AC/DC sensitive residual current monitoring module RCMB104
for electric vehicle charging systems
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) $I_n = 1 \times 48$ 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 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, 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 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)
- **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))

Ordering information

<table>
<thead>
<tr>
<th>Description</th>
<th>Diameter</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...2 kHz IEC 6/30 mA</td>
<td>–</td>
<td>RCMB104-1</td>
<td>894042480</td>
</tr>
<tr>
<td>0...2 kHz UL2231 5/20 mA</td>
<td>–</td>
<td>RCMB104-2</td>
<td>894042481</td>
</tr>
<tr>
<td>Measuring current transformer</td>
<td>15 mm (1470 ± 30 mm)</td>
<td>W15BS</td>
<td>898080065</td>
</tr>
<tr>
<td></td>
<td>15 mm (180 ± 30 mm)</td>
<td>W15BS-02</td>
<td>898080067</td>
</tr>
<tr>
<td></td>
<td>15 mm (325 ± 25 mm)</td>
<td>W15BS-03</td>
<td>898080068</td>
</tr>
</tbody>
</table>
AC/DC sensitive residual current monitoring module RCMB104

Connection socket measuring current transformer

Leiterplatte/circuit board

Recommended drilling diameter: ø 1,1 mm

Recommended drilling diameter

Leiterplatte/circuit board

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: $I_{\text{dn2}} < 30$ r.m.s. mA, no system fault
   HIGH: $I_{\text{dn2}} > 30$ r.m.s. mA and/or system fault
   UL: current output 20 mA (active low)
   LOW: $I_{\text{dn2}} < $ r.m.s. 20 mA, no system fault
   HIGH: $I_{\text{dn2}} \geq $ r.m.s. 20 mA and/or system fault
4 - DC IEC: current output DC 6 mA (active low)
   LOW: $I_{\text{dn1}} < $ DC6 mA, $I_{\text{dn2}} < $ r.m.s. 30 mA, no system fault
   HIGH: $I_{\text{dn1}} \geq $ DC6 mA and/or $I_{\text{dn2}} \geq $ r.m.s. 30 mA and/or system fault
   UL: current output r.m.s. 5 mA (active low)
   LOW: $I_{\text{dn1}} < $ r.m.s. 5 mA, no system fault
   HIGH: $I_{\text{dn1}} \geq $ 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)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage $U_n$</td>
<td>250 V</td>
</tr>
</tbody>
</table>
| Rated current $I_n$        | single-phase: 48 A  
                          three-phase: 32 A |
| Short-term continuous current $I_{\text{sh}}$ for 1 s | 200 A |

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

- Measuring circuit IC1: (L1, L2, L3, N)
- Electronics IC2: (a…f, Test, Error, RMS, DC, Vcc, GND, PWM)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
</table>
| Rated voltage $I_n$        | single-phase: 100 A  
                          three-phase: 150 A |
| Overvoltage category (OVC) | III            |
| Rated impulse voltage:     | 1 kV           |
| Rated insulation voltage:  | 250 V          |
| Pollution degree           | 2              |
| Protective separation      | OVC III, 250 V |

The data are valid from the monitored primary circuit to the output circuit.

**Power supply**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal supply voltage $V_{cc}$</td>
<td>DC 5 V</td>
</tr>
<tr>
<td>Tolerance of the supply voltage $V_{cc}$</td>
<td>±5 %</td>
</tr>
<tr>
<td>Voltage ripple $V_{rr}$</td>
<td>&lt; 100 mV</td>
</tr>
<tr>
<td>Absolute maximum supply voltage $V_{cc}$</td>
<td>DC 5.5 V</td>
</tr>
<tr>
<td>Nominal current $I_{cc}$</td>
<td>45 mA</td>
</tr>
</tbody>
</table>

**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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RCMB104-1 (IEC)</strong></td>
<td></td>
</tr>
<tr>
<td>Rated residual operating current r.m.s.</td>
<td>30 mA</td>
</tr>
<tr>
<td>Residual current $I_{\Delta n1}$</td>
<td>DC 6 mA</td>
</tr>
<tr>
<td>Response tolerance $I_{\Delta n1}$</td>
<td>0.5 … 1 x $I_{\Delta n1}$</td>
</tr>
<tr>
<td>Residual current $I_{\Delta n2}$</td>
<td>r.m.s. 30 mA</td>
</tr>
</tbody>
</table>
| Response tolerance $I_{\Delta n2}$ | for $f = DC$ … ≤ 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 $I_{\Delta n2}$ |
| Restart value                 | $I_{\Delta n1}$: < 3 mA  
                          $I_{\Delta n2}$: < 12 mA |
| Operating time $t_{ae}$ (at DC) | 1 x $I_{\Delta n1}$: < 440 ms  
                          2 x $I_{\Delta n1}$: < 230 ms  
                          5 x $I_{\Delta n1}$: < 100 ms |
| Operating time $t_{ae}$ (at r.m.s.) | 1 x $I_{\Delta n2}$: < 220 ms  
                          2 x $I_{\Delta n2}$: < 70 ms  
                          5 x $I_{\Delta n2}$: < 20 ms |

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RCMB104-2 (UL)</strong></td>
<td></td>
</tr>
<tr>
<td>Rated residual operating current r.m.s.</td>
<td>20 mA</td>
</tr>
<tr>
<td>Residual current $I_{\Delta n1}$</td>
<td>r.m.s. 5 mA</td>
</tr>
</tbody>
</table>
| 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 |

**Outputs DC, RMS, Error**

- Type: Open Collector (NPN)
- Switching capacity: DC 40 V/20 mA

**Measurement output (PWM)**

- Type: PushPull
  - HIGH level: 3.1 … 5.5 V
  - LOW level: 0 … 0.6 V
  - PWM frequency: 8 kHz

**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 fulfill the requirements of the voltage supply (see page 6 in the 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) 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: 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 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.