CD5.051

DC/DC Converter 5V, 10A, 50W



DC/DC Converter

- 24V DC-Input
- Isolated 5Vdc output
- Efficiency up to 81.5%
- Width only 32mm
- 20% output power reserves (PowerBoost)
- Full power between -25°C and +60°C
- Soft-start function included
- Minimal inrush current surge
- Reverse input polarity protection
- 3 year warranty

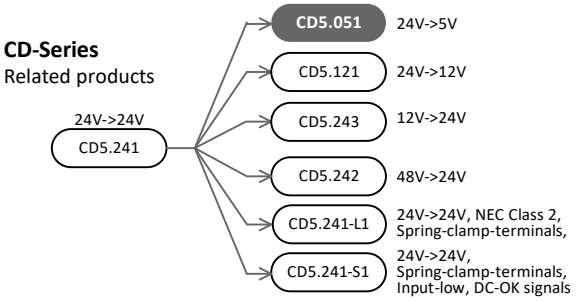
Product Description

The Dimension CD-Series offer DIN rail DC/DC converters in the 50-120W output power range in a very compact housing. These DC/DC converters can also to run on a battery or similar sources.

The CD5.051 converts 24Vdc on the input to 5Vdc at the output.

The device includes all the essential basic functions. The devices also offer PowerBoost: Power reserves of 20%, which may even be used continuously at temperatures up to +45°C.

The output is electrically isolated from the input in a safe way. The input is protected against reversed voltages and contains a soft start function.



Short-form Data

Output voltage	DC 5V	Nominal
Adjustment range	5 – 5.5V	Factory setting 5.1V
Output current	10A	up to +60°C ambient
	7.5A	at +70°C ambient
	Derate linearly between +60°C and +70°C	
PowerBoost	12A	up to +45°C ambient
	Linear decrease to nominal power between +45°C and +60°C	
Output ripple	< 50mVpp	20Hz to 20MHz
Input voltage	DC 24V	
Input voltage range	18.0 to 32.4Vdc	full power
	14.4 to 18.0Vdc	with derating
Input current	typ. 2.6A	at 24Vdc input
Input inrush current	typ. 1.2A$_{peak}$	
Efficiency	81.5%	at 24Vdc input
Power losses	11.5W	at 24Vdc input
Temperature range	-25°C to +70°C	operational
Derating	1.25W/°C	+60 to +70°C
Hold-up time	typ. 10ms	at 24Vdc input
Dimensions	32x124x102mm	WxHxD
Weight	425g	

Order Numbers

DC/DC Converter	**CD5.051**	Standard unit
Accessory	ZM10.WALL	Wall mount bracket
	ZM11.SIDE	Side mount bracket

Main Approvals

For details and the complete approval list, see chapter 17

UL 508 · ATEX · IECEx

UL 60950-1 · Class I Div 2

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

INDEX

	Page
1. Intended Use	3
2. Installation Instructions	3
3. DC-Input	5
4. Soft-start and Input Inrush Current Surge	6
5. Output	7
6. Hold-up Time	8
7. Efficiency and Power Losses	9
8. Functional Diagram	10
9. Front Side and User Elements	10
10. Terminals and Wiring	11
11. Lifetime Expectancy and MTBF	11
12. EMC	12
13. Environment	13
14. Protection Features	14
15. Safety Features	14
16. Dielectric Strength	15
17. Approved, Fulfilled or Tested Standards	16
18. Regulatory Product Compliance	17
19. Physical Dimensions and Weight	18
20. Accessories	19
20.1. ZM10.WALL Wall mounting bracket	19
20.2. ZM11.SIDE Side mounting bracket	20
21. Application Notes	20
21.1. Back-feeding Loads	20
21.2. Inductive and Capacitive Loads	20
21.3. External Input Protection	20
21.4. Requirements for the Supplying Source	21
21.5. Parallel Use to Increase Output Power	22
21.6. Parallel Use for Redundancy	22
21.7. Daisy Chaining of Outputs	23
21.8. Use in a Tightly Sealed Enclosure	23
21.9. Mounting Orientations	24

The information presented in this document is believed to be accurate and reliable and may change without notice. Some parts of this unit are patent by PULS (US patent No 091662,063, Des. 424,529, …).

No part of this document may be reproduced or utilized in any form without permission in writing from PULS GmbH.

TERMINOLOGY AND ABREVIATIONS

PE and ⏚ symbol	PE is the abbreviation for **P**rotective **E**arth and has the same meaning as the symbol ⏚.
Earth, Ground	This document uses the term "earth" which is the same as the U.S. term "ground".
t.b.d.	To be defined, value or description will follow later.
DC 24V	A figure displayed with the AC or DC before the value represents a nominal voltage with standard tolerances included. E.g.: DC 12V describes a 12V battery disregarding whether it is full (13.7V) or flat (10V)
24Vdc	A figure with the unit (Vdc) at the end is a momentary figure without any additional tolerances included.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

1. Intended Use

This device is designed for installation in an enclosure and is intended for the general use such as in industrial control, office, communication, and instrumentation equipment.
Do not use this DC/DC converter in equipment where malfunction may cause severe personal injury or threaten human life.

2. Installation Instructions

⚠ WARNING Risk of electrical shock, fire, personal injury or death.

- Do not use the DC/DC-converter without proper grounding (Protective Earth). Use the terminal on the input block for earth connection and not one of the screws on the housing.
- Turn power off before working on the device. Protect against inadvertent re-powering.
- Make sure that the wiring is correct by following all local and national codes.
- Do not modify or repair the unit.
- Do not open the unit as high voltages may present inside.
- Use caution to prevent any foreign objects from entering the housing.
- Do not use in wet locations or in areas where moisture or condensation can be expected.
- Do not touch during power-on, and immediately after power-off. Hot surface may cause burns.

Obey the following installation instructions:
This device may only be installed and put into operation by qualified personnel.
This device does not contain serviceable parts. The tripping of an internal fuse (if included) is caused by an internal defect.
If damage or malfunction should occur during installation or operation, immediately turn power off and send unit to the factory for inspection.
Install device in an enclosure providing protection against electrical, mechanical and fire hazards.
Install the device onto a DIN rail according to EN 60715 with the input terminals on the bottom of the device. Other mounting orientations require a reduction in output current.
Make sure that the wiring is correct by following all local and national codes. Use appropriate copper cables that are designed for a minimum operating temperature of 60°C for ambient temperatures up to+45°C, 75°C for ambient temperatures up to +60°C and 90°C for ambient temperatures up to +70°C.
Ensure that all strands of a stranded wire enter the terminal connection. Unused screw terminals should be securely tightened.
The device is designed for pollution degree 2 areas in controlled environments. No condensation or frost is allowed.
The enclosure of the device provides a degree of protection of IP20. The enclosure does not provide protection against spilled liquids.
The isolation of the device is designed to withstand impulse voltages of 1.5kV according to IEC 60664-1.
The input can be powered from batteries or similar DC sources. The voltage between the input terminals and ground must not exceed 60Vdc continuously.
The input must be powered from a PELV or SELV source or an "Isolated Secondary Circuit" in order to maintain a SELV or PELV output.
Check for correct input polarity. The device will not operate when the voltage is reversed.
A disconnecting means shall be provided for the input of the device.
The device is designed as "Class of Protection III" equipment according to IEC 61140. A PE (ground)connection is not required. However, connecting the chassis ground terminal to ground can be beneficial to gain a high EMI immunity.
The device is designed for convection cooling and does not require an external fan. Do not obstruct airflow and do not cover ventilation grid!
The device is designed for altitudes up to 5000m. Above 2000m a reduction in output current is required.
Keep the following minimum installation clearances: 40mm on top, 20mm on the bottom, 5mm left and right side. Increase the 5mm to 15mm in case the adjacent device is a heat source. When the device is permanently loaded with less than 50%, the 5mm can be reduced to zero.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The device is designed, tested and approved for branch circuits up to 50A without additional protection device. If an external fuse is utilized, do not use circuit breakers smaller than 10A B- or 8A Characteristic to avoid a nuisance tripping of the circuit breaker.
The maximum surrounding air temperature is +70°C. The operational temperature is the same as the ambient or surrounding air temperature and is defined 2cm below the device.
The device is designed to operate in areas between 5% and 95% relative humidity.

Installation Instructions for Hazardous Location Areas

The device is suitable for use in Class I Division 2 Groups A, B, C, D locations and for use in Group II Category 3 (Zone 2) environments.

Classification: ATEX: EPS 08 ATEX 1 142 X, II 3G Ex ec nC IIC T4 Gc / IECEx EPS 14.0001X

⚠ WARNING EXPLOSION HAZARDS!

Substitution of components may impair suitability for this environment.

Do not disconnect the device or operate the voltage adjustment unless power has been switched off or the area is known to be non-hazardous.

A suitable enclosure must be provided for the end product which has a minimum protection of IP54 and fulfils the requirements of the EN 60079-0.

Reduced output current conditions must be considered for high ambient temperatures and non-standard mounting orientations.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3. DC-INPUT

Input voltage	nom.	DC 24V	
Input voltage range		18.0-32.4Vdc	full power, see Fig. 3-2 for derating below 18.0Vdc
		14.4-18.0Vdc	max. 60s or with derating see Fig. 3-2
	max.	36.0Vdc	absolute maximum continuous input voltage with no damage to the DC/DC converter
Allowed voltage between input and earth	max.	60Vdc or 42.2Vac	in case the output voltage is not grounded.
Allowed input ripple voltage	max.	5Vpp	47Hz-500Hz, the momentary input voltage must always be within the specified limits
Turn-on voltage	typ.	17.5Vdc	steady-state value, see Fig. 3-1
Shut-down voltage	typ.	14.0Vdc	steady-state value, see Fig. 3-1
	typ.	35.0Vdc	steady-state value, see Fig. 3-1
Input current	typ.	2.6A	at 24Vdc input and output 5V, 10A, see Fig. 3-4
Start-up delay	typ.	420ms	see Fig. 3-3
Rise time	typ.	300ms	0mF, 5V, constant current load 10A, see Fig. 3-3
	typ.	350ms	8mF, 5V, constant current load 10A, see Fig. 3-3
Turn-on overshoot	max.	250mV	see Fig. 3-3
Input capacitance	typ.	3 000µF	external capacitors on the input voltage bus are allowed without any limitations

Fig. 3-1 **Input voltage range**

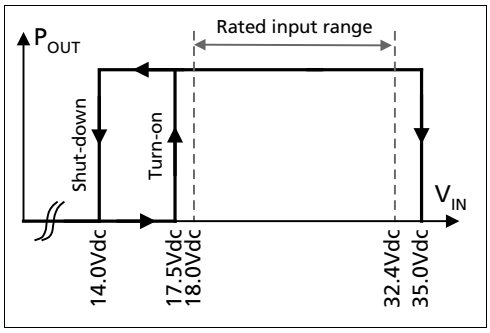


Fig. 3-2 **Allowable output current below 18V input voltage**

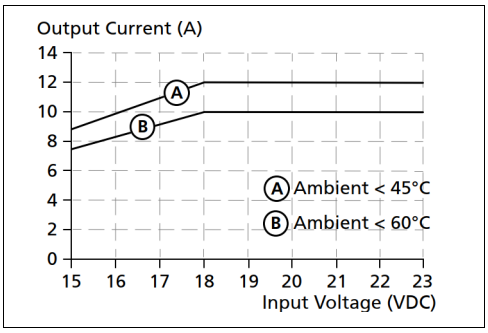


Fig. 3-3 **Turn-on behavior, definitions**

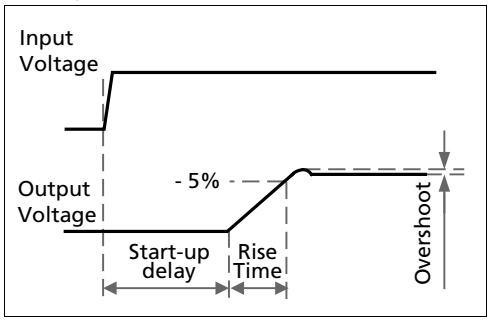
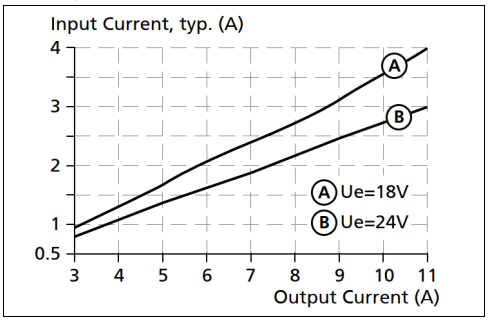


Fig. 3-4 **Input current vs. output load**



Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

4. SOFT-START AND INPUT INRUSH CURRENT SURGE

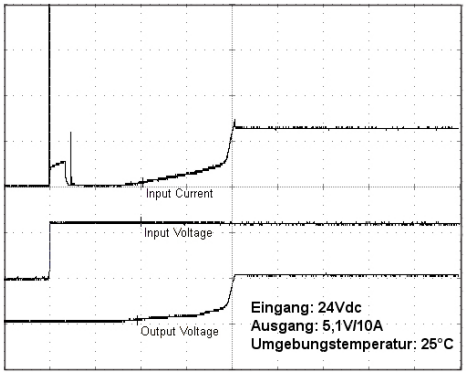
Inrush current limitation

An active inrush limitation circuit (inrush limiting resistor which is bypassed by a relay contact) limits the input inrush current after turn-on of the input voltage.

The charging current into EMI suppression capacitors is disregarded in the first microseconds after switch-on.

Inrush current	max.	$1.6A_{peak}$	-25°C to +70°C, input: 24Vdc
	typ.	$1.2A_{peak}$	-25°C to +70°C, input: 24Vdc
Inrush energy	typ.	negligible	-25°C to +70°C, input: 24Vdc

Fig. 4-1 **Input inrush current, typical behavior**



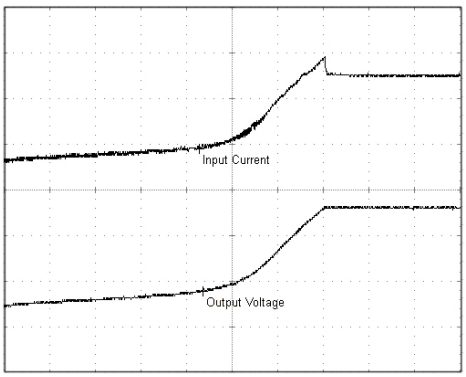
Input: 24Vdc
Output: 5V, 10A, constant current load
Ambient: 25°C

Upper curve: Input current 2A/DIV
Middle curve: Input voltage 20V/DIV
Lower curve: Output voltage 5V/DIV
Time basis: 100ms/DIV

Soft-start function:

After the DC/DC converter is turned on, the internal output current rises slowly to its nominal value. This method charges the output capacitors (internal and external capacitors) slowly and avoids high input currents during turn-on. High input currents can produce a high voltage drop on the input wiring (especially with long and thin cables) which reduces the terminal voltage on the DC/DC converter. If the terminal voltage is below the shut-down voltage, the DC/DC converter will turn-off and will make a new start-up attempt. This effect is avoided with the integrated soft-start function. Please note, that this function increases the rise time of the output voltage by a small amount.

Fig. 4-2 **Soft-start behavior**



Input: 24Vdc
Output: 5V, 10A, constant current load
Ambient: 25°C
No additional external output capacitors

Upper curve: Input current 1A/DIV
Lower curve: Output voltage 2 /DIV
Time basis: 20ms/DIV

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5. OUTPUT

Output voltage	nom.	5V	
Adjustment range		5-5.5V	guaranteed
	max.	5.8V	at clockwise end position of potentiometer
Factory setting		5.1V	±0.2%, at full load, cold unit
Line regulation	max.	25mV	Input voltage variations between 18 to 32.4Vdc
Load regulation	max.	120mV	static value, 0A → 10A
Ripple and noise voltage	max.	50mVpp	20Hz to 20MHz, 50Ohm
Output current	nom.	10A	At 5V and up to +60°C ambient temperature, see Fig. 5-1
	nom.	7.5A	At 5V and +70°C ambient temperature
	nom.	10A	At 5.5V and up to +60°C ambient temperature, see Fig. 5-1
	nom.	7.5A	At 5.5V and +70°C ambient temperature
	Input voltage range 18.0 to 32.4Vdc: Derate linearly between +60°C and +70°C, see Fig. 13-1		
	Input voltage range 14.4 to 18.0Vdc: Derate linearly between +45°C and +70°C, see Fig. 3-2		
PowerBoost*)	nom.	12A	at 5.0V up to +45°C ambient, see Fig. 5-1
	nom.	11A	at 5.5V up to +45°C ambient, see Fig. 5-1
	PowerBoost decreases linearly to nominal power between +45°C and +60°C, see chapter 13		
Short-circuit current	min.	12A	continuous current, short circuit impedance 10mOhm
	max.	20A	continuous current, short circuit impedance 10mOhm
Output capacitance	typ.	16000µF	

***) PowerBoost**
This power/ current is continuously allowed up to an ambient temperature of +45°C.
Above +45°C, do not use this power or current longer than a duty cycle of 10% and/or not longer than 1 minute every 10 minutes.

Fig. 5-1 **Output voltage vs. output current at 24Vdc input voltage, typ.**

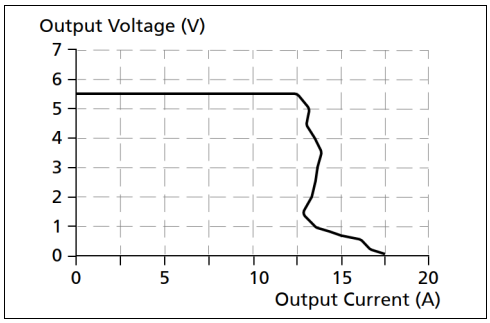
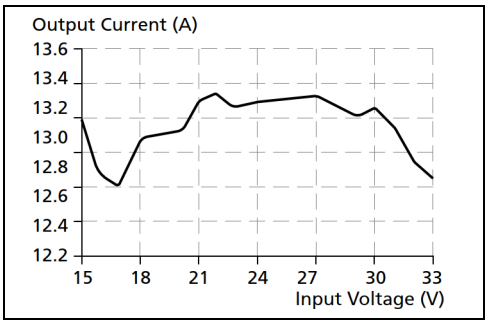


Fig. 5-2 **Current limitation vs. input voltage, (5V constant voltage load), typ.**



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6. HOLD-UP TIME

The input side of the DC/DC converter is equipped with a bulk capacitor which keeps the output voltage alive for a certain period of time when the input voltage dips or is removed. The bulk capacitor can be discharged by loading the DC/DC converter on the output side or through a load which is parallel to the input. There is no protection in the DC/DC converter which prevents current from flowing back to the input terminals. If prevention is needed, an external diode should be used.

Hold-up Time	typ.	20ms	input 24Vdc, output: 5V, 5A, see Fig. 6-1
	typ.	10ms	input 24Vdc, output: 5V, 10A, see Fig. 6-1

Fig. 6-1 **Hold-up time vs. input voltage**

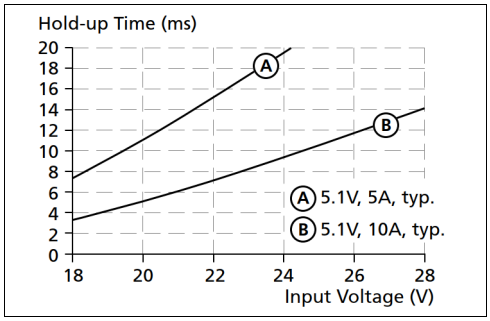


Fig. 6-2 **Shut-down test setup**

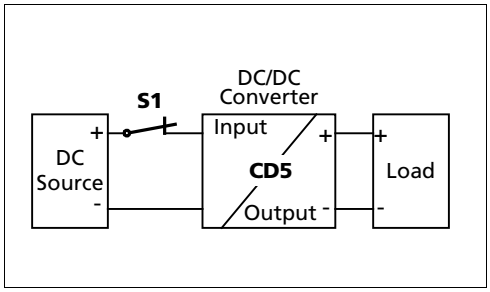
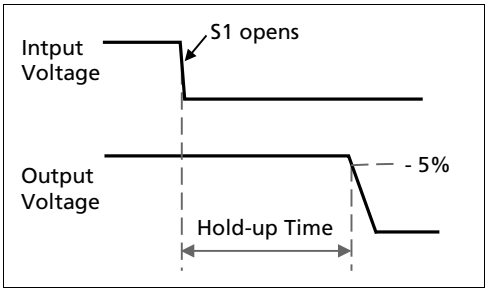


Fig. 6-3 **Shut-down behavior, definitions**



Note: At no load, the hold-up time can be up to several seconds. The green DC-OK LED is also on during this time.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

7. Efficiency and Power Losses

		Input 24Vdc	
Efficiency	typ.	81.5%	at 5.1V, 10A
Power losses	typ.	0.8W	at no output load
	typ.	5.5W	at 5.1V, 5A
	typ.	11.5W	at 5.1V, 10A
	typ.	14.5W	at 5.1V, 12A

Fig. 7-1 **Efficiency vs. output current at 5.1V output and 24Vdc input voltage, typ.**

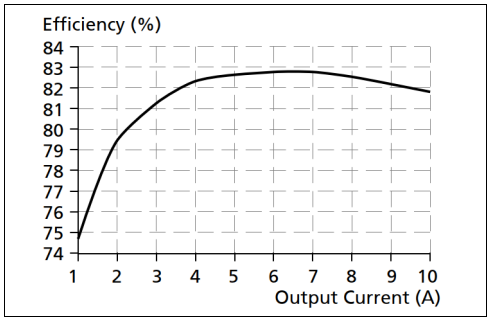


Fig. 7-2 **Losses vs. output current at 5.1V output and 24Vdc input voltage, typ.**

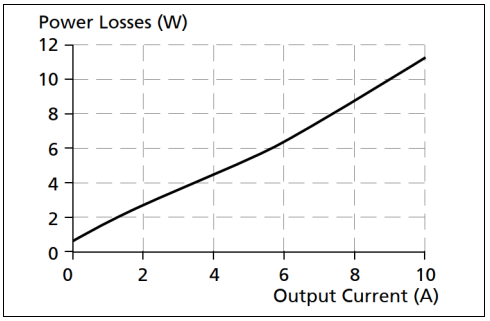


Fig. 7-3 **Efficiency vs. input voltage at 5.1V, 10A, typ.**

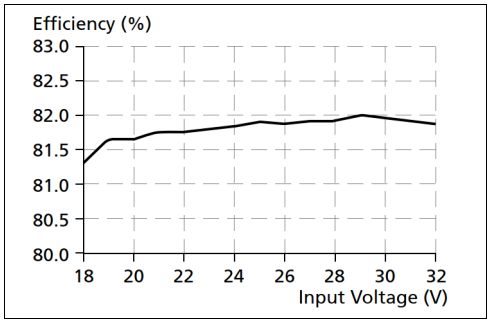
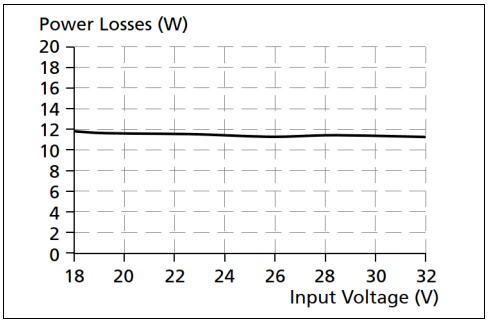


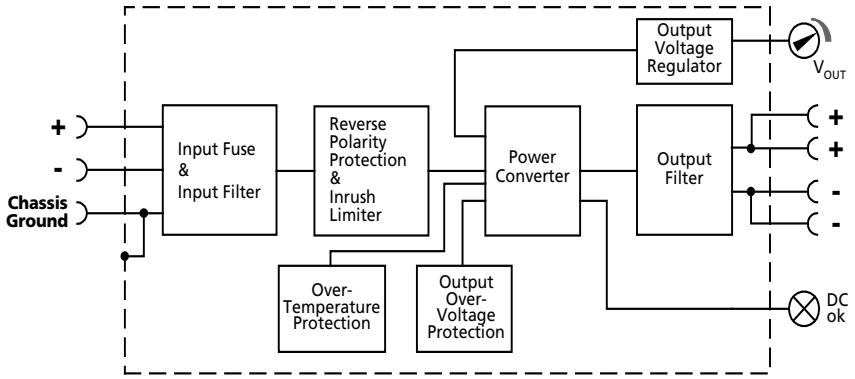
Fig. 7-4 **Losses vs. input voltage at 5.1V, 10A, typ.**



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

8. Functional Diagram

Fig. 8-1 **Functional diagram**



9. Front Side and User Elements

Fig. 9-1 **Front side**



A Input terminals
Screw terminals
+ Positive input
- Negative (return) input
Chassis ground: can be used to bond the housing to PE
Ground this terminal to minimize high-frequency emissions.

B Output terminals
Screw terminals, dual terminals per pole, both pins are equal
+ Positive output
- Negative (return) output

C Output voltage potentiometer
Open the flap to set the output voltage. Factory set: 5.1V

D DC-OK LED (green)
On when the voltage on the output terminals is > 2V

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

10. TERMINALS AND WIRING

	Input	Output
Type	screw terminals	screw terminals
Solid wire	max. 6mm²	max. 6mm²
Stranded wire	max. 4mm²	max. 4mm²
American Wire Gauge	20-10 AWG	20-10 AWG
Wire stripping length	7mm	7mm
Screwdriver	3.5mm slotted or Pozidrive No 2	3.5mm slotted or Pozidrive No 2
Recommended tightening torque	1Nm	1Nm

Instructions:

a) The external circuitry of all terminals must meet the safety requirements stipulated by IEC/EN/UL 60950-1: SELV.
b) Use appropriate copper cables that are designed for an operating temperature of:
60°C for ambient up to 45°C and
75°C for ambient up to 60°C minimum.
c) Follow national installation codes and installation regulations!
d) Ensure that all strands of a stranded wire enter the terminal connection!
e) Do not load the terminals with more than 25A! See chapter 21.7
f) Screws of unused terminal compartments should be securely tightened.
g) Ferrules are allowed.
h) Do not connect or disconnect the wires from the terminals below -25°C.

11. LIFETIME EXPECTANCY AND MTBF

	Input 24Vdc	
Lifetime expectancy *)	250 000h	at 5.1V, 5A and +40°C
	99 000h	at 5.1V, 10A and +40°C
	55 000h	at 5.1V, 12A and +40°C
	280 000h	at 5.1V, 10A and +25°C
MTBF **) SN 29500, IEC 61709	1 161 000h	at 5.1V, 10A and +40°C
	1 904 000h	at 5.1V, 10A and +25°C
MTBF **) MIL HDBK 217F	610 000h	at 5.1V, 10A and +40°C; Ground Benign GB40
	817 000h	at 5.1V, 10A and +25°C; Ground Benign GB25

*) The **Lifetime expectancy** shown in the table indicates the minimum operating hours (service life) and is determined by the lifetime expectancy of the built-in electrolytic capacitors. Lifetime expectancy is specified in operational hours and is calculated according to the capacitor's manufacturer specification. The prediction model allows only a calculation of up to 15 years from date of shipment.

) **MTBF stands for **M**ean **T**ime **B**etween **F**ailures, which is calculated according to statistical device failures, and indicates reliability of a device. It is the statistical representation of the likelihood of a unit to fail and does not necessarily represent the life of a product.
The MTBF figure is a statistical representation of the likelihood of a device to fail. A MTBF figure of e.g. 1 000 000h means that statistically one unit will fail every 100 hours if 10 000 units are installed in the field. However, it cannot be determined if the failed unit has been running for 50 000h or only for 100h.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

12. EMC

The DC/DC converter is suitable for applications in industrial environment as well as in residential, commercial and light industry environment.

The device complies with EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN IEC 61000-6-8 and EN 61000-6-4.

No restrictions apply for DC power ports in industrial, light-industrial and commercial environments. For DC power ports in residential environments no restrictions apply with a maximum DC output line length of 25 m.

EMC Immunity	Generic standards: EN 61000-6-1 and EN 61000-6-2			
Electrostatic discharge	EN 61000-4-2	Contact discharge Air discharge	8kV 15kV	Criterion A Criterion A
Electromagnetic RF field	EN 61000-4-3	80MHz-6GHz	10V/m	Criterion A
Fast transients (Burst)	EN 61000-4-4	Input lines Output lines	4kV 2kV	Criterion A Criterion A
Surge voltage on input	EN 61000-4-5	+ → - +/- → chassis ground +/- → chassis ground	1kV 1kV 2kV	Criterion A Criterion A Criterion B
Surge voltage on output	EN 61000-4-5	+ → - + / - → chassis ground	0,5kV 1kV	Criterion B Criterion A
Conducted disturbance	EN 61000-4-6	0.15-80MHz	10V	Criterion A

Criterions:

A: DC/DC converter shows normal operation behavior within the defined limits.

B: The DC/DC converter operates continuously during and after the test. During the test minor temporary impairments may occur, which will be corrected by the device itself.

C: Temporary loss of function is possible. DC/DC converter may shut-down and restarts by itself. No damage or hazards for the DC/DC converter will occur.

EMC Emission	Generic standards: EN 61000-6-3 and EN 61000-6-4	
Conducted emission input lines	IEC/CISPR 16-1-2, IEC/CISPR 16-2-1	EN IEC 61000-6-3 limits for DC power ports fulfilled for a maximum DC output line length of 25 m. EN IEC 61000-6-8 limits for DC power ports fulfilled without restrictions
Radiated emission	EN 55011, EN 55032	Class B

This device complies with FCC Part 15 rules.
Operation is subjected to following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Switching frequency	
	Variable between 40kHz and 120kHz depending on load and input voltage (output current > 0.5A)

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

13. ENVIRONMENT

Operational temperature *)	-25°C to +70°C	reduce output power according Fig. 13-1
Storage temperature	-40 to +85°C	for storage and transportation
Output derating	1.25W/K	between +60°C and +70°C
	Additional derating is required for input voltages below 18.0Vdc, see chapter 3	
Humidity **)	5 to 95% r.H.	IEC 60068-2-30
Vibration sinusoidal ***)	2-17.8Hz: ±1.6mm; 17.8-500Hz: 2g 2 hours / axis	IEC 60068-2-6
Shock ***)	30g 6ms, 20g 11ms 3 bumps / direction, 18 bumps in total	IEC 60068-2-27
Altitude	0 to 6000m	reduce output power or ambient temperature above 2000m sea level.
Altitude derating	6W/1000m or 5K/1000m	For altitudes >2000m, see Fig. 13-2
Degree of pollution	2	IEC 62477-1, EN 50178, not conductive

*) Operational temperature is the same as the ambient temperature and is defined as the air temperature 2cm below the unit.
**) Do not energize while condensation is present
***) Tested in combination with DIN rails according to EN 60715 with a height of 15mm and a thickness of 1.3mm and standard mounting orientation.

Fig. 13-1 **Output current vs. ambient temp. (Inom 10A; Iout with PowerBoost = 12A)**

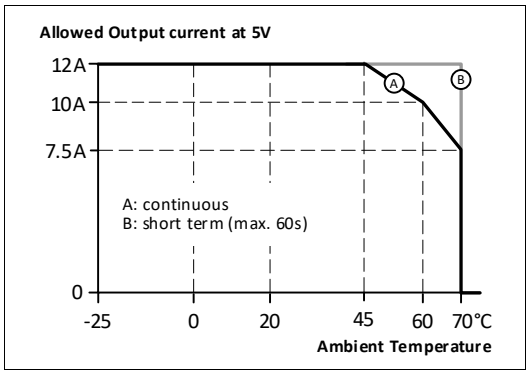
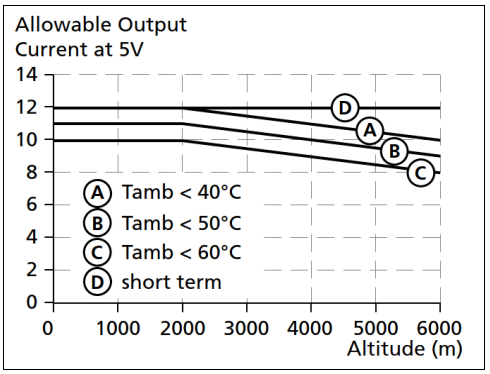


Fig. 13-2 **Output current vs. altitude at 24V**



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

14. PROTECTION FEATURES

Output protection	Electronically protected against overload, no-load and short-circuits *)	
Output overvoltage protection	typ. 5.9Vdc max. 6.1Vdc	in case of an internal power supply defect, a redundant circuit limits the maximum output voltage. The output shuts down and automatically attempts to restart.
Reverse input polarity protection	Included	unit does not start when input voltage is reversed
Output overcurrent protection	electronically limited *)	see Fig. 5-1
Degree of protection	IP20	EN/IEC 60529
Penetration protection	> 3.5mm	e.g. screws, small parts
Overtemperature protection	yes	output shut-down with automatic restart
Input transient protection	MOV	Metal Oxide Varistor
Internal input fuse	included	not user replaceable

*) In case of a protection event, audible noise may occur.

15. SAFETY FEATURES

Classification of output voltage	SELV	IEC/EN 60950-1
Class of protection	III	PE (Protective Earth) connection not required. A connection of the "Chassis Ground" pin to earth is recommended for best EMI performance
Isolation resistance	> 100MOhm	input to output, 500Vdc
PE resistance	< 0.1Ohm	between housing and Chassis Ground terminal
Touch current (leakage current)	The leakage current which is produced by the DC/DC converter itself depends on the input voltage ripple and need to be investigated in the final application. For a smooth DC input voltage, the produced leakage current is less than 100µA.	

*) provided, that the input voltage meets the requirements of chapter 2.

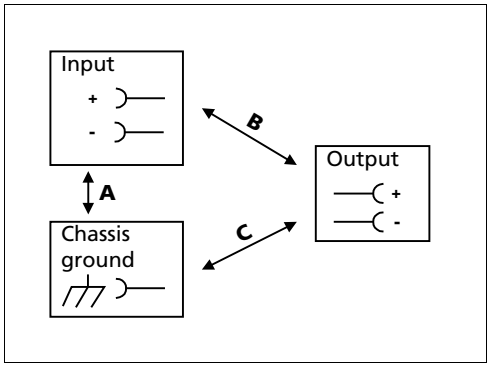
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

16. DIELECTRIC STRENGTH

The output voltage is floating and has no ohmic connection to the ground.

Type and factory tests are conducted by the manufacturer. Field tests may be conducted in the field using the appropriate test equipment which applies the voltage with a slow ramp (2s up and 2s down). Connect all input terminals together as well as all output poles before conducting the test. When testing, set the cut-off current settings to the value in the table below.

Fig. 16-1 **Dielectric strength**



		A	B	C
Type test	60s	1500Vac	1500Vac	500Vac
Factory test	5s	1500Vac	1500Vac	500Vac
Field test	5s	1000Vac	1000Vac	500Vac
Cut-off current setting		> 30mA	> 30mA	> 12mA

To fulfill the PELV requirements according to EN60204-1 § 6.4.1, we recommend that either the + pole, the – pole or any other part of the output circuit shall be connected to the protective earth system. This helps to avoid situations in which a load starts unexpectedly or cannot be switched off when unnoticed earth faults occur.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

17. APPROVED, FULFILLED OR TESTED STANDARDS

UL 508	c UL us LISTED	LISTED for use as Industrial Control Equipment; U.S.A. (UL 508) and Canada (C22.2 No. 107-1-01); E-File: E198865
IEC 60950-1	CB Report	CB Scheme Certificate General safety requirements for Information Technology Equipment (ITE)
UL 60950-1	c UL us	UL Certificate Recognized component for category QQGQ - Information Technology Equipment (ITE) Applicable for US and Canada E-File: E137006
ATEX	Ex	Agency Certificate (Bureau Veritas) EN 60079-0 Explosive atmospheres - General requirements EN 60079-7, EN 60079-15 Equipment protection by type of protection "e" and "n" Certificate: EPS 08 ATEX 1 142 X Temperature Code: T4 Type of Protection: ec nC
IECEx	IECEx	IECEx Certificate IEC 60079-0 Explosive atmospheres - General requirements IEC 60079-15 Equipment protection by type of protection "n" Certificate: IECEx EPS 14.0001X Temperature Code: T4 Type of Protection: ec nC
Class I Div 2	c UL us LISTED	UL Certificate Listed equipment for category NRAD - Listed equipment Industrial Control Equipment for Use in Hazardous Locations Applicable for US and Canada E-File: E246877 Temperature Code: T4A Groups: A, B, C and D
Labs	LABS VDMA 24364-C1-L/W	Paint Wetting Impairment Substances Test (or LABS-Test) Tested for Zone 2 and test class C1 according to VDMA 24364-C1-L/W for solvents and water-based paints

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

18. REGULATORY PRODUCT COMPLIANCE

EU Declaration of Conformity		The CE mark indicates conformance with the - EMC directive - RoHS directive
REACH Regulation (EU)		Manufacturer's Statement EU regulation regarding the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) fulfilled.
WEEE Regulation		Manufacturer's Declaration EU Regulation on Waste Electrical and Electronic Equipment Registered as business to business (B2B) products. EU Regulation 2012/19/EU

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

19. PHYSICAL DIMENSIONS AND WEIGHT

Weight	425g
DIN rail	Use 35mm DIN rails according to EN 60715 or EN 50022 with a height of 7.5 or 15mm. The DIN rail depth must be added to the unit depth (102mm) to calculate the total required installation depth.
Installation Clearances	See chapter 2

Fig. 19-1 **Front view**

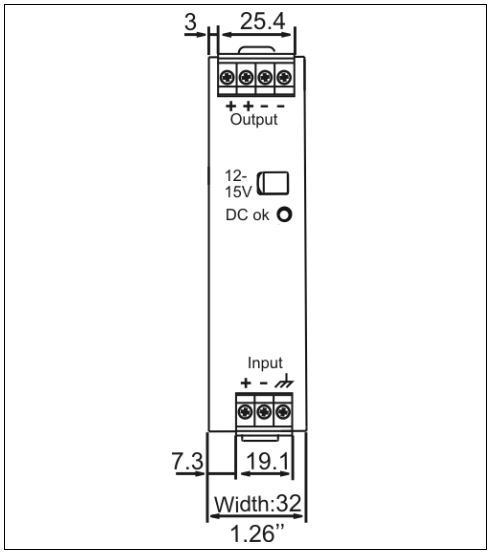
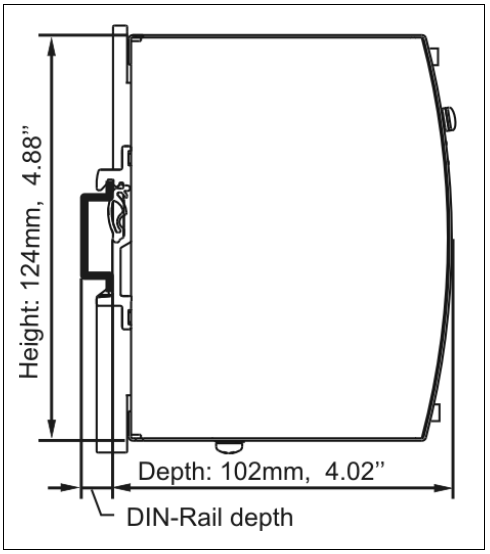


Fig. 19-2 **Side view**



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

20. ACCESSORIES

20.1. ZM10.WALL WALL MOUNTING BRACKET

This bracket is used to mount the devices on a wall/panel without utilizing the DIN rail. The bracket can be mounted without detaching the DIN rail brackets from the power supply. Product for illustration purpose only.

Fig. 20-1 **Isometric view**

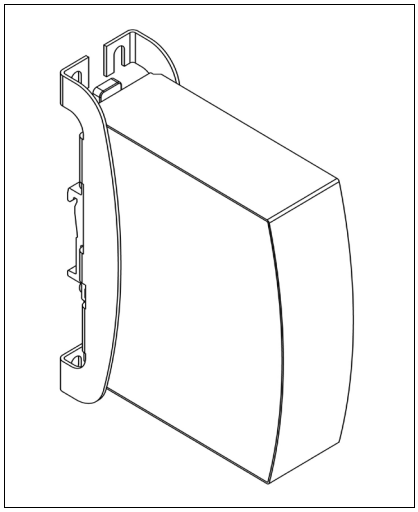


Fig. 20-2 **Isometric view**

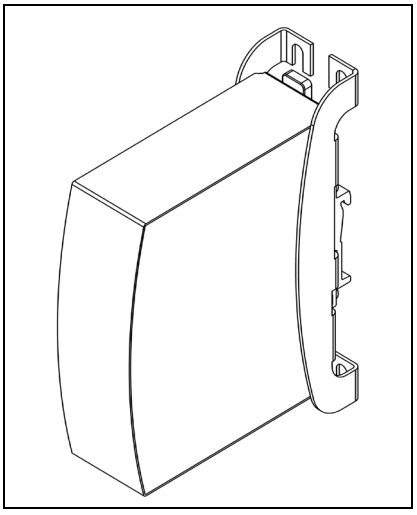


Fig. 20-3 **Isometric view**

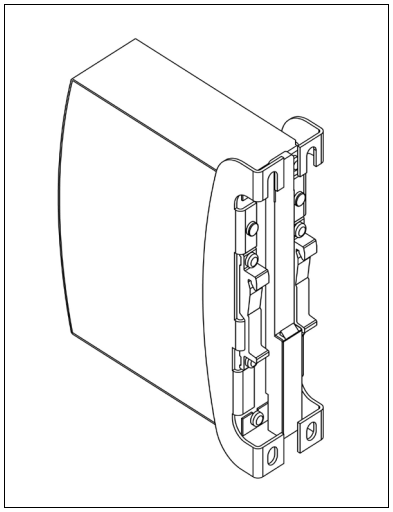


Fig. 20-4 **Wall/panel mounting, front view**

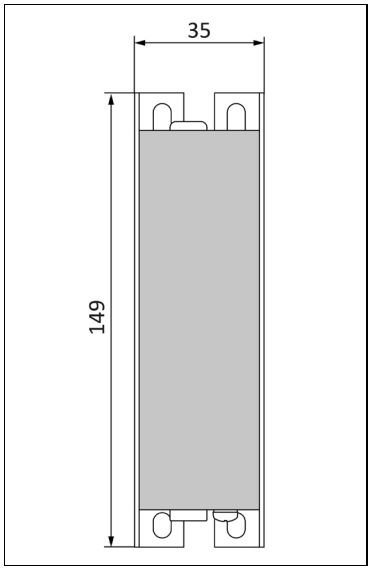


Fig. 20-5 **Hole pattern for wall mounting**

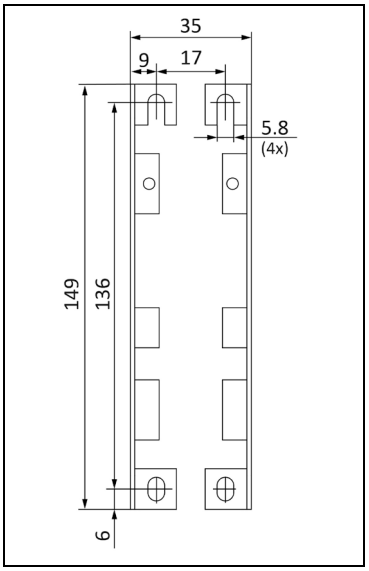
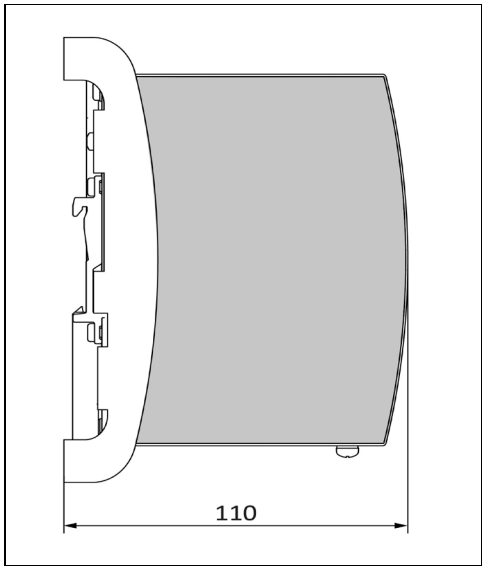


Fig. 20-6 **Wall/panel mounting, side view**



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

20.2. ZM11.SIDE SIDE MOUNTING BRACKET

This bracket is used to mount Dimension units sideways with or without utilizing a DIN rail. The two aluminum brackets and the black plastic slider of the unit have to be detached, so that the steel brackets can be mounted.

For sideway DIN rail mounting, the removed aluminum brackets and the black plastic slider need to be mounted on the steel bracket.

Fig. 20-3
ZM11.SIDE Side mounting bracket *)

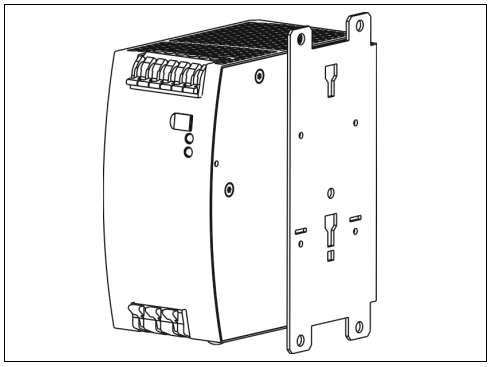
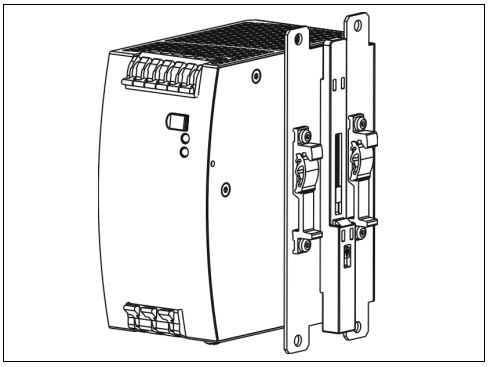


Fig. 20-4
Side mounting with DIN rail brackets *)



*) Picture of the DC/DC converter is for representation only

21. APPLICATION NOTES

21.1. BACK-FEEDING LOADS

Loads such as decelerating motors and inductors can feed voltage back to the DC/DC converter. This feature is also called return voltage immunity or resistance against Back- E.M.F. (Electro Magnetic Force).

This DC/DC converter is resistant and does not show malfunctioning when a load feeds back voltage to the DC/DC converter. It does not matter, whether the DC/DC converter is on or off.

The maximum allowed feed-back-voltage is 5.6Vdc. The absorbing energy can be calculated according to the built-in large sized output capacitance which is specified in chapter 5.

21.2. INDUCTIVE AND CAPACITIVE LOADS

The unit is designed to supply any kind of loads, including unlimited capacitive and inductive loads.

21.3. EXTERNAL INPUT PROTECTION

The unit is tested and approved for branch circuits up to 50A. An external protection is only required, if the supplying branch has an ampacity greater than this. Check also local codes and local requirements. In some countries local regulations might apply.

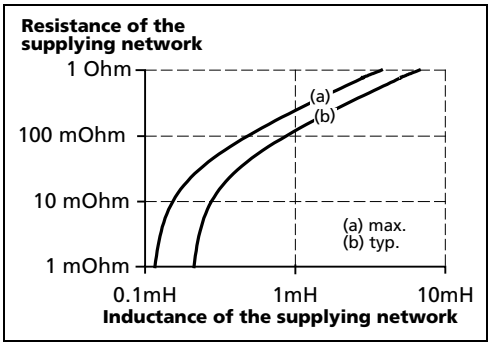
If an external fuse is necessary or utilized, minimum requirements need to be considered to avoid nuisance tripping of the circuit breaker. A minimum value of 10A B- or 8A C-Characteristic breaker should be used.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

21.4. REQUIREMENTS FOR THE SUPPLYING SOURCE

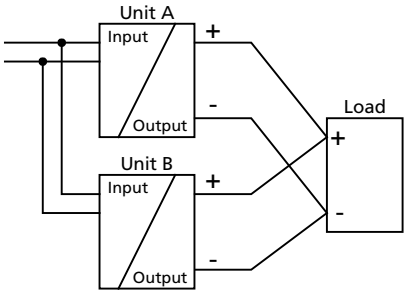
In certain circumstances, the input filter of the DC/DC converter can show a resonant effect which is caused by the supplying network. Especially when additional external input filters are utilized, a superimposed AC voltage can be generated on the input terminals of the DC/DC converter which might cause a malfunction of the unit. Therefore, additional input filters are not recommended. To avoid the resonant effects, the minimal resistance of the supplying network which depends on the inductance of the input network, shall be above the boundary curve in Fig. 21-1.

Fig. 21-1 **External input filter requirements to avoid filter instabilities**



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

21.5. Parallel Use to Increase Output Power



The DC/DC-converter can be paralleled to increase the output power. There are no feature included which balances the load current between the DC/DC-converters. Therefore some restrictions and limitations apply. The DC/DC-converter with the higher adjusted output voltage draws current until it goes into current limitation. This means no harm or switch-off to this DC/DC-converter as long as the ambient temperature stays below 45°C

The output voltages of all DC/DC-converters shall be adjusted to the same value (±100mV) at full load. A fuse or diode on the output of each unit is only required if more than three units are connected in parallel. This avoid that more than 2 times of the nominal output current can flow backwards into the DC/DC converter in case the output stage of one DC/DC converter has a defect. If a fuse (or circuit breaker) is used, choose one with approximately 150% of the rated output current of one DC/DC-converter. Keep an installation clearance of 15mm (left / right) between two DC/DC-converters and avoid installing the DC/DC-converters on top of each other. Do not use DC/DC-converters in parallel in mounting orientations other than the standard mounting orientation (input terminals on the bottom and output terminals on top of the unit).

21.6. Parallel Use for Redundancy

The DC/DC converters can be paralleled for 1+1 redundancy to gain higher system availability. Redundant systems require a certain amount of extra power to support the load in case one DC/DC converter fails. The simplest way is to put two DC/DC converters in parallel. This is called a 1+1 redundancy. In case one DC/DC converter fails, the other one is automatically able to support the load current without any interruption. Redundant systems for a higher power demand are usually built in an N+1 method. E.g. six DC/DC converters, each rated for 8A are paralleled to build a 40A redundant system.

Furthermore, 1+1 redundant systems can be built by using a DC/DC converter powered from a battery and a power supply with AC input.

Please note: This simple way to build a redundant system does not cover failures such as an internal short circuit in the secondary side of the DC/DC-converter. In such a case, the defect unit becomes a load for the other DC/DC-converters and the output voltage cannot be maintained any more. This can only be avoided by utilizing decoupling diodes which are included in the decoupling module YR2.DIODE.

Recommendations for building redundant power systems:

a) Use separate input fuses for each DC/DC-converter.

b) Monitor the individual DC/DC-converter units.

c) 1+1 Redundancy is allowed up to an ambient temperature of 60°C
N+1 Redundancy is allowed up to an ambient temperature of 45°C

d) It is desirable to set the output voltages of all units to the same value (± 100mV) or leave it at the factory setting.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

21.7. Daisy Chaining of Outputs

Daisy chaining (jumping from one DC/DC-converter output to the next) is allowed as long as the average output current through one terminal pin does not exceed 25A. If the current is higher, use a separate distribution terminal block.

Fig. 21-2 Daisy chaining of outputs

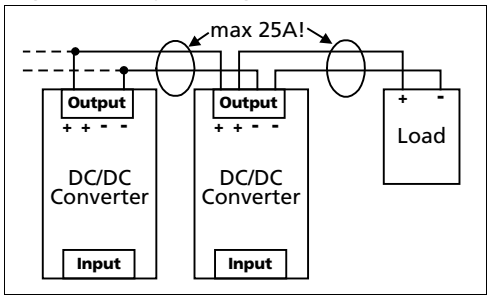
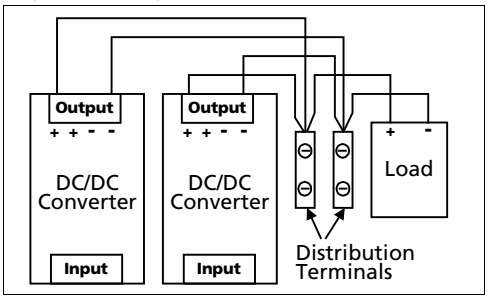


Fig. 21-3 Using distribution terminals



21.8. Use in a Tightly Sealed Enclosure

When the DC/DC-converter is installed in a tightly sealed enclosure, the temperature inside the enclosure will be higher than outside. In such situations, the inside temperature defines the ambient temperature for the DC/DC-converter.

The following measurement results can be used as a reference to estimate the temperature rise inside the enclosure.

The DC/DC-converter is placed in the middle of the box, no other heat producing items are inside the box

Enclosure:	Rittal Typ IP66 Box PK 9516 100, plastic, 110x180x165mm
Load:	5.1V, 8A; (=80%) load is placed outside the box
Input:	24Vdc
Temperature inside enclosure:	48.0°C (in the middle of the right side of the DC/DC converter with a distance of 2cm)
Temperature outside enclosure:	22.6°C
Temperature rise:	25.4K

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

21.9. MOUNTING ORIENTATIONS

Mounting orientations other than input terminals on the bottom and output on the top require a reduction in continuous output power or a limitation in the max. allowed ambient temperature. The amount of reduction influences the lifetime expectancy of the DC/DC converter. Therefore, two different derating curves for continuous operation can be found below:

Curve A1 Recommended output current.
Curve A2 Max allowed output current (results in approximately half the lifetime expectancy of A1).

Fig. 21-4
Mounting Orientation A
(Standard orientation)

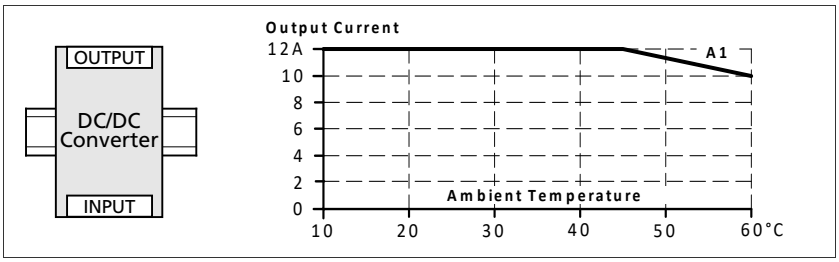


Fig. 21-5
Mounting Orientation B
(Upside down)

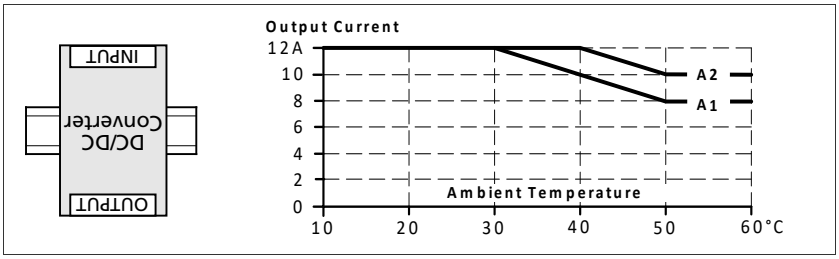


Fig. 21-6
Mounting Orientation C
(Table-top mounting)

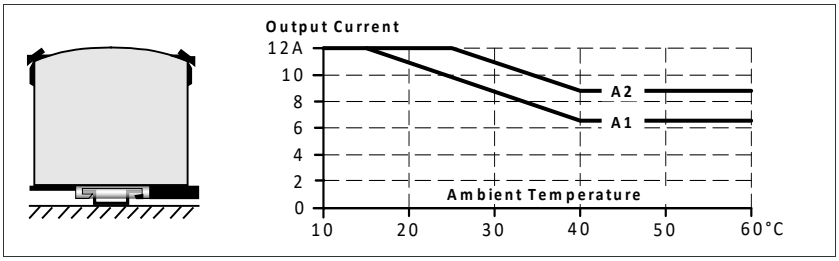


Fig. 21-7
Mounting Orientation D
(Horizontal cw)

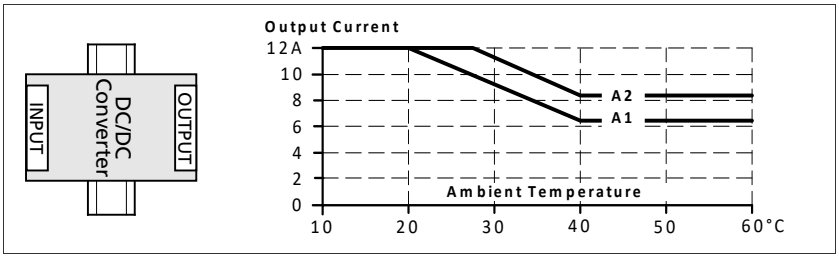
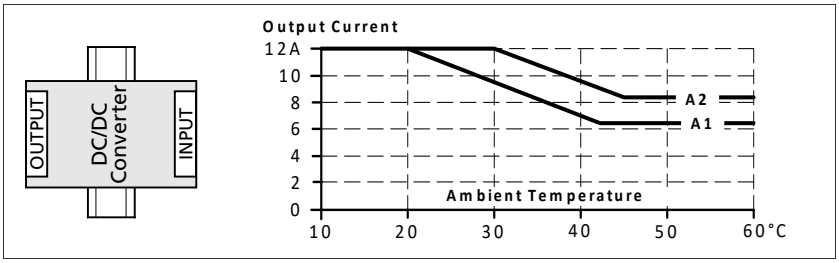


Fig. 21-8
Mounting Orientation E
(Horizontal ccw)



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000