Introduction: A low-cost addition to the PFLive Plus permits monitoring of the total leakage current of Lightning Arresters. A discussion of this integrated application outlines this concept.

The PFLive Plus is a continuous on-line monitoring system, for monitoring power factor in high voltage capacitive bushings and HVCT. The system acquires, analyzes, and trends data pertaining to AC Insulation Power Factor of Bushings and/or HV Current Transformers.

The PFLive Plus is capable of handling up to 16 or 32 sensors. Normally, a 16 Channel the PFLive Plus is used to monitor 6 bushings and 3 HVCT, leaving up to 6 or more channels available for other devices. It can also integrate other devices which have an analog output such as a 0-10Vdc, 10Vrms, 4-20mA, or 0-1mA signal.

Lightning Arrester monitoring is achieved by connecting a Current Transformer across the Ground Strap of the Lightning Arrester to measure the total leakage current. This total leakage current is made up of 2 main components:

1. Surface Leakage Current caused by pollutants being deposited on the ceramic surface.
2. Resistive Leakage Current traveling through the metal oxide blocks of the arrester, or other similar types of material used.

Increased levels of leakage current can be due to changes in either of the above two cases, and it would require corrective action. If a wash down of the surface pollutants of the ceramic does not decrease the leakage current, it becomes obvious that the metal oxide blocks are changing their characteristics. Further off-line tests on the Lightning Arrester will confirm that they are not fully protecting the transformer, and that they should be replaced.

PFLive Plus

The network ready PFLive Plus System is a powerful low-cost continuous on-line monitoring tool that provides 24/7 monitoring for critical substation apparatus, minimizing maintenance cost and preventing catastrophic failures. Other features include:

- Provides Test Data without an outage and at rated voltage.
- Monitors, stores, trends and analyzes continuously at user selectable time intervals from every minute to once a day.
- Analytical software to better diagnose insulation condition.
- Provides analog and digital alarm outputs.
- Permits interface to SCADA.
- Has Network capabilities to extend to remote monitoring.
- Expandable from a minimum of 3 up to a maximum of 32 sensors.
- Permits interfacing other IEDs, including Lightning Arrester leakage current.
- Does not require a dedicated PC for performing analysis.

The PFLive Plus, when to the customer’s LAN/WAN with an assigned IP address, permits continuous communication from any web-enabled PC, providing Alarms and Warning email messages.
Application Note
Leakage Current Monitoring of Lightning Arresters

Hardware: The Leakage Current monitoring option for the Lightning Arresters consists of a minimum of three sensors, one for each phase. Each of these sensors have a bandwidth 50 Hz to 10 kHz. Measuring capability is from 0.5 mA to 300 mA with accuracy in the µA range. The amplitude error is less than 1% and the phase shift is less than 1 degree. The sensor is well protected to survive lightning and switching surges.

It is required that the Lightning Arrester be insulated at the base and has a single ground point.

The output from the CT is cabled to the PF Live Plus, where it is input to the Analog Input Board. The PF Live Plus:
- Acquires the data at a user settable interval
- Stores the data
- Performs a multi-step statistical Analysis, and
- Provides a “Condition Value” based on the Statistical Analysis.
- Provides an absolute value of the Leakage Current.

Both the Condition and Absolute values are now stored and available to be viewed graphically as a time-tagged trending graph. The Condition value is utilized in providing Alarms and Warnings.

Software: The Plus software is a field proven and versatile software that will accommodate the inputs from various IEDs. In the case of the leakage current from Lightning Arresters, the data is obtained at a user settable interval, analyzed and stored. Changes in the value of the leakage current will start filling the green bar from the bottom with yellow. A full yellow bar will start changing with Red from the bottom, as the leakage current further increases.

A full yellow bar indicates a 70% change from the baseline leakage current value, and a full Red bar indicates a 100% change from the baseline value. On reaching either stage, the Plus system will provide an “Alarm”, or a “Warning”, indicating a potentially sensitive situation which requires immediate attention.

An increased level of leakage current can be due to:
1. Surface Leakage Current caused by pollutants and this is rectified by a wash down. Or,
2. Resistive Leakage Current traveling through the metal oxide blocks due to the changes in the characteristics of the arrester material, requiring replacement of the Arresters..

Several Industry studies indicate that the resistive leakage current of 35 mA is a level at which the Lightning Arrester no longer provides adequate protection to the transformer. At these levels, the Lightning Arresters must be replaced to avoid a catastrophic failure.