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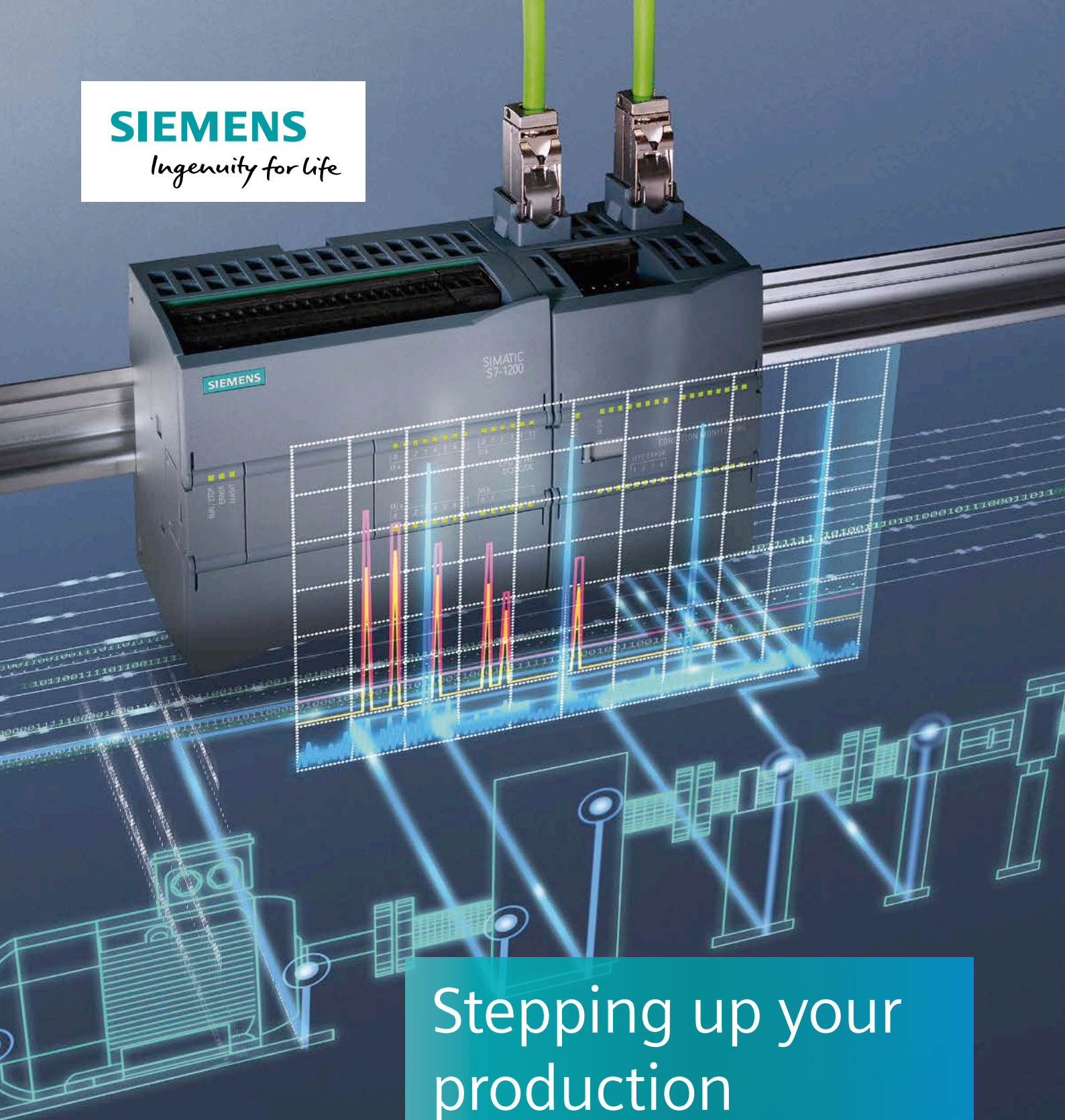


Stepping up your production

Efficient condition monitoring for the early detection of mechanical machine damages

siemens.com/siplus-cms

SIPLUS CMS – systematically boosting availability

The availability of machines and plants is a basic requirement for productivity. In order to minimize unplanned downtimes, it is necessary to detect the sources of error at an early stage. Then it's possible to plan maintenance activities to ensure that they do not interrupt productive operation. This is precisely where SIPLUS CMS Condition Monitoring Systems come in. They continuously monitor the condition of mechanical components in your machinery and throughout the plant. As a result, any changes resulting from wear or other damage based on the documented trend histories can be detected at an early stage and issues resolved before they lead to plant downtime.

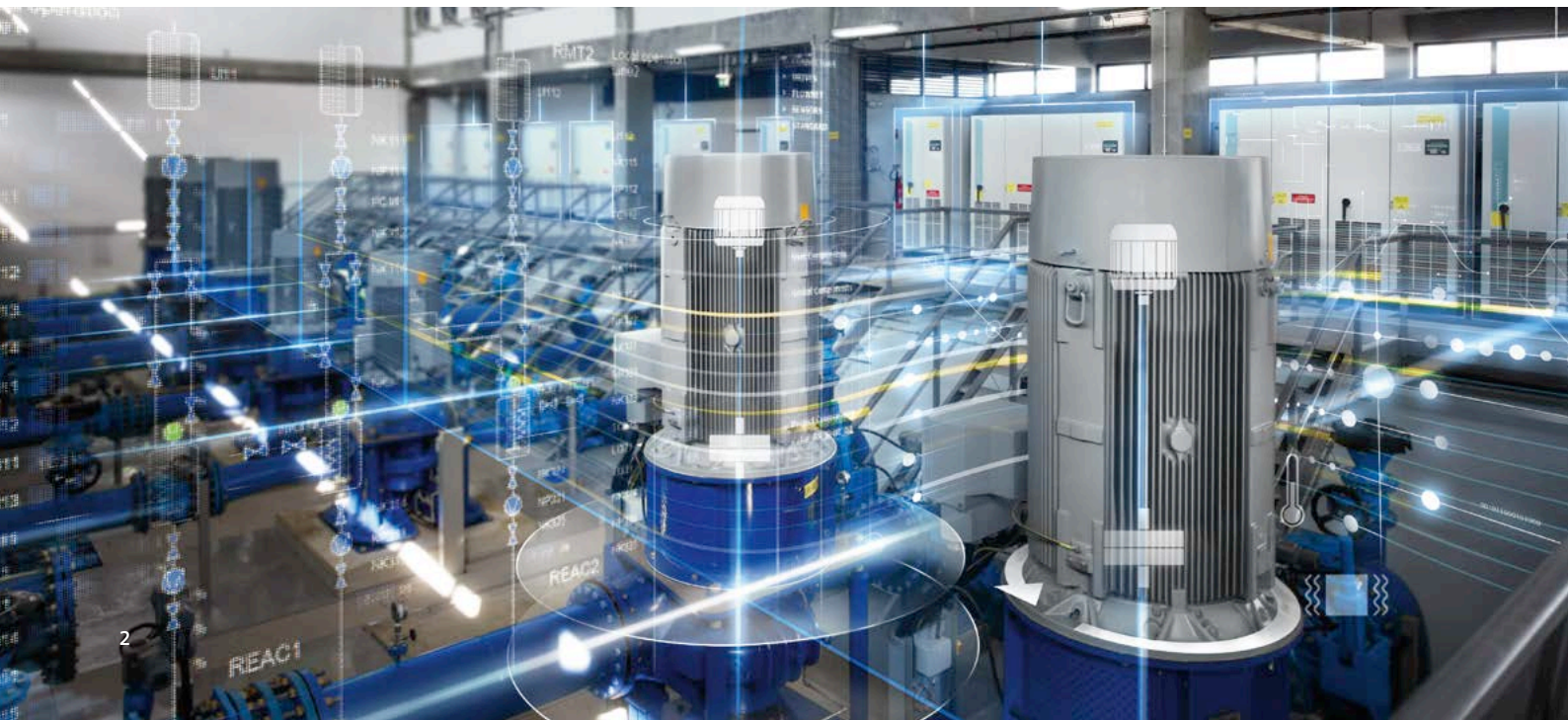
We're setting the standards for tomorrow

SIPLUS CMS also represents an important step toward the digital factory – where all the players including machines, products and people along the value chain will be networked. Mechanical condition data from the plants can be directly integrated into this data stream via a controller. If a component begins to show signs of fatigue, the merchandise management system can automatically check whether a spare part is already available.

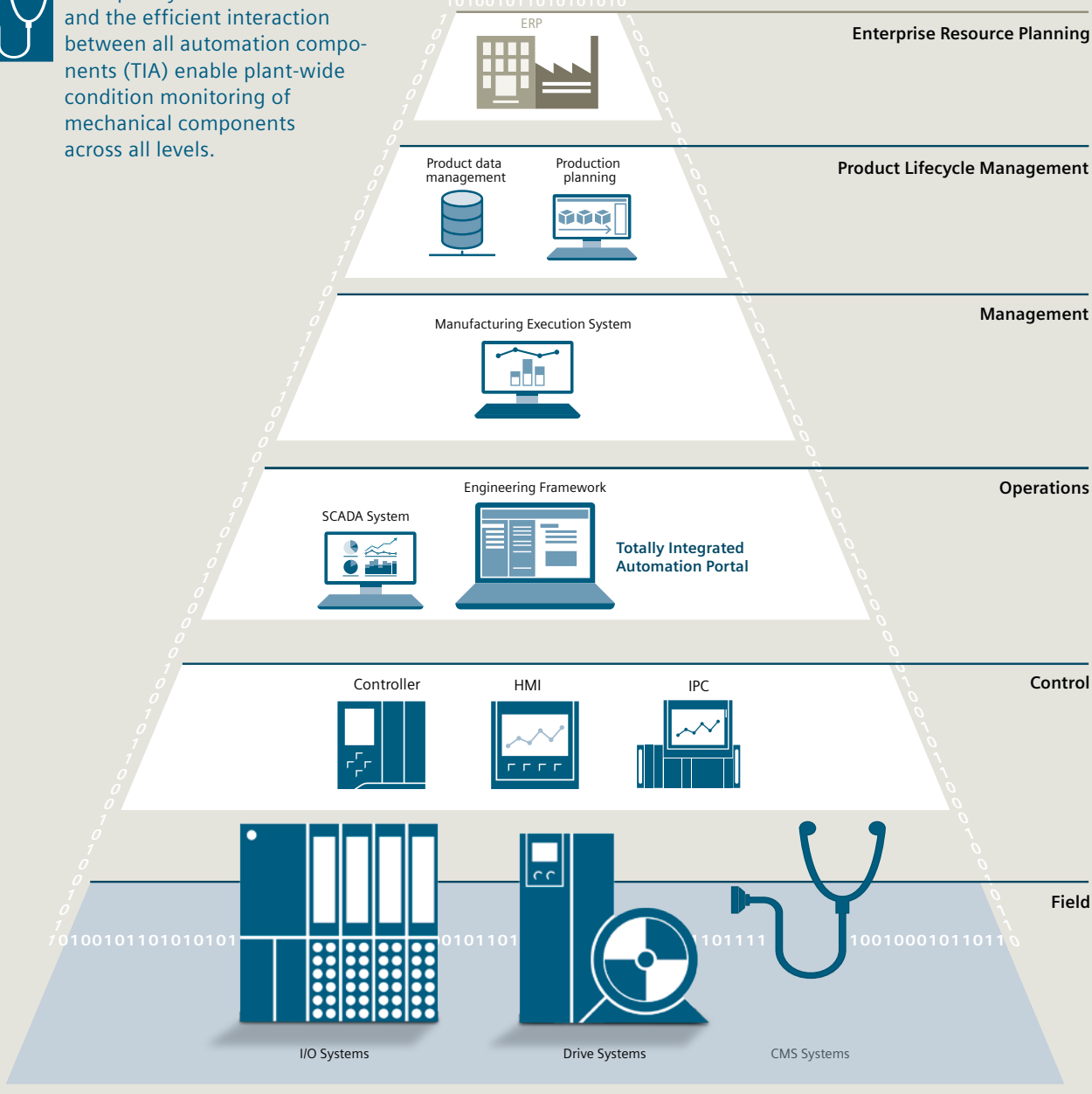
When SIPLUS CMS and MindSphere, the Siemens Cloud for Industry, work together, the result is completely new possibilities. The powerful cloud platform is designed to analyze large volumes of data and makes it possible to monitor machine fleets distributed around the world for service purposes and to reduce their downtimes. This is a major step towards digitalization and toward Industrie 4.0.

Transparency of mechanical variables across all levels

To support predictive maintenance, SIPLUS CMS records and analyzes mechanical variables from machines, integrates them into the automation world, and provides decision-making aids to maintenance staff, operators, and management. With this approach, control centers are able to closely monitor up-to-date status information, such as the conditions of fans in a paint shop or pumps in chemical facilities. In the event of an anomaly, it is possible to quickly make the right decisions, such as estimating how much longer secure operation is possible based on the measured variables over time. Also anomalies in a plant can be compared directly to the condition of surrounding components to determine whether an increase in temperature is an indication of a bearing overheating.



The open system architecture and the efficient interaction between all automation components (TIA) enable plant-wide condition monitoring of mechanical components across all levels.



Efficient condition monitoring with SIPLUS CMS – the benefits at a glance

No matter which SIPLUS CMS version you choose, you can be sure that you will benefit from numerous advantages in the system concept and from lower costs and greater efficiency.

System benefits	Cost reduction	Higher productivity	Part of digitalization
• Simple system configuration • Open standards • Easy expandability	• Longer lifecycle time • Effective spare parts maintenance • Investment protection	• Greater availability • Predictable maintenance and repair • Easy diagnostics	• Record and analyze mechanical variables • Connection to cloud solutions • Decision-making aids for service

SIPLUS CMS is available in three different versions, from compact and integrated to modular and powerful

SIPLUS CMS1200 – monitor with SIMATIC

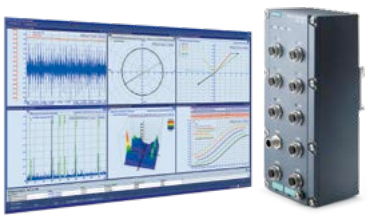
The compact SIMATIC based solution offers you the integration of condition monitoring of mechanical components into automation with SIMATIC S7-1200. You do not need any other software for diagnostics, visualization and parameterization.

SIPLUS CMS2000 – be self-sufficient

The modular, web-based system solution enables simple diagnostics, visualization, and parameterization via a web browser without additional software. The device is suitable for stand-alone operation and is easy to integrate.

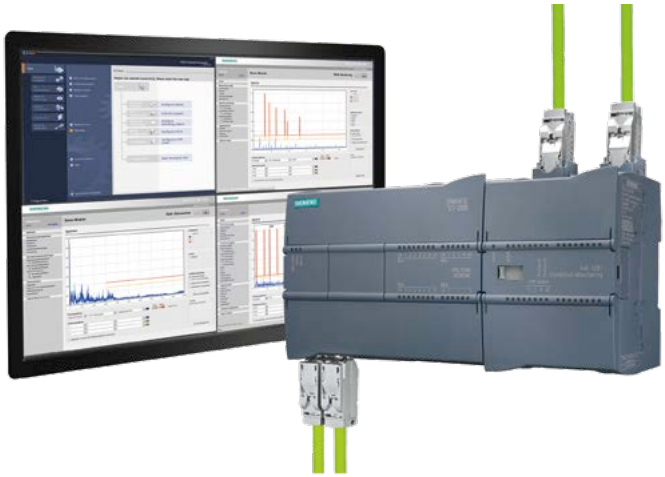
SIPLUS CMS4000 – make demands

The scalable and freely configurable Condition Monitoring System is particularly well suited for complex analysis and measurement tasks. It paves the way for detailed and comprehensive diagnostics and condition monitoring – in stand-alone operation as well as through easy integration into existing automation systems.



SIPLUS CMS1200 – compact, integrated, and flexibly expandable

SIPLUS CMS1200 is the SIMATIC S7-1200 Condition Monitoring System that continuously monitors the condition of critical mechanical components, such as motors, fans, and pumps. As many as 28 vibration sensors can be connected per CPU without additional software. The recorded data is analyzed by the internal software of the CMS1200 and stored on the SM 1281 condition monitoring module. Process variables, such as temperature, torque, and pressure can be recorded using additional S7-1200 modules. As such, SIPLUS CMS1200 condition monitoring solution with the TIA Portal, is fully integrated into the automation system.

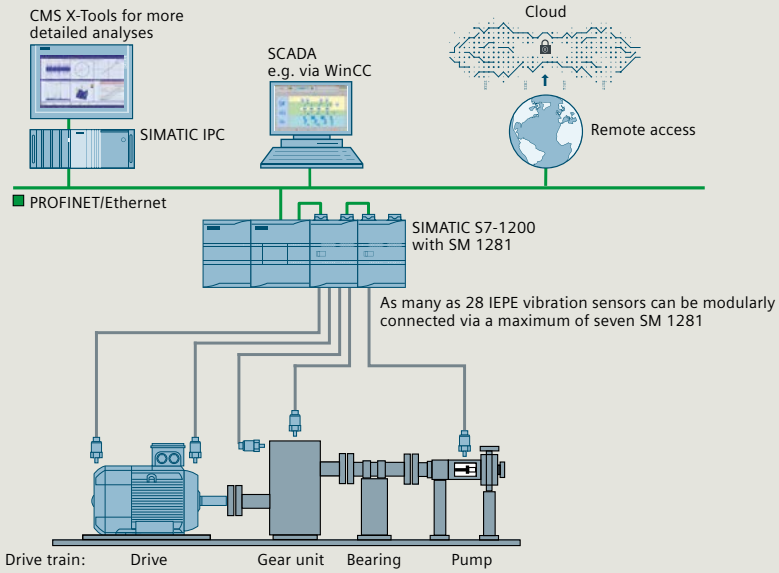


SIPLUS CMS1200 with SM 1281 condition monitoring module

- Software for parameter-based and frequency-selective onboard analyses (analysis algorithms)
- Easy archiving of data on the system's own memory
- Additional analysis options via raw data
- Connectable
  - 4 IEPE vibration acceleration sensors per SM 1281
  - 1 rotary speed sensor per SM
  - Up to seven SM 1281 per S7-1200 CPU

Functionality

- SIMATIC S7-1200 based condition monitoring via TIA Portal starting with V13 SP1
- Characteristic values (bearing & vibration monitoring)
- Frequency-selective analysis by means of FFT, H-FFT
- Limit value monitoring of frequency bands, process variables, temperature
- Recording with time stamp of trend values, raw data, frequency spectra, message archive
- Online data streaming to the CMS X-Tools analysis software
- Output of system and status messages
- Export of raw data for further diagnostics
- Long-term storage of raw data/trends in SM 1281
- Visualization via web browser



Benefits at a glance

- Simple integration of condition monitoring of mechanical components into automation using SIMATIC S7-1200
- No additional software required for parameterization and visualization
- Proactive maintenance through detailed and early damage localization
- Fast overall diagnostics at a glance
- Expert analysis based on raw data via the CMS X-Tools analysis software
- Process variables, such as temperature, torque, pressure and energy can be recorded via the corresponding S7-1200 modules

SIPLUS CMS2000 – modular and flexible

The proven SIPLUS CMS2000 Condition Monitoring System is available as a stand-alone solution independent of the automation system. It can be used to record signals via vibration sensors and analyze, diagnose, and visualize them in a web browser without additional software. A web browser can even be used for parameterization. This significantly simplifies both on-site and during remote operation handling for service personnel. The modular design makes it easy to perfectly tailor the system to specific requirements. As a result, the basic unit can be expanded by VIB-MUX (vibration multiplexer) modules for up to 16 vibration sensors. Furthermore, it is possible to measure the temperature, speed, and analog signals such as pressure.

Basic unit

- Software for parameter-based and frequency-selective analyses on board (analysis algorithms)
- Connectable
  - 2 IEPE interfaces for vibration sensors
  - 2 analog inputs
  - 1 speed input
  - 2 digital inputs, 3 digital outputs

Expansion modules

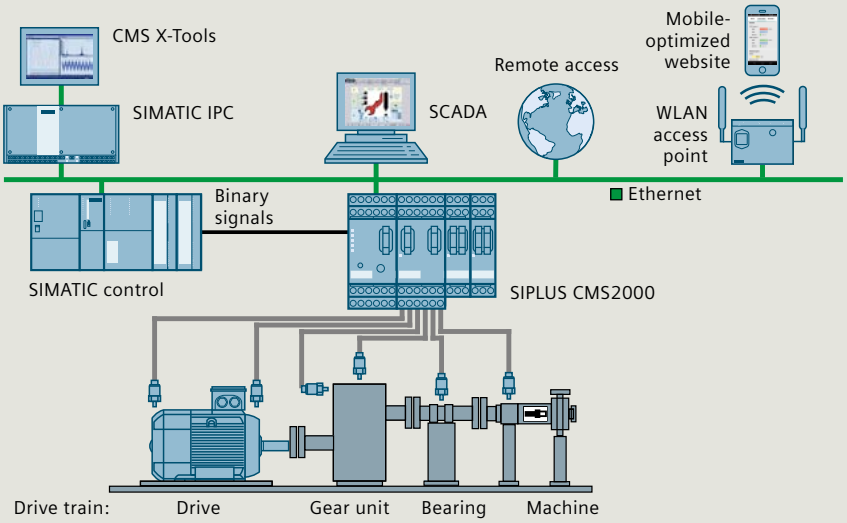
- Temperature modules (max. 2)
- SIPLUS CMS2000 VIB-MUX: max. 2 for a total of 9 or 16 IEPE vibration sensors

Functionality

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

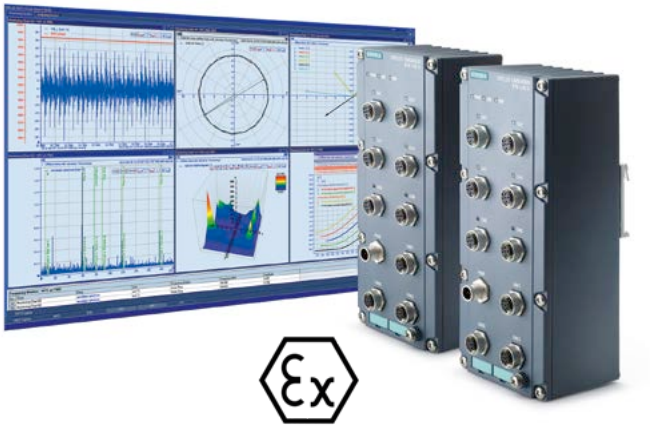
Benefits at a glance

- Parameterization and visualization via web browser
- Monitoring of individual machines to 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 CMS X-Tools



SIPLUS CMS4000 – powerful and expandable

SIPLUS CMS4000 can monitor anything, from individual machine components to complex plants. No matter how complex or dynamic your production processes happen to be, the system grows with your requirements and consistently provides you with the precise functions that you need.

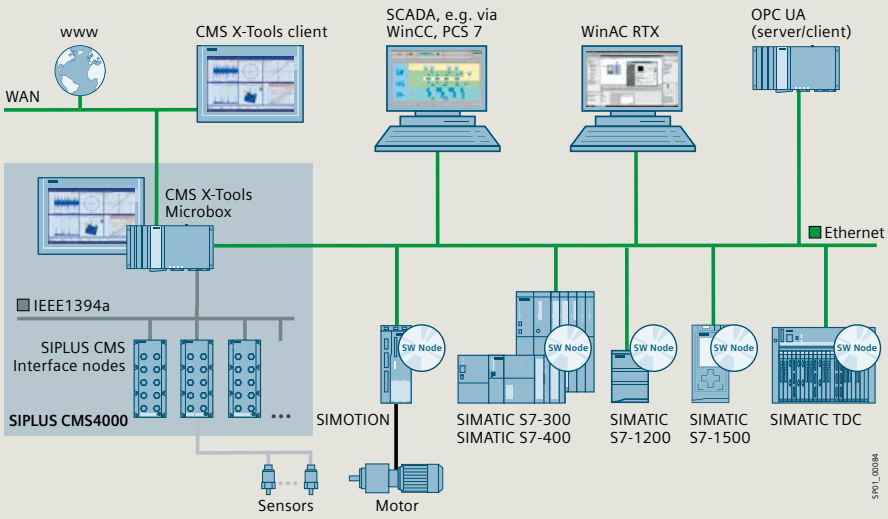


Design

- Connection of up to 30 hardware interface nodes (IFN) for the recording of vibration acceleration and analog signals as well as for slide bearing monitoring via distance measurement
- Software nodes (software IONs) as function blocks whose maximum number is plant-specific
- Bus technology: IEEE1394a (firewire) for the transfer of measured values to a PC (e.g. Microbox), long range via fiber-optic repeater (500 m)
- CMS X-Tools analysis software

Functionality

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



Benefits at a glance

- Monitoring of machine components to plants
- Monitoring of slide bearings
- Permanent condition monitoring of mechanical components down to low-frequency vibrations (e.g. in wind turbines)
- Optimized for non-reactive integration into new or existing automation systems
- Quality assurance through flight recorder functions
- Complies with the specifications of Germanischer Lloyd and Allianz for wind turbines
- For use in hazardous areas with ATEX approval II 3G

Analysis methods in condition monitoring

Parameter-based analysis

With parameter-based analysis, a traffic light, for example, indicates whether there is impending damage. The system analyzes the effective value of the vibration speed vRMS based on DIN ISO 10816-3 and for the bearing monitoring the effective value of the vibration acceleration aRMS or the diagnostic characteristic value DKW in accordance with VDI 3832. Ten years of your trend histories can be recorded.

Representation

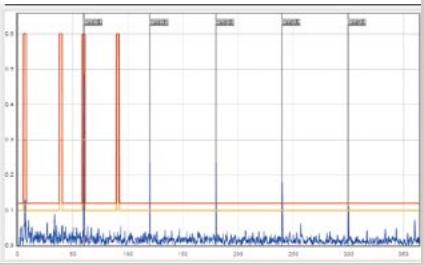
- Easy via a traffic light, for example
- Trend histories of vRMS and aRMS or DKW

Frequency-based analysis

The frequency-selective analysis provides you with information about the damage you should expect. Frequency bands indicate whether the damage relates to resonances, imbalance, misalignments, or the type of roller bearing damage that is involved.

Representation

- As speed, acceleration, or envelope curve spectrum via web browser
- Via integrated reporting system

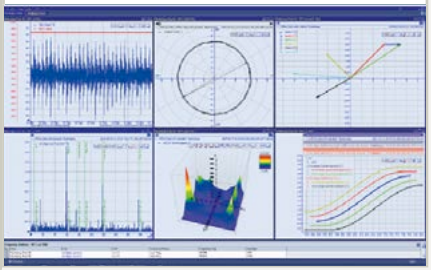


Expert analysis

If the information from the frequency-selective analysis is insufficient or if you require gear unit diagnostics, you can turn to the CMS4000 or you can export the raw data recorded from CMS1200 or CMS2000 and have it evaluated by experts using separate analysis software, such as CMS X-Tools.

Representation

- e.g. via CMS X-Tool: Spectrum, histogram, vector and waterfall diagram, orbit, time scale, etc.



Seven steps to a Condition Monitoring (CM) solution

1. Clarify CM requirements:
   Which mechanical components should be monitored for which damages?
2. Select/order the CM System that matches the requirements:
   Number of sensors, integrated or stand-alone; slide/rolling bearing
3. Install sensors and CM System:
   Selection of measurement locations/mounting of sensors (screws, adhesive), take maximum cable lengths into account
4. Select the analysis method: parameters and/or spectra
5. Commissioning of the CM System via CM library/application example or menu-guided:
   Specify alarms/warning limits of the parameters in accordance with ISO 10816-3;
   spectrum limits corresponding to the experience of the maintenance staff
6. CM commissioning of the control system/stand-alone system:
   Which CM data should be visualized/reported for whom?
7. Optimization of the warning and alarm limits according to initial trend curves in ongoing operation

SIPLUS CMS – in practice worldwide

SIPLUS CMS proves itself every single day in a wide range of applications around the world – thanks to the permanent monitoring of vibration levels in machines, rolling bearings and gear units, SIPLUS CMS significantly boosts availability. For that reason, countless companies in a wide variety of industries rely on condition monitoring with SIPLUS CMS.

- 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 round off the system:

- Integration in automation systems (TIA, PCS 7)
- Simple connection to SCADA systems (WinCC or other)
- Remote service

Easy integration

- CMS1200: part of SIMATIC S7-1200
- CMS2000/CMS4000: simple connection to automation systems (TIA, PCS 7) and SCADA systems (WinCC or other)

On track to success with SIPLUS CMS

From the cement to the auto industry, from Europe to India, numerous companies from a wide variety of industries rely on SIPLUS CMS worldwide.

Balaji Cement, India

The Indian cement supplier Balaji uses SIPLUS CMS4000 to monitor MultipleDrive, the cement mill's innovative drive train, to ensure that any gear damage is detected in a timely manner. This prevents unplanned and costly down-times and also helps to accelerate commissioning.

MTI Mischtechnik International GmbH, Germany

MTI, a manufacturer of special machines based in Detmold, combined its innovative mixing technology with the SIPLUS CMS2000 Condition Monitoring System to form a homogenous overall solution. "The CMS is ideally suited for the early detection of mechanical wear," adds Thomas Tegtmeier, head of Mechanical Design at MTI. The use of the CMS2000 makes it possible to integrate mechanical forces and flow rates into the diagnostics. "I need all the information about the condition of the plant in a single location to ensure the greatest possible protection and benefits for the operator, plant, and processes," explains company CEO Christian Honemeyer.

Press lines, automotive industry

In press lines, the powerful SIPLUS CMS4000 Condition Monitoring System and corresponding signal processing are used to continuously monitor the individual stages for potential damage of the drives or the entire drive train. The system's alarm signaling concept sends a corresponding message to the higher-level control system long before any actual damage can occur. This enables the service personnel to incorporate the repair of the damage into the normal maintenance cycle. This approach significantly increases the availability of the press lines.

Overview of technical specifications

	CMS1200 for SIMATIC S7-1200		CMS2000		CMS4000	
Article No.	6AT8007[1]		6AT8002[1]		6AT8000[1]	
Monitoring of	Motors, generators, fans, pumps, ... for imbalance, misalignment, rolling bearings, ...					
Memory	800 MB for trend history of characteristic values, raw data, spectra		800 MB for trend history of characteristic values, raw data, spectra		Memory-dependent (e.g. hard drive)	
Data export	Raw data as WAV file or online data streaming for additional diagnostics		Raw data as WAV file or online data streaming for additional diagnostics		All process and system data in CSV and Diadem format	
Maximum number and type of connectable sensors	4 IEPE vibration sensors, see below, 1 speed sensor (digital)		16 IEPE vibration sensors, sensor see CMS4000 (e.g. VIB-SENSOR S01), 1 speed sensor (digital), 6 temperature sensors		180 sensors, IEPE or analog	
Communication	Web services (HTTP), online data streaming to CMS X-Tools S7-1200 backplane bus		Web services (HTTP), online data streaming to CMS X-Tools		IEEE1394a, software nodes	
System						
Operator control	Web browser/TIA Portal/WinCC		Web browser / CMS X-Tools		CMS X-Tools software	
Construction design	Modular, max. 7 SM 1281 per S7-1200		Modular		Modular and scalable	
Power supply	DC 24 V		DC 24 V		DC 24 V	
Power loss	Typ. 4.8 W		Typ. 2.6 W		Typ. 4.6 W	
Self-monitoring	Sensor inputs, firmware, electronics		Sensor inputs, firmware, electronics		Sensor inputs, firmware, electronics, software, hardware nodes	
Measuring inputs	**SM 1281: SIMATIC S7-1200 module**		**Basic unit, VIB-MUX**	**Temperature module**	**IFN VIB-ACC**	**IFN AI, IFN AI-D**
Measuring application	Vibration acceleration		Vibration acceleration	Temperature measurement	Vibration acceleration	Analog signals, distance measurement
Number of measurement channels	per SM 1281: 4 max. 7 SM 1281/S7-1200 CPU: 28		Basic device: 2 • with 1 VIB-MUX: 9 • with 2 VIB-MUX: 16	3	6	6
Input signal	IEPE standard		IEPE standard	Pt100, Pt1000, KTY, NTC	IEPE standard	IFN AI: ± 10 V IFN AI-D: ± 20 V
Frequency range	0.1 Hz ... 10 kHz		10 Hz ... 10 kHz	–	0.1 Hz ... 40 kHz	0 Hz ... 40 kHz
Sampling frequency max.	46 kHz		46 kHz	500 ms refresh	192 kHz	192 kHz
Speed input	1 x digital DC 24 V pulse		1 x digital DC 24 V pulse + 2 x analog inputs, see below	–	1 x ± 10 V	Adjustable
Speed range	3 rpm ... 16,000 rpm		120 rpm ... 24,000 rpm	–	No limit	
Analog inputs	–		2 x ± 10 V or 2 x 4 ... 20 mA	–	Via IFN analog input	
Digital inputs	–		2 x DC 24 V, 500 mA	–	Via IFN analog input	
Constructional design	**SM 1281**	**VIB-SENSOR S01**	**Basic unit, VIB-MUX**	**Temperature module**	**IFN VIB-ACC, IFN AI**	**VIB-SENSOR S01**
Housing	Plastic	Stainless steel	Plastic	Plastic	Aluminum	Stainless steel
Dimensions (HxWxD) mm	112 x 70 x 75	Length 52; Ø 21	106 x 45 x 124	101 x 22.5 x 124	210 x 86 x 95	Length 52; Ø 21
Mounting	DIN rail	Mounting bolt UNF1/4-28 on M8	DIN rail	DIN rail	DIN rail	Mounting bolt UNF1/4-28 on M8
Weight	Approx. 260 g	Approx. 90 g	Approx. 300 g	Approx. 150 g	Approx. 1230 g	Approx. 90 g
Environmental conditions/standards						
Ambient temperature during operating	–20 ... +60 °C	–50 ... +120 °C	–20 ... +65 °C	–20 ... +60 °C	–40 ... +65 °C	–50 ... +120 °C
Relative humidity	5 ... 95% no condensation	5 ... 95 %	5 ... 95% no condensation	5 ... 95% no condensation	5 ... 95% no condensation	5 ... 95 %
Degree of protection	**IP20**	**IP20**	**IP20**	**IP20**	**IP67**	**IP65**
Certification	CE, cULus, RCM, KC, EAC; LR, DNV-GL, ABS, PRS, KR, NK; in preparation: BV, CCS	CE, UL, RCM, KC, EAC	CE, UL, CSA, RCM, KC, EAC	CE, UL, CSA, RCM, KC, EAC	CE, RCM, KC, EAC, ATEX II 3G, IECEx Zone2	CE, UL, RCM, KC, EAC

[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
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