SM1500 - **Series** 1500W DC POWER SUPPLIES

Models	Voltage range	Current range
SM 15-100	0 - 15 V	0 - 100 A
SM 35-45	0 - 35 V	0 - 45 A
SM 52-30	0 - 52 V	0 - 30 A
SM 52-AR-60 Autoranging output	0 - 26 V 0 - 52 V	0 - 60 A 0 - 30 A
SM 70-22	0 - 70 V	0 - 22 A
SM 120-13	0 - 120 V	0 - 13 A
SM 300-5	0 - 300 V	0 - 5 A
SM 400-AR-8 Autoranging output	0 - 200 V 0 - 400 V	0 - 8 A 0 - 4 A
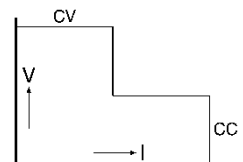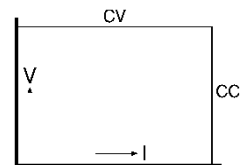
Features

- cTUVus safety approval

- Designed for long life at full power

- Excellent dynamic response to load changes

- Protected against all overload and short circuit conditions

- EMC surpasses CE requirements: low emission & high immunity

- Low audible noise: temperature controlled fans

- Available options: analog & digital Interfaces, High Speed Programming, Digital Encoders, Sequencer, Power Sink etc.

Functionalities

- Master/Slave parallel and series operation with voltage and current sharing

- Stacking is allowed, space between units is not required

- High power system configuration from multiple units

- 19" rack mounting or laboratory use (feet included)

- Remote sensing

- Interlock

	SM 15-100	SM 35-45	SM 52-30	SM 52-AR-60	SM 70-22	SM 120-13	SM 300-5	SM 400-AR-8
DC Power terminals								
voltage	0 - 15 V	0 - 35 V	0 - 52 V	0 - 52 V	0 - 70 V	0 - 120 V	0 - 300 V	0 - 400 V
current	0 - 100 A	0 - 45 A	0 - 30 A	0 - 60 A	0 - 22 A	0 - 13 A	0 - 5 A	0 - 8 A
AUTORANGING (2 ranges)	no	no	no	yes	no	no	no	yes
Max. output current / voltages	/	/	/	60 A / 0-26 V 30 A / 26-52 V	/	/	/	8 A / 0-200 V 4 A / 200-400 V
AC Input								
single phase, 48 - 62 Hz	90-265 V	90-265 V	90-265 V	90-265 V	90-265 V	90-265 V	90-265 V	90-265 V
rated voltage range	100-240 V	100-240 V	100-240 V	100-240 V	100-240 V	100-240 V	100-240 V	100-240 V
rated frequency	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz
rated current	max 16A	max 16A	max 16A	max 16A	max 16A	max 16A	max 16A	max 16A
Power Derating vs input:								
90 V : $P_{out\,max}$ (W), I_{in} (A)	1170, 16	1185, 16	1200, 16	1200, 16	1200, 16	1200, 16	1200, 16	1200, 16
100 V: $P_{out\,max}$ (W), I_{in} (A)	1317, 16	1334, 16	1350, 16	1350, 16	1350, 16	1350, 16	1350, 16	1350, 16
110 V: $P_{out\,max}$ (W), I_{in} (A)	1492, 16	1498, 16	1505, 16	1505, 16	1505, 16	1505, 16	1505, 16	1505, 16
230 V: $P_{out\,max}$ (W), I_{in} (A)	1500, 7.5	1575, 7.7	1560, 7.7	1560, 7.7	1540, 7.6	1560, 7.7	1500, 7.4	1600, 7.8
power factor, 100%, 50% load	0.99, 0.98	0.99, 0.98	0.99, 0.98	0.99, 0.98	0.99, 0.98	0.99, 0.98	0.99, 0.98	0.99, 0.98
internal fuses	25 AT	25 AT	25 AT	25 AT	25 AT	25 AT	25 AT	25 AT
standby input power ($V_o=I_o=0$)	12 W	12 W	12 W	12 W	12 W	12 W	12 W	12 W
standby input power ($V_o=V_{max}$)	22 W	22 W	22 W	22 W	22 W	22 W	22 W	25 W
				26 V / 52 V				200 V / 400 V
Efficiency								
230 V AC, 1 ph input, full load	87 %	90 %	90 %	89 / 90 %	90 %	90 %	91 %	90 / 91 %
115 V AC, 1 ph input, full load	83 %	86 %	86 %	84 %	86 %	86 %	86 %	86 %
Regulation								
Load 0 - 100% **CV**	0.5 mV	1 mV	2 mV	2 mV	2.5 mV	4 mV	10 mV	12 mV
Line 120 - 265 V AC **CV**	0.2 mV	0.5 mV	0.7 mV	0.7 mV	1 mV	2 mV	3 mV	4 mV
(measured on sense block)								
Load 0 - 100% **CC**	5 mA	3 mA	1.5 mA	2 mA	1 mA	0.6 mA	0.5 mA	0.5 mA
Line 120 - 265 V AC **CC**	1 mA	0.5 mA	0.5 mA	1 mA	0.25 mA	0.2 mA	0.1 mA	0.2 mA
(internal voltage sense)								
Ripple + noise								
rms (BW=300 kHz) **CV**	2 mV	1.8 mV	2 mV	2 mV	3 mV	7 mV	7 mV	15 mV
p-p (BW=20 MHz) **CV**	8 mV	8 mV	15 mV	15 mV	15 mV	30 mV	50 mV	80 mV
rms (BW=300 kHz) **CC**	15 mA	5 mA	3 mA	10 / 3 mA	3 mA	2 mA	0.5 mA	1.2 / 0.6 mA
p-p (BW=20 MHz) **CC**	80 mA	15 mA	10 mA	30 / 10 mA	10 mA	6 mA	4 mA	6 / 3 mA
CC-ripple at full load								

Temp. coeff., per °C [1] **CV**	35.10^{-6}
CC	60.10^{-6}

Stability [1] after 1 hr warm-up during 8 hrs **CV**	6.10^{-5}
CC	9.10^{-5}
$t_{amb} = 25 \pm 1$ °C, $V_{in} = 230$ VAC	(internal voltage sensing for CC-stab.)

Analog Programming	CV	CC
Programming inputs		
input range	0 - 5 V	0 - 5 V
accuracy	± 0.2%	± 0.5%
offset	- 0.1 ... +1.3 mV (on 5V)	0 ... +2.2 mV (on 5V)
temp. coeff. offset	10 µV / °C	50 µV / °C
input impedance	> 1 MOhm	> 1 MOhm
Monitoring outputs		
input range	0 - 5 V	0 - 5 V
accuracy	± 0.2%	± 0.2%
offset	- 1 ... 0 mV (on 5V)	- 1.1 ... 0 mV (on 5V)
temp. coeff. offset	3 µV / °C	60 µV / °C
input impedance	2 Ohm / max. 4mA	2 Ohm / max. 4mA
ISO AMP Programming (optional)	Isolated analog programming, range 0 - 5 V / 200 kOhm or 0 - 10 V / 400 kOhm. See datasheet ISO AMP on www.DeltaPowerSupplies.com for accuracy, offset etc.	
Reference voltage		
on prog. connector V_{ref}	5.114 ±15 mV (Ro = 2 Ohm, max. 4 mA)	
TC	20 ppm	
+12 V output V_o	12 V ± 0.2 V	
on prog. Connector I_{max}	0.2 A	
R_o	3 Ohm	

Notes: 1. Measured at full load.   2. See "Safety instructions".

Status Outputs			
CC	- status	CC - operation	5 V = logic 1 (Ro = 500 Ohm)
LIM	- status	CV or CC limit	5 V = logic 1 (Ro = 500 Ohm)
OT	- status	Over Temperature	5 V = logic 1 (Ro = 500 Ohm)
PSOL	- status	Power Sink Overload	5 V = logic 1 (Ro = 500 Ohm)
ACF	- status	AC - Fail	5 V = logic 1 (Ro = 500 Ohm)
DCF	- status	DC - Fail [1]	5 V = logic 1 (Ro = 500 Ohm)

Relay Outputs	ACF	AC - Fail	both NO and NC contact	
	DCF	DC - Fail [*]	both NO and NC contact	[*] output ± 5% beyond set point

Remote shutdown	with + 5 V, 1 mA or relay contact
Interlock	contact at rear panel, see photo of rear panel on page 1-6
Indicators (front panel)	AC-Fail, DC-Fail, Over Temperature, Power Sink Overload, Remote-ShutDown, Remote-CV, Remote-CC, Output On, CV-limit, CC-limit, CV- and CC- mode
Controls (front panel)	Mains on/off, CV-and CC-potmeter, CV- and CC-limit-potmeter, Display-Settings button, Display-Limits button, Remote/Local, Output On/Off, Front panel Lock

Programming speed *Standard Version* (resistive load)	SM 15-100	SM 35-45	SM 52-30	SM 52-AR-60	SM 70-22	SM 120-13	SM 300-5	SM 400-AR-8
Rise time (10 - 90%)								
output voltage step	0 → 15 V	0 → 35 V	0 → 52V	0 → 26 V	0 → 70 V	0 → 120 V	0 → 300 V	0 → 200 V
time, (100 % load)	6.1 ms	15.4 ms	7.3 ms	8.5 ms	13.2 ms	3.4 ms	9 ms	3.7 ms
time, (10 % load)	2.1 ms	5.1 ms	2.4 ms	2.8 ms	4.4 ms	2 ms	3.9 ms	2.6 ms
output voltage step	-	-	-	0 → 52 V	-	-	-	0 → 400 V
time, (100 % load)	-	-	-	34.2 ms	-	-	-	15 ms
time, (10 % load)	-	-	-	11 ms	-	-	-	5 ms
Fall time (90 - 10%)								
output voltage step	15 → 0 V	35 → 0 V	52 → 0 V	26 → 0 V	70 → 0 V	120 → 0 V	300 → 0 V	200 → 0 V
time, (100 % load)	6.1 ms	14.7 ms	7 ms	8.2 ms	12.9 ms	3.3 ms	9 ms	3.5 ms
time, (10 % load)	61 ms	147 ms	70 ms	82 ms	129 ms	33 ms	90 ms	35 ms
output voltage step	-	-	-	52 → 0 V	-	-	-	400 → 0 V
time, (100 % load)	-	-	-	33 ms	-	-	-	14.2 ms
time, (10 % load)	-	-	-	330 ms	-	-	-	142 ms
Programming speed *Optional High Speed* (resist. load)	SM 15-100 *Option P210*	SM 35-45 *Option P211*	SM 52-30 *Option P212*	SM 52-AR-60 *Option P213*	SM 70-22 *Option P214*	SM 120-30 *Option P215*	SM 300-5 *Option P216*	SM 400-AR-8 *Option P217*
Rise time (10 - 90%)								
output voltage step	0 → 15 V	0 → 35 V	0 → 52V	0 → 26 V	0 → 70 V	0 → 120 V	0 → 300 V	0 → 200 V
time, (100 % load)	0.20 ms	0.27 ms	0.32 ms	0.44 ms	0.47 ms	0.46 ms	1.0 ms	0.35 ms
time, (10 % load)	0.11 ms	0.14 ms	0.22 ms	0.45 ms	0.27 ms	0.27 ms	0.51 ms	0.33 ms
output voltage step	-	-	-	0 → 52 V	-	-	-	0 → 400 V
time, (100 % load)	-	-	-	0.42 ms	-	-	-	0.98 ms
time, (10 % load)	-	-	-	0.34 ms	-	-	-	0.59 ms
Fall time (90 - 10%)								
output voltage step	15 → 0 V	35 → 0 V	52 → 0 V	26 → 0 V	70 → 0 V	120 → 0 V	300 → 0 V	200 → 0 V
time, (100 % load)	0.21 ms	0.33 ms	0.39 ms	0.48 ms	0.67 ms	0.51 ms	1.4 ms	0.35 ms
time, (10 % load)	1.6 ms	3.5 ms	3.6 ms	1.9 ms	6.4 ms	4.5 ms	13 ms	3.8 ms
output voltage step	-	-	-	52 → 0 V	-	-	-	400 → 0 V
time, (100 % load)	-	-	-	0.7 ms	-	-	-	1.7 ms
time, (10 % load)	-	-	-	6.5 ms	-	-	-	18 ms
Ripple @ full load				26 V / 60 A				200V
typical (rms/pp)	20 / 80 mV	50 / 150 mV	50 / 185 mV	20 / 90 mV	30 / 125 mV	20 / 80 mV	25 / 115 mV	85 / 355 mV
				52 V / 30A				400 V
typical (rms/pp)				20 / 90mV				60 / 245 mV
Output Capacitance (typical)	390 µF	190 µF	135 µF	228 µF	135 µF	21 µF	10 µF	7 µF

	SM 15-100	SM 35-45	SM 52-30	SM 52-AR-60	SM 70-22	SM 120-13	SM 300-5	SM 400-AR-8
Recovery time				26 / 52 V				200 / 400 V
recovery within	50 mV	50 mV	100 mV	60 mV	100 mV	0.7 V	1.0 V	1.0 / 0.5 V
di/dt of load step	1.5 A/µs	0.8 A/µs	0.5 A/µs	1.0/0.5 A/µs	0.4 A/µs	0.2 A/µs	0.1 A/µs	0.2/0.1 A/µs
output voltage	14 V	30 V	48 V	24 / 48 V	65 V	110 V	280 V	185 / 370 V
time, @ 50 - 100% load step	100 µs	100 µs	100 µs	100 / 100 µs	100 µs	100 µs	100 µs	100 / 100 µs
max. deviation	200 mV	150 mV	250 mV	200/100 mV	200 mV	2.2 V	1.5 V	2.5 / 1.5 V
Output impedance								
CV, 0-1 kHz	< 1.3 mΩ	< 1.7 mΩ	< 3.5 mΩ	< 3.3 mΩ	< 7.5 mΩ	< 63 mΩ	< 125 mΩ	< 83 mΩ
CV, 1-100 kHz	< 25 mΩ	< 30 mΩ	< 30 mΩ	< 40 mΩ	< 30 mΩ	< 600 mΩ	< 1 Ω	< 1.3 Ω
Pulsating load max. tolerable AC component of load current								
f > 1 kHz	15 A$_{rms}$	15 A$_{rms}$	13 A$_{rms}$	20 A$_{rms}$	13 A$_{rms}$	2.5 A$_{rms}$	1.2 A$_{rms}$	0.8 A$_{rms}$
f < 1 kHz	100 A$_{peak}$	45 A$_{peak}$	30 A$_{peak}$	60 / 30 A$_{peak}$	22 A$_{peak}$	13 A$_{peak}$	5 A$_{peak}$	8 / 4 A$_{peak}$

Insulation	
AC mains / DC power terminals	3750 V_{rms} (1min.)
creepage / clearance	8 mm
AC mains / case	2500 V_{rms}
DC power terminals / case	600 V DC [2]

Safety	cTUVus / EN 60950 / EN 61010
EMC **Generic Emission**	**EN 61326-1,** class B equipment (for use in domestic establishments)
Generic Immunity	**EN 61326-1,** equipment for use in industrial and domestic establishments

Operating Temperature	– 20 to + 50 °C @ full load, 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

Hold-Up time (@ 230 VAC input)	
V_{out} = 100%, I_{out} = 100%	16 ms
V_{out} = 85%, I_{out} = 100%	20 ms
V_{out} = 100%, I_{out} = 50%	36 ms
Turn on delay	
after mains switch on	480 ms @ 230 VAC, 700 ms @ 115 VAC
Inrush current	22 A @ 230 VAC, 27 A @ 115VAC

	SM 15-100	SM 35-45	SM 52-30	SM 52-AR-60	SM 70-22	SM 120-13	SM 300-5	SM 400-AR-8
Series operation								
max. total voltage				600 V[2]				
Master / Slave operation				yes				
Parallel operation								
Normal				no limit				
Master / Slave operation				maximum 4 units				
Remote sensing								
max. voltage drop per load lead				2 V				
Limits Voltage adjust range				0 - 102 %				
Current adjust range				0 - 102 %				
Front panel CV/CC-controls				analog potentiometers [3]				
resolution				10 turns (0.03%)				
knob operation				standard				
screwdriver adjustment				optional (P001)				
Lock function for CV/CC-settings				no [3]				
Selectable Start-up at 0V / 0A or				no [3]				
at last settings								
				[3] optional with digital encoders (P220).				
Meters	3.5 digit	3.5 digit	3.5 digit	3.5 digit	3.5 digit	3.5 digit	3.5 digit	3.5 digit
scale voltage	0 - 15.00V	0 - 35.0 V	0 - 52.0 V	0 - 52.0 V	0 - 70.0V	0 - 120.0V	0 - 300 V	0 - 400 V
scale current	0 - 100.0 A	0 - 45.0 A	0 - 30.0A	0 - 60.0A	0 - 22.0 A	0 - 13.00 A	0 - 5.00 A	0 - 8.00 A
accuracy read output	0.5% + 2d	0.5% + 2d	0.5% + 2d	0.5% + 2d	0.5% + 2d	0.5% + 2d	0.5% + 2d	0.5% + 2d
read limit setting (d = digit)	2% + 2d	2% + 2d	2% + 2d	2% + 2d	2% + 2d	2% + 2d	2% + 2d	2% + 2d

Mounting	stacking of units allowed, air flow is from left to right
AC Terminals	IEC320/C20, EN60320/C20
DC Terminals	M8 bolts
Programming connector	15 pole D-connector at rear panel (Female)
Interlock	contact at rear panel
Cooling	low noise blower, fan speed adapts to temperature of internal system
audio noise level	ca. 45 dBA at full load, 25 °C ambient temperature, 1 m distance
	ca. 50 dBA at full load, 50 °C ambient temperature, 1 m distance
air flow	From left to right
Enclosure	
degree of protection	IP20
Dimensions	
front panel: h x w	89 x 483 mm (19", 2 U)
behind front panel: h x w x d	89 x 443 x 365 mm
Weight	9.9 kg

Notes: 1. Measured at full load.   2. See "Safety instructions".

Typical Applications

- Solar inverter testing, PV-Simulation
- Hybrid 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

Available Options

Increased Output Power

The conservatively rated unit allows to deliver extra output with the same reliability.
At some derating, either the maximum output voltage or the maximum output current can be increased by about 10%.

Order Code :
- P069

High Speed Programming

A 10 to 20 times higher programming speed (down to 0.2ms rise time at full load) and lower output capacitance[1]. Excellent for laser applications, test systems or as current source with low parallel capacitance as used in plasma chambers.

Order Codes :
- SM 15-100 P210 – SM35-45   P211
- SM 52-30 P212 – SM52-AR-60 P213
- SM 70-22 P214 – SM120-13   P215
- SM 300-5 P216 – SM400-AR-8 P217

Two-Quadrant Output Power Sink

Two quadrant operation maintains the DC output voltage constant regardless the output power is positive or negative[1]. Ideal for PWM-speed controlled DC-Motors and ATE systems.

Order Codes :
- SM 15-100 P202 – SM35-45   P203
- SM 52-30 P204 – SM52-AR-60 P205
- SM 70-22 P206

Sequencer

Arbitrary Waveform generator or standalone automation. The sequencer Is integrated in the Ethernet controller.

Order Code :
- P177

Digital CV- and CC-Settings

Reliable, long-life digital encoders can be 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.

Order Code :
- P220

Secured Voltage and Current Settings

For maximum security, the CV/CC settings can be adjusted with a screwdriver only and are protected with a plastic cap from accidental adjusting.

Order Code :
- P001

Software Control and Interfaces

Interfaces to be installed by factory [2].

Order Code:
- Ethernet controller   - P177
  (including sequencer)
- ISO AMP Card - isolated analog - P218
- RS232 controller   - P183
- IEEE488 controller   - P184

Notes: *1. Download datasheets about High Speed Programming, Power Sink and Battery Charging from www.DeltaPowerSupplies.com.*
2. There is only room for one of the interfaces in a unit.

Connections analog programming connector

Pin connections (left column, top to bottom):
- 1 — ∅ Analog GND
- 2 — I monitor
- 3 — I program
- 4 — CC status
- 5 — RSD
- 6 — PSOL
- 7 — +12V
- 8 — ∅ Digital GND

Pin connections (right column, top to bottom):
- 9 — Ref. 5.1V
- 10 — V monitor
- 11 — V program
- 12 — OT status
- 13 — LIM status
- 14 — DCF status
- 15 — ACF status
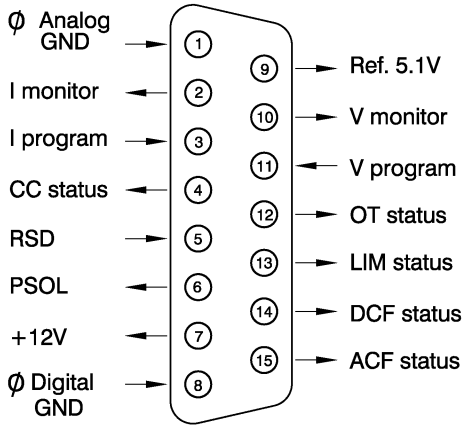
CV = Constant Voltage
CC = Constant Current

Specifications measured at
t_{amb} = 25 ± 5 °C and Vin = 230 VAC,
50 Hz unless otherwise noted.

The information in this document is
subject to change without notice.

442

40 or 70 for line cord   336   36

29

89   16

483 mm

35.0 V   45.0 A

Ethernet, IEEE488, Isolated Analog (all optional)
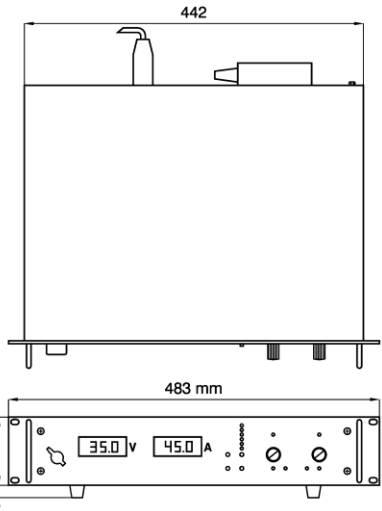
Ethernet user I/O, RS232, CAN, PROFI (all optional)

Analog (standard)

Programming Connectors

Line Cord supplied

Status Relay

Sense Block

CON E

ACF status 15   8   ∅ of status and +12V
DCF status 14   7   +12V
LIM status 13   6   PSOL status
OT status   12   5   RSD
V program   11   4   CC status
V monitor   10   3   I program
Ref. 5.1V   9   2   I monitor
                      1   ∅ of ref. prog. mon.

SW 1
1 : Analog / Optional programming
2 : Output On or Off after mains on
3 : Enable or Disable DC-fail
4 : Parallel or Series M / S

DELTA ELEKTRONIKA
www.DeltaPowerSupplies.com

Vissersdijk 4
4301 ND Zierikzee
The Netherlands

RATED VOLTAGE RANGE
100 - 240 V AC; 16 0- 7.4 A
50 / 60 Hz

WARNING ⚠

For continued protection against risk of fire,
replace with same type and rating of fuse.
Refer servicing to qualified personnel.
Before removing cover disconnect input
supply and wait 3 minutes.

DEFAULT CONFIGURATION
Front panel control with voltage
sensing on output terminals.

Put all switches of SW1 in pos. "ON"
Put jumpers on SENSE BLOCK between
S+ and + and between S- and -

CE   UKCA

Sn: 10340808

S+
S−   SENSE
      BLOCK

InterLock

Master / Slave

DC Power Terminals

AC Mains Connector

Feet are not mounted but included in packing

Safety Covers supplied for in- and output (not shown)