

Prevent unplanned  
system downtimes

Technical contribution: Insulation  
monitoring in drive technology

Electrical systems must be monitored. There are several reasons for this: This protects people and plants from damage, and monitoring also makes a significant contribution to availability. Modern insulation monitors can even monitor drive technology components when they are not in operation.

Electrical drive technology plays an important role in many applications in mechanical and plant engineering. If a drive fails once, this inevitably leads to a standstill of the machine or system. In the worst case, complete plants can no longer produce, which is usually associated with high costs.

### Monitoring electric drives

Drives are therefore monitored in many applications. By monitoring the speed, the function of the drive system as a whole can be verified. Temperature and vibration measurements can detect faults on the mechanical side of the drive, such as bearing damage. On the electrotechnical side of the drive, it is particularly important to detect insulation faults. In addition to the failure of the drive, these can also endanger persons by electric shock or damage - in the worst case even a fire of the motor is the result.

When monitoring drives for insulation faults, it depends on how the installation is carried out. Care must be taken whether the system is earthed or unearthed. In unearthed IT systems, there is no low impedance connection between the active conductors of the system and the ground potential. In this case, insulation monitors are used which measure the resistance between conductors and earth potential. With grounded TN or TT systems, on the other hand, common residual current monitors can be used, which measure the total current in the three phases and the neutral conductor. If this total current is not zero, an insulation fault must be present. In both cases - with earthed or unearthed systems - the monitoring device switches off the drive in a controlled manner if an insulation fault is detected. Subsequently, appropriate measures can be taken to eliminate the fault.

### What to do when the drives are switched off?

The monitoring of drives that are switched off, however, cannot easily be realized with all of the methods described above. In unearthed IT systems, the insulation monitors operate as described above. In electrical drive technology in industrial environments, such installations are still rather the exception and are only used where the power supply must not fail. Typical examples are hospitals but also areas in the process industry.



The insulation monitors from the Varimeter IMD series are suitable for monitoring switched-off drives in earthed networks.

However, the residual current monitors used in earthed systems only function when the electric motor is also in operation, since no currents flow when the drive is at a standstill. Depending on the application, however, switched-off electric motors should also be monitored in TN or TT systems. Typical applications in which this is particularly important include fire pumps, smoke extraction systems, pumping stations and various other systems that must be reliably commissioned in an emergency. It must be ensured that these drives actually function when required. A regular inspection of such drives is one possibility. However, this is associated with high costs and does not offer the safety that is possible with permanent monitoring. When electric motors are not in operation, environmental influences such as moisture or dust can attack the insulation in the supply lines or in the electric motor. When the drive is then switched on, the protective device responds and switches the electric motor off again. If a smoke extraction system or fire pump cannot be switched on in an emergency, this can have fatal consequences.



Electrically operated pumps in earthed networks, which are predominantly switched off, cannot be permanently monitored with residual current monitors.

### Insulation monitors for earthed systems

Dold offers special insulation monitors of the VARIMETER IMD series for monitoring switched-off loads, even in earthed systems. The insulation monitors MK 5880N and MH 5880 are connected to a drive in such a way that they only monitor the insulation resistance as long as the drive is disconnected from the mains. For this purpose, an insulation monitor is connected via the normally closed contact of the contactor or the circuit-breaker and only operates when the drive is disconnected. Otherwise the insulation monitor would trigger a false alarm during operation. With three-phase drives, it is sufficient to monitor only one phase, as the three phases are coupled with low impedance in the motor. In this way, insulation faults can also be detected on the unconnected phases.

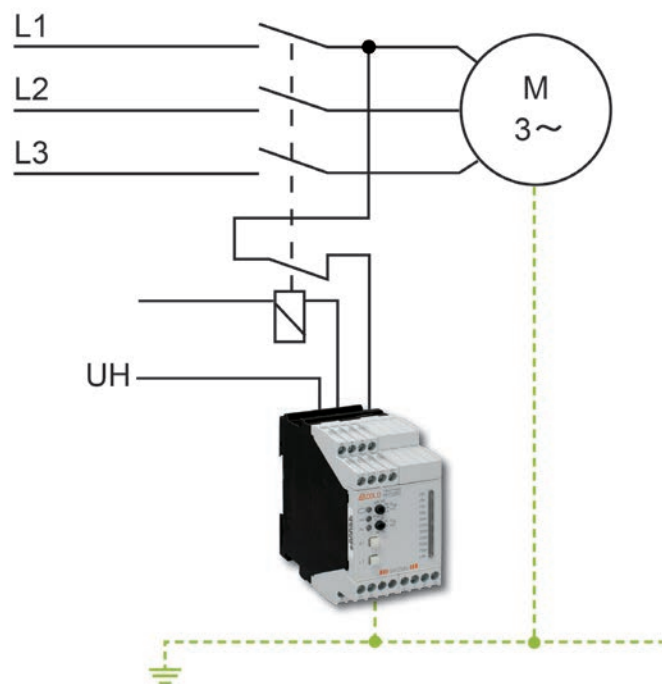
The two insulation monitors are suitable for three-phase and alternating current mains up to 500 V and for mains frequencies from 10 Hz to 1,000 Hz. The devices are designed for installation on DIN mounting rails and can therefore be quickly and easily installed in a terminal box or switch cabinet; the connections are available either as screw terminals or cage clamp terminals. Auxiliary voltage, measuring circuit and output contacts are galvanically isolated from each other. The alarm value for the earth fault can be set from 5  $\Omega$  to 100 k $\Omega$  for both devices. If the value falls below the set value, the output relay drops out and the alarm is triggered. At the same time, a red LED signals the insulation fault.

## Status-oriented maintenance before the fault occurs

The insulation monitor MK 5880N additionally has a pre-warning value that can be set from 10 k $\Omega$  to 5 M $\Omega$ . This allows a slowly occurring deterioration of the insulation resistance to be detected. A second output relay and an additional yellow LED are provided for this purpose. In this case, maintenance personnel can check the corresponding installation before a critical error occurs. With the MH 5880, the currently measured resistance is issued via an analog output from 0 V to 10 V. In addition, an 11-level LED bargraph display visualises the value directly on the device. Via the analog output, the insulation value can be evaluated by a higher-level system, such as a PLC. Here too an alarm can be issued and, if necessary, condition-based maintenance can be carried out.

## Monitoring ensures safety

The permanent monitoring of switched-off loads for insulation faults is highly recommended for safety reasons in numerous applications. A non-functioning drive on a gate valve, fire pump or smoke extraction system can have serious consequences. But availability should also be ensured for other drives, which are kept in reserve in industrial production facilities, for example. Otherwise, costly plant shutdowns can occur. With modern insulation monitors the monitoring of switched-off drives is possible without any problems.



The insulation monitor only measures when the contactor or circuit breaker trips the motor: