

NEWSLETTER

Asia • North America • South America • Middle East • Australasia • Africa • Europe

Issue 3, Year 2008

New Products

MYRKOS *Portable DGA MicroGC*

New Myrkos measures O₂ and N₂

Morgan Schaffer introduced this month an improved version of its MYRKOS Portable DGA MicroGC that measures both air components in addition to the seven most important fault gases.

Dissolved oxygen (O₂) and nitrogen (N₂) may be found in transformer oil as a result of contact with atmospheric air in the conservator of air-breathing equipment or through leaks in sealed equipment. It is a good practice to monitor the O₂/N₂ ratio to detect an unusual consumption of oxygen that could be due to accelerated oxidation or paper ageing. For in-service equipment, the O₂/N₂ ratio will typically be close to 0,5. Values below 0,3 may be indicative of excessive O₂ consumption and should prompt further investigation.

The MYRKOS solution comes complete with all the accessories necessary to perform on-site DGA. Now with the measurement of 9 dissolved gases, detection levels of 1 ppm for all hydrocarbon gases and full compliance to the ASTM D3612 and IEC 60567 standards, MYRKOS is the most precise, accurate and complete solution available on the market for on-site DGA.



Foreword



Thanks to Morgan Schaffer's continuous innovation efforts, we are proud to introduce an improved version of our MYRKOS analyzer that can now measure BOTH air components (oxygen and nitrogen) in addition to the seven dissolved fault gases.

This capability, combined with our unique MicroGC technology and Shake Test gas extraction method makes MYRKOS the fastest, most precise, most accurate and now most complete solution available today for on-site DGA testing.

Portable DGA analyzers are becoming increasingly popular, especially to rapidly confirm alarms triggered by on-line monitors or Buchholz relays. In such cases, being able to make a rapid, but more importantly, sound diagnosis, may save thousands of dollars in production losses.

MYRKOS' precision and accuracy is a critical functionality and, as such, MYRKOS on-site DGA results can be directly compared with on-line monitor and laboratory measurements.

This newsletter includes the second of a series of articles on Calisto monitoring. The article focuses on dissolved moisture measurements and how they can bring value to your monitoring program. We are also just coming back from Europe where we attended the CIGRE conference. This was Morgan Schaffer's first appearance at this biannual event and we will definitely be at the next conference given the enthusiasm we generated with the introduction of our Calisto 2 monitor.

I hope you enjoy reading our Newsletter and invite you to give me feedback at rberube@morganschaffer.com.

Sincerely,


Richard Bérubé - President

Assessing Transformer condition - How can moisture-in-oil help?

In a previous article, we demonstrated that fault stability can be assessed effectively using highly precise and accurate dissolved hydrogen measurements. Valuable additional information on a transformer's condition can also be obtained if dissolved moisture is being monitored. Let's see how.

Water ingress from the environment is known to be one of the most significant sources of dissolved moisture in transformer oil. On-line monitoring of dissolved moisture can therefore alert transformer owners to the need of corrective measures, before water ingress reaches problematic levels. However, on-line moisture monitoring offers additional value. As load on a transformer increases, moisture contained in the transformer cellulose will desorb from the paper and dissolve into the oil. This desorbing process will increase the dissolved moisture-in-oil content, which under varying temperatures, may translate in %RS variations. Figure 1 shows moisture-in-oil (top) and dissolved hydrogen (bottom) versus time, for the same transformer located in Arizona, USA. As weather gets warmer, additional load is demanded from this transformer which translates in increasing dissolved moisture content in the oil.

The graph clearly shows daily and weekly trends, but also outlines an important fact: dissolved hydrogen does not vary with load!

This characteristic of dissolved hydrogen makes it again very attractive for condition monitoring and assessment. Moreover, by comparing dissolved moisture-in-oil and dissolved hydrogen contents, one is in a position to better assess if a fault condition is evolving.

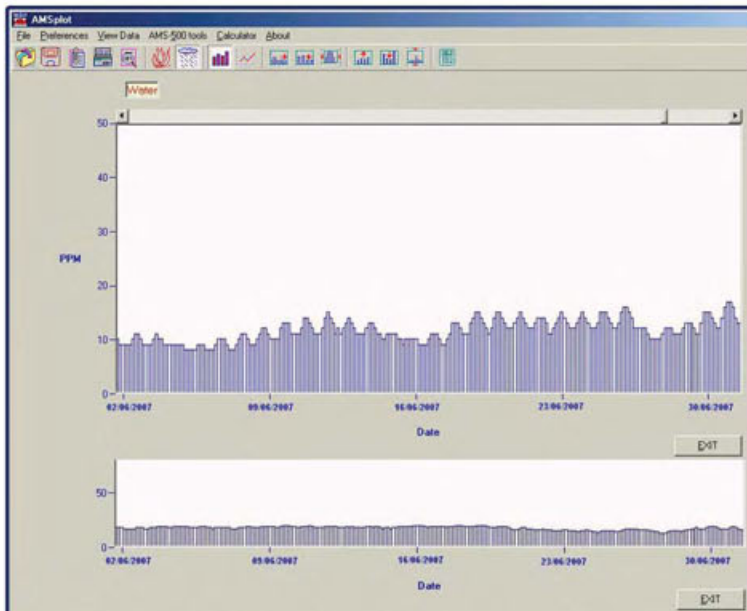


Figure 1. - Dissolved water and hydrogen - One-month period

Figure 2 shows a case of fault onset and condition evolution under varying loads. In the early days of this situation, dissolved hydrogen increased as load significantly varied. However, as of August 10th, the fault kept evolving despite a relatively constant load. Fortunately, the transformer owner recognized this condition evolution and was able to timely take this transformer out of service.

Figures 3 and 4 show the burn marks that were found on one of the in-tank LTC components. In this case, it is also critical to observe that the entire situation occurred at hydrogen concentrations well below 100 ppm. The ability of a monitor to precisely and accurately measure dissolved hydrogen and dissolved moisture at low concentrations is therefore a key feature if effective fault detection and condition monitoring is to be obtained.

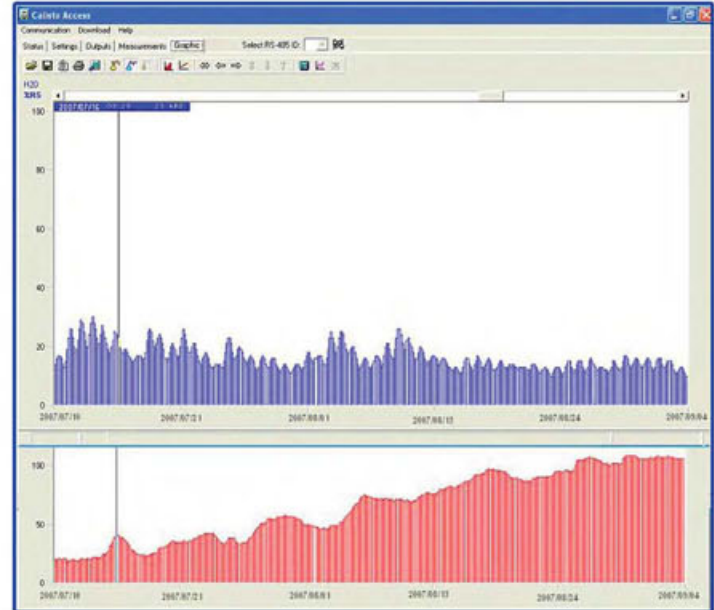


Figure 2. - Fault onset and evolution under varying and constant loads

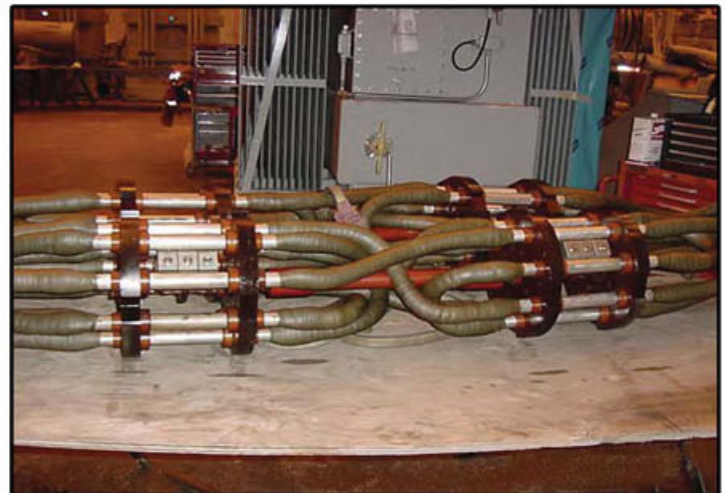


Figure 3. - In-tank LTC component



Figure 4. - Burn mark on in-tank LTC component

Assessing Transformer condition (cont'd)

Monitoring moisture-in-oil, what, where and how

When monitoring moisture-in-oil, what measurement should be made: ppm, %RS, or %RS at constant temperature? Once the right parameter has been chosen, where on the transformer should the measurement be made, and how? These questions are critical since an action plan (or alarm response protocol) will have to be followed when a moisture-in-oil alarm triggers.

Monitoring transformer condition has to do first with understanding the meaning of a signal and signal change. Actions can then be undertaken if the signal reaches threshold values indicative of a potentially damaging or dangerous condition. In terms of moisture-in-oil measurements, the industry has recognized that %RS is an important parameter to monitor as oil dielectric properties may be significantly affected by high %RS in the presence of contaminants. However, this signal is more complex to interpret, especially as oil temperature varies.

Monitoring dissolved moisture-in-oil in ppm

In the absence of on-line %RS measurements, utilities have historically used moisture-in-oil laboratory measurements (in ppm) to basically make a rough evaluation of the average water content in their transformer oil and cellulose. With this value in mind and oil quality test results, asset managers were able to qualitatively assess their risk level based on the minimum and maximum operating temperatures of their transformers.

This approach can still be used using a Calisto on-line monitor. The advantage of monitoring dissolved moisture content in ppm is that on-line measurements can directly be compared to laboratory measurements. As shown in Figure 1 above, the signal is also very easy to understand and will vary proportionally to the load. In order to provide highly accurate moisture readings in ppm, Morgan Schaffer's Calisto instruments use experimentally determined moisture solubility functions for commonly used dielectric fluids.

Monitoring %RS at constant temperature

Calisto can report %RS at a standard temperature of 25°C. For each type of oil, these readings are proportional to the moisture-in-oil ppm readings, related by the solubility of the moisture in the oil at 25°C. Changes in %RS@25°C can therefore serve the same role as ppm for transformer condition assessment. Since different oils have different capacity to retain water, the %RS@25°C readings allow easy comparison of relative saturation in different transformers running with different oil types.

Monitoring %RS – specific location, varying temperatures

Many transformer experts prefer to monitor the %RS at a temperature of importance for the transformer. For example, a transformer in Saudi Arabia could have high ppm levels of water, but have a comfortably low %RS@T given its high average operating temperature. To take another extreme, in cold conditions of operation or shutdown, the %RS at the coldest temperature determines the tendency for water to condense from the oil.

Sometimes the focus is rather on the %RS a specific critical location on the transformer. The rate of degradation of paper insulation is widely believed to correlate with the moisture level in the paper. For example, the %RS in the oil, evaluated at the temperature of the paper, is our best estimate of the working %RS in the paper.

To facilitate accurate %RS@T measurements, Morgan Schaffer offers a high precision oil temperature sensor that can be installed on a drain valve, in the incoming oil supply to the Calisto monitor. The sensor output is then fed to Calisto which continuously calculates the %RS at the sensor temperature. Figures 5 and 6 provide a view of the sensor and show how the signal is handled in the Calisto monitor.

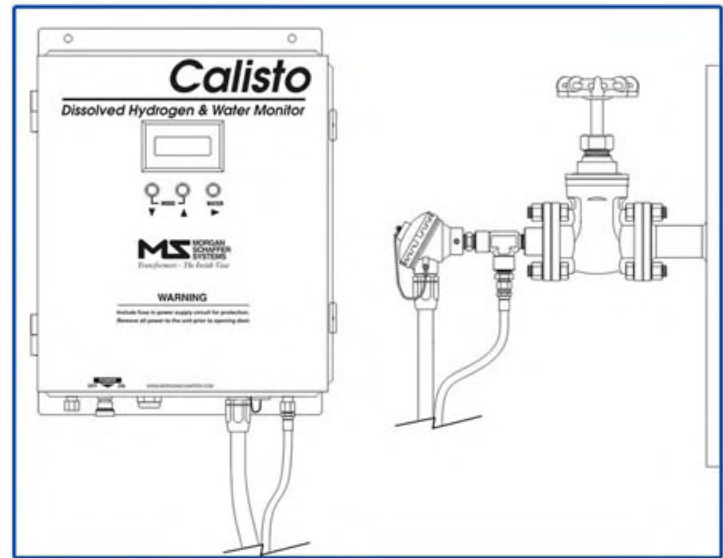


Figure 5. - Calisto temperature probe assembly

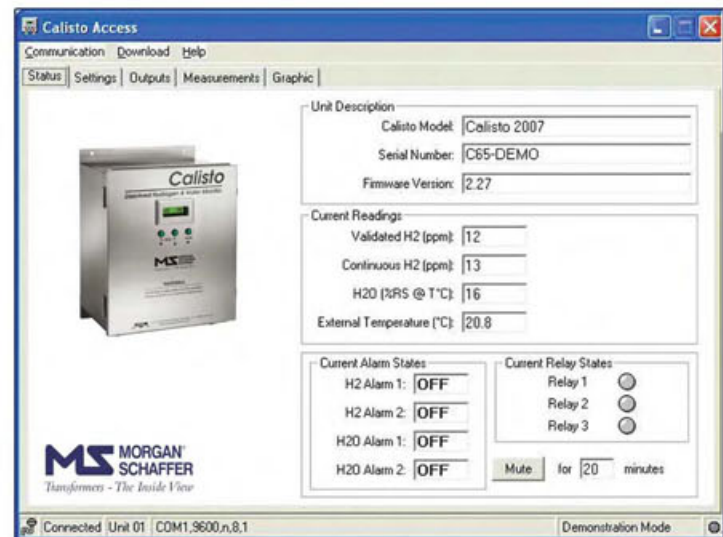


Figure 6. - Calisto reading status including H2O and external temperature

Conclusion

On-line monitoring of dissolved moisture can be performed in several different ways. In order to make sound diagnoses, transformer maintenance engineers must understand the meaning of the measurement being made and the relationship between this measurement and other critical parameters. The combination of dissolved hydrogen and dissolved moisture signals offer a simple yet powerful mean of detecting a changing condition at its earliest stage, and determining if this condition is load dependent.

In future articles, we will look at the different methods used to assess the nature and severity of transformer faults. We will also see how these methods can be used in conjunction with on-line and on-site instruments to maximize the protection of large oil-filled assets.

New Products

MORGAN SCHAFFER INTRODUCES TRUE NORTH LONG LIFE

A global resource for commercially available oil standards, Morgan Schaffer offers quality control tools that greatly facilitate validation of laboratory equipment and analytical processes.

Morgan Schaffer has just completed the development of TRUE NORTH LONG LIFE, a series of dissolved gas-in-oil standards with longer shelf life.

Key features of TRUE NORTH LONG LIFE are:

- *GUARANTEED shelf life of up to 60 days from shipping date;*
- *Signed certificate of concentration included with each individual sample guarantees accuracy and traceability;*
- *Available in various concentrations and gas profiles.*

Morgan Schaffer's ISO 17025 certified laboratory is a leading provider of oil standards and analytical services to the worldwide electrical industry.



EVENTS

CIGRE 2008

Morgan Schaffer's team recently attended CIGRE Technical Exhibition 2008 held at the Palais des Congrès in Paris.

The audience agreed with us on the enhanced benefits of our recently launched, CE marked CALISTO 2. Our MYRKOS Portable DGA MicroGC, the only portable analyzer on the market capable of measuring oxygen and nitrogen in addition to the seven fault gases, was also the center of attraction.

We thank all who dropped by and we look forward to seeing you in 2010. In the meantime, you can get more information on our products by visiting www.morganschaffer.com or through our authorized agents network.



SEMINARS ON TRANSFORMER PROTECTION

Morgan Schaffer frequently teams up with its agents to hold seminars on transformer monitoring. Last August, our Director of Sales and Marketing, visited Kuala Lumpur, Malaysia and Lima, Peru where he presented Morgan Schaffer's approach to transformer condition monitoring.

The presentation addressed the importance of using highly performing, cost effective and reliable measurement technologies like Morgan Schaffer's CALISTO and MYRKOS instruments in order to prevent equipment failure or unscheduled outages.

The response from the audience was phenomenal and generated a number of follow-up actions currently being handled by our technical team.

We thank all attendees and we look forward to seeing you again!

Feedback is welcome

If you are interested in a specific product, need a quotation or have any other feedback, we'd love to hear from you! E-mail us at sales@morganschaffer.com