TDK·Lambda

Medical Power Supplies

Edition 1 | 2009

Innovating Reliable Power

Innovating Reliable Power

TDK·Lambda

Contents

Highlights

- Small size & lightweight
- PCB board mountable
- Wide range input
- Medical safety certifications (4 kV AC input – output)
- Class II (no ground needed)

Features Benefits

Features	Benefits
• Small size	• Minimises PCB space
• Wide input range	• Global use with no manual intervention
• High efficiency	• 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)[1]	–	250 V / T2 A			250 V / T3.15 A		
Temperature coefficient (O/PV)	–	±0.01 % / °C					
Ripple and 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 (typical)	ms	20 ms			18 ms		
Enclosure leakage 240 V AC, 63 Hz 264 V AC, 63 Hz	mA mA	0.055 max. 0.06 max.			0.08 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[2]		
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					

1 For medical applications an equivalent external fuse should be installed in the neutral line
2 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[1] (%)	Cross regulation	Efficiency (%)
Single Output										
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 %
Dual Output										
KMD15-55	V1 V2	+5 V –5 V	150 mA 150 mA	1.5 A 1.5 A	15 W	±2 % ±2 %	0.5 % 0.5 %	1 % 1 %	5 % 5 %	78 %
KMD40-55	V1 V2	+5 V –5 V	400 mA 400 mA	4.0 A 4.0 A	40 W	±2 % ±2 %	0.5 % 0.5 %	1 % 1 %	5 % 5 %	79 %
KMD40-512	V1 V2	5 V[2] 12 V[2]	1250 mA 312 mA	5.0 A 1.25 A	40 W	±3 % ±5 %	0.5 % 5.0 %	2 % 6 %	1 % 7 %	80 %
KMD40-524	V1 V2	5 V[2] 24 V[2]	1250 mA 156 mA	5.0 A 0.625 A	40 W	±3 % ±5 %	0.5 % 5.0 %	2 % 6 %	1 % 7 %	80 %
KMD15-1212	V1 V2	+12 V –12 V	62.5 mA 62.5 mA	0.625 A 0.625 A	15 W	±2 % ±2 %	0.5 % 0.5 %	1 % 1 %	3 % 3 %	80 %
KMD40-1212	V1 V2	+12 V –12 V	166 mA 166 mA	1.66 A 1.66 A	40 W	±2 % ±2 %	0.5 % 0.5 %	1 % 1 %	5 % 5 %	83 %
KMD15-1515	V1 V2	+15 V –15 V	50 mA 50 mA	0.5 A 0.5 A	15 W	±2 % ±2 %	0.5 % 0.5 %	1 % 1 %	3 % 3 %	81 %
KMD40-1515	V1 V2	+15 V –15 V	133 mA 133 mA	1.33 A 1.33 A	40 W	±2 % ±2 %	0.5 % 0.5 %	1 % 1 %	5 % 5 %	81 %
Triple Output										
KMT15-51212	V1 V2 V3	5 V[3] +12 V –12 V	500 mA 50 mA 50 mA	2.0 A 0.2 A 0.2 A	15 W	±2 % ±3 % ±3 %	0.5 % 2.0 % 2.0 %	1 % 5 % 5 %	1 % 5 % 5 %	78 %
KMT40-51212	V1 V2 V3	5 V[3] +12 V –12 V	1250 mA 150 mA 150 mA	5.0 A 0.6 A 0.6 A	40 W	±3 % ±5 % ±3 %	0.5 % 5.0 % 5.0 %	3 % 7 % 7 %	3 % 7 % 7 %	80 %
KMT15-51515	V1 V2 V3	5 V[3] +15 V –15 V	500 mA 37.5 mA 37.5 mA	2.0 A 0.15 A 0.15 A	15 W	±2 % ±3 % ±3 %	0.5 % 2.0 % 2.0 %	1 % 5 % 5 %	1 % 5 % 5 %	78 %
KMT40-51515	V1 V2 V3	5 V[3] +15 V –15 V	1250 mA 125 mA 125 mA	5.0 A 0.5 A 0.5 A	40 W	±3 % ±5 % ±5 %	0.5 % 5.0 % 5.0 %	3 % 7 % 7 %	3 % 7 % 7 %	80 %

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

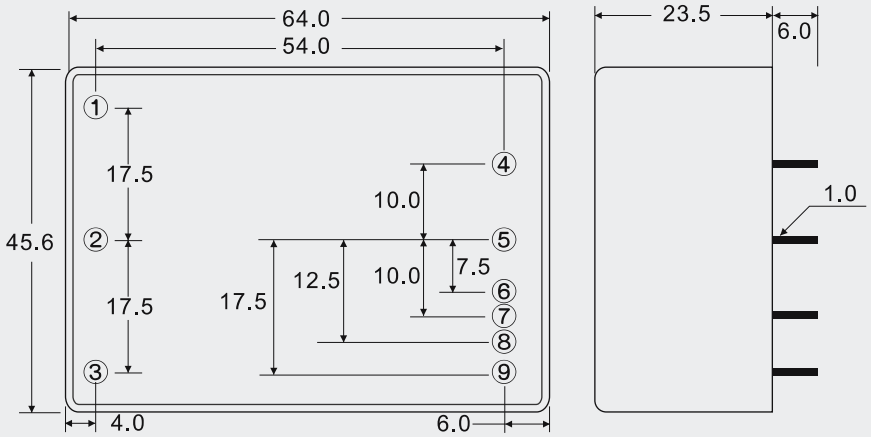
PIN #	Single O/P	Function Dual O/P	Triple O/P
1	no pin	no pin	no pin
2	AC (L)	AC (L)	AC (L)
3	AC (N)	AC (N)	AC (N)
4	–DC	–DC	+5 V GND
5	no pin	GND	+5 V
6	no pin	no pin	–DC
7	+DC	+DC	no pin
8	no pin	no pin	GND
9	no pin	no pin	+DC

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

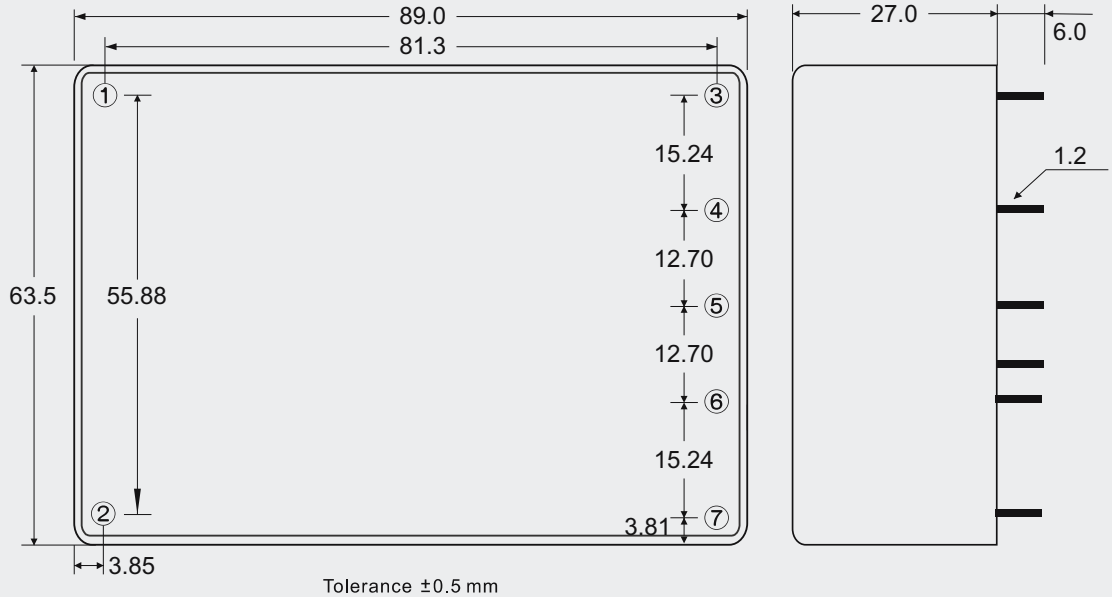
Outline Drawings

KM15



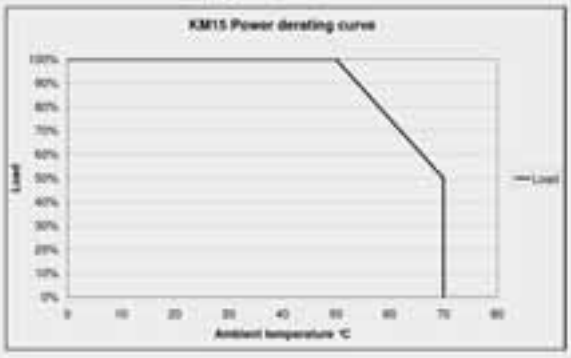
Tolerance ±0.5 mm

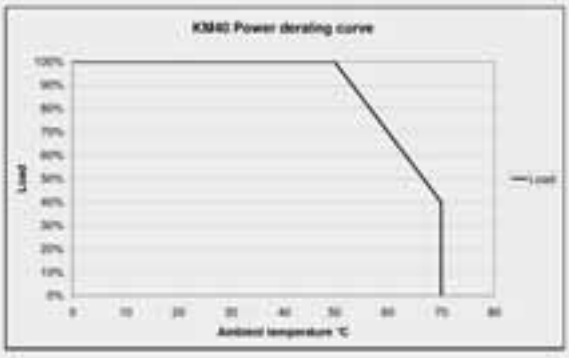
KM40



Tolerance ±0.5 mm

Derating curves





CME150 — 150 W

Highlights

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

Output Specifications

Items		Model	CME150-24	REV
Nominal output voltage		V	24	
Maximum output current		A	6.3	
Peak output current[1]		A	7.5	
Maximum output power		W	151.2	
Peak output power[1]		W	180	
Efficiency (typ.)[2]		%	82	
Input voltage range[3]		–	85 – 265 V AC (47 – 63 Hz) or 120 – 370 V DC	
Input current (100 / 200 V AC) (typ.)[2]		A	2.0 / 1.0	
Inrush current (typ.)[4]		–	14 A at 100 V AC, 28 A at 200 V AC. Ta=25 °C, cold start	
PFHC		–	built to meet EN61000-3-2	
Power factor (100 / 200 V AC) (typ.)[2]		–	0.99 / 0.95	
Output voltage range		V	21.6 – 26.4	
Max. ripple and noise[5]	0 ≤ Ta ≤ 60 °C	mV	150	
	–10 ≤ Ta ≤ 0 °C	mV	180	
Maximum line regulation[5, 6]		mV	96	
Maximum load regulation[5, 7]		mV	150	
Temperature coefficient		–	less than 0.02 % / °C	
Over current protection[8]		A	7.87	
Over voltage protection[9]		V	27.6 – 32.4	
Hold-up time (typ.)[10]		–	20 ms	
Leakage current[11]		–	0.3 mA max. at 265 V AC	A
Remote on/off control		–	–	
Parallel operation		–	–	
Series operation		–	possible	
Warranty		yrs	3 years	

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

1 Operating period at peak output current is less than 10 sec. (Average output power and current is less than maximum output power and current).

2 At 100/200 V AC, Ta=25 °C and maximum output power.

3 For cases where conformance to various safety specs (UL, CSA, EN) are required, to be described as 100 – 240 V AC (50/60 Hz).

4 Not applicable for the inrush current to noise filter for less than 0.2 ms.

5 Please refer to fig. A for measurement of line & load regulation and ripple voltage (measure with JEITA RC-9131 probe).

6 85 – 265 V AC, constant load.

7 No load – maximum load, constant input voltage.

8 Constant current limit with automatic recovery. Not operate at overload or dead short condition for more than 30 seconds.

9 OVP circuit will shut down output, manual reset (line recycle).

10 At 100/200 V AC nominal output voltage and maximum output current.

11 Measured by the each measuring method of IEC, UL, CSA, EN and DENAN (at 63 Hz).

Items	Model	CME150-24	REV
Operating temperature[12]	–	–10 to +60 °C convection: –10 to +50 °C: 100 %, +60 °C: 80 %	
Operating humidity	–	30 – 90 % RH (no dewdrop)	
Storage temperature	–	–30 to +85 °C	
Storage humidity	–	10 – 95 % RH (no dewdrop)	
Cooling	–	convection cooling	
Withstand voltage	–	input – FG: 2 kV AC (20 mA), input – output: 4 kV 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	
Vibration	–	at no operating, 10 – 55 Hz (sweep for 1 min.) 19.6 m/s² constant. X,Y,Z 1 hour each	
Shock (in package)	–	less than 196.1 m/s²	
Safety[13]	–	IEC60601-1, UL60950-1, CSA60950-1, EN60950-1, and DENAN	
EMI	–	EN55011/EN55022-B, FCC-Class B, VCCI-B	
Immunity	–	EN61000-4-2, -3, -4, -5, -6, -8, -11	
Weight (typ.)	g	500	
Size (W x H x D)	mm	80 x 40 x 208 (refer to outline drawing)	

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

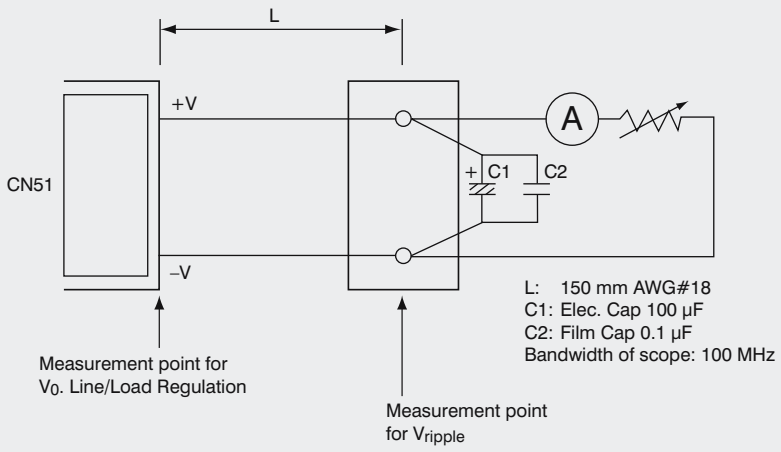
12 At standard mounting.
– Load (%) is percent of maximum output power or maximum output current, whichever is greater.
– For other mountings, refer to derating curve (B019-01-02_).

13 As for DENAN, built to meet at 100 V AC.

Output Specifications

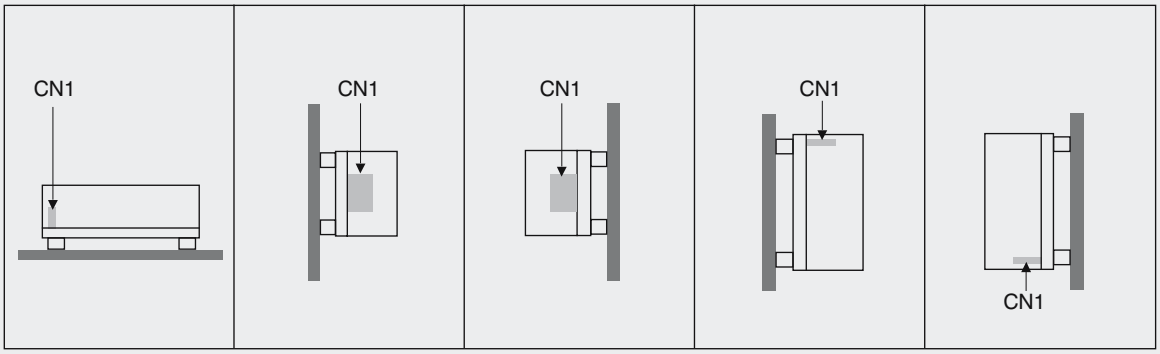
Ambient temperature Ta (°C)	Load (%)		
	Mounting A, B	Mounting C, D	Mounting E
–10 ~+25	100	100	100
30	100	100	100
35	100	100	100
40	100	100	100
45	100	100	90
50	100	87	80
55	90	73	70
60	80	60	60

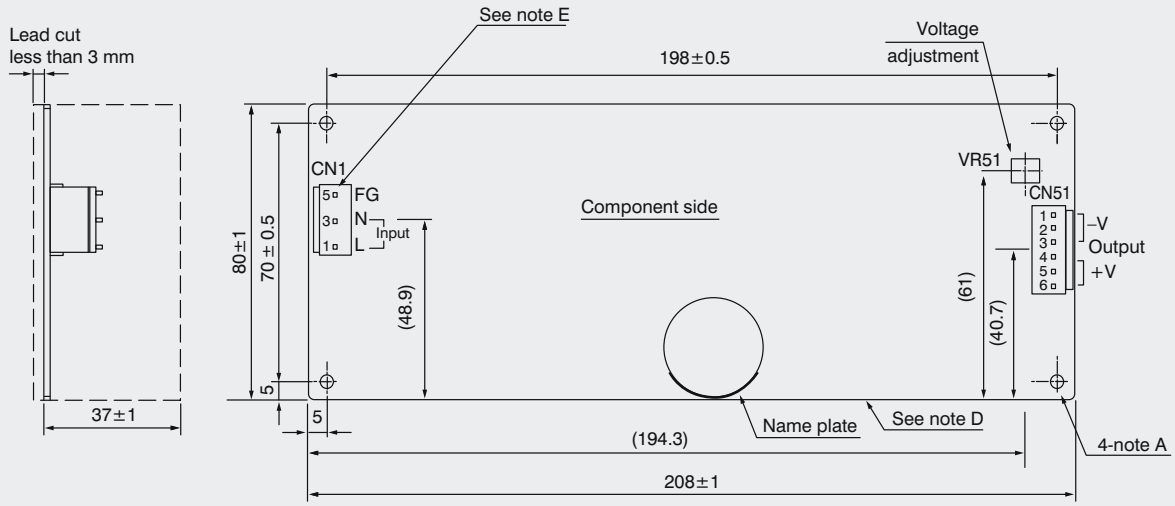
Outline Drawings

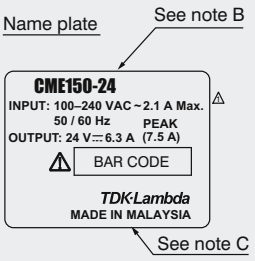


Outline Drawings

Mounting A (Standard Mounting) **Mounting B** **Mounting C** **Mounting D** **Mounting E**







Connectors used

Part description	Part name	Manufacturer	QTY
Pin header (input side CN1)	B3P5–VH	J.S.T.	1
Pin header (output side CN51)	B6P–VH	J.S.T.	1

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

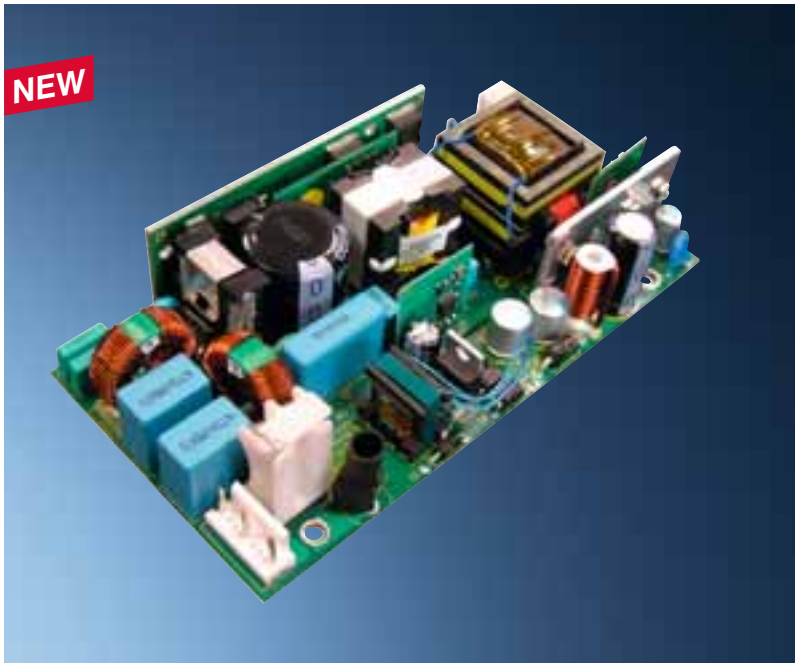
Matching housings & pin

Socket housing (CN1)	VHR-5N	J.S.T.	1
Socket housing (CN51)	VHR-6N	J.S.T.	1
Terminal pins (CN1, CN51)	SVH-21T-P1.1	J.S.T.	9

* Not included with the product.
Hand crimping tool: YC-160R Manufacturer: J.S.T.

Notes
A The 4–Ø 3.5 holes are customer's chassis mounting holes. All must be screwed in order to conform the vibration spec.
B Model name, input voltage range, nominal output voltage, maximum output current are shown here in accordance with the specifications.
C Country of manufacture will be shown here.
D To keep the distance more than 4 m / m between PC-Board edge and customer's chassis.
E FG is for safety ground connection.

EFE-300M **300 W**



Highlights

- Reinforced isolation
- Simplifies equipment design
- Full digital control
- Improves product performance
- High efficiency
- Minimises heat in system
- Low profile
- Fits 1 U applications
- 3 years warranty
- High power density (up to 18 W/in³)
- Less space
- Temperature controlled fan option
- Quieter operation
- Designed for medical equipment (BF-rated)
- 400 W peak power for 10 seconds

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 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, 0.5 mA Single Fault Condition)
Power factor	0.97 typical

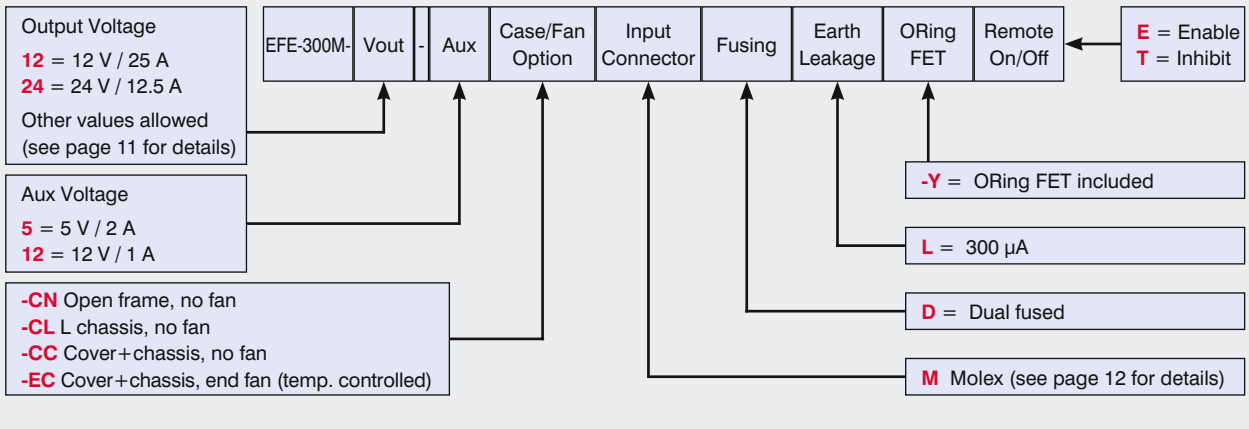
Quick Selector

preferred configurations

Output	Units without fan		Units with end fan
	Open Frame	Cover + Chassis	Cover + Chassis
12 V / 25 A	EFE-300M-12-5-CNMDL-YT	EFE-300M-12-5-CCMDL-YT	EFE-300M-12-5-ECMDL-YT
24 V / 12.5 A	EFE-300M-24-5-CNMDL-YT	EFE-300M-24-5-CCMDL-YT	EFE-300M-24-5-ECMDL-YT

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

		Notes
Output power	300 W	Continuous
Peak power	400 W	for 10 seconds (300 W average)
Total regulation	better than 4 %	Including Line (for 90 – 264 V AC input change) and Load (for 0 – 100 % load change)
Ripple & noise	1 %	Pk-Pk, using EIAJ test method & 20 MHz bandwidth
Voltage setting range	+10 % / –5 %	To be specified at time of ordering (chosen in “Output Voltage” part of product code)
Voltage setting accuracy	±1 %	at 50 % load
Turn on time	1.5 s max.	at 90 V AC & 100 % rated output power
Efficiency	90 %	typical
Hold-up	16 ms min.	at 90 V AC, 75 % load
Min load	none	
Transient response	<5 %	of set voltage for 50 % load change (in 50 µs within the range 25 – 100 % load)
Recovery	<1000 µs	for recovery to 1 % 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	Available if “no fan” is specified, otherwise used by PSU fan

Global Signals

Remote on/off	Enable – TTL logic level low enables channel 1 and fan supply Inhibit – TTL logic level low inhibits channel 1 and fan supply
Standby supply	5 V / 2 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**	**1500 V AC**

Environment

Temperature	0 to 50 °C operational, –40 °C to 85 °C storage (max. 12 months). Full load, with 2 m/s air blown from input to output
Convection rating	tbc.
Derating	50 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 514.4, Pro I, Cat 1,9
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 516.5, Pro I, IV, VI
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	tested to 4.4 kV	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	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
Flicker	EN61000-3-3	Compliant – d_{max} only

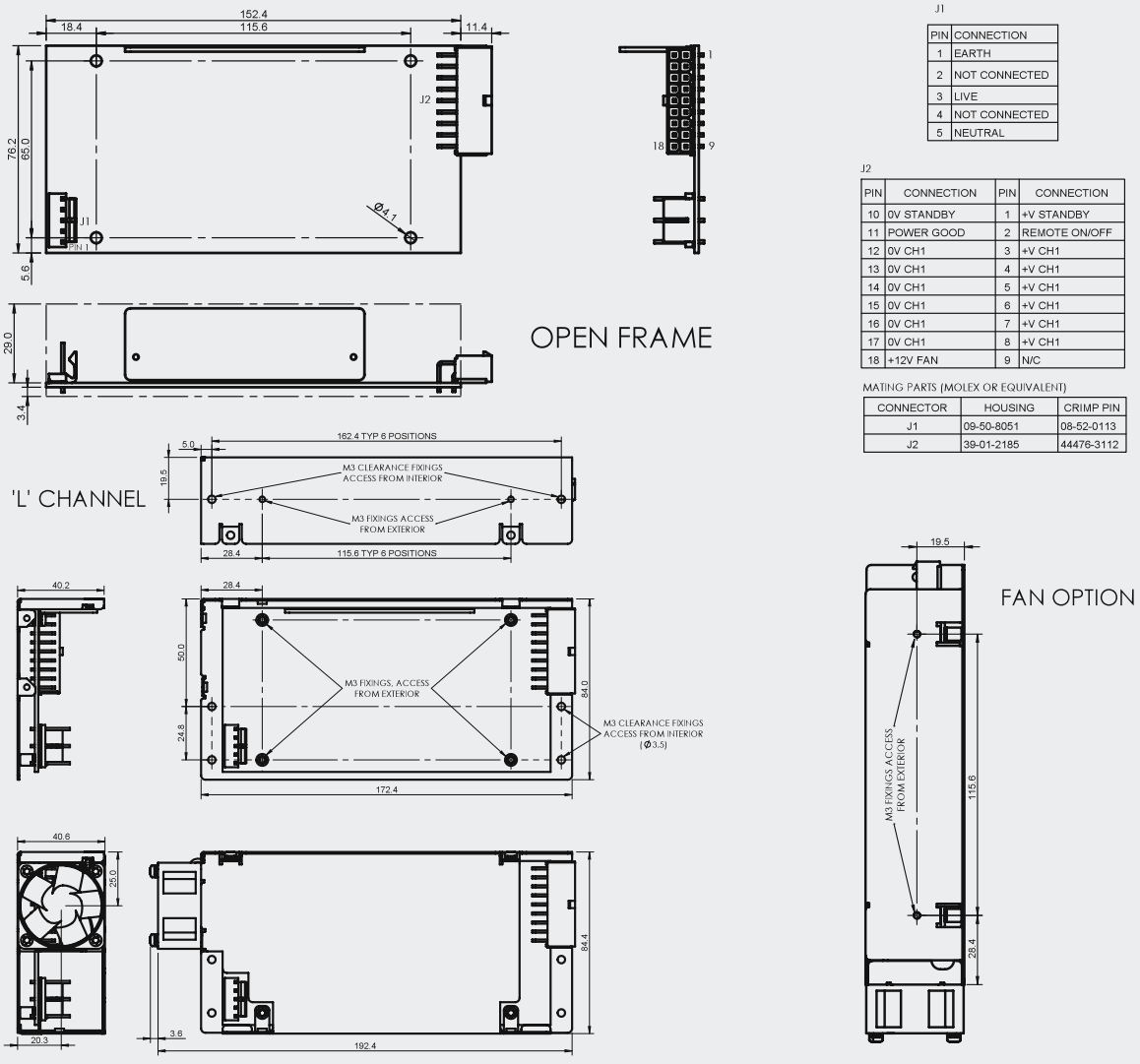
Safety Approvals

	Date	Amendments
EN60950-1	2006	
UL60950-1	2007	
EN61010-1	2001	
IEC60950-1*	2005	
EN60601-1	1990	A1, A2, A13
CE Mark	LV Directive 2006/95/EC (EN60950-1)	

	Date	Amendments
IEC60601-1*	2005	
CSA 22.2 No. 60950-1	2007	
IEC61010-1*	2007	

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

Outline & Connection Drawings



J1

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

J2

PIN	CONNECTION	PIN	CONNECTION
10	0V STANDBY	1	+V STANDBY
11	POWER GOOD	2	REMOTE ON/OFF
12	0V CH1	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	+12V FAN	9	N/C

MATING PARTS (MOLEX OR EQUIVALENT)

CONNECTOR	HOUSING	CRIMP PIN
J1	09-50-8051	08-52-0113
J2	39-01-2185	44476-3112

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

Features

- Lifetime warranty
- Medical approvals
- Wide range AC input

Benefits

- Lower cost of ownership
- Reduces system approval times
- Supports global use

Input Specifications

Items	Models	HWS30 HWS50	HWS100 HWS150	HWS300	HWS600	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.)[1]	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	19/10
Inrush current[1]	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)[2]	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				yes
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[3]	–	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				

Input Specifications

Continuation

Items	Models	HWS30 HWS50	HWS100 HWS150	HWS300	HWS600	HWS1500
Vibration (non-operating)	–	10 – 55 Hz (1 min. sweep), 19.6 m/s² constant, X, Y, Z axis, one hour each				
Shock (in packaging)	–	<196.1 m/s²				
Safety agency approvals[2]	–	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				
Weight (typ.)	g	220 280	450 500	1000	1600	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	280 x 82 x 126.5
Warranty		lifetime warranty (see TDK-Lambda's terms & conditions)				

1 100 / 200 V AC input
2 See clause 19.5DV.2 of UL60601 for equipment in proximity of patient
3 HWS300-600 2.5 kV AC input to ground
HWS30-150/ME are without cover, HWS300-1500 are with cover

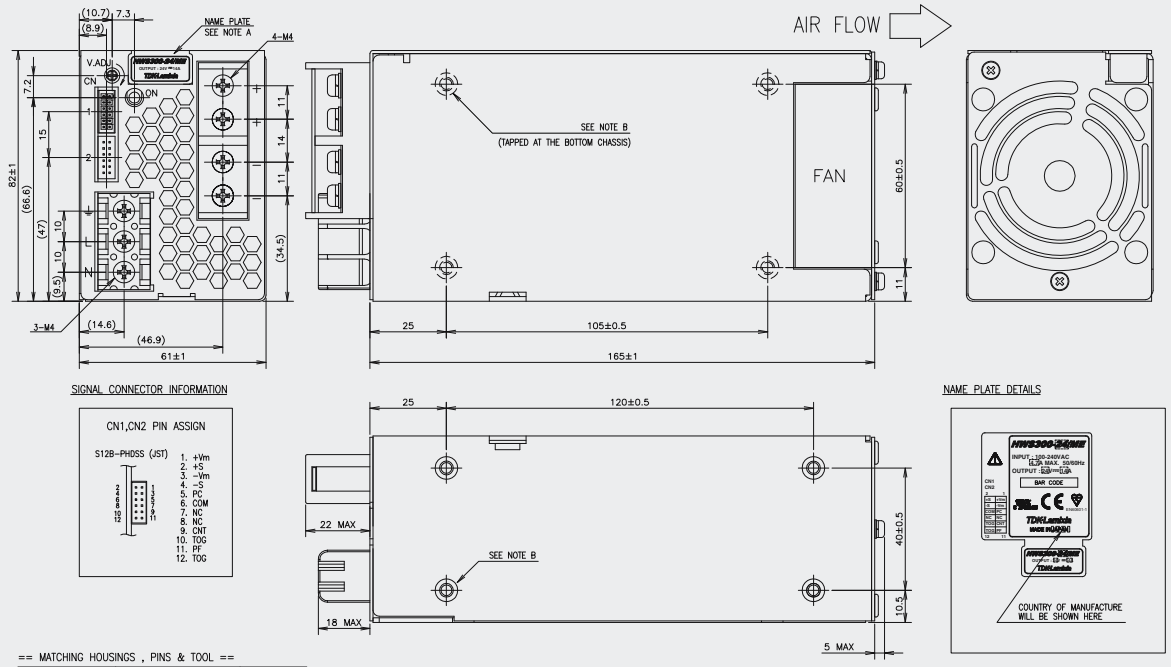
Output Specifications

Model	Voltage	Adjust range	Max. current (A)[4]	Max. power (W)	Load regulation (mV)	Line regulation (mV)	Ripple noise (mV)	Over-voltage (V)	Efficiency (typ.) %[1]
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
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
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	15 V	12.0 – 18.0	22	330	90	60	150	18.8 – 21.8	82 / 85
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
HWS1500-24/ME	24 V	19.2 – 28.8 4.8 – 28.8[6]	65/70[1] (105 Pk[5])	1560/1680[1] (2520 Pk[5])	144	96	200	30 – 34.8	84 / 88
HWS1500-36/ME	36 V	28.8 – 43.2 7.2 – 43.2[6]	42/46.5[1] (70 Pk[5])	1512/1674[1] (2520 Pk[5])	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
HWS1500-48/ME	48 V	38.4 – 52.8 9.6 – 52.8[6]	32	1536	288	192	200	55.2 – 64.8	86 / 90

4 Peak load for 10 sec. maximum on time, 35 % duty cycle
5 200 – 265 AC input
6 Using voltage programming input – see installation manual for details

Outline & Connection Drawings

HWS300



== MATCHING HOUSINGS , PINS & TOOL ==

PART DESCRIPTION	PART NAME	MANUFACT
SOCKET HOUSING	PHDR-12VS	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

== SIGNAL CONNECTOR USED ==

PART DESCRIPTION	PART NAME	MANUFACT
PIN HEADER	S12B-PHDSS	JST

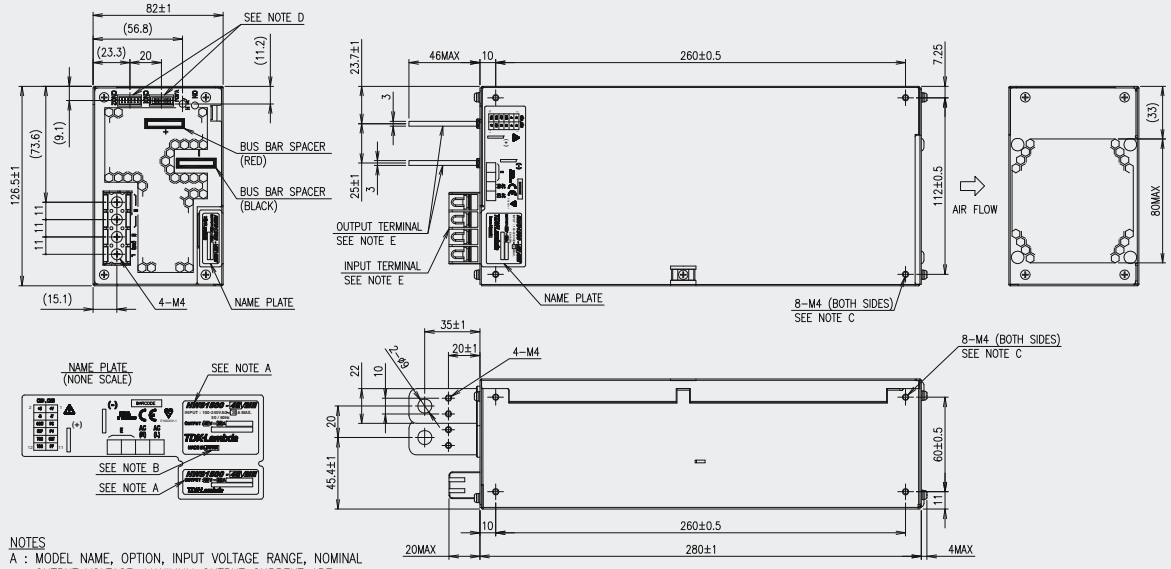
== ACCESSORIES ==

* COVER FOR BARRIER TERMINAL STRIP ------1
(ATTACHED ON TERMINAL AT SHIPMENT)
* SHORT PIECE ----------1
SHORTING +Vm — +S, -Vm — -S, CNT — TOG
(ATTACHED ON CN1 AT SHIPMENT)

== 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.)

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

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

12 10 8 6 4 2
11 9 7 5 3 1

ACCESSORIES

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

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)

Features Benefits

Features	Benefits
• Temperature controlled fan	• Low acoustic noise
• Global safety approvals	• Supports global use
• Wide temperature range	• Suitable for outdoor temperature extremes
• Level B EMI	• Assists system compliance

Input Specifications

Items	Model	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[1]	–	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/s² constant X, Y, Z 1 hour each plane)

1 Not available on 3.3 V & 5 V SWS1000L models

Input Specifications

Continuation

Items	Model	SWS1000L
Shock	–	235.2 m/s²
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

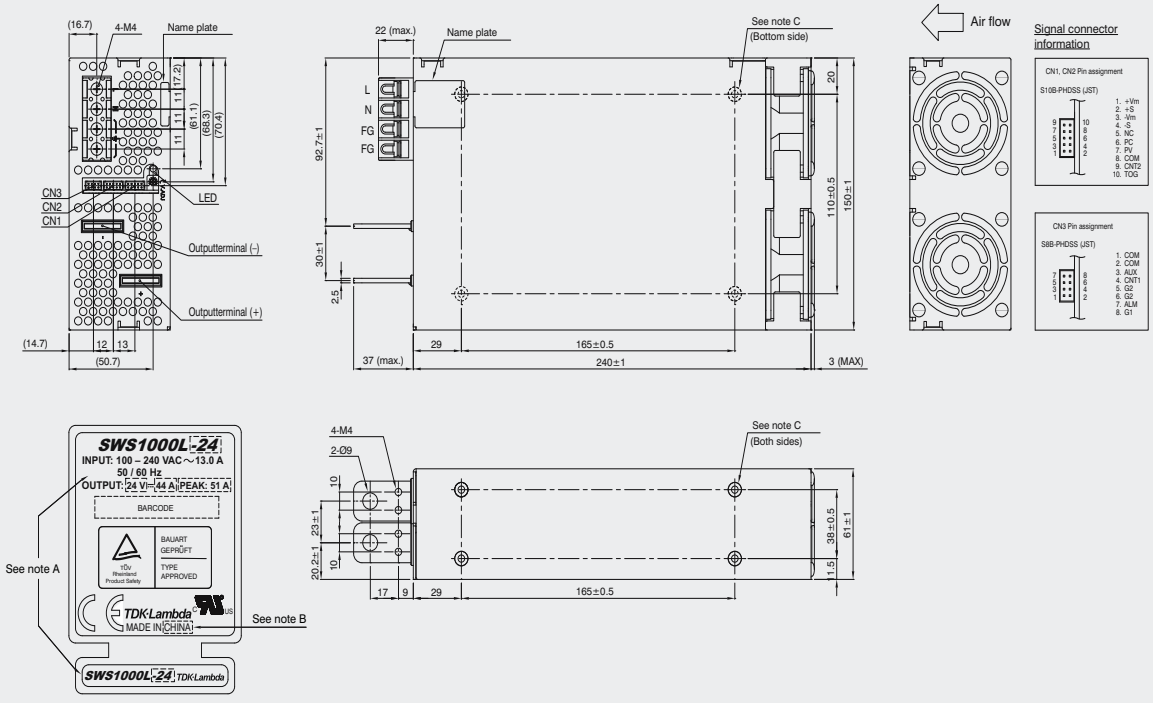
Output Specifications

Model	Voltage	Adjust range (via trim pot)	Max. current (A)	Max. power (W)	Load regulation (mV)	Lin. regulation (mV)	Ripple noise (mV)	Efficiency[2] (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)[3]	1056 (1224)[3]	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)[3]	1056 (1200)[3]	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



Accessories:

± Short piece ——————1

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:

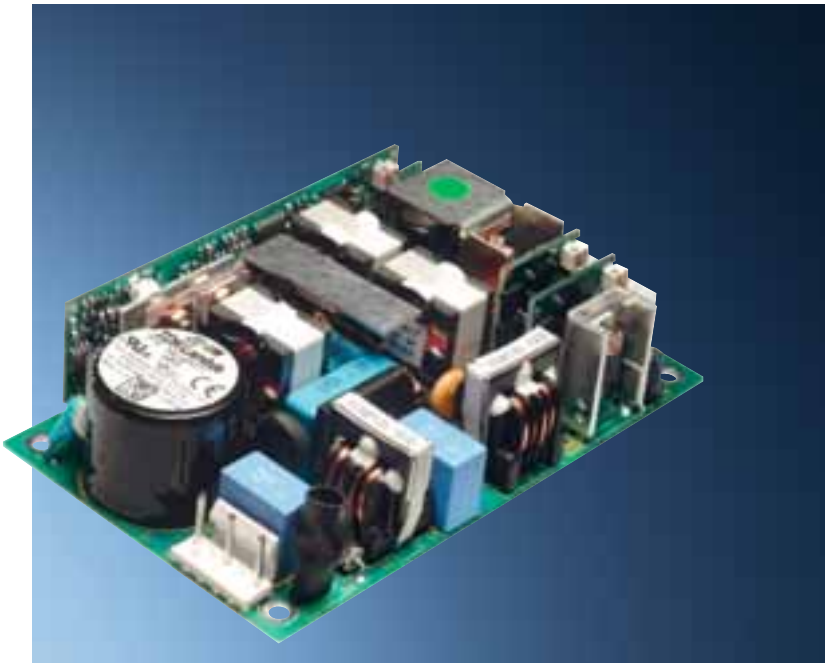
A Model name, input voltage range, nominal output voltage, nominal output current and peak output current are on name plate in accordance with the specifications.

B Country of manufacture is shown here.

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

NV-Power medical

180 / 200 W



Highlights

- Reinforced isolation for IEC60601-1
- Low earth leakage and class B EMC
- Medical approval
- High efficiency
- High power density (9.3 W/in^3)
- 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

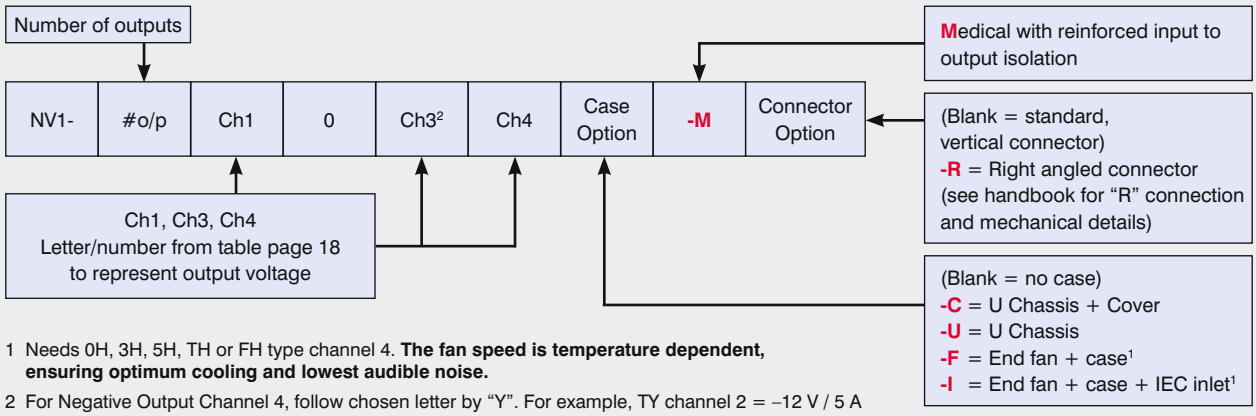
Above units available on rapid delivery. Additional variants available “Build to Order” – see below.

Available Outputs

Channel 1	Adjustment range	Channel 2	Channel 3[1]	Adjustment range	Channel 4[2]	Adjustment range
T 12 V / 15 A **F** 15 V / 12 A	12 – 15 V[3] 12 – 15 V[4]	not available	**T** 12 V / 5 A **F** 15 V / 5 A **G** 24 V / 2.5 A **0** Omit	12 – 15 V 12 – 15 V 18 – 24 V	**T** –12 V / 1 A **F** –15 V / 1 A **3HP** +3.3 V / 2 A[6] **5HP** +5 V / 2 A[6] **TH** –12 V / 2 A[6] **FH** –15 V / 2 A[6] **0H** Fan supply only **0** Omit	fixed fixed fixed fixed fixed fixed
G 24 V / 7.5 A	24 – 28 V[5]					

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

How to create a Product Code



1 Needs 0H, 3H, 5H, TH or FH type channel 4. **The fan speed is temperature dependent, ensuring optimum cooling and lowest audible noise.**

2 For Negative Output Channel 4, follow chosen letter by "Y". For example, TY channel 2 = –12 V / 5 A

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	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 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 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 514.4, Pro I, Cat 1,9
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 516.5, Pro I, IV, VI
Altitude	3,000 metres operational
Pollution	Degree 2, Material group 3b

Immunity EN61000-6-2: 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	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	Compliant
Flicker	EN61000-3-3	Compliant

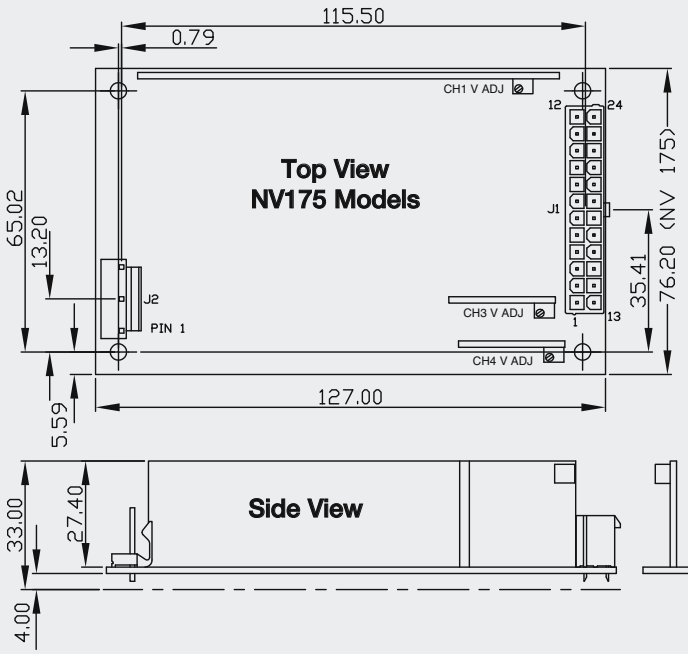
Safety Approvals

	Date	Amendments
EN60950-1	2006	
UL60950-1	2007	
CSA22.2 No 60950-1	2003	
IEC60950-1*	2005	
EN61010-1	2001	
IEC61010-1*	2001	

	Date	Amendments
IEC60601-1*	1988	A1, A2
EN60601-1	1990	A1, A2, A13
UL60601-1	2003	with revisions 2006
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



MATING PARTS (MOLEX OR EQUIVALENT)

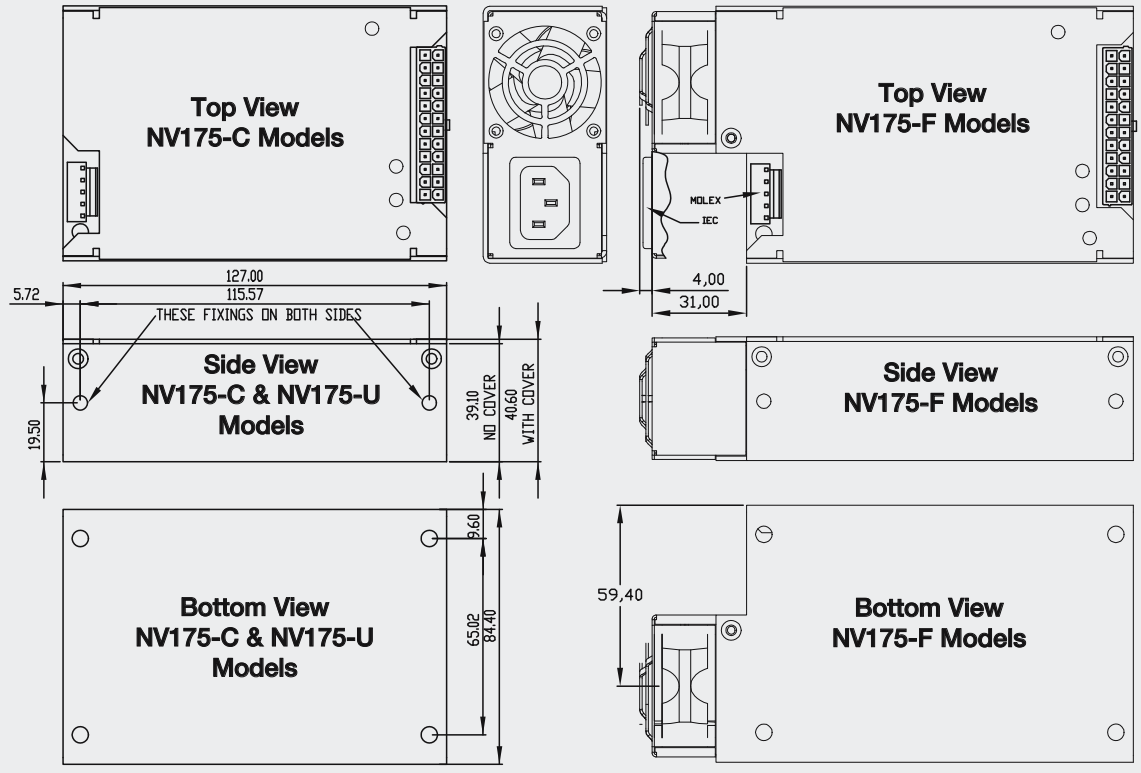
CONN	HOUSING	PINS
J1	39-01-2245	44476-3112
J2	09-50-8051	08-52-0113

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 ±0.5 mm

NV-Power 350 … 1150 W

Highlights

- High efficiency
- High power density (up to 19 W/in³)
- 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[3]	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 7 – 15 V 24 – 32 V	10 A 5 A 2 A	55 W 60 W 50 W
DB	2	4.75 – 5.5 V	25 A	3.3 – 5.5 V 7 – 15 V 24 – 32 V	10 A 5 A 2 A	55 W 60 W 50 W
DB	2	12 – 15 V	13A[1]	3.3 – 5.5 V 7 – 15 V 24 - 32 V 10 A	5 A 2 A	55 W 60 W 50 W
DB	2	24 – 28 V	7A[2]	3.3 – 5.5 V 7 – 15 V 24 – 32 V	10 A 5 A 2 A	55 W 60 W 50 W

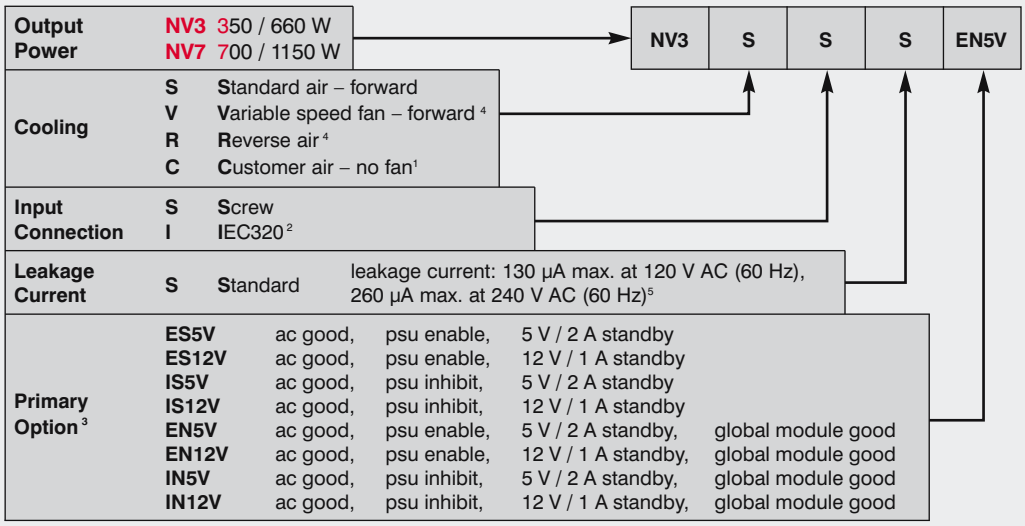
Notes 1 derate linearly from 13 A at 12.5 V to 10 A at 15.5 V 2 derate linearly from 7 A at 25 V to 6 A at 28 V 3 Only one per power supply

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[4] 22.5 A[5]	40 A 40 A[4] 22.5 A[5]
BH	2	12 – 15.5 V 24 – 28 V	20 A[6] 10 A[7]	20 A[6] 10 A[7]
C	3	12 – 13.2 V 15 – 16.5 V 24 – 26.4 V	37.5 A[8] 30 A[8] 18.75 A[8]	50 A[8] 37.5 A[8] 25 A[8]
CC	6	24 – 26.4 V 30 – 33 V 48 – 52.8 V	37.5 A[9] 30 A[9] 18.75 A[9]	50 A[9] 37.5 A[9] 25 A[9]

Notes
4 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
5 derate linearly from 22.5 A at 8 V to 20 A at 9 V
6 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
7 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
8 for NV3, 400 W max (to be confirmed)
for NV7, 600 W peak for up to 10 sec, 450 W average
9 for NV7 only, 1200 W peak for up to 10 sec, 900 W average

NV-350 / NV-700 Configuring



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**. 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 that 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. **NV3SSSES5V 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[6]	350 W	450 W	450 W	660 W
	Peak (10 s)[7]	400 W[1]	500 W[2]	500 W[2]	740 W[3]
NV-700	Continuous	700 W	700 W	1150 W	1150 W
	Peak (10 s)		850 W[4] (tbc.)	1150 W	1450 W[5] (tbc.)

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. Hiccub 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[1] 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

1 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_{max} only

Safety Approvals

	Date	Amendments
EN60950-1	2006	
UL60950-1	2003	
CSA22.2 No 60950-1	2003	
IEC60950-1*	2005	
CE Mark	LV Directive 2006/95/EC(EN60950-1)	

	Date	Amendments
EN61010-1	2001	
IEC61010-1*	2001	
IEC60601-1*	1988	A1, A2
EN60601-1	1990	A1, A2, A13
UL60601-1	2003	with revisions 2006

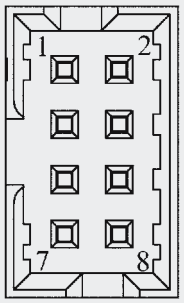
* CB certificate and report available on request.

Please check with Technical Sales for status of approvals.

Primary Option / DA Module

DA Module

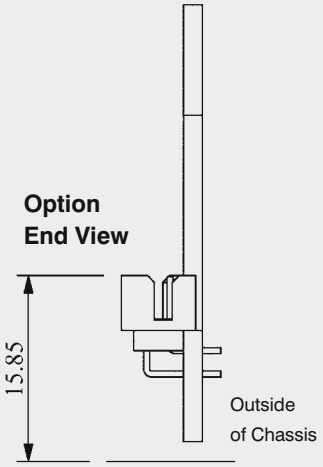
1 +12 V (channel 1)
2 +12 V (channel 1)
3 +12 V (channel 1)
4 0 V (common ch1 / ch2)
5 0 V (common ch1 / ch2)
6 0 V (common ch1 / ch2)
7 –12 V (channel 2)
8 –12 V (channel 2)



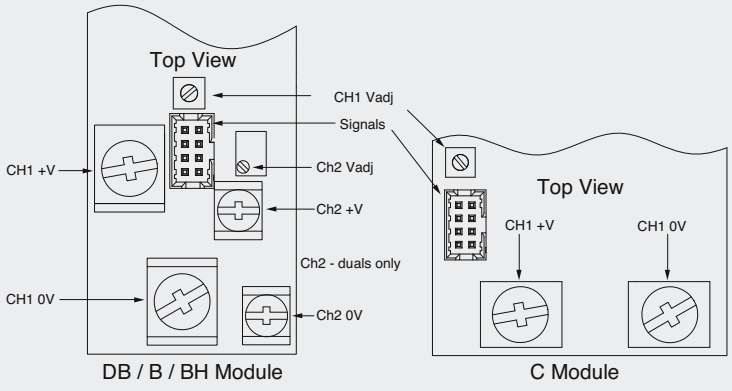
Primary Option

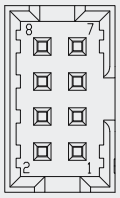
1 +V Standby
2 0 V Standby
3 EN/ES & IN/IS Logic 1
4 EN/ES & IN/IS Logic 0
5 Global Module Good Collector
6 Global Module Good Emitter
7 AC good Collector
8 AC good Emitter

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



Output Connections

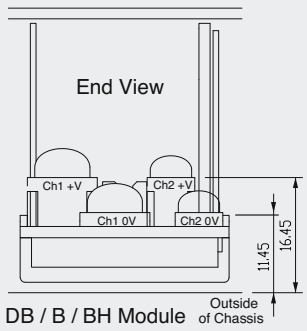


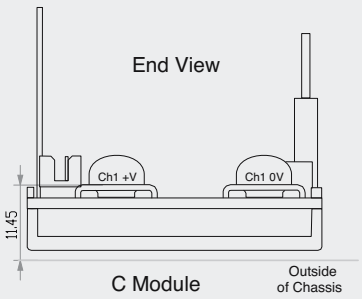


Signals

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

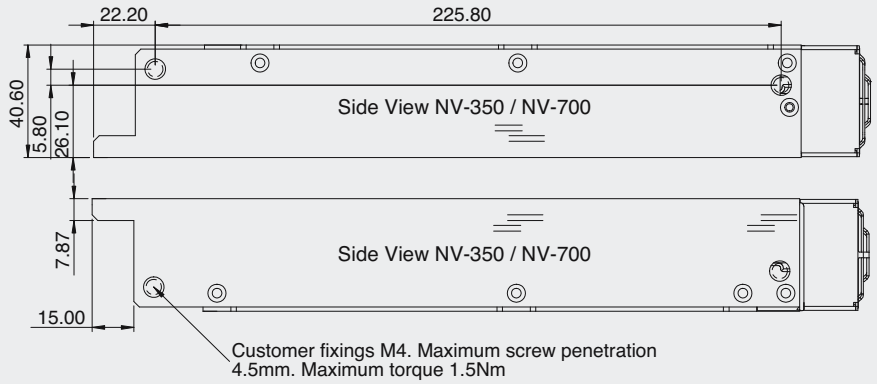




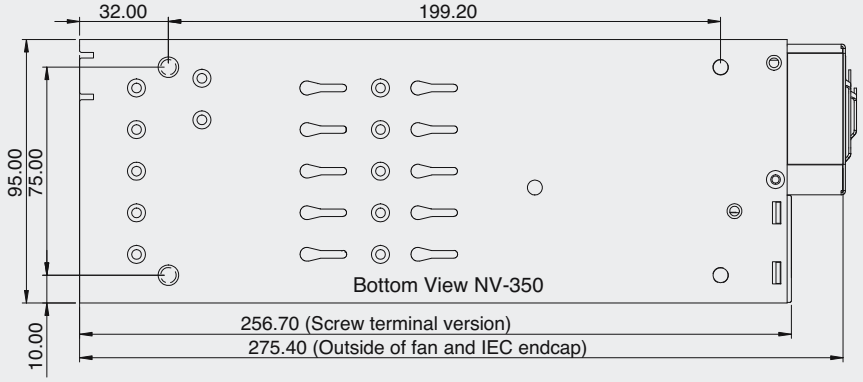
Connection Guidelines

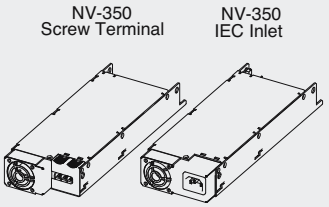
Ring Tags: Up to 50A, AMP PIDG terminals
Red: M3 36151, M4 320551, M5 130660
Blue: M3 320561, M4 320560, M5 130663
Yellow: M3 M4 320568, M5 130167
Crimp tool: 16900 Die set 169404

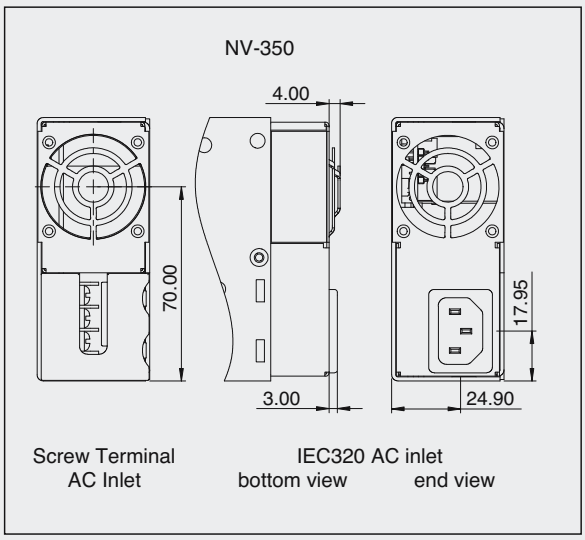
Outline & Connection Drawings

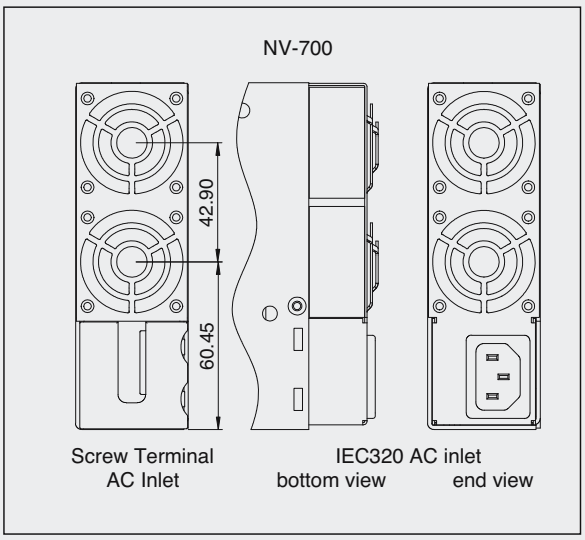


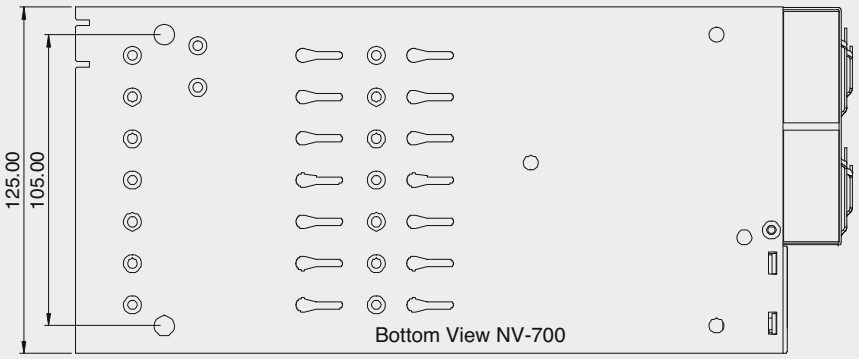
NOTES
1) Dimensions in mm
2) Tolerances:
Edge to edge/Edge to centre, +/-0.5
Centre to centre +/-0.2

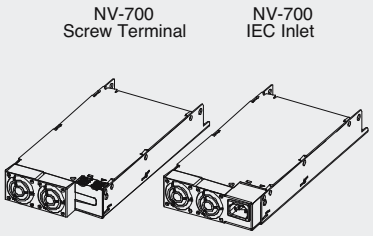












VEGA Lite

550 … 750 W

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[1, 2]

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

		Channel 1					
	Output voltage	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)

Module	Adjustment range (Volts)	Amps	Slots
C1S	1.8 – 3.4	35	1
D1LS	1.8 – 3.4	50	1.5
E1S	1.8 – 3.4	60	2
L1S	4.2 – 5.1	35	1
D2S	3.8 – 7.5	45	1.5
D1HS	3.9 – 5.1	50	1.5
E2S	3.8 – 7.5	60	2
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
D5S	21 – 28	15	1.5
E5HS	24 – 28	25	2
HH5/4S	32.5 – 48	4.5	1
BB4S	32.6 – 40	10	2
C5B4S	43 – 49	10	2
DD5S	42 – 56	15	3

Twin Output Modules

Module	V1 Adjustment range (Volts)	Amps	V2 Adjustment range (Volts)	Amps	Slots
H1H/1LS	3.9 – 5.1	12	1.8 – 3.8	8	1
H1H/3S	3.9 – 5.1	12	9.1 – 16.2	6	1
H3/1HS	9.1 – 15.5	10	3.9 – 5.5	8	1
H3/3S	9.1 – 15.5	10	9.1 – 16.2	6	1
H5/1HS	16.2 – 28	5	3.9 – 5.5	8	1
H5/3S	16.2 – 28	5	9.1 – 16.2	6	1
H5/4S	16.2 – 28	5	16.3 – 24	4.5	1

Options – Single Output Modules*	
N	Output Inhibit, Module Good Current Sharing

Options – Twin Output Modules*	
N	Output Inhibit, Module Good, Remote Sense
R	Remote Sense Only

* see configuring guide

Isolation/Insulation

Isolation	Insulation	
Input to output	reinforced	4.3 kV DC
Input to earth	basic	2.3 kV DC

Isolation	Insulation	
Output to earth	operational	200 V DC
Output to output	operational	200 V DC

Environment

Temperature	0 to 65 °C operational, –25 °C to 85 °C storage (max. 12 months)
Derating	50 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 514.4, Pro I, Cat 1, 9
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 516.5, Pro I, IV, VI
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
EN60950-1	2006	
UL60950-1	2003	
CSA22.2 No 60950-1	2003	
IEC60950-1*	2005	
EN61010-1	2001	

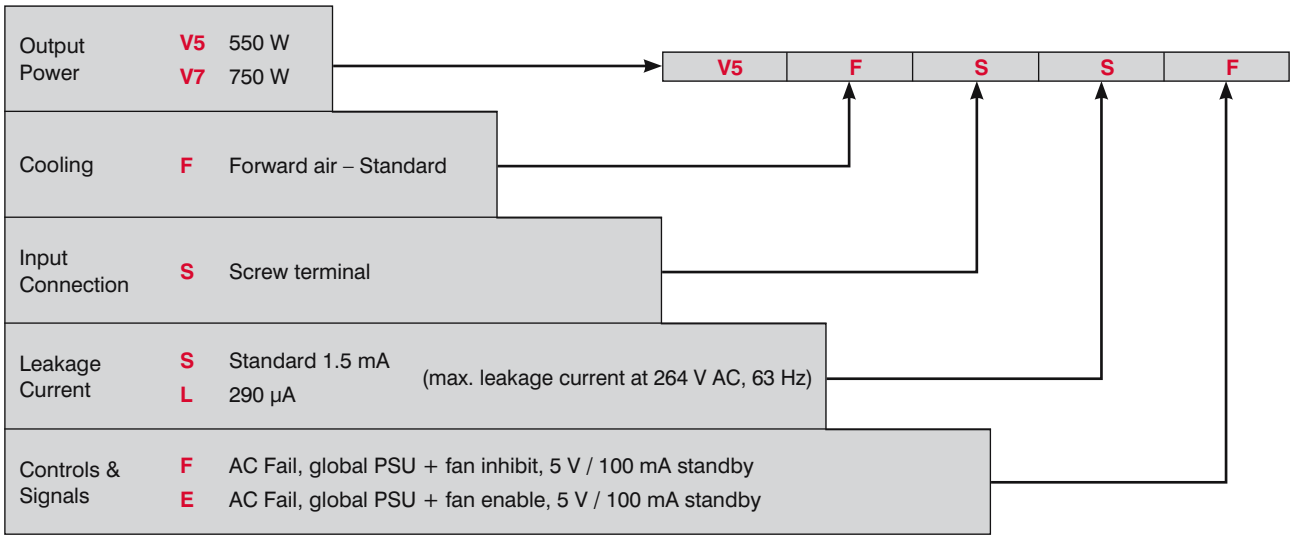
	Date	Amendments
IEC61010-1*	2001	Second Edition
IEC60601-1*	1988	A1, A2
EN60601-1[1]	1990	A1, A2, A13
UL60601-1[1]	2003	with revisions 2006
CE Mark	LV Directive 2006/95/EC (EN60950-1)	

* 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

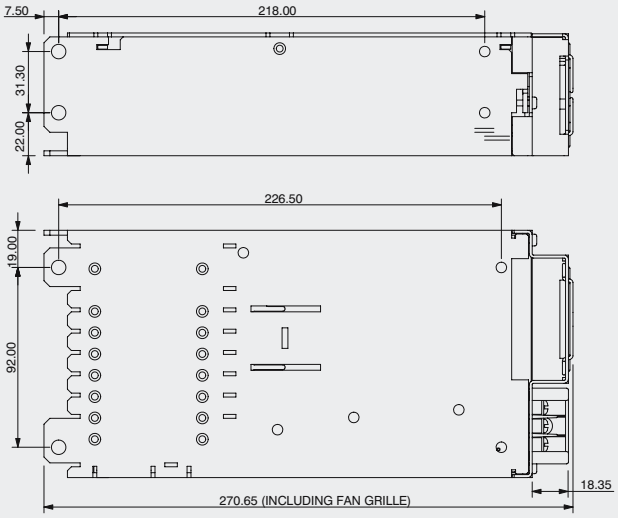
Ensure you do not select more than a total of 5 slots width of module.
This will create a complete product description eg:

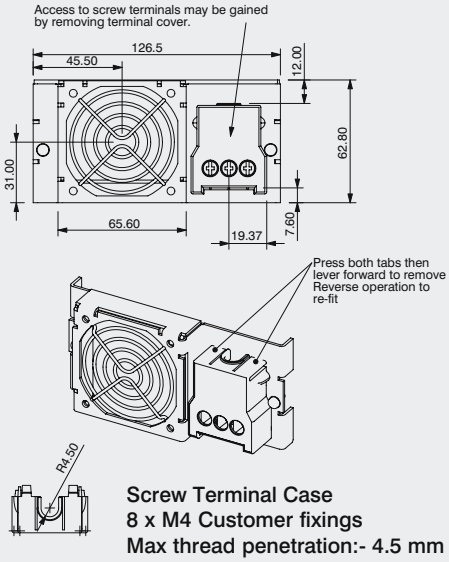
V5FSSF 5L1S 12/12H3/3S 24C5S which represents a four output 550 W VEGA with Forward air, Screw input terminals, 1.5 mA Earth Leakage, AC Fail, Global Inhibit & 5 V / 100 mA aux supply.

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

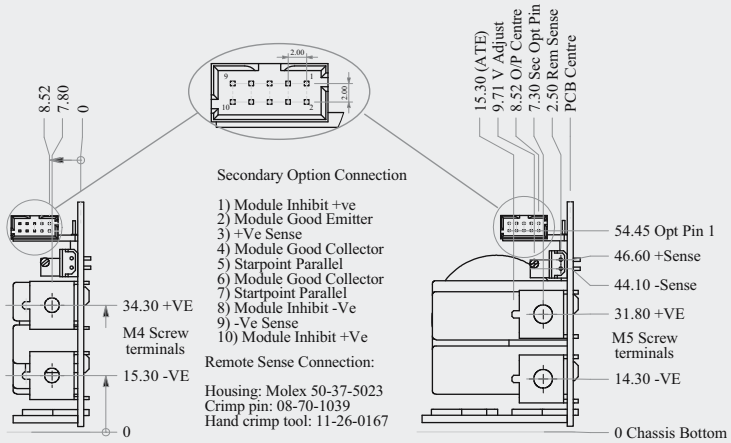
3. **Contact TDK-Lambda to validate configuration and issue a part number.**

Outline & Connection Drawings





Screw Terminal Case
8 x M4 Customer fixings
Max thread penetration:- 4.5 mm

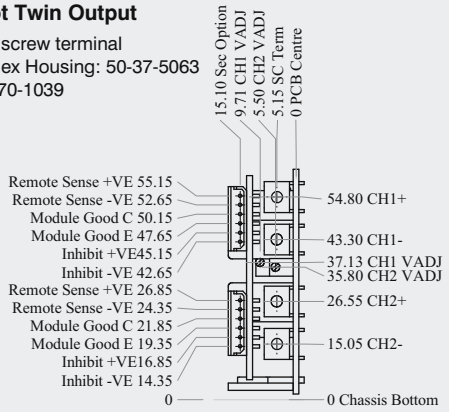


Dual Slot Single Output

Single Slot Single Output

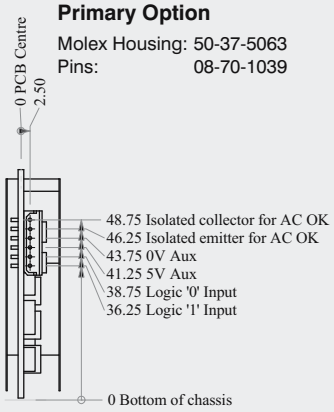
Single Slot Twin Output

Module: M3 screw terminal
Option: Molex Housing: 50-37-5063
Pins: 08-70-1039



Primary Option

Molex Housing: 50-37-5063
Pins: 08-70-1039



Highlights

- Industry leading power density
- 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	of set voltage for 50 % load change (above 25 % load)
	500 µs	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[1,2]

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

* see configuring guide

Isolation/Insulation

Isolation	Insulation	
Input to output	reinforced	4.3 kV DC
Input to earth	basic	2.3 kV DC

Isolation	Insulation	
Output to earth	operational	200 V DC
Output to output	operational	200 V DC

Environment

Temperature	0 to 65 °C operational, –25 °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 514.4, Pro I, Cat 1, 9
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 516.5, Pro I, IV, VI
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 EN61000-6-1: 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
EN60950-1	2006	
UL60950-1	2003	
CSA22.2 No 60950-1	2003	
IEC60950-1*	2005	
EN61010-1	2001	

	Date	Amendments
IEC61010-1*	2001	Second Edition
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EN60601-1[1]	1990	A1, A2, A13
UL60601-1[1]	2003	with revisions 2006
CE Mark	LV Directive 2006/95/EC (EN60950-1)	

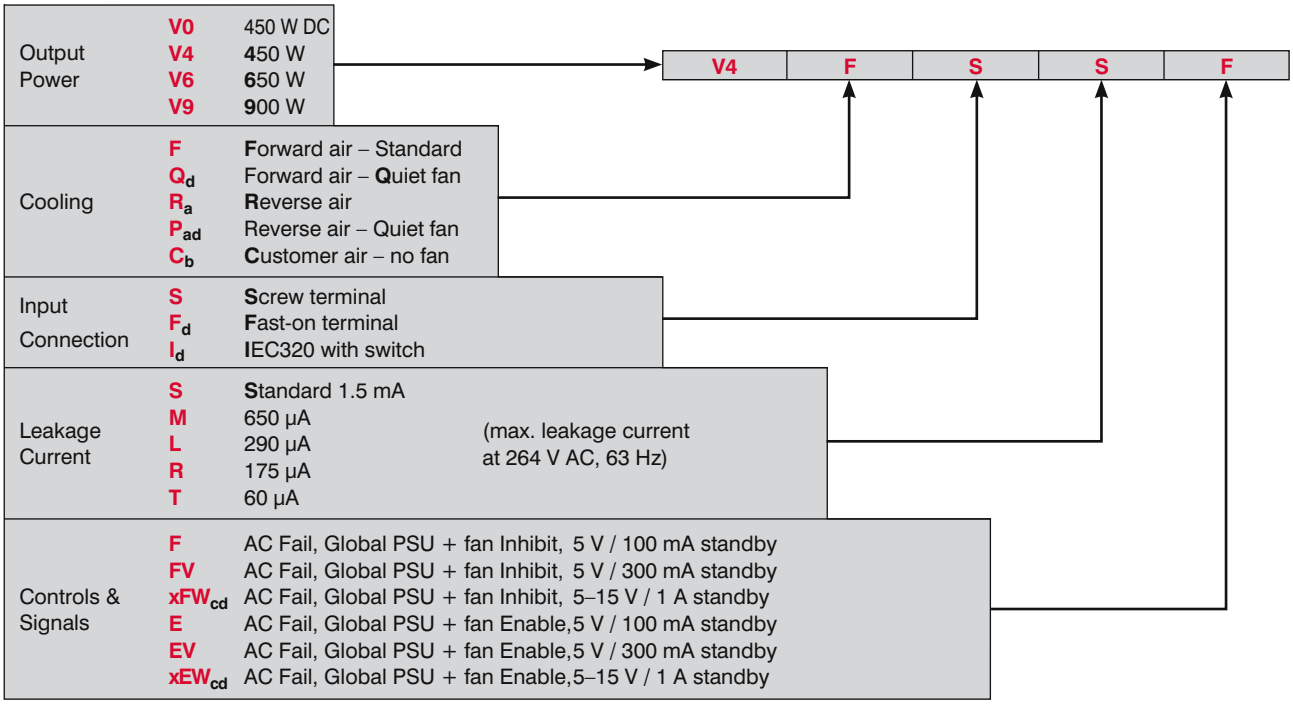
* CB certificate and report available on request.
Check with Technical Sales for status of approvals.

1 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

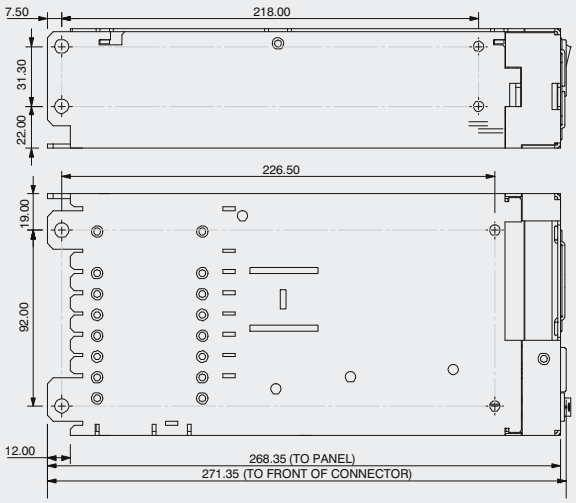
1. Calculate total output power to determine VEGA 450 W, 650 W or 900 W and select converter, then select required Cooling, Connection, Leakage Current and Controls / Signals from the table above.
2. Select Output Modules and Options from the Output Voltages tables.
   Example – if you require 5.2 V / 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 5.2B1H**S**)
   c) add suffix N for output inhibit (eg 5.2B1HS**N**)
   d) repeat for other outputs

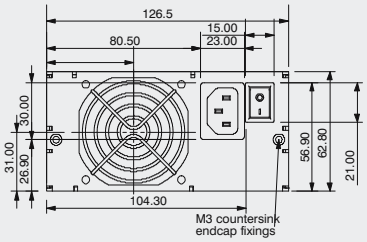
Ensure you do not select more than a total of 5 slots width of module. This will create a complete product description eg:

V6FSSF 5L1S 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.

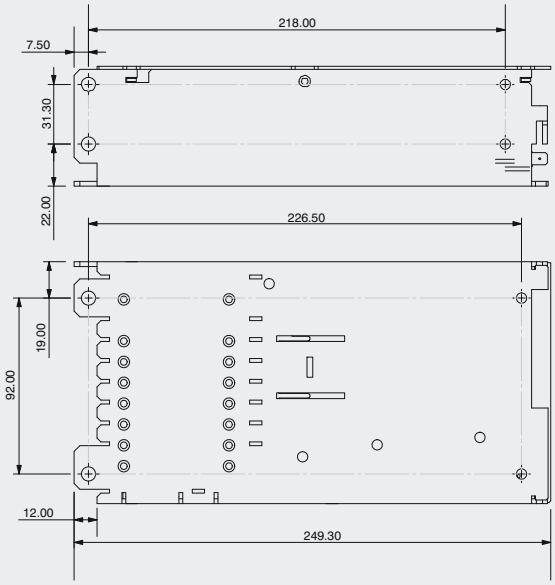
Outline & Connection Drawings

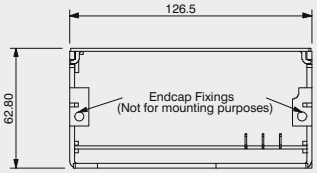




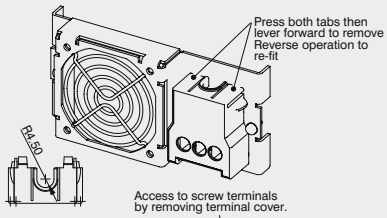
IEC-320 Connector Case

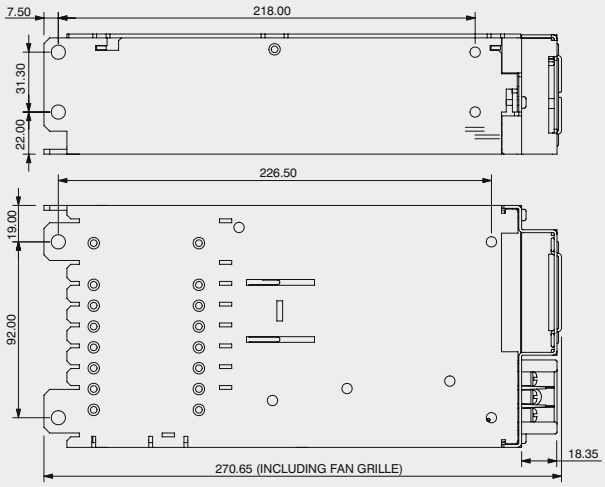
All versions have:
8 x M4 Customer fixings
Max thread penetration: 4.5 mm

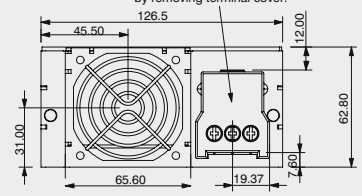




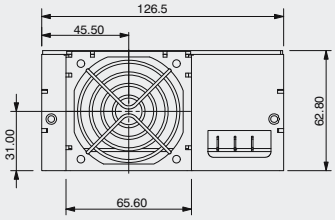
Customer Air Case (no fan)







Screw & Fast-on Terminal Case



ALPHA

1000 … 1500 W

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 – Forward converter	 100 kHz 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 Input-ground Output-ground	 3 kV RMS 1.5 kV RMS 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	Output N° 1		Output N° 2		Output N° 3		Output N° 4		Modules
	Watts	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.

Module Type	A	B	C	D	E		F	G	H		J
No. of slots	2	1	1	1	1		2	2	1		2
Output voltage (pre-set)	5 V	5 V	12 V	24 V	12 V	12 V	12 V	24 V	24 V	24 V	36 V
Adjustment range	4.5–5.5 V	4.5–5.5 V	5–16 V	18–29 V	5–16 V	5–16 V	9–15.5 V	17.5–29 V	18–32 V	18–32 V	30–48 V
Output current	60 A	25 A	16 A–12 V 12 A–15 V	8 A	8 A	8 A	33 A	25 A	5 A 1A->29 V	5 A 1A->29 V	10 A[1]

Module Type	K	L	M	N	P		Q	R	S	T
No. of slots	2	1	1	1	1		1	2	2	2
Output voltage (pre-set)	24 V	2 V	12 V	24 V	12 V	24 V	3.3 V	3.3 V	5 V	2 V
Adjustment range	18–29 V	1.8–2.7 V	5–16 V	18–32 V	5–16 V	18–29 V	2.7–3.9 V	2.7–3.9 V	2.5–5.7 V	1.8–2.4 V
Output current	15 A	25 A	8 A	5 A 1 A->29 V	8 A	5 A	25 A	60 A	85 A	60 A

* Remote sense not available on twin output modules (E, H and P).
Note: 1. Derate 0.25 V / A above 40 V.

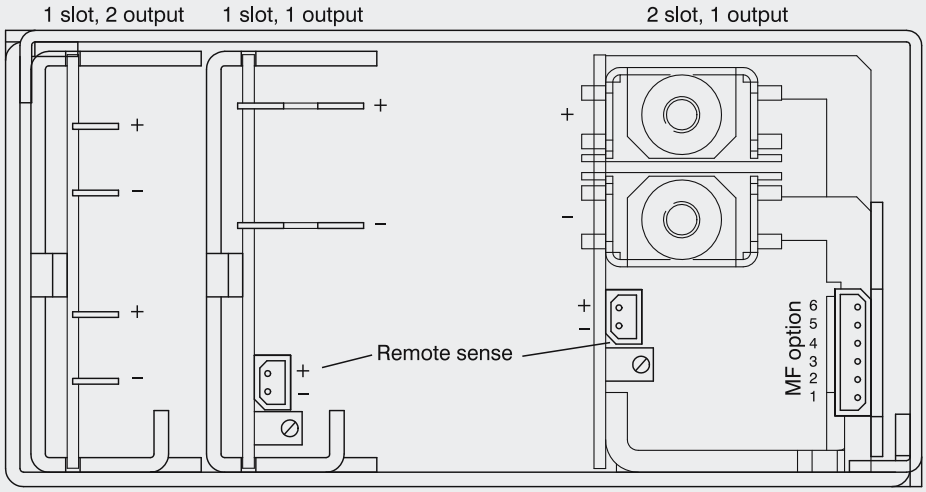
Options

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

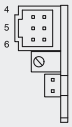
Low Leakage filter options
ML: 500 µA
LL: 240 µA
RL: 100 µA
TL: 50 µA

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)

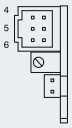
MF option connector



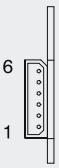
IN option
PIN 1: Not connected
PIN 2: Module Good
PIN 3: Inhibit
PIN 4: Not connected
PIN 5: – Power
PIN 6: – Power



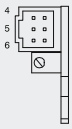
PA option
PIN 1: + Sense
PIN 2: Module good
PIN 3: Star point
PIN 4: – Sense
PIN 5: – Power
PIN 6: Star point



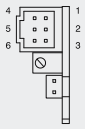
PIN 6: Not connected
PIN 5: Inhibit (high)
PIN 4: 0 V
PIN 3: Power Fail
PIN 2: 5 V supply
PIN 1: Inhibit (low)



PP option
PIN 1: + Sense
PIN 2: Not connected
PIN 3: Not connected
PIN 4: – Sense
PIN 5: Not connected
PIN 6: Not connected

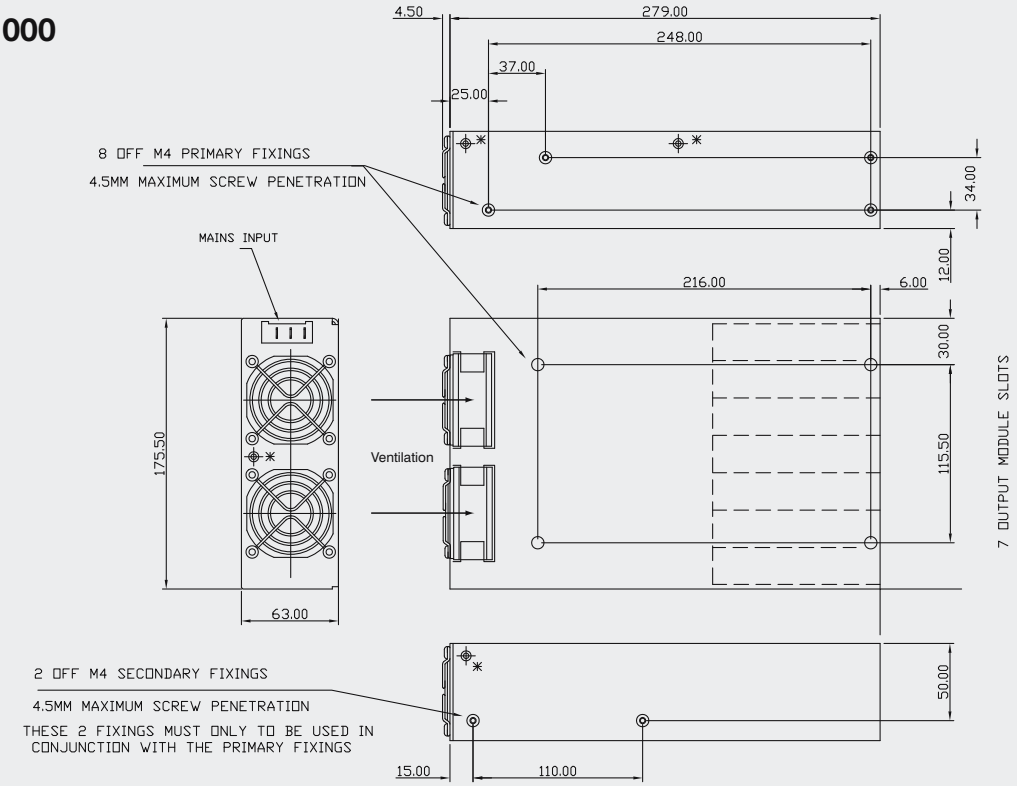


RP option
PIN 1: + Sense
PIN 2: – Sense
PIN 3: Control 2
PIN 4: Not connected
PIN 5: Control 1
PIN 6: Not connected

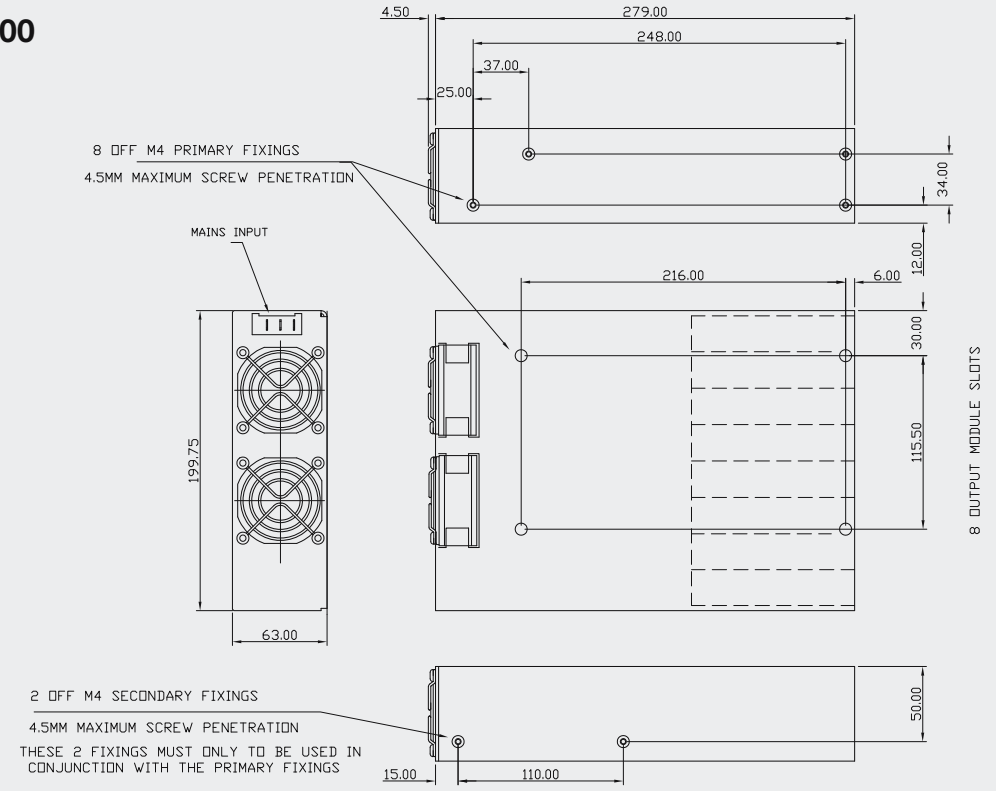


Outline & Connection Drawings

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 documentations.

www.emea.tdk-lambda.com

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