20 W AC-DC Converter PAC20E-Series

PHI-CON

- PCB-mountable plastic case
- Universal input 85..264 V_{AC} or 100..370 V_{DC}
- Continuously short circuit & over current protected
- Low output ripple & noise
- EMI meets EN 55032 Class B
- Output over voltage protection
- Input/output isolation voltage test 4 kV_{AC}
- Safety standard EN 62368-1, CLASS I

Model guide

Type	Output voltage [V_{DC}]	Output current [mA] max.	Output power [W] max.	Efficiency @ full load [%] typ.	Output load capacitance [µF] max.
PAC20E03S	3.3	3500	11.55	73	36000
PAC20E05S	5	3100	15.5	77	12240
PAC20E09S	9	2100	20	79	5600
PAC20E12S	12	1600	20	81	5000
PAC20E15S	15	1300	20	82	3000
PAC20E24S	24	950	20	84	900

Specification

Input		
Voltage range		85 … 264 V_{AC} , 100 …370 V_{DC}
Line frequency range		47…63 Hz
Full load input current		≤ 0.6 A @ 115 V_{AC} ≤ 0.34 A @ 230 V_{AC}
Inrush current		20 A typ. @ 115 V_{AC} 30 A typ. @ 230 V_{AC}
Recommended fuse		2 A / 250 V~, time delayed type
Input to output, test duration 1 minute, ≤5 mA leackage current		4000 V_{AC}
Isolation resistance		10^8 Ω
Output		
Voltage accuracy	PAC20E03S	± 3 %
	All others	± 2 %
Line regulation		± 0.5 %
Load regulation		± 1 %, typ. @ load 0 %...100 %
Minimum load		Not required
Output voltage trim range		≤ ± 10 %
Ripple & noise, BW 20 MHz		≤ 100 mVpp (see Figure 3)
Temperature coefficient		± 0.02 % / °C, typ.
Minimum load		Not required
Hold-up time		15 ms, typ. @ 115 V_{AC}
		80 ms, typ. @ 230 V_{AC}
Protection		
Short circuit		Continuous, hiccup, auto recovery
Over current		≥ 110 %, of rated load
Output over voltage protection (Output voltage clamp or hiccup)	PAC20E03S, PAC20E05S	≤ 7.5 V_{DC}
	PAC20E09S	≤ 15 V_{DC}
	PAC20E12S, PAC20E15S	≤ 20 V_{DC}
	PAC20E24S	≤ 30 V_{DC}
General		
Safety standard		EN-, IEC-, UL 62368-1
Switching frequency		70 kHz, typ.
Reliability calculated MTBF MIL-HDBK-217 @ 25 °C		≥ 300000 h

EMC compliance		
CE	EN 55032, CISPR 32	Class B
RE	EN 55032, CISPR 32	Class B
ESD	EN-, IEC 61000-4-2	air ± 8 kV, contact ± 6 kV, Perf. Criteria B
RS	EN-, IEC 61000-4-3	10 V/m Perf. Criteria A
EFT	EN-, IEC 61000-4-4	± 2 kV Perf. Criteria B (see Figure 1)
		± 4 kV Perf. Criteria B (see Figure 2)
Surge	EN-, IEC 61000-4-5	Line to line ± 1 kV Perf. Crit. B Line to GND ± 2 kV Perf. Crit. B (see Figure 1)
		Line to line ±.2 kV Perf. Crit B Line to GND ± 4 kV Perf. Crit B (see Figure 2)
CS	EN-, IEC 61000-4-6	10 Vrms. Perf. Criteria A
Voltage dips, short interruption and voltage variations	EN-, IEC 61000-4-11	0...70 % Perf. Criteria B
Safety Class		Class II
Environmental		
Operating ambient temperature		-40…85 °C, see derating diagram
Storage temperature		-40…105 °C
Storage humidity		95 %, non condensing
Cooling		Free air convection, ≥ 35 LFM
Physical		
Version mounting on		Dimensions [mm] / Weight [g]
PCB	PAC20ExxS	45 x 62 x 23.5 / 95
Chassis	PAC20ExxSA2	96.1 x 54 x 31 / 145
Din Rail	PAC20ExxSA4	96.1 x 54 x 35.6 / 185
Case material		Black plastic, UL94V-0 rated
Wave soldering temperature		≤ 265 °C, peak duration ≤ 10 s, ≥1.5 mm distance from case
Manual soldering temperature		≤ 370 °C, duration ≤ 5 s, ≥ 1.5 mm distance from case
Hot swap		Not usable

Part number structure

Brand		Type		Output power		Series	Output voltage		Outputs		Mounting	
P	PHI-CON	AC	AC/DC-Converter	20	20 W	E	03	3.3 V	S	single	Blank	PCB
							05	5 V			A2	Chassis
							09	9 V			A4	DIN-Rail
							12	12 V				
							15	15 V				
							24	24V				

Example: PAC20E24S — PHI-CON AC/DC-Converter, Pout 20 W, E-Serie, Vin 85..264 VAC, Vout 24 V, Single Output, for PCB mounting

Note:

1. Unless otherwise specified are all values specified at Ta 25 °C, humidity < 75 % and rated output load current.
2. The outputs of the AC/DC converters are not suitable for parallel operation.

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Figure 1 Typical application circuit

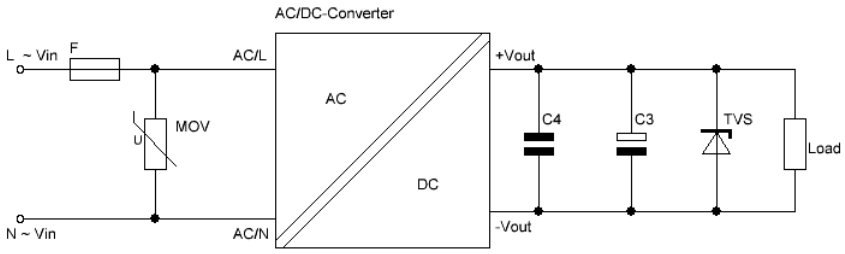
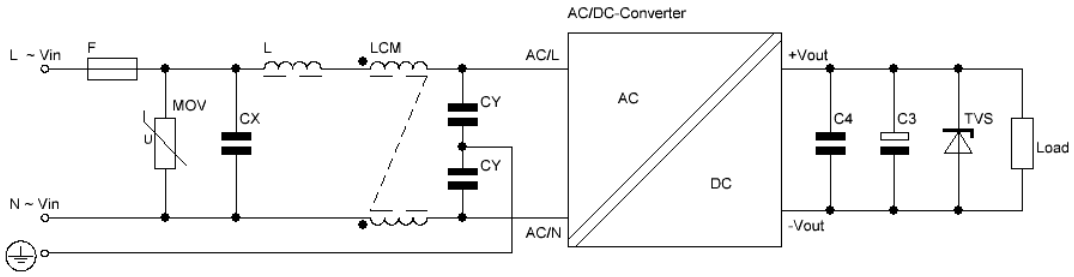


Figure 2 Application circuit and example for ripple and noise reduction under harsh EMC conditions

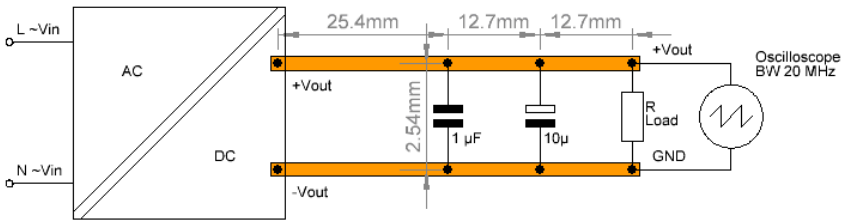


Component list for the typical application circuit Figure 1 & Figure 2									
Type	F (time delayed type)	MOV	CX 250VAC	L 2 A	LCM	CY 400 VAC	C4	C3	TVS
PAC20E03S	2 A, 250 V~	S14K300	0.1 µF	4.7 µH	10 mH	1 nF	1 µF, MLCC	680 µF	SMBJ7.0A
PAC20E05S	2 A, 250 V~	S14K300	0.1 µF	4.7 µH	10 mH	1 nF	1 µF, MLCC	680 µF	SMBJ7.0A
PAC20E09S	2 A, 250 V~	S14K300	0.1 µF	4.7 µH	10 mH	1 nF	1 µF, MLCC	470 µF	SMBJ12A
PAC20E12S	2 A, 250 V~	S14K300	0.1 µF	4.7 µH	10 mH	1 nF	1 µF, MLCC	220 µF	SMBJ20A
PAC20E15S	2 A, 250 V~	S14K300	0.1 µF	4.7 µH	10 mH	1 nF	1 µF, MLCC	220 µF	SMBJ20A
PAC20E24S	2 A, 250 V~	S14K300	0.1 µF	4.7 µH	10 mH	1 nF	1 µF, MLCC	68 µF	SMBJ30A
LCM Recommended common mode inductor: PCM1-103-05 (PHI-CON)									

Note:
1. Output filtering capacitors C2 is a electrolytic capacitor. It is recommended to use high frequency and low impedance electrolytic capacitors. For capacitance and current of capacitor please refer to manufacture's datasheet. Voltage derating of capacitor should be 80 % or above. C1 is ceramic capacitor. It is used to filter high frequency noise. TVS is a recommended component to protect post-circuits in case of a converter failure.

2. For standard EMC requirement, please refer to figure 1. If higher an EMC requirement, please refer to figure 2.

Figure 3 Measure circuit for output ripple and noise (BW 20 MHz)



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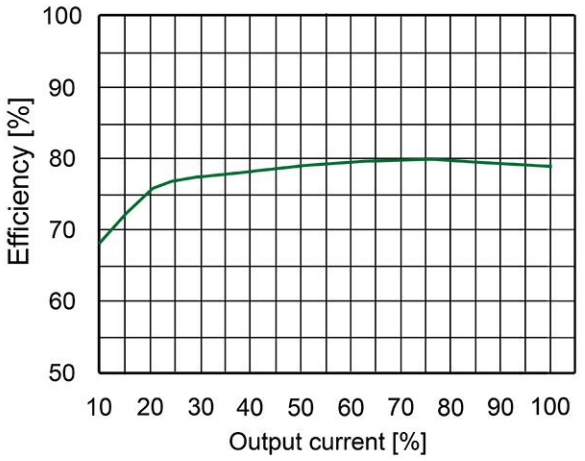
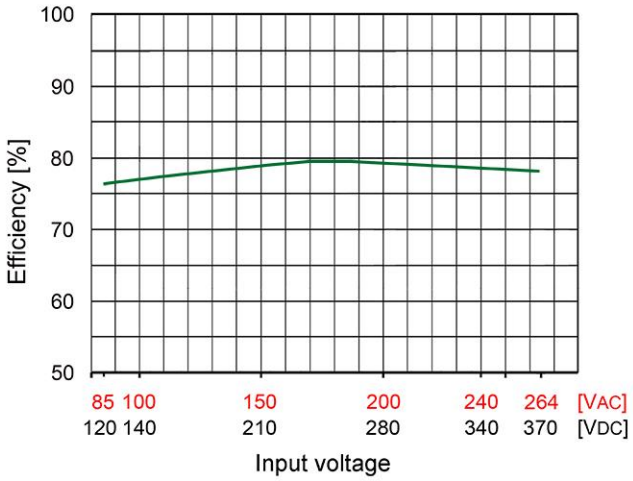
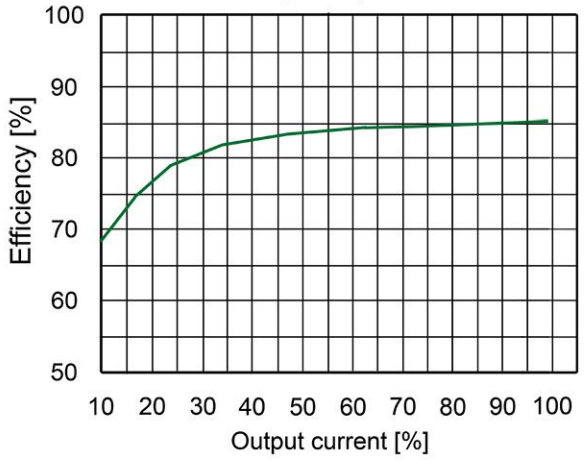
PAC20E05S Efficiency vs output load at Vin 230 VAC



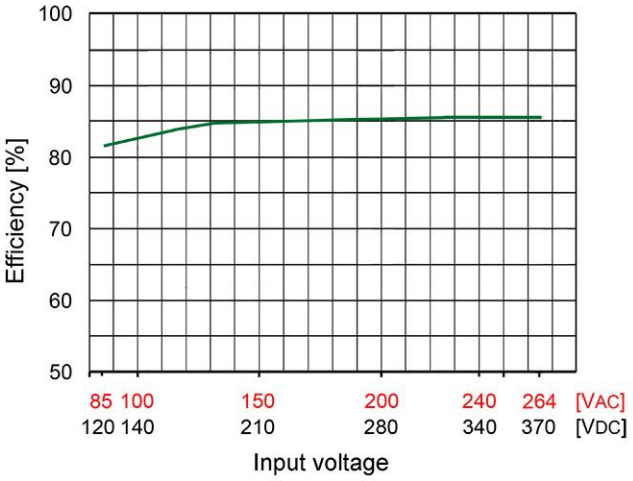
PAC20E05S Efficiency vs input voltage at full load



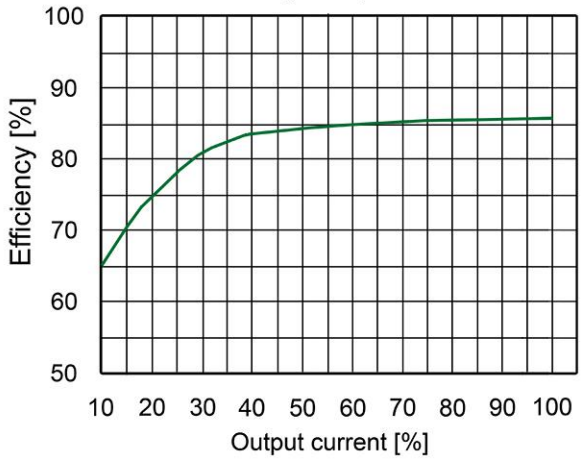
PAC20E12S Efficiency vs output load at Vin 230 VAC



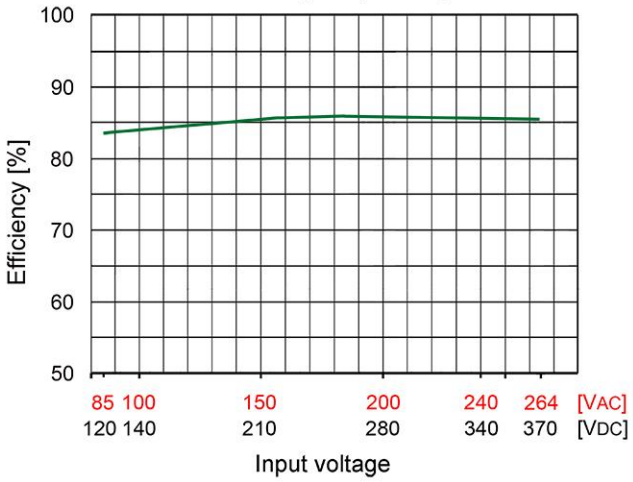
PAC20E12S Efficiency vs input voltage at full load



PAC20E24S Efficiency vs output load at Vin 230 VAC



PAC20E24S Efficiency vs input voltage at full load



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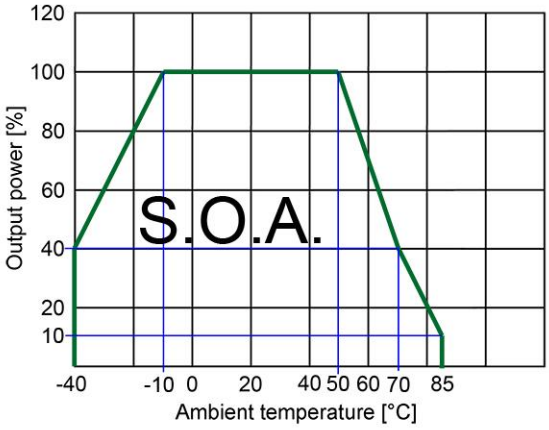
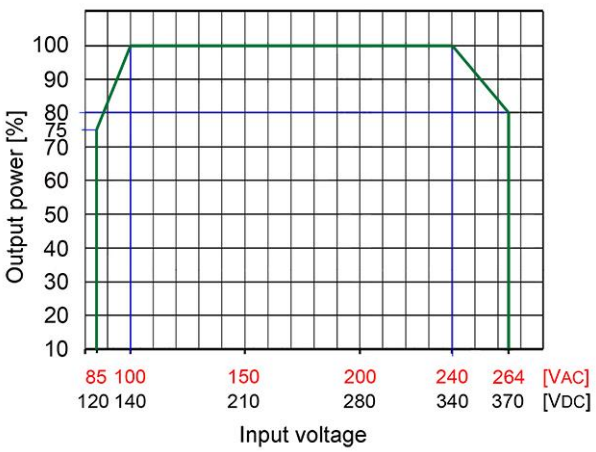
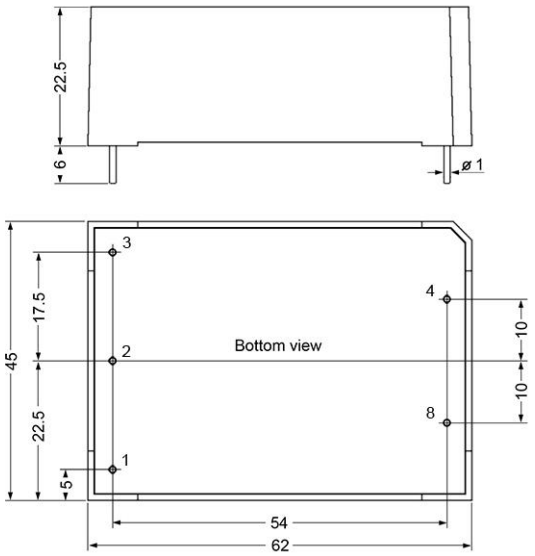
Derating diagram at Vin 85 - 264 VAC

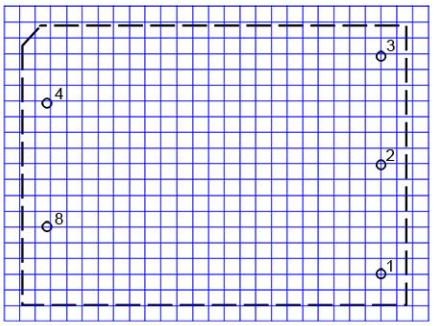


Power derating vs input voltage at Ta 25 °C



Mechanical dimensions mountable PCB version





Pitch 2.54 mm, Recommend drill diameter 1.5 mm

Unit: mm
Pin diameter tolerance: ± 0.1 mm
General tolerances: ± 0.5 mm

Pin assignment	
1	No pin
2	Input AC (N)
3	Input AC (L)
4	+ V output
5	No pin
6	No pin
7	No pin
8	- V output

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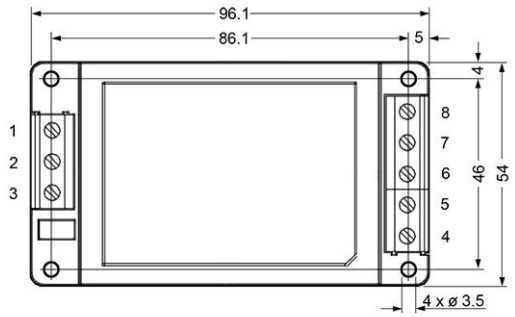
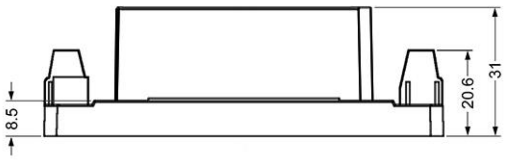
Mechanical dimensions chassis mountable version A2

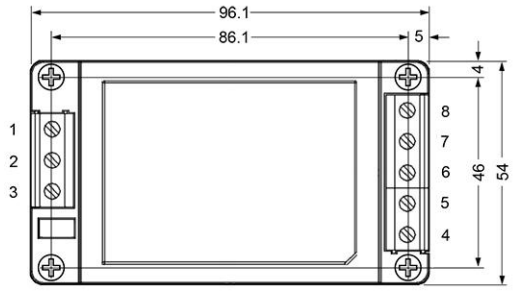


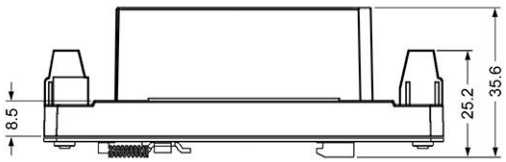


Terminal assignment	
1	Not connected
2	Input AC (N)
3	Input AC (L)
4	+ V output
5	Not connected
6	Not connected
7	Not connected
8	- V output

Unit: in mm
Wire range: 12…24 AWG
Tightening torque: ≤ 0.4 Nm
General tolerances: ± 1 mm

Mechanical dimensions Din-Rail mountable version A4





Terminal assignment	
1	Input AC (N)
2	Input AC (L)
3	Protective earth
4	Trim input
5	- V output
6	+ V output
7	Not connected
8	Not connected

Unit: in mm
Wire range: 12…24 AWG
Tightening torque: ≤ 0.4 Nm
The Din Rail must be connected with protective earth
General tolerances: ± 1 mm

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