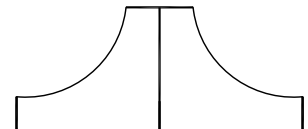




## SM 15K - Series 15kW DC POWER SUPPLIES

### Bi-Directional - Constant Power

Models	Voltage range	Current range
SM 70-CP-450	0 ... 70 V	-450 ... 450 A
SM 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%
- 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	SM500-CP-90	SM1500-CP-30
<b>DC Power terminals</b> voltage current	0 ... 70 V -450 ... 450 A	0 ... 500 V -90 ... 90 A	0 ... 1500 V -30 ... 30 A
<b>AC Input</b> 3 phase, 48 - 62 Hz rated voltage range rated frequency rated current  current (400 V / 3 ph, 15 kW) power factor, 15 kW, 7,5 kW  internal fuses standby AC input power ( $V_o=I_o=0$ ) standby AC input power ( $V_o=V_{max}$ )		342 ... 528 V 380 ... 480 V 50 / 60 Hz maximum 27 A  23 A 0.996, 0.988  30 AT 96 180 W	
<b>Efficiency</b> Sink & Source mode: 400 V AC, 3 ph input, 15 kW, $I_{out}=100\%$ 15 kW, $U_{out}=100\%$		95 % 96 %	
<b>Regulation</b>			
Load 0 - 100% <b>CV</b> Line 342 - 528 V AC <b>CV</b> (external voltage sense)	6 mV < 1 mV	4 mV < 1 mV	10 mV < 1 mV
Load 0 - 100% <b>CC</b> Line 342 - 528 V AC <b>CC</b> (internal voltage sense, after warm-up)	18 mA 4 mA	8 mA 1 mA	2 mA 1 mA
<b>Ripple + noise</b> Source mode: rms (BW=300 kHz) <b>CV</b> p-p (BW=20 MHz) <b>CV</b>  rms (BW=300 kHz) <b>CC</b> p-p (BW=20 MHz) <b>CC</b>  Source mode: rms (BW=300 kHz) <b>CV</b> p-p (BW=20 MHz) <b>CV</b>  rms (BW=300 kHz) <b>CC</b> p-p (BW=20 MHz) <b>CC</b>  Sink mode: rms (BW=300 kHz) <b>CV</b> p-p (BW=20 MHz) <b>CV</b>  rms (BW=300 kHz) <b>CC</b> p-p (BW=20 MHz) <b>CC</b>  Sink mode: rms (BW=300 kHz) <b>CV</b> p-p (BW=20 MHz) <b>CV</b>  rms (BW=300 kHz) <b>CC</b> p-p (BW=20 MHz) <b>CC</b>  <i>CC-ripple at full load</i>	33 V / 450 A 10 mV 60 mV  t.b.d. t.b.d.  70 V / 215 A 10mV 60mV  t.b.d. t.b.d.  33 V / 450 A 8 mV 50 mV  t.b.d. t.b.d.  70 V / 215 A 8 mV 50 mV  t.b.d. t.b.d.	167 V / 90 A 10 mV 55 mV  45 mA 200 mA  500 V / 30 A 25mV 115mV  45 mA 200 mA  167 V / 90 A 7 mV 35 mV  45 mA 200 mA  500 V / 30 A 10 mV 50 mV  90 mA 320 mA	500 V / 30 A 25 mV 150 mV  12 mA 70 mA  1500 V / 10 A 35mV 250mV  5 mA 25 mA  500 V / 30 A 15 mV 130 mV  10 mA 60 mA  1500 V / 10 A 25 mV 200 mV  3 mA 12 mA
<b>Programming &amp; monitoring accuracy</b> (excluding INT MOD ANA) Voltage Current		$\pm 0.08\%$ $\pm 0.15\%$	
<b>Minimum Sink Voltage</b>			
@ Sink current:	1.2 V @ -450 A 0.8 V @ -215 A 0.8 V @ -45 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
<b>Temp. coeff., per °C<sup>1</sup></b> <b>CV</b> <b>CC</b>		$20 \cdot 10^{-6}$ $50 \cdot 10^{-6}$	
<b>Stability<sup>1</sup></b> after 1 hr warm-up during 8 hrs <b>CV</b> <b>CC</b>  $t_{amb} = 25 \pm 1 \text{ °C}$ , $V_{in} = 400 \text{ V AC}$ internal voltage sensing for CC-stab.		$50 \cdot 10^{-6}$ $80 \cdot 10^{-6}$	

Notes: 1. Measured at full load  
2. Signal latency depends on the interface used and data traffic.  
3. See 'Safety Instructions' in the manual.

Programming speed <sup>2</sup> (resistive load)	SM70-CP-450	SM500-CP-90	SM1500-CP-30
<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 → 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 → 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	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	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	560 µF 145 nF	58 µF 145 nF

	SM70-CP-450	SM500-CP-90	SM1500-CP-30
<b>Recovery time</b> output voltage recovery within di/dt of load step time, @ 50 - 100% load step max. deviation	33 V, load step 225 → 450 A 100 mV 5 A/µs 100 µs 0.8 V	167 V, load step 45 → 90 A 750 mV 0.8 A/µs 100 µs 2.8 V	500 V, load step 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, load step 112 → 225 A 100 mV 2 A/µs 100 µs 0.3 V	500 V, load step 15 → 30 A 500 mV 0.25 A/µs 150 µs 1.2 V	1500 V, load step 5 → 10 A 1.2 V 0.085 A/µs 150 µs 3.5 V
<b>Pulsating load</b> max. tolerable AC component of load current f > 1 kHz f < 1 kHz	60 Arms 450 Apeak	15 Arms 90 Apeak	5 Arms 30 Apeak

<b>Insulation</b> AC pwr 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 61000-6-3, residential, light industrial environment (EN 55022 B) EN 61000-6-2, industrial environment	
<b>Operating Temperature at full load</b>	- 20 ... 50 °C derate output to 75% at 60 °C	
<b>Humidity</b>	max. 95 % RH, non condensing, up to 40 °C max. 75 % RH, non condensing, up to 50 °C	
<b>Storage temperature</b>	- 40 ... 85 °C	
<b>Thermal protection</b>	output shuts down in case of insufficient cooling	
<b>MTBF</b>	500 000 hrs	

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

Notes: 1. Measured at full load.  
2. Signal latency depends on the interface used and data traffic.  
3. See 'Safety Instructions' in the manual.

	SM70-CP-450	SM500-CP-90	SM1500-CP-30
<b>Series operation</b> max. total voltage	Not possible	750V* 1000V**	Not possible
Master / Slave operation		maximum 6 units <sup>3</sup>  *) delivered before Q4 / 2018 **) delivered Q4 / 2018 or newer Contact factory for upgrading to 1000V series operation for older units.	
<b>Parallel operation</b> Master / Slave operation	Under development	maximum 20 units contact factory for more units	maximum 20 units contact factory for more units
<b>Remote sensing</b> max. voltage drop per load lead	default 1 V, can be set to 10 V		
<b>Limits</b>			
<b>Voltage</b> adjust range		0 ... 101 %	
<b>Current</b> adjust range		0 ... 101 %	
<b>Power</b> adjust range		0 ... 101 %	
<b>Potentiometers &amp; Encoders</b> front panel control with knobs resolution	15 bits.		
<b>Meters</b>	4 digit	4 digit	4 digit
scale   voltage	0.00 ... 70.00 V	0.0 ... 500.0 V	0.0 ... 1500.0 V
scale   current	-450.0 ... 450.0 A	-90.0 ... 90.0 A	-30.0 ... 30.0 A
scale   power	-15000 ... 15000 W	-15000 ... 15000 W	-15000 ... 15000 W
accuracy read output	0.2% + 2 digit	0.2% + 2 digit	0.2% + 2 digit

<b>Mounting</b>	stacking of units allowed, air flow is from left to right
<b>AC Terminals</b>	screw Terminals for wire 4 mm <sup>2</sup> , 3 phase + earth (no neutral), CON A
<b>DC Terminals</b>	M8 bolts, CON B1 & CON B2
<b>Programming connectors</b>	standard with RJ45-connector for Ethernet at rear panel, LAN
<b>Interlock</b>	input for contact at rear panel, CON F
<b>Cooling</b> audio noise level  airflow	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) <i>no extra depth is required with optional interfaces assembled.</i>
<b>Weight</b>	27 kg

Notes: 1. Measured at full load.  
2. Signal latency depends on the interface used and data traffic.  
3. See 'Safety Instructions' in the manual.

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

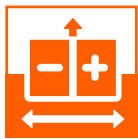
Specifications measured at  
 $T_{amb} = 25 \pm 5 \text{ }^\circ\text{C}$  and  $V_{in} = 400 \text{ VAC}$ ,  
50 Hz, 3 phase, unless otherwise noted.

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

## 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, longlife 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

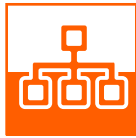
Arbitrary Waveform generator or standalone automation.



### High Voltage Isolation

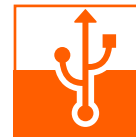
A high DC output isolation allows series operation up to 1000 V for SM70-CP-450 and

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:

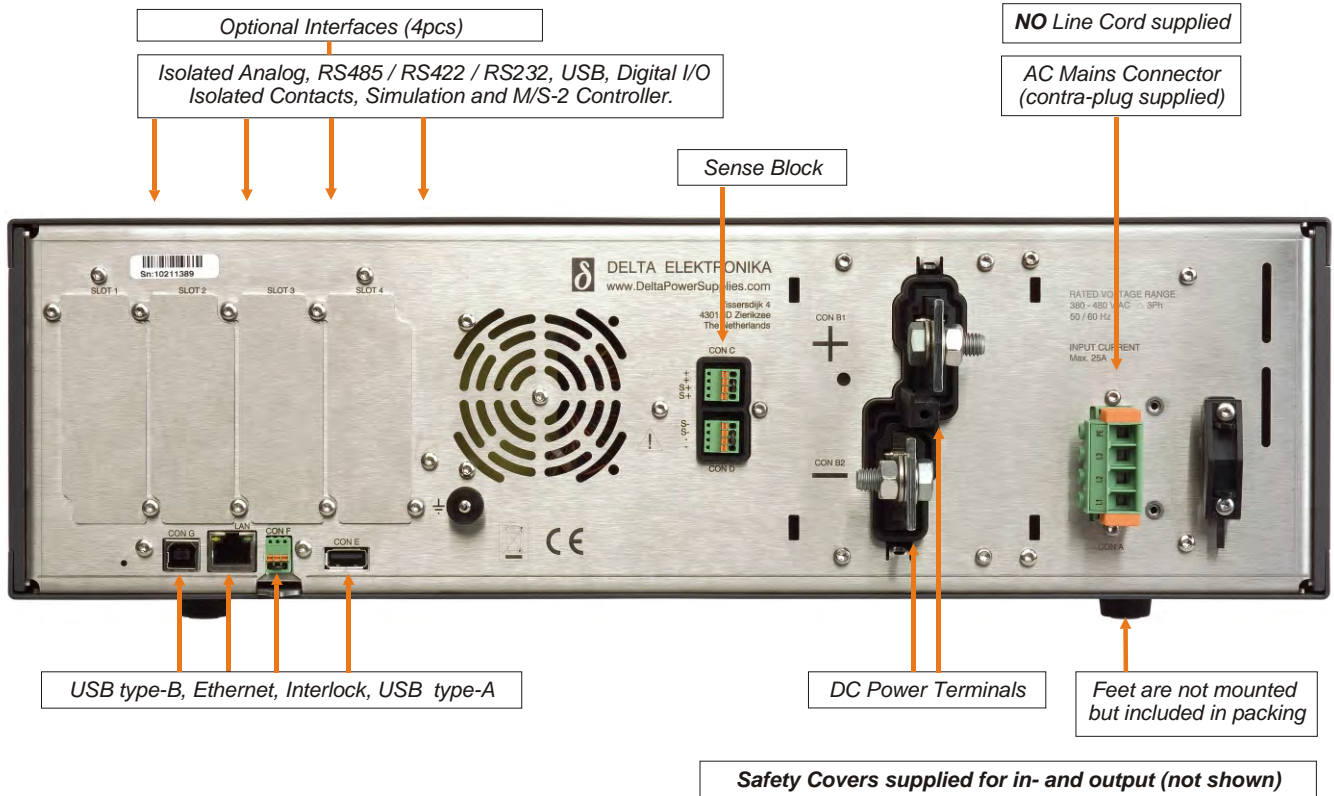
- Master / Slave controller
- Isolated Contacts
- Serial controller with multiple protocols  
RS 232, RS 485, RS 422 and USB (Device)
- Digital I/O
- Isolated Analog Programming

Order Codes :

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

Under development is:

- Simulation Interface



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