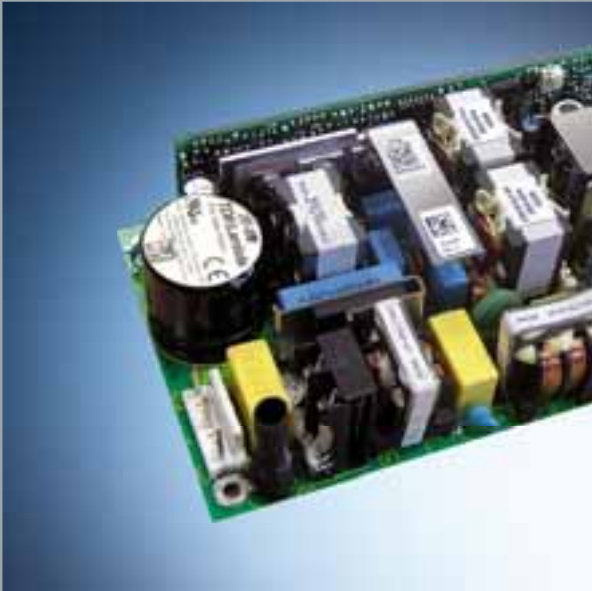


**Medical Power Supplies**

Edition 1 | 2010





*Innovating Reliable Power*



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### Highlights

- Small size & lightweight
- PCB board mountable
- Wide range input
- Medical safety certifications (4 kV AC input – output)
- Class II (no ground needed)
- High efficiency
- Minimises PCB space
- Global use with no manual intervention
- Lower heat dissipated in system

### Input Specifications

Items	Models	KMS15	KMD15	KMT15	KMS40	KMD40	KMT40
Input voltage range	–	90 – 264 V AC, 47 – 440 Hz or 100 – 375 V DC					
Inrush current limiting	A	10 / 20 A, cold start, 25 °C ambient (115 / 230 V AC)					
Input current (115 / 230 V AC)	mA	220 / 118 mA			860 / 460 mA		
Internal fuse (live line) <sup>1</sup>	–	250 V / T2 A			250 V / T3.15 A		
Temperature coefficient (O/PV)	–	±0.01 % / °C					
Ripple & noise (Pk-Pk)	mV	50 mV or 1 %, whichever is greater					
Overcurrent protection	–	> 105 %, hiccup mode, automatic recovery					
Overvoltage protection	%	yes, zener diode clamp					
Hold-up time (typ.)	ms	20 ms			18 ms		
Enclosure leakage 240 V AC, 63 Hz	mA	0.055 max.			0.08 max.		
264 V AC, 63 Hz	mA	0.06 max.			0.085 max.		
Operating temperature	–	–25 °C to 70 °C, derate linearly to 50 % load from 50 °C to 70 °C. Max case temperature 95 °C					
Storage temperature	–	–40 °C to 100 °C					
Humidity	% RH	20 % to 95 % RH (non-condensing)					
Cooling	–	Convection, over temperature protected ~100 °C case temperature)					
Withstand voltage	V AC	Input to output: 4 kV AC					
Immunity	–	EN60601-1-2					
Safety agency certification	–	UL60601-1, IEC60601-1, CE Mark					
Conducted EMI	–	EN55011 Class B			EN55011 Class A <sup>2</sup>		
Switching frequency	kHz	132 kHz					
Weight	g	120			280		
Size (L x W x H)	mm	64 x 46 x 24			89 x 64 x 27		
Mounting & case	–	PC board mountable. Plastic resin fibreglass case (UL 94V-0)					
MTBF	hrs	200,000 to 400,000 hours, model dependent					
Warranty	yrs	2 years					

<sup>1</sup> For medical applications an equivalent external fuse should be installed in the neutral line

<sup>2</sup> Class I applications: An external filter can be added to meet EN55011 Class B – see application notes

## Output Specifications

Model	Output voltage (V)	Minimum current (A)	Maximum current (A)	Power (W)	Output set accuracy (%)	Line regulation (%)	Load regulation <sup>1</sup> (%)	Cross regulation	Efficiency (%)	
<b>Single output</b>										
KMS15-3P3	V1	3.3 V	–	3.0 A	9.9 W	±2 %	0.5 %	1 %	–	74 %
KMS40-3P3	V1	3.3 V	80 mA	8.0 A	26.4 W	±2 %	0.5 %	1 %	–	75 %
KMS15-5	V1	5 V	–	3.0 A	15 W	±2 %	0.5 %	1 %	–	78 %
KMS40-5	V1	5 V	80 mA	8.0 A	40 W	±2 %	0.5 %	1%	–	79 %
KMS15-9	V1	9 V	–	1.67 A	15 W	±2 %	0.5 %	1 %	–	79 %
KMS40-9	V1	9 V	44 mA	4.44 A	40 W	±2 %	0.5 %	1 %	–	82 %
KMS15-12	V1	12 V	–	1.25 A	15 W	±2 %	0.5 %	1 %	–	81 %
KMS40-12	V1	12 V	33 mA	3.33 A	40 W	±2 %	0.5 %	1 %	–	83 %
KMS15-15	V1	15 V	–	1.0 A	15 W	±2 %	0.5 %	1 %	–	81 %
KMS40-15	V1	15 V	26.7 mA	2.67 A	40 W	±2 %	0.5 %	1 %	–	83 %
KMS15-24	V1	24 V	–	0.62 A	15 W	±2 %	0.5 %	1 %	–	83 %
KMS40-24	V1	24 V	16.7 mA	1.67 A	40 W	±2 %	0.5 %	1 %	–	83 %
<b>Dual output</b>										
KMD15-55	V1	+5 V	150 mA	1.5 A	15 W	±2 %	0.5 %	1 %	5 %	78 %
	V2	–5 V	150 mA	1.5 A		±2 %	0.5 %	1 %	5 %	
KMD40-55	V1	+5 V	400 mA	4.0 A	40 W	±2 %	0.5 %	1 %	5 %	79 %
	V2	–5 V	400 mA	4.0 A		±2 %	0.5 %	1 %	5 %	
KMD40-512	V1	5 V <sup>2</sup>	1250 mA	5.0 A	40 W	±3 %	0.5 %	2 %	1 %	80 %
	V2	12 V <sup>2</sup>	312 mA	1.25 A		±5 %	5.0 %	6 %	7 %	
KMD40-524	V1	5 V <sup>2</sup>	1250 mA	5.0 A	40 W	±3 %	0.5 %	2 %	1 %	80 %
	V2	24 V <sup>2</sup>	156 mA	0.625 A		±5 %	5.0 %	6 %	7 %	
KMD15-1212	V1	+12 V	62.5 mA	0.625 A	15 W	±2 %	0.5 %	1 %	3 %	80 %
	V2	–12 V	62.5 mA	0.625 A		±2 %	0.5 %	1 %	3 %	
KMD40-1212	V1	+12 V	166 mA	1.66 A	40 W	±2 %	0.5 %	1 %	5 %	83 %
	V2	–12 V	166 mA	1.66 A		±2 %	0.5 %	1 %	5 %	
KMD15-1515	V1	+15 V	50 mA	0.5 A	15 W	±2 %	0.5 %	1 %	3 %	81 %
	V2	–15 V	50 mA	0.5 A		±2 %	0.5 %	1 %	3 %	
KMD40-1515	V1	+15 V	133 mA	1.33 A	40 W	±2 %	0.5 %	1 %	5 %	81 %
	V2	–15 V	133 mA	1.33 A		±2 %	0.5 %	1 %	5 %	
<b>Triple output</b>										
KMT15-51212	V1	5 V <sup>3</sup>	500 mA	2.0 A	15 W	±2 %	0.5 %	1 %	1 %	78 %
	V2	+12 V	50 mA	0.2 A		±3 %	2.0 %	5 %	5 %	
	V3	–12 V	50 mA	0.2 A		±3 %	2.0 %	5 %	5 %	
KMT40-51212	V1	5 V <sup>3</sup>	1250 mA	5.0 A	40 W	±3 %	0.5 %	3 %	3 %	80 %
	V2	+12 V	150 mA	0.6 A		±5 %	5.0 %	7 %	7 %	
	V3	–12 V	150 mA	0.6 A		±3 %	5.0 %	7 %	7 %	
KMT15-51515	V1	5 V <sup>3</sup>	500 mA	2.0 A	15 W	±2 %	0.5 %	1 %	1 %	78 %
	V2	+15 V	37.5 mA	0.15 A		±3 %	2.0 %	5 %	5 %	
	V3	–15 V	37.5 mA	0.15 A		±3 %	2.0 %	5 %	5 %	
KMT40-51515	V1	5 V <sup>3</sup>	1250 mA	5.0 A	40 W	±3 %	0.5 %	3 %	3 %	80 %
	V2	+15 V	125 mA	0.5 A		±5 %	5.0 %	7 %	7 %	
	V3	–15 V	125 mA	0.5 A		±5 %	5.0 %	7 %	7 %	

1 Symmetrical loading, from minimum to maximum load

2 Output V1 is isolated from output V2

3 Output V1 is isolated from 2 outputs V2 & V3

### Pinout – KM15

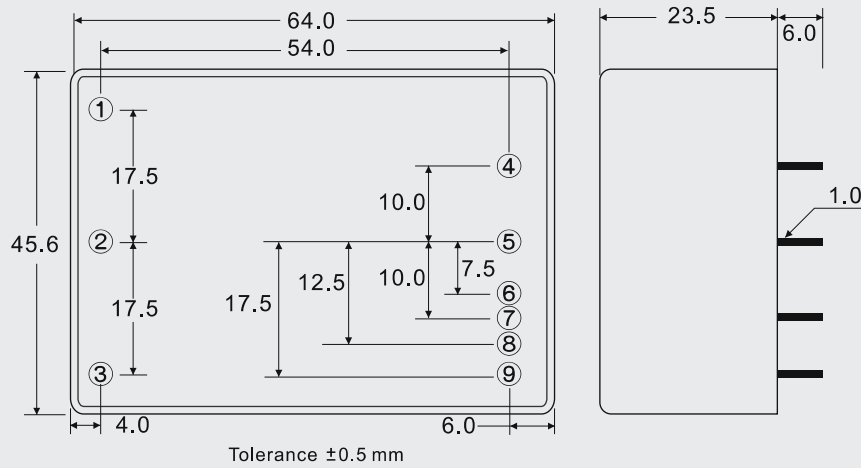
PIN #	Single O/P	Function dual O/P	Triple O/P
1	no pin	no pin	no pin
2	AC (L)	AC (L)	AC (L)
3	AC (N)	AC (N)	AC (N)
4	–DC	–DC	+5 V GND
5	no pin	GND	+5 V
6	no pin	no pin	–DC
7	+DC	+DC	no pin
8	no pin	no pin	GND
9	no pin	no pin	+DC

### Pinout – KM40

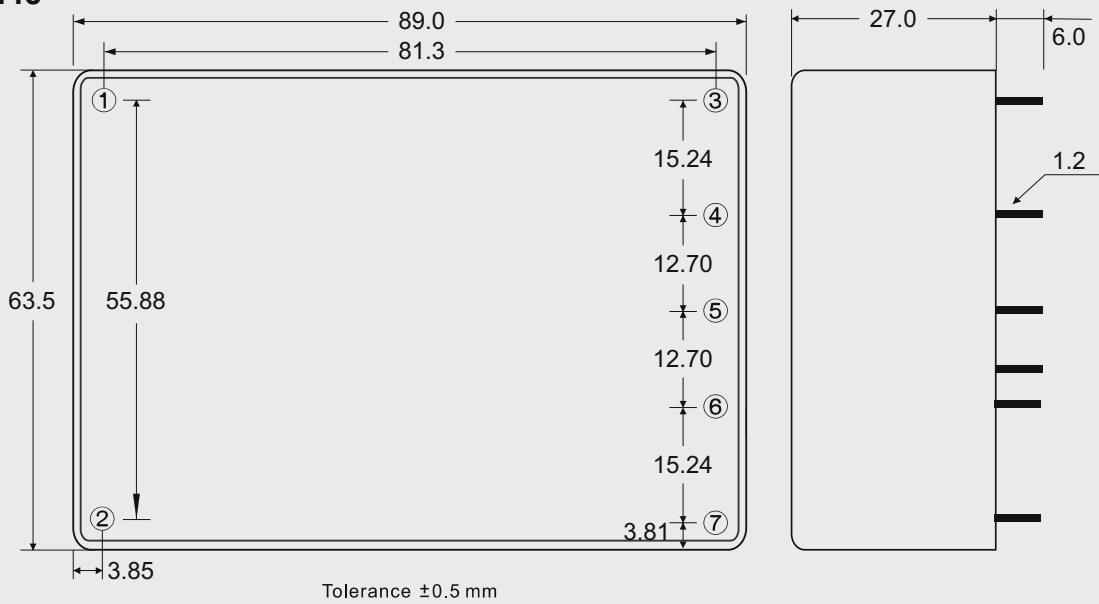
PIN #	Single O/P	Function dual O/P	5S/12 & 24S	Triple O/P
1	AC (L)	AC (L)	AC (L)	AC (L)
2	AC (N)	AC (N)	AC (N)	AC (N)
3	+DC	+DC	+O/P2	+DC
4	no pin	no pin	+O/P1	+5V
5	–DC	GND	GND1	GND
6	no pin	no pin	GND2	+5V GND
7	no connection	–DC	no connection	–DC

Outline Drawings

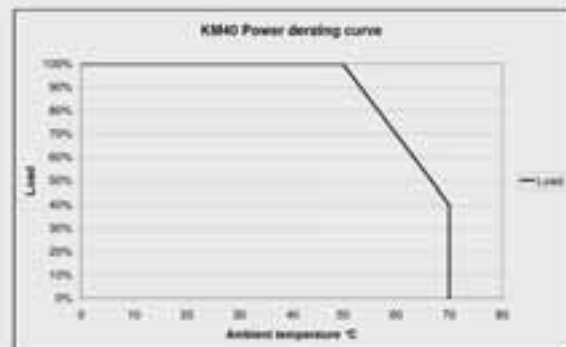
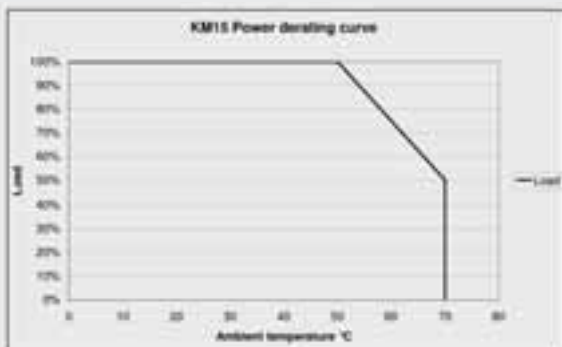
KM15



KM40



Derating curves



## Highlights

- Wide range input
- Medical safety certifications (4 kV AC input – output)
- Convection cooled (no fan needed)
- Up to 180 / 480 W peak power
- Low leakage current 0.3 mA



## Specifications

Items/Units		Models	CME150-24	CME240P-24
Input	Voltage range <sup>3</sup>	V	AC85 - 265 or DC120 - 370	
	Frequency <sup>3</sup>	Hz	47-63	
	Power factor (100/200 V AC) (typ.) <sup>2</sup>	–	0.99 / 0.95	
	Efficiency (typ.) <sup>2</sup>	%	82	80
	Current (100/200 V AC) (typ.) <sup>2</sup>	A	2.0 / 1.0	3.2 / 1.6
	Inrush current (100/200 V AC) (typ.) <sup>4</sup>	A	14 at 100 V AC, 28 at 200 V AC, Ta=25 °C, Cold start	
	Leakage current (265 V AC) <sup>10</sup>	mA	Less than 0.3	Less than 0.22
Output	Nominal voltage	V DC	24	
	Maximum current	A	6.3	10
	Maximum peak current <sup>1</sup>	A	7.5	20
	Maximum power	W	151.2	240
	Maximum peak power <sup>1</sup>	W	180	480
	Maximum line regulation <sup>5, 6</sup>	mV	96	
	Maximum load regulation <sup>5, 7</sup>	mV	150	192
Function	Temperature coefficient	–	Less than 0.02 % / °C	
	Maximum Ripple & noise 0<Ta<60 °C <sup>5</sup>	mVp-p	150	240
	Maximum Ripple & noise -10<Ta<0 °C <sup>5</sup>	mVp-p	180	360
	Hold-up time (typ.) <sup>2</sup>	ms	20	
	Voltage adjustable range <sup>10</sup>	V DC	21.6-26.4	21.6-28.8
	Over current protection <sup>8</sup>	A	7.87 -	20.5 -
	Over voltage protection <sup>9</sup>	V DC	27.6 - 32.4	30.0 - 35.0
Environment	Remote on/off control	–	–	
	Parallel operation	–	–	
	Series operation	–	Possible	
	Operating temperature <sup>11</sup>	°C	-10 to +60 °C (-10 to +50 °C:100 %, +60 °C:80 %)	-10 to +60°C (-10 to +45 °C:100 %, +60 °C:60 %)
	Storage temperature	°C	-30 to + 85 °C	
	Operating humidity	% RH	30 - 90 (No dewdrop)	
	Storage humidity	% RH	10 - 95 (No dewdrop)	
Vibration	–	At no operating, 10-55Hz (Sweep for 1min.) 19.6 m/s <sup>2</sup> constant, X,Y,Z 1 hour each		
Shock (in package)	–	Less than 196.1 m/s <sup>2</sup>		
Cooling	–	Convection cooling		

### Specifications

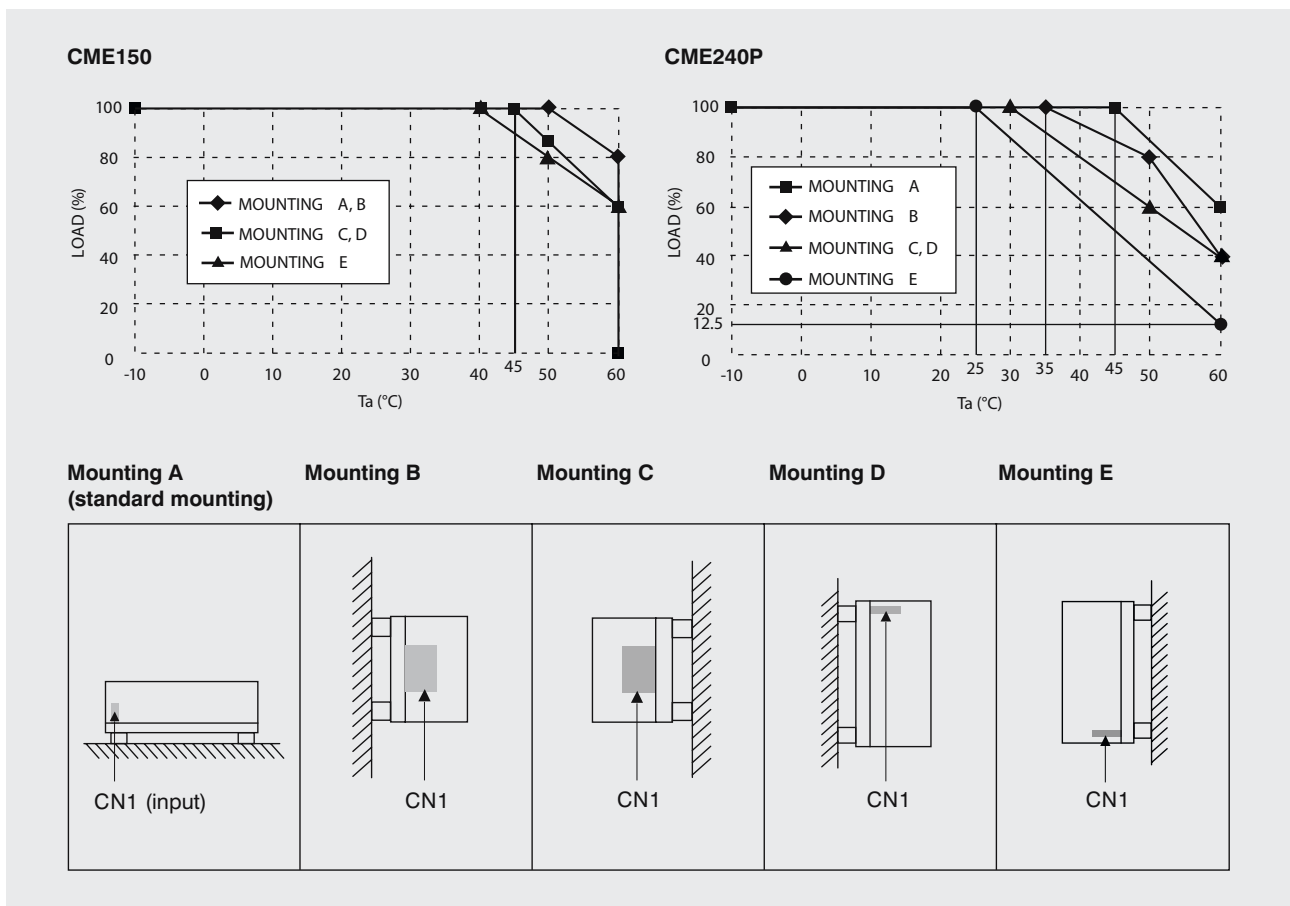
Items/Units		Models	CME150-24	CME240P-24
Isolation	Withstand voltage	-	Input - FG: 2k V AC (20 mA), input - output: 4k V AC (20 mA) Output - FG: 500 V AC (100 mA) for 1 min.	
	Isolation resistance	-	More than 100 MΩ at 25 °C and 70 % RH, output - FG: 500 V DC	
Standards	Safety standards <sup>12</sup>		Approved by UL60601-1, EN60601-1 Built to meet UL60950-1, CSA60950-1, EN60950-1 and DENAN	
	PFHC		Built to meet EN61000-3-2	
	EMI <sup>13</sup>		Built to meet EN55011 / EN55022-B, FCC-ClassB, VCCI-B	
	Immunity		Built to meet EN61000-4-2, -3, -4, -5, -6, -8, -11	
Mechanical	Weight (typ.)	g	500	800
	Size (W×H×D)	mm	80 x 40 x 208 (Refer to outline drawing)	105 x 50 x 242 (Refer to outline drawing)

**Read instruction manual carefully, before using the power supply unit.**

- Operating period at peak output current is less than 10 sec.  
Input voltage < 95V : Duty < 0.2  
Input voltage > 95V : Duty < 0.35  
(Average output power and current is less than Maximum output power and current).  
For peak load derating method, please refer to the instruction manual for details.
- At 100/200 V AC, Ta=25 °C and maximum output power.
- For cases where conformance to various safety specs (UL,CSA,EN) are required, to be described as 100 - 240 V AC, 50/60 Hz on name plate.
- Not applicable for the in-rush current to Noise Filter for less than 0.2 ms.
- Please refer to Fig. A for measurement of line & load regulation and ripple voltage. (Measure with JEITA RC-9131 probe)
- 85 – 265 V AC, constant load.

- No load - Full load (maximum power), constant input voltage.
- Constant current limit and hiccup with automatic recovery. Avoid to operate at overload or dead short condition for more than 30 seconds.
- OVP circuit will shut down output, manual reset. (Line recycle)
- Measured by the each measuring method of IEC, UL, CSA, EN and DENAN (at 63 Hz).
- At standard mounting.  
- Load (%) is percent of maximum output power or maximum output current, whichever is greater.  
- For other mountings, refer to derating curve.
- As for DENAN, built to meet at 100 V AC.
- No load - Full load (maximum power), constant current and input voltage.

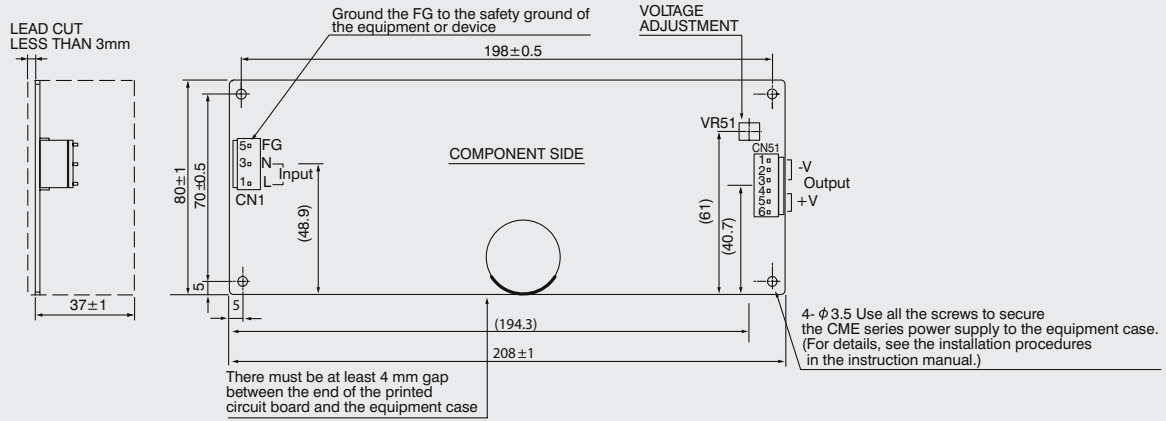
### Output Derating



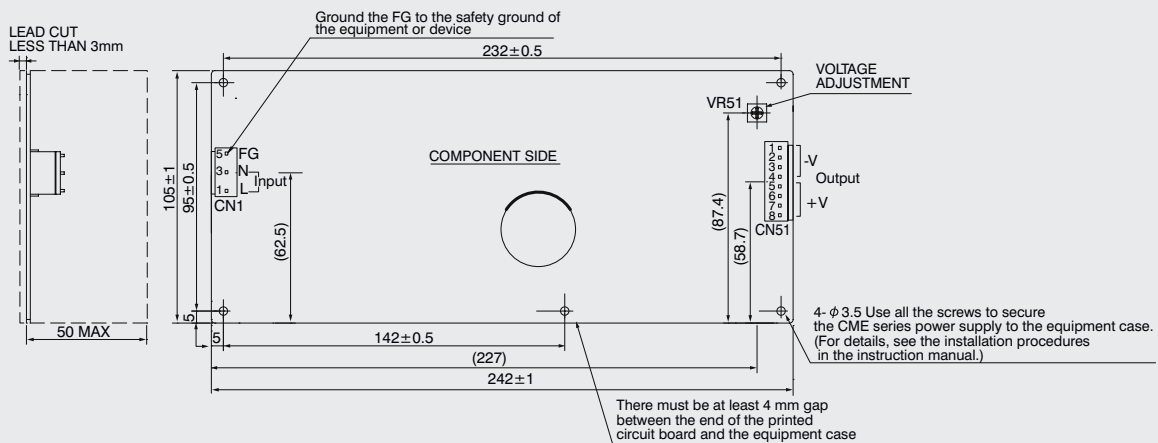


# Outline Drawings

## CME150



## CME240P



### Connector used

Part description	Part name		Manufact	QTY
	CME150	CME240P		
Pin header (input side CN1)	B3P5-VH		J.S.T.	1
Pin header (output side CN51)	B6P-VH	B8P-VH	J.S.T.	1

Output current of each connector pin must be less than 5 A.

### Matching housings & pin (Not included with the product)

Part description	Part name		Manufact	QTY	
	CME150	CME240P		CME150	CME240P
Socket housing (CN1)	VHR-5N		J.S.T.	1	
Socket housing (CN51)	VHR-6N	VHR-8N	J.S.T.	1	
Terminal pins (CN1, CN51)	SVH-21T-P1.1		J.S.T.	9	11

Hand crimping tool: YC-160R (Manufacturer: J.S.T.)



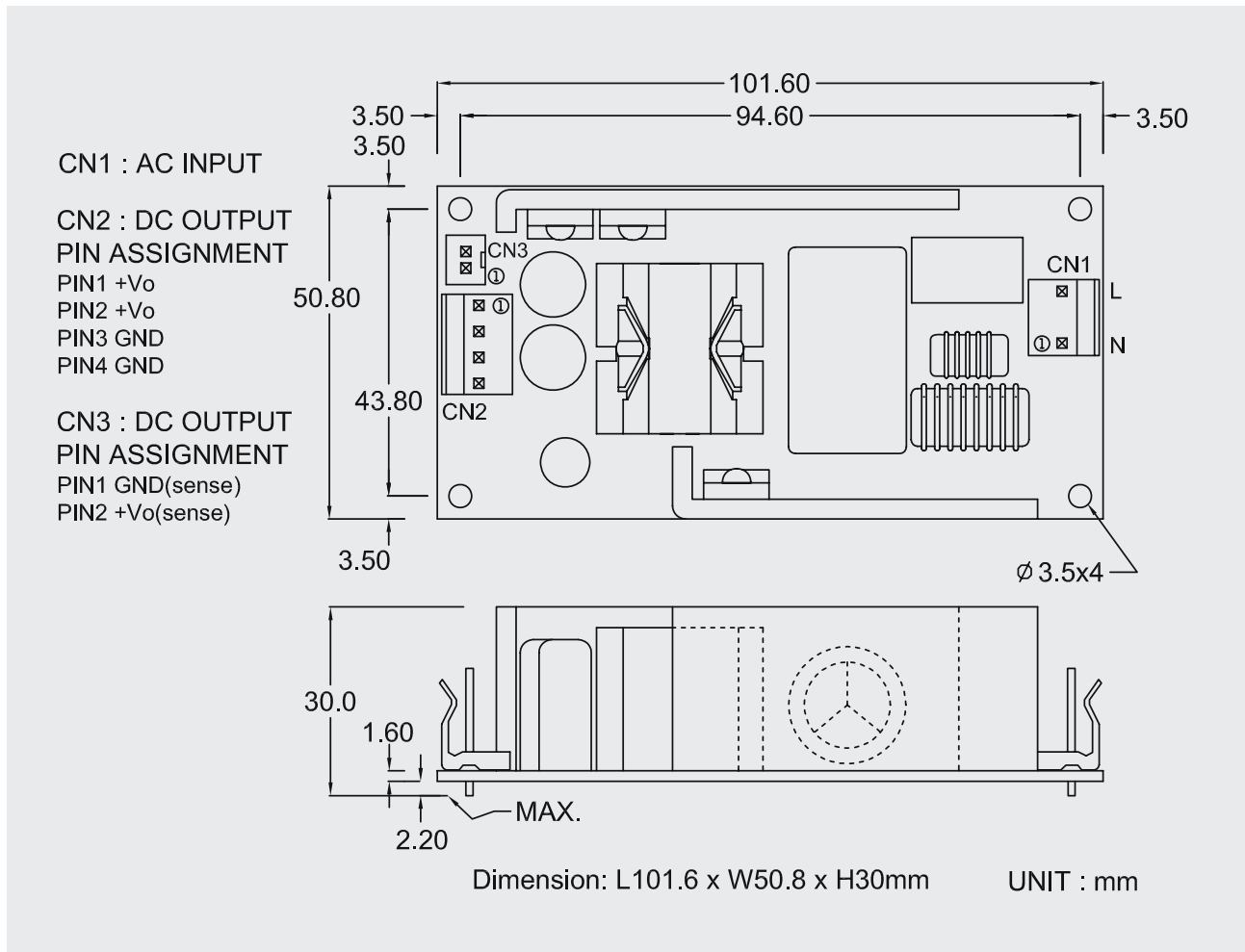
## Highlights

- Wide range AC input
- Low profile, industry standard footprint
- Global safety agency compliance
- Remote sense
- Dual input fuses
- Availability to second source
- Global operation
- Easier system compliance

## Specifications

Items	Models	CSS65
Input voltage range	V	90 - 264 V AC (47 - 63 Hz) or 120 - 370 V DC
Inrush current	A	< 40 A maximum at 115 V AC input, 25 °C ambient cold start
Input current (115 / 230 V AC)	A	2 / 1
Leakage current	uA	< 250 uA 264 V AC 63 Hz
Hold up time (typ.)	ms	10 ms at 115 V AC input
Temperature coefficient	°C	± 0.05 % / °C
Adjustment range	–	None
Remote sense	–	Yes
Minimum load	A	None
Regulation	%	5V: ± 5 %, 12 - 24 V: ± 3 %, 36 - 48 V: ± 2 % (10 - 100 % load change, 100 - 240 V AC line change)
Ripple & noise	%	1 % whichever is greater
Short circuit protection	–	Continuous - hiccup mode
Overvoltage protection	V	110 - 150 % of nominal (automatic reset)
Efficiency	%	86 % typical (115 V AC input)
Operating temperature	°C	0 to + 70 °C derate linearly to 50 % load from 50 to 70 °C
Storage temperature	°C	- 10 to + 70 °C
Humidity (non condensing)	–	20 - 95 % RH
Cooling	–	Convection
Withstand voltage	–	Input to ground 1.5 k V AC, input to output 4 k V AC, output to ground 500 V DC for 1 min.
Isolation resistance	–	> 20 M at 25 C & 70 % RH, output to ground 500 V DC
Vibration (non operating)	–	23.52 m/s <sup>2</sup> (10 - 55 Hz: constant sweep 1 min X, Y, Z for 1 hour)
Shock	–	< 196.1 m/s <sup>2</sup> (20 G)
Safety agency approvals	–	UL 60601 - 1, EN 60601 - 1, IEC 60601 - 1
Conducted & radiated EMI	–	EN 55011 - B, FCC Class B
Immunity	–	EN 60601 - 1 - 2
Weight (typ.)	g	200 g
Size (WxLxH)	in	2 x 4 x 1.18" (including underside components)
Warranty	yrs	2 years

## Outline Drawings



## Model Selector

Model	Output (V)	Maximum output (A)	Maximum power (W)
CSS65-5	5	8.0	40
CSS65-12	12	5.0	60
CSS65-15	15	4.0	60
CSS65-19	19	3.43	65
CSS65-24	24	2.71	65
CSS65-36	36	1.81	65
CSS65-48	48	1.36	65

- Input connector mates with Molex Housing 09-50-3031 or equivalent
- Output connector mates with Molex Housing 09-50-3041 or equivalent
- Sense connector (CN3) mates with J.S.T. XHP-2



### Highlights

- Medical approval for BF applications
- High efficiency
- 300 W = 6 in x 3 in footprint, 400 W = 6.5 in x 3.5 in
- 1 W standby (EFE400M only)
- High power density (up to 18 W/in<sup>3</sup>)
- No minimum load
- Fits 1U applications
- 3 years warranty

### Input Specifications

Input voltage	90 – 264 V AC / 120 – 350 V DC
Input frequency	45 – 63 Hz (440 Hz with reduced PFC – consult factory)
Input harmonics	EN61000-3-2 compliant
Inrush current	<40 A at 25 °C and 230 V AC, (cold start) (meets EN61000-3-3)
Input fuse	Dual fuses (Live + Neutral) Fast acting (not user accessible)
Earth leakage current	123 µA at 120 V AC (60 Hz) 257 µA max. at 240 V AC (60 Hz). Worst case leakage current is less than 300 µA at 264 V AC, 63 Hz (normal condition, 0.5 mA Single Fault Condition)
Power factor	0.97 typical

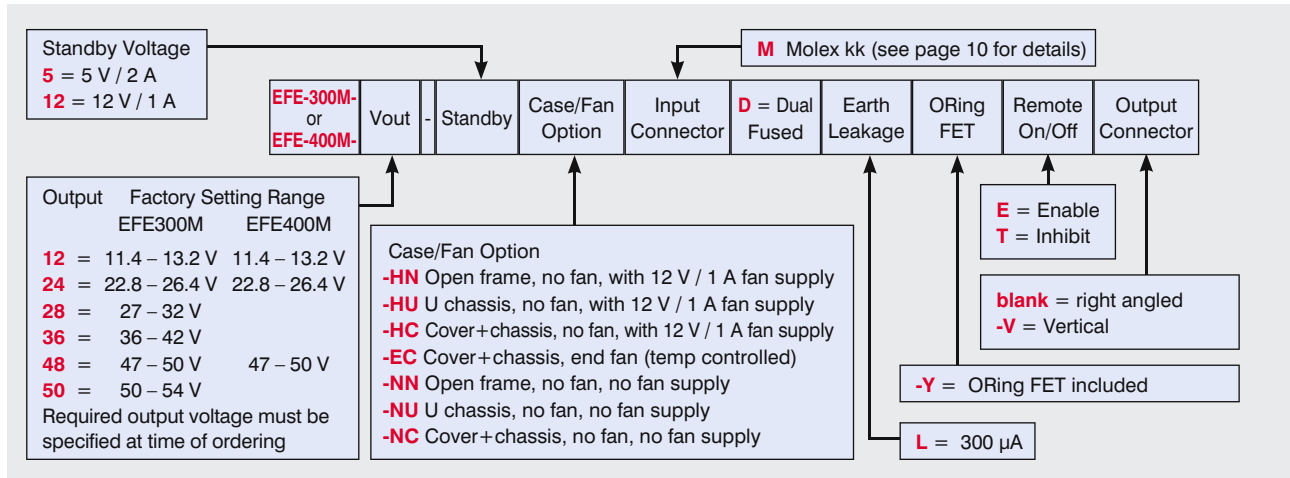
### Quick Selector

preferred configurations

Output	Description Order Code	Units without fan		Units with end fan
		Open Frame	Cover + Chassis	Cover + Chassis
12 V / 25 A	Description Order Code	EFE300M-12-5-HNMDL-YT U5Y0020	EFE300M-12-5-HCMDL-YT U5Y001Z	EFE300M-12-5-ECMDL-YT U5Y0031
12 V / 33.3 A	Description Order Code	EFE400M-12-5-HNMDL-YT U6Y001H	EFE400M-12-5-HCMDL-YT U6Y004L	EFE400M-12-5-ECMDL-YT U6Y007P
24 V / 12.5 A	Description Order Code	EFE300M-24-5-HNMDL-YT U5Y0053	EFE300M-24-5-HCMDL-YT U5Y0042	EFE300M-24-5-ECMDL-YT U5Y0064
24 V / 16.7 A	Description Order Code	EFE400M-24-5-HNMDL-YT U6Y002J	EFE400M-24-5-HCMDL-YT U6Y005M	EFE400M-24-5-ECMDL-YT U6Y008Q
48 V / 6.25 A	Description Order Code	EFE300M-48-5-HNMDL-YT U5Y0201	EFE300M-48-5-HCMDL-YT U5Y0223	EFE300M-48-5-ECMDL-YT U5Y0166
48 V / 8.3 A	Description Order Code	EFE400M-48-5-HNMDL-YT U6Y003K	EFE400M-48-5-HCMDL-YT U6Y006N	EFE400M-48-5-ECMDL-YT U6Y009R

Additional variants available “Build to Order” – see below.

### How to create a Product Code



Confirm availability of created product code with the factory.

### Output Specifications

	EFE300M	EFE400M	Notes
Output power	300 W	400 W	Continuous (including fan supply) or RMS (including Peak power)
Peak power	400 W	530 W	EFE300M – for 10 seconds. Outputs above 36 V, 350 W EFE400M – for 10 seconds. No peak power for outputs 47 V and above
Total regulation	better than 4 %		Including Line (for 90 – 264 V AC input change) and Load (for 0 – 100 % load change) and temperature (0 – 50 °C)
Ripple & noise	1.5 %		Pk-Pk, using EIAJ test method & 20 MHz bandwidth
Voltage setting accuracy	$\pm 1$ %		at 50 % load
Turn on time	1.5 s max.		at 90 V AC & 100 % rated output power
Efficiency	90 %		typical. 87 % typical if Standby Supply is fully loaded
Hold-up	16 ms min.		typical at 90 V AC, 75 % load
Min load	none		
Transient response	<5 %		of set voltage for 50 % load change (in 50 $\mu$ s within the range 25 – 100 % load)
Recovery	<1 ms		for recovery to 2 % of set voltage
Short circuit protection	yes		Auto recovery after removal of short circuit
Over temperature protection	yes		Primary – auto recovers, secondary – cycle power to restart
Over voltage protection	yes		Latching, need to cycle AC to restart unit
Fan supply	12 V / 1 A		Depending on “Case/Fan Option” selected

### Global Signals

Remote on/off	Enable – TTL logic level low (relative to Standby 0V) enables channel 1 and fan supply Inhibit – TTL logic level low (relative to Standby 0V) inhibits channel 1 and fan supply
Standby supply	5 V / 2 A or 12 V / 1 A, isolated supply, not affected by remote on/off.
Power good	Logic high indicates AC supply is good and Ch1 is within regulation
ORing FET	Allows redundant connection of power supplies with no additional diodes required

## Isolation

Input to output	reinforced	4 kV AC, 5.7 kV DC type tested to 4 kV AC (equivalent to 5.7 kV DC), production tested to 4.3 kV DC		
Input to earth	basic	1.5 kV AC, 2.3 kV DC	Output to earth	1.5 kV AC

## Environment

Temperature	0 °C to 50 °C operational, –40 °C to 70 °C storage (max. 12 months). Full load, with 2 m/s air blown from input to output (approximately 10CFM)
Convection rating	tbc.
Derating	50 °C to 70 °C derate each output by 2.5 % per °C
Low temperature start-up	–20 °C
Humidity	5 – 95 % RH non condensing
Shock	±3 x 30 g shocks in each plane, total 18 shocks 30 g shock = 11ms (±0.5 msec), half sine Conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987. Conforms to MIL-STD-810E/F, Method 516.5, Pro I, IV, VI
Vibration	Single axis 10 – 500 Hz at 2 g (sweep and endurance at resonance) in all 3 planes Conforms to EN60068-2-6, IEC68-2-6 Conforms to MIL-STD-810E, Method 514.4, Pro I, Cat 1,9
Altitude	–200 to 3,000 metres operational (–200 to 5,000 m storage/transportation)
Pollution	Degree 2, Material group 3b

## Immunity EN61000-6-2: 2005

				Criteria
Electrostatic discharge	EN61000-4-2	Level 4	Air discharge 15 kV Contact discharge 8 kV Not applicable to open frame units	A
Electromagnetic field	EN61000-4-3	Level 3	12 V/m	A
Fast / Burst transient	EN61000-4-4	Level 4	AC input tested to 4.4kV DC output tested to 2.2kV	A
Surge immunity	EN61000-4-5	Level 3	Common mode – 2.2 kV, Differential – 1.1 kV	A
Conducted RF immunity	EN61000-4-6	Level 3	12 V	A
Power frequency magnetic field	EN61000-4-8	Level 4	30 A/m	A
Voltage dips, variations, interruptions	EN61000-4-11	Class 3	Criteria B for 5 sec. interruption Criteria B for 1 cycle interruption	A
Ring Wave	EN61000-4-12	Level 3	Common mode – 2.2 kV, Differential – 1.1 kV	A
Voltage Fluctuations	EN61000-4-14	Class 3		A

## Emissions EN61000-6-3: 2007, EN60601-1-2: 2001

Radiated electric field	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B see application note for details
Conducted emissions	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B
Conducted harmonics	EN61000-3-2	Class A, Class C (at 100 W and above)
Flicker	EN61000-3-3	Compliant – d <sub>max</sub> only

## Safety Approvals

	Edition / Date	Amendments		Edition / Date	Amendments
EN60950-1	Edition 2 - 2006		IEC60950-1*	Edition 2 - 2005	
UL60950-1	Edition 2 - 2007		CSA22.2 No. 60950-1	Edition 2 - 2007	
EN61010-1	Edition 2 - 2001		IEC61010-1*	Edition 2 - 2001	
EN60601-1	Edition 2 - 1990	A1, A2, A13	IEC60601-1*	Edition 2 - 1988	A1, A2
CE Mark	LV Directive 2006/95/EC (EN60950-1)		UL/CSA60601-1	Edition 2 - 2003	With Revisions 2006

\* CB certificate and report available on request. Check with factory for status of approvals.

## Outline & Connection Drawings

### EFE-300M (not -V version)

**J1 CONNECTION**

PIN	CONNECTION
1	EARTH
2	NOT CONNECTED
3	LIVE
4	NOT CONNECTED
5	NEUTRAL

**J2 CONNECTION**

PIN	CONNECTION	PIN	CONNECTION
10	0V STANDBY	1	LV STANDBY
11	POWER GOOD	2	REMOTE ON/OFF
12	0V CH1	3	LV CH1
13	0V CH1	4	LV CH1
14	0V CH1	5	LV CH1
15	0V CH1	6	LV CH1
16	0V CH1	7	LV CH1
17	0V CH1	8	LV CH1
18	0V CH1	9	LV CH1
19	0V CH1	10	LV CH1
20	+12V FAN (NOTE 1)	8	0V

NOTE\* 1: M3 MODEL, PIN 10/C

**MATING PARTS (MOLEX OR EQUIVALENT)**

CONNECTOR	HOUSING	CRIMP PIN
J1	98-50-8051	98-52-0113
J2	39-01-2185	44476-3112

**NOTE:**  
A 4 OFF HOLES: Ø3.5mm CLEARANCE FOR M3 FIXINGS.  
B 8 OFF FIXING HOLES FOR M3, MAXIMUM PENETRATION 4.5mm, MAXIMUM TORQUE 0.9Nm.  
ALL TOLERANCES ±0.5mm.

### EFE-400M (not -V version)

**J1 CONNECTION**

PIN	CONNECTION
1	EARTH
2	NOT CONNECTED
3	LIVE
4	NOT CONNECTED
5	NEUTRAL

**J2 CONNECTION**

PIN	CONNECTION	PIN	CONNECTION
1	+V STANDBY	11	0V STANDBY
2	REMOTE ON/OFF	12	POWER GOOD
3	+V CH1	13	0V CH1
4	+V CH1	14	0V CH1
5	+V CH1	15	0V CH1
6	+V CH1	16	0V CH1
7	+V CH1	17	0V CH1
8	+V CH1	18	0V CH1
9	+V CH1	19	0V CH1
10	+V CH1	20	+12V FAN

**NOTE:**  
A 5 OFF HOLES: Ø3.5mm CLEARANCE FOR M3 FIXINGS.  
B 9 OFF M3 CUSTOMER FIXINGS, MAXIMUM PENETRATION 4.5MM

Note connection details and outline drawings for -V (vertical) connector are different. (See handbook for details)

Notes: 1. All customer fixings M3 2. Maximum Penetration 4.5 mm 3. Maximum torque 0.9 Nm 4. All tolerances ±0.5 mm



## Highlights

- Lifetime warranty
- Medical approvals
- Universal input (85 – 265 V AC)
- High efficiency
- Broad 30 W to 1500 W product range
- RoHS compliant design
- Suitable for medical test equipment and analysers
- Wide range AC input
- Lower cost of ownership
- Reduces system approval times
- Supports global use

## Input Specifications

Items	Models	HWS30 HWS50	HWS100 HWS150	HWS300	HWS600	HWS1000	HWS1500
Input voltage range	–	85 – 265 V AC (47 – 63 Hz) or 120 – 370 V DC		85 – 265 V AC (47 – 330 V DC)		85 – 265 V AC (47 – 63 Hz)	
Input current (typ.) <sup>1</sup>	A	0.8 / 0.4 0.7 / 0.35	1.3 / 0.65 1.9 / 0.95	4.1 / 2.1	8.1 / 3.9	13.5 / 7.0	19/10
Inrush current <sup>1</sup>	A	14 / 28		20 / 40			
Power factor / flicker	–	meets EN61000-3-2, EN61000-3-3					
Temperature coefficient	–	<0.02 % / °C					
Overcurrent protection	–	>104 %					
Overvoltage protection	V	yes (see table on page 11)					
Hold-up time (typ.)	ms	20					
Leakage current (60 Hz) <sup>2</sup>	mA	<0.5 mA					
Remote sense	–	no		yes			
Indicator	–	Green LED = on					
Remote on/off	–	no		yes (isolated from output)			
Parallel operation	–	no		single wire conn. (5 units max.)			
DC good	–	no		yes			
Voltage programming	–	no					
Operating temperature and derating	–	HWS30-150: –10 °C to +70 °C, (–10 to +50 °C: 100 %, +60 °C: 60 %, +70 °C: 20 %) HWS300-1500: –10 °C to +70 °C, (–10 to +50 °C: 100 %, derate linearly to 50 % load from +50 to +70 °C)					
Storage temperature	°C	–30 to +85 °C					
Humidity (non condensing)	–	operating: 30 – 90 % RH (10 – 90 % on HWS300-1500), non-operating 10 – 95 % RH					
Cooling	–	convection		internal fan			
Withstand voltage <sup>3</sup>	–	input to ground 2 kV AC, input to output 3 kV AC, output to ground 500 V AC for 1 min.					
Isolation resistance	–	>100 MΩ at 25 °C & 70 % RH, output to ground 500 V DC, >10 MΩ output to remote on/off 100 V DC					
Vibration (non-operating)	–	10 – 55 Hz (1 min. sweep), 19.6 m/s <sup>2</sup> constant, X, Y, Z axis, one hour each					
Shock (in packaging)	–	<196.1 m/s <sup>2</sup>					
Safety agency approvals <sup>2</sup>	–	UL60601-1, EN60601, CSA-C22.2 No. 6011-M90 (C-UL) (basic insulation), CE Mark					
Line dip	–	complies with SEMI F47 (200 V AC line only)					
Conducted & radiated EMI	–	EN55011 / EN55022-B, FCC-B, VCCI-B (HWS600 & 1500 Class A)					
Immunity	–	IEC61000-4-2 (Level 2,3), -3, -4, -6, (Level 3), -5 (Level 3,4), -11					



## Input Specifications

Continuation

Items	Models	HWS30 HWS50	HWS100 HWS150	HWS300	HWS600	HWS1000	HWS1500
Weight (typ.)	g	220 280	450 500	1000	1600	3200	3800
Size (W x H x D)	mm	26 x 82 x 95 26 x 82 x 120	28 x 82 x 160 37 x 82 x 160	61 x 82 x 165	100 x 82 x 165	126.5 x 82 x 240	280 x 82 x 126.5
Warranty		lifetime warranty (see TDK-Lambda's terms & conditions)					

1 100 / 200 V AC input

3 HWS300-600 2.5 kV AC input to ground

2 See clause 19.5DV.2 of UL60601 for equipment in proximity of patient  
HWS30-150/ME are without cover, HWS300-1500 are with cover

## Output Specifications

Model	Voltage	Adjust range	Max. curr (A) <sup>4</sup>	Max. power (W)	Load reg (mV)	Line reg (mV)	Ripple noise (mV)	Over-voltage (V)	Efficiency (typ.) % <sup>1</sup>
HWS30-5/ME	5 V	4.0 – 6.0	6	30	40	20	120	6.25 – 7.25	77 / 80
HWS50-5/ME	5 V	4.0 – 6.0	10	50	40	20	120	6.25 – 7.25	82 / 84
HWS100-5/ME	5 V	4.0 – 6.0	20	100	40	20	120	6.25 – 7.25	83 / 86
HWS150-5/ME	5 V	4.0 – 6.0	30	150	40	20	120	6.25 – 7.25	83 / 86
HWS600-5/ME	5 V	4.0 – 6.0	120	600	30	20	120	6.25 – 7.25	80 / 83
HWS30-12/ME	12 V	9.6 – 14.4	2.5	30	96	48	150	15 – 17.4	81 / 83
HWS50-12/ME	12 V	9.6 – 14.4	4.3	51.6	96	48	150	15 – 17.4	81 / 83
HWS100-12/ME	12 V	9.6 – 14.4	8.5	102	96	48	150	15 – 17.4	83 / 86
HWS150-12/ME	12 V	9.6 – 14.4	13	156	96	48	150	15 – 17.4	83 / 86
HWS300-12/ME	12 V	9.6 – 14.4	27	324	72	48	150	15 – 17.4	80 / 83
HWS600-12/ME	12 V	9.6 – 14.4	53	636	72	48	150	15 – 17.4	80 / 83
HWS30-15/ME	15 V	12.0 – 18.0	2	30	120	60	150	18.8 – 21.8	81 / 83
HWS50-15/ME	15 V	12.0 – 18.0	3.5	52.5	120	60	150	18.8 – 21.8	81 / 83
HWS100-15/ME	15 V	12.0 – 18.0	7	105	120	60	150	18.8 – 21.8	83 / 86
HWS150-15/ME	15 V	12.0 – 18.0	10	150	120	60	150	18.8 – 21.8	83 / 86
HWS300-15/ME <sup>5</sup>	15 V	12.0 – 18.0	22	330	90	60	150	18.8 – 21.8	82 / 85
HWS600-15/ME	15 V	12.0 – 18.0	43	645	90	60	150	18.8 – 21.8	81 / 84
HWS30-24/ME	24 V	19.2 – 28.8	1.3	31.2	192	96	200	30 – 34.8	83 / 86
HWS50-24/ME	24 V	19.2 – 28.8	2.2	52.8	192	96	150	30 – 34.8	82 / 84
HWS100-24/ME	24 V	19.2 – 28.8	4.5	108	192	96	150	30 – 34.8	84 / 87
HWS150-24/ME	24 V	19.2 – 28.8	6.5	156	192	96	150	30 – 34.8	85 / 88
HWS300-24/ME	24 V	19.2 – 28.8	14 (16.5 Pk)	336	144	96	150	30 – 34.8	82 / 85
HWS600-24/ME	24 V	19.2 – 28.8	27 (31 Pk)	648	144	96	150	30 – 34.8	82 / 85
HWS1000-24/ME	24 V	19.2 – 28.8	46 (58.5 Pk)	1104	150	96	150	30 – 34.8	85 / 87
HWS1500-24/ME	24 V	4.8 – 28.8 <sup>7</sup>	65/70 <sup>1</sup> (105 Pk <sup>6</sup> )	1560/1680 <sup>1</sup> (2520 Pk <sup>6</sup> )	144	96	200	30 – 34.8	84 / 88
HWS1000-36/ME	36 V	28.8 – 43.2	30.7 (39 Pk)	1104	150	144	200	45 – 49.7	85 / 88
HWS1500-36/ME	36 V	7.2 – 43.2 <sup>7</sup>	42/46.5 <sup>1</sup> (70 Pk <sup>6</sup> )	1512/1674 <sup>1</sup> (2520 Pk <sup>6</sup> )	150	144	200	34 – 49.7	84 / 88
HWS30-48/ME	48 V	38.4 – 52.8	0.65	31.2	384	192	200	55.2 – 64.8	82 / 83
HWS50-48/ME	48 V	38.4 – 52.8	1.1	52.8	384	192	200	55.2 – 64.8	83 / 85
HWS100-48/ME	48 V	38.4 – 52.8	2.1	100.8	384	192	200	55.2 – 64.8	84 / 87
HWS150-48/ME	48 V	38.4 – 52.8	3.3	158.4	384	192	200	55.2 – 64.8	85 / 88
HWS300-48/ME	48 V	38.4 – 52.8	7	336	288	192	350	55.2 – 64.8	82 / 85
HWS600-48/ME	48 V	38.4 – 52.8	13	624	288	192	350	55.2 – 64.8	83 / 86
HWS1000-48/ME	48 V	38.4 – 52.8	23	1104	300	192	200	55.2 – 60	86 / 88
HWS1500-48/ME	48 V	9.6 – 52.8 <sup>7</sup>	32	1536	288	192	200	55.2 – 64.8	86 / 90

4 Peak load for 10 sec. maximum on time, 35 % duty cycle

6 200 – 265 AC input

5 Safety agency in progress – contact factory for status

7 Using voltage programming input – see installation manual for details

## Options

Suffix	Description
Blank	No cover (except HWS300-1500 cover fitted) as standard
/ A	Cover fitted (egHWS100-24/MEA) option available for HWS100 & HWS150 only

# Outline & Connection Drawings

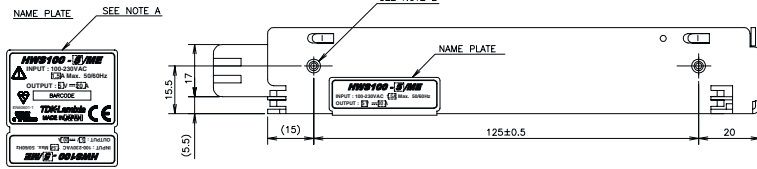
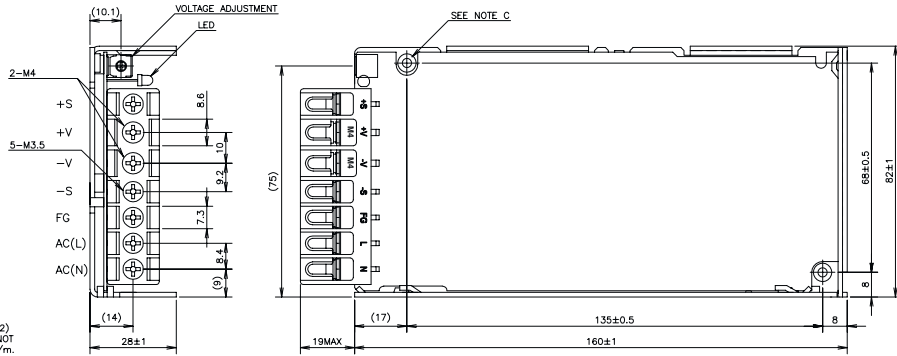
## HWS100

**NOTES**

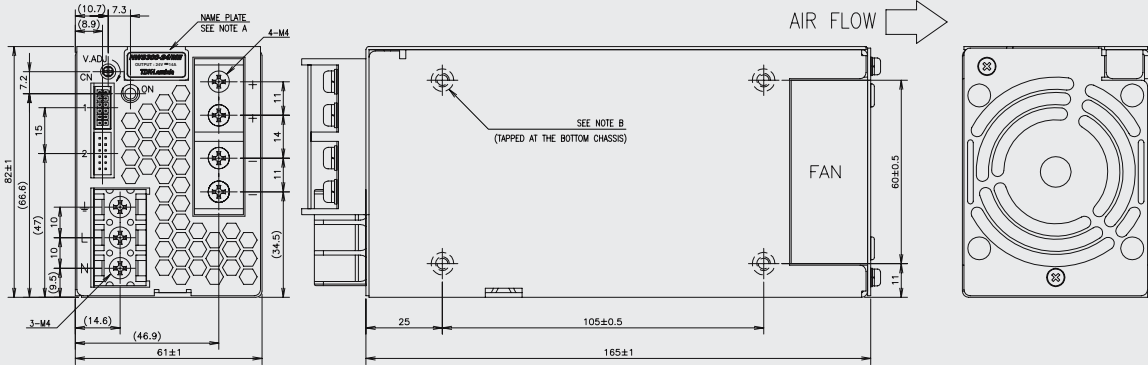
- A : MODEL NAME, INPUT VOLTAGE RANGE, NOMINAL OUTPUT VOLTAGE, MAXIMUM OUTPUT CURRENT AND COUNTRY OF MANUFACTURE ARE SHOWN HERE IN ACCORDANCE WITH THE SPECIFICATIONS.
- B : M3 EMBOSSED, TAPPED AND COUNTERSUNK HOLES (2) FOR CUSTOMER CHASSIS MOUNTING. SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 6m/m.
- C : M3 TAPPED HOLES (2) FOR CUSTOMER CHASSIS MOUNTING. SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 6m/m.

**ACCESSORIES**

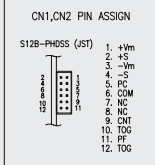
- \* SHORT PIECE (NET 2) FOR SHORTING PURPOSE (+S~+V, -S~-V) : MOUNTED AT TIME OF SHIPMENT.



## HWS300



**SIGNAL CONNECTOR INFORMATION**



**== MATCHING HOUSINGS, PINS & TOOL ==**

PART DESCRIPTION	PART NAME	MANUFACT
SOCKET HOUSING	PHDR-12VS	JST
TERMINAL PINS	SPHD-002T-PO.5(AW/C28-24) SPHD-001T-PO.5(AW/C26-22)	JST
HAND CRIMPING TOOL	YRS-820(SPHD-002T-PO.5) YC-610R(SPHD-001T-PO.5)	JST

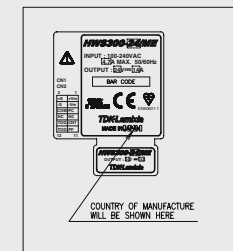
**== SIGNAL CONNECTOR USED ==**

PART DESCRIPTION	PART NAME	MANUFACT
PIN HEADER	S12B-PHDSS	JST

**== ACCESSORIES ==**

- \* COVER FOR BARRIER TERMINAL STRIP (ATTACHED ON TERMINAL AT SHIPMENT)
- \* SHORT PIECE (NET 2) FOR SHORTING PURPOSE (+Vm~+S, -Vm~-S, CNT~TOG (ATTACHED ON CN1 AT SHIPMENT))

**NAME PLATE DETAILS**

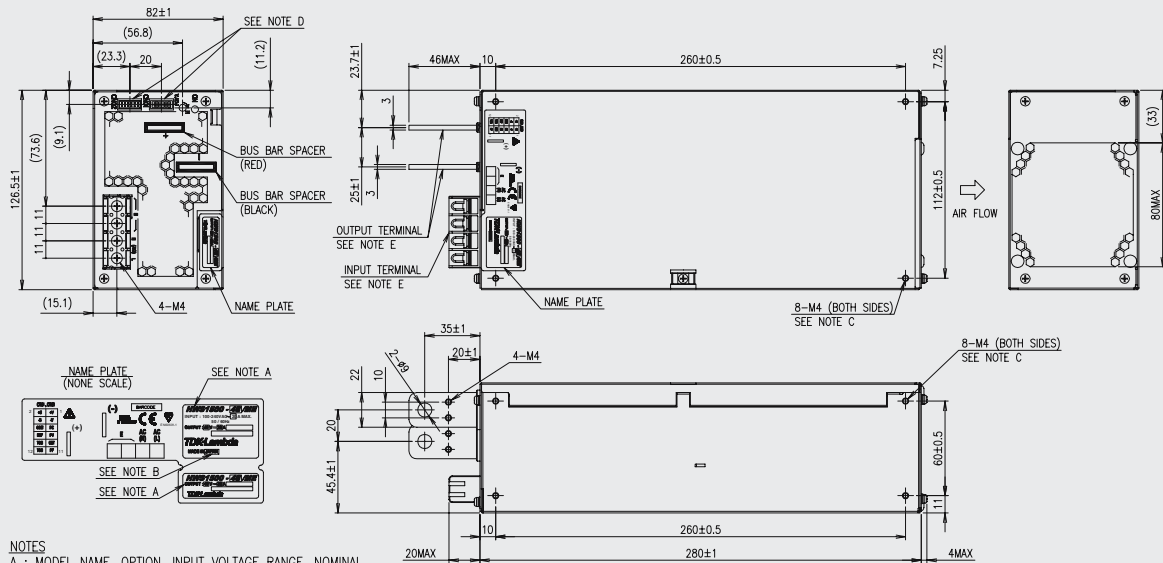


**== NOTES ==**

- A : MODEL NAME, NOMINAL OUTPUT VOLTAGE AND MAXIMUM OUTPUT CURRENT ARE SHOWN IN THE NAME PLATE IN ACCORDANCE WITH THE SPECIFICATIONS.
- B : M4 TAPPED HOLES (8) FOR CUSTOMER CHASSIS MOUNTING. (SCREW PENETRATION DEPTH 6m/m MAX.)

# Outline & Connection Drawings

## HWS1500



### NOTES

- A : MODEL NAME, OPTION, INPUT VOLTAGE RANGE, NOMINAL OUTPUT VOLTAGE, MAXIMUM OUTPUT CURRENT ARE SHOWN HERE IN ACCORDANCE WITH THE SPECIFICATIONS.  
 B : COUNTRY OF MANUFACTURE IS SHOWN HERE.  
 C : M4 TAPPED HOLES (16) FOR CUSTOMER CHASSIS MOUNTING. (SCREWS MUST NOT PROTRUDE INTO POWER SUPPLY BY MORE THAN 6m/m).  
 RECOMMENDED M4 SCREWS TORQUE : 1.27N·m  
 D : I/O SIGNAL CONNECTOR  
 CONNECTOR : S12B-PHDSS(LF)(SN) (JST)  
 MATCHING HOUSING : PHDR-12VS (JST)  
 MATCHING CONTACT : SPHD-002T-P0.5(AWG28~24) (JST) OR SPHD-001T-P0.5(AWG26~22) (JST) OR BPHD-001T-P0.5(AWG26~22) (JST)  
 HAND CRIMPING TOOL : YRS-620(SPHD-002T-P0.5) (JST) YC-610R(SPHD-001T-P0.5) (JST) YC-610R(BPHD-001T-P0.5) (JST)

- E : RECOMMENDED TORQUE FOR THE TERMINAL PIECE.  
 INPUT TERMINAL (M4 SCREW) : 1.27N·m  
 OUTPUT TERMINAL (M8 BOLT & NUT) : 10.8N·m  
 OUTPUT TERMINAL (M4 SCREW) : 1.27N·m

### ACCESSORIES

- \* ATTACHED CONNECTOR  
 SHORTING +S~+V, -S~-V, PV~REF & CNT~TOG  
 ATTACHED ON CN01 AT SHIPMENT

### SIGNAL CONNECTOR INFORMATION

CN01, CN02 PIN ASSIGN	
S12B-PHDSS (JST)	1. +V 7. PV
	2. +S 8. REF
	3. -V 9. CNT
	4. -S 10. TOG
	5. PC 11. PF
	6. COM 12. TOG

## Highlights

- Quiet temperature controlled fan
- Low cost
- Low profile
- Wide operating temperature range
- Active power factor correction
- Input transient protected IEC61000-4
- Medical approvals (IEC60601-1)
- Global safety approvals
- Level B EMI
- Low acoustic noise
- Supports global use
- Suitable for outdoor temperature extremes
- Assists system compliance



## Input Specifications

Items	Models	SWS1000L
Input voltage range	–	85 – 265 V AC (47 – 63 Hz) or 120 – 350 V DC
Inrush current (115 / 230 V AC)	A	20 / 40
Power factor	–	meets EN61000-3-2 Class A
Input current (100 / 200 V AC)	A	12 / 6
Temperature coefficient	–	<0.02 % / °C
Overcurrent protection	–	> 105 %, constant current style
Overvoltage protection	V	125 – 145 %
Overtemperature protection	–	yes, cycle AC or remote on/off to reset
Hold-up time (typ.)	ms	20 ms at 115 / 230 V AC
Leakage current (max.)	mA	<0.3 mA
Remote sense	–	yes
Parallel connection	–	yes
Remote on/off (CNT)	–	yes
Voltage programming <sup>1</sup>	–	yes, 1 – 6 V adjusts output from 20 – 120 % of nominal
DC good & fan fail signal	–	yes, open collector output
Auxiliary output	–	12 V 0.1 A
LED indicator	–	Green LED = on
Operating temperature	–	–40 °C start-up. –20 to 74 °C, derating linearly to 50 % load above 50 °C
Storage temperature	–	–40 to +85 °C
Humidity (non condensing)	–	20 – 90 % RH operating, 10 – 95 % RH non-operating
Cooling	–	internal fan
Withstand voltage (1 min.)	–	input to ground 2 kV AC, input to output 4 kV AC, output to ground 500 V AC, output to CNT 120 V AC
Isolation resistance	–	>50 MΩ at 25 °C & 70 % RH, output to ground 500 V DC
Vibration (non-operating)	–	10 – 55 Hz (sweep for 1 min.) 23.52 m/s <sup>2</sup> constant X, Y, Z 1 hour each plane)

<sup>1</sup> Not available on 3.3 V & 5 V SWS1000L models

# Input Specifications

Continuation

Items	Models	SWS1000L
Shock	–	235.2 m/s <sup>2</sup>
Immunity	–	EN61000-4-2, -3, -4, -5, -6, -8, -11
Safety agency approvals	–	UL, CSA, EN60950-1, EN/UL60601-1, EN50178, CE Mark
Conducted & radiated EMI	–	EN55011 / EN55022-B, FCC Class B
Weight (typ.)	g	2300
Size (W x H x D)	mm	61 x 150 x 240
Warranty	yrs	3 years

# Output Specifications

Model	Voltage	Adjust range (via trim pot)	Max. current (A)	Max. power (W)	Load regulation (mV)	Lin. regulation (mV)	Ripple noise (mV)	Efficiency <sup>2</sup> (typ.) %
SWS1000L-3	3.3 V	2.64 – 3.96 V	200	660	30	20	120	74 / 76
SWS1000L-5	5 V	4 – 6 V	200	1000	30	20	120	79 / 81
SWS1000L-12	12 V	9.6 – 14.4 V	88	1056	72	48	150	82 / 84
SWS1000L-15	15 V	12 – 19.5 V	70	1050	90	60	150	82 / 84
SWS1000L-24	24 V	19.2 – 28.8 V	44 (51) <sup>3</sup>	1056 (1224) <sup>3</sup>	144	96	150	84 / 86
SWS1000L-36	36 V	28.8 – 43.2 V	29	1044	216	144	200	84 / 86
SWS1000L-48	48 V	38.4 – 56 V	22 (25) <sup>3</sup>	1056 (1200) <sup>3</sup>	288	192	200	84 / 86
SWS1000L-60	60 V	48 – 66 V	17	1020	360	240	200	84 / 86

2 115 / 230 V AC

3 Peak current and power available at 170 – 265 V AC input, 10 sec. max. 35 % duty cycle

# Outline Drawings

**Signal connector information**

**CN1, CN2 Pin assignment**  
S10B-PHDSS (JST)

1	+Vm
2	-Vm
3	NC
4	NC
5	NC
6	NC
7	NC
8	NC
9	COM
10	CN2
11	TOG

**CN3 Pin assignment**  
S8B-PHDSS (JST)

1	COM
2	COM
3	AUX
4	COM
5	RES
6	ALM
7	SI

**Accessories:**  
± Short piece \_\_\_\_\_  
Shorting +Vm +S, Vm -S (Attached on CN1 at shipment)

**Signal connector used**

Part description	Part name	Manufact
Pin header (CN1 & CN2)	S10B-PHDSS	JST
Pin header (CN3)	S8B-PHDSS	JST

**Matching housings, pins & tool**

Part description	Part name	Manufact
Socket housing (CN1 & CN2)	PHDR-10VS	JST
Socket housing (CN3)	PHDR-8VS	JST
Terminal pins	SPHD-002T-P0.5(AWG28~24) SPHD-001T-P0.5(AWG26~22)	JST
Hand crimping tool	YRS-620(SPHD-002T-P0.5) YC-610R(SPHD-001T-P0.5)	JST

**Notes:**

A Model name, input voltage range, nominal output voltage, nominal output current and peak output current are on name plate in accordance with the specifications.

B Country of manufacture is shown here.

C M4 tapped holes (12) for customer chassis mounting. (Screw penetration depth 6 m / m max.)



### Highlights

- Reinforced isolation for IEC60601-1
- Low earth leakage and class B EMC
- Medical approval
- High efficiency
- High power density (9.3 W/in<sup>3</sup>)
- Up to 3 outputs
- No minimum load
- Fits 1 U applications
- 3 years warranty
- Temperature controlled fan option
- Low profile
- Minimises heat in system
- Less space

### Input Specifications

Input voltage	90 – 264 V AC (100 – 240 V AC nominal)
Input frequency	45 – 63 Hz
Input harmonics	EN61000-3-2 compliant
Inrush current	<40 A at 25 °C and 264 V AC, (cold start)
Input fuse	Fast acting (not user accessible)
Earth leakage current	123 µA max. at 120 V AC (60 Hz) 257 µA max. at 240 V AC (60 Hz) Worst case leakage current is less than 300 µA at 264 V AC, 63 Hz (normal condition, 500 µA Single Fault Condition)
Power factor	0.97 typical

### Quick Selector

preferred configurations

Model	Ch1	Ch3	Ch4
NV1-1T000-M	12 V / 15 A	–	–
NV1-1G000-M	24 V / 7.5 A	–	–
NV1-3G0TT-M	24 V / 7.5 A	12 V / 5 A	–12 V / 1 A
NV1-3G0FF-M	24 V / 7.5 A	15 V / 5 A	–15 V / 1 A

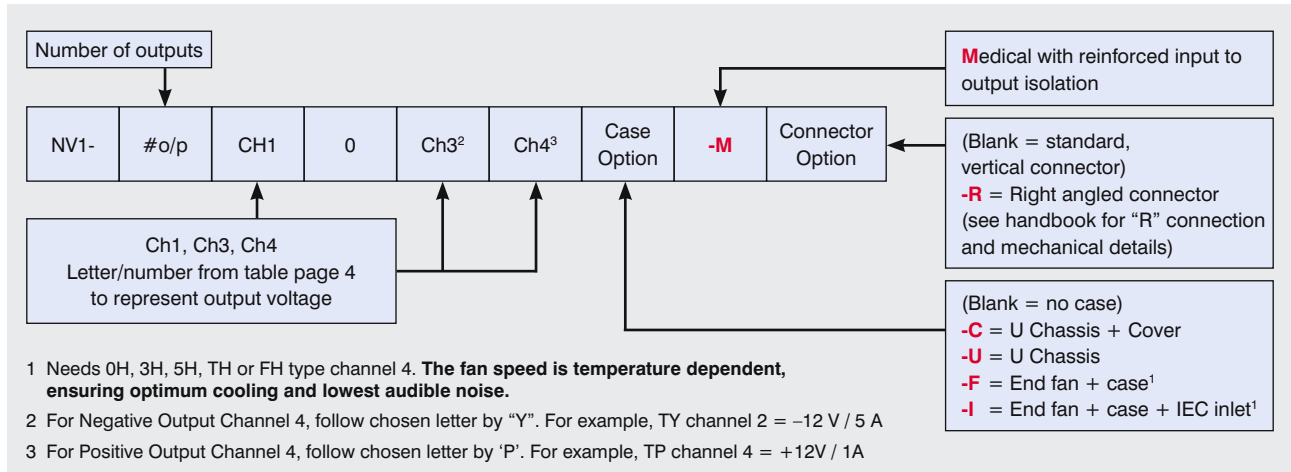
Above units available on rapid delivery. Additional variants available “Build to Order” – see below.

### Available Outputs

Channel 1	Adjustment range	Channel 2	Channel 3 <sup>1</sup>	Adjustment range	Channel 4 <sup>2</sup>	Adjustment range
<b>T</b> 12 V / 15 A <b>F</b> 15 V / 12 A	12 – 15 V <sup>3</sup> 12 – 15 V <sup>4</sup>	not available	<b>T</b> 12 V / 5 A <b>F</b> 15 V / 5 A <b>G</b> 24 V / 2.5 A <b>O</b> Omit	12 – 15 V 12 – 15 V 18 – 24 V	<b>T</b> –12 V / 1 A <b>F</b> –15 V / 1 A <b>3HP</b> +3.3 V / 2 A <sup>6</sup> <b>5HP</b> +5 V / 2 A <sup>6</sup> <b>TH</b> –12 V / 2 A <sup>6</sup> <b>FH</b> –15 V / 2 A <sup>6</sup> <b>OH</b> Fan supply only <b>O</b> Omit	fixed fixed fixed fixed fixed
<b>G</b> 24 V / 7.5 A	24 – 28 V <sup>5</sup>					

Notes: 1 Follow letters in red by “Y” for negative output channel 3. 3 12 – 12.5 V if 24 V channel 3 fitted. 5 24 – 26 V if 24 V channel 3 fitted.  
2 Follow letters in red by “P” for positive output channel 4. 4 14.5 – 15 V if 24 V channel 3 fitted. 6 1.5 A max. if fitted with “-F” option.

## How to create a Product Code



Confirm availability of created product code with the factory.

## Output Specifications

		Notes
Remote sense	yes	Channel 1 – max. 0.5 V total line drop
Total regulation	1 %	Including line (for 90 – 264 V AC input change), Load (for 0 – 100 % load change) and Cross (for 0 – 100 % load change on any other output) regulation
Ripple & noise	1 %	(or 50 mV if higher) Pk-Pk, using EIAJ test method 20 MHz bandwidth
Voltage accuracy	±1 %	±4 % for Channel 4 with "T" or "F" type outputs, +4 % / -3 % for all other Ch 3
Turn on time	1.5 s max.	at 90 V AC & 100 % rated output power
Efficiency	up to 90 %	configuration dependent
Hold-up	16 ms min.	at 90 V AC
Minimum load	none	on any output
Transient response	<4 %	of set voltage for 50 % load change (in 50 µs within the range 25 – 100 % load)
Recovery	<500 µs	for recovery to 1 % of set voltage
Short circuit protection	yes	
Over temperature protection	yes	
Over voltage protection	yes	See application notes for details
Ch1 good signal	yes	Provides a Logic "low" signal after output is within 90 % (±5 %) of nominal
Peak output power	200 W	Single output units. Average output power must not exceed 180 W over any 5 minute period

## Isolation

Input to output	reinforced	4 kV AC type tested to 4 kV AC (equivalent to 5.7 kV DC), production tested to 4.3 kV DC		
Input to earth	basic	2.3 kV DC	Output to earth	200 V DC

## Environment

Temperature	0 °C to 50 °C operational, -40 °C to 85 °C storage (max. 12 months). Full load with either "-F" option fitted or 2 m/s air blown from input to output
Convection rating	See application note for details
Derating	50 °C to 65 °C derate each output by 2.5 % per °C
Low temperature start-up	-20 °C
Humidity	5 – 95 % RH non condensing
Shock	±3 x 30 g shocks in each plane, total 18 shocks 30 g shock = 11ms (±0.5 msec), half sine Conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987 Conforms to MIL-STD-810E/F, Method 516.5, Pro I, IV, VI
Vibration	Single axis 10 – 500 Hz at 2 g (sweep and endurance at resonance) in all 3 planes Conforms to EN60068-2-6, IEC68-2-6 Conforms to MIL-STD-810E, Method 514.4, Pro I, Cat 1,9
Altitude	3,000 metres operational
Pollution	Degree 2, Material group 3b

### Immunity EN61000-6-2: 2001

				Criteria
Electrostatic discharge	EN61000-4-2	Level 4	Air discharge 15 kV Contact discharge 8 kV Not applicable to open frame units	A
Electromagnetic field	EN61000-4-3	Level 3	12 V/m	A
Fast / Burst transient	EN61000-4-4	Level 4	tested to 4.4 kV	A
Surge immunity	EN61000-4-5	Level 3	Common mode to 2.2 kV Differential mode to 1.1 kV	A
Conducted RF immunity	EN61000-4-6	Level 3	12 V	A
Power frequency magnetic field	EN61000-4-8	Level 4	30 A/m	A
Voltage dips, variations, interruptions	EN61000-4-11	Class 3	Criteria B for 5 sec. interruption	A

### Emissions EN61000-6-3: 2001

Radiated electric field	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B (2005) see application note for details
Conducted emissions	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B (2005)
Conducted harmonics	EN61000-3-2	Class A
Flicker	EN61000-3-3	Compliant – d <sub>max</sub> only

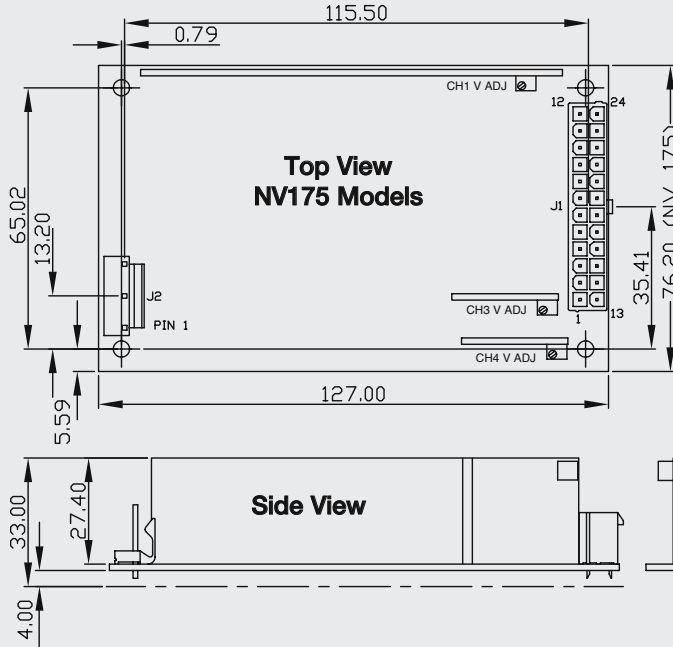
### Safety Approvals

	Date	Amendments		Date	Amendments
EN60950-1	2006		IEC60601-1*	1988	A1, A2
UL60950-1	2007		EN60601-1	1990	A1, A2, A13
CSA22.2 No 60950-1	2003		UL60601-1	2003	with revisions 2006
IEC60950-1*	2005		CE Mark	LV Directive 2006/95/EC (EN60950-1)	
EN61010-1	2001				
IEC61010-1*	2001				

\* CB certificate and report available on request.  
Check with factory for status of approvals.



# Outline & Connection Drawings

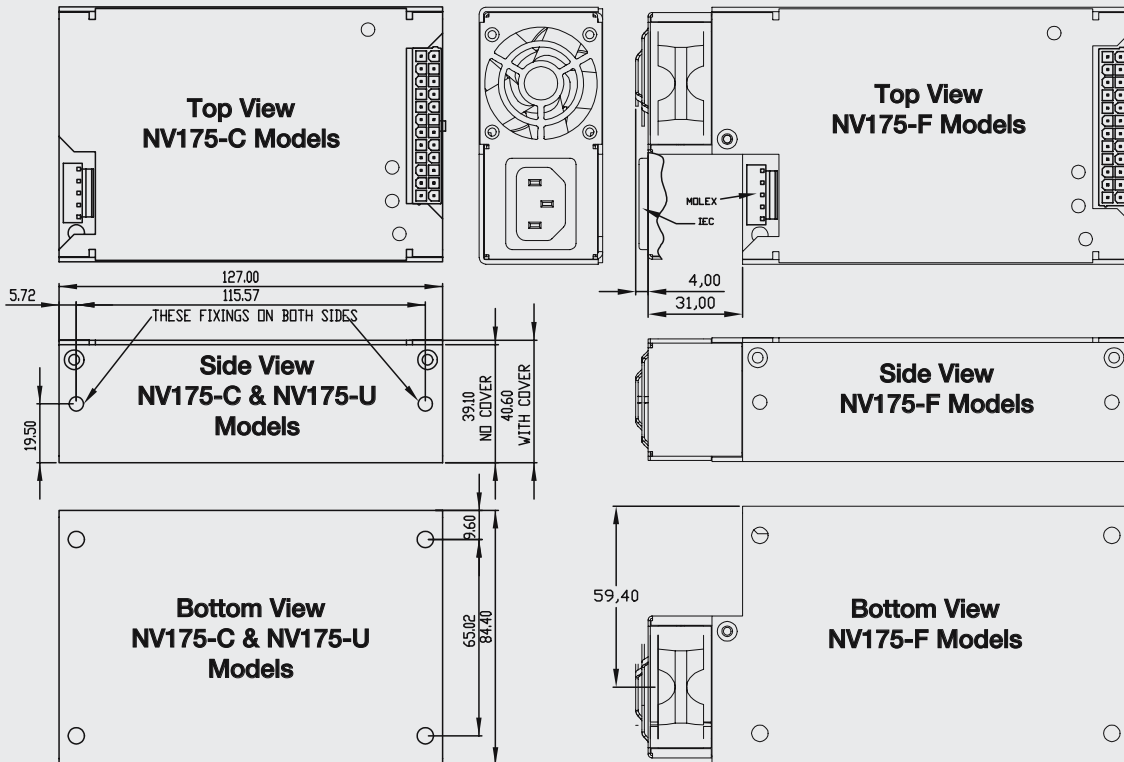


MATING PARTS (MOLEX OR EQUIVALENT)

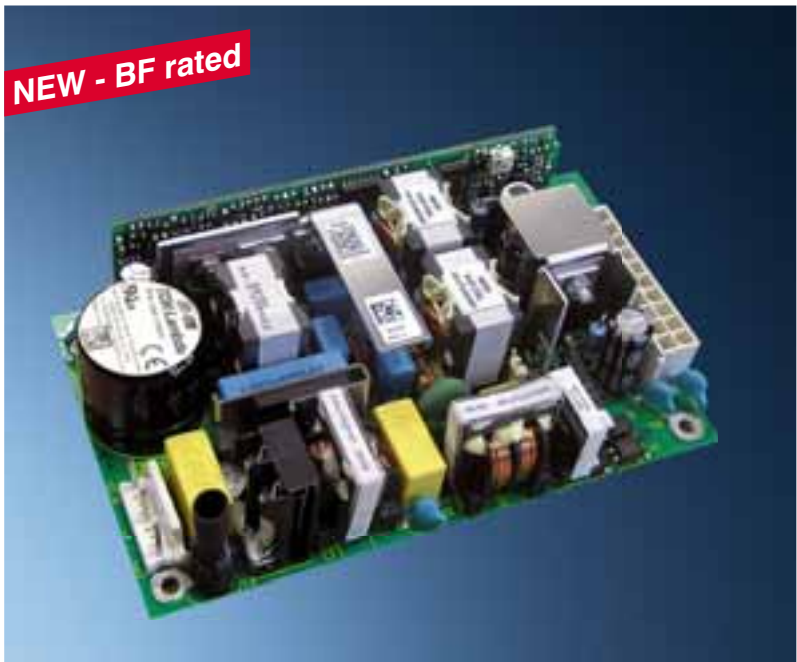
CONN	HOUSING	PINS
J1	39-01-2245	44476-3112
J2	09-50-8051	08-52-0113

J1			
PIN	FUNCTION	PIN	FUNCTION
12	STANDBY +Ve	24	Do not connect
11	Do not connect	23	Do not connect
10	CH1 OUTPUT	22	CH1 POWER GOOD
9	CH1 OUTPUT	21	CH1 OUTPUT
8	CH1 OUTPUT	20	CH1 OUTPUT
7	+SENSE CH1	19	-SENSE CH1
6	0V COMMON	18	0V COMMON
5	0V COMMON	17	0V COMMON
4	Do not connect	16	0V COMMON
3	Do not connect	15	Do not connect
2	Do not connect	14	Do not connect
1	CH3 OUTPUT	13	CH4 OUTPUT

J2	
PIN	FUNCTION
1	EARTH
2	NOT CONNECTED
3	LIVE
4	NOT CONNECTED
5	NEUTRAL



Notes: 1. All customer fixings M3 2. Maximum Penetration 4.5 mm 3. Maximum torque 0.9 Nm 4. All tolerances  $\pm 0.5$  mm



### Highlights

- Medical approval for BF applications
- Reinforced input to output Isolation for IEC60601
- Very low earth leakage and class B EMC
- Below 1 W standby power
- 5" x 3" footprint
- Standby supply and remote on/off
- High efficiency & high power density (9.3 W/in<sup>3</sup>)
- No minimum load
- Fits 1U applications
- 3 years warranty

### Input Specifications

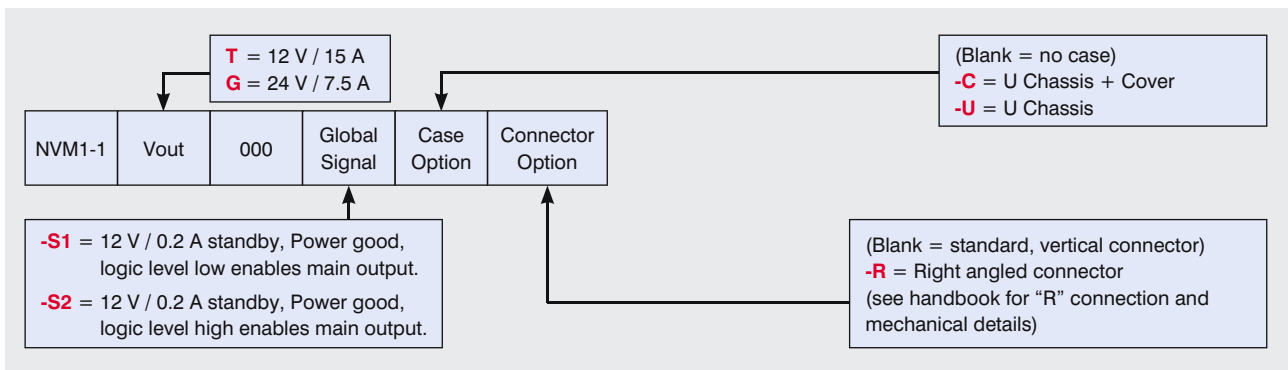
Input voltage	90 – 264 V AC (100 – 240 V AC nominal)
Input frequency	45 – 63 Hz
Input harmonics	EN61000-3-2 compliant
Inrush current	<40 A at 25 °C and 264 V AC, (cold start)
Input fuse	Dual Fused, Fast acting (not user accessible)
Earth leakage current	80 µA max at 120 V AC (60 Hz), 170 µA max at 240 V AC (60 Hz). Worst case leakage current is less than 200 µA at 264 V AC, 63 Hz (normal condition, =330 µA Single Fault Condition)
Power factor	0.97 typical

### Quick Selector

preferred configurations

Model	Ch1	Standby	Remote on/off
NVM1-1T000-S1	12 V / 15 A	12 V / 0.2 A	TTL high / OC to inhibit
NVM1-1G000-S1	24 V / 7.5 A		

### How to create a Product Code



Confirm availability of created product code with the factory.

## Output Specifications

		Notes
Remote sense	yes	Channel 1 – max. 0.5 V total line drop
Total regulation	1 %	Including line (for 90 – 264 V AC input change) and Load (for 0 – 100 % load change)
Ripple & noise	1 %	(or 50 mV if higher) Pk-Pk, using EIAJ test method & 20 MHz bandwidth
Voltage accuracy	±1 %	
Turn on time	1.5 s max.	at 90 V AC & 100 % rated output power
Efficiency	up to 90 %	
Hold-up	16 ms min.	at 90 V AC
Minimum load	none	on any output
Transient response	<4 %	of set voltage for 50 % load change (in 50 µs within the range 25 – 100 % load)
Recovery	<500 µs	for recovery to 1 % of set voltage
Short circuit protection	yes	
Over temperature protection	yes	
Over voltage protection	yes	120 – 135 % of Vout. Remove AC for 10 seconds then reapply to restart unit
Power good signal (J1, pin 12)	yes	'S1' and 'S2' type global signals. Logic 'High' signal indicates ac supply is good and output 1 is within regulation. Provides minimum 4 ms AC fail warning.

## Isolation

Input to output	reinforced	4.5 kV AC type tested to 4.5 kV AC (equivalent to 6.3 kV DC), production tested to 4.3 kV DC		
Input to earth	basic	1.5 kV AC, 2.3 kV DC	Output to earth	1.5 kV AC

## Environment

Temperature	0 °C to 50 °C operational, –40 °C to 85 °C storage (max. 12 months). Full load, with 1.5m/s air blown from input to output (approximately 10CFM)
Convection rating	See application note for details
Derating	50 °C to 70 °C derate each output by 2.5 % per °C with 2.0 m/s air blown from input to output
Low temperature start-up	–20 °C
Humidity	5 – 95 % RH non condensing
Shock	±3 x 30 g shocks in each plane, total 18 shocks 30 g shock = 11ms (±0.5 msec), half sine Conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987 Conforms to MIL-STD-810E/F, Method 516.5, Pro I, IV, VI
Vibration	Single axis 10 – 500 Hz at 2 g (sweep and endurance at resonance) in all 3 planes Conforms to EN60068-2-6, IEC68-2-6 Conforms to MIL-STD-810E, Method 514.4, Pro I, Cat 1,9
Altitude	5,000 metres operational (3,000 metres for IEC/EN/UL60601-1)
Pollution	Degree 2, Material group 3b

## Immunity EN61000-6-2: 2001

				Criteria
Electrostatic discharge	EN61000-4-2	Level 4	Air discharge 15 kV Contact discharge 8 kV Not applicable to open frame units	A
Electromagnetic field	EN61000-4-3	Level 3	12 V/m	A
Fast / Burst transient	EN61000-4-4	Level 4	tested to 4.4 kV	A
Surge immunity	EN61000-4-5	Level 3	Common mode to 2.2 kV Differential mode to 1.1 kV	A
Conducted RF immunity	EN61000-4-6	Level 3	12 V	A
Power frequency magnetic field	EN61000-4-8	Level 4	30 A/m	A
Voltage dips, variations, interruptions	EN61000-4-11	Class 3	Criteria B for 5 sec. interruption	A

**Emissions EN61000-6-3:2001, EN60601-1-2:2001**

Radiated electric field	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B (2005) see application note for details
Conducted emissions	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B (2005)
Conducted harmonics	EN61000-3-2	Class A
Flicker	EN61000-3-3	Compliant – d <sub>max</sub> only

**Safety Approvals**

	Date	Amendments		Date	Amendments
EN60950-1	2006		IEC60601-1*	1988	A1, A2
UL60950-1	2007		EN60601-1	1990	A1, A2, A13
CSA22.2 No 60950-1	2003		UL60601-1	2003	with revisions 2006
IEC60950-1*	2005		CE Mark	LV Directive 2006/95/EC (EN60950-1)	

\* CB certificate and report available on request. Check with factory for status of approvals.

**Outline & Connection Drawings**

**Output Connector J1**

Pin	Function	Pin	Function
10	standby +ve	20	standby -ve
9	Power good	19	Remote on/off
8	+V output	18	Do not connect
7	+V output	17	+V output
6	+V output	16	+V output
5	+ Sense	15	- Sense
4	0V (DC return)	14	0V (DC return)
3	0V (DC return)	13	0V (DC return)
2	Do not connect	12	0V (DC return)
1	Do not connect	11	Do not connect

**Mating Parts (Molex or equivalent)**

Conn	Housing	Pins
J1	39-01-2205	44476-3112
J2	09-50-8051	08-52-0113

Notes: 1. All customer fixings M3 2. Maximum Penetration 4.5 mm 3. Maximum torque 0.9 Nm 4. All tolerances ±0.5 mm



### Highlights

- High efficiency
- High power density (8.3 W/in<sup>3</sup>)
- Up to 5 outputs
- No minimum load
- Fits 1 U applications
- Medical approval
- 3 years warranty
- Temperature controlled fan option

### Input Specifications

Input voltage	90 – 264 V AC / 120 – 350 V DC (below 100 V AC input, derate by 3 W per V)
Input harmonics	EN61000-3-2 compliant
Input fuse	6.3 A, Fast acting (not user accessible)
Input frequency	45 – 63 Hz (440 Hz with reduced PFC – consult factory)
Inrush current	15 A (typical) at 20 °C and 264 V AC, (cold start)
Power factor	0.97 typical
Earth leakage current	123 µA max. at 120 V AC (60 Hz), 257 µA max. at 240 V AC (60 Hz). Worst case leakage current is less than 300 µA at 264 V AC, 63 Hz (normal condition, 500 µA Single Fault Condition)

### Quick Selector

preferred configurations

Model	Ch1	Ch2	Ch3	Ch4	Ch5	Global option <sup>1</sup>
NVA3-453TT	5 V / 40 A	3.3 V / 15 A	12 V / 5 A	-12 V / 1 A	–	no
NVA3-453TT-N3	5 V / 40 A	3.3 V / 15 A	12 V / 5 A	-12 V / 1 A	5 V / 2 A	ATX (-N3)
NVA3-350TT	5 V / 40 A	–	12 V / 5 A	-12 V / 1 A	–	no
NVA3-350TT-N3	5 V / 40 A	–	12 V / 5 A	-12 V / 1 A	5 V / 2 A	ATX (-N3)
NVA3-453FF	5 V / 40 A	3.3 V / 15 A	15 V / 5 A	-15 V / 1 A	–	no
NVA3-453FF-N3	5 V / 40 A	3.3 V / 15 A	15 V / 5 A	-15 V / 1 A	5 V / 2 A	ATX (-N3)
NVA3-350FF	5 V / 40 A	–	15 V / 5 A	-15 V / 1 A	–	no
NVA3-350FF-N3	5 V / 40 A	–	15 V / 5 A	-15 V / 1 A	5 V / 2 A	ATX (-N3)

Above units available on rapid delivery. See over for additional variants available "Build to Order".

<sup>1</sup> See page 22 for details of global option.

## Available Outputs

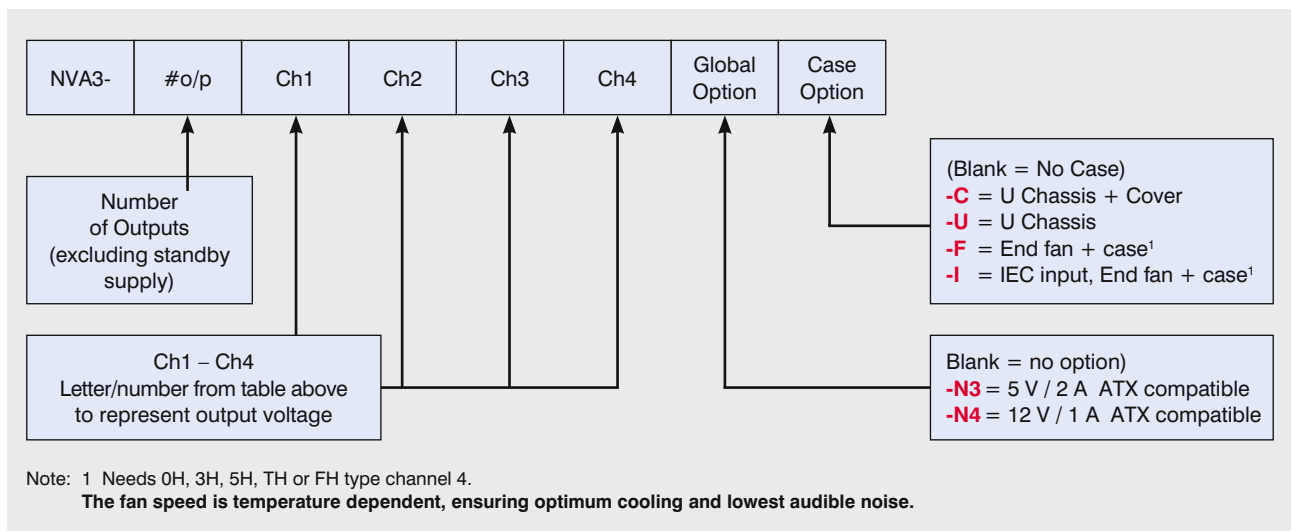
Channel 1	Adj. range <sup>5</sup>	Channel 2 <sup>1</sup>	Adj. range <sup>5</sup>	Channel 3	Adj. range <sup>5</sup>	Channel 4 <sup>3</sup>	Adj. range
<b>5</b> 5 V / 40 A <sup>2</sup>	5 – 5.5 V	<b>1</b> 1.8 V / 15 A <b>2</b> 2.7 V / 15 A <b>3</b> 3.3 V / 15 A <b>2H</b> 2.7 V / 24 A <b>3H</b> 3.3 V / 24 A <b>0</b> Omit	0.9 – 2.5 V 2.5 – 3.8 V 2.5 – 3.8 V 2.5 – 3.8 V 2.5 – 3.8 V	<b>T</b> 12 V / 5 A <sup>4</sup> <b>TH</b> 12 V / 8 A <sup>6</sup> <b>F</b> 15 V / 4 A <sup>4</sup> <b>FH</b> 15 V / 6.4 A <sup>6</sup> <b>G</b> 24 V / 2.5 A <b>0</b> Omit	12 – 15 V 12 – 15 V 12 – 15 V 12 – 15 V 18 – 24 V	<b>3H</b> –3.3 V / 2 A <sup>8</sup> <b>5H</b> –5 V / 2 A <sup>8</sup> <b>TH</b> –12 V / 2 A <sup>8</sup> <b>FH</b> –15 V / 2 A <sup>8</sup> <b>OH</b> Fan supply only <b>0</b> Omit	Fixed Fixed Fixed Fixed Fixed Fixed
<b>T</b> 12 V / 25 A	12 – 13 V	<b>5</b> 5 V / 10 A <b>5H</b> 5 V / 16 A <b>0</b> Omit	3.3 – 5.5 V 3.3 – 5.5 V				
<b>G</b> 24 V / 12.5 A	24 – 28 V <sup>7</sup>	<b>5</b> 5 V / 8 A <b>5H</b> 5 V / 12.5 A <b>T</b> 12 V / 10 A <b>F</b> 15 V / 10 A <b>0</b> Omit	5 – 5.5 V 5 – 5.5 V 12 – 15.5 V 12 – 15.5 V				

- 1, 2, 3, 2H & 3H channel 2 only available with 5 V channel 1.  
5 V / 10 A channel 2 only available with 12 or 15 V channel 1  
5 V / 8 A channel 2 only available with 24 V channel 1.
- Maximum combined output current from Ch1 & Ch2 = 40 A.
- Follow letters in red by "P" for positive output channel 4.
- 60 W max output power.

- Max voltage at the output (includes remote sense).
- 96 W max output power.
- 24 – 24.5 V if 5 V channel 2 fitted, 24 – 26 V if 24 V channel 3 fitted.
- 1.5 A max if fitted with "-F" option.

Other output options are available, please contact factory with your requirements.

## How to create a Product Code



Confirm availability of created product code with the factory.

## Output Specifications

Remote sense	yes	Channels 1 & 2 – max. 0.5 V total line drop.
Total regulation	1.5 %	For channels 1, 2 and 3 (2.5 % for channel 4) Including Line (for 90 – 264 V AC input change), Load (for 0 – 100 % load change) and Cross (for 0 – 100 % load change on any other output) regulation
Ripple & noise	1 %	(or 50 mV if higher) Pk-Pk, using EIAJ test method & 20 MHz bandwidth 1.5 % for units with 5 V Channel 1
Voltage accuracy	±1 %	±5 % for Channel 4
Turn on time	1.5 s max.	at 90 V AC & 100 % rated output power
Efficiency	up to 90 %	configuration dependent
Hold-up	16 ms min.	at 90 V AC
Min. load	none	on any output
Transient response	<5 %	of set voltage for 40 % load change (in 50 µs within the range 25 – 100 % load)
Recovery	<500 µs	for recovery to 1 % of set voltage
Short circuit protection	yes	
Over temperature protection	yes	
Over voltage protection	yes	See application notes for details
Ch1 good signal	yes	Provides a logic "low" signal after channel 1 output is within 90 % (±5 %) of nominal
Output power	300 W	Total output power from all outputs (including standby supply)

### Global Signals -N3 and -N4 Option Models

ATX remote on/off	TTL logic level high or open circuit will inhibit all outputs (except Standby)
ATX power good	Logic high indicates AC supply is good and output 1 is within regulation
Standby supply	Common 0 V with power supply. Not affected by ATX remote on/off -N3 Option = 5 V / 2 A    -N4 Option = 12 V / 1 A

### Isolation

Input to output	reinforced	4.3 kV DC Note: Basic for IEC/EN/UL/CSA60601-1		
Input to earth	basic	2.25 kV DC	Output to earth	200 V DC

### Environment

Temperature	0 °C to 50 °C operational, –40 °C to 85 °C storage (max. 12 months) Full load with either “-F” option fitted or 2 m/s air blown from input to output
Derating	50 °C to 70 °C derate each output by 2.5 % per °C
Low temperature start-up	–20 °C
Humidity	5 – 95 % RH non condensing
Shock	±3 x 30 g shocks in each plane, total 18 shocks 30 g shock = 11 ms (±0.5 msec), half sine Conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987 Conforms to MIL-STD-810E/F, Method 516.5, Pro I, IV, VI
Vibration	Single axis 10 – 500 Hz at 2 g (sweep and endurance at resonance) in all 3 planes Conforms to EN60068-2-6, IEC68-2-6 Conforms to MIL-STD-810E, Method 514.4, Pro I, Cat 1,9
Altitude	3,000 metres operational
Pollution	Degree 2, Material group 3

### Immunity EN61000-6-2: 2005, EN60601-1-2: 2001

				Criteria
Electrostatic discharge	EN61000-4-2	Level 3	Air discharge 8 kV Contact discharge 4 kV Not applicable to open frame units	A
Electromagnetic field	EN61000-4-3	Level 3	12 V/m	A
Fast / Burst transient (AC input)	EN61000-4-4	Level 4	tested to 4.4 kV	A
Fast / Burst transient (DC output)	EN61000-4-4	Level 4	tested to 2.2 kV	A
Surge immunity	EN61000-4-5	Level 3	Common mode to 2.2 kV Differential mode to 1.1 kV	A
Conducted RF immunity	EN61000-4-6	Level 3	12 V	A
Power frequency magnetic field	EN61000-4-8	Level 4	30 A/m	A
Voltage dips, variations, interruptions	EN61000-4-11	Class 3	Criteria B for 5 sec. interruption	A
Voltage fluctuations	EN61000-4-14	Class 3	for 100 – 240 V nominal	A

### Emissions EN61000-6-3: 2001, EN60601-1-2: 2001

Radiated electric field	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B see application note for details
Conducted emissions	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B
Conducted harmonics	EN61000-3-2	Class A
Flicker	EN61000-3-3	Compliant – d <sub>max</sub> only

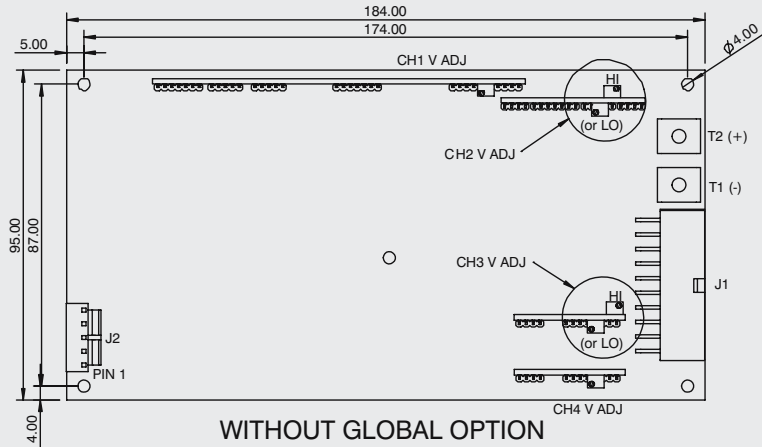
### Safety Approvals

	Date	Amendments		Date	Amendments
EN60950-1	2006		EN61010-1	2001	
UL60950-1	2007		IEC61010-1*	2001	
CSA22.2 No 60950-1	2003		IEC60601-1*	1988	A1, A2
IEC60950-1*	2005		EN60601-1	1990	A1, A2, A13
CE Mark	LV Directive 2006/95/EC (EN60950-1)		UL60601-1	2003	with revisions 2006

\* CB certificate and report available on request.

Check with factory for status of approvals.

# Outline & Connection Drawings

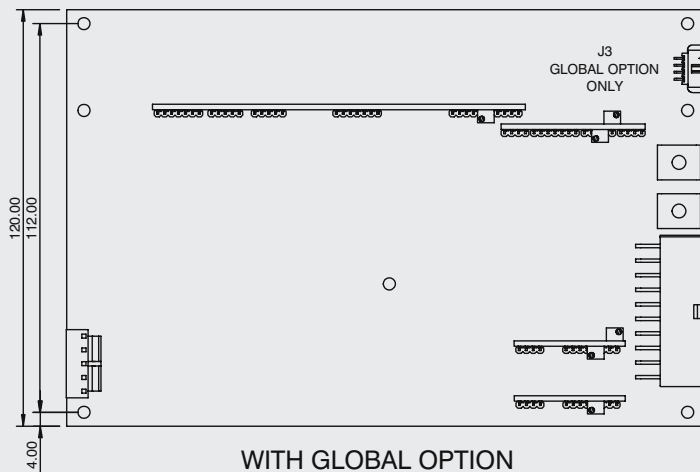


**J2**

PIN	CONNECTION
1	EARTH
2	NOT CONNECTED
3	LIVE
4	NOT CONNECTED
5	NEUTRAL

**J1**

PIN	CONNECTION	PIN	CONNECTION
11	0V COMMON	1	0V COMMON
12	0V COMMON	2	0V COMMON
13	CH2 +Ve	3	CH2 +Ve
14	CH2 +Ve	4	CH2 +Ve
15	+SENSE CH1	5	-SENSE CH1
16	+SENSE CH2	6	-SENSE CH2
17	CH1 GOOD	7	N/C
18	CH3 +Ve	8	CH3 +Ve
19	0V COMMON	9	0V COMMON
20	CH4 O/P	10	CH4 O/P



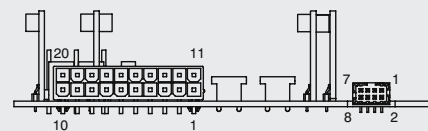
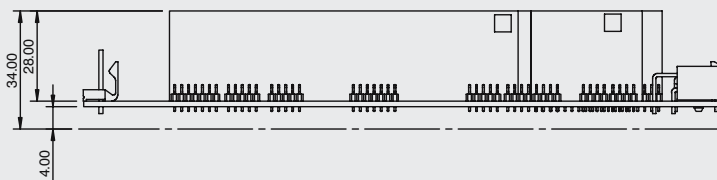
T1 & T2 (SEE TOP LEFT)

**J3 (GLOBAL OPTION ONLY)**

PIN	CONNECTION	PIN	CONNECTION
1	STANDBY -Ve	5	N/C
2	STANDBY +Ve	6	N/C
3	STANDBY -Ve	7	POWER GOOD
4	STANDBY +Ve	8	REM ON/OFF

**MATING PARTS (MOLEX OR EQUIVALENT)**

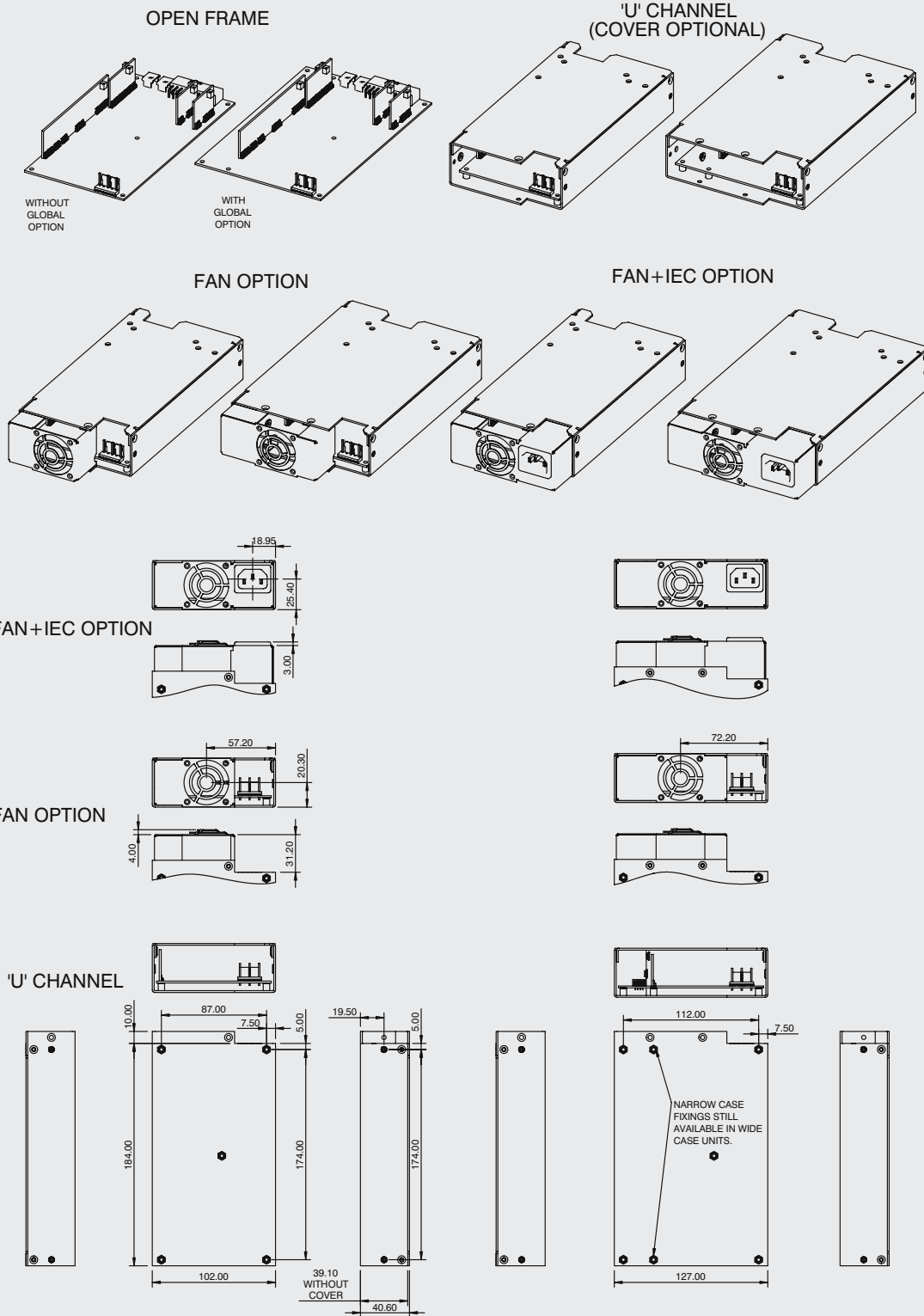
CONNECTOR	HOUSING	CRIMP PIN
J1	39-01-2205	44476-3112
J2	09-50-8051	08-52-0113
J3	51110-0860	50394
T1 & T2	N/A	TAG 19073-0165



Notes: 1. All customer fixings M3 2. Maximum Penetration 4.5 mm 3. Maximum torque 0.9 Nm 4. All tolerances ±0.5 mm



Outline & Connection Drawings



Other dimensions same as cases without fans (above)

Notes: 1. All customer fixings M3 2. Maximum Penetration 4.5 mm 3. Maximum torque 0.9 Nm 4. All tolerances ±0.5 mm

### Highlights

- High efficiency
- High power density (up to 19 W/in<sup>3</sup>)
- High peak power rating
- Up to 8 outputs (6 for NV-350)
- No minimum load
- Fits 1 U applications
- Medical approval
- 3 years warranty



### Input Specifications

Input voltage	90 – 264 V AC		
Input frequency	47 – 63 Hz (up to 440 Hz with reduced PFC)		
Input harmonics	EN61000-3-2 compliant		
Inrush current	NV-350 <15 A	NV-700 <40 A	at 25 °C and 264 V AC (cold start)
Input fuse	NV-350 6.3 A	NV-700 16 A	250 V AC HBC Fast Acting (not user accessible)
Power factor	0.97 typical		
Leakage current	130 µA max. at 120 V AC (60 Hz), 260 µA max. at 240 V AC (60 Hz). Worst case leakage current is less than 300 µA at 264 V AC, 63 Hz (Normal Condition, <500 µA Single Fault Condition)		

### Dual Output Modules

Module		Output 1		Output 2		Max Power
Code	Slots	Voltage range	Current	Voltage range	Current	
DA	1 <sup>8</sup>	12 V (fixed)	3 A	-12 V (fixed)	1 A	48 W
DB	2	3.2 – 3.6 V	25 A	3.3 – 5.5 V	10 A	55 W
				7 – 15 V	5 A	60 W
				24 – 32 V	2 A	50 W
DB	2	4.75 – 5.5 V	25 A	3.3 – 5.5 V	10 A	55 W
				7 – 15 V	5 A	60 W
				24 – 32 V	2 A	50 W
DB	2	5.5 – 6.5 V	25 A	3.3 – 6.0 V	10 A	55 W
DB	2	12 – 15 V	13 A <sup>1</sup>	3.3 – 5.5 V	10 A	55 W
				7 – 15 V	5 A	60 W
				24 – 32 V	2 A	50 W
DB	2	24 – 28 V	7 A <sup>2</sup>	3.3 – 5.5 V	10 A	55 W
				7 – 15 V	5 A	60 W
				24 – 32 V	2 A	50 W

### Single Output Modules

Module		Voltage range	Current	
Code	Slots		Continuous	Peak
B	2	3.2 – 3.6 V 4.75 – 5.5 V 7 – 9 V	40 A 40 A <sup>3</sup> 22.5 A <sup>4</sup>	40 A 40 A <sup>3</sup> 22.5 A <sup>4</sup>
BH	2	12 – 15.5 V 24 – 28 V	20 A <sup>5</sup> 10 A <sup>6</sup>	20 A <sup>5</sup> 10 A <sup>6</sup>
C	3	12 – 13.2 V 15 – 16.5 V 24 – 26.4 V 27 – 32 V	37.5 A <sup>7</sup> 30 A <sup>7</sup> 18.75 A <sup>7</sup> 16.6 A <sup>7</sup>	50 A <sup>7</sup> 37.5 A <sup>7</sup> 25 A <sup>7</sup> 19.7 A <sup>7</sup>
CM	3	24 – 26.4 V	18.75 A <sup>7</sup>	25 A <sup>7</sup>
CC	6	24 – 26.4 V 30 – 33 V 48 – 52.8 V 54 – 63 V	37.5 A <sup>9</sup> 30 A <sup>9</sup> 18.75 A <sup>9</sup> 16.6 A <sup>9</sup>	50 A <sup>9</sup> 37.5 A <sup>9</sup> 25 A <sup>9</sup> 19.7 A <sup>9</sup>
CCM	6	48 – 52.8	18.75 A <sup>9</sup>	25 A <sup>9</sup>

Notes 1 derate linearly from 13 A at 12.5 V to 10 A at 15.5 V  
 2 derate linearly from 7 A at 25 V to 6 A at 28 V  
 3 for NV3 – derate linearly from 40 A at 5.2 V to 36 A at 5.5 V  
 for NV7 – derate linearly from 40 A at 5 V to 36 A at 5.5 V  
 4 derate linearly from 22.5 A at 8 V to 20 A at 9 V

5 for NV3 – derate linearly from 20 A at 13.2 V to 16.5 A at 15.5 V  
 for NV7 – derate linearly from 20 A at 12.5 V to 15.5 A at 15.5 V  
 6 for NV3 – derate linearly from 10 A at 25.7 V to 8.5 A at 28 V  
 for NV7 – derate linearly from 10 A at 24 V to 8.5 A at 28 V  
 7 for NV3, 400 W max  
 for NV7, 600 W peak for up to 10 sec, 450 W average  
 8 only one per power supply  
 9 for NV7 only, 1200 W peak for up to 10 sec, 900 W average

### NV-350 / NV-700 Configuring

<b>Output Power</b>	NV3 350 / 660 W NV7 700 / 1150 W								
<b>Cooling</b>	S Standard air – forward V Variable speed fan – forward <sup>4</sup> R Reverse air <sup>4</sup> C Customer air – no fan <sup>1</sup>								
<b>Input Connection</b>	S Screw I IEC320 <sup>2</sup>								
<b>Leakage Current</b>	S Standard	leakage current: 130 µA max. at 120 V AC (60 Hz), 260 µA max. at 240 V AC (60 Hz) <sup>5</sup>							
<b>Primary Option<sup>3</sup></b>	ES5V ac good, psu enable, 5 V / 2 A standby ES12V ac good, psu enable, 12 V / 1 A standby IS5V ac good, psu inhibit, 5 V / 2 A standby IS12V ac good, psu inhibit, 12 V / 1 A standby EN5V ac good, psu enable, 5 V / 2 A standby EN12V ac good, psu enable, 12 V / 1 A standby IN5V ac good, psu inhibit, 5 V / 2 A standby IN12V ac good, psu inhibit, 12 V / 1 A standby								

Notes

- 1 Thermocoupled sample recommended to ensure adequate cooling – consult sales
- 2 Not with customer air Cooling
- 3 The Primary Option uses 1 slot
- 4 Not with NV7 (variable speed fan standard on NV7). Recommended for new designs for NV-350
- 5 Worst case leakage current is less than 300 µA at 264 V AC, 63 Hz Normal Condition (<500 µA Single Fault Condition)

The extensive range of output modules and options make it possible to achieve almost any combination of Volts and Amps. You can create your own NV-350 or NV-700 configuration online at [www.nv-power.com](http://www.nv-power.com). This method checks your configuration and offers the optimum solution. Alternatively, you can do this manually by using the guide below.

1. Calculate total output power to ensure power requirements are within 350 W or 1150 W, then select required Cooling, Connection and Controls/Signals from the table above.
2. Select Output Modules from the Module Tables below ensuring that no more than 6 slots (NV-350) or 8 slots (NV-700) in total are used.

Example – if you require 13 V 20 A:

- a) select B as closest match for voltage & current and prefix with voltage eg. **13BH**
- b) repeat for other outputs

This will create a complete product description eg. **NV3SSSE5V 13BH 12/15DB** which represents a three output NV-350 with Forward air cooling, Screw input terminals, standard leakage filter, ac good, PSU enable & 5 V / 2 A aux supply

Output 1 = 13 V / 20 A  
 Output 2 = 12 V / 13 A with screw terminals  
 Output 3 = 15 V / 4 A with screw terminals  
 Max. 350 W continuous output power

3. Contact TDK-Lambda to validate configuration and issue a part number.

## Output Power

		90 – 115 V AC	115 – 150 V AC	150 – 180 V AC	180 – 264 V AC
NV-350	Continuous <sup>6</sup>	350 W	450 W	450 W	660 W
	Peak (10 s) <sup>7</sup>	400 W <sup>1</sup>	500 W <sup>2</sup>	500 W <sup>2</sup>	740 W <sup>3</sup>
NV-700	Continuous	700 W	700 W	1150 W	1150 W
	Peak (10 s)		850 W <sup>4</sup>	1150 W	1450 W <sup>5</sup>

1 350 W average 2 450 W average 3 600 W average 4 700 W average 5 1150 W average 6 250 W for reverse air 7 not for reverse air

## Output

Voltage / current	See module tables	
Turn on time	1.5 s max.	at 90 V AC and 100 % rated output power
Rise time	<50 ms	to 90 % of voltage, monotonic rise above 10 %
Efficiency	up to 90 %	configuration dependent
Hold-up	16 ms min.	at 90 V AC and 100 % rated power (12 ms for NV-700 above 700 W output power)
Ripple and noise	<1 %	Pk-Pk, using EIAJ test method & 20 MHz bandwidth
Voltage accuracy	<1 %	of set voltage (DA module: +5/-1% for channel 1, +2/-3.5 % for channel 2)
Remote sense	yes	standard on single o/p + ch 1 of dual modules, max. 0.5 V total line drop (DA module: none)
Minimum load	no	on any output (DA module: 150 mA on channel 1)
Temperature coefficient	<0.02 %	of rated voltage per °C
Load regulation	<1 %	for 0 – 100 % load change (<2 % for channel 2, DA module: <3 %)
Line regulation	<0.1 %	for 90 – 264 V AC input change
Cross regulation	<0.1 %	for 100 % load change on any output (DA module: 0.2 % for channel 1, 3 % for channel 2)
Transient response	<4 %	of set voltage for 50 % load change
Recovery	500 µs	for recovery to 1 % of set voltage (DA module: 1000 µs)
Over voltage protection	yes	
Over current protection (singles)	110 – 150 %	of module current. Hiccup mode. Module primary side protected
Power Limit (duals)	110 – 150 %	of max. Power ch 1 + ch 2. Hiccup mode. Module primary side protected (DA module: 110 – 220 % for channel 1, 110 – 170 % for channel 2)
Short circuit protection	yes	
Over temperature protection	yes	cycle ac off/on to reset. Shut-down temperature varies according to ambient, output power & input voltage.

## Signals – Standard

Ch1/Ch2 module good	Open collector output. “On” indicates output is within 90 % (±5 %) of nominal
Module inhibit	TTL logic high inhibits the output (both outputs for duals) of the module
Ch2 on/off (duals only)	TTL logic low inhibits output 2 of the module

All signals referenced to 0 V of channel

## Global Interface Signals

with Primary Option

AC good collector AC good emitter	Uncommitted optocoupler. Turns on typically 5 ms after AC is good and off typically 5 ms before any channel falls below 95 % of nominal
Global module good collector Global module good emitter	Uncommitted optocoupler. Turns on typically 200 ms after all outputs are within 90 % (±5 %) of nominal and off typically 5 ms before any channel falls below 90 % (±5 %) of nominal. Do not connect for ES and IS type primary option.
EN/ES & IN/IS logic 0	TTL low enables (EN or ES) or inhibits (IN or IS) the entire psu including fan (except standby)
EN/ES & IN/IS logic 1	TTL high enables (EN or ES) or inhibits (IN or IS) the entire psu including fan (except standby)
Standby supply	5 V / 2 A (2.5 A peak) or 12 V / 1 A (1.2 A peak)

## Isolation

Input to output	reinforced	4 kV AC, 5.7 kV DC type tested to 4 kV AC (equivalent to 5.7 kV DC), production tested to 4.3 kV DC Units fitted with C and CC modules only		
		4.3 kV DC Note: Basic for IEC/EN/UL/CSA60601-1 Units with any other module or primary option		
Input to earth	basic	2.3 kV DC	Output to earth	200 V DC

## Environment

Temperature	0 °C to 50 °C operational, –40 °C to 85 °C storage (max. 12 months)
Derating	50 °C <sup>1</sup> to 70 °C derate total output power and each output current by 2.5 % per °C
Low temperature start-up	–20 °C
Humidity	5 – 95 % RH non condensing
Shock	±3 x 30 g shocks in each plane, total 18 shocks 30 g shock = 11 ms (±0.5 ms), half sine conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987
Vibration	Single axis 10 – 500 Hz at 2 g (sweep and endurance at resonance) in all 3 planes
Altitude	3,000 metres operational (5,000 metres non-operational)
Pollution	Degree 2, Material group 3b

<sup>1</sup> 45 °C for NV7 with input voltage below 100 V AC.

## Immunity EN61000-6-2: 2005, EN60601-1-2: 2001

				Criteria
Electrostatic discharge	EN61000-4-2	Level 4	Air discharge 15 kV Contact discharge 8 kV	A
Electromagnetic field	EN61000-4-3	Level 3	12 V/m	A
Fast / Burst transient (AC input)	EN61000-4-4	Level 4	tested to 4.4 kV	A
Fast / Burst transient (DC output)	EN61000-4-4	Level 4	tested to 2.2 kV	A
Surge immunity	EN61000-4-5	Level 3	Common mode to 2.2 kV Differential mode to 1.1 kV	A
Conducted RF immunity	EN61000-4-6	Level 3	12 V	A
Power frequency magnetic field	EN61000-4-8	Level 4	30 A/m	A
Voltage dips, variations, interruptions	EN61000-4-11	Class 3	Criteria B for 5 sec. interruption	A
Voltage fluctuations	EN61000-4-14	Class 3	for 100 – 240 V nominal	A

## Emissions EN61000-6-3: 2001, EN60601-1-2: 2001

Radiated electric field	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B see application note for details
Conducted emissions	EN55011, EN55022	(as per CISPR.11/22) Class B, FCC47 part 15 subpart B
Conducted harmonics	EN61000-3-2	Class A
Flicker	EN61000-3-3	Compliant – d <sub>max</sub> only

## Safety Approvals

	Date	Amendments		Date	Amendments
EN60950-1	2006		EN61010-1	2001	
UL60950-1	2003		IEC61010-1*	2001	
CSA22.2 No 60950-1	2003		IEC60601-1*	1988	A1, A2
IEC60950-1*	2005		EN60601-1	1990	A1, A2, A13
CE Mark	LV Directive 2006/95/EC(EN60950-1)		UL60601-1	2003	with revisions 2006

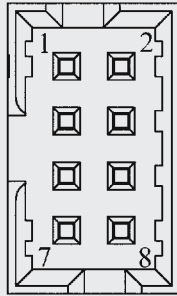
\* CB certificate and report available on request.

Please check with Technical Sales for status of approvals.

## Primary Option / DA Module

### DA Module

- 1 +12 V (channel 1)
- 2 +12 V (channel 1)
- 3 +12 V (channel 1)
- 4 0 V (common ch1 / ch2)
- 5 0 V (common ch1 / ch2)
- 6 0 V (common ch1 / ch2)
- 7 -12 V (channel 2)
- 8 -12 V (channel 2)

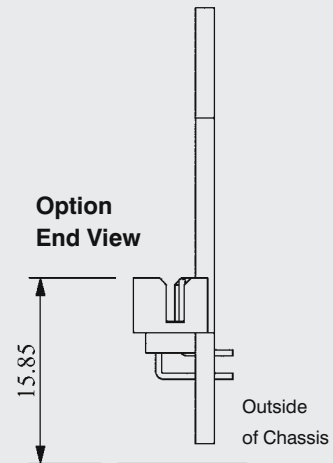


### Primary Option

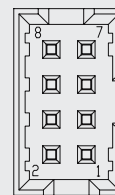
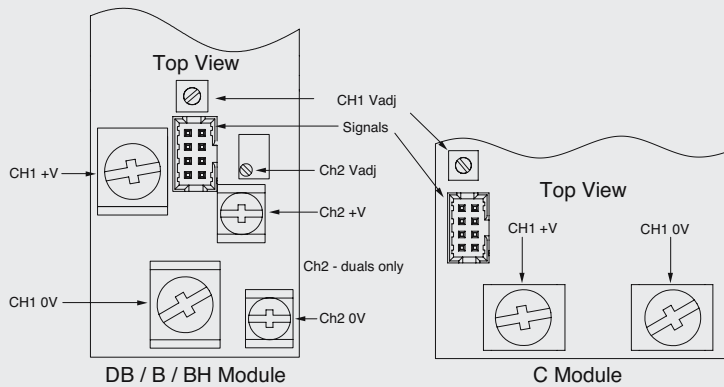
- 1 +V Standby
- 2 0 V Standby
- 3 EN/ES & IN/IS Logic 1
- 4 EN/ES & IN/IS Logic 0
- 5 Global Module Good Collector
- 6 Global Module Good Emitter
- 7 AC good Collector
- 8 AC good Emitter

Housing: Molex 51110-0860  
 Crimp pin: 50394  
 Hand crimp tool: 69008-0959

### Option End View



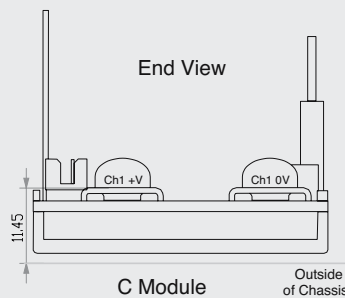
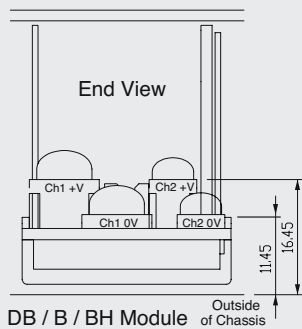
## Output Connections



### Signals

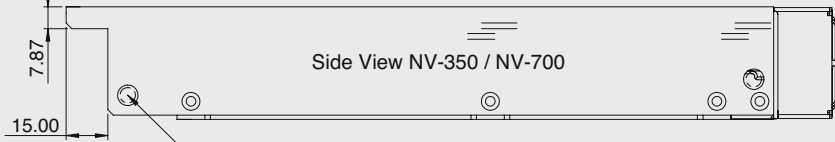
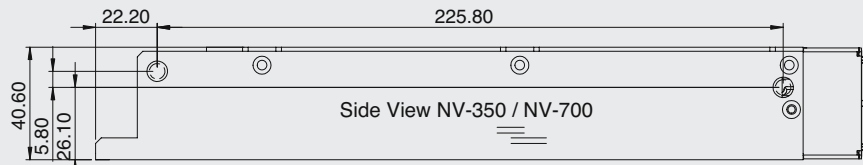
- 1 Ch2 0V
- 2 Ch2 Output Good
- 3 Ch2 On/Off
- 4 Module Inhibit
- 5 Ch1 0V
- 6 Ch1 Output Good
- 7 Ch1 Remote Sense -
- 8 Ch1 Remote Sense +

Housing: Molex 51110-0860  
 Crimp pin: 50394 Hand crimp tool: 69008-0959  
 Note: Do not connect pins 1-3 on single output modules



### Connection Guidelines

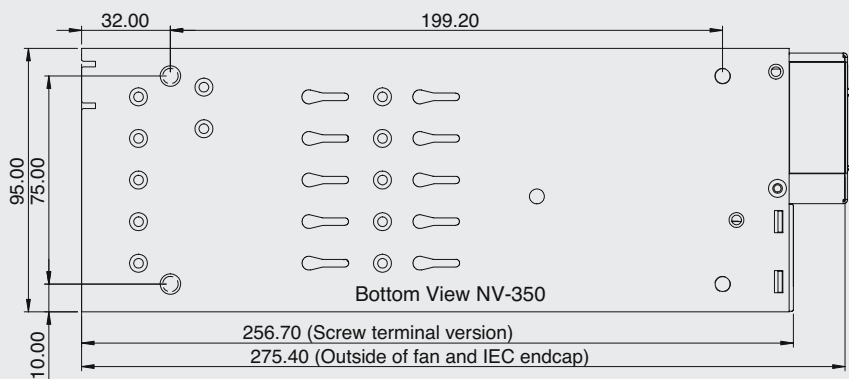
Ring Tags: Up to 50A, AMP PIDG terminals  
 Red: M3 36151, M4 320551, M5 130660  
 Blue: M3 320561, M4 320560, M5 130663  
 Yellow: M3 M4 320568, M5 130167  
 Crimp tool: 16900 Die set 169404



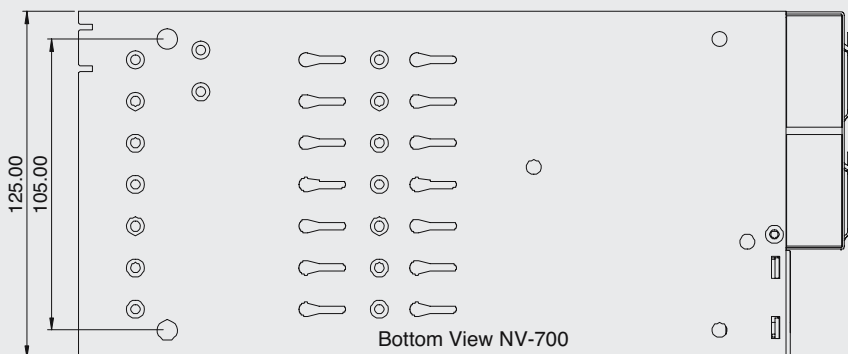
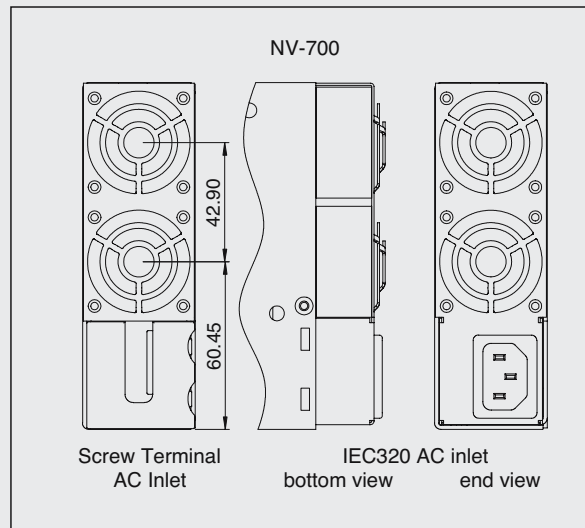
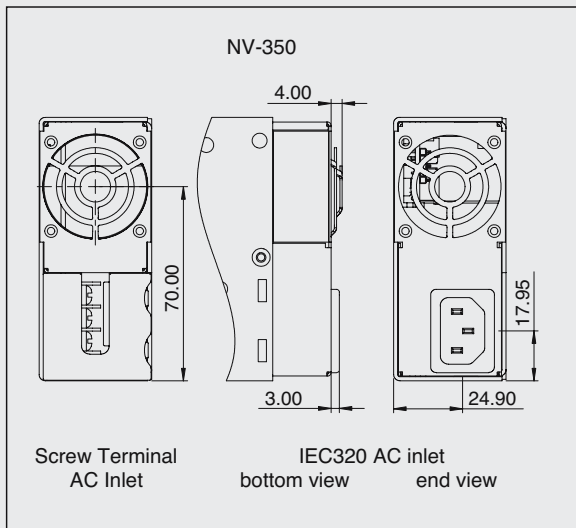
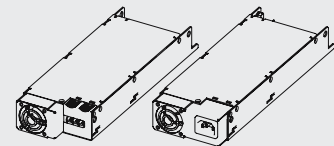
Customer fixings M4. Maximum screw penetration 4.5mm. Maximum torque 1.5Nm

NOTES

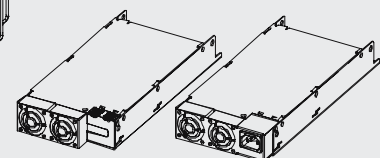
- 1) Dimensions in mm
- 2) Tolerances:  
Edge to edge/Edge to centre, +/-0.5  
Centre to centre +/-0.2



NV-350 Screw Terminal      NV-350 IEC Inlet

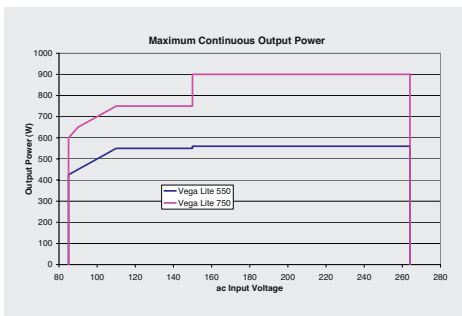


NV-700 Screw Terminal      NV-700 IEC Inlet



## Highlights

- Industry leading power density
- 1 to 11 outputs
- Voltages from 1.8 to 56 V
- Current up to 60 A
- Screw connection
- Worldwide approvals & CB report
- Medical approval option



## Input Specifications

Voltage range	85 – 264 V AC
Frequency	47 – 63 Hz (440 Hz with reduced PFC – consult factory)
Inrush current	< 40 A at 25 °C and 264 V AC (cold start)
Fuse	16 A/250 V AC High Breaking Capacity, Fast Acting (not user accessible)
Leakage current	1.5 mA max. at 264 V AC & 63 Hz (medical version also available)
Power factor	0.99 typical

## Output Specifications

Voltage / current	See module tables	
Turn on delay	1.5 s max.	at 90 V AC & 100 % rated output power
Rise time	<50 ms	to 90 % of voltage, monotonic rise above 10 %
Turn on overshoot	<5 % or 250 mV	Load type dependent, no overshoot with resistive load
Efficiency	75 %	typical at 230 V AC & 100 % rated power, configuration dependent
Hold-up	16 ms min.	at 100 V AC & 100 % rated output power
Ripple & noise	<1%	(or 50 mV if higher) Pk-Pk, using EIAJ test method & 20 MHz bandwidth
Voltage accuracy	< 1 %	of set voltage
Remote sense	yes	Standard on single output modules, max. 0.75 V total line drop. Option for twin output modules
Minimum load	no	on any output
Temperature coefficient	<0.02 %	of rated voltage per °C
Load regulation	<0.5 % or 25 mV	for 0 – 100 % load change
Line regulation	<0.1 %	for 100 – 264 V AC input change
Cross regulation	<0.2 %	for 100 % load change on any other output
Transient response	<6 % or 300 mV	of set voltage for 50 % load change (above 25 % load)
Recovery	500 µs	for recovery to 1 % or 100 mV of set voltage
Over voltage protection	120 – 130 %	of set voltage for outputs >4.1 V (Tracking OVP)
	140 – 150 %	of set voltage for outputs <4.1 V (Tracking OVP)
	120 – 150 %	of max. rated output (Fixed OVP)
Over current protection	105 – 125 %	of rated current, constant current characteristic
Short circuit protection	<150 %	of rated current, when output voltage <1 %
Over temperature protection	yes	Shuts down all outputs and fan. Cycle AC off/on to reset <sup>1, 2</sup>

Notes 1: shutdown temp varies according to ambient, output power & input V

2: AC fail signal (if fitted) provides 5 ms warning of thermal shutdown



## Output Voltages (Single Modules)

Module width (slots)								
Output voltage	1 Slot		1.5 Slots		2 Slots		3 Slots	
	Module	Current	Module	Current	Module	Current	Module	Current
1.8 V	1.8C1S	35 A	1.8D1LS	50 A	1.8E1S	60 A		
2 V	2C1S	35 A	2D1LS	50 A	2E1S	60 A		
3.3 V	3.3C1S	35 A	3.3D1LS	50 A	3.3E1S	60 A		
5 V	5L1S	35 A	5D1HS	50 A	5E2S	60 A		
6.5 V	6.5B2S	25 A	6.5D2S	45 A	6.5E2S	60 A		
12 V	12C3S	18 A	12D3S	24 A	12E3LS	40 A		
15 V	15C3S	18 A	15D3S	24 A	15E4S	30 A		
18 V	18C4S	14 A	18D4S	18 A	18E4S	30 A		
24 V	24C5S	10 A	24D5S	15 A	24E5HS	25 A		
28 V	28C5S	10 A	28D5S	15 A	28E5HS	25 A		
36 V	36HH5/4S	4.5 A			36BB4S	10 A		
48 V	48HH5/4S	4.5 A			48C5B4S	10 A	48DD5S	15 A

## Output Voltages (Twin Modules) – all 1 Slot Width

Output voltage		Channel 1					
		5 V / 12 A	12 V / 10 A	15 V / 10 A	18 V / 5 A	24 V / 5 A	28 V / 5 A
Channel 2	1.8 V / 8 A	5/1.8H1H/1LS					
	2 V / 8 A	5/2H1H/1LS					
	3.3 V / 8 A	5/3.3H1H/1LS					
	5 V / 8 A		12/5H3/1HS	15/5H3/1HS	18/5H5/1HS	24/5H5/1HS	28/5H5/1HS
	12 V / 6 A	5/12H1H/1LS	12/12H3/3S	15/12H3/3S	18/12H5/3S	25/12H5/3S	28/12H5/3S
	15 V / 6 A	5/15H1H/1LS	12/15H3/3S	15/15H3/3S	18/15H5/3S	25/15H5/3S	28/15H5/3S
	18 V / 4.5 A				18/18H5/4S	24/18H5/4S	28/18H5/4S
	24 V / 4.5 A				18/24H5/4S	24/24H5/4S	28/24H5/4S

## Output Voltages (Single Modules)

## Twin Output Modules

Module	Adjustment range (Volts)	Amps	Slots	Module	V1 Adjust-ment range (Volts)	Amps	V2 Adjust-ment range (Volts)	Amps	Slots
C1S	1.8 – 3.4	35	1	H1H/1LS	3.9 – 5.1	12	1.8 – 3.8	8	1
D1LS	1.8 – 3.8	50	1.5	H1H/3S	3.9 – 5.1	12	9.1 – 16.2	6	1
E1S	1.8 – 3.4	60	2	H3/1HS	9.1 – 15.5	10	3.9 – 5.5	8	1
L1S	4.2 – 5.1	35	1	H3/3S	9.1 – 15.5	10	9.1 – 16.2	6	1
D2S	3.8 – 7.5	45	1.5	H5/1HS	16.2 – 28	5	3.9 – 5.5	8	1
D1HS	3.9 – 5.1	50	1.5	H5/3S	16.2 – 28	5	9.1 – 16.2	6	1
E2S	3.8 – 7.5	60	2	H5/4S	16.2 – 28	5	16.3 – 24	4.5	1
B2S	5 – 8	25	1						
C3S	9.1 – 15	18	1						
D3S	8 – 15	24	1.5						
E3LS	8 – 12.5	40	2						
D4S	14 – 18	18	1.5						
E4S	14 – 19	30	2						
C4S	16.2 – 18	14	1						
C5S	21.6 – 30	10	1	<b>Options – Single Output Modules*</b>					
D5S	21 – 28	15	1.5	<b>N</b>	Output Inhibit, Module Good Current Sharing				
E5HS	24 – 28	25	2						
HH5/4S	32.5 – 48	4.5	1	<b>Options – Twin Output Modules*</b>					
BB4S	32.6 – 40	10	2	<b>N</b>	Output Inhibit, Module Good, Remote Sense				
C5B4S	43 – 49	10	2	<b>R</b>	Remote Sense Only				
DD5S	42 – 56	15	3	* see configuring guide					

## Isolation/Insulation

Isolation	Insulation		Isolation	Insulation	
Input to output	reinforced	4 kV AC, 5.7 kV DC	Output to earth	operational	200 V DC
Input to earth	basic	2.3 kV DC	Output to output	operational	200 V DC

## Environment

Temperature	0 °C to 65 °C operational, –40 °C to 85 °C storage (max. 12 months)
Derating	50 °C to 65 °C derate each output by 2.5 % per °C
Low temperature start-up	–20 °C
Humidity	5 – 95 % RH non-condensing
Shock	±3 x 20 g shocks in each plane, total 18 shocks 20 g shock = 11 ms (±0.5 ms), half sine Conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987 Conforms to MIL-STD-810E/F, Method 516.5, Pro I, IV, VI
Vibration	Single axis 10 – 500 Hz at 2 g (sweep and endurance at resonance) in all 3 planes Conforms to EN60068-2-6, IEC68-2-6 Conforms to MIL-STD-810E, Method 514.4, Pro I, Cat 1,9
Altitude	5,000 m operational and non-operational
Pollution	Degree 2, Material group 3b
IP Rating	IP10

## Immunity BS EN61000-6-2: 2001

(Industrial Environment)\*

				Criteria
Electrostatic discharge	EN61000-4-2	Level 4	Air discharge 15 kV Contact discharge 8 kV	A
Electromagnetic field	EN61000-4-3	Level 3	10 V/m (tested to 12 V/m)	A
Fast / Burst transient	EN61000-4-4	Level 4	Input 4 kV, Outputs 2 kV tested at 5 kHz and 100 kHz	A
Surge immunity	EN61000-4-5	Level 3	Line to Line 1 kV (tested to 1.1 kV) Line to Earth 2 kV (tested to 2.2 kV)	A
Conducted RF immunity	EN61000-4-6	Level 3	10 V (tested to 12 V)	A
Power frequency magnetic field	EN61000-4-8	Level 4	30 A continuous	A
Voltage dips, variations, interruptions	EN61000-4-11	Class 3	B for 5 sec. interruptions	A

\* Also complies with BS EN61000-6-1: 2001.

## Emissions BS EN61000-6-3: 2001

(Residential, Commercial & Light Industrial Supply)\*

Radiated electric field	EN55022	Class B (as per CISPR.22)	See application note for details. Only for "S" type leakage versions.
Conducted emissions	EN55022	Class B (as per CISPR.22)	Only for "S" type leakage versions. "L" types meet Class A.
Conducted harmonics	EN61000-3-2	Compliant to Class A	
Flicker	EN61000-3-3	Compliant	

\* Also complies with BS EN61000-6-4: 2001.

## Safety Approvals

	Date	Amendments		Date	Amendments
EN60950-1	2006		IEC61010-1*	2001	Second Edition
UL60950-1	2003		IEC60601-1*	1988	A1, A2
CSA22.2 No 60950-1	2003		EN60601-1 <sup>1</sup>	1990	A1, A2, A13
IEC60950-1*	2005		UL60601-1 <sup>1</sup>	2003	with revisions 2006
EN61010-1	2001		CE Mark		LV Directive 2006/95/EC (EN60950-1)

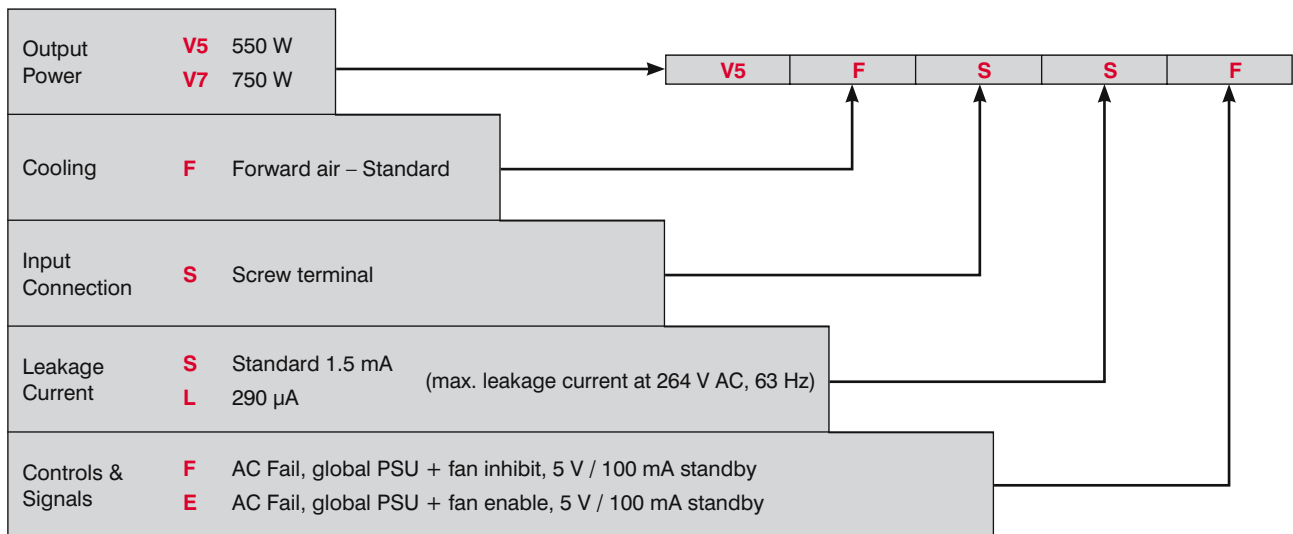
\* CB certificate and report available on request. 1 Only for "L" type leakage variants.

Check with Technical Sales for status of approvals.

The extensive range of output modules and options make it possible to achieve all popular combinations of Volts and Amps. The “online” configurator is the best way to achieve the optimum configuration, however you can also create your own VEGA configuration from this datasheet by using the guide below.

## Web Configurator

1. Visit the TDK-Lambda website, select “VEGA Configurator” and follow the online instructions.
2. Enter your required Volts / Amps, and any additional functions (if required)
3. Enter preferred type of cooling, input connection, lower leakage current (if required) and controls & signal functions (if required)
4. Configurator will select the most suitable modules and options and give a unique part number.



## Configuring from Datasheet

1. Calculate total output power to determine VEGA 550 W (560 W at 150 V AC and above) or 750 W (900 W at 150 V AC and above) and select converter, then select required cooling, connection, leakage current and controls/signals from the table above.

2. Select Output Modules and Options from the available Output Voltages Tables.

Example – if you require 5 V / 18 A with output inhibit:

- a) select 5L1S as closest match for voltage and current
- b) add suffix N for output inhibit eg **5L1SN**
- c) repeat for other outputs

Ensure you do not select more than a total of 5 slots width of module.

This will create a complete product description eg:

**V5FSSS 5L1SN 12/12H3/3S 24C5S** which represents a four output 550 W VEGA with Forward air, Screw input terminals, 1.5 mA Earth Leakage, AC Fail, Global Inhibit & 5 V / 100 mA aux supply.

Output 1 = 5 V / 35 A with output inhibit, Module Good and Current Share option

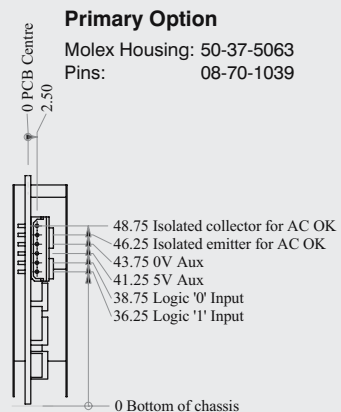
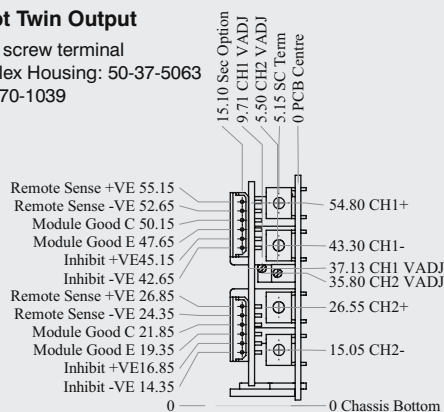
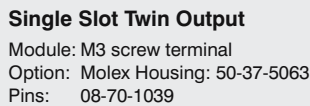
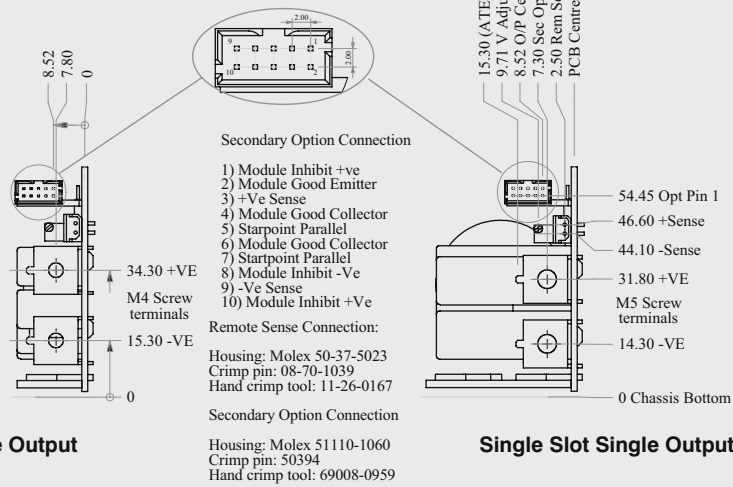
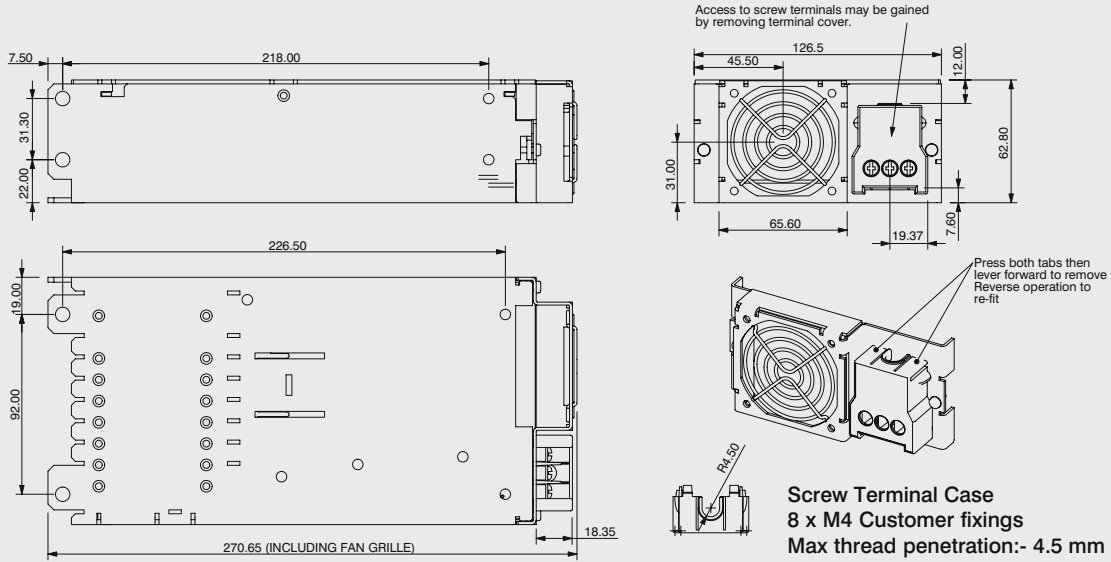
Output 2 = 12 V / 10 A

Output 3 = 12 V / 6 A

Output 4 = 24 V / 10 A

3. Contact TDK-Lambda to validate configuration and issue a part number.

Outline & Connection Drawings





### Highlights

- Industry leading flexibility
- Up to 11 outputs
- Voltages up to 62 V
- Current up to 114 A
- Screw, fast-on or IEC connection
- Worldwide approvals & CB report
- Medical approval option
- 3 years warranty
- AC or DC input versions

### Input Specifications

	VEGA 450, 650 and 900	VEGA DC (450 W)
Input voltage	90 – 264 V AC 900 W version is 150 – 264 V AC only, 650 W below 150 V AC	34 – 75 V DC Derate linearly below 44 V to 340 W at 34 V
Input frequency	47 – 63 Hz (440 Hz with reduced PFC – consult factory)	DC only
Inrush current	<40 A at 25 °C and 264 V AC (cold start)	<40 A at 25 °C ETSI EN300132-2
Input fuse	16 A / 250 V AC HBC Fast Acting (not user accessible)	20 A Fast Acting (not user accessible)
Leakage current	1.5 mA max. at 264 V AC & 63 Hz	n/a
Lower leakage option	see configuring guide	n/a
Power factor	0.99 typical	n/a

### Output Specifications

Voltage / current	See module tables	
Turn on delay	1.5 s max.	at 90 V AC (150 V AC for 900 W, 48 V DC for VEGA DC) & 100 % rated output power
Rise time	<50 ms	to 90 % of voltage, monotonic rise above 10 %
Turn on overshoot	<5 % or 250 mV	Load type dependent, no overshoot with resistive load
Efficiency	75 %	typical at 230 V AC (48 V DC for VEGA DC) & 100 % rated power, configuration dependent
Hold-up	16 ms min.	at 90 V AC (150 V AC for 900 W) & 100 % rated output power, 10 ms min. for VEGA DC
Ripple & noise	<1% or 50 mV	Pk-Pk, using EIAJ test method & 20 MHz bandwidth
Voltage accuracy	<1 %	of set voltage
Remote sense	yes	Standard on single output modules, max. 0.75 V total line drop. Option for twin output modules
Minimum load	no	on any output
Temperature coefficient	<0.02 %	of rated voltage per °C
Load regulation	<0.5 % or 25 mV	for 0 – 100 % load change
Line regulation	<0.1 %	for 90 – 264 V AC input change (34 – 75 V DC for VEGA DC)
Cross regulation	<0.2 %	for 100 % load change on any other output
Transient response recovery	<6 % or 300 mV 500 µs	of set voltage for 50 % load change (above 25 % load) for recovery to 1 % or 100 mV of set voltage

Output Specifications

Continuation

Over voltage protection	120 – 130 %	of set voltage for outputs >4.1 V (Tracking OVP)
	140 – 150 %	of set voltage for outputs <4.1 V (Tracking OVP)
	120 – 150 %	of max. rated output (Fixed OVP)
Over current protection	105 – 125 %	of rated current, constant current characteristic
Short circuit protection	<150 %	of rated current, when output voltage <1 %
Over temperature protection	yes	Shuts down all outputs and fan. Cycle AC off/on to reset <sup>1,2</sup>

Notes: 1. shutdown temp varies according to ambient, output power & input V 2. AC fail signal (if fitted) provides 5 ms warning of thermal shutdown

Output Voltages

Single output modules				Twin output modules					
Module	Adjustment range (Volts)	Amps	Slots	Module	V1 Adjustm. range (Volts)	Amps	V2 Adjustm. range (Volts)	Amps	Slots
B1L	1.8 – 3.8 <sup>e</sup>	20	1	H1L/1L	1.8 – 3.8 <sup>n</sup>	12	1.8 – 3.8 <sup>n</sup>	8	1
C1	1.8 – 4.1 <sup>e</sup>	35	1	H1L/1H			3.9 – 5.5 <sup>d</sup>	8	1
C1Y	1.8 – 4.1 <sup>e</sup>	40	1	H1L/2			5.6 – 9.0 <sup>f</sup>	6	1
D1L	1.8 – 3.8	50	1.5	H1L/3			9.1 – 16.2 <sup>u</sup>	6	1
E1	1.8 – 3.8 <sup>e</sup>	60	2	H1L/4	16.3 – 25 <sup>p</sup>	4.5	1	1	
F1 <sup>a</sup>	1.8 – 3.8	80	2	H1H/1L	3.9 – 5.5 <sup>d</sup>	12	1.8 – 3.8 <sup>n</sup>	8	1
Z2	1.8 – 3.8 <sup>e</sup>	95	3	H1H/1H			3.9 – 5.5 <sup>d</sup>	8	1
Z3	1.8 – 3.8 <sup>e</sup>	114	4	H1H/2			5.6 – 9.0 <sup>f</sup>	6	1
B1H	3.9 – 5.5 <sup>d</sup>	20	1	H1H/3			9.1 – 16.2 <sup>u</sup>	6	1
L1	4.2 – 5.5 <sup>d</sup>	35	1	H1H/4	16.3 – 25 <sup>p</sup>	4.5	1	1	
D2	3.8 – 9.0 <sup>k</sup>	45	1.5	H2/1L	5.6 – 9.0 <sup>f</sup>	10	1.8 – 3.8 <sup>n</sup>	8	1
D1H	3.9 – 5.5 <sup>d</sup>	50	1.5	H2/1H			3.9 – 5.5 <sup>d</sup>	8	1
E2	3.8 – 8.0 <sup>k</sup>	60	2	H2/2			5.6 – 9.0 <sup>f</sup>	6	1
Z18	4.2 – 5.5	66	2	H2/3			9.1 – 16.2 <sup>u</sup>	6	1
F2 <sup>a</sup>	3.8 – 8.0	75	2	H2/4	16.3 – 25 <sup>p</sup>	4.5	1	1	
Z4	3.9 – 5.5 <sup>d</sup>	95	3	H3/1L	9.1 – 16.2 <sup>u</sup>	10	1.8 – 3.8 <sup>n</sup>	8	1
Z6	3.9 – 5.5 <sup>d</sup>	104	3.5	H3/1H			3.9 – 5.5 <sup>d</sup>	8	1
B2	5.0 – 9.0 <sup>f</sup>	25	1	H3/2			5.6 – 9.0 <sup>f</sup>	6	1
B3	9.1 – 16.2 <sup>g</sup>	12	1	H3/3			9.1 – 16.2 <sup>u</sup>	6	1
C3	9.1 – 16.2 <sup>g</sup>	18	1	H3/4	16.3 – 25 <sup>p</sup>	4.5	1	1	
D3	8.0 – 16.5 <sup>g</sup>	24	1.5	H5/1L	16.2 – 28	5	1.8 – 3.8 <sup>n</sup>	8	1
E3L	8.0 – 13.9 <sup>j</sup>	40	2	H5/1H			3.9 – 5.5 <sup>d</sup>	8	1
Z7	8.0 – 16.5 <sup>g</sup>	45	3	H5/2			5.6 – 9.0 <sup>f</sup>	6	1
EE2	7.6 – 16.0 <sup>g</sup>	45	4	H5/3			9.1 – 16.2 <sup>u</sup>	6	1
D4	14 – 21.5 <sup>i</sup>	18	1.5	H5/4	16.3 – 25 <sup>p</sup>	4.5	1	1	
E4	14 – 19.9 <sup>m</sup>	30	2	Wide range programmable modules					
E3H	14 – 15	36	2	Module	Voltage range (Volts)	Amps	Slots	Select features from table below	
C4	16.3 – 21.5 <sup>i</sup>	14	1	W2 <sup>a</sup>	1.0 – 7.5	30	1		
CC3	18.2 – 32.4 <sup>j</sup>	18	2	W5	0.5 – 32	8.5	1		
E5L <sup>v</sup>	20 – 24	27	2						
B5	21.6 – 31 <sup>h</sup>	6	1						
C5	21.6 – 31 <sup>j</sup>	10	1	follow by	F or T	Fixed or Tracking Overvoltage protection			
D5	21 – 28	15	1.5		F or S	Fast-on or Screw terminal			
E5H <sup>v</sup>	24 – 28	25	2		R or V	Resistance (0 – 32 kOhm)			
Z19 <sup>oo</sup>	24 – 28	36	3.5		Voltage (0 – 5 V) Programming				
HH5/3	25.3 – 44.2 <sup>b</sup>	5	1		1 Inhibit, Fixed current limit				
DD4	28 – 43 <sup>s</sup>	18	3		2 Inhibit, Programmable current limit (0 – 5 V)				
EE4 <sup>c</sup>	28 – 38	22.5	4	1, 2, 3 or 4	3 Enable, Fixed current limit				
HH5/4	32.5 – 53 <sup>l</sup>	4.5	1		4 Enable, Programmable current limit (0 – 5 V)				
BB4	32.6 – 43 <sup>q</sup>	10	2	Follow non wide range modules by F (Fast-on) or S (Screw) terminal					
EE5L <sup>oo</sup>	40 – 48	18	4	Options – Single output modules*					
C5B4	43 – 48	10	2	N	Output Inhibit, Module Good Current Sharing				
EE5H <sup>oo</sup>	48 – 56	18	4	Options – Twin output modules*					
CC5	48.1 – 62 <sup>r</sup>	10	2	N	Output Inhibit, Module Good, Remote Sense				
DD5	42 – 56	15	3	R	Remote Sense Only				

- a) F1, F2 and W2 modules not for VEGA 900
- b) 38 V max. for 900 W
- c) Only available for VEGA 900
- d) 5.1 V max. for 900 W
- e) 3.4 V max. for 900 W
- f) 8 V max. for 900 W
- g) 15 V max. for 900 W
- h) 28 V max. for 900 W
- i) 18 V max. for 900 W
- j) 30 V max. for 900 W
- k) 7.5 V max. for 900 W
- l) 12.5 V max. for 900 W
- m) 19 V max. for 900 W
- n) 3.4 V max. for 900 W
- o) "N" option not available
- p) 24 V max. for 900 W
- q) 40 V max. for 900 W
- r) 60 V max. for 900 W
- s) 36 V max. for 900 W
- t) 52 V max. for 900 W
- u) 15.5 V max. for 900 W
- v) "N" option not available if more than 1 E5 module fitted

\* see configuring guide

## Isolation/Insulation

Isolation	Insulation		Isolation	Insulation	
Input to output	reinforced	4 kV AC, 5.7 kV DC	Output to earth	operational	200 V DC
Input to earth	basic	2.3 kV DC	Output to output	operational	200 V DC

## Environment

Temperature	0 °C to 65 °C operational, –40 °C to 85 °C storage (max. 12 months)
Derating	50 °C to 65 °C derate each output by 2.5% per °C (1.5% per °C for VEGA DC)
Low temperature start-up	–20 °C
Humidity	5 – 95 % RH non-condensing
Shock	±3 x 20 g shocks in each plane, total 18 shocks 20 g shock = 11 ms (±0.5 ms), half sine Conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987 Conforms to MIL-STD-810E/F, Method 516.5, Pro I, IV, VI
Vibration	Single axis 10 - 500 Hz at 2 g (sweep and endurance at resonance) in all 3 planes Conforms to EN60068-2-6, IEC68-2-6 Conforms to MIL-STD-810E, Method 514.4, Pro I, Cat 1, 9
Altitude	5,000 metres operational / non operational (IEC inlet 3,000 m operational, 5,000 m non-operational)
Pollution	Degree 2, Material group 3
IP Rating	IP10

## Immunity BS EN61000-6-2: 2001

Industrial Environment\*

				Criteria
Electrostatic discharge	EN61000-4-2	Level 4	Air discharge 15 kV Contact discharge 8 kV	A
Electromagnetic field	EN61000-4-3	Level 3	10 V/m (tested to 12 V/m)	A
Fast / Burst transient	EN61000-4-4	Level 4, Level 3 for VEGA DC	Input 4 kV, (2 kV for VEGA DC) Outputs 2 kV, (1 kV for VEGA DC) tested at 5 kHz and 100 kHz	A
Surge immunity	EN61000-4-5	Level 3, Level 2 for VEGA DC	Line to Line 1 kV (tested to 1.1 kV) (0.5 kV, tested to 0.55 kV for VEGA DC) Line to Earth 2 kV (tested to 2.2 kV) (1 kV, tested to 1.1 kV for VEGA DC)	A
Conducted RF immunity	EN61000-4-6	Level 3	10 V (tested to 12 V)	A
Power frequency magnetic field	EN61000-4-8	Level 4	30 A continuous	A
Voltage dips, variations, interruptions	EN61000-4-11	Class 3 na – VEGA DC		A B for 5 s interruptions

\*also complies with BS EN61000-6-4: 2001

## Emissions BS EN61000-6-3: 2001

Residential, Commercial & Light Industrial Supply\*

Radiated electric field	EN55022	Class B (as per CISPR.22) Class A for VEGA DC	See application note for details. Only for "S" type leakage versions
Conducted emissions	EN55022	Class B (as per CISPR.22) Class A for VEGA DC	Only for "S" type leakage versions. "M" and "L" types meet Class A
Conducted harmonics	EN61000-3-2	Compliant to Class A	Not applicable to VEGA DC
Flicker	EN61000-3-3	Compliant	Not applicable to VEGA DC

\*also complies with BS EN61000-6-4: 2001

## Safety Approvals

	Date	Amendments		Date	Amendments
EN60950-1	2006		IEC61010-1*	2001	Second Edition
UL60950-1	2003		IEC60601-1*	1988	A1, A2
CSA22.2 No 60950-1	2003		EN60601-1 <sup>1</sup>	1990	A1, A2, A13
IEC60950-1*	2005		UL60601-1 <sup>1</sup>	2003	with revisions 2006
EN61010-1	2001		CE Mark		LV Directive 2006/95/EC (EN60950-1)

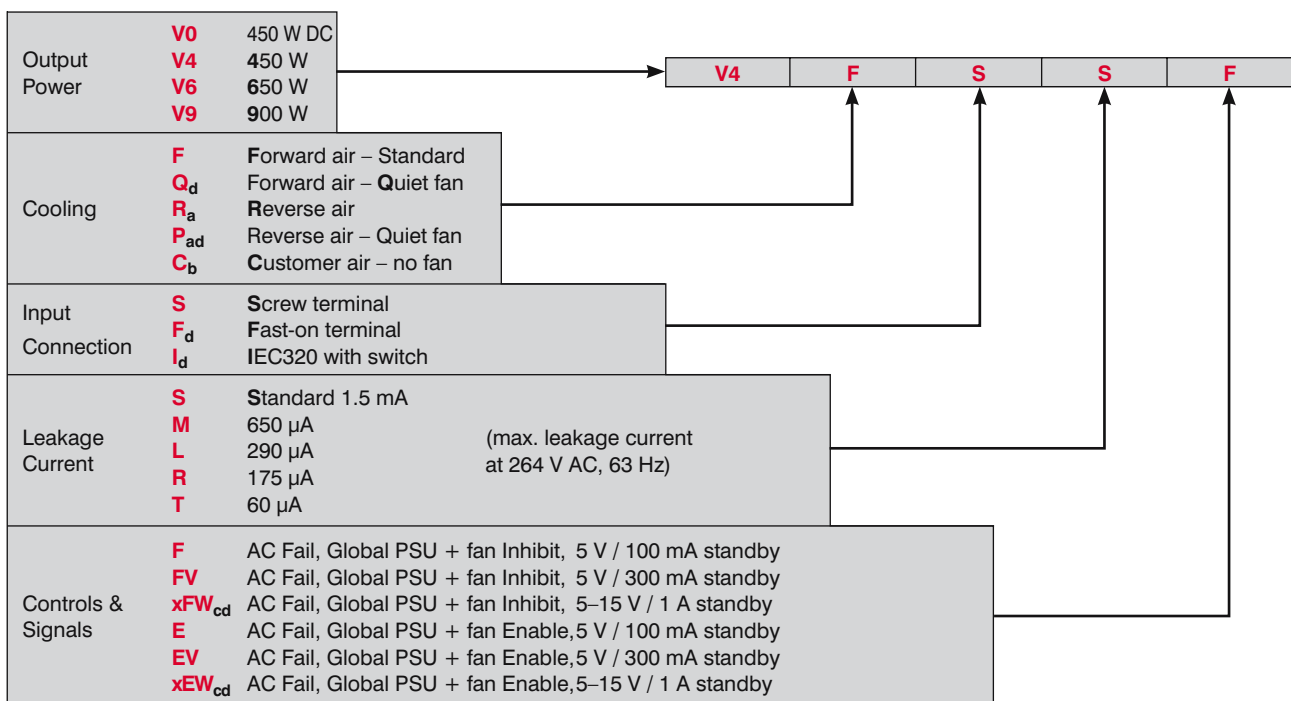
\* CB certificate and report available on request.  
Check with Technical Sales for status of approvals.

<sup>1</sup> Only for L, R and T leakage variants. Not applicable to VEGA DC.

The extensive range of output modules and options make it possible to achieve almost any combination of Volts and Amps. The “online” configurator is the best way to achieve the optimum configuration, however you can also create your own VEGA configuration from this datasheet by using the guide below.

### Web Configurator

1. Visit the TDK-Lambda website, select “VEGA Configurator” and follow the online instructions.
2. Enter your required Volts / Amps, type of output connection and any additional functions (if required).
3. Enter preferred type of cooling, input connection, lower leakage current (if required) and controls & signal functions (if required).
4. Configurator will select the most suitable modules and options and give a unique part number.



Notes: a) Not available for VEGA 900. b) Thermocoupled sample recommended to ensure adequate cooling – consult sales. c) xFW and xEW options increase leakage current by 90 µA. Replace “x” with required output voltage (5FW = 5 V aux supply). d) Not available for VEGA DC.

### Configuring from Datasheet

1. Calculate total output power to determine VEGA 450 W, 650 W or 900 W and select converter, then select required Cooling, Connection, Leakage Current and Controls / Signals from the table above.
2. Select Output Modules and Options from the Output Voltages tables.
  - Example – if you require 5.2 V / 18 A with output inhibit:
    - a) select B1H as closest match for voltage and current and prefix with voltage (eg **5.2B1H**)
    - b) add suffix S or F for Screw or Fast-on connection (eg **5.2B1HS**)
    - c) add suffix N for output inhibit (eg **5.2B1HSN**)
    - d) repeat for other outputs

Ensure you do not select more than a total of 5 slots width of module. This will create a complete product description eg:

**V5FSSF 5L1SN 12/12H3/3S 24C5S** which represents a four output 650 W VEGA with Forward air, Screw input terminals, 1.5 mA Earth Leakage, AC Fail, Global Inhibit & 5 V / 100 mA aux supply with the following outputs:

Output 1 = 5 V / 35 A with output inhibit, Module Good and Current Share option

Output 2 = 12 V / 10 A

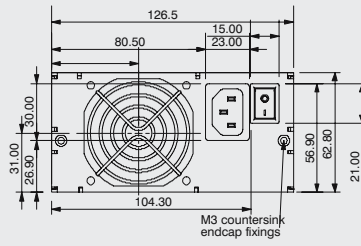
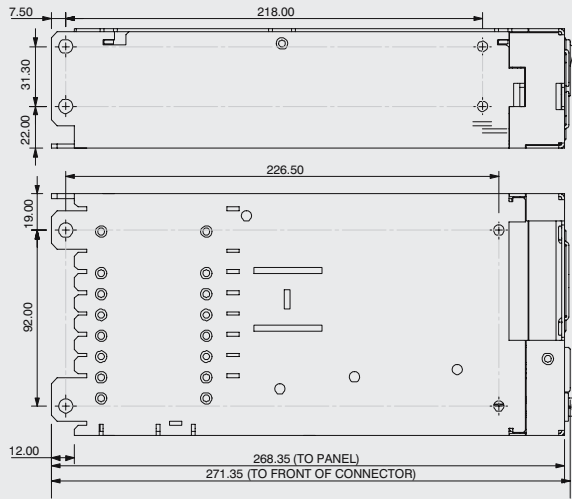
Output 3 = 12 V / 6 A

Output 4 = 24 V / 10 A

3. Contact TDK-Lambda to validate configuration and issue a part number.

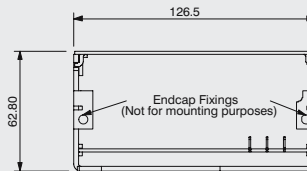
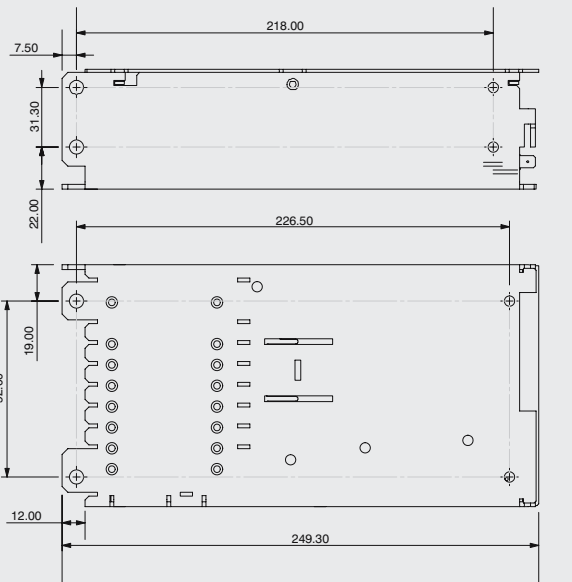


# Outline & Connection Drawings

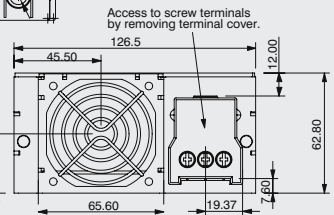
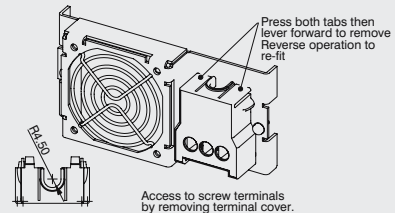
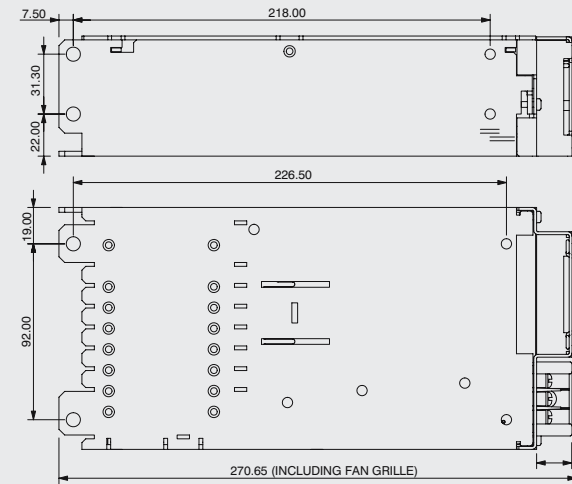


## IEC-320 Connector Case

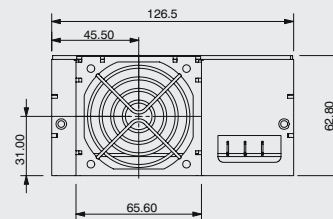
All versions have:  
8 x M4 Customer fixings  
Max thread penetration: 4.5 mm



## Customer Air Case (no fan)



## Screw & Fast-on Terminal Case



## Highlights

- 1 to 16 outputs
- Standard or configurable
- No minimum load
- Rapid connection
- Wide range input
- EN61000-3-2 compliant
- Class B conducted



## Input Specifications

Input voltage range	ALPHA 1500: 150 – 264 V AC ALPHA 1000: 90 – 264 V AC
Frequency	47 to 63 Hz
Inrush current	< 50 A
Switching frequency	
– PFC	100 kHz
– Forward converter	200 kHz
Leakage current	1.1 mA (see options for lower leakage current)
Input protection	internal fuse
Thermal protection	standard

## Output Specifications

Power	1000 to 1500 W
Voltage adjustment	Multi-turn potentiometer
Line regulation	< 0.5 %
Load regulation	< 2 % < 0.5 % (sense connected)
Remote sense	single o/p modules only
Ripple and noise (value peak to peak)	2 %
Overcurrent protection	standard
Overvoltage protection	standard

## General

Efficiency	75 % typically
Voltage isolation	
Input-output	3 kV RMS
Input-ground	1.5 kV RMS
Output-ground	500 V DC

## Environment

Operating temperature	
Range	0 °C to +70 °C
Derating (typ)	50 °C – 70 °C derate 2.5 % / °C
Storage temperature	-40 °C to +70 °C
EMI	Curve A – conducted
Safety approvals	CB Certificated, IEC/EN60950, UL1950 CSA 22.2 No. 950 (all models)

## Standard Electrical Specification – Standard Models

Model	Max.** power Watts	Output N° 1		Output N° 2		Output N° 3		Output N° 4		Modules
		Volts	Amp.	Volts	Amp.	Volts	Amp.	Volts	Amp.	
CA1000-5A, 12F, 12F	1000 W	5 V	60 A	12 V	33 A	12 V	33 A			A, F, F
CA1000-12C, 5A, 3.3R, 12F	1000 W	5 V	60 A	3.3 V	60 A	12 V	33 A	12 V	16 A	C, A, R, F
CA1000-24G_PP, 24G_PP	1000 W	24 V	40 A*							G, G

\* Modules in parallel.

\*\* Total output power must not exceed: 1000 W for ALPHA 1000.

See next section for information on 1500 W models.

## Configured Models

To meet your requirements it is possible to configure an ALPHA power supply using any of the standard ALPHA models and converters. 1500 W (CA1500) models can accommodate up to 8 slots and 1000 W (CA1000) models up to 7 slots. To ensure ALPHA meets your exact requirements please contact Technical Sales or visit our Website.

Single output modules				Twin output modules					
Module	Adjustment range (Volts)	Amps	Slots	Module	V1 Adjustm. range (Volts)	Amps	V2 Adjustm. range (Volts)	Amps	Slots
A	4.5 – 5.5	60	2	E	5 – 16	8	5 – 16	8	1
AA	4.5 – 6.2	60	2	EB	4.5 – 5.5	9	4.5 – 5.5	9	1
B	4.5 – 5.5	25	1	EQ	4.5 – 5.5	9	2.7 – 3.9	9	1
BB	4.5 – 6.5	25	1	H	18 – 32	5 <sup>c</sup>	18 – 32	5 <sup>c</sup>	1
C	5 – 16	16 <sup>a</sup>	1	P	18 – 29	5	5 – 16	8	1
D	18 – 29	8	1						
F	9 – 15.5	33	2						
G	17.5 – 29	25	2						
J	30 – 48	10 <sup>b</sup>	2						
K	18 – 29	15	2						
L	1.8 – 3.2	25	1						
M	5 – 16	8	1						
N	18 – 32	5 <sup>c</sup>	1						
Q	2.7 – 3.9	25	1						
R	2.7 – 3.9	60	2						
S	2.5 – 5.7	85	2						
T	1.8 – 3.2	60	2						
U	10 – 21	16	1						
V	10 – 21	25	2						
W	4.5 – 5.5	15	1						
Z	4.5 – 5.5	25	1						

Note: a) 12 A max above 12 V b) Derate output current by 0.25 A / V above 40 V c) 1 A max above 29 V

Options

**Input Options**

MF: AC Fail, Global inhibit,  
5 V / 50 mA standby supply

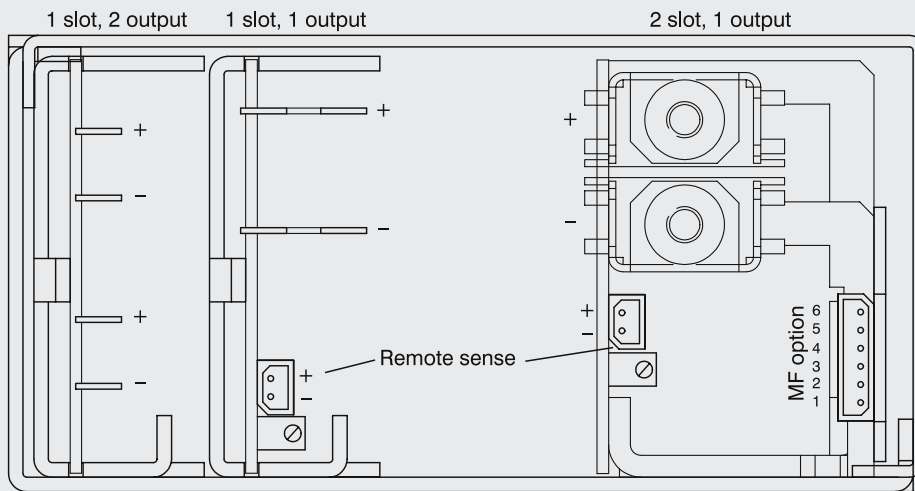
**Low Leakage filter options**

ML: 500  $\mu$ A  
LL: 240  $\mu$ A  
RL: 100  $\mu$ A  
TL: 50  $\mu$ A

**Output Options**

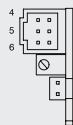
IN: Output inhibit and output good signal  
PP: Parallel outputs to increase current from one psu  
PA: Current share and output good  
(for N + 1 redundant applications)  
RP: Remote program (resistance)

MF option connector



**IN option**

PIN 1: Not connected  
PIN 2: Module Good  
PIN 3: Inhibit  
PIN 4: Not connected  
PIN 5: - Power  
PIN 6: - Power



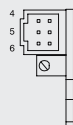
**PA option**

PIN 1: + Sense  
PIN 2: Module good  
PIN 3: Star point  
PIN 4: - Sense  
PIN 5: - Power  
PIN 6: Star point



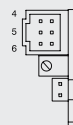
**PP option**

PIN 1: + Sense  
PIN 2: Not connected  
PIN 3: Not connected  
PIN 4: - Sense  
PIN 5: Not connected  
PIN 6: Not connected



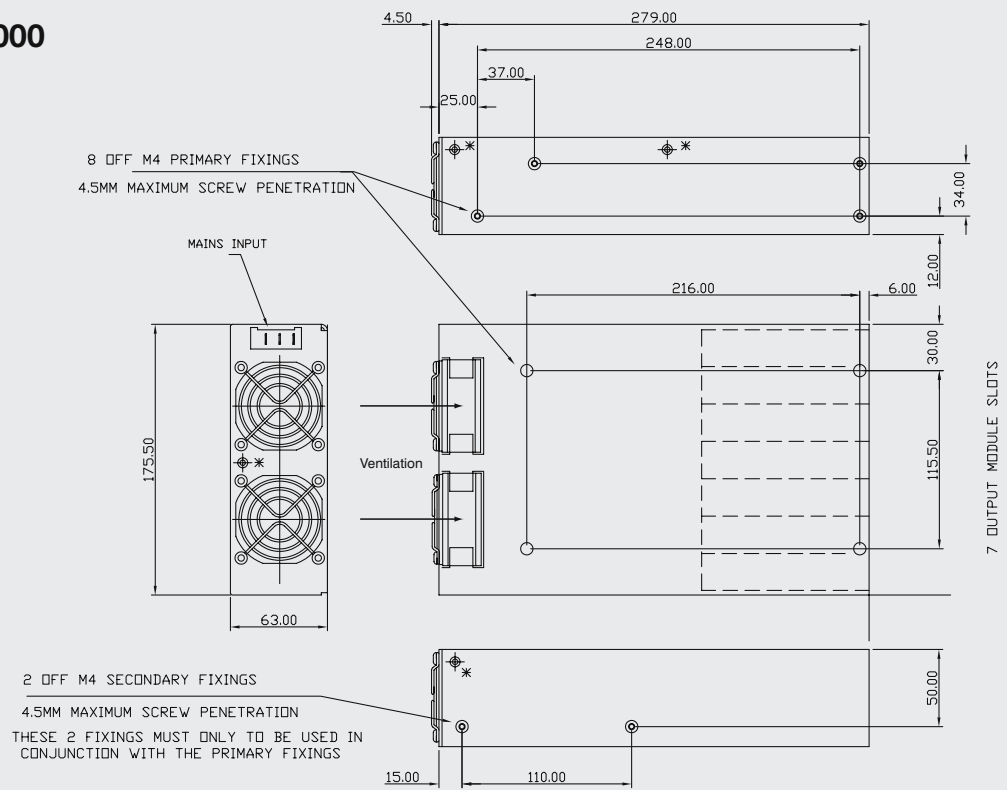
**RP option**

PIN 1: + Sense  
PIN 2: - Sense  
PIN 3: Control 2  
PIN 4: Not connected  
PIN 5: Control 1  
PIN 6: Not connected

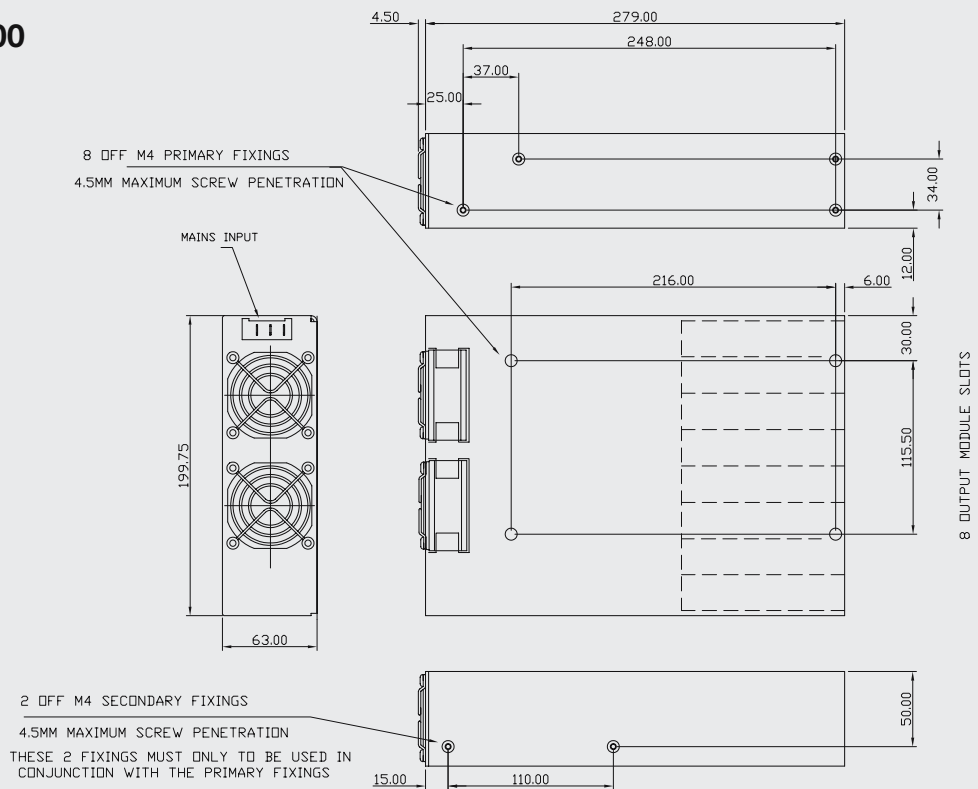


# Outline & Connection Drawings

## Alpha 1000



## Alpha 1500





*Innovating Reliable Power*

# TDK·Lambda



With production facilities in Asia, America and Europe, TDK-Lambda has positioned itself as one of the world's largest manufacturers of electronic power supplies. Boasting a comprehensive range of AC/DC power supplies, DC/DC converters and laboratory power devices ranging from 1.5 W to 15 kW, TDK-Lambda offers the right solution for a host of different applications.

“Power supply” to us is more than just an electronic device. It is the fundamental basis of the safety and reliability of our customers' products. This is why we support you with everything from design, EMC standards and safety certification to serial production, so that we are confident of offering you the best possible solution in every aspect.

## More detailed information:

Visit our website and discover the many possibilities offered by TDK-Lambda. Browse through the latest product highlights and download our catalogues and documentation.

[www.emea.tdk-lambda.com](http://www.emea.tdk-lambda.com)



Please contact your local sales office to find the best solution to your application.



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