SM 6000 - Series 6000 W DC POWER SUPPLIES

Three phase input

<table>
<thead>
<tr>
<th>Models</th>
<th>Voltage range</th>
<th>Current range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM 15-400</td>
<td>0 - 15 V</td>
<td>0 - 400 A</td>
</tr>
<tr>
<td>SM 30-200</td>
<td>0 - 30 V</td>
<td>0 - 200 A</td>
</tr>
<tr>
<td>SM 45-140</td>
<td>0 - 45 V</td>
<td>0 - 140 A</td>
</tr>
<tr>
<td>SM 60-100</td>
<td>0 - 60 V</td>
<td>0 - 100 A</td>
</tr>
<tr>
<td>SM 70-90</td>
<td>0 - 70 V</td>
<td>0 - 90 A</td>
</tr>
<tr>
<td>SM 120-50</td>
<td>0 - 120 V</td>
<td>0 - 50 A</td>
</tr>
<tr>
<td>SM 300-20</td>
<td>0 - 300 V</td>
<td>0 - 20 A</td>
</tr>
<tr>
<td>SM 600-10</td>
<td>0 - 600 V</td>
<td>0 - 10 A</td>
</tr>
</tbody>
</table>

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
**DELTA ELEKTRONIKA BV**

**SM6000**

### Output
- **voltage**
  - SM15-400: 0 - 15 V, 0 - 400 mA
  - SM30-200: 0 - 30 V, 0 - 200 mA
  - SM45-140: 0 - 45 V, 0 - 140 mA
  - SM60-100: 0 - 60 V, 0 - 100 mA
  - SM70-90: 0 - 70 V, 0 - 90 mA
  - SM120-50: 0 - 120 V, 0 - 50 mA
  - SM300-20: 0 - 300 V, 0 - 20 mA
  - SM600-10: 0 - 600 V, 0 - 10 mA
- **current**
  - SM15-400: 0 - 15 V, 0 - 400 mA
  - SM30-200: 0 - 30 V, 0 - 200 mA
  - SM45-140: 0 - 45 V, 0 - 140 mA
  - SM60-100: 0 - 60 V, 0 - 100 mA
  - SM70-90: 0 - 70 V, 0 - 90 mA
  - SM120-50: 0 - 120 V, 0 - 50 mA
  - SM300-20: 0 - 300 V, 0 - 20 mA
  - SM600-10: 0 - 600 V, 0 - 10 mA

### Input
- **AC 3 phase, 48 - 62 Hz**
  - **rated voltage range**
    - SM30-20: 342 - 528 V
    - SM600-10: 342 - 528 V
  - **rated frequency**
    - SM30-20: 50 / 60 Hz
    - SM600-10: 50 / 60 Hz
  - **rated current**
    - SM30-20: 10.2 A
    - SM600-10: 10 A

### Efficiency
- **400 V AC, 3 ph input, full load**
  - SM15-400: 87 %
  - SM30-200: 89 %
  - SM45-140: 90 %
  - SM60-100: 89 %
  - SM70-90: 89 %
  - SM120-50: 89 %
  - SM300-20: 89 %
  - SM600-10: 89 %

### Regulation
- **Load 0 - 100%**
  - CV: 2.5 mV
  - CC: 0.2 mA
- **Line 342 - 457 V AC (external voltage sense)**
  - CV: 2.5 mV
  - CC: 0.2 mA
- **Load 0 - 100%**
  - CV: 24 mA
  - CC: 4 mA
- **Line 342 - 457 V AC (internal voltage sense, after warm-up)**
  - CV: 24 mA
  - CC: 4 mA

### Ripple + noise
- **rms**
  - CV: 0.8 mV
  - CC: 8 mA
- **p-p**
  - CV: 8 mV
  - CC: 8 mV

### Temp. coeff., per °C
- CV: 35.10⁻⁶
- CC: 60.10⁻⁶

### Stability
- **after 1 hr warm-up**
  - CV: 5.10⁻⁵
  - CC: 10.10⁻⁵

### Analog Programming
- **Note: for SM300-20 / SM600-10 see ISO AMP**

#### Programming inputs
- **input range**
  - 0 - 5 V
- **accuracy**
  - ±0.2%
- **offset**
  - -0.1 ... +1.3 mV (on 5 V)
- **temp. coeff. offset**
  - 10 μV / °C
- **input impedance**
  - > 1 MOhm

#### Monitoring outputs
- **output range**
  - 0 - 5 V
- **accuracy**
  - ±0.2%
- **offset**
  - -1 ... 0 mV (on 5 V)
- **temp. coeff. offset**
  - 3 μV / °C
- **output impedance**
  - 2 Ohm / max. 4 mA

#### ISO AMP Programming
- **optional for low volt. units up to 120V (P154), standard on SM300-20 and SM600-10**

#### Reference voltage
- **on prog. connector**
  - $V_{ref}$
  - TC: 5.114 ± 15 mV (Ro = 2 Ohm, max. 4 mA)
  - 20 ppm / °C
- **+12 V output**
  - $V_o$
  - $I_{max}$
  - $R_o$

### July 2003, rev. Sept 2014
### Status outputs

<table>
<thead>
<tr>
<th>Status Outputs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC - status</td>
<td>5 V = logic 1 (R&lt;sub&gt;q&lt;/sub&gt; = 500 Ohm)</td>
</tr>
<tr>
<td>LIM - status</td>
<td>5 V = logic 1 (R&lt;sub&gt;q&lt;/sub&gt; = 500 Ohm)</td>
</tr>
<tr>
<td>OT - status</td>
<td>5 V = logic 1 (R&lt;sub&gt;q&lt;/sub&gt; = 500 Ohm)</td>
</tr>
<tr>
<td>PSOL - status</td>
<td>5 V = logic 1 (R&lt;sub&gt;q&lt;/sub&gt; = 500 Ohm)</td>
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<tr>
<td>ACF - status</td>
<td>5 V = logic 1 (R&lt;sub&gt;q&lt;/sub&gt; = 500 Ohm)</td>
</tr>
<tr>
<td>DCF - status</td>
<td>5 V = logic 1 (R&lt;sub&gt;q&lt;/sub&gt; = 500 Ohm)</td>
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</tbody>
</table>

### Relay Outputs

<table>
<thead>
<tr>
<th>Relay Outputs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACF</td>
<td>both NO and NC contact</td>
</tr>
<tr>
<td>DCF</td>
<td>both NO and NC contact</td>
</tr>
</tbody>
</table>

### Remote ShutDown

- 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

### 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

### Specifications

#### Programming speed

<table>
<thead>
<tr>
<th>Version</th>
<th>SM 15-400</th>
<th>SM 30-200</th>
<th>SM 45-140</th>
<th>SM 60-100</th>
<th>SM 70-90</th>
<th>SM 120-50</th>
<th>SM 300-20</th>
<th>SM 600-10</th>
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<tbody>
<tr>
<td>Standard</td>
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<td>Option</td>
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<td>P167</td>
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</tbody>
</table>

#### Recovery time

- (10 - 90%)

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>SM 15-400</th>
<th>SM 30-200</th>
<th>SM 45-140</th>
<th>SM 60-100</th>
<th>SM 70-90</th>
<th>SM 120-50</th>
<th>SM 300-20</th>
<th>SM 600-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 V</td>
<td>1.25 ms</td>
<td>1.25 ms</td>
<td>1.25 ms</td>
<td>1.25 ms</td>
<td>1.25 ms</td>
<td>1.25 ms</td>
<td>1.25 ms</td>
<td>1.25 ms</td>
</tr>
<tr>
<td>30 V</td>
<td>2.5 ms</td>
<td>2.5 ms</td>
<td>2.5 ms</td>
<td>2.5 ms</td>
<td>2.5 ms</td>
<td>2.5 ms</td>
<td>2.5 ms</td>
<td>2.5 ms</td>
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<tr>
<td>60 V</td>
<td>5.0 ms</td>
<td>5.0 ms</td>
<td>5.0 ms</td>
<td>5.0 ms</td>
<td>5.0 ms</td>
<td>5.0 ms</td>
<td>5.0 ms</td>
<td>5.0 ms</td>
</tr>
<tr>
<td>120 V</td>
<td>10.0 ms</td>
<td>10.0 ms</td>
<td>10.0 ms</td>
<td>10.0 ms</td>
<td>10.0 ms</td>
<td>10.0 ms</td>
<td>10.0 ms</td>
<td>10.0 ms</td>
</tr>
</tbody>
</table>

#### Output Impedance

<table>
<thead>
<tr>
<th>CV, 0-1 kHz</th>
<th>SM 15-400</th>
<th>SM 30-200</th>
<th>SM 45-140</th>
<th>SM 60-100</th>
<th>SM 70-90</th>
<th>SM 120-50</th>
<th>SM 300-20</th>
<th>SM 600-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.5 mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>&lt; 2.3 mΩ</td>
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<td></td>
</tr>
</tbody>
</table>

#### Pulsating load

<table>
<thead>
<tr>
<th>F &gt; 1 kHz</th>
<th>SM 15-400</th>
<th>SM 30-200</th>
<th>SM 45-140</th>
<th>SM 60-100</th>
<th>SM 70-90</th>
<th>SM 120-50</th>
<th>SM 300-20</th>
<th>SM 600-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Arms</td>
<td>600 Arms</td>
<td>140 Arms</td>
<td>20 Arms</td>
<td>10 Arms</td>
<td>5 Arms</td>
<td>2.5 Arms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 Apeak</td>
<td>200 Apeak</td>
<td>100 Apeak</td>
<td>90 Apeak</td>
<td>50 Apeak</td>
<td>20 Apeak</td>
<td></td>
<td></td>
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<tr>
<td>f &lt; 1 kHz</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>F &gt; 1 kHz</th>
<th>SM 15-400</th>
<th>SM 30-200</th>
<th>SM 45-140</th>
<th>SM 60-100</th>
<th>SM 70-90</th>
<th>SM 120-50</th>
<th>SM 300-20</th>
<th>SM 600-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 mΩ</td>
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<td></td>
<td></td>
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<tr>
<td>&lt; 1.2 mΩ</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1.5 mΩ</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1.8 mΩ</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 11 mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 34 mΩ</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>&lt; 70 mΩ</td>
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</tbody>
</table>

#### Insulation

- input / output creepage / clearance: 3750 Vrms (1 min.) 8 mm
- input / case: 2500 Vrms 600 V DC (1200 V DC for SM300-20 and SM600-10)

#### Safety

- cTUVus / EN 60950 / EN 61010

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EMC Power Supply Standard

| Generic Emission | EN 61204-3, Emission: residential, light industrial environment (CISPR22-Class B) |
| Generic Immunity | Immunity: 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

<table>
<thead>
<tr>
<th>Model</th>
<th>V_out = 100%</th>
<th>I_out = 100%</th>
<th>V_out = 85%</th>
<th>I_out = 100%</th>
<th>V_out = 100%</th>
<th>I_out = 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM 15-400</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>33 ms</td>
<td></td>
</tr>
<tr>
<td>SM 30-200</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>28 ms</td>
<td></td>
</tr>
<tr>
<td>SM 45-140</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>27 ms</td>
<td></td>
</tr>
<tr>
<td>SM 60-100</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>28 ms</td>
<td></td>
</tr>
<tr>
<td>SM 70-90</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>27 ms</td>
<td></td>
</tr>
<tr>
<td>SM 120-50</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>27 ms</td>
<td></td>
</tr>
<tr>
<td>SM 300-20</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>27 ms</td>
<td></td>
</tr>
<tr>
<td>SM 600-10</td>
<td>11 ms</td>
<td>11 ms</td>
<td>23 ms</td>
<td>23 ms</td>
<td>27 ms</td>
<td></td>
</tr>
</tbody>
</table>

Turn on delay

- after mains switch on
- 200 ms

Inrush current

- 20 A (electronic limit)

Phase loss

- Output shuts down in case of phase loss

Series operation

| Normal/Slave operation | yes | yes | yes | yes | yes | yes |

Parallel operation

| Normal/Slave operation | no limit | max. 3 units |

Remote sensing

| Voltage drop per load lead | max. 2 V |

Limits

| Voltage | adjust range | 0 - 102% |
| Current | adjust range | 0 - 102% |

Front panel CV/CC-controls

| resolution | analog potentiometers 1) |
| knob operation | 10 turns (0.03%) standard |
| screwdriver adjustment | optional (D001) |

Lock function for CV/CC-settings

| selectable start-up at 0V / 0A or at last settings | no |

1) optional with digital encoders (P220) - specifications for controls are similar to SM300-20 and SM600-10.

Meters

| scale voltage | 3.5 digit 0 - 15.00 V 0 - 400 A 0.5% + 2 d 2% + 2 d |
| scale current | 3.5 digit 0 - 30.0 V 0 - 200 A 0.5% + 2 d 2% + 2 d |
| accuracy | 3.5 digit 0 - 45.0 V 0 - 140.0 A 0.5% + 2 d 2% + 2 d |
| read output | 3.5 digit 0 - 60.0 V 0 - 100.0 A 0.5% + 2 d 2% + 2 d |
| read limit setting | 3.5 digit 0 - 70.0 V 0 - 90.0 A 0.5% + 2 d 2% + 2 d |
| (d = digit) | 3.5 digit 0 - 120.0 V 0 - 200 A 0.5% + 2 d 2% + 2 d |
| | 3.5 digit 0 - 300 V 0 - 10.0 A 0.5% + 2 d 2% + 2 d |

Mounting

| Stacking of units allowed, air flow is from left to right. |

Input Terminals

| Screw Terminals for cable 2.5 - 4 mm², 3 phase + earth (no neutral required) |

Output Terminals

| M12 bolts | M10 bolts | M10 bolts | M10 bolts | M10 bolts | M8 bolts | M8 bolts | M8 bolts |

Programming connector

| 15 pole D-connector at rear panel (FEMALE) |

Cooling

| Low noise blower, fan speed adapts to temperature of internal heatsink. |
| ca. 56 dBA at full load, 25 °C ambient temperature, 1 m distance |
| ca. 62 dBA at full load, 50 °C ambient temperature, 1 m distance |

Enclosure

| degree of protection | IP20 |

Dimensions

| behind front panel: h x w x d | 177 x 443 x 500 mm |
| front panel: h x w | 177 x 483 mm (19", 4 U) |

Weight

| 27 kg |
Typical Applications

- Solar inverter testing, PV-Simulation
- Controlled Battery (dis)charging
- Plasma chambers
- Lasers
- Hybrid Car test systems
- Driving PWM-Controlled DC motors
- ATE in industrial production lines
- Accurate current sources
- Automotive battery simulations
- 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 0.4 ms 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 15-400 P166 - SM 30-200 P167
  - SM 45-140 P168 - SM 60-100 P169
  - SM 70-90 P170 - SM 120-50 P171
  - SM 300-20 P172 - SM 600-10 P270

Two-Quadrant Output: Power sink
Two quadrant operations maintain the 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 15-400 P230 - SM 30-200 P231
  - SM 45-140 P232 - SM 60-100 P233
  - SM 70-90 P234

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

• Order Code - P157

High Voltage Isolation
A higher output isolation allows series operation up to 1200V. Is standard on SM300-20 and SM600-10.

• Order Code - P089

High Input Voltage
All units standard have a rated input voltage range of 380...480 V AC.

For older units, the nominal input voltage was 440 V AC, and option P165 was needed for operation at 480 V AC (check rear panel).

Software control and Interfaces
Factory installed programming interfaces 2):
- ISO AMP Card - isolated analog - P154 3)
- RS232 controller - P155
- IEEE488 controller - P156
- Ethernet contr. (incl. sequencer) - P157
- PROFIBUS controller - P277
- CANBUS controller - P278

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. Is standard on SM300-20 and SM600-10.

• Order Code - P220

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. SM300-20, SM600-10 and units with option P220 already have secured settings.

• Order Code - P001

Notes: 1. Download special datasheets about High Speed Progr.. Power Sink and Battery Charging from www.DeltaPowerSupplies.com.
2. There is only room for one of the interfaces in a unit (P154, P155, P156, P157, P277 or P278).
3. SM300-20 and SM 600-10 standard equipped with ISO AMP, this can be replaced by P155, P156, P157, P277 or P278.
**Connections analog programming connector**

1. Ref. 5.1V
2. V monitor
3. V program
4. OT status
5. LIM status
6. DCF status
7. ACF status

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**Specifications measured at $T_{\text{amb}} = 25 \pm 5\, ^\circ\text{C}$ and $V_i = 400$ V AC, 50 Hz, 3 phase, unless otherwise noted.**

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