Intelligent maintenance ensures sustainable investment
Efficient condition monitoring for machines and processes

siemens.com/siplus-cms

Answers for industry.
SIPLUS CMS – Systematically more availability

You want to avoid unpleasant surprises involving downtimes and the associated costs? You want to know how your system is doing? And about the mechanical wear on your machine? Are you looking for assured investment protection?

Then opt for a far-sighted solution and increase the availability of your machines and plants – with SIPLUS CMS. Our Condition Monitoring Systems (CMS) facilitate detection of damage to machinery and equipment early on and allow targeted maintenance planning.

Permanent monitoring of machine and plant states
High system availability is the most effective lever for increasing productivity. The less downtimes, the better. This is why it is important to identify potential sources of error early and to perform scheduled maintenance at the right time within the production cycle.

Our SIPLUS CMS Condition Monitoring Systems are ideal for monitoring mechanical components. You have all your machines and the entire system constantly in view. This facilitates predictive maintenance, allowing you to plan and implement maintenance operations in due time.

After prolonged operating periods without interruptions, significant irregularities resulting from wear or other damage-related causes can be detected early on with the help of the documented trend histories.

Foreseeable problems can be corrected at an early stage – before resulting in major damage or even total failure, with the often costly consequences.

Used worldwide – in the service of productivity
SIPLUS CMS proves its worth day after day in applications all around the world, and in many industries contributes to a significant increase in machine and plant availability due to the permanent monitoring of levels of vibration in machines, bearings and gear units – which in turn makes a huge contribution to increasing productivity.

- Automotive industry
- Chemicals
- Renewable energies
- Mechanical engineering
- Metals and mining
- Food and beverages
- Oil and gas
- Pharmaceuticals
- Water and wastewater
- Pulp and paper

Cross-industry applications complete the system
- Integration in automation systems (TIA, PCS 7)
- Simple connection to SCADA systems (WinCC or other)
- Remote service
Predictive maintenance ensures sustainable investment

A short history of maintenance

Past

Condition-based

Time-based

Preventive

Failure-oriented

Today

Maintenance

Energy efficiency – through predictive maintenance
Mechanical wear, imbalances, defective bearings and other damage scenarios can cause machinery to increase its energy consumption.
SIPLUS CMS facilitates the early detection of such deficiencies which are then signaled via the SIMATIC Maintenance Station, for example. This allows appropriate maintenance measures to be taken to ensure restoration of the system’s scheduled energy efficiency levels.

Services – plant maintenance & condition monitoring
Maintenance management and condition monitoring ensure increased system availability, reliability and productivity in a sustainable manner. Siemens service experts support our global customers, always having focus on protection, safety and security.

Convincing condition monitoring advantages at a glance

<table>
<thead>
<tr>
<th>Lower costs</th>
<th>More efficiency</th>
<th>Better planning</th>
<th>Part of Totally Integrated Automation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customized systems</td>
<td>Optimized utilization of resources</td>
<td>Higher productivity</td>
<td>Transparency</td>
</tr>
<tr>
<td>- Easy system integration</td>
<td>- Effective spare part inventories</td>
<td>- Planned standstills</td>
<td>- Process data recording</td>
</tr>
<tr>
<td>- Open standard</td>
<td>- Planned maintenance</td>
<td>- High availability</td>
<td>- Mechanical wear</td>
</tr>
<tr>
<td>- Expandability</td>
<td>- Global service portfolio</td>
<td>- Investment protection</td>
<td>- Quality assurance</td>
</tr>
</tbody>
</table>
Customized condition monitoring:
One system range for all requirements

The SIPLUS CMS portfolio comprises three different Condition Monitoring Systems: From compact and simple to modular and powerful. The SIPLUS CMS X-Tools diagnostics software facilitates your system’s detailed analysis and conclusive visualization as well as comfortable process data archiving.

<table>
<thead>
<tr>
<th>CMS system</th>
<th>SIPLUS CMS1000 – the compact, simple starter solution</th>
<th>SIPLUS CMS2000 – the modular, web-based system solution</th>
<th>SIPLUS CMS4000 – the powerful, expandable system solution</th>
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<tbody>
<tr>
<td>Application areas</td>
<td>Condition monitoring for motors, generators, fans, pumps, etc. – for imbalance, misalignment, roller bearings, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analysis method</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics values</td>
<td>Bearing monitoring: DKW, based on K(t) according to VDI 3832 Vibration monitoring: RMS, based on DIN ISO 10861-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration analysis</td>
<td>Parameterable</td>
<td>Configurable</td>
<td></td>
</tr>
<tr>
<td>Journal bearing monitoring</td>
<td>Configurable orbit analysis</td>
<td></td>
<td></td>
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<tr>
<td>Monitoring function</td>
<td>Configurable limit values for DKW and RMS: Warning, alarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recording function</td>
<td>Raw data recording: manual or event-triggered, snapshot of FFT, characteristic values, long-term trend recording</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visualization</td>
<td>Traffic light display via binary outputs Software SIPLUS CMS X-Tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local display</td>
<td>Web browser / software SIPLUS CMS X-Tools</td>
<td></td>
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</tbody>
</table>
SIPLUS CMS1000 – Simple and compact

SIPLUS CMS1000 consists of a compact bearing guard and a rugged, industrial-grade vibration acceleration sensor. The compact system is characterized by its ease-of-use: switch-on, teach-in, start monitoring – and profiting!

**Design**
- Compact bearing guard for evaluating vibration measurements
- Local display and control buttons for status messages and entering limit values
- MEMS sensor to accurately detect the vibration acceleration of the machine or bearings
- Pre-assembled cables in a variety of lengths for sensor connection

**Functionality**
- Roller bearing diagnostics, based on K(t) method
- Machine monitoring with RMS
- Monitoring of limit values for warning and alarm
- Switching of floating outputs in case of limit violations
- Operating and fault messages on local display
- Teach-in of the roller bearing's initial status

**Advantages at a glance**
- Simple roller bearing monitoring
- Monitoring for imbalance, alignment errors, set-up problems
- Traffic light display to signal the diagnostic status
- Complete diagnostics at a glance
- No expert know-how required
- Fast and safe wiring
SIPLUS CMS2000 is simply visualized and parameterized via web browser, without additional software. This considerably eases the system’s handling by service staff – both on-site and with remote operation. Its modular design allows for the system’s perfect adjustability to your requirements. For example, if you want to connect more IEPE vibration sensors, the basic unit can be expanded by VIB-MUX (vibration multiplexer) modules. This supports the connection of up to 16 vibration sensors. Moreover, temperature, speed and analog signals such as pressure can be measured.

**Design**

**Basic unit**
- Integrated diagnostics software
- 2 IEPE interfaces for vibration sensors
- 2 analog inputs
- 1 speed input
- 2 digital inputs, 3 digital outputs

**Expansion modules**
- SIMOCODE temperature modules (max. 2)
- SIPLUS CMS2000 VIB-MUX: max. 2 for a total of 9 or 16 IEPE vibration sensors

**Construction design**
- DIN rail mounting
- Removable terminal blocks (screw terminals)

**Functionality**
- Characteristic values (bearing, vibration monitoring)
- Frequency-selective analysis using FFT, H-FFT
- Limit value monitoring of frequency bands, process variables, temperature
- Recording of trend values, raw data, frequency spectra, message archive with time stamp
- Easy damage localization through fingerprint comparison
- Output of system and status messages
- Raw data export for further diagnostics
- Web server and e-mail notification
- Time synchronization via LAN
- Diagnostics suppression via inhibit input

**Advantages at a glance**
- Parameterization and visualization via web browser
- Monitoring of individual machines as well as complex drive trains
- No additional software required for parameterization and visualization
- Proactive maintenance through detailed and early damage localization
- Fast overall diagnostics at a glance
- Event-triggered notification of the service center
- Expert analysis based on raw data via the analysis software SIPLUS CMS X-Tools
SIPLUS CMS4000 – Powerful and expandable

SIPLUS CMS4000 can be used for monitoring of individual machine components as well as complex plants. No matter how complex or dynamic your production processes: The system grows with your requirements – and consistently provides you with the functions you require.

**Design**
- Connection of up to 30 hardware interface nodes (IFN) for the detection of vibration acceleration and analog signals, as well as for slide bearing monitoring through distance measuring
- Software nodes (software IONs) as function blocks with system-specific maximum number
- Bus technology: IEEE1394a (firewire) for measured value transfer to a PC (e.g. Microbox), large range via fiber-optic repeater (500 m)
- Analysis software SIPLUS CMS X-Tools

**Functionality**
- Detection of “mechanical signals” up to 180 sensors – synchronously and in real time with a sampling rate of up to 192 kHz
- IFNs can be directly mounted on the mechanics to be monitored – thanks to high degree of protection IP67
- Process data acquisition via software IONs directly from SIMATIC S7, SIMATIC TDC and SIMOTION; data transfer to SIPLUS CMS X-Tools via Ethernet TCP/IP connection

**Advantages at a glance**
- Monitoring of individual machine components as well as complex plants
- Permanent condition monitoring of mechanical components down to low-frequency vibrations (e.g. in wind power plants)
- Optimized for non-reactive integration in existing and new automation systems
- Quality assurance of production processes by means of flight recorder functions
- Compliance for wind power plant specifications of Germanischer Lloyd and Allianz

Analysis model FFT with alarm bands
The quality and quantity of data acquisition and analysis are decisive for the effectiveness of condition monitoring. This is where the powerful analysis software SIPLUS CMS X-Tools sets new standards.

SIPLUS CMS-X-Tools facilitates the interlinking of a plant’s various operating parameters and signals and their visualization in logical interrelation. This creates the prerequisites for targeted maintenance measures. The interfaces to management systems (e.g. for maintenance and spare parts logistics) are flexibly applicable. SIPLUS CMS X-Tools comprises a comprehensive library of analysis blocks for comfortable analysis, diagnostics, visualization, archiving and reporting.

**Functionality**
- Synchronous, rapid and comfortable condition analysis
- Graphical representation, e.g. by means of vector diagram, orbit, histogram
- Automatic report generation
- Measuring cursor and frequency markers, e.g. for sidebands or harmonic frequencies
- Open software design, e.g. by means of graphical or script-based interconnection of function blocks to create analysis models
- Multi-user support, authorization management – also in remote operation
- Execution on standard and industrial PCs, e.g. SIMATIC IPC
- Fast, flexible and event-controlled archiving of operating parameters and signals, e.g. for quality data

**Analysis and data processing**
- Analysis models and scripts can be optionally used on online or offline data with X-Tools. The execution of analysis scripts can be realized in an equidistant, event-controlled or sequential manner.

**Visualization**
- Visualization supports multiple time axes and thus facilitates the joint representation of multiple time scales in one chart. The monitoring view allows for the combination of multiple visualization options in one overview, e.g. spectrum, histogram, vector diagram, orbit and time scale.

**Archiving**
- Functions for data reduction are available within the scope of data recording. For example, recording in the ring buffer is only enabled when a measured value is changed. Partial or compressed loading and saving of measuring data to/from files is supported for faster processing.
Client-server architecture
- Up to 16 clients can be connected to an X-Tools server. If required, server operation is also possible without client – e.g. for data recording. X-Tools can be automatically started as service. This makes manual operation unnecessary for starting the recording of measuring data. Moreover, the set-up of a single-user system as combined client-server architecture does not require any time-consuming installation. Last but not least, data access rights can be controlled user-dependently and configured customer-specifically.

Advantages at a glance
- Cost-efficient plant monitoring by means of client-server configuration for multi-user applications
- Easy integration in industrial automation by means of modular software with interfaces to SIMATIC S7, SIMATIC TDC, SIMOTION and ePS network
- Efficient condition monitoring by means of conclusive data visualization with optimum data compression
- Comfortable quality management thanks to flight recorder function

Process data acquisition and communication
- SIPLUS CMS X-Tools facilitates the interlinking of condition monitoring and process data from SIMATIC S7, SIMATIC TDC and SIMOTION. The acquisition and interlinking of numerical bus data from PROFIBUS DP can be realized in a non-reactive manner without additional bus configuration. Diagnostics results and analysis data can, for example, be transferred to a controller, control station or maintenance system by means of TCP/IP coupling of SIPLUS CMS X-Tools.
- The analysis software SIPLUS CMS X-Tools facilitates easy integration in a maintenance structure, e.g. under SIMATIC WinCC or SIMATIC PCS 7.
Effective condition monitoring in practice

Balaji Cement, India
The Indian cement supplier Balaji employs SIPLUS CMS4000 for monitoring of the cement mill’s innovative drive train MultipleDrive in order to ensure the timely detection of gear damage. This prevents unplanned and costly downtimes and also contributes to accelerated commissioning.

Press lines, automotive industry
In press lines, the individual stages are continuously monitored for pending damage of the drive or the entire drive train by means of the powerful SIPLUS CMS4000 Condition Monitoring System and corresponding signal processing.

Siemens AG, Nuremberg
For the online monitoring of large Siemens drives, the SIPLUS CMS2000 Condition Monitoring System was integrated in a motor condition monitoring box.

The bearings’ vibrations and temperatures as well as the motor’s winding temperatures are measured during ongoing operation. This facilitates the online monitoring of critical parameters and the elimination of foreseeable problems from the start on the basis of trend curves.

The system’s alarm signaling concept sends a respective message to the superior control system in good time before an actual case of damage occurs. This enables the service staff to incorporate damage rectification in the normal maintenance cycle. This allows for a significant increase in the availability of press lines.
# SIPLUS CMS – Technical specifications

<table>
<thead>
<tr>
<th>Order No.</th>
<th>CMS1000 6AT8001* ¹⁾</th>
<th>CMS2000 6AT8002* ¹⁾</th>
<th>CMS4000 6AT8000* ¹⁾</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monitoring of</strong></td>
<td>Motors, generators, fans, pumps, etc., for imbalance, misalignment, roller bearings, ...</td>
<td>1 GB, e.g. for trend history of characteristic values, raw data, spectra</td>
<td>Memory-dependent (e.g. hard drive)</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>No trend memory</td>
<td>Raw data as WAV file for additional diagnostics (e.g. for SIPLUS CMS X-Tools) downloaded via web browser</td>
<td>All process and system data in CSV and Diadem format</td>
</tr>
<tr>
<td><strong>Data output</strong></td>
<td>None</td>
<td>Raw data as WAV file for additional diagnostics (e.g. for SIPLUS CMS X-Tools) downloaded via web browser</td>
<td>Memory-dependent (e.g. hard drive)</td>
</tr>
<tr>
<td><strong>Max. number and type of connectable sensors</strong></td>
<td>1 MEMS sensor, 1 speed sensor</td>
<td>16 IEPE vibration sensors, sensor see CMS4000 (e.g. VIB-SENSOR S01), 1 speed sensor (digital), 6 temperature sensors</td>
<td>180 sensors, IEPE or analog</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>Binary signals</td>
<td>Binary signals, web services (HTTP, e-mail)</td>
<td>IEEE1394a, ION PROFIBUS DP SPY, software nodes</td>
</tr>
</tbody>
</table>

## System

<table>
<thead>
<tr>
<th></th>
<th>Basic unit, VIB-MUX</th>
<th>Temperature module</th>
<th>IFN VIB-ACC</th>
<th>IFN AI, IFN AI-D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring inputs</strong></td>
<td>Vibration acceleration</td>
<td>Vibration acceleration</td>
<td>Temperature measuring</td>
<td>Vibration acceleration</td>
</tr>
<tr>
<td><strong>Number of measuring channels</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td><strong>Input signal</strong></td>
<td>Differential voltage signal</td>
<td>IEPE standard</td>
<td>Pt1000, Pt1000, KTY, NTC</td>
<td>IEPE standard</td>
</tr>
<tr>
<td><strong>Frequency range</strong></td>
<td>1 to 6.5 kHz</td>
<td>2 or 10 Hz to 10 kHz</td>
<td>0.1 Hz to 40 kHz</td>
<td>0 Hz to 40 kHz</td>
</tr>
<tr>
<td><strong>Sampling frequency max.</strong></td>
<td>20 kHz</td>
<td>46 kHz</td>
<td>500 ms refresh</td>
<td>192 kHz</td>
</tr>
<tr>
<td><strong>Speed input</strong></td>
<td>± 10 V or 4 – 20 mA or digital 24 V DC pulse</td>
<td>Digital 24 V DC pulse</td>
<td>–</td>
<td>1 x ± 10 V</td>
</tr>
<tr>
<td><strong>Analog inputs</strong></td>
<td>–</td>
<td>2 x ± 10 V or 2 x 4 – 20 mA</td>
<td>–</td>
<td>Via IFN analog input</td>
</tr>
<tr>
<td><strong>Digital inputs</strong></td>
<td>1 x 24 V DC, 500 mA</td>
<td>2 x 24 V DC, 500 mA</td>
<td>–</td>
<td>Via IFN analog input</td>
</tr>
</tbody>
</table>

## Outputs

<table>
<thead>
<tr>
<th></th>
<th>2 x relays 24 V, max. 4 A</th>
<th>3 x 24 V, 500 mA</th>
<th>–</th>
<th>Via controller</th>
</tr>
</thead>
</table>

## Environmental conditions / standards

<table>
<thead>
<tr>
<th></th>
<th>–25 ... +60 °C</th>
<th>–40 ... +120 °C</th>
<th>–20 ... +65 °C</th>
<th>–20 ... +60 °C</th>
<th>–40 ... +65 °C</th>
<th>–50 ... +120 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient operating temp.</td>
<td>–25 ... +60 °C</td>
<td>–40 ... +120 °C</td>
<td>–20 ... +65 °C</td>
<td>–20 ... +60 °C</td>
<td>–40 ... +65 °C</td>
<td>–50 ... +120 °C</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>5 to 95% no condensation</td>
<td>5 to 95% no condensation</td>
<td>5 to 95% no condensation</td>
<td>5 to 95% no condensation</td>
<td>5 to 95% no condensation</td>
<td>5 to 95% no condensation</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP20</td>
<td>IP67</td>
<td>IP20</td>
<td>IP67</td>
<td>IP65</td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>CE</td>
<td>CE, UL, CSA, C-TICK</td>
<td>CE</td>
<td>CE, UL, CSA, C-TICK</td>
<td>CE</td>
<td></td>
</tr>
</tbody>
</table>

¹⁾ Current ordering information as well as the terms of sale and delivery can be found in Catalog CA 01 and on the Internet at siemens.com/industrymall
Subject to technical change / improvement
Additional information

on SIPLUS CMS Condition Monitoring Systems is available on the Internet at: 
siemens.com/siplus-cms

on SIMOCODE is available on the Internet at: 
siemens.com/simocode

Technical Assistance
Tel.: +49 911 895-5900

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