
RCMB104

AC/DC sensitive residual current monitoring module
for electric vehicle charging systems



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Intended use

The residual current monitoring modules are used **in combination** with a **measuring current transformer**, e. g. the 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 module is, depending on the variant, suitable for integration into a charging unit (Mode 2, IC-CPD,) according to IEC 62752 or UL 2231-2 (CCID5 or CCID20).

The monitoring module RCMB104 must be soldered or plugged directly on the customer's own PCB via the provided connection pins, the length of the connection conductor paths should not exceed 100 mm!

The monitoring modules are only intended for purchase by the manufacturer of the charging system and not for end users!

Device features

- Four outputs (Switch1, Switch2, Error, PWM)
- Measuring range ± 300 mA
- Residual current resolution < 0.2 mA
- Patented measurement technology
- Load current up to 32 A or 80 A* RMS (singlephase) or 3 x 32 A RMS (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 fields)
- In applications according to IEC 62752, the device can replace a type B RCD when combined with a type A RCD and a suitable switching device (e.g. a power relay)

* Only in case of use according to UL2231-2

Approvals



except RCMB104-1

Function

The residual current evaluation unit consists of an externally connected measuring current transformer for measuring and the monitoring module for evaluating the residual currents. The module determines with its patented measuring method the RMS value of the DC component contained in the residual current and the AC component that is below the cutoff frequency.

The outputs **Switch1** and **Switch2** of the RCMB104 signal a limit value overrun. The limit values are variantdependent and, in combination with RCD type A, comply with the respective normative trip requirements according to IEC 62752 or UL 2231-2 (CCID5 or CCID20).

Residual current measurement: AC/DC sensitive residual current measurement

Charging process: Before each charging process, the charge controller must check that the monitoring module 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 is magnetically shielded, so that no external interference can affect the residual current measurement.

Standards

The monitoring modules compliens, depending on the variant, with the following device standards:

RCMB104-1:

IEC 62752 In-cable control and protection device for mode 2 charging of electric road vehicles (IC-CPD)

RCMB104-2:

CCID20 acc. to UL 2231-2 (Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems)

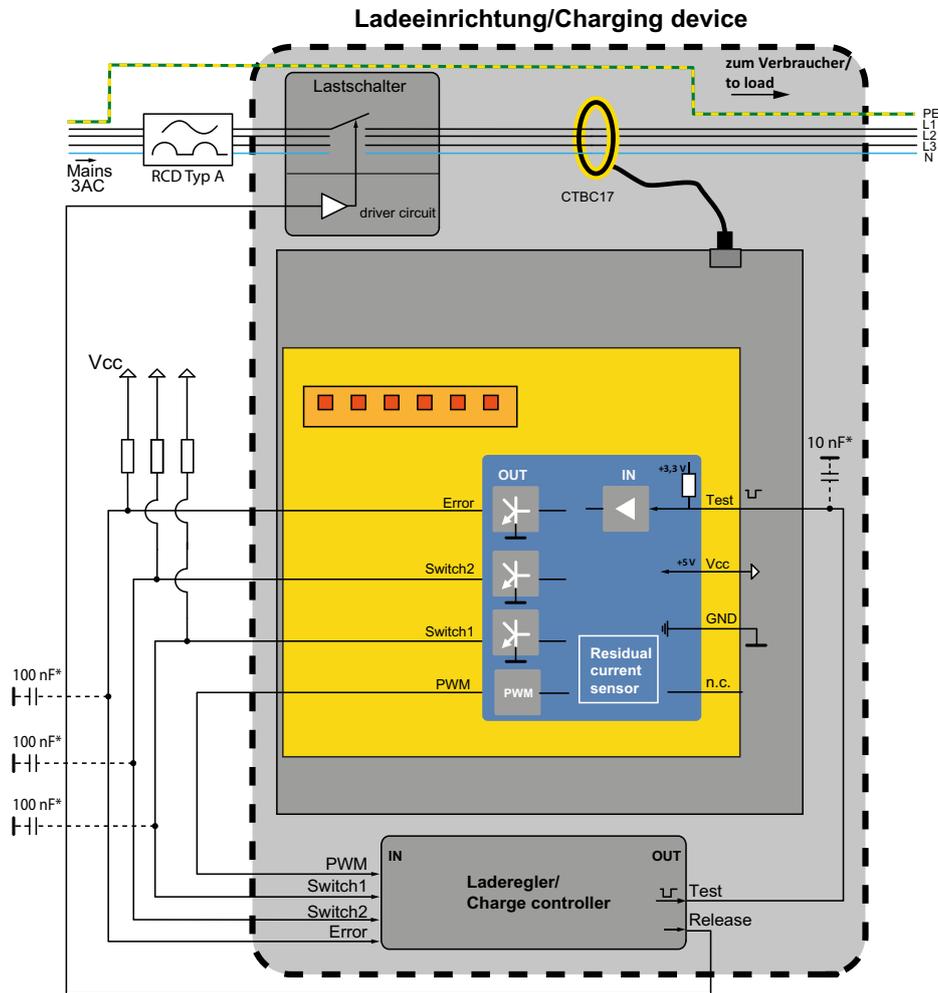
RCMB104-2

CCID5 acc. to UL 2231-2 (Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems)

Patents

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

Wiring diagram



* Optional capacities for EMC optimisation

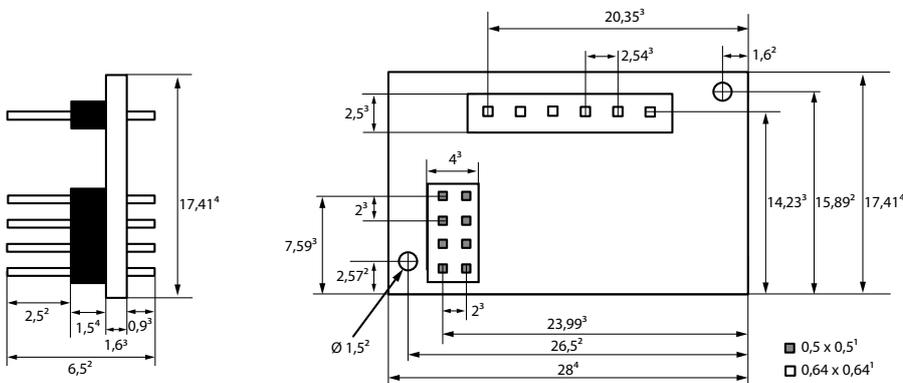
Dimension diagram

Dimension in mm

Side view;

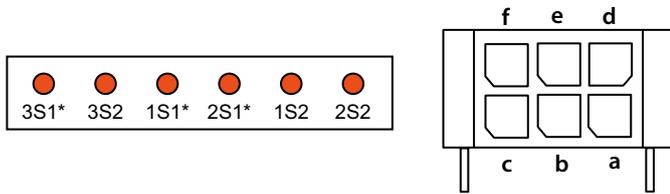
Front view

Recommended drilling diameter: $\varnothing 1,1\text{mm}$



Tolerances dimensions	
x ¹	± 0,05
x ²	± 0,1
x ³	± 0,2
x ⁴	± 0,3

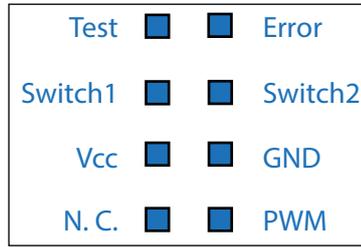
Connection socket measuring current transformer



Description Pin assignment 1	Valuating board	Connection Socket CT
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

i Only valid for wired variants. For the soldered variant of the CTBC17, the corresponding manual must be observed. Further Information see "Technical data".

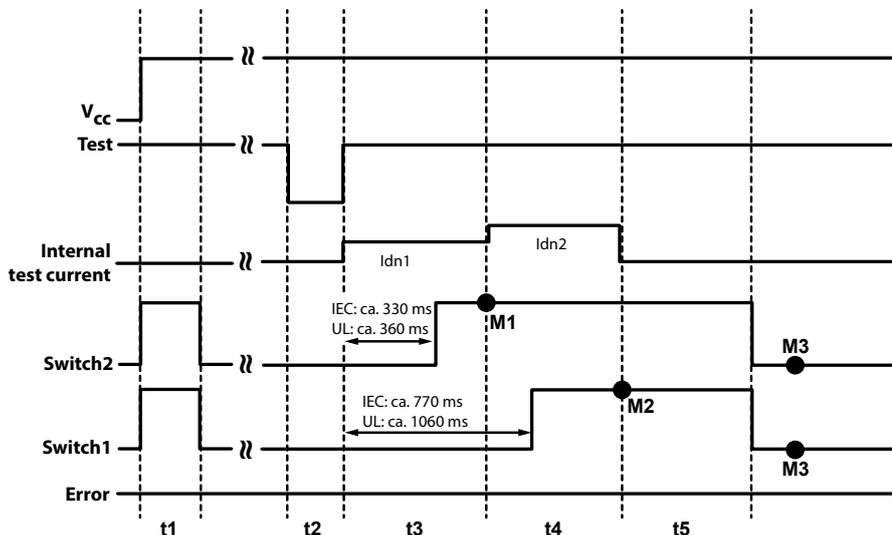
Inputs/outputs



Recommended drilling diameter pins: Ø 0.9 mm

Pin	Description
Test	Input test: activated by GND for 40 ms... 1.2 s
Error	Fault output (active low) LOW: no system fault HIGH: system fault
Switch1	RCMB104-1 (active low): LOW: $I_{\Delta rms1} < \text{RMS } 30 \text{ mA}$, no system fault HIGH: $I_{\Delta rms1} \geq \text{RMS } 30 \text{ mA}$ or system fault RCMB104-2 CCID20 acc. to UL 2231-2 (active low) LOW: $I_1 < \text{RMS } 20 \text{ mA}$, no system fault HIGH: $I_1 \geq \text{RMS } 20 \text{ mA}$ or system fault
Switch2	RCMB104-1 IEC 62752 (active low): LOW: $I_{\Delta dc2} < \text{DC } 6 \text{ mA}$, $I_{\Delta rms2} < \text{RMS } 30 \text{ mA}$, no system fault HIGH: $I_{\Delta dc2} \geq \text{DC } 6 \text{ mA}$ or $I_{\Delta rms2} \geq \text{RMS } 30 \text{ mA}$ or system fault RCMB104-2 CCID5 acc. to UL 2231-2 (active low): LOW: $I_2 < \text{RMS } 5 \text{ mA}$, no system fault HIGH: $I_2 \geq \text{RMS } 5 \text{ mA}$ and/or system fault
Vcc	+ VCC: Voltage supply module +5 V
GND	Ground
N. C.	Not connected
PWM	Output pulse width modulation (f = 8 kHz) RCMB104-1: 0... 100 % = DC 0... 30 mA RCMB104-2: 0... 100 % = RMS 0... 50 mA

Timing diagram „Test“ RCMB104-1 and -2



M1-M3= Measurement time point
 t1 = typ. 270 ms (start up delay to drive outputs)
 t2 = 30 ms... 1.2 s
 t3 = 700 ms
 t4 = 700 ms
 t5 = 600 ms

After starting the test, the charging system must ensure that the outputs are set correctly at the measurement time points M...:

- M1:** Switch2 = HIGH
- M2:** Switch1 = HIGH
- M3:** Switch2 / Switch1 = LOW

i The offset measurement only takes place when, after the test, both outputs are LOW (M1, M2). If the outputs are not set correctly at the measuring times M..., the RCMB104 must be regarded as defective.

Technical data

Main circuit (current paths trough CT)

Rated operational voltage U_e	230/400 V
Rated current I_n	single-phase: 32 A (80 A) three-phase: 32 A

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

Definitions:	
Main circuit IC1	(L1, L2, L3, N)
Control circuit IC2	(a...f, Test, Error, Switch2, Switch1, Vcc, GND, PWM)
Rated voltage	250 V
Overvoltage category (ÜK)	III
Rated impulse voltage:	
IC1/IC2	4 kV
Rated insulation voltage U_i :	
IC1/IC2	250 V
Pollution degree	2
Protective separation (reinforced insulation) between:	
IC/IC2	ÜK III, 250 V

The data are valid from the main circuit to the control 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
Supply current I_{cc}	45 mA

Residual current measuring range

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

Response values

RCMB104-1 (Switch1)

Rated residual operating current $I_{\Delta rms1}$	RMS 30 mA
Response tolerance $I_{\Delta rms1}$	
for $f = DC \dots \leq 100$ Hz	$0.7 \dots 1 \times I_{\Delta rms1}$
for $f = 100 \dots \leq 400$ Hz	$0.8 \dots 2.5 \times I_{\Delta rms1}$
for $f = 400 \dots 2000$ Hz	$1.5 \dots 6 \times I_{\Delta rms1}$
Restart value $I_{\Delta rms1}$	< 10 mA
Operating time t_{ae} (DC... ≤ 100 Hz)	
1x $I_{\Delta n1}$	< 270 ms
2x $I_{\Delta n1}$	< 80 ms
5x $I_{\Delta n1}$	< 20 ms

RCMB104-1 (Switch2, IEC 62752)

Rated residual operating current $I_{\Delta dc2}$	DC 6 mA
Response tolerance $I_{\Delta dc2}$	$> 0.5 \dots 1 \times I_{\Delta dc2}$
Rated residual operating current $I_{\Delta rms2}$	RMS 30 mA
Response tolerance $I_{\Delta rms2}$	
for $f = DC \dots \leq 100$ Hz	$0.7 \dots 1 \times I_{\Delta rms2}$
for $f = 100 \dots \leq 400$ Hz	$0.8 \dots 2.5 \times I_{\Delta rms2}$
for $f = 400 \dots 2000$ Hz	$1.5 \dots 6 \times I_{\Delta rms2}$
Restart value	
$I_{\Delta dc2}$	< 2.5 mA
$I_{\Delta rms2}$	< 10 mA
Operating time t_{ae}	
DC 6 mA	< 700 ms
DC 60 mA	< 240 ms
DC 300 mA	< 20 ms
Operating time t_{ae} (DC... ≤ 100 Hz)	
1x $I_{\Delta rms2}$	< 270 ms
2x $I_{\Delta rms2}$	< 80 ms
5x $I_{\Delta rms2}$	< 20 ms

RCMB104-2 (Switch1, CCID20 acc. to UL 2231-2)

Ground fault threshold I_1	
60 Hz	RMS 20 mA
DC	40 mA x 1.141
Response tolerance I_1	
for $f = 60$ Hz	0.75...1 x I_1
for $f = > 60 \dots \leq 2000$ Hz	0.8...3.5 x I_1
Restart value I_1	< 10 mA
Operating time t_{ae} (DC... ≤ 100 Hz)	
All fault current except pure DC	$< (20/I)^{1.43} - 10$ ms
DC $> 30 \dots \leq 100.6$ mA	$< (40 \times 1.414/I)^4 - 10$ ms
DC > 100.6 mA	$< (20/I)^{1.43} - 10$ ms
Release time t_{off}	< 2.5 s

RCMB104-2 (Switch2, CCID5 acc. to UL 2231-2)

Ground fault threshold I_2	
60 Hz	RMS 5 mA
DC	30 mA
Response tolerance I_2	
for $f = \geq 60 \dots \leq 500$ Hz	0.94...1.1 x I_2
for $f = > 500 \dots \leq 2000$ Hz	0.8...2 x I_2
Restart value I_2	< 2 mA
Operating time t_{ae} (DC... ≤ 100 Hz)	
All fault current except pure DC	$< (20/I)^{1.43} - 10$ ms
DC $> 30 \dots \leq 100.6$ mA	$< (40 \times 1.414/I)^4 - 10$ ms
DC > 100.6 mA	$< (20/I)^{1.43} - 10$ ms
Release time t_{off}	< 2.5 s

Outputs Switch1, Switch2, 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
Switch1	≤ 2.5 s
Switch2	≤ 2.5 s

PMW output

Type	PushPull
HIGH level	3.1...3.5 V*
LOW level	0...0.5 V*
PWM frequency	8000 Hz
Scaling	
RCMB104-1	0...100% = DC 0...30 mA
RCMB104-2	0...100% = RMS 0...50 mA
Maximum current-carrying ability	10 mA

* The overvoltage protection must be ensured by the customer.

Control input (TEST)

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

EMV (IEC 62752, UL 2231-2)

ESD restrictions: The device must be mounted in an enclosure that complies with the mentioned standards.	
Restrictions line-conducted interferences:	
Maximum connection length:	100 mm
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)	3K24 (except condensation, water and formation of ice)
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

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

Ordering information

Type	Description	Art. No.	Documentation number
RCMB104-1	0...2000 Hz IEC 6/30 mA	B94042480	D00294
RCMB104-2	0...2000 Hz UL 2231 5/20 mA	B94042481	D00294
CTBC17P-03	Measuring current transformer $\varnothing = 17$ mm	B98080070	D00421
CTBC17- Kabel180MM	Connection cable 180 ± 30 mm	B98080540	
CTBC17- Kabel325MM	Connection cable 325 ± 25 mm	B98080541	
CTBC17- Kabel600MM	Connection cable 600 ± 30 mm	B98080543	
CTBC17- Kabel1470MM	Connection cable 1470 ± 30 mm	B98080542	

Connection measuring current transformer CTBC17

Maximum distance 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.



Bender GmbH & Co. KG

Londorfer Straße 65
35305 Grünberg
Germany

Tel.: +49 6401 807-0
info@bender.de
www.bender.de



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Subject to change!

The specified standards take into account the edition valid until 08.2023 unless otherwise indicated.