

## Manufacturer's declaration

Residual current protection devices, earlier also known as an „earth leakage circuit breaker (ELCB)“, are today referred to simply as RCDs (Residual Current protective Device) and RCMs (Residual Current operated Monitor). They are used in domestic and industrial applications as additional protection against dangerous residual currents. They are an efficient way of avoiding injuries to people and animals by accidents caused by electric shocks. They also prevent fires following the occurrence of residual currents.

In installation guidelines and technical standards, special types of RCD or RCM are recommended for use in particular types of power distribution grids, when combined with inverters, for safety reasons. For photovoltaic inverters the use of RCDs or RCMs is regulated accordingly in product standard EN 62109-1. This standard recommends that RCD/RCM type B is used if galvanically unisolated, i.e. transformerless inverters are installed.



**Legal notice:** In the country of use, legal or official standards, guidelines and instructions must always be complied with! The use of the exceptions otherwise permitted for RCD/RCM type A in this Manufacturer's Declaration is then not permitted!

By providing this Manufacturer's Declaration, the manufacturer of the inverter makes no guarantees concerning it.

PIKO solar inverters from KOSTAL Solar Electric GmbH feed the generated AC current into the AC power grid directly, i.e. transformerlessly. Due to their construction they might generate a DC current in the outside protective conductor during correct operation. This DC current is usually unavoidable and is permitted within the bounds of threshold values that must be adhered to. The DC current must however be taken into account when selecting the RCD/RCM type. If the DC current can exceed the value of 6 mA, then only a type B RCD/RCM is permitted on the AC current side to the grid.

KOSTAL also principally recommends the use of the type B RCD/RCM in combination with PIKO inverters.

However, there are also permitted exceptions to every rule. It is also permitted to use a type A RCD/RCM, in contradiction to the recommendation in the standard, if at least the same protection is provided as when a type B RCD/RCM is used.

PIKO inverters already contain several protection devices. Thus, for example, an internal RCMU of type B (Residual Current Monitoring Unit) is installed, which ensures protection against residual currents within the PV system. A system error that would cause a DC residual current is immediately stopped with an all-pole disconnection from the grid in accordance with EN 62109-2 Triggering characteristics. The inverter also monitors insulation faults of the PV system and errors of the grid (alternating voltage and frequency). In addition to this, the direct current share of the earth leakage current of the PIKO solar inverters from KOSTAL Solar Electric GmbH are significantly less than 6 mA.

A direct current share of the earth leakage current that exceeds 6 mA can in some circumstances cause the premagnetisation of RCDs/RCMs with electromagnetic coils. RCDs/RCMs capture the residual current electromagnetically. For this reason, if type A is used, it is necessary to check and exclude the possibility that a more powerful DC current might negatively affect its proper functioning as protection equipment. KOSTAL has carried out a highly detailed evaluation of this residual risk of impairment to residual current operated circuit breakers (RCCBs) of type A for its PIKO inverters, both in theoretical terms and through technical measurements. In the process, the maximum possible occurrence of DC currents for each inverter type and the effect on the investigated RCCB were considered.

KOSTAL tested the following type A RCCBs (Residual Current Operated Circuit Breaker). No fault could be detected in the monitoring property that was caused by the inverter characteristics of the PIKO inverter types named below while in operation:

**A) Solar inverter PIKO 3.0, PIKO 4.2, PIKO 4.6, PIKO 5.5, PIKO 7.0, PIKO 8.5, PIKO 10, PIKO 12, PIKO 15, PIKO 17, PIKO 20, PIKO 36 EPC from FW 5.0 and PIKO BA from FW 2.0:**

- Type A RCCBs supplied by ABB, serie F 204 A-...
- Type A RCCBs supplied by Siemens, serie 5SM3...
- Type A RCCBs supplied by Schneider, serie A9Z21440

The monitoring properties of other RCCB types from the same or other manufacturers were not tested. For this reason, this Manufacturer's Declaration refers specifically to only the types previously mentioned. **If other RCCB types, including those from other manufacturers, are used, then type B RCCBs must always be used!**

In the case of the type A RCCB tested by KOSTAL in A), the minimum rated residual current from the RCCB for operating an inverter is 30 mA. For operating up to 3 inverters, the RCCB's rated residual current is at least 100 mA. However, higher rated residual currents may also be necessary, dependent on the installation.

The PIKO solar inverters from KOSTAL Solar Electric GmbH therefore also comply with the requirements of DIN VDE 0100-712 (IEC 60364-7-12) with regard to installation and operation.

**KOSTAL Solar Electric GmbH – Freiburg, 2017-07-01**



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