalone automation.



### High Voltage Isolation

A high DC output isolation allows floating operation up to 1000 V for SM70-CP-450, SM210-CP-150 and SM500-CP-90, and up to 1500 V for SM1500-CP-30.



### Ethernet Interface

Ethernet interface for programming and monitoring



### USB-Input

Not yet available: Front and rear panel USB-Input for exchange of settings and waveforms (Host / Type-A), or for controlling the unit (Device / Type-B).

## Options



### Software control and Interfaces

Field installable interfaces:

- Master / Slave controller
- Isolated Contacts
- Serial controller with multiple protocols: RS 232, RS 485, RS 422 and USB (Device)
- Digital I/O
- Isolated Analog Programming

Order Codes :

- INT MOD M/S-2
- INT MOD CON
- INT MOD SER
- INT MOD DIG
- INT MOD ANA

