DELTA ELEKTRONIKA B.V.
DC POWER SUPPLIES

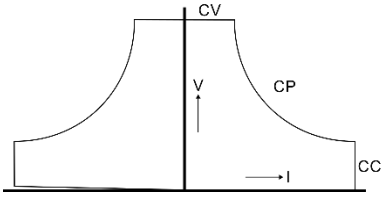
Vissersdijk 4, 4301 ND
Zierikzee, the Netherlands

DeltaPowerSupplies.com
Tel. +31 111 413656

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

- 15 kW bidirectional DC source & sink
- Constant-power output curve for extended operating range
- Regenerative design: sink power returned to the grid
- ≥ 95 % efficiency resulting in low heat dissipation
- Fast digital control with tunable load response
- Rated for continuous full-power operation
- Comprehensive overload and short-circuit protection

Functionalities

- Wide-range three-phase AC input
- Expandable in functions, interfaces and Master-Slave
- Built-in Ethernet interface with browser-based web interface
- Digital encoders for voltage/current setting and navigation
- Large front-panel display with menu-driven operation
- Temperature-controlled fans for low audible noise
- EMC performance beyond CE (low emission, high immunity)

		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		0.8 V @ – 215 A	1.5 V @ – 75 A	5.0 V @ – 30 A	8.5 V @ – 15 A	14 V @ – 10 A
between source ↔ sink.		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, 15 kW				23 A		
Power factor, 15 kW / 7.5 kW				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	33 V, 225 → 450 A	100 V, 75 → 150 A	167 V, 45 → 90 A	333 V, 22.5 → 45A	500 V, 15 → 30 A
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	70 V, 112 → 215 A	210 V, 36 → 72 A	500 V, 15 → 30 A	1000 V, 7.5 → 15A	1500 V, 5 → 10 A
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 [10]					
X-capacitors	22000 µF	1170 µF	560 µF	141 µF	58 µF
Y-capacitors	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, output power is available				
Inrush current [10]	23 A				
Safety standards	EN 60950 / EN 61010				
Insulation					
AC / DC terminals	3750 V_{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	– 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 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*

	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		750 V [13],1000 V [14] Max. 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				

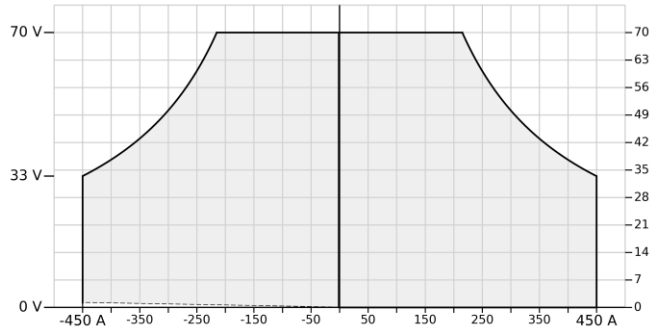
CV = Constant Voltage
CC = Constant Current
CP = Constant Power

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.

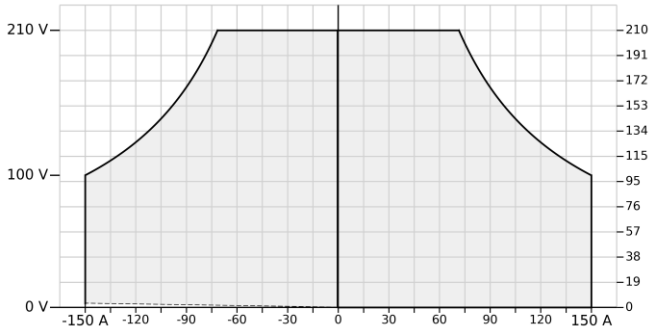
[11] *Unit should be configured to switch on the output at startup.*
[12] *See "Safety Instructions" in the product manual.*
[13] *Units delivered before Q4 / 2018. Contact factory for upgrading to enable 1000 V series operation for older units.*
[14] *Units delivered in Q4 / 2018 or later.*
[15] *See "Safety Instructions" in the product manual.*

Operating range

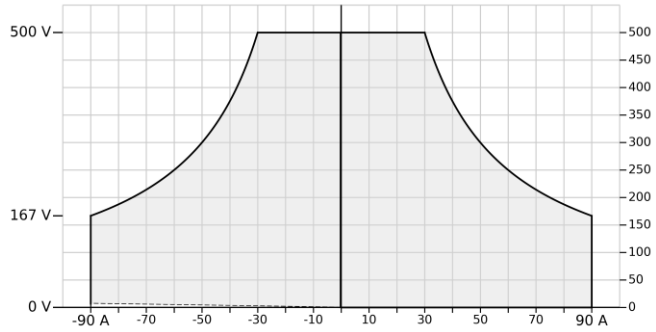
SM70-CP-450



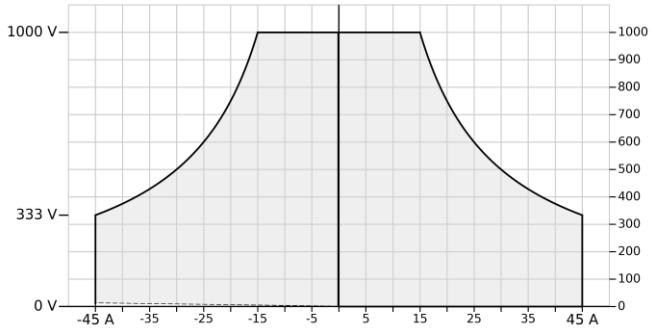
SM210-CP-150



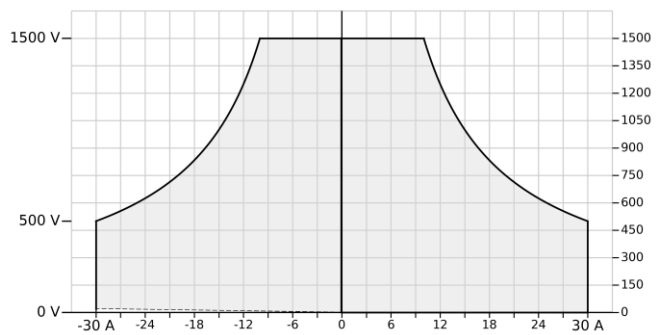
SM500-CP-90



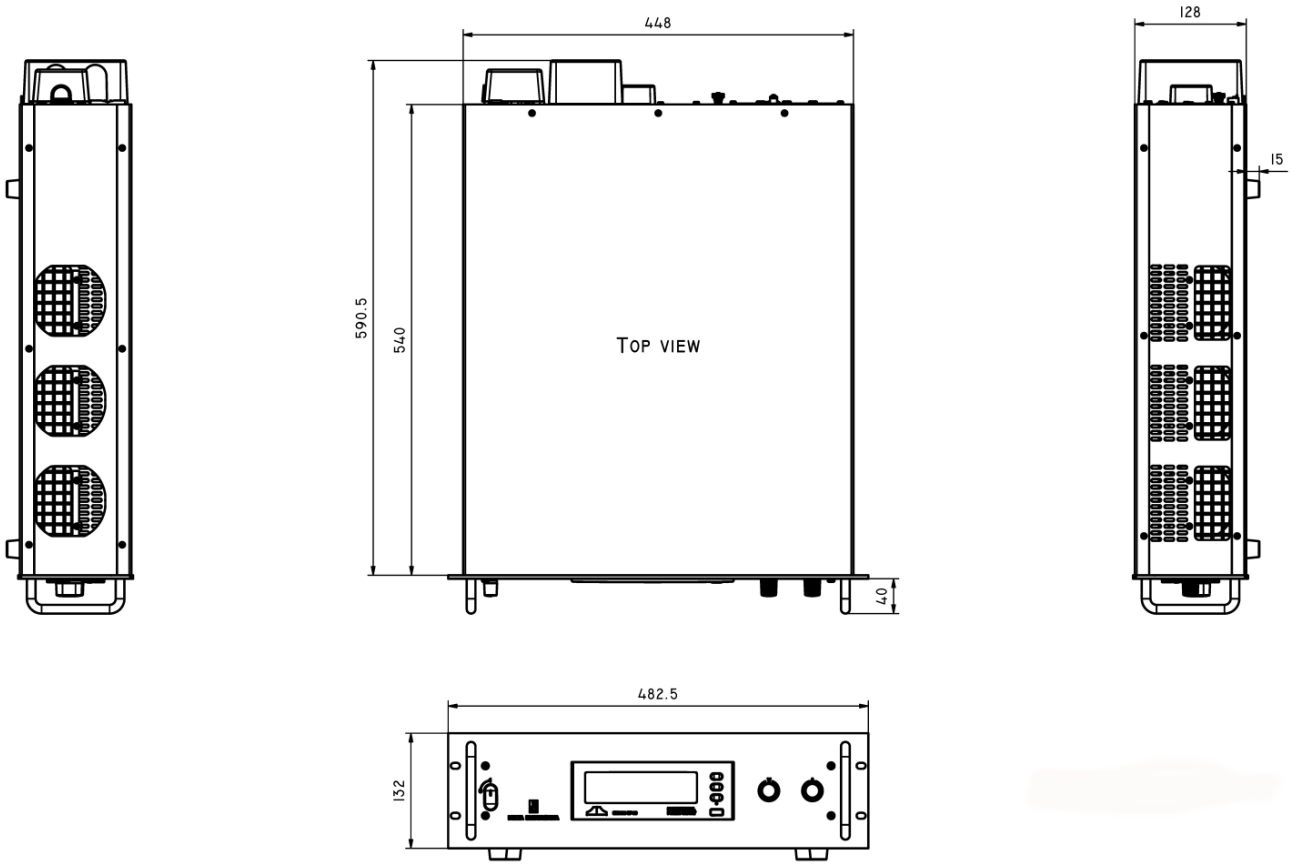
SM1000-CP-45



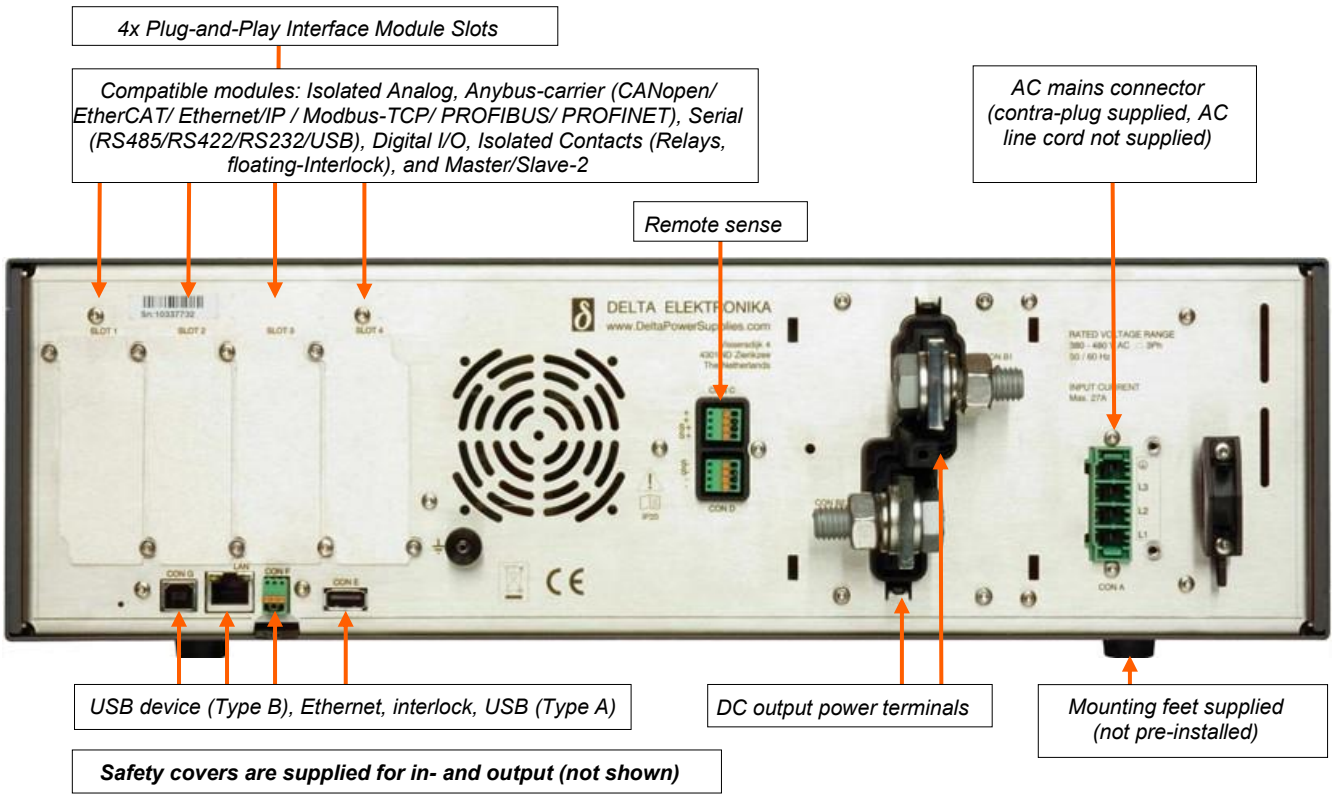
SM1500-CP-30



Dimensions



Rear view



Typical Applications

- PV simulation and inverter testing
- Automotive test systems
- Automotive battery simulation
- Controlled battery (dis)charge test
- ATE in industrial production lines
- Precision current sources
- PWM-controlled DC motor testing
- Renewable-energy systems
- Plasma chambers
- Lasers
- Aerospace applications
- Defense / military applications

Standard Features

Bi-Directional Two-Quadrant Output

Full-power bidirectional two-quadrant operation keeps the DC output voltage constant whether power is sourced or sunk. Ideal for PWM-controlled DC motors and ATE systems.

Digital CV- and CC-Settings

Long-life digital encoders on the front panel provide precise CV/CC setting with coarse/fine adjustment and full front-panel lock (including CV/CC knobs).

High Voltage Isolation

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 and Function Blocks

Includes a sequencer for standalone automation or waveform generation. Function blocks support PV simulation, lead-less sensing and internal resistance function.

Ethernet Interface

Ethernet interface for programming and monitoring (SCPI), including an integrated web interface for remote control.

USB-Input

Feature not yet available.
Front and rear USB inputs (Host / Type-A) are planned for exchanging settings and waveforms. Sequences can be uploaded via the web interface.

Interfaces

Plug-and-play extension modules

The interfacing and functional capabilities of the power supply can be extended at any time by inserting plug-and-play modules. Four slots are available at the rear of the power supply unit.

See the Interfaces data sheet for details.

Modules:

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

  Assembly kits for parallel (M/S-PAR-SET) and series (M/S-SER-SET) operation are available for multi-unit systems. The number of units that can be connected in series or parallel depends on the power supply model.

Ordering Information

A complete overview of base-unit order codes, optional interface modules, Anybus options, and output assembly kits is provided in the SM15K Order Codes document on our website. For product details, downloads, and quotation requests, please visit the SM15K series page or contact Delta Elektronika or your local authorized distributor.

Delta Elektronika B.V.
Vissersdijk 4, 4301 ND
Zierikzee
The Netherlands

T: +31 111 413656
E: via contact form on our website
W: www.DeltaPowerSupplies.com

Online resources

- SM15K product page
- SM15K order codes
- Contact Delta Elektronika
- Authorized distributors

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