VKR400 Series

FiDUS
power in motion...

400 Watts

- Very high power density 4 x 6”
- 300W Convection / 400W Fan cooled
- 480W Peak power for 5 seconds
- IT & medical (BF) safety approvals
- Open frame, U-channel & Covered versions
- EN55022 Level B conducted & radiated
- 10 Year warranty

The VKR400 series of compact open frame AC-DC PSUs provide 400W (300W convection) from a 4” x 6” package. The range is approved for use in both IT and medical applications and is available with either a 12 or 24V output. In addition to the rated output, the VKR400 offers a 480W peak for up to 5 seconds. Optional U-channel and covered versions are available, all with a FiDUS 10 year warranty.

Dimensions:
Open Frame: 4 x 6 x 1.38” (101.6 x 152.4 x 35mm)
Covered (-C): 4.4 x 6 x 1.72” (110 x 153 x 43.5mm)
U-Channel (-U): 4.4 x 6 x 1.72” (110 x 153 x 43.5mm)

Models & Ratings

INSTALLATION ADVICE PG5

Model Number	Output Power	Output voltage	Output Current			Fan output	Efficiency[5]
			Forced Air[3]	Convection	Peak[4]		
VKR40012	400W	12V	33.3A	25A	40A	12V/0.3A	93%
VKR40024	400W	24V	16.7A	12.5A	20A	24V/0.1A	94%
VKR40012-C[1]	400W	12V	33.3A	25A	40A	12V/0.3A	93%
VKR40024-C[1]	400W	24V	16.7A	12.5A	20A	24V/0.1A	94%

Notes

1. Suffix ‘-C’ added for covered version
2. Add suffix ‘-U’ for U-channel version
3. Requires 33 CFM
4. 5 seconds, duty cycle <10%, average power to not exceed 300W
5. At 100% load
6. Screw terminal input/output connectors available on request
7. Loom kits available, see ‘Installation Advice’ on page 5

Key specifications

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
AC Input range	90		264	VAC	No derating
Operating temperature	-30		70	°C	Derate linearly from 100% power at 50°C to 50% power at 70°C. See derating curve
Efficiency	93		94	%	20%/50%/100% load average <87.5%
Dimensions	4 x 6 x 1.38” (101.6 x 152.4 x 35.0mm)				
EMC	EN55022 Level B conducted and radiated. EN61000-3 and EN61000-4, harmonics, flicker, Surge, EFT, ESD, conducted and radiated.				
Safety	IEC 60601-1:3.1 edition, ANSI/AAMI/CSA 60601-1: 3rd edition, EN60601-1: 3.1 edition. IEC 60950-1: 2nd edition, UL/CSA 60950-1: 2nd edition, EN60950-1: 2nd edition				

Input

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Input voltage	90		264	VAC	No derating
Input frequency	47		63	Hz	
Power factor	0.93				EN61000-3-2 class A compliant
Input current		3/6		A	3A at 230VAC, 6A at 115VAC
Inrush current		<30/60		A	115/230 VAC cold start at 25°C
Earth leakage current			<300	uA	
Touch current			<100	uA	

Output

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Output voltage	12		24	VDC	See Model & Ratings table
Set point accuracy			±0.8	%	12V output
			±0.4		24V output
Line regulation			±0.5	%	
Load regulation			±1	%	
Minimum load	0			%	
Transient response			4	%	Recovery within 1% within 500 µs for 25% step
Ripple & Noise	12V: <100, 24V: <200			mV pk-pk	15MHz band. 0.1uF + 47uF capacitor on output
Hold up time		>16		mS	At rated load and 115VAC
Overload / Short circuit protection					Trip & restart. Automatic recovery
Overvoltage protection					Latch off. AC reset required,

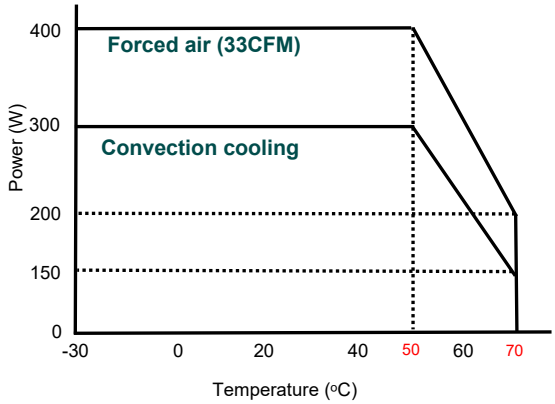
General

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency	93		94	%	See models & Ratings table
Isolation: Input to Output	4000			VAC	
Input to Ground	1500			VAC	
Output to Ground	1500			VAC	
Power density			12.1	W/In^3	
MTBF	200			Khrs	SR-332, rated load, 50°C
Weight		515		g	

Environmental

Parameter	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating temperature	-30		70	°C	Derate linearly from 100% power at 50°C to 50% power at 70°C. See derating curve
Storage temperature	-40		85	°C	
Cooling					Fan cooled (requires 33CFM, starts at 30% load) or convection cooled
Temperature coefficient			0.05	%/°C	
Humidity	5		95	%RH	Non-condensing
Operating altitude			5000	M	

Derating curve



EMC: Emissions

	Standard	Test level	Criteria	Notes & Conditions
Conducted	EN55022	B		
Radiated	EN55022	B		
Harmonic current	EN61000-3-2	Class A		Also meets Class D requirements.
Voltage flicker	EN61000-3-3			

EMC: Immunity

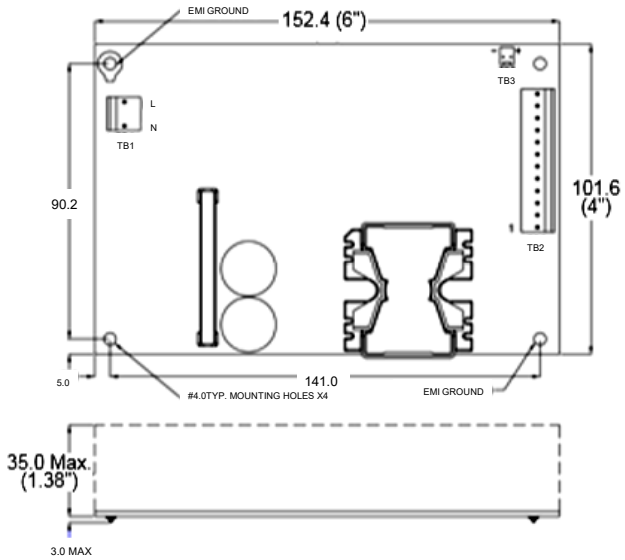
	Standard	Test level	Criteria	Notes & Conditions
ESD	EN61000-4-2	4	A	±8kV contact, ±15kV air
Radiated	EN61000-4-3	3	A	
EFT	EN61000-4-4	3	A	
Surges	EN61000-4-5	Installation Class 3	A	
Conducted	EN61000-4-6	3	A	
Dips and interruptions	EN61000-4-11	Dips: 30% 500ms, 60% 200ms, 100% 10ms, 100% 5000ms, 100% 20ms. Per criteria A,B,A,B,B		

Safety Approvals

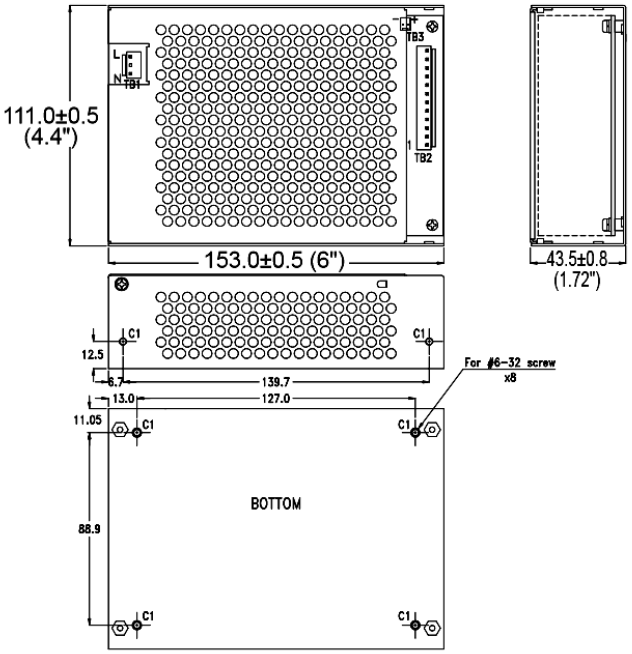
	Safety standard	Notes & Conditions
UL	UL/CSA/ 60950-1: 2nd edition ANSI/AAMI/CSA/ 60601-1: 3.1 edition	
CB	IEC 60950-1: 2nd edition IEC 60601-1: 3.1 edition	
TUV	EN60950-1: 2nd edition EN60601-1: 3.1 edition	
CE		2011/65/EU RoHS Directive and 2014/35/EU Low voltage directive
Means of patient protection	Input to Output: 2 x MOPP Input to Ground: 1 x MOPP Output to Ground: 1 x MOPP	
Equipment protection class		Class II

Mechanical Details

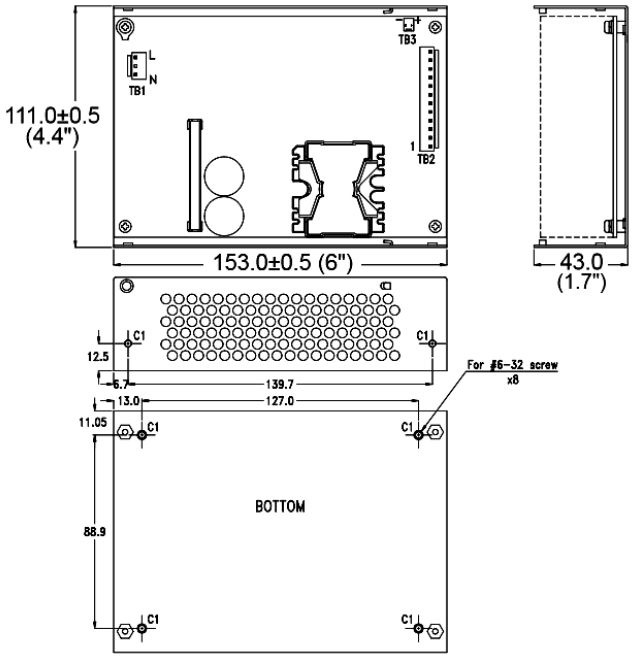
Open Frame



Covered (-C)



U-Channel (-U)



Pin Connections—Input (TB1)[4]	
Pin	**Function**
+	Live
-	Neutral

Pin Connections—Fan Output (TB3)[6]	
Pin	**Function**
+	+12V/24V
-	GND

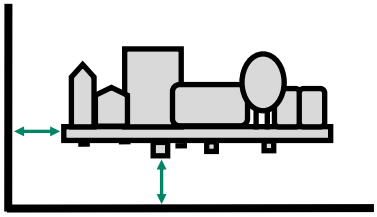
TB2: Pin Connections[5]	
Pin	**Function**
1	GND
2	GND
3	GND
4	GND
5	GND
6	GND
7	Vout
8	Vout
9	Vout
10	Vout
11	Vout
12	Vout

Notes

1. All dimensions in mm (inches)
2. Mounting holes: Open frame: 90.2 x 141mm
-U/-C: 12.5 x 139.7mm (Side edge), 88.9 x 127mm (Bottom)
3. Recommended: if available, connect PSU to metal sheet beneath the PSU via the EMI ground.
4. TB1: AC input header: Molex 09-65-2029 mates with Molex 09-50-1023
5. TB2: DC output header: 09-65-2128 mates with Molex 09-50-1121
6. TB3 Fan output connector: Molex 5045-02A mates with: Molex 22-01-1022

Installation Advice

Safety

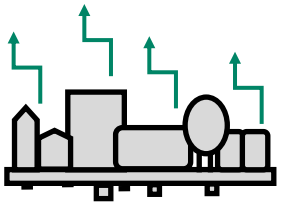


On installation customers must consider the required creepage and clearance distances between the PSU and the end-equipment enclosure. These distances vary depending on the installation class and safety standard requirements.

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

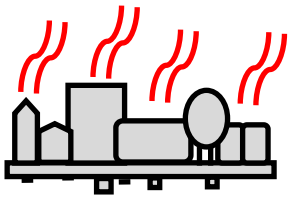


Conducted and radiated emissions compliance is a common application consideration. It is important to remember that even when using a properly filtered PSU, an application may still not achieve compliance if it is not designed to minimise emissions. That being said, there are a number of things that 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.

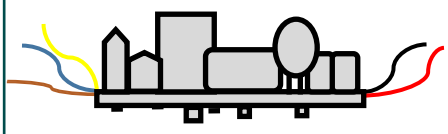
Thermal



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.

Connectivity



All FiDUS Power engineering samples requested will arrive with a free of charge loom kit for ease of testing.

The loom kit connects to the input/output terminals of the PSU and provides the customer with bare wire ends to connect with.

The loom kits can also prove advantageous for ease of installation in production. Please contact sales if you are interested in including the loom kit in your quotation.
Alternatively the input/output connector and mating part details can be found in the attached table.

	Part Number	Mating Part Number
Input	Molex 09-65-2029	Molex 09-50-1023
Output	Molex 09-65-2128	Molex 09-50-1121
Loom Kit	VKR400 LK	