GRIDSENSE™

Steady-State Voltage Problems

Steady-state voltage problems involve over and/or under voltage situations in which the voltage is typically more than 10% above or below the nominal voltage for durations longer than approximately 1 minute. International standards require logging equipment to be set at 10 minute averages when logging for steady-state voltage problems. However, it may be more appropriate to record at much shorter averages when trying to determine the cause of such problems.

The PowerMonic 45 can log at averages down to 5 seconds and is equipped with memory allocated for steady state logging (or profiling as it is sometimes called) independent of logged events. Thus, the number of logged events, even if excessive, will not impact steady-state logging.

A PowerMonic 45 is installed at a residence to diagnose a problem.

Causes of Steady-State Voltage Problems

Overloading - Overloading of distribution cables and transformers, or of cabling within the installation often results in long duration under-voltage problems. Overvoltage problems can when a single phase is overloaded on a three phase system. This can offset the neutral point in a three phase star system and cause one of the phases to go above and the other phases to go below the standard.

Inappropriate Design - Networks are sometimes installed with inappropriate sized conductors, which may result in overloads.

Load Switching - Switching large loads on or off can cause significant variations in the voltage. Network automatic tap changers (voltage adjusting equipment) can take some minutes to respond to such situations, allowing lengthy voltage variations. Under-voltage can occur when a large load is switched on; over-voltage when the large load is switched off.

Faulty Regulating Equipment - Distribution companies often have automatic regulator equipment on their high and medium voltage networks; some are even installing it on their low voltage distribution networks to correct localized problems. Regulator equipment failure is likely to cause over and/or under voltage depending on several factors, including the amount of load on the feeder/circuit.

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Network Reconfiguration - Distribution companies sometimes need to reconfigure their networks, which results in less than ideal supply voltage. This may be until regulating equipment responds or for much longer durations until the network is returned to normal.

Effects of Sustained Over-Voltage

- Reduced light bulb lifespan
- Reduced electronic equipment lifespan
- Equipment destruction from high voltages
- Increased motor losses
- Overvoltage protection operation

Effects of Sustained Under-Voltage

- Less efficient stoves
- Dull incandescent lighting
- Dropping out of discharge lighting
- Contactor chatter and heating
- Increased motor losses

Required Standard (Australia)

The required level of voltage to be supplied by a distributor in Australia is either set by the National Electricity Rules, AS60038 and/or state based legislation. At low voltage, the distributor should supply a nominal voltage of 230 volts, plus 10% and minus 6% at the point of supply.

A voltage transformer will be required to measure voltages at high voltage and a GridSense PowerMonic substation converter kit to connect to substation CTs (Application Note – Monitoring Zone Substations).

A power company received customer complaints that correlated with a zone substation supplying a large level of commercial load. The zone substation was supplied from a long transmission network that also supplied numerous other zone substations.

A PowerMonic 45 power quality analyzer was installed at the zone substation on the output from the substation power transformer. Fig. 2 shows that the voltage output from the zone substation was drooping at peak load times. Following an analysis of the graph, engineers suspected that the transformer tap changer was running out of boost taps. They analyzed tap position information from the data acquisition system at the zone substation and verified their suspicions.

As a short-term method to boost supply voltage at peak times, the transmission company included line drop compensation settings on their supply. This solved the problem and a long-term fix was scheduled for the following year.