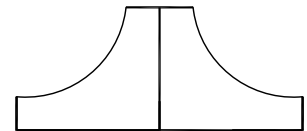




## SM 15K - Series 15kW DC POWER SUPPLIES

### Bi-Directional - Constant Power

Models	Voltage range	Current range
SM 500-CP-90	0 ... 500 V	-90 ... 90 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 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

		SM500-CP-90
<b>DC Power terminals</b>		
voltage		0 ... 500 V
current		-90 ... 90 A
<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		Max. 27 A
current (400 V / 3 ph, 15 kW)		23 A
power factor, 15 kW, 7,5 kW		0.996, 0.988
internal fuses		30 AT
standby AC input power ( $V_o=I_o=0$ )		96 W
standby AC input power ( $V_o=V_{max}$ )		180 W
<b>Efficiency</b>		
Sink & Source mode:		
400 V AC, 3 ph input,		
15 kW, 167 V, 90 A		95 %
15 kW, 500 V, 30 A		96 %
<b>Regulation</b>		
Load 0 - 100%	<b>CV</b>	2 mV
Line 342 - 528 V AC	<b>CV</b>	< 1 mV
(external voltage sense)		
Load 0 - 100%	<b>CC</b>	8 mA
Line 342 - 528 V AC	<b>CC</b>	1 mA
(internal voltage sense, after warm-up)		
<b>Ripple + noise</b>		
Source mode 167 V / 90 A:		
rms (BW=300 kHz)	<b>CV</b>	10 mV
p-p (BW=20 MHz)	<b>CV</b>	55 mV
rms (BW=300 kHz)	<b>CC</b>	45 mA
p-p (BW=20 MHz)	<b>CC</b>	200 mA
Source mode 500 V / 30 A:		
rms (BW=300 kHz)	<b>CV</b>	20 mV
p-p (BW=20 MHz)	<b>CV</b>	100 mV
rms (BW=300 kHz)	<b>CC</b>	45 mA
p-p (BW=20 MHz)	<b>CC</b>	200 mA
Sink mode 167 V / 90 A:		
rms (BW=300 kHz)	<b>CV</b>	7 mV
p-p (BW=20 MHz)	<b>CV</b>	35 mV
rms (BW=300 kHz)	<b>CC</b>	45 mA
p-p (BW=20 MHz)	<b>CC</b>	200 mA
Sink mode 500 V / 30 A:		
rms (BW=300 kHz)	<b>CV</b>	10 mV
p-p (BW=20 MHz)	<b>CV</b>	50 mV
rms (BW=300 kHz)	<b>CC</b>	90 mA
p-p (BW=20 MHz)	<b>CC</b>	320 mA
<i>CC-ripple at full load</i>		
<b>Minimum Sink Voltage</b>		
Sink current:		
-90 A		5.5 V
-30 A		3.0 V
-10 A		1.0 V
<b>Temp. coeff., per °C<sup>1</sup></b>	<b>CV</b>	$20 \cdot 10^{-6}$
	<b>CC</b>	$50 \cdot 10^{-6}$
<b>Stability<sup>1</sup></b>		
after 1 hr warm-up		
during 8 hrs	<b>CV</b>	$50 \cdot 10^{-6}$
	<b>CC</b>	$80 \cdot 10^{-6}$
$t_{amb} = 25 \pm 1 \text{ °C}$ , $V_{in} = 400 \text{ V AC}$ internal voltage sensing for CC-stab.		

- Notes:
1. Measured at full load
  2. Signal latency depends on the interface used and data traffic.
  3. See 'Safety Instructions' in the manual.
  4. The optional interfaces are under development.

<b>Programming speed</b> <sup>2</sup> <i>Standard Version</i> (resistive load)	<b>SM500-CP-90</b>	
<b>Rise time (10 - 90%)</b> output voltage step time, (load = 15 kW) time, (load = 1500 W)  output voltage step time, (load = 15 kW) time, (load = 1500 W)	0 → 167 V 1.5 ms 1 ms  0 → 500 V 4.5 ms 3.5 ms	
<b>Fall time (90 - 10%)</b> output voltage step time, (load = 15 kW) time, (load = 1500 W)  output voltage step time, (load = 15 kW) time, (load = 1500 W)  <b>DC Output Capacitance</b> X-capacitors (typical) Y-capacitors (typical)	167 → 0 V 0.8 ms 0.9 ms  500 → 0 V 2.5 ms 3.5 ms  560 µF 145 nF	
<b>Programming speed</b> <sup>2</sup> <i>High Speed Version</i> (resistive load)	<b>SM500-CP-90</b> <i>Not yet available</i>	
<b>Rise time (10 - 90%)</b> output voltage step time, (load = 15 kW) time, (load = 1500 W)  output voltage step time, (load = 15 kW) time, (load = 1500 W)  Ripple @ full load typical (rms / pp)	0 → ... / ... V ... / ... ms ... / ...ms  ... ... ...  ... mV / ... mV	
<b>Fall time (90 - 10%)</b> output voltage step time, (load = 15 kW) time, (load = 1500 W)  output voltage step time, (load = 15 kW) time, (load = 1500 W)  <b>DC Output Capacitance</b> X-capacitors (typical) Y-capacitors (typical)	... / ... → 0 V ... / ... ms ... / ... ms  ... ... ...  ... µF ... nF	

	<b>SM500-CP-90</b>	
<b>Recovery time</b> output voltage	167 V, load step 45 → 90 A	500 V, load step 15 → 30 A
recovery within	500 mV	500 mV
di/dt of load step	0.8 A/µs	0.25 A/µs
output voltage	167 V	500 V
time, @ 50 - 100% load step	100 µs	150 µs
max. deviation	2.8 V	1 V
<b>Pulsating load</b> max. tolerable AC component of load current f > 1 kHz f < 1 kHz	... Arms ... 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 <sup>3</sup> 1000 V DC <sup>3</sup>
<b>Safety</b>	EN 60950 / EN 61010

Notes: 1. Measured at full load  
2. Signal latency depends on the interface used and data traffic.  
3. See 'Safety Instructions' in the manual.  
4. The optional interfaces are under development.

<b>EMC</b> <b>Generic Emission</b> <b>Generic Immunity</b>	<b>EN 61000-6-3</b> , residential, <b>light</b> industrial environment (EN 55022 B) <b>EN 61000-6-2</b> , 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

	<b>SM500-CP-90</b>
<b>Hold-Up time</b> $V_{out} = 100\%$ , $P_{out} = 15kW$ ... ms $I_{out} = 100\%$ , $P_{out} = 15kW$ ... ms $V_{out} = 100\%$ , $P_{out} = 7.5kW$ ... ms <i>@ 400 V AC input</i>	
<b>Turn on delay</b> after mains switch on	2.5 s
<b>Inrush current</b>	23 A

<b>Series operation</b> max. total voltage Master / Slave operation <sup>4</sup>	1000 V <sup>3</sup> M/S interface is under development
<b>Parallel operation</b> Master / Slave operation <sup>4</sup>	M/S interface is under development
<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 <b>Current</b> adjust range <b>Power</b> adjust range	0 ... 101 % 0 ... 101 % 0 ... 101 %
<b>Potentiometers &amp; Encoders</b> front panel control with knobs resolution	15 bits.
<b>Meters</b> scale    voltage scale    current scale    power accuracy read output	4 digit 0.0 ... 500.0 V –90.0 ... 90.0 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</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. ... dBA at full load, 25 °C ambient temperature, 1 m distance ca. ... 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.  
4. The optional interfaces are under development.

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

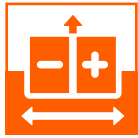
Specifications measured at  
 $T_{amb} = 25 \pm 5 \text{ °C}$  and  $V_{in} = 400 \text{ VAC}$ ,  
50 Hz, 3 phase, unless otherwise noted.

The information in this document is  
subject to change without notice

## Typical Applications

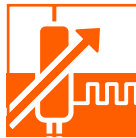
- Solar inverter testing, PV-Simulation
- Car testing systems
- ATE in industrial production lines
- Plasma chambers
- Automotive battery simulations
- Controlled battery (dis)charging
- Lasers
- Sustainable energy
- Driving PWM-Controlled DC motors
- Accurate current sources
- Aerospace and military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



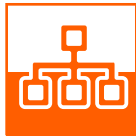
### Sequencer

Arbitrary Waveform generator or standalone automation.



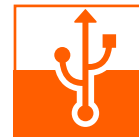
### High Voltage Isolation

A high DC output isolation allows series operation up to 1000 V.



### 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:

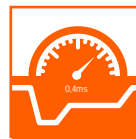
- Digital I/O
- Isolated Contacts
- Serial controller with multiple protocols RS 232, RS 485, RS 422 and USB (Device)

Order Codes :

- INT MOD DIG
- INT MOD CON
- INT MOD SER

Under development are:

- Simulation Interface
- Isolated Analog Programming
- Master / Slave controller



### High Speed Programming

High speed programming is under development.

