PDiagnosticM

Portable Partial Discharge Online Monitoring System

Product Manual

Power Monitoring and Diagnostic Technology Ltd.

POWER MONITORING AND DIAGNOSTIC TECHNOLOGY LTD.

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Before using PDiagnosticM, please read the instruction manual carefully while operating PDiagnosticM.

Please pay attention when the following signs display on the PDiagnosticM or HV equipment or operation manual.

WARNING

This sign represents possible personal safety risk or there may be a life threatening situation. If this sign is posted on the equipment or in the instructions manual, please stop work immediately, or pay close attention.

CAUTION

This sign signifies the equipment has indeed incurred some problems and damages, but it still can be used after proper care.

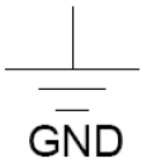
EARTH

This sign represents external ground connection is necessary to ensure safety.

WARNING

1. If the sign as shown in the left figure is posted at the field site, please follow the rules strictly. Otherwise, your personal safety may be endangered. Something could go wrong with live equipment. Proper safety precautions must always be seriously taken.

2. Please use an outlet with a ground, then power on the equipment. If it is not grounded well when connected to the power supply, a huge impact and damage to the equipment may occur.



3. The user is not allowed to repair the equipment. Do not open the cover plate or disassemble the internal parts. There are high voltage components in this equipment, which may cause deadly electric shock, and the internal components of which are also dangerous.

4. Please use this equipment in the proper place. Don't place it on an unstable surface or it a harsh environment. Dropping the instrument or getting it wet can severely damage the instrument.

Damage protection:

1. 1. Proper voltage - Do not use the over voltage power supply.
2. Proper air circulation Please keep proper air circulation environment for the equipment that may overheat.
3. If the equipment is deemed to be damaged, please do not continue to use it. Please contact the equipment manufacturer or service center.
4. If the protection facilities are damaged, please do not continue using it.
5. If the equipment is damaged or starts working abnormally, the self-protection circuit will be damaged. Please do not start it in this condition.

Place of use:

1. Liquid gets into equipment: if the liquid gets into the equipment that is not a part of the equipment itself. Once the user touches the power button, there will be danger, and damage will incur to the instrument. Similarly, it is also an inadequacy if liquid is

splashed on the instrument.

2. Do not place the instrument on the unstable foundation including the pedestal part, a tripod, and launch partition. No matter how far the equipment falls, it will cause harm to personnel and damage the equipment.

Equipment preservation:

1. Please put the equipment in a storage compartment.
2. Please do not lose any spare parts of the equipment.

Guarantee statement:

The situation beyond the scope of guarantee of the instruction manual:

1. Faulty operation, users perform maintenance by themselves without permission.
2. Beyond the usage scope that the device was designed for, and other unreasonable situations.
3. The situation caused by improper service and maintenance problems.
4. The situation caused by force majeure factors such as fire, flood or earthquake.
5. Misuse of the peripheral equipment or component.
6. Use improper power supply. Use the equipment in the unassigned or unguaranteed site.

※ For the above cases, the guarantee is unavailable.

※ Equipment product support only work for the original purchaser.

※ The product problems caused by the wrong operation of the users shall not be responsible for.

Power supply:

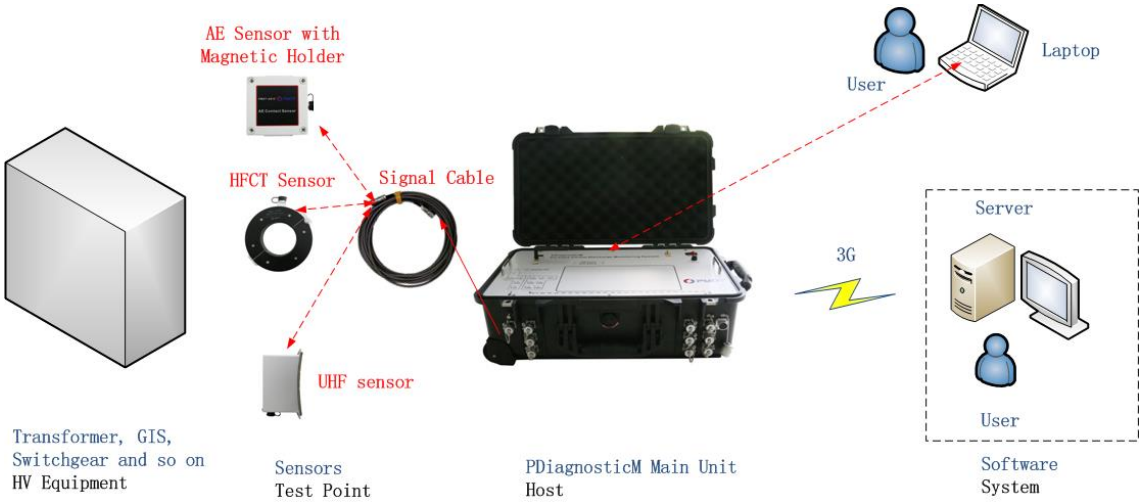
1. Start the system by turn the switch from OFF to ON
2. Connect the power cord to 115V AC socket.
3. Turn on the equipment switch. The power indicator lights
4. Shutdown by turning the switch OFF
5. Close the switch, and disconnect the power supply.

Content

1 PDiagnosticM Quick View

PDiagnosticM portal online partial discharge system is especially designed for the detection and monitoring the partial discharge activities for HV equipment. The system uses AE sensors, UHF sensors and HFCT sensors to detect partial discharge and acoustic-electric combination analysis methods is used for HV equipment partial discharge online analysis. It can find the internal defects in the early age. It may have all kinds of insulation, and fixing the discharge signal occurred. When the field has interference, which can be set along the channel to channel interference, inhibition of outside interference. Then system through the analysis of the background of multiplex channel carries on the analysis to the collected signals processing. When the judgment of HV equipment internal partial discharge occurs, determine the defects by pattern recognition for what type PD it is.

The system is mainly composed of AE sensors, UHF sensors, HFCT sensors, a laptop, and PDServer software.



In order to ensure the stability and safety of the power system, it is critical to maintain routine inspections of the HV equipment with the use of our PD detection and acoustic signals analysis equipment. This PD detection equipment will help you discover whether there are any internal insulation degradations either due to normal tear and wear or some kind of internal defects. The acoustic signal analysis will help locate any discharge of the UHF electromagnetic waves, which is typically one of the first indications of the degradation and aging of the equipment insulation.

1.1 Characteristics

PDiagnosticM system consists of AE, HFCT, and UHF sensors, data acquisition module, PD detection module and so on. It consists of multi-function modules and uses for HV equipment partial discharge online detection. PDiagnosticM adopts advanced acoustic-electric combination detection methods for HV equipment partial discharge signals online detection and diagnostic.

- AE, UHF and HFCT technologies are used together to get rid of the low frequency noise and improve signal-to-noise ratio.
- Ten channels can acquire the signals at the same time and reduce various interferences.
- Acoustic-electric combination analysis technologies are used to locate the signal source through the calculations of AE-UHF/HFCT time flight difference method.
- A variety of operating modes are used: waveform and pulses analysis modes, PRPD and PRPS display modes. It can display multiple cycle power frequency signals.
- **PDiagnosticM Software** contains data statistics and defects in fingerprint library. The software can determine PD types automatically.
- PDiagnosticM system can continuously online monitor PD signals. Historical signals can also be processed and reliable maintenance suggestions can be given afterwards.

1.2 Specifications

- Apply for various voltage classes HV equipment.
- Power supply: 85~264 VAC 50Hz/60Hz
- Sensors: four AE, three HFCT, and three UHF sensors
- Channels：ten channels
- Sensitivity：-65dBm
- Bandwidth：300MHz ~ 1.5GHz (UHF)，20kHz ~ 300kHz（AE），500kHz ~ 50MHz（HFCT）
- Communication：Ethernet/3G

2 System Composition

PDiagnosticM portable partial discharge system uses the acoustic-electric combination detection technologies. Up to ten channels can connect to different sensors. The intelligent PDiagnosticM algorithm can eliminate interferences, identify types of defects, evaluate insulation condition of HV equipment. That makes PDiagnosticM powerful enough to provide solutions for decision-making of HV equipment overhaul or not.

2.1 Main Unit

PDiagnosticM consists of signal processing circuit, data acquisition unit, microcomputer intelligent analysis unit, communication, and control unit etc., It also collects, processes the detection signals, and sends the collected data to the monitor computer via network communication;

The PDiagnosticM is the main component of the **Portable Partial Discharge Monitoring System**. The system provides interfaces and matches 10 channels freely with corresponding sensors. That includes four AE sensors, three UHF sensors, and three HFCT sensors which can be connected all at once. Laptop is connected with the main unit through Ethernet. The data after processed can be sent to the PDserver software through Ethernet or 3G network.

2.2 UHF Sensor

The UHF sensor detects UHF PD signals generated in HV equipment. Up to 3 channels could be used simultaneously.

2.3 AE Sensor

The AE sensor and amplifier are used to compare signals with UHF PD sensor, utilizing acoustic-electric joint detection technology can enhance the confidence coefficient of PD PDiagnosticM analysis.

2.4 HFCT Sensor

HFCT is the abbreviation of “high frequency current transformer”. It is used to detect the PD signals through clamping around the ground cable/strap of the HV equipment system.

2.5 Accessories: Laptop and PDServer Software

The laptop communicates with the PDiagnosticM main unit through Ethernet and obtains the detection data. The PDServer software identities the possible defects type and the general area of the defects; and statistic and analyze the historical data to estimate PD trend within the equipment.

AE sensors are placed on the tank of HV equipment and UHF sensor is held in the air around the HV equipment. HFCT sensor is clamped around the ground/neutral strap of the tank. All the sensors sample the partial discharge signals emitted from inside of HV equipment at the same time. PDiagnosticM system processes and amplifies the signals from the sensors. PDServer software analyzes the historical data to estimate PD variation trend within the equipment and determines the trends of deterioration of PD activities. According the characteristics of signals, PDiagnosticM system can determine PD type. PDiagnosticM system can monitor PD with 10 channels data acquisition at the same time.

2.6 Accessories Case

Sensor Case contains:

Three UHF sensors, three HFCT sensors, and four AE sensors.

Cable case contains:

Ten signal cables, one power cable, and one Ethernet cable

AE sensors, UHF sensors, and HFCT sensors are connected with PDiagnosticM main unit via signal cables.

3 Installation of PDiagnosticM

3.1 AE Sensor

AE contact sensors are attached on the surface of the tank of HV equipment. The PD signals from inside of HV equipment can be detected by AE sensors in the real time. The signals are sent to the PDiagnosticM main unit through coaxial cables for analysis.
Magnetic AE sensor holders are used to hold AE sensors on the body of the tank. Grease in the assembly case helps to improve the detection effect when daubed on surface of the senor before testing.
AE sensors are placed on the tank and connected with the four channels of PDiagnosticM main unit through the signal cables.

3.2 UHF sensor

The UHF sensor detects PD externally with the sensitivity <5pC. The UHF sensor obtains UHF signals when PD happens inside the HV equipment. The UHF amplifier is internally installed inside the main unit. It is responsible for processing and amplifying the detected signals from the sensor, and sending signals to collection unit of the system for analysis and processing.
In practice, place the UHF sensor at the location where needs to be tested of the HV equipment.

3.3 HFCT sensor

HFCT sensor is easy to use with clip-on mechanism.
How to use HFCT sensor as follows:

- Open the HFCT sensor；
- Clamp HFCT sensor around ground/neutral strap or cable；
- Close HFCT sensor；

- Connect HFCT sensor with cable.

Note: During the testing work, HFCT sensor should not be removed in order to avoid impacting the test result.

3.4 System

Partial Discharge PDiagnosticM system can realize the synchronous detection of 10 detection channels. In practice, users can choose configurations based on the requirements. The PDiagnosticM main unit provides signal and data interface, is responsible for sending the detected signal from the frontend sampling channels and transmitting sampling data from at most 10 channels to the laptop for analyzing and processing. Meanwhile, the system provides a working platform for the laptop.

The ground terminal should be connected with the ground cable externally to ensure the system being grounded reliably.

Before use, connect the PDiagnosticM main unit with all the sensors and power cable as the above means, ensure there is an intact fuse in the fuse block and turn on the power switch, the red LED light will turn on, so will the green LED lights. Then the PDiagnosticM will start working.

The ground terminal must be grounded reliably in order to avoid damages to safety of operator and instruments.

3.5 Laptop

The laptop provides the users with interface through the PDServer Software and displays the current configurations of the system. When using onsite, connect the laptop with the PDiagnosticM main unit through Ethernet cable. Start the PDServer software in the laptop after startup, the software will show the current system configurations. If the configurations are correct, then it is able to start analysis work.

The laptop can set the parameters of the PDiagnosticM system. Save the data through data collection control program, save it as data file after processing, and store the relevant information into a database. Users can query historical data at any time, and utilize statistical technology and intelligent PDiagnosticM technology to describe PD trends of the system and identify the type of defects based on the features of signals. Using the

external Ethernet interface can place the regular analysis data and PDiagnosticM results of the system on file, and build up the maintenance records of HV equipment.

3.6 PDServer software

Database system: adapt database to store all monitoring data;
Typical defects and interference features database: the system includes all kinds of typical defects and interference features database;
PDServer software: utilizes statistical technology and intelligent PDiagnosticM technology to analyze and process the historical data and provide the system PD trends and PDiagnosticM suggestions.
Partial Discharge PDiagnosticM system provides all kinds of typical discharge spectrum diagrams in HV equipment serving as a reference for onsite testing.

4 PDiagnosticM Self-check

4.1 Power supply test

After done connecting all the sensors and power cable of the equipment, it is necessary to inspect the power, check if the PDiagnosticM system and the laptop that have been connected and powered on. Observe the indicator lights of the system are lightened to ensure the equipment power supply is working properly.

4.2 Network inspection

Check the connection between PDiagnosticM system and laptop, if the local connection of the laptop shows the connection is normal, and if there is no issue of sending and receiving packages, meaning the network is connected correctly.

4.3 Inspecting the software program of the running system

Check the disk capacity in computer used for storing data to make sure there is enough space. It is necessary to make space for new data to be collected.
Check the log file of the program. Observe if there are any abnormalities.
Check the program window if there is any error command window popup. Otherwise, eliminate the error immediately.
Observe the running status bar of the data collection program.

5 Hardware maintenance

5.1 Notes

- Follow the instructions manual strictly, please do not alter the original design without authorization;
- If the system needs disassembly, it must be done by PMDT professional personnel. Please do not press any buttons on the panel during the system's operations;
- If you are not familiar with the PDiagnosticM system. Please do not try to download or install software into the laptop.

5.2 Problem and countermeasure

When PDiagnosticM software cannot connect to the frontend collection devices, users should check if the parameter configurations of the software are correct as well as the connection of each measurement channel and network working properly. Restart the system software or laptop if necessary.

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