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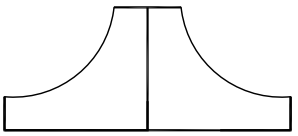
DELTA ELEKTRONIKA B.V.

SM 15K - Series 15kW DC POWER SUPPLIES

Bi-Directional - Constant Power

Models	Voltage range	Current range
SM 500-CP-90	0 ... 500 V	–90 ... 90 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 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

		SM500-CP-90
DC Power terminals		
voltage		0 ... 500 V
current		–90 ... 90 A
AC Input		
3 phase, 48 - 62 Hz		342 ... 528 V
rated voltage range		380 ... 480 V
rated frequency		50 / 60 Hz
rated current		Max. 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 W
standby AC input power (V_o=V_{max})		180 W
Efficiency		
Sink & Source mode:		
400 V AC, 3 ph input,		
15 kW, 167 V, 90 A		95 %
15 kW, 500 V, 30 A		96 %
Regulation		
Load 0 - 100%	**CV**	2 mV
Line 342 - 528 V AC	**CV**	< 1 mV
(external voltage sense)		
Load 0 - 100%	**CC**	8 mA
Line 342 - 528 V AC	**CC**	1 mA
(internal voltage sense, after warm-up)		
Ripple + noise		
Source mode 167 V / 90 A:		
rms (BW=300 kHz)	**CV**	10 mV
p-p (BW=20 MHz)	**CV**	55 mV
rms (BW=300 kHz)	**CC**	45 mA
p-p (BW=20 MHz)	**CC**	200 mA
Source mode 500 V / 30 A:		
rms (BW=300 kHz)	**CV**	20 mV
p-p (BW=20 MHz)	**CV**	90 mV
rms (BW=300 kHz)	**CC**	45 mA
p-p (BW=20 MHz)	**CC**	200 mA
Sink mode 167 V / 90 A:		
rms (BW=300 kHz)	**CV**	7 mV
p-p (BW=20 MHz)	**CV**	35 mV
rms (BW=300 kHz)	**CC**	45 mA
p-p (BW=20 MHz)	**CC**	200 mA
Sink mode 500 V / 30 A:		
rms (BW=300 kHz)	**CV**	10 mV
p-p (BW=20 MHz)	**CV**	50 mV
rms (BW=300 kHz)	**CC**	90 mA
p-p (BW=20 MHz)	**CC**	320 mA
CC-ripple at full load		
Minimum Sink Voltage		
Sink current:		
–90 A		5.5 V
–30 A		3.0 V
–10 A		1.0 V
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.
4. The optional interfaces are under development.

Programming speed [2] *Standard Version* (resistive load)	**SM500-CP-90**
Rise time (10 - 90%)	
output voltage step	0 → 167 V
time, (load = 15 kW)	1.5 ms
time, (load = 1500 W)	1 ms
output voltage step	0 → 500 V
time, (load = 15 kW)	4.5 ms
time, (load = 1500 W)	3.5 ms
Fall time (90 - 10%)	
output voltage step	167 → 0 V
time, (load = 15 kW)	0.8 ms
time, (load = 1500 W)	0.9 ms
output voltage step	500 → 0 V
time, (load = 15 kW)	2.5 ms
time, (load = 1500 W)	3.5 ms
DC Output Capacitance	
X-capacitors (typical)	560 µF
Y-capacitors (typical)	145 nF
Programming speed [2] *High Speed Version* (resistive load)	**SM500-CP-90** *Not yet available*
Rise time (10 - 90%)	
output voltage step	0 → ... / ... V
time, (load = 15 kW)	... / ... ms
time, (load = 1500 W)	... / ...ms
output voltage step	...
time, (load = 15 kW)	...
time, (load = 1500 W)	...
Ripple @ full load	
typical (rms / pp)	... mV / ... mV
Fall time (90 - 10%)	
output voltage step	... / ... → 0 V
time, (load = 15 kW)	... / ... ms
time, (load = 1500 W)	.... / ... ms
output voltage step	...
time, (load = 15 kW)	...
time, (load = 1500 W)	...
DC Output Capacitance	
X-capacitors (typical)	... µF
Y-capacitors (typical)	... nF

	SM500-CP-90	
Recovery time output voltage	167 V, load step 45 → 90 A	500 V, load step 15 → 30 A
recovery within	500 mV	500 mV
di/dt of load step	1.5 A/µs	0.5 A/µs
output voltage	167 V	500 V
time, @ 50 - 100% load step	100 µs	150 µs
max. deviation	2.8 V	1 V
Pulsating load		
max. tolerable AC component of load current		
f > 1 kHz	... Arms	
f < 1 kHz	... Apeak	

Insulation	
AC pwr terminals / DC pwr terminals	3750 Vrms (1 min.)
creepage / clearance	8 mm
AC power terminals / case	2500 Vrms
DC power terminals / case	1000 V DC [3]
Safety	EN 60950 / EN 61010

Notes: 1. Measured at full load
2. Signal latency depends on the interface used and data traffic.
3. See 'Safety Instructions' in the manual.
4. The optional interfaces are under development.

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 ... 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

	SM500-CP-90
Hold-Up time V_{out} = 100%, P_{out} = 15kW I_{out} = 100%, P_{out} = 15kW V_{out} = 100%, P_{out} = 7.5kW *@ 400 V AC input*	 ... ms ... ms ... ms
Turn on delay after mains switch on	 2.5 s
Inrush current	23 A

Series operation max. total voltage Master / Slave operation [4]	 1000 V [3] M/S interface is under development
Parallel operation Master / Slave operation [4]	 M/S interface is under development
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 0.0 ... 500.0 V –90.0 ... 90.0 A –15000 ... 15000 W 0.2% + 2 digit

Mounting	Stacking of units allowed, air flow is from left to right.
AC Terminals	Screw Terminals for wire 4 mm^2, 3 phase + earth (no neutral), CON A
DC Terminals	M8 bolts, CON B1 & CON B2
Programming connectors	Standard with RJ45-connector for Ethernet at rear panel, LAN.
Interlock	Input for contact at rear panel, CON F
Cooling audio noise level airflow	Low noise blower, fan speed adapts to temperature of internal system. ca. ... dBA at full load, 25 °C ambient temperature, 1 m distance ca. ... 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

Notes: *1. Measured at full load*
2. Signal latency depends on the interface used and data traffic.
3. See 'Safety Instructions' in the manual.
4. The optional interfaces are under development.

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

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 series operation up to 1000 V.

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:

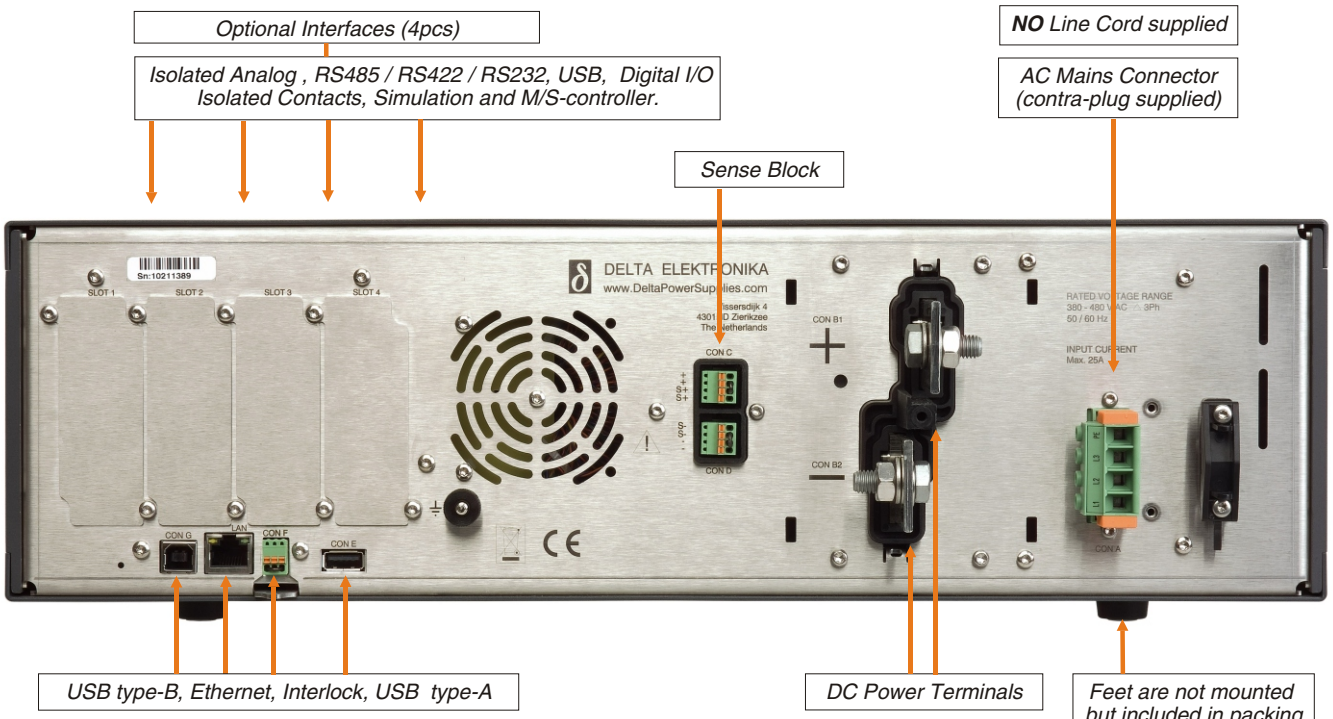
- Digital I/O
- Isolated Contacts
- Serial controller with multiple protocols RS 232, RS 485, RS 422 and USB (Device)

High Speed Programming

High speed programming is under development.

Order Codes :
- INT MOD DIG
- INT MOD CON
- INT MOD SER

Under development are:
- Simulation Interface
- Isolated Analog Programming
- Master / Slave controller


Optional Interfaces (4pcs)
Isolated Analog , RS485 / RS422 / RS232, USB, Digital I/O
Isolated Contacts, Simulation and M/S-controller.
NO Line Cord supplied
AC Mains Connector
(contra-plug supplied)
Sense Block
DELTA ELEKTRONIKA
www.DeltaPowerSupplies.com
SLOT 1
SLOT 2
SLOT 3
SLOT 4
CON C
CON D
CON B1
CON B2
CON A
CON G
LAN
CON F
CON E
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)