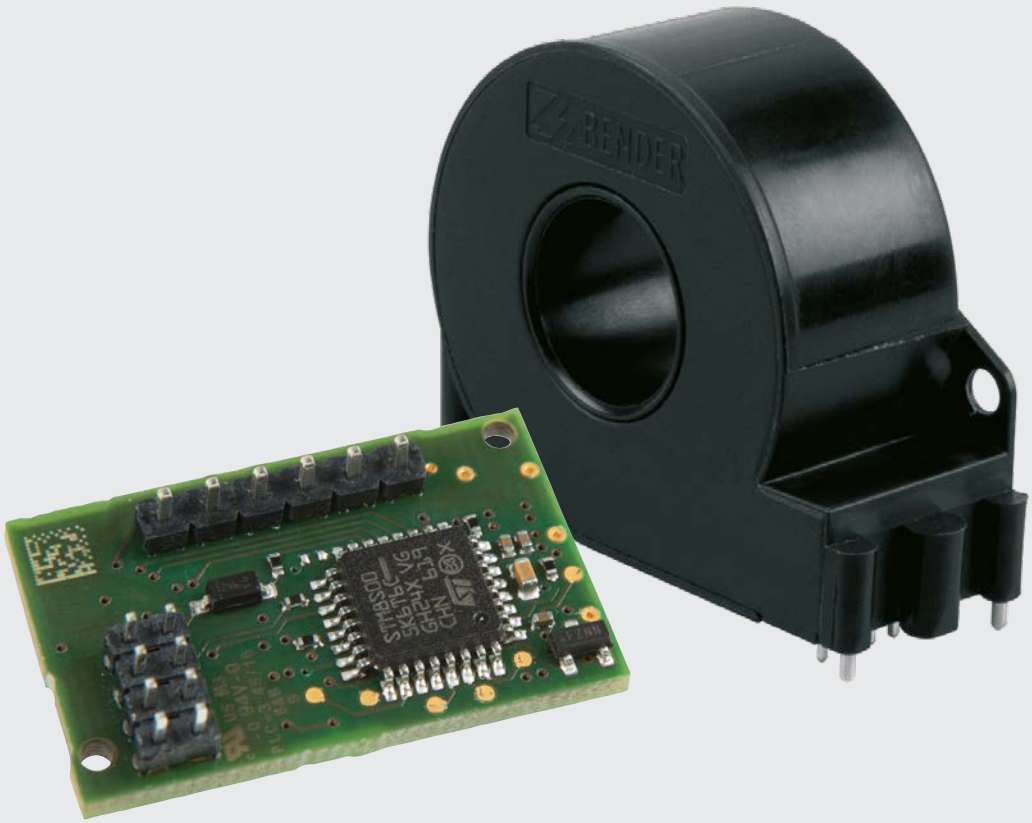
AC/DC sensitive residual current monitoring module RCMB104

for electric vehicle charging systems



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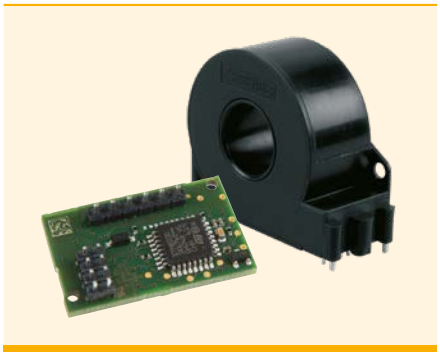


RCMB104

Device features

- Three outputs (DC, RMS, Error)
- Measuring range ±300 mA
- Residual current resolution 0.2 mA
- Patented measurement technology
- 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 DIN EN 61851-1/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 DIN EN 61851-1 or 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 residual current monitoring module RCMB104 is used **in combination** with a **measuring current transformer** CTBC17 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 x 48 A/3 x 32 A. The RCMB104 is suitable for integration into a charging unit (IC-CPD, wall box) according to IEC 61851-1, 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 CTBC17 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, DIN EN 61851-1 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 CTBC17 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)
- **DIN EN 61851-1** (Electrical equipment of electric road vehicles – Electric vehicle conductive charging system - Part 1: General requirements)
- **IEC 62752** (In-Cable Residual Current Device for mode 2 charging of electric road vehicles (IC-RCD))

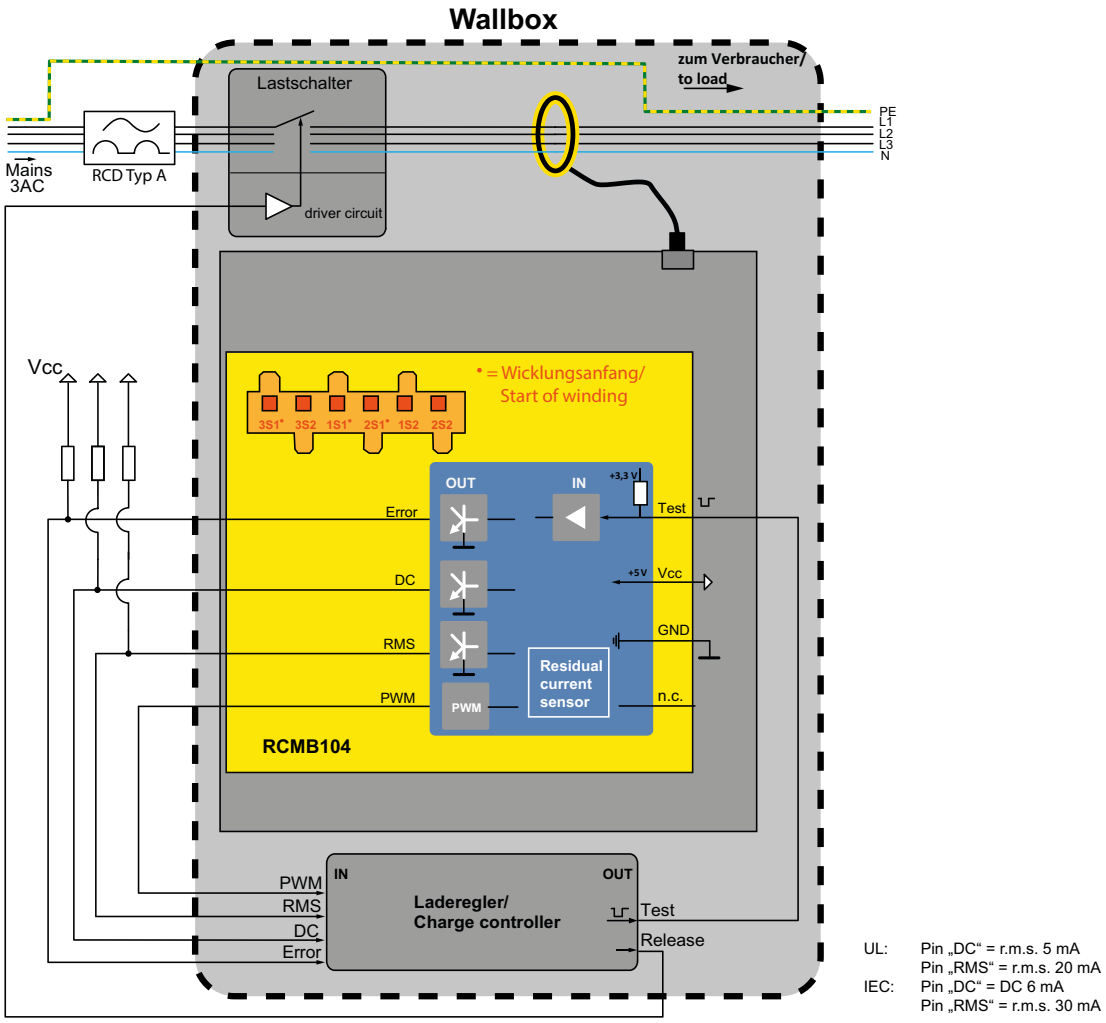
Patents

EP 2 571 128 / US 9,397,494 / ZL 201210157968.6 / CN 103001175, EP 2 813 856

Ordering information

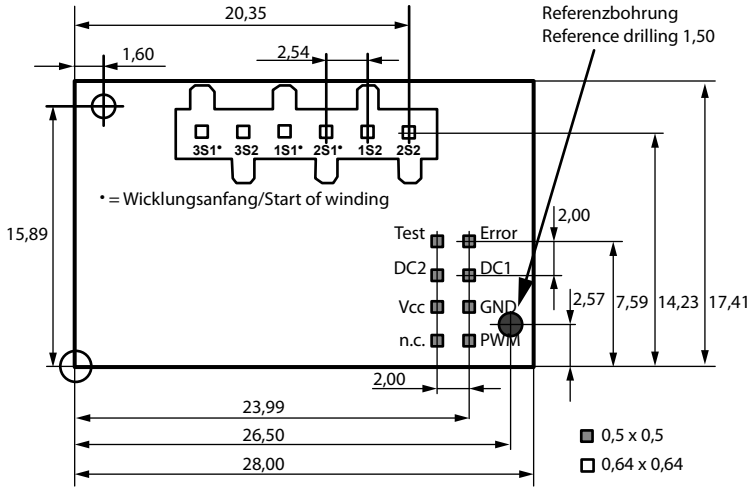
Description	Diameter/ Connection cable	Type	Art. No.
0…2 kHZ IEC 6/30 mA	–	RCMB104-1	B94042480
0…2 kHZ UL2231 5/20 mA	–	RCMB104-2	B94042481
Measuring current transformer	17 mm/--	CTBC17	B98080070
Connection cable CTBC17	--/180 ± 30 mm	CTBC17-Cable180MM	B98080540
	--/325 ± 25 mm	CTBC17-Cable325MM	B98080541
	--/1470 ± 30 mm	CTBC17-Cable1470MM	B98080542

Wiring diagram

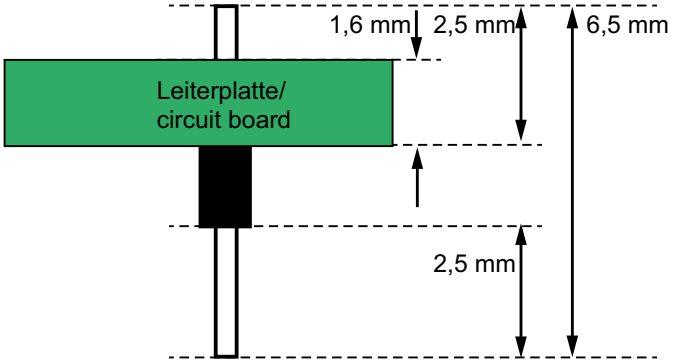


UL: Pin „DC“ = r.m.s. 5 mA
Pin „RMS“ = r.m.s. 20 mA
IEC: Pin „DC“ = DC 6 mA
Pin „RMS“ = r.m.s. 30 mA

Dimension diagram

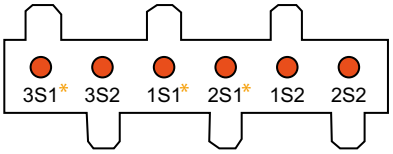


Connection socket measuring current transformer

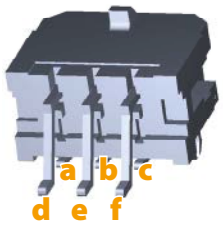


Side view RCMB104

Recommended drilling diameter: ø 1,1 mm

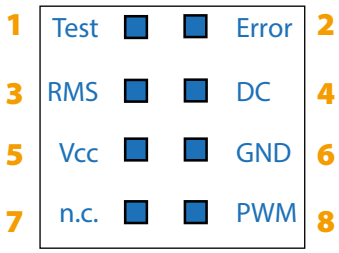


* = Start of winding



Description	Evaluating board	Socket
Test winding (start of winding)	3S1	b
Test winding	3S2	e
Measuring winding 2 (start of winding)	1S1	c
Measuring winding 1 (start of winding)	2S1	a
Measuring winding 2	1S2	d
Measuring winding 1	2S2	f

Recommended drilling diameter



Side view RCMB104

Recommended drilling diameter: ø 0,9 mm

1 - **Test** **Input test**
activated by GND for 30 ms…1.2 s

2 - **Error** **Fault output** (active low)
LOW: no system fault
HIGH: system fault

3 - **RMS** **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: $I_{\Delta n2}$ < r.m.s. 20 mA, no system fault

HIGH: $I_{\Delta n2}$ ≥ r.m.s. 20 mA and/or system fault

4 - **DC** **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: $I_{\Delta n1}$ ≥ DC6mA and/or $I_{\Delta n2}$ ≥ 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: $I_{\Delta n1}$ ≥ r.m.s. 5 mA and/or system fault

5 - **Vcc** + Vcc
Voltage supply module +5 V

6 - **GND** Ground

7 - **n.c.** Not connected

8 - **PWM** **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: 48 A
	three-phase: 32 A
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
Overvoltage 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}	±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 = DV…≤ 100 Hz	0,7…1 x $I_{\Delta n2}$
for f = 100…≤ 1000 Hz	2…5 x $I_{\Delta n2}$
for f = 1…2 kHz	3…6 x I_{dn2}
Restart value	
$I_{\Delta n1}$	< 3 mA
$I_{\Delta n2}$	< 12 mA
Operating time t_{ae} (at DC or > 15 Hz)	
1x $I_{\Delta n1}$	< 480 ms
2x $I_{\Delta n1}$	< 240 ms
5x $I_{\Delta n1}$	< 120 ms
Operating time t_{ae} (at r.m.s. or > 15 Hz)	
1x $I_{\Delta n2}$	< 180 ms
2x $I_{\Delta n2}$	< 70 ms
5x $I_{\Delta n2}$	< 20 ms

RCMB104-2 (UL)

Rated residual operating current	r.m.s. 20 mA
Residual current $I_{\Delta n1}$	r.m.s. 5 mA
Response tolerance $I_{\Delta n1}$	
for f = DC…1 kHz	0.8…1.2 x $I_{\Delta n1}$
for f = 1…2 kHz	0.8…2.5 x $I_{\Delta n1}$
Residual current $I_{\Delta n2}$	r.m.s. 20 mA
Response tolerance $I_{\Delta n2}$	
for f = DC…1 kHz	0.8…1.2 x $I_{\Delta n2}$
for f = 1…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, 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 (see manual)

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)	3K24
Transport (IEC 60721-3-2)	2K11
Long-term storage (IEC 60721-3-1)	1K21

Classification of mechanical conditions

Stationary use (IEC 60721-3-3)	3M11
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12
Range of use	≤ 4000 m

Technical data (continuation)

Degree of protection

RCMB104	IP00
Measuring current transformer (without connector plug)	IP55

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 CTBC17

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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