



White Paper

**Predictive Maintenance
Solutions in the
Chemical Industry**



Predictive Maintenance Solutions in the Chemical Industry

Today, predictive maintenance is becoming more and more important, especially in complex processes and in large facilities. The fact that predictive maintenance helps maintenance personnel make complex decisions reduces unplanned downtime, and improves chemical plant efficiency is one of the key advantages of this technology.

Fact

There are approximately 13,500 chemical production facilities in operation in the United States today. Source: Environmental Protection Agency

Big data, machine-to-machine communication (M2M), and the Internet of Things (IoT) are just some of the most important components of the fourth industrial revolution. Although the chemical industry has taken remarkable steps in digitalization in the last few years, there is still a long way to go.



So how can the chemical industry be successful in the transition to 4.0?

The first step in this process may be the application of predictive maintenance models to the production cycle of a chemical production facility. This document handles the innovative predictive maintenance solutions offered by Artesis for chemical plants.

Challenges to Predictive Maintenance in the Chemical Industry

The manufacturing processes used in the chemical industry consist of corrosive or toxic chemicals generally reactive, operating at high pressures and temperatures. When critical production assets fail, interruption of these processes can cause serious production and raw material loss, as well as environmental damage and even injury and work accidents.

Fact

Studies show that 98% of organizations report that even one hour of downtime can cost more than \$100,000 in terms of financial costs. Source: Plant Maintenance Engineering

Data Security and Company Confidentiality

While the chemical industry is a highly competitive market, it is a field where inventions and research are made confidentially and processes are specific to the production of each company. The bill of materials is critical for companies and should be meticulously protected for the sustainability of the company. For this reason, an integrated predictive maintenance solution or cloud based IoT technologies urge facility managers, especially IT experts, to scrutinize new technologies before accepting and integrating them into the plant's network.



Quick Action Requirement

Time is critical for chemical plant operations. Due to the uniqueness of the processes and equipment in the plant, it is necessary to take action months in advance on many issues, especially spare parts. Even though the traditional predictive maintenance methods warn for equipment replacement 1-2 months in advance, there might not be enough time for procurement.

Difficulties in Accessing the Accurate Data

Thanks to machine learning and IoT applications, sensors have generalized rapidly in industrial facilities recently. However, the data from the sensor in the chemical plants are generally focused on process control and do not provide



data regarding asset health. Therefore, even if there are thousands of sensors in the plant, it will be difficult to reach accurate data for predictive maintenance. Therefore, innovative sensorless predictive maintenance technologies will come to the fore.

How do predictive maintenance practices in chemical Plants help you?

An effective predictive maintenance method provides months in advance notice of equipment breakdowns, allowing intervention before the fault worsens. This primarily prevents unplanned downtimes and improves spare parts and stock management.



Fact

By some estimates, the chemical industry loses about \$20 billion a year due to departmental or complete plant downtimes. These costs can manifest in a variety of ways whose effects are not immediately apparent or measurable. Source: WSJ

Predictive maintenance improves production processes and prevents production losses. The decrease in the waste products in plants where raw material use is intense, such as in the chemical sector, contributes significantly to the profitability of the

company. Another potential impact of predictive maintenance is on the quality of the product produced. Interrupting and restarting your production process can lead to the output quality not being up to the required standard.

Chemical plants are the leading ones among the most challenging and dangerous industries. Preventing equipment breakdowns will increase occupational and worker health and contribute significantly to reducing possible work accidents.

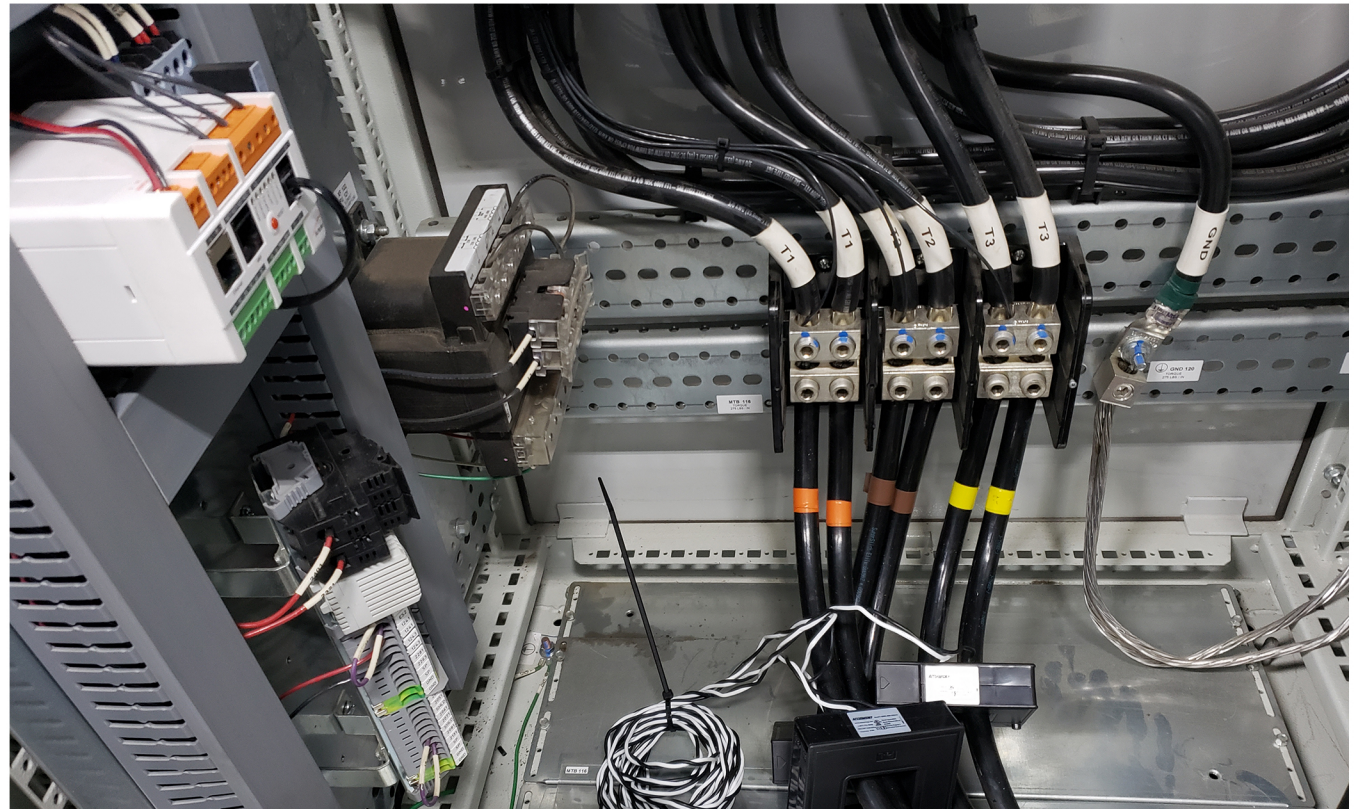
Fact

There are more than 86,000 types of chemicals in chemical plants in the USA that can cause serious harm to the environment and human health. Source: Environmental Protection Agency

Predictive maintenance also facilitates the increase in General Equipment Efficiency (OEE), an important measure of operational efficiency. If assets are maintained regularly, once a malfunction is detected, healthy assets can continue to operate until they need to be replaced. This will reduce your operational expenses.

How Does Artesis Help You?

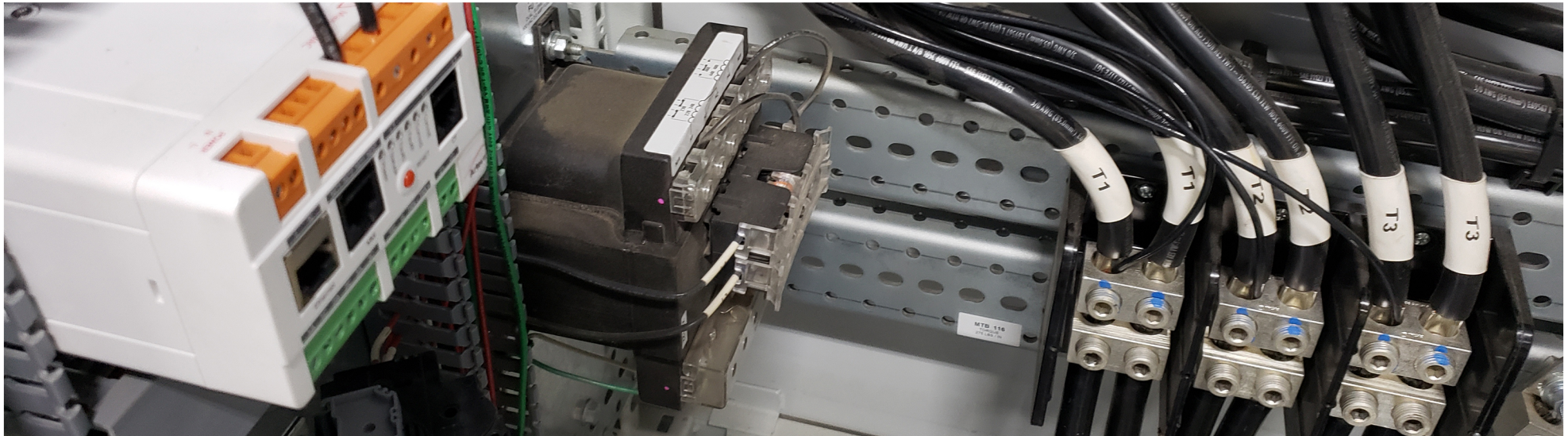
With Artesis sensorless predictive maintenance solutions, it monitors reactors, pumps, fans, compressors, and much more in chemical plants, preventing unexpected faults, reducing your maintenance costs, saving energy, and maximizing plant reliability.



Intelligent Solutions Without Sensor Requirements

Artesis predictive maintenance solution only receives current and voltage information from the rotating equipment determines possible malfunctions up to 6 months in advance and warns the maintenance team. Since no sensor is required, **ATEX** can be used safely in areas.

As chemical plants are spread on a large area and there are many types of equipment that are difficult to access, traditional predictive maintenance methods may be dysfunctional. To reliably monitor pumps, fans, compressors, centrifuges, and other assets operating in difficult conditions, it is sufficient to install the Artesis e-MCM in the motor control cabinet. The e-MCM is also quick and simple to set up; there are none of the security or access restrictions that disturb placing on the asset.



Artesis accurately warns when rotating equipment needs attention, eliminating the need for "just in case" inspection and maintenance planning. Knowing months in advance that a failure will occur allows you to repair machines before they break down, reducing the need for asset redundancy. In addition, Artesis is effective in diagnosing both electrical and mechanical faults.

Electrical and Mechanical Failures

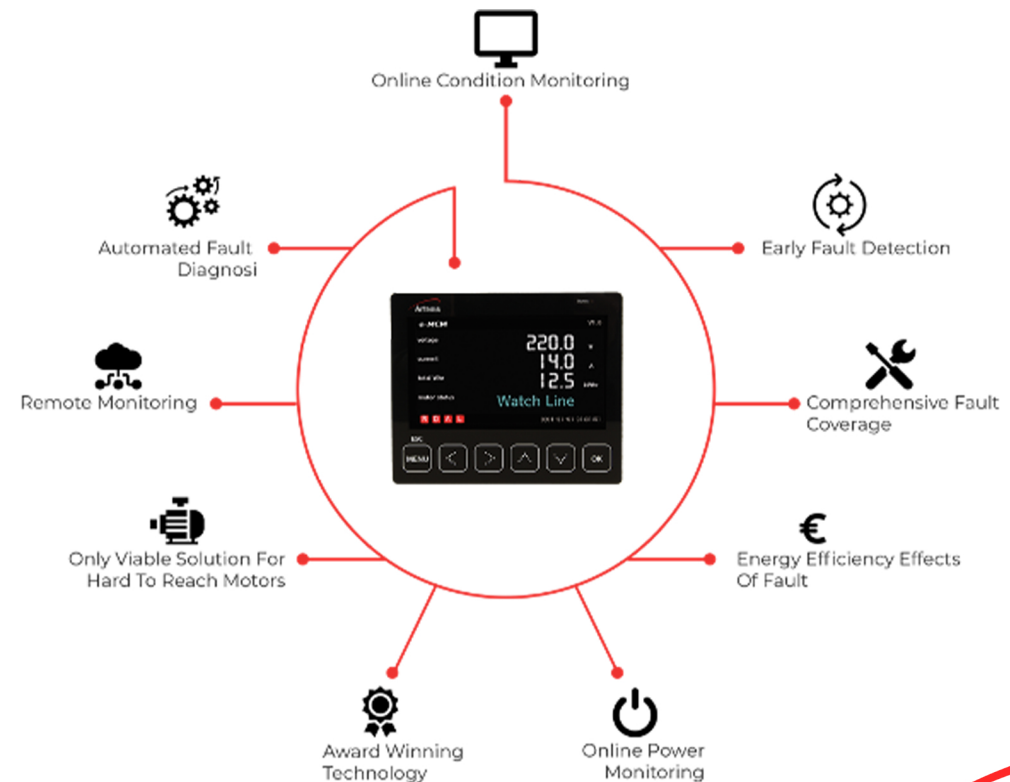
- Loose foundation / components
- Mechanical imbalance / misalignment
- Transmission faults
- Motor-driven equipment faults
- Gearbox, belt, coupling and bearing faults
- Stator and rotor faults
- Internal electrical faults
- External electrical faults

Process Failures

- Higher energy consumption
- Low productivity
- Cavitation in pumps
- Flow turbulence in fans, blowers
- Contamination in the filter and heat exchanger
- Lubrication
- Overload

Artesis Model-Based Fault Detection Technology

Artesis' uniquely patented Model-Based Fault Detection (MBFD) technology detects a wide range of faults using the voltage and current of Three Phase AC Electric Motors. This model-based approach works according to the principle that the current drawn by an electric motor is not only affected by the voltage applied, but also by the action of both the motor and the motor-driven equipment. It defines the distortion in the current waveform that should not be caused by the distortions in the voltage waveform and should therefore be caused by the action of the motor and the motor-driven equipment system. The frequency of these distortions indicates the qualification of the cause, and the magnitude of the distortions indicates the severity of the cause.

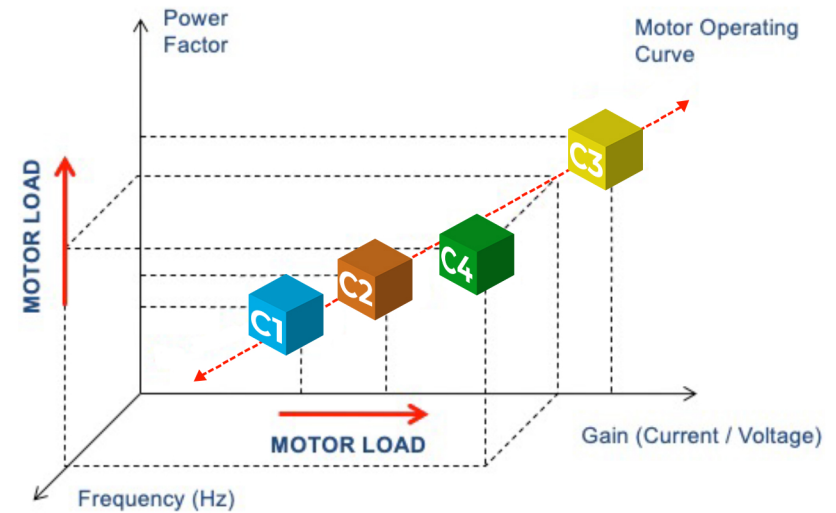


Fact

Artesis can use the motor as an effective sensor for the entire system without the need for additional special sensors.

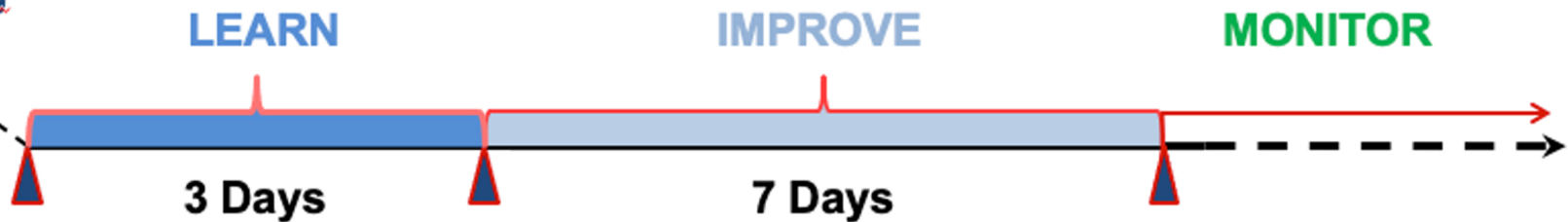
Artesis e-MCM Clustering Algorithm

During the learning period, the Artesis e-MCM treats each operating point of the motor as a cluster in three-dimensional space (power factor, gain, supply frequency). Each cluster has a separate model.



MCM needs to complete the learning process to create the mathematical model of the motor it is connected to. This period may take 7-10 days.

Installation & Commissioning



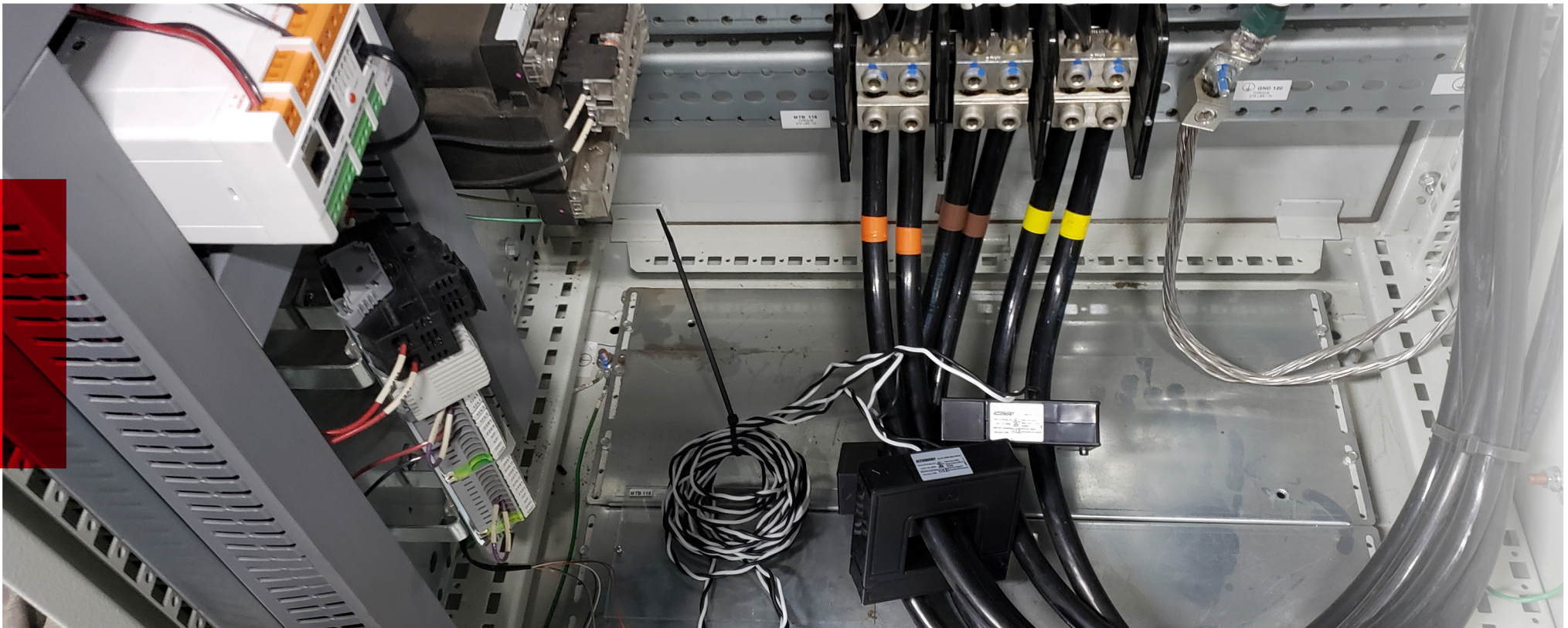
There are two stages of the learning period.

- Learning stage in which Artesis e-MCM classifies signals and does not perform any monitoring
- The stage in which Artesis e-MCM starts to monitor and also updates the mathematical model(created in the first stage) with new data

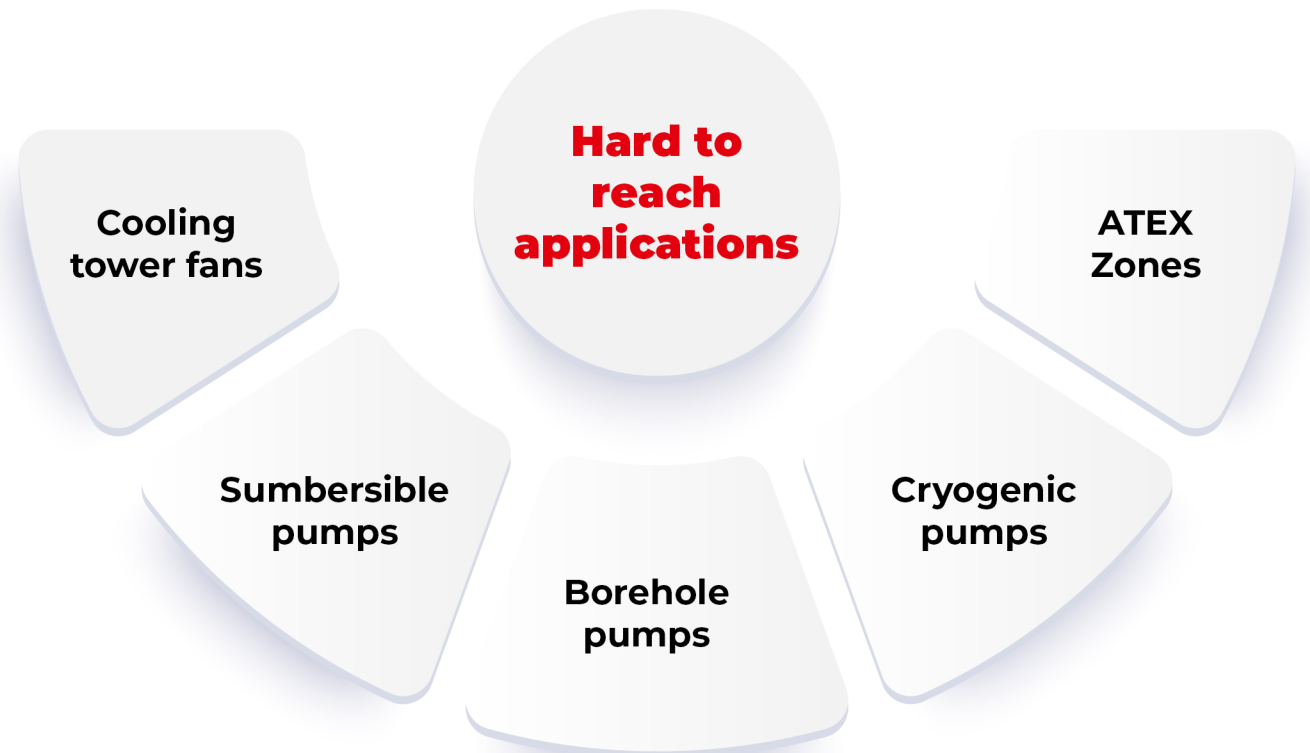
What Advantages Does Artesis Basically Provide in Chemical Plants?

Installation Advantage

In chemical plants that are ATEX zone, critical equipment to be monitored is far from production centers and difficult to access. Artesis is installed only in the control board without requiring any additional physical equipment. This significantly reduces your installation and cabling costs.



Make An Easy Stride Towards Digitalization



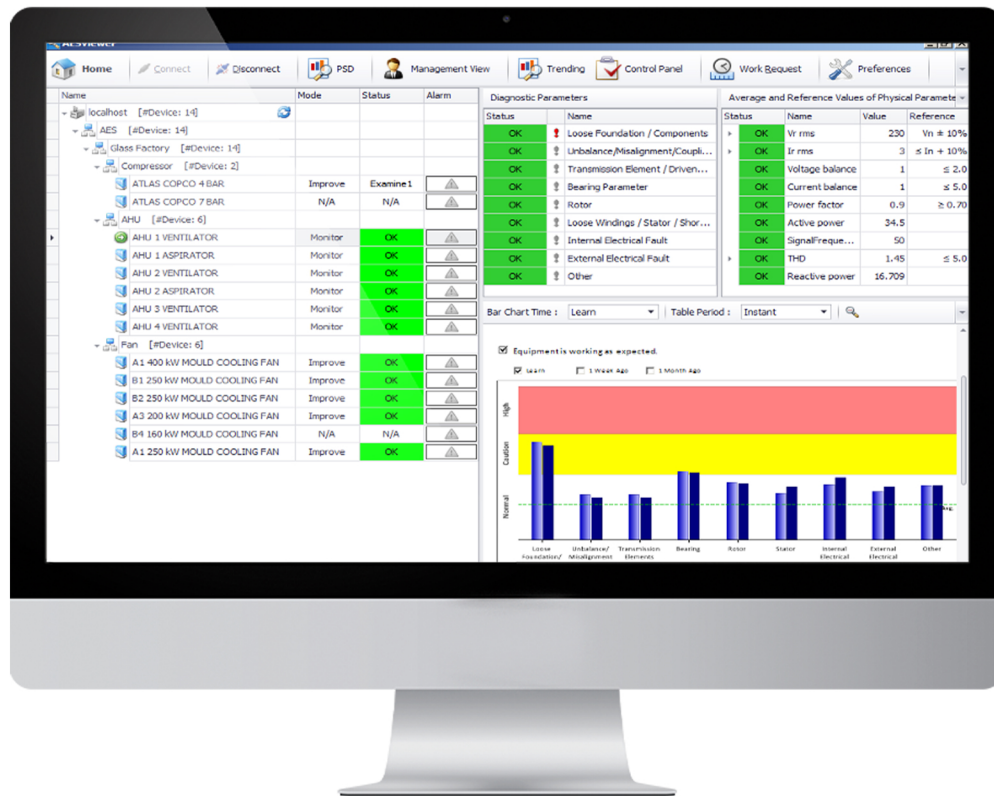
One of the most important reasons for production units to stay away from predictive maintenance is the difficulties they experience in application and use. Artesis provides quick and easy use, thanks to its unique technology, automatic fault detection feature. Instead of dealing with dense and complex data, maintenance personnel takes quick action only with actionable data.

After installing e-MCM systems in your chemical plant, Artesis IoT platform communicates easily with e-MCMs. You can establish a wireless connection by integrating a 4G / LTE router into your system that allows communication between e-MCMs Artesis IoT cloud platform. Integration packages can be used for a wide range of third-party systems, including integrated condition monitoring, SCADA / HMI, and reporting/business intelligence.



Real-Time Monitoring for Rotating Equipment

Artesis constantly monitors your rotating equipment and informs you in advance of problems such as cavitation, recirculation, and sealing that progress silently. Considering the problems experienced in the procurement of expensive equipment and spare parts for chemical plants, a real-time intervention will save your facility considerable time and costs.



Process Improvements and Energy Efficiency

Artesis offers power quality and energy analysis for each asset type without the need for additional sensors. With these features, we will provide you with insights to help you permanently reduce your energy consumption. In addition, our extensive fault detection capability will detect your process failures and make improvements.

Conclusion

In recent years, the chemical industry is undergoing rapid change and transformation in parallel with the rapidly increasing digitalization trend. Meeting a predictive maintenance solution for your facility will not only prevent unplanned downtimes but will also enable you to make a stride towards digitalization. If you want to meet our predictive maintenance solutions for the chemical industry, we are just a step away from you.

Artesis

Contact Us

If you have any queries related to condition monitoring for Chemical Industry please kindly contact us.

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