DELTA ELEKTRONIKA B.V.
DC POWER SUPPLIES

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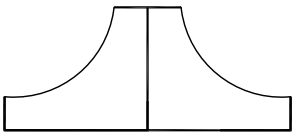
SM 15K - Series 15kW DC POWER SUPPLIES

Bi-Directional - Constant Power

Models	Voltage range	Current range
SM 70-CP-450	0 ... 70 V	–450 ... 450 A
SM 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%
- 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	SM500-CP-90	SM1500-CP-30
DC Power terminals			
voltage	0 ... 70 V	0 ... 500 V	0 ... 1500 V
current	–450 ... 450 A	–90 ... 90 A	–30 ... 30 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, 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	
standby AC 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	4 mV	10 mV
Line 342 - 528 V AC **CV** (external voltage sense)	< 1 mV	< 1 mV	< 1 mV
Load 0 - 100% **CC**	25 mA	8 mA	2 mA
Line 342 - 528 V AC **CC** (internal voltage sense, after warm-up)	4 mA	1 mA	1 mA
Ripple + noise			
Source mode:	33 V / 450 A	167 V / 90 A	500 V / 30 A
rms (BW=300 kHz) **CV**	10 mV	10 mV	25 mV
p-p (BW=20 MHz) **CV**	60 mV	55 mV	150 mV
rms (BW=300 kHz) **CC**	t.b.d.	45 mA	12 mA
p-p (BW=20 MHz) **CC**	t.b.d.	200 mA	70 mA
Source mode:	70 V / 215 A	500 V / 30 A	1500 V / 10 A
rms (BW=300 kHz) **CV**	10mV	25mV	35mV
p-p (BW=20 MHz) **CV**	60mV	115mV	250mV
rms (BW=300 kHz) **CC**	t.b.d.	45 mA	5 mA
p-p (BW=20 MHz) **CC**	t.b.d.	200 mA	25 mA
Sink mode:	33 V / 450 A	167 V / 90 A	500 V / 30 A
rms (BW=300 kHz) **CV**	8 mV	7 mV	15 mV
p-p (BW=20 MHz) **CV**	50 mV	35 mV	130 mV
rms (BW=300 kHz) **CC**	t.b.d.	45 mA	10 mA
p-p (BW=20 MHz) **CC**	t.b.d.	200 mA	60 mA
Sink mode:	70 V / 215 A	500 V / 30 A	1500 V / 10 A
rms (BW=300 kHz) **CV**	8 mV	10 mV	25 mV
p-p (BW=20 MHz) **CV**	50 mV	50 mV	200 mV
rms (BW=300 kHz) **CC**	t.b.d.	90 mA	3 mA
p-p (BW=20 MHz) **CC**	t.b.d.	320 mA	12 mA
CC-ripple at full load			
Programming & monitoring accuracy *(excluding INT MOD ANA)*			
Voltage		± 0.08%	
Current		± 0.15%	
Minimum Sink Voltage			
@ Sink current:	1.2 V @ –450 A 0.8 V @ –215 A 0.8 V @ –45 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
Temp. coeff., per °C [1] **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 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.

Programming speed [2] (resistive load)	**SM70-CP-450**	**SM500-CP-90**	**SM1500-CP-30**
Rise time (10 - 90%)			
output voltage step	0 → 33 V	0 → 167 V	0 → 500 V
time, (load = 15 kW)	2.2 ms	1.5 ms	1.5 ms
time, (load = 1500 W)	1.5 ms	1 ms	1 ms
output voltage step	0 → 70 V	0 → 500 V	0 → 1500 V
time, (load = 15 kW)	5.5 ms	4.5 ms	4.5 ms
time, (load = 1500 W)	3.5 ms	3.5 ms	3.5 ms
Fall time (90 - 10%)			
output voltage step	33 → 0 V	167 → 0 V	500 → 0 V
time, (load = 15 kW)	1.5 ms	0.8 ms	0.8 ms
time, (load = 1500 W)	1.5 ms	0.9 ms	0.9 ms
output voltage step	70 → 0 V	500 → 0 V	1500 → 0 V
time, (load = 15 kW)	2.6 ms	2.5 ms	2.8 ms
time, (load = 1500 W)	3.5 ms	3.5 ms	3.5 ms
DC Output Capacitance			
X-capacitors (typical)	22000 µF	560 µF	58 µF
Y-capacitors (typical)	950 nF	145 nF	145 nF

	SM70-CP-450	**SM500-CP-90**	**SM1500-CP-30**
Recovery time output voltage	33 V, load step 225 → 450 A	167 V, load step 45 → 90 A	500 V, load step 15 → 30 A
recovery within	100 mV	750 mV	2.8 V
di/dt of load step	5 A/µs	0.8 A/µs	0.25 A/µs
time, @ 50 - 100% load step	100 µs	100 µs	100 µs
max. deviation	0.8 V	2.8 V	9.0 V
output voltage	70 V, load step 112 → 215 A	500 V, load step 15 → 30 A	1500 V, load step 5 → 10 A
recovery within	100 mV	500 mV	1.2 V
di/dt of load step	2 A/µs	0.25 A/µs	0.085 A/µs
time, @ 50 - 100% load step	100 µs	150 µs	150 µs
max. deviation	0.3 V	1.2 V	3.5 V
Pulsating load			
max. tolerable AC component of load current			
f > 1 kHz	60 Arms	15 Arms	5 Arms
f < 1 kHz	450 Apeak	90 Apeak	30 Apeak

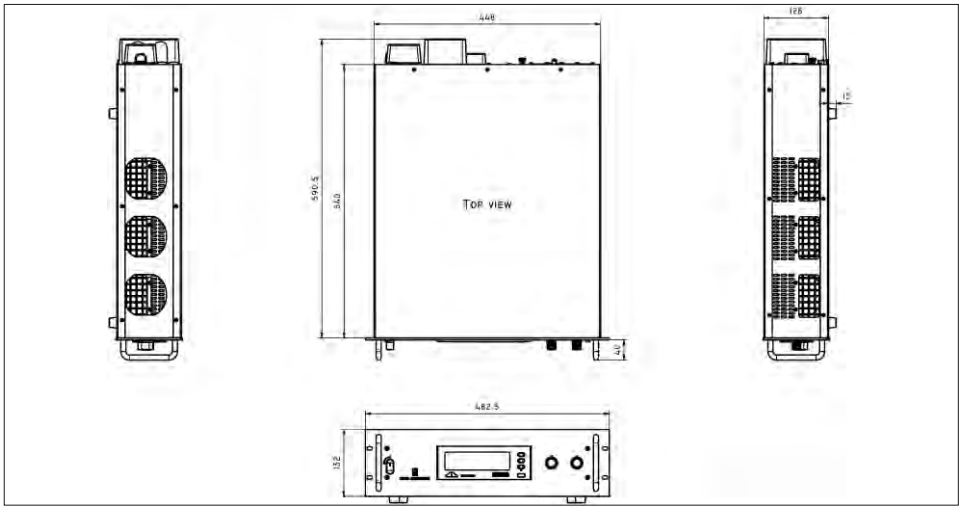
Insulation		
AC pwr terminals / DC pwr terminals	3750 Vrms (1 min.)	3750 Vrms (1 min.)
creepage / clearance	8 mm	8 mm
AC power terminals / case	2500 Vrms	2500 Vrms
DC power terminals / case	1000 V DC [3]	1500 V DC [3]
Safety	EN 60950 / EN 61010	
EMC Generic Emission	**EN 61000-6-3**, residential, **light** industrial environment (EN 55022 **B**)	
Generic Immunity	**EN 61000-6-2**, industrial environment	
Operating Temperature at full load	– 20 ... 50 °C derate output to 75% at 60 °C	
Humidity	max. 95 % RH, non condensing, up to 40 °C max. 75 % RH, non condensing, up to 50 °C	
Storage temperature	– 40 ... 85 °C	
Thermal protection	output shuts down in case of insufficient cooling	
MTBF	500 000 hrs	

	SM70-CP-450	**SM500-CP-90**	**SM1500-CP-30**
Hold-Up time			
V_{out} = 100%, P_{out} = 15kW	10 ms	15 ms	15 ms
I_{out} = 100%, P_{out} = 15kW	10 ms	15 ms	15 ms
V_{out} = 100%, P_{out} = 7.5kW	25 ms	35 ms	35 ms
@ 400 V AC input			
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 and data traffic.
3. See 'Safety Instructions' in the manual.

	SM70-CP-450	SM500-CP-90	SM1500-CP-30
Series operation max. total voltage Master / Slave operation	Not possible	750 V* 1000 V** maximum 6 units[3] **) delivered before Q4 / 2018* ***) delivered Q4 / 2018 or newer* *Contact factory for upgrading to 1000V series operation for older units.*	Not possible
Parallel operation Master / Slave operation	maximum 6 units contact factory for more units	maximum 60 units contact factory for more units	maximum 60 units contact factory for more 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	0 ... 101 % 0 ... 101 % 0 ... 101 %		
Potentiometers & Encoders 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 ... 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 airflow	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, 3 phase, 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 manual.

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 floating operation up to 1000 V for SM70-CP-450 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

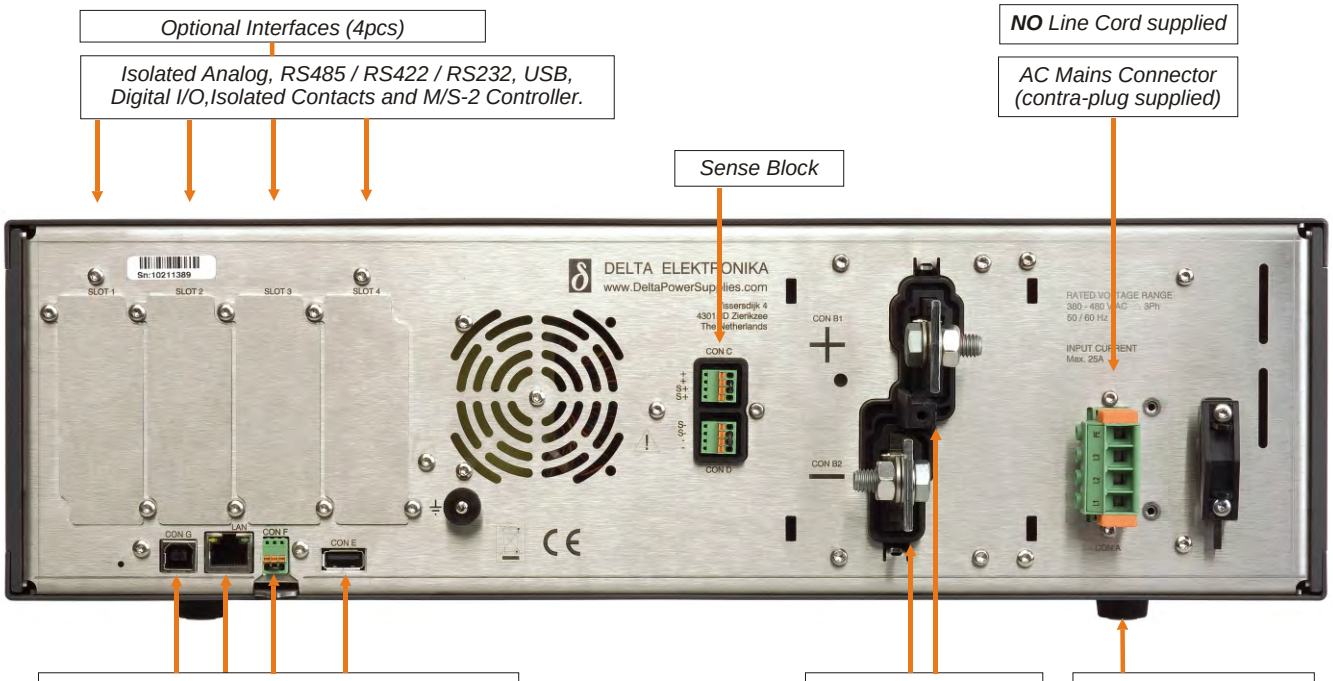
Software Control and Interfaces

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


Optional Interfaces (4pcs)
Isolated Analog, RS485 / RS422 / RS232, USB, Digital I/O,Isolated Contacts and M/S-2 Controller.
NO Line Cord supplied
AC Mains Connector (contra-plug supplied)
Sense Block
DELTA ELEKTRONIKA
www.DeltaPowerSupplies.com
USB type-B, Ethernet, Interlock, USB type-A
DC Power Terminals
Feet are not mounted but included in packing
Safety Covers supplied for in- and output (not shown)