



SENTRON RESIDUAL CURRENT MONITORING FOR ELECTRICAL SYSTEMS

Reliable safety without insulation resistance measurement

Whether it's sub-distribution boards, machine connections, HVAC systems, server rooms, or socket and lighting circuits: in all buildings with electrical installations, insulation resistance measurement is required as part of the periodic inspection in accordance with IEC 60364-6 to ensure the protection of people and property. However, this measurement is not only time-consuming, but also has several disadvantages. A practical alternative is residual current monitoring using SENTRON measuring and communication-capable circuit protection devices and SENTRON Powercenter 3000. This can replace insulation resistance measurement – and even increase safety. [siemens.com/protection-devices](https://www.siemens.com/protection-devices)

Insulation as a risk and the insulation resistance measurement

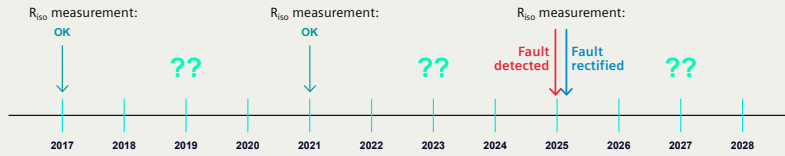
Damaged or aged insulation, as well as insulation faults, increase the risk of electrical accidents such as electrical shock. They can also lead to system failures or cause arcs and short circuits, which pose a significant fire hazard. Recurring insulation resistance measurements are used to check the condition of the insulation, but require system shutdowns. This leads to system downtime and potential production losses. Additionally, the measurement may require disassembly which is prone to error – and the test voltage can damage sensitive equipment.

Residual current monitoring instead of insulation resistance measurement

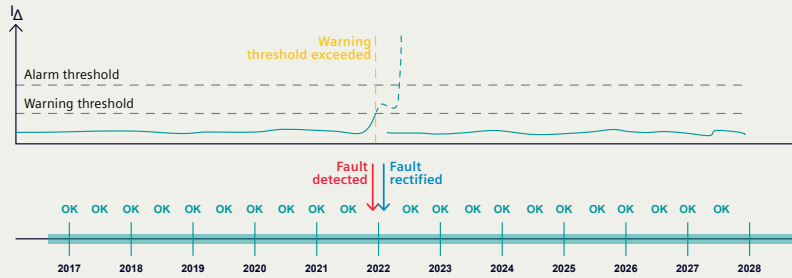
The SENTRON 5SL6 COM RCM miniature circuit breakers and SENTRON 5SV8 COM residual current measuring devices (RCMs) can replace the insulation resistance measurement in accordance with applicable standards: According to IEC 60364-6, insulation resistance measurement is not required during periodic inspections of fixed electrical installations if the circuit in question is monitored by a properly functioning residual current monitoring device in accordance with IEC 62020-1.

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Periodic insulation resistance measurement



Permanent residual current monitoring



Continuous monitoring instead of isolated snapshots:

Unlike periodic insulation resistance measurements, continuous residual current monitoring allows defects to be detected as soon as they occur and rectified promptly.

Permanent condition monitoring instead of selective measurement

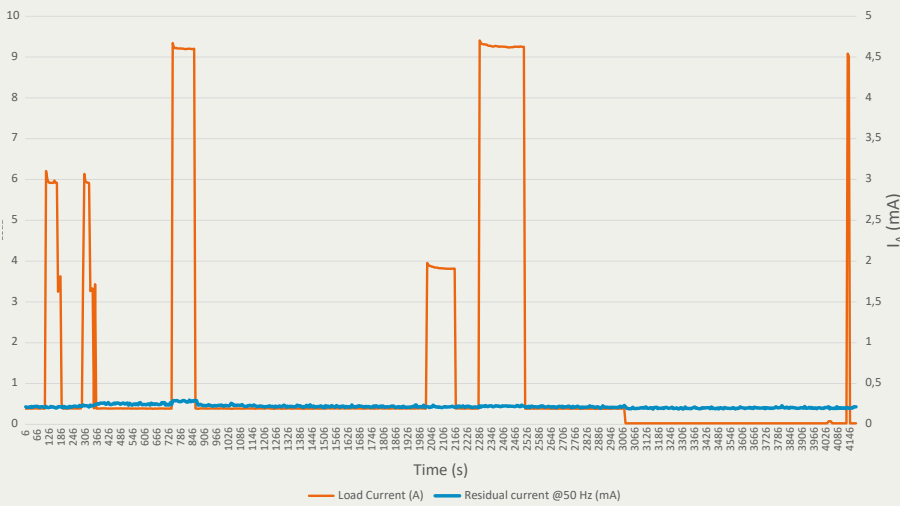
Complete transparency through residual current monitoring

With permanent residual current monitoring, the circuit is continuously monitored, and any exceedance of an alarm or warning threshold is reported immediately. This enables insulation risks to be identified at an early stage – easily and with minimal manpower during operation. This applies regardless of the system's size and complexity, or the accessibility of the measuring points.

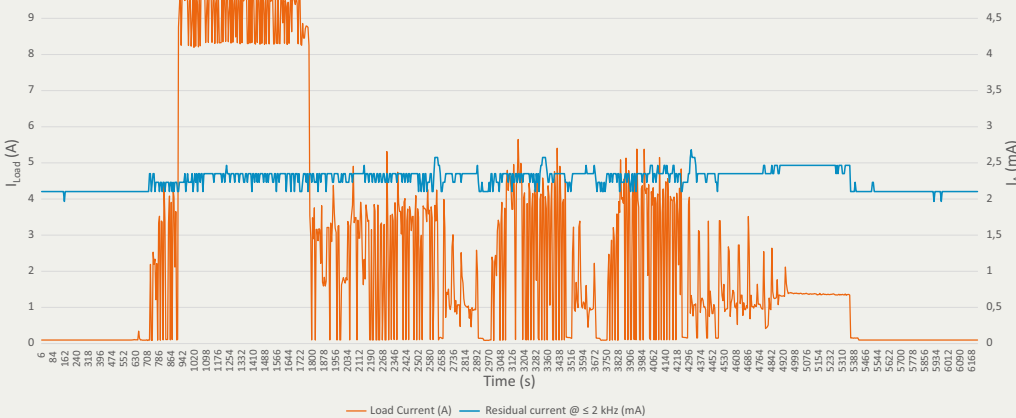
In contrast, insulation resistance measurement only provides a brief snapshot: it shows the condition of the relevant circuit only at the exact moment the measurement is taken. This may sometimes require considerable manpower, especially in widespread, distributed systems or when measuring points are difficult to access. If insulation faults occur between test intervals, they can remain undetected for months or even years.

Additional recording of the equipment condition

Residual current monitoring with SENTRON 5SL6 COM RCM miniature circuit breakers, SENTRON 5SV8 COM residual current monitoring devices, and the SENTRON Powercenter 3000 monitoring software can do even more: It also provides information about the condition of all equipment connected to the respective circuit. This is not possible with insulation resistance measurement, since many consumers must be disconnected beforehand in order to perform the measurement.



Recording of load current of various loads and residual current with a SENTRON 5SL6016-6MF miniature circuit breaker in the monitored final circuit – period approx. 1 h, alarm threshold 10 mA, pre-warning threshold 50% (5 mA)



Recording of load current and residual current with a SENTRON 5SL6016-6MF miniature circuit breaker in the monitored final circuit – period approx. 1.5 h, alarm threshold 15 mA, pre-warning threshold 50% (7.5 mA)

Setting the monitored frequency range

The frequency range of residual current monitoring to be set on the RCM depends on what is being monitored. If only the cable section is to be monitored for insulation faults, it is recommended to detect residual currents only in the mains frequency range. If, on the other hand, all fault currents that can occur in typical electronic equipment due to insulation faults are to be detected during measurement at final circuit level, it may be advisable to set the monitored frequency range of the low-pass filter to $\leq 2\text{ kHz}$.

Setting the alarm thresholds

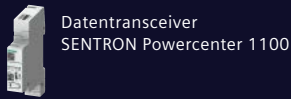
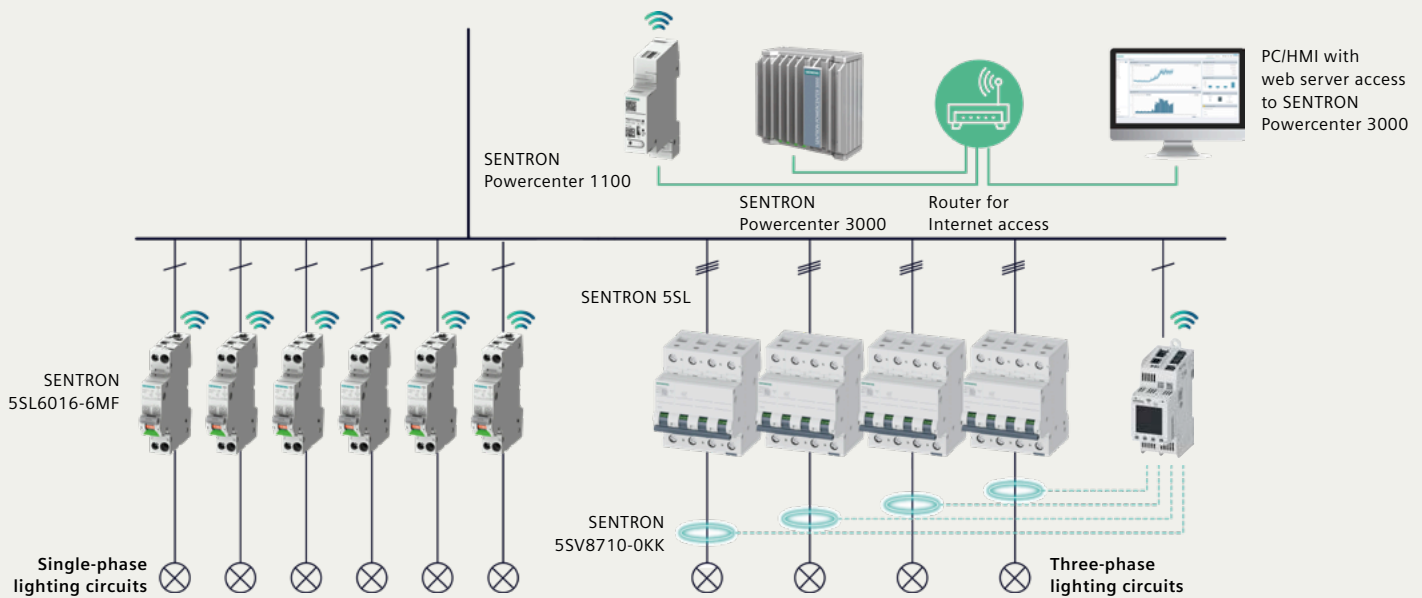
The alarm threshold of the RCMs should ideally be set to below 30 mA so that insulation faults can be detected as early as possible – even under unfavorable grounding conditions – and well before the touch voltage reaches hazardous values of 50 V or more. However, it is important to ensure that the threshold is set high enough to avoid false alarms caused by operational leakage currents. A good reference point for setting threshold can be provided by recording the leakage current during system commissioning.

Data analysis and documentation

According to the standard, all measurement results, as well as the event and alarm messages of the RCMs, must be recorded and documented in a way that allows trend changes and deteriorations in the system condition to be identified. The SENTRON Powercenter 3000 monitoring software and its associated carrier hardware make this possible: Here, data, alarms, and messages from the circuits monitored by SENTRON 5SL6 COM RCM miniature circuit breakers or SENTRON 5SV8 COM residual current monitoring devices are stored long-term. In addition, they can be visualized and analyzed via the SENTRON Powercenter 3000 web interface in dashboards accessible from PCs, HMIs, or mobile devices in the company's internal network.

Personnel and organizational requirements

Replacing insulation resistance measurements also requires certain personnel and organizational measures – for example, regular testing of the RCM function using the test button, continuous monitoring and maintenance of the system by qualified electricians, and a reporting chain that ensures prompt response and initiation of appropriate measures when needed.



Datentransceiver
SENTRON Powercenter 1100



SENTRON Powercenter 3000
gateway and software



SENTRON 5SV8223-6MP
residual current
monitoring device



SENTRON 5SL6016-6MF
miniature circuit breaker



SENTRON 5SV8710-OKK
summation current transformer



SENTRON 5SL miniature
circuit breaker

Example setup of a residual current monitoring system to replace recurring insulation resistance measurements in lighting circuits in an industrial building

Example: Application for lighting circuits in industrial buildings

Residual current monitoring replaces recurring insulation resistance measurements in lighting circuits in an industrial building.

Example setup from measurement to monitoring

Residual currents in single-phase lighting circuits are monitored using the integrated RCM function of the communication-capable SENTRON 5SL6016-6MF miniature circuit breaker (MCB). In three-phase lighting circuits, by contrast, this is done using the communication-capable four-channel (type A) SENTRON 5SV8223-6MP residual current monitoring device (RCM) and corresponding type A SENTRON 5SV8710-OKK summation current transformers.

The measurement and threshold monitoring data is transmitted wirelessly to the SENTRON Powercenter 1100 data transceiver, which forwards the data to SENTRON Powercenter 3000 via a connected router. As WW IoT gateway, SENTRON Powercenter 3000 handles long-term data storage and, as a software application, visualizes the data in dashboards. It also alerts the electrician if limit values are exceeded. Thanks to the router connection, the data is available within the local network and can be analyzed in detail via PC, an HMI, or even mobile devices.

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