

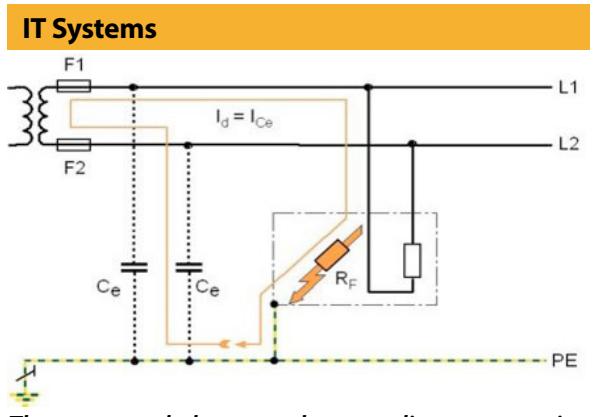
# Effective Control and Auxiliary Circuit Monitoring Can Reduce Downtime and Increase Profitability



**Early identification of earth faults in mission critical AC or DC control and auxiliary supplies can prevent equipment shutdown, increase production output and improve profitability.**

## Unearthed IT Power Systems

An unearthed IT system as per BS7671 section 3 and IEC60364-4, is tolerant to the first earth fault and will not cut power, unlike a TN system which would cause a power failure - therefore an IT system makes it more reliable and safer for mission critical systems, protecting both production and people.



*The ungrounded system has no direct connection between live conductors and earth. The system does not shut down when the first low R earth fault occurs, which means the power supply is maintained.*

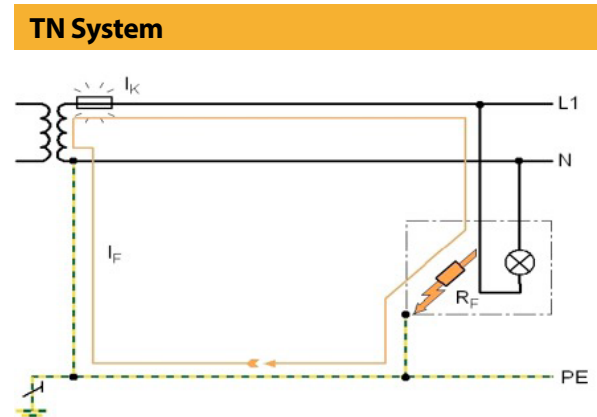
An IT system is used widely in critical applications like Group 2 Medical locations and AC/DC auxiliary circuit applications for more effective protection, control and tripping supply in substations/power stations.

IT systems are particularly appropriate for auxiliary circuits where high reliability is required - see BS7671 557.3.4.1 Note 2.

However, the full benefit of an IT system can only be realised by detecting development of the first earth fault and repairing it before it develops to a second earth fault on a different conductor. That requires an Insulation Monitoring Device (IMD) which performs best when paired with a fault location system (IFLS) which enables maintenance teams to easily find the faulty circuit.

## Insulation Monitoring Device (IMD) in Unearthed IT Systems

BS7671 clause 411.6.3.1 states *“Where an IT system is used for reasons of continuity of supply, an insulation monitoring device shall be provided...”*



*Neutral conductor N and ground conductor PE are connected via a bonding jumper. First low R earth fault results in disconnection of supply.*

# Effective Control and Auxiliary Circuit Monitoring Can Reduce Downtime and Increase Profitability



The governing standard of the Insulation monitoring device (IMD) is BS EN 61557-8 as per IEC 60364-4 and BS7671 557.3.4.3. and 538.1.1

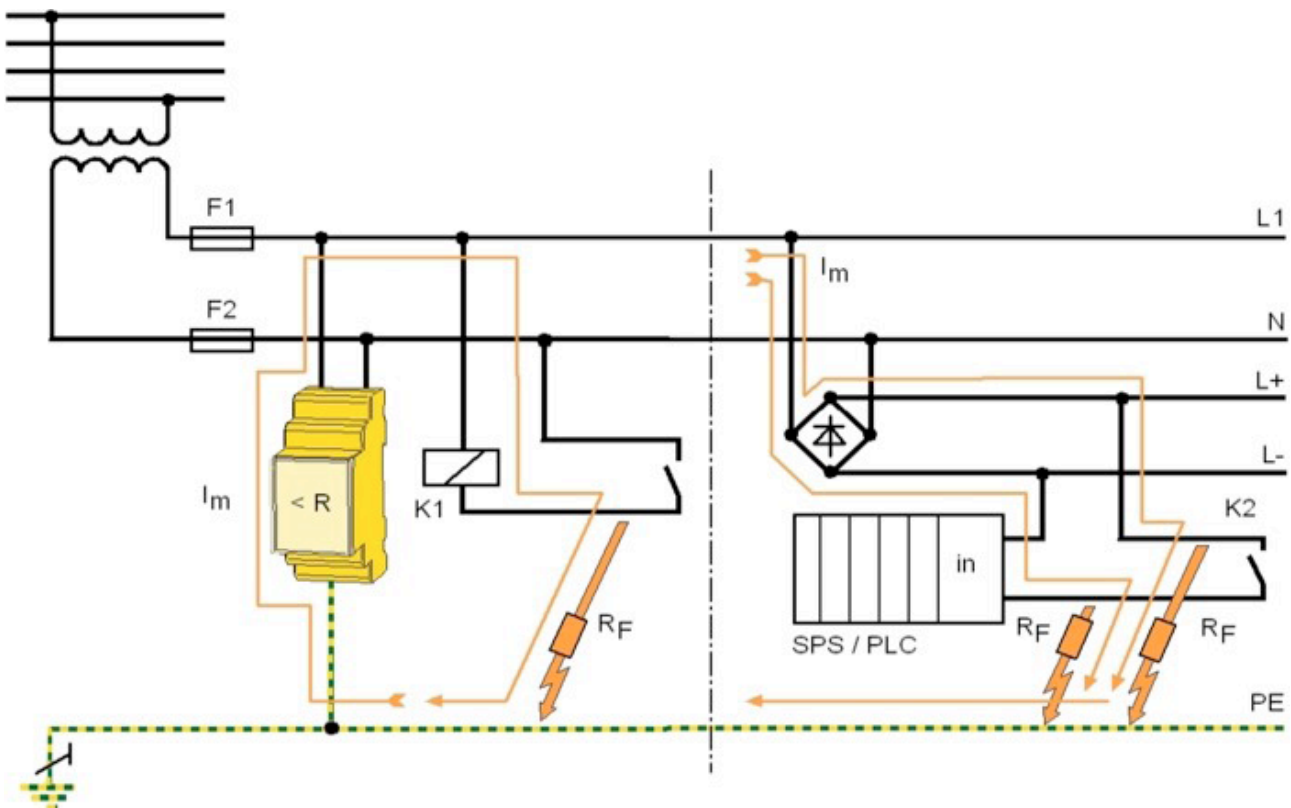
BS EN 61577-8 prohibits use of passive devices in an IT circuits which cannot detect symmetrical faults. A symmetrical fault is particularly dangerous to control circuit because it can lead to inadvertent switching or false tripping without detection. The diagram below shows a double high resistance symmetrical insulation fault on DC PLC circuit. The fault is not detectable by the passive device and can therefore cause switch to be seen as closed.

BS7671 clause 557.3.201 states: *“A control circuit shall be designed, arranged and protected to limit dangers resulting from a fault between the control circuit and other conductive parts liable to cause malfunction (e.g. inadvertent operation) of the controlled equipment.”*

All IMDs must be labelled to highlight system of use i.e AC, DC or AC/DC.



Insulation monitoring technology combined with earth fault location systems developed by Bender are employed in a wide range of critical control circuit applications within industry sectors that simply cannot afford unscheduled shutdowns or interruptions in production and process operations.



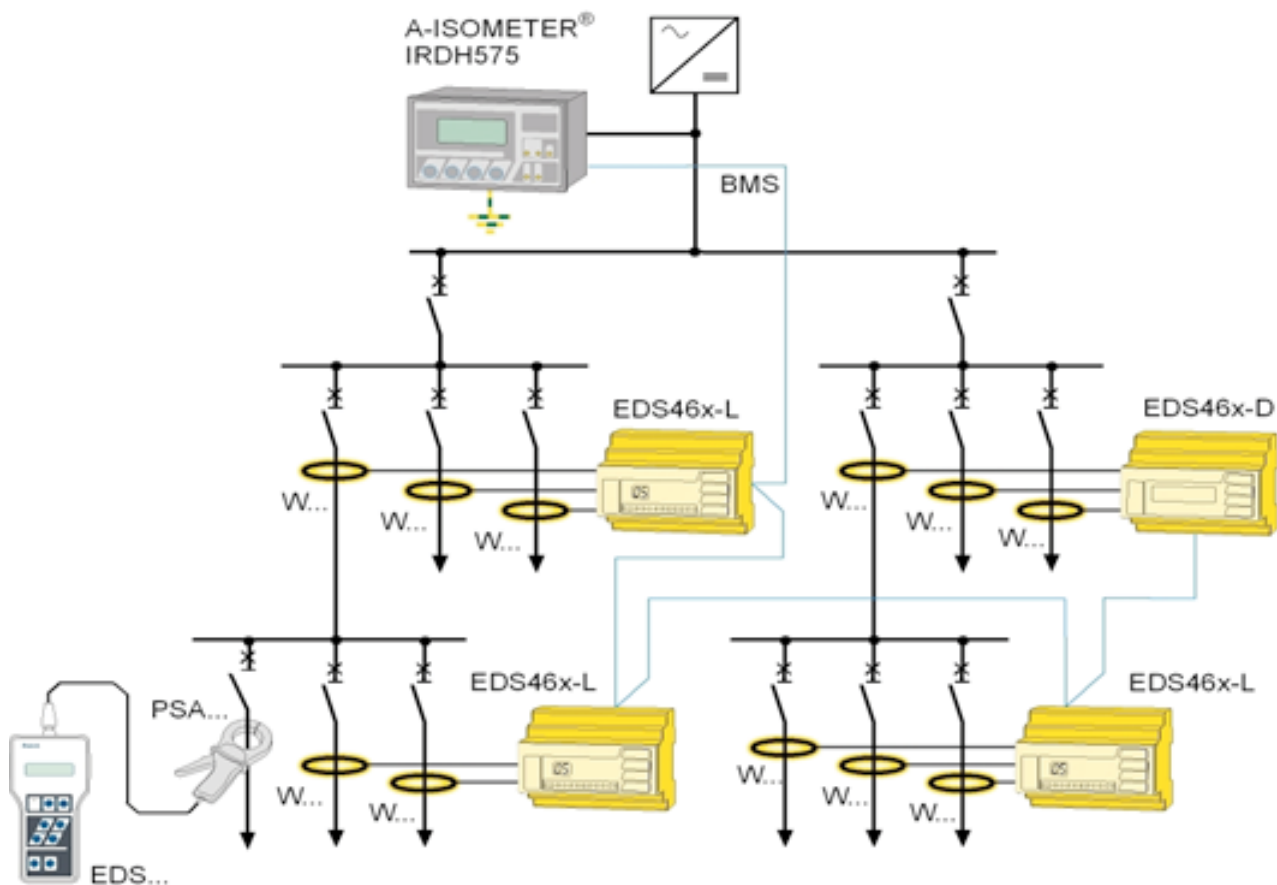
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The diagram below shows a typical structure of a Control System incorporating IMD with fixed and portable earth fault location to precisely identify faults from distribution to control circuit level.

Bender technology can be permanently retrofitted and also has been extensively used to locate long standing earth faults via portable terminals.

## Typical Structure of Insulation Monitoring Devices in a Control System



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An alternative way of monitoring for earth faults is by using a passive measurement principle, although this method does not comply with the IEC61557-8 regulations for insulation monitoring devices.

Battery management system such as a BA 300 provides the following monitoring functions compared with IMD:

- ▶ Over and under voltage conditions
- ▶ High impedance alarm
- ▶ Earth fault alarm
- ▶ Battery ability to provide load current
- ▶ Battery in service monitoring

Earth fault alarm is an optional function on BA300 and shouldn't be included with an external earth fault monitoring system. Comparison of earth fault detection features on an IT system is shown below.

## Knowledge is power

The benefits of using insulation monitoring technology to enable early identification of earth faults in mission critical AC or DC control and auxiliary supplies cannot be underestimated. Continuous monitoring equips maintenance teams and plant operators with the vital information to deliver effective predictive and preventive maintenance that avoids shutdowns, reduces downtime, increases productivity and improves profitability.

Feature	BA 300	Bender IMD
Comply with EN 61557-8	No	Yes
Detection of symmetrical faults	No (Passive, voltage imbalance principle)	Yes
Insulation faults in AC/DC mixed circuit I,e involving battery charger, UPS	No	Yes (full)
Measured resistance value	5K-90K Ohms	1K – 20M Ohms
Self-test and checks for IR	No	Yes
Fault location system as per IEC 61557-9	No	Yes (optional)
Availability of measured value	No	Yes
E/F detection in de-energised circuit	No	Yes