

BUSHING MONITOR SYSTEMS PERFECTED OVER FOUR DECADES



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ZVCM-1001 Transformer Bushing Monitor



Transformer bushing failures are considered as one of the major causes of transformer outages. Historically, bushings were tested with off-line methods to measure the capacitance and dissipation/power factor.

The ZVCM-1001m is a permanently installed on-line bushing monitoring system. It continuously measures up to six leakage currents, tests the power factor and capacitance values for any bushing with a C1 test tap. Free-standing CTs, CCVTs, circuit breaker bushings, and GIS-to-AIS transition bushings may all be monitored.

The ZVCM bushing adapters replace the test tap grounding cover at the bushing base. The installation is semi-permanent and can be accessed for off-line power factor testing.

Measurements for all six bushings are taken simultaneously not serially, preserving time alignment

ZVCM bushing sensors are available for grounded or ungrounded capacitor taps. Redundant circuits within the sensor also limit the voltage at the output cable, protecting both the bushing and also personnel, if a cable is accidentally cut or damaged.

A standard installation with three high-side and three low-side bushings provides

- Sum-of-Three Current Test
- Adjacent Phase Reference Test
- Phase Comparison Test
- Patented High-to-Low Test

Additionally, with optional configuration with three PT voltage inputs and three bushing C1 inputs

- Reference Test (3 bushings and 3 CCVTs)
- Reference Test (6 CCVTs and 6 bushings) requires twin-ZVCM system

Key Advantages

- System hardware and bushing sensor of highest quality, hard-wired to control box. No connectors at the sensor to corrode and give trouble over time.

Sophisticated algorithms determine

- Relative capacitance in percentage to the start-up value
- Relative power factor %PF for each bushing
- Magnitude of imbalance currents for three-phase sets of bushings
- Phase angles of imbalance currents
- Alarm assertion for any parameter outside preferred limits

TransMAX 2000 Transformer Bushing Monitor With PD



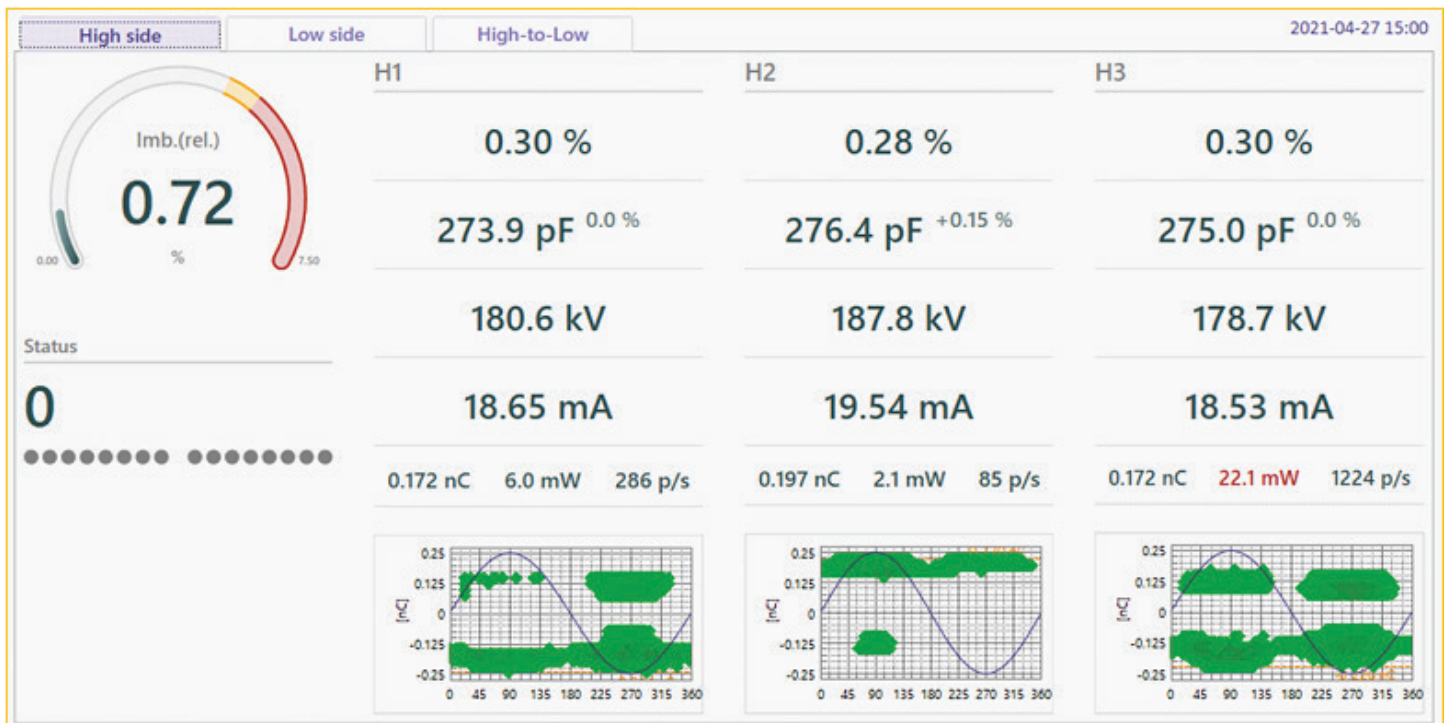
Transformer bushing failures sometimes occur outside the capacitive layers, where traditional analysis of leakage currents will not give indication of an internal problem.

When the utmost in transformer reliability is required for critical transformer assets, partial discharge detection must be part of the monitoring strategy. The TransMAX 2000 performs all the test methods of the ZVCM-1001 but also monitors for partial discharge (PD). The PD activity in the bushings is monitored in parallel with the power factor calculations.

PD is detected using the same bushing sensor as with the ZVCM-1001, there are no other sensors or Rogowski coils.

PD is caused by defective insulation in high-stress areas, movement of energized parts, or design errors where low-level discharges occur. Some types of PD may not present a problem, but others can develop into surface tracking or insulation failure, which can lead to bushing or transformer failure. The TransMAX 2000 also has the unique capability of monitoring GIC events and trends which potentially could damage the transformer.

Easy-to-use MultiTool software works with both the TransMAX 2000 and ZVCM-1000.



Specifications ZVCM-1001

Power Supply Input Operating Range	85-264 VAC, 120-370 VDC, 24 VA
Operating Temperature Range	-55 °C to +90 °C
Humidity	0 to 95%, non-condensing
Leakage Current Measurement Range	0 mA to 140 mA
Leakage Current Measurement Accuracy	± 1.5% of reading
Leakage Current Measurement Resolution	0.1 mA
Power Factor Measurement Range	0 % to 100 % PF
Power Factor Measurement resolution	0.01 %
Power Factor Measurement Accuracy	± 0.045 % of reading
Capacitance Measurement	100 – 5000 pF
Capacitance Measurement Accuracy	± 1.0 % of reading
Phase Angle of imbalance current	0 - 360°
Phase Angle of imbalance current Accuracy	± 1.0 % of reading
16 BIT A/D Resolution	

Outputs

PF, C1, leakage current for each bushing
Imbalance for each group of 3 bushings

Alarm Contact Rating	3 relays, 8.0 amp continuous at 125VDC, 10.0 amp continuous at 250 VAC
SCADA Interfaces	DNP3.0 Level 1 Protocol using half duplex RS-485 interface and MODBUS
Surge Withstand/Fast Transient	Relay outputs and station battery inputs: ANSI C37.90.1
EMI Withstand	ANSI C37.90.2
Electrostatic Discharge	IEC 801-2

Additional Specifications TransMAX 2000

Power Supply Input Operating Range	85-264 VAC, 120-370 VDC, 50 VA
PD Frequency HF	<20 MHz
PD Resolution	1.0°
Time Resolution	10 nS
Dynamic Range	65 dB
PD Intensity	0 – 5000 mW
PD Amplitude	0.02 – 100 nC ± 10 V

Top oil temperature sensor input
Three load current CT sensor inputs
Ambient Temperature and Humidity sensor inputs

USB port for ZTZ software	configuration, commissioning and data analysis
RS-485 port for SCADA	Modbus RTU or DNP 3.0 Serial access
Ethernet port	remote access via ZTZ Software, SCADA access over Modbus TCP or DNP over Ethernet

Outputs

PF, C1, leakage current for each bushing
Imbalance for each group of 3 bushings
PD power, PD amplitude, PD pulse count for each channel
PRPD plots for each channel
Top oil temperature
Load currents
Hot-Spot temperature
Ambient temperature and humidity

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