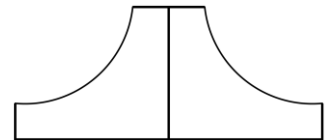




SM15K - Series 15kW DC POWER SUPPLIES

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 | |
|--|--|--|--|--|--|--|
| DC Power terminals voltage range current range Absolute maximum Sink voltage <i>Warning! Higher voltages will damage the unit!</i> Minimum Sink Voltage @ var. sink current: <i>Note that unit switches automatically between Source ↔ Sink.</i> | | 0 - 70 V - 450 - 450 A | 0 - 210 V - 150 - 150 A | 0 - 500 V - 90 - 90 A | 0 - 1500 V - 30 - 30 A | |
| | | ≤ 74 V | ≤ 220 V | ≤ 525 V | ≤ 1575 V | |
| | | 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 | |
| | | | | | | |
| Minimum sink current | | 0.4% | | | | |
| AC Input 3 phase, 48 - 62 Hz rated voltage range rated frequency rated current current (400 V / 3 ph, 15kW) power factor, 15kW, 7.5kW internal fuses standby input power (V _o =I _o =0) standby 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 W 180 W | | | | |
| | | | | | | |
| Efficiency (Sink & Source mode): 400 V AC, 3 ph input, 15 kW, I _{out} =100% 15 kW, U _{out} =100% | | 95 % 96 % | | | | |
| | | | | | | |
| Regulation | | | | | | |
| Load 0 - 100% Line 342 - 528 V AC (external voltage sense) | CV CV | 6 mV < 1 mV | 5 mV < 1 mV | 4 mV < 1 mV | 10 mV < 1 mV | |
| Load 0 - 100% Line 342 - 528 V AC (internal voltage sense, after warm up) | CC CC | 35 mA 4 mA | 12 mA 3 mA | 8 mA 1 mA | 2 mA 1 mA | |
| Ripple + noise (CC-ripple at full load) Source mode: rms (BW=300 kHz) p-p (BW=20 MHz) rms (BW=300 kHz) p-p (BW=20 MHz) Source mode: rms (BW=300 kHz) p-p (BW=20 MHz) rms (BW=300 kHz) p-p (BW=20 MHz) Sink mode: rms (BW=300 kHz) p-p (BW=20 MHz) rms (BW=300 kHz) p-p (BW=20 MHz) Sink mode: rms (BW=300 kHz) p-p (BW=20 MHz) rms (BW=300 kHz) p-p (BW=20 MHz) | CV CV CC CC CV CV CC CC CV CV CC CC | 33 V / 450 A 10 mV 60 mV 100 mA - 70 V / 215 A 10 mV 60 mV 100 mA - 33 V / 450 A 8 mV 50 mV 100 mA - 70 V / 215 A 8 mV 50 mV 100 mA - | 100 V / 150 A 30 mV 150 mV t.b.d. - 210 V / 71.5 A 20 mV 125 mV t.b.d. - 100 V / 150 A 30 mV 150 mV t.b.d. - 210 V / 71.5 A 20 mV 125 mV 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 | |
| | Programming & monitoring accuracy (excluding INT MOD ANA) Voltage Current | | ± 0.08% ± 0.15% | | | |
| | | | | | | |
| | Temp. coeff., per °C Stability ¹ after 1 hr warm-up, during 8 hrs t _{amb} = 25 ± 1 °C, V _{in} = 400 VAC (internal voltage sensing for CC-stab.) | CV CC | 20.10 ⁻⁶ 50.10 ⁻⁶ 50.10 ⁻⁶ 80.10 ⁻⁶ | | | |
| | | | | | | |

Notes: 1. Measured at full load. 2. Signal latency depends on the interface used & data traffic. 3. See "Safety Instructions"

| Programming speed ² <i>Note: Values on resistive load, unit in CV-mode. With other load, or in CC-mode, values can be longer.</i> | SM70-CP-450 | SM210-CP-150 | SM500-CP-90 | SM1500-CP-30 |
|--|------------------------------|-------------------------------|-------------------------------|--------------------------------|
| Rise time (10 - 90%) 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 |
| Fall time (90 - 10%) 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 |
| DC Output Capacitance X-capacitors (typical) Y-capacitors (typical) | 22000 µF 950 nF | 1170 µF 950 nF | 560 µF 145 nF | 58 µF 145 nF |

| | SM70-CP-450 | SM210-CP-150 | SM500-CP-90 | SM1500-CP-30 |
|---|--|--|--|--|
| Recovery time 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> | | | | |
| Pulsating load 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 |

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

| | SM70-CP-450 | SM210-CP-150 | SM500-CP-90 | SM1500-CP-30 |
|---|-------------------------|-------------------------|-------------------------|-------------------------|
| Hold-Up time (@ 400 VAC input) V _{out} = 100%, P _{out} = 15 kW I _{out} = 100%, P _{out} = 15 kW V _{out} = 100%, P _{out} = 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 |
| Turn on delay after mains switch on | 2.5 s | | | |
| Inrush current | 23 A | | | |

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

3. See "Safety Instructions"

| | SM70-CP-450 | SM210-CP-150 | SM500-CP-90 | SM1500-CP-30 |
|---|--|--|--|---|
| Series operation max. total voltage | Not possible | Not possible | 750V* 1000V** | Not possible |
| Master / Slave operation | | | maximum 6 units ³ *) units delivered before Q4 / 2018 **) units delivered Q4 / 2018 or newer Contact factory for upgrading to enable 1000V series operation for older units. | |
| Parallel operation Master / Slave operation | maximum 60 units | | | |
| Remote sensing max. voltage drop per load lead | default 1 V, can be set to 10 V | | | |
| Limits 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) | | | |
| Potentiometers front panel control with knobs resolution | 15 bits | | | |
| Meters 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 |

| | | | |
|--|--|----------|--|
| Mounting | stacking of units allowed, air flow is from left to right | | |
| AC Terminals (CON A) | screw terminals for wire 4 mm ² , 3 phase + earth (no neutral) | | |
| DC Terminals (CON B1 & B2) | M12 bolts | M8 bolts | |
| Programming connectors (LAN) | standard with RJ45-connector for Ethernet at rear panel | | |
| Interlock (CON F) | input for contact at rear panel | | |
| Cooling 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 | | |
| Enclosure degree of protection | IP20 | | |
| Dimensions 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 | | |
| Weight | 27 kg | | |

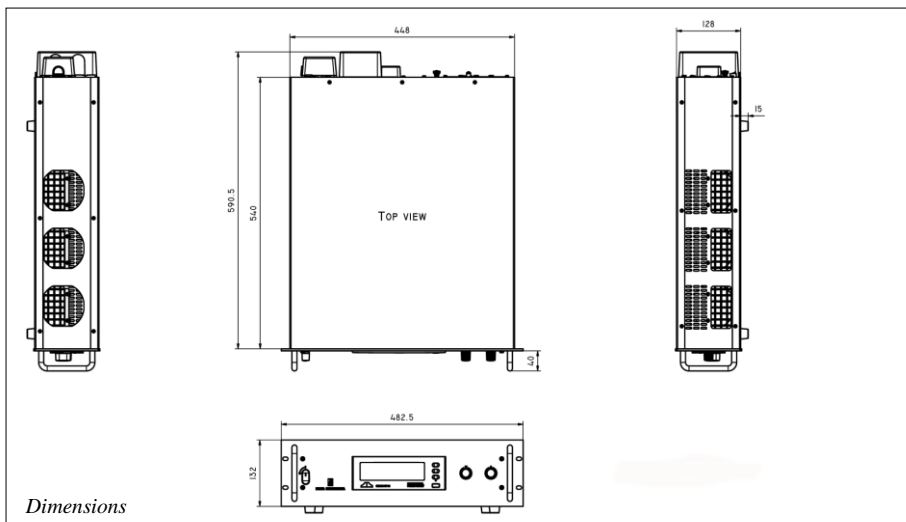
CV = Constant Voltage
 CC = Constant Current
 CP = Constant Power

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

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

