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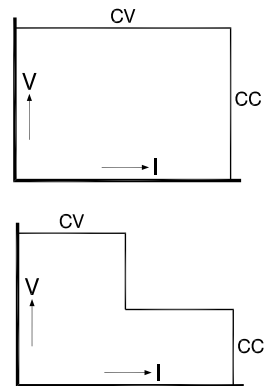


DELTA ELEKTRONIKA B.V.



SM 1500 - Series 1500 Watts 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: fans are temperature controlled
- Available options: High Speed Programming, Interfaces, Extra Isolation, Sequencer, Digital Encoders, 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 for 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
Output voltage current AUTORANGING (2 ranges) max. output current / voltage	0 - 15 V 0 - 100 A no -	0 - 35 V 0 - 45 A no -	0 - 52 V 0 - 30 A no -	0 - 52 V 0 - 60 A yes 60 A / 0-26 V 30 A / 26-52 V	0 - 70 V 0 - 22 A no -	0 - 120 V 0 - 13 A no -	0 - 300 V 0 - 5 A no -	0 - 400 V 0 - 8 A yes 8 A / 0-200 V 4 A / 200-400 V
Input AC single phase, 48 - 62 Hz rated voltage range rated frequency	90 - 265 V 100 - 240 V 50 / 60 Hz	90 - 265 V 100 - 240 V 50 / 60 Hz	90 - 265 V 100 - 240 V 50 / 60 Hz	90 - 265 V 100 - 240 V 50 / 60 Hz	90 - 265 V 100 - 240 V 50 / 60 Hz	90 - 265 V 100 - 240 V 50 / 60 Hz	90 - 265 V 100 - 240 V 50 / 60 Hz	90 - 265 V 100 - 240 V 50 / 60 Hz
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	1500,16	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
Efficiency AC 230 V input, full load AC 115 V input, max. load	87 % 83 %	90 % 86 %	90 % 86 %	89 / 90 % 84%	90 % 86 %	90 % 86 %	91 % 86 %	90 / 91% 86%
Regulation								
Load 0 - 100% CV Line 120 - 265 V AC CV (measured on sense block)	0.5 mV 0.2 mV	1 mV 0.5 mV	2 mV 0.7 mV	2 mV 0.7 mV	2.5 mV 1 mV	4 mV 2 mV	10 mV 3 mV	12 mV 4 mV
Load 0 - 100% CC Line 120 - 265 V AC CC (internal voltage sense)	5 mA 1 mA	3 mA 0.5 mA	1.5 mA 0.5 mA	2 mA 1 mA	1 mA 0.25 mA	0.6 mA 0.2 mA	0.5 mA 0.1 mA	0.5 mA 0.2 mA
Ripple + noise rms (BW=300 kHz) CV p-p (BW=20 MHz) CV	2 mV 8 mV	1.8 mV 8 mV	2 mV 15 mV	2 mV 15 mV	3 mV 15 mV	7 mV 30 mV	7 mV 50 mV	15 mV 80 mV
rms (BW=300 kHz) CC p-p (BW=20 MHz) CC	15 mA 80 mA	5 mA 15 mA	3 mA 10 mA	10 / 3 mA 30 / 10 mA	3 mA 10 mA	2 mA 6 mA	0.5 mA 4 mA	1.2 / 0.6 mA 6 / 3 mA
Temp. coeff., per °C CV CC	35.10 ⁻⁶ 60.10 ⁻⁶							
Stability after 1 hr warm-up during 8 hrs CV CC $t_{amb} = 25 \pm 1\ ^\circ\text{C}$, $V_{in} = 230\ \text{V AC}$ (int. voltage sensing for CC-stab.)	6.10 ⁻⁵ 9.10 ⁻⁵							

Analog Programming	CV	CC
Programming inputs input range accuracy offset temp. coeff. offset input impedance	0 - 5 V $\pm 0.2\%$ - 0.1 ... +1.3 mV (on 5V) 10 $\mu\text{V} / ^\circ\text{C}$ > 1 MOhm	0 - 5 V $\pm 0.5\%$ 0 ... +2.2 mV (on 5V) 50 $\mu\text{V} / ^\circ\text{C}$ > 1 MOhm
Monitoring output output range accuracy offset temp. coeff. offset output impedance	0 - 5 V $\pm 0.2\%$ - 1... 0 mV (on 5V) 3 $\mu\text{V} / ^\circ\text{C}$ 2 Ohm / max. 4 mA	0 - 5 V $\pm 0.5\%$ - 1.1... 0 mV (on 5V) 60 $\mu\text{V} / ^\circ\text{C}$ 2 Ohm / max. 4 mA

Reference voltage on prog. connector	V_{ref} TC	5.114 V $\pm$ 15 mV (Ro = 2 Ohm, max. 4 mA) 20 ppm
+12 V output on prog. Connector	V_o I_{max} R_o	12 V $\pm$ 0.2 V 0.2 A 3 Ohm
Relay Outputs ACF DCF	AC - Fail DC - Fail	both NO and NC contact both NO and NC contact 1) output voltage $\pm$ 5% beyond set point

Status outputs CC - status LIM - status OT - status PSOL - status ACF - status DCF - status	CC - operation	5 V = logic 1 ($R_o = 500 \text{ Ohm}$)	
	CV or CC limit	5 V = logic 1 ($R_o = 500 \text{ Ohm}$)	
	Over Temperature	5 V = logic 1 ($R_o = 500 \text{ Ohm}$)	
	Power Sink Overload	5 V = logic 1 ($R_o = 500 \text{ Ohm}$)	
	AC - Fail	5 V = logic 1 ($R_o = 500 \text{ Ohm}$)	
	DC - Fail ²⁾	5 V = logic 1 ($R_o = 500 \text{ Ohm}$)	²⁾ output voltage $\pm 5\%$ beyond set point
Remote ShutDown	with + 5V, 1 mA or relay contact		
Interlock	contact at rear panel, see photo of rear panel on page 1-6		
Indicators (front panel)	Voltage meter, Ampere meter, 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 switch, CV-and CC-potmeter, CV- and CC-limit-potmeter, Display-Settings button, Display-Limits button, Remote/Local button, Output On/Off button, Front panel Lock button.		

Programming speed	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 time, (100 % load) time, (10 % load)	0 → 15 V 6.1 ms 2.1 ms	0 → 35 V 15.4 ms 5.1 ms	0 → 52 V 7.3 ms 2.4 ms	0 → 26 V 8.5 ms 2.8 ms	0 → 70 V 13.2 ms 4.4 ms	0 → 120 V 3.4 ms 2 ms	0 → 300 V 9 ms 3.9 ms	0 → 200 V 3.7 ms 2.6 ms
output voltage step time, (100 % load) time, (10 % load)	- - -	- - -	- - -	0 → 52 V 34.2 ms 11 ms	- - -	- - -	- - -	0 → 400 V 15 ms 5 ms
Fall time (90 - 10%) output voltage step time, (100 % load) time, (10 % load)	15 → 0 V 6.1 ms 61 ms	35 → 0 V 14.7 ms 147 ms	52 → 0 V 7 ms 70 ms	26 → 0 V 8.2 ms 82 ms	70 → 0 V 12.9 ms 129 ms	120 → 0 V 3.3 ms 33 ms	300 → 0 V 9 ms 90 ms	200 → 0 V 3.5 ms 35 ms
output voltage step time, (100 % load) time, (10 % load)	- - -	- - -	- - -	52 → 0 V 33 ms 330 ms	- - -	- - -	- - -	400 → 0 V 14.2 ms 142 ms
Programming speed	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 time, (100 % load) time, (10 % load)	0 → 15 V 0.20 ms 0.11 ms	0 → 35 V 0.27 ms 0.14 ms	0 → 52 V 0.31 ms 0.23 ms	0 → 26 V 0.44 ms 0.43 ms	0 → 70 V 0.47 ms 0.30 ms	0 → 120 V 0.46 ms 0.27 ms	0 → 300 V 1.0 ms 0.51 ms	0 → 200 V 0.35 ms 0.33 ms
output voltage step time, (100 % load) time, (10 % load)	- - -	- - -	- - -	0 → 52 V 0.53 ms 0.34 ms	- - -	- - -	- - -	0 → 400 V 0.98 ms 0.59 ms
Fall time (90 - 10%) output voltage step time, (100 % load) time, (10 % load)	15 → 0 V 0.21 ms 1.6 ms	35 → 0 V 0.33 ms 3.5 ms	52 → 0 V 0.38 ms 3.9 ms	26 → 0 V 0.27 ms 3.2 ms	70 → 0 V 0.78 ms 8.3 ms	120 → 0 V 0.51 ms 4.5 ms	300 → 0 V 1.40 ms 13 ms	200 → 0 V 0.35 ms 3.8 ms
output voltage step time, (100 % load) time, (10 % load)	- - -	- - -	- - -	52 → 0 V 1.0 ms 9.7 ms	- - -	- - -	- - -	400 → 0 V 1.7 ms 18 ms
Ripple @full load (rms/pp) @full load (rms/pp)	15/ 50 mV	50/115 mV	55 /135 mV	26 V / 60 A 30 / 105 mV 52 V / 30 A 25 / 90 mV	45/150 mV	20/80 mV	25/115 mV	200 V 85 / 355 mV 400 V 60 / 245 mV
Output capacitance	390 μF	190 μF	91 μF	195 μF	113 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 recovery within di/dt of load step output voltage time, @ 50 - 100% load step max. deviation	50 mV 1.5 A/ μs 14 V 100 μs 200 mV	50 mV 0.8 A/ μs 30 V 100 μs 150 mV	100 mV 0.5 A/ μs 48 V 100 μs 250 mV	26 V / 52 V 60 mV 1.0 / 0.5 A/ μs 24 / 48 V 100 / 100 μs 200 / 100 mV	100 mV 0.4 A/ μs 65 V 100 μs 200 mV	0.7 V 0.2 A/ μs 110 V 100 μs 2.2 V	1.0 V 0.1 A/ μs 280 V 100 μs 1.5 V	200 V / 400 V 1.0 / 0.5 V 0.2 / 0.1 A/ μs 185 / 370 V 100 / 100 μs 2.5 / 1.5 V
Output impedance CV, 0-1 kHz CV, 1-100 kHz	< 1.3 m Ω < 25 m Ω	< 1.7 m Ω < 30 m Ω	< 3.5 m Ω < 30 m Ω	< 3.3 m Ω < 40 m Ω	< 7.5 m Ω < 30 m Ω	< 63 m Ω < 0.6 Ω	< 125 m Ω < 1 Ω	< 83 m Ω < 1.3 Ω
Pulsating load max. tolerable AC component of load current f > 1 kHz f < 1 kHz	15 Arms 100 Apeak	15 Arms 45 Apeak	13 Arms 30 Apeak	20 Arms 30 / 60 Apeak	13 Arms 22 Apeak	2.5 Arms 13 Apeak	1.2 Arms 5 Apeak	0.8 Arms 8 / 4 Apeak

Insulation 1 input / output creepage / clearance input / case output / case	3750 Vrms (1 min.) 8 mm 2500 Vrms 600 V DC
Safety	cTUVus / EN 60950 / EN 61010
EMC Power Supply Standard	EN 61204-3 , Emission: residential, light industrial environment (CISPR22-Class B) Immunity: industrial environment
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	max. 95% RH, non condensing, up to 40 °C max. 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 $V_{out} = 100\%$, $I_{out} = 100\%$ $V_{out} = 85\%$, $I_{out} = 100\%$ $V_{out} = 100\%$, $I_{out} = 50\%$	16 ms 20 ms 36 ms
Turn on delay after mains switch on	480 ms @ 230 V AC, 700 ms @ 115 V AC
Inrush current	27 A @ 115 V AC, 22 A @ 230 V AC

Series operation max. total voltage Master / Slave operation		600 V yes							
Parallel operation max. total current Master / Slave operation		no limit max. 4 units (including master)							
Remote sensing max. volt. drop per load lead		2 V							
Limits Voltage	adjust range	0 - 102%							
Current	adjust range	0 - 102%							
Potentiometers & Encoders front panel control with knobs resolution screwdriver adjustment digital encoders		standard 0.03 % Option P001 (at front panel) Option P220							
		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
Meters		3.5 digit 0 - 15.00 V	3.5 digit 0 - 35.0 V	3.5 digit 0 - 52.0 V	3.5 digit 0 - 52.0 V	3.5 digit 0 - 70.0 V	3.5 digit 0 - 120.0 V	3.5 digit 0 - 300 V	3.5 digit 0 - 400 V
scale voltage		0 - 100.0 A	0 - 45.0 A	0 - 30.0 A	0 - 60.0 A	0 - 22.0 A	0 - 13.00 A	0 - 5.00 A	0 - 8.00 A
scale current		0.5% + 2 d	0.5% + 2 d	0.5% + 2 d	0.5% + 2 d	0.5% + 2 d	0.5% + 2 d	0.5% + 2 d	0.5% + 2 d
accuracy read output		2% + 2 d	2% + 2 d	2% + 2 d	2% + 2 d	2% + 2 d	2% + 2 d	2% + 2 d	2% + 2 d
read limit setting (d = digit)									

Mounting	Stacking of units allowed, air flow is from left to right.
Input Connector	IEC320/C20, EN 60320/C20
Output Terminals	M8 bolts
Programming connector	15 pole D-connector at rear panel (FEMALE)
Cooling audio noise level airflow	Low noise blower, fan speed adapts to temperature of internal heatsink. 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 from left to right
Enclosure degree of protection	IP20
Dimensions behind front panel: h x w x d front panel: h x w	89 x 442 x 365 mm (feet removed) 89 x 483 mm (19", 2 U)
Weight	9.9 kg

Typical Applications

- Solar inverter testing, PV-Simulation
- Semiconductor burn-in & processing
- Car test systems
- ATE in industrial production lines
- Lasers
- Controlled battery (dis)charging
- Component device testing
- 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

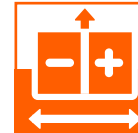


High speed programming

A 10 to 20 times higher programming speed (down to 0.2 ms rise time at full load)

and lower output capacitance. 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 - SM 70-22 P214
 SM 35-45 P211 - SM 120-13 P215
 SM 52-30 P212 - SM 300-5 P216
 SM 52-AR-60 P213 - SM 400-AR-8 P217



Two-Quadrant Output: Power sink

Two quadrant operations maintains the output voltage constant

regardless the output power is positive or negative. Ideal for PWM-speed controlled DC-motors and ATE systems.

- Order Codes :
 SM 15-100 P202 - SM 52-AR-60 P205
 SM 35-45 P203 - SM 70-22 P206
 SM 52-30 P204



Sequencer

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

- Order Code - P177



High Voltage Isolation

A higher output isolation allows series operation up to 1000V.

- Order Code - P089



Secured Voltage and Current Setting

For a 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



Digital Voltage and Current Setting

Reliable, longlife 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.

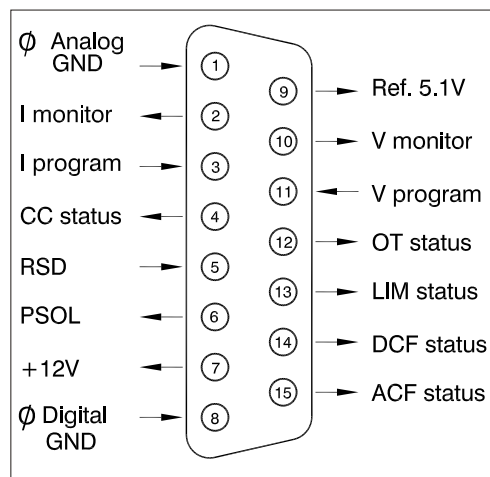
- Order Code - P220



Software Control and Interfaces

Factory installed programming interfaces:

- Ethernet controller (incl.sequencer) - P177
- RS232 controller - P183
- IEEE488 controller - P184
- ISO AMP CARD - isolated analog - P218
- PROFIBUS controller - P273
- CANBUS controller - P274



Connections programming connector

CV = Constant Voltage
 CC = Constant Current

Specifications measured at
 $t_{amb} = 25 \pm 5^\circ\text{C}$ and $V_{in} = 230\text{ V AC}$,
 50 Hz, unless otherwise noted.

The information in this document is
 subject to change without notice

