

What to Look for in a Transformer DGA Monitor

by **Dominique Legrand**



When choosing a transformer monitoring system for DGA (Dissolved Gas Analysis), there are now plenty of brands and systems on offer and it is becoming harder to understand the differences and make a selection. More often, the underlying technology and the resulting technical specifications are used to differentiate. But times have changed and over the years, a new wave of asset managers has resulted in the products evolving. Now, some previously less regarded factors should also be considered. We will explore the main ones here.



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Technology

Different underlying technologies are used for DGA monitors, including Gas Chromatography (GC), Non Dispersive InfraRed (NDIR), Photo Acoustic Spectroscopy (PAS), etc. While the fundamental differences are rather well known, so are the issues with gas consumables management, recalibration requirements, measurement discontinuities and Lower Detection Limits (LDL). Judging from product brochures, it seems that most specifications end up looking very similar, even if that is not always verified by customer testing protocols. Large customers are increasingly conducting their own tests to validate the product's theoretical values, using their own testing method in their own environment. While this is a time-consuming exercise, it certainly highlights the differences.

Accuracy and LDL are always well prized attributes, but others like repeatability and response time are often overlooked. The latter indicates, following a gas increase, the percentage of the gas value that is measured by the monitor at the first measurement – 90% is good, but if it is only 65%, then it will take a second measurement to reach the same level and show the true gas level increase. If the machine is set to measure DGA every eight hours (three measurements per day), it may take another day before the alarm threshold is reached and you get alerted to the true magnitude of the problem.

Many systems automatically increase the measurement frequency when an alarm is raised to show more rapidly the rate of change. Some technologies will have limits as to the minimum time between measurements; others will degrade accuracy if the frequency is increased. If, for example, the acetylene level is rising fast, this is particularly frustrating, when you would like another confirmatory result (or two) before you decide to shut down the transformer. Some products offer one hour minimum, some newer product offer as low as 30 minutes.



There are many factors to consider when selecting a transformer DGA monitor: the monitor with its features and performance; the underlying technology used as well as the long-term reliability; the software environment available and the reputation of the manufacturer to continually enhance the product over time.

Data/Communication

More and more DGA systems are connected to large databases to collect data, so that the trends can be interpreted and patterns recognised. This is where Artificial Intelligence (AI) and data scientists are now trying to help transformer experts predict what is going to happen to a transformer. Therefore, having a range of reliable communication options is key to facilitate connections. Most systems offer Modbus and DNP3, but the future belongs to IEC 61850. This protocol should be supported, even if it is not needed right now. It should

be up to date (latest edition) and preferably certified by an outside body to make sure that your new system will not have any issues integrating with others.

Collecting data into a historian is one thing, but transforming this data into actionable intelligence is the real worth of a DGA monitor. Otherwise, it becomes another un-mined data lake. Fortunately, there are a lot of standards and graphical tools that can be used to analyse the data and provide a diagnostic of the transformer. Having easy access to quality software tools connected to your

DGA monitor is therefore essential. With more monitors being deployed, even with these tools, it becomes harder to spend the time analysing the results one by one, without some fleet management functionalities. Otherwise, one quickly relies solely on alarms and loses some of the benefits of continuous monitoring.

Some software and/or systems can perform an automated analysis of the data and provide a 1-to-5 Risk Index (RI) to deliver a quick transformer assessment and an indication of the severity of the problem. This is particularly useful for non-DGA

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experts, who may not instantly appreciate the difference between a huge acetylene vs methane increase. The risk indexes provide the added advantage of being able to categorise and rank your transformer fleet, so that you can concentrate your resources on the transformers with worst RI or with a recently changed RI.

Finally, living in a modern world, the ability to send an email or SMS text message when an alarm is raised is a nice feature that should not be overlooked; and so is having a local display where you can appraise the situation when at the substation,



without having to connect your laptop. Nice colour graphic web pages are what we all expect nowadays from products.

Cybersecurity

Making it harder for the unscrupulous to gain access and disrupt the power infrastructure is becoming a mandatory requirement for all connected products. It is now all about adding “defensive layers”: having multiple password levels that can be changed, offering secure data transmission using https, being able to upload SSL certificates, providing

firewall and white listing functionalities, etc. These are some of the features to look out for when evaluating the cybersecurity credentials. The firmware should also allow remote uploading of any security patches whenever a weakness is discovered, all this without having to go to site.

In America, there is a recent trend at some utilities for prohibiting contractors' laptops inside their substation. This makes it difficult to either install or repair a unit if it does not have a built-in LCD display or internet web browser interface that can be accessed through a utility's standard laptop / internet browser. This trend is likely to accelerate.

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Evolution

Transformers are designed to last a long time. Monitors should also be a long-term investment with the ability to be supported, upgraded and kept relevant.

New functionalities and improvements will happen over the life of the product and are most likely to be firmware related, rather than hardware based – whether it is to meet a new standard, update the communication protocol, deliver new data analysis or simply improve the basic performance of the system. A DGA monitor will soon be like a PC or a phone and need to have remote upgrade capability to be kept up to date.

Making sure that the monitors do not cause more maintenance issues than the transformers themselves has long been a customer request.

Standards compliance (Electrical Safety, Environmental Resistance, EMC interference) is also an issue. Safety standards change and test certificates obtained 10 years ago may no longer guarantee that the machine would pass the current version of the compliance tests. To maintain appropriate compliance, one should insist on fairly recent test (or re-test) reports as well as reports from an independent third-party testing house.

It is important to select a supplier for the long run, that has capabilities in terms of R&D, that believes in “Kaizen” continuous quality improvement and that will constantly invest in improving the product, so that it remains state of the art.



Reliability

With some utilities having hundreds (and even thousands) of DGA monitors deployed, making sure that the monitors do not cause more maintenance issues than the transformers themselves has long been a customer request. As new technology was rolled out, it performed, but often proved not to be very robust in the long term. Failures and need for repairs accumulated, and this, I believe, has led to a slower adoption rate of DGA monitoring in some countries. But time has moved on and vendors have worked hard to improve both their quality and reliability. Manufacturer's warranty periods are getting longer, although it is important to ensure that they are backed-up by field experience and/or long-term reliability testing.

It is a bit like buying a stock market fund: you need to look at the fund manager's reputation, how long he has been managing that fund and what his long-term track record shows. Newer funds might show a better short-term return but, with only a very short history, they have an unknown ability to weather stock market storms. The same type of analysis should be applied when evaluating DGA vendors, also taking into account their ability to provide rapid local service and support in your country.

Conclusion

There are many factors to consider when selecting a DGA transformer monitor: the monitor with its features and performance; the underlying technology used as well as the long-term reliability; the software environment available and the reputation of the manufacturer to continually enhance the product over time.

With "asset optimisation" being the current buzz word in the industry, it boils down to the ability for the monitor to reliably and consistently deliver data that can easily be processed into actionable intelligence. This is how users will make best use of their monitor to reduce risk, extend asset life and save both time and money.



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