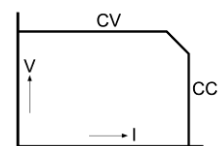
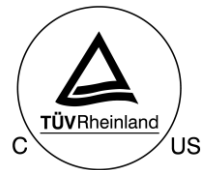




Three phase input

SM6000 - Series 6000W DC POWER SUPPLIES

| Models | Voltage range | Current range |
|-----------|---------------|---------------|
| SM 15-400 | 0 - 15 V | 0 - 400 A |
| SM 30-200 | 0 - 30 V | 0 - 200 A |
| SM 45-140 | 0 - 45 V | 0 - 140 A |
| SM 60-100 | 0 - 60 V | 0 - 100 A |
| SM 70-90 | 0 - 70 V | 0 - 90 A |
| SM 120-50 | 0 - 120 V | 0 - 50 A |
| SM 300-20 | 0 - 300 V | 0 - 20 A |
| SM 600-10 | 0 - 600 V | 0 - 10 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 15-400 | SM 30-200 | SM 45-140 | SM 60-100 | SM 70-90 | SM 120-50 | SM 300-20 | SM 600-10 |
|--|------------|------------|------------|------------|------------|------------|------------|---------------------|
| DC Power terminals | | | | | | | | |
| voltage | 0 - 15 V | 0 - 30 V | 0 - 45 V | 0 - 60 V | 0 - 70 V | 0 - 120 V | 0 - 300 V | 0 - 600 V |
| current | 0 - 400 A | 0 - 200 A | 0 - 140 A | 0 - 100 A | 0 - 90 A | 0 - 50 A | 0 - 20 A | 0 - 10 A |
| AC Input | | | | | | | | |
| 1 or 3 phase, 48 - 62 Hz | 342-528 V | 342-528 V | 342-528 V | 342-528 V | 342-528 V | 342-528 V | 342-528 V | 342-528 V |
| rated voltage range | 380-480 V | 380-480 V | 380-480 V | 380-480 V | 380-480 V | 380-480 V | 380-480 V | 380-480 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 12.2A | max 12.2A | max 12.2A | max 12.2A | max 12.2A | max 12.2A | max 12.2A | max 12.2A |
| current (400 V / 3 ph, full load) | 10.2 A | 10 A | 10.3 A | 10 A | 10.4 A | 9.9 A | 10 A | 10 A |
| power factor, 100%, 50% load | 0.98, 0.97 | 0.98, 0.97 | 0.98, 0.97 | 0.98, 0.97 | 0.98, 0.97 | 0.98, 0.97 | 0.98, 0.97 | 0.98, 0.97 |
| internal fuses | 15 AT | 15 AT | 15 AT | 15 AT | 15 AT | 15 AT | 15 AT | 15 AT |
| standby input power ($V_o=I_o=0$) | 55 W | 55 W | 55 W | 55 W | 55 W | 55 W | 55 W | 55 W |
| standby input power ($V_o=V_{max}$) | 110 W | 110 W | 110 W | 110 W | 130 W | 130 W | 120 W | 130 W |
| Efficiency | 87 % | 89 % | 90 % | 89 % | 89 % | 89 % | 89 % | 89 % |
| 400 V AC, 3 ph input, full load | | | | | | | | |
| Regulation | | | | | | | | |
| Load 0 - 100% CV | 2.5 mV | 5 mV | 5 mV | 5 mV | 5 mV | 8 mV | 15 mV | 20 mV |
| Line 342 - 457 V AC CV (external voltage sense) | 0.2 mV | 0.5 mV | 1 mV | 2 mV | 2 mV | 2 mV | 3 mV | 4 mV |
| Load 0 - 100% CC | 24 mA | 12 mA | 9 mA | 6 mA | 5 mA | 3 mA | 1.2 mA | 1.0 mA |
| Line 342 - 457 V AC CC (internal voltage sense, after warm up) | 4 mA | 2 mA | 1.5 mA | 1 mA | 1 mA | 0.5 mA | 0.2 mA | 0.2 mA |
| Ripple + noise | | | | | | | | |
| rms (BW=300 kHz) CV | 0.8 mV | 1 mV | 1.5 mV | 2 mV | 2 mV | 3 mV | 5 mV | 10 mV |
| p-p (BW=20 MHz) CV | 8 mV | 8 mV | 10 mV | 10 mV | 10 mV | 25 mV | 50 mV | 100 mV |
| rms (BW=300 kHz) CC | 100 mA | 20 mA | 8 mA | 3 mA | 3 mA | 3 mA | 2 mA | 2 mA |
| p-p (BW=20 MHz) CC CC-ripple at full load | 300 mA | 60 mA | 25 mA | 10 mA | 10 mA | 10 mA | 5 mA | 5 mA |
| Temp. coeff., per °C⁻¹ | | | | | | | | |
| CV | | | | | | | | 35.10 ⁻⁶ |
| CC | | | | | | | | 60.10 ⁻⁶ |
| Stability ¹ after 1 hr warm-up during 8 hrs | | | | | | | | |
| CV | | | | | | | | 5.10 ⁻⁵ |
| CC | | | | | | | | 10.10 ⁻⁵ |
| $t_{amb} = 25 \pm 1$ °C, $V_{in} = 400$ VAC (internal voltage sensing for CC-stab.) | | | | | | | | |

| Analog Programming <i>Not applicable for SM300-20 & SM600-10: see below ISO AMP specs</i> | 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 <i>optional for low volt. units up to 120V, standard on SM300-20 and SM600-10.</i> | 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 LIM - status OT - status PSOL - status ACF - status DCF - status | CC - operation CV or CC limit Over Temperature Power Sink Overload AC - Fail DC - Fail ¹⁾ | 5 V = logic 1 (Ro = 500 Ohm) 5 V = logic 1 (Ro = 500 Ohm) 5 V = logic 1 (Ro = 500 Ohm) 5 V = logic 1 (Ro = 500 Ohm) 5 V = logic 1 (Ro = 500 Ohm) 5 V = logic 1 (Ro = 500 Ohm) |
| Relay Outputs | ACF DCF | AC - Fail DC - Fail ¹⁾ | both NO and NC contact both NO and NC contact ¹⁾ 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 | | |
| 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 | | |

| | SM 15-400 | SM 30-200 | SM 45-140 | SM 60-100 | SM 70-90 | SM 120-50 | SM 300-20 | SM 600-10 |
|---|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Programming speed <i>Standard Version</i> (resistive load) | | | | | | | | |
| Rise time (10 - 90%) output voltage step time, (100 % load) time, (10 % load) | 0 → 15 V 3.3 ms 1.3 ms | 0 → 30 V 6.4 ms 2.5 ms | 0 → 45V 2.7 ms 1.1 ms | 0 → 60 V 5.4 ms 2.2 ms | 0 → 70 V 6.8 ms 2.8 ms | 0 → 120 V 5.1 ms 1.9 ms | 0 → 300 V 8.5 ms 3.2 ms | 0 → 600 V 12 ms 4.8 ms |
| Fall time (90 - 10%) output voltage step time, (100 % load) time, (10 % load) | 15 → 0 V 3.5 ms 34 ms | 30 → 0 V 6.7 ms 67 ms | 45 → 0 V 2.9 ms 32 ms | 60 → 0 V 5.8 ms 59 ms | 70 → 0 V 7.7 ms 77 ms | 120 → 0 V 4.9 ms 52 ms | 300 → 0 V 8.3 ms 83 ms | 600 → 0 V 12 ms 120 ms |
| Programming speed <i>Optional High Speed</i> (resist. load) | SM 15-400 <i>option 166</i> | SM 30-200 <i>option 167</i> | SM 45-140 <i>option 168</i> | SM 60-100 <i>option 169</i> | SM 70-90 <i>option 170</i> | SM 120-50 <i>option 171</i> | SM 300-20 <i>option 172</i> | SM 600-10 <i>option 270</i> |
| Rise time (10 - 90%) output voltage step time, (100 % load) time, (10 % load) | 0 → 15 V 0.40 ms 0.38 ms | 0 → 30 V 0.41 ms 0.38 ms | 0 → 45V 0.53 ms 0.16 ms | 0 → 60 V 0.44 ms 0.41 ms | 0 → 70 V 0.62 ms 0.40 ms | 0 → 120 V 0.57 ms 0.19 ms | 0 → 300 V 1.1 ms 0.44 ms | 0 → 600 V 1.9 ms 0.80 ms |
| Fall time (90 - 10%) output voltage step time, (100 % load) time, (10 % load) | 15 → 0 V 0.39 ms 1.5 ms | 30 → 0 V 0.41 ms 3.6 ms | 45 → 0 V 0.26 ms 10 ms | 60 → 0 V 0.57 ms 5.6 ms | 70 → 0 V 0.50 ms 6.2 ms | 120 → 0 V 0.38 ms 4.2 ms | 300 → 0 V 1.0 ms 10 ms | 600 → 0 V 2.2 ms 20 ms |
| Ripple @ full load typical (rms/pp) | 6/20mV | 28/80mV | 34/80mV | 34/90mV | 38/100mV | 30/120mV | 48/150mV | 35/220mV |
| Output Capacitance (typical) | 1200 µF | 800 µF | 520 µF | 330 µF | 290 µF | 73 µF | 32 µF | 19 µF |

| | SM 15-400 | SM 30-200 | SM 45-140 | SM 60-100 | SM 70-90 | SM 120-50 | SM 300-20 | SM 600-10 |
|--|--|---|--|--|--|---|--|--|
| Recovery time recovery within di/dt of load step output voltage time, @ 50 - 100% load step max. deviation | 60 mV 5 A/µs 13 V 120 µs 320 mV | 50 mV 2.5 A/µs 25 V 100 µs 260 mV | 100 mV 1.8 A/µs 40 V 100 µs 380 mV | 100 mV 1.3 A/µs 55 V 100 µs 250 mV | 100 mV 1.7 A/µs 65 V 100 µs 280 mV | 0.5 V 1 A/µs 110 V 100 µs 1 V | 1 V 0.25 A/µs 280 V 100 µs 1.8 V | 1 V 0.12 A/µs 560 V 100 µs 1.8 V |
| Output impedance CV, 0-1 kHz CV, 1-100 kHz | < 0.5 mΩ < 2.3 mΩ | < 1.2 mΩ < 5 mΩ | < 1.7 mΩ < 10 mΩ | < 1.5 mΩ < 12 mΩ | < 1.8 mΩ < 12 mΩ | < 11 mΩ < 90 mΩ | < 34 mΩ < 330 mΩ | < 70 mΩ < 700 mΩ |
| Pulsating load max. tolerable AC component of load current f > 1 kHz f < 1 kHz | 30 A _{rms} 400 A _{peak} | 35 A _{rms} 200 A _{peak} | 20 A _{rms} 140 A _{peak} | 20 A _{rms} 100 A _{peak} | 20 A _{rms} 90 A _{peak} | 10 A _{rms} 50 A _{peak} | 5 A _{rms} 20 A _{peak} | 2.5 A _{rms} 10 A _{peak} |

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

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

| | |
|---|--|
| Operating Temperature at full load | - 20 to + 50 °C 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 |

| | SM 15-400 | SM 30-200 | SM 45-140 | SM 60-100 | SM 70-90 | SM 120-50 | SM 300-20 | SM 600-10 |
|---|--|-----------|-----------|-----------|----------|-----------|-----------|-----------|
| Hold-Up time (@ 400 VAC input) | | | | | | | | |
| $V_{out} = 100\%$, $I_{out} = 100\%$ | 11 ms | 11 ms | 11 ms | 11 ms | 13 ms | 13 ms | 12 ms | 11 ms |
| $V_{out} = 85\%$, $I_{out} = 100\%$ | 23 ms | 23 ms | 23 ms | 24 ms | 23 ms | 24 ms | 24 ms | 23 ms |
| $V_{out} = 100\%$, $I_{out} = 50\%$ | 33 ms | 28 ms | 27 ms | 28 ms | 30 ms | 32 ms | 28 ms | 27 ms |
| 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. | | | | | | | |

| | SM 15-400 | SM 30-200 | SM 45-140 | SM 60-100 | SM 70-90 | SM 120-50 | SM 300-20 | SM 600-10 |
|--|---|--|---|---|--|---|--|--|
| Series operation max. total voltage Master / Slave operation | 600 V ² yes | | | | | | | |
| Parallel operation Normal Master / Slave operation | no limit maximum 3 units | | | | | | | |
| Remote sensing max. voltage drop per load lead | 2 V | | | | | | | |
| Limits Voltage adjust range Current adjust range | 0 - 102 % 0 - 102 % | | | | | | | |
| Front panel CV/CC-controls resolution knob operation screwdriver adjustment Lock function for CV/CC-settings Selectable Start-up at 0V / 0A or at last settings | analog potentiometers ³⁾ 10 turns (0.03%) standard optional (P001) no no | | | | | | digital encoders 10 or 64 turns ⁴⁾ standard no yes yes | |
| | ³⁾ optional with digital encoders (P220) : specifications for controls are similar to SM300-20 and SM600-10. | | | | | | ⁴⁾ variable pitch depending on operation speed | |
| Meters scale voltage scale current accuracy read output read limit setting (d = digit) | 3.5 digit 0 - 15.00V 0 - 400 A 0.5% + 2d 2% + 2d | 3.5 digit 0 - 30.0 V 0 - 200 A 0.5% + 2d 2% + 2d | 3.5 digit 0 - 45.0 V 0 - 140.0A 0.5% + 2d 2% + 2d | 3.5 digit 0 - 60.0 V 0 - 100.0A 0.5% + 2d 2% + 2d | 3.5 digit 0 - 70.0V 0 - 90.0 A 0.5% + 2d 2% + 2d | 3.5 digit 0 - 120.0V 0 - 50.0 A 0.5% + 2d 2% + 2d | 3.5 digit 0 - 300 V 0 - 20.0 A 0.5% + 2d 2% + 2d | 3.5 digit 0 - 600 V 0 - 10.0 A 0.5% + 2d 2% + 2d |

| | | | | | | | | |
|--|--|-----------|-----------|-----------|-----------|----------|----------|----------|
| Mounting | stacking of units allowed, air flow is from left to right | | | | | | | |
| AC Terminals | screw terminals for wire 2.5 - 4 mm ² , 3 phase + earth (no neutral) | | | | | | | |
| DC 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 | | | | | | | |
| Interlock | contact at rear panel | | | | | | | |
| Cooling audio noise level air flow | low noise blower, fan speed adapts to temperature of internal system 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 From left to right | | | | | | | |
| Enclosure degree of protection | IP20 | | | | | | | |
| Dimensions front panel: h x w behind front panel: h x w x d | 177 x 483 mm (19", 4 U) 177 x 443 x 500mm | | | | | | | |
| Weight | 27 kg | | | | | | | |

CV = Constant Voltage CC = Constant Current
Specifications measured at $t_{amb} = 25 \pm 5$ °C and $V_{in} = 400$ VAC, 50 Hz
unless otherwise noted.

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

Notes: 1. Measured at full load.

2. See safety Instructions in the operating manual.

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 0.4ms rise time at full load) and lower output capacitance¹⁾. 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 – SM30-200 P167
- SM 45-140 P168 – SM60-100 P169
- SM 70-90 P170 – SM120-50 P171
- SM 300-20 P172 – SM600-10 P270



Two-Quadrant Output Power Sink

Two quadrant operation maintains the DC output voltage constant regardless the output power is positive or negative¹⁾. Ideal for PWM-speed controlled DC-Motors and ATE systems.

Order Codes :

- SM 15-400 P230 – SM30-200 P231
- SM 45-140 P232 – SM60-100 P233
- SM 70-90 P234



Sequencer

Arbitrary Waveform generator or standalone automation. The sequencer

Is integrated in the Ethernet controller.

Order Code :

- P157



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

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

Order Code :

- P001



Software Control and Interfaces

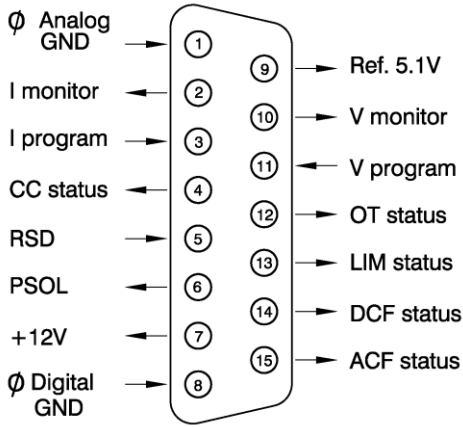
Interfaces to be installed by factory ²⁾.

Order Code:

- ISO AMP Card - isolated analog - P154³⁾
- RS232 controller - P155
- IEEE488 controller - P156
- Ethernet controller (including sequencer) - P157

Notes:

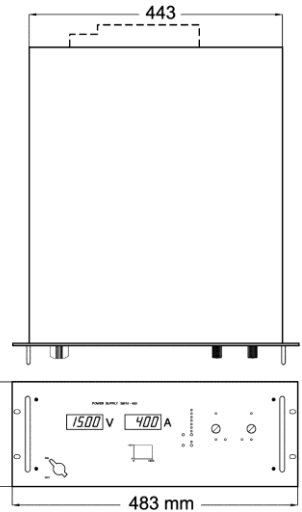
1. Download datasheets about High Speed Programming, Power Sink and Battery Charging from www.DeltaPowerSupplies.com.
2. There is only room for one of the interfaces in a unit.
3. SM300-20, SM 600-10 are standard equipped with ISO AMP, this can be replaced by RS232 or IEEE488 controller (P155 or P156).



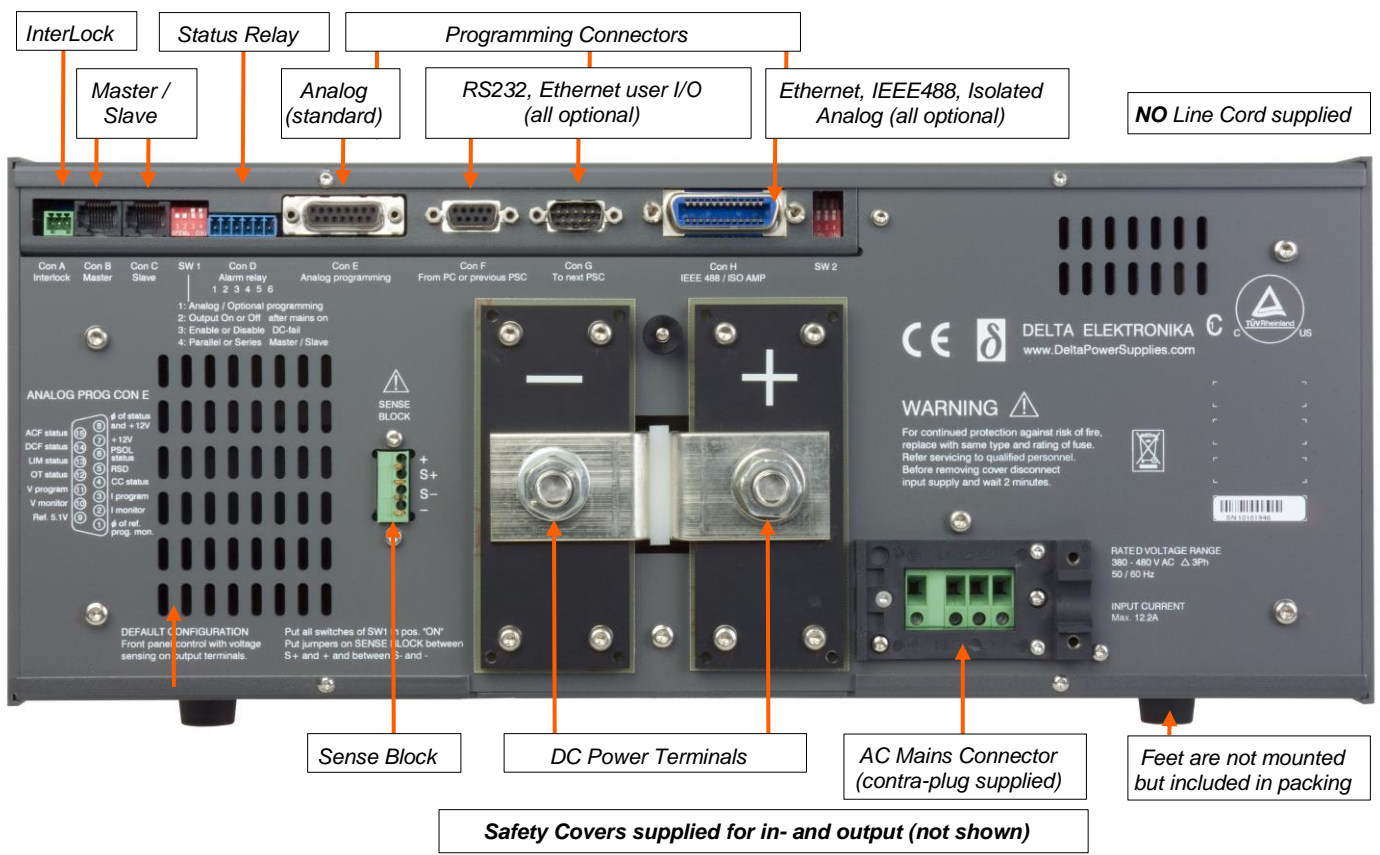
CV = Constant Voltage
CC = Constant Current

Specifications measured at
 $t_{amb} = 25 \pm 5 \text{ }^\circ\text{C}$ and $V_{in} = 400 \text{ VAC}$,
50 Hz unless otherwise noted.

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



Connections analog programming connector



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

Note: SM300-20, SM600-10 are standard equipped with isolated analog programming via ISO AMP on CON H (CON E is not available).

