AC/DC sensitive residual current monitoring module RCMB121-…
for safe charging of electrical vehicles according to IEC 62752 for IC-CPD and IEC 60364-7-722 for Wall Boxes
Different Types
Planned variants of the VAC/Bender DI Sensors:
• Version with primary feed through opening for full flexibility
• Version with integrated primary conductors for 1-phase systems
• Version with integrated primary conductors for 3-phase systems
  – Standard versions are designed for PCB mounting and wave soldering process.
  – Customer specific design (e.g. press fit) upon request.
VAC/Bender DI sensors are optimized for fast, low-cost assembly, combined with the highest product and production quality.

Applications and Advantages
To satisfy new standards including IEC 62752 and IEC 60364-7-722, the charging of electrical vehicles requires residual current sensors to avoid hazardous situations in cases where the vehicle battery (DC) is connected to the home power supply (AC). Generally, AC/DC-sensitive residual current sensors can be used where direct current and alternating current circuits are directly connected and therefore AC/DC leakage currents can occur. Typically type A residual current circuit breakers (RCCBs) are installed in private households. However, these RCCBs are to identify and deactivate DC fault currents. In order to charge an electric vehicle (EV) from a home power supply, a costly type B RCCB would be required to guarantee safety in the event of a DC fault current.

By using a VAC/Bender DI sensor integrated into an IC-CPD or wall box, customers can save the high costs of installing a type B RCCB to provide all-current sensitivity and electrical safety at low cost.

A single DI sensor simultaneously monitors all currents in phases and neutral conductors sensing AC/DC fault currents. The sensors can activate automatic shut-off in the event of hazardous electrical faults. As the residual currents to be monitored only occur in the event of electrical faults and are extremely low (mA), maximum measurement precision is critical. In addition, a fast response time is required to maintain safety features.

Manufactured with soft tools (plastic components) and production tools and facilities that are not definitive.

Status before design freeze, subject to modifications regarding technical characteristics and external dimensions until subsequent series production.

Standards
Constructed and manufactured and tested in accordance with IEC 61800-5-1, IEC 62752 (In-Cable Control and Protection Device for mode 2 charging of electric road vehicles (IC-CPD)) and IEC 60364-7-722 (Low-voltage electrical installations - Part 7-722: Requirements for special installations or locations - Supplies for electric vehicles).
**Technical Data**

**Electrical data - Ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{\text{P}}$</td>
<td>80/40 A</td>
</tr>
<tr>
<td>$I_{\Delta N1}$</td>
<td>6/5 mA</td>
</tr>
<tr>
<td>$I_{\Delta N2}$</td>
<td>30/20 mA</td>
</tr>
<tr>
<td>$I_{\Delta N1\text{tol}}$</td>
<td>-30...0 %</td>
</tr>
<tr>
<td>$I_{\Delta N2\text{tol}}$</td>
<td>-20...-50 %</td>
</tr>
</tbody>
</table>

**Accuracy – Dynamic performance data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{\text{max}}$</td>
<td>-300...+300 mA</td>
</tr>
<tr>
<td>$X$</td>
<td>$&lt; 0.2 \text{ mA}$</td>
</tr>
<tr>
<td>$t_r$</td>
<td>According to IEC 62752 5.3.11 (rev. Sept 2012)</td>
</tr>
<tr>
<td>$f_{\text{BW}}$</td>
<td>DC 2 kHz</td>
</tr>
</tbody>
</table>

**General data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_{\text{op}}$</td>
<td>-40...+85 °C</td>
</tr>
<tr>
<td>$T_{\text{st}}$</td>
<td>-40...+85 °C</td>
</tr>
<tr>
<td>$m$</td>
<td>23 g</td>
</tr>
<tr>
<td>$V_{\text{CC max}}$</td>
<td>7 V</td>
</tr>
<tr>
<td>$I_{\text{MAX}}$</td>
<td>50 mA</td>
</tr>
</tbody>
</table>

**Electrical data of Open Collector Outputs:**

- **Pin 1** – ERROR OUT
  - If no system fault is detected, Pin 1 outputs a low level. If a system fault is detected Pin 1 has high impedance. (active low)
- **Pin 2** – Test IN
  - Input is active if a low pulse (GND) is applied for a period of 30 ms to 1.2 sec. Input is inactive if left open.
- **Pin 3** – 6 mA dc OUT
  - If the residual current is below 6 mA dc and no system fault occurs, Pin 3 outputs a low level. In all other cases Pin 3 has high impedance. (active low)
- **Pin 4** – 30 mA rms OUT
  - If the residual current is below 30 mA rms and no system fault occurs, Pin 4 outputs a low level. In all other cases Pin 4 has high impedance. (active low)
- **Pin 5** – GND
- **Pin 6** – +VCC
- **Pin 7** – PWM OUT
  - Depending on the fault current, a PWM with $f = 8 \text{ kHz}$ is generated.
  - Scaling:
    - IEC: 0...100 % = 0...30 mA dc
    - UL: 0...100 % = 0...50 mA rms
- **Pin 8** – not connected
**Dimension diagram**

Dimensions in mm

![Dimension diagram](image)

**Meaning of switching recovery level**

If the trip-level $I_{\Delta N1}/I_{\Delta N2}$ is accomplished, the output X6-OUT/X30-OUT will change its state from low-level (GND) to high impedance.

Depending on the existence of the differential current $I_\Delta$, the outputs X6-OUT/X30-OUT will remain in this state until $I_\Delta$ fell below threshold $I_{\Delta R1}/I_{\Delta R2}$. 
TEST-IN Timing Diagram

Interrupting Time according to IEC62572:2012

Trip level and timing according to IEC 62572:2012 Tab. 2a + 2b

Interruption Time according to IEC62572:2012

- **300 mA dc**: < 40 ms
- **150 mA r.m.s.**: 40 ms
- **60 mA r.m.s.**: 150 ms
- **30 mA r.m.s.**: 300 ms
- **6 mA dc**: 500 ms