The implementation of an RCM measurement (Residual Current Monitoring) with total current evaluation across three phases in IT socket strips (PDU, measurement level 4) is to be considered sufficient for IT operation, as it ensures reliable detection and monitoring of residual currents. The basis for this consideration is the Bitkom document "Electrical periodic testing without switching off" from 2021, which provides comprehensive guidelines for periodic testing in data centers. the term residual current refers to both operational and device-related leakage currents as well as fault currents caused by insulation faults or defects. Theoretically, 3-phase summation current measurement in residual current monitoring (RCM) harbors the risk that symmetrical residual currents can lead to falsification or even dissolution of the measured RCM value. However, this law mainly occurs with symmetrical 3-phase loads in a housing, such as those found in motors or heaters, and for applications in the IT sector where single-phase loads are used, the probability of the conditions that could lead to a falsification of the measured values occurring at the same time is extremely low. A significant falsification of the residual current measurement, i.e. a deviation of at least 50 %, would require the following conditions to be fulfilled simultaneously:

1. Ideal residual current symmetry: The residual currents should be almost identical on all three phases (U1=U2=U3, I1=I2=I3) and there should be no phase shift (ΔPhi=0).
2. Temporal synchronism: Symmetrical residual currents must occur simultaneously (<180ms) in at least two phases and be recorded at the same time.

In practice, the simultaneous occurrence of these conditions is almost impossible. For this reason, residual current monitoring has proven to be reliable in many electrotechnical applications, including in comparison to residual current circuit breakers (RCDs) used in industrial and domestic installations.While an RCD switches off immediately if a defined residual current limit value is exceeded (e.g. If=20/30 mA), an RCM system provides an immediate warning or alarm message if the set residual current thresholds are exceeded (e.g. >5/10 mA for a warning, >20 mA for an alarm). This real-time notification makes it possible to take technical measures at an early stage before a hazardous situation arises, and the measurement accuracy of the RCM system (RCM TYPE B) is around 1 %, which is considered sufficiently precise to make a well-founded assessment of hazardous situations. The time resolution of the measurement is less than 180ms. The messages are continuously documented in a system logbook and are available to specialist personnel for detailed analysis and evaluation. If the residual current exceeds the set threshold of e.g. 10/20 mA, specific measures can be taken in the affected area to ensure operational safety.

Conclusion

An RCM measurement (Residual Current Monitoring) with total current evaluation across three phases in IT socket strips (PDU, measurement level 4) is sufficient for IT operation, as it enables reliable monitoring of residual currents without the need to switch off the system immediately. This method is particularly suitable for use in IT environments where the probability of all conditions for falsifying the measured value occurring simultaneously is extremely low.
The term "residual current" covers both operational leakage currents and residual currents caused by insulation faults. Despite its potential distortion in the case of symmetrical residual currents, total current measurement is useful in many electrotechnical areas due to its proven application. In practice, it is unlikely that all the conditions for distortion are met at the same time, as these rely on ideal grid symmetry and fully symmetrical loads.

In contrast to residual current circuit breakers (RCDs), which switch off immediately when a limit value is exceeded, the RCM system immediately provides a warning or alarm message when a limit value is exceeded. This procedure enables precise and continuous monitoring of the residual currents with a high measuring accuracy of around 1 %, which is considered sufficient for assessing hazardous situations. The recorded data can be evaluated by specialist personnel at any time in order to initiate technical measures in good time should a critical residual current occur.