DriveMonitor

Embedded product intelligence that enhances lifecycle management and performance in drive systems

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Good products offer more when they are combined with comprehensive support and maintenance packages. Optimal performance and minimal costs can be achieved through service agreements over the lifecycle of a product, but effective lifecycle management requires continuous tracking of asset history – operation, wear, damage, and maintenance. Careful monitoring of the condition and performance of assets allows the implementation of predictive maintenance programs that significantly reduce maintenance costs and the risk of failure. Without this information, performance suffers and maintenance costs rise.

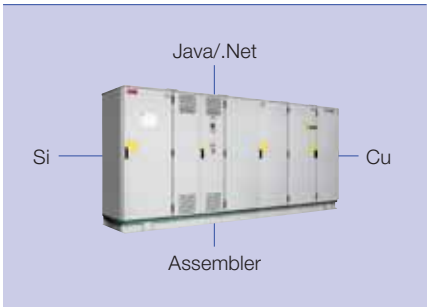
ABB Medium Voltage (MV) Drives, in cooperation wih ABB Corporate Research, has developed a new customer support system – The DriveMonitor™ – a software package that allows an operator to monitor the performance of an MV drive system, collect data and store the drive's history, all from a remote computer. The system is being tested in the Gotthard base tunnel construction site in Switzerland and offers a significant improvement in lifecycle management tools.

Real plant systems comprise a wide variety of assets. Some are straightforward, simplistic even, while others are "intelligent" and capable of self-diagnosis or even self-correction. Large and critical assets often come with their own supervisory control systems, but all of the assets in a process chain are information providers – either directly, via built-in sensors, or indirectly, by reporting on other assets in the chain. All of these assets need careful monitoring.

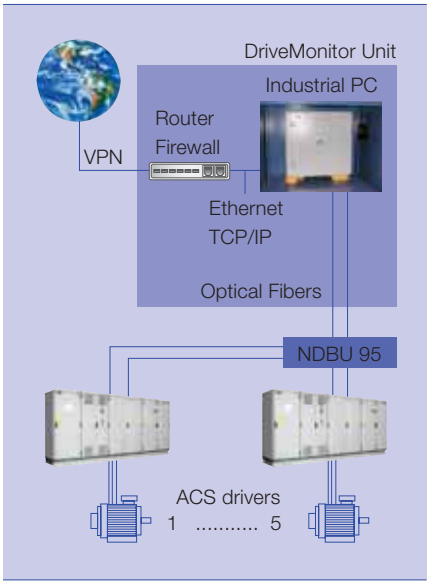
Cost-effective data collection and processing

An efficient lifecycle management system requires scalable tools that can be adapted to the nature of an asset, its value, status, and general maintenance policy. The first aspect to be considered is the comprehensiveness of the system, whether it be a single asset (eg, a drive), or a whole production line, which contains many assets.

1 MV drive – an asset with a broad technology span and a rich information source



2 The DriveMonitor™ design principles



The second aspect is the availability of data: From "what's already there" to dedicated measuring systems that detect vibrations, current, corrosion etc. The third aspect relates to increasing levels of knowledge content and diagnostic functions: At one extreme is a simple limit threshold, at the other are advanced lifetime prediction algorithms.

In order to keep tool costs down, maintenance systems should be flexible and able to accommodate a wide range of asset types. Similar assets should be treated similarly, but with individual attention dependent on their context in the system. For example, two electric motors might be identical, but if one is running a ventilation fan of low importance and the other a critical fume-exhaust fan, their maintenance programs would be similar, but the level of investment in each would differ according to their importance.

A scalable system is not the same thing as a combination of different approaches that address different aspects of lifecycle management. To be efficient, a tool must guarantee full data interoperability, single data entry points, and unified interfacing, usage and reporting. Multiple systems can be combined in an IT integration project, but only a scalable tool can provide true maintenance optimization.

In short, individual assets must be assessed to determine the level of investment that can be justified by their individual roles in a process.

A good condition assessment system is:

- expandable, to accommodate single or multiple asset objects
- able to apply rules of varying complexity to the assets – vibration-based, temperature-based, electrical test-based, operation data-based, statistics- and history-based etc.
- able to acquire data from various sources, eg, drive systems, control systems, vibration measuring tools, manual entries, and the asset itself.

ABB used this methodology in the development of its Asset Optimization/Asset Monitors concepts and DriveMonitor™ is a part of this truly scalable solution 1.

ABB Drives – assets as "knowledge containers".

ABB MV Drives focuses attention on product design and development, but also on configuration and optimization in relation to customer applications. A quick look "under the hood" of a drive unit will immediately show that the technological complexity of this "torque delivery plant" ranges from copper bars to electronic circuit boards. Its software ranges from

3 DriveMonitor™ – Analyzing the system's heartbeat

assembler code to the newest high-level languages. To obtain the highest possible performance from such a device over its entire lifetime requires some attention. However, drive units – such as the MV Drive from ABB – are represented by huge banks of data. This recorded information relates not only to the drive converter performance, but also to the driven equipment, and even to the whole downstream production process. Efficient use of these drive data is the first step towards lifecycle management – initially for the converter itself and ultimately for the whole drive-powered process.

An efficient lifecycle management system requires scalable tools that can be adapted to the nature of an asset, its value, status, and general maintenance policy.

Efficient lifecycle management

A pragmatic approach to lifecycle management issues should answer the following questions:

- What should be done to the asset in order to maintain the highest performance and the lowest costs
- When should this action be taken?

Ideally the asset should be intelligent enough to provide this information to the operator. Alternatively, the intelligence can be embedded as an asset extension – intelligence that fully utilizes the data processed in the drive.

The DriveMonitor™ system is designed to meet these requirements. On the one hand it provides continuous monitoring and analysis of the drive state and operation, supports root-cause analysis (RCA) and helps to follow predictive maintenance paths. On the other, it provides a platform upon which to offer the customer unique extension features that, by utilizing drive signals, allow the operator to visualize the whole shaft state, along with application-related KPI's, etc. In addition, customers can rely on the ABB Support Line[1)] with access to experts who can remotely monitor current situations.

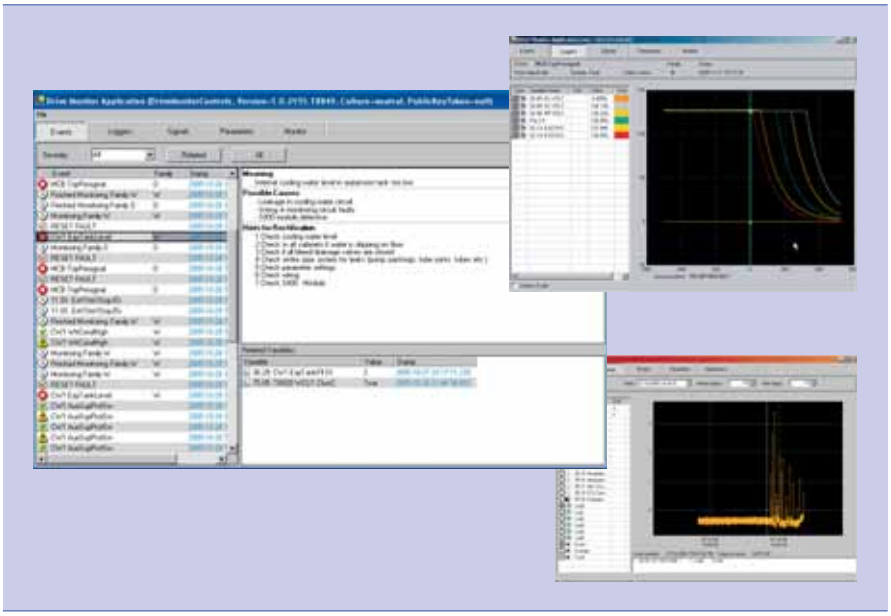
Intelligent, scaleable and secure

The system comprises a hardware and a software layer 2. The hardware layer is a properly interfaced industrial PC that is factory installed with the most powerful new ABB MV Drives (it is also available as an upgrade to existing models). The software layer automatically collects and analyses selected drive signals and parameters. The hardware is based on an industrial PC platform to provide the expected longevity and remote accessibility. Virtual Private Network (VPN) solutions are used for remote access to ensure high security.

Scalability – the biggest challenge

The software layer is extremely flexible with respect to the configuration of diagnostic rules, the range of the assets with which it can be used, its alarm and reporting functions, and its data intake sources. Being compatible with ABB's Asset Monitor family, DriveMonitor™ opens the door to the whole ABB Asset Management portfolio, with Asset Optimizer and other Asset Monitors as optional extensions. It can be integrated easily into automation systems using the ABB 800xA platform (other systems can be connected through OPC[2)] Servers). The monitor is designed for use with a single drive, and with large systems. There are possibilities for expansion to include other measurements such as corrosion, vibrations, additional temperature sensors, etc. It provides millisecond-based sampling rates with year-based scheduling, event-driven actions and alarms, and more. The various components of the system can be distributed to different computers. For instance, several monitoring units can be configured in parallel to cover larger installations and the results can be brought to a central control room PC for operator convenience.

4 Extended support information facilitating root-cause analysis



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Scalability – hardware dimension.

MV drive configuration can cover a broad range of products. Depending on the application, several rectifier and inverter units, each suitable for monitoring purposes, can be included in the set up. In order to acquire data

Footnotes

1) ABB Suport Line is one of the service products offered by MV Drives

2) OPC-OLE for Process Control

quickly and reliably, multiple monitoring units can be configured around a single unit that acts as the access point for all the data acquisition. The central computer can again be placed in a control room. Similar system solutions can be configured for multi-drive units.

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Application area

The basic function of the DriveMonitor™ is to "watch" the converter part of a drive shaft system 3. It continuously monitors the drive status and responds when that status changes. Changes in drive status can be caused by drive faults (unexpected drive stoppages), alarms (signals crossing threshold values), user-defined parameter changes, and higher level, DriveMonitor™-generated application-specific alarms. In this basic mode, when an event occurs, the software saves the current state and commences in-depth monitoring of relevant drive subsystems 4. These data are critical to determining the root cause of an event. Without such a tool, by the time a service engineer arrives on site, this information is lost, and some tell-tale events (such as threshold alarms) may be ignored if they did not lead directly to a fault. Altogether, the insight gained from the monitor's data will lead to quicker elimination of faults and quicker identification of failing components, which result in more up-time for the customer.

With extra diagnostic packages, DriveMonitor™ can follow other shaft-train components such as the main circuit breaker, the transformer, and the driven machine. At the highest level, specialist packages directly related to specific application areas (such as rolling mills, water pumps, and compressors) can be integrated into the system. This kind of expansion can be done at any point in time depending on the customer's needs. It is also possible to incorporate extra measurements that go beyond the drive signals. In such cases, the DriveMonitor™ system, which can already incorporate data from several sources, can accommodate a number of off-the-shelf solutions. DriveMonitor™-based diagnostic routines are valuable extensions to any plant-level Asset Management program like ABB Asset Optimization solution.

5 DriveMonitor™ connects experts to most remote locations, here the Gotthard Tunnel construction site in Switzerland

Integrated in the bigger picture

ABB's Product Support organization ensures the efficient deployment of lifecycle management policies to drive products. Diagnostic tools such as DriveMonitor™ play a central role in the support system, but are part of an integrated approach to customer care that performs core maintenance functions, problem solving, spare part delivery and performance optimization.

DriveMonitor™ continuously monitors the drive status and responds when that status changes.

Concluding remarks

Due to their complex role in industrial processes, drives generate and have access to large quantities of data. Though normally used to support a drive's controlling function, these data can also be used for diagnostic purposes. No additional measures are necessary as the data are already available. ABB's drive monitoring solution exploits this opportunity to the benefits of its customers. The system is already being piloted at several industrial locations, including the Gotthard Tunnel construction site 5, where a powerful ABB hoist machine has been installed, powered with a ACS6000 drive unit. The hoist machine is critical for the progress of the tunnel since it removes the spoils from the tunnel level up to the surface through an 800-m long shaft. DriveMonitor™ helps to optimize the machine's performance and maintenance processes.

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