

PowerPAC™

Technology Package for Acoustic Emission Testing Instrument and Procedure for Detecting, Locating and Assessing Electrical and Thermal Faults in Power Transformers during On-Line Monitoring

This Technology Package is being introduced for Acoustic Emission (AE) testing of Power Transformers. This package was developed under an ongoing EPRI sponsored Tailored Collaboration (Project I.D. No. 051481) and is designed to provide on-line monitoring of Power Transformers for detecting, locating and assessing electrical and thermal faults .

This monitoring follows a procedure that was introduced in the Tailored Collaboration and refined throughout two Phases of program development. Transformers are instrumented with AE sensors covering both the tank and the LTC compartment (if one is present). In addition, other sensors (used to monitor pump current, fan current, load current, tank wall temperature and LTC compartment wall temperature) are used to collect data for comparison with the AE data during post test data analysis.

Data is collected over a period of 24 hours in order to observe the effects of a complete load cycle. Results are presented showing the location (in three dimensions) and types of faults. A grading system is used to grade each fault and to provide an overall grading of the transformer to be used for maintenance or operations planning.

The system is based on the Physical Acoustics Corporation (PAC) model DiSP, digital AE instrument. It operates using application specific software designed for data acquisition during field testing and has several utilities for post test analysis. Some of the key features of this software is its ability to perform three dimensional source location and to grade each fault using a four-grade system (A – D).



The details of the different items offered in this technology package are described as follows:

- DiSP-24 Hardened, Portable Computer
- PCI/DSP-4 Data Acquisition Boards w/ up to 4 parametric inputs
- R15I-AST sensors with integral 40dB preamp
- Parametric breakout box and parametric sensors
- PowerPAC™ Data Acquisition and Analysis Software w/ AEwin 2D & 3D Location Software Modules
- AEwin Post Processing Analysis Software
- Database Skeleton Software
- Automated software in Post-processing software
- 3-Days Classroom Training (theory) and Start-up Assistance
- 10 Days on the job Training (Field Test)
- Consulting Time (Remote and On-site)

The details of the different items offered in this technology package are described as follows:

Hardware:

DiSP-24 24 channel, digital AE instrument. It includes PAC R15I integral preamp sensors with built-in self diagnostics capability (Auto Sensor Testing) and 30 meter cables. The system comes with a built-in high performance PC controller, RW-CD, keyboard, mouse and video monitor and is shipped in a rugged transport case. This system can be used from the smallest of transformers (typically around 13.8 kV) up to the largest GSU transformers (typically around 500 kV). 3 current transducers (CT) and 2 resistance thermal devices (RTD) needed for recording parametric signals are also included in this package.



DiSP-24

Software:

PowerPAC™ This is real time AE data acquisition and feature extraction software. It is used in real time test as well as post analysis to remove unwanted data due to such extraneous noise sources as pump operation, fan operation, wind and rain. Accomplished with this is the AE-WIN- POST utility that is included with this package. Other utilities include the TBFH software that is used to identify whether the AE source is due to either an electrical or thermal fault.

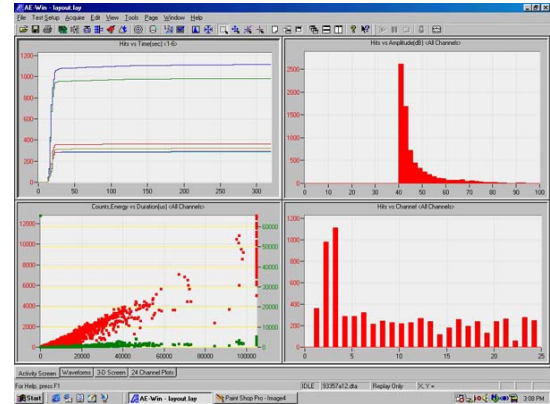
This software also includes the 3-dimensional location software to provide real time test as well as post analysis for three dimensional source location of faults detected in either the main tank or the LTC compartment

PowerPAC™ Database

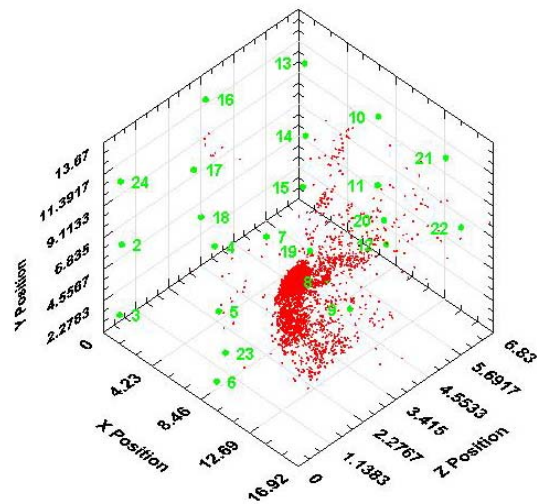
PowerPAC Database is a system created to facilitate the management of data generated by testing power transformers with Acoustic Emission. The main components are: transformer nameplate and test data.

A design number can be assigned to a transformer of some characteristics. This allows comparing acoustic activity obtained in identical transformers.

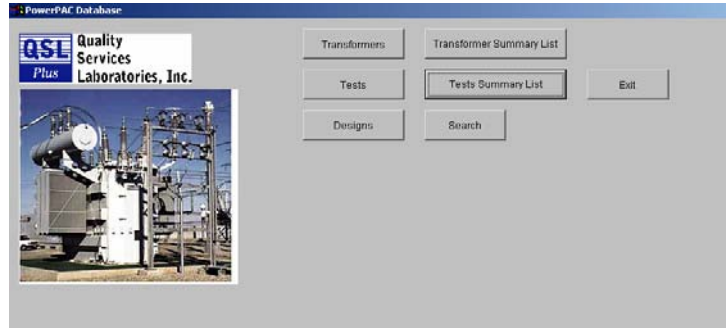
This software also allows the user to “Grade” each source obtained during the test and provides an “overall grade” for the unit [A, B, C or D]. This allows the utility to prioritize maintenance activities. Grades are performed using the information from the acoustic test and dissolved gas analysis data.



An AE-WIN24 graphic screen



Three dimensional fault showing a fault (red dots)



Database

Transformer nameplate.

Cluster ID	Events	Max Amplitude (dB)	Time Active (%)	Intensity Level
1	4	78	50.0	B

Test information.

HQTS: 195 Clarksville Road • Princeton Junction, New Jersey 08550-5303 • Telephone: (609) 716-4000 • Fax: (609) 716-0706
 Regional Hqts: *East Coast* - Philadelphia (610) 497-0400 • *Southeast* - Monroe (704) 291-2360 • *Gulf Coast* - Houston (713) 473-6111
Midwest - Chicago (630) 260-1650 • *West Coast* - Los Angeles (562) 597-3932

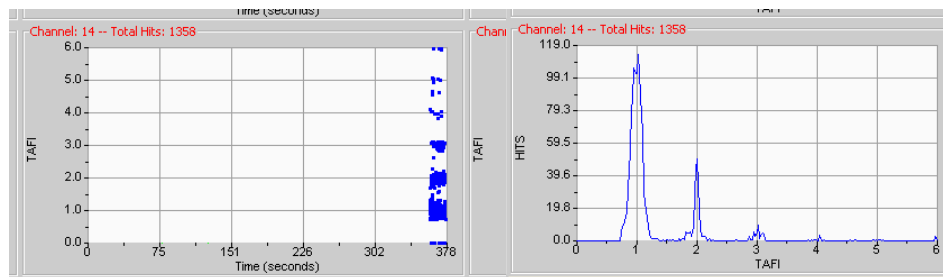
Acoustic Emission Partial Discharge Detection Mate (PDDMate)

This post-processing software allows the user to determine if the acoustic activity detected during the test is in synchrony with the nominal frequency of the system. When synchronicity exists, it is likely for the source to have an electrical origin such as Partial Discharge. It provides a graphic visualization of the results per channel.

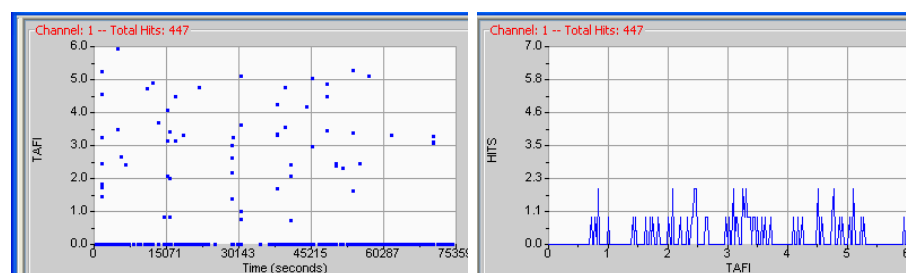
The PDDMate reads the data file created by PowerPACwin and performs signal processing, statistics, filtering and spectrum analysis etc., with effective proprietary algorithms.

Two features are presented by the PDDMate, one is named “TAFI” which exhibits scattered dots along the testing time to reveal a possibility of the partial discharge. Evenly distributed and properly aligned TAFI along the testing time show a pattern that could be correlated with partial discharge. However, on the other hand, extraneous noises, show random distribution pattern.

The second feature is named “TAFI Distribution” which exhibits the spectrum feature of the AE hits in the time domain. A pattern with a single or multiple equally spaced big spikes indicates a correlation with partial discharge whilst a pattern with randomly spaced small spikes indicates extraneous noises.



Patterns of TAFI & TAFI Distribution with apparent partial discharge



Patterns of TAFI & TAFI Distribution with no partial discharge (extraneous noise)

Technology & Support:

The purchase of this technology package includes all of the pertinent documents produced during the Phase I, II and III such as: papers, case studies, test procedure, sample reports, presentations, etc.

Consulting via telephone and email will also be provided over the course of the first year in support of the customer's need to analyze and interpret data.

Commissioning, equipment training and On-The-Job Training (OJT) are included in the PowerPAC package, but a more detailed quotation will be provided based on the geographic location of the customer site.

This technology package comes with a standard one year warranty for the equipment and software update.

For more information please contact:

Arturo Núñez

Substation Reliability Services & Products Manager

MISTRAS Holdings Group

Physical Acoustics Corporation/CONAM Inspection & Engineering Services

Cellular: (267) 968-3289

Office: (609) 716-4162

Fax: (609)716-0706

http://www.qslplus.com/power_equipment.htm