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Permanent Insulation Monitors

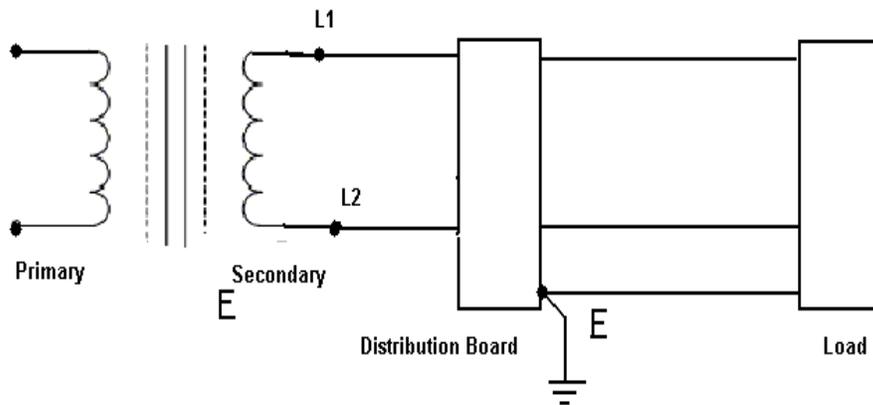
Abstract

This document explains how an IT wiring network is protected using Permanent Insulation Monitors (PIM), also known as Insulation Monitoring Devices (IMD) or Earth Leakage Monitors. It also explains the various applications and how this relates to a UPS.

Technical Description

Electric shock cannot occur without the circuit being completed. An example of this would be birds on non-insulated power cables. In such cases there is no return path so there is no danger with physical contact.

Looking closer at the IT network, we see that this system is different to the other systems as no part of the secondary side of the transformer is connected to Earth so that there is a floating earth in such systems. As there is no return path this system is very safe if installed properly. It is used in hospitals, mines and other special areas. For a basic understanding of this system see schematic below:



Operation:

However, it would not be practical or safe to use such an IT Network as standard, as there is always a possibility that some part of the secondary IT Network could touch earth (First Fault) and this would mean that there is a danger in the event of the second fault. For this reason, Insulation Monitoring Devices or Permanent Insulation Monitors (PIM) must be used.

In older devices, DC was used to monitor the impedance, but they could be used exclusively for AC applications. In contrast, Modern Insulation Monitoring Devices operate by having a pulsed measuring voltage superimposed on the secondary side of the Transformer which enables them to be used for both DC and AC.

Permanent Insulation Monitors (PIMs) can be configured for different applications, the impedance value can be set, and they can be set to give an alarm or to disconnect according to the individual requirements.

Normally an IT is used where a high up time is required so earth leakage monitors are used for protection. The principal is simple, see below fig.1 & 2.

Fig. 1 - First Fault:

Secondary side of transformer is not earthed so there is no loop for fault current. Very low fault current and no dangerous fault voltage to metal parts.

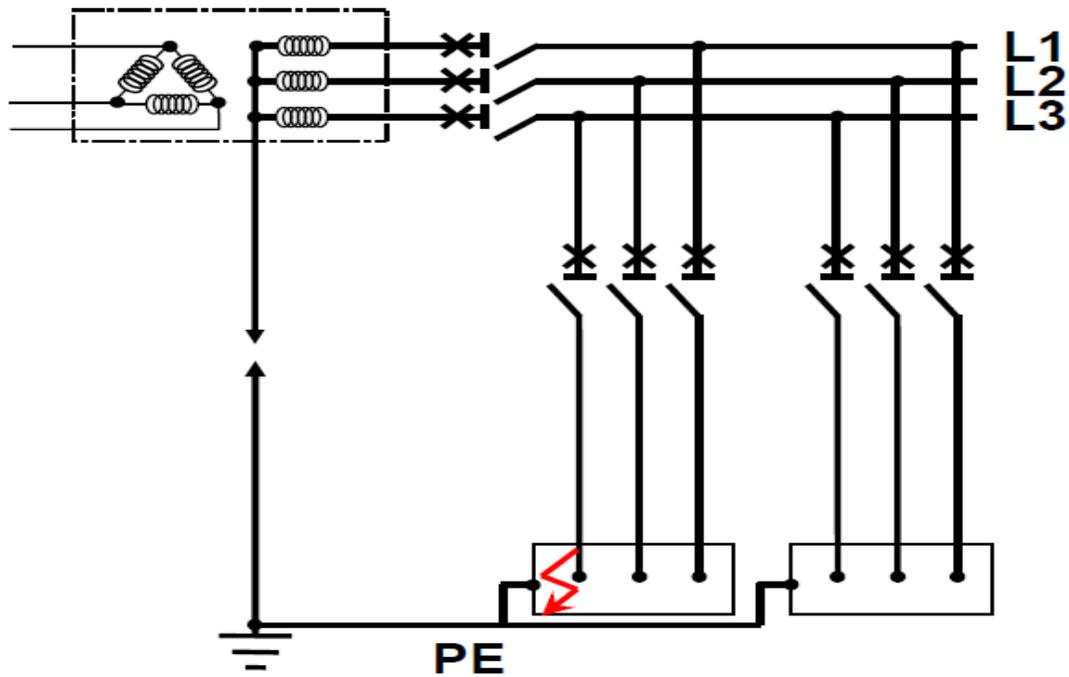


Fig. 1

No protection trips, so there is continuity of operation.

Fig. 2 – Second Fault:

Second fault on same live conductor. Again, very low fault current and no dangerous fault voltage to metal parts. Still no loop for fault current.

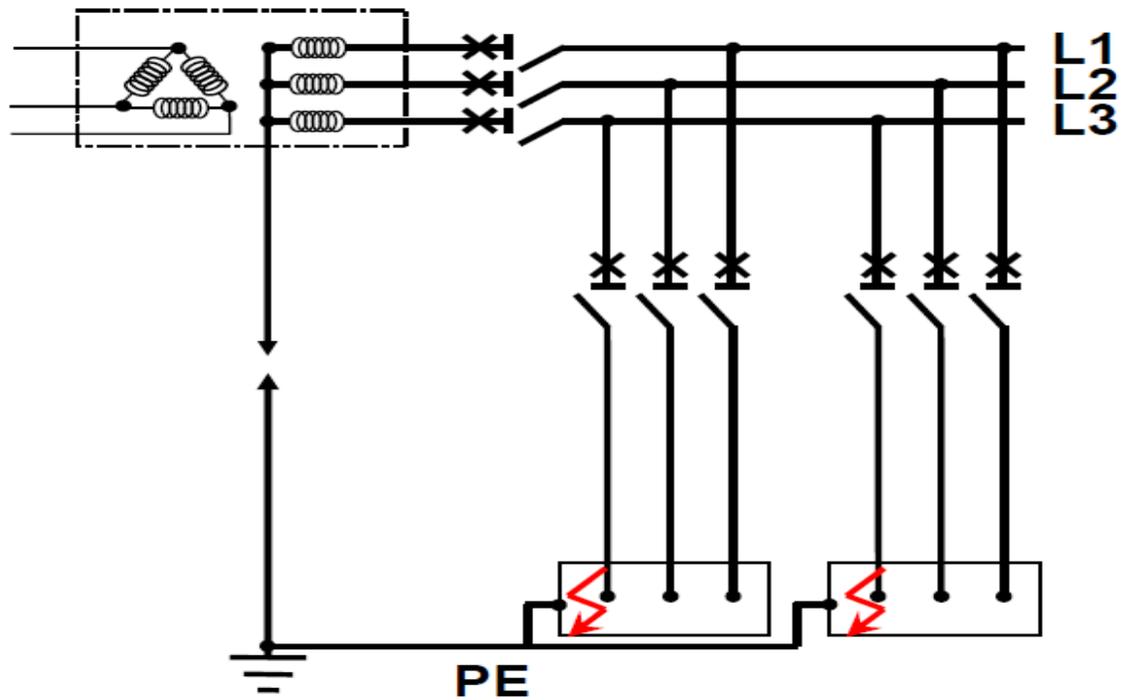


Fig.2

No protection trips, so there is continuity of operation.

Fig.3
Second fault on Different Live Conductor

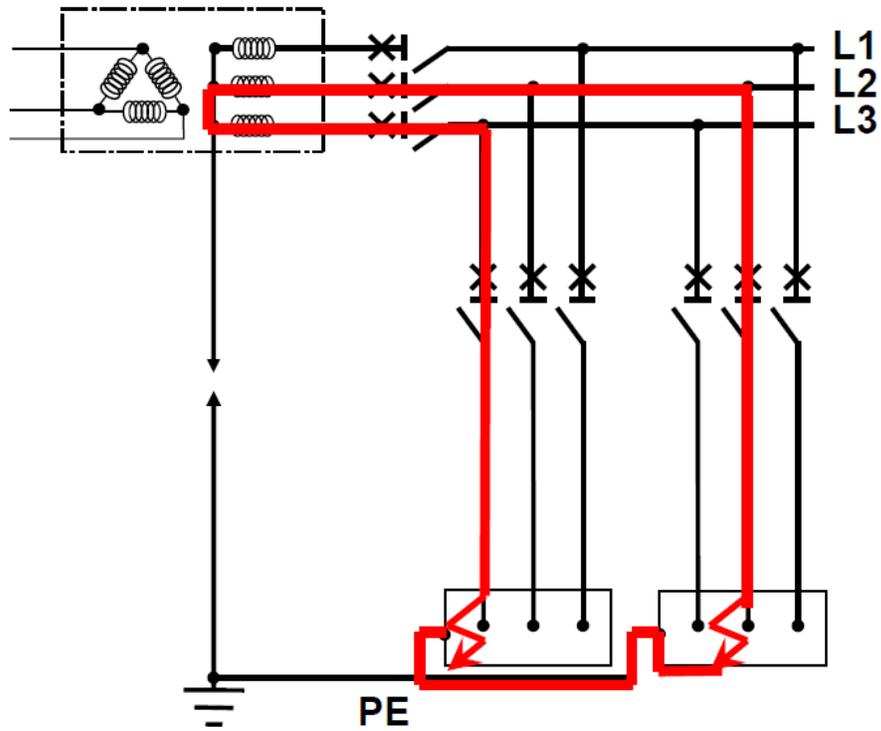
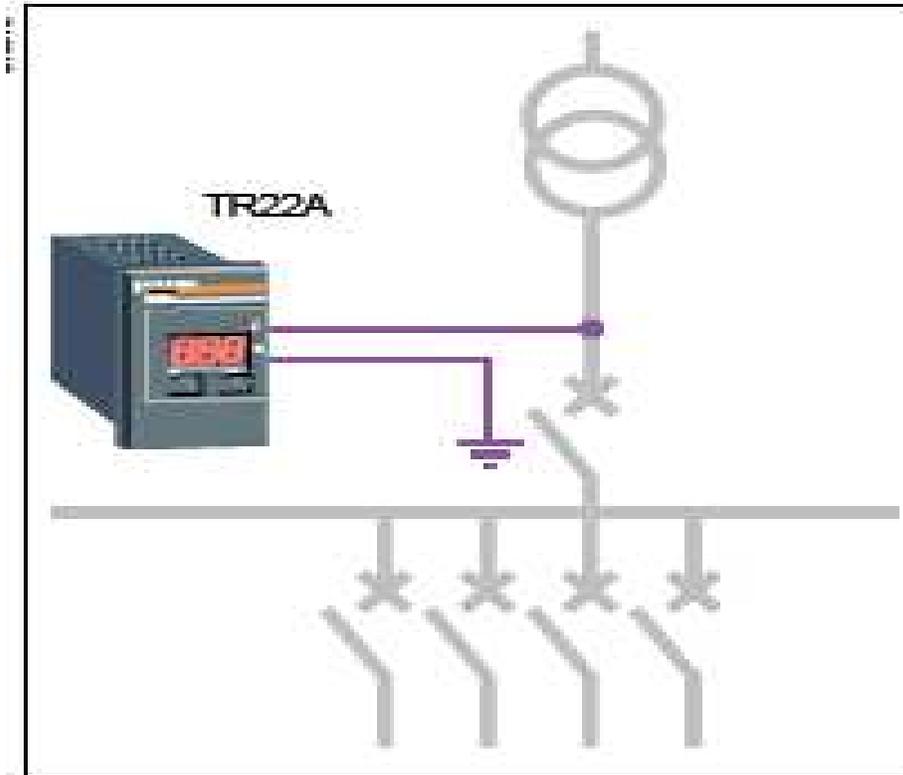


Fig. 3

This time there is a short circuit. Now there is very high fault current. Overcurrent protection device trips.



The above shows the principle of operation of an Insulation Monitoring Device (TR22A by Schneider Electric)

These devices inject a low-frequency AC voltage between the installation and earth. The insulation resistance is determined by measuring the resulting leakage current.

Schneider Electric products such as the Vigilohm devices also give a signal to indicate the presence of an insulation fault within the installation. This signal can activate a buzzer or an indicator light to give a warning that there is a low insulation alarm. Modular Devices are designed for small installations or sub-systems isolated from earth. Other products such as the IM400 are used in for hospitals. These devices detect insulation faults, and, in addition, they continuously indicate the value of the insulation resistance on a digital display. They can also be connected via Modbus to a building Management system.

How does this apply to a UPS?

The question commonly asked about this system is if a UPS can be used on an IT Network. There should no problem in connecting a UPS to an IT Network.

However, some customers want to monitor the UPS output while on battery. For units with double pole back feed protection on the output, the PIM would protect against the first fault BUT only when on battery. As soon as it would go back online, the impedance drops, and this would cause a low insulation alarm.

When using a transformer to create an IT Network, please ensure that the secondary side of the transformer is not connected to earth, as is the case in the SURT003.