DELTA ELEKTRONIKA B.V.
DC POWER SUPPLIES

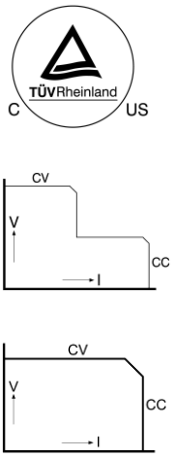
Vissersdijk 4, 4301 ND
Zierikzee, the Netherlands

www.DeltaPowerSupplies.com
Tel. +31 111 413656

SM3300 - Series 3300W DC POWER SUPPLIES

One or Three phase input

Models	Voltage range	Current range
SM 18-220	0 - 18 V	0 - 220 A
SM 66-AR-110 Autoranging output	0 - 33 V 0 - 66 V	0 - 110 A 0 - 55 A
SM 100-AR-75 Autoranging output	0 - 50 V 0 - 100 V	0 - 75 A 0 – 37.5 A
SM 330-AR-22 Autoranging output	0 - 165 V 0 - 330 V	0 - 22 A 0 - 11 A
SM660-AR-11 Autoranging output	0 - 330 V 0 - 660 V	0 - 11 A 0 – 5.5 A



Features

- 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: fan is temperature controlled
- Available Options : Software control and Interfaces,
  High Speed Programming, Two-Quadrant Output - PowerSink

Functionalities

- Operation on single and three phase input voltages
- Standard Ethernet interface
- Large user display, menu driven operations
- Durable digital encoders for voltage and current adjustment
- Plug and play optional interfaces

	SM 18-220	SM 66-AR-110	SM 100-AR-75	SM 330-AR-22	SM 660-AR-11
DC Power terminals					
voltage	0 - 18 V	0 - 66 V	0 - 100 V	0 - 330 V	0-660V
current	0 - 220 A	0 - 110 A	0 - 75 A	0 - 22 A	0-11 A
AC Input					
1 or 3 phase, 48 - 62 Hz	180-528 V	180-528 V	180-528 V	180-528 V	180-528 V
rated voltage range	200 - 480 V	200 - 480 V	200 - 480 V	200 - 480 V	200 - 480 V
rated frequency	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz	50 / 60 Hz
rated current	Max. 16 A	Max. 16 A	Max. 16 A	Max. 16 A	Max. 16 A
current (400 V / 3 ph, 3300W)	5.8 A	5.6 A	5.6 A	5.6 A	5.6 A
power factor, 3300W, 1750W	0.94, 0.92	0.94, 0.92	0.94, 0.92	0.94, 0.92	0.94, 0.92
Power Derating vs input					
Single phase:					
230 V : P_{out} max (W), I_{in} (A)	3050, 16	3100, 16	3100, 16	3200, 16	3200, 16
205 V : P_{out} max (W), I_{in} (A)	2650, 16	2700, 16	2700, 16	2800, 16	2800, 16
180 V : P_{out} max (W), I_{in} (A)	2300, 16	2400, 16	2400, 16	2400, 16	2400, 16
Three phase					
190 V : P_{out} max (W), I_{in} (A)	3300, 12.5	3300, 12.5	3300, 12.5	3300, 12.5	3300, 12.5
180 V : P_{out} max (W), I_{in} (A)	3100, 12.5	3100, 12.5	3100, 12.5	3100, 12.5	3100, 12.5
power factor single phase	0.99	0.99	0.99	0.99	0.99
internal fuses	20 AT	20 AT	20 AT	20 AT	20 AT
standby input power (V_o=I_o=0)	30 W	30 W	30 W	30 W	30 W
standby input power (V_o=V_{max})	60 W	50 W	50 W	50 W	60 W
Efficiency	89 %	90 %	90 %	91 %	92 %
400 V AC, 3 ph input, full load					
Regulation					
Load 0 - 100% **CV**	2.5 mV	5 mV	5 mV	5 mV	5 mV
Line 180 - 528 V AC **CV**	0.2 mV	1 mV	1 mV	3 mV	4 mV
(external voltage sense)					
Load 0 - 100% **CC**	12 mA	6 mA	2 mA	1.2 mA	1.2 mA
Line 180 - 528 V AC **CC**	3 mA	1 mA	0.5 mA	0.2 mA	0.2 mA
(internal voltage sense, after warm up)					
		33 / 66V	*50 / 100 V*	*165 / 330 V*	*330 / 660 V*
Ripple + noise					
rms (BW=300 kHz) **CV**	3 mV	7 mV	7 mV	10 mV	15 mV
p-p (BW=20 MHz) **CV**	12 mV	18 mV	22 mV	50 mV	120 mV
rms (BW=300 kHz) **CC**					
p-p (BW=20 MHz) **CC**	50 mA	15 / 7.5 mA	6 / 2 mA	4.5 / 1.5 mA	1.8 / 0.6 mA
CC-ripple at full load	250 mA	90 / 45 mA	60 / 20 mA	24 / 8 mA	7.5 / 2.5 mA
Programming & monitoring accuracy *(excluding INT MOD ANA)*					
Voltage	± 0.1%	± 0.1%	± 0.1%	± 0.1%	± 0.1%
Current	± 0.18%	± 0.25%	± 0.25%	± 0.15%	± 0.15%
Temp. coeff., per °C [1] **CV**	35.10^{-6}				
CC	60.10^{-6}				
Stability [1] after 1 hr warm-up					
during 8 hrs **CV**					
CC	6.10^{-5}				
t_{amb} = 25 ± 1 °C, V_{in} = 400 VAC	9.10^{-5}				
(internal voltage sensing for CC-stab.)					

Programming speed [2] Standard Version (resistive load)	SM 18-220	SM 66-AR-110	SM 100-AR-75	SM 330-AR-22	SM 660-AR-11
Rise time (10 - 90%)					
output voltage step	0 → 15 / 18 V	0 → 33 V	0 → 50V	0 → 165 V	0 → 330 V
time, (load = 3300W)	4 / 5.5 ms	1.6 ms	3.6 ms	3.8 ms	4.2 ms
time, (load = 330 W)	2.2 / 2.6 ms	1 ms	2 ms	2 ms	2.5 ms
output voltage step	-	0 → 66 V	0 → 100 V	0 → 330 V	0 → 660 V
time, (load = 3300W)	-	7 ms	15 ms	15 ms	15 ms
time, (load = 330 W)	-	3.7 ms	8 ms	8 ms	7.5 ms
Fall time (90 - 10%)					
output voltage step	15 / 18 V → 0 V	33 V → 0 V	50 V → 0 V	165 V → 0 V	330 V → 0 V
time, (load = 3300W)	6 / 8 ms	3 ms	6 ms	6 ms	6 ms
time, (load = 330 W)	52 / 75 ms	33 ms	65 ms	65 ms	70 ms
output voltage step	-	66 V → 0 V	100 V → 0 V	330 V → 0 V	660 V → 0 V
time, (load = 3300W)	-	11 ms	26 ms	25 ms	28 ms
time, (load = 330 W)	-	100 ms	260 ms	250 ms	270 ms

Notes: 1. Measured at full load. 2. Signal latency depends on the interface used & data traffic. 3. See "Safety instructions" 4. With optional Interface.

Programming speed [2] High Speed Version (resistive load)	**SM 18-220** ***Option P300***	**SM 66-AR-110** ***Option P302***	**SM 100-AR-75** ***Option P303***	**SM 330-AR-22** ***Option P304***	**SM 660-AR-11** ***Option P305***
Rise time (10 - 90%)					
output voltage step	0 → 15 / 18 V	0 → 33 V	0 → 50V	0 → 165 V	0 → 330 V
time, (load = 3300W)	0.17 / 0.24 ms	0.34 ms	0.46 ms	0.38 ms	0.8 ms
time, (load = 330 W)	0.13 / 0.15 ms	0.33 ms	0.46 ms	0.35 ms	0.7 ms
output voltage step	-	0 → 66 V	0 → 100 V	0 → 330 V	0 → 660 V
time, (load = 3300W)	-	0.44 ms	0.53 ms	1.6 ms	2.8 ms
time, (load = 330 W)	-	0.35 ms	0.47 ms	0.8 ms	2.0 ms
Ripple @ full load					
Typical (rms / pp)	15 mV / 50 mV	25 mV / 70 mV	35 mV / 120 mV	50 mV / 120 mV	60 mV / 250 mV
Output Capacitance (typical)	750 µF	315 µF	95 µF	31 µF	15 µF
Fall time (90 - 10%)					
output voltage step	15 / 18 V → 0 V	33 V → 0 V	50 V → 0 V	165 V → 0 V	330 V → 0 V
time, (load = 3300W)	0.19 / 0.27 ms	0.34 ms	0.42 ms	0.45 ms	0.82 ms
time, (load = 330 W)	0.52 / 0.75 ms	1.6 ms	1.4 ms	4.3 ms	8 ms
output voltage step	-	66 V → 0 V	100 V → 0 V	330 V → 0 V	660 V → 0 V
time, (load = 3300W)	-	0.58 ms	0.53 ms	2.1 ms	3.4 ms
time, (load = 330 W)	-	5.7 ms	5 ms	17 ms	30 ms

	SM 18-220	**SM 66-AR-110**	**SM 100-AR-75**	**SM 330-AR-22**	**SM 660-AR-11**
Recovery time range		33 V / 66 V	50 V / 100 V	165 V / 330 V	330 V / 660 V
recovery within	50 mV	100 mV	100 mV	500 mV	800 / 500 mV
di/dt of load step	2.7 A/µs	1.7 / 0.7 A/µs	1.1 / 0.5 A/µs	0.35 / 0.17 A/µs	0.16 / 0.08 A/µs
output voltage	15V	30V / 60V	45V / 90V	150 / 300 V	300 / 600 V
time, @ 50 - 100% load step	100 µs	100 µs	100 µs	100 µs	100 µs
max. deviation	250 mV	260 / 180 mV	180 / 80 mV	1.8 / 1.4 V	2.2 / 1.8 V
Output impedance					
CV, 0-1 kHz	< 0.8 mΩ	< 3 mΩ	< 1.8 mΩ	< 30 mΩ	< 60 mΩ
CV, 1-100 kHz	< 12 mΩ	< 25 mΩ	< 18 mΩ	< 250 mΩ	< 600 mΩ
Pulsating load					
max. tolerable AC component of load current					
f > 1 kHz	25 A_{rms}	20 A_{rms}	11 A_{rms}	*t.b.d.*	*t.b.d.*
f < 1 kHz	220 A_{peak}	110 A_{peak}	75 A_{peak}	22 A_{peak}	11 A_{peak}

Insulation			
AC power terminals / DC power term.	3750 V_{rms} (1min.)	3750 V_{rms} (1min.)	3750 V_{rms} (1min.)
creepage / clearance	8 mm	8 mm	8 mm
AC power terminals / case	2500 V_{rms}	2500 V_{rms}	2500 V_{rms}
DC power terminals / case	1000 V DC [3]	1330 V DC [3]	1400 V DC [3]
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 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 18-220	**SM 66-AR-110**	**SM 100-AR-75**	**SM 330-AR-22**	**SM 660-AR-11**
Hold-Up time (@ 400 VAC input)					
V_{out} = 100%, P_{out} = 3300 W	6 ms	12 ms	12 ms	12 ms	12 ms
I_{out} = 100%, P_{out} = 3300 W	13 ms	13 ms	13 ms	13 ms	13 ms
V_{out} = 100%, P_{out} = 1750 W	18 ms	24 ms	24 ms	24 ms	24 ms
Turn on delay after mains switch on	1.4 s				
Inrush current	15 A				

Notes: 1. Measured at full load. 2. Signal latency depends on the interface used & data traffic. 3. See "Safety instructions" 4. With optional Interface.

	SM18-220	SM66-AR-110	SM100-AR-75	SM330-AR-22	SM660-AR-11
Series operation					
max. total voltage	1000 V [3]	1000 V [3]	1000 V [3]	1330 V [3]	1400 V [3]
Master / Slave operation [4]	yes	yes	*yes*	yes	yes
Parallel operation					
Normal	no limit				
Master / Slave operation [4]	maximum 8 units				
Remote sensing					
max. voltage drop per load lead	2 V				
Limits **Voltage** adjust range	0 - 101 %				
Current adjust range	0 - 101 %				
Potentiometers					
front panel control with knobs					
resolution	15 bits				
Meters	4 digit	4 digit	4 digit	4 digit	4 digit
scale voltage	0.00 - 18.00 V	0.00 - 66.00 V	0.0 – 100.0 V	0.0 - 330.0 V	0.0 - 660.0 V
scale current	0.0 - 220.0 A	0.0 - 110.0 A	0.00 - 75.00 A	0.00 - 22.00 A	0.00 - 11.00 A
accuracy read output	0.2% + 2 digit	0.2% + 2 digit	0.2% + 2 digit	0.2% + 2 digit	0.2% + 2 digit
read limit setting	0.3% + 2 digit	0.3% + 2 digit	0.3% + 2 digit	0.3% + 2 digit	0.3% + 2 digit

Mounting	stacking of units allowed, air flow is from left to right
AC Terminals (CON D)	screw terminals for wire 2.5 - 4 mm^2, 3 phase + earth (no neutral)
DC Terminals (CON B1 & B2)	M8 bolts
Programming connectors (LAN)	standard with RJ45-connector for Ethernet at rear panel
Interlock (CON A)	input for contact at rear panel
Cooling	low noise blower, fan speed adapts to temperature of internal system
audio noise level	ca. 50 dBA at full load, 25 °C ambient temperature, 1 m distance ca. 57 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	88.1 x 483 mm (19", 2 U)
behind front panel: h x w x d	86 x 448 x 455 mm (excluding feet) with optional interfaces the required depth is 500…530mm
Weight	15 kg

CV = Constant Voltage
CC = Constant Current

Specifications measured at t_{amb} = 25 ± 5 °C and Vin = 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. *Signal latency depends on the interface used and data traffic.*
3. *See safety Instructions in the operating manual.*
4. *With optional 'plug and play' interface.*

ELSO
riešenia na presné meranie

Elso Philips Service
Jilemnického 2; 911 01 Trenčín
tel: +421 32 6582410
fax: +421 32 6582592
email: elso@elso.sk
web: www.elso.sk

Typical Applications

- Solar inverter testing, PV-Simulation
- 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

Standard Features

Digital CV- and CC-Settings

Reliable, long-life digital encoders are 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.

Ethernet Interface

Ethernet interface for programming and monitoring

Sequencer

Arbitrary Waveform generator or standalone automation.

High Voltage Isolation

A high DC output isolation allows floating operation up to 1000 V for SM18-220, SM66-AR-110 and SM100-AR-75, and up to 1330V and 1400 V for SM330-AR-22 and SM660-AR-11.

USB-Input

Not yet available:
Front and rear panel USB-Input for exchange of settings and waveforms (Host / Type-A).

Options

Software control and Interfaces

Field installable interfaces:

- Master / Slave controller
- Isolated Contacts
- Serial controller with multiple protocols: RS 232, RS 485, RS 422 and USB (Device)
- Digital I/O
- Isolated Analog Programming
- Simulation interface

Order Codes :

- INT MOD M/S
- INT MOD CON
- INT MOD SER
- INT MOD DIG
- INT MOD ANA
- INT MOD SIM

High Speed Programming

A 10 to 20 times higher programming speed (down to 0.2ms 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 :

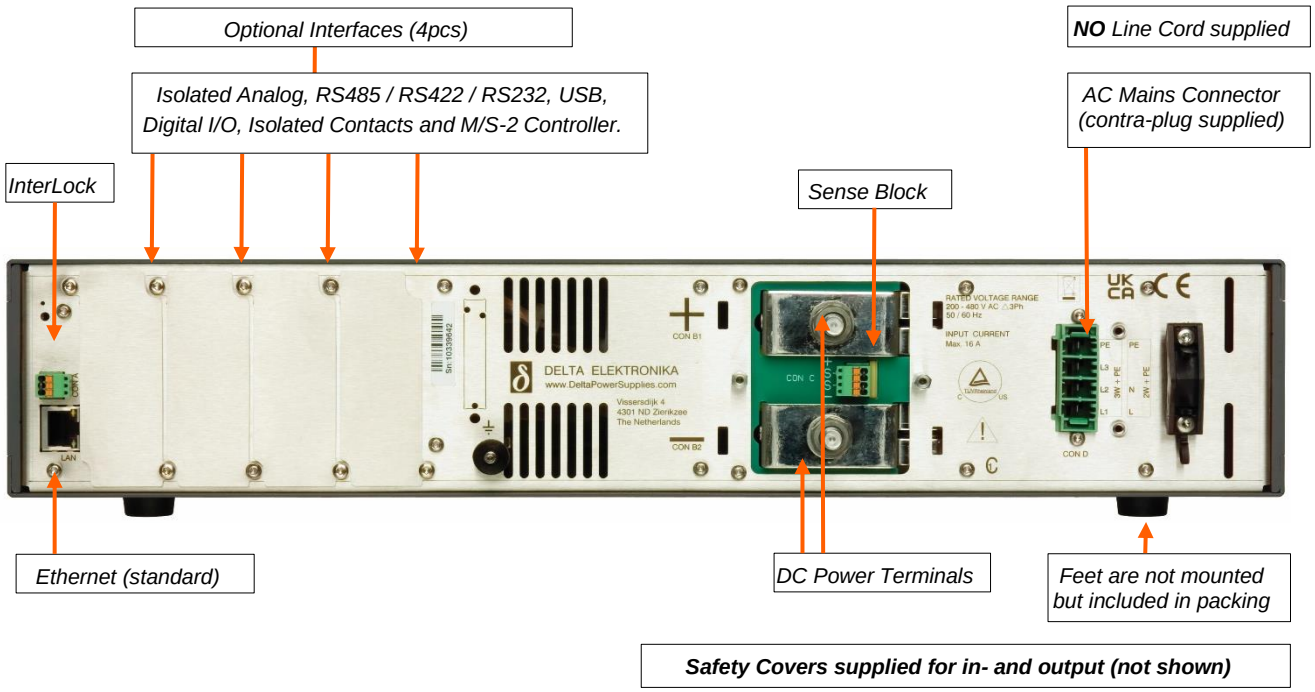
- SM 18-220 – P300
- SM 66-AR-110 – P302
- SM 100-AR-75 – P303
- SM 330-AR-22 – P304
- SM 660-AR-11 – P305

Two-Quadrant Output Power Sink

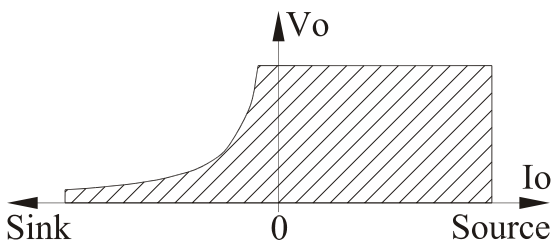
Two quadrant operation maintains the DC output voltage constant regardless the output power is positive or negative. Ideal for PWM-speed controlled DC-Motors and ATE systems.

Order Codes :

- SM 18-220 – P306
- SM 66-AR-110 – P308
- SM 100-AR-75 – P309
- SM 330-AR-22 – P310
- SM 660-AR-11 – P311



Models	Order Code
SM 18-220	P306
SM 66-AR-110	P308
SM 100-AR-75	P309
SM 330-AR-22	P310
SM 660-AR-11	P311



DELTA ELEKTRONIKA B.V.
DC POWER SUPPLIES

Vissersdijk 4, 4301 ND
Zierikzee, the Netherlands

www.DeltaPowerSupplies.com
Tel. +31 111 413656

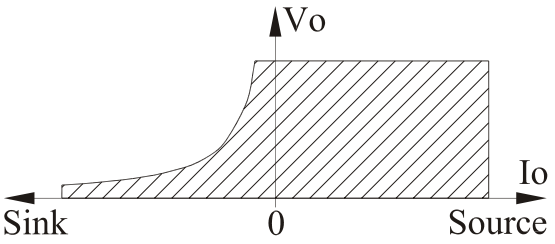
SM3300 with Power Sink Option

2 Quadrant operation: Source and Sink

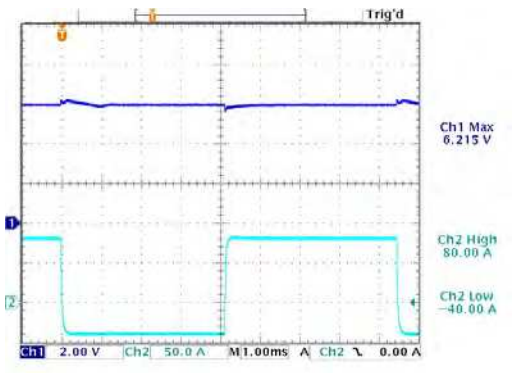
SM66-AR-110

Models	Order Code
SM 18-220	P306
SM 66-AR-110	P308
SM 100-AR-75	P309
SM 330-AR-22	P310
SM 660-AR-11	P311

The Power Sink Option permits the power supply to absorb bursts of power fed back to the unit. An internal module senses the status of power supply and sinks current across the output terminals, thus maintaining a constant output voltage.
The Power Sink Option allows a faster response when the power supply is step programmed to a lower voltage at low load conditions.

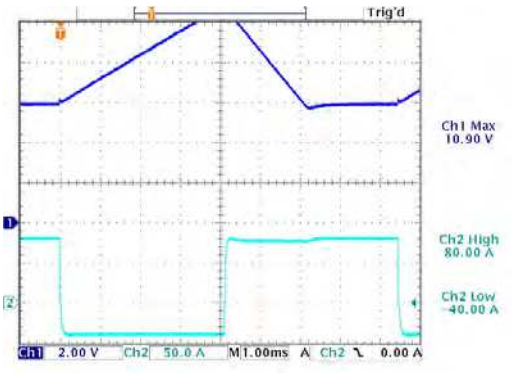


- Can absorb up to 300 W peak power
- Maintains output voltage setting regardless output power is positive or negative (source and sink)
- Ideal solution for supplying electric motors with PWM-speed control. These systems often return power to the power supply during a braking action
- Ideal solution for ATE systems requiring fast down programming at no load conditions
- Generation Automotive waveforms (fast)



SM18-220 **with** Power Sink Option
Current – 40 A means the load delivers 40 A to the power supply (sink operation)

Upper trace: output voltage
Lower trace: output current
(current switching from +80 A to –40 A at Vo=6 V)

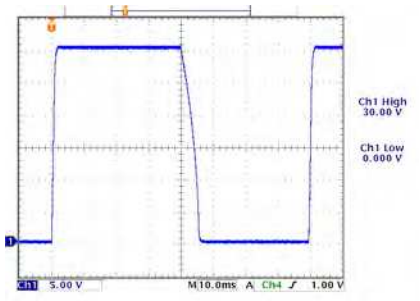


SM18-220 **without** Power Sink Option
*The output voltage is out of control when the output current is **negative***

Upper trace: output voltage
Lower trace: output current
(current switching from +80 A to –40 A at Vo=6 V)

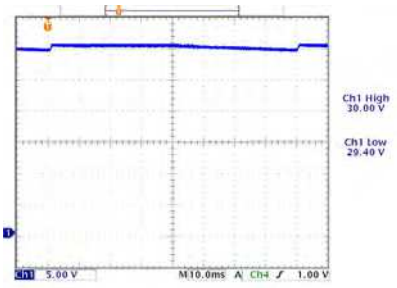
Power Sink Specifications	SM18-220 ***Option P306***	SM66-AR-110 ***Option P308***	SM100-AR-75 ***Option P309***	SM330-AR-22 ***Option P310***	SM660-AR-11 ***Option P311***
Sink Power Rating max. peak power (electronically limited) max. continuous power ($T_{amb.}$ = 25 °C) max. continuous power ($T_{amb.}$ = 50 °C)	300W 300W 275W				
Max. duration Sink Peak Power P_{sink} =P_{max} , $T_{amb.}$ = 25 °C **Duty Cycle for use at Peak Power** P_{sink} =P_{max} , $T_{amb.}$ = 25 °C	continuous @ P_{sink} = 300 W 100% @ P_{sink} = 300 W				
Max. Sink Current (V_o >= 2 V and P <= P_{max})	Limited at 75 A	Limited at 75 A	Limited at 75 A	Limited at 10 A	Limited at 10 A
Protection	Electronic Power Limit limits the current. The temperature of the power sink is fan controlled and the circuit shuts down in case of thermal overload.				
Recovery time / Deviation Vo = 6 V, I_o: +100 A → –30 A recovery within 100 mV / deviation:	di/dt = – 2.5A/µs 400 µs / 0.30 V	di/dt = – 2.5A/µs 750 µs / 1.20 V	-	-	-
Vo = 15 V, I_o: +100 A → –10 A recovery within 100 mV / deviation:	di/dt = – 2.5A/µs 450 µs / 0.30 V	di/dt = – 2.5A/µs 600 µs / 0.85 V	-	-	-
Vo = 24 V, I_o: +70 A → –7.5 A recovery within 100 mV / deviation:	-	di/dt = – 1.5A/µs 1.1 ms / 0.90 V	di/dt = – 1.8A/µs 600 µs / 0.65 V	-	-
Vo = 60 V, I_o: +35 A → –3 A recovery within 100 mV / deviation:	-	di/dt = – 1.0A/µs 2.0 ms / 0.90 V	di/dt = – 0.8A/µs 2.2 ms / 0.60 V	-	-
Vo = 300 V, I_o: +8 A → –0.5 A recovery within 1 V / deviation:	-	-	-	di/dt = – 0.3A/µs 1.0 ms / 1.9 V	di/dt = – 0.15A/µs 0.5 ms / 3.0 V
Vo = 600 V, I_o: +4 A → –0.25 A recovery within 1 V / deviation:	-	-	-	-	di/dt = – 0.07A/µs 1.5 ms / 3.0 V
(load current switches from positive to negative)	*note: values are typical*	*note: values are typical*	*note: values are typical*	*note: values are typical*	*note: values are typical*
Programming Down Speed Fall time at **no load** (90 - 10%) Fall time at no load *without Power Sink*	(6 → 0 V) 2.3 ms 1.2 s	(33 → 0 V) 5.6 ms 3.5 s	(50 → 0 V) 11.5 ms 2.3 s	(165 → 0 V) 14 ms 3.5 s	(330 → 0 V) 12 ms 3.5 s
Fall time at no **load** (90 - 10%) Fall time at no load *without Power Sink*	(18 → 0 V) 14.8 ms 4.2 s	(66 → 0 V) 23 ms 5 s	(100 → 0 V) 45.0 ms 9.4 s	(330 → 0 V) 50 ms 12 s	(660 → 0 V) 45 ms 11 s
Unit with Fast Programming Option	***P306+P300***	***P308+P302***	***P309+P303***	***P310+P304***	***P311+P305***
Fall time at **no load** (90 - 10%) Fall time at no load *without Power Sink*	(6 → 0 V) 0.09 ms 23 ms	(33 → 0 V) 0.55 ms 150 ms	(50 → 0 V) 0.48 ms 60.6 ms	(165 → 0 V) 1.5 ms 600 m s	(330 → 0 V) 2.2 ms 720 ms
Fall time at no **load** (90 - 10%) Fall time at no load *without Power Sink*	(18 → 0 V) 0.3 ms 34 ms	(66 → 0 V) 1.5 ms 600 ms	(100 → 0 V) 1.4 ms 425 ms	(330 → 0 V) 4.8 ms 2 s	(660 → 0 V) 8 ms 3.8 s
Parallel and Series operation Refer to power sink manual for details and restrictions.	Using multiple units in parallel operation, only one unit can have a power sink. Using multiple units in series operation, all units must have a power sink.				

Notes:
- *The maximum sink current at higher voltages will not be the maximum specified current due to the power limit. For example for an SM66-AR-110 at 30V, the max sink current will be 10 A (30 V x 10 A = 300 W = max power).*
- *A higher sink current than the maximum current will cause the output voltage to rise.*



SM66-AR-110 **with** Power Sink Option
fast discharge of output capacitors by Power Sink circuit

Trace: output voltage
Voltage Programming Speed at NO LOAD



SM66-AR-110 **without** Power Sink Option
slow response time during voltage step down, time needed to discharge the output capacitors

Trace: output voltage
Voltage Programming Speed at NO LOAD