

AC/DC sensitive residual current monitoring module RCMB104

for electric vehicle charging systems



RCMB104

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RCMB104

Device features

- Three outputs (DC, RMS, Error)
- Frequency range DC...2 kHz
- Measuring range ± 300 mA
- Residual current resolution 0.2 mA
- Load current up to 80 A r.m.s. (single-phase) or 3 x 32 A r.m.s. (three-phase)
- Fault output (integrated self monitoring and test functions)
- High insensitivity to external interferences
- Available variants for application according to IEC 62752 and UL 2231-2
- Wide range of use even in severe environments (e.g. in the event of external interference fields)
- In applications according to IEC 62752, the RCMB104 can replace a type B RCD when combined with a type A RCD and a suitable switching device (e.g. a power relay).

Approvals



Product description

The AC/DC sensitive residual current monitoring module RCMB104 is used in combination with a measuring current transformer W15BS... and a type A RCD which has to be provided in the installation for fault current monitoring of AC charging systems for electric vehicles in which AC or DC fault currents can occur.

The rated voltage U_n is 250 V and the rated current (charging current) $I_n = 1 \times 80$ A / 3 x 32 A. The RCMB104 is suitable for integration into a charging unit (IC-CPD, wall box) according to IEC 62752 and UL 2231-2.

The RCMB104 is only intended for purchase by the manufacturer of the charging system and not for end users!

Function

The residual current evaluation unit consists of an externally connected measuring current transformer W15BS for measuring and the RCMB104 for evaluating the residual currents. The RCMB104 determines the r.m.s. value of the DC component contained in the residual current and the AC component that is below the cutoff frequency.

The RCMB104 signals a limit value violation at the outputs **DC** and **RMS**. The limit values depend on the variant and, in connection with the type A RCD, meet the respective normative shutdown requirements in accordance with IEC 62752 or UL 2231-2.

Residual current measurement: AC/DC sensitive residual current measurement.

Charging process: Before each charging process, the charge controller must check that the RCMB104 functions correctly. The charging process must be disabled. Regular testing increases the safety of the charging process and prevents long-term drift of the residual current measurement by means of an internal offset measurement.

Measuring current transformer: The measuring current transformer W15BS is magnetically shielded, so that no external interference can affect the residual current measurement.

Standards

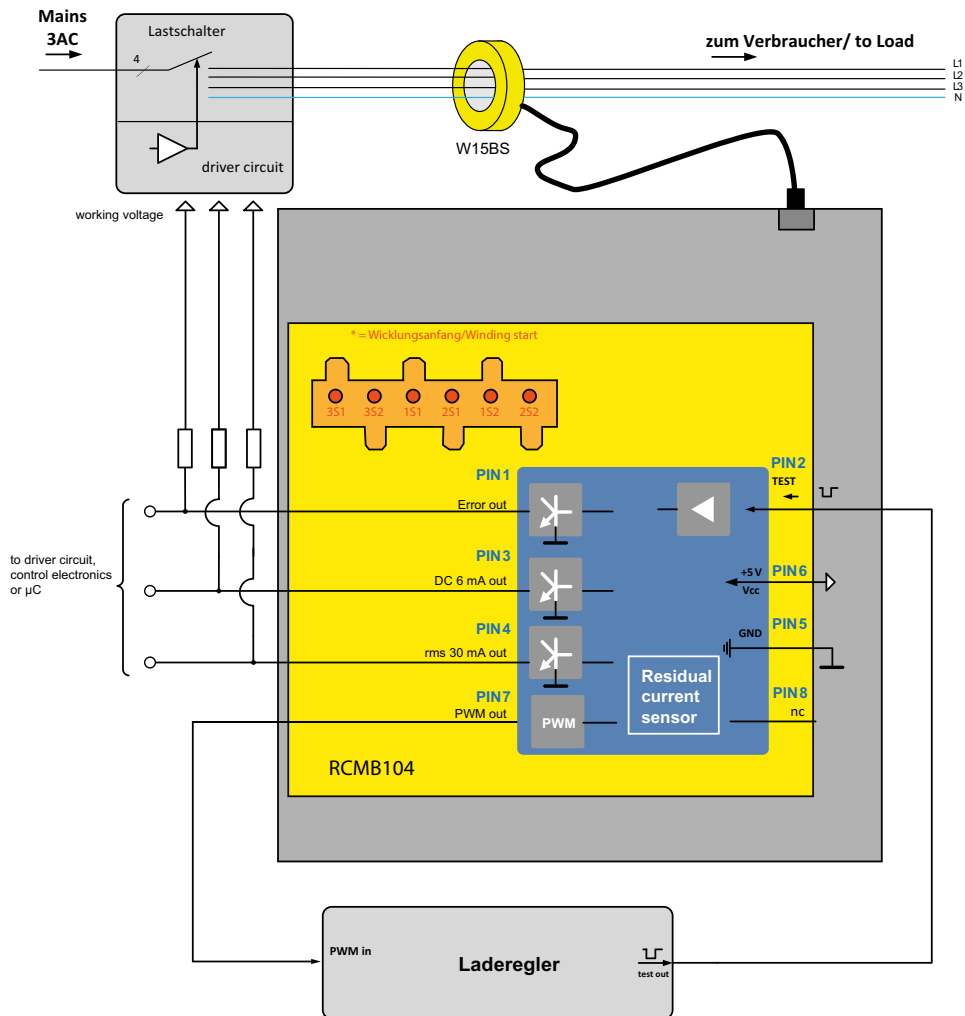
The RCMB104... series complies with the following device standards:

- IEC 60364-7-722 (Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supplies for electric vehicles)
- IEC 62752 (In-Cable Residual Current Device for mode 2 charging of electric road vehicles (IC-RCD))

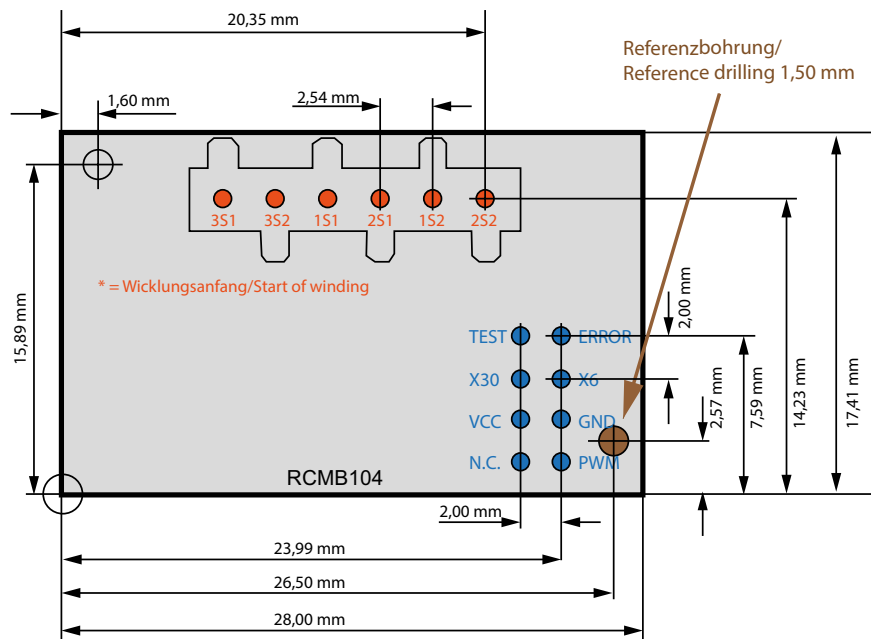
Ordering information

Description	Diameter	Type	Art. No.
0...2 kHz IEC 6/30 mA	–	RCMB104-1	B94042480
0...2 kHz UL2231 5/20 mA	–	RCMB104-2	B94042481
Measuring current transformer	15 mm (1470 ± 30 mm)	W15BS	B98080065
	15 mm (180 ± 30 mm)	W15BS-02	B98080067
	15 mm (325 ± 25 mm)	W15BS-03	B98080068

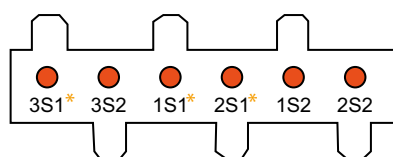
Wiring diagram



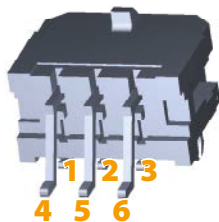
Dimension diagram



Connection socket measuring current transformer

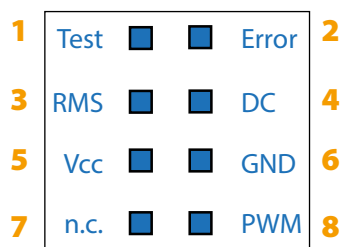


* = Start of winding



Description	Evaluating board	Socket
Test winding (start of winding)	3S1	2
Test winding	3S2	5
Measuring winding 2 (start of winding)	1S1	3
Measuring winding 1 (start of winding)	2S1	1
Measuring winding 2	1S2	4
Measuring winding 1	2S2	6

8 Pins



1 - Input test

activated by GND for 30 ms...1.2 s

2 - Fault output (active low)

LOW: no system fault
HIGH: system fault

3 - IEC: current output 30 mA (active low)

LOW: $I_{\Delta n2} < 30$ r.m.s. mA, no system fault
HIGH: $I_{\Delta n2} > 30$ r.m.s. mA and/or system fault

UL: current output 20 mA (active low)

LOW: $I_{\Delta n2} < 20$ r.m.s. mA, no system fault
HIGH: $I_{\Delta n2} \geq 20$ r.m.s. mA and/or system fault

4 - IEC: current output DC 6 mA (active low)

LOW: $I_{\Delta n1} < DC6mA$, $I_{\Delta n2} < r.m.s. 30$ mA, no system fault
HIGH: $I_{\Delta n1} \geq DC6mA$ and/or $I_{\Delta n2} \geq r.m.s. 30$ mA and/or system fault

UL: current output r.m.s. 5 mA (active low)

LOW: $I_{\Delta n1} < r.m.s. 5$ mA, no system fault
HIGH: $I_{\Delta n1} \geq r.m.s. 5$ mA and/or system fault

5 - + Vcc

Voltage supply module +5 V

6 - Ground

7 - Not connected

8 - Output pulse width modulation (f = 8 kHz)

IEC: 0...100 % = DC 0...30 mA

UL: 0...100 % = r.m.s. 0...50 mA

Technical data
Primary circuit (monitored circuit)

Rated voltage U_n	250 V
Rated current I_n	single-phase: 80 A three-phase: 32 A
Bemessungsspannung nach UL:	single-phase: 120 Vac split-phase: 120/240 Vac or 120/208 Vac 60 Hz
Short-term continuous current I_n for 1 s	200 A

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit IC1	(L1, L2, L3, N)
Electronics IC2	(a...f, Test, Error, RMS, DC, Vcc, GND, PWM)
Rated voltage	250 V
Overshoot category (OVC)	III
Rated impulse voltage:	
IC1 / IC2	4 kV
Rated insulation voltage:	
IC1/IC2	250 V
Pollution degree	2
Protective separation (reinforced insulation) between:	
IC/IC2	OVC III, 250 V
The data are valid from the monitored primary circuit to the output circuit.	

Power supply

Nominal supply voltage V_{cc}	DC 5 V
Tolerance of the supply voltage V_{cc}	$\pm 5\%$
Voltage ripple V_{cc}	< 100 mV
Absolute maximum supply voltage V_{cc}	DC 5.5 V
Nominal current I_{cc}	45 mA

Residual current measuring range

Frequency range $I_{\Delta n}$	0...2000 Hz
Measuring range $I_{\Delta n}$	± 300 mA
Resolution $I_{\Delta n}$	0.2 mA

Response values
RCMB104-1(IEC)

Rated residual operating current	r.m.s. 30 mA
Residual current $I_{\Delta n1}$	DC 6 mA
Response tolerance $I_{\Delta n1}$	0.5...1 x $I_{\Delta n1}$
Residual current $I_{\Delta n2}$	r.m.s. 30 mA
Response tolerance $I_{\Delta n2}$	
for $f = DC \dots \leq 100$ Hz	0.7...1 x $I_{\Delta n2}$
for $f = 100 \dots \leq 1000$ Hz	2...5 x $I_{\Delta n2}$
for $f = 1 \dots 2$ kHz	3...6 x $I_{\Delta n2}$
Restart value	
$I_{\Delta n1}$	< 3 mA
$I_{\Delta n2}$	< 12 mA
Operating time t_{ae} (at DC or > 15 Hz)	
1x $I_{\Delta n}$	< 180 ms
2x $I_{\Delta n}$	< 70 ms
5x $I_{\Delta n}$	< 20 ms

RCMB104-2 (UL)

Auto Supervisory Check; CCID	
Rated residual operating current $I_{\Delta n1}$: (CCID 20)	r.m.s. 20 mA
Rated residual operating current $I_{\Delta n2}$: (CCID 5)	r.m.s. 5 mA
Response tolerance $I_{\Delta n1}$	
for $f = DC \dots 1$ kHz	0.8...1.2 x $I_{\Delta n1}$
for $f = 1 \dots 2$ kHz	0.8...2.5 x $I_{\Delta n1}$
Response tolerance $I_{\Delta n2}$	
for $f = DC \dots 1$ kHz	0.8...1.2 x $I_{\Delta n2}$
for $f = 1 \dots 2$ kHz	0.8...2.5 x $I_{\Delta n2}$
Restart value	
$I_{\Delta n1}$	< 3 mA
$I_{\Delta n2}$	< 12 mA
Operating time t_{ae} (at DC or > 15 Hz)	
AC and mixed currents	$< (20/\Delta I)^{1.43} - 10$ ms
DC 30 mA...100.6 mA	$< (40 \times 1.414/\Delta I)^4 - 10$ ms
DC > 100.6 mA	$< (20/\Delta I)^{1.43} - 10$ ms
Recovery time t_b	300 ms
Release time t_{off}	< 2.5 s

Outputs DC, RMS, Error

Type	Open Collector (NPN)
Switching capacity	DC 40 V/20 mA
Signalling times in the event of module and hardware errors	
Error	≤ 1.5 s
DC	≤ 2.5 s
RMS	≤ 2.5 s

Measurement output (PWM)

Type	PushPull
HIGH level	3.1...3.5 V
LOW level	0...0.5 V
PWM frequency	8 kHz
Scaling	
RCMB104-1	0...100 % = DC 0...30 mA
RCMB104-2	0...100 % = r.m.s. 0...50 mA
Maximum current-carrying ability	10 mA

Control input (TEST)

Type	LOW: activated state HIGH: deactivated state
Switching thresholds	HIGH: 3.1... 5.5 V LOW: 0... 0.6 V

EMC (DIN EN 61851-1, DIN EN 61851-22, IEC 62752, UL 2231-2)

ESD restrictions: The RCMB104 must be mounted in an enclosure that complies with the mentioned standards.	
Restrictions line-conducted interferences: The supply conductor must fulfil the requirements of the voltage supply	
ESD immunity acc. to Human Body Model JESD22-A114	± 2 kV (air) ± 2 kV (contact)
Operating temperature	-30...80 °C
Storage temperature	-40...85 °C

Climatic class

Stationary use (IEC 60721-3-3) (except condensation, water and formation of ice)	3K5
Transport (IEC 60721-3-2)	2K2
Long-term storage (IEC 60721-3-1)	1k2

Classification of mechanical conditions

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

 Range of use ≤ 4000 m

Technical data (continuation)

Degree of protection

RCMB104-x	IP 00
Measuring current transformer (without connector plug)	IP 55

Connections

Measuring current transformer

Connection type	PCB plug-in connector 0.65 x 0.65 mm
Modular dimensions	single row 6 x 2.54 mm
Contact surface	tinned
Pin length	2.5 mm

Inputs/outputs

Connection type	PCB plug-in connector 0.5 x 0.5 mm
Arrangement of connections	double row 2 x 4 pins
Modular dimensions	2.00 mm
Contact surface	tinned
Pin length	2.5 mm
Soldering process for PCB	recommended: selective soldering

Connection measuring current transformer W15BS

Maximum distance RCMB104 to connector	100 mm
Connection type	PCB plug-in connector
Number of poles	6 (2x3 poles)
Modular dimensions	3.0 mm
Number of mating cycles	30
Manufacturer type designation	Molex MicroFit 3.0 Header
Article number	43045-0607

The connector is not included in the scope of delivery. For further information, refer to the original data sheet created by Molex.



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