

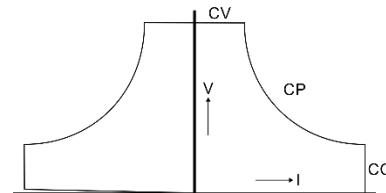


SM15K - Series 15kW DC POWER SUPPLIES



Bi-Directional - Constant Power

Models	Voltage range	Current range
SM70-CP-450	0 – 70 V	-450 – 450 A
SM210-CP-150	0 – 210 V	-150 – 150 A
SM500-CP-90	0 – 500 V	-90 – 90 A
SM1000-CP-45	0 – 1000 V	-45 – 45 A
SM1500-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	SM1000-CP-45	SM1500-CP-30
Output rating					
Voltage range	0 - 70 V	0 - 210 V	0 - 500 V	0 - 1000 V	0 - 1500 V
Current range	-450 - 450 A	-150 - 150 A	-90 - 90 A	-45 - 45 A	-30 - 30 A
Regenerative mode					
Minimum sink voltage	1.2 V @ -450 A	3.0 V @ -150 A	7.0 V @ -90 A	12.0 V @ -45 A	19.5 V @ -30 A
Note: Unit switches automatically between source ↔ sink.	0.8 V @ -215 A	1.5 V @ -75 A	5.0 V @ -30 A	8.5 V @ -15 A	14 V @ -10 A
Absolute maximum sink voltage	0.8 V @ -45 A	1.5 V @ -15 A	2.0 V @ -10 A	2.5 V @ -5 A	4.5 V @ -3 A
Minimum sink current	74 V	220 V	525 V	1050 V	1575 V
0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
AC Input					
Rated voltage range			380 - 480 V		
Rated frequency			50 / 60 Hz		
Rated current			Maximum 27 A		
Current, 15kW			23 A		
Power factor, 15kW / 7.5kW			0.996 / 0.988		
Internal fuses			30 AT		
Standby input power ($V_o=I_o=0$) ¹			100 W		
Standby input power ($V_o=V_{max}$) ¹			180 W		
Efficiency (Sink & Source mode):					
15 kW, $I_{out}=100\%$			95 %		
15 kW, $U_{out}=100\%$			96 %		
Regulation					
Load 0 - 100%	CV	6 mV	5 mV	4 mV	10mV
Line 342 - 528 V _{AC} ²	CV	< 1 mV	< 1 mV	< 1 mV	<1mV
Load 0 - 100%	CC	35 mA	12 mA	8 mA	2mA
Line 342 - 528 V _{AC} ^{1,3}	CC	4 mA	3 mA	1 mA	1mA
Ripple + noise ⁵					
Source mode:					
rms (BW=300 kHz)	CV	33 V / 450 A	100 V / 150 A	167 V / 90 A	333V / 45A
p-p (BW=20 MHz)	CV	10 mV 60 mV	30 mV 150 mV	10 mV 55 mV	25mV 150mV
rms (BW=300 kHz)	CC	100 mA	-	45 mA	45mA
p-p (BW=20 MHz)	CC	-	-	200 mA	200mA
rms (BW=300 kHz)	CV	70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1000V / 15A
p-p (BW=20 MHz)	CV	10 mV 60 mV	20 mV 125 mV	25mV 115mV	35mV 250mV
rms (BW=300 kHz)	CC	100 mA	-	45 mA	45mA
p-p (BW=20 MHz)	CC	-	-	200 mA	200mA
Sink mode:					
rms (BW=300 kHz)	CV	33 V / 450 A	100 V / 150 A	167 V / 90 A	333V / 45A
p-p (BW=20 MHz)	CV	8 mV 50 mV	30 mV 150 mV	7 mV 35 mV	15mV 75mV
rms (BW=300 kHz)	CC	100 mA	-	45 mA	60mA
p-p (BW=20 MHz)	CC	-	-	200 mA	-
rms (BW=300 kHz)	CV	70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1000V / 15A
p-p (BW=20 MHz)	CV	8 mV 50 mV	20 mV 125 mV	10 mV 50 mV	25mV 125mV
rms (BW=300 kHz)	CC	100 mA	-	90 mA	60mA
p-p (BW=20 MHz)	CC	-	-	320 mA	-
Programming & monitoring accuracy ⁴					
Voltage				± 0.08%	
Current				± 0.15%	
Temperature coefficient, per °C ^{1,5}					
	CV			20 ppm	
	CC			50 ppm	
Stability over 8 hours ^{1,5}	CV			50 ppm	
$25 \pm 1 \text{ }^{\circ}\text{C}$	CC ³			80 ppm	

¹ After 1 hour warm up² Remote voltage sense³ Local voltage sense⁴ Excluding INT MOD ANA⁵ Measured at full load

	SM70-CP-450	SM210-CP-150	SM500-CP-90	SM1000-CP-45	SM1500-CP-30
Programming speed^{6, 7}					
Rise time (10 - 90%)					
Output voltage step Load = 15 kW	0 → 33 V 2.2 ms	0 → 100 V 1.6 ms	0 → 167 V 1.5 ms	0 → 333 V 1.5 ms	0 → 500 V 1.5 ms
Load = 1500 W	1.5 ms	1.3 ms	1 ms	1 ms	1 ms
Output voltage step Load = 15 kW	0 → 70 V 5.5 ms	0 → 210 V 3 ms	0 → 500 V 4.5 ms	0 → 1000 V 4.5 ms	0 → 1500 V 4.5 ms
Load = 1500 W	3.5 ms	2.7 ms	3.5 ms	3.5 ms	3.5 ms
Fall time (90 - 10%)					
Output voltage step Load = 15 kW	33 → 0 V 1.5 ms	100 → 0 V 1.3 ms	167 → 0 V 0.8 ms	333 → 0 V 0.9 ms	500 → 0 V 0.8 ms
Load = 1500 W	1.5 ms	1.3 ms	0.9 ms	1.0 ms	0.9 ms
Output voltage step Load = 15 kW	70 → 0 V 2.6 ms	210 → 0 V 2.5 ms	500 → 0 V 2.5 ms	1000 → 0 V 2.8 ms	1500 → 0 V 2.8 ms
Load = 1500 W	3.5 ms	2.5 ms	3.5 ms	3.5 ms	3.5 ms
Recovery time^{8, 9}					
Condition Recovery within di/dt of load step	33V, 225 → 450A 100 mV 5 A/μs	100V, 75 → 150A 500 mV 2.4 A/μs	167V, 45 → 90A 750 mV 0.8 A/μs	333V, 22.5 → 45A 100 μs 0.4 A/μs	500V, 15 → 30A 2.5 V 0.25 A/μs
Time	100 μs	100 μs	100 μs	100 μs	100 μs
Maximum deviation	0.8 V	1.4 V	2.8 V	9.0 V	9.0 V
Condition Recovery within di/dt of load step	70V, 112 → 215A 100 mV 2 A/μs	210V, 36 → 72A 250 mV 1.15 A/μs	500V, 15 → 30A 500 mV 0.25 A/μs	1000V, 7.5 → 15A 1 V 0.15 A/μs	1500V, 5 → 10A 1.2 V 0.085 A/μs
Time	100 μs	100 μs	150 μs	150 μs	150 μs
Maximum deviation	0.3 V	0.75 V	1.2 V	3.0 V	3.5 V
DC output capacitance					
X-capacitors (typical)	22000 μF	1170 μF	560 μF	141 μF	58 μF
Y-capacitors (typical)	950 nF	950 nF	145 nF	145 nF	145 nF
Output impedance¹⁰					
0-1 kHz	CV	< 0.75 mΩ	< 5 mΩ	< 16 mΩ	< 150 mΩ
1-100 kHz	CV	< 40 mΩ	< 40 mΩ	< 160 mΩ	< 800 mΩ
< 250 mΩ					
< 2 Ω					
Pulsating load					
Max. tolerable AC component of load current					
f > 1 kHz					
f < 1 kHz	60 A _{RMS} 450 A _{pk}	15 A _{RMS} 150 A _{pk}	15 A _{RMS} 90 A _{pk}	3 A _{RMS} 45 A _{pk}	2.5 A _{RMS} 30 A _{pk}
Hold-up time					
V _{out} = 100%, P _{out} = 15 kW		10 ms	10 ms	15 ms	15 ms
I _{out} = 100%, P _{out} = 15 kW		10 ms	10 ms	15 ms	15 ms
V _{out} = 100%, P _{out} = 7.5 kW		25 ms	20 ms	35 ms	35 ms
Turn on delay¹¹		2.5 s after mains switch is turned on, the rated output voltage is reached			
Inrush current¹⁰		23 A			
Safety standards		EN 60950 / EN 61010			
Insulation					
AC / DC terminals		3750V _{RMS} (1 min.) 8 mm			3750 V _{RMS} (1 min.) 8 mm
Creepage / clearance		2500 V _{RMS}			2500 V _{RMS}
AC power terminals / case		1000 V _{DC} ¹²			1500 V _{DC} ¹²
DC power terminals / case					
EMC		EN 61326-1, class B equipment(for use in domestic establishments) EN 61326-1, equipment for use in industrial and domestic establishments			
Environmental conditions					
Storage temperature		-40 to + 70 °C			
Operating temperature		-20 to + 50 °C, Derate output to 75% at 60 °C			
Output automatically disabled at overtemperature					
Humidity		Maximum 95% RH, non-condensing, up to 40 °C Maximum 75% RH, non-condensing, up to 50 °C			
IP Rating		IP20			
Pollution degree		2			
MTBF		500 000 hrs			

⁶ Measured on resistive load with power supply in CV mode, different conditions may influence the specified speed⁷ Signal latency depends on the interface used & data traffic⁸ Local voltage sense⁹ Remote sensing and long wiring may influence the values¹⁰ Typical¹¹ Unit should be configured to switch on the output at startup¹² See "Safety Instructions"

	SM70-CP-450	SM210-CP-150	SM500-CP-90	SM1000-CP-45	SM1500-CP-30
Series operation Maximum total voltage Master / slave operation		Series operation not allowed	750V ¹³ 1000V ¹⁴ Maximum 6 units ¹⁵		Series operation not allowed
Parallel operation Master / slave operation				Maximum 60 units	
Remote sensing Maximum voltage drop per load lead				Default 1 V, can be set to 10 V	
Limits Adjustable Voltage Current Power			0 - 101 %	0 - 101 %	0 - 101 %
Fixed Voltage OverLoad level Voltage Self-Protection level			102.5 % - unit will continue to operate (OL-indication in display) 105 % - output is automatically disabled (PROT-indication in display)		
Potentiometers Front panel control knob resolution			15 bits		
Meter scale Voltage Current Power Accuracy read output	4 digits 0.00 - 70.00V -450.0 - 450.0A -15000 - 15000W 0.2% + 2 digit	4 digits 0.0 - 210.0V -150.0 - 150.0A -15000 - 15000W 0.2% + 2 digit	4 digits 0.0 - 500.0V -90.0 - 90.0A -15000 - 15000W 0.2% + 2 digit	4 digits 0 - 1000V -45.00 - 45.00A -15000 - 15000W 0.2% + 2 digit	4 digits 0 - 1500V -30.00 - 30.00A -15000 - 15000W 0.2% + 2 digit
Mounting			Stacking of units allowed		
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, 100 Mb/s, full-duplex		
Interlock (CON F)			Input for contact at rear panel		
Cooling Audio noise level Airflow direction Thermal protection		Low noise, 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 Output shuts down in case of insufficient cooling (over temperature indication in display)			
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) <i>No additional depth is required with optional interfaces assembled</i>			
Weight		27 kg			

CV = Constant Voltage

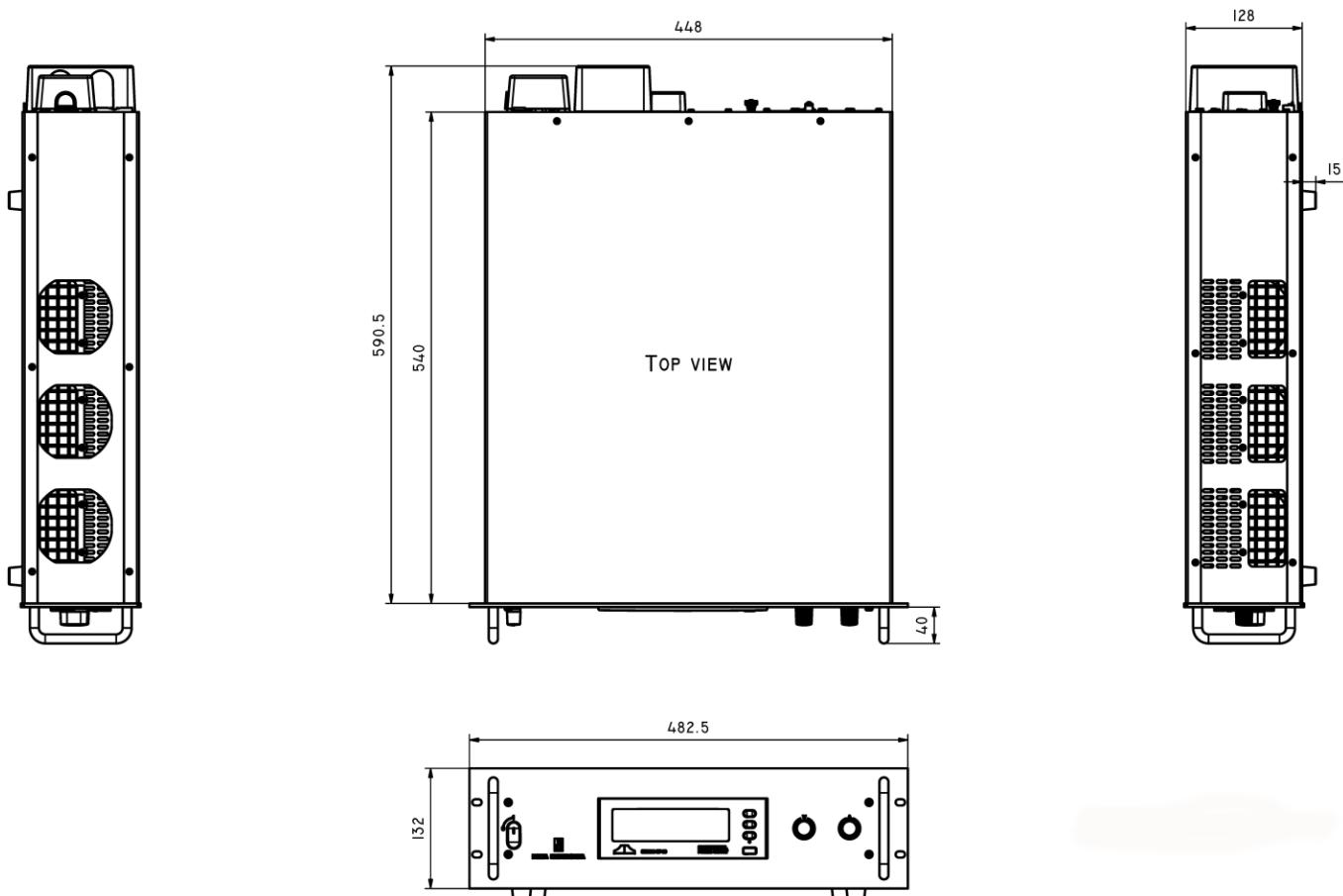
CC = Constant Current

CP = Constant Power

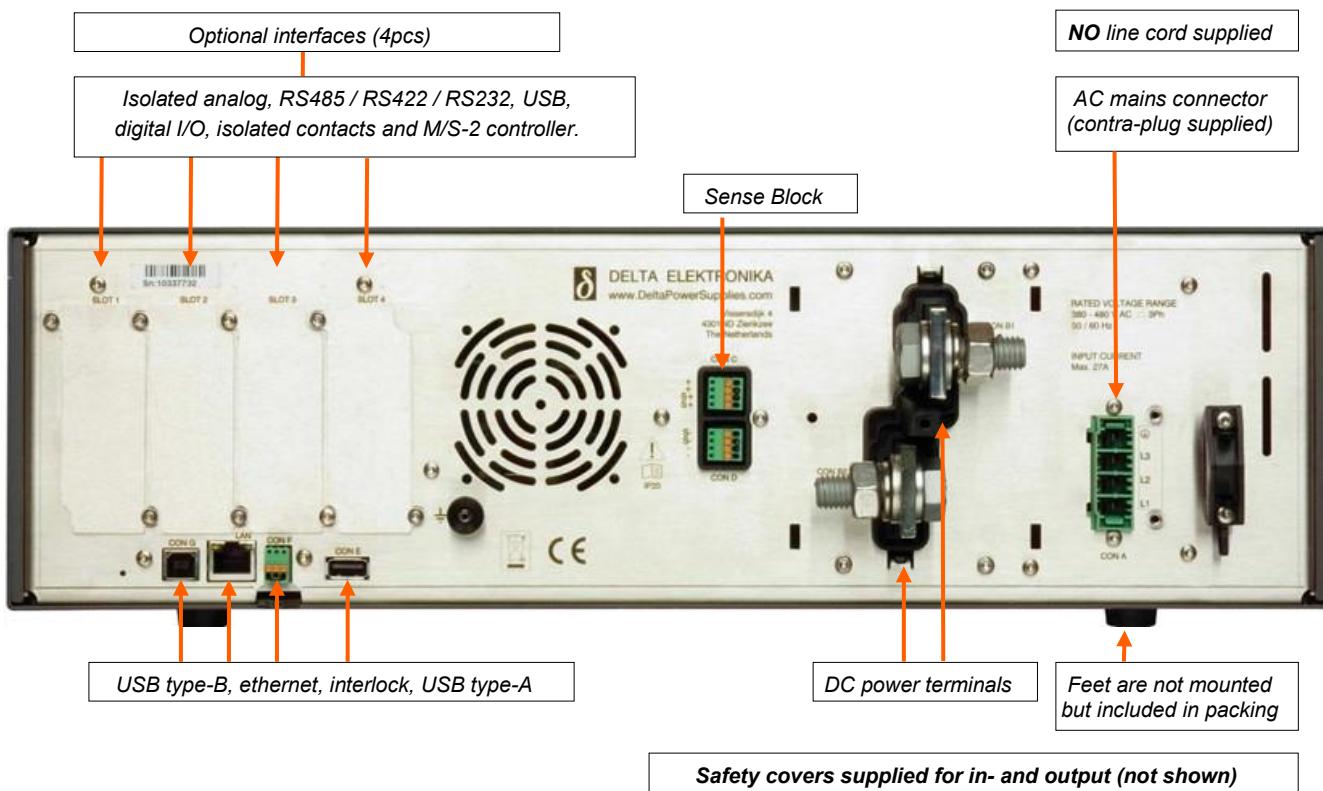
Specifications measured at $T_{amb} = 25 \pm 5$ °C and $Vin = 400$ V_{AC}, 3 phase, 50 Hz unless otherwise noted. The information in this document is subject to change without notice.

¹³ Units delivered before Q4 / 2018. Contact factory for upgrading to enable 1000V series operation for older units.¹⁴ Units delivered in Q4 / 2018 or later.¹⁵ See "Safety Instructions"

Dimensions



Rear view



Typical Applications

- PV-Simulation and inverter testing
- Car testing systems
- ATE in industrial production lines
- Plasma chambers
- Automotive battery simulations
- Controlled battery (dis)charging
- Lasers
- Sustainable energy
- PWM-controlled DC motor testing
- Accurate current sources
- Aerospace
- Military

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- and CC-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.



High Voltage Isolation

A high DC output isolation allows floating operation up to 1000 V for SM70-CP-450, SM210-CP-150, SM500-CP-90 and SM1000-CP-45 and up to 1500 V for SM1500-CP-30.



Sequencer

Arbitrary Waveform generator or standalone automation.



Ethernet Interface

Ethernet interface for programming and monitoring



USB-Input

Feature not yet available.
Front and rear panel USB inputs (Host / Type-A) are planned for the exchange of settings and waveforms. A web interface is available for uploading sequences.

Interfaces



Plug-and-play extension modules

Interfacing and functional capabilities of the power supply can be extended at any time by inserting modules. Four slots are available at the rear of the power supply unit. Consult the [interfaces data sheet](#) for more information.

Modules:

- **Analog programming**
(INT MOD ANA)
High speed and accuracy
- **Anybus carrier**
(INT MOD ANY)
Carrier for Anybus CompactCom 40 fieldbus modules:
CANopen, EtherCAT, Ethernet/IP, Modbus-TCP, POWERLINK, PROFIBUS, PROFINET
- **Digital I/O**
(INT MOD DIG)
Interacts with sequencer
- **Isolated contacts**
(INT MOD CON)
Relay and interlock contacts
- **Serial communication**
(INT MOD SER)
RS232, RS485, RS422, USB
- **Master/Slave**
(INT MOD M/S-2)
Series/parallel output configuration

Where to buy?

Visit our [website to request a quote](#), free of charge.

Alternatively, contact us directly or get in touch with one of our
[authorized distributors](#).

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