

DC-DC CONVERTER ACR 150/LEC, LEC-C

RAILWAY CONVERTER.

FOR STANDARD EURO RACK SIZE 19"



HIGHLIGHTS

- + Output Power up to 150 Watts**
- + Efficiency up to 90%
- + High Power Density
- + Wide Input Range
- + Wide Temperature Range
- + RoHS compliance
- + According to EN50155

INPUT

Input Voltage Nominal 12/24 VDC, 24 VDC, 72 VDC, 110 VDC

OUTPUT

Output Voltage 5 V / 12 V / 24 V

Initial Set Accuracy < 1%*

Minimum Load No minimum load

Line Regulation < 0,5%

Load Regulation <2% (0% - 100% load)****

<3% (0% - 100% load only for $V_{out,5V}$)****

Ripple & Noise <1% pk-pk, 20 MHz bandwidth*

Start Time < 90 ms

Max. Output Capacitance 500 μ F x $I_{out,max}$

Temperature Coefficient <0.02%/°C

FEATURES

Reverse Polarity Protection	By internal fuse to $V_{in,max}$ By internal diode to $V_{in,max}$ (at $V_{in,nom} = 110V$)
Enable Signal	Switched to high level, the converter switches off. Open pin enables the converter.
Thermal Warning Signal	Isolated open-collector output. Active level: Low when the case reaches the temperature of 5-10°C below the OTP.
Output Power Good	Isolated open-collector output. Active level: Low when output voltage is over 80% of $V_{out,nom}$
Trim	A resistor-programmable input to trim the output voltage in the range of +10% / - 20%.
Share	Up to 3 converters can be connected in parallel sharing within < 10% at 90% load. Each converter max. 90% load.
Yellow LED	To indicate operating mode

* For $T_{amb} = 25^{\circ}C$, $V_{in,nom}$, $I_{out,nom}$

** The maximum ambient temperature without additional cooling

$$T_{amb} = 97^{\circ}C - 2,0 \frac{^{\circ}C}{W} \times P_{out} (W) \left(\frac{100\%}{\eta(\%)} - 1 \right)$$

$$P_{out} = (97^{\circ}C - T_{amb}) / \left(2,0 \times \left(\frac{100\%}{\eta(\%)} - 1 \right) \right)$$

*** In built-in condition our devices may show different EMC properties

**** Value could be higher, depending on the voltage drop of the connector

PROTECTION

Over Voltage Protection (OVP) 120-130% $V_{out,nom}$, latched (independent of the trimmed voltage).

Over Current Protection (OCP) $I_{out,nom} > 105\%$. The output switches-off when $V_{out,nom} < 70\%$ (at $V_{out,nom} = 5V < 80\%$) and restarts automatically latest after 0.5 s of elimination of the overload.

Over Temperature Protection (OTP) Shutdown at +97 -102°C case with approx. 5°C hysteresis and auto recovery.

GENERAL

Product Standard	EN 50155:2007
Isolation	2200 VDC Input to Output 1500 VDC Input to Baseplate 710 VDC Output to Baseplate
Switching Frequency	Typ. 400 kHz
Dimensions [mm]	164,5 x 111,0 x 20,0
Weight	approx. 585 g
MTBF	TBD

ENVIRONMENTAL

Operating Ambient Temp.	-40°C to +85°C**
Operating Case Temp.	-40°C to +97°C
Storage Temperature	-55°C to +100°C
Vibration / Shock / Bump	EN 61373:1999, Cat. 1B (ACR 150)

EMC & SAFETY

EMC Standard	EN 50121-3-2:2006
Emissions	EN 55011:2007+A2:2007, Class A***
ESD Immunity	EN 61000-4-2:1995+A1:1998+A2:2001, level 3 (6kV/8kV), Criteria B
Burst	EN 61000-4-4:2004, level 3 (2kV), Criteria A
Surge	EN 50121-3-2:2006, line to line $\pm 1kV$, 42R, and line to case $\pm 2kV$, 42R, Criteria B EN 61000-4-5:2006, level 1, $\pm 0,5kV$ (except $V_{in} = 110V$)
Conducted Immunity	EN 61000-4-6:2007, level 3 (10V), Criteria A
Radiated Immunity	EN 61000-4-3:2006, 20V/m, Criteria A

TECHNICAL DATA

For $T_{amb} = 25^{\circ}C$, $V_{in nom}$, $I_{out nom}$, unless otherwise specified.

SPECIFICATION Input 9,5 - 36 VDC (12/24 Vin nom)

TYPE		ACR150 12/24S24			
ORDER NUMBER		73 42 24 0322 6 (LEC)		73 42 24 0321 2 (LEC-C)	
CHARACTERISTIC		Unit	Min	Typ	Max
INPUT	Input Voltage Operating	V	10,5...36		
	Input Voltage Range	V	9,5...40 ($t \leq 1,0$ sec.)		
	Under Voltage Turn-on	V	< 10		
	Under Voltage Turn-off	V	< 9,5		
	Input Current @ Vin nom = 24 V	A	5,9		
	Input Current @ Vin nom = 12 V	A	12,0		
	Input Current @ Vin = 9,5 V	A	15,3		
	Input Current @ No Load (24 V)	mA	90		
	Input Current @ No Load (12 V)	mA	110		
	Disabled Input Current	mA	4,0		
OUTPUT	Internal Fuse	A	16		
	Output Voltage	V	24,0		
	Output Current	A	5,0		
	Output Power	W	120		
	Efficiency (24V) @ Pout (80%)	%	86		
	Efficiency (12V) @ Pout (80%)	%	85		
	Efficiency (24V) @ Pout (100%)	%	85		
	Efficiency (12V) @ Pout (100%)	%	83		
Transient Response 25% / 75% Load Step, Recovery Time < 500 us	mV	±300			

SPECIFICATION Input 14,4 - 40 VDC (24 Vin nom)

TYPE		ACR150 24S05			ACR150 24S12			ACR150 24S24			
ORDER NUMBER		72 42 08 0522 8 (LEC)	72 42 08 0521 4 (LEC-C)	72 42 12 0522 3 (LEC)	72 42 12 0521 8 (LEC-C)	72 42 24 0522 8 (LEC)	72 42 24 0521 4 (LEC-C)	72 42 24 0522 8 (LEC)	72 42 24 0521 4 (LEC-C)		
CHARACTERISTIC		Unit	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
INPUT	Input Voltage Operating	V	16,8...36								
	Input Voltage Range	V	14,4...40 ($t \leq 1,0$ sec.)								
	Under Voltage Turn-on	V	< 14,4								
	Under Voltage Turn-off	V	< 14,3								
	Input Current @ Vin nom = 24 V	A		4,29			7,18			7,05	
	Input Current @ Vin = 14,4 V	A		7,27			12,15			12,0	
	Input Current @ No Load	mA		130			130			60	
	Disabled Input Current	mA		4,0			4,0			4,0	
	Internal Fuse	A		10					16		
	OUTPUT	Output Voltage	V		5,0			12,0			24,0
Output Current		A			18,0			12,5			6,25
Output Power		W			90			150			150
Efficiency @ Pout (80%)		%		87			88			89	
Efficiency @ Pout (100%)		%		86			87			88	
Transient Response 25% / 75% Load Step, Recovery Time < 500 us		mV		±200			±600			±500	

TECHNICAL DATA

For $T_{amb}=25^{\circ}C$, $V_{in nom}$, $I_{out nom}$ unless otherwise specified.

SPECIFICATION Input 66 - 154 VDC (110 Vin nom)

TYPE	ACR150 110S12										
	ORDER NUMBER	77 42 12 0522 4 (LEC)					77 42 12 0521 9 (LEC-C)				
CHARACTERISTIC	Unit	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
INPUT	Input Voltage Operating	V	77...138								
	Input Voltage Range	V	66...154 (t ≤ 1,0 sec.)								
	Under Voltage Turn-on	V	< 77,0								
	Under Voltage Turn-off	V	< 66,0								
	Input Current @ Vin nom = 110V	A				1,51					
	Input Current @ Vin = 66 V	A				2,53					
	Input Current @ No Load	mA				50					
	Disabled Input Current	mA				3,5					
	Internal Fuse	A				3,15					
OUTPUT	Output Voltage	V				12,0					
	Output Current	A							12,5		
	Output Power	W							150		
	Efficiency @ Pout (80%)	%				91					
	Efficiency @ Pout (100%)	%				90					
	Transient Response 25% / 75% Load Step, Recovery Time < 500 us	mV				± 500					

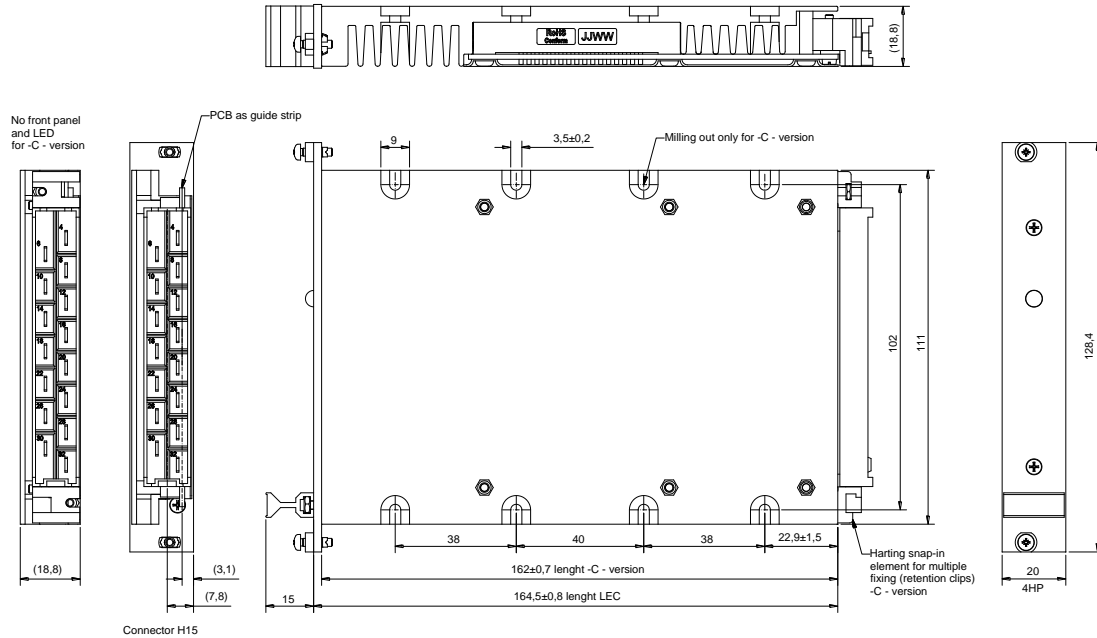
TECHNICAL DATA

For $T_{amb} = 25^{\circ}\text{C}$, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified.

MECHANICAL DETAILS

- Dimensions are in mm.
- Unless otherwise specified, general tolerances $\pm 0,5$ are for values in brackets (XX).
Values not in brackets are according to ISO 2768-1m.

Coating: Lackwerke Peters ELPEGUARD SL 1307-FLZ/2

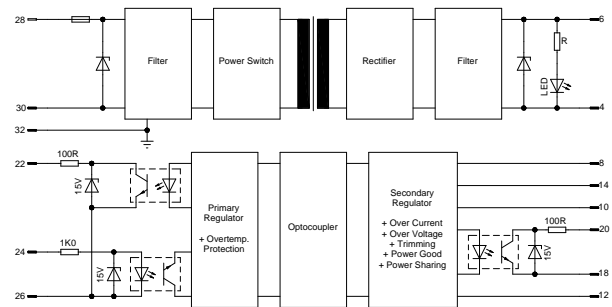


Resin compound: Polyurethane black (ACR150), UL94-V0, EN45545-2:2016-02 HL-HL2-HL3 (R24)

PINNING

Pin	Function	Pin	Function
4	-V _{out} Negative Output Voltage	20	+PG +Power Good
6	+V _{out} Positive Output Voltage	22	+TW +Thermal Warning
8	+R Positive reference for Trim	24	EN Enable Signal
10	-R Negative reference for Trim and Share	26	EN/TW Enable and Thermal Warning Ground
12	Share Current sharing	28	+V _{in} Positive Input Voltage
14	Trim Output Voltage Trimming	30	-V _{in} Negative Input Voltage
16	n.c. Not connected	32	Case Potential of the case
18	-PG -Power Good		

BLOCK DIAGRAM



NOTES

Installation Instructions:

The converters have to be installed according to the guidelines currently in force, like other open electronic component assemblies. Attention must be paid to sufficient ventilation, carry off heat, fastening and protection against accidental contact. The mounting surface must be flat and able to remove the thermal energy of the baseplate (baseplate temperature must not exceed $+97^{\circ}\text{C}$). Plug in not under voltage if converter connected parallel or in series. Attention! At Pout max (constantly) a warming up of the front plate up to 40°C over the ambient temperature is possible.

The pin 32, case: (/), has to be properly connected to Chassis/Earth in order to assure operation.

Internal Fuse:

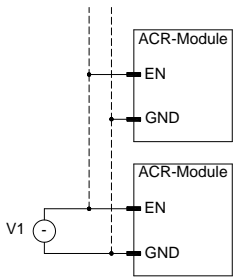
The converter is equipped with a soldered-in-time-lag fuse corresponding to IEC 60127-2 for input protection. In case of fault the supplying current source must be capable to blow the fuse.

DESCRIPTION OF FEATURES

For $T_{amb} = 25^{\circ}\text{C}$, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified.

ENABLE SIGNAL

Switched this input EN-Pins to high level $>3,3\text{V}$ then the converter switches off. This may be done with an external control voltage (V1).



V1:
 0...0,8 V (Enable inactive, converter on)
 3,3...5,0 V (Enable active, converter off)
 Input current: from 1,0mAmin to 5,0mAmax
 If the signal Enable not potential-free required, then -EN can be connected to $-V_{in}$

When not in use, leave Enable pin not-connected.

THERMAL WARNING SIGNAL

Maximum ratings
 TW to GND: 0...10 V
 $I_{TW} \leq 1\text{ mA}$
 Saturation voltage $< 0,8\text{ V}$

When not in use, leave Thermal Warning pin not-connected.

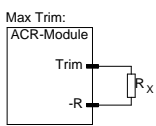
OUTPUT POWER GOOD

Maximum ratings
 +PG to -PG: 0...10 V
 $I_{PG} \leq 1\text{ mA}$
 Saturation voltage $< 0,8\text{ V}$

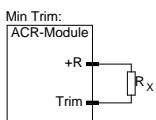
When not in use, leave Output Power Good pins not-connected.

TRIM

The output voltage of the converter can be adjusted or programmed via fixed resistors or potentiometers - see table below.



The resistor must be connected to the -R pin. $R_x [k\Omega] = \frac{a(V_{out} - V_{Trim}) + b}{V_{Trim} - V_{out}}$



The resistor must be connected to the +R pin. $R_x [k\Omega] = \frac{c(V_{Trim} - V_{out}) + d}{V_{out} - V_{Trim}}$

Table of parameters

	a	b	c	d
ACR150 (xx)S05	3,856	2,089	5,384	6,097
ACR150 (xx)S12	6,922	10,728	9,823	26,364
ACR150 (xx)S24	16,944	46,697	24,497	139,461

When not in use, leave Trim pin not-connected.

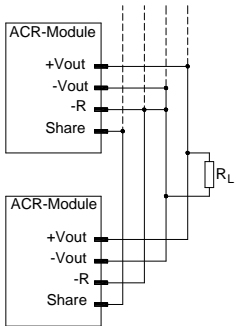
DESCRIPTION OF FEATURES

For $T_{amb} = 25^{\circ}\text{C}$, $V_{in\ nom}$, $I_{out\ nom}$ unless otherwise specified.

SHARE

The Share pin supports paralleling for increased power (max. 90% load per converter).

Modules of the same input voltage, output voltage and power level will current share if all Share pins are suitably interfaced.



After overload switch-off, the converters should be restarted by enable signal or input voltage.

Connection should be as short as possible.

When not in use, leave Share pin not-connected.