

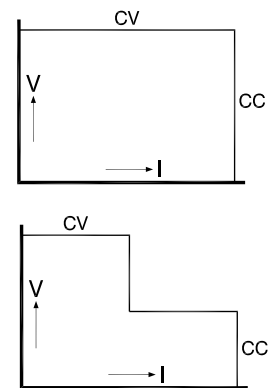


DELTA ELEKTR ONIKA B. V.



## 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
<b>Output</b> 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
<b>Input</b> <b>AC</b> single phase, 48 - 62 Hz rated voltage range rated frequency  <i>Power Derating vs input:</i> 90 V : P <sub>out max</sub> (W), I <sub>in</sub> (A) 100 V : P <sub>out max</sub> (W), I <sub>in</sub> (A) 110 V : P <sub>out max</sub> (W), I <sub>in</sub> (A)  <b>230 V : P<sub>out max</sub> (W), I<sub>in</sub> (A)</b>  power factor, 100%, 50% load  internal fuses standby input power (V <sub>o</sub> =I <sub>o</sub> =0) standby input power (V <sub>o</sub> =V <sub>max</sub> )	90 - 265 V 100 - 240 V 50 / 60 Hz  1170,16 1317,16 1492,16  1500,7.5 0.99, 0.98  25 AT 12 W 22 W	90 - 265 V 100 - 240 V 50 / 60 Hz  1185,16 1334,16 1498,16  1575,7.7 0.99, 0.98  25 AT 12 W 22 W	90 - 265 V 100 - 240 V 50 / 60 Hz  1200,16 1350,16 1505,16  1560,7.7 0.99, 0.98  25 AT 12 W 22 W	90 - 265 V 100 - 240 V 50 / 60 Hz  1200,16 1350,16 1505,16  1560,7.7 0.99, 0.98  25 AT 12 W 22 W	90 - 265 V 100 - 240 V 50 / 60 Hz  1200,16 1350,16 1505,16  1540,7.6 0.99, 0.98  25 AT 12 W 22 W	90 - 265 V 100 - 240 V 50 / 60 Hz  1200,16 1350,16 1505,16  1560,7.7 0.99, 0.98  25 AT 12 W 22 W	90 - 265 V 100 - 240 V 50 / 60 Hz  1200,16 1350,16 1500,16  1500,7.4 0.99, 0.98  25 AT 12 W 22 W	90 - 265 V 100 - 240 V 50 / 60 Hz  1200,16 1350,16 1505,16  1600,7.8 0.99, 0.98  25 AT 12 W 25 W
				26 V / 52 V				200 V / 400 V
<b>Efficiency</b> 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 %
<b>Regulation</b>								
Load 0 - 100% Line 120 - 265 V AC (measured on sense block)	<b>CV</b> 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% Line 120 - 265 V AC (internal voltage sense)	<b>CC</b> 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
<b>Ripple + noise</b> rms (BW=300 kHz) p-p (BW=20 MHz)  rms (BW=300 kHz) p-p (BW=20 MHz) CC-ripple at full load	<b>CV</b> 2 mV 8 mV  <b>CC</b> 15 mA 80 mA	1.8 mV 8 mV  5 mA 15 mA	2 mV 15 mV  3 mA 10 mA	2 mV 15 mV  10 / 3 mA 30 / 10 mA	3 mV 15 mV  3 mA 10 mA	7 mV 30 mV  2 mA 6 mA	7 mV 50 mV  0.5 mA 4 mA	15 mV 80 mV  1.2 / 0.6 mA 6 / 3 mA
<b>Temp. coeff., per °C</b>	<b>CV</b> <b>CC</b>			35.10 <sup>-6</sup> 60.10 <sup>-6</sup>				
<b>Stability</b> after 1 hr warm-up during 8 hrs t <sub>amb</sub> = 25 ± 1 °C, V <sub>in</sub> = 230 V AC (int. voltage sensing for CC-stab.)	<b>CV</b> <b>CC</b>			6.10 <sup>-5</sup> 9.10 <sup>-5</sup>				

Analog Programming	CV	CC
<b>Programming inputs</b> input range accuracy offset temp. coeff. offset input impedance	0 - 5 V ± 0.2% - 0.1 ... +1.3 mV (on 5V) 10 μV / °C > 1 MOhm	0 - 5 V ± 0.5% 0 ... +2.2 mV (on 5V) 50 μV / °C > 1 MOhm
<b>Monitoring output</b> output range accuracy offset temp. coeff. offset output impedance	0 - 5 V ± 0.2% - 1... 0 mV (on 5V) 3 μV / °C 2 Ohm / max. 4 mA	0 - 5 V ± 0.5% - 1.1... 0 mV (on 5V) 60 μV / °C 2 Ohm / max. 4 mA

<b>Reference voltage</b> on prog. connector	V <sub>ref</sub> TC	5.114 V ± 15 mV (R <sub>o</sub> = 2 Ohm, max. 4 mA) 20 ppm
<b>+12 V output</b> on prog. Connector	V <sub>o</sub> I <sub>max</sub> R <sub>o</sub>	12 V ± 0.2 V 0.2 A 3 Ohm
<b>Relay Outputs</b> ACF DCF	AC - Fail DC - Fail	both NO and NC contact both NO and NC contact 1) output voltage ± 5% beyond set point

<b>Status outputs</b>	
CC - status	CC - operation 5 V = logic 1 ( $R_o = 500 \text{ Ohm}$ )
LIM - status	CV or CC limit 5 V = logic 1 ( $R_o = 500 \text{ Ohm}$ )
OT - status	Over Temperature 5 V = logic 1 ( $R_o = 500 \text{ Ohm}$ )
PSOL - status	Power Sink Overload 5 V = logic 1 ( $R_o = 500 \text{ Ohm}$ )
ACF - status	AC - Fail 5 V = logic 1 ( $R_o = 500 \text{ Ohm}$ )
DCF - status	DC - Fail <sup>2)</sup> 5 V = logic 1 ( $R_o = 500 \text{ Ohm}$ ) <sup>2)</sup> output voltage $\pm 5\%$ beyond set point
<b>Remote ShutDown</b>	with + 5V, 1 mA or relay contact
<b>Interlock</b>	contact at rear panel, see photo of rear panel on page 1-6
<b>Indicators</b> (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
<b>Controls</b> (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 <i>Standard Version</i>	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
<b>Rise time (10 - 90%)</b>								
output voltage step	0 $\rightarrow$ 15 V	0 $\rightarrow$ 35 V	0 $\rightarrow$ 52 V	0 $\rightarrow$ 26 V	0 $\rightarrow$ 70 V	0 $\rightarrow$ 120 V	0 $\rightarrow$ 300 V	0 $\rightarrow$ 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 $\rightarrow$ 52 V	-	-	-	0 $\rightarrow$ 400 V
time, (100 % load)	-	-	-	34.2 ms	-	-	-	15 ms
time, (10 % load)	-	-	-	11 ms	-	-	-	5 ms
<b>Fall time (90 - 10%)</b>								
output voltage step	15 $\rightarrow$ 0 V	35 $\rightarrow$ 0 V	52 $\rightarrow$ 0 V	26 $\rightarrow$ 0 V	70 $\rightarrow$ 0 V	120 $\rightarrow$ 0 V	300 $\rightarrow$ 0 V	200 $\rightarrow$ 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 $\rightarrow$ 0 V	-	-	-	400 $\rightarrow$ 0 V
time, (100 % load)	-	-	-	33 ms	-	-	-	14.2 ms
time, (10 % load)	-	-	-	330 ms	-	-	-	142 ms
Programming speed <i>High Speed Version</i>	SM 15-100 <i>Option P210</i>	SM 35-45 <i>Option P211</i>	SM 52-30 <i>Option P212</i>	SM 52-AR-60 <i>Option P213</i>	SM 70-22 <i>Option P214</i>	SM 120-13 <i>Option P215</i>	SM 300-5 <i>Option P216</i>	SM 400-AR-8 <i>Option P217</i>
<b>Rise time (10 - 90%)</b>								
output voltage step	0 $\rightarrow$ 15 V	0 $\rightarrow$ 35 V	0 $\rightarrow$ 52 V	0 $\rightarrow$ 26 V	0 $\rightarrow$ 70 V	0 $\rightarrow$ 120 V	0 $\rightarrow$ 300 V	0 $\rightarrow$ 200 V
time, (100 % load)	0.20 ms	0.27 ms	0.31 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	0.23 ms	0.43 ms	0.30 ms	0.27 ms	0.51 ms	0.33 ms
output voltage step	-	-	-	0 $\rightarrow$ 52 V	-	-	-	0 $\rightarrow$ 400 V
time, (100 % load)	-	-	-	0.53 ms	-	-	-	0.98 ms
time, (10 % load)	-	-	-	0.34 ms	-	-	-	0.59 ms
<b>Fall time (90 - 10%)</b>								
output voltage step	15 $\rightarrow$ 0 V	35 $\rightarrow$ 0 V	52 $\rightarrow$ 0 V	26 $\rightarrow$ 0 V	70 $\rightarrow$ 0 V	120 $\rightarrow$ 0 V	300 $\rightarrow$ 0 V	200 $\rightarrow$ 0 V
time, (100 % load)	0.21 ms	0.33 ms	0.38 ms	0.27 ms	0.78 ms	0.51 ms	1.40 ms	0.35 ms
time, (10 % load)	1.6 ms	3.5 ms	3.9 ms	3.2 ms	8.3 ms	4.5 ms	13 ms	3.8 ms
output voltage step	-	-	-	52 $\rightarrow$ 0 V	-	-	-	400 $\rightarrow$ 0 V
time, (100 % load)	-	-	-	1.0 ms	-	-	-	1.7 ms
time, (10 % load)	-	-	-	9.7 ms	-	-	-	18 ms
<b>Ripple @ full load</b>								
(rms/pp)	15/ 50 mV	50/115 mV	55 /135 mV	26 V / 60 A 30 / 105 mV	45/150 mV	20/80 mV	25/115 mV	200 V 85 / 355 mV
@ full load				52 V / 30 A 25 / 90 mV				400 V 60 / 245 mV
(rms/pp)								
<b>Output capacitance</b>	390 $\mu\text{F}$	190 $\mu\text{F}$	91 $\mu\text{F}$	195 $\mu\text{F}$	113 $\mu\text{F}$	21 $\mu\text{F}$	10 $\mu\text{F}$	7 $\mu\text{F}$

Notes: All specifications regarding programming speed are typical and measured on a 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
<b>Recovery time</b>								
recovery within	50 mV	50 mV	100 mV	26 V / 52 V 60 mV	100 mV	0.7 V	1.0 V	200 V / 400 V 1.0 / 0.5 V
di/dt of load step	1.5 A/ $\mu\text{s}$	0.8 A/ $\mu\text{s}$	0.5 A/ $\mu\text{s}$	1.0 / 0.5 A/ $\mu\text{s}$	0.4 A/ $\mu\text{s}$	0.2 A/ $\mu\text{s}$	0.1 A/ $\mu\text{s}$	0.2 / 0.1 A/ $\mu\text{s}$
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 $\mu\text{s}$	100 $\mu\text{s}$	100 $\mu\text{s}$	100 / 100 $\mu\text{s}$	100 $\mu\text{s}$	100 $\mu\text{s}$	100 $\mu\text{s}$	100 / 100 $\mu\text{s}$
max. deviation	200 mV	150 mV	250 mV	200 / 100 mV	200 mV	2.2 V	1.5 V	2.5 / 1.5 V
@ 230 V AC input voltage								
<b>Output impedance</b>								
CV, 0-1 kHz	< 1.3 m $\Omega$	< 1.7 m $\Omega$	< 3.5 m $\Omega$	< 3.3 m $\Omega$	< 7.5 m $\Omega$	< 63 m $\Omega$	< 125 m $\Omega$	< 83 m $\Omega$
CV, 1-100 kHz	< 25 m $\Omega$	< 30 m $\Omega$	< 30 m $\Omega$	< 40 m $\Omega$	< 30 m $\Omega$	< 0.6 $\Omega$	< 1 $\Omega$	< 1.3 $\Omega$
<b>Pulsating load</b>								
max. tolerable AC component								
of load current								
f > 1 kHz	15 Arms	15 Arms	13 Arms	20 Arms	13 Arms	2.5 Arms	1.2 Arms	0.8 Arms
f < 1 kHz	100 Apeak	45 Apeak	30 Apeak	30 / 60 Apeak	22 Apeak	13 Apeak	5 Apeak	8 / 4 Apeak

<b>Insulation</b> 1 input / output creepage / clearance  input / case output / case	3750 Vrms (1 min.) 8 mm  2500 Vrms 600 V DC
<b>Safety</b>	cTUVus / EN 60950 / EN 61010
<b>EMC Power Supply Standard</b>	<b>EN 61204-3</b> , Emission: residential, <b>light</b> industrial environment (CISPR22-Class <b>B</b> ) Immunity: industrial environment
<b>Generic Emission Generic Immunity</b>	<b>EN 61000-6-3</b> , residential, <b>light</b> industrial environment (EN 55022 <b>B</b> ) <b>EN 61000-6-2</b> , industrial environment
<b>Operating Temperature at full load</b>	- 20 to + 50 °C derate output to 75% at 60 °C
<b>Humidity</b>	max. 95% RH, non condensing, up to 40 °C max. 75% RH, non condensing, up to 50 °C
<b>Storage temperature</b>	- 40 to + 85 °C
<b>Thermal protection</b>	Output shuts down in case of insufficient cooling
<b>MTBF</b>	500 000 hrs

<b>Hold-Up time</b> $V_{out} = 100\%$ , $I_{out} = 100\%$ $V_{out} = 85\%$ , $I_{out} = 100\%$ $V_{out} = 100\%$ , $I_{out} = 50\%$ @ 230 V AC input	16 ms 20 ms 36 ms (time till DC-fail = 1)
<b>Turn on delay</b> after mains switch on	480 ms @ 230 V AC, 700 ms @ 115 V AC
<b>Inrush current</b>	27 A @ 115 V AC, 22 A @ 230 V AC

<b>Series operation</b> max. total voltage Master / Slave operation	600 V yes
<b>Parallel operation</b> max. total current Master / Slave operation	no limit max. 4 units (including master)
<b>Remote sensing</b> max. volt. drop per load lead	2 V
<b>Limits Voltage</b> adjust range <b>Current</b> adjust range	0 - 102% 0 - 102%
<b>Potentiometers &amp; Encoders</b> front panel control with knobs resolution  screwdriver adjustment digital encoders	standard 0.03 %  Option P001 (at front panel) Option P220
	<b>SM 15-100</b> <b>SM 35-45</b> <b>SM 52-30</b> <b>SM 52-AR-60</b> <b>SM 70-22</b> <b>SM 120-13</b> <b>SM 300-5</b> <b>SM 400-AR-8</b>
<b>Meters</b> scale voltage scale current accuracy read output read limit setting (d = digit)	3.5 digit 0 - 15.00 V 0 - 100.0 A 0.5% + 2 d 2% + 2 d
	3.5 digit 0 - 35.0 V 0 - 45.0 A 0.5% + 2 d 2% + 2 d
	3.5 digit 0 - 52.0 V 0 - 30.0 A 0.5% + 2 d 2% + 2 d
	3.5 digit 0 - 52.0 V 0 - 60.0 A 0.5% + 2 d 2% + 2 d
	3.5 digit 0 - 70.0 V 0 - 22.0 A 0.5% + 2 d 2% + 2 d
	3.5 digit 0 - 120.0 V 0 - 13.00 A 0.5% + 2 d 2% + 2 d
	3.5 digit 0 - 300 V 0 - 5.00 A 0.5% + 2 d 2% + 2 d
	3.5 digit 0 - 400 V 0 - 8.00 A 0.5% + 2 d 2% + 2 d

<b>Mounting</b>	Stacking of units allowed, air flow is from left to right.
<b>Input Connector</b>	IEC320/C20, EN 60320/C20
<b>Output Terminals</b>	M8 bolts
<b>Programming connector</b>	15 pole D-connector at rear panel (FEMALE)
<b>Cooling</b> 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
<b>Enclosure</b> degree of protection	IP20
<b>Dimensions</b> 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)
<b>Weight</b>	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

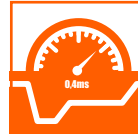


### Increased Output Power

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

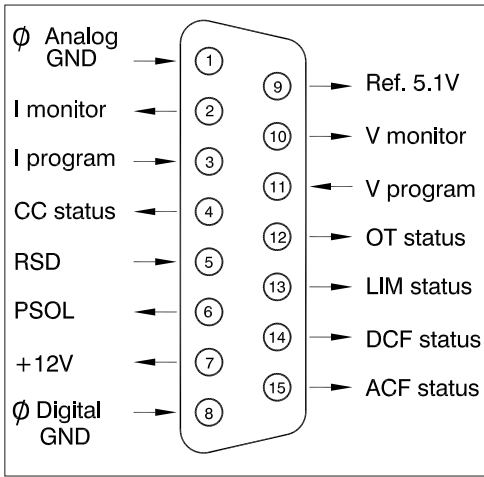


### Software Control and Interfaces

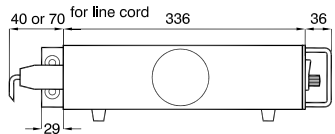
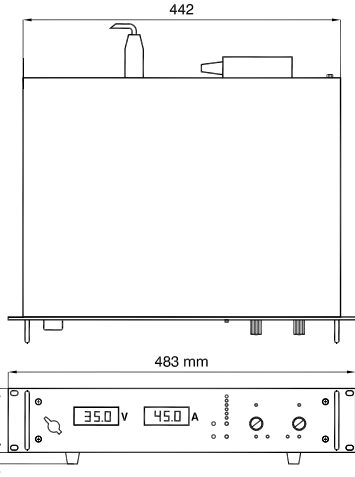
Factory installed programming interfaces:

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

Note: 1. Download special datasheet about High Speed Program., Power Sink and Battery Charging from [www.DeltaPowerSupplies.com](http://www.DeltaPowerSupplies.com).  
2. There is only room for one of the interfaces in a unit (P177, P183, P184, P218, P273 or P274).



CV = Constant Voltage  
 CC = Constant Current  
  
 Specifications measured at  
 $t_{amb} = 25 \pm 5^\circ C$  and  $V_{in} = 230 V AC$ ,  
 50 Hz, unless otherwise noted.  
  
 The information in this document is  
 subject to change without notice



Connections programming connector

