PDiagnostic

Portable OLPD Diagnostic and Location System

The PDiagnostic is a portable system that utilizes Ultra-High Frequency (UHF), Acoustic Emissions (AE), High-Frequency Current Transformer (HFCT), and Transient Earth Voltage (TEV) sensors to detect, analyze, and locate the PD signals in real time for a multitude of medium and high voltage electric power equipment.

The multi-channel PDiagnostic system locates PD on power equipment down to the measurement of a meter by utilizing Acoustic-Electromagnetic Combination Location Technique, Time Difference of Signals' Arrival (TDOA), Partial Discharge Signals Separation (PDSS), and 3D Positioning Technology with PC software included.

The system features advanced PD diagnostic, automatic PD type pattern recognition, and accurate PD Location capabilities. The PDiagnostic is an ideal trouble-shooting tool for your PD programs. Severity is determined and maintenance suggestions are provided accordingly.

Applications

- MV & HV Switchgear
- Transformers
- Power Cables
- Gas Insulated Switchgear (GIS)
- And Other Equipment

Main Features

- Detects PD activity via multiple sensor channels simultaneously
- Advanced PD detection and analysis capability with 100 MSPS sampling rate
- Advanced PC software with Quick Detection, Pulse Statistics, and Scope Detection modes
- Built-in typical PD and disturbance characteristics database for automatic PD recognition
- UHF and HFCT detection results displayed in Phase Resolved PRPD and PRPS charts
- AE detection results displayed in PEAK, Frequency Content (×1, ×2), Phase Distribution, Fly chart, Waveforms, and PDSS spectrums
- Synchronization methods: power sync., internal sync., and external sync.
- Compliant with IP55

System Configurations

The PDiagnostic system consists of a Main Unit, AE contact sensors, UHF sensors, HFCT sensors, TEV sensors, PDiagnostic Software, and cables.

The system has up to 10 customizable channels. The recommended configurations are as follows:

Transformer Diagnostic Kit:

6 Channels: 4 AE, 1 UHF, and 1 HFCT sensors

GIS Diagnostic Kit:

6 Channels: 4 UHF and 2 AE sensors

Power Cable Diagnostic Kit:

4 Channels: 3 HFCT and 1 UHF sensors

MV & HV Switchgear Diagnostic Kit:

5 Channels: 1 UHF, 2 AE, and 2 TEV sensors

* Note: Please inquire us for customized channel configuration.

UHF Sensors

The Ultra-High Frequency (UHF) sensor detects UHF PD signals generated in power equipment and is placed at the appropriate location for optimal results.

PDiagnostic Main Unit

The PDiagnostic main unit consists of a signal processing circuit, data acquisition unit, microcomputer intelligent analysis unit, and a communication/control unit. It collects and processes the detection signals, and sends the collected data to the software on the laptop via Ethernet connection. The PDiagnostic main unit is either powered by embedded rechargeable Li-ion battery or 85V-264V AC 50/60Hz power supply. The system supports multiple frequency synchronization methods such as: power sync., internal sync., and external sync.

HFCT Sensors

High Frequency Current Transformer (HFCT) sensors are used to detect the HFCT PD signals through a clamp connection around the ground/neutral straps or cables of the power equipment.

AE Contact Sensors

Acoustic Emissions (AE) contact sensors are attached on the surface of the power equipment's tank to detect acoustic signals. Magnetic AE sensor holders are used to hold AE sensors on the body of the tank.

The AE sensors are used to compare signals with the UHF sensors. Utilizing the advanced acoustic-electromagnetic combination detection technique can enhance the confidence of PD analysis of the system.

Accessory Case

PDiagnostic Software

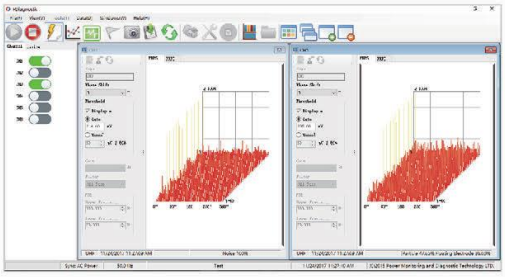
Advanced PD Data Analysis Tool

The advanced PDiagnostic software is used to detect, store, and analyze abnormal signals. The software includes data acquisition control and data analysis modules. The data acquisition control module controls the PDiagnostic main unit to collect data. The data analysis module is used for data analysis, data query, trend analysis, and to help locate PD, etc.

The software features automatic digital filtering and characteristic fingerprint extracting, excluding disturbance signals and identifying the PD type through an intelligent diagnostic algorithm, historical data statistics & analysis, and accurate fault Location capabilities.

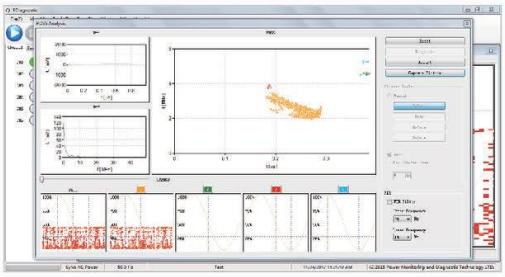
Quick Detection Mode

Searches for signals from each channel rapidly and displays PRPD and PRPS spectrums in real time. Helps to determine whether it is noise or PD and what the PD type might be automatically. This detection mode is convenient for the user to check the amplitude, phase characteristics, and the diagnostic results.



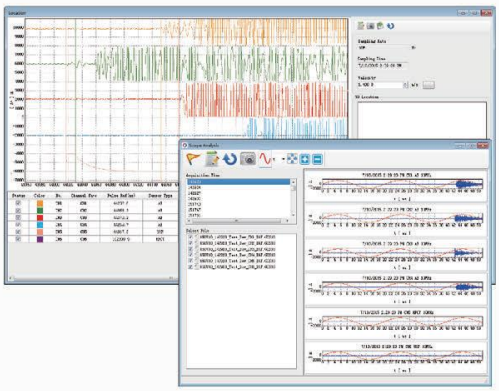
Pulse Mode

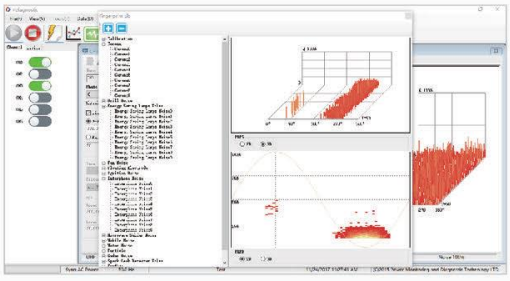
Searches for signals from each channel rapidly and displays the pulse, PRPD, and PDSS spectrums. The pulse spectrum displays signals' time domain characteristics. Advanced Partial Discharge Signals Separation (PDSS) data analysis technique is utilized to separate noises from PD signals, and to separate different types of PD signals into different groups. The PDSS spectrum displays the time and frequency characteristics of signals.



Scope Mode

Searches for signals from each channel, displays the original waveforms, and conducts time domain analysis for each channel. The pulse's amplitude, width, and characteristics can be observed. Acoustic-electromagnetic combination Location technique is utilized. The signal source can be accurately located through acoustic- electromagnetic time of flight calculation.



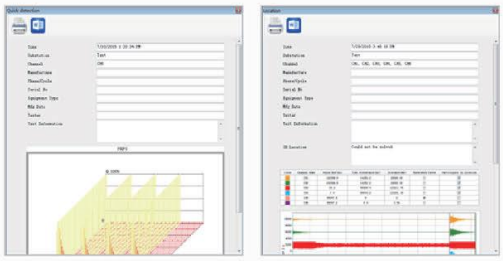


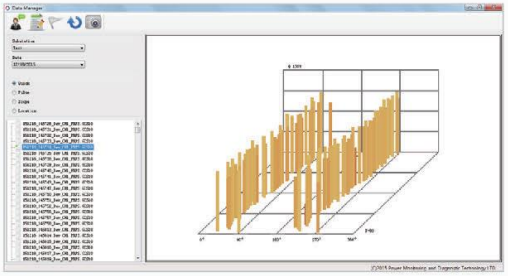
Fingerprint Library

The Fingerprint Library is a built-in, typical PD and noise/disturbance characteristics database which includes PRPD and PRPS characteristic spectrums of typical types of PD and various kinds of disturbance signals. The Fingerprint Library supports automatic PD recognition under quick detection and pulse detection modes, and is useful for the user to study about characteristics of each type of PD and disturbance.

Automatic Reporting

Various reports are generated automatically which are clear and easy to read and review. The reports can be printed and exported in MS word format. 7 kinds of reports are provided: quick detection report, pulse detection report, scope detection report, PRPS analysis report, PDSS analysis report, scope analysis report, and location report.



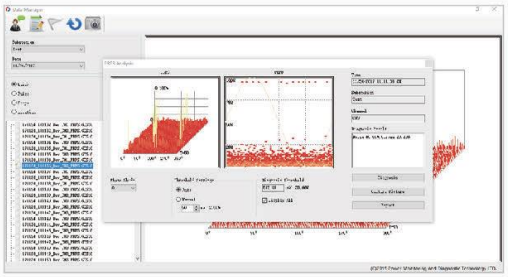


Historical Data Analysis

The system analyzes and processes the historic data in the database through statistics and intelligent diagnostic technology, and provides the developing PD trends.

Expert Diagnostic Function

The system integrates with the expert diagnostic function, which determines if the signal is PD and what type or noise automatically for each data spectrum immediately after data sampling with a manual selection or under the “history data check” mode with a manual selection.



PMDT's Solutions

Rising to the Challenges of OLPD Testing Programs

1. Reduce Noise Signals

Filter Noise Signals

PMDT utilizes the following filtering techniques to filter the noise signals of certain frequencies:

- Hardware Filtering: Absorption type filter.
- Software Filtering: Adaptive filtering - Finite Impulse Response (FIR) and Fast Fourier Transform (FFT) frequency domain filtering method.

The UHF Sensor is Useful for Isolating Noise Signals Outside the Bandwidth

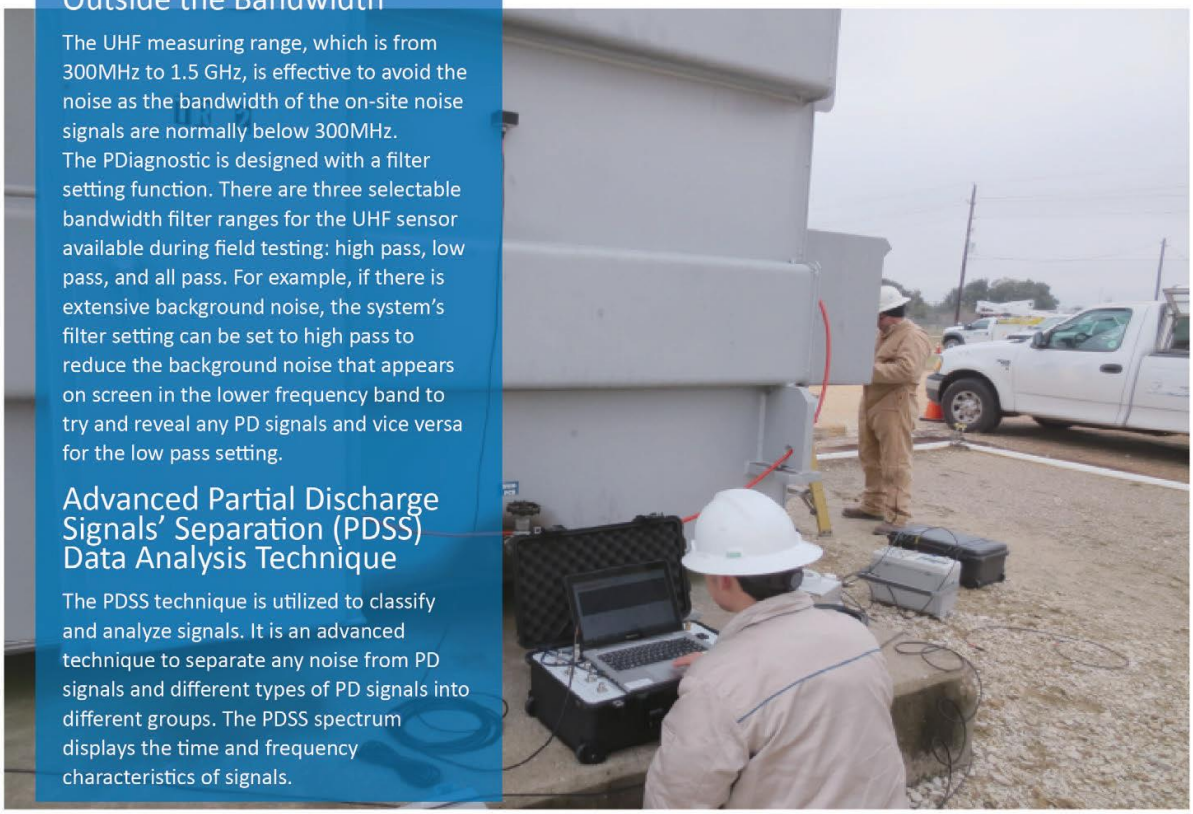
The UHF measuring range, which is from 300MHz to 1.5 GHz, is effective to avoid the noise as the bandwidth of the on-site noise signals are normally below 300MHz.
The PDiagnostic is designed with a filter setting function. There are three selectable bandwidth filter ranges for the UHF sensor available during field testing: high pass, low pass, and all pass. For example, if there is extensive background noise, the system's filter setting can be set to high pass to reduce the background noise that appears on screen in the lower frequency band to try and reveal any PD signals and vice versa for the low pass setting.

Advanced Partial Discharge Signals' Separation (PDSS) Data Analysis Technique

The PDSS technique is utilized to classify and analyze signals. It is an advanced technique to separate any noise from PD signals and different types of PD signals into different groups. The PDSS spectrum displays the time and frequency characteristics of signals.

2. Determine the PD Type

The core issue for analyzing the severity of the PD signal is to first determine what type of PD signal it is. PMDT utilizes PD type determination technique based on time domain spectrums. Each PD type has a typical characteristic which is useful in determining the PD's developing progress and critical level. The PDiagnostic determines the PD type automatically through the built-in typical disturbance and PD type characteristics fingerprint library.



3. Accurately Locate the PD with Advanced PD Location Technique

The portable, multi-channel PDiagnostic system locates PD on power equipment within a meter by utilizing Acoustic-Electric, TDOA, PDSS, and 3D Positioning techniques with the PC software included. The system features advanced PD diagnostic and Location capabilities.

Acoustic- Electromagnetic Combination Location Technique

The user must utilize at least 1 acoustic contact sensor and at least 1 electromagnetic sensor (UHF/HFCT) to accurately locate the fault. Consider the time difference between the electromagnetic signal and the acoustic signal(s) as the time travel from the fault location to the acoustic sensor(s). The fault location can be calculated by using the PDiagnostic system's advanced diagnostic algorithm. The Acoustic-Electromagnetic Combination Location Technique is utilized for MV & HV Switchgear, Transformers, GIS, and Power Cables.

Time Difference of Signals' Arrival (TDOA) Location Technique

The user can utilize at least 2 acoustic contact sensors to accurately locate the fault. Consider the time difference between one acoustic signal's initial edge from the other's as the signal's time travel from the fault location to each acoustic sensor. The fault location can be calculated by using the PDiagnostic system's advanced diagnostic algorithm.

3D Location Technique for Power Transformers

By utilizing 4 acoustic contact sensors and 1 UHF sensor on a Power Transformer, fault location can be found in three-dimensional space. By using triangulation techniques, utilizing the UHF signal as the origin of the coordinate, the location of the fault can be calculated by referencing the coordinate positions of the acoustic contact sensors on each side of the transformer tank (a total of 4 acoustic contact sensors).

Locate the Fault Phase on Power Cables

Use three HFCT sensors to test the grounding strap or the body of the adjacent three phases of the power cable. The signals from the defected phase will have a larger peak amplitude and have an opposite peak direction in comparison to the other two phases. For example, the PD signal with an initial peak in the positive direction, the other good phases will have two peaks in the negative direction. Thus, the defective phase can be confirmed conveniently and accurately.

4. Insulation Condition Evaluation and Suitable Maintenance Strategy Development

From the comprehensive analysis with the magnitude of PD signals (dB or mV values), the PD location, the PD type, and the structure of the MV/HV power equipment, the severity of the PD is determined and the suitable maintenance strategy is developed.

Normal

- Test the power equipment semi-annually with the PDetector

Warning

- Locate the PD source with the PDiagnostic
- Monitor and trend the PD activity for a short period of time with the PDiagnosticM

Critical

- Conduct pre-outage inspections
- Conduct maintenance immediately
- Monitor the power asset with the PDiagnosticM System until maintenance can be provided

5. PMDT's OLPD Testing Strategy

Multi-Sensor OLPD Testing

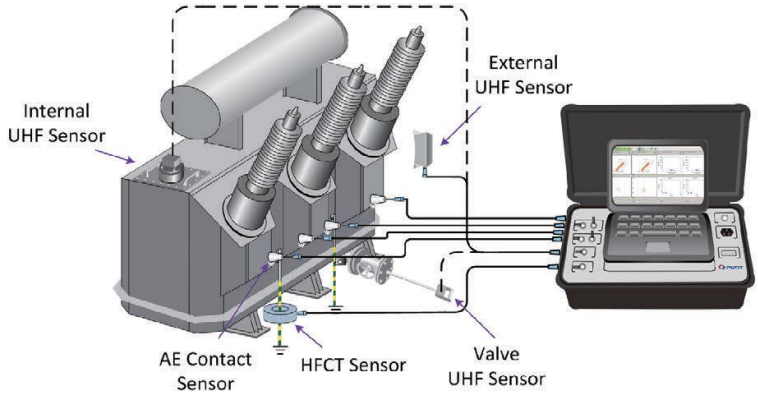
Acoustic-Electromagnetic Combination OLPD Testing

Since there are limitations to each PD detection method, it is not sufficient to reflect the true operating status of the power equipment and get the complete picture if only one kind of PD sensor is in use. By utilizing two or three other sensors, the system can provide a much more accurate assessment of the power equipment.

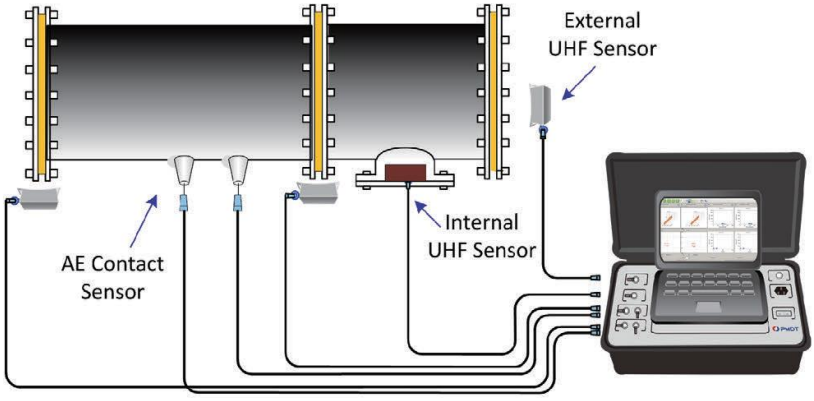
PMDT provides the proven solutions to use multiple kinds of sensors in combination together and use acoustic-electromagnetic technique to test, analyze, and locate the PD accurately, which enables the user to get the most reliable evaluation of the operational status for the power asset and make the most suitable maintenance decision.

How to Use the PDiagnostic System

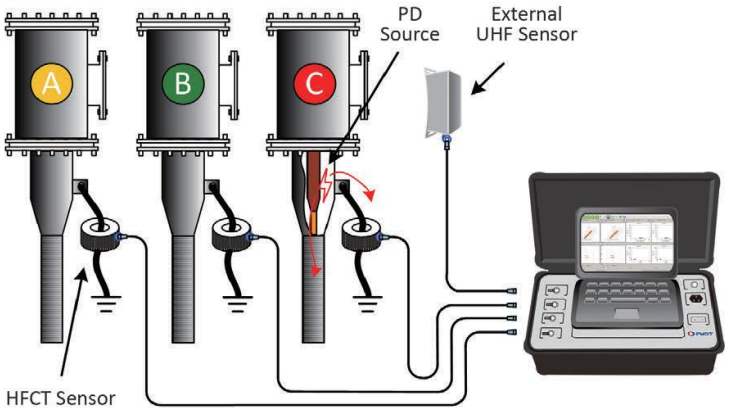
PDiagnostic for Power Transformer



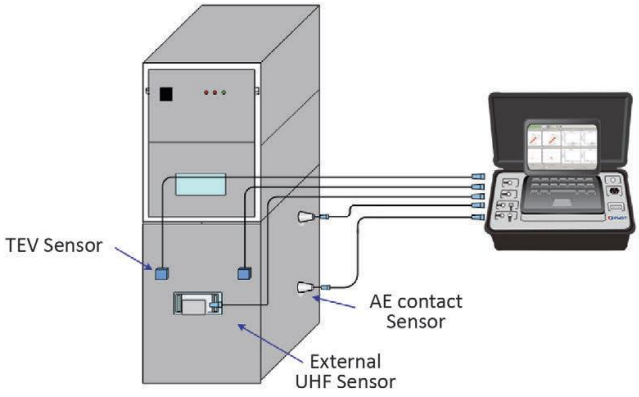
PDiagnostic for GIS



PDiagnostic for Power Cables



PDiagnostic for MV Switchgear



PDiagnostic Main Unit	
Channel Qty.	Up to 10
Communication	Ethernet
Sampling Rate	100 MSPS
Synchronization Methods	Power sync./Internal sync. /External sync.
Dimensions (LxWxH)	22'' x 13.8'' x 9'' 55.9cm x 35cm x 23cm
Weight	22lbs / 10kg
External UHF Sensor	
Bandwidth	300MHz~1.5GHz
Measurement Range	0mV~2000mV
Filters	All pass, Low pass, and High pass
Data Analysis and Storage	PRPD/PRPS/scope/PDSS and location scope
AE Contact Sensors	
Bandwidth	AE sensor for GIS: 20kHz~80kHz AE sensor for Transformer: 80kHz~300kHz
Gain	0dB/20dB/40dB
Data Analysis and Storage	PRPD/PRPS/scope/PDSS and location scope
HFCT Sensor	
Bandwidth	500kHz~50MHz
Measurement Range	0mV~2000mV
Gain	-40dB/-20dB/0dB
Data Analysis and Storage	PRPD/PRPS/scope/PDSS and location scope
Environmental	
Operating Temperature	32°F~131°F / 0°C~55°C
Humidity	0-90% RH non-condensing
IP Rating	IP55
Power Supply	
Internal Battery	Lithium-ion; operating time: 6 hours
Power Supply	85V~264V AC, 50/60Hz

Technical Specifications

The PDiagnostic and the PDiagnosticM

The PDiagnostic and the PDiagnosticM are two different systems with different features. Choose one of the two or both systems according to your needs:

Online PD Diagnostic and Location

PDiagnostic

The portable, multi-channel PDiagnostic system locates PD on power equipment down to a meter by utilizing Acoustic-Electromagnetic, TDOA (Time Difference of Signals' Arrival), PDSS (Partial Discharge Signals Separation), and 3D Positioning Technology with PC software included. The system features advanced PD diagnostic and Location capabilities.

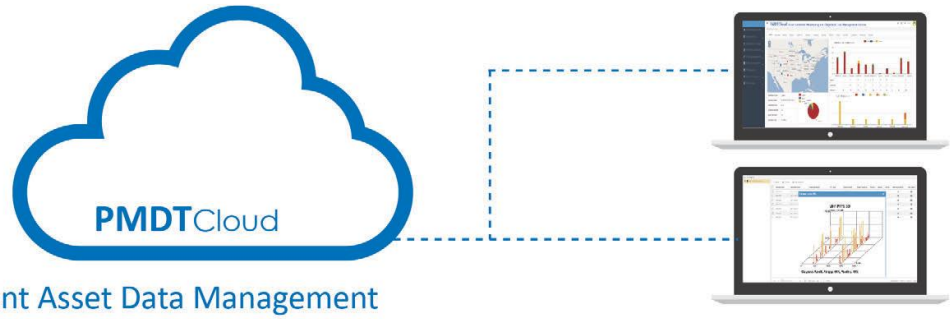
Short-Term Online PD Monitoring for Critical Assets

PDiagnosticM

The portable, online PD monitoring system for short-term PD monitoring of a critical power asset, utilizing PMDT's proprietary Intelligent Cloud Diagnostic Technology. With 3G/4G data capability, this system allows for remote monitoring, alarm functions, and analyzing the data by utilizing the Deep Learning Technology.

The PMDT Solution

Solutions for Condition-Based Maintenance

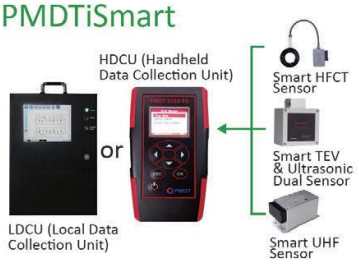


Intelligent Asset Data Management

Detection and Monitoring

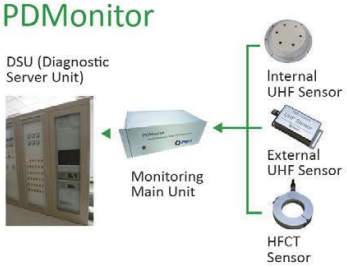
Online PD&IR Testing

PMDTiSmart



Wireless Autonomous Online PD Testing

PDMonitor



Permanent Online PD Monitoring

Diagnostic and Location

Online PD Diagnostic and Location

Online PD Expert Diagnostic and Location

Short-Term Online PD Monitoring for Critical Assets