HV POWER

POWER AUTOMATION TECHNOLOGIES

RE+DS

Resonant Earthing & Earth-fault Detection Systems

- Resonant earthed networks offer improved SAIDI and CAIDI
- Applicable to 11kV and 33kV and higher voltage networks
- Highly cost effective
- Suitable for overhead and cable, rural or urban networks
- Advanced fault finding and location technology

In New Zealand and Australia there is increasing demand to reduce the number of supply interruptions experienced by consumers. For Network owners there is also a statutory requirement to meet minimum SAIDI and CAIDI standards. One way of substantially improving these is to be able to continue operating the network safely in the presence of earth faults. Since April 2010 alternative earthing technologies have been permitted under the New Zealand Electricity Regulations.

In New Zealand and Australian distribution networks, which are based on the “British” model of solid earthing, even transient earth faults result in at least a momentary interruption to consumers. However in Europe there is a technology which has been widely used for many years which allows the network to continue to safely operate in the presence of an earth fault.

This technology “Resonant Earthing” or “Compensated Networks” is now finding increasing favour in other parts of the world.

The experiences of Italy, France, Germany and Austria where thousands of networks have been converted to Resonant Earthing show a reduction in supply interruptions in the order of 50%. Distribution Utilities in the UK have recently started the conversion to Resonant Earthing to gain the advantages that these systems offer.

HV Power’s RE+DS system offers a cost effective approach to Compensated Networks combining Petersen coil and Controller with advanced Earth-fault Detection solutions.

In New Zealand and Australia distribution systems have historically been solidly earthed to limit transient overvoltages and to assist in the detection and clearance of earth faults. To work effectively, and especially to operate safely, requires a very low impedance earth connection which in many areas is difficult and expensive to achieve.

If high impedance is used for earthing the neutral point of the network, or if the neutral is unearthed, the earth-fault current will be substantially reduced.

A special type of high impedance earthing is the Resonant Earth System where the inductive earthing reactance is made equal to the total system capacitive reactance to earth. This is made possible by the use of a tuned reactance or Petersen coil. In this system the Petersen coil provides compensation for earth-fault current flowing in the network.

In the presence of an earth fault, with a correctly tuned system, this method results in a steady state earth-fault current approaching zero so that ***arcing faults become self-extinguishing***. This system also allows the feeder to be operated with a permanent earth fault on one phase until such time as the fault can be identified and repaired, thereby resulting in no interruption to consumers.

Resonant Earthing systems are especially beneficial in rural overhead networks where frequent transient earth faults are caused by lightning strikes, bird strikes, vegetation clashes, or animal contact. It is these faults which result in frequent interruptions to consumers and an increase in utility SAIDI and CAIDI indices.

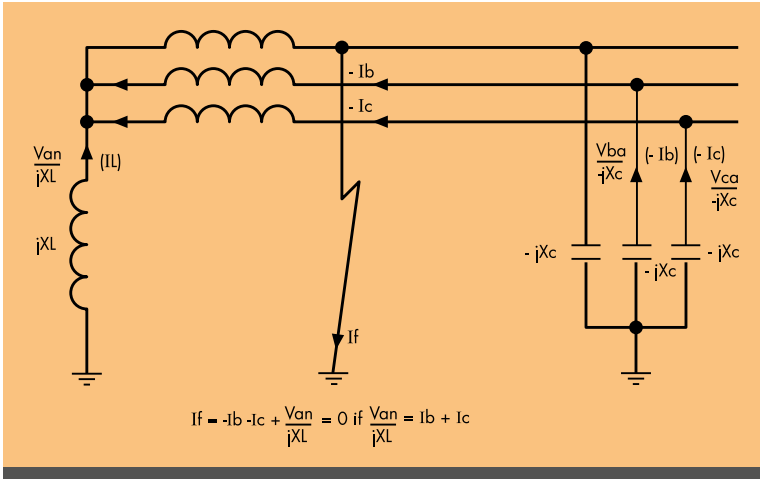


Fig. 1: Current distribution in Petersen Coil earthed system

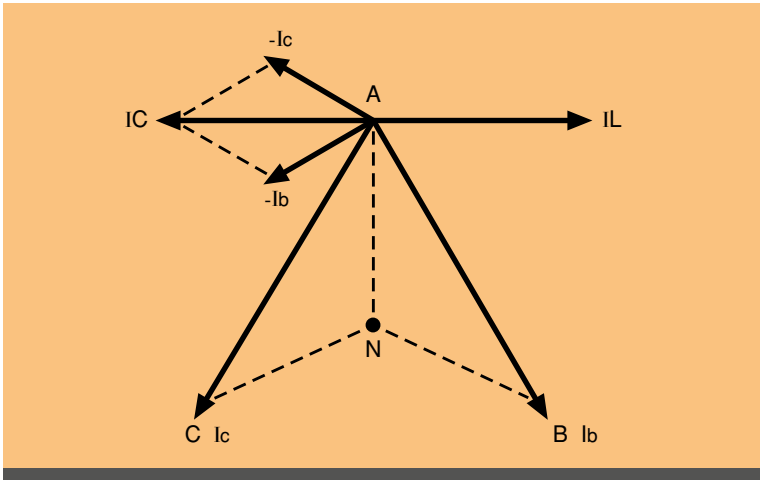


Fig. 1a: Current vectors for A phase fault

Fig. 1 shows a system earthed via a Petersen coil with an earth fault on A phase. This results in the A phase capacitance being short circuited and shows with the Petersen coil tuned correctly that the earth-fault current will be zero. The current vectors in this case are shown on Fig. 1a.

Resonant Earthing & Earth-fault Detection Systems

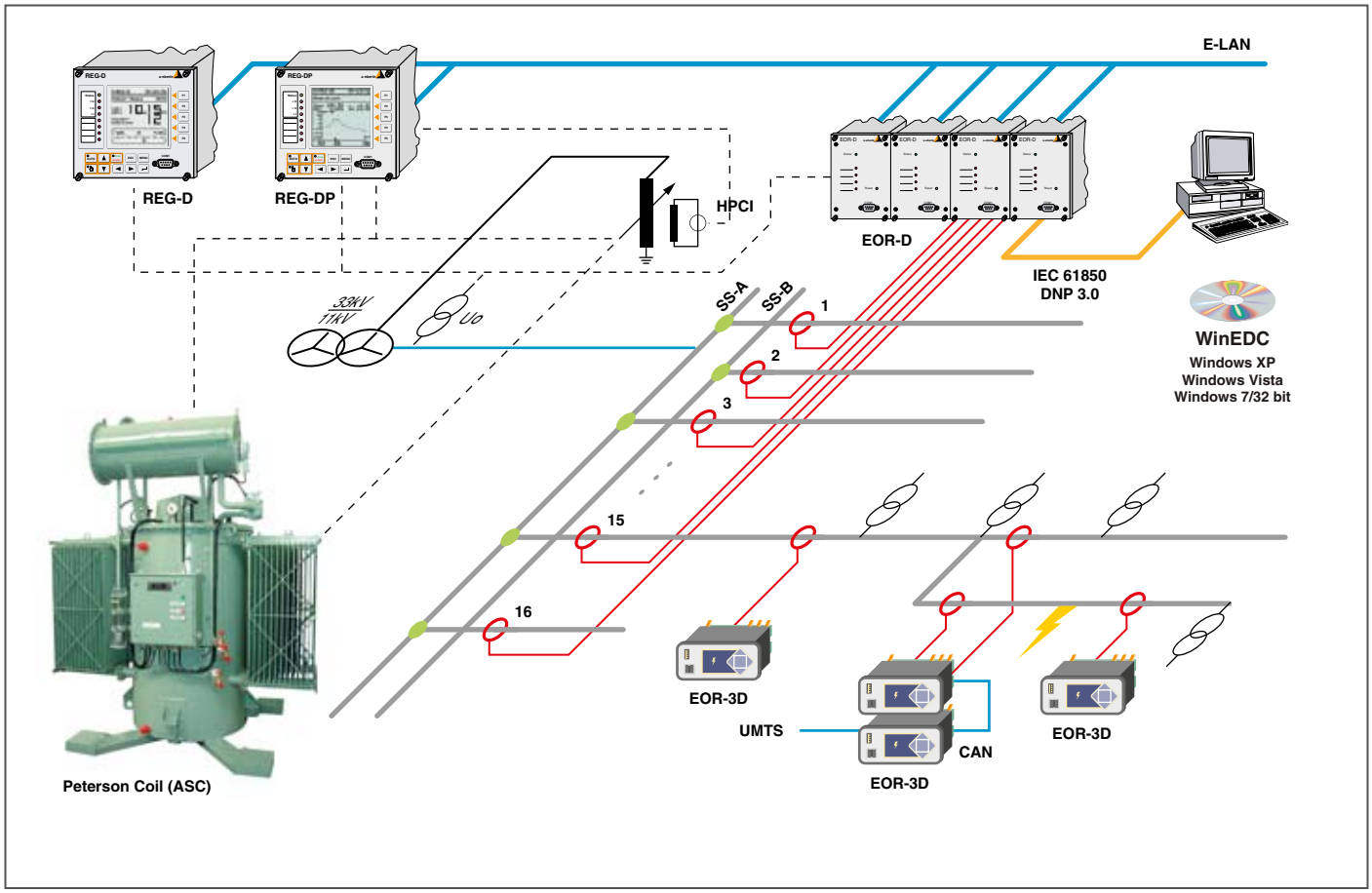


Fig. 2: Combined earth-fault detection and short circuit indicator with high power current injection

Earth fault Detection

Fig. 2 shows a typical system topology for an 11kV Resonant Earth system with the Petersen coil connected between the neutral point of the supply transformer and earth. The Petersen coil is controlled by the REG-DP controller which tunes the coil to match the system capacitive reactance. Each feeder circuit is monitored by an EOR-D relay which detects earth faults on the system and provides feedback via the REG-DP through SCADA interface to the network control centre. This means that the determination of which feeder has the fault present is made without staff having to go to the substation and use manual methods to identify the faulted feeder.

Field Fault Indication

Fig. 2 shows EOR-3D fault detection indicators installed at various points on the feeder network. These devices enable line crews to quickly identify the region of the fault both for earth faults as well as phase to phase faults. If the EOR-3D is connected to the network SCADA by remote communication, control room staff can immediately identify the area of the faulted feeder and despatch crews to that location, resulting in greater efficiency in line crew utilisation.

Systems Planning

HV Power can take responsibility for all aspects of Design, Engineering, Installation and Commissioning of Resonant Earthing systems for your network. We can work with your own installation contractors and provide training for them during this phase. Integration of the system with your existing control system can also be a key feature of the solution we deliver.

On-going technical training and support is always available either on your premises or at our offices.

The Company

Founded in 1994, HV Power is a privately held technology company. HV Power has always been at the forefront of substation automation, from protection systems, transformer control, time synchronisation, power quality and metering and now; the complete design, engineering, installation and commissioning of Resonant Earthing systems.

HV Power has built a solid reputation for providing comprehensive technical and hands-on support to our customers amongst the New Zealand and Australian power utility companies and their engineering consultants and contractors.

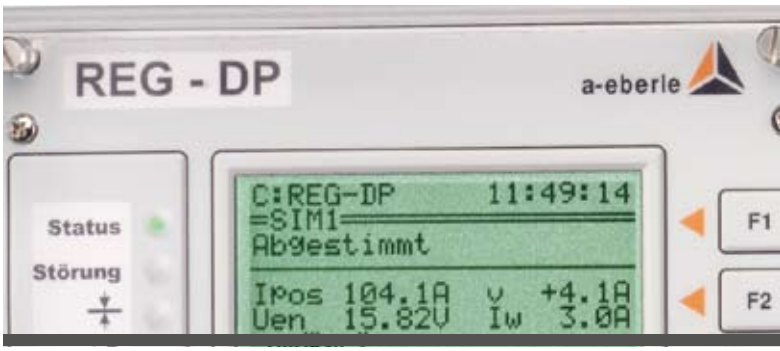
The HV Power team has many years of industry experience and knowledge in the application of the various technologies we supply. As an example of a practical hands-on success, since early 2005 we have been closely involved with the first implementations in Australasia of substation automation based on IEC 61850 protocol.

Our Technology Partners

a-eberle

A-Eberle, headquartered in Nurnburg, Germany are the market leader with New Zealand utilities for transformer tap changer controls. Utilities implement REG-D and REG-DA as integrated one box solutions for automatic voltage regulation and transformer temperature control and condition monitoring. The REG-DP and REG-DPA Petersen coil controllers utilise the same hardware platform and WinREG programming software that utilities are already very familiar with. Alternatively the new user friendly WinEDC can program both the REG DP/DPA as well as the EOR fault indicators and CIF current injection unit.

A-Eberle also have a range of power quality analysers for portable field use or permanent monitoring.



EGE

EGE, headquartered in Ceske Budejovice in the Czech Republic is a company specialising in the manufacture of equipment for the power engineering industry. EGE has over 60 years experience in the manufacture of Petersen coils and are a market leader in Europe. Typically every day in Europe a new EGE Petersen coil is installed. In addition they have extensive experience in the manufacture of earthing resistors and earthing transformers.

All their production facilities are ISO 9001 and ISO 14001 accredited. Customers of EGE include ABB, AREVA, ENEL, E-ON, Siemens and Voith.

HV POWER

POWER AUTOMATION TECHNOLOGIES

HV Power Measurements and Protection Ltd
Unit 4, 1 Porters Avenue, Eden Terrace
PO Box 26-074, Epsom, Auckland 1344, New Zealand
Tel **64-9-377 2001** Fax 64-9-302 2142

Wellington Office
8 Rongotai Road, Kilbirnie, Wellington, New Zealand
Tel: **64-4-387 7339** Fax 64-4-387 7319

Australia
Tel: **1-800 172 120**