

## «DIM-Loc-1» and «DIM-Loc-4» - The Universal Devices for Partial Discharge Location in High Voltage Equipment Insulation

The «DIM-Loc-1» and «DIM-Loc-4» universal devices are for PD measurement and analysis, as well as for effective defect location in high voltage equipment insulation. The devices are most effective for PD measurement in:

- Power transformers;
- Instrument voltage transformers and current transformers;
- Switchgears and Gas-Insulated switchgears;
- Cables and joints;
- Post insulators and overhead line insulators.

The two devices are for the same purpose: they both are for express-diagnostics of high voltage equipment insulation. The devices are different in capability, because of the functional solutions and the PD sensors used with them.

The «**DIM-Loc-1**» device is simpler. It has got only one UHF measuring channel. Using rod or directional antenna with the device, you can distantly measure the PD impulses from 200 to 1500 MHz.

The PD measurement in UHF frequency range allows to get rid of corona discharge influence, 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.

The PD electromagnetic radiation in HV equipment insulation can be measured by «DIM-Loc-1» with the antennas of two types:

- **The UHF Rod Antenna**, equally sensitive in all the directions. In this case the defect location is done by comparing the HV radiation intensity from different parts of the substation: usually the equipment with the insulation defect, which causes the PD pulses, is situated in the zone of the most intensive radiation.

The «DIM-Loc» screen-shots to the right show the difference of the HV radiation intensity of the radiation coming from the "normal" equipment (1) and the equipment with the insulation defects (2). It is clear that both the PD pulse amplitude and energy considerably grow up as the defect develops.



- **The UHF Directional Antenna**, which has the maximum sensitivity in its longitudinal axes direction. In this case the location of the defect zone (the zone with the most intensive electromagnetic radiation) is done by the antenna turning, which is rather convenient in practice.

### Expert Evaluation of the Measurements

The «DIM-Loc-1» allows not only to reveal a defect, but to specify its type and place. For that it is necessary to synchronize the measurement process with the power supply phase. For that the «PFR-1» device, which passes the synchronizing pulse to the «DIM-Loc-1»

by the radio channel, is the most suitable. The example of the PD pulse «PRPD» distribution measured by the «DIM-Loc-1» with «PFR-1» is in Figure 3.

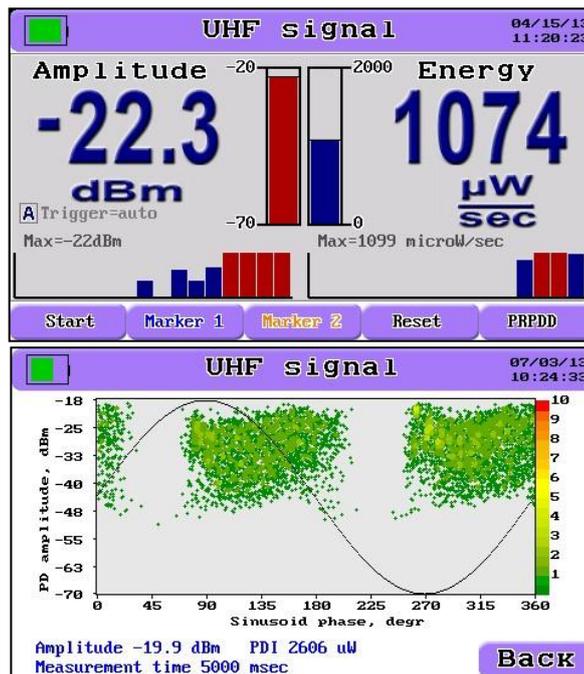
It is important that during the PD measurement synchronizing to the power supply phase it is possible to view the library of the standard insulation defect images.

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

As «DIM-Loc-1» is a simple device, which gives limited information about PD pulses, so only the simplest insulation defects can be diagnosed with the software. Also the defects should be considerably developed so that their specific features were evident and easy to diagnose.

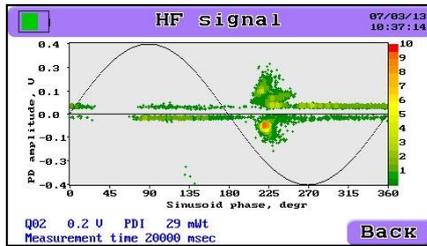
The «**DIM-Loc-4**» device diagnostic abilities are wider, because the device has four measurement channels, which allows measuring the pulses in any of the three frequency ranges:

- Low Frequency range (LF) 30 ÷ 300 kHz, using acoustic sensors.
- High Frequency range (HF) 0,5 ÷ 30,0 MHz, using coupling capacitors and high frequency current transformers.



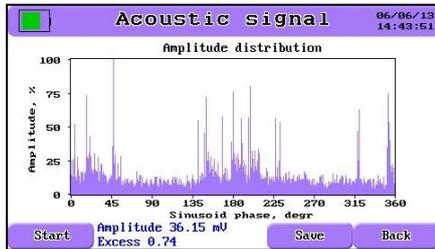
- Ultra High Frequency range (UHF) 200 ÷ 1500 MHz, using electromagnetic antennas, like «DIM-Loc-1» does. Besides in the UHF range it is possible to carry out narrowband measurements, that is to analyze the electromagnetic radiation spectrum.

The wider frequency range for PD measurement of the «DIM-Loc-4» comparative to «DIM-Loc-1», gives wider diagnostic abilities.



**The wider frequency range gives additional PD measurement opportunities, such as:**

- Different types of insulation defects generate pulses of different frequency, due to their specific features. Some defects are better diagnosed in LF range by acoustic sensors, others in HF or UHF ranges.



- There are many types of high voltage equipment of different constructions, and the place for PD sensor installation is sometimes limited. So it often happens that the sensors are chosen according to their ability to fit in. That is why the wideband equipment, using several types of sensors, provides wider diagnostic abilities.

The frequency ranges and PD sensors recommended for different types of HV equipment:

### Power transformers

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

- High-voltage bushings - capacitance dividers (HF) and electromagnetic antennas (UHF).

**Instrument current transformers and voltage transformers.**

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

**Switchgears and Gas-Insulated switchgear (GIS)**

- Sections of switchgear busses - acoustic sensors (LF), coupling capacitors (HF), antennas (UHF).

- Gas-Insulated switchgear (GIS) active volume-acoustic sensors (LF), electromagnetic antennas (UHF).

- Switchgear enclosures – acoustic sensors (LF), high frequency current spreading sensors (UHF), electromagnetic antennas (UHF).

### Cables and joints

- Cables - high-frequency transformers (HF), electromagnetic antennas (UHF).

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

### Post insulators and overhead line insulators

- Electromagnetic antennas (UHF).

### The «DIM-Loc 1,4» devices are used for:

- Periodic insulation monitoring. In this case general PD measurement is done with the device.

- Deeper insulation condition monitoring with «DIM-Loc-4» additional functions and the expert system supplied. The insulation defect type specification.

- Periodic monitoring of the overhead line insulators with «DIM-Loc-1» and «DIM-Loc-4», integrated into GPS.

### «DIM-Loc» Delivery Set

Nº	Item	«DIM-Loc-1»	«DIM-Loc-4»
1	Device in case	1	1
2	Rod UHF antenna (telescopic)	1	1
3	Directional UHF antenna	1	1
4	AES sensor	1	1
5	TSM-1/HF-B sensor	-	1
6	RFCT-5 sensor	-	1
7	RFCT-6 sensor	-	1
8	Acoustic sensor	-	1
9	"PFR-1" phase sensor	1	1
10	Synchronization antenna (433 MHz)	2	2
11	RG-58 cable, 3 m with BNC-BNC slots	-	2
12	RG-58 cable, 3 m with SMA-N-Type slots	1	1
13	Charger	1	1
14	PC Software	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