Monitoring Solutions
For Power Transformers, Reactors, Bushings and Instrument Transformers

- Complete Transformer Monitoring System (TMS)
- ZVCM-1001 Bushing Monitoring System
- Hydrocal Dissolved Gas-In-Oil Monitoring System
- Continuous On-Line Transformer Health Monitor
Critical power transformers and reactors are the backbone of any power system. On-line monitoring enables asset managers to check the condition of critical equipment without the need for costly or difficult-to-schedule outages. When developing equipment problems can be detected before failures occur, maintenance and repairs can be performed on a condition-based, rather than time-based schedule, reducing maintenance costs and the risk of workmanship errors.

The TMS combines all of our monitoring devices to provide continuous on-line monitoring of:
- Dissolved gas-in-oil levels for hydrogen, carbon monoxide, carbon dioxide, methane, ethane, ethylene, acetylene and moisture
- Bushing power factor, capacitance and leakage current
- Partial discharge inside the transformer and bushings
- Top oil and hot-spot temperatures
- Transformer aging and loss-of-life

Also available with optional LTC monitoring.

Our software provides alarm setpoints, graphical displays and algorithm-based alarms that maximize response without nuisance alarms. Our software engineers can design custom applications for any type of system.

Complete Transformer Monitoring System (TMS)

TMS continuous on-line monitoring system for
- Generator step up transformers
- SST and UAT transformers
- Wind Farm step up transformers
- HVDC transformers
- Autotransformers
- Substation power transformers
- Shunt and series reactors

ZVCM continuous monitoring system for
- Condenser bushings
- Capacitance Coupled Voltage Transformers (CCVT’s)
- Potential transformers
- EHV current transformers
Made in the USA, the ZVCM system is a 6-channel, continuous monitoring system that can be connected on any type of condenser bushing as well as Capacitor Coupled Voltage Transformers (CCVT’s), potential transformers or EHV current transformers. The ZVCM system allows the user to utilize a combination of analysis methods to provide fast and reliable determination of bushing condition. Other bushing monitoring systems only use the sum-of-three-currents and adjacent analysis methods to identify changes to bushing condition and to calculate bushing power factor and capacitance values, but these methods are subject to substantial dynamic changes in power factor and capacitance values due to power system fluctuations in system voltage magnitudes and phase angles as well as transformer temperatures. For installations where more stable power factor and capacitance values are desired without data smoothing, the ZVCM-1001 can be configured for comparison or reference mode analysis and can also provide full leakage current magnitude and phase angle data for custom algorithm applications.

ZVCM software employs proprietary algorithms that evaluate all available analysis modes to eliminate false alarms and ensure that bushing deterioration is detected early on.

The HYDROCAL 1001+ is a permanently installed composite gas in oil sensor for the Total Dissolved Combustible Gases (TDCG) analysis of the key fault gases Hydrogen (H₂), Carbon Monoxide (CO), Methane (CH₄), Acetylene (C₂H₂), Ethylene (C₂H₄) and Ethane (C₂H₆). To detect an even wider range of potential transformer faults, the HYDROCAL 1001+ analyses additionally the content of Moisture (H₂O) in the transformer oil. The HYDROCAL 1001+ is a fully integrated (6 key fault gases and Moisture in oil) compact and cost effective device used in particular for early transformer fault detection and preventative maintenance.

**Key advantages:**
- Cost effective and comprehensive monitoring of 6 fault gases
- Measurement of Moisture (H₂O) in the transformer oil
- Easy and fast installation while the transformer is operating
- Compact and resistant design for long lasting usage
- ETHERNET and CAN bus interfaces to support proprietary communication protocols and to be open/prepared for substation communication protocols MODBUS TCP, CANopen

**Gas-in-oil analysis**

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<tr>
<th>HYDROCAL 1001+</th>
<th>HYDROCAL 1003</th>
<th>HYDROCAL 1005</th>
<th>HYDROCAL 1008</th>
<th>HYDROCAL 100x-3/-2/-1</th>
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<td>C₂H₂</td>
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**Specifications:**
- Moisture in oil analysis (H₂O): ✓
- Transformer monitoring inputs / outputs: X
- Offshore suitable: ✓
- HYDROCAL MS-7: X
- Bushing Monitor ZVCM-1001: X
- Monitoring of multiple transformers: X

1) Special version with corrosively protection for the installation on offshore platforms
2) Extension packages (options)
The new PPI THM transformer health monitoring system utilizes multiple current, voltage, temperature, and pressure inputs in an integrated system to provide monitoring of up to 7 critical areas of transformer performance as well as control cooling operation.
Partial discharge monitor

Partial discharge (PD) is an indication of excessive insulation stress. Increasing levels of PD can be a sign of movement inside the transformer or insulation damage. PD is monitored with inputs from the bushing test taps, filtered to collect the high frequency currents.

Bushing monitor

Condensor-type bushings can deteriorate with age and adverse service conditions. Evolving problems can be detected by increases in power factor and/or capacitance as well as imbalance current magnitude. Bushing power factor and capacitance is measured as well as imbalance current phase angle and magnitude, utilizing the power frequency current inputs from the bushing test taps. Our 12-channel THM enables the user to measure bushing parameters with multiple methods, minimizing the risk of false alarms. When inputs from CCVT’s or potential transformers (PT’s) are available, both the transformer bushings and the CCVT’s or PT’s can be monitored.

Geomagnetic induced current (GIC) monitor

Solar activity can have a dramatic impact on transmission line voltages which can cause damaging levels of DC offset and resulting damage to power transformers. Our system detects ground currents and power system harmonics to provide an early warning when GIC events occur. The monitor utilizes voltage inputs from the bushing sensors and ground current magnitude from a DC current transducer around the transformer tank ground.

Leakage impedance monitor

Transformer impedance is a key indicator of the physical clearances in the active part of the transformer and a change in impedance indicates a likely movement in the windings or other critical parts of the transformer. Our monitor utilizes voltages from the bushing sensors with load currents from the transformer’s bushing CT’s to regularly measure the transformer impedance.

Thermal monitor and cooling controller

Proper cooling operation is critical to prevent accelerated aging of transformer insulation. The system utilizes oil and ambient temperature RTD’s and load current auxiliary CT’s to determine oil and winding temperatures. These temperatures are used as inputs to switch transformer cooling stages on and off, as needed.

Electronic oil level monitor

The oil level in power transformers varies as a function of temperature and the temperature varies as a function of loading. Transformers are designed to operate safely over the normal range of thermal oil expansion, but when transformers are not properly filled, or when excessive leaks occur, energized parts can become exposed which can lead to internal flashover and catastrophic failure. Our float-less electronic oil level monitor uses oil pressure and temperature telemetry with tank geometry to accurately determine oil level and volume. The display can be mounted in easy to read locations unlike float-type gauges and the system can also detect high tank pressure conditions before the pressure relief device activates and spills oil, and other abnormal operating conditions such as a clogged breather. The monitor works on both conservator and gas-blanketed transformer designs.

Dissolved Gas-in-oil Analysis (DGA) monitor

DGA is the most widely used method to assess transformer condition. The standard DGA monitor for our system is the Hydrocal 1005 or 1008 on-line DGA monitor which utilize near-infrared measurement technology for measurement of dissolved hydrocarbon gasses plus hydrogen and moisture sensors. Other types of DGA monitors can be incorporated into the THM system, if needed.

Central processing and communications

The THM central processor routes all of the inputs to the monitoring modules and accepts the outputs from each module. It also stores the settings and algorithms and makes the calculations for all of the functions. The system has digital and analog outputs to provide alarms and streaming data. The required analog outputs must be specified, and are available in Ethernet or RS-485, using Modbus, DNP 3.0 or IEC61850 protocol over hardwire, fiber optic, wireless or cellular communications networks.

TraMos Software

Our TraMos software is a Windows-based database that can download, store and analyze data for all monitors on each transformer at each user’s site. The program is compatible with Windows 95 through Windows 8 and provides tabular and graphical data interfaces for easy analysis of transformer condition. Special graphical functions are also included such as PD waveform location and Duval triangles for Hydrocal 1008 and similar system DGA analysis.
Efficient Electricity Solutions

In a span of two decades, PPI Pazifik Power, Inc. successfully supplied the Philippine market a wide range of high quality innovative power and infrastructure equipment from the best manufacturers in Europe and from its own automated design concept to more than 200 customers who are at the forefront of the country’s engines of industrial growth.

Among PPI’s most sought after power product lines are: Turnkey projects for Supply of Substations rated voltage of up to 230kV, Electricity Meters, Transformers, Switchgears, Disconnectors, Fault Indicators, Surge Arresters, Protective Relays, Diagnostic and Testing Equipments, Batteries, Harmonic Filters, UPS and AVR systems.

PPI’s seasoned Electrical Engineers deliver the unique support tailored fit for each customer’s needs. PPI’s cutting edge is its high product quality with an unparalleled delivery of after-service performance.

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**PD Portable**
Partial Discharge localization and measurement on cable segments, joints and cable terminations.

**Frida**
For testing of medium-voltage cables using VLF technology. Integrated tan delta (TD) measurements for cable diagnostics.

**Insulating Fluids Tester**
Automatic measurement of dielectric strength, dissipation factor TD, specific resistance of insulating liquid.

**Frisa**
For testing of medium-voltage cables using VLF technology. Integrated tan delta (TD) measurements for cable diagnostics.

**Digital Recorder System**
Combine the monitoring function of digital fault recorder with the features of power quality analyzer in a single system.

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**ExLi**

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**AFFILIATES**

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**www.ppi.ph/dlfiles/B2-TMS.pdf**