

APPLICATION NOTE

Power and Control Applications for Insulation Monitoring

Battery Energy Storage Systems (BESS)



Protect your battery energy storage system against ground faults with our insulation monitoring relays. As one of the few suppliers of insulation monitoring devices (IMDs), our reliable solutions can provide secure and continuous monitoring.

What is insulation monitoring?

Insulation monitoring, also known as insulation resistance monitoring or earth fault monitoring, detects insulation faults and prevents electrical hazards, such as short circuits and electric shocks. IMDs detect real-time insulation deterioration prior to a fault occurring.

Why do you need power and control solutions for your Battery Energy Storage System (BESS)?

Insulation monitoring devices play a crucial role in ensuring the safety and reliability of electrical installations. ABB's insulation monitoring relays help prevent damage and electrical accidents caused by insulation faults in a BESS.

Main benefits



Continuous operation

Prevent unintended downtime with our insulation relays. By monitoring voltage free networks and providing pre-warnings, ABB's insulation monitoring relays allow you to proactively maintain your system.



Safety and protection

ABB's insulation monitoring relays deliver safe and reliable insulation fault detection in accordance with the latest standards. The portfolio extends from standard to more challenging applications and can prevent fire due to fast and reliable earth fault detection. Built-in self-diagnosis and interrupted wire detection further ensure safety.



Easy to install

Our insulation monitoring relays are designed to be almost maintenance free and easy to install with clear marking of the terminals, direct reading rotary switches, and a wiring diagram printed on the device.

Battery energy storage systems

BESS overview

As focus on decarbonization, decentralization, and digitalization increases, the battery energy storage system (BESS) market is forecasted to become a megatrend in upcoming years. The implementation of BESS is becoming increasingly imperative for the provision of reliable, clean energy. These systems source and store energy for various applications

such as peak shaving, transmission and distribution congestion relief, and arbitrage. As the BESS market and its applications continue to expand, it is critical to take the proper safety measures to reduce hazards and prevent downtime. ABB's insulation monitoring relays can help protect your system by alerting to fault-vulnerability before it occurs.



Ground fault in BESS

What is ground fault?

Ground fault occurs when an energized conductor comes in contact with grounded equipment due to faulty wiring, damaged insulation, or the buildup of moisture or debris.

Grounded v. ungrounded BESS

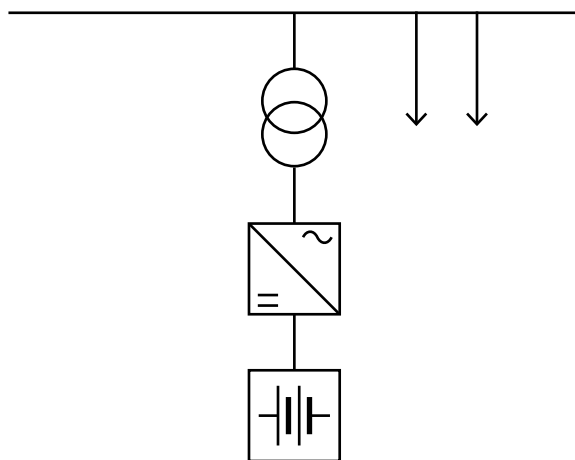
In a BESS, two grounding systems can be utilized: grounded and ungrounded. A grounded system directly connects a conductor to ground to serve as a return path for current generated by a ground fault. On the other hand, an ungrounded system, most

commonly used, isolates conductors from grounding. This allows the BESS to keep operating even during a first fault.

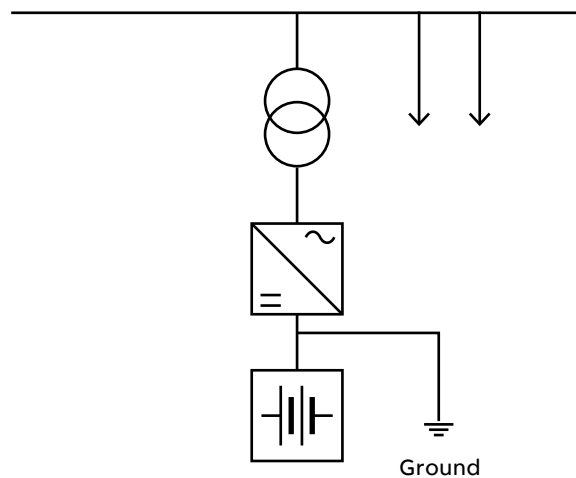
Preventing system damage

If your system experiences an initial fault, it is critical to clear the fault quickly as possible to avoid a short-circuit in the event of a second fault. Insulation monitoring devices are helpful in keeping you informed about insulation degradation before a first fault arises, helping you stay ahead of the problem.

Ungrounded



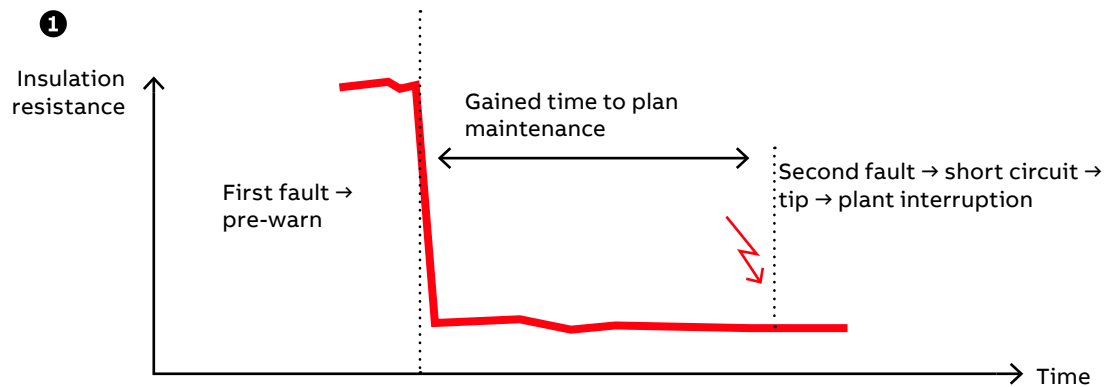
Grounded



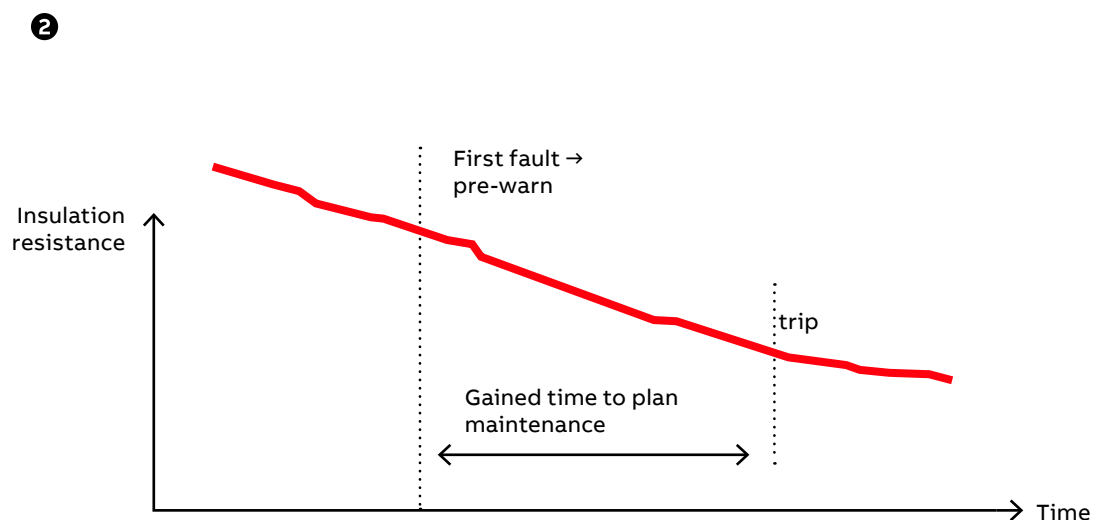
Insulation monitoring

An Insulation monitoring device provides pre-fault warnings, helping to prevent system disruption and safety hazards. It works by detecting deterioration of the insulation resistance and/or a first fault. This is done by generating test signals that measure the resistance to ground, establishing a resistance

threshold. When an insulation monitoring device detects values outside of the threshold, it generates a pre-warning alert. These alerts paired with constant monitoring allow you to oversee insulation quality and proactively maintain your system.



IMDs detect a first fault

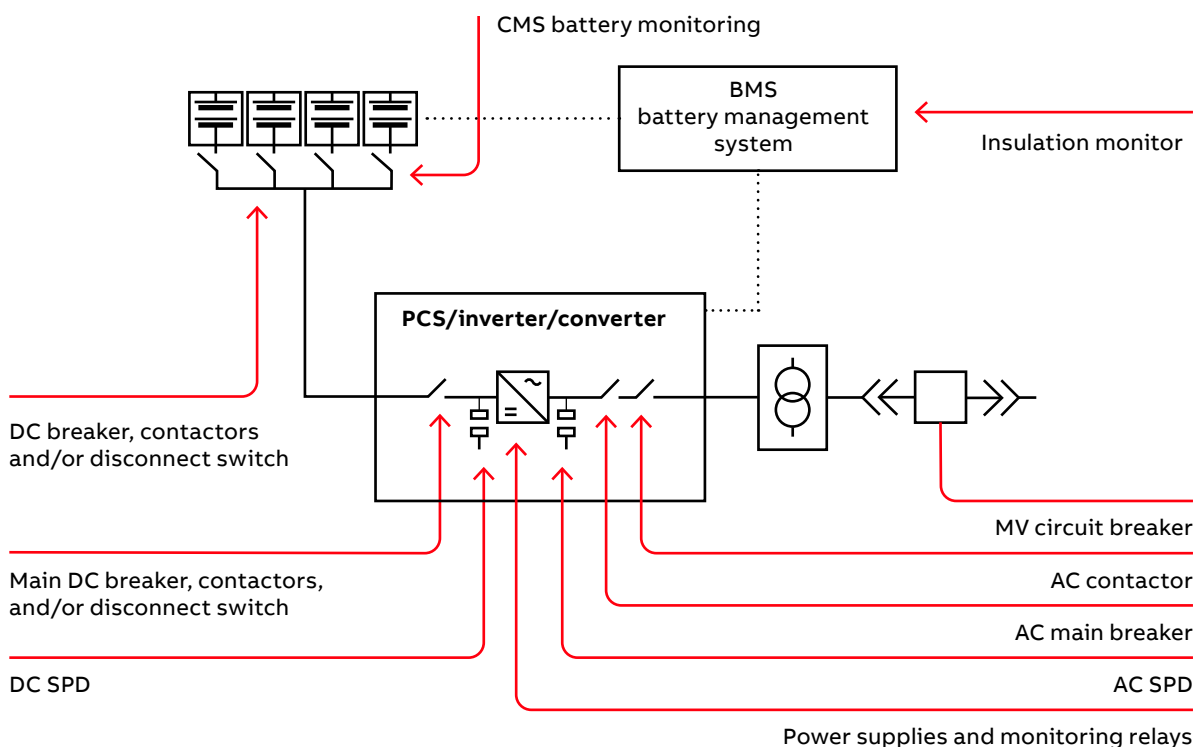


IMDs detect creeping deterioration of the insulation resistance

Insulation monitoring in BESS

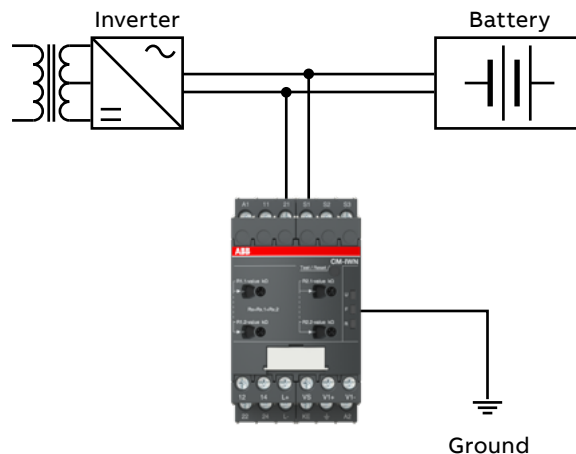
BESS experience high operational stresses due to factors such as constant charge cycling and fluctuating environmental conditions. As a result, leaks and insulation deterioration pose significant risk to not

only the BESS, but also the area surrounding the system. Earth leakage can reduce the efficiency of your BESS and cause severe equipment, personnel, and fire damage if not mitigated in time.



Insulation monitoring devices are the optimal fault protection solution for your ungrounded BESS as they measure the insulation resistance of each pole in respect to ground. When the impedance to ground of either pole drops to a lower setting, the IMD emits a pre-warning signal, allowing for maintenance to be done before a fault occurs.

Note:
Insulation monitoring devices work to detect insulation concerns before a fault occurs, while residual current devices trip at the occurrence of a primary fault. Both devices are critical for the safety and protection of your BESS.



Power and control for BESS

Advanced application insulation monitoring relays

CM-IWM

Features

- Up to 1,500 V DC or 1,100 V AC network voltage
- Up to 3,000 μF system leakage capacitance
- High adjustable range up to 250 $\text{k}\Omega$
- 1 SPDT contact each for pre-warning and warning
- LED status indication
- Auto self test

Benefits

- Designed for usage in networks with connected rectifiers, inverters, thyristor controllers, or directly connected DC components
- Clear visualization of device status via LED bar showing insulation resistance value in $\text{k}\Omega$
- 90 mm width
- Primarily for BESS coupled systems and industrial applications



General purpose insulation monitoring relays

CM-IWS and CM-IWN

Features

- Up to 0–400 V AC or 0–600 V DC
- Up to 20 μF system leakage capacitance
- 1 SPDT contact each for pre-warning and warning
- Coupling unit CM-IVN allows monitoring at 690 V AC or 1,000 V DC
- LED status indication
- Adjustment/DIP switches via front panel

Benefits

- Monitoring of voltage free networks
- Clear visualization of device status via LED
- Various push-in terminals
- 22.5 mm to 45 mm width
- Primarily used for main and battery supply networks



Product offering

Insulation monitoring relays

Additional Model

CM-IWS.1
CM-IWN.1
CM-IWM.11
CM-IWS.2
CM-IWM.10





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CONTACT US

Do you have a similar project and are you searching for the right Application configuration? Contact us and talk to our experts!



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