DELTA ELEKTRONIKA B.V.
DC POWER SUPPLIES

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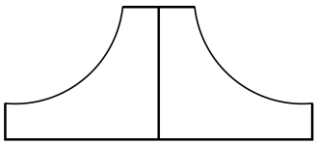
SM15K - Series 15kW DC POWER SUPPLIES

Bi-Directional - Constant Power

Models	Voltage range	Current range
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

	SM 70-CP-450	SM 210-CP-150	SM 500-CP-90	SM 1500-CP-30
DC Power terminals				
voltage range	0 - 70 V	0 - 210 V	0 - 500 V	0 - 1500 V
current range	– 450 - 450 A	– 150 - 150 A	– 90 - 90 A	– 30 - 30 A
Absolute maximum Sink voltage ***Warning!** Higher voltages will damage the unit!*	≤ 74 V	≤ 220 V	≤ 525 V	≤ 1575 V
Minimum Sink Voltage @ var. sink current: *Note that unit switches automatically between Source <-> Sink.*	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
AC Input				
3 phase, 48 - 62 Hz	342 - 528 V			
rated voltage range	380 - 480 V			
rated frequency	50 / 60 Hz			
rated current	maximum 27 A			
current (400 V / 3 ph, 15kW)	23 A			
power factor, 15kW, 7.5kW	0.996 / 0.988			
internal fuses	30 AT			
standby input power (V_o=I_o=0)	96 W			
standby input power (V_o=V_{max})	180 W			
Efficiency *(Sink & Source mode):*				
400 V AC, 3 ph input,				
15 kW, I_{out}=100%	95 %			
15 kW, U_{out}=100%	96 %			
Regulation				
Load 0 - 100% **CV**	6 mV	5 mV	4 mV	10 mV
Line 342 - 528 V AC **CV**	< 1 mV	< 1 mV	< 1 mV	< 1 mV
(external voltage sense)				
Load 0 - 100% **CC**	35 mA	12 mA	8 mA	2 mA
Line 342 - 528 V AC **CC**	4 mA	3 mA	1 mA	1 mA
(internal voltage sense, after warm up)				
Ripple + noise *(CC-ripple at full load)*				
Source mode:	33 V / 450 A	100 V / 150 A	167 V / 90 A	500 V / 30 A
rms (BW=300 kHz) **CV**	10 mV	30 mV	10 mV	25 mV
p-p (BW=20 MHz) **CV**	60 mV	150 mV	55 mV	150 mV
rms (BW=300 kHz) **CC**	100 mA	t.b.d.	45 mA	12 mA
p-p (BW=20 MHz) **CC**	-	-	200 mA	70 mA
Source mode:	70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1500 V / 10 A
rms (BW=300 kHz) **CV**	10 mV	20 mV	25mV	35mV
p-p (BW=20 MHz) **CV**	60 mV	125 mV	115mV	250mV
rms (BW=300 kHz) **CC**	100 mA	t.b.d.	45 mA	5 mA
p-p (BW=20 MHz) **CC**	-	-	200 mA	25 mA
Sink mode:	33 V / 450 A	100 V / 150 A	167 V / 90 A	500 V / 30 A
rms (BW=300 kHz) **CV**	8 mV	30 mV	7 mV	15 mV
p-p (BW=20 MHz) **CV**	50 mV	150 mV	35 mV	130 mV
rms (BW=300 kHz) **CC**	100 mA	t.b.d.	45 mA	10 mA
p-p (BW=20 MHz) **CC**	-	-	200 mA	60 mA
Sink mode:	70 V / 215 A	210 V / 71.5 A	500 V / 30 A	1500 V / 10 A
rms (BW=300 kHz) **CV**	8 mV	20 mV	10 mV	25 mV
p-p (BW=20 MHz) **CV**	50 mV	125 mV	50 mV	200 mV
rms (BW=300 kHz) **CC**	100 mA	t.b.d.	90 mA	3 mA
p-p (BW=20 MHz) **CC**	-	-	320 mA	12 mA
Programming & monitoring accuracy *(excluding INT MOD ANA)*				
Voltage	± 0.08%			
Current	± 0.15%			
Temp. coeff., per °C **CV**	20.10^{-6}			
CC	50.10^{-6}			
Stability [1]				
after 1 hr warm-up, during 8 hrs **CV**	50.10^{-6}			
CC	80.10^{-6}			
t_{amb} = 25 ± 1 °C, V_{in} = 400 VAC (internal voltage sensing for CC-stab.)				

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

Programming speed [2] *Note: Values on **resistive load**, unit in **CV-mode**.* *With other load, or in CC-mode, values can be longer.*	**SM 70-CP-450**	**SM 210-CP-150**	**SM 500-CP-90**	**SM 1500-CP-30**
Rise time (10 - 90%)				
output voltage step	0 → 33 V	0 → 100 V	0 → 167 V	0 → 500 V
time, (load = 15 kW)	2.2 ms	1.6 ms	1.5 ms	1.5 ms
time, (load = 1500 W)	1.5 ms	1.3 ms	1 ms	1 ms
output voltage step	0 → 70 V	0 → 210 V	0 → 500 V	0 → 1500 V
time, (load = 15 kW)	5.5 ms	3 ms	4.5 ms	4.5 ms
time, (load = 1500 W)	3.5 ms	2.7 ms	3.5 ms	3.5 ms
Fall time (90 - 10%)				
output voltage step	33 → 0 V	100 → 0 V	167 → 0 V	500 → 0 V
time, (load = 15 kW)	1.5 ms	1.3 ms	0.8 ms	0.8 ms
time, (load = 1500 W)	1.5 ms	1.3 ms	0.9 ms	0.9 ms
output voltage step	70 → 0 V	210 → 0 V	500 → 0 V	1500 → 0 V
time, (load = 15 kW)	2.6 ms	2.5 ms	2.5 ms	2.8 ms
time, (load = 1500 W)	3.5 ms	2.5 ms	3.5 ms	3.5 ms
DC Output Capacitance				
X-capacitors (typical)	22000 µF	1170 µF	560 µF	58 µF
Y-capacitors (typical)	950 nF	950 nF	145 nF	145 nF

	SM 70-CP-450	**SM 210-CP-150**	**SM 500-CP-90**	**SM 1500-CP-30**
Recovery time output voltage	33 V, 225 → 450 A	100 V, 75 → 150 A	167 V, 45 → 90 A	500 V, 15 → 30 A
recovery within	100 mV	500 mV	750 mV	2.8 V
di/dt of load step	5 A/µs	2.4 A/µs	0.8 A/µs	0.25 A/µs
time, @ 50 - 100% load step	100 µs	100 µs	100 µs	100 µs
max. deviation	0.8 V	1.4 V	2.8 V	9.0 V
output voltage	70 V, 112 → 215 A	210V, 36 → 72 A	500 V, 15 → 30 A	1500 V, 5 → 10 A
recovery within	100 mV	250 mV	500 mV	1.2 V
di/dt of load step	2 A/µs	1.15 A/µs	0.25 A/µs	0.085 A/µs
time, @ 50 - 100% load step	100 µs	100 µs	150 µs	150 µs
max. deviation	0.3 V	0.75 V	1.2 V	3.5 V
*Note: Values are with **Local Sensing**.* *With Remote Sensing + long cables, values can be different.*				
Pulsating load				
max. tolerable AC component of load current				
f > 1 kHz	60 Arms	15 Arms	15 Arms	5 Arms
f < 1 kHz	450 Apeak	150 Apeak	90 Apeak	30 Apeak

Insulation		
AC power terminals / DC pwr terminals	3750 Vrms (1 min.)	3750 Vrms (1 min.)
creepage / clearance	8 mm	8 mm
AC power terminals / case	2500 Vrms	2500 Vrms
DC power terminals / case	1000 V DC [3]	1500 V DC [3]
Safety	EN 60950 / EN 61010	
EMC Generic Emission **Generic Immunity**	**EN 61000-6-3,** residential, **light** industrial environment (EN 55022 **B**) **EN 61000-6-2,** industrial environment	
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	

	SM 70-CP-450	**SM 210-CP-150**	**SM 500-CP-90**	**SM 1500-CP-30**
Hold-Up time (@ 400 VAC input)				
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 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"

	SM 70-CP-450	SM 210-CP-150	SM 500-CP-90	SM 1500-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	

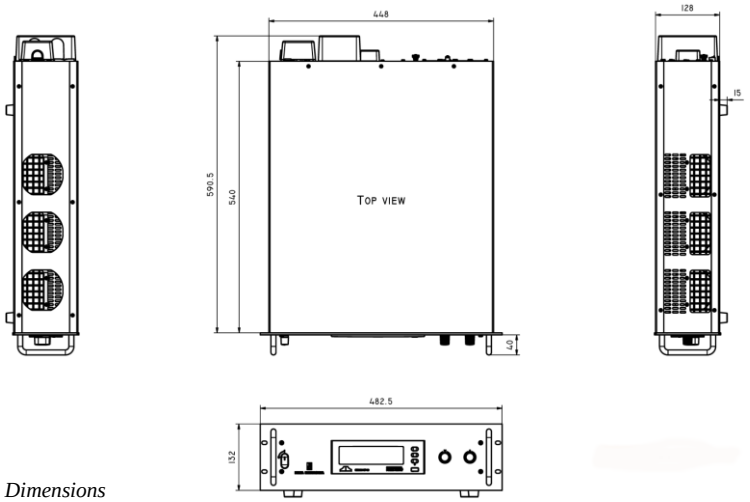
CV = Constant Voltage
CC = Constant Current
CP = Constant Power

Specifications measured at t_{amb} = 25 ± 5 °C and Vin = 400 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.*



Dimensions

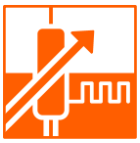
Typical Applications

- 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, 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

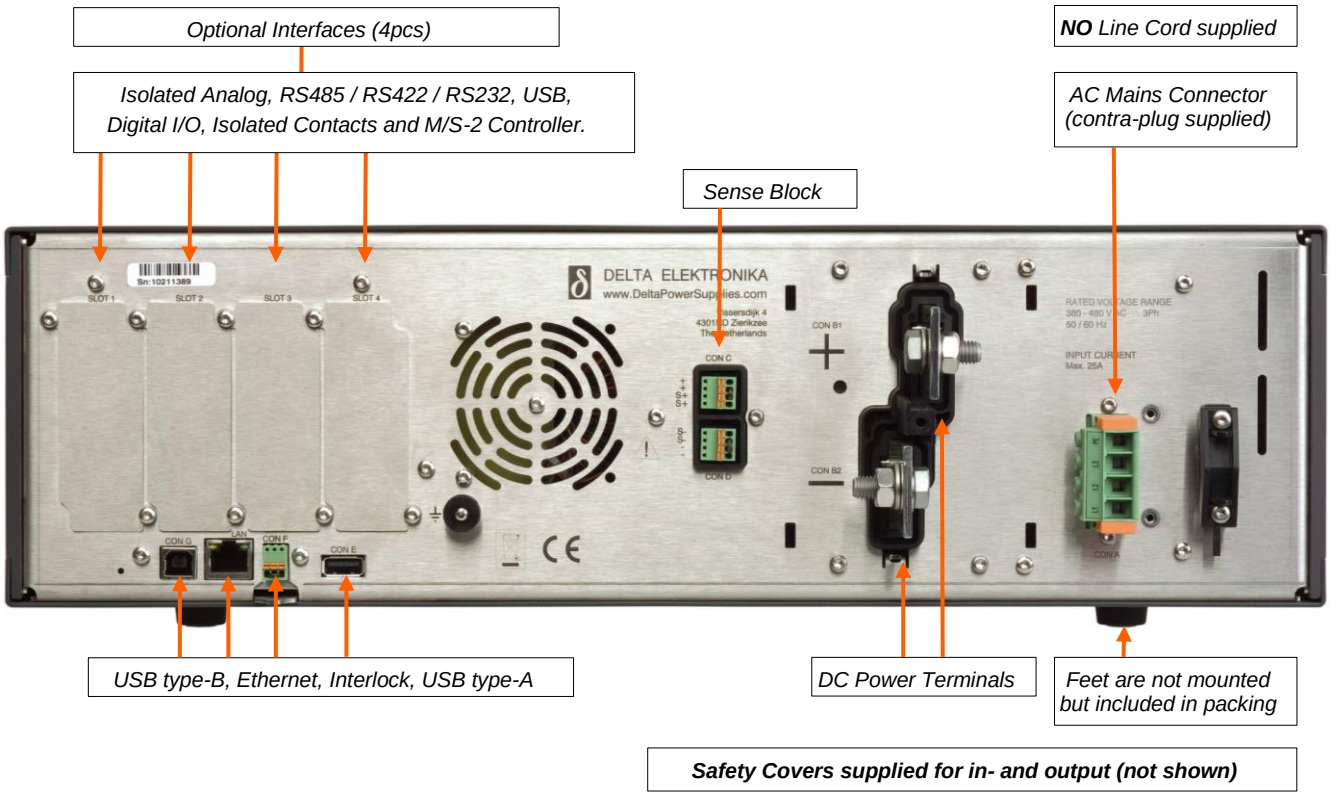
Software control and Interfaces

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



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