Description

The RCM500 and RCM1000 Series converters are reliable power supplies for railway and transportation systems. They are optimized for 72 or 110 V railway batteries. The output delivers 24 V with 500 or 1000 W. The converters are designed for chassis mounting and exhibit a closed housing with cooling openings.

Many options are available, such as an output ORing FET for redundant operation, output voltage adjustment, interruption time of 10 ms, shutdown input, and a monitoring relay (change-over contact).

Features

- Optimized for 72 V or 110 V railway batteries
- Output voltage 24 V
- Closed housing for chassis mounting
- Extremely high efficiency and high power density
- Low inrush current
- 3 connectors: Input, output, auxiliary (option)
- Overtemperature, overvoltage, overcurrent, and short-circuit protection
- Many options available
- Compliant to EN 50155, EN 50121-3-2
- RoHS-compatible for all 6 substances
- Fire and smoke: compliant to EN 45545 and NFPA 130.

Safety-approved to the latest edition of IEC/EN 60950-1 and UL/CSA 60950-1

[1] pending

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Model Selection

Table 1: Model Selection

Input voltage				Output		Power	Efficiency[2]		Model	Options
$V_{i\,min}$[1] [V]	$V_{i\,cont}$ [V]			$V_{o\,nom}$ [V]	$I_{o\,nom}$ [A]	$P_{o\,nom}$ [W]	η_{min} [%]	η_{typ} [%]		
			$V_{i\,max}$[1] [V]							
43.2	50.4 (72) 90		100.8	24	21	500		96	72RCM500-24	D, M, Q, F
66	77 (110) 137.5		154	24	21	500	96	96.4	110RCM500-24	
				24	42	1000	96	96.4	110RCM1000-24	

1 Short time; see table 2 for details
2 Efficiency at T_A = 25 °C, $V_{i\,nom}$, $I_{o\,nom}$, $V_{o\,nom}$, option D fitted.

Part Number Description

110 RCM 500 -24 D M Q

Operating input voltage $V_{i\,cont}$ (continuously):
- 50.4 – 90 VDC 72
- 77 – 137.5 VDC 110

Series .... RCM

Output power:
- 500 W 500
- 1000 W 1000

Nominal output voltage:
- 24 V .... -24

Auxiliary functions and options:
- Out OK, output voltage adjust, shutdown[1] .... D
- Interruption time .... M
- ORing FET .... Q
- Fuse .... F

1 Opt. D requires an additional signal connector.

Note: The sequence of options must follow the order above.

Note: All models are RoHS-compliant for all six substances.

Example: 110RCM500-24DMQ: DC-DC converter, input voltage range 77 to 137.5 V continuously, output providing 24 V / 21 A, monitoring relay, output voltage adjust, shutdown input, active current sharing, interruption time 10 ms, integrated ORing FET, RoHS-compliant for all six substances.

Available combinations of options:

72/110RCMxxx-24	No option
72/110RCMxxx-24D	Basic model (railway)
72/110RCMxxx-24DF	Basic model (industrial)
72/110RCMxxx-24DMQ	Full model (railway)
72/110RCMxxx-24DMQF	Full model (industrial)

Product Marking

Type designation, applicable safety approval and recognition marks, CE mark, pin allocation, and product logo.

Input voltage range and input current, nominal output voltage and current, degree of protection, batch no., serial no., and data code including production site, version (modification status) and date of production.

Functional Description

The input voltage is fed via an efficient input filter and a step-up converter (switching with 2 × 110 kHz) to the high-efficient DC-DC converter operating at a switching frequency of approximately 90 kHz. The built-in overvoltage limiter protects against input voltage surges.

The inrush current is limited by an electronic circuitry. A VDR resistor protects against external surges.

If there is no external circuit breaker, the converter can be ordered with built-in fuse (opt. F). This fuse is not accessible.

The circuitry to provide the interruption time (opt. M) is located after the input filter together with the reverse polarity protection formed by a FET.

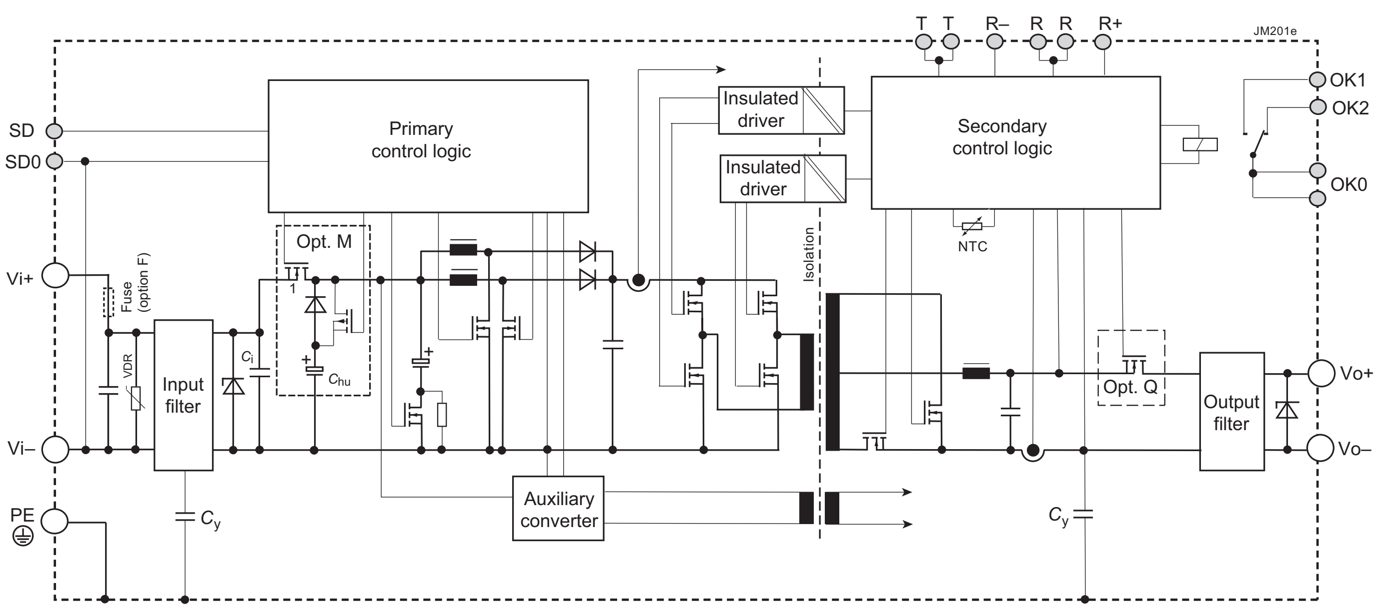
The rectification on the secondary side is provided by synchronous rectifiers, in order to keep the losses as low as possible. The output voltage control logic is located on the secondary side and controls the FETs of the DC-DC converter via insulated drivers.

An auxiliary converter supplies all circuits with a stable bias voltage.

An output ORing FET is available (opt. Q) and allows for a redundant power supply system.

Opt. D encompasses an additional signal connector to allow for output voltage adjustment, active current sharing, primary shutdown, and an output voltage monitor activating a relay with change-over contact.

The converter is mounted onto a base plate which acts as cooling plate. An additional heatsink for natural convection cooling is available as accessory. A thermal protection on the input and output side prevents from overheating.



Auxiliary connector (only with option D)

1 Reverse polarity protection (FET), only fitted with opt. F or M

Fig. 1
Block diagram

Electrical Input Data

General Conditions:
– T_A = 25 °C, unless specified.

Table 2: Input data

Input			72RCM500-24			110RCM500-24			110RCM1000-24			Unit
Characteristics		Conditions	min	typ	max	min	typ	max	min	typ	max	
V_i	Operating input voltage	$I_o = 0 – I_{o\,max}$ $T_{A\,min} – T_{A\,max}$	50.4	(72)	90	77	(110)	137.5	77	(110)	137.5	V
$V_{i\,2s}$	for ≤2 s	without shutdown	43.2		100.8	66		154	66		154	
$V_{i\,nom}$	Nominal input voltage			72			110			110		
$V_{i\,abs}$	Input voltage limits	3 s without damage	0		108	0		165	0		165	
I_i	Typical input current	$V_{i\,nom}$, $I_{o\,nom}$		7.3			4.8			9.5		A
$P_{i\,0}$	No-load input power	$V_{i\,min} – V_{i\,max}$, $I_o = 0$		2.5	4		2.5	4		3	4	W
$P_{i\,SD}$	Idle input power	$V_{i\,min} – V_{i\,max}$, $V_{SD} = 0$ V		2	3		2	3		2.5	3	
C_i	Input capacitance[1]			7			7			7		μF
R_i	Input resistance			14			14			14		mΩ
$I_{inr\,p}$	Peak inrush current	$V_i = V_{i\,max}$, $P_{o\,nom}$			20			20			40	A
$t_{inr\,d}$	Duration of inrush current				0.5			0.5			0.5	ms
t_{on}	Start-up time at switch on	$0 \rightarrow V_{i\,min}$, $P_{o\,nom}$		300	500		300	500		300	500	
	Start-up time after removal of shutdown	$V_{i\,min}$, $P_{o\,nom}$ $V_{SD} = 0 \rightarrow 5$ V		300	500		300	500		300	500	

[1] Not smoothed by the inrush current limiter at start-up (for inrush current calculation)

Input Transient and Reverse Polarity Protection

A VDR resistor and a symmetrical input filter form an effective protection against input transients, which typically occur in many installations, but especially in battery-driven mobile applications.

If the input voltage has the wrong polarity, the incorporated reverse diode will cause the external input circuit breaker or fuse to trip. With option M or F (incorporated fuse), an active reverse-polarity protection circuit prevents from any damage.

Input Under-/Overvoltage Lockout

If the input voltage is out of range, an internally generated signal disables the converter to avoid any damage.

Efficiency

See fig. 2.

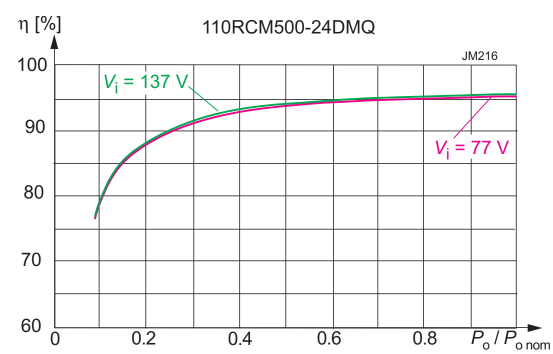


Fig. 2a
Efficiency versus V_i and P_o (110RCM500-24DMQ)

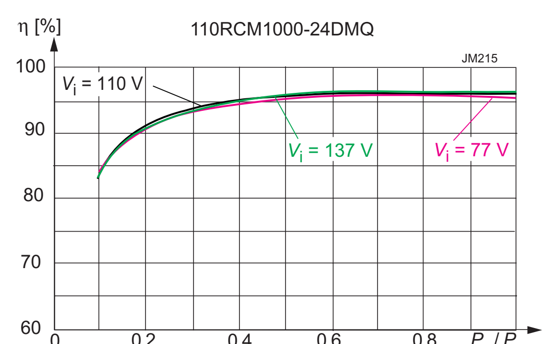


Fig. 2b
Efficiency versus V_i and P_o (110RCM1000-24DMQ)

Electrical Output Data

General Conditions:
- T_A = 25 °C, unless T_C is specified.
- R input not connected

Table 3: Output data

Output Characteristics			Conditions	72/110RCM500-24			110RCM1000-24			Unit
				min	typ	max	min	typ	max	
V_o	Output voltage [1]		$V_{i\,nom}$, 0.5 $I_{o\,nom}$	23.76	24	24.24	23.76	24	24.24	V
V_{ow}	Worst case output voltage		$V_{i\,min}$ – $V_{i\,max}$ $T_{C\,min}$ – $T_{C\,max}$, 0 – $I_{o\,nom}$	23.28		24.72	23.28		24.72	
V_{odroop}	Voltage droop				–10			–5		mV/A
$V_{o\,L}$	Overvoltage shutdown [6]				28			28		V
$V_{o\,P}$	Overvoltage protection [2]			28.5	30	31.5	28.5	30	31.5	V
$I_{o\,nom}$	Nominal output current		$T_{C\,min}$–$T_{C\,max}$		21			42		A
$I_{o\,L}$	Output current limit					23			45	
v_o	Output noise [3]	Switching frequ.	$V_{i\,nom}$, $I_{o\,nom}$ BW = 20 MHz			240			240	mV_{pp}
		Total incl.spikes				480			480	
$v_{o\,d}$	Dynamic load regulation	Voltage deviation [5]	$V_{i\,nom}$ 0.1 ↔ 0.9 $I_{o\,nom}$			1			1	
t_d [4]		Recovery time				5			5	ms
α_{Vo}	Temp. coefficient of V_o (NTC)		0 – $I_{o\,nom}$, $T_{C\,min}$–$T_{C\,max}$	–0.02		0	–0.02		0	%/K

1 If the output voltage is increased above $V_{o\,nom}$ through R-input control, the output power should be reduced accordingly, so that $P_{o\,max}$ and $T_{C\,max}$ are not exceeded.
2 Breakdown voltage of the incorporated suppressor diode at 1 mA . Exceeding this value might damage the suppressor diode.
3 Measured according to IEC/EN 61204 with a probe described in annex A
4 Recovery time until V_o returns to ±1% of V_o; see fig. 3.
5 No overshoot at switch on.
6 Output overvoltage shutdown by an electronic circuitry, with automatic recovery.

Output Voltage Regulation

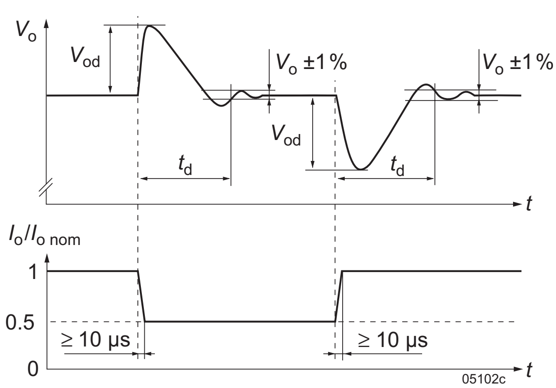


Fig.3
Typical dynamic load regulation of output voltage

Output Current Limitation

The output is continuously protected against open-circuit (no load) and short-circuit by an electronic current limitation with rectangular characteristic; see fig. 4.

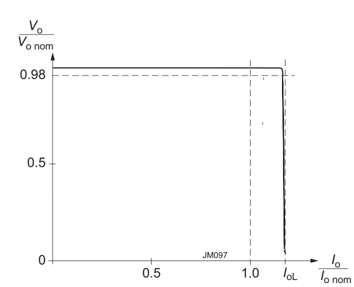


Fig. 4
Rectangular current limitation

Parallel and Series Connection, and Redundancy

The outputs of several RCM Series converters may be connected in series.

Note: If the sum of the output voltages is greater than 60 V, it cannot be considered being SELV (Safety Extra Low Voltage) according to the safety standards. but the voltage may exceed the SELV level.

The outputs RCM Series converters may be connected in parallel. In order to ensures proper current sharing, the load lines should have equal length and section. The output voltage exhibits a slight droop characteristic, which facilitates current sharing. In addition, the output voltage tends to be lowered with increasing temperature.

Converters with option D exhibit an additional pin T to provide active current sharing by simply interconnecting these pins

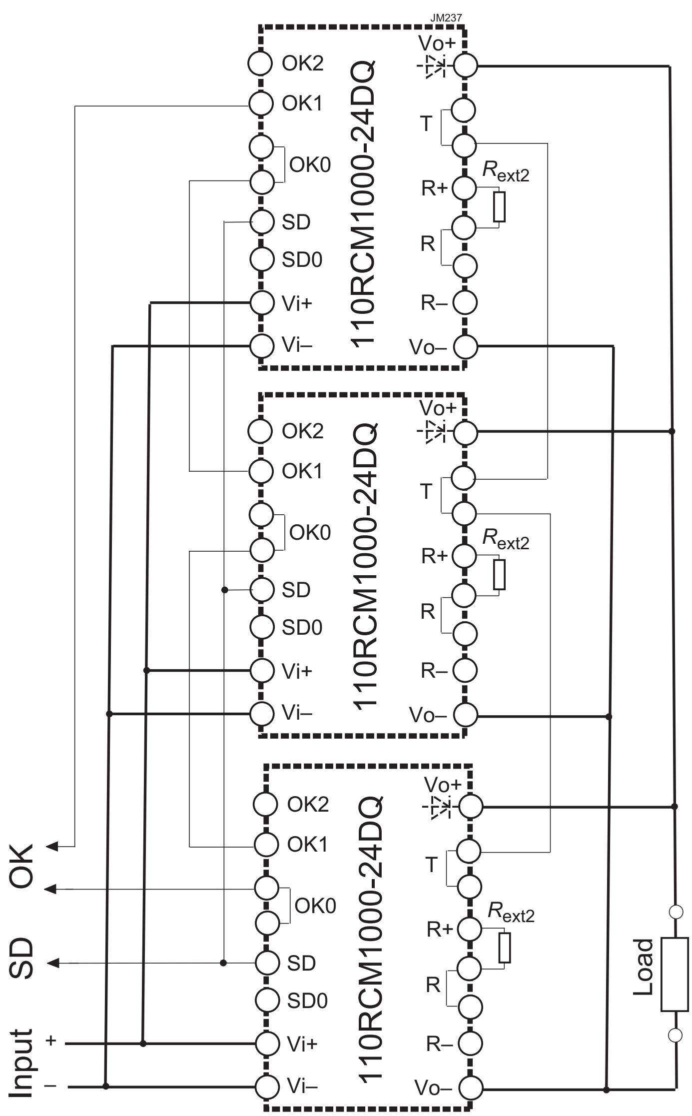


Fig. 5
Parallel connection of 3 converters

(up to 5 parallel RCM Series converters). For redundant systems, we recommend option Q, which exhibits ORing diodes built by FETs, in order to keep the losses to a minimum. Figure 5 shows a system with 3 parallel-connected converters forming a redundant system. The output voltage is increased by the resistor R_{ext2} (as an example). The OK signals, connected in series, allow for monitoring all 3 converters.

LED Indicator

Each converter exhibits a green LED "Out OK", signaling that the output voltage is within the specified range.

Thermal Considerations and Protection

A temperature sensor is incorporated in the secondary control logic. It disables the converter, when an over temperature is detected. It automatically recovers, when the temperature drops below the limit.

Description of Options

Option D: Output Monitor, Output Adjust, Shutdown

Option D consists of several auxiliary functions (R, OK, SD, T) and encompasses an additional auxiliary connector.

Output Voltage Adjust (R)

Note: With open R-input, $V_o = V_{o\,nom}$.

The converter allows for adjusting the output voltage in the range of 80 to 105% of $V_{o\,nom}$. The adjust is accomplished by an external resistor R_{ext1} or R_{ext2}, connected to input R; see fig. 6.

Depending on the value of the required output voltage, the resistor shall be connected:

either: Between the pins R and R– to adjust the output voltage to a value below $V_{o\,nom}$:

$$R_{ext1} \approx 4\,k\Omega \bullet \frac{V_o}{V_{o\,nom} - V_o} - 15.8\,k\Omega$$

Note: $R_{ext1} = 0\,\Omega$ reduces V_o to 80%.

or: Between the pins R and R+ to adjust the output voltage to a value greater than $V_{o\,nom}$:

$$R_{ext2} \approx 4\,k\Omega \bullet \frac{(V_o - 2.5\,V)}{2.5\,V \bullet (V_o / V_{o\,nom} - 1)} - 682\,k\Omega$$

Note: $R_{ext2} = 0\,\Omega$ increases V_o to 105%.

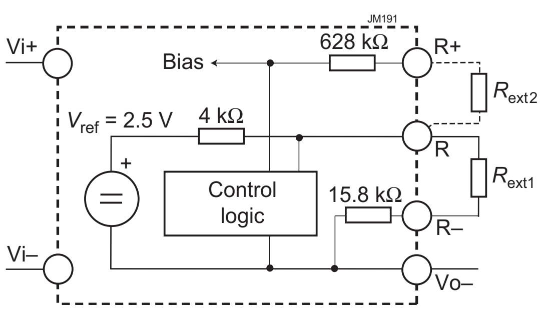


Fig. 6
Output voltage control via R-input

Output Voltage Monitor (OK)

The output voltage V_o is monitored. When V_o is in range, a relay with a changeover contact connected to the auxiliary connector is activated, and OK0 is connected with OK1.

Note: The trigger levels are typ. ±5 % of V_{onom} (with open R-input).

Data of relay contacts: 0.4 A / 150 VDC.

Primary Shutdown (SD)

The output of the converter may be enabled or disabled by a logic signal (e.g. CMOS) applied between the shutdown pin SD and SD0 (= Vi–). If the shutdown function is not required, pin SD can be left open-circuit. Voltage on pin SD:

Converter operating:	12 V to $V_{i\,max}$ or open-circuit
Converter disabled:	–2 to +2 V

The output response is shown in fig.7

Note: In systems consisting of several converters, this feature may be used to control the activation sequence by logic signals or to enable the power source to start up, before full load is applied.

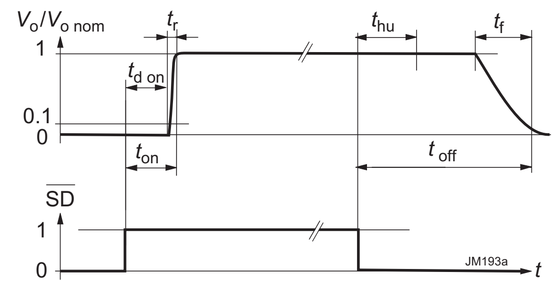


Fig. 7
Typical output response to the SD-signal. If option M is not fitted, $t_{hu} = 0$.

Current Share Function in Parallel Operation (T)

Just interconnect the T-pins of all converters to balance their output currents. Only a single-wire connection is needed.

Option Q: ORing FET for Redundant Systems

Two parallel connected converters are separated with ORing diodes (built by FETs). If one converter fails, the remaining one still delivers the full power to the loads. If more power is needed, the system may be extended to more parallel converters (n+1 redundancy).

Current sharing must be ensured by load lines of equal section and length. In addition, a slight droop characteristic of the outputs and a negative temperature coefficient are helpful as well.

To keep the losses as small as possible, the ORing diode is replaced by a FET.

Note: In the case of a failing converter, the output voltage is maintained by the redundant converters. However, the failing item should be identified and replaced. We recommend the Out OK function (option D).

Option M: Interruption Time

The interruption time t_{hu} is specified in the railway standard EN 50155:2007 clause 5.1.1.3: Class S2 is 10 ms. It is measured at $V_{B\,nom}$ (nominal battery voltage) for interruption and short-circuit of the input. After such an event, the system is ready for the next event after 10 s. Fig. 6 shows the output voltage V_o, if option M is fitted. Option M encompasses a backrush protection formed by a FET device.

For less critical applications, option M is not required (class S1). Such units have a slightly better efficiency.

Option F: Incorporated Fuse

The railway standard EN 50155 does not recommend fuses in converters. Consequently, the installer should preview an external fuse or circuit breaker.

However, when this is not possible, we offer an incorporated fuse (option F) with active reverse polarity protection formed by a FET device. The fuse is not accessible and will not trip, unless the converter is really defect. The type of the incorporated fuses is specified in table 4. Such fuses are also recommended for external fuses.

Table 4: Input fuses

Converter	Fuse specification	Ordering number
72RCM500-24	15 A, fast acting	Littlefuse 0505015.MX52LEP
110RCM500-24	15 A, fast acting	Littlefuse 0505015.MX52LEP
110RCM1000-24	25 A fast acting	Littlefuse 0505025.MX52LEP

Electromagnetic Compatibility (EMC)

Electromagnetic Immunity

Table 5: Electromagnetic immunity (type tests)

Phenomenon	Standard	Level	Coupling mode[1]	Value applied	Waveform	Source imped.	Test procedure	In oper.	Perf. crit.[2]
Electrostatic discharge (to case)	IEC/EN 61000-4-2	4 [3]	contact discharge	6000 V_p	1/50 ns	330 Ω 150 pF	10 positive and 10 negative discharges	yes	A
			air discharge	8000 V_p					
Electromagnetic field	IEC/EN 61000-4-3	x [4]	antenna	20 V/m	AM 80% /1 kHz	n.a.	80 – 800 MHz	yes	A
		[5]	antenna	20 V/m	AM 80% /1 kHz	n.a.	800 – 1000 MHz	yes	A
				10 V/m			1400 – 2000 MHz		
				5 V/m			2000 – 2700 MHz		
				3 V/m			5100 – 6000 MHz		
Electrical fast transients/burst	IEC/EN 61000-4-4	3 [6]	capacitive, o/c	±2000 V_p	bursts of 5/50 ns 2.5/5 kHz over 15 ms; burst period: 300 ms	50 Ω	60 s positive 60 s negative transients per coupling mode	yes	A
		3	i/c, +i/–i direct						
Surges	IEC/EN 61000-4-5	3 [7]	i/c	±2000 V_p	1.2/50 µs	42 Ω 0.5 µF	5 pos. and 5 neg. surges per coupling mode	yes	A
			+i/–i	±1000 V_p					
Conducted disturbances	IEC/EN 61000-4-6	3 [8]	i, o, signal wires	10 VAC (140 dBµV)	AM 80% 1 kHz	150 Ω	0.15 – 80 MHz	yes	A
Power frequency magnetic field	IEC/EN 61000-4-8	3 [8]	i, o, signal wires	300 A/m	50 / 60 Hz	150 Ω	0.15 – 80 MHz	yes	A

[1] i = input, o = output, c = case
[2] A = normal operation, no deviation from specs.; B = normal operation, temporary loss of function or deviation from specs possible
[3] Exceeds EN 50121-3-2:2016 table 5.3.
[4] Corresponds to EN 50121-3-2:2016 table 5.1.
[5] Corresponds to EN 50121-3-2:2016 table 5.2.
[6] Corresponds to EN 50121-3-2:2016 table 3.2.
[7] Covers or exceeds EN 50121-3-2:2016 table 3.3.
[8] Corresponds to EN 50121-3-2:2016 table 3.1 (radio frequency common mode).

Electromagnetic Emissions

The conducted emissions (fig. 8) have been tested according to EN 55011, group 1, class A (similar to EN 55032), much better values than requested by EN 50121-3-2:2016, table 2.1. The limits in fig. 8 and 9 apply to quasipeak values, which are always lower then peak values.

Radiated emissions have been tested as per EN 55011, group 1, class A, similar to EN 61000-6-4+A1:2011, table 1. The test was executed with horizontal and vertical polarization; the worse result is shown in fig. 9.

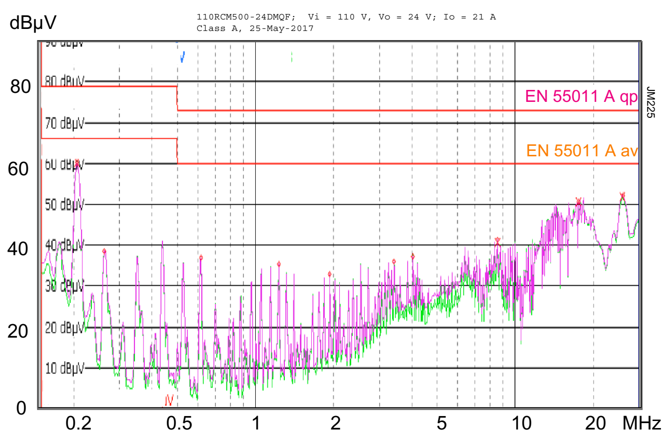


Fig. 8a
110RCM500-24: Typ. conducted disturbances at the input (V_i =110 V, $I_{i\ nom}$, resistive load, quasi peak and average).

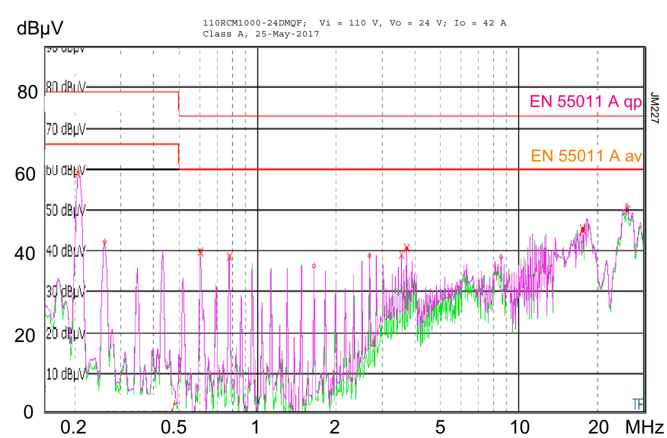


Fig. 8b
110RCM1000-24: Typ. conducted disturbances at the input (V_i =110 V, $I_{i\ nom}$, resistive load, quasi peak and average).

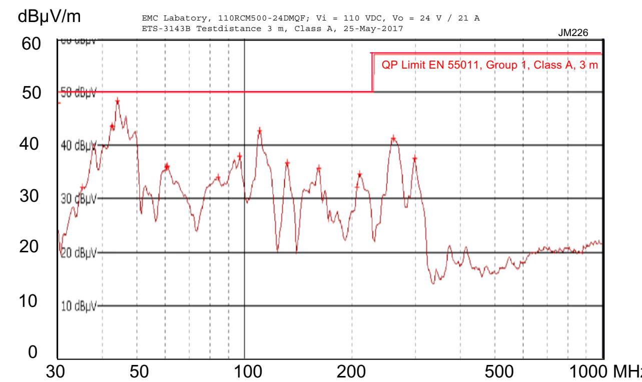


Fig. 9a
110RCM500-24: Typ. radiated disturbances in 3 m distance (V_i = 110 V, $I_{i\ nom}$, resistive load, quasi peak).

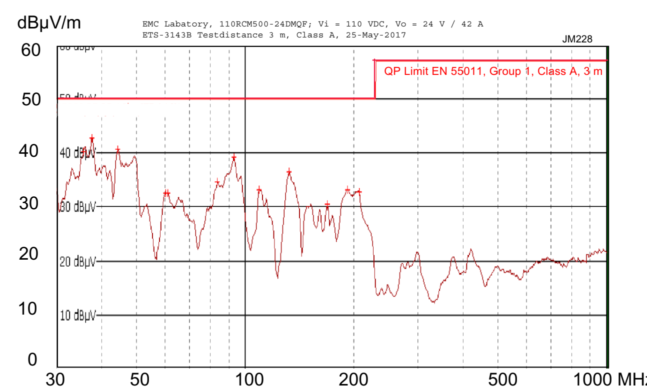


Fig. 9b
110RCM1000-24: Typ. radiated disturbances in 3 m distance (V_i = 110 V, $I_{i\ nom}$, resistive load, quasi peak).

Immunity to Environmental Conditions

Table 6: Mechanical and climatic stress. Air pressure 800 – 1200 hPa

Test	method	Standard	Test conditions		Status
Db	Damp heat test, cyclic	EN 50155:2007, clause 12.2.5 IEC/EN 60068-2-30	Temperature: Cycles (respiration effect): Duration:	55 °C and 25 °C 2 2× 24 h	Converter not operating
Bd	Dry heat test steady state	EN 50155:2007, clause 12.2.4 IEC/EN 60068-2-2	Temperature: Duration:	RCM500: 70 °C, RCM1000: 55 °C 6 h	Converter operating
Ad	Cooling test steady state	EN 50155:2007, clause 12.2.3 IEC/EN 60068-2-1	Temperature, duration Performance test	–40 °C, 2 h +25 °C	Conv. not operating
--	Low temperature storage test	EN 50155:2007, clause 12.2.14 IEC/EN 60068-2-1	Temperature, duration then start-up	–40 °C, 16 h	Conv. not operating
Ka [1]	Salt mist test sodium chloride (NaCl) solution	EN 50155:2007, clause 12.2.10 IEC/EN 60068-2-11 class ST2	Temperature: Duration:	$35^{\pm 2}$ °C 16 h	Converter not operating
--	Shock	EN 50155:2007 clause 12.2.11 EN 61373 sect. 10, class B, body mounted [2]	Acceleration amplitude: Bump duration: Number of bumps:	5.1 g_n 30 ms 18 (3 in each direction)	Converter operating
--	Simulated long life testing at increased random vibration levels	EN 50155:2007 clause 12.2.11 EN 61373 sect. 8 and 9, class B, body mounted [2]	Acceleration spectral density: Frequency band: Acceleration magnitude: Test duration:	0.02 g_n^2/Hz 5 – 150 Hz 0.8 $g_{n\,rms}$ 15 h (5 h in each axis)	Converter operating

[1] This test is not mandatory in EN 50155:2007. It was not yet executed for RCM1000.
[2] Body mounted = chassis of a railway coach

Temperatures

Table 7: Temperature specifications, valid for an air pressure of 800 – 1200 hPa (800 – 1200 mbar)

Model			RCM500 EN 50155:2007 Class TX			RCM1000 EN 50155:2007 Class T2			Unit
Characteristics		Conditions	min	max	10 min	min	max	10 min	
T_A	Ambient temperature	Converter operating	–40	70	85	–40	55 [2]	70	°C
T_C	Case temperature [1]		–40		90			90	
T_S	Storage temperature	Converter not operating	–55	85		–55	85		

[1] Measured at the measurement point T_C; see *Mechanical Data.*
[2] RCM1000 can be operated at higher temperature with reduced output power.

Reliability

Table 8: MTBF and device hours

Ratings at specified case temperature between failures	Model	MTBF	Demonstrated hours [1]
Accord. to IEC 62380	110RCM500-24DMQF	1 120 000 h	
	110RCM1000-24DMQF	1 110 000 h	

[1] Statistical values, based upon an average of 4300 working hours per year and in general field use over 5 years; upgrades and customer-induced errors are excluded.

Safety and Installation Instructions

Connectors and Pin Allocation

- Input connector, 3 pins: Wago 745-353: Vi+, Vi–, PE; recommended wire sections:
  RCM500: 2 – 6 mm^2, 14 – 10 AWG;
  RCM1000: 3.3 – 6 mm^2, 12 – 10 AWG;
- Output connector, 2 pins: Wago 745-652/006-000: Vo+, Vo–; recommended wire sections:
  RCM500: 3.3 – 13 mm^2, 12 – 06 AWG;
  RCM1000: 5 – 13 mm^2, 10 – 06 AWG;
- Auxiliary connector: Phoenix Contact 1874043; recommended wire section: 0.2 – 1.5 mm^2, 24 – 16 AWG;

R+	R–	T	n.c.	OK1	OK2	n.c.	SD
R	R	T	n.c.	OK0	OK0	n.c.	SD0

Fig. 10
Auxiliary connector pin allocation

Installation Instructions

These converters are components, intended exclusively for inclusion by an industrial assembly process or by a professionally competent person. Installation must strictly follow the national safety regulations in respect of the enclosure, mounting, creepage distances, clearances, markings and segregation requirements of the end-use application.

Connection to the system shall only be effected with cables with suitable section (primary and secondary connector in cage clamp technique).

The auxiliary connector shall be connected via the suitable female connector; see *Accessories*.

Other installation methods may not meet the safety requirements. Check that PE is safely connected to protective earth.

No fuse is incorporated in the converter (except for option F). An external circuit breaker or a fuse in the wiring to one or both input pins.

Do not open the converters, or the warranty will be invalidated. Make sure that there is sufficient airflow available for convection cooling and that the temperature of the bottom plate is within the specified range. This should be verified by measuring the case temperature at the specified measuring point, when the converter is operated in the end-use application. $T_{C\ max}$ should not be exceeded. Ensure that a failure of the converter does not result in a hazardous condition.

Standards and Approvals

The RCM Series converters are approved according to the safety standards IEC/EN 60950-1 and UL/CSA 60950-1 2nd Ed.

They have been evaluated for:

- Class I equipment
- Building in
- Double or reinforced insulation based on 250 VAC or 240 VDC between input and output and between input and OK signals (relay contacts)
- Pollution degree 2 environment

The converters are subject to manufacturing surveillance in accordance with the above mentioned UL standards and with ISO 9001:2008.

Cleaning Liquids and Protection Degree

The converters are not hermetically sealed. In order to avoid possible damage, any penetration of liquids shall be avoided.

The converters correspond to protection degree IP 30.

Railway Applications

The RCM Series converters have been designed observing the railway standards EN 50155:2007 and EN 50121-3-2:2016. All boards are coated with a protective lacquer. The converters comply with the fire & smoke standard EN 45545-2, HL1 to HL3.

Isolation

The electric strength test is performed in the factory as routine test in accordance with EN 50514 and IEC/EN 60950 and should not be repeated in the field. The Company will not honor warranty claims resulting from incorrectly executed electric strength tests.

Table 11: Isolation

Characteristic		Input to		Output	Relay contacts to			Unit
		output[1]	case+output	to case	input	case	output	
Electric strength test	Factory test >1 s	4.2	2.86	1.0	2.86	2.86	2.86	kVDC
	AC test voltage equivalent to actual factory test	3.0	2.0	0.7	2.0	2.0	2.0	kVAC
Insulation resistance		>300[2]	>300[2]	>100	>300	>300	>300	MΩ
Creepage distances		5.0	3.5	1.5	3.5	3.5	3.5	mm

[1] Pretest of subassemblies in accordance with IEC/EN 60950
[2] Tested at 500 VDC

Mechanical Data

Dimensions in mm.

European Projection

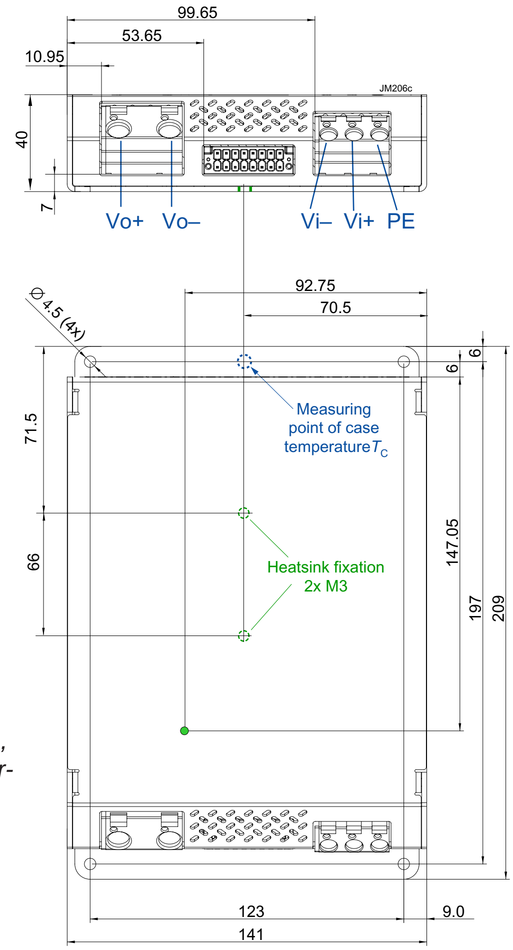


Fig. 11
Case for RCM500. (RCM03), Aluminum, EP powder-coated.

1160 g.

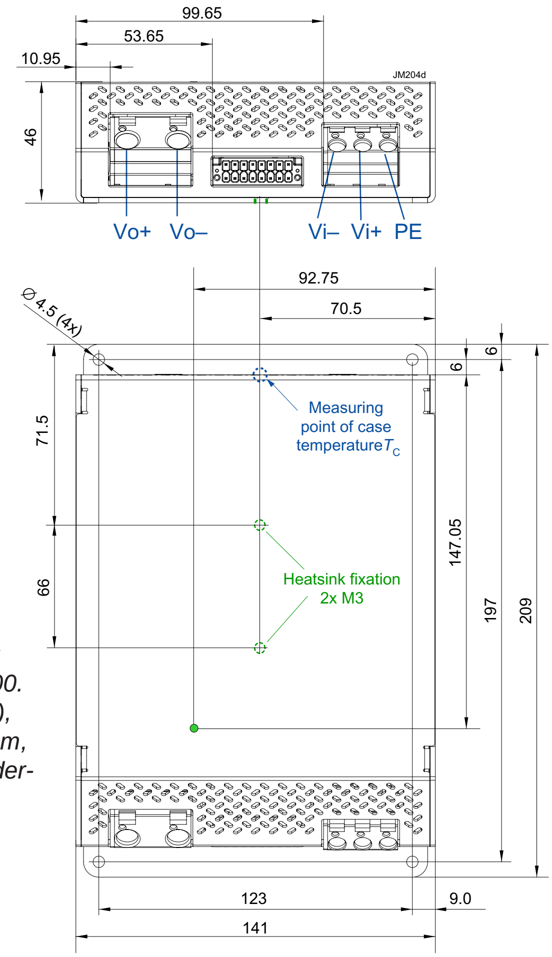


Fig. 12
Case for RCM1000. (RCM04), Aluminum, EP powder-coated.

1250 g.

Accessories

Female Connector

A suitable 16 pin female connector is available.

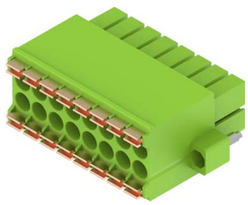


Fig. 13
Female connector 16 pins, HZZ00146-G
(Phoenix Contact 17903573)

Additional Heatsink

A suitable heat sink (HZZ00149-G) for free air cooling is available, if cooling by wall or a chassis mounting is not possible; see fig. 14

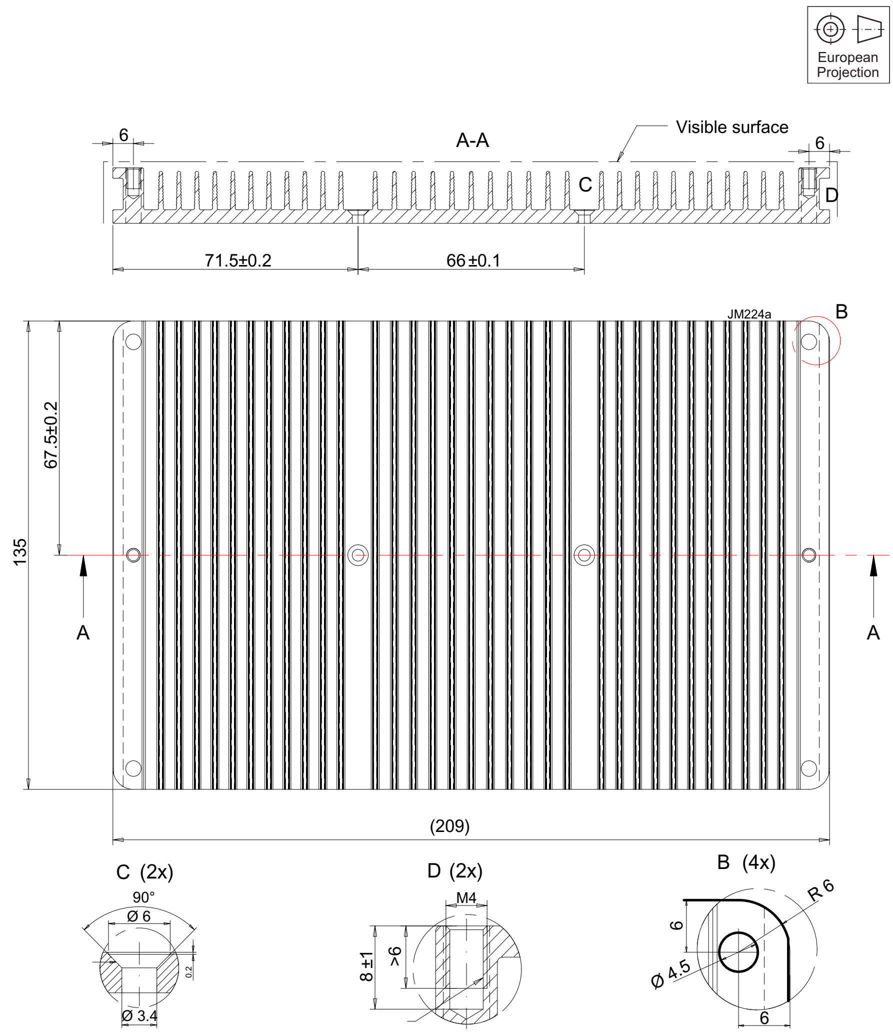


Fig. 14
Additional heatsink for RCM500 and RCM1000 (HZZ00149-G)
Weight 530 g

Content:
Heatsink + 6 screws M3 x 6 mm