
From transformer monitoring to predictive maintenance
Prolong asset life and lower your total cost of ownership!
COMEM

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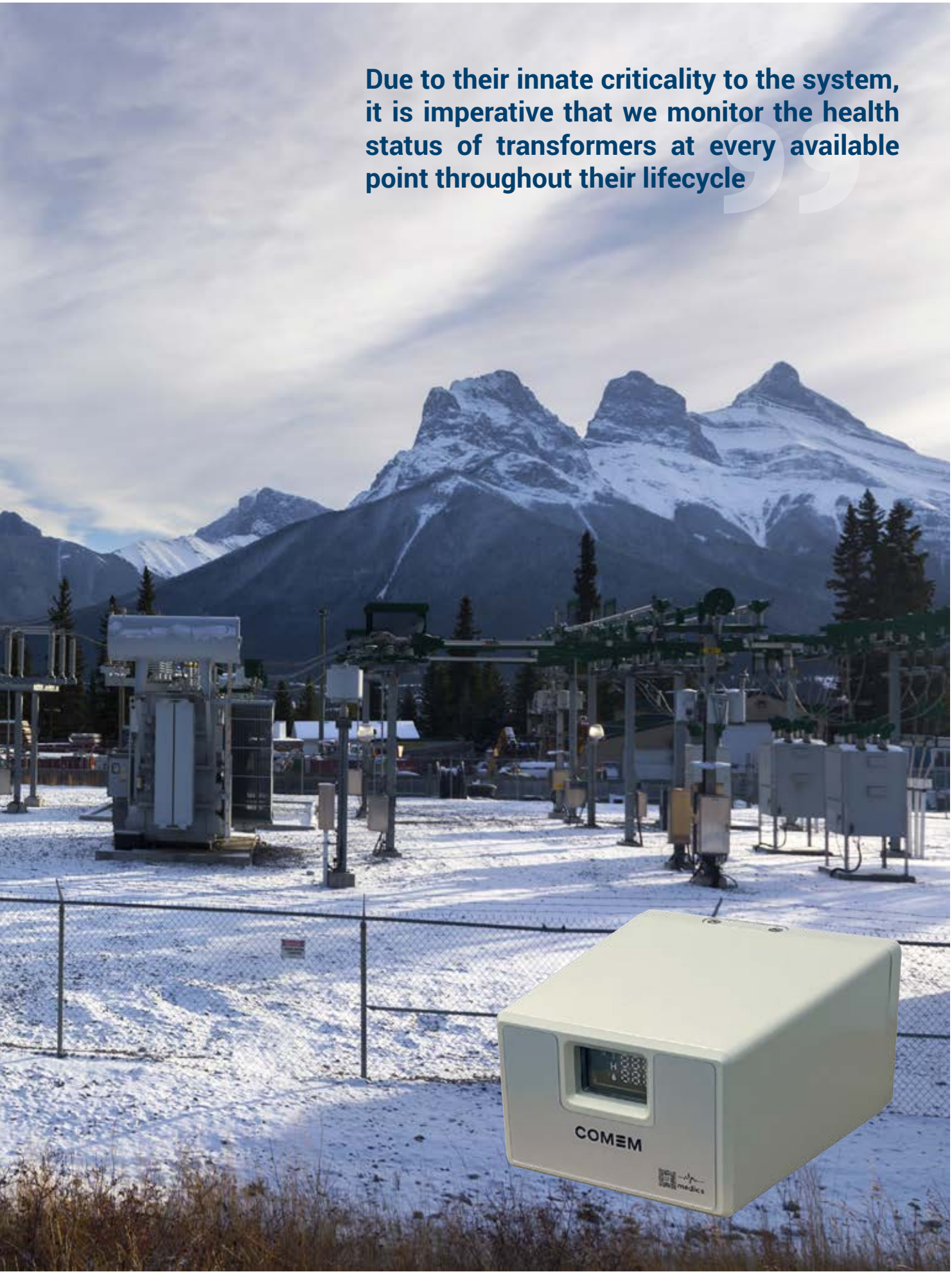


Continuous monitoring of asset parameters allows you to collect data and use trend analysis to spot patterns and predict future events

Transformers are irreplaceable components of any power system. They are designed to last approximately 30 – 40 years and play a vital role in delivering power to the consumer. Due to their innate criticality to the system, it is imperative that we monitor the health status of these valuable and expensive assets at every available point throughout their lifecycle.

There are many challenges for transformer end users:

- Gathering relevant health data remotely to make informed decisions.
- Building a suitable transformer maintenance strategy.
- Prolonging transformer life and lowering transformer total cost of ownership.

... and many asset health parameters to keep under control:

Temperature

With the global increase in energy demand, the average loading on transformers rises and the end users strive for higher asset utilization. Higher loads mean hotter operation and the need for improved thermal management. However, overheating affects the insulation material properties and causes transformer aging.

Load

The operator can define the overload capacity of the transformer over time with a precise definition of the immediate risk, making the most of the transformer's potential without compromising its lifespan.

Moisture

Humidity accelerates the insulation material aging. The presence of moisture is an indicator of an abnormal condition, and further investigation is needed to determine the next course of action.

Gases

The oil must be stable at high temperatures and have excellent electrical insulating properties to withstand electrical and mechanical stresses and assure the safe operation of the transformer. Dissolved gases present in the transformer oil are indicators of possible faults.

Gas accumulation

Detecting abnormal gas accumulation and abnormal rate of gas accumulation in the transformer provides valuable insight into internal malfunctions, allowing the opportunity to promptly shut down the transformer and prevent possible destruction of transformers.

Pressure

Pressure in the transformer is one of the key health parameters that predict early signs of decreased performance or an upcoming failure. Overpressure in the transformer tank can lead to an explosion and a hot oil spill in the surrounding environment.

Oil level

Liquids like mineral and silicone oils insulate and cool a transformer. It's essential to monitor the oil level to ensure reliable and safe operation of the transformer.

Continuous monitoring of asset parameters allows you to collect data and use trend analysis to spot patterns and predict future events.

Just like proactive and regular healthcare for the human body, preventive maintenance programs based on regular testing and data interpreting have become fundamental for improved transformer lifespan quality and significantly increased it.

MeDICA is a modular ecosystem designed for specific customer needs, which consists of hardware – safety monitoring devices, sensors, data aggregators - and services

Decisions on proactive transformer healthcare should be taken upon relevant data analysis and consist of monitoring, testing, and consulting services. A digital transformation journey moves from a process-defined world to a data-driven world.

Traditional time-based maintenance scheduled on fixed set-time intervals and manual data collection is not efficient enough in an era where technology is rapidly advancing and where customers have a need for speed and seek an immediate response to questions.

Digital monitoring allows you to gather relevant data remotely and in real time and to have full control over the course of anomalous events. The availability of more detailed information enables a wider evaluation of both asset operation and maintenance strategy. Furthermore, you can avoid errors caused by manual sample collection and being caught off guard by unexpected events.

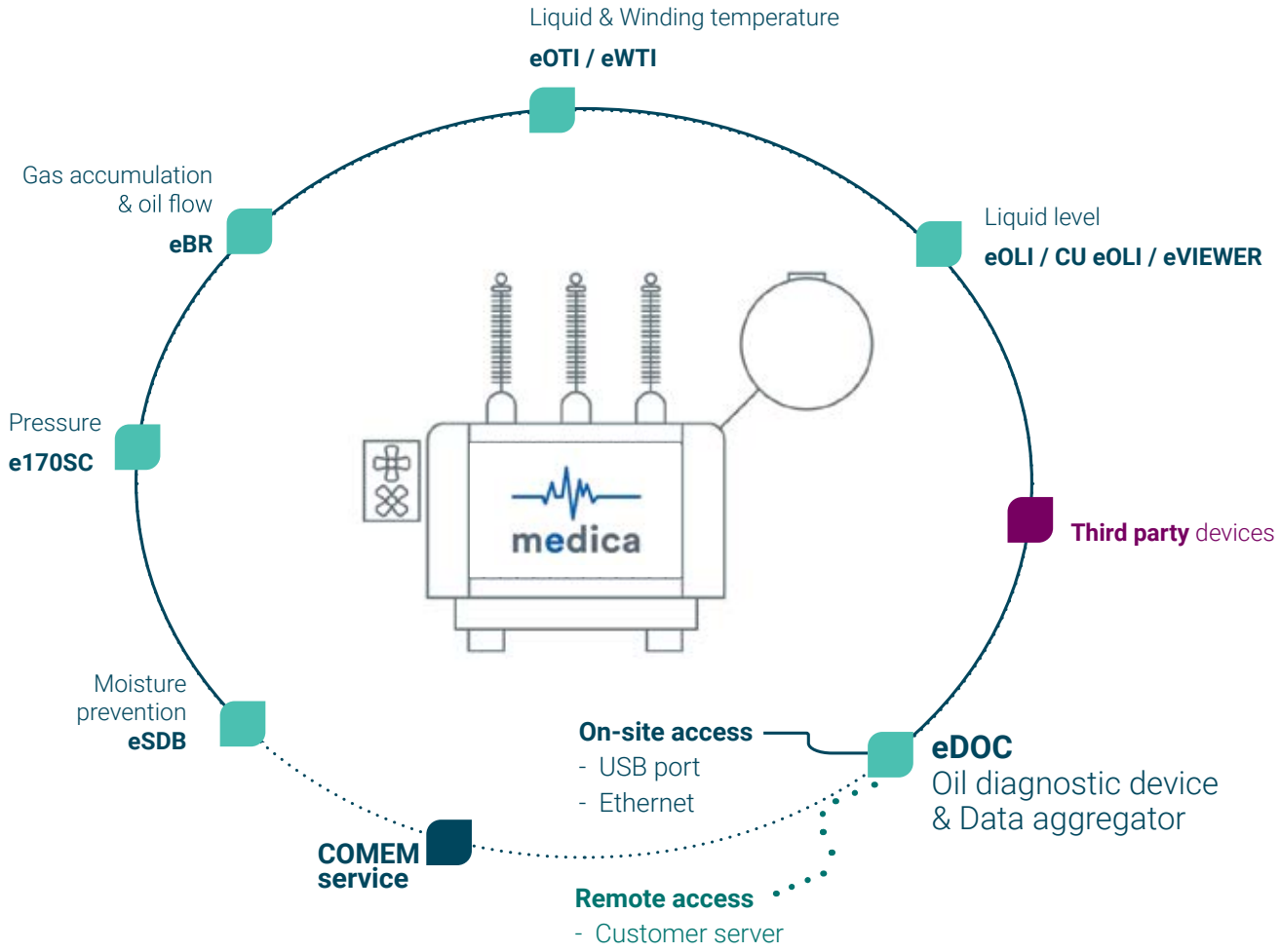
Choose the right solution for transformer digital monitoring and adopt a reliable data collection system that fully integrates with your transformer protection and control systems.

MeDICA is a modular ecosystem designed for specific customer needs, which can be adapted over time. The solution consists of hardware – safety monitoring devices, sensors, data aggregators - and services.

By integrating and interpreting data from online monitoring and offline testing, we can build a sustainable maintenance program and guarantee a longer lifespan for your transformers.

Dissolved gases in transformer oil

The demand for reliable and sustainable power continues to grow, and the transformers that are currently in service are subject to increased stress. Unfortunately, this increased stress accelerates the aging of the insulating systems, thus



The presence of dissolved gases and moisture is an indicator of an abnormal condition, and further investigation is needed to determine the next course of action

reducing the reliable life of these critical assets.

Insulating materials inside the transformer liberate gases while breaking down.

To make sure transformer oil is suitable for use, end users must periodically control its properties. The presence of dissolved gases and moisture is an indicator of an abnormal condition, and further investigation is needed to determine the next course of action.

Sensors are essential for transformer monitoring, enabling end users to monitor asset health parameters, plan for proper maintenance, and prevent failures. By combining the results of electrical tests with oil analysis, you can obtain a complete status of the transformer's health.

Dissolved Gas Analysis (DGA) is among the most powerful tools for detecting faults in power transformers.

By **trending the dissolved gas levels,** problems can be identified and evaluated further before they cause a catastrophic failure.

As seen in Table 1, **hydrogen gas** is clearly present in most fault types. As it is the first gas to appear and the only gas to be continuously present during thermal and electrical faults, hydrogen can be thought of as an early warning or "check engine light," alerting transformer operators to a potentially significant issue inside the transformer.

Moisture is another key factor affecting the dielectric strength and aging of transformer insulation. It is also an indicator for verifying the proper functionality of the oil protection system.

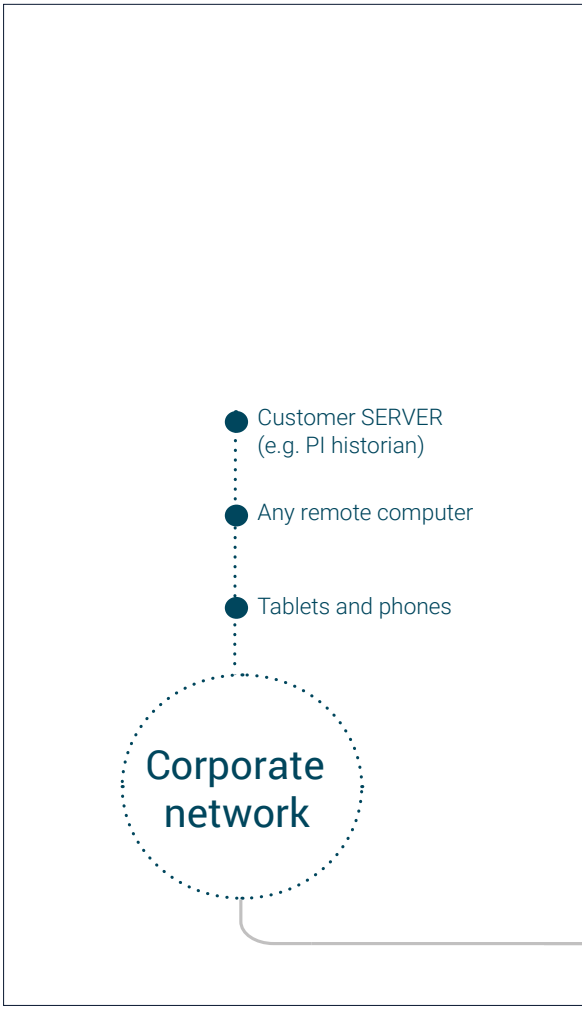
To have complete control of the thermal operation of the transformer, it is

Moisture is another key factor affecting the dielectric strength and aging of transformer insulation, which is also an indicator for verifying the proper functionality of the oil protection system

Table 1. DGA is based on the principle of the generation of different combustible gases depending on the temperatures reached by the oil.

Fault/gas generated	Carbon monoxide (CO)	Carbon dioxide (CO_2)	Methane (CH_4)	Acetylene (C_2H_2)	Ethylene (C_2H_4)	Ethane (C_2H_6)	Oxygen (O2)	Nitrogen (N2)	Hydrogen (H2)	Moisture (H2O)
Cellulose aging	+	+								+
Mineral oil decomposition			+	+	+	+			+	
Leaks into oil		+					+	+		+
Oil oxidation							+	+		
Thermal decomposition of cellulose	+	+	+				+		+	
Overheated transformer core	+	+	+						+	
"Thermal faults in oil (150°C to 300°C)"			+		Trace	+			+	
"Thermal faults in oil (300°C to 700°C)"			+	Trace	+	+			+	
"Thermal faults in oil (>700°C)"			+	+	+	+			+	
Partial discharge			+	Trace					+	
Arching			+	+	+				+	

Self-dehydrating breather type eSDB



*MeDICA offering includes 1, 5 and 9 gas analyzers

necessary to monitor the temperature because high **temperature** causes transformer aging. Transformer mineral oil can degrade when exposed to heat, oxygen, and moisture.

Predictive maintenance

If you could predict the future, you might be able to plan better, make your maintenance plan more effective, and avoid transformer failure that could cause a serious impact on your business.

It is possible to collect data required for transformer health management remotely or on-site. By integrating and interpreting data from online monitoring and offline testing from the past and from today, we can spot patterns and see trends to better predict and forecast the future health status of the asset.

If you are looking for a relatively economical digital monitoring solution with an immediate effect on both operation and maintenance without complicating the data flow too much, choose our **Oil diagnostic device type eDOC, a single gas analyzer.** It continuously measures the presence of moisture and hydrogen in transformer oil and enables you to make informed decisions about asset maintenance needs. Thanks to this basic monitoring solution, the operation of the transformer is enhanced with detailed control of the thermal balance, the overload capacity, and the aging of the main insulation. As part of our MeDICA solution, it can also serve as a bridge to all other connected eDevices (Data Aggregator).

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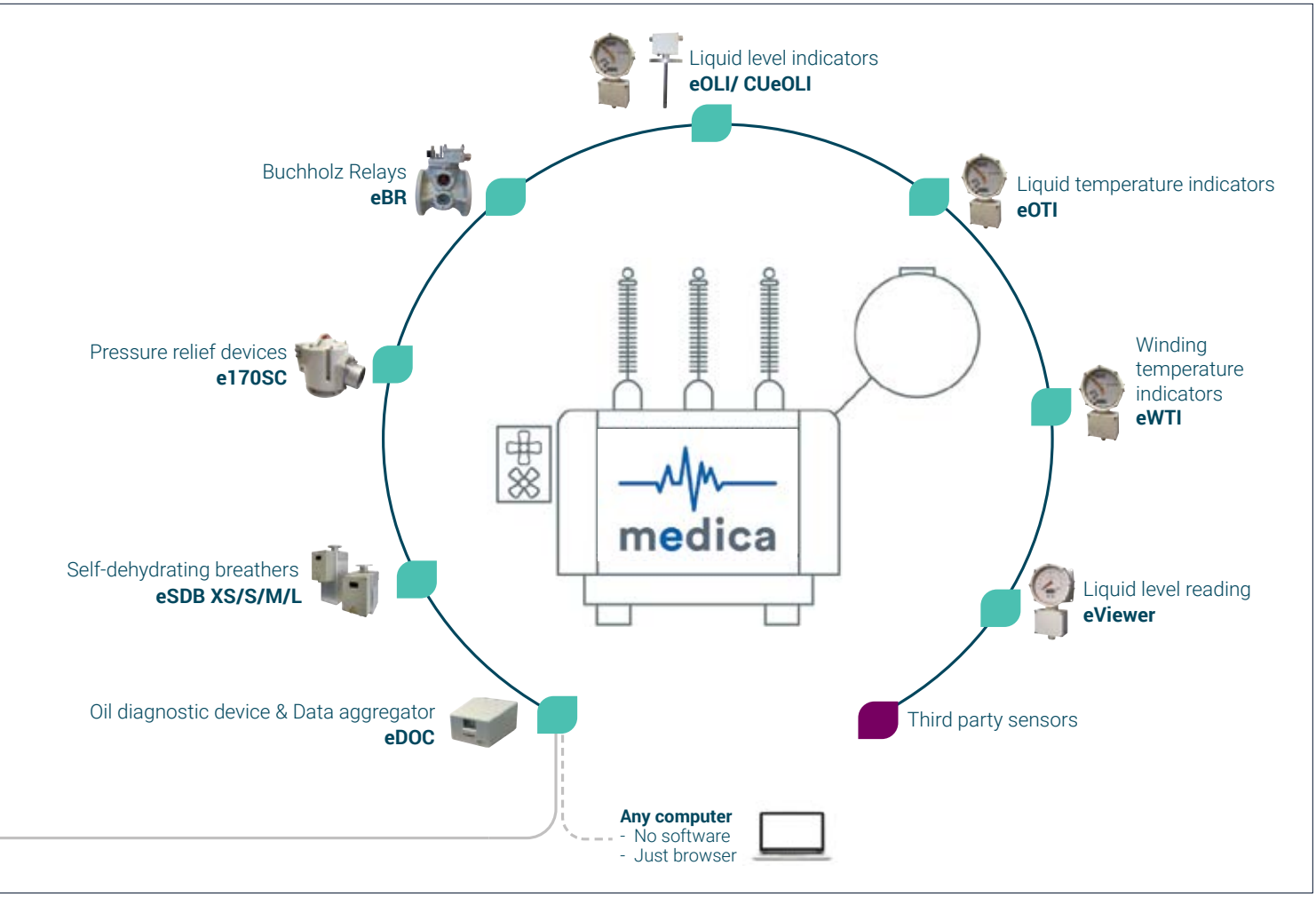
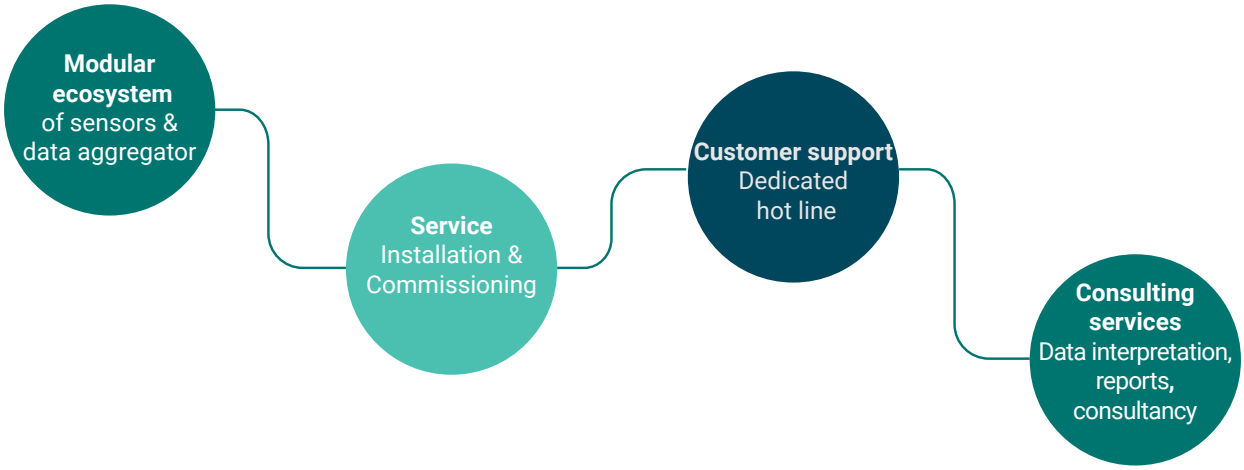
To perform a more detailed diagnosis almost in real-time and to take advantage of a wide range of services embedded in the MeDICA offering, combine the **Dissolved Gas Analyzer/Data aggregator* (1, 5, or 9 gas)** with at least one sensor from our eDevice family (self-dehydrating breather, pressure relief device, Buchholz relay, liquid level indicator, liquid and/or winding temperature indicator).

MeDICA is the right solution for the digitalization of transformers, both new



MeDICA is the right solution for the digitalization of transformers, both new applications as well as retrofit solutions for the existing installed base



applications as well as retrofit solutions for the existing installed base.

Together, **we** can build a proper transformer maintenance strategy based on a data-driven preventive and predictive maintenance program, increase the lifespan of your asset, and optimize your maintenance costs.

COMEM Service can help you with:

- Offline measurements
- Installation & commissioning
- Data interpretation, reports, and consultancy
- The provision of a user-friendly ecosystem with an embedded web interface & a common communication protocol.

Contact us, and our on-field team of experts will take care of your request during the entire project lifecycle, from the product selection to the installation, commissioning, and after-sales support.

We provide a wide range of solutions for different applications and installations in special environments, from offshore and marine to seismic areas.

Oil diagnostic device type eDOC

Choose **MeDICA** and get a complete customer solution that includes products and services that can enable a longer and more efficient transformer life cycle.

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Monitoring **E**cosystem for transformer **D**iagnostics with **I**ntegrated **C**ustomer services & **A**nalytics

SCAN ME

Contact us & get support with the product selection:
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