

«DIM-Loc» - Multipurpose Device for Effective HV Equipment Insulation Monitoring by Partial Discharge

«DIM-Loc» multipurpose device is for PD measurement and analysis, as well as for effective defect location in high voltage equipment insulation.

The device is the most effective for PD measurement in:

- Power transformers;
- Instrument voltage transformers and current transformers;
- Switchgears and Gas-Insulated switchgears;
- Cables and joints;
- Insulators of various types;

The device is for express-diagnostics of high voltage equipment insulation.

Frequency Ranges

«DIM-Loc» device has vast range of diagnostic functions, due to the use of PD sensors of various types for three different frequency ranges.

- Low Frequency range (LF) 30 ÷ 300 kHz, using acoustic sensors.
 - High Frequency range (HF) 0,5 ÷ 30,0 MHz, using RFCT high frequency current transformers.
 - Ultra High Frequency range (UHF) 200 ÷ 1500 MHz, using electromagnetic antennas and TEV (Transient Earth Voltage) sensors.
- Partial discharge measurements can be done either in the whole frequency spectrum or in narrow bands, i.e. PD spectrum can be analyzed.

The ability of «DIM-Loc» device to carry out PD measurements in three frequency ranges widens the sphere of its use considerably for the following reasons:

- HV substation equipment varies considerably in design and function, thus the PD sensors of different frequency range need to be used.
- Sometimes the installation of definite types sensors is impossible because of their design: in such cases when the choice of the sensors is limited, the diagnostic equipment of a wider frequency range is at an advantage.
- Different types of insulation defects generate pulses of different frequency, that is why some defects are better found in LF range by acoustic sensors, others in HF or UHF frequency range.



The following types of PD sensors are preferable for the HV substation equipment:

Power transformers

- Transformer tank – acoustic sensors (LF), high-frequency current transformers (HF) and electromagnetic antennas (UHF) and TEV sensors.
- High-voltage bushings – specialized sensors (HF) and electromagnetic antennas (UHF).

Instrument current transformers and voltage transformers.

- Transformer tank – acoustic sensors (LF), RFCT transformers (HF) and inbuilt electromagnetic antennas (UHF).

Switchgears and Gas-Insulated switchgear (GIS)

- Sections of switchgear busbars - acoustic sensors (LF), coupling capacitors (HF), TEV sensors and electromagnetic antennas (UHF).
- GIS bay – acoustic sensors (LF), electromagnetic antennas (UHF).

- Switchgear enclosures – acoustic sensors (LF), TEV sensors (UHF), electromagnetic antennas (UHF).

Cables and joints

- Cables - high-frequency transformers (HF), electromagnetic antennas (UHF).
- Terminations and joints - acoustic sensors (LF), high-frequency current transformers (HF) and electromagnetic antennas (UHF).

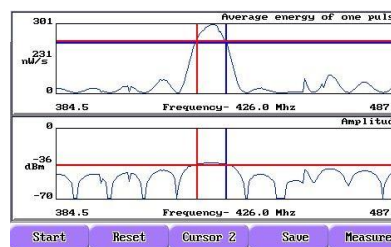
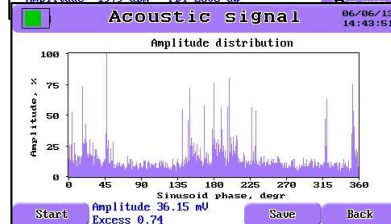
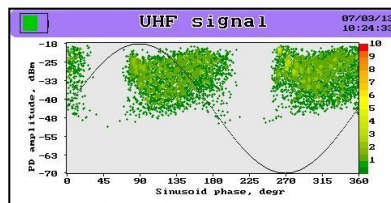
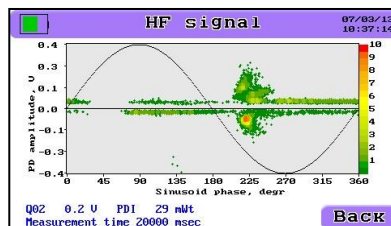
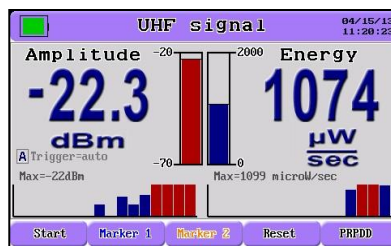
Post insulators and overhead line insulators

- Electromagnetic antennas (UHF).

The Variants of «DIM-Loc» Device Delivery Set.

The complete delivery set of «DIM-Loc» includes the «DIM-Loc» measurement device with all the four measuring channels and the corresponding sensors:

- PD measuring channel for acoustic sensors (LF);
- PD measuring channel for RFCT sensors (HF);
- Wideband PD measuring channel for antennas and TEV-sensors (UHF);
- Narrowband PD measuring channel for electromagnetic antennas (UHF).



The complete «DIM-Loc» set allows PD measuring and defect location in almost all types of HV equipment.

For measuring partial discharges in such equipment as switchgears, outdoor switchgears and Gas-Insulated switchgear (GIS), the two UHF measuring channels (wideband and narrowband) are sufficient. PD measurement in UHF frequency range allows rejecting corona discharges, which is very intensive at high voltage substations, especially of the open type. This is because the corona pulses are of low frequency, usually less than 100 MHz, so they are not measured.

For PD measuring in HV cables, joints and transformers the acoustic and HF measuring channels are sufficient.

«DIM-Loc» device is available in three modifications:

- «DIM-Loc-4» - the complete modification of the device;
- «DIM-Loc-UHF» - the modification with UHF channels only;
- «DIM-Loc-HF» - the modification with UHF and HF channels.

«DIM-Loc» Device Modifications' Purpose

HV equipment	«DIM-Loc-HF»	«DIM-Loc-UHF»	«DIM-Loc-4»
HV cables, joints	++	+	++
Switchgears and GIS	+	++	++
Instrument and power transformers	++	+	++
Outdoor switchgears and overhead line insulators	-	++	++

Defect Diagnostics and PD Measurement and Analysis

«DIM-Loc» device is supplied with «PD-Expert» diagnostic system for defect type specifying. «PD-Expert» system compares the «PRPD» and «PD-Cloud» of the measured PD pulses to the "fingerprint" of the pulses stored in the «PD-Expert» defect database.

It is necessary to synchronize the measured signal to the supply voltage phase. The synchronizing pulse is emitted by «PFR-1» device and transmitted to «DIM-Loc» through the radiochannel. «DIM-Loc» allows finding the defect, specifying its type and locating the defect. In ultrasonic range the location is done by moving the sensor along the equipment; in HF range - by reflectogram analyzing and in UHF range - by using directional antenna.

«DIM-Loc» Device Application

There are three levels of «DIM-Loc» application:

1. Insulation condition express-diagnostics. At this level PD presence/absence, PD quantity and time trends are assessed. This level does not require any specialized training of the staff.
2. Periodic insulation condition monitoring by «DIM-Loc» device, data storing and processing with «PD-Expert» diagnostic system. Diagnostic training required.
3. Profound expert PD analysis. Well-trained diagnostic staff required.

«DIM-Loc» Delivery Set

Nº	Item	«DIM-Loc-HF»	«DIM-Loc-UHF»	«DIM-Loc-4»
1	«DIM-Loc» device in case	1	1	1
2	Rod antenna	-	1	1
3	Directional antenna	-	1	1
4	AES sensor	-	1	1
5	TEV sensor	-	-	1
6	RFCT-5 sensor	1	-	1
7	RFCT-6 sensor	1	-	1
8	Acoustic sensor	1	-	1
9	PFR-1 phase sensor	1	1	1
10	Synchronization antenna	2	2	2
11	Cables	2	1	3
12	Charger	1	1	1
13	PC Software	1	1	1

«DIM-Loc-4» Specifications

Nº	Parameter	Value
1	Measuring channels, number	3
2	Acoustic channel, kHz	30 ÷ 300
3	HF channel, MHz	0.5 ÷ 30.0
4	UHF channel, MHz	200 ÷ 1500
5	Sensitivity, pC	10 ÷ 100000
6	LCD resolution (pixel)	640 * 480
7	PC interface	USB
8	Temperature mode, °C	-20 ÷ +40
9	Dimensions, mm	220 * 170 * 35
10	Device weight, kg	1.0
11	Device weight in case, kg	12.0