

## «TDM» - Power Transformers Condition Monitoring and Diagnostics System

The problem of power supply reliability raising is very serious nowadays. It could be partly solved by improving the reliability of power transmission infrastructure, including the high voltage power transformers.

This could be achieved by introducing the systems of on-line monitoring and diagnostics both for new transformers and the transformers already in use.

The complex monitoring «TDM» (Transformer Diagnostics Monitor) system by «DIMRUS» is for efficient power transformer condition monitoring. It includes the number of hardware and software for power transformer condition diagnostics and assessment.

### Power Transformer Monitoring with «TDM» System.

«TDM» is a module system. The «TDM» modules – is the real opportunity to create a unique monitoring and diagnostic system with the functions suitable for a definite power transformer. It allows to minimize the economic cost of the diagnostic monitoring and to collect a monitoring device with the necessary functions.

Choosing the necessary modules, the customer can create a system with definite diagnostic parameters and functions. It is important that one system can include several modules of the same type, which is very convenient for big monitoring system creation.

Besides the «TDM» modules, the complex monitoring system can include the devices for dissolved gas analysis and other parameters' monitoring. The advantage of «TDM» system is that the data from all the modules and additional monitoring devices is included into the complex diagnostic report on the power transformer condition.

In dependence of the monitoring system configuration, «TDM» system receives and processes the information from 10 - 80 sensors, mounted on the transformer.



### «iNVA» Software.

The data from the sensors mounted on the transformer is collected, processed and stored in the corresponding functional modules. There is a specialized expert system in each module; the system gives the diagnostic report on the current condition of the transformer subsystem, monitored by the module.

The data (both primary and processed) from all the «TDM» modules is transmitted through connection channels to the monitoring system workstation, equipped with «iNVA» software. With «iNVA» software, the data is processed, displayed and archived. If necessary, all the data or the most important part of it can be transmitted into SCADA of upper level.

The use of «iNVA» software allows assessing the condition of some separate transformer subsystems,

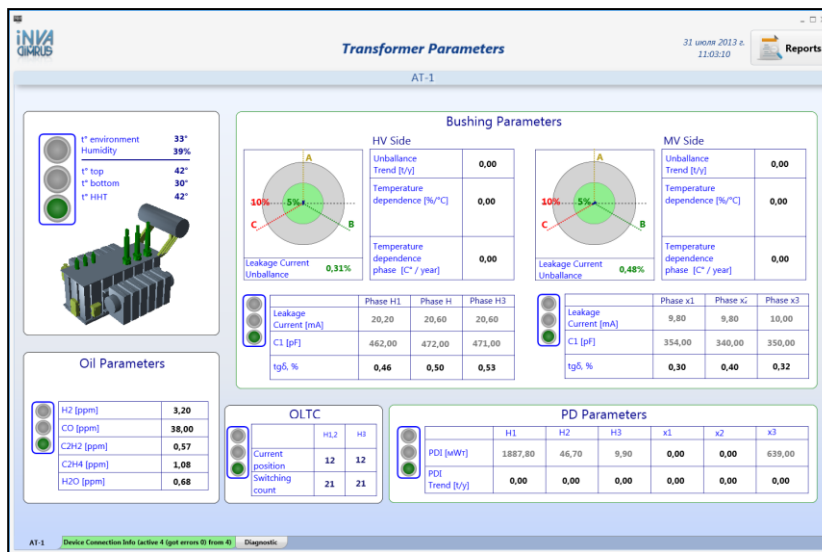
as well as the whole of the transformer, and give the full diagnostic report on the transformer condition.

The final diagnostic report formed by «iNVA» software is multilevel. The report includes the information about the defects revealed, and the forecast for the defect development. It has

become possible thanks to the unique adaptive mathematic models used in «iNVA». The models are constantly improved, as more data is collected.

For complex diagnostic report formation the software uses complicated models, processing typical parameters from several diagnostic models of the transformer subsystems.

The complex diagnostic reports include the information from the additional inbuilt models, such as the location of the hottest winding point, the estimation of the cooling system operation, moisture content in oil and solid insulation, etc.

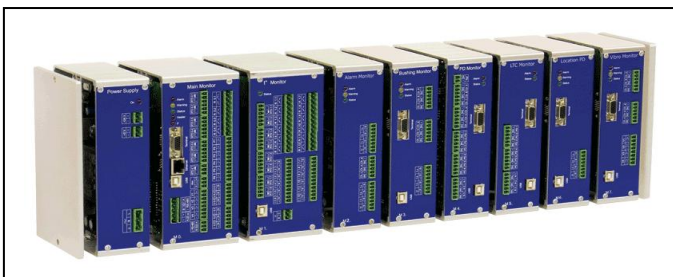


The diagnostic reports from separate subsystems of the monitored transformer are rated according to the level of defects' development and their danger for the further equipment operation. Such defects are shown as a simple list.

All the information about the transformer operation - primary and processed - is displayed at the workstation computer digitally and as standard color signals - green, yellow, red - for the effective warning of the cable condition. Specially trained staff can carry out deep multiple-factor processing of the trends and diagnostic reports.

«TDM» system is realized as separate modules, connected by common bus. Each module is a complete device, solving the definite diagnostic task.

**«TDM» system includes 14 types of functional modules.**



PS Module – the universal power supply for all the modules and sensors.

M0 Module – the main monitoring module; it provides module management, data integration, archiving, SCADA connection.

The data from the separate diagnostic modules of the monitoring system is integrated in M0 Module, which itself is a monitoring system of primary level and can measure the signals from up to 20 sensors. In this module the data from the local modules is summarized and transmitted to SCADA system as a transformer condition report.

M1 Module – the module for temperature monitoring; provides the diagnostics of the coolers and oil pumps. The system can be supplied with the independent block of the transformer cooling system managing and diagnostics.

M2 Module – the module for alarm and transient modes monitoring; protection and automation relay monitoring.

M3 Module – the insulation condition monitoring for both paper-oil insulation bushings and solid RIP insulation bushings.

3F Module – the module for partial discharge (PD) measurement in transformer tank in UHF range; winding deformation monitoring.

M4 Module – the module for partial discharge (PD) measurement and analysis in transformer windings and bushings.

M5 Module – the module for condition monitoring and defect diagnostics of power transformer OLTC.

M6 Module – the module for acoustic insulation defect location inside the transformer tank.

M7 Module – the module for the transformer tank vibration measurement, oil-pump vibration parameter analyzing.

M8 Module – the module for surge arrester monitoring.

M9 Module – the module for the «TDM» PC interface widening.

M3.1 Module – the module with additional slots for portable PD measuring device plug-in.

BICT Module – the block of insulating current transformers (BICT) 0,1 / 0,1A for circuit isolating monitoring.

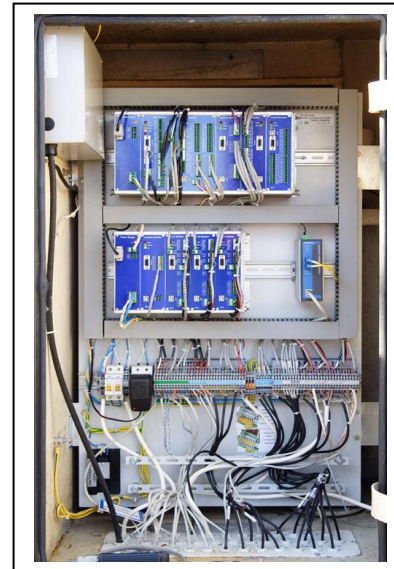
**«TDM» Design.**

All the «TDM» modules are suitable for the operational temperature range from - 40° C, so they could be mounted beside the monitored transformer without any additional heating.

Usually «TDM» system is supplied in protective enclosure, where all the modules and devices are installed. If necessary, the additional heating system is available.

For the data transmission form «TDM» to SCADA optical cable or copper twisted-pair cable is used.

In dependence of the task either RS-485 interface or a radio channel could be used for data transmission to SCADA.



**«TDM» Specifications**

Parameter	Value
The mounting enclosure dimensions, mm	600x700x250
Operation temperature range (with heating system), °C	-55 ÷ +60
The modules' power supply, V	80 ÷ 265 AC/DC
The enclosure power supply (with heating system), W	250 - 300