AFR500U Series

FiDUS
power in motion...

500 Watts

- 500W 30CFM / 450W conduction / 330W convection
- Latest approvals IEC 62368-1
- High efficiency up to 92%
- Operation from –30 to 80°C
- 5V / 1A Stand by
- 5 Year warranty

The AFR500U series of power dense, conduction cooled, open frame AC-DC power modules offer 500W and 450W fan and conduction cooled respectively in a 3.25 x 5.11" package. They have excellent efficiency up to 92%, remote on off, 5V / 1A stand by, DC OK, remote sense, a wide operating temperature of –30 to 80°C and are available in output models 12, 24 & 48V. All come with a FiDUS 5 year warranty.

Dimensions:

3.25 x 5.11 x 1.6" (82.55 x 129.79 x 40.64mm)

Models & Ratings

INSTALLATION ADVICE PG5

Model Number[1]	Output voltage	Output Current					Efficiency[2]	Capacitive load
		Convection		Conduction		30CFM fan 100-264VAC		
		100VAC[1]	230VAC	100VAC[1]	230VAC			
AFR50012S-U	12V	20.83A	27.50A	33.3A	37.50A	41.50A	90.5%	5000uF
AFR50024S-U	24V	10.42A	13.75A	16.60A	18.75A	20.80A	91%	2500uF
AFR50048S-U	48V	5.21A	6.87A	8.33A	9.37A	10.41A	92%	1250uF

Notes

1. See page 3 for further detail on AC derating
2. At 230VAC max load

Key specifications

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
AC Input range	90		264	VAC	See derating curve page 3
Operating temperature	-30		80	°C	See derating curve page 3
Efficiency	See ratings table above				
Dimensions	3.25 x 5.11 x 1.6" (82.55 x 129.79 x 40.64mm)				
EMC	EN55032 Level B conducted and radiated EN61000-3 and EN61000-4, harmonics, flicker, Surge, EFT, ESD, conducted and radiated (EN55035)				
Safety	IEC/EN/UL 62368-1, UL 60950				

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Input

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Input voltage	90		264	VAC	See deraing curve page 3
Input frequency	47		63	Hz	
Power factor	0.94				EN61000-3-2 class A compliant
Input current (rms)			6.3	A	At 115VAC
			3.15		At 230VAC
Inrush current			40	A	115VAC cold start at 25°C
			80		230VAC cold start at 25°C
No load input power	0.75	2-3	4	W	0.75W when inhibited, 2-3W without fan and 4W with fan

Output

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Output voltage	12		48	VDC	See Model & Ratings table
Output Voltage Adjust		±5		%	
Set point accuracy			±2	%	
Line regulation			±1	%	
Load regulation			±1	%	10% to 100%
Minimum load	1			%	
Ripple & Noise	1		1.3	%	All models measured with 0.1uF ceramic and 47uF electrolytic capacitor. 20 MHz bandwidth. At rated line. 1.3% for 12V only
Hold up time	8			ms	At 115VAC to 90% Vout
Overload protection					Trip and restart. Automatic recovery
Short circuit protection					Trip and restart. Automatic recovery. High current latch.
Overvoltage protection					Trip and restart. Automatic recovery

General

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Isolation: Input to output	4000			VAC	Or 5656VDC –test with DC only or remove Y caps
Input to ground	2000			VAC	Or 2828VDC–test with DC only or remove Y caps
Output to ground	1500			VAC	Or 2121VDC–test with DC only or remove Y caps
Power density			18.81	W/In^3	
MTBF	160			kHrs	As per MIL-HDBK-217F
Weight		605		g	

Environmental

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating temperature	-30		80	°C	See deraing curve page 3
Storage temperature	-30		85	°C	
Temperature coefficient	±0.03		±0.06	%/°C	±0.06 –30 to 0°C, ±0.03 from 0-50°C
Altitude			5000	m	
Humidity			95	% RH	Non condensing
Vibration & Shock	IEC 60068-2-6 (2G 10-500MHz x,y,z) and IEC 60068-2-27				

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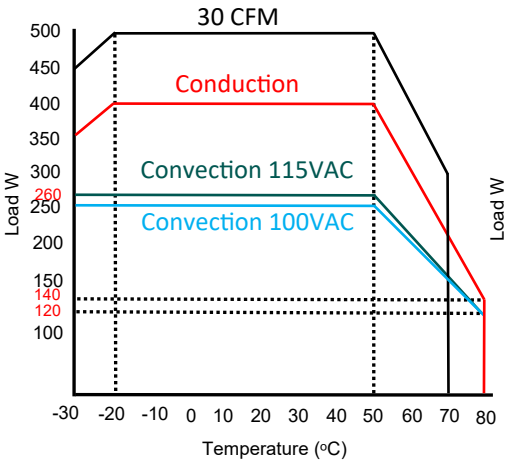
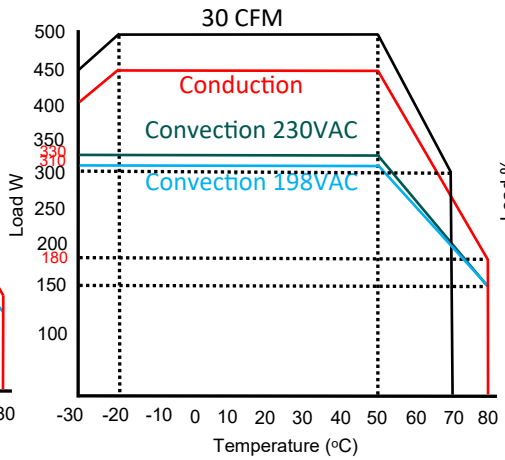
Thermal Derating Curve

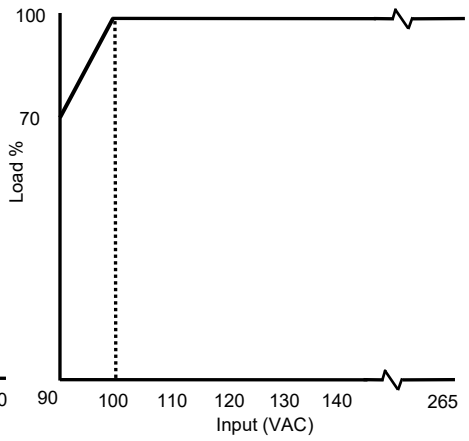
100-197VAC



198-264VAC



AC Input Derating Curve



EMC: Emissions

	Standard	Test level	Criteria	Notes & Conditions
Conducted	EN55032	B		
Radiated	EN55032	A		
Harmonic current	EN61000-3-2	Class A		
Voltage flicker	EN61000-3-3			

EMC: Immunity

	Standard	Test level	Criteria	Notes & Conditions
ESD	EN61000-4-2	3	A	8KV Air, 4KV contact
Radiated	EN61000-4-3	2	A	3V/m
EFT	EN61000-4-4	3	A	2KV
Surges	EN61000-4-5	Installation Class 3	A	1KV Live-Neutral, 2KV Live/Neutral—Earth
Conducted	EN61000-4-6	2	A	3Vrms.
Magnetic Fields	EN61000-4-8	4	A	30A/m
Voltage Dips and Interruptions	EN61000-4-11	>95% 0.5 cycles, 30% 25 cycles, >95% 250 cycles: 110V: A,B,B 240V:A,A,B		

Safety Approvals

	Safety standard	Notes & Conditions
UL/CSA	UL/CSA 62368-1, UL 60950	
CB	IEC 62368-1	
CE	EN 62368-1	2015/863/EU RoHS Directive and 2014/35/EU Low voltage directive
Equipment protection class		Class I

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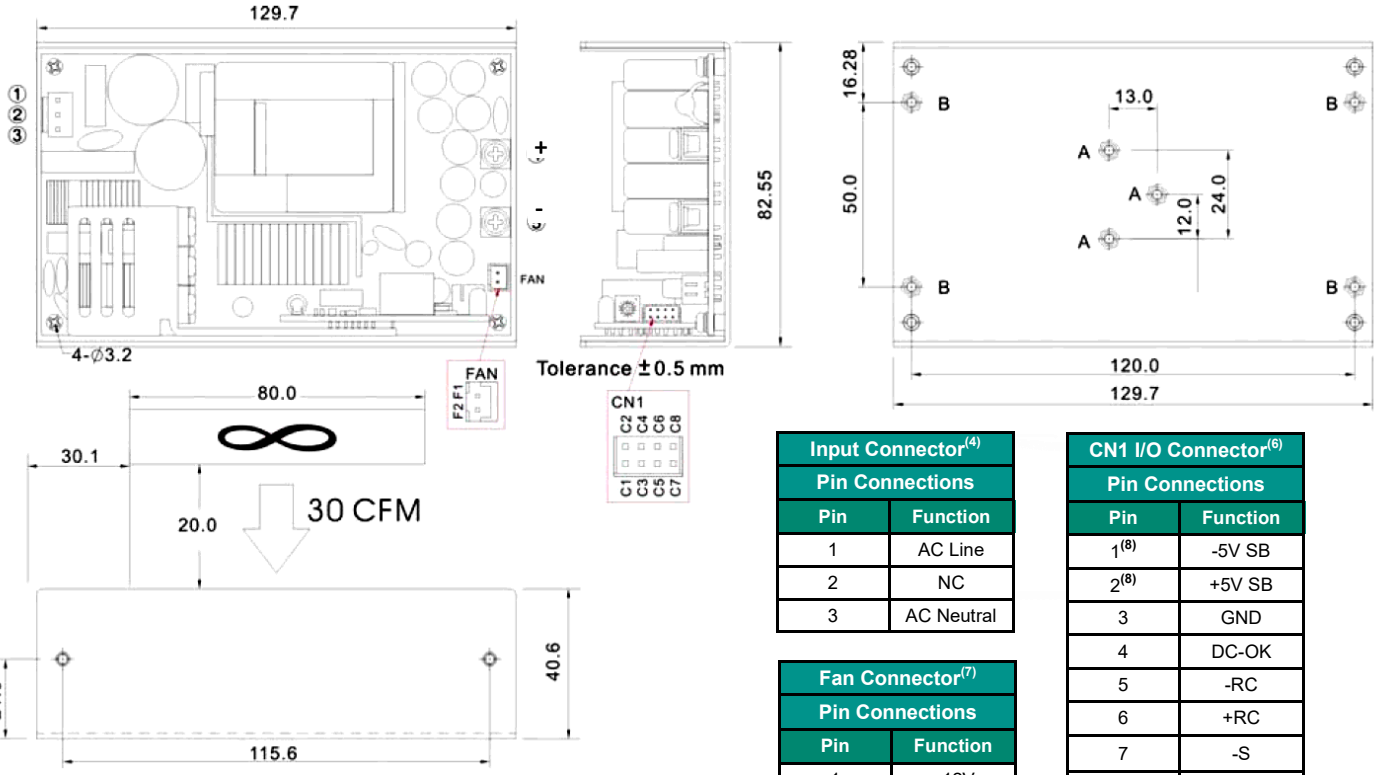
Mechanical Details



Input Connector[4]	
Pin Connections	
Pin	Function
1	AC Line
2	NC
3	AC Neutral

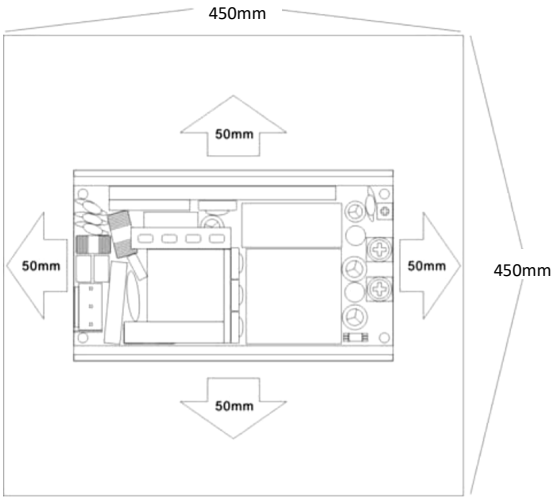
Fan Connector[7]	
Pin Connections	
Pin	Function
1	+12V
2	GND

CN1 I/O Connector[6]	
Pin Connections	
Pin	Function
1[8]	-5V SB
2[8]	+5V SB
3	GND
4	DC-OK
5	-RC
6	+RC
7	-S
8	+S

Notes

1. All dimensions shown in mm
2. A fixtures M3(0.5) x 4mm din clip only
3. B fixtures M3(0.5) x 4mm chassis mount use no more than 2.5mm
4. Input connector JST B3P-VH mates with VHR-3N
5. Output connector M3.5 pan head (torque to 90cNm) or JST B6P-VH Mates with VHR-6N
6. I/O connector mates with JST PHDR-08VS
7. Fan connector mates with JST XHP-2
8. 5V stand by 1A blown 0.4A natural convection

Base Plate

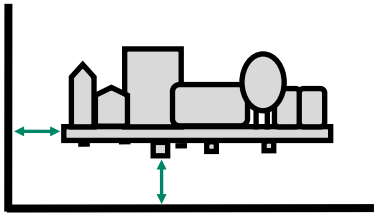


Notes

Size of aluminium base plate required for best thermal performance. Base plate is 3mm thick and the AFR500U is thermally bonded using paste or thermal pad to ensure good and even thermal conductivity

Installation Advice

Safety

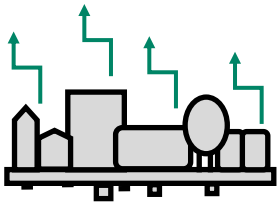


On installation customers must consider the required creepage and clearance distances between the PSU and the end-equipment enclosure. These distances vary depending on the installation class and safety standard requirements.

For **Class I** installations there should be 3-4mm between any part of the PSU and any earthed metal part of the enclosure. 3mm is acceptable for IT applications, 4mm required for medical applications. In Class I installations the PSU earth point must be connected to system safety ground.
For **Class II** installations distances may need to be increased if being installed into a surrounding metal enclosure.
Ensure consideration of components on the underside of the PCB or low lying spills when measuring clearance distances between the PSU and the end-equipment. Also top surface especially in tight enclosures such as 1U boxes. An insulation material can be used between PSU and metal if smaller gap required.

FiDUS recommends installing the PSU on 6mm stand offs typically, but check the distances.

EMC

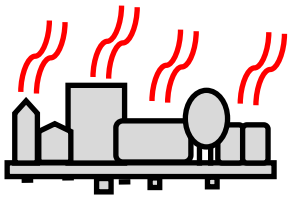


Conducted and radiated emissions compliance is a common application consideration. It is important to remember that even when using a properly filtered PSU, an application may still not achieve compliance if it is not designed to minimise emissions. That being said, there are a number of things that can be done to optimise EMC performance either as best practice, or if you are struggling for compliance:

1) Connect all marked EMI ground points to earth. Often these are combined with the safety earth point (in class I installations), but on some power supplies there may be additional earth tags or mounting points.
2) Minimise the length of input/output wiring where possible and try to maintain max distance of the conductors from the PSU, to prevent noise pick up. Avoid bundling input and output cables together. A common component to avoid placing wiring near is the PFC inductor in power factor corrected power supplies.
3) Apply additional filtering before the PSU input (ensure consideration of which frequencies there are issues with before selecting a filter).
4) When using an open frame PSU, mount the supply on a metal plate and connect EMI mounting points.
5) In multi circuit systems, decouple the circuits locally.
6) Ferrites added between the PSU and system input connector and/or the DC output cables can help in reducing radiated noise issues in systems. If seen, issues are commonly in the 30-150MHz area.

For more detailed assistance, if you still have any concerns with compliance, please get in contact with our Engineering department who are on hand to assist with any queries.

Thermal



Thermal management is an important consideration when thinking about equipment service life. Electrolytic capacitors within the PSU wear with time and are typically the first end-of-life failure. Keeping the operation temperature of key components within the PSU, such as the electrolytic capacitors, as low as possible is paramount. As a general rule, for every 10°C drop in the operating temperature of the electrolytic capacitators you double their lifetime, and thus the lifetime of the power supply. When looking at thermal performance it is helpful to test under a worst-case set of conditions, to ensure component temperatures are in an acceptable range for the required service life. Then consider the impact of operational time, load and temperature profile to estimate a more realistic lifetime for your PSU.

Also, many FiDUS power supplies offer a *Peak Power* rating to provide for customers with pulsing loads. When using a peak power capability customers must consider:
1) Peak duration rating: the maximum length of time the peak can be drawn for
2) Duty cycle: the frequency with which the peak can be drawn. (e.g. 10% duty cycle, 1 second on:9 seconds off)
3) Average power value: datasheets will state the maximum average power acceptable with peak power PSUs.
If any of these elements are exceeded the supply may overheat, with performance and lifetime suffering as a result.