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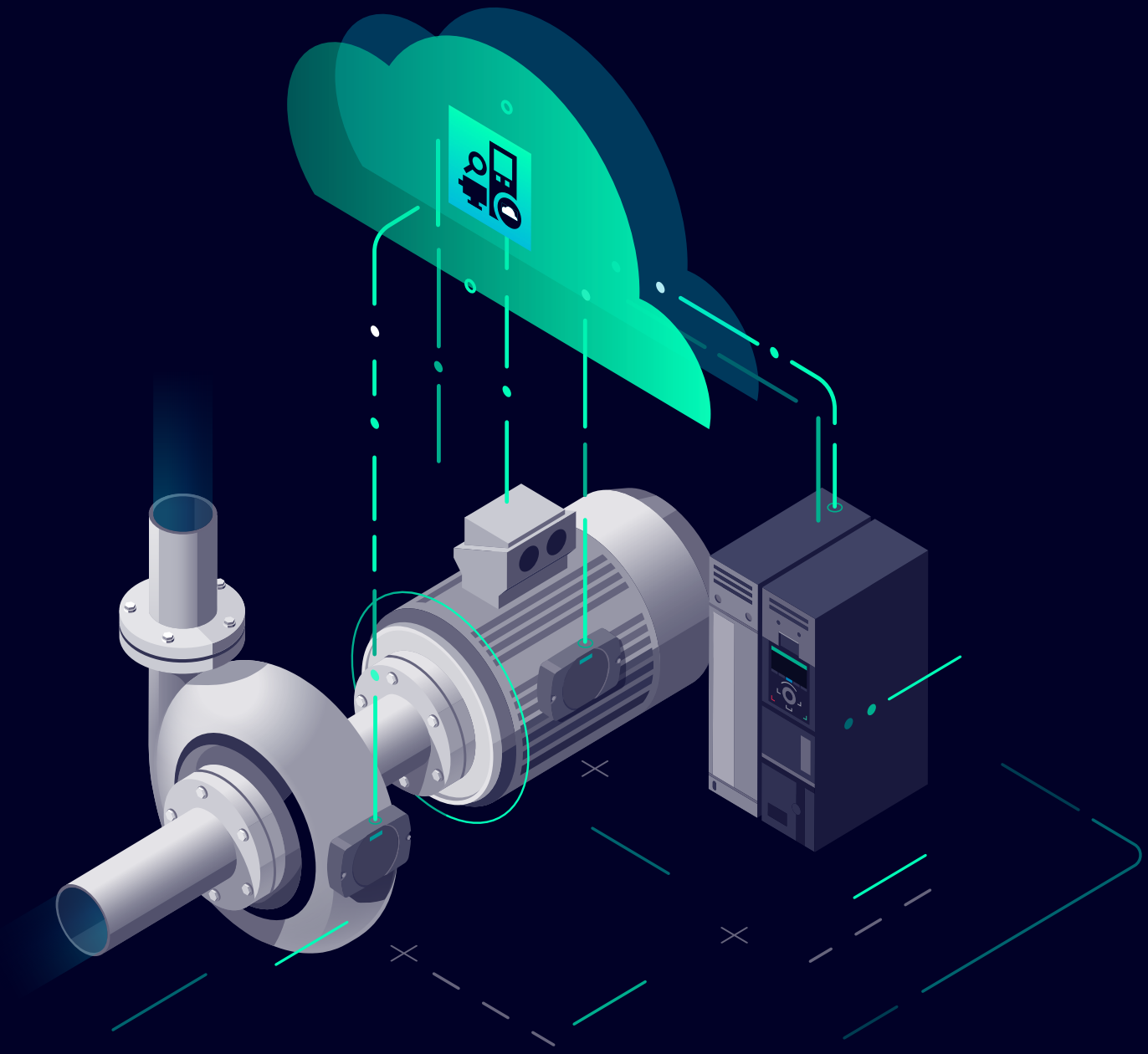


DRIVETRAIN ANALYZER CLOUD AND CONNECTION MODULE IOT

360° monitoring of your drivetrain

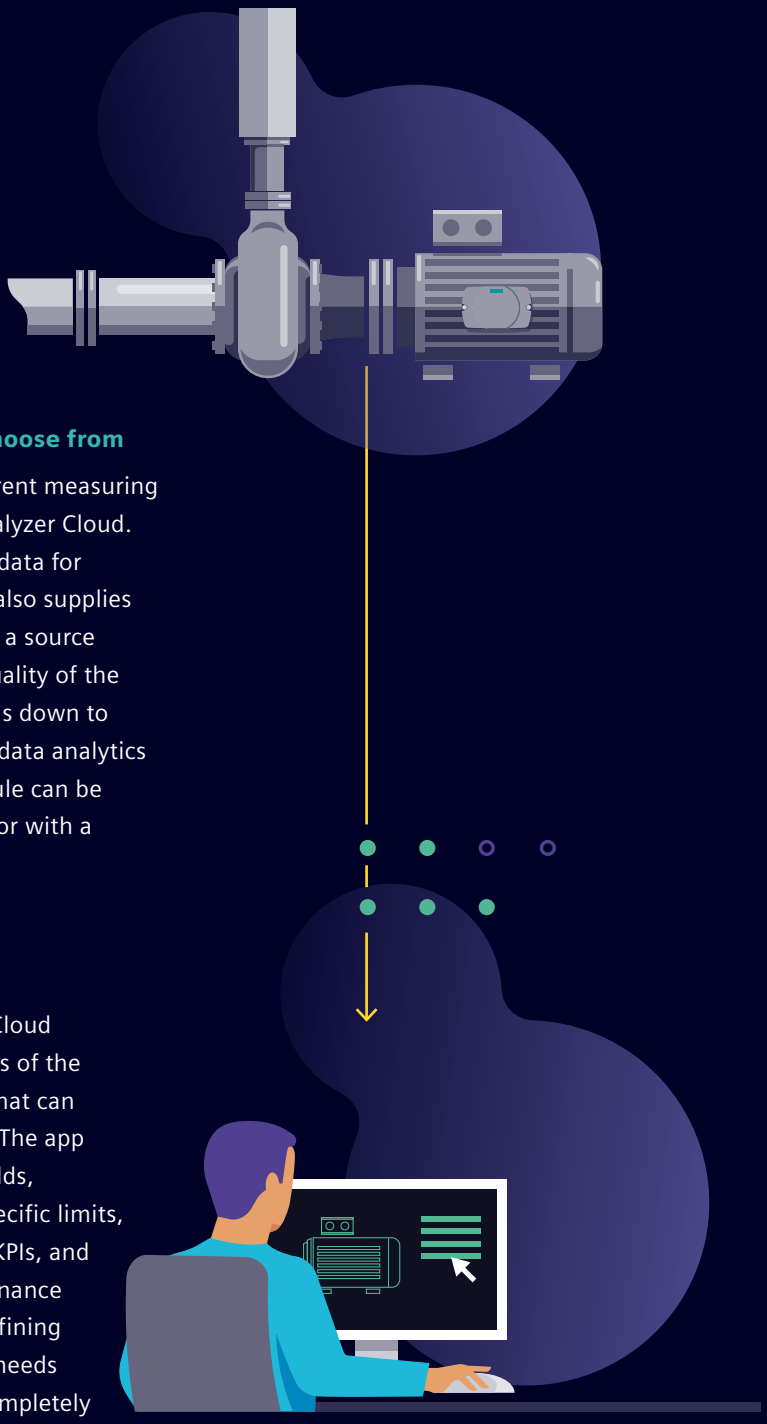
Using the Drivetrain Analyzer Cloud app and the plug-and-play Connection Module IOT, you can connect, analyze and optimize your drivetrain: Take a detailed look at the current health status of your entire drivetrain to detect anomalies before they cause trouble, or monitor your drivetrain's energy consumption and costs and get recommendations for improvement.

siemens.com/dta-cloud

Plug-and-play monitoring

Imagine to set up your entire monitoring system in the twinkling of an eye ...

The plug-and-play **Connection Module IOT** can be mounted and commissioned in just a few minutes. Its multiple sensors measure raw data and automatically transfers it to the cloud – without the need for additional expertise or own software development.

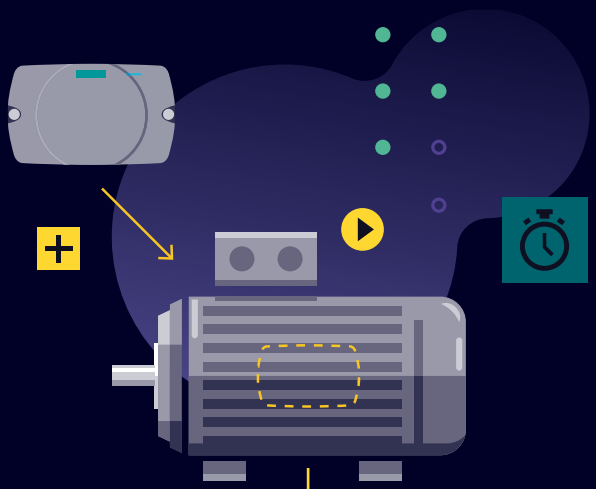


Comprehensive measuring concepts to choose from

Connection Module IOT provides data in different measuring formats that can be analyzed in Drivetrain Analyzer Cloud. To start with, the sensor provides continuous data for trend analysis and long-term observations. It also supplies a daily raw data fingerprint for FFT analysis as a source for spectrum-based health monitoring. The quality of the built-in sensors and the measurement intervals down to one minute enable best-in-class and in-depth data analytics for continuous motion applications. The module can be operated with an external 24 V power supply or with a battery for a maximum of flexibility.

Monitoring what you need to know

The analytics application Drivetrain Analyzer Cloud displays the data from the various components of the drivetrain in a state-of-the-art user interface that can be customized to meet the needs of the user. The app provides in-depth analysis for generic thresholds, operating point detection, operating point-specific limits, anomaly detection, fingerprinting, condition KPIs, and even energy optimization, as well as a maintenance counter based on operating hours. Besides defining the fingerprint, none of those functionalities needs any sort of manual input – analysis is done completely automatically.



Motor-specific historical data and global thresholds

Accessing and recording motor-specific data and using current and historical data for trend analysis: Motor state, Electrical stator Frequency (Hz), Slip frequency (Hz), Torque (Nm or lbf-ft), Electrical power (kW), Energy efficiency (%), Temperature (°C or °F), Axial (x), Tangential (y) and Radial (z) vibration (mm/s or in/s), Number of starts, Speed (rpm), Sound level (dB).

By using the “Global Thresholds” function, you can define the global limit values for various signals, e.g. temperature, vibration, torque, power, speed or noise level. This function can e.g. be used for application- or ambient-specific maximum values from machine datasheets.

In addition, you ensure to get on-time notifications in case of possible failures to avoid downtimes.

Intelligent Threshold Vibration Monitoring

Motor data including operating point information (speed, torque) and vibration data (VRMS in three axes) are collected and an operating point and plateu detection algorithm is applied. Based on historical data, vibration and threshold model training functions are performed for each individual operating point.

The outcome of the operating point detection is used in trained vibration and threshold models, and therefore our automatic and intelligent vibration monitoring. This way, smart and individualized notifications and warnings can be sent out in case of anomalies. This functionality is essential for converter operation of a motor, because it calculates precise vibration limits for each operating point.

This feature and its operation, informs you in the event of an anomaly that could cause a possible failure of the entire machine, and considers overall vibration behaviour according to ISO 10816. It ensures correct threshold levels to warn effectively and avoid false alarms.

Mechanical analysis and anomaly detection

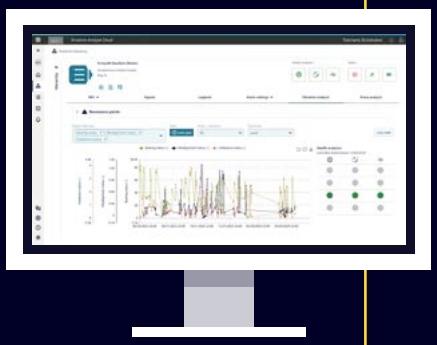
Besides measuring data continuously, the sensor module captures a comprehensive daily raw data snapshot which is being used for in-depth analysis. Based on those raw data snapshots along with application type and bearing specifications, FFT and a trained analytics models are applied to achieve robust and real-time mechanical analysis (bearing, unbalance, and misalignment). This enables the early detection of potential mechanical failures, and the generation of proactive notifications accordingly.

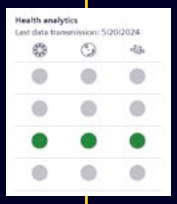
A model is trained based on the bearing, unbalance and misalignment status signals and for each of the most common operating points. A traffic light is generated based on historical machine data, taking into account total vibration according to ISO 10816.

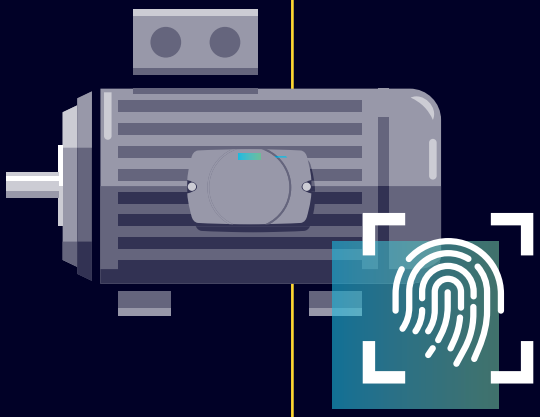
The traffic light remains in calibration state until the new model has been adequately trained. Once sufficient data has been collected and the model has been trained, the user is notified and the continuous mechanical analysis starts.

Based on the trained model, the values of the received status signals are evaluated for each operating point. If the values show a low up to medium failure probability, indicating slight bearing damage or an increase in the level of unbalance/ misalignment, the traffic light switches to “yellow”.

If, based on multiple factors, the failure probability rises above a certain level over a certain period of time, indicating more significant bearing damage, or critical unbalance/ misalignment levels are exceeded, the traffic light switches to “red”.
The user will also receive a notification. As a result, the user should quickly check the condition of the motor status on site and replace the respective bearing before significant damage occurs.





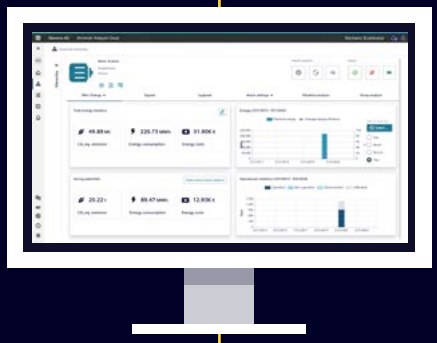


Fingerprinting function

Fingerprinting describes comparing incoming data vs. a defined (local) optimum or good state within the operation. The fingerprint can be optionally configured by the operator by selecting a time interval in which the machine/motor has been running well.

Ideal situations for defining a fingerprint are initial commissioning of a machine, a motor replacement or maintenance action such as a bearing exchange. The data within the fingerprint time interval is used to train an additional model which is being used for extended condition monitoring and anomaly detection.

Fingerprint monitoring is available for motors connected directly to the line supply (DOL) and for motors connected to a converter (VSD) as well as assets with “Generic Vibration Monitoring”.



Operational transparency based on energy consumption and operating hours

The “KPIs” view allows the user to see all the key data associated with the selected asset: The “Overall Energy Statistics” section shows the total CO_2 emissions of the motor, the total energy consumption and the total energy costs since commissioning. The values are initially calculated using the extended equivalent circuit diagram of the respective motor and parameters from “World Energy Council”.

Drivetrain Analyzer Cloud analyses the operating energy consumption of the motor and compares the energy KPIs with an alternative motor with a higher efficiency. By that, users can easily find out the saving potentials in terms of CO_2 emissions and money based on the real load profiles of the application.

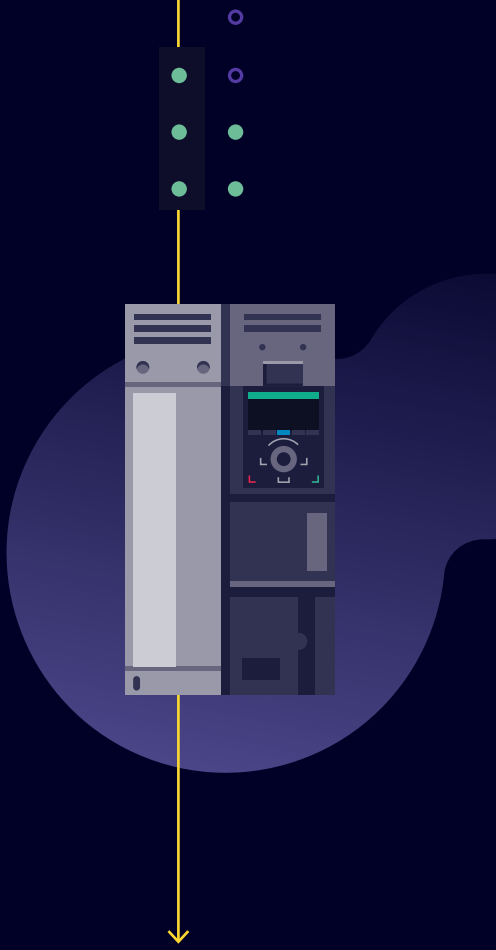
The potential savings in terms of energy consumption, CO_2 emissions and energy price are given as annual averages. The alternative motor and savings are recalculated every week.

The return on investment (ROI) is calculated based on the customer price of the alternative motor and the annual energy cost savings. Optional “Fleet Statistics” display asset KPIs and energy consumption information at a fleet level to compare assets. In addition to energy statistics and optimizations, operating hours are counted and can be optionally used for time-based maintenance intervals. This feature can be useful to add time-based, machine-specific maintenance intervals on top the condition-based approach for the motor itself.

Integration of Converter Data

Drivetrain Analyzer Cloud supports drives and offers a comprehensive set of monitoring, notification and support resources in its user interface.

The app allows accessing and recording the drive signals such as Current, Power, CU Temperature, DC Link Voltage, Output Voltage, Speed, Speed Setpoint, Actual Torque, Alarm & Fault number and Status Word. You can customize displays of up to three key drive signals together (e.g. current, speed and power). Definition of alarm and fault thresholds and recording of messages in a dedicated logbook for historical analysis and troubleshooting purposes. You can get on-time notifications (including e-mails) in case predefined thresholds are exceeded. You also get instant access to support links via Siemens Industry Online Support (SIOS) and “Spares On Web” by entering MLFB and serial number.

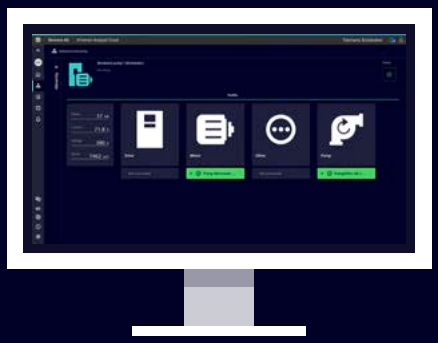


Generic vibration monitoring

In addition to low-voltage motors, the Connection Module IOT can be mounted on other components of the drivetrain, too. This allows for a vibration analysis of all moving parts of your drivetrain to provide you with extra insights.

This includes the following components:

- Gearbox
- Coupling
- Pillow block bearing
- Pump
- Fan
- Compressor
- Other rotating and non-rotating equipment



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