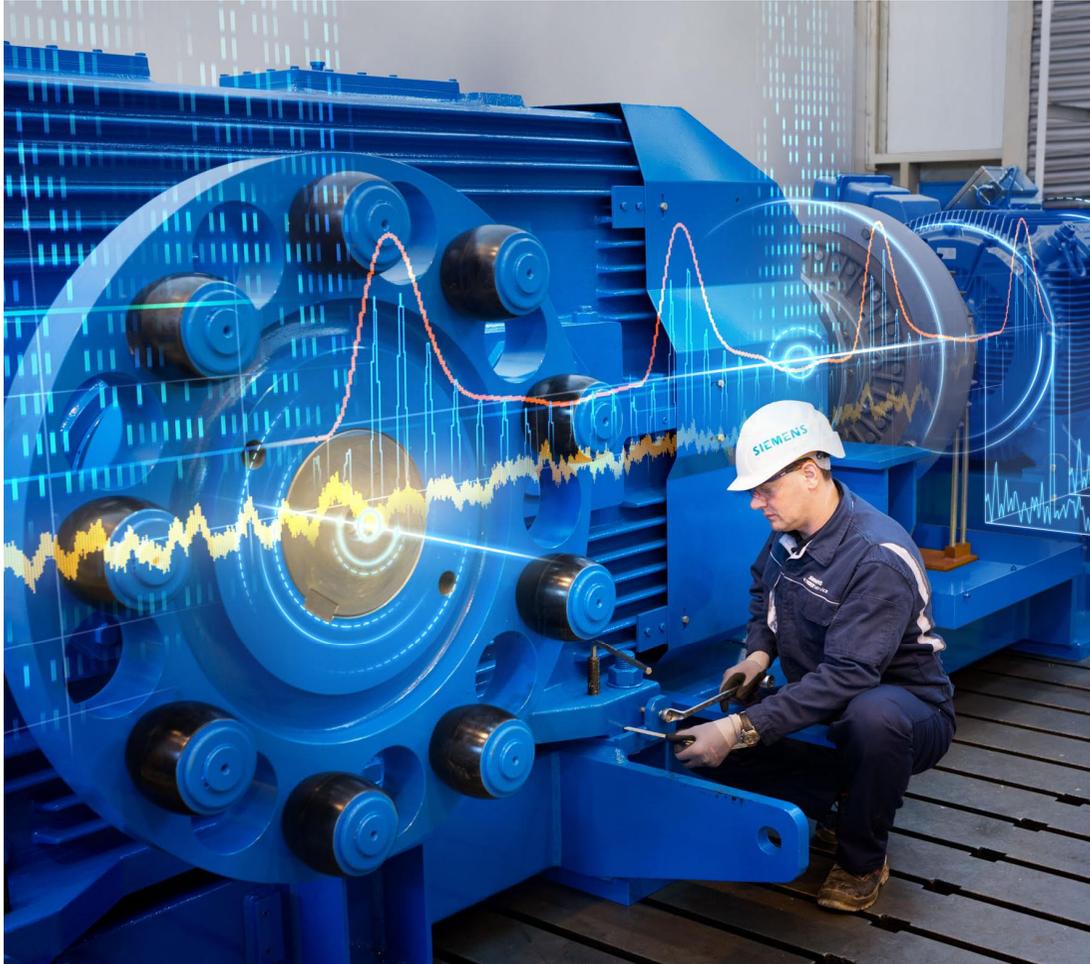


Gear Unit Condition Monitoring

Portfolio overview

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Introduction

Challenges for plant operators

Whether in the extraction or in the processing and subsequent treatment of materials – production facilities must operate safely, reliably and with as little downtime as possible



Solution

Siemens **Machine Protection** and **Gear Unit Condition Monitoring** including:

- Mobile Services
- Remote Monitoring Services
 - *Remote Monitoring Service for Application Gear Units*
 - *Remote Monitoring Service for Standard Gear Units*
 - *Torque Monitoring*

Targets

- Improved productivity and availability of the plant
- Detection, diagnosis and location of anomalies and pinpointing their cause
- Optimization of maintenance activities and schedule
- Purchase of spare parts just when they are needed

Business Impact

- Plannable maintenance activities and optimized spare parts storage
- Reduced maintenance costs through early detection of significant wear-related anomalies
- Avoiding failures caused by mechanical overloads

Introduction

Overview of monitoring solutions

Diagnostic capability



Machine protection



Mobile
Measurement

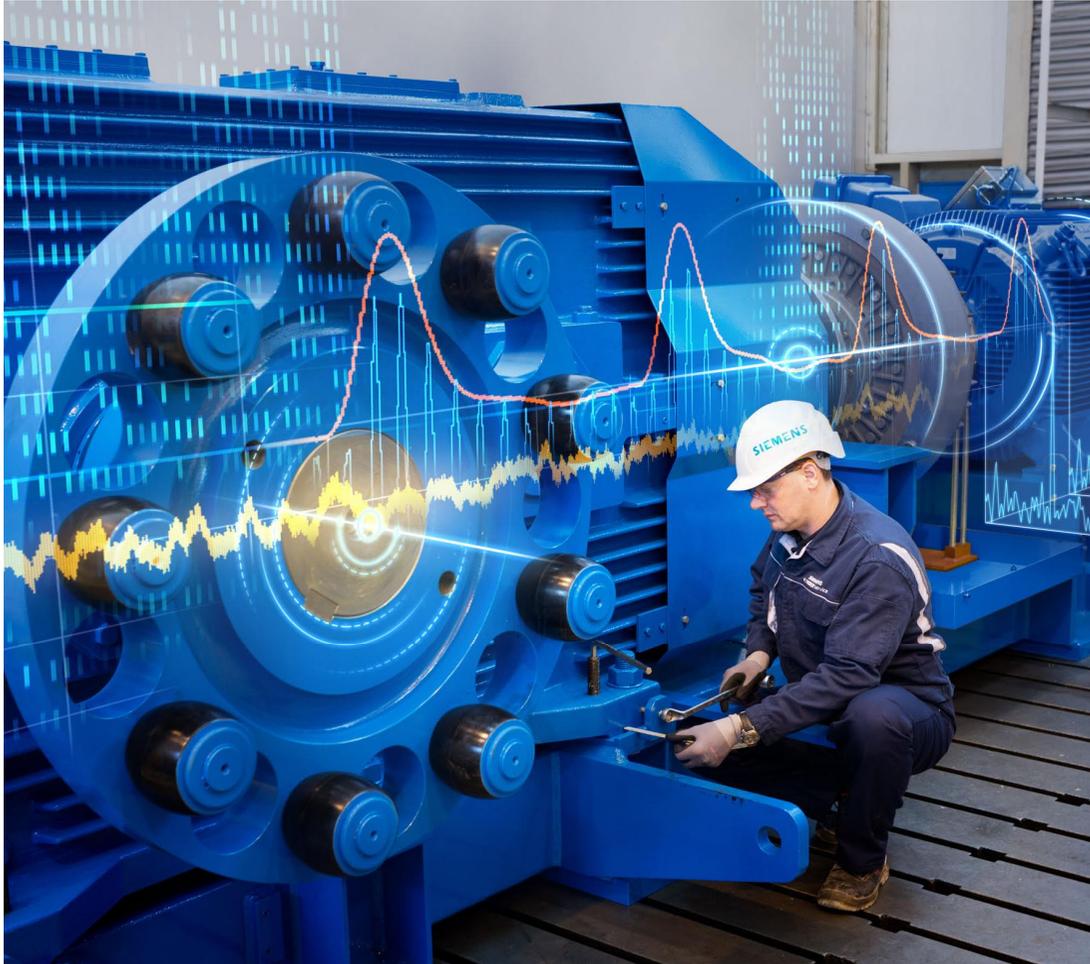


Online-System

Complexity

- Siemens offers **solutions matching** the **customer requirements** in terms of diagnostic capability and complexity
- Full product range coverage from **machine protection** components up to full **online monitoring** of critical equipment
- **Machine protection** components provide simple yet reliable alarming in case of illicit operating conditions
- **Online monitoring** of critical equipment by Siemens experts provides early indicators for degrading system conditions

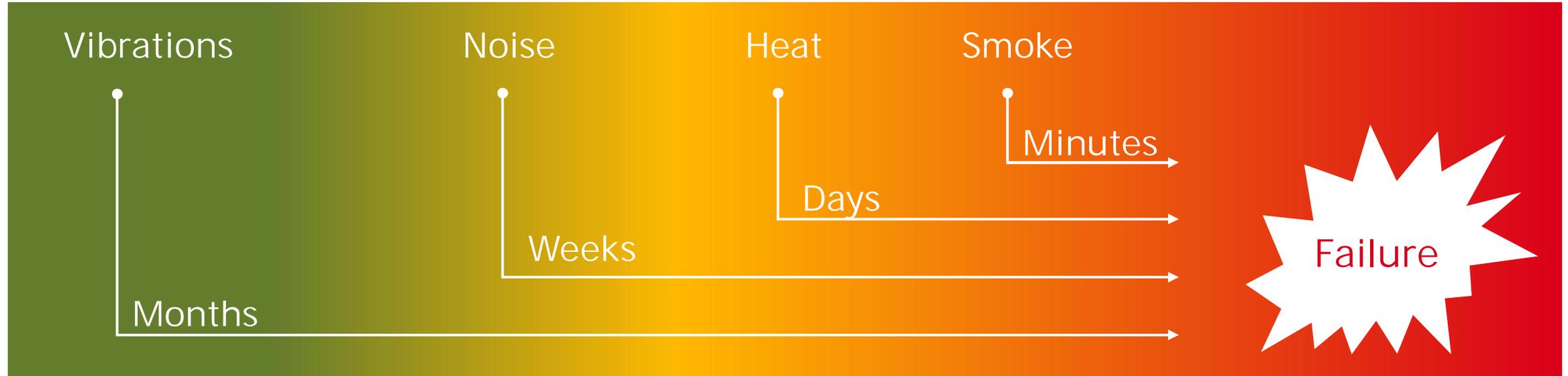
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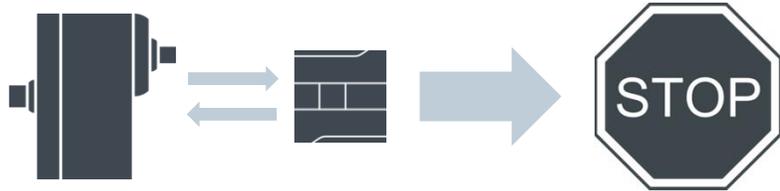
How can mechanical components be monitored?

Machine Protection vs. Condition Monitoring



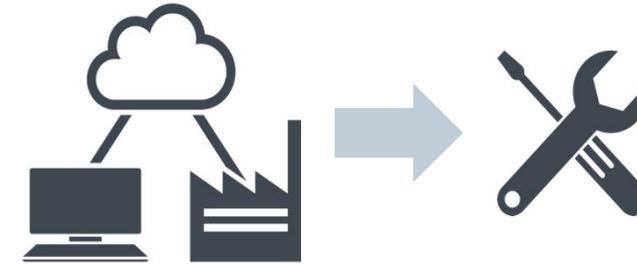
- Changes in the vibration behavior can be detected considerably earlier than changes in temperature and acoustic behavior
- Vibration-based **Condition Monitoring** enables **detecting initial problems** before they lead to equipment failure
- Some technical malfunctions can occur suddenly and unpredictably potentially leading to the failure of the equipment. In this case a **machine protection system** will automatically shut down the drive before any further damage occurs

Machine Protection vs. Condition Monitoring



A machine protection system interacts directly with the equipment's operation

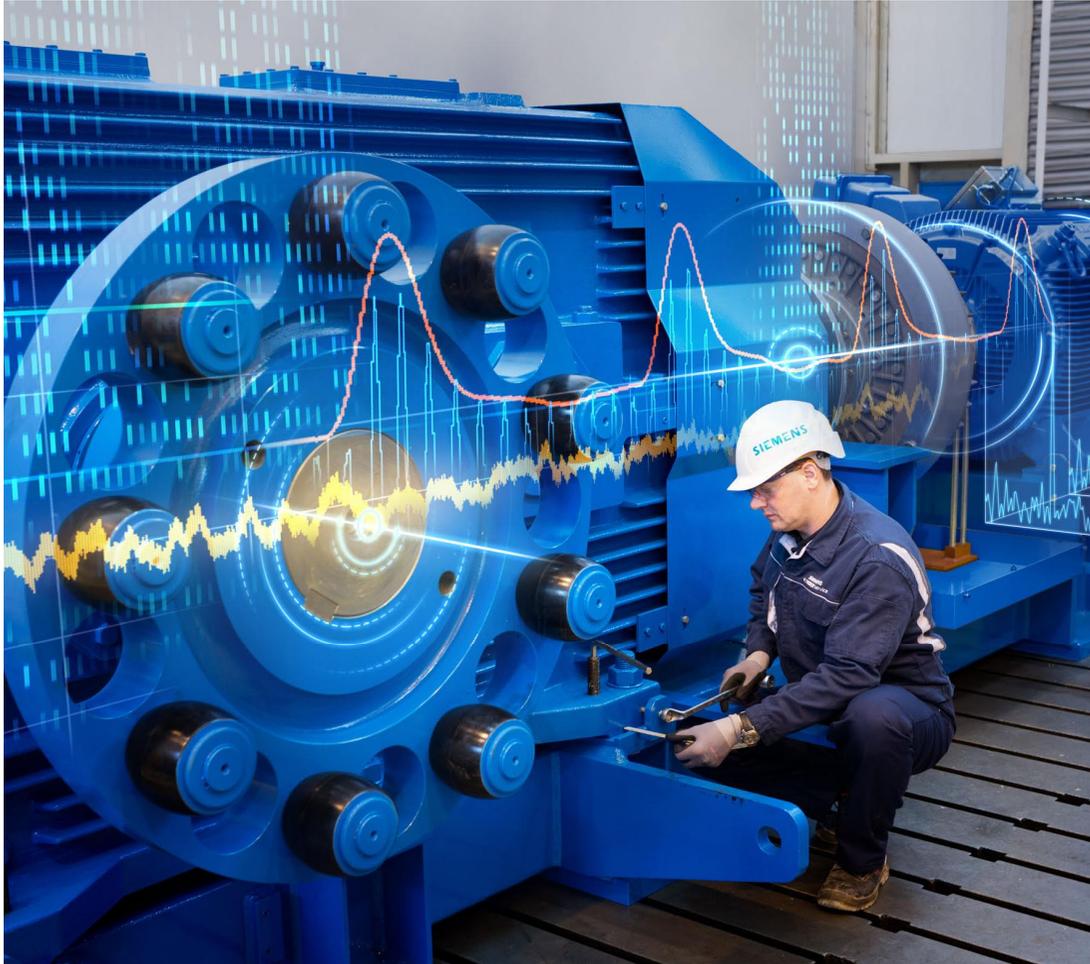
- Monitoring of machine's operational parameters. Should these parameters reach values threatening safe operation, the machine is automatically shut-down before further damage occurs
- Typical sensors include pressure, temperature or overall vibration velocity sensors
- Siemens offers tailor made sensor solutions for machine protection for each gear unit



Condition monitoring provides information for the equipment's maintenance

- Monitoring of machine's operating behavior for small shifts indicating a change in the machine's condition
- When an alarm is triggered, an in-depth analysis is made by qualified experts providing recommendations for the drivetrain's further operation
- Typical sensors include acceleration, speed and torque sensors
- For further information see our [technote on vibration sensor technology](#).

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Mobile Services

A flexible solution for standard and application-specific gear units



Mobile Services offer a flexible and cost-effective solution for both standard and application-specific gear units. Measurements are carried out using hand-held devices by Siemens service professionals at regular intervals or when required e.g. in troubleshooting cases. Data evaluation and diagnosis are carried out by our competent expert team.



Your benefits at a glance:

- Plannable maintenance activities
- Optimized spare parts management
- Reduced maintenance costs through early detection of wear-related anomalies

Mobile Services

Step by step



1

Definition and preparation of measurement tasks by Siemens experts using original gear unit documentation before the vibration measurement

2

On site data collection by qualified personnel using portable device GearControl and visual inspection

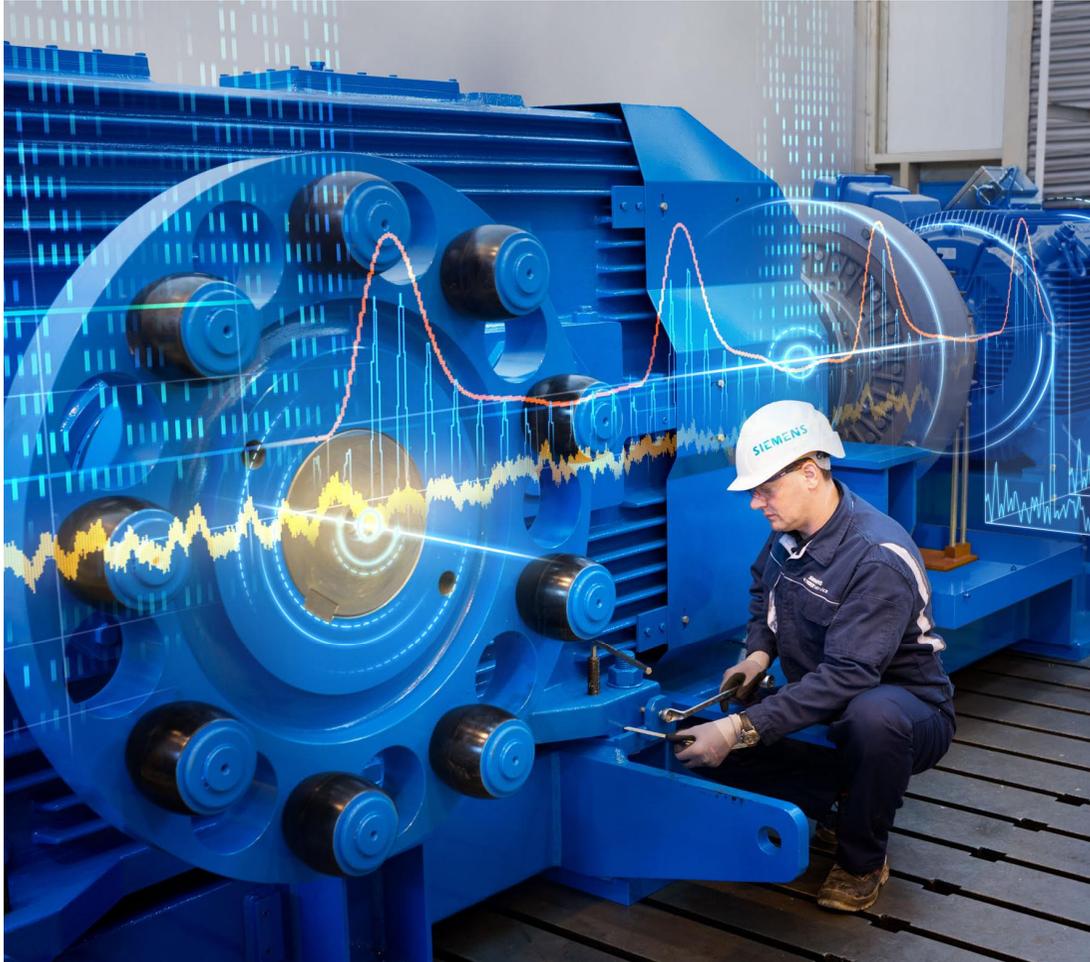
3

Evaluation of measurement data and in-depth diagnosis by expert team

4

Detailed report with maintenance recommendations

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Remote Monitoring Services

Continuous monitoring for better transparency



With online Condition Monitoring systems, Siemens provides a diagnostic tool optimally tailored to the individual requirements of plant operators. Our Remote Monitoring Services enable condition-oriented maintenance. Diagnostic know-how from drive experts, combined with the Siemens SIPLUS CMS hardware, considerably expands the options beyond normal machine protection.



Your benefits at a glance:

- Plannable maintenance activities
- Optimized spare parts management
- Reduced maintenance costs through early detection of wear-related anomalies
- Avoiding failures caused by mechanical overloads

Remote Monitoring Services

Step 1: Data collecting

1. Data collecting

2. Data evaluation & diagnosis

3. Reporting



1.1

Continuous measurement of sensor signals including speed, vibration and optionally torque, temperature and pressure

1.2

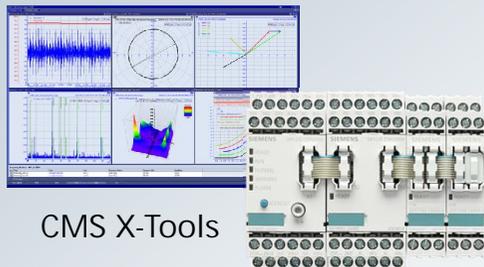
Digitalization of analog sensor data by SIPLUS CMS 2000 online system

1.3

Implementation of the available process data from customer's PLC and optionally of the frequency inverter data

1.4

Continuous transfer of measured data, analyzed data and alarm messages from plant to remote service center by secure data communication



CMS X-Tools

SIPLUS CMS 2000

Remote Monitoring Services

Step 2: Data evaluation & diagnosis

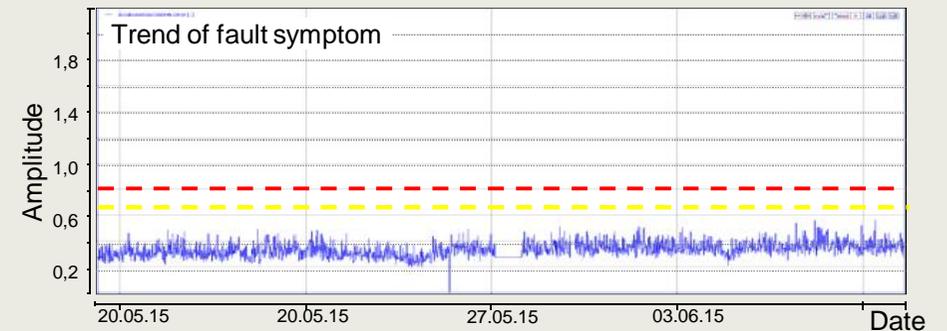
1. Data collecting

2. Data evaluation & diagnosis

3. Reporting



Normal
operating
condition

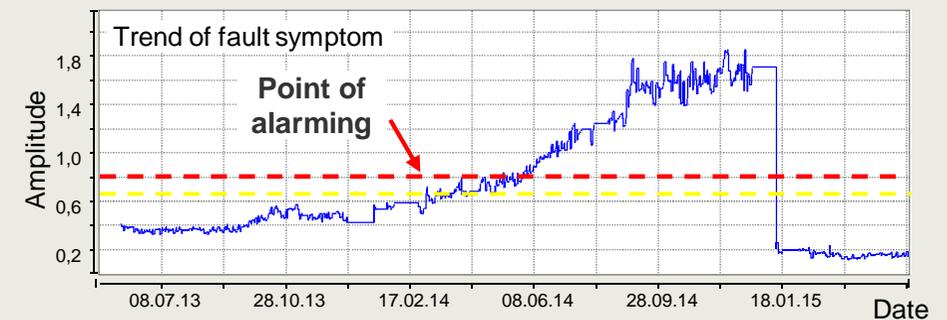


2.1 Set up of alarm limits

2.2 Correlation of fault symptoms

2.2 Derivation of the fault diagnosis by certified experts

Alarm on
condition
changes



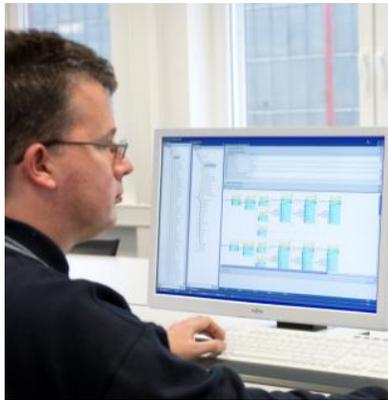
Remote Monitoring Services

Step 3: Reporting

1. Data collecting

2. Data evaluation & diagnosis

3. Reporting



In case of normal operating

Regular status reports with recommendations for further failure-free operation



In case of alarming

- Executive summary based on diagnosed data
- Recommendations for concrete actions based on gear unit expert knowledge including spare part management and staff planning

Remote Monitoring Services

Levels of data collection and processing

Analytics,
Fleet management



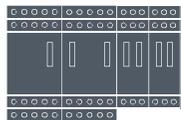
Remote Service Expert Center

- Remote system commissioning and diagnosis
- Reporting and expert recommendations



CMS X-Tools

- Automatic data processing, analysis and storage
- Calculation of frequency selective diagnostic values
- Automatic alarm monitoring
- Bidirectional data exchange with SIMATIC controller



SIPLUS CMS 2000

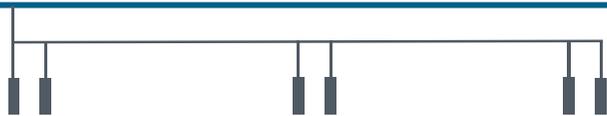
or



SIPLUS CMS 4000

SIPLUS CMS 2000 or SIPLUS CMS 4000

- Conversion of sensor signals into digital data
- CMS 2000 measures signals cyclically
- CMS 4000 measures all signals continuously and simultaneously



Sensors

Speed, acceleration, displacement, pressure, temperature, torque, current ...



Assets

Electric motors, gear units, machines (fan, pump, conveyor...)

Remote Monitoring Services Options

Remote Monitoring Service for Standard Gear Units

Optimal for a wide range of standard applications including gear units for belt conveyors, bucket elevators, compressors, pumps and water turbines



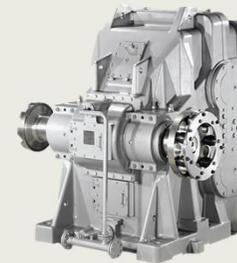
FLENDER standard gear units (FZG)

Torque Monitoring

We offer torque monitoring for all gear unit types either independently or as an add-on option to vibration-based analysis

Remote Monitoring Service for Application-specific Gear Units

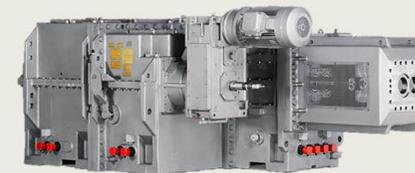
A perfect fit for gear units for tube and vertical roller mills as well as for planetary and extruder drives



Gear units for tube mills



Gear units for vertical roller mills



Extruder gear units



PLANUREX gear units

Siemens is your reliable partner



**Keep your plant
running at top
performance**

Mobile measurement and diagnosis service provided worldwide by our local service teams

Condition monitoring solutions for application-specific and standard gear units as standard packages

Highest accuracy and reliability thanks to extensive technological and product know-how as well as our industry expertise

Gear unit service directly from the manufacturer, from a single source