ERICSSON

PKC

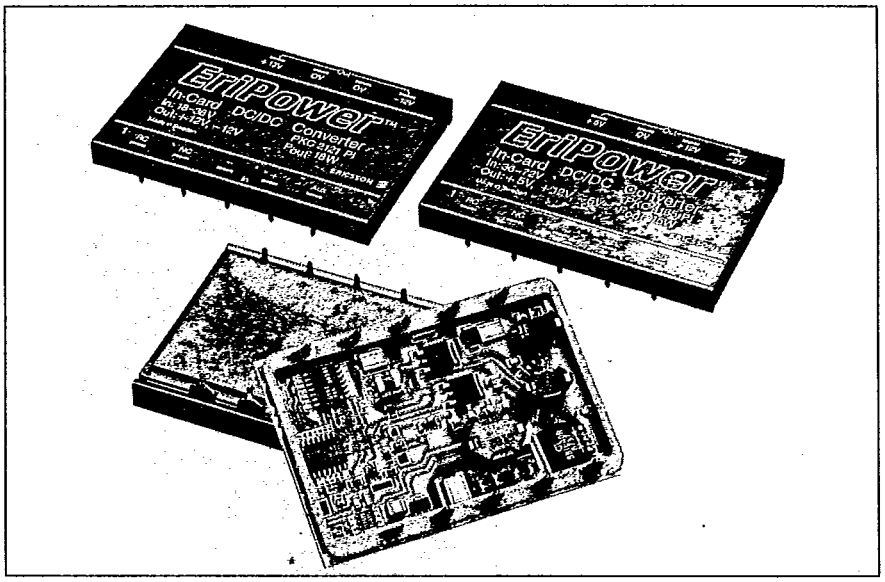
T-57-11

EriPower™

DC/DC Converters 15 – 18W

Output: Single, Dual or Triple
Input: 24V⎓ or 48/60V⎓

- **All outputs regulated**
- **Low Profile Enclosure: 8.5 mm/0.33", by the use of In-Card mounting, facilitates 3TE/0.6" board spacing**
- **Input range 2:1 24V (18 – 36V) 48/60V (36 – 72V)**
- **Very low heat dissipation, typical efficiency 85%, P_d =3W at full output power**
- **Parallelable for redundancy or system expansion**



500 V⎓ isolated On-Card / In-Card power modules in SMD hybrid technology

The PKC series In-Card DC/DC converters are specially designed for distributed low profile power requirements. Their output data offer easy paralleling for upgrading or redundancy. The converters can either be mounted as On-Card converters (using maximum height of 10.7mm/0.42") with 4TE/0.8" board spacing, or as In-Card (i.e. the converters are recessed into a punched hole in the board), allowing 3TE/0.6" board spacing. Maximum height over the board surface for this mounting is as low as 8.5mm/0.33".

They feature up to three well regulated outputs allowing the defined outputs to stay within a ±3% range for all specified load, line and temperature conditions. Thus digital and analog circuits can saftely be supplied from the same converter.

The PKC series consist of complete units, i.e. no extra components or filtering are required for full operation including applications with stringent RFI requirements. The RFI suppression is in comformance with VDE/FCC/CISPR's curve A or N , temperature range is – 45 to +85°C and the rugged mechanical design conforms to IEC 68-2 specifications, normally applicable for discrete components such as resistors and capacitors.

Surface mount hybrid technology, provides excellent thermal management. The high and constant switching frequency of 300kHz allows ceramic capacitors only to be used. This makes it possible to achieve an MTBF of >200 years. Their low weight (50g/1.76ozs) along with their high reliability makes them ideal for e.g. Telecom Datacom, Medical, Industrial and Airborne applications.

EriPower is a Trade Mark of Ericsson Components AB

Data Sheet
October 1989
Subject to alterations without prior notice

Contents

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Product program

Input	Output O/P1	Output 0/P2	Output O/P3	P_{out}	Type No.
PKC 2000 PI					
	Single output				
24V⎓ (18–36)	5V/3A 12V/1.5A			**15W** **18W**	**PKC 2111 PI** **PKC 2113 PI**
	Dual outputs				
	+12V/1A +15V/0.8A		–12V/1A* –15V/0.8A*	**18W** **18W**	**PKC 2121 PI** **PKC 2126 PI**
	Triple outputs				
	+5V/3A +5V/3A +5V/3A	+12V/0.6A +15V/0.5A +12V/0.6A	–12V/0.6A* –15V/0.5A* –5V/1A*	**15W** **15W** **15W**	**PKC 2131 PI** **PKC 2132 PI** **PKC 2135 PI**
PKC 4000 PI					
	Single output				
48/60V⎓ (36–72)	5V/3A 12V/1.5A			**15W** **18W**	**PKC 4111 PI** **PKC 4113 PI**
	Dual outputs				
	+12V/1A +15V/0.8A		–12V/1A* –15V/0.8A*	**18W** **18W**	**PKC 4121 PI** **PKC 4126 PI**
	Triple outputs				
	+5V/3A +5V/3A +5V/3A	+12V/0.6A +15V/0.5A +12V/0.6A	–12V/0.6A* –15V/0.5A* –5V/1A*	**15W** **15W** **15W**	**PKC 4131 PI** **PKC 4132 PI** **PKC 4135 PI**

* Max output power is limited to P_{out}

Ordering information

PKC XXXX PI

Isolation	I (500V⎓)
Mechanical version	P(PC-card version On-Card or In-Card)
Voltage code	1, 2, 3, 4 etc.
No. of outputs	1, 2 resp. 3
Output power	1 (10–19.9W e.g. 15W)
Input range	2 (24V⎓) 4 (48/60V⎓)

Common features

Short circuit proof for protection of the converter and the distribution cables.

Low RFI and noise according to VDE 0871 curve A, FCC class A and CISPR curve N.

Input transient protected by a power zener.

Input sense with shutdown command at undervoltage for safe battery operation.

Remote control output facilitates remote start/stop by means of a TTL compatible output.

Soft start adapted for capacitive loads and microprocessor start up.

Auxiliary output for supervision of the converters operation and offer other electronics to be synchronized to the 300kHz switching frequency.

General data

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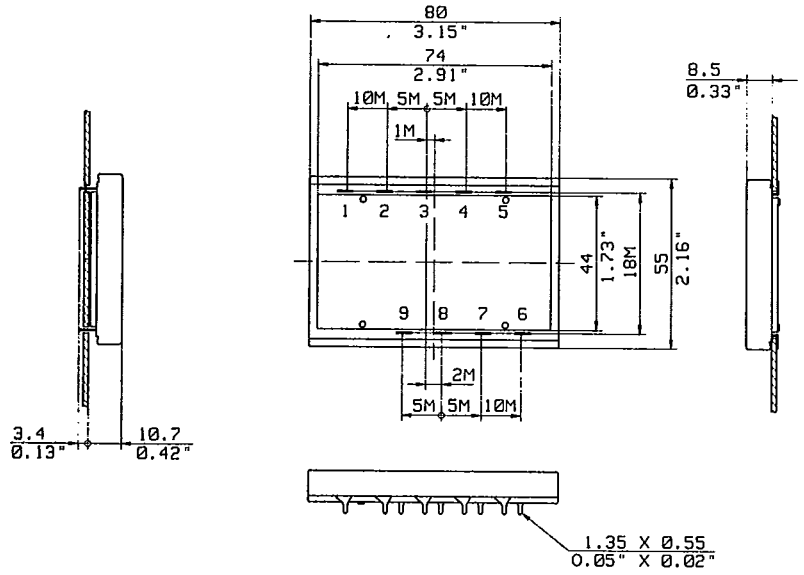
Dimensions (Given as maximum values in mm unless otherwise stated)

On-Card version **In-Card version**



Pin spacing figures are nominal ±0.1M. 1M=2.54mm (0.1 inch)

Package

Blue anodized aluminium heat-sink profile with plastic bottom cover.

Weight

50 grams (1.76 ozs.)

Thermal data

Thermal resistance heat-sink to ambient R_{th} case-amb = 9°C/W

PCB-guide lines

When using single-sided PCB it's recommended to enter tubular rivets into the mounting holes to improve the electrical and mechanical performance. Mounting holes shall have a diameter of 1.8-2.0mm.

Mounting

The PKC DC/DC converter must be mounted in a vertical position for full temp range, up to +85°C at maximum output power.

Connections

Output version	Termination pin no.									
	Vin		**O/P1**		**O/P2**		**O/P3**		**Remote control**	**Auxiliary**
	+	**−**	**+**	**−**	**+**	**−**	**−**	**+**		
Single output	4	3	9	8					1	5
Dual output*	4	3	9	8, 7			6	7, 8	1	5
Triple output	4	3	9	8	7	8	6	8	1	5

* pin 7 and 8 are internally connected.

Environmental tests according to IEC

Test method	**Reference**	**Test conditions**		
Vibration (Sinusoidal)	IEC 68-2-6 F_c	Frequency Displacement amplitude Accerelation amplitude Number of cycles	10-500Hz 0.75mm 100m/s² 10 in each axis	10.2g
Shock (Half-sin.)	IEC 68-2-27 E_a	Peak accerelation Shock duration	2000m/s² 3ms	204g
Bump (Half-sin.)	IEC 68-2-29 E_b	Peak accerelation Bump duration Number of bumps	400m/s² 6ms 1000 in 6 directions	40.8g
Temperature change	IEC 68-2-14 N_a	Temperature Number of cycles	−40...+125°C 10	
Damp heat constant temperature	IEC 68-2-3 C_a	Temperature Duration	40°C 56 days	

15–18W DC/DC Converters

Input: 18 – 36V⎓ (PKC 2000)
36 – 72V⎓ (PKC 4000)

For definitions, see "Test and operation" section.

Absolute maximum ratings

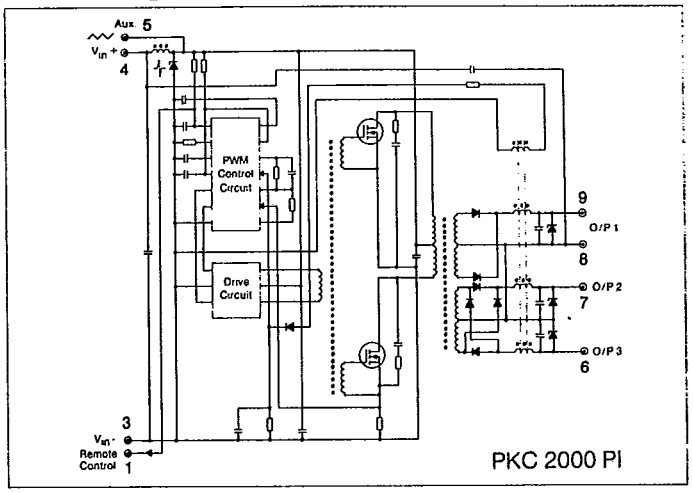
T_{amb}	Operating ambient temp. at full load	–45°C...+85°C
T_{stg}	Storage temperature	–55°C...+125°C
$T_c$max	Case temperature	+115°C
I_o	Output current	Internally limited
W_{tr}	Transient input energy, T_{amb}=+25°C	0.6Ws
V_{iso}	Input/Output isolation voltage	500V⎓

T_{amb}=0...+65°C (T_c=0...+95°C),
V_i=$V_i$nom and I_o=$I_o$nom unless otherwise specified.

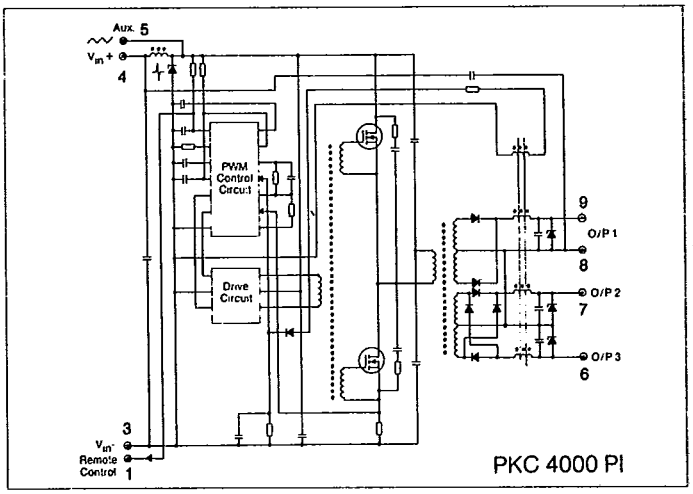
Input data (T_c < $T_c$max)

		PKC 2000			PKC 4000			
Characteristics		min	nom	max	min	nom	max	unit
V_i	Input voltage	18	26	36	36	50	72	V
V_{ish}	Shutdown input voltage	13	15	16.7	28	32	35	V
	Insertion I^2t value	typ. 1 • 10^{-3}						A^2s
	Input power at no load condition	typ. 2						W
rfi	RFI suppression 0.01 – 30 MHz	VDE0871/FCC Curve A/Class A						

Block diagram



PKC 2000 PI



PKC 4000 PI

Output data Single output models

Characteristics		Conditions	PKC 2111/4111 PI Min	Typ	Max	PKC 2113/4113 PI Min	Typ	Max	U
V_{oi}	Output voltage initial setting and accuracy	T_{amb} = + 25°C Stabilized conditions		5.05	±0.7%		12.00	±0.5%	V
V_o	Output voltage	I_o = 0.1-$I_o$nom , $V_i$min-$V_i$max	4.90		5.25	11.80		12.35	V
		I_o=o			5.25			12.35	V
$I_o$nom	Nominal load			3.0			1.5		A
t_{st}	Start-up time	I_o > 0.1$I_o$nom		10			10		ms
I_o	Output current	$V_i$min-$V_i$max, T_c < $T_c$max	0		3.0	0		1.5	A
$P_o$max	Max output power	$V_i$min-$V_i$max, T_c < $T_c$max	15			18			W
I_{oi}	Current limiting threshold	$V_i$min-$V_i$max, T_c < $T_c$max	3.1			1.6			A
η	Efficiency	I_o = 0.5-$I_o$nom		83			86		%
V_{ov}	Line regulation	$V_i$min -$V_i$max			±0.5			±0.7	%
V_{ol}	Load regulation	I_o = 0.1-$I_o$nom			±1.5			±1.5	%
t_{tr}	Load transient recovery time	I_o > 0.1$I_o$nom		100			200		µs
T_{coelf}	Temperature coefficient	$V_i$min-$V_i$max, T_c < $T_c$max		–0.5			–1.2		mV/°C
V_{oitp}	Output ripple	V_i = $V_i$min-$V_i$max			100			100	mV_{p-p}
				20			20		mV~
SVR	Supply voltage rejection	f = 100Hz Sine wave $1V_{p-p}$	50			43			dB

Electrical characteristics

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T_{amb} = 0 ... +65°C (T_c = 0 ...+95°C), V_i = $V_i$nom and I_o=$I_o$nom unless otherwise specified.

Output data Dual output models — PKC 2121/4121 PI

Characteristics		Conditions	O/P1 Min	O/P1 Typ	O/P1 Max	O/P3 Min	O/P3 Typ	O/P3 Max	Unit
V_{oi}	Output voltage initial setting and accuracy	T_{amb} = + 25°C Stabilized conditions		12.00	±0.7%		12.00	±1.3%	V
V_o	Output voltage	I_o = 0.1-$I_o$nom, $V_i$min-$V_i$max I_o (O/P3) = $I_o$nom	11.75		12.35				V
		I_o = 0			12.35		15		V
$I_o$nom	Nominal load			0.75			0.75		A
t_{st}	Start-up time	I_o > 0.1$I_o$nom		10			10		ms
I_o	Output current	$V_i$min-$V_i$max, T_c < $T_c$max	0		1.2	0		1.2	A
$P_o$max	Max output power	$V_i$min-$V_i$max, T_c < $T_c$max			min 18				W
I_{ol}	Current limiting threshold	$V_i$min-$V_i$max, T_c < $T_c$max			min 102*				%
η	Efficiency	I_o = 0.5-$I_o$nom			typ 87				%
V_{ov}	Line regulation	$V_i$min – $V_i$max			±0.5			±0.6	%
V_{ol}	Load regulation	I_o = 0.1-$I_o$nom, I_o(O/P3)=$I_o$nom			±1.5				%
t_{tr}	Load transient recovery time	I_o > 0.1$I_o$nom		200			200		µs
T_{coeff}	Temperature coefficient	$V_i$min – $V_i$max, T_c < $T_c$max		–1			–1		mV/°C
V_{orip}	Output ripple	$V_i$min-$V_i$max			100			100	mV_{p-p}
				10			10		mV_{rms}
SVR	Supply voltage rejection	f = 100Hz Sine wave 1V_{p-p}	43			43			dB

Output data Dual output models — PKC 2126/4126 PI

Characteristics		Conditions	O/P1 Min	O/P1 Typ	O/P1 Max	O/P3 Min	O/P3 Typ	O/P3 Max	Unit
V_{oi}	Output voltage initial setting and accuracy	T_{amb} = + 25°C Stabilized conditions		15.00	±0.7%		15.00	±1.2%	V
V_o	Output voltage	I_o = 0.1-$I_o$nom,$V_i$min-$V_i$max I_o (O/P3) = $I_o$nom	14.70		15.40				V
		I_o=0			15.40		18		V
$I_o$nom	Nominal load			0.6			0.6		A
t_{st}	Start-up time	I_o > 0.1$I_o$nom		10			10		ms
I_o	Output current	$V_i$min-$V_i$max, T_c < $T_c$max	0		1.0	0		1.0	A
$P_o$max	Max output power	$V_i$min-$V_i$max, T_c < $T_c$max			min 18				W
I_{ol}	Current limiting threshold	$V_i$min-$V_i$max, T_c < $T_c$max			min 102*				%
η	Efficiency	I_o = 0.5-$I_o$nom			typ 87				%
V_{ov}	Line regulation	$V_i$min – $V_i$max			±0.8			±0.9	%
V_{ol}	Load regulation	I_o = 0.1-$I_o$nom,I_o(O/P3)=$I_o$nom			±1.5				%
t_{tr}	Load transient recovery time	I_o > 0.1$I_o$nom		250			250		µs
T_{coeff}	Temperature coefficient	$V_i$min – $V_i$max, T_c < $T_c$max		–1			–1		mV/°C
V_{orip}	Output ripple	$V_i$min – $V_i$max			100			100	mV_{p-p}
				10			10		mV_{rms}
SVR	Supply voltage rejection	f = 100Hz Sine wave 1V_{p-p}	40			40			dB

* PKC is power limited. Current limiting threshold on each output is set by the total load.

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Electrical characteristics

T_{amb} = 0...+65°C (T_c = 0...+95°C), and V_i = $V_i$nom I_o = $I_o$nom unless otherwise specified.

Output data Triple output models — PKC 2131/4131 PI

Characteristics		Conditions	O/P1 Min	O/P1 Typ	O/P1 Max	O/P2, O/P3 Min	O/P2, O/P3 Typ	O/P2, O/P3 Max	Unit
V_{oi}	Output voltage initial setting and accuracy	T_{amb} = + 25°C Stabilized conditions		5.05	±0.7%		12.00	±1.3%	V
V_o	Output voltage	I_o = 0.1-$I_o$nom, Vimin-Vimax I_o (O/P2, 3) = I_o nom	4.90		5.25				V
		I_o = 0			5.25		15		V
$I_o$nom	Nominal load			2.0			0.2		A
t_{st}	Start-up time	I_o > 0.1$I_o$nom		10			10		ms
I_o	Output current	$V_i$min-$V_i$max, T_c < $T_c$max	0		3.0	0		0.6	A
$P_o$max	Max output power	$V_i$min-$V_i$max, T_c < $T_c$max	min 15						W
I_{oi}	Current limiting threshold	$V_i$min-$V_i$max, T_c < $T_c$max	min 102*						%
η	Efficiency	I_o = 0.5-$I_o$nom	typ 82						%
V_{ov}	Line regulation	$V_i$min – $V_i$max			±0.5			±0.6	%
V_{oi}	Load regulation	I_o = 0.1-$I_o$nom			±1.5				%
t_{tr}	Load transient recovery time	I_o > 0.1$I_o$nom		100			200		µs
T_{coeff}	Temperature coefficient	$V_i$min – $V_i$max, T_c < $T_c$max		0.5			–1.2		mV/°C
V_{orip}	Output ripple	Vimin-Vimax			100			150	mV_{p-p}
				15			15		mV_{rms}
SVR	Supply voltage rejection	f = 100Hz Sine wave 1V_{p-p}	50			43			dB

Output data Triple output models — PKC 2132/4132 PI

Characteristics		Conditions	O/P1 Min	O/P1 Typ	O/P1 Max	O/P2, O/P3 Min	O/P2, O/P3 Typ	O/P2, O/P3 Max	Unit
V_{oi}	Output voltage initial setting and accuracy	T_{amb} = + 25°C Stabilized conditions		5.05	±0.7%		15.00	±1.3%	V
V_o	Output voltage	I_o = 0.1-$I_o$nom, Vimin-Vimax I_o (O/P2, 3) = I_o nom	4.90		5.25				V
		I_o =O			5.25		18		V
$I_o$nom	Nominal load			2.0			0.17		A
t_{st}	Start-up time	I_o > 0.1$I_o$nom		10			10		ms
I_o	Output current	$V_i$min-$V_i$max, T_c < $T_c$max	0		3.0	0		0.5	A
$P_o$max	Max output power	$V_i$min-$V_i$max, T_c < $T_c$max	min 15						W
I_{oi}	Current limiting threshold	$V_i$min-$V_i$max, T_c < $T_c$max	min 102*						%
η	Efficiency	I_o = 0.5-$I_o$nom	typ 82						%
V_{ov}	Line regulation	$V_i$min – $V_i$max			±0.5			±0.6	%
V_{oi}	Load regulation	I_o = 0.1-$I_o$nom			±1.5				%
t_{tr}	Load transient recovery time	I_o > 0.1$I_o$nom		100			250		µs
T_{coeff}	Temperature coefficient	$V_i$min – $V_i$max, T_c < $T_c$max		–0.5			–1.5		mV/°C
V_{orip}	Output ripple	$V_i$min – $V_i$max			100			150	mV_{p-p}
				20			20		mV_{rms}
SVR	Supply voltage rejection	f = 100Hz Sine wave 1V_{p-p}	50			40			dB

*PKC is power limited. Current limiting threshold on each output is set by the total load.
Maximum total power on output 2 and 3 is10W.

Electrical characteristics

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T_{amb} = 0... +65°C (T_c = 0... +95°C) V_i = $V_i$nom and I_o = $I_o$nom unless otherwise specified.

Output data Triple output models — PKC 2135/4135 PI

Characteristics		Conditions	O/P1 Min	O/P1 Typ	O/P1 Max	O/P2 Min	O/P2 Typ	O/P2 Max	O/P3 Min	O/P3 Typ	O/P3 Max	Unit
V_{or}	Output voltage initial setting and accuracy	T_{amb} = + 25°C Stabilized conditions		5.05	±0.6%		12.10	±1.7%		5.00	±0.8%	V
V_o	Output voltage	I_o = 0.1-$I_o$nom, $V_i$min-$V_i$max I_o (O/P2, O/P3) = $I_o$nom	4.90		5.25							V
		I_o = 0			5.25		15			6		V
$I_o$nom	Nominal load			2.0			0.2			0.5		A
t_{st}	Start-up time	I_o > 0.1$I_o$nom		10			10			10		ms
I_o	Output current	$V_i$min-$V_i$max, T_c < $T_c$max	0		3.0	0		0.6	0		1.0	A
$P_o$max	Max output power	$V_i$min-$V_i$max, T_c < $T_c$max					min 15					W
I_{ol}	Current limiting threshold	$V_i$min-$V_i$max, T_c < $T_c$max					min 102*					%
η	Efficiency	I_o = 0.5-$I_o$nom					typ 82					%
V_{ov}	Line regulation	$V_i$min – $V_i$max, I_o,nom			±0.7			±0.8			±0.8	%
V_{ol}	Load regulation	I_o = 0.1-$I_o$nom			±1.5							%
t_{tr}	Load transient recovery time	I_o > 0.1$I_o$nom		100			200			100		µs
T_{coeff}	Temperature coefficient	$V_i$min – $V_i$max, T_c < $T_c$max		–0.5			–1			–0.5		mV/°C
V_{orip}	Output ripple	$V_i$min – $V_i$max			100			150			100	mV_{p-p}
				15			15			15		mV_{rms}
SVR	Supply voltage rejection	f = 100Hz Sine wave 1V_{p-p}	50			43			50			dB

*PKC is power limited. Current limiting threshold on each output is set by the total load.
Maximum total power on output 2 and 3 is10W.

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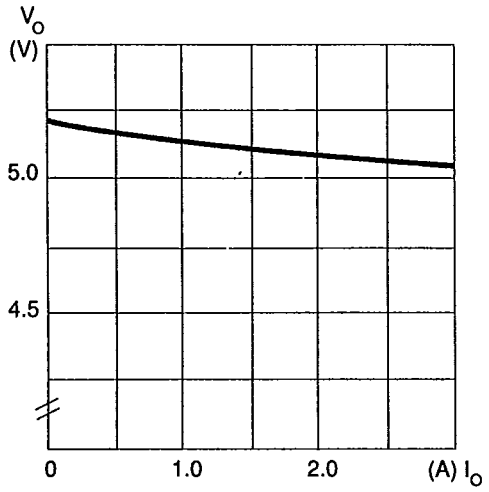
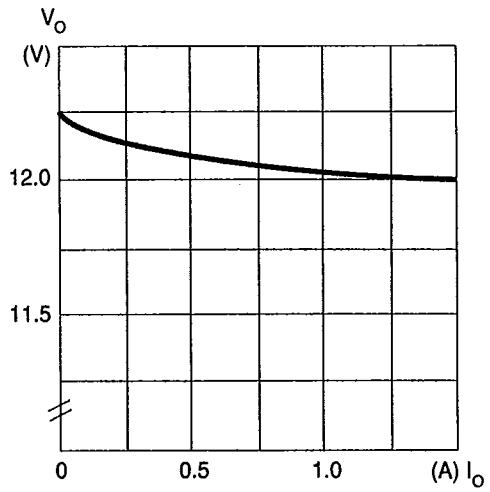
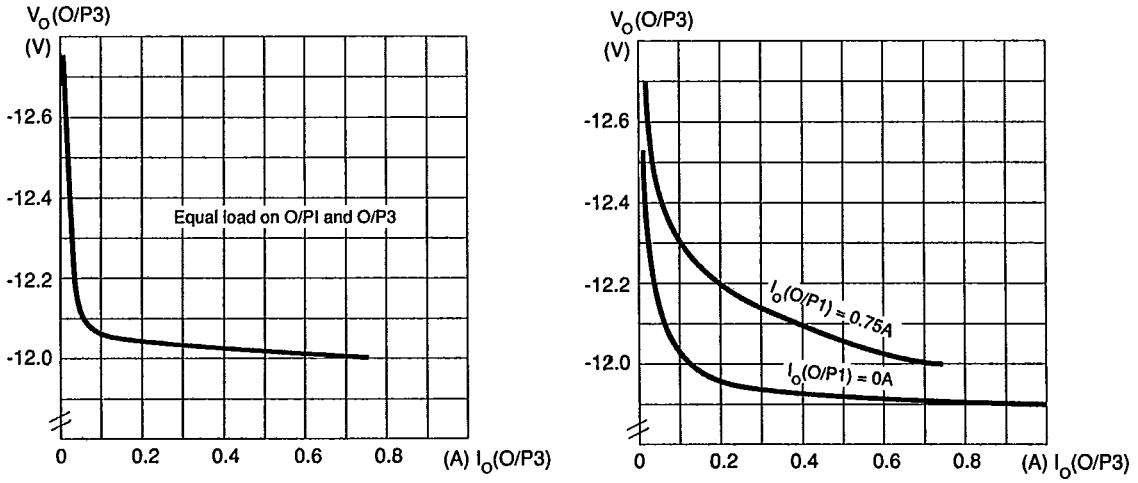
Load regulation



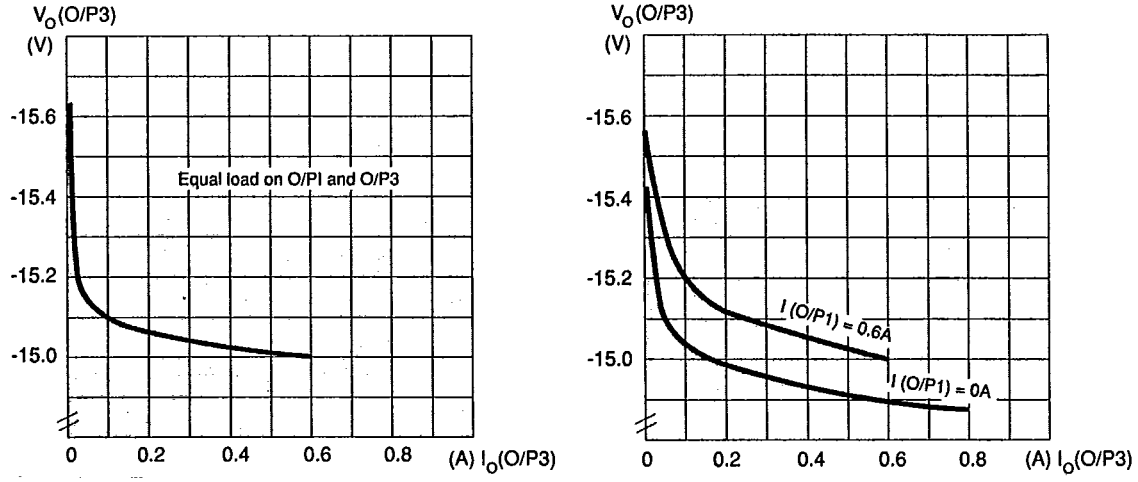
Load regulation PKC 2111/4111 PI



Load regulation PKC 2113/4113 PI



Load regulation PKC 2121/4121 PI



Load regulation PKC 2126/4126 PI

Load regulation

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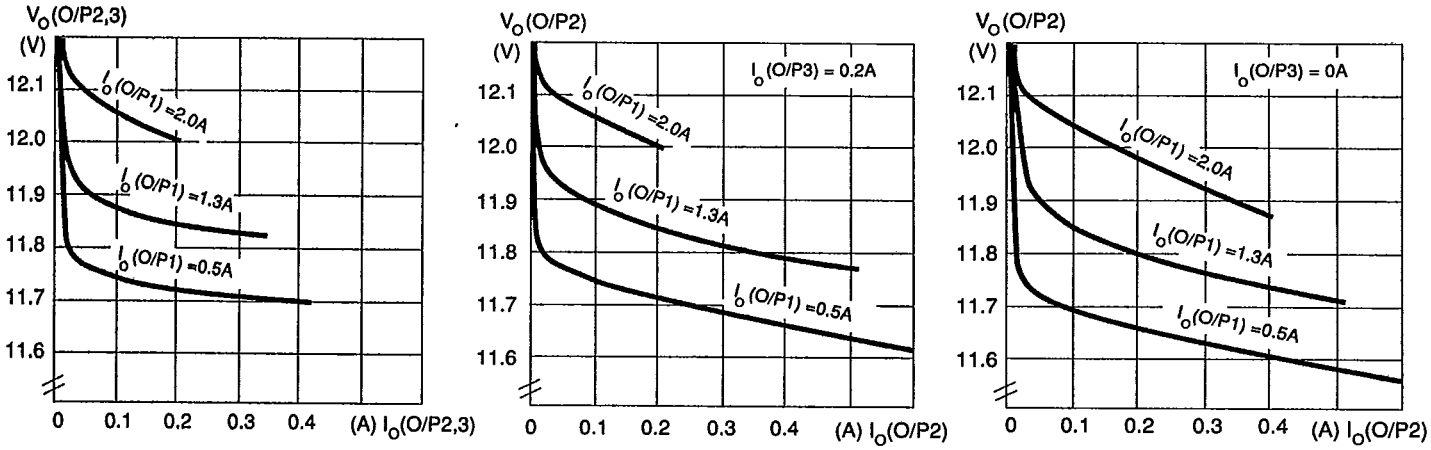
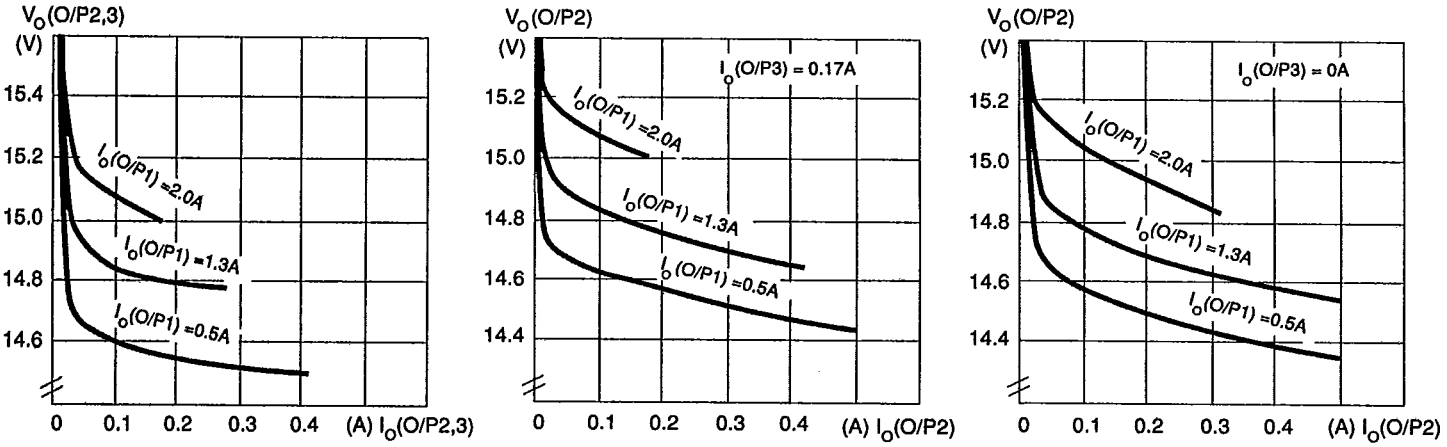
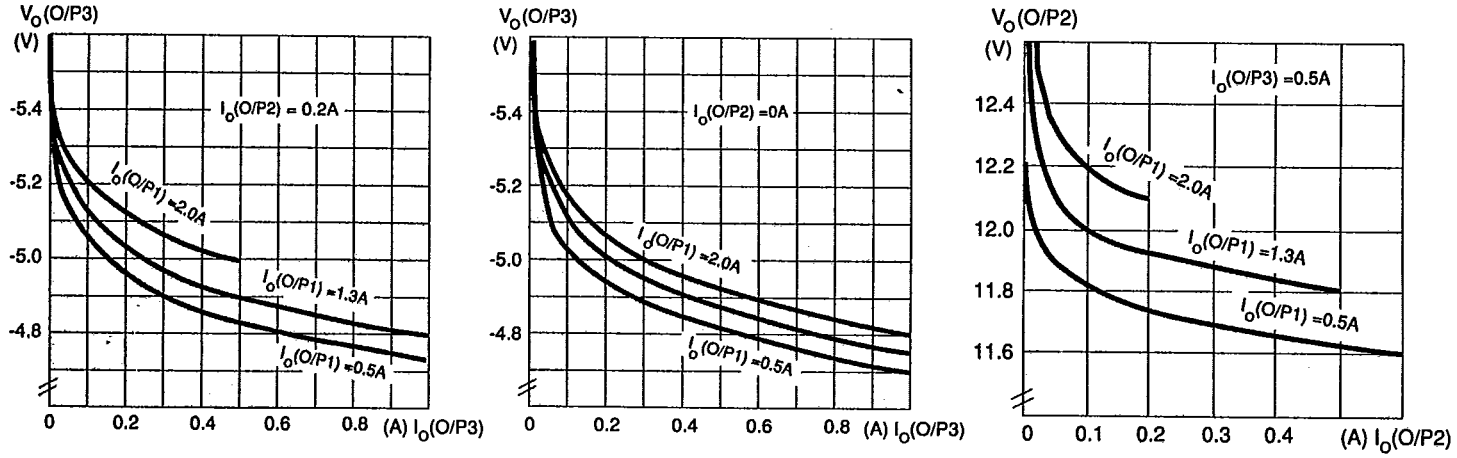


Load regulation PKC 2131/4131 PI



Load regulation PKC 2132/4132 PI



Load regulation PKC 2135/4135 PI

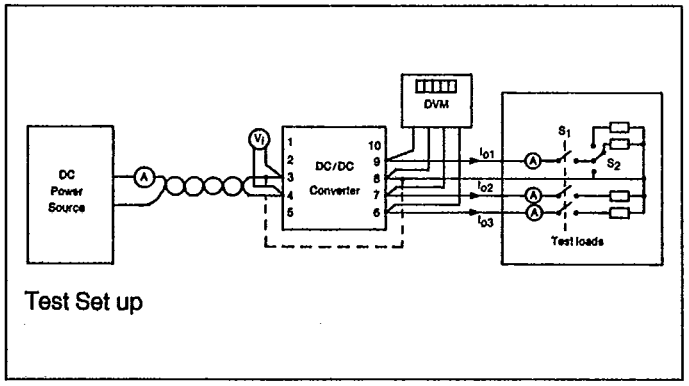
Compliance with specified electrical parameters will be achieved under the following conditions.

Absolute maximum ratings

Stress above data listed under Absolute Maximum Ratings may cause permanent damage to the converter. These are stress ratings only. Operation of the converter at these or any other conditions above those indicated in the electricial characteristics sections of the specification for extended periods will significantly affect the reliability performance.

General conditions

Temperature:	0-65 °C
Input voltage:	Nominal 26/50V⎓
Output loading:	Full rated output power ($I_o = I_o$ nom) unless otherwise stated
Test equipment:	Accuracy and stability 10 times better than desired resolution of test. The test load should have low inductance, otherwise use a capacitor across the output for compensation.
Cables:	Shortest possible and twisted



Test Set up

Fig. 1 Switch S_1 for measurement of input power at no load Switch S_2 for dynamic load regulation measurement and short circuit test.

Output voltage

Measured output voltage shall be within specified output voltage (V_o). 5V output is laser trimmed to 5.05V, at nominal load, for compensation of distribution losses. The other outputs, e.g. 12, 15 and –5V, are centered at the rated values.

Slow start

The PKC series of DC/DC converters have a built-in slow start to ensure start up when loaded with capacitive loads. A slew-rate of 0.5 V/ms ensures safe operation of µ-processors. After connecting the input voltage there will be a delay time of typ. 10ms before the output voltage begins to ramp up.

Current limiting protection

The output power is limited at loads above the output current limiting threshold (I_{lo}), specified as minimum value.

As the PKC multiple output converters are power limited, current limiting threshold for each output is set by the loads assignment between the outputs. The unit can withstand continous short circuit without destruction. A hick-up mode is used on all units to minimize the internal power dissipation. The hick-up time constant is set by the slow start.

Output power characteristics

All PKC DC/DC converters have wide temperature range with full output power. No extra heatsinks required!

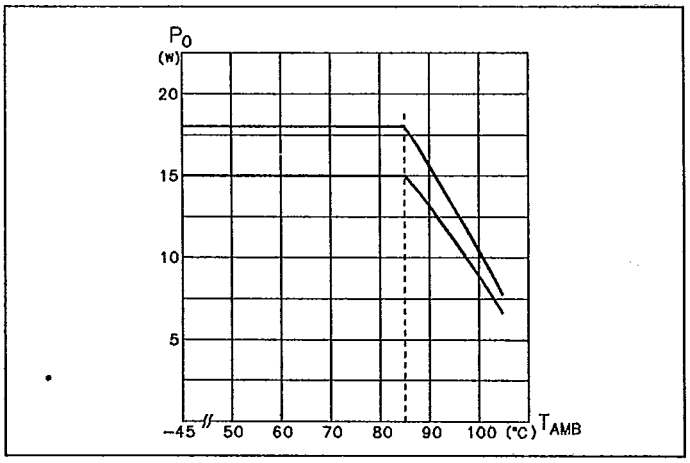


Fig. 2 Output power vs. ambient temperature.

Efficiency

The ratio of output to input power given in percentage.
$\eta = P_{out}/P_{in} = (P_{in}-P_{diss})/P_{in}$ [%]

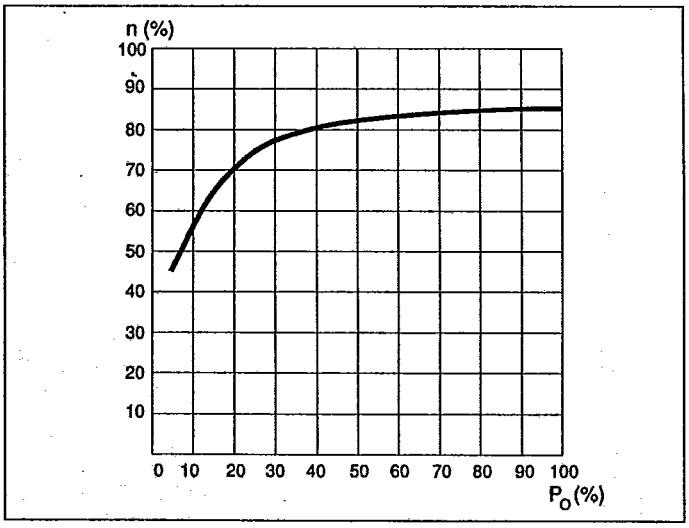


Fig. 3 Typical efficiency diagram for PKC DC/DC converters.

Ripple and noise

The magnitude of AC voltage superimposed on the DC output. Specified with peak-peak and RMS values.

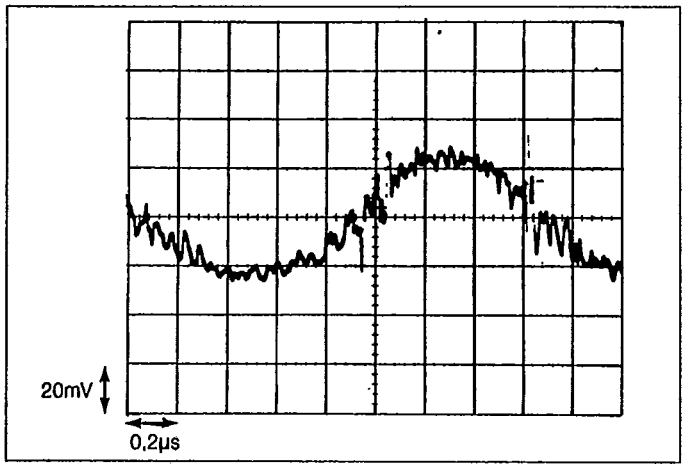


Fig. 4 Output ripple on 5V output.

Ripple data (V_{orip}) specified under electrical characteristics is measured at the output terminals with a 50MHz oscilloscope and a true RMS voltmeter (DVM, crestfactor >4.5) respectively.
The oscilloscope coaxial cable (Z=50Ω) is a zero ground loop type ended with 50Ω into the oscilloscope, to avoid reflexion of high freuency noise.
30 cm (12") twisted cables ended with a 47µF capacitor reduces the measured ripple with 12dB (0.25).

Load regulation

The maxmum deviation of the output voltage in percent of V_o as the load is varied from minimum to maximum rated load. Input voltage is at nominal value and the temperature is held constant. Multiple output units are tested with constant nominal load on the other outputs. All outputs are regulated by means of a magnetically coupled feed-back loop. Multiple output units will therefore regulate on the integration of all the output values in the output choke.
The values are given as ±0.5 x max deviation.

Line regulation

The maximum deviation of the output voltage in percent of V_o as the input voltage is varied from nominal to high limit and nominal to low limit. Output load and temperature are held constant.

Cross regulation

The maximum devation in percent of a dual or a triple output converter's output, as the other output is varied from minimum to maximum load. Input voltage is nominal value and the temperature is held constant. Cross regulation can be found from the load regulation diagrams.

Dynamic load response

The maximum deviation in percent of the output voltage as the load step-changes, and the time for recover to within specified limits.

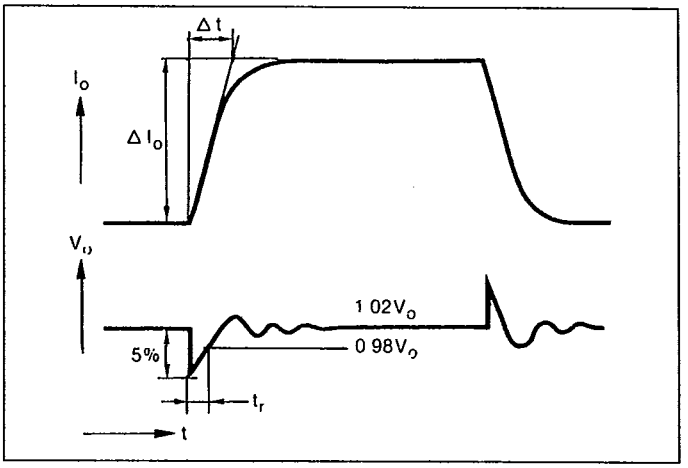


Fig. 5 ΔI_o=0.8x$I_o$nom, Δt=100µs.

A very short recovery time is achieved by the switching frequency and small filter capacitors, which allows the cross-over frequency of the control loop to be as high as 30kHz. It takes approximately 10 -15 cycles for the PKC converter to respond. The transient peak value is determined by the load step slope change.

Isolation voltage

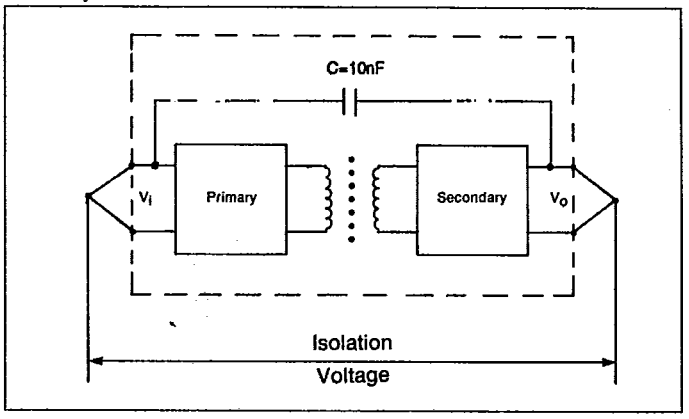


Fig. 6

The maximum DC voltage which may be applied between input and output terminals of the isolated PKC converters, V_{iso}=500V. Isolation between input/output and case is > 1000V.

Note, no AC voltage is rated for the PKC because of the internally connected decoupling capacitor between input and output grounds, which precludes an AC test of the converter. Hower the leakage current at 500V~ will be less than 2mA, (50/60Hz).

RFI Suppression

Conducted RFI

Noise generated by a system and reflected in to the power source. Measured in dBµV over a specified frequency range. The PKC series of DC/DC converters meets the German specification VDE 0871 curve A and FCC 20780 class A.

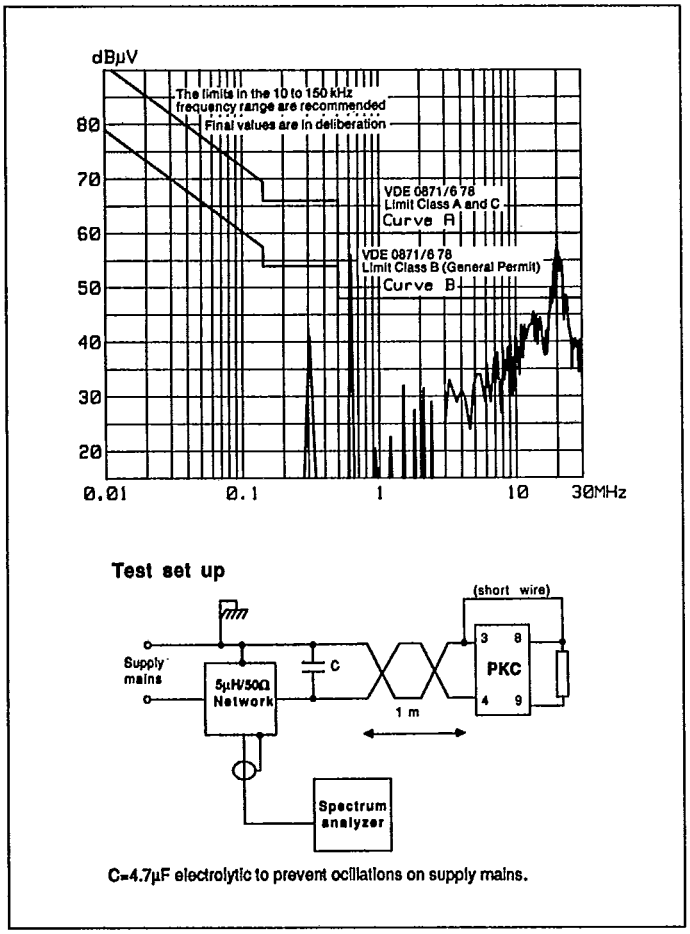


Fig. 7 Conducted RFI measured with a 5µH/50Ω line-filter. A defined ground-plane is essential for the high-frequence part, and a small capacitor (4.7µF) across the line might be necessary it the line impedance is causing unstable operation.

Radiated RFI

The electromagnetic radiation emitted by a system into the environment. Measured at a specified distance and frequency range. No official measurements on PKC converters are performed because it is application dependent. However the PKC converters metallic cover shields radiated noise and the units small size compared to the wave-lenght (>3m at 100MHz) eliminates transmission.

Input transient energy

A transient protection device is incorporated in the PKC unit.
The device can withstand a transient energy of 0.6Ws. To keep the energy and the input clamp voltage within safe current must be kept < 8A into PKC 2000 and 4A < into PKC 4000.

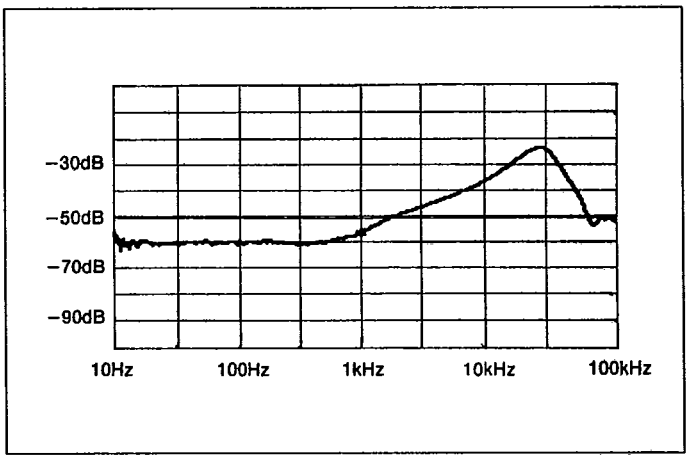


Fig. 8 SVR vs. input voltage ripple frequency. SVR is log. proportional to the output voltage.

Supply voltage rejection

The internal filters and the high cross over frequency of the control loop suppresses ac signals superimposed on the DC input voltage to be transferred to the converters output.
Values are given in dB as a ratio between input signal and output response.

100% burn-in test

Conditions: T_{amb}=+80°C
T_{case}=+110°C
V_i=$V_i$nom
I_o=$I_o$nom
t=12 hours

Accepted quality level: (AQL)

Major defect (Operational error)	0.25
Minor A defect (Parameter error)	1.5
Minor B defect (Other errors)	2.5

Warranty

Warranty given in any Sales conditions is not valid if the PKC converter is opened.

Power distribution considerations

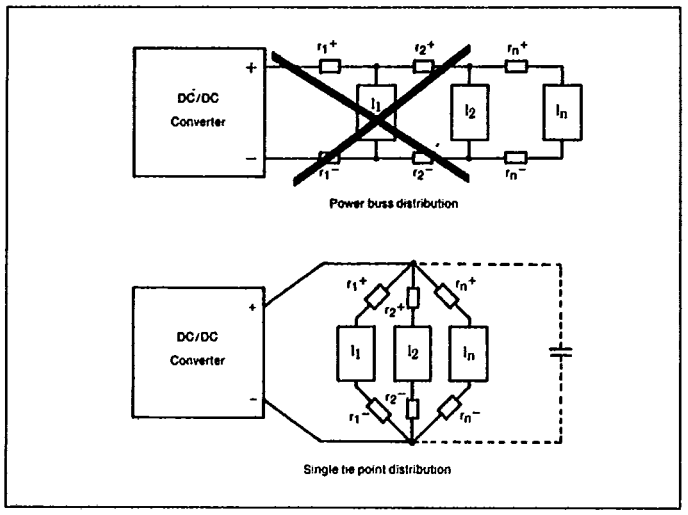


Fig. 9 The single tie point distribution minimizes interferences between the loads. Distribution resistors r_1 + and r_1 – connected to load I_1 will not generate voltage drops caused by changes of loads I_2 and I_n.

Input and output impedance

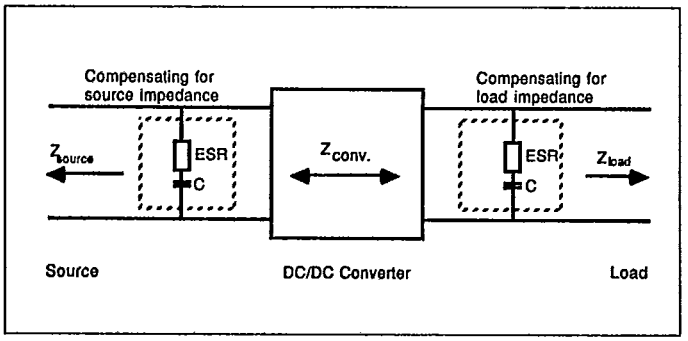


Fig. 10 Both the source impedance of the power feeding and the load impedance will interact with the impedance of the DC/DC converter.

It is most important to have the ratio between L and C as low as possible, i.e. a low characteristic impedance, both at the input and output, as the converters have a low energy storage capability. A compensation is necessary if the source or load inductance is larger than 10 µH. Use wet electrolytic capacitors. Their internal resistance together with the capacitance acts as a lossless damping filter. Suitable capacitance is 10-100 µF. It is recommended not to use tantalum capacitors, due to their low ESR-value.

Maximum capacitive loads

Single 5V	up to 1500 µF
Single 12V	up to 470 µF
Duals	up to 2 x 220 µF
Triples	1000 µF on + 5V output and 2 x 100 µF on ± 12V outputs or 2 x 68 µF on ± 15V outputs

These are max. capacitive loads without inductance or resistance in series. Low ESR (Eqvivalent Series Resistance) capacitors with high capacitances may cause unstable operation if connected close to the output terminals.

Input voltage shutdown

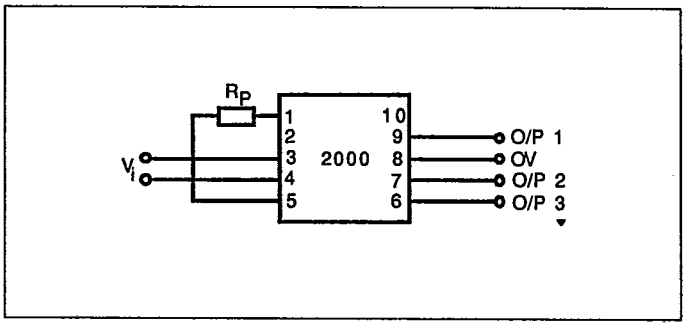


Fig. 11 Rp = 100 kΩ decreases V_{ish} to < 16V /PKC 2000).

If the input voltage decreases below 0.95x$V_i$min the output voltage decreases proportionally to V_i at an output current of 0.75x$I_o$nom. Higher output voltage can be achieved with further derating of I_o.

Over Voltage Protection (OVP)

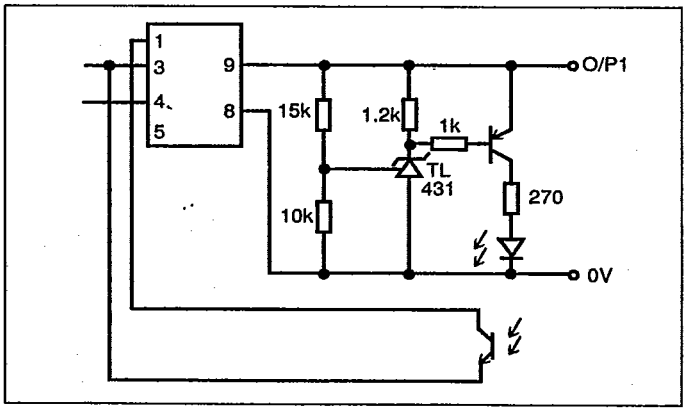
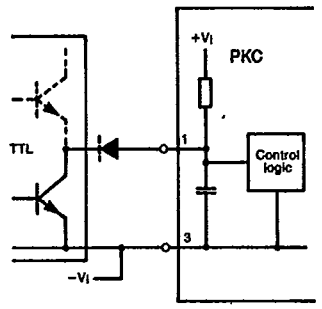
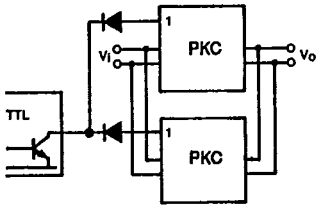


Fig. 12

When activated the oscillator circuit is unconditionally shorted and the output is down. The converter restarts automatically after overvoltage conditions.

Remote control





If the remote controls are used, when paralleling PKC converters, they should be connected together via diodes to avoid interference between the converters.

Fig 13

A feature that makes it possible to turn off or start up the converter externally with TTL logic signal or a mechanical switch connected to pin 1.

	V(Pin 1-3)
On	Open curcuit
Off	<1.8V_{DC}

The internal pull-up resistance is 15kohm for PKC 2000, and 36kohm for PKC 4000.

Note pin 1 is an output and no current should be driven into pin 1. Use a diode if necessary e.g. totem-pole TTL logic.

Parallel operation

Direct parallel connection

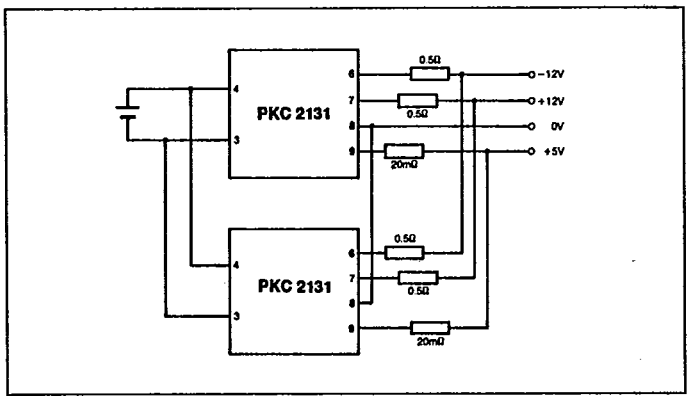


Fig. 14

External resistors are normally not needed the voltage drop across each resistor improves output current sharing. Resistor values depends on load current ratings and should be designed for highest efficiency and acceptable load sharing performance.

Improved EMC

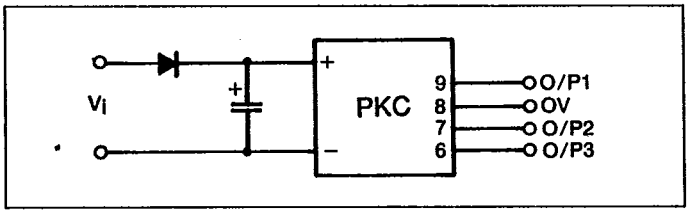


Fig. 15

Brown-outs
Avoiding input voltage shutdown during transient voltage drops, e.g. when connecting other equipment to the power lines, use a schottky rectifier for lowest power loss and a 100µF wet electrolytic capacitor.

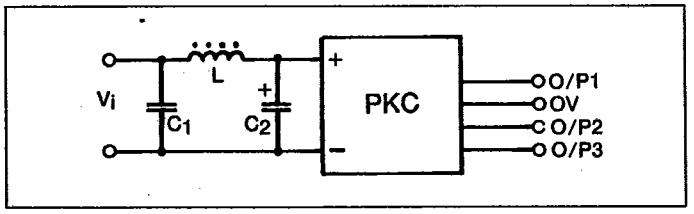


Fig. 16

External RFI-filter
By adding a small LC-filter at the input, conducted RFI could be decreased in very sensible applications. With C_1= 2µF, C_2= 22µF and L = 5µH the attenuation will be more than 40dB. C_1should be a high freq. met. paper or plastic with a voltage rating of 250V. The inductance L should be designed for a current of 1A using a ferrite core.

ERICSSON

Ericsson Components AB
Power Products
S-164 81 KISTA-STOCKHOLM, SWEDEN, Tel. +46 8 721 60 00, Telex 149 10 ERICS, Telefax +46 8 721 70 01