DELTA ELEKTRONIKA B.V.
DC POWER SUPPLIES

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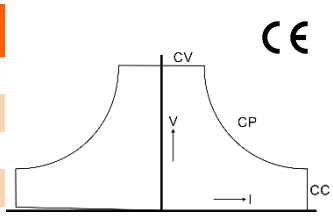
SM15K - Series 15kW DC POWER SUPPLIES

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
		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
Absolute maximum sink voltage		74 V	220 V	525 V	1050 V	1575 V
Minimum sink current		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	10 mV
Line 342 - 528 V_{AC} [2]	**CV**	< 1 mV	< 1 mV	< 1 mV	<1mV	< 1 mV
Load 0 - 100%	**CC**	35 mA	12 mA	8 mA	2mA	2 mA
Line 342 - 528 V_{AC} [1, 3]	**CC**	4 mA	3 mA	1 mA	1mA	1 mA
Ripple + noise [5]						
Source mode:		33 V / 450 A	100 V / 150 A	167 V / 90 A	333V / 45A	500 V / 30 A
rms (BW=300 kHz)	**CV**	10 mV	30 mV	10 mV	25mV	25 mV
p-p (BW=20 MHz)	**CV**	60 mV	150 mV	55 mV	150mV	150 mV
rms (BW=300 kHz)	**CC**	100 mA	-	45 mA	45mA	12 mA
p-p (BW=20 MHz)	**CC**	-	-	200 mA	200mA	70 mA
		70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1000V / 15A	1500 V / 10 A
rms (BW=300 kHz)	**CV**	10 mV	20 mV	25mV	35mV	35mV
p-p (BW=20 MHz)	**CV**	60 mV	125 mV	115mV	250mV	250mV
rms (BW=300 kHz)	**CC**	100 mA	-	45 mA	45mA	5 mA
p-p (BW=20 MHz)	**CC**	-	-	200 mA	200mA	25 mA
Sink mode:		33 V / 450 A	100 V / 150 A	167 V / 90 A	333V / 45A	500 V / 30 A
rms (BW=300 kHz)	**CV**	8 mV	30 mV	7 mV	15mV	15 mV
p-p (BW=20 MHz)	**CV**	50 mV	150 mV	35 mV	75mV	130 mV
rms (BW=300 kHz)	**CC**	100 mA	-	45 mA	60mA	10 mA
p-p (BW=20 MHz)	**CC**	-	-	200 mA	-	60 mA
		70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1000V / 15A	1500 V / 10 A
rms (BW=300 kHz)	**CV**	8 mV	20 mV	10 mV	25mV	25 mV
p-p (BW=20 MHz)	**CV**	50 mV	125 mV	50 mV	125mV	200 mV
rms (BW=300 kHz)	**CC**	100 mA	-	90 mA	60mA	3 mA
p-p (BW=20 MHz)	**CC**	-	-	320 mA	-	12 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 ± 1 °C	**CC** [3]			80 ppm		

[1] *After 1 hour warm up*
[2] *Remote voltage sense*
[3] *Local voltage sense*
[4] *Excluding INT MOD ANA*
[5] *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	0 → 33 V	0 → 100 V	0 → 167 V	0 → 333 V	0 → 500 V
Load = 15 kW	2.2 ms	1.6 ms	1.5 ms	1.5 ms	1.5 ms
Load = 1500 W	1.5 ms	1.3 ms	1 ms	1 ms	1 ms
Output voltage step	0 → 70 V	0 → 210 V	0 → 500 V	0 → 1000 V	0 → 1500 V
Load = 15 kW	5.5 ms	3 ms	4.5 ms	4.5 ms	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	33 → 0 V	100 → 0 V	167 → 0 V	333 → 0 V	500 → 0 V
Load = 15 kW	1.5 ms	1.3 ms	0.8 ms	0.9 ms	0.8 ms
Load = 1500 W	1.5 ms	1.3 ms	0.9 ms	1.0 ms	0.9 ms
Output voltage step	70 → 0 V	210 → 0 V	500 → 0 V	1000 → 0 V	1500 → 0 V
Load = 15 kW	2.6 ms	2.5 ms	2.5 ms	2.8 ms	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	33V, 225 → 450A	100V, 75 → 150A	167V, 45 → 90A	333V, 22.5 → 45A	500V, 15 → 30A
Recovery within	100 mV	500 mV	750 mV	2.5 V	2.8 V
di/dt of load step	5 A/µs	2.4 A/µs	0.8 A/µs	0.4 A/µs	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	70V, 112 → 215A	210V, 36 → 72A	500V, 15 → 30A	1000V, 7.5 → 15A	1500V, 5 → 10A
Recovery within	100 mV	250 mV	500 mV	1 V	1.2 V
di/dt of load step	2 A/µs	1.15 A/µs	0.25 A/µs	0.15 A/µs	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 impedance [10]					
0-1 kHz **CV**	< 0.75 mΩ	< 5 mΩ	< 16 mΩ	< 150 mΩ	< 250 mΩ
1-100 kHz **CV**	< 40 mΩ	< 40 mΩ	< 160 mΩ	< 800 mΩ	< 2 Ω
Pulsating load					
Max. tolerable AC component of load current					
f > 1 kHz	60 A_{RMS}	15 A_{RMS}	15 A_{RMS}	3 A_{RMS}	2.5 A_{RMS}
f < 1 kHz	450 A_{pk}	150 A_{pk}	90 A_{pk}	45 A_{pk}	30 A_{pk}
Hold-up time					
V_{out} = 100%, P_{out} = 15 kW	10 ms	10 ms	15 ms	15 ms	15 ms
I_{out} = 100%, P_{out} = 15 kW	10 ms	10 ms	15 ms	15 ms	15 ms
V_{out} = 100%, P_{out} = 7.5 kW	25 ms	20 ms	35 ms	35 ms	35 ms
Turn on delay [11]	2.5 s after mains switch is turned on, the rated output voltage is reached				
Inrush current [10]	23 A				
Safety standards	EN 60950 / EN 61010				
Insulation					
AC / DC terminals	3750V_{RMS} (1 min.)				3750 V_{RMS} (1 min.)
Creepage / clearance	8 mm				8 mm
AC power terminals / case	2500 V_{RMS}				2500 V_{RMS}
DC power terminals / case	1000 V_{DC} [12]				1500 V_{DC} [12]
EMC					
Emission	**EN 61326-1,** class B equipment(for use in domestic establishments)				
Immunity	**EN 61326-1,** equipment for use in industrial and domestic establishments				
Environmental conditions					
Storage temperature	– 40 to + 70 °C				
Operating temperature *Output automatically disabled at overtemperature*	– 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				
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 speed*
[7] *Signal latency depends on the interface used & data traffic*
[8] *Local voltage sense*
[9] *Remote sensing and long wiring may influence the values*
[10] *Typical*
[11] *Unit should be configured to switch on the output at startup*
[12] *See "Safety Instructions"*

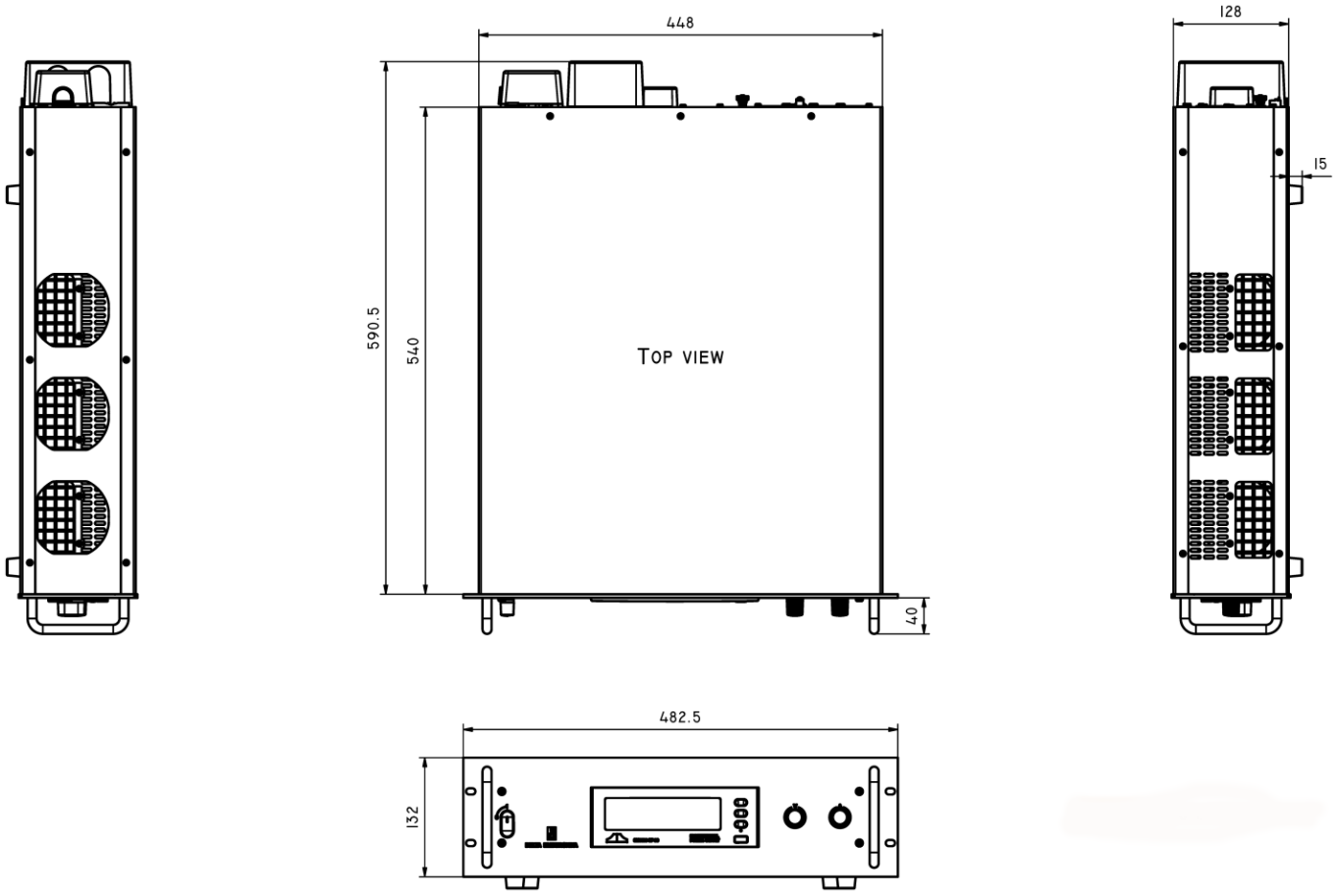
	SM70-CP-450	SM210-CP-150	SM500-CP-90	SM1000-CP-45	SM1500-CP-30
Series operation Maximum total voltage Master / slave operation	Series operation not allowed		750V [13] 1000V [14] Maximum 6 units[15]	Series operation not allowed	
Parallel operation Master / slave operation	Maximum 60 units				
Remote sensing Maximum voltage drop per load lead	Default 1 V, can be set to 10 V				
Limits Adjustable Voltage Current Power Fixed 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 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) *No additional depth is required with optional interfaces assembled*				
Weight	27 kg				

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

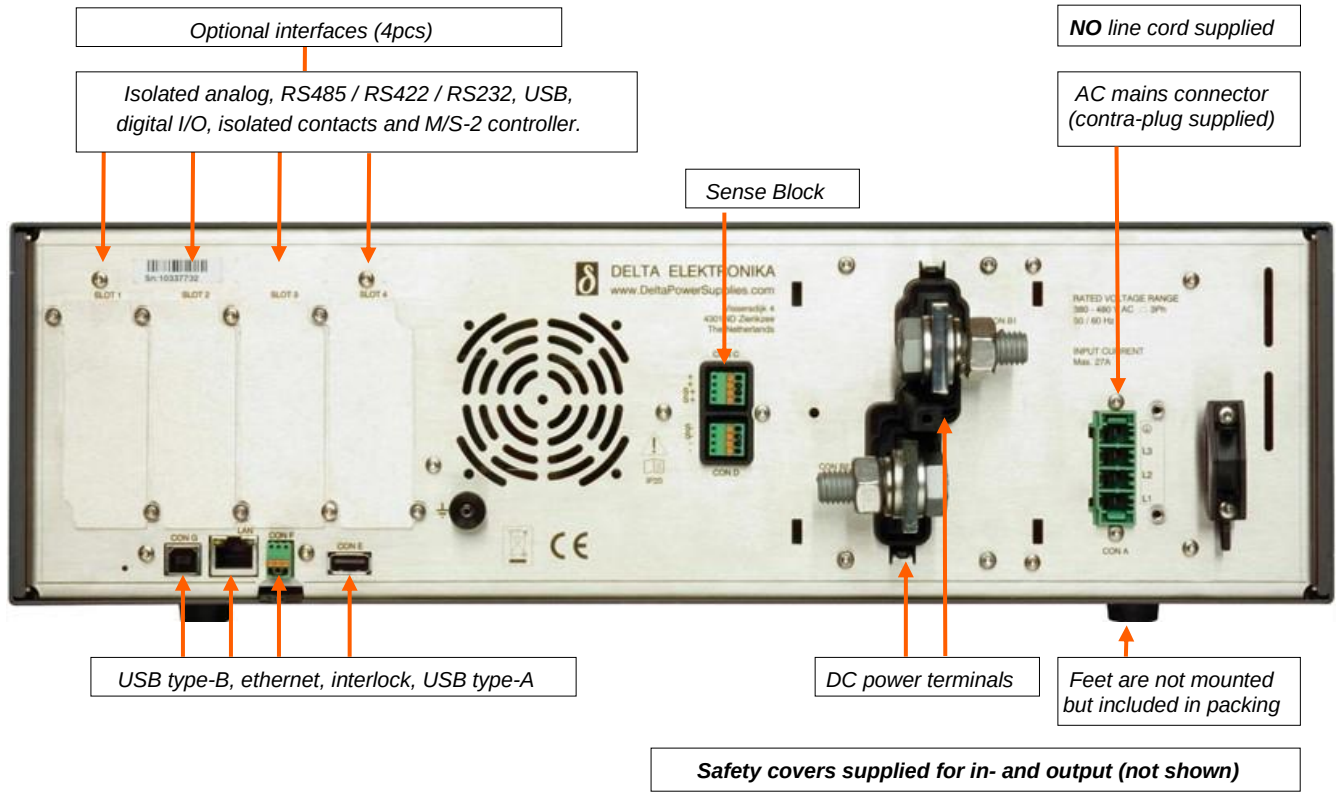
Specifications measured at T_{amb} = 25 ± 5 °C and Vin = 400 V_{AC}, 3 phase, 50 Hz unless otherwise noted. The information in this document is subject to change without notice.

[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 interface**
  (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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