Transformer Monitor E3

Continuous condition monitoring for power transformers: bushings, windings, OLTC, cooling and insulation in a single system

Transformer Monitor E3: CPU, modules and front panel

The Transformer Monitor E3 applies field-proven technology to data collection, analysis and visualisation, communicating and notifying changes in transformer condition. Combined with LIFESTREAM® support services it delivers a comprehensive, data driven approach to online condition monitoring of bushings, windings, on-load tap changer, cooling system and insulation.

Full service solution

- Monitors all key transformer components.
- Consolidates data and manages communication to third party IEDs and DGAs on the transformer.
- Provides a single point of communication for alarms.
- LIFESTREAM® support services verify that units are implemented properly and provide training and support throughout the life cycle of the asset management programme.

Monitoring capabilities

Thermal	Top oil temperature, winding temperature, fibre optic, insulation ageing
Bushings	Change in power factor, change in capacitance, partial discharge
Power system	Harmonics, load profile, load power factor, voltage level
Transformer faults	Fault detection, fault counting, fault magnitude accumulation
Core, coil and DETC	DGA (key gas and multigas), moisture, partial discharge
OLTC	Time since last thru neutral, tap counter, contact wear, excessive tap operations, motor failure, contact overheating, slow tap change, breather
GIC	DC currents in the neutral and harmonics
Cooling system	Fan and pump current, loss of cooling power, contactor fail, breaker trip, cooler efficiency, run hours
Oil and preservation	Oil level with alarm, oil leak, conservator bladder rupture, breather, nitrogen pressure
Control system	Panel heater, loss of auxiliary power, circuit breaker trip, cabinet door left open, not in auto

Improved reliability

E Series installed on a power transformer

With online condition-based data, users receive alarms when problems first arise, allowing action before they escalate. 50 % of bushing failures can end in a fire; offline testing is typically conducted every few years, whereas online monitoring is continuous and performed at normal operating temperature at the network voltage.

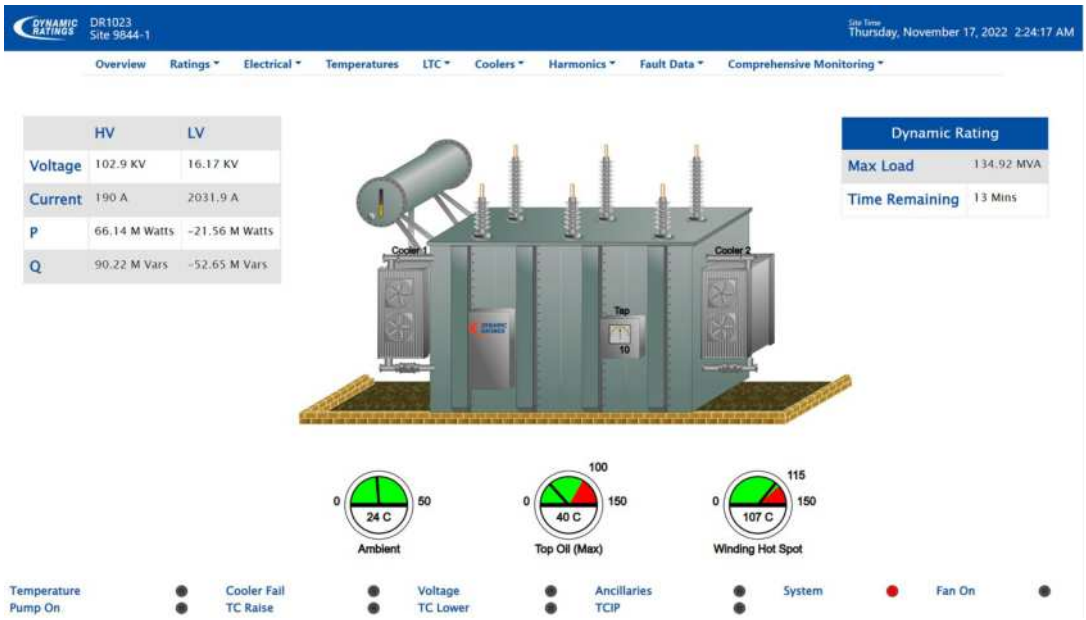
The on-load tap changer has the highest failure rate of all devices on the transformer. The E3 gives early indication of OLTC drive or motor problems by monitoring motor current and voltage and alarming on any unexpected deviation. An individual counter is maintained for each tap position, providing a summary of historic operation.

Reduced maintenance costs

Advanced analytics filter through the condition data to automatically identify issues requiring maintenance attention, letting operations and maintenance crews resolve problems rather than manually collect data. Alarms are routed to the right stakeholders through multiple SCADA connections and email notifications, and can be grouped into common, major and minor alarm groups.

E3 analytics include active moisture modelling, advanced thermal modelling — precise winding temperatures, insulation ageing, dynamic rating, "what if" rating calculations, predictive oil temperature model, cooling efficiency and cooling system health — and insulation health with fault counting.

Maximised life and loading



E3 web dashboard: dynamic rating, temperatures and alarms

The dynamic rating provides the time remaining at the current state and the maximum safe load the transformer can carry given the present health of the cooling system and the environmental and operating conditions, without exceeding the thermal limit. Built on the predictive oil temperature model, the "what if" function answers two questions: how long the transformer can run at an assumed load before exceeding a limit, and what maximum load it can sustain over a given time.

Predictive SMART cooling turns the cooling system on earlier to reduce insulation loss of life and reserve overload capacity for later in the day. Cooling control supports discrete control of more than four stages, dual speed fans, parallel pumps with automatic duty cycling for equal wear, and direct drive of variable speed drive systems.

Safety

- Online monitoring through SCADA connectivity, increasing situational awareness for crews entering substations.
- Advanced analytics that ensure crews bring the right equipment and replacement parts: fewer trips to site means less exposure to hazards.
- User interfaces providing key safety warnings, diagnostic interpretations and trouble shooting tips.

Modules and architecture

In addition to the CPU and power supply, both mandatory in any configuration, the E3 supports up to twelve modules. The multiport module counts as one of the twelve regardless of how many cards are installed on it.

CPU and power supply	Connection via USB, copper ethernet or fibre ethernet. Operation from 48 to 275 V DC and 60 to 275 VAC at 50 or 60 Hz
Digital input	12 per module, isolated to 2.5 kV AC for 60 s and 5 kV impulse, with status LEDs
Digital output	8 form C outputs per module, NO and NC, rated 6 A @ 250 VAC / 6 A @ 30 VDC
Analog input	6 per module: 2 AC current, 2 PT100 RTD (3-wire) and 2 DC inputs configurable for 0-1 mA, 4-20 mA or 0-10 VDC
Analog input/output	The above plus 8 outputs of 4-20 mA, accuracy ±0.2 % of range
Fibre optic	Temperature probes for direct winding hot spot measurement
Multiport	OLTC motor current, dual CT+, dual PT100 RTD, AC+ input, RS-232, RS-485, serial fibre optic and DC analog

Product specifications

Mounting	35 mm (1.37 in.) DIN rail
Connection type	Numbered terminal blocks (removable)
Operating temperature	-40 °C to 80 °C (-40 °F to 176 °F)
Humidity	Up to 95 % non-condensing
Power supply	DC input 48 to 275 V DC; AC input 60 to 265 V RMS, 47-63 Hz; 50 W
DC output	24 VDC nominal unregulated (18-32 V DC), 0.5 A
Power input	275 VDC / 265 VAC rms maximum, IEC 60664 over-voltage category II
Digital inputs	125 VDC / 125 VAC rms maximum, IEC 60664 category I
Digital outputs	125 VDC / 250 VAC rms maximum, IEC 60664 category I
Motor energy input	300 VAC rms maximum, 47-63 Hz
VT inputs	150 VAC rms maximum, 47-63 Hz
Module dimensions	166.87 mm high; 50.80 mm (2") or 76.20 mm (3") wide; 105.66 mm deep

Frequently asked questions

Which transformer components does the E3 monitor? Bushings, windings, on-load tap changer, cooling system, oil and preservation system, core and coil, control system, through faults and geomagnetic induced currents.

Does it integrate with third party equipment? Yes. Its open architecture allows integration with a wide array of third party multigas DGAs and moisture monitors over a serial link, which preserves measurement precision and gives access to additional diagnostic information.

Can it replace the existing voltage regulator? The E3 provides voltage control for the transformer and can be configured as primary control or as backup for an existing system, reducing the number of devices and potential failure points.

How is the data accessed? Every unit includes a software system with its own web pages: dynamic rating, transformer overview, harmonics, total harmonic distortion, voltage control and temperatures, available remotely at any time.

What does DynamicMetrix® add? It aggregates data from multiple monitors into a single web-based visualisation solution, designed to prioritise decisions across a large fleet of transformers from each asset's current and historical status.

Images and technical data: Dynamic Ratings, E Series brochure. Specifications subject to change without notice.