SIEMENS

Condition Monitoring Systems

SIPLUS

CMS2000

Operating Instructions

Edition 03/2016

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction 1

1.1 Preface

Purpose of this documentation

These operating instructions contain all the information required for installing, commissioning, and operating the SIPLUS CMS2000 condition monitoring system. The manual also provides basic knowledge about vibration analysis and vibration diagnostics.

These operating instructions are intended for qualified personnel in the following target groups:

- Commissioning engineers
- Operating and service personnel
- I&C personnel (optional)
- Network administrator (optional)

Application

The SIPLUS CMS2000 Condition Monitoring System is used for monitoring mechanical components in plants and machines.

The system permits a permanent monitoring of vibrations of machines, roller bearings and gear units, for example.

Basic knowledge required

These operating instructions assume general knowledge of automation engineering and condition monitoring.

They describe components valid at the time of publication. Siemens reserves the right to include updated Product Information for new components, and for subsequent versions of components.

Validity of the documentation

This documentation is valid for all components of the SIPLUS CMS2000 system specified in these operating instructions and describes the current delivery state.

Trademarks

SIPLUS® is a registered trademark of Siemens AG.

History

Edition	Remarks
11/2011	First edition
02/2013	Revised edition for firmware version V2.0
06/2013	Revised edition for firmware version V2.1 FW version V2.1 supports both English and German in the user interface.
10/2013	Addition of notes on IT security
10/2014	Revised edition for firmware version V3.0
03/2016	Revised edition for firmware version V4.0

Naming conventions and abbreviations

A synonym, an abbreviation, or the term "device" is sometimes used in this documentation instead of the full product name.

The followings terms and abbreviations are used:

SIPLUS CMS2000 Basic Unit VIB	Basic unit, Basic Unit VIB, device
SIPLUS CMS2000 VIB-MUX	VIB-MUX, device

Safety instructions 2

2.1 Safety instructions

⚠ CAUTION
Observe the safety instructions on the inside front cover of this documentation.

CMS2000 devices correspond to the approvals printed on the rating plate. If you have questions about whether it is permissible to install the device in the planned environment, please contact your service representative.

NOTICE
Alterations to the devices are not permitted. Failure to observe this requirement shall constitute a revocation of the CE approval and manufacturer's warranty.

Intended use

NOTICE
• SIPLUS CMS2000 is a condition monitoring system for preventive monitoring of machines and plants. • SIPLUS CMS2000 is not a machine protection solution. The status displays output by CMS2000 in the form of LEDs, digital outputs, Ethernet telegrams, e-mails, and web pages must not be used for control purposes (e.g. machine shutdown).

Connection of sensors

⚠WARNING

Voltage hazards

May cause death or serious injury

The inputs of the CMS2000 feature a functional electrical isolation up to 500 V.

Only those sensors may be used that ensure safe electrical separation up to the maximum level of the potentials configured for the plant.

It is imperative that you observe the key insulation values of the sensors used and take additional measures to ensure safe electrical separation!

Repairs

Repairs to the device may only be performed by authorized specialists.

⚠WARNING

No user-serviceable parts.

May cause death or serious injury

Unauthorized opening or improperly performed repairs can cause considerable damage to property and/or danger to users. Return the device to Siemens for repair.

Safety extra-low voltage

Note

Only connect the device via a safety extra-low voltage

The device is designed for operation using directly connectable safety extra-low voltage (SELV) with safe electrical isolation to IEC 60364-4-41.

You must, therefore, only connect the supply terminals and the process and communication signals (including Ethernet) to safety extra-low voltage (SELV) with safe electrical isolation to IEC 60364-4-41.

Note

Safety extra-low voltage

Contact with live components can result in a mild electric shock.

- Disconnect from the power supply before starting work.
- Ensure that no wires or strands protrude from the terminals that can be touched.

Battery

⚠ WARNING

Danger of explosion and release of harmful substances from batteries

May cause death, serious injury or property damage

Therefore, do not throw lithium batteries into an open fire, do not solder or open the cell body, do not short-circuit or reverse polarity, do not heat up above 100° C, dispose of in accordance with regulations and protect against direct exposure to sunlight, moisture and condensation.

2.2 IT security

IT security guidelines

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information on industrial security, go to Hotspot-Text (http://www.siemens.com/industrialsecurity).

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information go to Hotspot-Text (https://support.industry.siemens.com).

Protective measures for the CMS2000 system

NOTICE
Make sure that only authorized persons are granted access – both physically and in terms of data technology – to the CMS2000 system. • Change the preset password of the Basic Unit ("0000") to an individual password. • Data transfer, including passwords, between a client PC and the CMS2000 system via a network is carried out unsecured (i.e. without encryption). For secured (remote) access to the CMS2000 system, you must therefore use for example a router, that establishes a secure connection, i.e. with encryption and authentication.

Fundamentals of vibration monitoring and diagnostics

3

To ensure that a machine is effectively protected during operation, you need to monitor the machine using specific measured variables. The most important measured variables are those that best describe the state of the machine. Mechanical vibration is of special significance in this regard.

There is a great variety of vibration types, measured variables and characteristics when describing mechanical vibration.

3.1 Mechanical vibration

3.1.1 Meaning and information content of vibration

Term

Mechanical vibration is vibration that can be sensed and measured on the surface of objects. When dealing with machine monitoring, this especially includes the surfaces of machines, components and foundations.

Mechanical vibration is sometimes referred to as "structure-borne sound," because it is only propagated in solid structures. Audible "air-borne sound," by contrast, moves through gaseous media, such as air.

Cause of mechanical vibration

Mechanical vibration always occurs when mass moves. Such mass may be rotating or oscillating parts of machines. It can also include gasses or fluids that collide with solid objects, however.

Significance of vibration

Mechanical vibration has an especially high information content. In terms of machine monitoring, this information is highly significant in several respects as:

- Indicator of the machine condition
- Indication of dynamic stresses on the machine, machine base, adjacent machine components
- Indication of safety of operation, service life, and economic efficiency of machines
- Basics of machine diagnostics and vibration damping

Meaning of vibration diagnostics

Various symptoms on running machines allow inferences to be made about the machine condition, such as an impending damage to the machine.

Fault symptoms indicating a condition include:

- Changes in air-borne noise
- Displacement of machine components
- Rising bearing temperatures
- Changed mechanical vibration characteristics

3.1.2 Causes of mechanical vibration

Origins of vibration

Vibration largely originates from the centrifugal forces on rotating machine parts.

This may be caused by:

- Unbalance
- Misalignment of machine drive trains
- Bearing damage
- Gear defect
- Magnetic, hydraulic and / or other functional alternating forces

Transmission and severity of the vibration

Vibration of the rotor and rotor shaft is excited by dynamic forces. This vibration is then transmitted via rolling element bearings or sleeve bearings. Transmission follows this path: from moving to non-moving machine parts, from there to the machine base.

Parameters by which the severity of the transmitted vibrations can be measured include the following:

- Rigidity and damping:
  – of the machine design
  – of the bearing design
  – of the machine base
- Condition of rolling element bearing lubricant
- Decoupling the machine base
- Ratio of machine mass to machine base mass

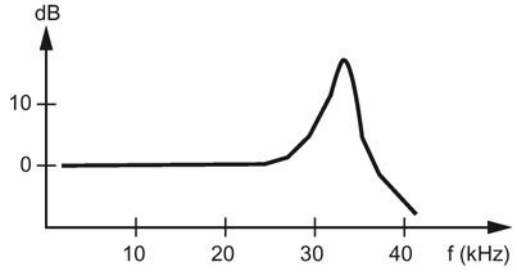
3.2 Measuring vibration

3.2.1 Acceleration sensor

Piezoelectric sensors

Piezoelectric sensors are used for the frequencies and frequency bands to be covered for vibration monitoring with CMS2000. These sensor generate an analog voltage signal that can be further processed in response to dynamic compressive and tensile forces. Static acceleration forces, such acceleration due to gravity, are not picked up by these sensors. An industrial standard for piezoelectric sensors is IEPE (Integrated Electronics Piezo-Electric).

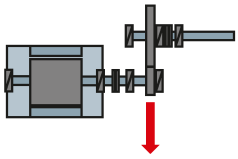
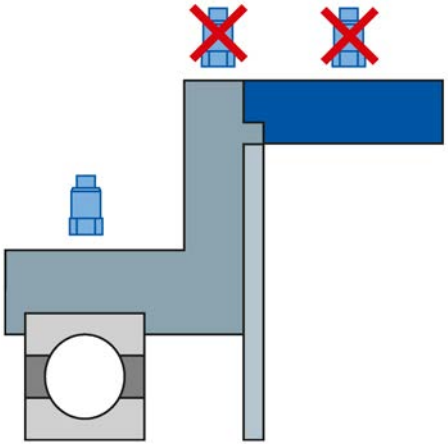
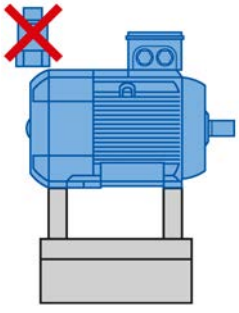
The following figure shows an example of a frequency sensor with the typical frequency response.

Acceleration sensor	Typical frequency response (resonance at 34 to 36 kHz)
	

3.2.2 Choice of measuring point

Choosing the measuring point

Here as some basic tips on how to choose the measuring point, i.e. where the acceleration sensor will be placed.

For an optimum measurement result, the measurement axis of the sensor should be oriented in the direction of the load if possible.	 Example: Direction of load of gear wheel
The measurement path between the machine bearing and the measuring point should be as short and direct as possible • The longer the signal path, the weaker vibration signals become. • Material transitions damp and/or reflect the signal to be measured.	
Freely vibrating or elastically deformable parts of the enclosure or cladding (e.g. fan cover) are not suitable as measuring points.	 Fan cover as measuring point

3.2.3 Mounting on the object to be measured

Mounting acceleration sensors

The way the sensor is mounted will greatly influence the measurement accuracy.

A high quality of signal can only be achieved with smooth and clean mounting surfaces. Coats of paint on mounting surfaces also impair the result.

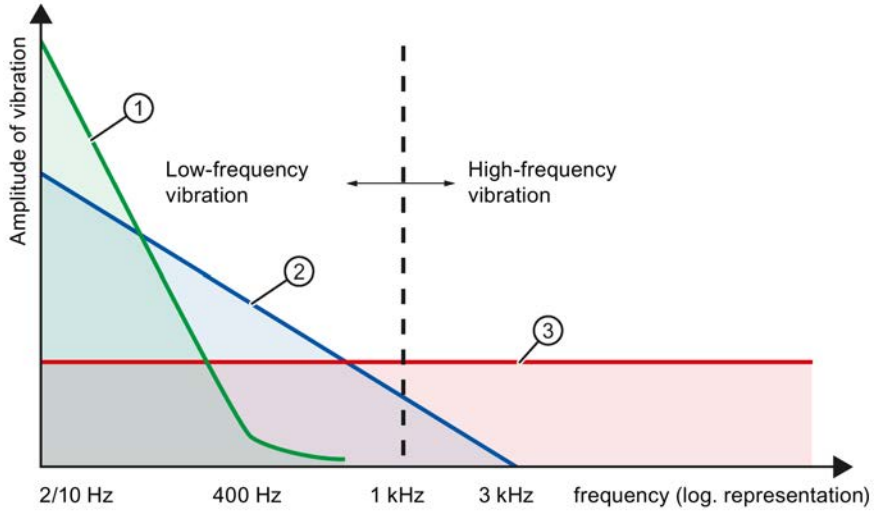
Here are some common types of fixing or mounting acceleration sensors:

Fastening methods		Suitability / special aspects	Frequency band
	Direct screw fastening with threaded bolts	For flat, smooth surface	Upper frequency limit 10 kHz to 20 kHz
	Screw fastening via adapter	For non-flat and/or coated surfaces	Upper frequency limit 10 kHz to 20 kHz
	Adhesive bond, e.g. with superglue or epoxy resin	Depending on the temperature properties of the adhesive used	Upper frequency limit 10 kHz to 18 kHz
	Fastening with permanent magnets	For fast and flexible mounting Suitability depends on adhesive force, falls of at higher frequencies	Upper frequency limit typically approx. 5 kHz to 15 kHz

3.2.4 Measured variable , frequencies, and energy

Interrelationship between measured variables, frequencies, and energy

The following diagram shows how the amplitudes of the three vibration variables (displacement, velocity, and acceleration) develop as frequency rises. The diagram provides information about the frequencies up to which measurement and evaluation of a certain vibration variable can provide meaningful data.



No.	Vibration variable	Causes of vibration and measurement limits
①	Vibration displacement (µm)	Shaft vibration 1 Hz to 0.4 kHz
②	Vibration velocity (mm/s)	Enclosure vibration 2 Hz / 10 Hz to 1 kHz
③	Vibration acceleration (m/s^2)	Gearbox, structure-borne noise 2 Hz / 10 Hz to 20 kHz

3.3 Method of fault detection and diagnostics

3.3.1 Overview of diagnostic methods

Method for condition monitoring

In machine monitoring, there are a number of different way of monitoring and diagnosing the machine condition. Only those methods are listed below that are implemented in CMS2000.

Characteristic value formation by vibration measurement in the time range

The condition of a machine is monitored by acquiring characteristic values with which the general vibration condition of the machine can be assessed. The trends of these variables indicate whether the condition is becoming worse, i.e. incipient damage.

- The rms value of the vibration velocity (RMS) for monitoring the general vibration condition
- Characteristic value formation for vibration acceleration (DKW) for rolling element bearing monitoring

Vibration diagnostics by frequency analysis

In themselves, characteristic value measurements are not enough for precise defect location. For this purpose, the vibration pattern of the machine must be analyzed more precisely. Most types of damage are recognizable in the spectrum by the occurrence of typical damage frequencies or typical patterns of damage frequencies. The following spectra can be calculated for CMS2000 and used as a basis for vibration diagnosis and vibration monitoring:

- Vibration velocity spectrum
- Vibration acceleration spectrum
- Envelope spectrum

3.3.2 Types of defect and diagnostics

Diagnostics methods

Fault type	Vibration measurement in the time range (characteristic value method)	Frequency analysis spectrum		
		Vibration velocity	Vibration acceleration	Envelope curve
Unbalance	RMS	Single rot. frequency f_n	--	--
Misalignment, coupling defect	RMS	Single rot. frequency f_n Double rot. frequency f_n	--	--
Mounting defect	RMS	Single rot. frequency f_n Double rot. frequency f_n Triple rot. frequency f_n	--	--
Blade passing frequency	RMS	$f_{SP} \leq 1$ kHz	$f_{SP} > 1$ kHz	--
Meshing defect	--	$f_Z \leq 1$ kHz	$f_Z > 1$ kHz	--
Belt defect	RMS	$f_R \leq 1$ kHz	$f_R > 1$ kHz	--
Resonance	RMS	Resonance frequency = rot. frequency f_n	--	--
Bearing wear	DKW	--	3 kHz ≤ f_{LE} ≤ 10 kHz	--
Bearing damage frequencies	DKW	--	--	Geometry-dependent for: Outer race, inner race, cage and rolling element (ball)
Electrical stator fault	RMS	Double line frequency f_{line}	--	--
Electrical rotor faults	RMS	$f_{bar} \leq 1$ kHz	$f_{bar} > 1$ kHz	--
	RMS	Double line frequency f_{line} Modulation with slip frequency f_{slip}	--	--

3.4 Vibration diagnostics by characteristic value formation in the time range

3.4.1 Overview

Applications of vibration measurement in the time range

Wide-band vibration measurement in the time range provides information about the overall condition of a machine and the effectiveness of measures taken to suppress vibration.

The development of the machine condition can be checked by comparing up-to-date measurements with previous vibration levels or by comparing with published guidance values or manufacturers' data. With this trend analysis, worsening conditions can be detected in good time and appropriate measures planned and implemented.

Note

Detailed fault diagnostics is not possible or only possible to a limited degree for wide-band vibration measurement based on characteristic values.

Characteristics of vibration measurements in the time range

- The measurement methods and assessment of wide-band vibration measurements are defined and standardized in national and international guidelines and standards.
- The values of rms vibration velocity are measured and calculated over a defined frequency band.
- The range includes the frequencies 2 Hz or 10 Hz to 1000 Hz.
  Depending on the speed, the measuring range starts either at 2 Hz (speeds from 120 to 600 rpm) or at 10 Hz (speeds greater than or equal to 600 rpm) according to the DIN ISO 10816 standard.

3.4.2 Standards and guidelines

Standards and guidelines

The following standards and guidelines are applicable to machine monitoring using wide-band characteristics:

Standards	ISO 10816	Vibration measurement, evaluation at site of installation Characteristic value: RMS (root mean square) vibration velocity.
	EN 60034-14	Vibration measurement, acceptance measurements at the factory
Guidelines	VDI 3832	Rolling element bearing condition, various procedures SIPLUS CMS2000 uses the DKW diagnostic characteristic value based on the K(t) method

3.4.3 ISO10816

ISO 10816

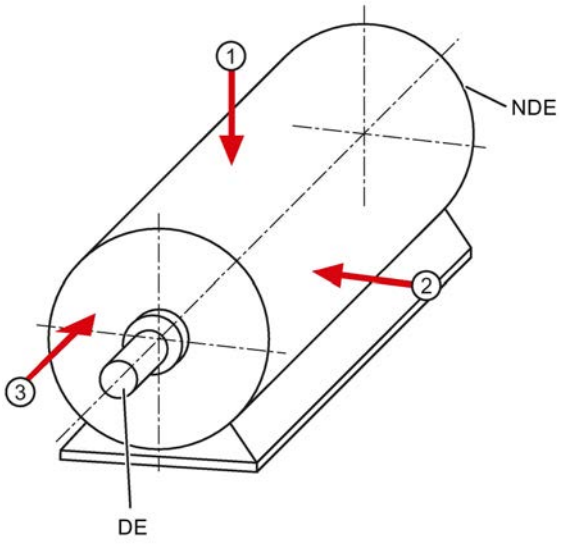
This standard provides general instructions for measuring and evaluation the mechanical vibrations of machines when these are measured on non-rotating parts of the machine.

Title of standard: Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts

The following parts of the standard are relevant for vibration monitoring CMS2000:

- Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 rpm and 15 000 rpm when measured in situ (ISO 10816-3:2009)
- Part 7: Rotodynamic pumps for industrial applications, including measurements on rotating shafts (ISO 10816-7:2009).

Measuring points

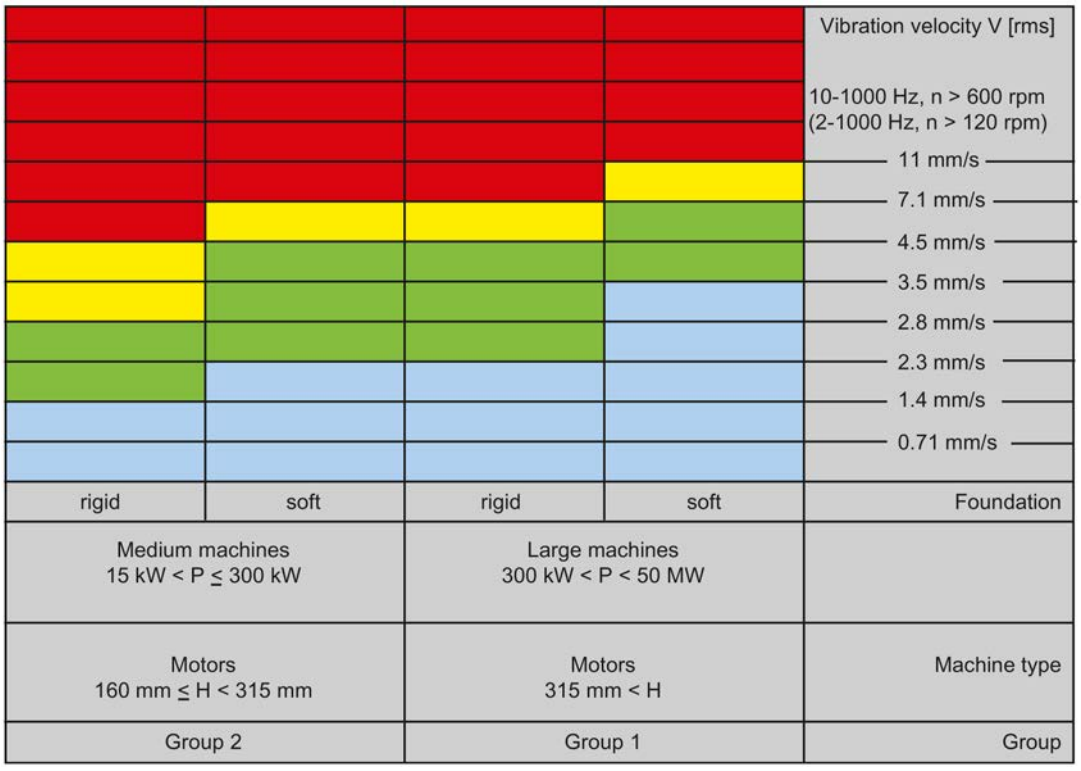


① vertical
② horizontal
③ axial

The measurements are taken at the installation site of the machine. The standard provides information about the choice of suitable measuring points for the vibration sensors.

Classification of the vibration severity according to ISO 10816-3

The standard classifies the vibration severity. The classification is based on the machine type, nominal power or shaft height, elasticity of the machine base.



Criterion 1 for assessing machine vibration

Criterion 1 considers the magnitude of the vibration. The vibration is assessed against defined evaluation zones.

Evaluation zone		Description	Actions
A		Newly commissioned machine.	None The vibration values are in the permissible range
B		Unrestricted long-term operation.	None The vibration values are in the permissible range
C		Only limited-period operation permissible.	The cause of the vibration must be investigated. Shut-down should be planned to enable remedial action to be taken.
D		The vibration values are of sufficiently severity to cause damage to the machine.	Immediate action is required to locate and remedy the cause of vibrations.

Criterion 2 for assessing machine vibration

Criterion 2 looks at the change in the magnitude of the vibration. This criterion provides ways of assessing the change in the magnitude of the vibration as compared with a previously defined reference values and can be used as a basis for trend analyses.
One requirement of the standard in respect of criterion 2 is "that the vibration measurements to be compared are performed at the same measuring point and in the same direction of measurement and in approximately the same steady-state operating conditions.
Considerable deviations from the usual vibration values – irrespective of the vibration magnitude – should be investigated to avoid hazardous conditions."

3.4.4 Guideline VDI 3832

Application

The VDI 3832 guideline provides information and recommendations on performing and evaluating the measurement of structure-borne sound of rolling element bearings in machines and plants for evaluation of state condition.

Characteristic values for condition assessment

The VDI 3832 guideline looks as both characteristic values capable of broadband diagnosis and (frequency-selective) characteristic values capable of narrowband diagnosis.

The characteristic values considered in the guideline include:

- RMS value
- K(t) value (DKW is used with CMS2000. DKW is the reciprocal value of K(t))
- Envelope spectrum

3.4.5 Monitoring measured variable trends

Trend monitoring

The following diagram shows a typical trend curve obtained by measurement or calculation of characteristic values. Signs of an incipient fault are usually detectible long before failure, e.g. because the vibration value increases.

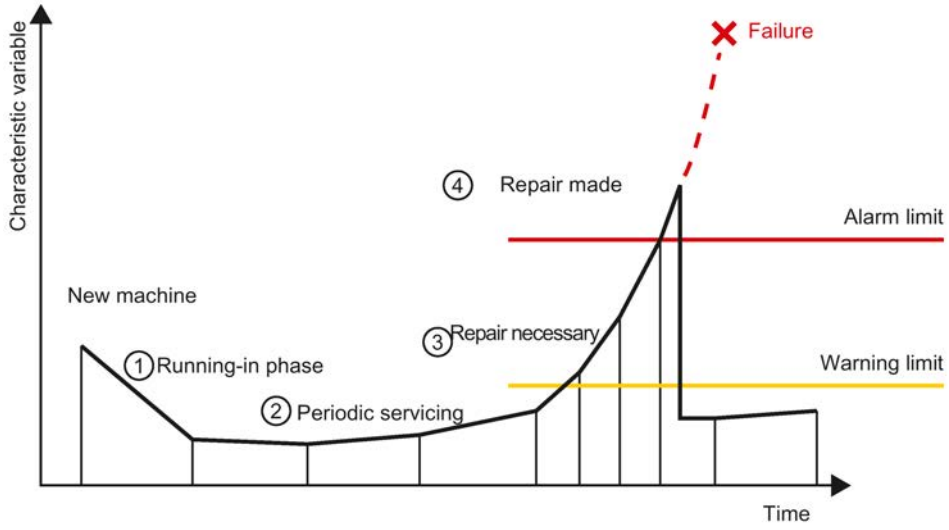


Image 3-1 Characteristic value trend

Explanations of the diagram

①	The characteristic values are initially somewhat higher during the start-up phase of a new machine. The characteristics variables then decline to the values that represent the fault-free condition of the machine.
②	The maintenance strategy may be periodic servicing, for example. By regular condition monitoring, developing damage can be detected as it occurs.
③	The characteristic value has exceeded a warning limit. Repair is necessary. However, the machine can still be used. Further measurements show a steep increase in the characteristic values. It is possible to extrapolate from the trend when major damage resulting in failure would occur.
④	The defined alarm limit is exceeded. The machine is now repaired. Measurements of the characteristic values again indicate the fault-free condition of the machine.

3.4.6 Evaluation of the machine condition via the vibration severity (RMS)

3.4.6.1 Description of the diagnostic method (RMS)

Characteristics of CMS2000

Characteristic value	Frequency band	Monitorable
RMS (Root Mean Square)	2 / 10 Hz to 1 kHz	Machine vibration

In the vibration frequency band 2 Hz / 10 Hz to 1 kHz, the rms value of the vibration velocity is the most meaningful analysis value. Typical excitation of machine vibrations at the frequency of rotation is in this frequency band.

Evaluation via the rms value of the vibration velocity is standardized and has also been included in the standardization (DIN ISO 10816; Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts).

Calculating / determining the RMS

The rms value of the vibration velocity is a wide-band vibration value. It is calculated as the arithmetic mean of all vibration events within a defined frequency band (e.g. 10 Hz to 1 kHz for the rms vibration velocity according to ISO 10816).

3.4.6.2 Application example machine analysis: Unbalance (RMS)

Application example

Machine vibration is frequently caused by misalignment, unbalance or frames mounted under stress.

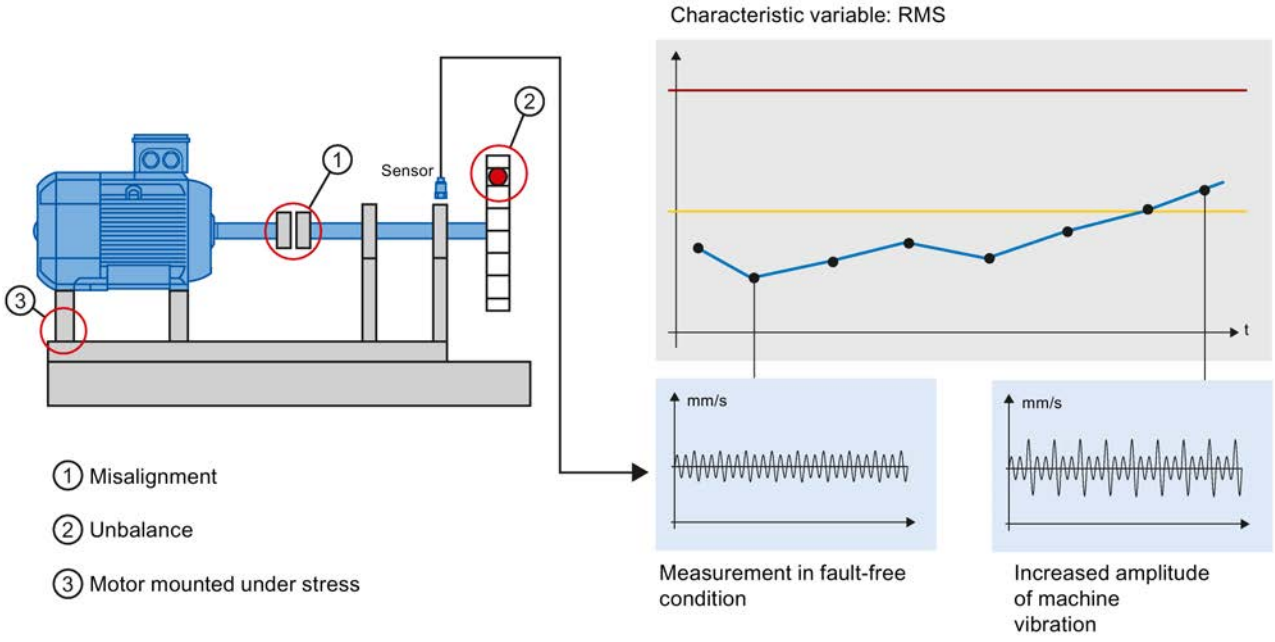


Image 3-2 Example of RMS

Measuring method according to ISO 10816

(see Section ISO10816 (Page 28))

3.4.7 Characteristic value formation via vibration acceleration (DKW)

3.4.7.1 Description of the diagnostic method (DKW)

Characteristics of diagnostics characteristic value (DKW) for CMS2000

Characteristic value	Frequency band	Monitorable
DKW (diagnostic characteristic value)	> 1 kHz	Rolling element bearing condition

- Formation of the characteristic value via the diagnostic characteristic value DKW enables qualitative diagnostics of the overall condition of the rolling element bearing without expert know-how.
- For calculation of the DKW value, the measured rms values and peak values of the vibration acceleration in the initial condition (fault-free condition) of the bearing are related to those of the current condition.
- The diagnostic characteristic value DKW exhibits a high correlation with the damage condition of rolling element bearings and is therefore very meaningful.

3.4.7.2 Operating principle of DKW monitoring

Calculation of the DKW value

The diagnostic characteristic value (DKW) is calculated by following formula:

$$DKW\ (t) = \frac{a_{max}(t) \cdot a_{eff}\ (t)}{a_{max}(0) \cdot a_{eff}\ (0)}$$

$a_{max}(t)$	Current peak value for vibration acceleration
$a_{RMS}(t)$	Current RMS value for vibration acceleration
$a_{max}(0)$	Initial peak value for vibration acceleration
$a_{RMS}(0)$	Initial RMS value for vibration acceleration

Note

The DKW is the reciprocal value of the diagnostic characteristic value K(t) according to VDI 3832

According to the K(t) method, the characteristic value would reduce as the damage increases. For the purposes of clarity, SIPLUS CMS2000 therefore generates the reciprocal of K(t).

Information on parameterization in CMS2000

The term $a_{max}(0) * a_{RMS}(0)$ represents the reference value for the DKW calculation. This reference value can be parameterized independently of the speed in CMS2000.

If the reference value is parameterized correctly, the DKW is typically close to 1 and increases as the vibration values increase.

3.4.7.3 Application example: Rolling element bearing damage (DKW)

Application example damaged rolling element bearing

The following example shows application of the DKW characteristic value to determine the condition of the rolling element bearing.

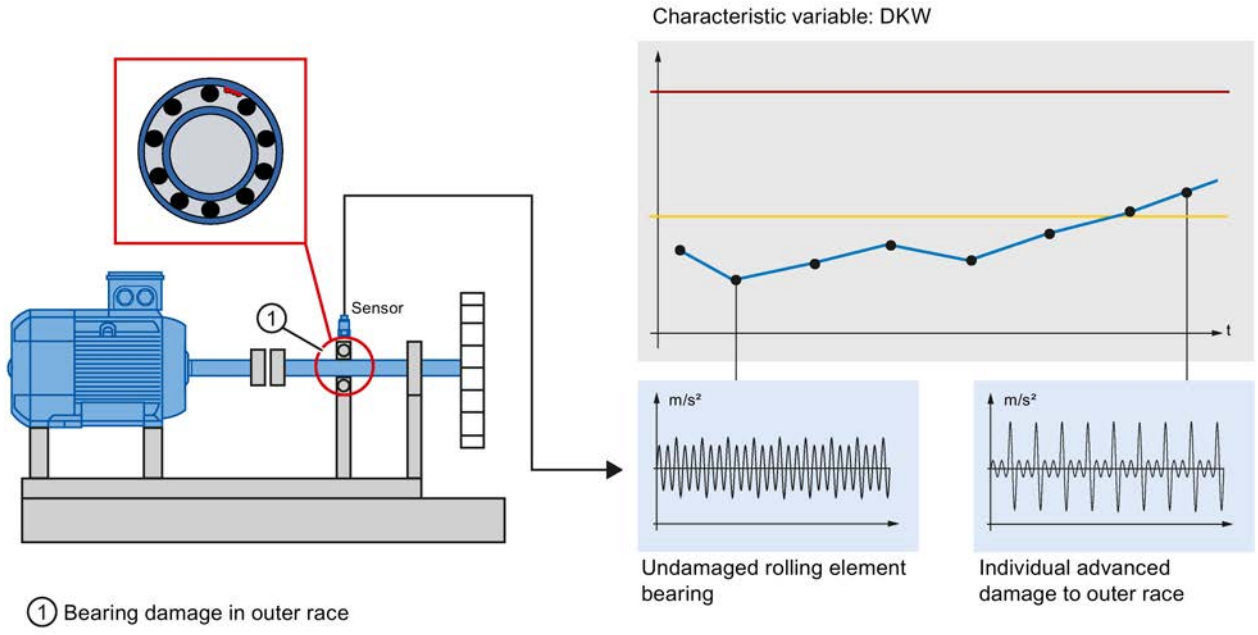


Image 3-3 Example of a DKW characteristic value

The DKW is in itself not sufficient to examine and determine the cause of damage precisely. Further analysis methods are used such as envelope curve analysis (see Section Envelope spectrum (Page 42))

3.5 Vibration diagnostics by frequency analysis

3.5.1 Overview

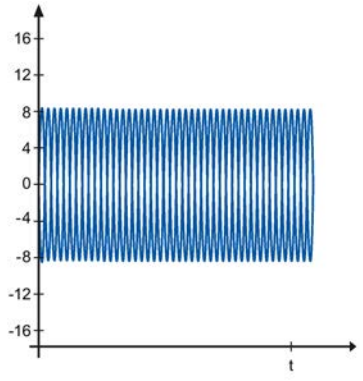
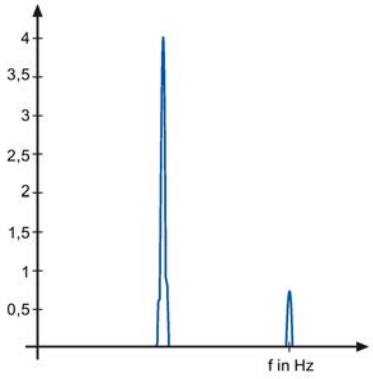
The vibration diagnostics in the time range reaches its limits when it comes to examining the causes of wear more precisely. Frequency analysis is used as the diagnostic method for more detailed examination of vibrations.

It is the basis for diagnostic vibration measurement:

1. Analyze vibration signals
2. Locate the cause
3. Define remedial action

Frequency analysis

The principle of frequency analysis is to convert a signal from the time band into the frequency band by means of spectral analysis. One common mathematical method is the fast Fourier transform (FFT).

Time signal	Frequency spectrum
	

3.5.2 Vibration velocity spectrum

3.5.2.1 Description of the diagnostic method

Characteristics of CMS2000

Spectrum	Frequency band	Resolution	Monitorable
Vibration velocity	2 Hz to 1 kHz 2 Hz to 2 kHz	0.2 Hz 0.4 Hz	Any combination of speed-dependent and speed-independent monitoring functions.

Depending on the current velocity or the monitoring to be conducted, CMS2000 automatically uses the appropriate frequency range.

Vibration velocity spectrum

The following figures shows the frequency band of the spectrum for the vibration velocity 2 Hz to 1 kHz and several examples of errors with their characteristic frequencies, which can be detected and revealed in this spectrum.

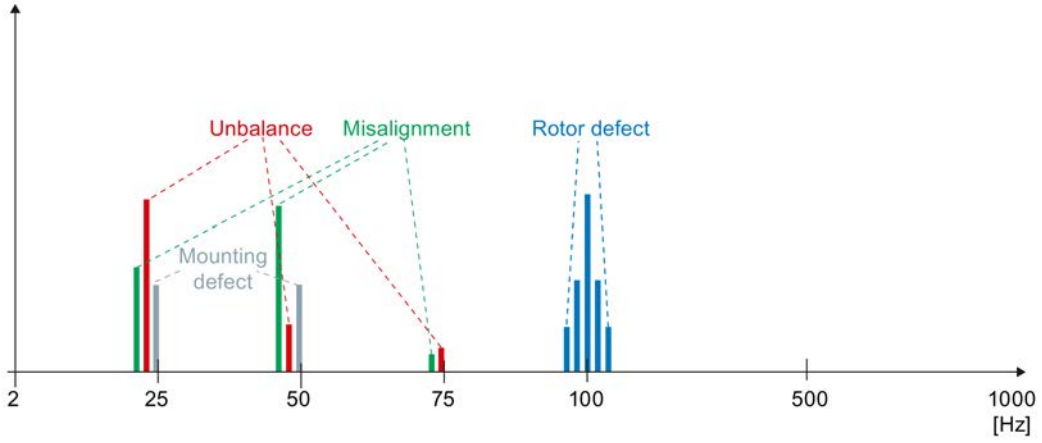


Image 3-4 Overall spectrum of vibration velocity

3.5.2.2 Application example: Unbalance

Example of unbalance

In the case of unbalance, the amplitude of the rotational frequency is very pronounced in both the horizontal and vertical directions of measurement.

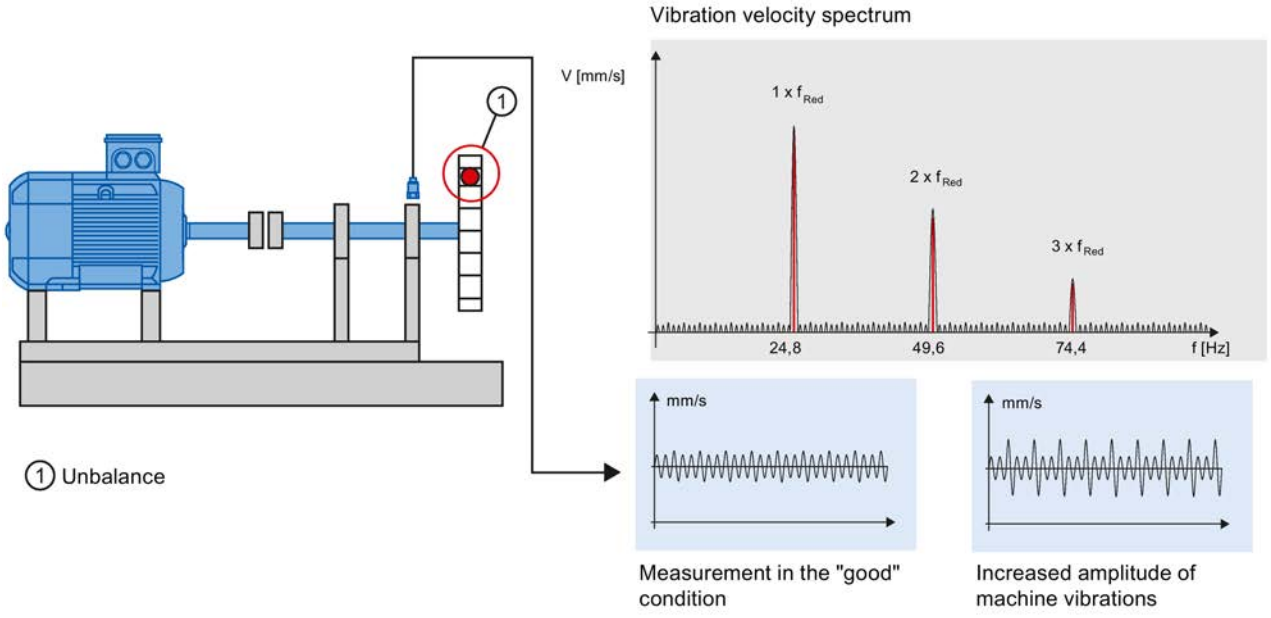


Image 3-5 Example of a spectrum of vibration velocity (unbalance)

3.5.3 Vibration acceleration spectrum

3.5.3.1 Description of the diagnostic method

Characteristics of CMS2000

Spectrum	Frequency band	Resolution	Monitorable
Vibration acceleration	2 Hz to 10 kHz	2.8 Hz	Any combination of speed-dependent and speed-independent monitoring functions.

Vibration acceleration spectrum

The following figures shows the frequency band of the spectrum for the vibration acceleration 2 Hz to 10 kHz and several examples of errors with their characteristic frequencies, which can be detected and revealed in this spectrum.

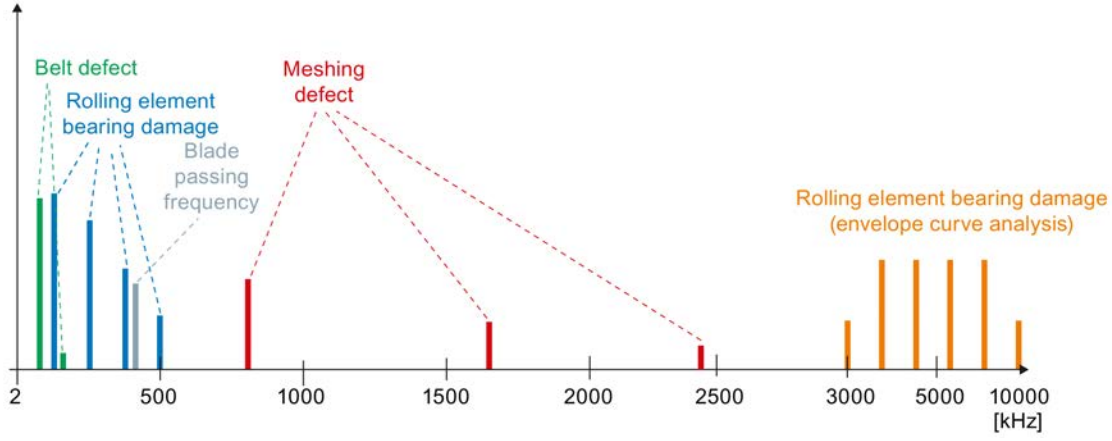


Image 3-6 Overall spectrum of vibration acceleration

3.5.3.2 Application example (rotor field fault)

Example rotor field fault

The causes of a defective rotor can be, for example, a broken or loose bar. Such faults can be detected by:

- Bar passing frequency with sidebands of twice the line frequency
- Twice the line frequency with sidebands of the slip frequency

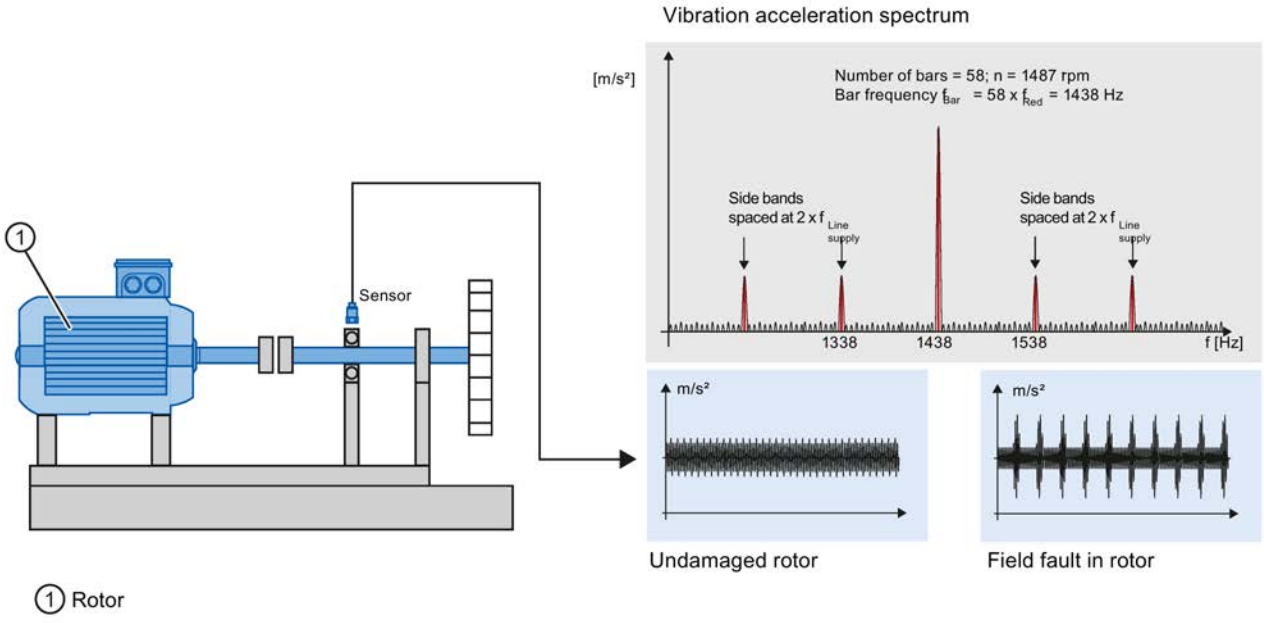


Image 3-7 Example: Spectrum of the vibration acceleration (rotor field fault)

3.5.4 Envelope spectrum

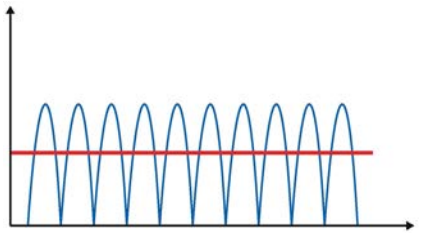
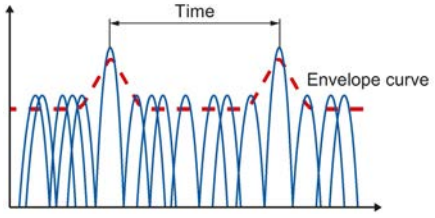
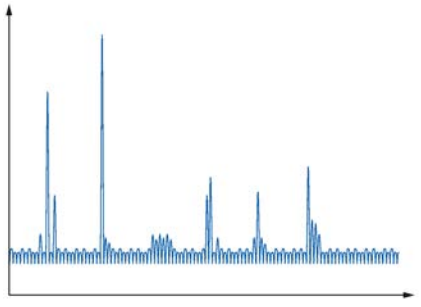
3.5.4.1 Description of the diagnostic method (envelope curve)

Characteristics of CMS2000

Spectrum	Frequency band	Resolution	Monitorable
Envelope curve analysis	2 Hz to 1 kHz 2 Hz to 2 kHz 2 Hz to 5 kHz 2 Hz to 10 kHz	0.2 Hz 0.4 Hz 1.0 Hz 1.4 Hz	Bearing damage frequencies and other speed-dependent monitoring functions

Depending on the current velocity or the monitoring to be conducted, CMS2000 automatically uses the most appropriate frequency range.

Method for envelope curve analysis

Filtered time signal of the vibration acceleration for analyzing roller bearing damage. For constant amplitude, the envelope for this time signal is an almost horizontal straight line.	
When a defect is rolled over, however, pulses occur periodically that overlay the machine vibrations, i.e. the horizontal straight line described above as the envelope curve is interrupted periodically or overlaid by these pulses. The resulting envelope curve only contains information about defects. The smallest defects are therefore visible, regardless of the much more energy-rich machine vibrations that do not modulate the vibration signal in the frequency bands under consideration. The envelope curve forms in the middle of the rectified carrier signal.	
The defect frequencies become apparent when the time signal is converted to a frequency signal.	

3.5.4.2 Application example bearing analysis: Rolling element bearing damage (envelope curve)

Example rolling element bearing damage

Damage frequently develops in the raceway of the outer race. Such damage can normally be detected using envelope curve analysis several months before a critical condition develops. The following example shows the envelope curve spectrum of the vibration acceleration. Damage frequency of the outer race: 125 Hz

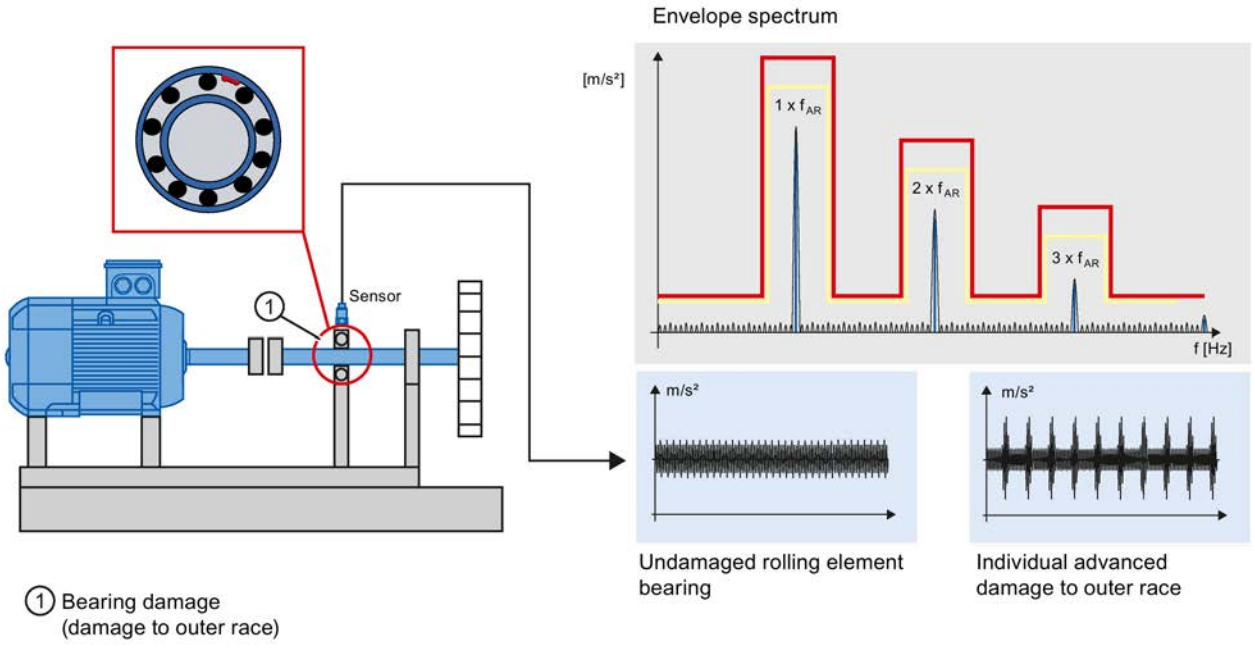


Image 3-8 Example of envelope curve analysis

3.5.5 Method of operation for spectrum monitoring

Combining different monitoring methods (speed-dependent / speed-independent) on one spectrum results in a single "limit band" for warning and alarm. The amplitude values of the spectrum are tested continuously against the limit band.

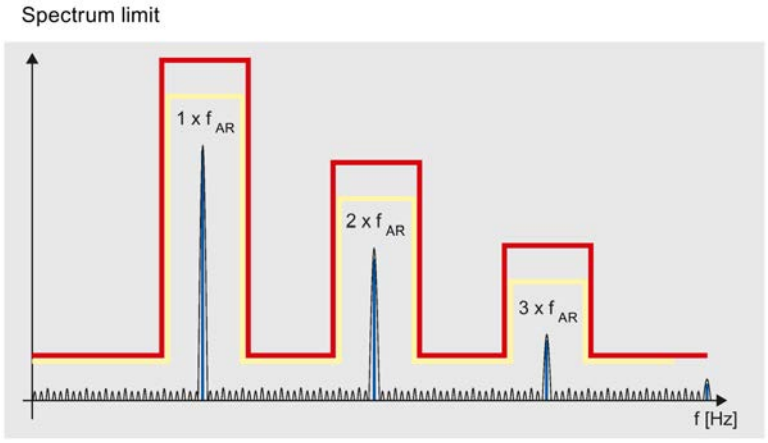


Image 3-9 Spectrum limit band

System overview

4

4.1 Features

SIPLUS CMS2000 is part of the SIPLUS CMS product family. Alongside the SIPLUS CMS1000 and SIPLUS CMS4000 systems, SIPLUS CMS2000 covers the middle operating range.

With the SIPLUS CMS2000 Condition Monitoring System, you can continuously monitor the condition of components subject to wear (such as motors, bearings) and critical machine parts.

SIPLUS CMS2000 is a compact condition monitoring system that can be operated as a stand-alone, or linked to a remote service center (LAN interface). The device provides a system interface for connecting expansion modules.

From firmware version V3.0, CMS2000 can be used either as a stand-alone monitoring system, or as a data supplier for the CMS X-Tools analysis software, or as a combination of the two. CMS X-Tools, Version 04.02 and higher, is required for using the X-Tools interface.

Other features

- Acquisition and evaluation of analog and digital signals
- Problem-free integration into new and existing machines
- Easy, reliable connection of a wide range of different signal sources
- High sampling rates
- Synchronous data recording
- Flexible definition of diagnostic tasks
- Parameterization and visualization via Web interface, no addition operating software required
- X-Tools interface for online transfer (data streaming) of detected vibration data and other data enables more advanced analyses in X-Tools, such as gearbox diagnostics.

4.2 System configuration

The SIPLUS CMS2000 Condition Monitoring System may consist of the following components, depending on the expansion level

- Basic unit VIB
- Max. 2 temperature modules (optional)
- Max. 2 expansion modules VIB-MUX (optional)

System configuration CMS2000 Basic Unit VIB with two temperature modules

In this system configuration, up to two IEPE acceleration sensor can be operated on the Basic Unit VIB. The following figure shows an expansion level with a Basic Unit VIB and two temperature modules. The acceleration sensor is directly connected to an IEPE input of the Basic Unit VIB. Up to two IEPE sensors can be used simultaneously on one Basic Unit VIB.

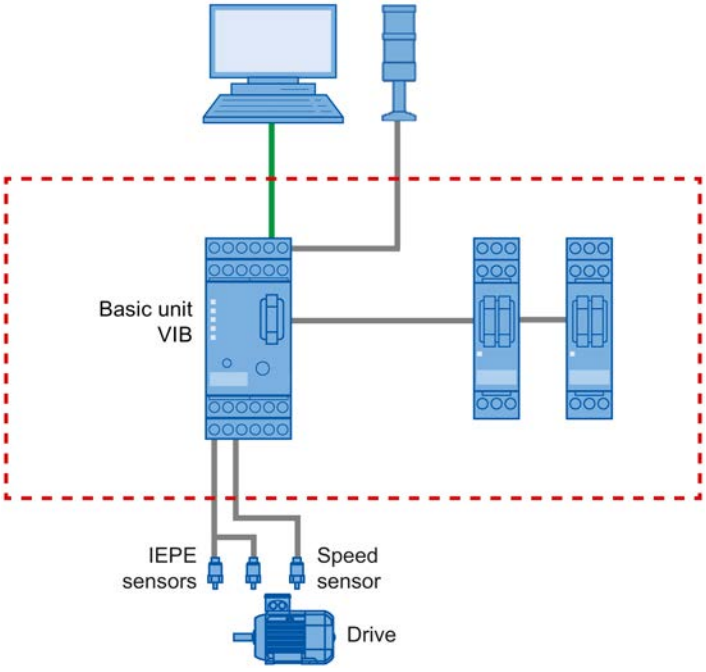


Image 4-1 System configuration

System configuration CMS2000 maximum configuration

In the maximum configuration of the CMS2000, up to two VIB-MUX and two temperature modules can be operated on one Basic Unit VIB. Each VIB-MUX provides 8 IEPE inputs, which are switched to one IEPE input of the Basic Unit VIB sequentially by multiplexing. Up to 16 IEPE sensors can be operated in the maximum configuration.

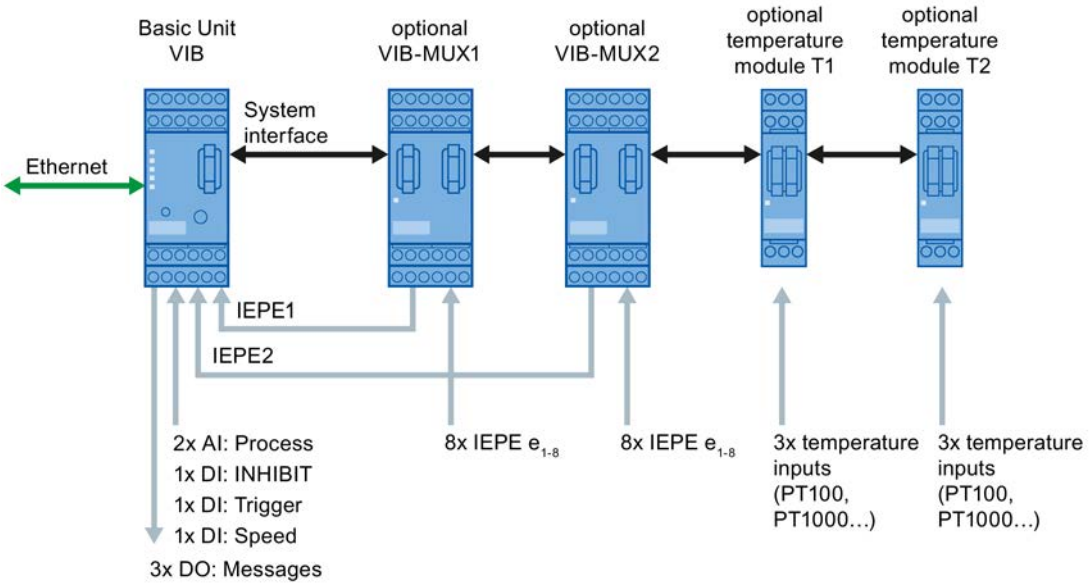


Image 4-2 System configuration CMS2000 maximum configuration

4.3 Integration into system environments / networks

Configuration

An Ethernet interface is available for integrating the device into system environments/networks.

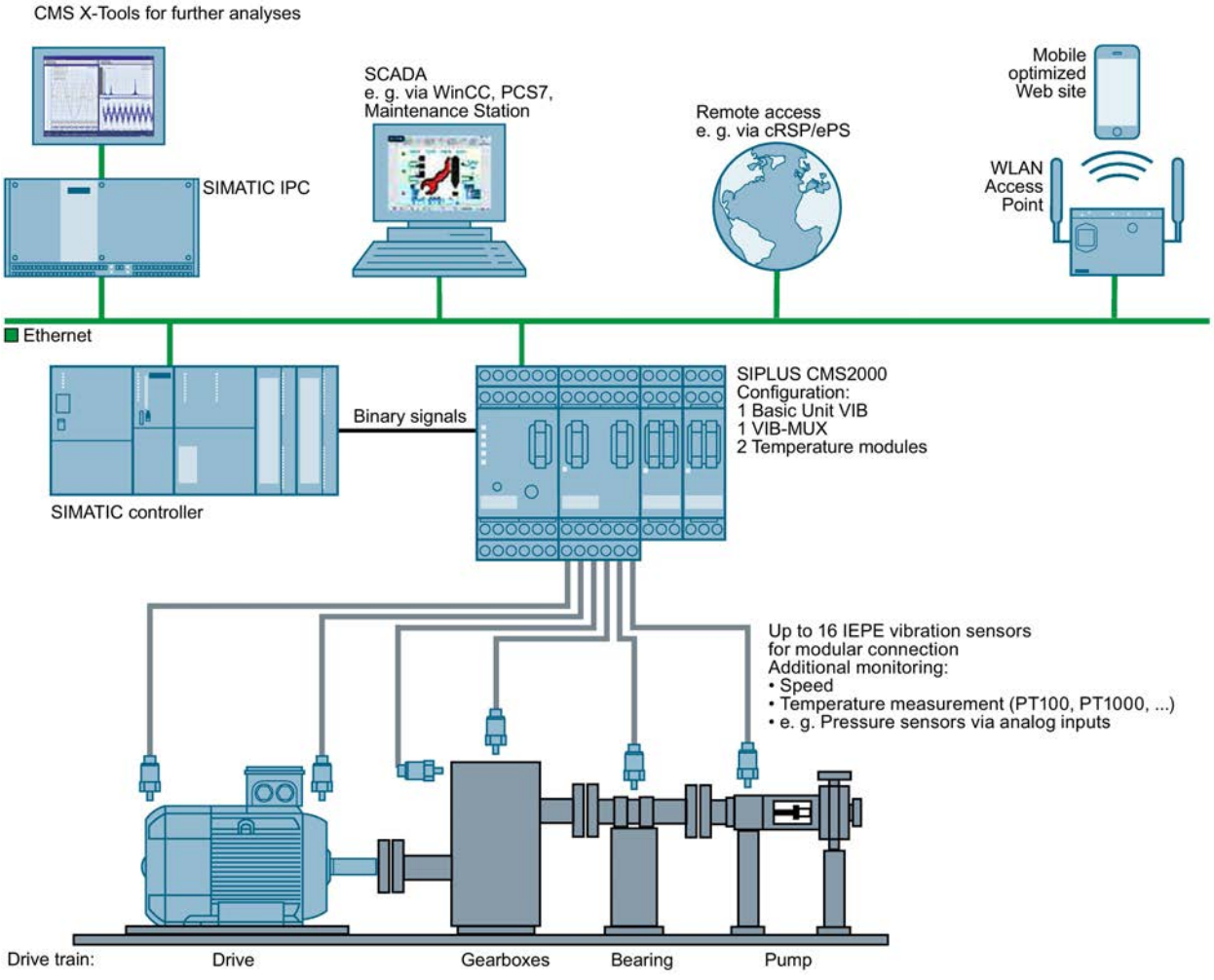


Image 4-3 Integration into system environments

Application options

- Parameterize, diagnose, visualize with Web browser
- For detailed diagnostics, analyze recorded data with CMS X-Tools (offline analysis)
- For detailed diagnostics, transfer raw data continuously to CMS X-Tools, and analyze it there (online analysis on the basis of data streaming)
- Send Ethernet telegrams with measured value and status information cyclically, e.g., to a SIMATIC controller

- Event-triggered notification to the Service Center via e-mail
- Archive device configuration and monitoring results

4.4 Ordering data

Devices

Product	Order No.	Remarks
SIPLUS CMS2000 Basic Unit VIB	6AT8002-1AA00	Basic device
SIPLUS CMS2000 VIB-MUX	6AT8002-2AA00	Expansion module for connecting up to eight IEPE sensors
Temperature module	3UF7700-1AA00-0	3 inputs for connecting up to 3 temperature sensors (e.g. PT100, PT1000)

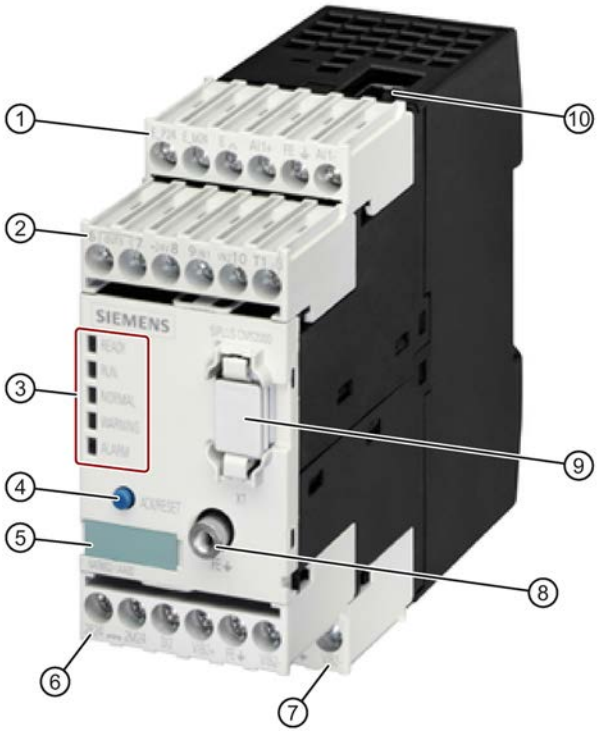
Accessories

Product	Order No.	Remarks
Connecting cable for the connection of expansion modules via the system interface	3UF7930-0AA00-0	For connecting VIB-MUX expansion modules and temperature modules For reasons of electromagnetic compatibility, this connecting cable (2.5 cm in length) must be used.
SIPLUS CMS2000 CABLE-MIL-300	6AT8002-4AC03	Connecting cable for connecting VIB sensors to MIL plugs; length = 3 m
SIPLUS CMS2000 CABLE-MIL-1000	6AT8002-4AC10	Connecting cable for connecting VIB sensors to MIL plugs; length = 10 m
SIPLUS CMS2000 VIB-SENSOR S01	6AT8002-4AB00	Vibration sensor (IEPE)
SIPLUS CMS2000 shield support	6AT8002-4AA00	-
CMS X-TOOLS PROFESSIONAL EDITION V 04.03	9AE4160-1AC00	Engineering software for recording, evaluating, simulating, visualizing and saving field and process data.

4.5 Basic Unit VIB

4.5.1 Structure of Basic Unit VIB

Basic Unit VIB overview

Structure		
	①	Connection block D
	②	Connection block C
	③	LED operating display
	④	Pushbutton: (Acknowledge / Reset)
	⑤	Label
	⑥	Connection block B
	⑦	Connection block A
	⑧	Functional grounding connection (optional)
	⑨	System interface for connecting expansion modules
	⑩	Ethernet interface

Features and functions

Features	Functions
• Integrated diagnostics software • 2 IEPE interfaces for vibration sensors • 2 analog inputs • 1 speed input • Ethernet interface • 2 digital inputs, • 3 digital outputs • System interface for connecting expansion modules • Assembly system: DIN rail mounting:	• Characteristic values (bearing, vibration monitoring) • Frequency-selective analysis using FFT, H-FFT • Speed measurement • Trend analysis • Limit monitoring of frequency bands, process variables, temperature • Recording with time stamp of trend values, raw data, frequency spectra, message log • Simple localization of damage using fingerprint comparison • Output of system and status messages • Export of raw data for further diagnostics (offline and online) • Web server and e-mail notification • Time synchronization via LAN • Diagnostics suppression via inhibit input

4.5.2 Operator control and display elements (VIB)

Indicators

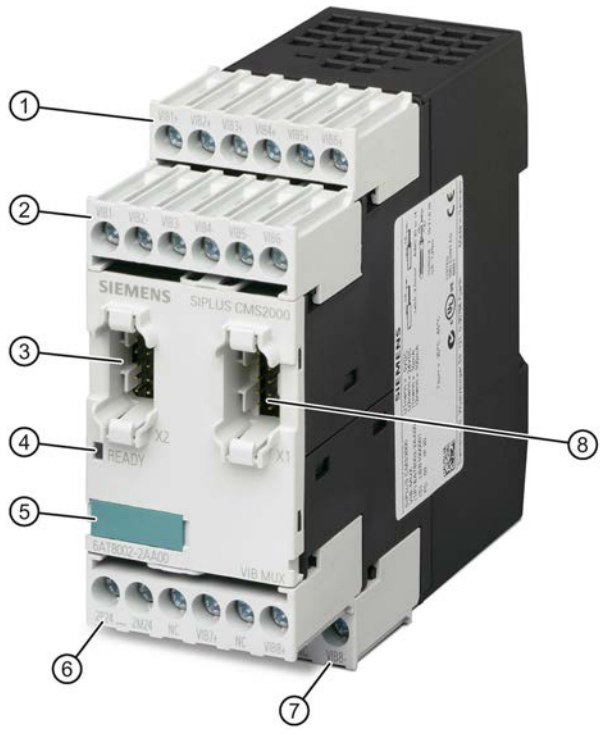
LEDs	Meaning
	These LEDs provide information about the current status of the devices and about the monitored subsystems. For a detailed description of the LED displays, see Section LED status indicator on the Basic Unit VIB (Page 217).

Pushbutton functions

Pushbutton	Functions	
	**Acknowledgment of messages**	A single short press of the pushbutton acknowledges all pending messages that require acknowledgment.
	Resetting the device	Press and hold down the pushbutton for approximately 10 seconds. The "READY" LED flashes to indicate a successful reset and the start of a hot restart.

4.6 VIB-MUX expansion module

4.6.1 Configuration of the VIB-MUX expansion module



①	Connection block D
②	Connection block C
③	System interface (basic unit or VIB-MUX1)
④	LED operating display
⑤	Label
⑥	Connection block B
⑦	Connection block A
⑧	System interface (VIB-MUX 2 or temperature module)

4.6.2 Overview of functions

Function

The expansion module VIB-MUX connects 8 IEPE input channels to one output channel sequentially by multiplexing. The device is controlled via the system interface of the CMS2000 Basic Unit. The signals are evaluated and diagnosed only via the CMS2000 Basic Unit VIB.

Functions

5

5.1 Operating modes

The SIPLUS CMS2000 condition monitoring system can assume different operating modes during operation. To clarify the various functions of the CMS2000, the operating modes will be briefly explained at this point.

You can see from the figure below what modes the system can assume and the events that initiate a change in status.

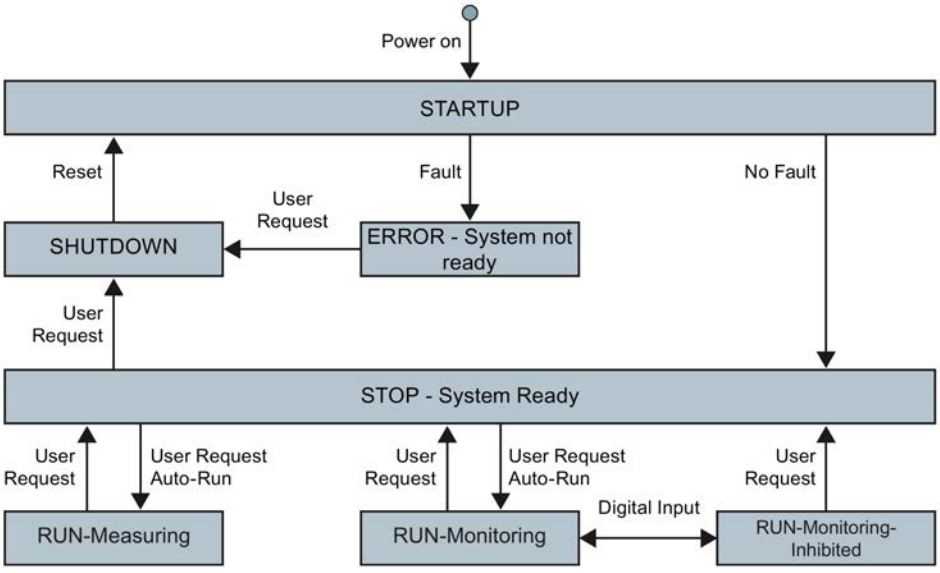


Image 5-1 Operating modes

Startup

After switching on, the device is in "Startup" mode. Non-recurrent initial settings are made in this state. Steps are subsequently performed that prepare the device for operation. If an error occurs at this point, the system will switch to "ERROR - System not ready" mode (see Section "ERROR - System not ready" mode (Page 228)).

STOP - System ready

When all initialization and preparation steps have been successfully completed, "STOP - System ready" mode is entered. The device is now ready for operation, but not yet in an active operating mode. That is, no acquisition or monitoring of process measured variables is performed. You can perform the following actions in "STOP - System ready" mode :

- Change the hardware configuration and parameters for diagnostics mode
- Switch to one of the active operating modes
  - RUN-Monitoring
  - RUN-Measuring
- Erase, back-up and restore data
- Restart the device
- Reset the device to default settings
- Administrative tasks

Note

You have to actively control the changeover from STOP to an active operating mode and back by means of an explicit request via the web site.

After rebooting, the device switches automatically to RUN if it was in RUN before the restart. The monitoring function of the device is therefore always maintained, even after an unintentional restart (e.g. power off/on).

Please note that when a device is restarted via the website, it will not automatically switch to RUN, because it was in STOP beforehand.

RUN-Measuring

In RUN measuring mode, the SIPLUS CMS2000 functions as a pure measuring instrument. The measured variables of the configured channels are acquired and displayed. The process data are recorded, but no monitoring is performed. Measuring mode is used for test purposes and supports commissioning procedures.

In measurement mode, reference values for monitoring the RMS and DKW characteristic values are acquired and updated on the vibration channels. These teach values are used as guidance values for the user for determining the RMS limits of the speed-dependent DKW reference values.
In measuring mode, the user can also create fingerprints, record raw data, and transfer raw data to X-Tools using data streaming.

RUN-Monitoring

In RUN-Monitoring mode, the device is actually performing monitoring, i.e. all the diagnostic tasks created by the user will be processed. The device acquires the measured values of the configured channels, evaluates them, records process data and triggers responses in the case of limit violations. The X-Tools interface can also be used in RUN-Monitoring mode.

RUN-Monitoring inhibited

All diagnostic procedures can be suppressed with one specific digital input ("Inhibit"). If a high-level is detected at the inhibit-input in the RUNmonitoring status, the "RUN-Monitoring deactivated" mode is entered immediately. The switch back to RUN monitoring is triggered by a low level on the "Inhibit" input.

In "RUN-Monitoring inhibited" mode, all the values are continuously acquired or calculated and displayed on the "Actual values (Page 128)" page. Monitoring, however, is no longer performed (the values are highlighted in blue, see also Section Actual values (Page 128)). Queuing messages concerning threshold violations are canceled. If limits are violated in "RUN-Monitoring inhibited" operating mode, no messages will be generated. If "RUN-Monitoring inhibited" monitoring mode is exited, monitoring is resumed and limit violations will result in messages again (i.e. they will come and go in accordance with the monitored variables and their limits).

"RUN-Monitoring inhibited" allows temporary interruption of the CMS2000 monitoring function. It can be used to exclude transitory states (e.g. start-up or coast-down of a machine) of the monitored object from the CMS2000 monitoring. This feature can be used to avoid unwanted messages from CMS2000 due to transitory states of the monitored object.

Example: When a machine is started up alongside the monitored equipment, the measured vibration signal is affected. To prevent unwanted messages, the Basic Unit can be switched to "RUN-Monitoring inhibited" during start-up.

Data transfer to X-Tools is not affected by the inhibit input.

Shutdown

Changeover to the "Shutdown" operating mode and therefore shutdown of the device is performed when:

- The "Restart basic unit" function is called via the user interface (web page; see Section General (Page 178))
- The "Reset to factory settings" function is called (see Section Cleanup (Page 192))

The device remains in "Shutdown" operating mode for approx. 5 s, allowing all active operations to be completed.

This is always followed by a warm restart of the system.

Changing operating modes

You can change the operating states using buttons on the web pages (see Section Changing operating mode (Page 122)):

- Switch from the "STOP - System ready" operating mode to an active operating mode ("RUN-Monitoring" or "RUN-Measuring")
- Switch from an active operating state back to "STOP – System ready"

5.2 Measuring mode

Overview of the method of operation

Measurement mode is for test purposes and to support commissioning, in particular, to define the limits to be monitored.

In measurement mode, measured variables chosen by the user are measured, calculated and displayed as trend curves on selected channels. The measured variables are not measured during measurement mode.

Teach values are determined and updated for RMS and DKW values. These teach values can be used as reference values for the fault-free condition of the machine.

Spectra can be stored as fingerprints and are thus a record of the fault-free condition of the machine.

For subsequent analysis and evaluation, current raw data can also be stored by the user (see Section "Recording raw data (Page 76)."

In measurement mode, it is possible to modify and visualize monitoring parameters.

The following figure shows some essential functions of CMS2000 measurement mode.

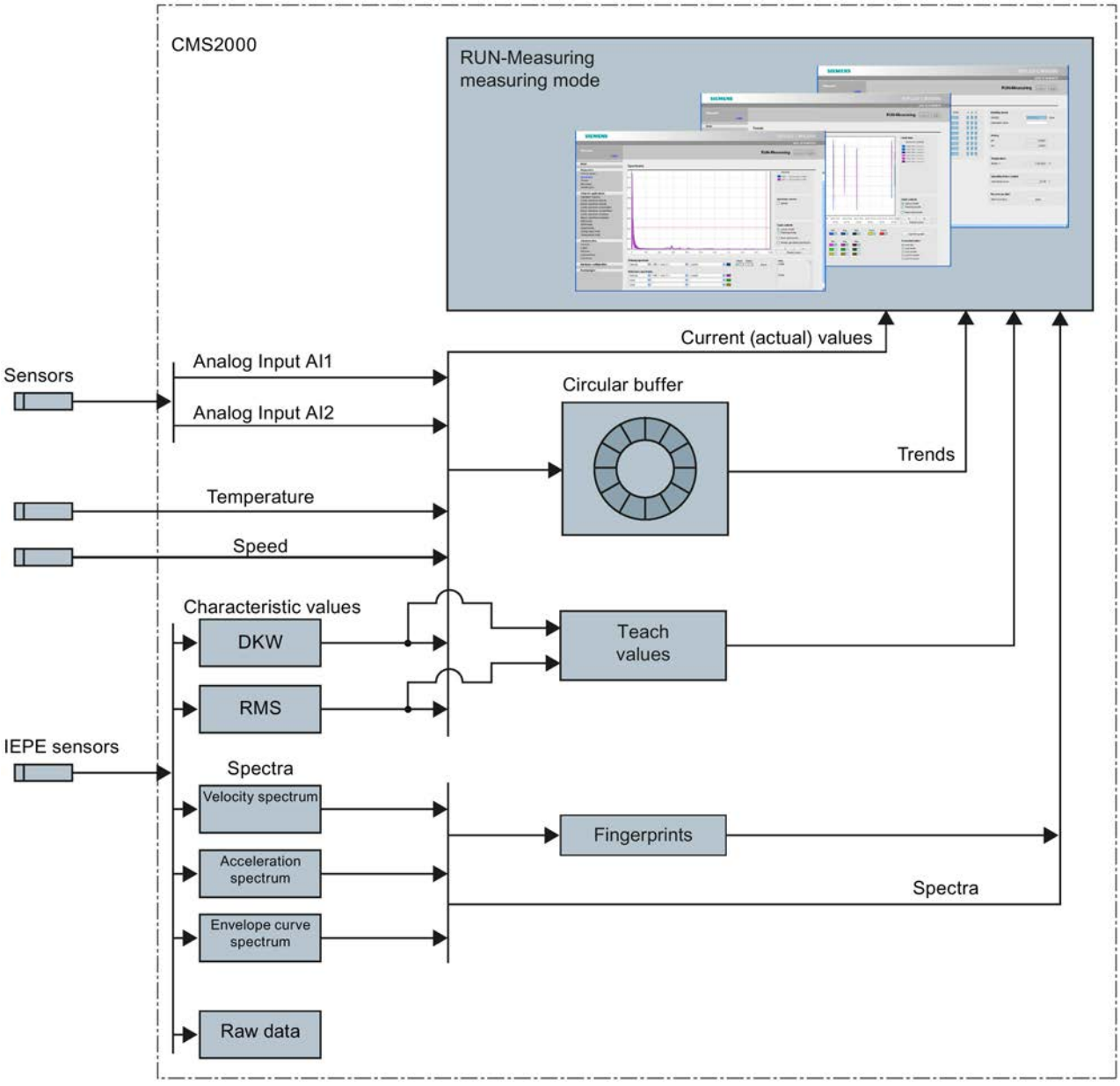


Image 5-2 Measurement mode method of operation

Measurement mode with activated X-Tools interface

If the X-Tools interface is activated, measurement mode is also useful in continuous operation. The CMS2000 is then used as a data supplier for X-Tools without performing its own monitoring.

In measurement mode, the maximum number of VIB channels is permanently set (see Changing operating mode (Page 122)). Calculation of the characteristic values RMS / DKW and the spectra is optional. With this, X-Tools can access all configured channels in measurement mode, and their calculated characteristic values, if applicable.

5.3 Monitoring mode

5.3.1 Monitoring: Overview of the method of operation

Overview of the method of operation

In monitoring mode, all measured variables to be monitored are constantly measured, calculated and monitored for parameterized limits. If limits are violated, relevant messages are output and the parameterized responses, e.g. controlling digital outputs or LEDs.

The characteristic values RMS and DKW are calculated for configured vibration channels if the limit values for the characteristic value are defined.

Spectra are monitored using parameterized operation states. An operation state is characterized by a certain speed range. A spectrum is calculated and monitored if the current speed is within an operation state and limits have been defined for the spectrum for this operation state.

The measured variables are recorded in a trend curve.

Frequency bands and speed ranges

CMS2000 supports the following speed ranges and frequency bands for the monitoring method:

Monitoring method	Frequency band	Speed range
RMS	2 / 10 Hz to 1000 Hz	120 rpm to 24000 rpm
DKW	> 1 kHz	
Velocity spectrum	2 Hz to 1 / 2 kHz	
Acceleration spectrum	2 Hz to 10 kHz	
Envelope spectrum	2 Hz to 1 / 2 / 5 / 10 kHz	

The following figures shows some essential functions of CMS2000 monitoring operation.

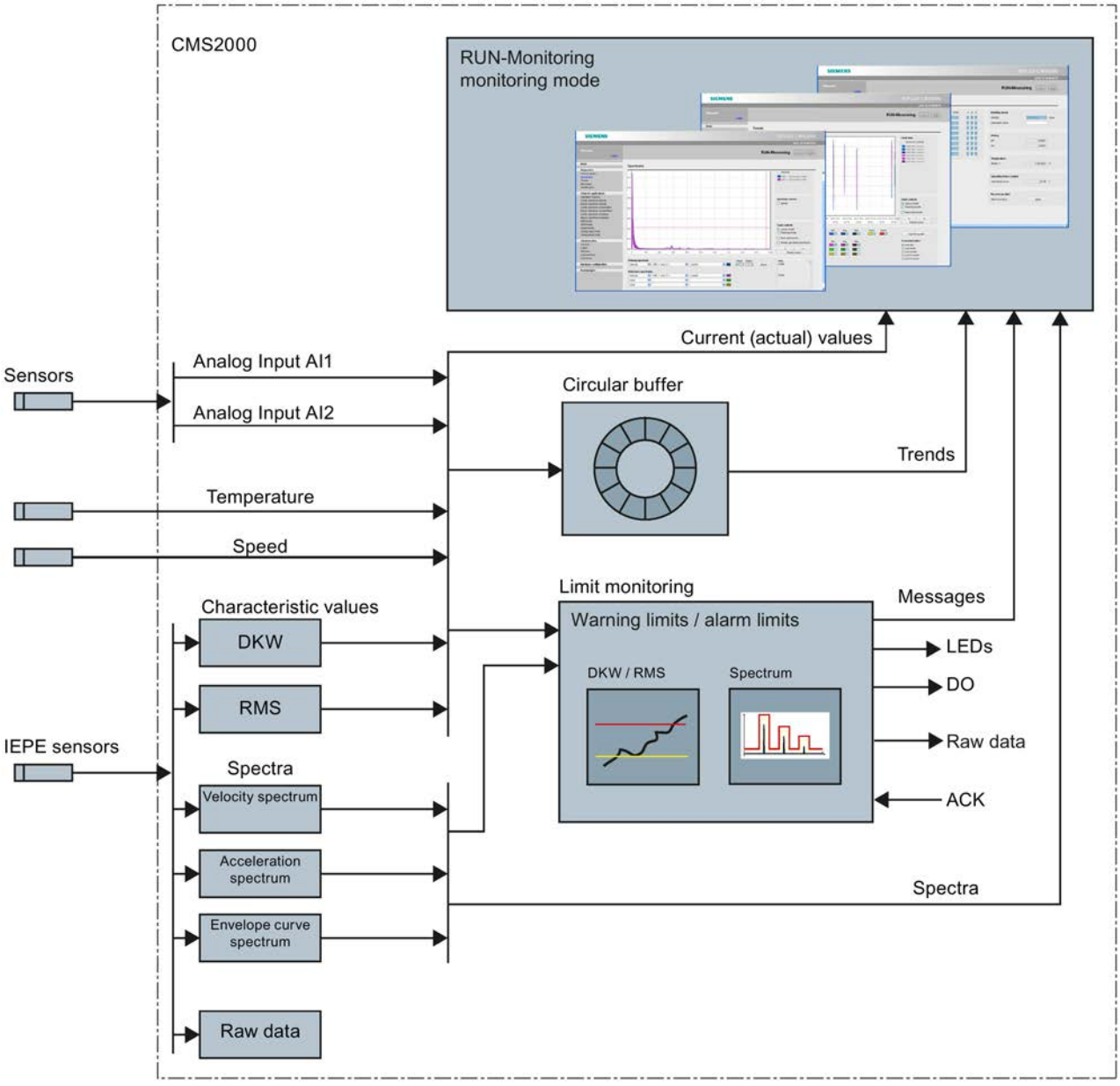


Image 5-3 Monitoring mode

Monitoring mode with activated X-Tools interface

Data is streamed to X-Tools when the X-Tools interface is active at the same time as monitoring mode (see Section Operation with activated X-Tools interface (Page 83)).

5.3.2 Vibration/bearing monitoring (characteristic values DKW/RMS)

Limit monitoring

To monitor RMS/DKW characteristic values, limits can be activated and the associated limit and hysteresis values defined.

It is also possible to parameterize whether warnings/alarms have to be acknowledged and what the response will be to a limit violation.

RMS monitoring

The characteristic values are calculated based on the rms value of the vibration velocity. Selection of limits in accordance with ISO 10816-3 and ISO 10816-7 is supported. See Section ISO10816 (Page 28).

DKW monitoring

The user parameterizes speed-dependent DKW reference values as a basis for calculating DKW characteristic values. For precise information on calculating the DKW diagnostic characteristic values, see Section Characteristic value formation via vibration acceleration (DKW) (Page 34).

The reference values that can be used for DKW calculation are the teaching values determined in the measuring mode.

Cyclic monitoring

RMS and DKW are monitored cyclically. Three RMS values calculated consecutively must violate the specified limits before a monitoring response is triggered. Similarly, three consecutive limit undershoots must occur (including the absolute value hysteresis), before the warning or alarm is canceled again.

If the speed is not stable enough (deviation greater than ±5% of the average value), the characteristic value will not be monitored.

5.3.3 Frequency-selective monitoring (spectrum velocity/acceleration)

Monitoring of spectra (velocity, acceleration)

The following methods can be combined to monitor the acceleration spectrum or velocity spectrum:

- Speed-independent peak monitoring of individual frequencies. For positioning in the spectrum, a factor is stated that is multiplied by the single rotational frequency.
  For the monitored frequency, a frequency tolerance band for monitoring can be set. It states the band around a certain frequency in the spectrum that will be monitored for limits.
- Speed-independent peak monitoring of absolute frequency bands (e.g. 100 to 500 Hz)
- "Mask limits" for monitoring the rest of the spectrum (that is, only for the frequencies that are not monitored by one of the above methods)

Warning and alarm limits can be entered for the stated methods.

Where methods overlap, certain priority rules apply:

- Speed-independent monitoring functions interrupt the mask frequency band
- Speed-dependent monitoring functions interrupt speed-independent monitoring functions and the mask frequency band

Three consecutive limit violations must occur before a warning or alarm is triggered. Similarly, three consecutive limit undershoots must occur (including the absolute value hysteresis), before the warning or alarm is canceled again.

The analysis works speed-dependently, so while the relevant spectra are being determined, the minimum, maximum and average values of the speed are recorded. If the speed is not stable enough (deviation greater than ±3 % of the average value) or outside the operation state, the relevant analysis will not be monitored.

5.3.4 Monitoring of envelope spectrum (roller bearing analysis)

Monitoring of the envelope spectrum (bearing analysis)

In bearing analysis, the spectrum of the envelope curve is monitored via the vibration acceleration. The following methods can be combined:

- Speed-dependent peak monitoring of individual frequencies with settable frequency tolerance for monitoring
  The fault frequencies are determined from the bearing data entered.
- "Mask limits" for monitoring the rest of the spectrum (that is, only for the frequencies that are not yet monitored by the above method)

Where different methods overlap, the priority rule is:

- Speed-dependent monitoring functions interrupt the mask frequency band

Warning and alarm limits can be entered for the stated methods.

The limit bands comprise warning and alarm limits for four types of damage:

- Outer race defect
- Inner race defect
- Ball damage
- Cage damage

These limits can be specified for up to five orders of magnitude (multiples of the respective fault frequencies).

Moreover, speed-dependent monitoring functions can be configured for any frequencies irrespective of the fault frequencies.

Operating principle of the bearing analysis

The four bearing components, outer race, inner race, ball, and cage, have different fault frequencies which are determined by the bearing geometry and speed. The fault frequency of each bearing component multiplied by the specified order gives the frequency to be monitored in the envelope spectrum in each case.

The frequency band considered for limit comparison around the determined frequencies can be set (typically ±0.3 Hz).

Three consecutive limit violations must occur before a warning or alarm is triggered. Similarly, three consecutive limit undershoots must occur (including the absolute value hysteresis), before the warning or alarm is canceled again.

5.3.5 Temperature monitoring

The measurement of temperatures on bearings and windings can provide valuable information about incipient damage or overload. Temperature increases occur, e.g. because of lack of lubricant. The consequences are dry running and wear.

On the VIB basic device, up to two temperature modules can be operated with 3 temperature sensors each.

You define the number of temperature modules installed, configure the number of measuring channels and define the sensor type on the "Hardware configuration (Page 199)" web page. The values for the warning and alarm limits, as well as the required responses to limit violations are defined on the "Temperatures (Page 175)" web page.

5.3.6 Analog channels

The Basic Unit VIB has two analog inputs AI1 and AI2. At one analog input, a sensor with a current output (±4 to ±20 mA) or a sensor with a voltage output (-10 to +10 V) can be connected.

On the "Hardware configuration (Page 199)" web page, you can configure the analog inputs:

- Sensor type (current/voltage) and scaling of the measuring range
- The analog inputs can also be used for speed acquisition (Page 69).

5.3.7 Absolute and cyclic hysteresis

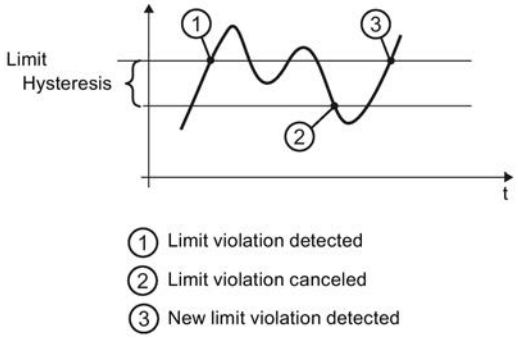
Hysteresis

Hysteresis is used to reduce the number of alarms generated, especially when measured values fluctuate around parameterized limits.

For monitoring spectra, a hysteresis can be specified for each limit band.

With spectra, the hysteresis can be stated as an absolute value or as a percentage, that is, relative to the limit.

The hysteresis is always specified as an absolute value for all other monitored measured variables.

Working principle of hysteresis	Description
	This hysteresis is a single-sided absolute value hysteresis that is only considered when the monitored value falls below the limit. The monitored value and the limit are directly compared to detect a violation ①. If a limit violation occurs, and the monitored value falls below the limit again, the value must fall below the limit minus the hysteresis before the limit violation can be canceled ②.

Cyclic hysteresis

When monitoring RMS, DKW, and spectra, three consecutive limit violations must have occurred before a warning or an alarm is triggered. Similarly, three consecutive limit undershoots must occur (including the absolute value hysteresis), before the warning or alarm is canceled again.

5.3.8 Operation states

Operation states

Spectra are monitored depending on so-called operation states (for parameterization, see "Operation states (Page 144)"). You define operation states for measured speeds by specifying the speed ranges. Up to three speeds can be measured (SPEED 1 / 2 / 3, see Hardware configuration (Page 199)). You can set up a maximum of five operation states per SPEED channel. The speed ranges within a SPEED channel must not overlap.

Example:

Operation state	Speed range
Idle speed	120-150
Normal operation	400-600
Full load	800-850

The limits for the above-mentioned monitoring functions are defined for each operation state. In spectrum monitoring, the relevant operation state is first determined before the corresponding limits are applied. If none of the defined operation states is currently available, no monitoring takes place for this.
The current operation state is displayed on the Web site "Actual values (Page 128)".

5.4 Speed acquisition/monitoring

CMS2000 provides the following ways of acquiring speed and monitoring speed:

- Permanently set constant speed
- Measurement through digital input: The Basic Unit VIB has a digital input for connecting a digital pulse encoder (BERO) The device expects one pulse per rotation here.
- Measurement through analog input: The Basic Unit VIB provides two analog inputs. You can connect one speed sensor here that supplies a speed-proportional output signal in the range ±4 mA to ±20 mA (current) or -10 V to +10 V (voltage).

CMS2000 enables monitoring of a complete drive train including gearing. The transmission ratio for the measured speed is entered for each vibration channel.

From firmware version V3.0 and higher, an individual speed source can be assigned to each vibration channel (see the chapter Hardware configuration (Page 199)).

You define the values for the warning and alarm limits and the corresponding responses when limits are violated, on the "Speeds (Page 171)" web page.

5.5 Message system

The message system of the CMS2000 enables display and logging of events that occur in the system/device or in the process. There are the following types of message:

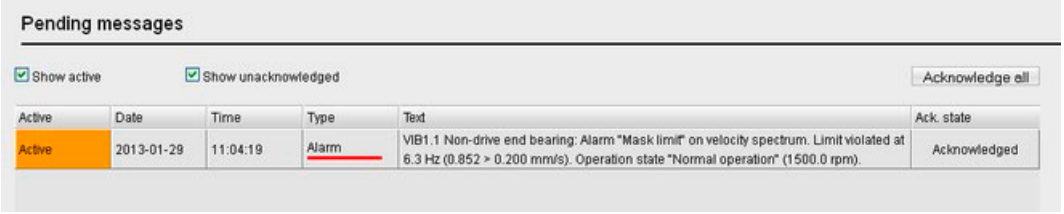
- Process messages (alarms, warnings)
- System messages (alarms, warnings, information)

No alarms or warnings are pending in normal operation of the CMS2000.

Process messages

Process messages are triggered when limits of IEPE channels, speed, analog, and temperature channels are violated.

Example of a process message:

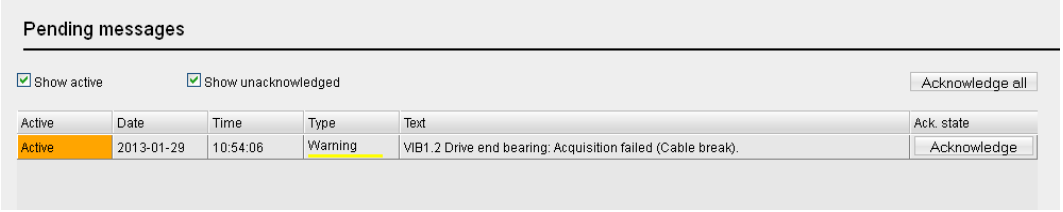


For the warning limit and alarm limit of a channel, you can configure whether the message output on violation of the limit has to be acknowledged.

System messages

System messages are triggered by internal conditions or by faults in the system/device.

Example of a system message:



It is possible to configure whether system messages have to be acknowledged by the user (see Section "Administration > General (Page 178)")

Message status

Messages can have different message statuses. Here is an overview of some essential message statuses:

Message status	Description
Incoming (active)	Example: A warning limit has been exceeded.
Outgoing (inactive)	Example: A previously overshot warning limit has been undershot again. A message can also be set to the "outgoing" status automatically by the system (e.g. on entering stop mode).
Acknowledged	By acknowledging a message, the user confirms that he or she is aware of the condition that triggered the message. Acknowledgment is possible both for "incoming" and for "outgoing" messages. A message can also be acknowledged automatically by the system.

Acknowledging messages

Messages can be acknowledged in one of the following ways:

- Acknowledgment by the user on the "Pending messages (Page 140)" web page.
- Acknowledgment by the user on the device with the ACK/Reset pushbutton (acknowledges all active messages that require acknowledgement).

Viewing active messages

You can view all messages that are pending and/or have not yet been acknowledged on the "Pending messages (Page 140)" web page. On this page, you can acknowledge messages that require acknowledgment.

Viewing the message log

All process and system messages are stored in a message log. You can view the stored messages on the Message log (Page 142) page.

The message log can hold approximately 30,000 entries. If more messages occur, the oldest data will automatically be overwritten.

5.6 Status and actual displays

You can obtain information about the current state of the device/system/process as follows:

LEDs

The LEDs on the Basic Unit VIB provide information about the current operating mode of the device and about the parts of the plant being monitored.

For detailed information on the meaning of the LED displays, see Section LED status indicator on the Basic Unit VIB (Page 217).

Digital outputs

The three digital outputs DO1 to DO3 are permanently assigned to the process statuses Normal, Warning, and Alarm.

For more information, see Section Digital outputs for controlling a signaling column (Page 218).

Web pages

On the "Home page (Page 126)" and on page "Pending messages (Page 140)," you will find up-to-date status information about the system/process. You can view the current measured values of the system on the Actual values (Page 128) page. The current operating state of the device is displayed in the header area of each Web site.

E-mails

The e-mail function of the CMS2000 is used for transferring process and system messages as well as up-to-date system information to one or more e-mail recipients.

- Event-triggered e-mails provide information about limit violations, system messages, and mode changes
- Cyclic e-mails (alive e-mails) include current system information such as system date/time, status of the LEDs as well as the number of pending process and system messages. Cyclic e-mails (alive e-mails) can be used as signs of life.

You will find detailed information about parameterizing e-mail functions in Section E-mail (Page 186).

Sending telegrams via Ethernet

Actual data of the CMS2000 can be sent cyclically via Ethernet telegrams (TCP/IP). This is possible because the CMS2000 is integrated into higher-level systems.

Two types of telegram are available for selection:

- Compact telegram: Contains essential information of the Home page (Page 126).
- Extended telegram: Contains the data of the compact telegram as well as the current measured values and status information displayed under "Actual values (Page 128)"

Sending telegrams is parameterized and activated on the "Ethernet (Page 183)" web page. The precise telegram formats are listed in Section Definition of Ethernet telegrams that can be sent cyclically (Page 240).

5.7 Recording data

5.7.1 Trends

Trend charts

Valid measured variables (RMS/DKW, speeds, analog values, temperature values) are automatically stored as trends in RUN mode. Minimum, maximum, and average values are recorded for every measured variable.

The trend values are stored with time resolutions that are permanently stored in the system. For each time resolution, the data are stored in a circular buffer, that is, the oldest data are overwritten when the maximum size of the circular buffer has been reached.
For the user, the most recent data are available in a high time resolution and older data are available in a lower time resolution.

The following time periods are available for visualization with the following resolutions:

Time period	Resolution
Last day	1 min
Last week	10 min
Last month	30 min
Last six months	3 h
Last ten years	24 h

As an option, the amplitude values monitored in the frequency spectra can be stored as a trend (see Section Limit bands (Page 148)). The recording scheme is as above, except that the recording density can be automatically reduced in the individual ring buffers with regard to the memory capacity of the device.

Note

The "last day" trend data is held in the work memory (RAM) and is therefore deleted when the device is restarted.

5.7.2 Fingerprints

This function enables you to record the condition of a machine. For this purpose, the calculated spectra and characteristic values of an IEPE channel are stored as a "Fingerprint" (see Section Spectra (Page 132)). Up to 100 fingerprints can be stored in the device.

Composition of a fingerprint

The stored fingerprint contains time-synchronous data about each IEPE channel and is composed of the following data:

- Displayed frequency spectrum.
- Associated speed
- Further frequency spectra on the same IEPE channel; that is if all three frequency spectra v(f), a(f), and env(f) of the IEPE channel calculated simultaneously are stored
- RMS/DKW characteristic values calculated at the same time on the same IEPE channel (if present)

5.7.3 Teach values

In measuring mode, teach values for calculated RMS and DKW values are determined and updated automatically. These teach values can be used as reference values for the fault-free condition of the machine and thus support definition of suitable monitoring limits.

The values calculated during the teaching process are updated cyclically:

- RMS: Minimum, average, maximum value (see Section RMS (Page 166))
- DKW: Maximum value of the reference value (see the chapter DKW (Page 168))

Up to 1000 teach values per characteristic value are saved

5.7.4 Recording raw data

The SIPLUS CMS2000 condition monitoring system is able to store raw data in the form of WAV files. The raw data contains high-resolution recordings of the vibration inputs of the device as well as the analog inputs and the speed. You can use the raw data for further analyses, e.g., with CMS X-Tools.

- Both vibration inputs of the Basic Unit are always recorded. In the case of VIB-MUX channels, however, there must be a clear connection to the trigger of the recording, otherwise no recording will be made.
- The duration of raw data recording can be parameterized in the range 1 to 90 seconds for each vibration channel.

  You can parameterize the recording on the "Recording raw data (Page 177)" web page.
- For each recorded vibration channel, the associated speed is always also recorded.
- You can parameterize whether the analog channels AI1 or AI2 will also be recorded.

Triggering raw data recording

Raw data recording can be triggered by three events:

- A limit violation:
  It can be determined for each channel or for each analysis method of a vibration channel whether a limit violation will result in the recording of raw data.
  In this way, up to three raw data recordings are possible for each limit during a RUN phase. This serves to protect the internal flash memory, so that raw data recording is not performed continuously in the case of limit violations that constantly come and go.
- User command:
  On the "Actual values (Page 128)" web page, you can start raw data recording directly using a button. All vibration channels being acquired are recorded.
- Digital input TRIGGER:
  A rising edge on the digital input TRIGGER also causes the recording of raw data. Raw data recording can be activated in this manner up to once per minute. This ensures that the device is not overloaded by recordings and the internal flash memory is protected when disturbances are present at the device input.

Recording starts after raw data recording has been triggered and ends after the parameterized duration.

The filename of the generated raw data file is automatically generated by the system and contains:

- Date and time
- Device name
- Recorded vibration channels

Example: "20121820_142305_*devicename*_VIB1.5_VIB2.3.wav"
In this file, channel 5 of the first VIB-MUX and channel 3 of the second VIB-MUX are recorded as well as the associated speed channels and the analog channels as parameterized.

Each raw data recording is logged in the message log.

Downloading of raw data files

You can download the recorded raw data files in one of the following ways

- Via the Download (Page 189) web page
- Via WebDAV (see Section Data transfer over WebDAV (Page 80))
- Via FTP (see the chapter Data exchange via FTP (Page 82))

5.8 Self-monitoring of the system

CMS2000 has functions for self-monitoring that ensure a high level of reliability of the system in continuous operation.

Self-test

The Basic Unit VIB performs a self-test during start-up and various initialization operations. If an error occurs, the device will enter the "ERROR - System not ready" operating state (see Section "ERROR - System not ready" mode (Page 228)).

Watchdog

The Basic Unit VIB has a watchdog function that prevents the system from being in an undefined operating mode. The watchdog triggers a reset in response to an error and the Basic Unit VIB then performs a restart.

Automatic recovery of the operating mode

It enters the last operating mode of the Basic Unit VIB again automatically after a restart. The following operating modes are possible: STOP, RUN-Monitoring, RUN-Measuring.

This means that, after rebooting, the device switches automatically to "RUN-Monitoring" if it was in "RUN-Monitoring" before the restart. The monitoring function of the device is therefore always maintained, even after an unintentional restart (e.g. reset by watchdog, power failure).

Measured value acquisition

To ensure that only meaningful and valid measured values are included in the evaluation, the following functions are implemented:

- Signal quality: Evaluation of the recorded vibration signals by the CMS2000.
  A system message is output if the signal quality is inadequate.
- Open circuit/short circuit at the vibration inputs or analog inputs: These faults are detected and a system message is output.
- Speed quality: If unstable or too high/too low speed repeatedly prevents vibration analysis, a system message is output.
- Failure of the 24 V power supply for the process: A system message is output and the vibration and analog signals are reported as defective.

If data acquisition is disturbed, monitoring is no longer performed on the affected channel.

An exception to this are the momentary limit violations of the valid IEPE input voltage range (6.2 to 15.0 V) as a result of strong vibrations. This situation is indicated by a corresponding system message; at the same time, the monitoring of the characteristic values and spectra is continued on this channel, so that process warnings or alarms can be issued if necessary. In this way, a deterioration in the machine status can be detected, even if the applicable vibration measuring range is already exceeded on individual occasions. If, however, the system message about overshooting the measuring range is present for a prolonged period

or permanently, the precision of the measuring results is insufficient and replacement of the vibration sensor is urgently recommended (replacement with a sensor with lower sensitivity).

Hardware configuration

In the active operating modes "RUN-Monitoring" and "RUN-Measuring", the parameterized hardware configuration is constantly compared with the configuration actually detected at the system interface.

Deviations from the parameterized configuration		System response
Number of temperature modules	Example: TARGET: BU + VIB-MUX + TM1 + TM2 ACTUAL: BU + VIB-MUX + TM	• A system message is output automatically. • No temperature channels are evaluated.
Number of VIB-MUX modules	Example: TARGET: BU + VIB-MUX1 + VIB-MUX2 + TM ACTUAL: BU + VIB-MUX + TM	• A system message is output automatically. • No vibration channels are evaluated.
Order of the expansion modules	Example: TARGET: BU + VIB-MUX1 + VIB-MUX2 + TM ACTUAL: BU + TM + VIB-MUX1 + VIB-MUX2	• A system message is output automatically • No temperature channels and no vibration channels are evaluated.

5.9 Time keeping

The Basic Unit VIB contains a battery-backed hardware clock. You can set the time zone, date, and time of day on the "Date and time (Page 181)" web page.

The time resolution is 1 second. The accuracy of the hardware clock results in a maximum deviation of ±1.5 hours per year.

Time synchronization of the clock can be performed via an NTP server. The synchronization interval can be parameterized.

5.10 Data transfer over WebDAV

Functions

Exchanging data

Via WebDAV, files can be transferred to the device or downloaded from the device. Typical applications include:

- Download/delete the recorded raw data files (wav files).
- Upload parameter settings or historic data to restore a backed-up stated.
- Firmware updates

It is not possible to download parameter settings and historical data via WebDAV. This is done using the functions on page Download (Page 189).

Information on using WebDAV

Note

- Only files that were exported from a CMS2000 device or that are compatible with CMS2000 may be imported. These files may only be copied into the WebDAV directories provided for this purpose.
- Do not use WebDAV to change file names. This can cause error messages in the system.
- Only use WebDAV for importing/exporting the files intended for WebDAV (configuration data, recording data, firmware update).
- After a data import using WebDAV, the device must be restarted. Otherwise the device may malfunction.

Adding WebDAV as drives

Proceed as follows under Windows:

1. Open the "Control Panel."
2. Under "Tools," click "Map Network Drive..."
   The "Map Network Drive" window will open.
   - Select a free drive letter in the "Drive" selection box .
   - Select the path that should be connected as a network drive in the "Folder" selection box . Use a path from the table below ("Paths").

Paths

Contents	Path	Description
Parameters	\\<IP address>\config	All the parameter databases for the device are located here.
Historical data	\\<IP address>\history	The databases for historical data and messages are located here.
Directory for firmware update files	\\<IP address>\update	Firmware update files are copied to this location.
Directory for raw data	\\<IP address>\rawdata	Here, you will find the recorded raw data files

Authentication

Importing of files to the device via WebDAV is secured by an additional authentication.

User name	The user name is the standard login name "admin"
Password	The valid password is the one that was most recently set in the device administration on the "General (Page 178)" web page. If the password was not changed here, the default password "0000" applies.

Constraints

Note

Note that you may only load files on the device in **STOP operating mode**. You can also download raw data files in RUN mode.

Note

Data exchange errors due to incorrect time setting

WebDAV accesses always contain a file comparison. It is therefore important to ensure that the time settings (both on the device and on the PC that is used for accessing) are always correct. Otherwise this can lead to undesirable effects on exchanging data. Older versions of files can be erroneously regarded as the latest version. So the wrong files may be saved or read.

5.11 Data exchange via FTP

You can access the SIPLUS CMS2000 basic unit via FTP (File Transfer Protocol) as well as by using WebDAV (Page 80).

Establishing a connection, and authentication

Below are two methods for establishing a connection via FTP under Windows Explorer:

"ftp://admin@<IP-address>"

Example for factory settings: "ftp://admin@192.168.1.160"
Then a dialog appears for entering the password.

"ftp://admin:<Password>@<IP-address>"

Example for factory settings: "ftp://admin:0000@192.168.1.160"
The password is already included here and immediate access to the Basic Unit is permitted.

Note

Note that you may only load files on the device in **STOP operating mode**. You can also download raw data files in RUN mode.

Directories

Exactly like WebDAV, FTP allows access to the following directories in the SIPLUS CMS2000 Basic Unit:

Content	Directory	Description
Parameter	/config	All the parameter databases for the device are located here.
Historical data	/history	The databases for historical data and messages are located here.
Directory for firmware update files	/update	Firmware update files are copied to this location.
Directory for raw data	/rawdata	Here, you will find the recorded raw data files

5.12 Operation with activated X-Tools interface

CMS2000 offers an interface to the "CMS X-Tools" analysis software.

CMS X-Tools is powerful analysis software with an extensive library of standard function blocks such as FFT, envelope analysis, and input filters, and it enables the graphical creation of diagnostics models. The software runs on standard PCs and industrial PCs (e.g., Microbox PC).

The interface enables the online transfer (data streaming) of detected vibration data and other process data from CMS2000 to X-Tools.

The application options of CMS2000 can be expanded using the X-Tools analysis software:

- Analyses such as gearbox diagnostics, or monitoring outside the speed range 120…24000 rpm that cannot be covered by CMS2000, can be carried out in X-Tools.
- CMS2000 can be integrated into existing CMS4000 systems

Requirements for using the X-Tools interface

- CMS2000 from firmware version V3.0 and higher
- CMS X-Tools from version 04.02 and higher

System configuration

The following figure shows one possible system configuration. Both CMS2000 components and CMS4000 components are used for data acquisition in this example.

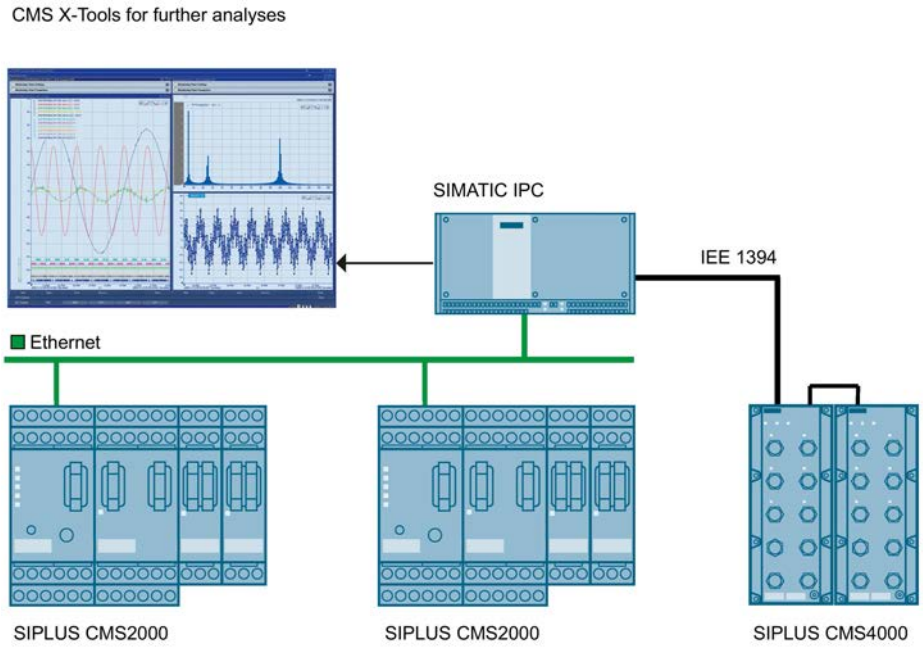


Image 5-4 Typical system configuration

Features of the X-Tools interface

- Data transfer between CMS2000 and X-Tools takes place via Ethernet (TCP/IP).
- The X-Tools interface can be used in addition to the previous functionality of CMS2000.
- Effect of X-Tools on the CMS2000 device with activated interface and activated data streaming:
  - CMS2000 works more slowly, but the full range of functions remains available
  - VIB-MUX channel switching can take place optionally using X-Tools, or it can be left to CMS2000
- The connection is established using X-Tools. In the case of communication errors, or if the X-Tools sign-of-life does not appear, CMS2000 clears the connection down and resumes handling of VIB-MUX channel switching. CMS2000 is again ready for a renewed connection buildup.

Data streaming

The following raw data and process data can be transferred from CMS2000 to X-Tools:

- Raw data of vibration channels VIB 1 / VIB 2
- Calculated RMS and DKW of VIB 1 / VIB 2
- Speed value as raw data signal (from the speed encoder) and calculated speed value
- Analog input channel 1 and 2 of the Basic Unit
- Temperature values of connected temperature modules
- Status information such as
  - LED/DO states "Normal" (green), "Warning" (yellow), "Alarm" (red)
  - Number of messages pending/to be acknowledged

Adjustable sampling rate

For all data transmitted in high resolution (vibration raw values, analog and digital values), an individual sampling rate can be set in X-Tools. This requires X-Tools Version V 04.02 SP2 or higher. In principle, the use of a lower sampling rate permits a reduction in the volume of data to be processed and thus lowers the performance demands made on the X-Tools processor.

The maximum sampling rate is 46.875 kHz. Vibration data transmitted at a lower rate is subjected to down-sampling in the CMS2000 prior to transmission, including low-pass filtering in the context of an anti-aliasing-filter. For analog and digital values, the down-sampling is performed without low-pass filtering.

The adjustable sampling rates and the properties of the filters used for the vibration data are summarized in the table below. Explanations:

- Filter passband = frequency range that can be analyzed in X-Tools
- Filter passband: The ripple is <= 0.02 dB; with slight attenuation of max. -0.5 database beginning at the end
- Filter intermediate range: The attenuation rises from -0.5 dB to -80 dB
- Filter blocking range: The attenuation is continuous >= -80 dB (prevents aliasing effects)

Down-sampling factor	Sampling rate adjustable in X-Tools	Filter passband	Filter intermediate range	Filter blocking range
1	46.875 kHz	0 – approx. 19 kHz	> 19 kHz	> 23 kHz
2	23.438 kHz	0 – 9.55 kHz	9.55 – 11.70 kHz	> 11.70 kHz
3	15.625 kHz	0 – 6.20 kHz	6.20 – 7.80 kHz	> 7.80 kHz
4	11.719 kHz	0 – 4.55 kHz	4.55 – 5.85 kHz	> 5.85 kHz
5	9.375 kHz	0 – 3.55 kHz	3.55 – 4.65 kHz	> 4.65 kHz
6	7.813 kHz	0 – 2.85 kHz	2.85 – 3.90 kHz	> 3.90 kHz
7	6.696 kHz	0 – 2.35 kHz	2.35 – 3.35 kHz	> 3.35 kHz
8	5.859 kHz	0 – 2.00 kHz	2.00 – 2.90 kHz	> 2.90 kHz
9	5.208 kHz	0 – 1.75 kHz	1.75 – 2.60 kHz	> 2.60 kHz
10	4.688 kHz	0 – 1.55 kHz	1.55 – 2.35 kHz	> 2.35 kHz
11	4.261 kHz	0 – 1.35 kHz	1.35 – 2.10 kHz	> 2.10 kHz
12	3.906 kHz	0 – 1.20 kHz	1.20 – 1.95 kHz	> 1.95 kHz

Activation/deactivation of the interface

You activate and deactivate the X-Tools interface via the Web interface (see the chapter Ethernet (Page 183)). The CMS2000 must be in the STOP state for this purpose. In the RUN state (monitoring or measuring), X-Tools can establish the connection to the CMS2000.

It is still possible to operate the CMS2000 via the Web pages. The transition from RUN ⇒ STOP terminates the connection to X-Tools.

Information on the status of the connection

You can view the current status of the connection (active / inactive) under Pending messages (Page 140).

Information on building up and clearing down the connection is to be found in the Message log (Page 142).

In the RUN dialog (see Changing operating mode (Page 122)), corresponding information is available when the X-Tools interface is activated.

Application planning

6

6.1 Shipping

Shipping

NOTICE
Damage to the device The device can be damaged by inappropriate shipping. Transport the device, therefore, only in the original packaging. This will give it the necessary protection against shock and impact.

6.2 Storage

It is absolutely essential that SIPLUS CMS2000 is stored in compliance with the storage conditions as described in the Technical data (Page 231) Section. In the event of ingress of dirt or liquid into the equipment, formation of condensation, damage or any other failures to comply with the prescribed storage conditions, the equipment must not be commissioned until the correct remedial procedure has been discussed with Siemens AG.

6.3 Scope of delivery

- SIPLUS CMS2000 Basic Unit VIB
- Operating Instructions (compact)

Note

Please note that expansion modules, such as VIB-MUX or temperature modules, must be ordered separately.

Unpacking and checking the delivery

1. Unpack the device.
2. Make sure that the package is complete.
3. Check the device for transport damage by visual inspection.

Accessories for SIPLUS CMS2000 are not included in the scope of supply. You can order (Page 49) the accessories separately.

NOTICE
Damage to the system Damaged parts can result in damage to the system. Do not use any parts that show evidence of damage!

6.4 Installation location

Selection of the installation site / mounting position

The SIPLUS CMS2000 condition monitoring system is intended for attachment to DIN rail (Page 93).

- The device is to be installed vertically on a horizontal DIN rail.
- Ensure that the permissible ambient temperature range is not exceeded (see Section Technical data (Page 231)).
- Maintain the minimum clearances from walls and other devices:
  - Sides 0 mm, top 40 mm, bottom 22 mm for ventilation
  - Note the following device dimensions in this regard:

Table 6- 1 Device dimensions

Dimensions	
Width	45 mm
Height	106 mm
Depth	124 mm (incl. protrusions)

NOTICE
Damage due to overheating You must comply with all the instructions regarding the installation location and mounting position. Otherwise the device may malfunction or incur permanent damage as a result of overheating.

Installation in control cabinet/device connection box

The SIPLUS CMS2000 condition monitoring system is suitable for installation in a control cabinet or device connection box.

- In these cases, only the LEDs and the pushbuttons on the front of the device will remain visible and operable during commissioning. Please take this into consideration for subsequent operation of the device.
- It is important to note that installation in a control cabinet or a device connection box is essential for compliance with the UL regulations.
- The control cabinet / device connection box must satisfy the regulations regarding fire-protection housing.
- Ensure that all cables and leads that protrude externally are equipped with adequate strain relief.

Installation in accordance with cULus

The SIPLUS CMS2000 Condition Monitoring System is classified according to cULus as "open type". To comply with the requirements of the cULus approval for safe operation, the following installation versions are mandatory:

- Installation in a suitable cabinet
- Installation in a suitable enclosure

Information on the suitability of the cabinet or enclosure can be found in the manufacturer's data.

Installation in accordance with DIN/EN 61131-2:

In accordance with DIN/EN 61131-2, alternative installation is permissible in an appropriately designed, closed electrical service room. The requirements of cULus are not covered by this.

Electromagnetic compatibility (EMC)

NOTICE
Damage to the device Inadequately dimensioned overvoltage protection can result in severe damage to the device. Always ensure, therefore, that the overvoltage protection is adequate (see Technical data (Page 231)Section).

6.5 Sensors

Various sensors can be connected to the CMS2000. The following sensors are compatible with the SIPLUS CMS2000 condition monitoring system:

Vibration sensors / IEPE sensors

You can use all IEPE sensors (integrated electronics piezo-electric) that fulfill the specification for the relevant sensor inputs (VIB1, VIB2). We recommend that you use vibration sensors from the Siemens portfolio (see Section Ordering data (Page 49)).

The technical specifications for the sensor inputs are listed in Section Technical specifications Basic Unit VIB (Page 231).

Temperature sensors

Up to two temperature modules can be connected via the system interface. The temperature sensors that can be connected are listed in the technical documentation for these temperature modules (see Section Ordering data (Page 49)).

⚠ WARNING

Voltage hazards

May cause death or serious injury

Contact with temperature sensors that are connected to a power supply can result in serious injury.

Use only temperature sensors that are provided with insulation rated for the voltages of the system in which they are installed.

Current/voltage sensors

Current/voltage sensors can be connected via the analog inputs with output ranges of ±4 mA to ±20 mA or -10 V to +10 V. For further technical characteristics of the analog inputs, see Section Technical specifications Basic Unit VIB (Page 231).

Speed sensor

A speed sensor with properties as described in Section Technical specifications Basic Unit VIB (Page 231) can be connected to the "Speed / BERO signal input" terminal.

Alternatively, the speed can be acquired using a speed sensor with a speed-proportional output signal in the range ±4 mA to ±20 mA (current) or -10 V to +10 V (voltage) that is connected to an analog input.

Mounting

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7.1 Mounting the Basic Unit VIB and expansion modules

The Basic Unit VIB and the expansion modules (VIB-MUX, temperature modules) are designed for vertical mounting on a horizontal DIN rail.

Procedure

1. Hook the device onto the DIN rail and swing it down into place.
2. Push the device down until the spring clamp on the rear of the device has clicked into place.

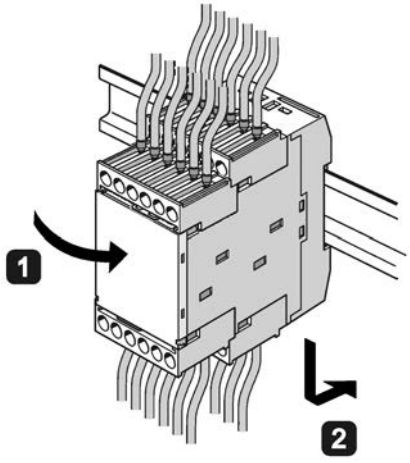


Image 7-1 Mounting of Basic Unit VIB

7.2 Mounting the shield support

The shield support is used to ground the cables. The shield support can be ordered separately as an accessory (see Section Ordering data (Page 49)).

Note

The shield support must not be used as strain relief!

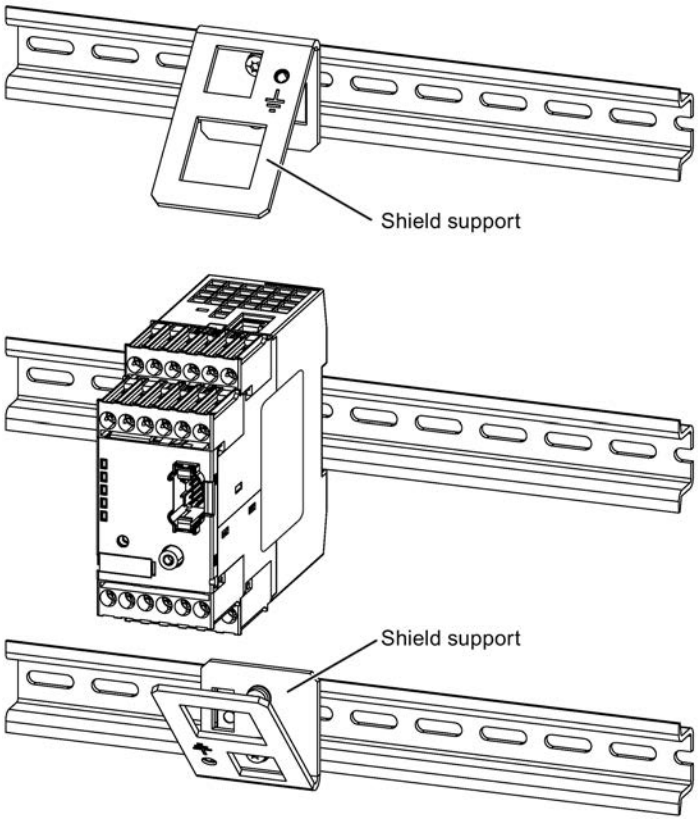


Image 7-2 Mounting the shield support

Procedure

1. Hook the shield support above and below the DIN rails, above and below the Basic Unit.
2. Press each shield support down firmly.
3. Check that the latch springs are correctly latched onto the DIN rail.

See also

Connecting to functional ground (Page 110)

7.3 Mounting the VIB sensor

Choice of mounting type

Before choosing a fixing method you should weigh up the advantages and disadvantages of each individual method. Influences such as the point of attachment, surface roughness, access to the sensor and temperature factors are key parameters influencing the quality of the measuring results. The most important aspect in this context is the considerable influence that the type of attachment has on the frequency range of the sensor.

For more information on this topic, see the basic sections Choice of measuring point (Page 21) and Mounting on the object to be measured (Page 22).

For the properties and technical specifications of your sensor, please refer to the sensor data sheet.

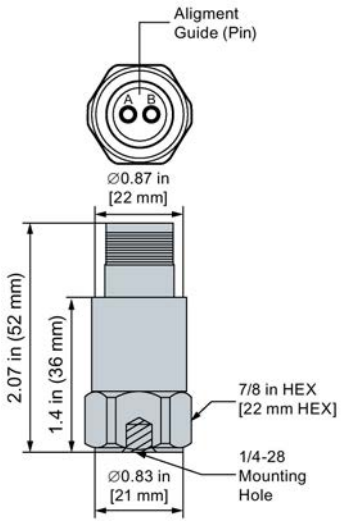
Screw attachment

The following instructions explain the mounting of the VIB sensor S01. This sensor is attached with a screw connection. This type of attachment is suitable for permanent and secure installation. Optimum and clean contact surfaces are a prerequisite. The screw connection should be used especially when high frequency ranges are to be measured.

NOTICE
Do not provide any screw connection on bent, uneven or rough surfaces. Incorrect alignment or a lack of surface contact can have a significant effect on the upper frequency range of the measuring results.

Dimensions and pin assignment of the VIB S01 sensor

The diagram below shows the dimensions and pin assignment of the S01 sensor (6AT8002-4AB00).



Sensor pin assignment

Q** + (plus potential) vibration

B - (minus potential)

Image 7-3 Sensor S01 dimensions and pin assignment

Preparing the attachment surface

1. Prepare a smooth attachment surface. For an optimum screw connection, a surface with a maximum surface roughness of 1.6 µm is required.

   Note

   If it is not possible to prepare the surface appropriately for the measuring point, adhesive fixing could be considered as a practical alternative.

2. Tap the threaded hole in the middle of the prepared surface as shown in the following diagram.

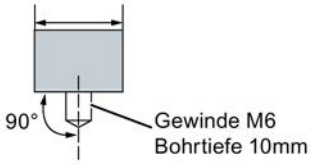


Image 7-4 Sensor threaded hole

3. Clean the attachment surface and apply a thin film of oil or grease prior to installation. This improves the transmission of the vibrations by filling the smallest imperfections in the surface. This results in greater stiffness for the attachment of the sensor.

Mounting the VIB sensor S01

1. Before mounting, make sure that there are no foreign bodies between the contact surfaces.
2. Screw the sensor in finger-tight. Then secure the connection by tightening to the required torque. Further details on the torque setting can be found in the sensor data sheet.

Note

Torque

It is imperative that you use a torque wrench for tightening the connection, **max. 2.7-6.8 Nm.** Too low a torque setting can result in the sensor having a loose seat; too high a torque can cause the attachment thread to be stripped.

Connection 8

8.1 Safety instructions and guidelines

Safety instructions

⚠ WARNING

Connection to safety extra-low voltage / protective extra-low voltage only

May cause death or serious injury

The device is designed for operation using directly connectable safety extra-low voltage (SELV) with safe electrical isolation according to IEC 60364-4-41.

The supply terminals and the process and communication signals (including Ethernet) must only be connected to safety extra-low voltage (SELV) with safe electrical isolation according to IEC 60364-4-41 (Class 2 Power Supply in North America).

Cable routing and grounding

Note

Interference due to incorrect cable routing

Route all analog signals (AI1, AI2, VIB1 and VIB2) spatially isolated from other cables to ensure that the measurement signals can be transmitted without interference. Analog signal cables must be laid at a minimum distance of 15 cm from other cables.

Maintain this spatial separation throughout the entire cable route. This is the only way to provide optimal EMC protection.

Note

Electromagnetic interference

Ensure that adequate equipotential bonding is implemented for all plants or systems in which SIPLUS CMS2000 is installed, e.g. using a low-impedance connection to a ground potential.

NOTICE

Danger of short-circuiting

When connecting the temperature sensors via the system interface, ensure that the signal cables are not electrically connected to ground via this signal path.

The system interface is not electrically isolated in SIPLUS CMS2000.

Note

Note the current carrying capacity when selecting the cables. See also Section Technical data (Page 231).

Note

Securing the cable shielding

Attach the cable shield no further than 15 cm away from the input terminal. We recommend the shield support that is available as an accessory.

Note

Strain relief

Ensure that all cables and leads that protrude externally are equipped with adequate strain relief.

Other requirements

NOTICE

Damage to the cable

- The cables must be suitably dimensioned to ensure that they cannot be damaged. Make sure that the cables are suitable for the individual application.
- The cables must be specified for an ambient temperature of +75 °C.
- Observe the bending radius specified for the cables.
- We recommend that suitable wire end ferrules are used.
- To prevent damage to the cables (cable break / short-circuit), careful cable routing is recommended.

8.2 Wiring the Basic Unit VIB and expansion modules

8.2.1 Removable terminals

Removable terminals

The Basic Unit VIB is supplied with removable connecting terminals. These connecting terminals allow you to replace the device easily without having to disconnect and reconnect the wiring.

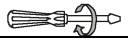
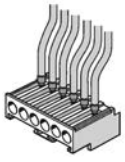
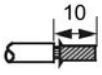
For commissioning, we recommend that the terminals are mounted first and then the cables are connected.

Note

Character coding

Please note that the removable terminals are coded. The codes are labeled with letters of the alphabet. A terminal will only fit the terminal block for which it is intended. You will find the letter on the back of the terminal.

Table 8- 1 Conductor cross-sections, stripped lengths, and tightening torques of the conductors

Removable terminals	Screwdriver 	Tightening torque
	PZ2 / diam. 5 ... 6 mm	TORQUE: 7 lb/in to 10.3 lb/in 0.8 ... 1.2 Nm
	Stripped length	**Conductor cross-section**
	 Solid	2x 0.5 mm² ... 2.5 mm² 1x 0.5 mm² ... 4 mm² 2x AWG 20 to 16 / 1x AWG 20 to 14
	 Finely stranded with/without end sleeve	2x 0.5 mm² ... 1.5 mm² 1x 0.5 mm² ... 2.5 mm² 2x AWG 20 to 16 / 1x AWG 20 to 14

8.2.2 Requirements for cable parameters

Requirements for cable parameters

Cable designation	Conductor cross-section	AWG	Remarks
Module supply PS	See table (Page 101)		
Analog input			
Digital input/output			
Ethernet	-	-	CAT5 or higher
Functional grounding connection	At least 2.5 mm^2	at least AWG 14	-

8.3 Terminal assignment Basic Unit VIB

Terminal assignment

The figure below shows the assignment of the connecting terminals of the device, as well as the associated block diagram:

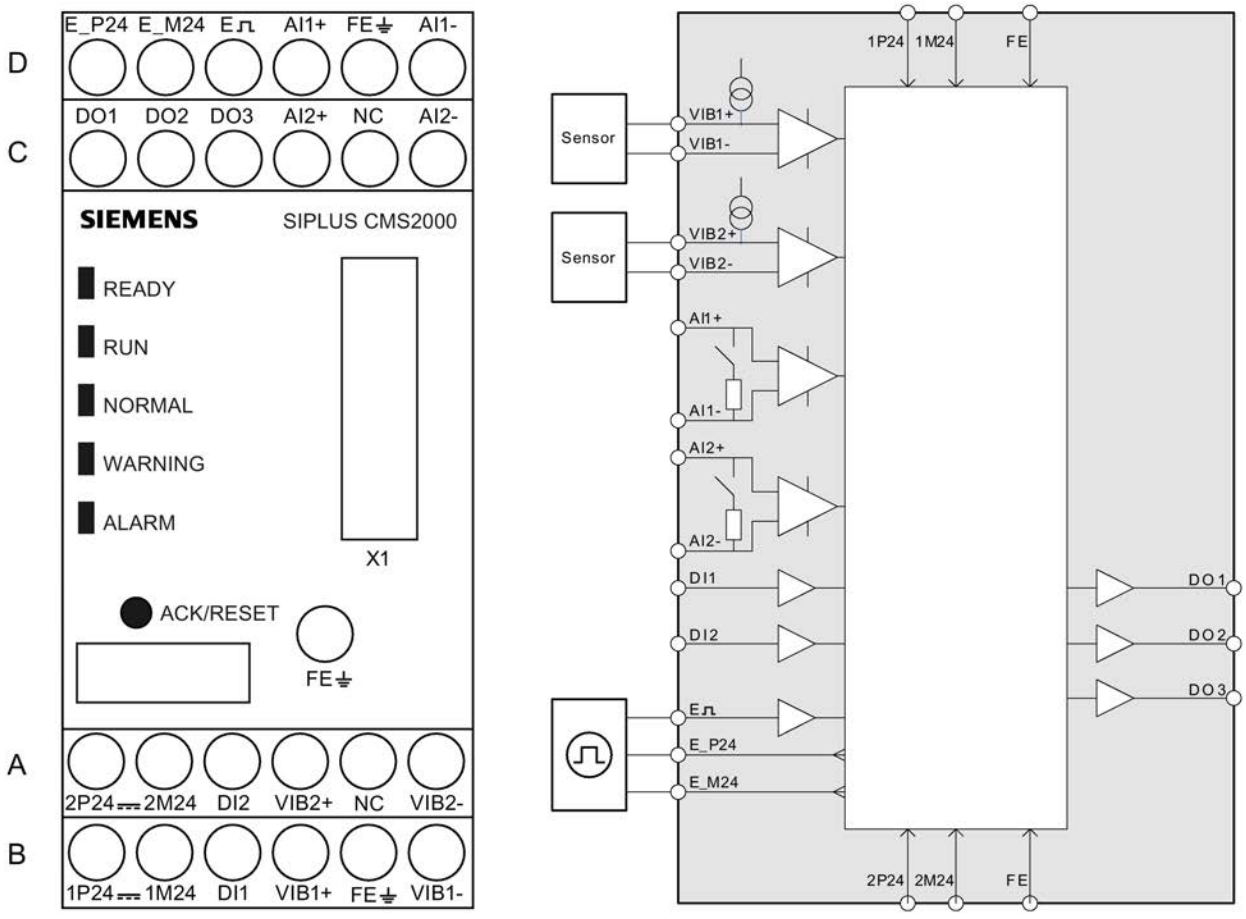


Image 8-1 Terminal assignment and block diagram

Table 8- 2 Terminal block A

2P24	Supply for the internal components of the device used in process-oriented functions. Electrically isolated internally from 1P24 / 1M24. (+)
2M24	Supply for the internal components of the device used in process-oriented functions. Electrically isolated internally from 1P24 / 1M24. (-)
DI2	Digital input 2 "Inhibit" (see Section Operating modes (Page 55))
VIB2+	IEPE sensor input 2
NC	Not connected
VIB2-	IEPE sensor input 2

Table 8- 3 Terminal block B

1P24	Supply for internal device logic (CPU). Electrically isolated internally from 2P24 / 2M24. (+)
1M24	Supply for internal device logic (CPU). Electrically isolated internally from 2P24 / 2M24. (-)
DI1	Digital input 1 "Trigger" (see Section Recording raw data (Page 76))
VIB1+	IEPE sensor input 1
FE	Functional grounding
VIB1-	IEPE sensor input 1

Table 8- 4 Terminal block C

DO1	Digital output 1 ("Normal" / green)
DO2	Digital output 2 ("Warning" / yellow)
DO3	Digital output 3 ("Alarm" / red)
AI2+	Analog input 2
NC	Not connected
AI2-	Analog input 2

Table 8- 5 Terminal block D

E_P24	Speed / BERO voltage supply (+)
E_M24	Speed / BERO voltage supply (-)
E⎍	Speed / BERO signal input
AI1+	Analog input 1
FE	Functional grounding
AI1-	Analog input 1

8.4 Terminal assignment VIB-MUX

Position of the connecting terminals

The following diagram shows the positions of the terminal blocks and connecting terminals on the VIB-MUX:

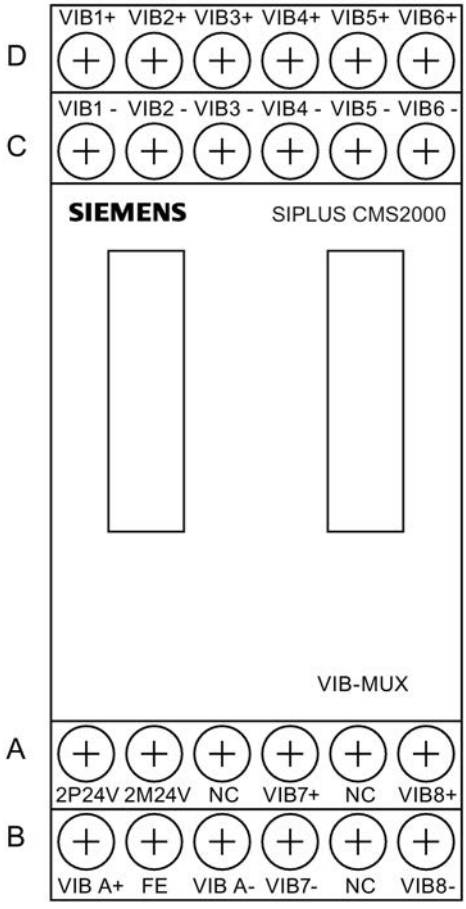


Image 8-2 VIB-MUX: Position of the connecting terminals

Terminal assignments

Terminal block A	
2P24	Power supply for the process functionality. The process supply and logic supply are galvanically isolated internally.
2M24	
NC	Not connected
VIB7+	IEPE sensor input 7
NC	Not connected
VIB8+	IEPE sensor input 8

Terminal block B	
VIB A+	IEPE output A+ for connection to an IEPE input on the Basic Unit VIB (terminal block B VIB1+ or terminal block A VIB2+)
FE	Functional grounding
VIB A-	IEPE output A- for connection to an IEPE input on the Basic Unit VIB (terminal block B VIB1- or terminal block A VIB2-)
VIB 7-	IEPE sensor input 7
NC	Not connected
VIB8-	IEPE sensor input 8

Terminal block C	
VIB1- ... VIB6-	IEPE sensor inputs 1 to 6

Terminal block D	
VIB1+ ... VIB6+	IEPE sensor inputs 1 to 6

8.5 24 V DC power supply

24 V DC power supply

The power supply of the Basic Unit VIB and of the expansion modules is drawn from the external 24 V DC power supply. Power supply units, for example, from the SITOP product line are suitable.

Safety instructions

⚠ WARNING

Connection to safety extra-low voltage / protective extra-low voltage only

May cause death or serious injury

The device is designed for operation using directly connectable safety extra-low voltage (SELV) with safe electrical isolation according to IEC 60364-4-41.

The supply terminals and the process and communication signals (including Ethernet) must only be connected to safety extra-low voltage (SELV) with safe electrical isolation according to IEC 60364-4-41 (Class 2 Power Supply in North America).

Connection

The Basic Unit VIB has two electrically isolated power supply terminals for the internal logic and process power supply. To ensure a high level of noise immunity, we recommend power the logic and process from two independent power supplies.

8.6 Connect the shields of the signal and data cables

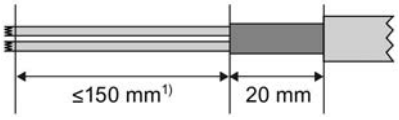
The following SIPLUS CMS2000 process signals must be connected via shielded cables with their shields attached at both ends:

- Sensor signals (VIB1 / VIB2)
- Analog inputs (AI1 / AI2)
- LAN (Ethernet)

The shields of the cables must be attached to the upper and/or lower shield support using the clamp connections. The shield support can be ordered as an accessory (see Section Ordering data (Page 49)).

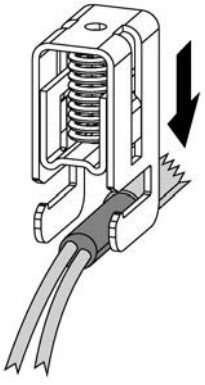
Proceed as follows:

1. Strip the cable.

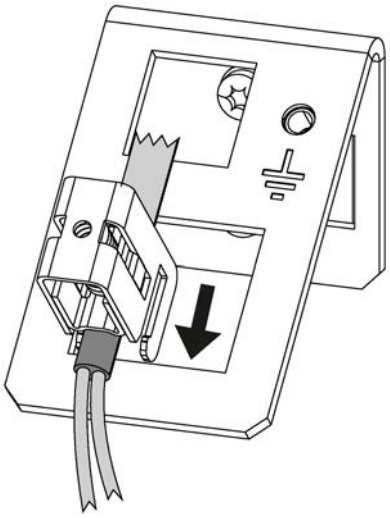


[1] Length depends on distance between shield support and device.

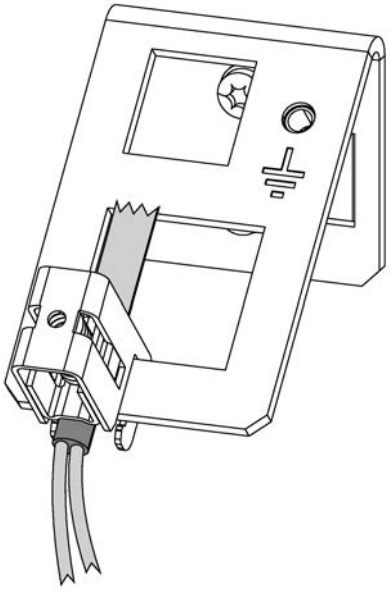
2. Press the clamp connection onto the protective braided shield of the cable.



3. Slide the clamp connection onto the shield support.



4. The result should look like this:



Note

Attach the cable shield no further than 15 cm away from the input terminal.

8.7 Connect system interfaces

If you are using expansion modules, connect the devices via the system interface.

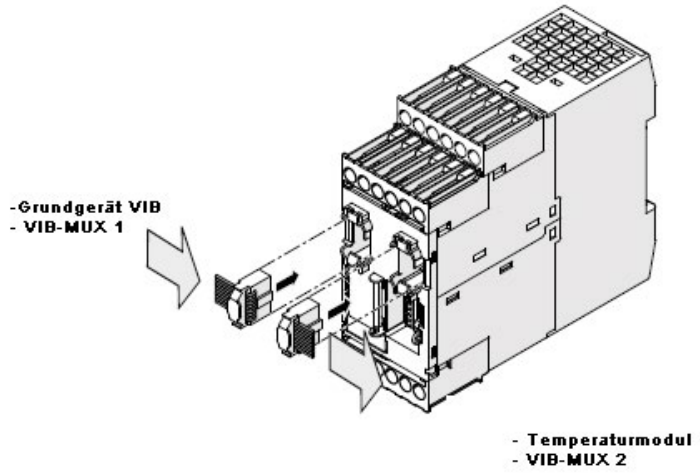


Image 8-3 Expansion module: Connection via system interface

8.8 Connecting to functional ground

Prerequisites

- Ensure that the protective braided shield for the functional grounding is as short as possible.
- The conductor cross-section of the strands must be at least 2.5 mm^2.
- The maximum permissible spacing between the Basic Unit VIB and the shield support is 15 cm.
- Use the functional ground (FE) and not a PE connection for grounding.
- Note the parameter requirements according to Requirements for cable parameters (Page 102) when selecting the grounding cables.

Procedure

1. Connect all terminals labeled "FE" to the functional ground connection on the shield supports.
   For the Basic Unit VIB, see "Terminal assignment Basic Unit VIB (Page 103)";
   for the VIB-MUX, see "Terminal assignment VIB-MUX (Page 105)"
2. Connect the shield connection to the functional ground centrally (star point).
3. Attach the collected cables to equipotential bonding (e.g. standard DIN rail) via a low impedance connection.

Note

The FE connection of the Basic Unit VIB at the front can be optionally connected to FE.

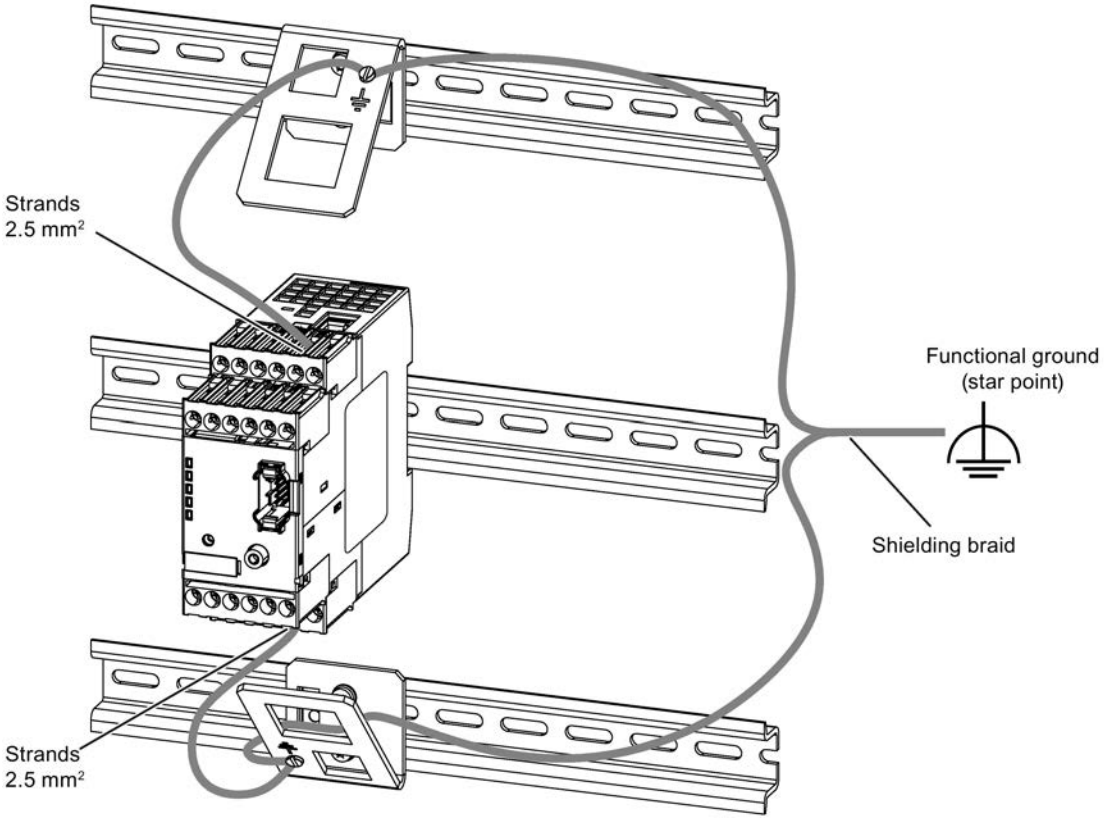


Image 8-4 Functional grounding connection

Commissioning

9

9.1 Commissioning of the hardware

Prerequisites

1. The Basic Unit VIB and optional expansion modules (VIB-MUX, temperature modules) are mounted (see Section Mounting the Basic Unit VIB and expansion modules (Page 93)).
2. The shield connection has been fitted (see Section Mounting the shield support (Page 94)).
3. The sensors are installed.
4. The Basic Unit VIB and all other components have been wired and connected.

Procedure

1. Switch the power supply on.
   The Basic Unit VIB starts up (approx. 40 seconds) and signals with a lighted "READY" LED that access is possible via the web page (see Section LED status indicator on the Basic Unit VIB (Page 217)).

Result

The hardware of the SIPLUS CMS2000 condition monitoring system has been successfully commissioned.

9.2 Commissioning of the software

Procedure

1. Enter the IP address of the Basic Unit VIB in the address field of the specified Internet browser. If you do not know the IP address of your device, ask your network administrator.

   Note

   The device has the following factory setting:

   After switch-on, the device waits for an IP address to be assigned by a DHCP server. If this does not occur, the IP address 192.168.1.160 is applied.

   The start page opens.

2. Click "Login" in the login area and enter the password. (see Section Logging in / logging out (Page 121))
   - Standard login name: admin
   - Default password: 0000

   Note

   Several simultaneous user sessions (web sessions) are possible in principle, i.e. several users can access the same CMS2000 device via the website from different PCs. The device only permits one login at a time, i.e. after a user has logged in, the others will only have read access.

Result

Following successful user login, all the functions of the website are available.

9.2.1 Recommended configuration sequence

You can parameterize the SIPLUS CMS2000 system in any order, but the following sequence is recommended:

1. Hardware configuration:
   - Hardware configuration (Page 199)
2. Administration:
   - General (Page 178)
   - Date and time (Page 181)
   - Ethernet (Page 183)
   - E-mail (Page 186)
3. Diagnostics configuration:

   Operation states (Page 144)

   Velocity spectra (Page 146)

   Acceleration spectra (Page 153)

   Envelope spectra (Page 159)

   RMS (Page 166)

   DKW (Page 168)

   Speeds (Page 171)

   Analog inputs (Page 173)

   Temperatures (Page 175)

9.3 Assigning the IP address

A unique IP address must be assigned for each device.

NOTICE
Devices connected to an enterprise network or directly to the internet must be appropriately protected against unauthorized access, e.g. by use of firewalls and network segmentation. For more information about industrial security, please visit http://www.siemens.com/industrialsecurity.

9.3.1 Operation with DHCP server

Requirements

SIPLUS CMS2000 is connected to the power supply and in "STOP - System ready" mode.

Procedure

1. Make a note of the MAC address on the device rating plate.
2. Define a new IP address.
3. Ensure that the DHCP coordinator enters the MAC address as well as the newly defined IP address in the DHCP administration.
4. Connect the device to the PC via the LAN.

9.3.2 Operation without DHCP server

Requirements

SIPLUS CMS2000 is connected to the power supply and in READY mode.

Procedure

1. Connect the device to the PC via the LAN.
2. After the "READY" LED has stopped flashing, wait approximately for another 10 seconds and then address the device at the following fixed IP address:
   – 192.168.1.160
3. Define a new, unique IP address (see Ethernet (Page 183)).

Note

Only one device at a time may be commissioned in this manner, otherwise an address conflict could occur if all devices have the IP address 192.168.1.160.

Note

Have you forgotten the IP address?

Make a note of the newly assigned IP address so that you don't forget it. If you do lose the IP address, you can obtain further support from your network administrator. Otherwise you must send in the device.

Parameterizing via the web user interface 10

The following chapters describe the standard Web pages with the full functional range for parameterizing and displaying data. The website for mobile devices has a restricted range of functions and is described in Section Web site for mobile devices (Page 207).

10.1 Hardware and software requirements

Supported browsers

The web pages are designed to be used and displayed in the following browsers:

- Mozilla Firefox 38
- Google Chrome 37
- Internet Explorer 10

Note

Display problems

If other browsers are used, display problems may occur.

Browser settings

The websites uses cookies. Accept the use of cookies in the browser settings. Otherwise unwanted effects may result.

Screen resolution

The web pages have been optimized for a screen resolution of 1280 x 1024 pixels.

10.2 General operation

10.2.1 Structure of the user interface

The user interface structure of the website is as follows:

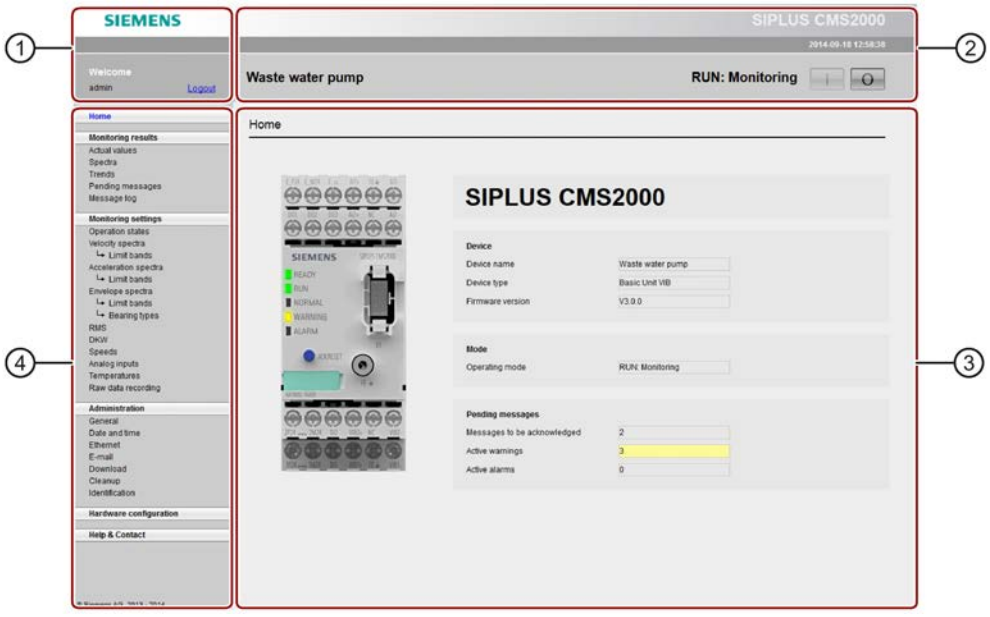


Image 10-1 Structure of the user interface

① **Login area**
This area contains:

- Name of the logged in user.
- Login / logout function

② **Title area**
This area contains:

- Device name
- Date and time of the device
- Current operating mode, see Section Operating modes (Page 55)
- Button for switching to STOP if the device is in RUN
- Button for switching to "RUN-Monitoring" or "RUN-Measuring" if the device is in STOP

③ **Work area**:
This area contains:

- Name of the page that was selected in the navigation area
- The selected web page with all the associated contents and parameters.

④ **Navigation area**
This area contains:

- Navigation tree that displays all the web pages that can be selected for the device
- Highlighting of the currently selected entry in the navigation tree

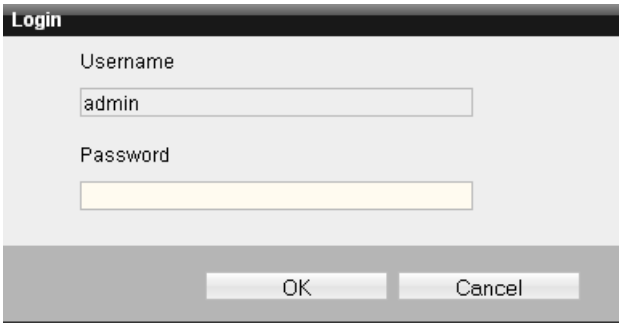
10.2.2 Logging in / logging out

Logging in / logging out

Before you can modify the device parameters, you must first log in. If you do not log in, you will have read-only access to the CMS2000 device.

You can log in and log out on any selected web page.

To log in, click on "Login" in the log-in area. The following dialog box will open:



Enter the log-in data and confirm with OK.

- Default user name: admin
- Default password: 0000

Note

Multiple simultaneous user sessions (web sessions) are possible in principle, i.e. more than one user can access the same CMS2000 device via the website from different PCs. The device only permits one login at a time, i.e. after a user has logged in, the others will only have read access.

10.2.3 Setting the language for the device

The language for the web interface can be switched over between German and English. The language is set on the "Administration > General (Page 178)" page.

The language of the interface is assigned to the device (SIPLUS CMS2000 Basic Unit) and not to the web session. This means that all users accessing at the same time will use the same language. If a logged-in user switches the language, all other users accessing at the same time will be affected by the language switchover.

10.2.4 Changing operating mode

Changing operating mode

The current operating mode is displayed to the left of the I/O buttons.

You can switch to STOP mode from any page using the I/O buttons.

You can switch to "RUN-Monitoring" or "RUN-Measuring" modes from STOP mode.

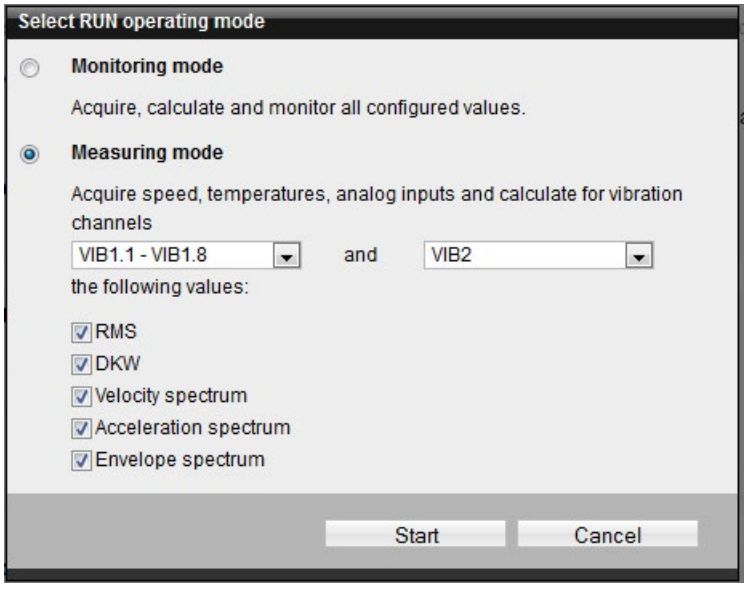


Image 10-2 Mode selection

Monitoring mode

In monitoring mode (RUN-Monitoring), all configured measured variables are constantly acquired and calculated, monitored, and recorded as trends.

Measuring mode

Each time you switch to measuring mode (RUN-Measuring) you can decide in a dialog which IEPE channels should be used (one or all for VIB-MUX) and which measured variables (RMS, DKW, spectra) should be calculated.
The configuration selected for measuring mode is stored automatically and offered again when measuring mode is reselected.
The configuration selected for measuring mode is based on the parameterized hardware configuration (see the Hardware configuration (Page 199) web page), but is otherwise independent of the configuration for monitoring mode and does not influence it.

Operation with activated X-Tools interface

In the RUN dialog, reference is made to the activated X-Tools interface by means of the corresponding operating mode headers.

In measurement mode, the maximum number of VIB channels is permanently set. Calculation of the characteristic values RMS / DKW and the spectra is optional. With this, X-Tools can access all configured channels in measurement mode, and their calculated characteristic values, if applicable.

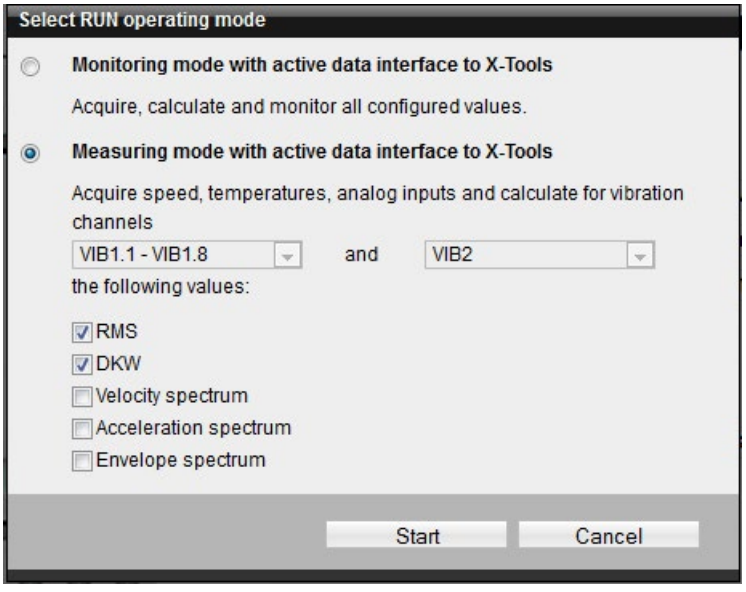


Image 10-3 Mode selection: Measurement mode with X-Tools

10.2.5 Editing and saving values and settings

Generally valid rules

- Only elements that you are allowed to modify can be edited.
- Only elements that you can use directly (in the current operating mode) can be edited.

Entering values

- Decimal places have already been appropriately defined for each input field. Rounding is performed automatically when you exit the input field.
- Decimal values must always be entered using a point ("."). This is the case regardless of which language is configured on the web pages (English or German).

Incorrect inputs

The input is automatically checked when you exit the input field.

- In the case of incorrect inputs, a tool tip will appear with the error message
- On multiple errors, all affected fields will be marked
- On saving, the values are either applied completely, if not error is found, or the data remains unchanged if an error is found on saving.

Saving data

Save the data using the "Save" button only. The "Save" button is offered if you have made changes on the web page. If a page is updated ("Reload" button or "Refresh" function of the browser) without saving, the most recently saved data will be displayed.

10.2.6 Browser-specific operation

Browser-specific operation

- Multiple browser tabs or windows are supported. Changes made on one tab will not appear on other tabs until the changes have been saved and the other tabs have been reloaded.
- "Forward" and "Back" browser buttons are supported. Changes that have not been saved are lost on switching to a new page, even if only by clicking the "Back" button because the page is reloaded.
- Refresh (F5) using the browser is supported. This has the same effect as "Forward"/"Back" in this case, that is, unsaved changes will be lost.

10.2.7 Error messages

Error messages

If an error occurs during operation or a data request, or if an action is not possible, a message box will be opened in the working area that describes the error in more detail.

Example:

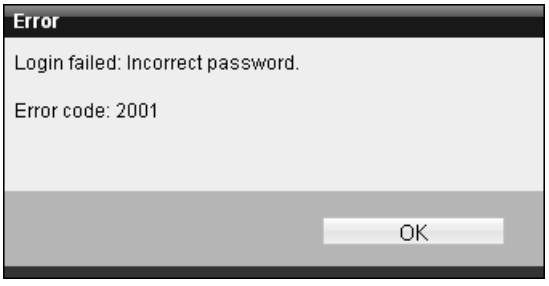


Image 10-4 Example of an error message

10.3 Home page

10.3.1 Home page

On the "Home" page, important system values (such as operating mode or pending messages) are displayed.

To open the page, click "Home" in the navigation area.

Display data

An image of the device is presented on the "Home" page that shows the status of the LEDs. An overview of grouped information about pending messages is also provided here. The number of unacknowledged messages is indicated under "Messages to be acknowledged". "Active warnings" and "Active alarms" show the number of active warnings and alarms respectively. All three numbers, and the LEDs, take account of an overlap of warnings with the associated alarms.

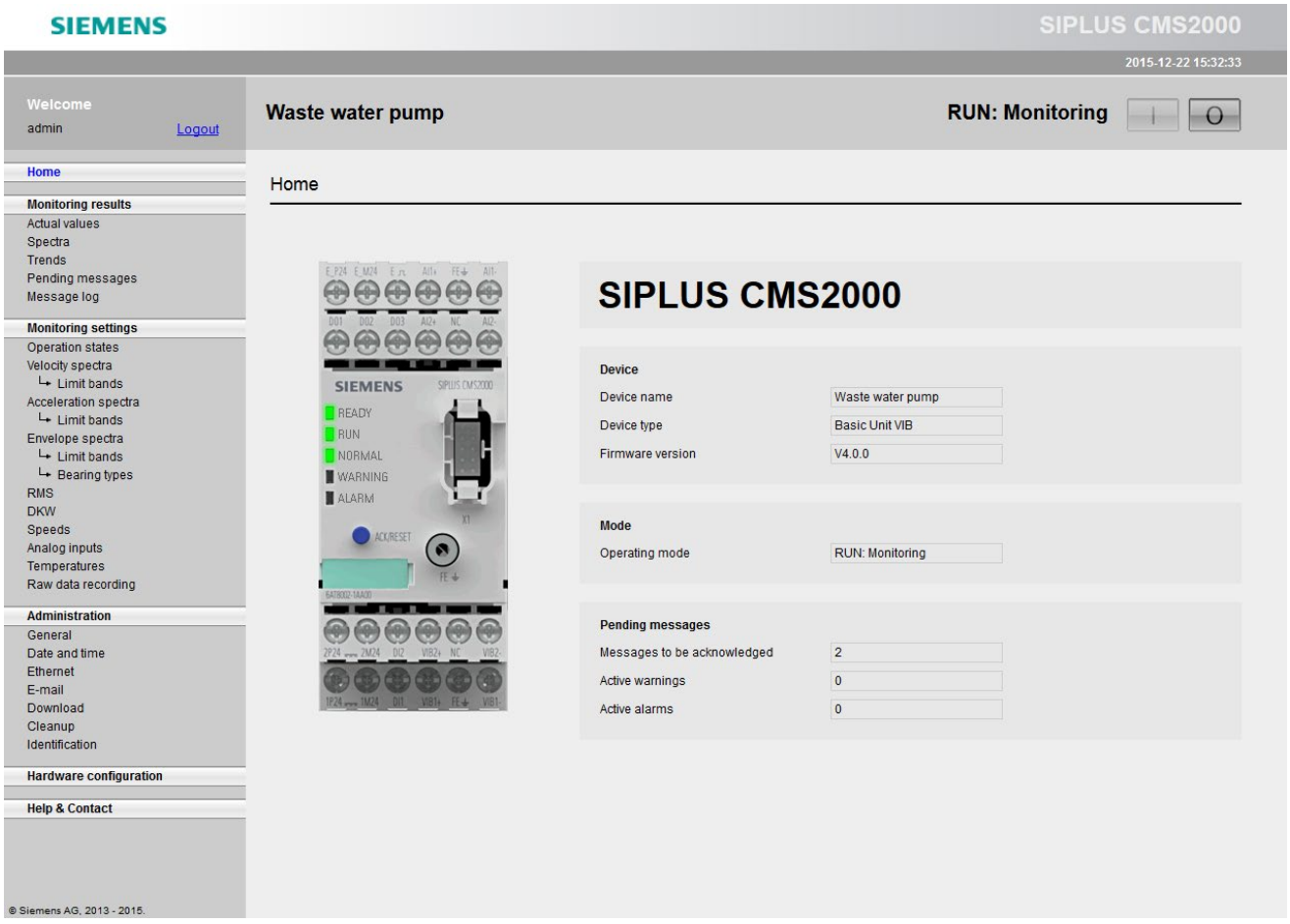


Image 10-5 Home page

Device

Device name	The device name defined by the user is displayed here.
Device type	The device type is displayed here. This cannot be changed.
Firmware version	Installed firmware version.

Operating mode

Display of the current operating mode:

Startup	Device in power-up.
ERROR: System not ready	Device not ready.
STOP: System ready	Device ready / no monitoring.
RUN: Measuring	Measured values are acquired / teaching reference values are acquired / no monitoring
RUN: Monitoring	Monitoring is running.
RUN: Monitoring inhibited	Measurements are being performed / monitoring has been suppressed.
Shutdown...	Device is shutting down. A warm restart will be performed after a few seconds.
Operating mode undefined	During a firmware update.

Pending messages

Messages to be acknowledged	Number of unacknowledged messages.
Active warnings	Number of active warnings.
Active alarms	Number of active alarms.

To obtain detailed information about the message, click on one of the output fields. This will take you directly to the "Pending messages (Page 140)" web page with detailed information about the relevant messages.

10.4 Monitoring values

This category comprises pages that enable the user to view and evaluate the results from the monitoring system.

10.4.1 Actual values

On the "Actual values" page, you can read the current measured values of the system. All the variables that were selected in the hardware configuration are displayed.

SPEED 1 / 2 / 3

In the case of VIB channels with measured speed, the currently measured speed and the operation state are displayed as the header for each SPEED channel. Under this header are arranged all VIB channels that belong to the respective SPEED channel, each with the current characteristic values RMS / DKW, as well as the spectrum types.

Constant speed

In the case of VIB channels with fixed speed, the defined fixed speed is displayed as the header. Under this header are arranged all VIB channels with this fixed speed.

If you are using a VIB-MUX, the configured channels will be switched through sequentially. You can see which channel is currently being evaluated by an arrow that is displayed.

To open the web page, click "Monitoring results > Actual values" in the navigation area.

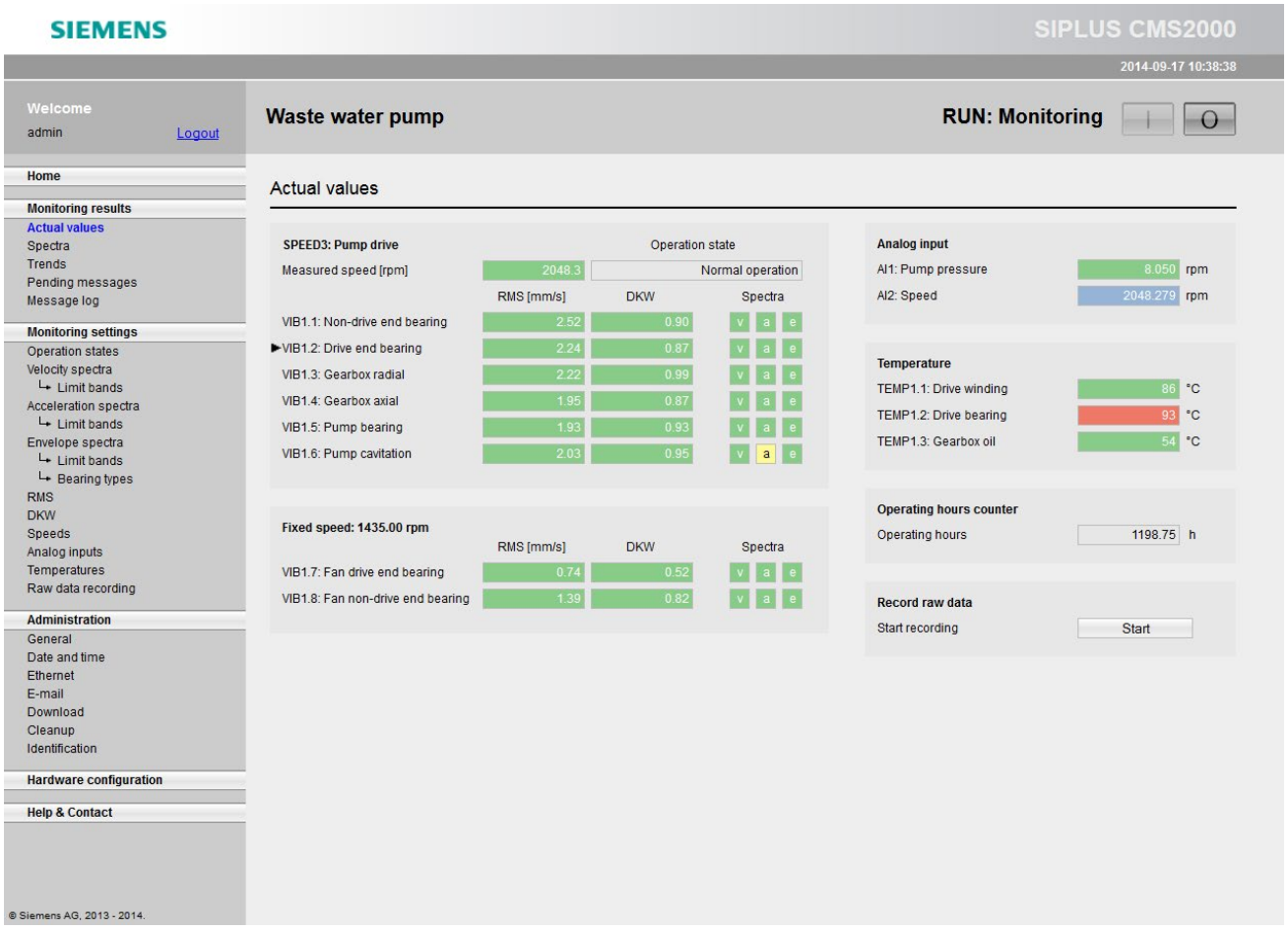


Image 10-6 Actual values

Display of values

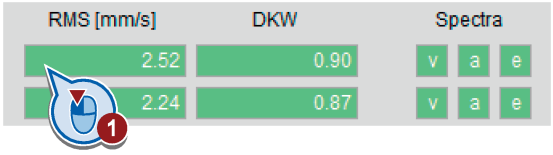
Display of value	Meaning
Empty field	The value is not configured and is therefore neither measured nor calculated.
???	The value is configured but not yet known, or the calculation has not yet finished. The sensor or connecting cable may be defective.
<Value>?	The value has been calculated, but the result is uncertain. An uncertain result can arise, for example, if the value is located in an implausible value range, or if the sensor or connecting cable is defective. This is indicated by the gray background to the display area.
<Value>	The value has been calculated and is judged to be correct. This is indicated by the green, yellow, red or blue background to the display area.

Color identification

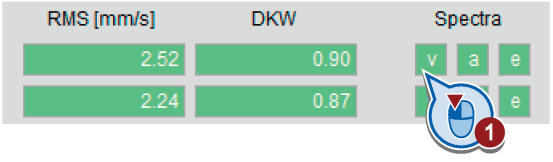
Correctly calculated values are highlighted using different background colors to indicate any limit transgressions.

Color identification		Meaning
Gray		Measured value acquisition has not been performed or is faulty.
Light blue		Measured value acquisition is OK. Value is not being monitored, however.
Green		Measured value acquisition is OK. Value is being monitored. There has been no limit transgression.
Yellow		Measured value acquisition is OK, value is being monitored, and a warning limit has been transgressed.
Red		Measured value acquisition is OK, value is being monitored, and an alarm limit has been transgressed.

Display trends

Clicking one of the fields with the mouse will take you directly to the page with the associated trend. You can use the mouse to jump to a trend for: • Speeds • RMS, DKW • Analog inputs • Temperature values	

Displaying spectra

Clicking one of the fields v,a,e with the mouse will take you directly to the page with the relevant type of spectrum. v = velocity spectrum v(f) a = acceleration spectrum a(f) e = envelope spectrum env(f)	

Operating hours counter

The display of the operating hours counter indicates for how many hours the device has been operated in "RUN-Monitoring" mode

Recording raw data

With the "Start" button, you can save the current measured values as raw data in a file.

10.4.2 Spectra

On the "Spectra" web page, you can display spectra in a chart and save fingerprints of current spectra. One primary spectrum and up to three reference spectra can be displayed at the same time. The following types of spectrum can be displayed:

- Velocity spectrum
- Acceleration spectrum
- Envelope spectrum

To open the web page, click "Monitoring results > Spectra" in the navigation area.

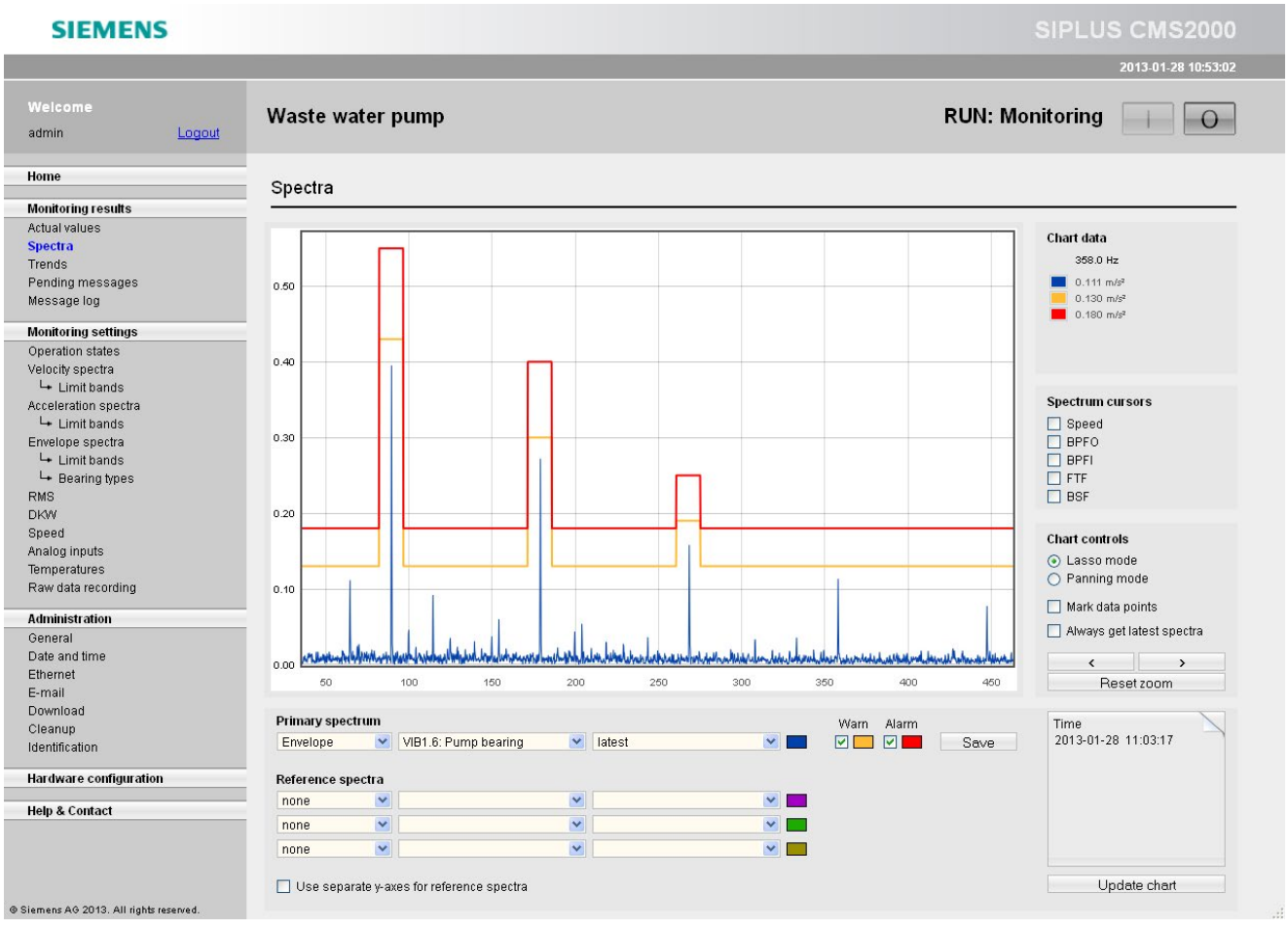


Image 10-7 Spectra

The x axis shows the frequency; the y axis, the amplitude.

Primary spectrum, reference spectra

To display spectra, choose one primary spectrum and up to three reference spectra.

To define a spectrum, select

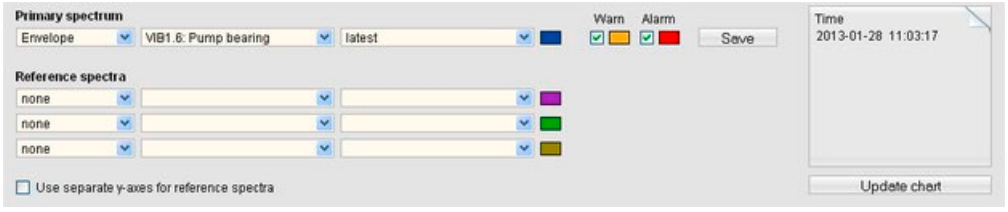
- Spectrum type (velocity, acceleration, envelope curve)
- The IEPE channel (e.g. VIB1)
- Either the current spectrum that was calculated last or a spectrum stored as a fingerprint

For the primary spectrum, you can additionally display the warning and alarm limits.

Clicking the "Update chart" button applies your settings and updates the chart display.

The color scheme for displaying the maximum of four curves is permanently defined.

You can define whether a shared Y axis will be displayed or whether each reference spectrum will be displayed on a separate Y axis.



The current spectrum can only be displayed if the relevant IEPE channel has been configured and the spectrum has been calculated. Spectra from fingerprints, on the other hand, can be displayed irrespective of the current configuration and the current operating mode.

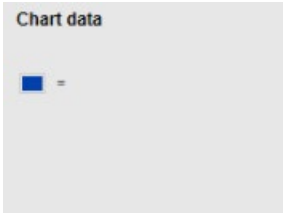
Saving a fingerprint

If a current frequency spectrum is displayed as the primary spectrum, you can save it with "Save" as a fingerprint with a freely selectable name.

Displaying other data

You can display further relevant data for each spectrum. By clicking on the button, you can scroll through the following displays: Time stamp, RMS, DKW, speed, operation state.

Chart data

	The frequency corresponding to the horizontal position of the mouse pointer is displayed. When you move the mouse pointer over the curves and limits displays, the associated numerical values will be displayed with the respective unit.

Cursor

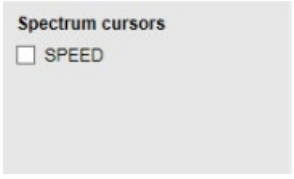
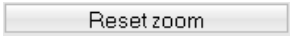
	For the selected primary spectrum, you can display markings in the charge based on the associated speed and the currently stored bearing type: • For all spectra: Speed cursor (with multiples) • For envelope spectrum: Bearing fault frequencies (with multiples) Meaning of the abbreviations: BPFO: **B**all **P**assing **F**requency **O**uter race BPFI: **B**all **P**assing **F**requency **I**nner race FTF: **F**undamental **T**rain **F**requency (cage rotation) BSF: **B**all **S**pin **F**requency (rolling element rotation)

Chart controls

	**Lasso mode:** You show a magnified view of a specific section using the mouse wheel or lasso (drag the rectangle over the required area using the left mouse button).
	Panning mode: In this mode, you can pan the area of the screen being displayed holding the left mouse button down.
	Show data points: Highlight / hide curve interpolation points.
	Always get latest spectra: Active (checkbox selected): Cyclic updating of the displayed spectra Inactive (checkbox cleared): No cyclic updating of the displayed spectra. The current spectra available when this checkbox is cleared are retained until the checkbox is selected again. **HINWEIS:** Even if cyclic updating is not active, the current spectra are still calculated and monitoring for limit violations is performed. The monitoring results for the current spectra are displayed on the "Actual values" web page.
	With these buttons, you can horizontally shift the displayed frequency band.
	This button resets the display to the original time range.
	Apply settings and update chart display

10.4.3 Trends

On the "Trends" web page, you can display characteristic values / measured values recorded by the system in a trend chart.

You can optionally display monitored spectrum values, RMS, DKW, analog inputs, speed, and temperature. The time interval can be selected.

To open the web page, click "Monitoring results" > Trends" in the navigation area.

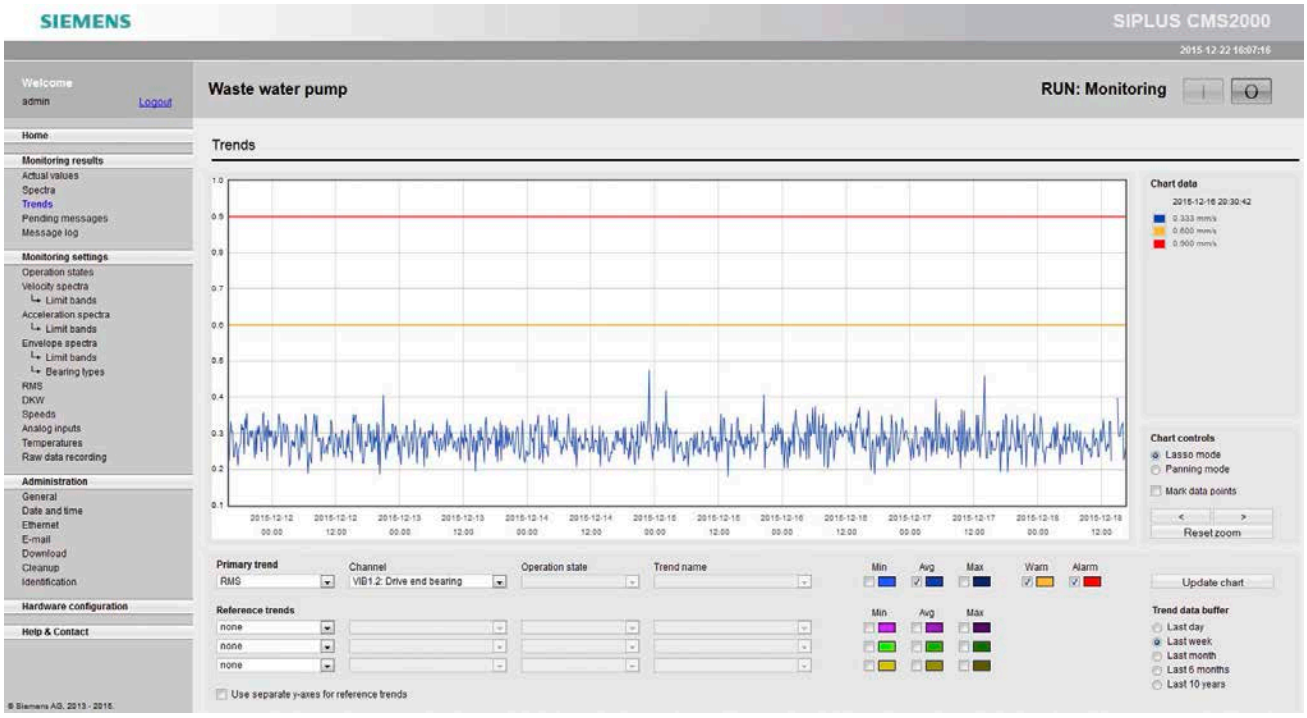


Image 10-8 Trends

The x axis shows the time; the y axis the respective measured value in the appropriate units.

Primary trend, reference trends

To display trend charts, you can choose

- Any channel-related measured value / characteristic value as a primary value (e.g. the spectrum type "speed" on VIB1)
- Up to three further channel-related values as reference values (e.g. RMS on VIB1)

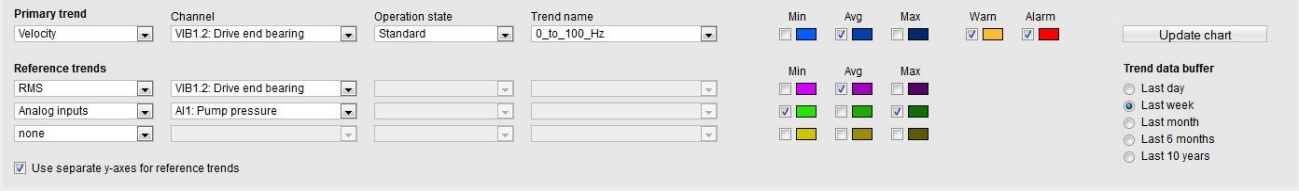


Image 10-9 Primary trend, reference trend

Up to 4 trend charts can be displayed at the same time. The procedures and channels can be combined as required. For each selected value, the minimum, maximum, and/or average value can be displayed. The up to 12 curves can be displayed in a fixed color scheme.

You can define whether a shared Y axis will be displayed or whether each "reference trend" will be displayed on a separate Y axis.

Trend display for RMS, DKW, analog inputs, speed, temperature

The measured variables RMS, DKW, analog inputs, speed and temperature are selected by means of the first two columns.

Trend display for spectra

If a trend display of spectra is selected (spectrum types: speed, acceleration, envelope curve), two additional selection columns "Operation state" and "Trend name" are activated.

- For channels with fixed speed, "Fixed speed" is displayed in the third selection element instead of an operation state.
- The selected spectrum trend is displayed as a measured value characteristic over time; as an option, the associated current warning/alarm thresholds can also be shown. Periods in which the selected operation state was not present, are presented as gaps.
- The combination of procedures (= spectrum type), VIB channel, operation state and trend name (this identifies a monitoring function in the threshold band) clearly defines which value trend of a spectrum is to be displayed; even if the threshold band is used jointly by several channels.

If the browser window is not wide enough to display 4 selection columns side by side, a more compact display is automatically presented:

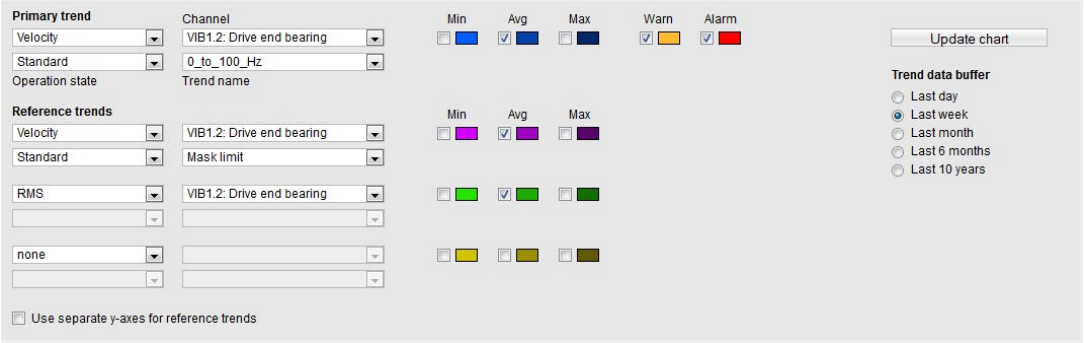
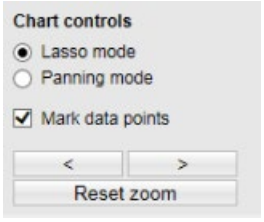
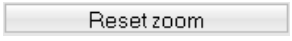


Image 10-10 Trends: Compact presentation in the case of 4 selection columns

Information on the activation of trend recording for spectra can be found in the Section Limit bands (Page 148).

Chart controls

	**Lasso mode:** A specific section can be magnified using the mouse wheel or lasso (drag the rectangle over the required area using the left mouse button). This zoom setting is retained if the chart is updated. NOTE: For zooming, fresh data is not fetched from the archive, i.e. a display that has been compressed due to the volume of data will not be displayed with a higher resolution through zooming. To do this, a smaller time interval must be selected.
	Panning mode: In this mode, the area of the screen being display can be shifted holding the left mouse button down. "Panning mode" can only be active if "Lasso mode" is inactive.
	Show data points: Highlight / hide curve points. NOTE: It is only appropriate to display the points if the display is already relatively detailed, i.e. when there are only a few curve points in the curve window.
	With these buttons, you can horizontally shift the displayed time range.
	This button resets the display to the original time range.
	Apply settings and update chart display.

Trend data buffer

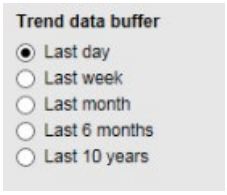
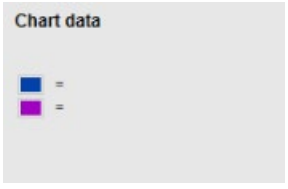
	Here, you can define which time range will be displayed from the trend data buffer. The smaller the time range chosen, the finer the time resolution of the data and therefore the greater the precision. • Last day: 1 min • Last week: 10 min • Last month: 30 min • Last 6 months: 3 h • Last 10 years: 24 h

Chart data

	The instant corresponding to the horizontal position of the mouse pointer is displayed. When you move the mouse pointer over the curves and limits displays, the associated numerical values will be displayed with the respective unit.

10.4.4 Pending messages

This web pages shows all currently pending and all as yet unacknowledged messages.

To open the page, click "Monitoring results > Pending messages" in the navigation area.

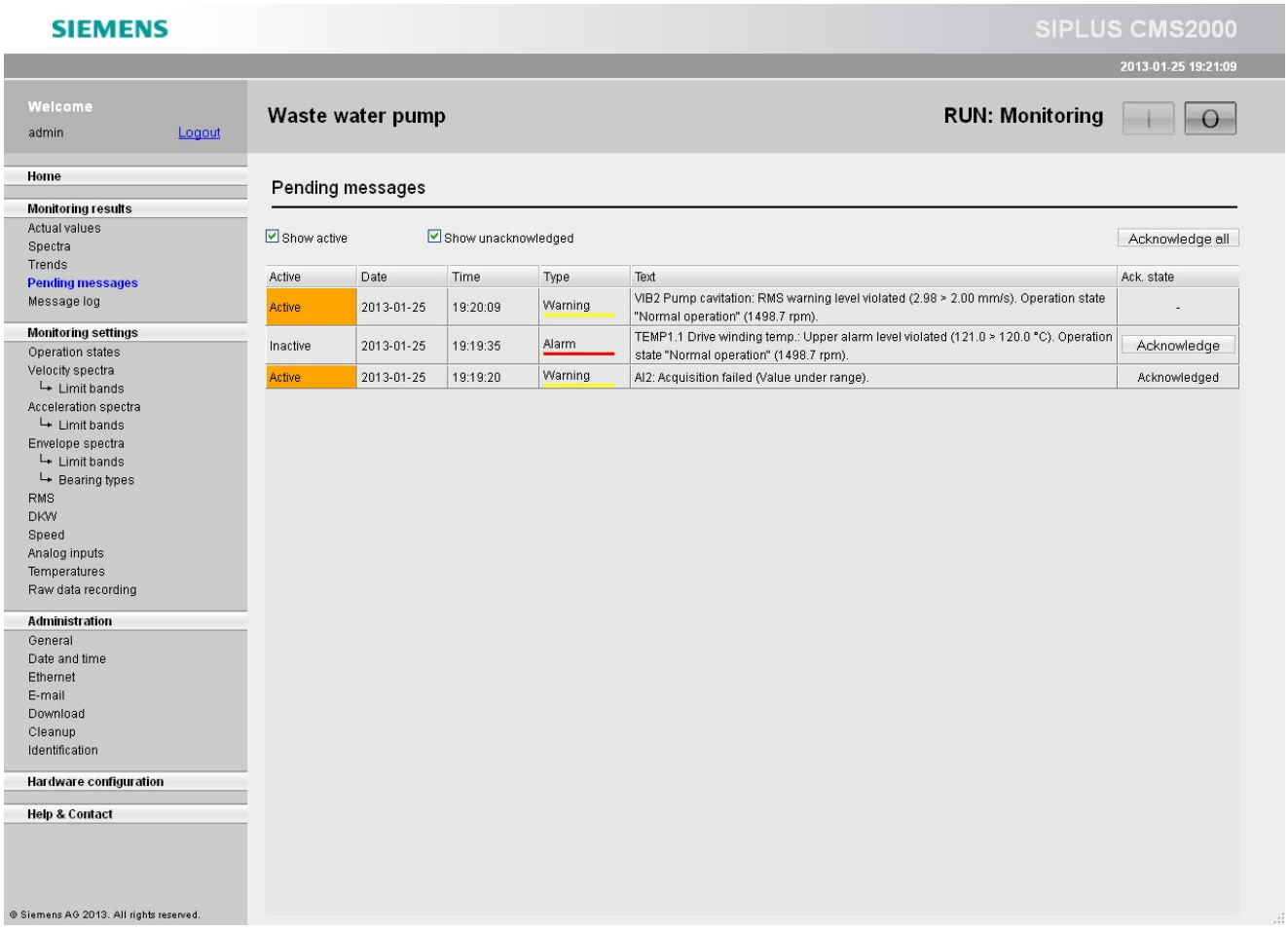


Image 10-11 Pending messages

The list of messages is sorted by the time of creation of the message, most recent first.

Display filter

For displaying messages, you can use the following filters via checkboxes:

Filter	Meaning
Show active	Display all currently pending messages Feature: If both an alarm and a warning are active for a channel or a monitoring method, only the alarm will be displayed.
Show unacknowl-edged	Display all as yet unacknowledged message that must be acknowledged.

Acknowledging a message

You can either acknowledge messages individually or all messages at once using the "Acknowledge all" button.

Note

You can also acknowledge all active messages by briefly pressing down and releasing the front pushbutton (ACK/RESET).

10.4.5 Message log

On this web page, you can view the entire message history.

To open the page, click "Monitoring results > Message log" in the navigation area.

The list of messages is sorted by the time of creation of the message, most recent first.

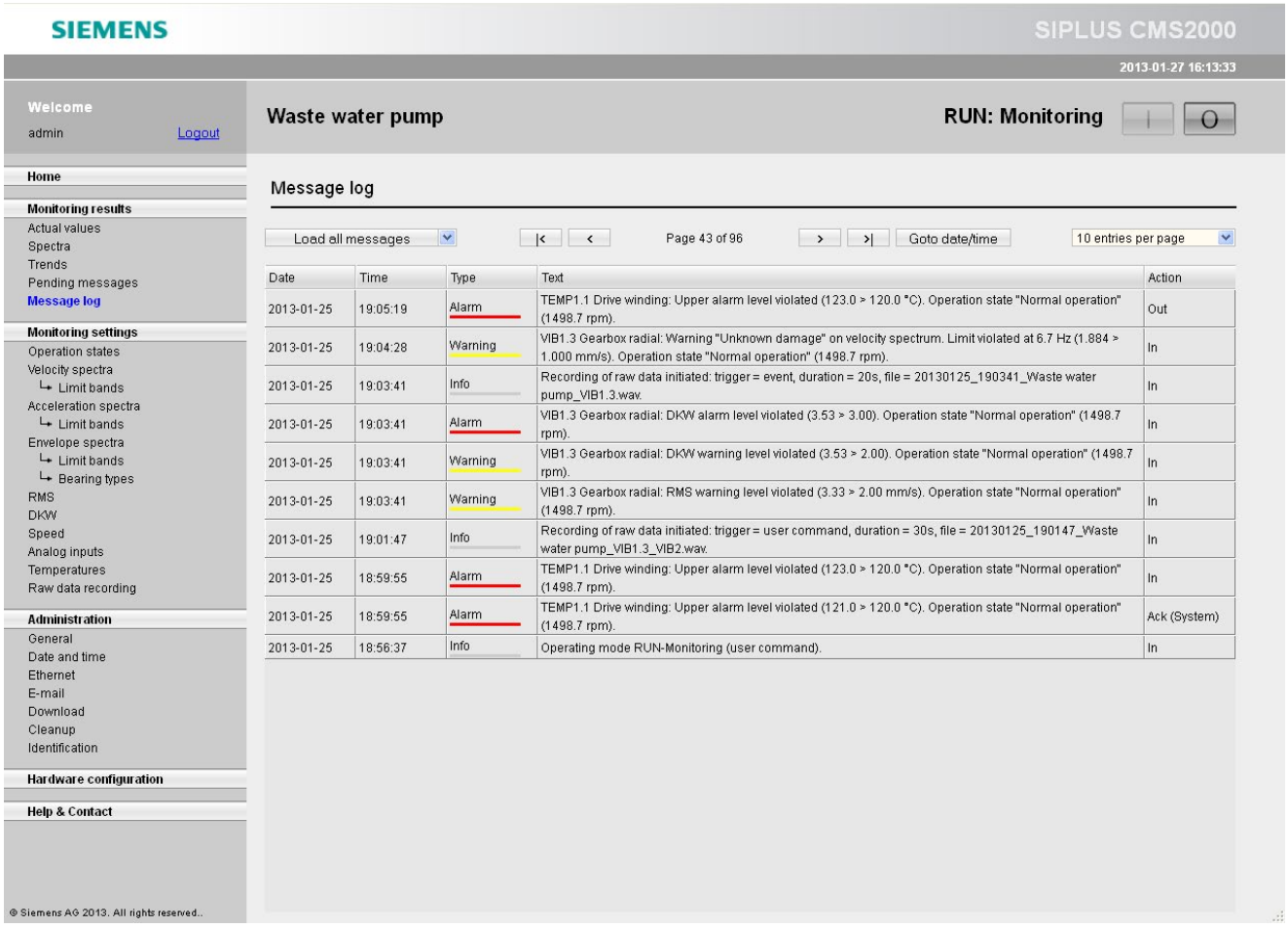


Image 10-12 Message log

Display filter

For displaying messages, you can use the following filters via a dropdown menu:

Filter	Meaning
Load all messages	Display All Messages
Load process messages	Only Display Process Messages
Load system messages	Only Display System Messages

After selecting an entry, this entry can be clicked as a button.

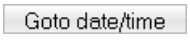
Via a further dropdown menu, you can select between 10 and 200 entries per page.

Displaying messages in the message log

Table 10- 1 Message status

Action	Description	Remarks
In	A message has arrived.	Example: A warning limit has been exceeded.
Out	A message has gone.	Example: The previously overshot warning limit has been undershot again.
Out (cleanup)	A message has been automatically set to "Gone" by the system.	This is performed when the relevant channel can no longer be monitored, e.g. if data recording fails or the mode changes to STOP.
Acknowledged	A message has been acknowledged.	Acknowledgment is performed by the user.
Ack. (system)	A message has been automatically acknowledged by the system.	A message is repeatedly incoming and outgoing in succession. The user must acknowledge the last occurrence of the message.

Navigating in the message log

	To the first item / one page back
	One page forward / to the last item
	Opens a dialog box in which you state the time from which the entries will be displayed.

Navigating in the message log does not cause the most recent messages to be loaded. You can update the messages using the display filters (Load all messages, Load process, Load system).

10.5 Monitoring configuration

This category contains the pages that are required for setting the parameters for the monitoring algorithms and for definition of the monitoring reactions.

10.5.1 Operation states

Operation states

You can define up to 5 operation states for each of the SPEED channels SPEED1 / 2 / 3.

You define an operation state by entering the name and speed range.

The default operation state is defined as "Standard", which covers the speed range from 120 rpm to 6000 rpm.

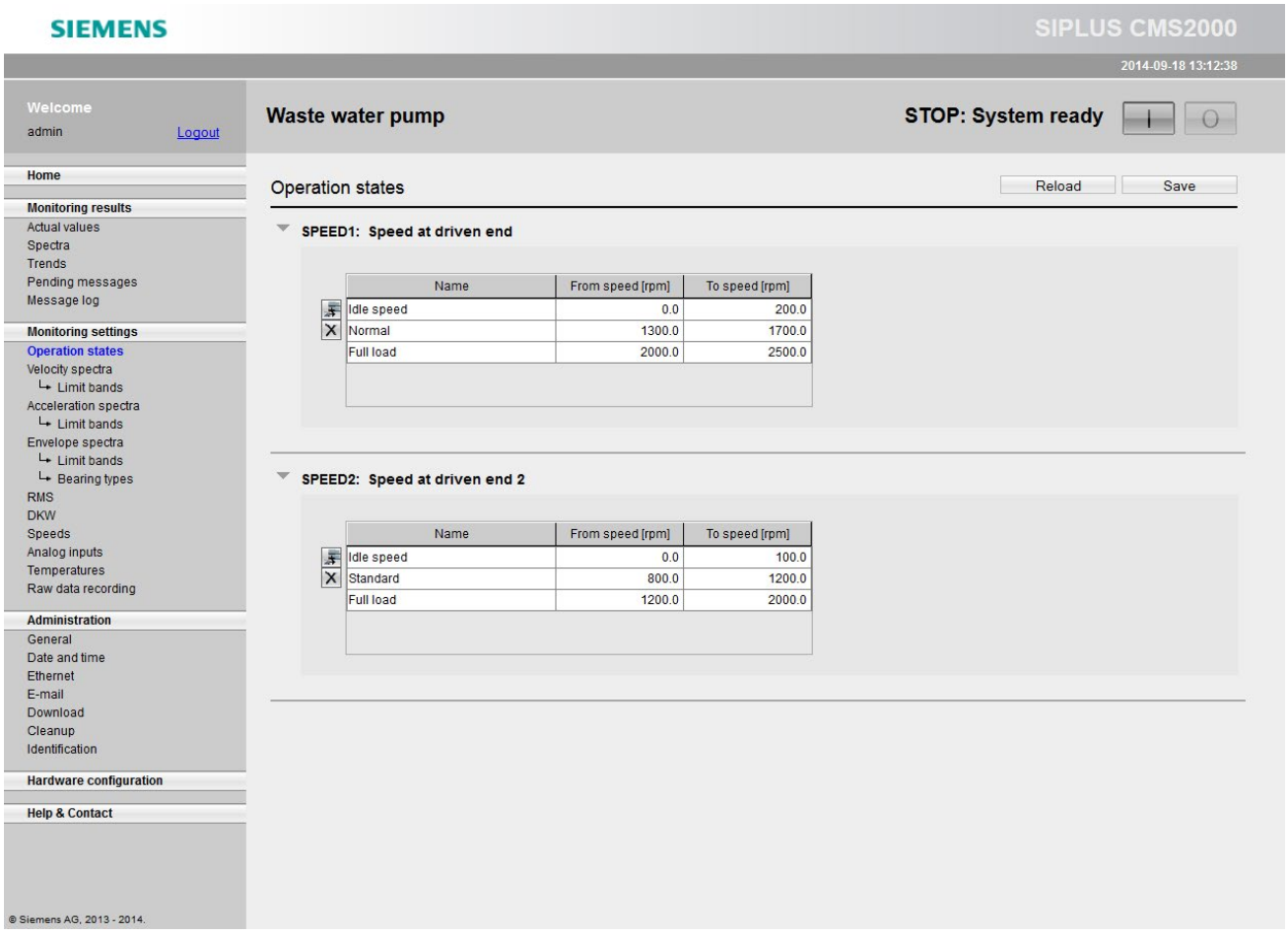


Image 10-13 Operation states

Note

The speed ranges of the operation states within a SPEED channel must not overlap.

Operating functions

Inserting/deleting rows

You can insert new rows and delete rows using the buttons to the left of the table.

Button	Meaning
	Adding a row A new row is always added at the end of the table
	Delete row Place the mouse pointer on the row to be deleted Note: The last remaining row cannot be deleted.

10.5.2 Velocity spectra

On the "Velocity spectra" page, you can activate the limits and define the associated limit bands. The settings refer exclusively to the vibration channels and the "velocity spectrum" monitoring method.

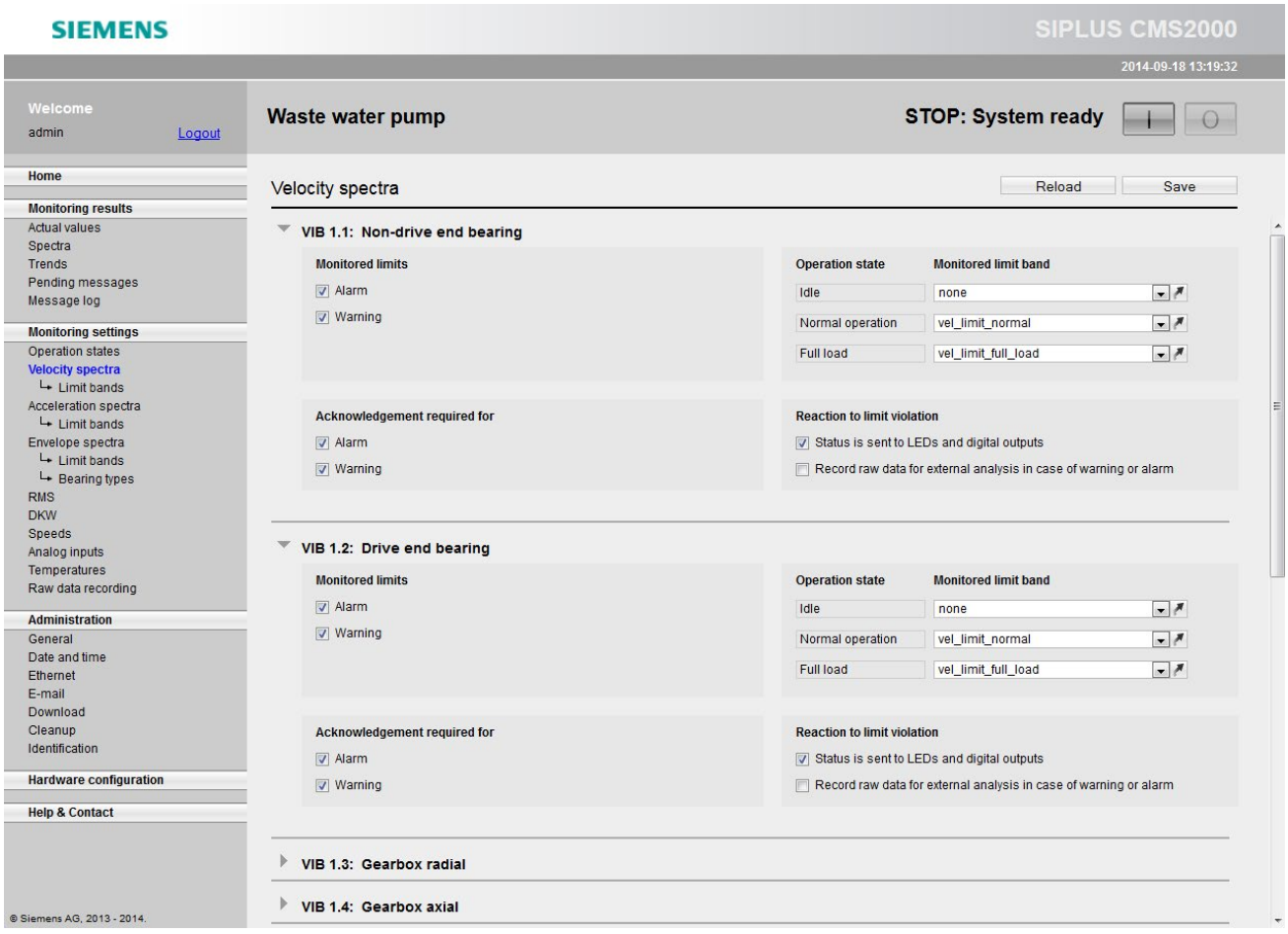


Image 10-14 Velocity spectra

Monitored limits

Activate or deactivate monitoring of the warning / alarm limits for this channel.

Monitored limit band

All operation states configured for the speed source of the respective VIB channel are displayed. From the list of defined limit bands (see the chapter Limit bands (Page 148)), you can assign a monitoring band to the respective operation state. This band contains information as to which frequencies must be checked as well as the limits for the frequencies to be checked.

In the case of VIB channels with fixed speed, "<Fixed speed>" is displayed as the operation state, and you can assign precisely one limit band.

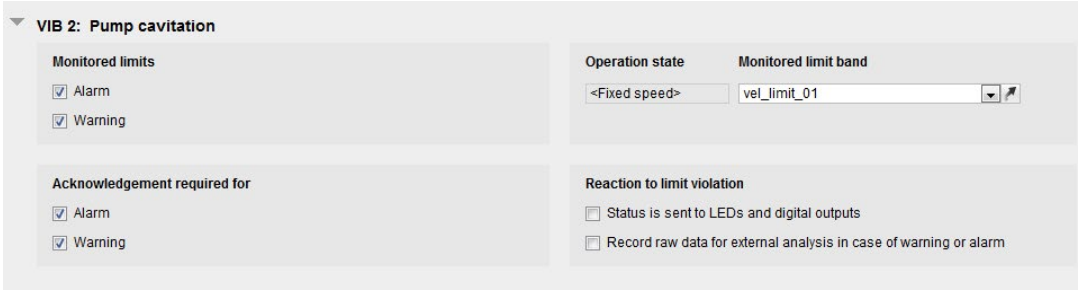


Image 10-15 Velocity spectra: VIB channel with fixed speed

The link icon will take you directly to the page of the currently selected limit frequency band.

Acknowledgement required for alarm/warning

Here you define whether a violation of a alarm / warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

10.5.2.1 Limit bands

On the "Velocity spectrum band" page, you can create, modify and administer the limit bands for the velocity spectrum.

You can define speed-independent limits and speed-dependent limits. As an option, you can activate a trend recording of the spectra.

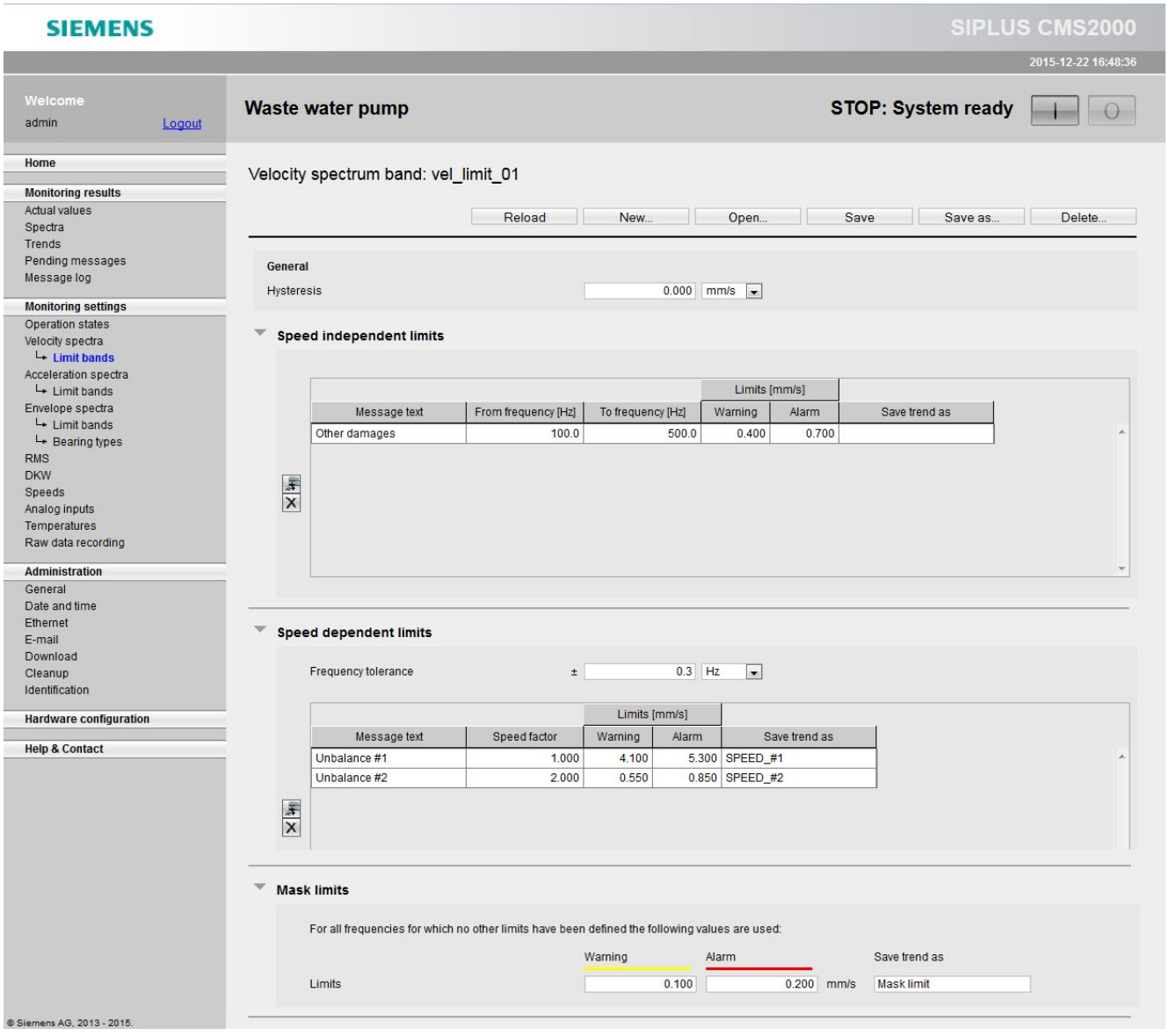


Image 10-16 Velocity spectrum band

General

Here you define the hysteresis for the limit bands. This value applies to the entire limit band defined here.

You can specify the value in mm/s or as a percentage.

Speed-independent limits

Speed-independent peak monitoring of absolute frequency bands.

For each speed-independent monitoring function, you can specify a message text. This text will be included in the relevant process message to provide a clearer explanation when a limit is violated.

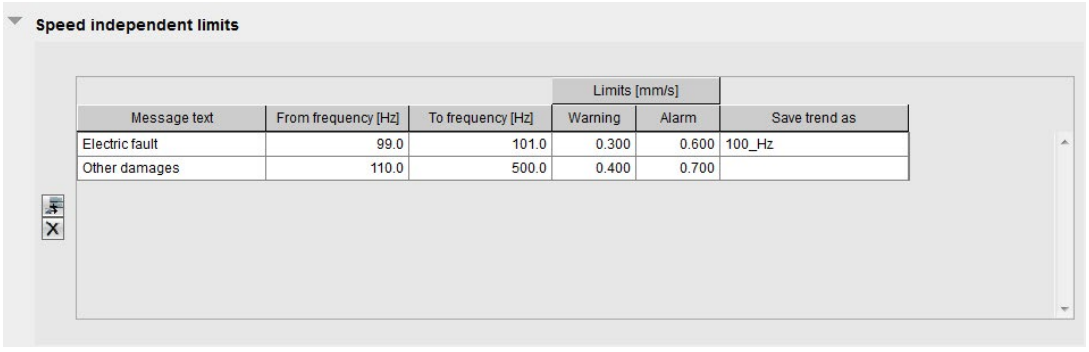


Image 10-17 Speed-independent limits

The warning limits and alarm limits in the tables do not have to be filled out completely. In this way, you can configure any part of the monitoring functions.

Speed-dependent limits

Speed-dependent peak monitoring of individual frequencies with settable frequency tolerance for monitoring.

The frequency to be monitored is entered as a multiple of the simple rotation frequency ("Rotational speed factor").

For speed-dependent peak monitoring of individual frequencies, a frequency tolerance band for monitoring can be set.

The frequency tolerance can be specified absolutely in Hz or relatively as a percentage. It states the band around a certain frequency in the spectrum that will be monitored for limits. The default value for the frequency tolerance is ±0.3 Hz

For each speed-dependent monitoring function, you can specify a message text. This text will be included in the relevant process message to provide a clearer explanation when a limit is violated.

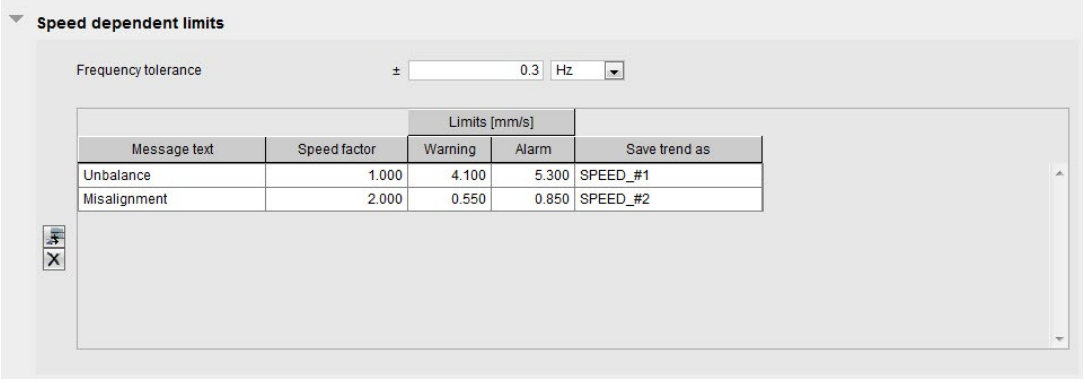


Image 10-18 Speed-dependent limits

The warning limits and alarm limits in the tables do not have to be filled out completely. In this way, you can configure any part of the monitoring functions.

Mask limits

Limits of the mask frequency band for monitoring remaining frequencies to cover the entire spectrum.

The mask frequency band covers the frequencies not yet monitored by one of the procedures defined above.

Trend recording for spectra

- For each monitoring function in the threshold band (including mask band) a trend recording can be activated; to do this, assign a name for the trend recording in the threshold band.
- The recorded value in each case is the maximum amplitude value in the monitored spectrum range and thus corresponds exactly to the value that is compared with the parameterized alarm and warning limits.
- The spectrum values are recorded in the normal time scales (last day, last week, last month, …) and therefore in a similar way to the trend recordings (RMS, DKW, speed etc.).
- The following combinations are possible:
  - Monitoring only, no recording (specify limits in the threshold band, but no name for the trend recording)
  - Monitoring + logging (specify limits and name for trend recording in the threshold value band)
  - Recording only, no monitoring (specify name for trend recording in the threshold value band, but no limit values)
- The spectra are monitored only in the RUN-Monitoring operating state; the trend recording is performed both in RUN-Monitoring and in RUN-Measuring.
- If the user modifies a trend name in the threshold band, then the trend data recorded under the previous name can no longer be displayed.

Operating functions

Inserting/deleting rows

You can insert new rows and delete rows using the buttons to the left of the table.

Button	Meaning
	Inserting a row A new row is always added at the end of the table
	Delete row Place the mouse pointer on the row to be deleted

Creating, loading, saving, deleting limit bands

Button	Meaning
Reload	All entries on the page are rejected and the previous values are displayed again
New ...	You can create a new band of limits using the "New ..." button. A window opens in which the name for the new limit band must be entered. After the "OK" button has been clicked, a new band is created with the specified name. Unsaved changes to existing bands are lost as a result. The new band of limits is not saved until the "Save" button is clicked.
Open ...	When the "Open …" button is clicked, a window opens that contains a list of saved limit bands. After a list entry has been selected and the "OK" button has been clicked, the selected limit band is loaded and displayed.
Save	With the "Save" button, the changes of the currently loaded limit band will be saved.
Save as ...	With the "Save as …" button, an existing limit band can be saved with a new name. A window opens in which the new name can be entered. After the "OK" button has been clicked in the window, the limit band is saved with the new name and also displayed as the current limit band. Limit bands can be copied in this manner. After the copy has been edited, the changes must be saved by clicking the "Save" button.
Delete ...	You can delete an existing limit band from the archive using the "Delete ..." button. A window opens that contains the name of the currently displayed limit band. After the "OK" button has been clicked, the limit band of this name will be deleted from the archive. The first limit band found in the archive will then be displayed as the current limit band.

10.5.3 Acceleration spectra

On the "Acceleration spectra" page, you can activate the limits and define the associated limit bands. The settings refer exclusively to the vibration channels and the "acceleration spectrum" monitoring method.

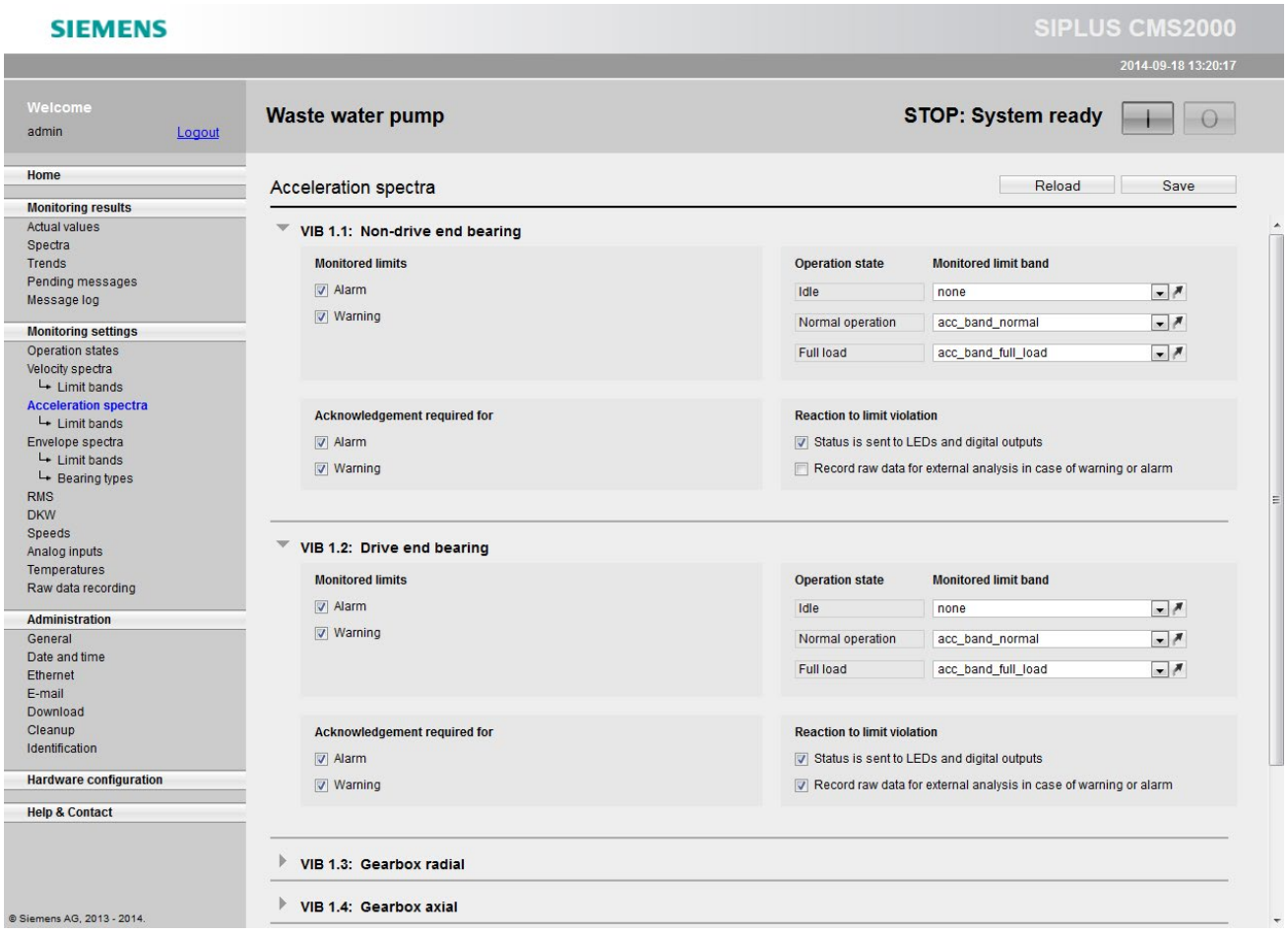


Image 10-19 Acceleration spectra

Monitored limits

Activate or deactivate monitoring of the warning / alarm limits for this channel.

Monitored limit band

All operation states configured for the speed source of the respective VIB channel are displayed. From the list of defined limit bands (see the chapter Limit bands (Page 155)), you can assign a monitoring band to the respective operation state. This band contains information as to which frequencies must be checked as well as the limits for the frequencies to be checked.

In the case of VIB channels with fixed speed, "<Fixed speed>" is displayed as the operation state, and you can assign precisely one limit band.

Image 10-20 Acceleration spectra: VIB channel with fixed speed

The link icon will take you directly to the page of the currently selected limit frequency band.

Acknowledgement required for alarm/warning

Here you define whether a violation of a alarm / warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

10.5.3.1 Limit bands

On the "Acceleration spectrum band" page, you can create, modify and administer the limit bands for the acceleration spectrum.

You can define speed-independent limits and speed-dependent limits.

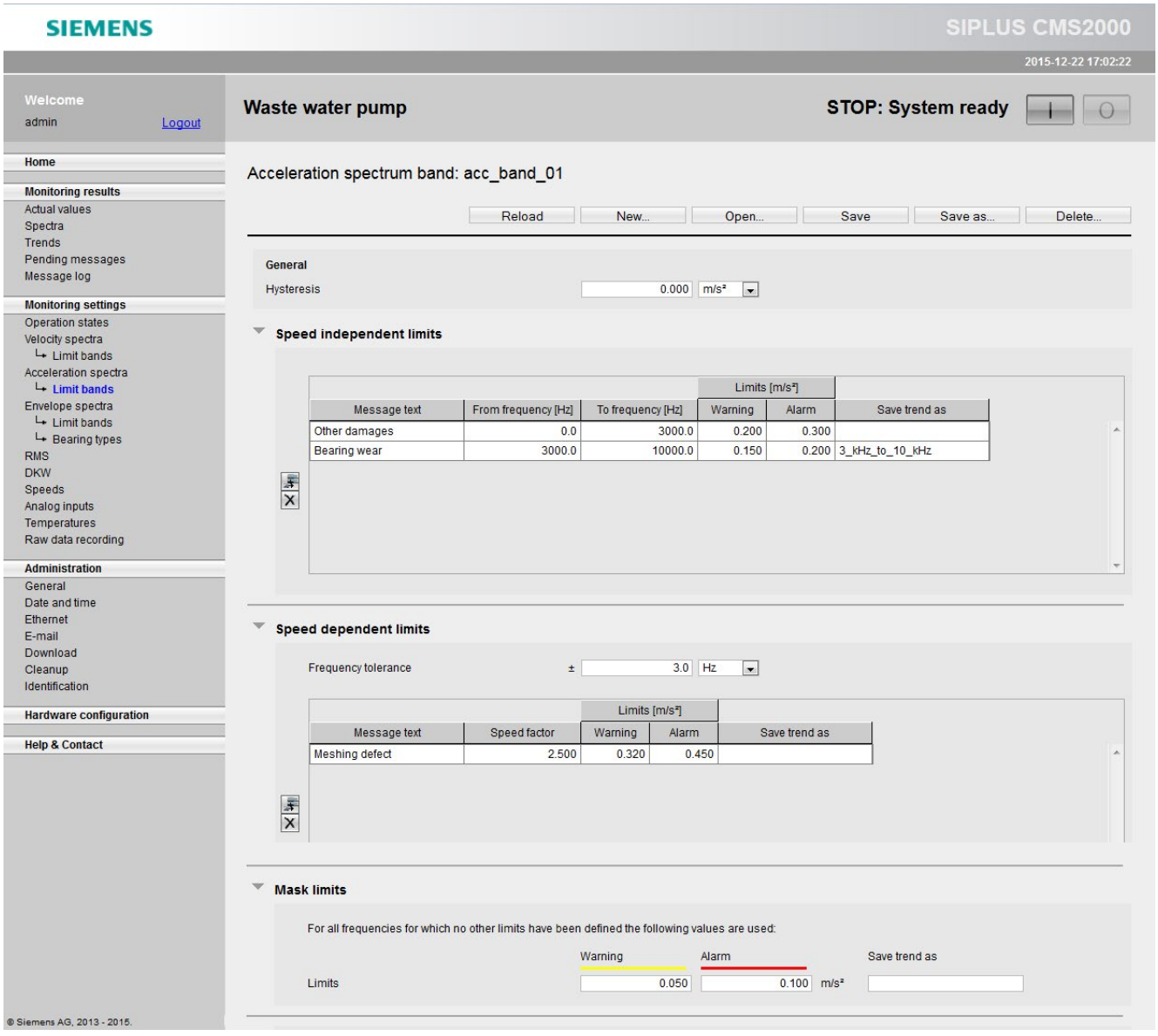


Image 10-21 Acceleration spectrum band

General

Here you define the hysteresis for the limit bands. The value applies to all the limit bands defined here.

You can specify the value in m/s^2 or as a percentage.

Speed-independent limits

The limits you create here are speed-independent. For each speed-independent monitoring function, you can specify a message text. This text will be included in the relevant process message to provide a clearer explanation when a limit is violated.

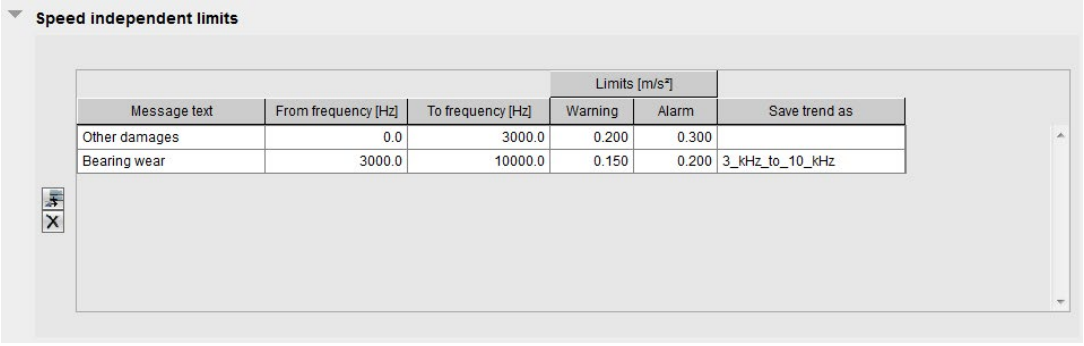


Image 10-22 Speed-independent limits

The warning limits and alarm limits in the tables do not have to be filled out completely. In this way, you can configure any part of the monitoring functions.

Speed-dependent limits

Speed-dependent peak monitoring of individual frequencies with settable frequency tolerance for monitoring.

The frequency to be monitored is entered as a multiple of the simple rotation frequency ("Rotational speed factor").

For speed-dependent peak monitoring of individual frequencies, a frequency tolerance band for monitoring can be set.

The frequency tolerance can be specified absolutely in hertz or relatively as a percentage. It states the band around a certain frequency in the spectrum that will be monitored for limits. The default value for the frequency tolerance is ±0.3 Hz.

For each speed-dependent monitoring function, you can specify a message text. This text will be included in the relevant process message to provide a clearer explanation when a limit is violated.

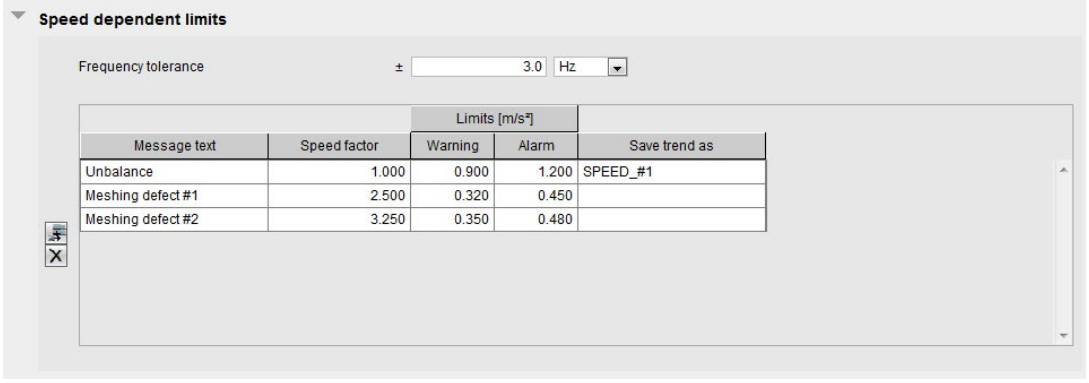


Image 10-23 Speed-dependent limits

The warning limits and alarm limits in the tables do not have to be filled out completely. In this way, you can configure any part of the monitoring functions.

Mask limits

Limits of the mask frequency band for monitoring remaining frequencies to cover the entire spectrum.

The mask frequency band covers the frequencies not yet monitored by one of the procedures defined above.

Operating functions

Inserting/deleting rows

You can insert new rows and delete rows using the buttons to the left of the table.

Button	Meaning
	Inserting a row A new row is always added at the end of the table.
	Deleting a row Selecting the row to be deleted

Creating, loading, saving, deleting limit bands

Button	Meaning
Reload	All entries on the page are rejected and the previous values are displayed again.
New ...	You can create a new band of limits using the "New ..." button. A window opens in which the name for the new limit band must be entered. After the "OK" button has been clicked, a new band is created with the specified name. Unsaved changes to existing bands are lost as a result. The new band of limits is not saved until the "Save" button is clicked.
Open ...	When the "Open …" button is clicked, a window opens that contains a list of saved limit bands. After a list entry has been selected and the "OK" button has been clicked, the selected limit band is loaded and displayed.
Save	With the "Save" button, the changes of the currently loaded limit band will be saved.
Save as ...	With the "Save as …" button, an existing limit band can be saved with a new name. A window opens in which the new name can be entered. After the "OK" button has been clicked in the window, the limit band is saved with the new name and also displayed as the current limit band. Limit bands can be copied in this manner. After the copy has been edited, the changes must be saved by clicking the "Save" button.
Delete ...	You can delete an existing limit band using the "Delete ..." button. A window opens that contains the name of the currently displayed limit band. After the "OK" button has been clicked, the limit band of this name will be deleted from the archive. The first limit band found in the archive will then be displayed as the current limit band.

10.5.4 Envelope spectra

On the "Envelope spectra" page, you can activate the limits and define the associated limit bands. The settings refer exclusively to the vibration channels and the "envelope spectrum" monitoring method.

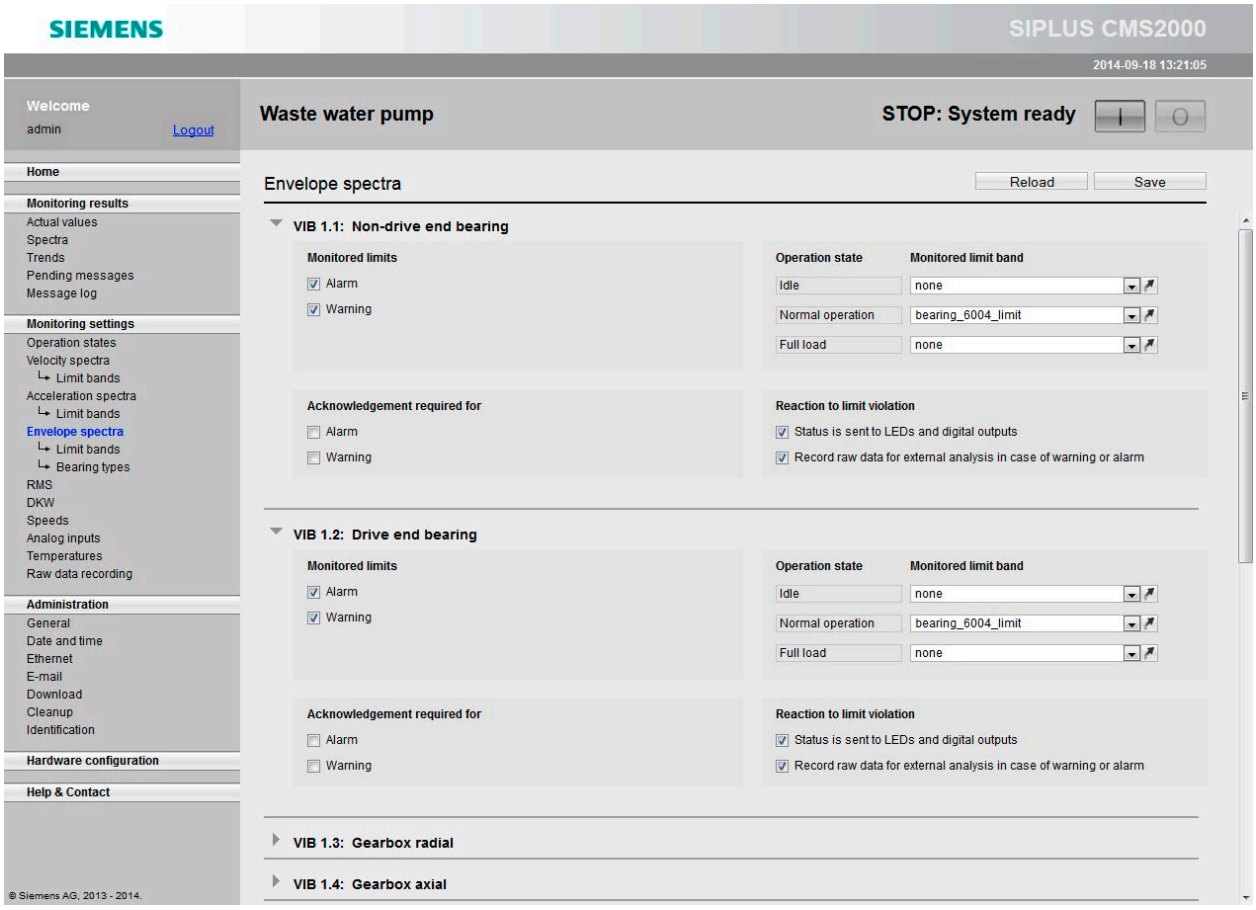


Image 10-24 Envelope spectra

Monitored limits

Activate or deactivate monitoring of the warning / alarm limits for this channel.

Monitored limit band

All operation states configured for the speed source of the respective VIB channel are displayed. From the list of defined limit bands (see the chapter Limit bands (Page 161)), you can assign a monitoring band to the respective operation state. This band contains information as to which frequencies must be checked as well as the limits for the frequencies to be checked.

In the case of VIB channels with fixed speed, "<Fixed speed>" is displayed as the operation state, and you can assign precisely one limit band.

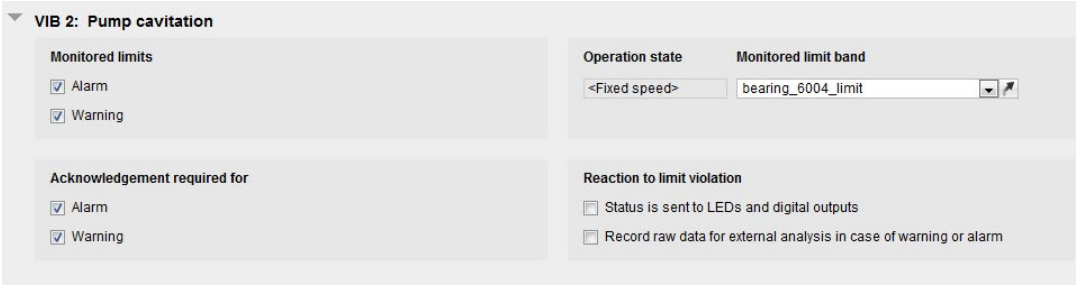


Image 10-25 Envelope spectra: VIB channel with fixed speed

The link icon will take you directly to the page of the currently selected limit frequency band.

Acknowledgement required for alarm/warning

Here you define whether a violation of a alarm / warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

10.5.4.1 Limit bands

On the "Envelope spectrum band" page, you can create, modify and administer the limit bands for the envelope spectrum.

You can define speed-dependent limits and speed-independent limits for the remaining frequencies.

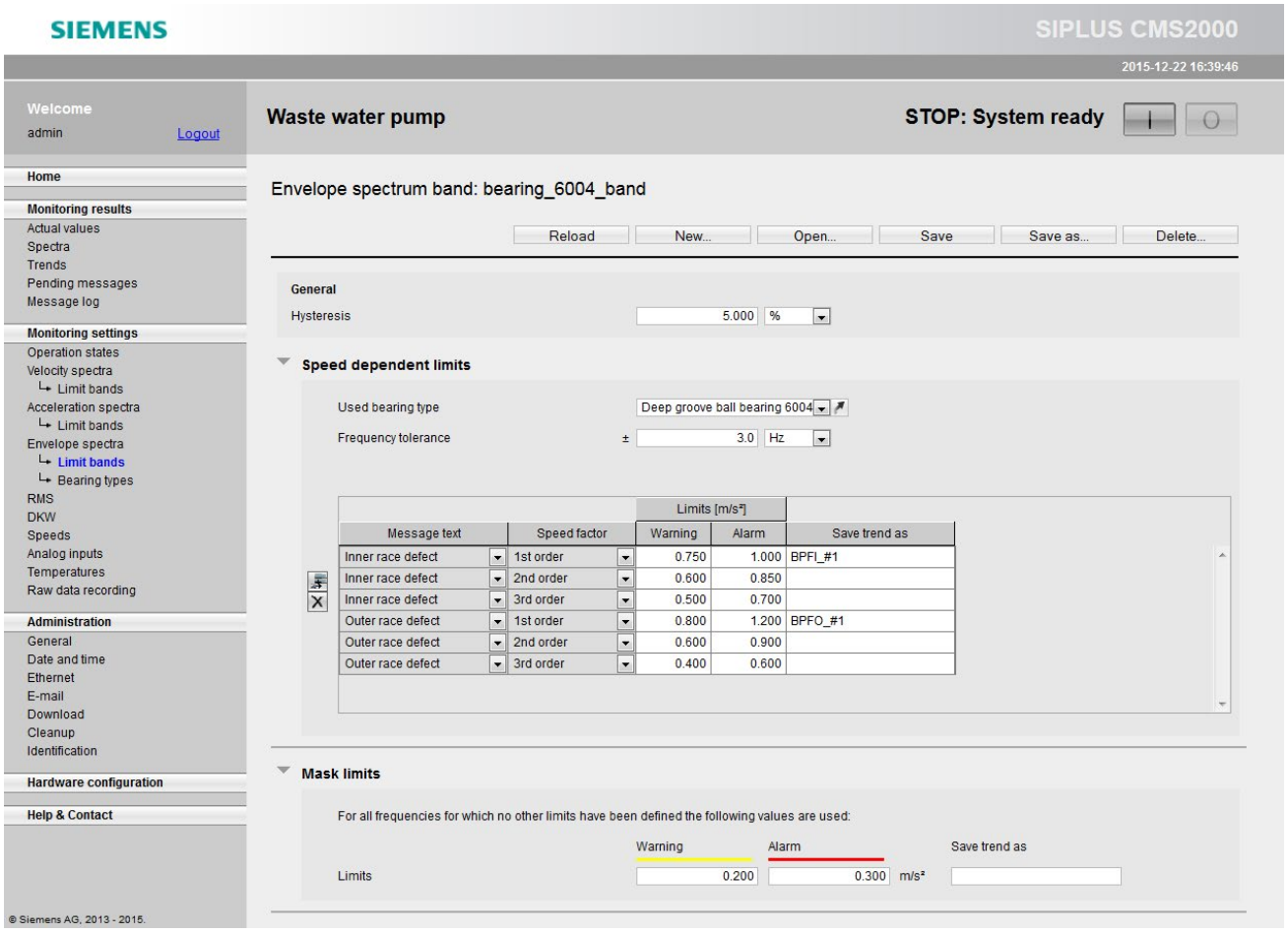


Image 10-26 Envelope spectrum band

General

Here you define the hysteresis for the limit bands. The value applies to all the limit bands defined here.

You can specify the value in m/s² or as a percentage.

Speed-dependent limits

Speed-dependent peak monitoring of individual frequencies with settable frequency tolerance for monitoring.

Select a bearing from the list of defined bearings. Bearings are defined on the "Bearing types (Page 164)" web page.

For speed-dependent monitoring of individual frequencies, a frequency tolerance band for monitoring can be set.

The frequency tolerance can be specified absolutely in Hz or relatively as a percentage. It states the band around a certain frequency in the spectrum that will be monitored for limits. The default value for the frequency tolerance is ±0.3 Hz

The message texts for the 4 types of damage are already predefined and can be selected under "Message text."

This text will be included in the relevant process message to provide a clearer explanation when a limit is violated.

The limits can be specified for up to five orders of magnitude (multiples of the respective fault frequencies).

You can configure not only the predefined bearing frequencies but also any speed-dependent monitoring functions.

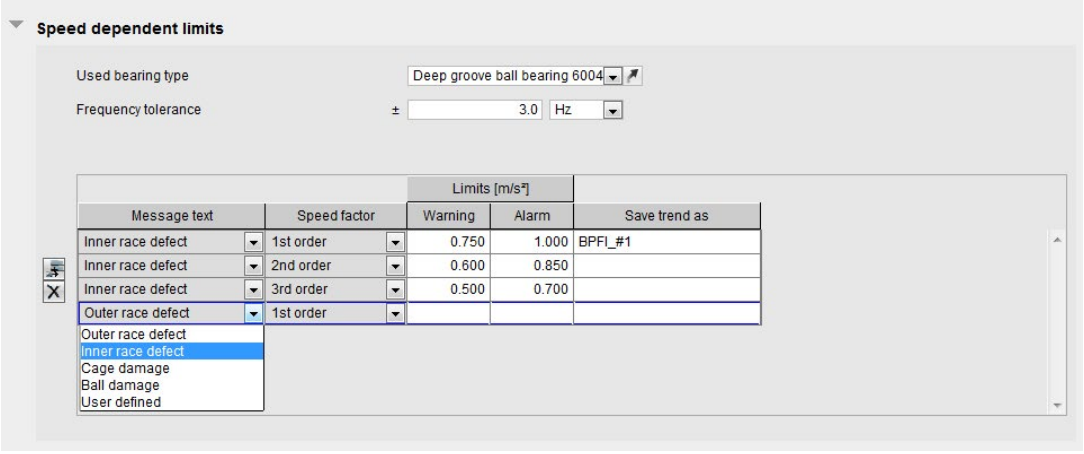


Image 10-27 Speed-dependent limits

For each speed-dependent monitoring function, you can specify a message text. This text will be included in the relevant process message to provide a clearer explanation when a limit is violated.

The warning limits and alarm limits in the tables do not have to be filled out completely. In this way, you can configure any part of the monitoring functions.

Mask limits

Limits of the mask frequency band for monitoring remaining frequencies to cover the entire spectrum.

The mask frequency band covers the frequencies not covered by the method stated above.

Operating functions

The operating functions are described by way of example in Section "Limit bands (Page 155)."

10.5.4.2 Bearing types

On the "Bearing types" page, you can create, modify and administer the data for the different bearing types.

The data stored for each bearing type is used in the bearing analysis to determine the fault frequencies for the outer race, inner race, rolling elements (balls) and cage. The limit bands for bearing analysis contain limits in accordance with these fault frequencies.

To open the page, click "Monitoring settings > Envelope spectra > Bearing types" in the navigation area.

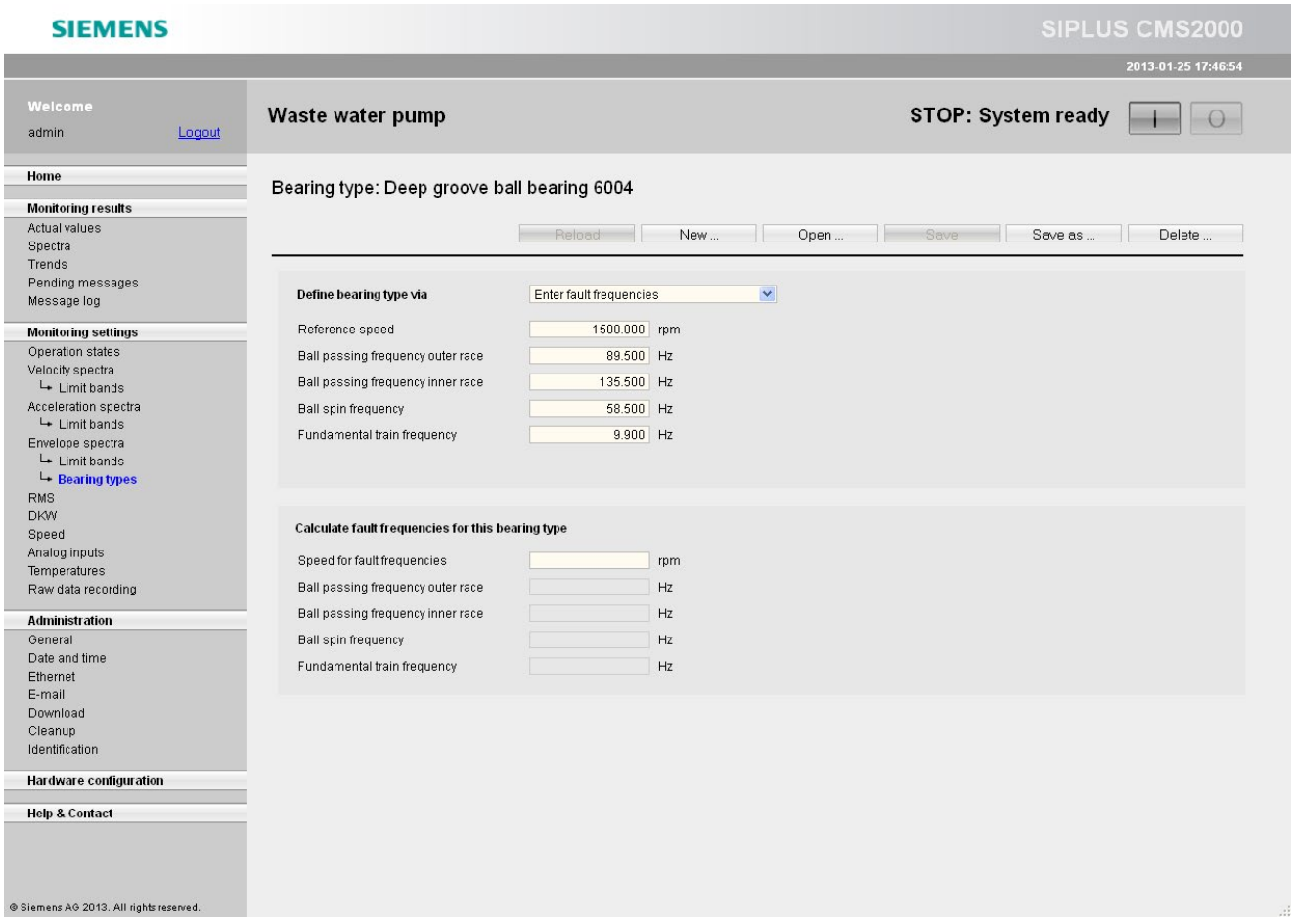


Image 10-28 Envelope spectra: Bearing types

You can choose between the following two input modes for the bearing type parameter:

- Direct entry of the fault frequencies
- Input of the bearing geometry

Direct entry of the fault frequencies

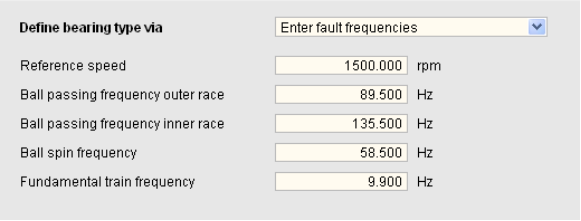


Image 10-29 Defining the bearing type by direct entry of the fault frequencies

For direct entry of the frequencies, you enter a speed as the reference value and the bearing fault frequencies for outer race, inner race, rolling element and cage. An incomplete entry of the fault frequencies is also accepted, but in this case you will be unable to activate monitoring of the bearing for a particular type of damage.

Input of the bearing geometry

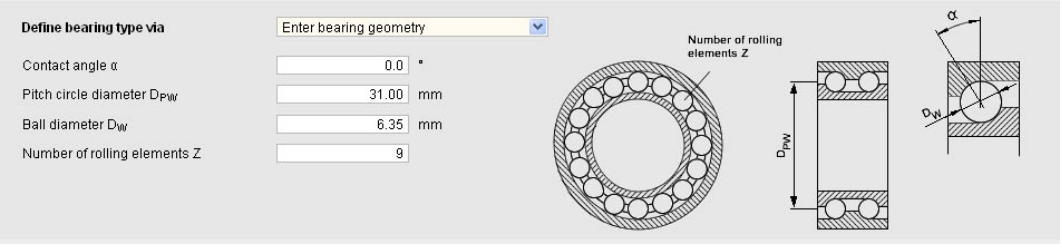


Image 10-30 Defining the bearing type by entering the bearing geometry

For entry of the bearing geometry, four geometric characteristic values are specified:

- Contact angle of the rolling element (ball) in the cage α
- Ball diameter $D_{\rho W}$
- Ball diameter D_W
- Number of balls Z

Fault frequency calculator

The "Bearing types" menu contains a fault frequency calculator. After a speed ("Speed for fault frequencies") has been entered, the bearing fault frequencies for outer race and inner race, the rolling element and cage are displayed immediately for the current bearing type.

10.5.5 RMS

In the "RMS" menu, you can activate limits and set the associated limit and hysteresis values. The settings refer exclusively to the vibration channels and the "RMS" monitoring method.

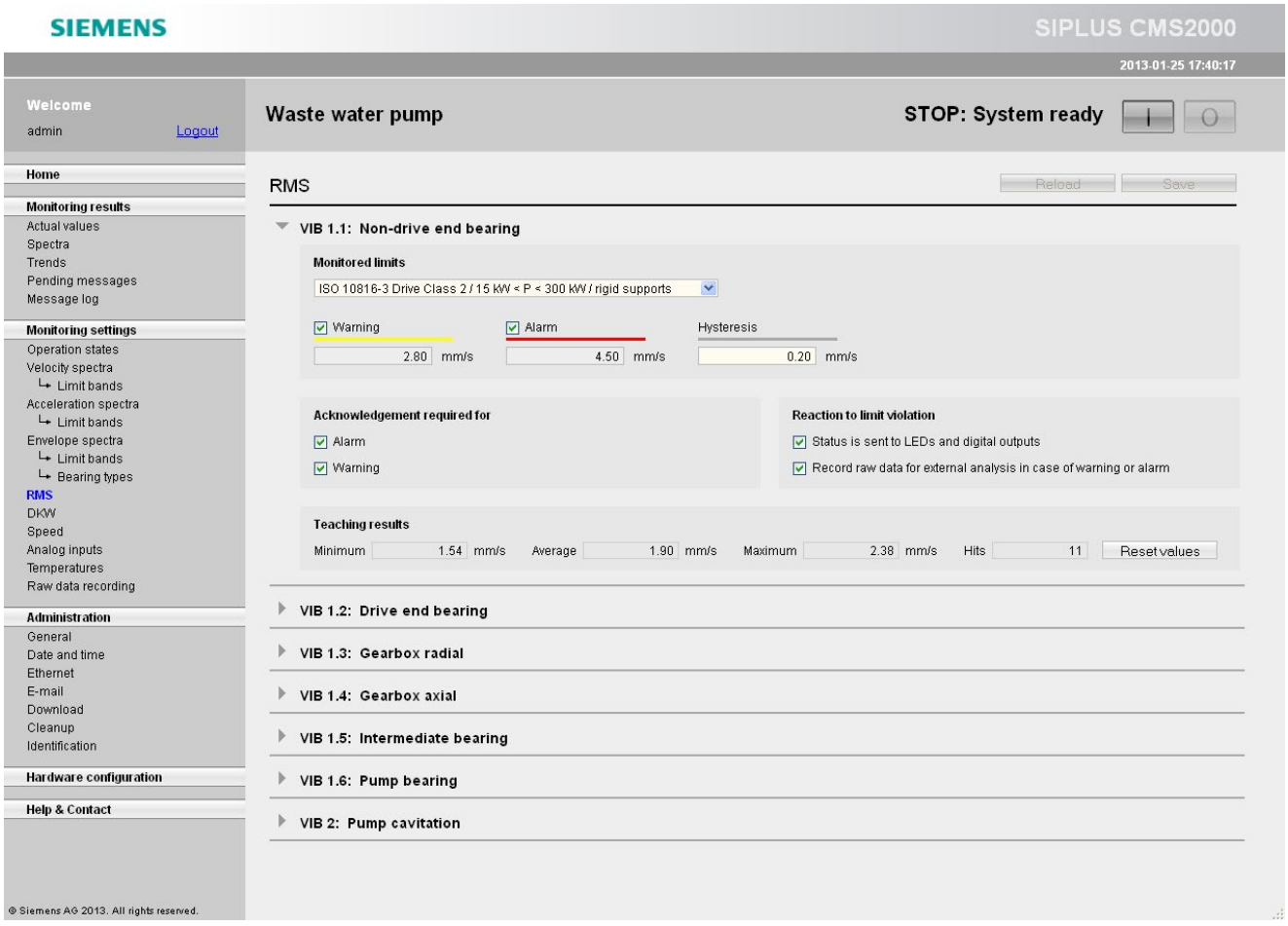


Image 10-31 RMS

Monitored limits

You can define a hysteresis value for each alarm and warning limit that you can activate. See Section Absolute and cyclic hysteresis (Page 67) for an explanation of hysteresis.

Selection of limits in accordance with ISO 10816-3 and ISO 10816-7 is supported. If a set of limits defined by the standard is selected from the list, these values are entered in the limit fields and cannot be changed manually. To enter limits manually, you must select "User defined" from the list.

Note

Warning limit < Alarm limit

Please note that the warning limit must always be lower than the alarm limit.

If this is not the case, changing to RUN operating mode will fail.

This does not apply when warning or alarm limits are deactivated.

Acknowledgement required for alarm/warning

Here you define whether a violation of the alarm/warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

Teaching results

The RMS values calculated by teaching serve as a guide for entering the limits.

Note

The teach values are automatically ascertained in measuring mode (RUN-Measuring) and continuously stored.

The values calculated during teaching are updated cyclically in "RUN-Measuring" mode:

- Minimum RMS
- Average RMS
- Maximum RMS

The "Teaching results" display shows how many successful calculations were incorporated into the minimum, maximum and average values.

With "Reset values," you can delete the teach values obtained. Up to 1000 teaching results per vibration channel are saved in the device. Following "Reset", 1000 measurements are again available.

10.5.6 DKW

In the "DKW" menu, you can activate limits and set the associated limit and hysteresis values. The settings refer exclusively to the vibration channels and the "DKW" monitoring method.

To open the page, click "Monitoring settings > DKW" in the navigation area.

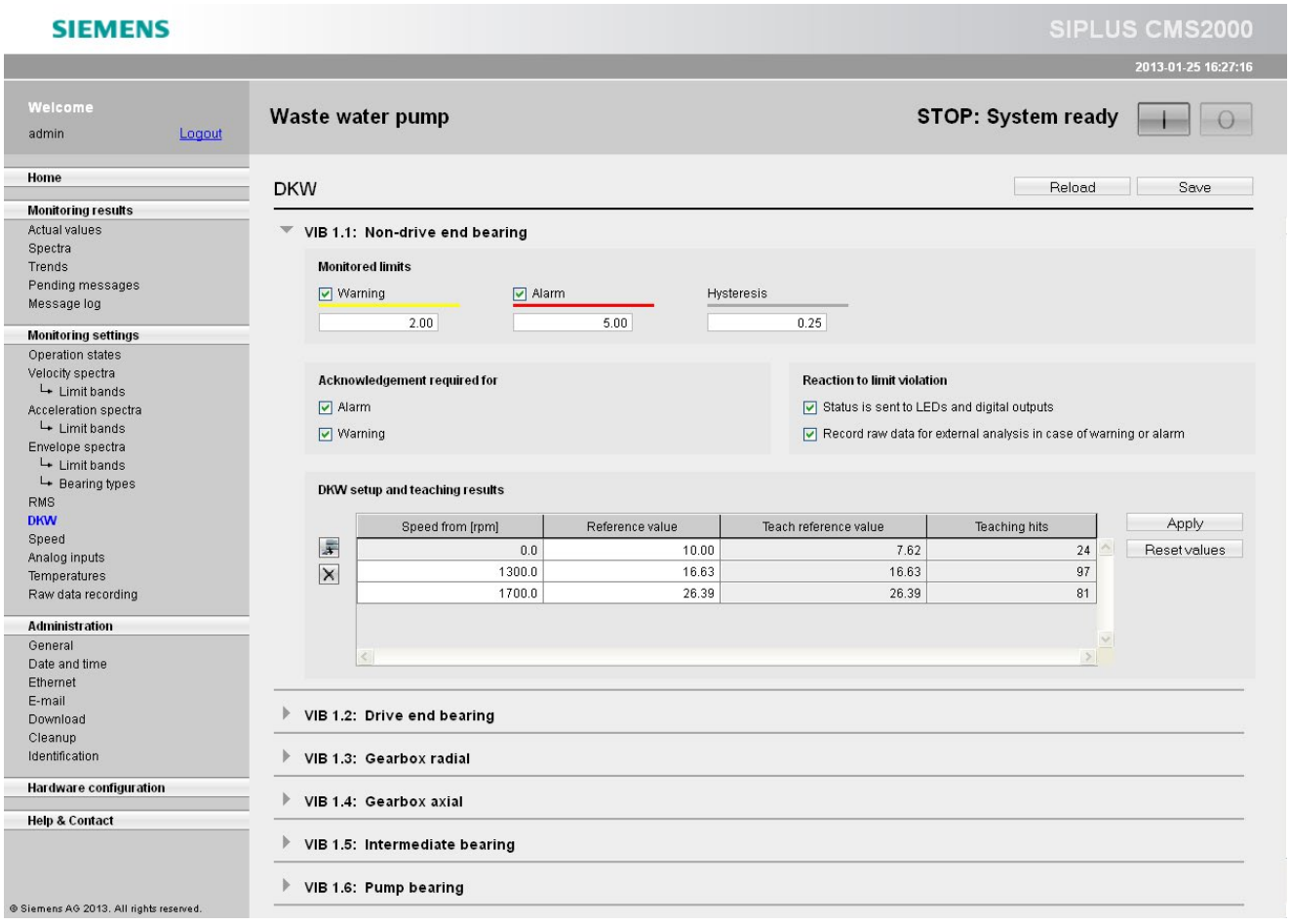


Image 10-32 DKW

Monitored limits

You can define a hysteresis value for each alarm and warning limit that you can activate. See Section Absolute and cyclic hysteresis (Page 67) for an explanation of hysteresis.

Note

Warning limit < Alarm limit

Please note that the warning limit must always be lower than the alarm limit.

If this is not the case, changing to RUN operating mode will fail.

This does not apply when warning or alarm limits are deactivated.

Acknowledgement required for alarm/warning

Here you define whether a violation of the alarm/warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

DKW setup and teaching results

To specify the speed-dependent reference values, the corresponding rows must be added to the table. The acquired speed of the monitored plant is assigned to the row with the next lowest speed value in each case. The reference value saved in this row is then used for calculation of the DKW. The row for speed "0" is entered by the system. If a measured speed cannot be assigned to one of the entered speeds, it will be entered in row "0". This row cannot be deleted and the value 0 for the speed cannot be changed.

The reference values determined from teaching can be used for DKW calculation.

Even if teaching mode is not used, reference values can be entered and saved in the table.

Note

The teach values are automatically ascertained in measuring mode (RUN-Measuring) and continuously stored.

The values calculated during the teaching process are updated cyclically. The "Teaching hits" column contains the number of calculated reference values that were determined at this speed, for each speed range. You can apply the reference values obtained by teaching with the "Apply" button.

With "Reset values," you can delete the teach values obtained. For each vibration channel, up to 1000 teaching results per speed range are saved in the device. Following "Reset", 1000 measurements are again available per speed range.

Note

Applying a changed speed distribution

Please note that when the speed distribution is changed, settings must be saved by clicking the "Save" button. Otherwise the last settings saved will be used for teaching.

10.5.7 Speeds

On the "Speeds" page, you can monitor the three measured speeds SPEED1 / SPEED2 / SPEED 3 for upper and lower limits respectively. You can activate limits and set the associated limit and hysteresis values for each of the speed channels. The settings refer exclusively to speed monitoring.

To open the Web page, click "Monitoring settings > Speeds" in the navigation area.

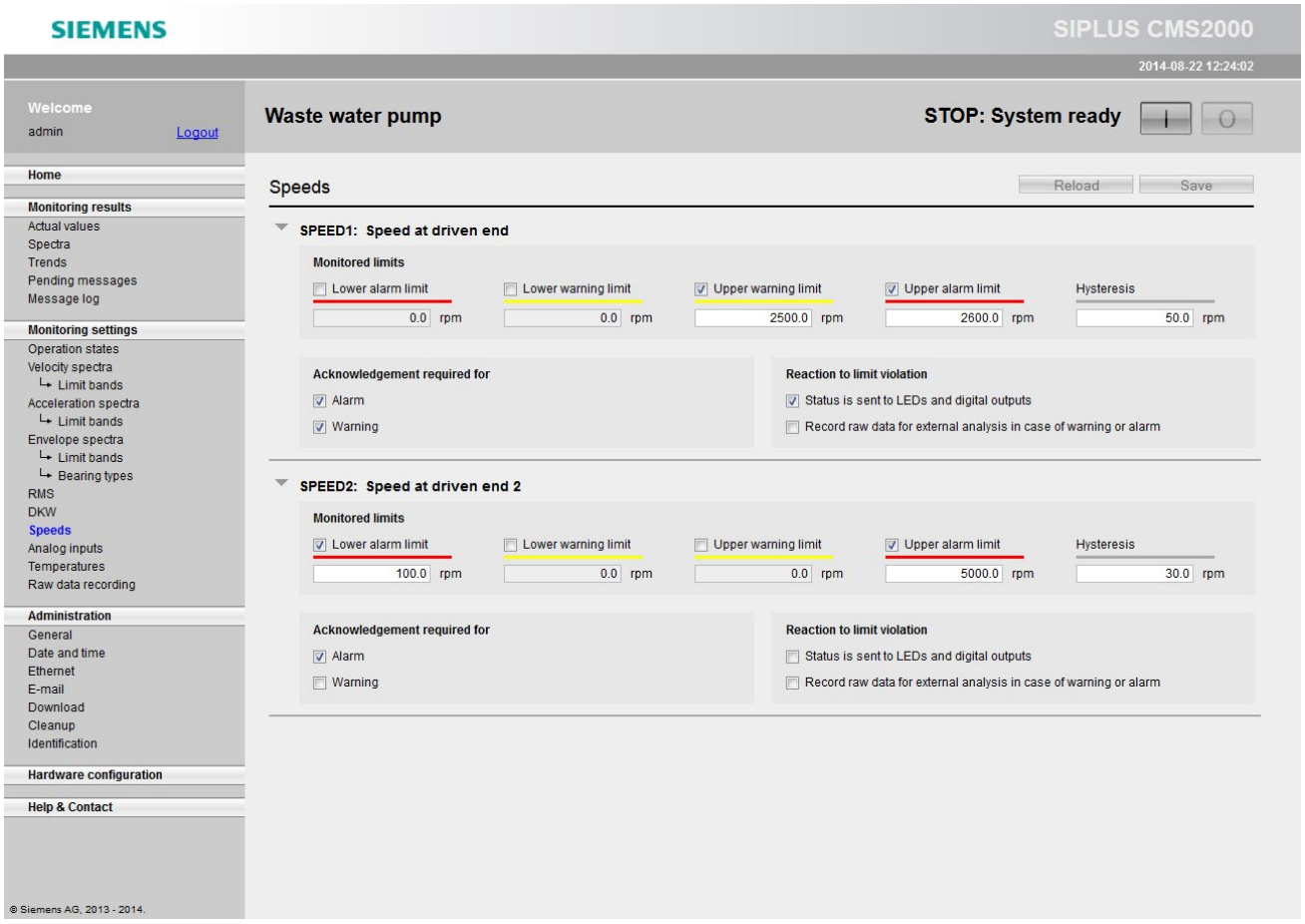


Image 10-33 Speed

Monitored limits

You can define the following for each channel:

- Monitoring the lower alarm limit / warning limit
- Monitoring the upper warning limit / alarm limit
- Hysteresis for the warning limits / alarm limits

For an explanation of hysteresis, see Section Absolute and cyclic hysteresis (Page 67).

Note

Lower alarm limit < Lower warning limit < Upper warning limit < Upper alarm limit

Please note that the lower alarm limit must always be lower than the lower warning limit. And that the lower warning limit must always be lower than the upper warning limit. And that the upper warning limit must be lower than the upper alarm limit.

If this is not the case, changing to RUN operating mode will fail.

This does not apply when warning or alarm limits are deactivated.

Acknowledgement required for alarm/warning

Here you define whether a violation of the alarm/warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

10.5.8 Analog inputs

In the "Analog inputs" menu, you can activate limits for analog inputs AI1 and AI2 and set the associated limit and hysteresis values. The settings refer exclusively to analog value monitoring.

To open the page, click "Monitoring settings > Analog inputs" in the navigation area.

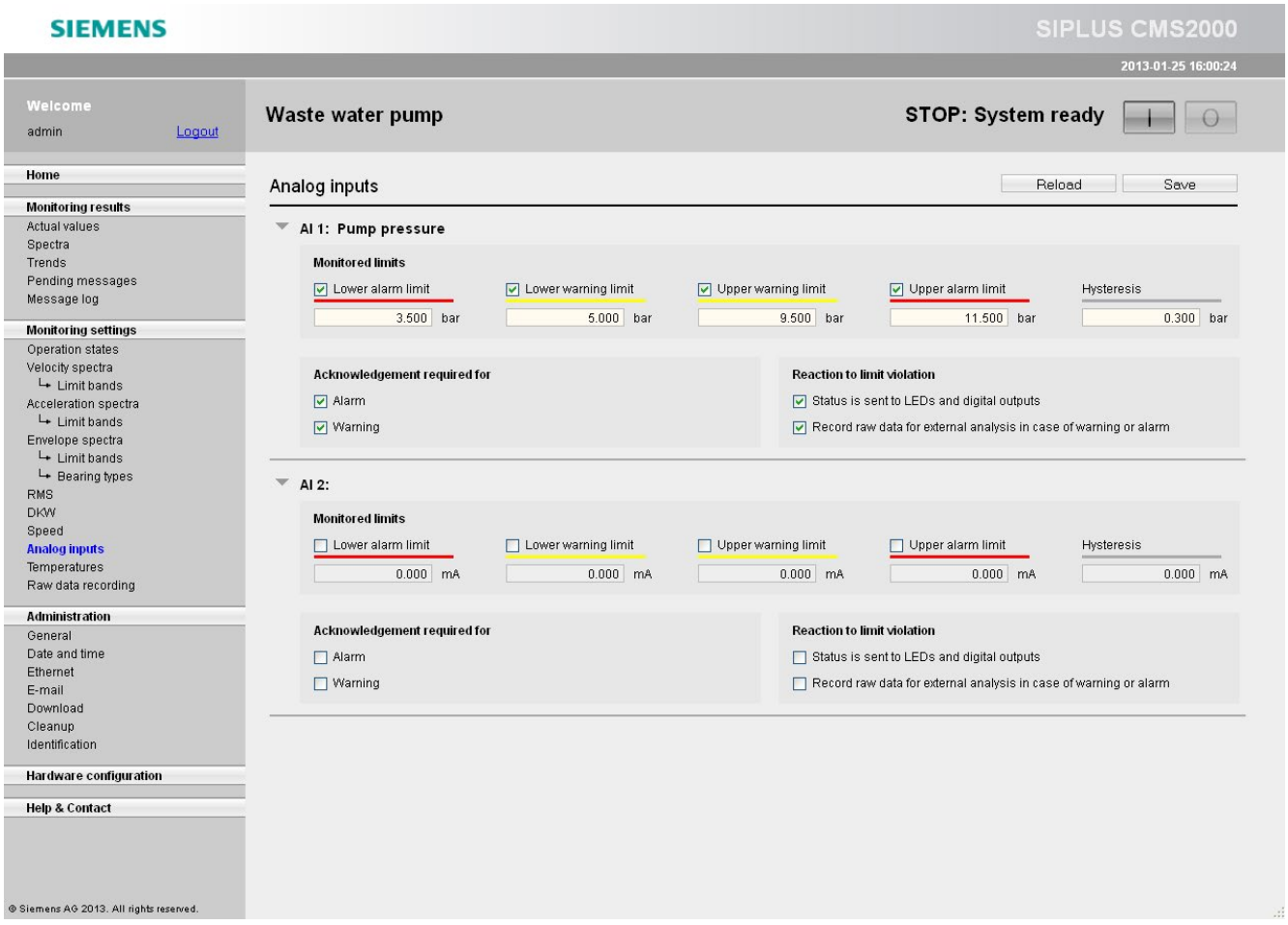


Image 10-34 Analog inputs

Monitored limits

You can define the following for each channel:

- Monitoring the lower alarm limit / warning limit
- Monitoring the upper warning limit / alarm limit
- Hysteresis for the warning limits / alarm limits

For an explanation of hysteresis, see Section Absolute and cyclic hysteresis (Page 67).

Note

Lower alarm limit < Lower warning limit < Upper warning limit < Upper alarm limit

Please note that the lower alarm limit must always be lower than the lower warning limit. And that the lower warning limit must always be lower than the upper warning limit. And that the upper warning limit must be lower than the upper alarm limit.

If this is not the case, changing to RUN operating mode will fail.

This does not apply when warning or alarm limits are deactivated.

Acknowledgement required for alarm/warning

Here you define whether a violation of the alarm/warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

10.5.9 Temperatures

In the "Temperatures" menu, you can activate limits and set the associated limit and hysteresis values. The settings only apply to temperature monitoring.

To open the page, click "Monitoring settings > Temperatures" in the navigation area.

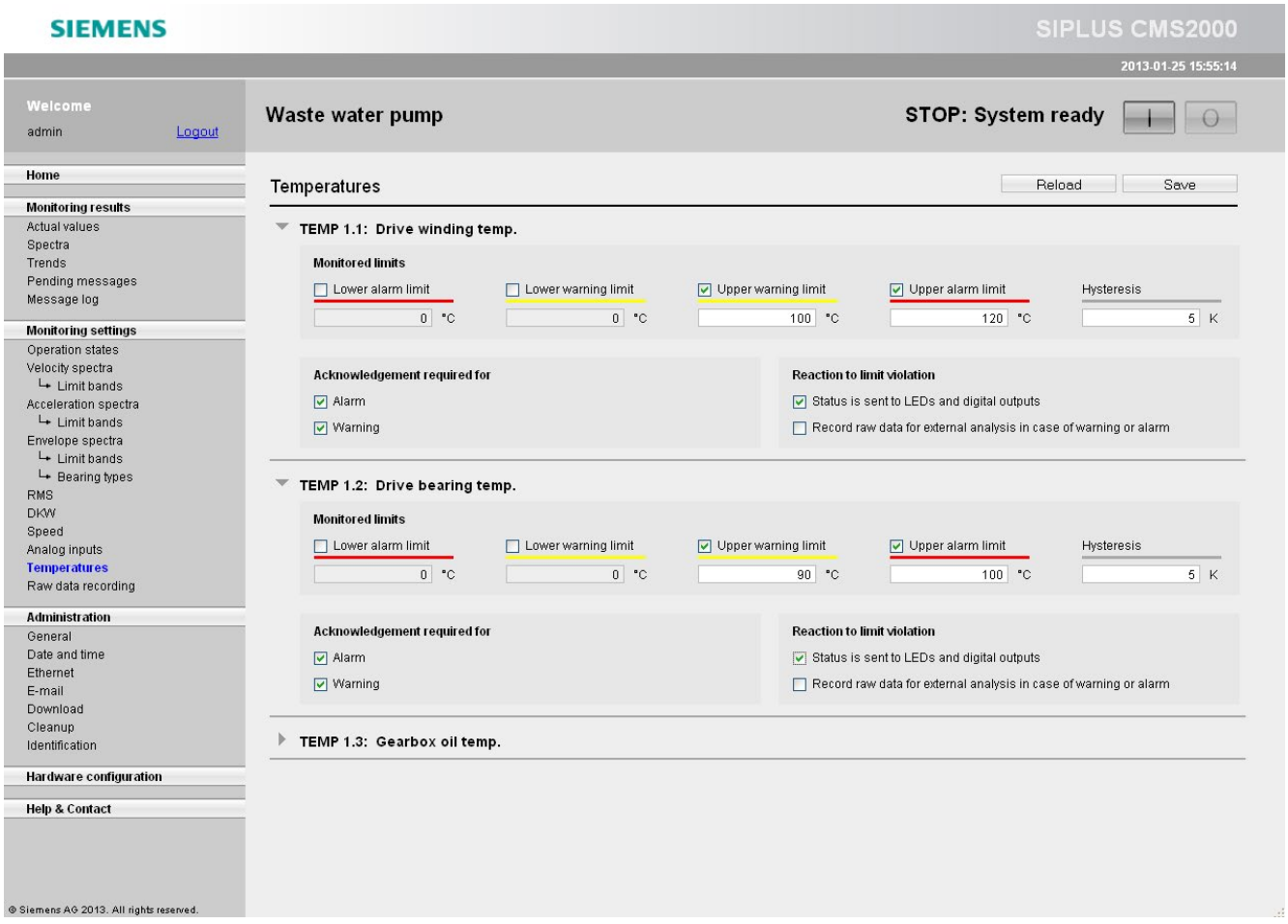


Image 10-35 Temperatures

Monitored limits

You can define the following for each channel:

- Monitoring the lower alarm limit / warning limit
- Monitoring the upper warning limit / alarm limit
- Hysteresis for the warning limits / alarm limits

For an explanation of hysteresis, see Section Absolute and cyclic hysteresis (Page 67).

Note

Lower alarm limit < Lower warning limit < Upper warning limit < Upper alarm limit

Please note that the lower alarm limit must always be lower than the lower warning limit. And that the lower warning limit must always be lower than the upper warning limit. And that the upper warning limit must be lower than the upper alarm limit.

If this is not the case, changing to RUN operating mode will fail.

This does not apply when warning or alarm limits are deactivated.

Acknowledgement required for alarm/warning

Here you define whether a violation of the alarm/warning limit has to be acknowledged.

Reaction to limit violation

Here you activate the response to a limit violation.

- Status is sent to the relevant LEDs and digital outputs.
- Start raw data recording

10.5.10 Recording raw data

For each vibration channel, you can define for how long the raw data recording will continue. Values from 1 second through 90 seconds are permitted. You can define whether analog channel AI1 and/or analog channel AI2 will also be recorded.

For each recorded vibration channel, the associated speed is automatically also recorded.

To open the web page, click "Monitoring settings > Raw data recording" in the navigation area.

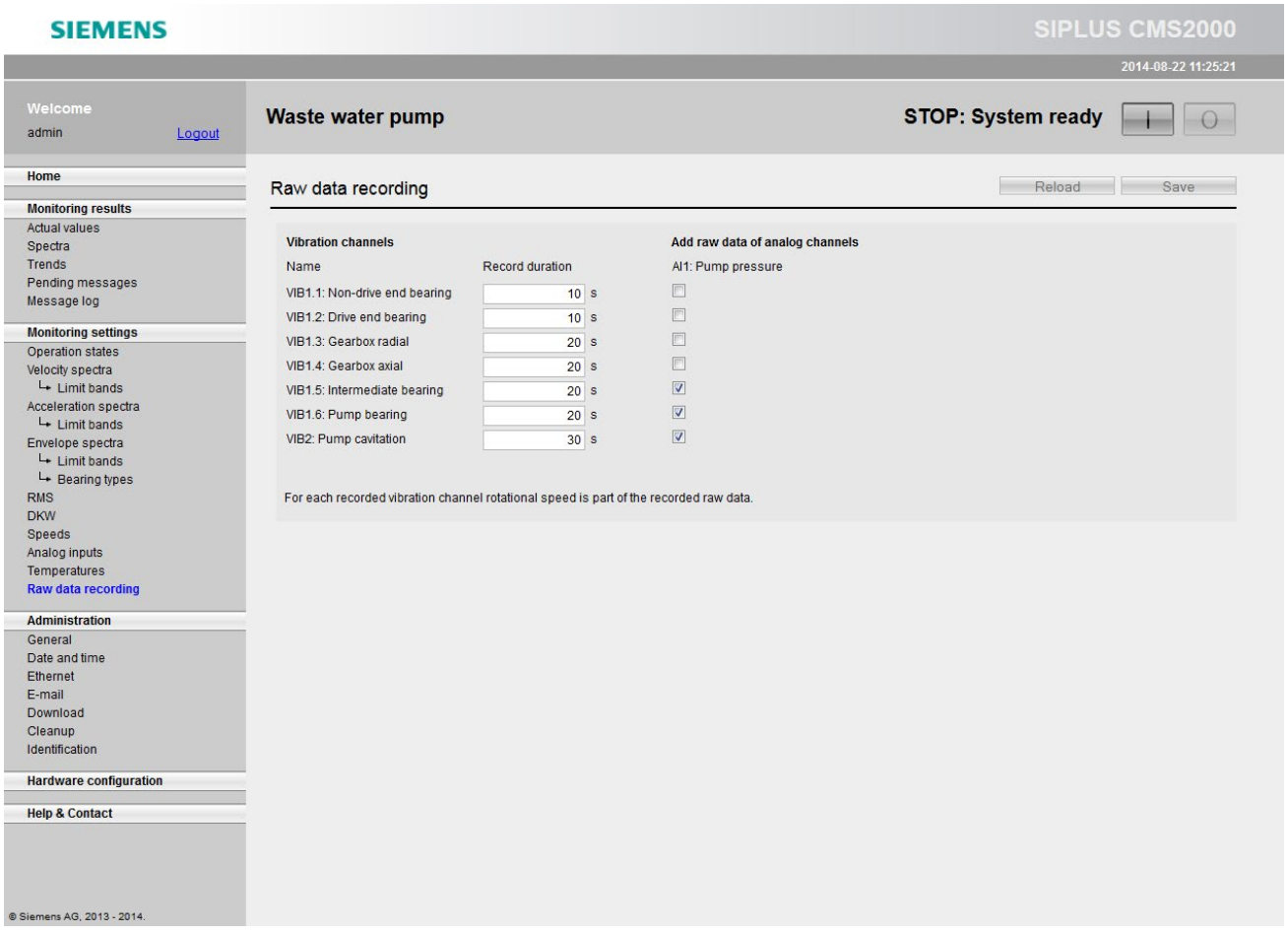


Image 10-36 Recording raw data

10.6 Administration

This category contains pages that are used for managing the device.

10.6.1 General

You can make general administration settings on the "General" page: Click "Save" to save inputs.

To open the page, click "Administration > General" in the navigation area.

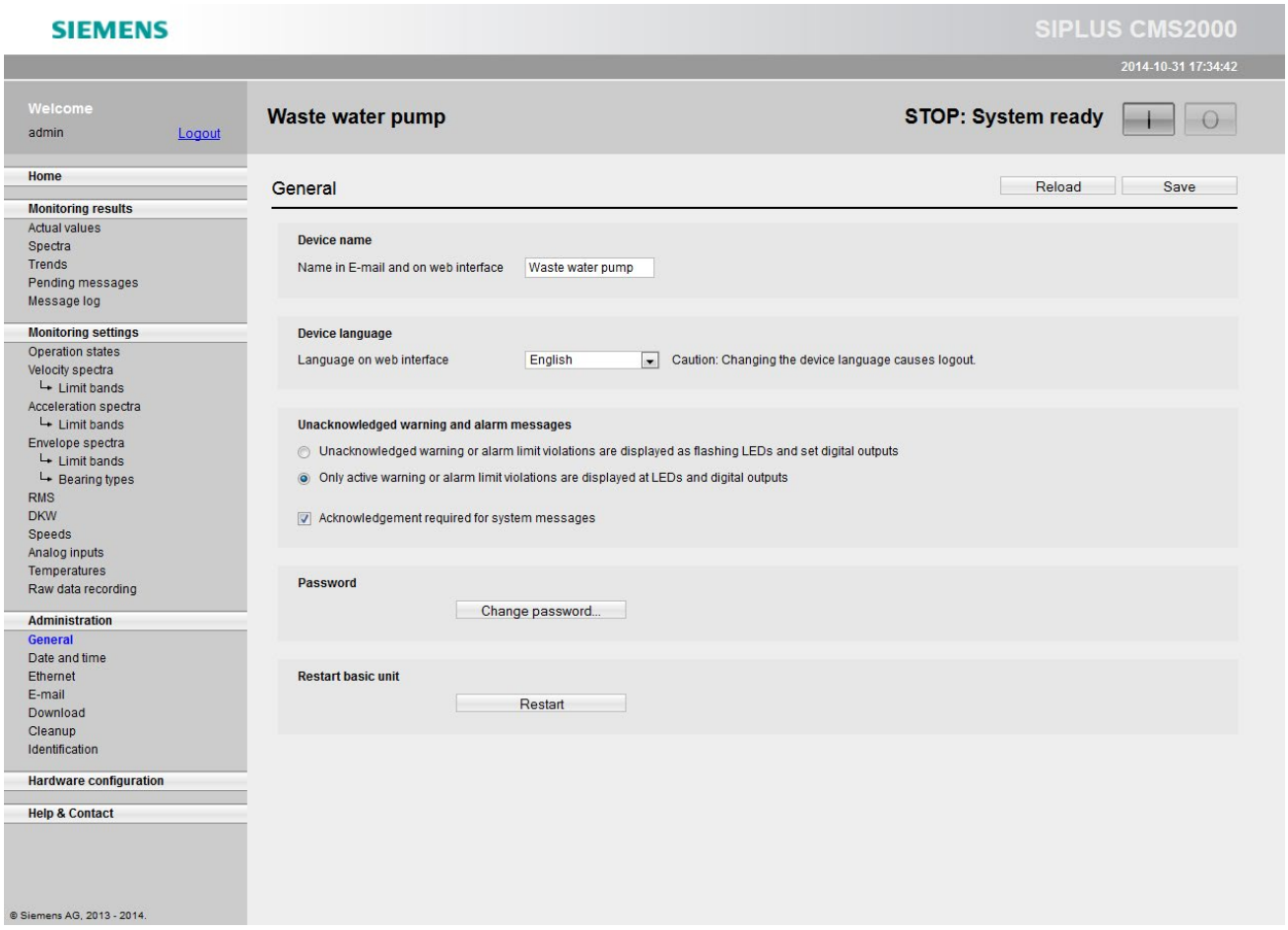


Image 10-37 Administration: General

Device name

The name of the device can be entered here. It will appear in the title area, e-mails and on the Identification (Page 197) page.

Device language

You can switch the language of the web interface between English and German. Select the desired language and click "Save". Language switchover takes about 10 seconds. The connection to the device is temporarily interrupted and the user is logged out.

Unacknowledged warning and alarm limits

For unacknowledged warnings and alarm, you can choose between two responses of the message system:

- Unacknowledged messages are indicated by flashing LEDs and set outputs, even when the corresponding limit violation is no longer active.
- Unacknowledged messages will be indicated by lit LEDs and set outputs. Displays are reset when the limit transgression no longer applies.

Here you can also activate/deactivate the requirement for system messages to be acknowledged.

Password

To change the password stored in the device, click "Change password". The corresponding dialog box opens. Enter the old and new password, and repeat the new password. The password must have a length between 4 and 40 characters. The following characters are permissible:

- Lower and upper case letters (a to z and A to Z, no umlaut characters)
- Digits (0 to 9)
- Special characters "-" and "_"

Note

Return the device if you have forgotten the password

If you forget your password, the device has to be returned (Page 250). To avoid this, be sure to remember your password, or make a note of it and store it in a secure location.

Restart basic unit

A system restart can be performed in the STOP state by clicking the "Restart" button.

Note

During the restart

During the restart, operation via the browser is not possible, because the connection to the device has been interrupted.

Note

After the restart

After the restart, it is necessary to log on again before operator commands are possible.

10.6.2 Date and time

On the "Date and time" web page, you can set the date, time and time zone of the system.

To open the page, click "Administration > Date and time" in the navigation area.

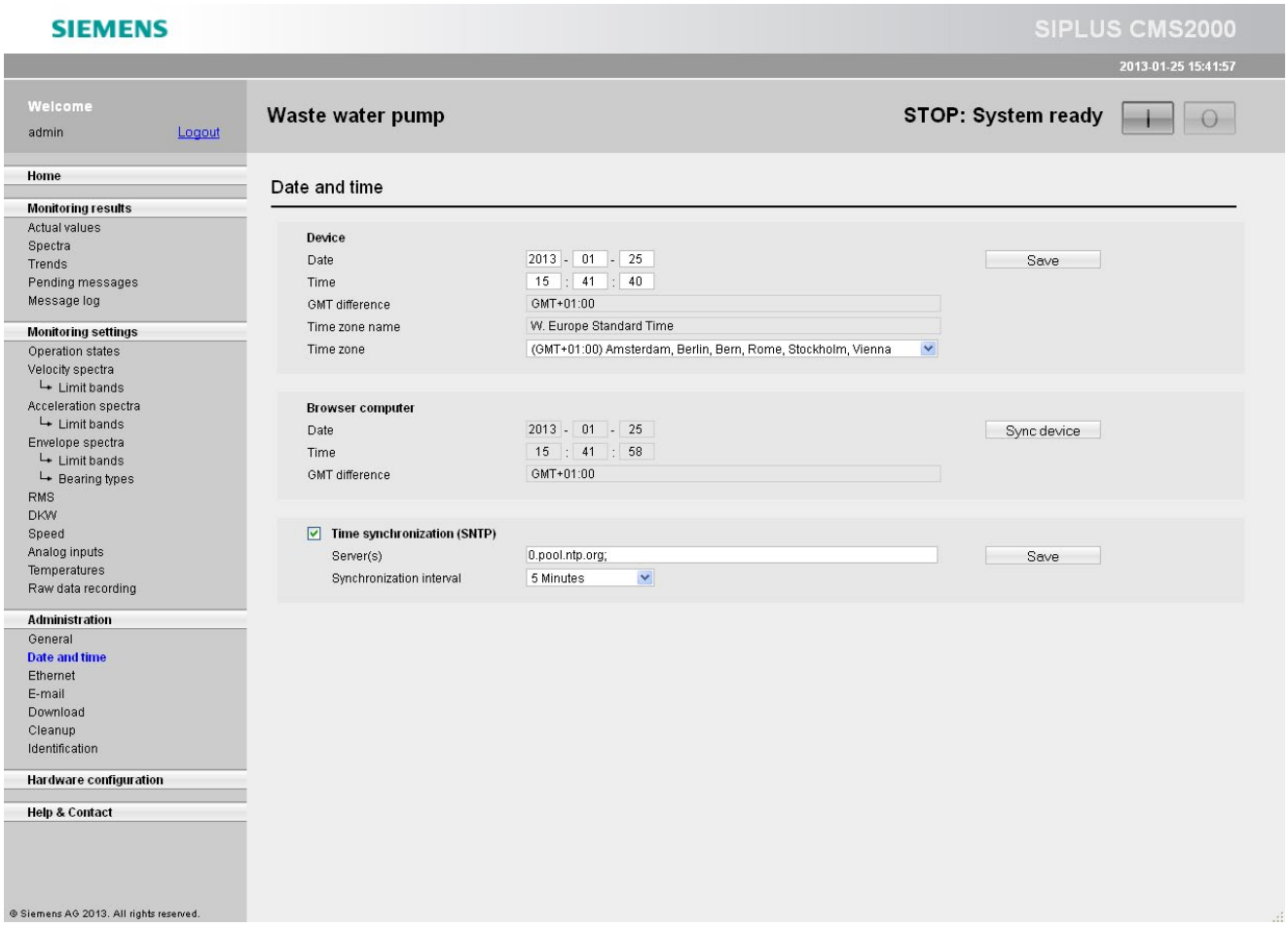


Image 10-38 Date and time

Device

When the page opens, the fields under "Device" contain the time and time zone applicable for the device at this moment.

Enter the required time and time zone and save them via "Save." The device will then be in the new time zone with the specified time set as the local time.

Browser computer

The "Sync device" button is used to load the local time of the browser into the device as the system time, taking into account the set time zone.

Note

Ensure that the time zones are correctly set on your PC and in CMS2000.

Note

The time zone can only be set using the "Save" button under "Device."

Note

Incorrect time in the browser

If the time zone is set incorrectly, the wrong time will be displayed in the browser.

Time synchronization (SNTP)

We recommend synchronizing the time of of the device via an SNTP server. To activate this function, select the relevant checkbox.

The values for the SNTP server and synchronization interval are displayed for the "Time synchronization" field. If the server is not specified by means of an IP address, the DNS server must be set correctly.

10.6.3 Ethernet

On the "Ethernet" page, you can define the parameters for Ethernet communication. You can also activate the cyclic transmission of current device data in Ethernet telegrams and the online data interface to X-Tools.

To open the page, click "Administration > Ethernet" in the navigation area.

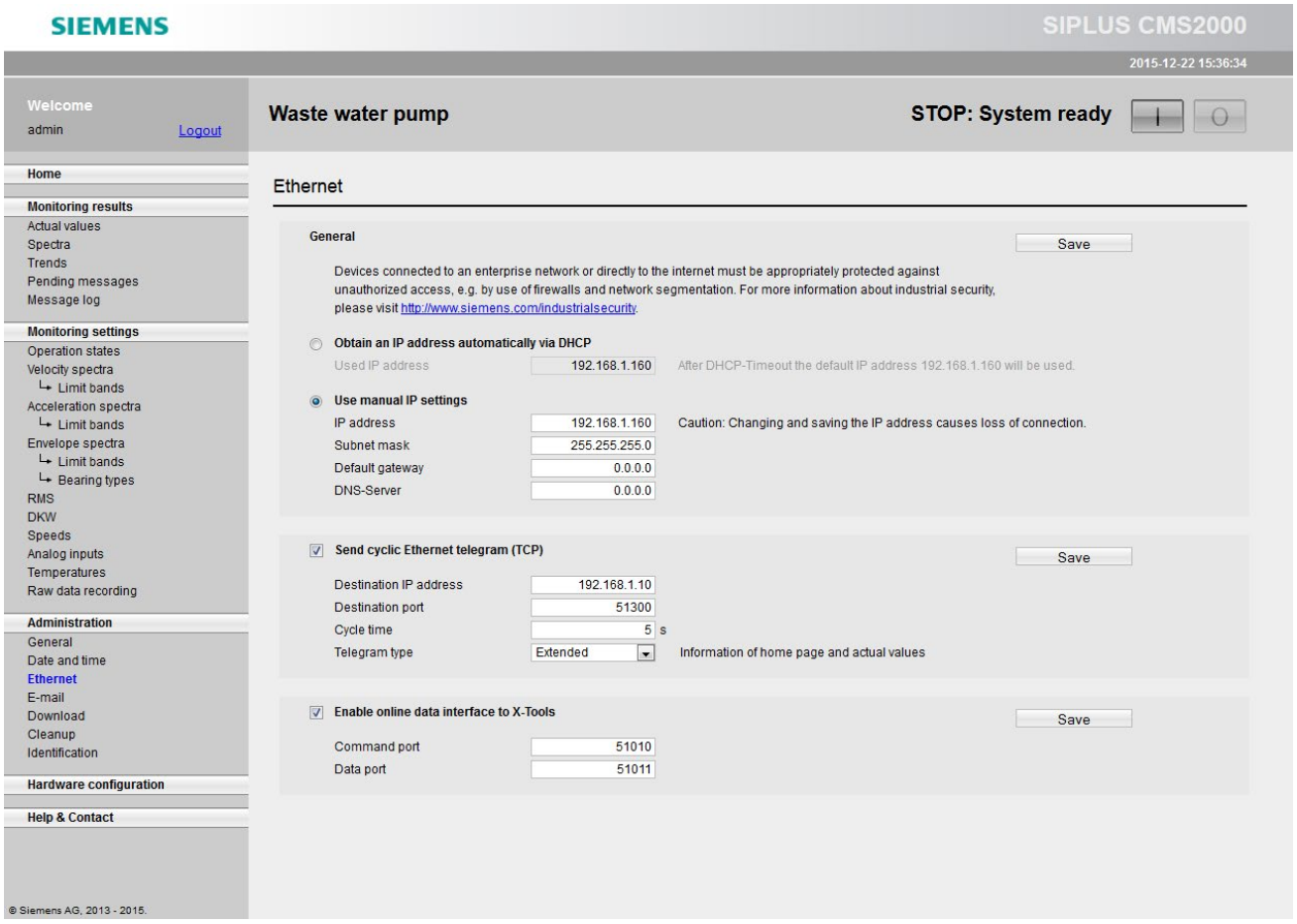


Image 10-39 Ethernet

General

Select either IP address assignment via DHCP or manual address settings in the "General" section. When the IP address is obtained automatically via DHCP, the connection between the browser and the device is lost, because it is not known which IP address will be provided. You have to enter the new address in the browser to restore the connection.

The IP address, subnet mask, default gateway and DNS server can be entered manually as required. Even when making a manual entry/change to the IP address, you have to enter the new address in the browser to restore the connection.

Note

You will normally be able to obtain the values required for these settings from your network administrator.

Note

For saving e-mails and for time synchronization over an NTP server, it is essential to enter a DNS server.

Note

Incorrect settings can result in malfunctioning when the device is addressed via the web interface.

Save: The network settings are saved in the device and are applied immediately for the current operation. A logout is also performed. The user must log on again.

Send cyclic Ethernet telegram (TCP)

You can use the option "Send cyclic Ethernet telegram (TCP)" to activate the cyclic sending of current device data over Ethernet (TCP/IP protocol). This serves to integrate CMS2000 devices in higher-level systems, whereby interfacing to a PLC (SIMATIC) especially is supported.

Two types of telegram are available for selection:

- Compact telegram:
  Contains important information from the "Home page (Page 126)", such as operating status and number of active messages
- Extended telegram:
  Contains the data of the compact telegram as well as the current measured values and status information displayed on the "Actual values (Page 128)" page

The detailed telegram format is specified in the Appendix (Page 240). Telegrams are sent in all operating modes with the exception of "Startup" and "Shutdown".

The following parameters can be assigned for this function:

- Telegram sending on/off
- IP address and port of the recipient
- Cycle time for sending telegrams in multiples of seconds
- Telegram type (compact/extended)

The connection via TCP/IP is normally established by the CMS2000 device and must be accepted by the communication partner. Whenever the above parameters are saved, the connection is cleared and re-established so the communication partner must support repeated connection buildup. The communication partner, however, cannot establish a connection to the CMS2000. The CMS2000 outputs a system message when telegram sending was activated, but was unsuccessful. In the event of a fault, continuous attempts are made to establish a connection or to send a telegram.

Save: The settings for sending telegrams are saved in the device and are applied immediately for the current operation.

Activate online data interface to X-Tools

With this option, you can activate/deactivate the online data interface to X-Tools.

The port addresses for the command and data connection to X-Tools can be freely assigned. The following port addresses are set as defaults:

Command port	51010
Data port	51011

Save: The CMS2000 must be in the STOP state for this purpose.

In the RUN state (monitoring or measuring), X-Tools can establish the connection to the CMS2000 when the data interface is activated.

An active connection with X-Tools is indicated under "Pending messages" as a status display.

10.6.4 E-mail

E-mail function

The e-mail function is used for transferring process and system messages as well as up-to-date system information to one or more e-mail recipients.

To open the page, click "Administration > E-mail" in the navigation area. The "E-mail" page opens in the working area:

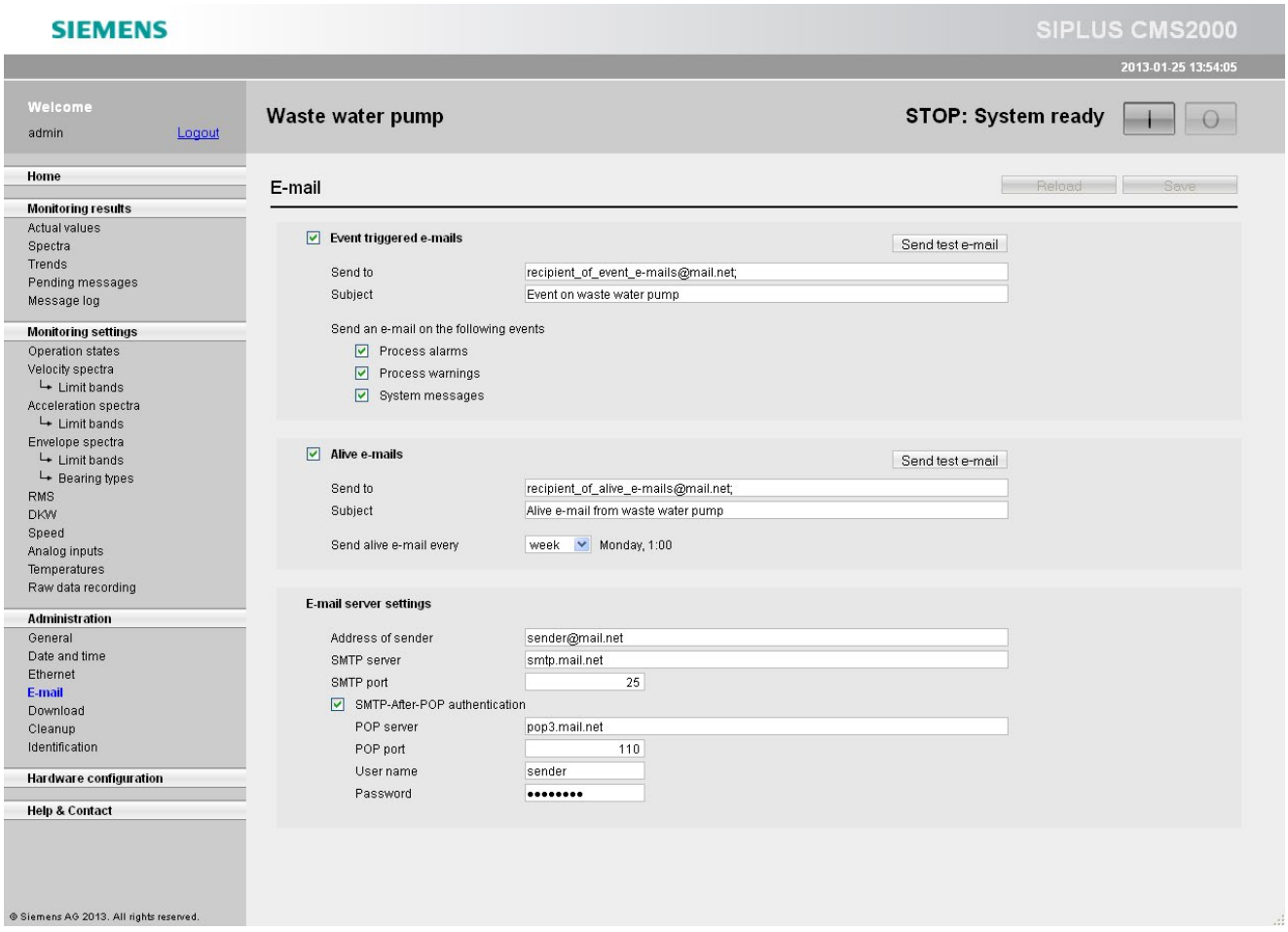


Image 10-40 E-mail

Event triggered e-mails

You can use the option "Event-triggered e-mails" to activate the sending of event-triggered e-mails. These can inform you about limit violations (warnings/alarms), system messages or operating mode changes (startup, STOP → RUN, RUN → STOP) as they occur.

You can set the following parameters for this function:

- E-mail address(es) of recipient(s)

  Note

  If more than one e-mail recipient is entered, addresses must be separated by a ";" (semi-colon), a "," (comma) or a blank.

- The subject line of the e-mail

You must also specify which message classes should trigger an e-mail. The following message classes are available:

- Process alarms
- Process warnings
- System messages (system messages and operation state transitions)

The e-mail text comprises the message ID, message type, time of message, IP address of the device, statuses of the "NORMAL," "WARNING," and "ALARM" LEDs before and after occurrence of the message, as well as the message text as it is shown on the "Message log (Page 142)" web page.

Alive e-mails

You can use the option "Alive e-mails" to activate the sending of cyclic e-mails that can serve as signs of life. Enter one or more recipient addresses here, as well as an e-mail subject. These can differ from the recipients entered for the event-triggered e-mails. You can select a cycle time of 1 x daily or 1 x weekly, at 01:00 hrs local system time.

The text of the cyclic e-mails includes current system information such as system date/time, status of the LEDs "NORMAL", "WARNING" and "ALARM" as well as the number of active process and system alarms.

E-mail server settings

In the section "E-mail server settings", you can set the parameters for sending e-mails.

SMTP / SMTP-after-POP authentication

You can check the box "SMTP-after-POP authentication" to activate the procedure; otherwise SMTP only will be used. If "SMTP-after-POP authentication" is used, you must complete all the fields under "E-mail server settings".

SMTP

If SMTP is used, only the following information is required:

- Sender address
- SMTP server address
- SMTP server port

Operation

Save	The entered values are stored on the device. The changes will only be effective after a change from STOP mode to one of the active modes "RUN-Measuring" or "RUN-Monitoring".
Send test mail (Event-triggered e-mails / Alive e-mails)	To test the e-mail settings, you can click this button in STOP mode to send a test e-mail for the respective e-mail category.

Note

After changing the settings, you must write them to the device by clicking the button "Save" before you can use the function "Send test mail".

Troubleshooting

If an error occurs when sending an e-mail, a message of the type "System-Info" is entered in the message history. A separate message appears for every failed e-mail.

If an e-mail is successfully sent, this does not automatically mean that the e-mail has also been successfully delivered. The specified SMTP server is responsible for delivery. No success or failure messages are sent from here to the CMS2000.

10.6.5 Download

On the "Download" page, you can download data that is stored in the device. This data can then be transferred to other CMS devices, or to other software for further processing.

To open the page, click "Administration > Download" in the navigation area.

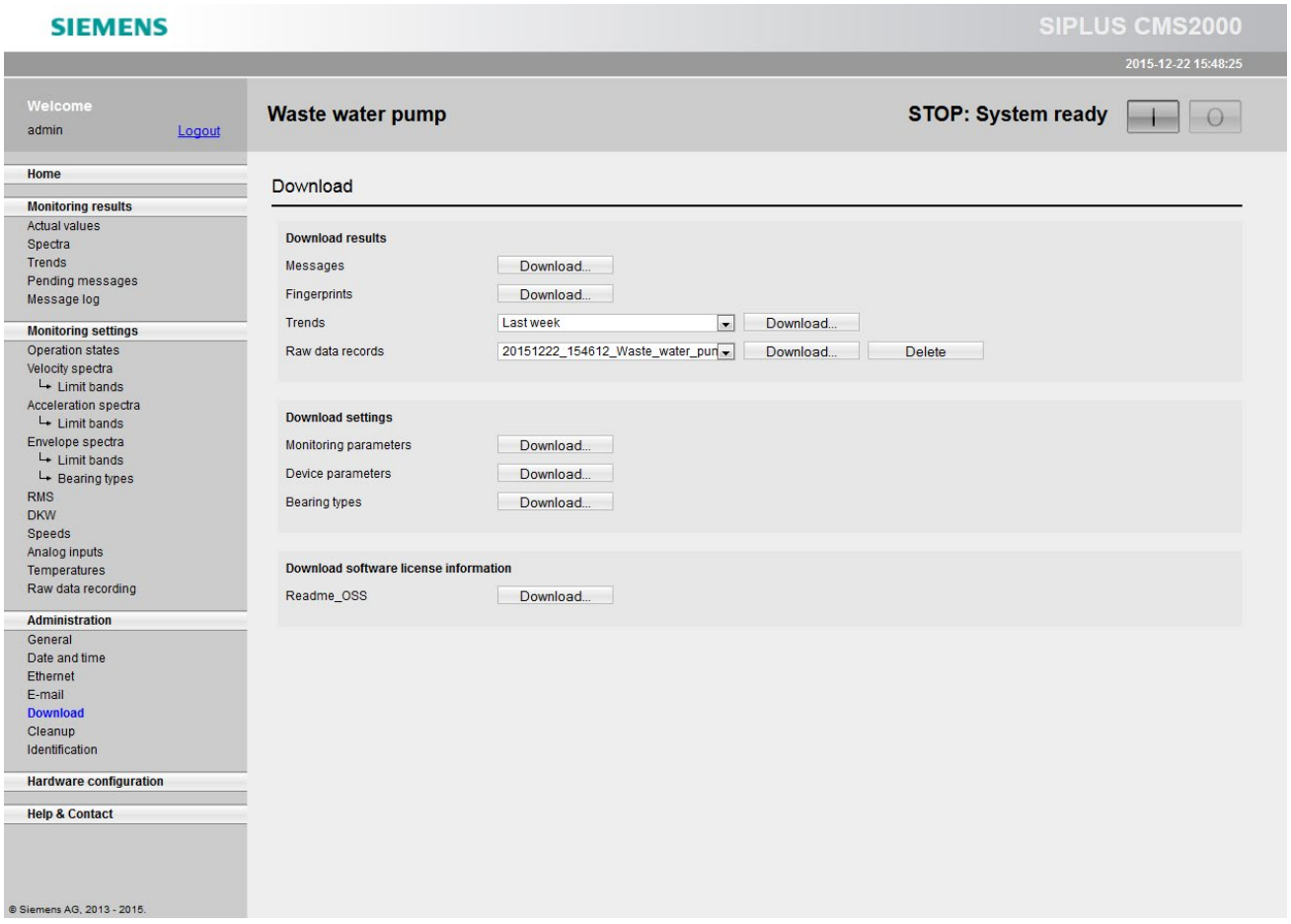


Image 10-41 Download

Note

In "RUN" mode, only downloading of raw data records and "Readme_OSS" is possible.

For all other data, downloading is only possible **in STOP mode**. You must switch to STOP, if you have not already done so.

Download results

Trends	Trends are the measured variables stored in the various time resolutions. The time resolutions "Last week", "Last month", "Last 6 months" and "Last 10 years" can be be downloaded as a separate file.
Messages	The messages that are generated as a result of events (e.g. limit transgressions).
Fingerprints	All the "Fingerprints" are saved in this database file.
Raw data records	Raw data are recorded in WAV files. A WAV file is generated for each recording of raw data. • Downloading raw data: Select a file from the list of existing files and click the download button next to it. • Deleting raw data: Select a file from the list of existing files and click the delete button next to it.

Note

What do you do if a raw data recording (wav-file) is played in the browser instead of being downloaded:

- In the browser settings, change the action linked with the suffix "*.wav" from "Playback" or "Execute" to "Save" or "Query"
- If this is not possible, the download should be performed by entering <IP-address>/rawdata in the browser address line; after authentication of the user, the content of the raw data folder is listed and individual files can be downloaded by right-clicking and selecting "Save as…".

Download settings

Download data	Description
Monitoring parameters	This file contains all monitoring parameters, e.g. hardware configuration, limit bands, responses to limit violations.
Device parameters	This database file contains the device parameters (e-mail settings, clock settings, Ethernet addresses).
Bearing types	This database file contains all the types of bearings that have been defined.

Password

Downloading of files from the device is secured by an additional authentication. The default login name must be entered as the default login name "admin". The password required is the one that was most recently set in the device administration on the appropriate web page. If the password was not changed here, the default password "0000" applies.

Download software license information

Here, you can download the license conditions of the open source software used in the CMS2000 system as a pdf file.

10.6.6 Cleanup

On the "Cleanup" page, you can delete device data and settings that are no longer required. The following data and settings can be deleted:

- Trends
- Messages
- Recorded raw data
- Fingerprints
- Teach values
- Diagnostic parameters

You can reset the device the factory settings.

To open the page, click "Administration > Cleanup" in the navigation area.

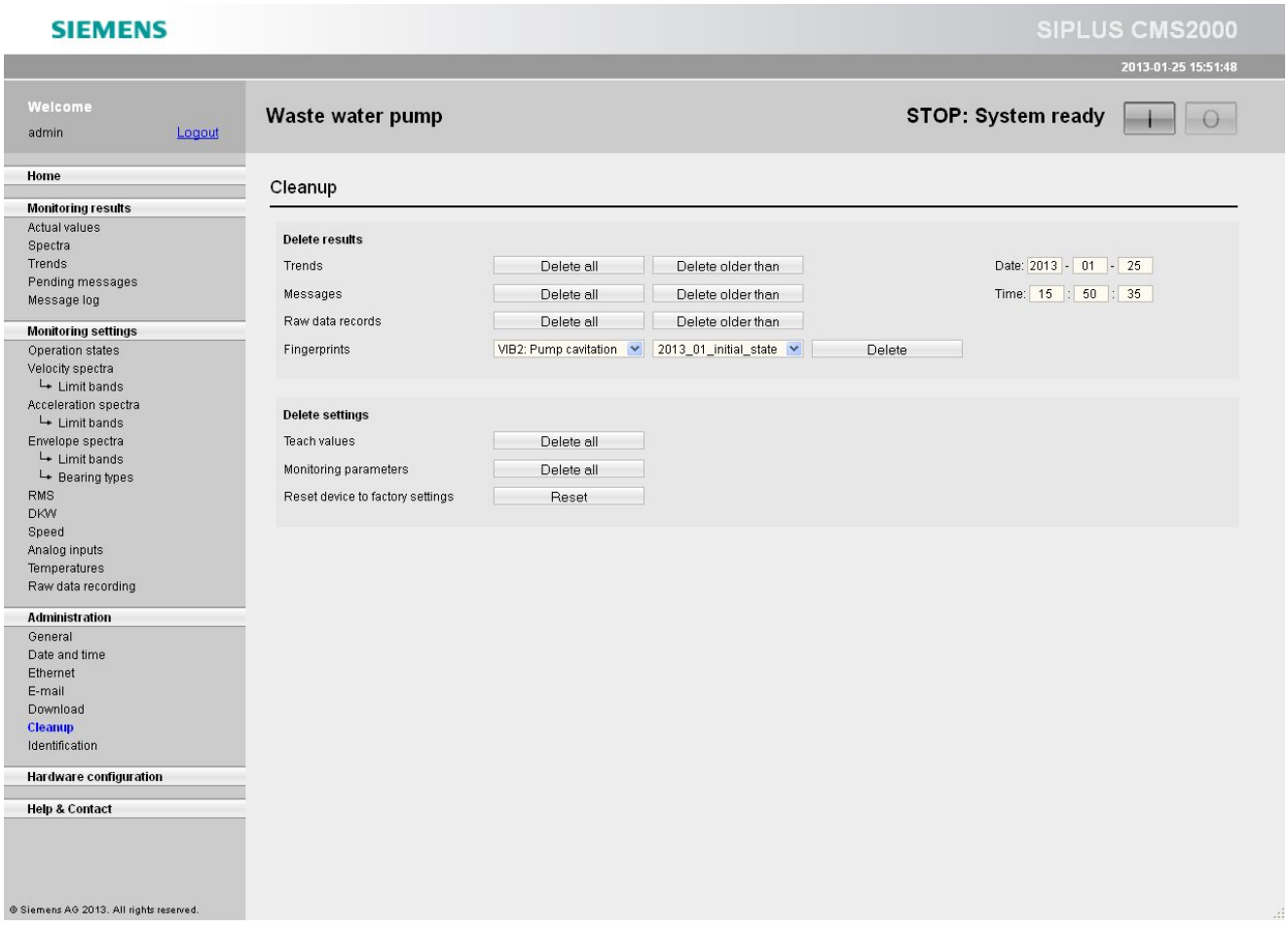


Image 10-42 Cleanup

Requirements

In "RUN" mode, you can delete the "Fingerprints" and the "Raw data records." All other functions of the "Cleanup" page can only be performed in STOP mode.

Deleting trends, messages, raw data records

You have the following options for deleting trends, messages, and raw data records:

- Delete all data in one step
- Delete only data that are older than a set time

When you open the page, the current date and time are automatically entered as the default setting. Enter the required values for the time from which all values are to be deleted in the date and time fields.

Safety query: Clicking on the "Delete all" button or "Delete older than" button opens a dialog box, in which you must confirm the deletion. The data will only be deleted after confirming with "OK".

Deletion is performed in the background and, depending on the quantity of data, can take several minutes. If the cleanup procedure is not completed before the device is switched off, the data will not be deleted or only incompletely deleted.

Deleting fingerprints

Fingerprints are saved with a name with reference to the channel. The names of all fingerprints saved are available in a dropdown list from which you select the fingerprint to be deleted. Delete the selected fingerprint with the "Delete" button. A dialog box opens in which you must confirm deletion.

Deleting teach values

You can delete all saved teach values with the "Delete all" button. A dialog box opens in which you must confirm deletion.

Deleting monitoring parameters

The following time-dependent data is deleted or reset to default values:

- Hardware configuration
- Limit value settings for methods of analysis and channels
- Diagnostic reactions for methods and channels
- Limit bands

Note

The device is inoperable during the deletion process.

Resetting device to factory settings

The following actions are performed using the "Reset" button:

- Deletion of all recorded data (historical data, messages, raw data, fingerprints, teaching results)
- Deleting all diagnostic parameters
- Deleting the hardware configuration
- Resetting the device parameters
- Resetting the password
- Resetting the operating hours counter to "0."

Note

Bearing data is excluded from this function. This is always retained.

Note

After this function has been performed, the device may not be addressable under the previous IP address.

10.6.6.1 Initial status / Default values

The status described below represents the delivery status of the device. If a cleanup action is performed on the parameters, or if a database is deleted via WebDAV or FTP, the affected part of the system data is returned to this status or recreated with this status.

Default settings

Parameter groups	Default setting
Device configuration [Factory settings]	Flashing is deactivated for unacknowledged alarms
	Module name is ""
	NTP is deactivated
	NTP server name is ""
	NTP refresh time is 5 minutes
Network configuration [Factory settings]	DHCP is activated
	The static IP address is "192.168.1.160"
	The subnet mask is "255.255.255.0"
	The default gateway is "0.0.0.0"
	The DNS server is "0.0.0.0"
E-mail configuration [Factory settings]	Sending of event-triggered and cyclic e-mails (alive e-mails) is deactivated
	POP server name is ""
	POP server port is 110
	POP user name is ""
	POP password is ""
	SMTP server name is ""
	SMT server port is 25
	Sender address is ""
	Recipient addresses are ""
Hardware configuration [Factory settings]	No expansion modules
	No analog channels (no names, no sensors selected)
	Sensor scaling for analog channels is 0 V to 0 V for voltage
	Sensor scaling for analog channels is 0 mA to 0 mA for current
	No vibration channels (no names, no sensors selected)
	Sensor scaling for vibration channels is 100 mV/g
	Fixed speed value is 120 rpm in each case
Diagnostic parameters [Factory settings] [Delete monitoring parameters]	All channels are deactivated
	All reactions for all channels are deactivated
	All messages (alarms and warnings) for all channels are not subject to acknowledgement
	All diagnostic methods for all vibration channels are deactivated
	All reactions to diagnostic methods of the vibration channels are deactivated
	All messages (alarms and warnings) for all reactions to diagnostic methods are not subject to acknowledgement

Parameter groups	Default setting
Speed, temperature and analog monitoring limits [factory settings] [Delete monitoring parameters]	Upper and lower alarm and warning limits are deactivated
	All limits are 0
	All hysteresis values are 0
Vibration analysis limits [Factory settings] [Delete monitoring parameters]	All alarm and warning limits are deactivated
	All limits are 0
	All hysteresis values are 0
Limit bands [Factory settings] [Delete monitoring parameters]	No limit bands are available.
Bearing types	No bearing types exist in the delivery status
	The bearing types are not affected by reset/delete operations
	They must be deleted manually by the user
Historical data [Factory settings]:	No messages, trends, and fingerprints are stored
Operating hours counter [Factory settings]	Operating hours counter is 0
User account [Factory settings]	User name = "admin"
	Password = "0000"

10.6.7 Identification

On the "Identification" page, you can display information about the system, the Basic Unit VIB and the browser. This page is for information only. You cannot change any settings.

To open the page, click "Administration > Identification" in the navigation area. The "Identification" page opens in the working area:

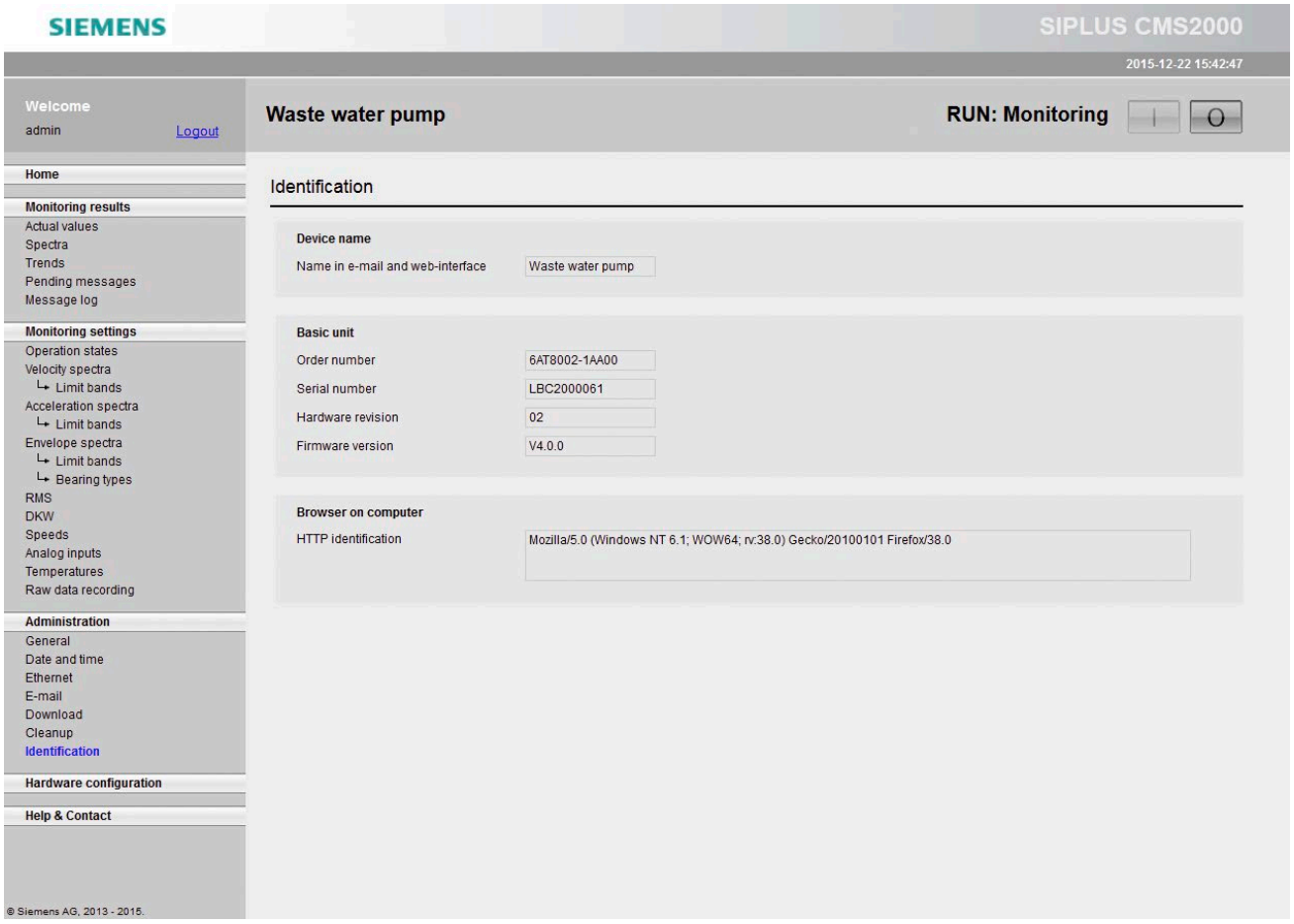


Image 10-43 Identification

Display parameters

Display parameters	Description
Device name	
Name in e-mail and web-interface	The name of the system is displayed here as it appears in e-mails and in the title of every webpage. This name can be changed on the General (Page 178) web page.
Basic unit	
Order number	Order number for the Basic Unit VIB; factory setting
Serial number	Serial number for the Basic Unit VIB; factory setting
Hardware version	Hardware version for the Basic Unit VIB; factory setting
Firmware version	Firmware version for the Basic Unit VIB
Browsers	
HTTP identification	Browser version used on the PC

10.7 Hardware configuration

On the "Hardware configuration" page, you define the equipment that is actually installed in the system. To open the page, click "Hardware configuration" in the navigation area.

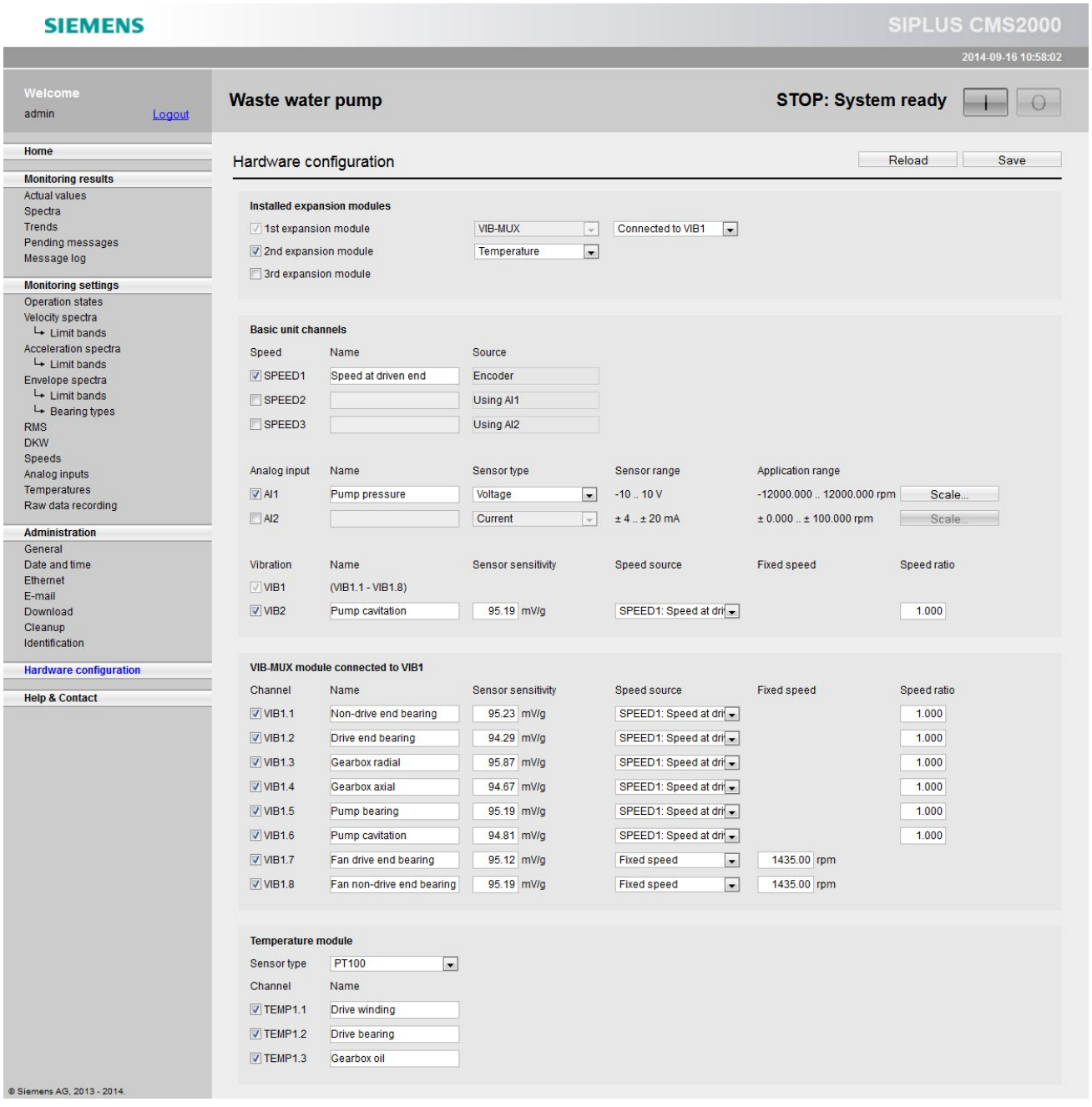


Image 10-44 Hardware configuration

Note

You must make these settings before you continue with the parameterization under "Monitoring configuration (Page 144)".

10.7.1 Installed expansion modules

Here, you define what expansion modules are installed. This selection also defines the connection sequence of the expansion modules.

Example: Two temperature modules

Definition of a system configuration with two temperature modules

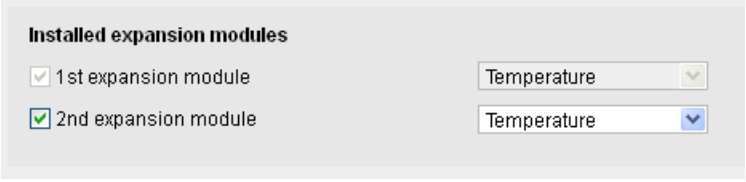


Image 10-45 Installed expansion modules (temperature modules)

Example: Two VIB-MUX and two temperature modules

Definition of a system configuration with two VIB-MUX and two temperature modules (maximum configuration).

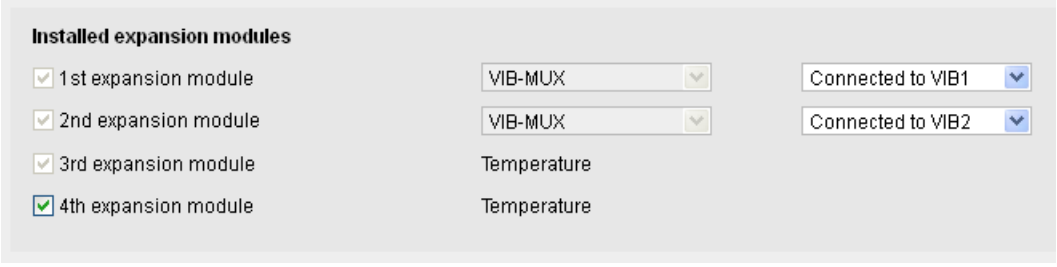


Image 10-46 Installed expansion modules (VIB-MUX and temperature modules)

You assign one IEPE input of the Basic Unit to each configured VIB-MUX.

10.7.2 Basic unit channels

Speeds

CMS2000 has 3 SPEED channels for measured speeds. You first configure the SPEED channels SPEED1, SPEED2, SPEED3 and assign them later to the vibration channels. In this way, you can assign an individual speed to each vibration channel. You can activate / deactivate the SPEED channels and assign a name to them.

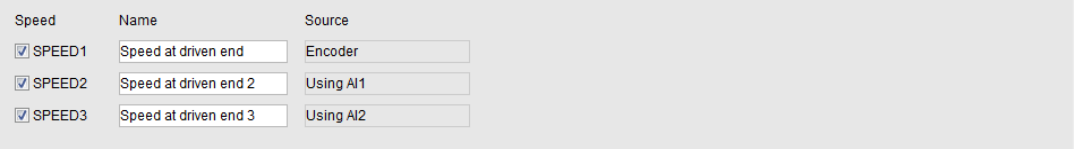


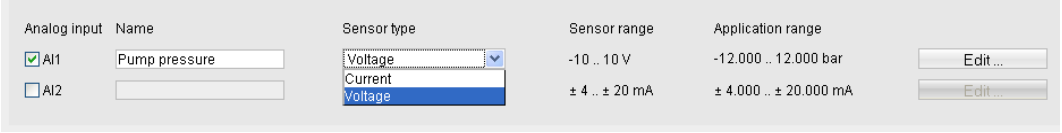
Image 10-47 Speed channel

As the source for the speed measurement, the following permanently assigned hardware channels are available:

Speeds	Source	Description
SPEED1	Speed encoder	The speed is measured via the digital speed/BERO input.
SPEED2	AI1 used	The speed is acquired via an analog input. This requires connection of a speed sensor that outputs a current signal proportional to the rotation speed in the range of ±4 mA to ±20 mA or a voltage signal proportional to the rotation speed in the range of -10 V to +10 V. For the selected analog channel, the acquired current or voltage signal converted to a speed with the fixed units of rpm must then be parameterized. The absolute value of the acquired and converted analog value is used for the speed (the analog value converted to the target range can be negative, depending on the direction of rotation). Otherwise, the analog channel used for speed acquisition is processed normally, i.e. it is displayed under "Actual values (Page 128)" and is separately monitored and can be separately recorded.
SPEED3	AI2 used	

Analog input

A voltage sensor or a current sensor can be selected for the analog channels.



The sensors of the analog channels are scaled in a separate window, in accordance with the sensor type.

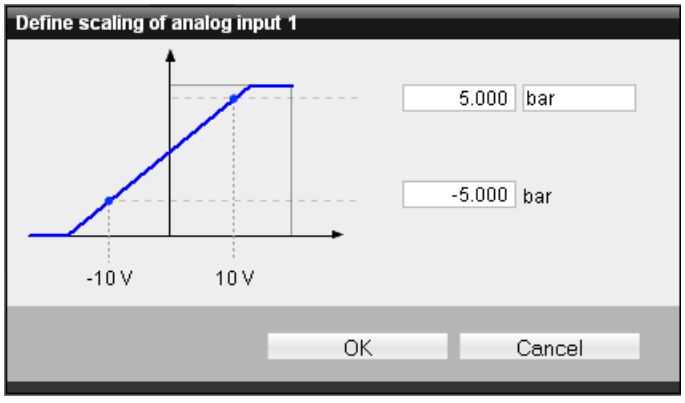


Image 10-48 Window for voltage sensor

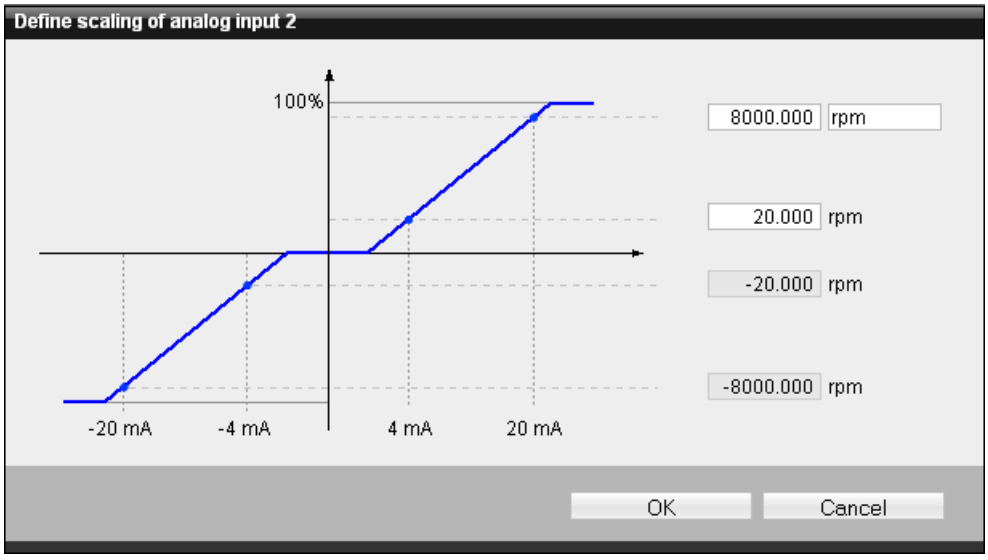


Image 10-49 Window for current sensor

The measuring range is mapped linearly onto a target area for this purpose. The measuring range is fixed as -10 V to +10 V (voltage) or ±4 mA to ±20 mA (current). The target area complete with target units can be assigned as required. The acquired voltage or current value is continuously presented in the target area, and the calculated value is displayed and used in limit monitoring.

Example: Voltage with target range of -5 bar to +5 bar, with a measured voltage of 3.7 V, gives a result of 1.85 bar that is displayed on the "Actual values (Page 128)" page and is compared against the limits selected for the corresponding channel.

Vibration

Configuration without expansion modules

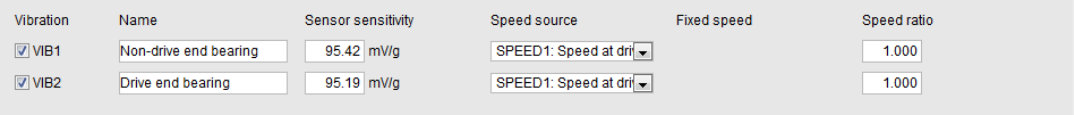


Image 10-50 Vibration channels: Configuration without expansion modules

VIB 1 / VIB 2 is the respective vibration channel to which the IEPE sensor is directly connected at input 1 or IEPE input 2 of the Basic Unit. In this way, you can assign an individual speed source to each vibration channel. The speed source can be any fixed speed or a measured speed (SPEED channel 1 / 2 / 3). You can assign a transmission ratio only to a vibration channel with measured speed. The measured rotational speed is multiplied by the transformation ratio in order to obtain the "channel-related" speed which is then used for the analyses.

Parameterizing possibilities:

- Channel active/inactive
- Name of channel
- Sensor sensitivity in mV/g
- Speed source for measured speeds and transmission ratio
- Constant speed

Configuration with expansion modules VIB-MUX

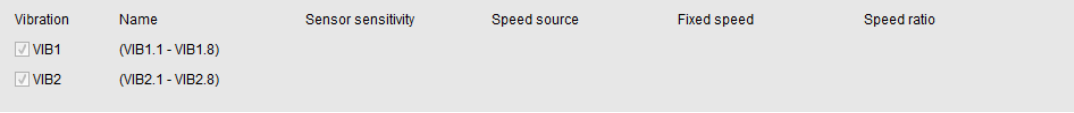


Image 10-51 Vibration channels: Configuration with expansion modules VIB-MUX

VIB1: "VIB1.1 – VIB1.8" are the vibration channels 1-8 of a VIB-MUX, which is connected to the IEPE input 1 of the Basic Unit
VIB2: "VIB2.1 – VIB2.8" are the vibration channels 1-8 of a VIB-MUX, which is connected to the IEPE input 2 of the Basic Unit.

You define parameterization of the individual channels of a VIB-MUX under "VIB-MUX module connected to VIB1/VIB2."

10.7.3 VIB-MUX module connected to VIB1/2

VIB-MUX module connected to VIB1/2

This dialog box only appears if you have entered an expansion module VIB-MUX under "Installed expansion modules."

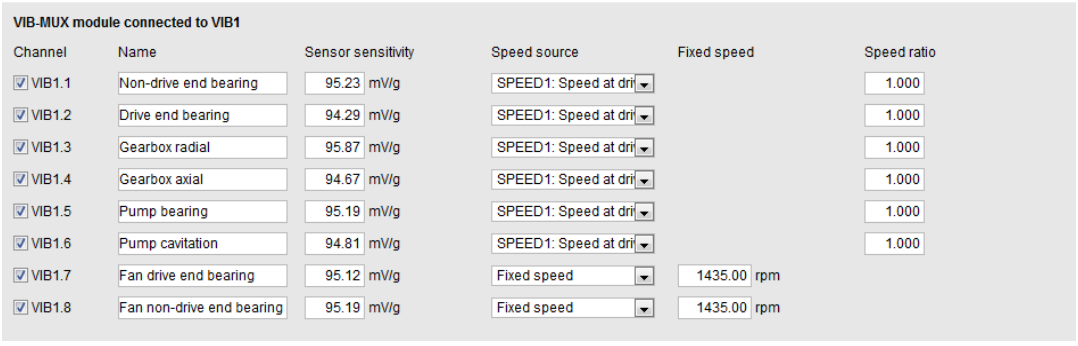


Image 10-52 VIB-MUX module connected to VIB1/2

You can assign an individual speed source to each channel of the VIB-MUX. The speed source can be any fixed speed or a measured speed (SPEED channel 1 / 2 / 3). You can assign a transmission ratio only to a vibration channel with measured speed. The measured rotational speed is multiplied by the transformation ratio in order to obtain the "channel-related" speed which is then used for the analyses.

Parameterizing possibilities:

- Channel active/inactive
- Name of channel
- Sensor sensitivity in mV/g
- Speed source for measured speeds and transmission ratio
- Constant speed

10.7.4 Temperature module

Temperature module

The temperature modules are connected via the system interface. Any sensor supported by this interface for temperature acquisition can be selected as the temperature sensor. You can activate / deactivate three channels individually for the temperature inputs.

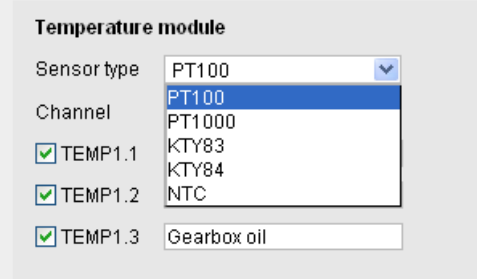


Image 10-53 Temperature module

10.8 Help and Contact

On this page, you can download the operating instructions of the CMS2000 system directly from the Basic Unit.

On this page, you will also find a summary of the communication routes and contact addresses for

- Technical support
- Siemens Industry Online Support

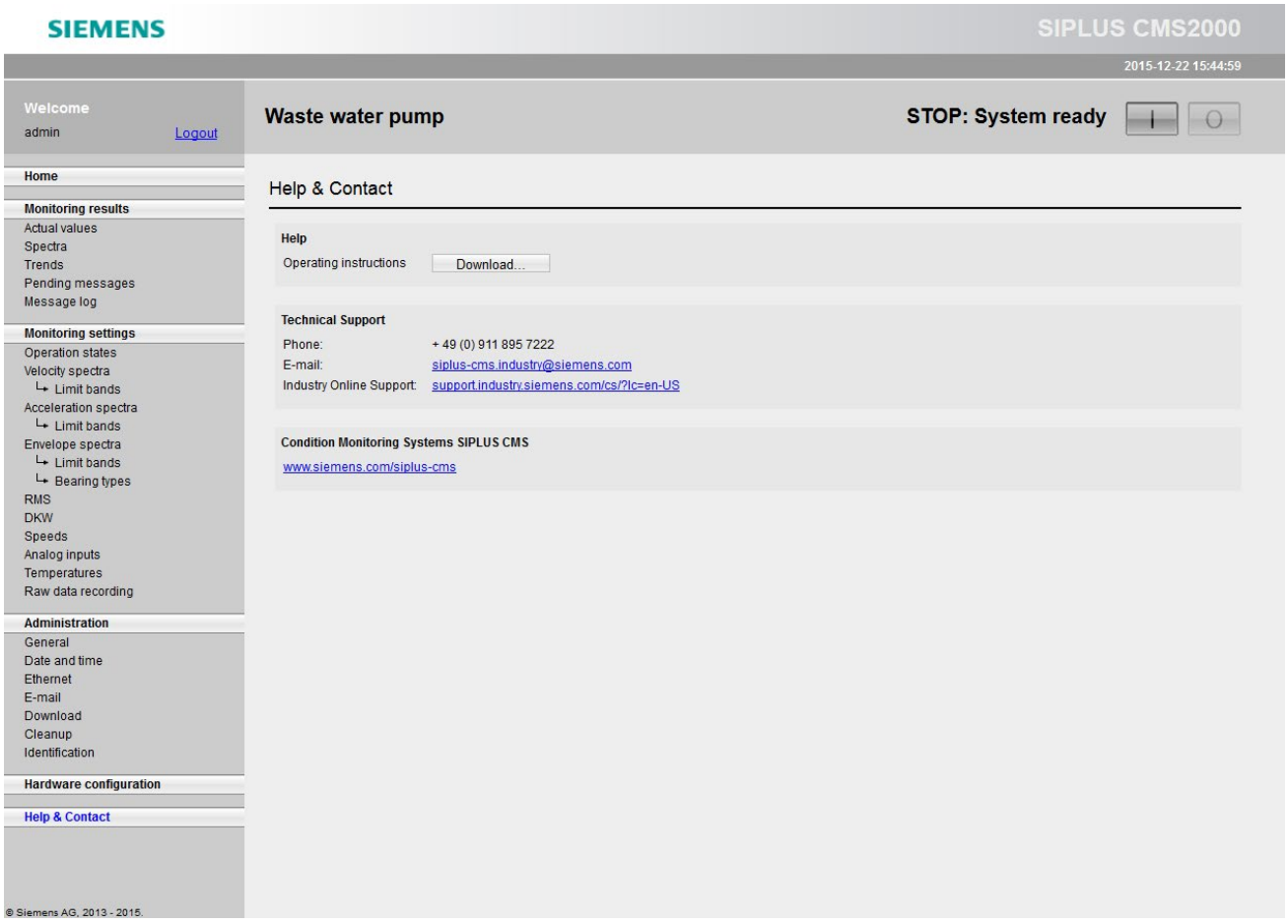


Image 10-54 Help and Contact

10.9 Web site for mobile devices

CMS2000 has an integrated Web site for mobile devices. With this, you have the option of viewing different current information of the CMS2000 on, for example, a smartphone or tablet.

Characteristics

- The Web site offers read-only access to the device without login. You cannot change any values / settings.
- The mobile Web site is autonomous and is not linked to the "standard" pages.
- The Web pages are designed for the displaying in portrait and landscape formats. The display is automatically adjusted to the screen width.
- Suitable browsers include: Safari (iOS), Chrome or "Internet" (Android)
- The pages are updated automatically approximately every two seconds

Call

You call the mobile Web site as follows:

\\<*IP address*>\mobile

Example with default IP address of the device:

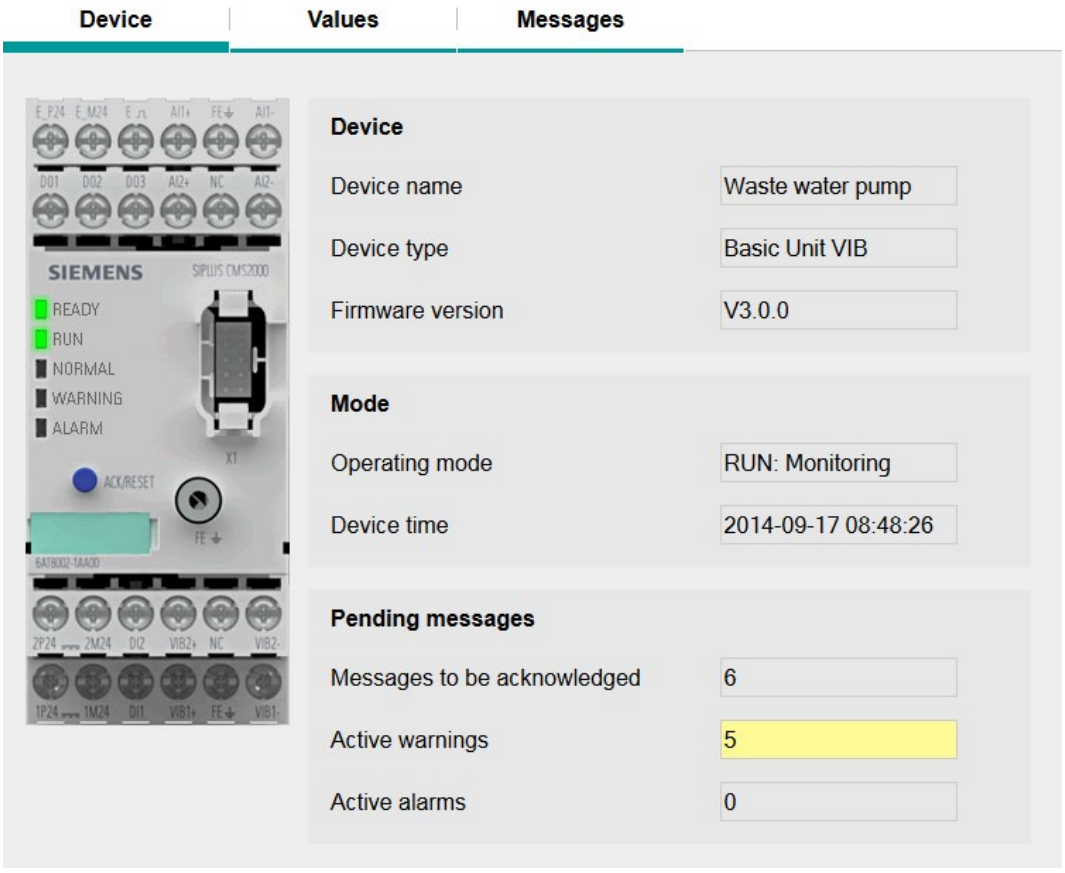
\\192.168.1.160\mobile

Structure

The mobile Web site consists of three Web pages between which you can switch using tabs: Device, Values, Messages

Device

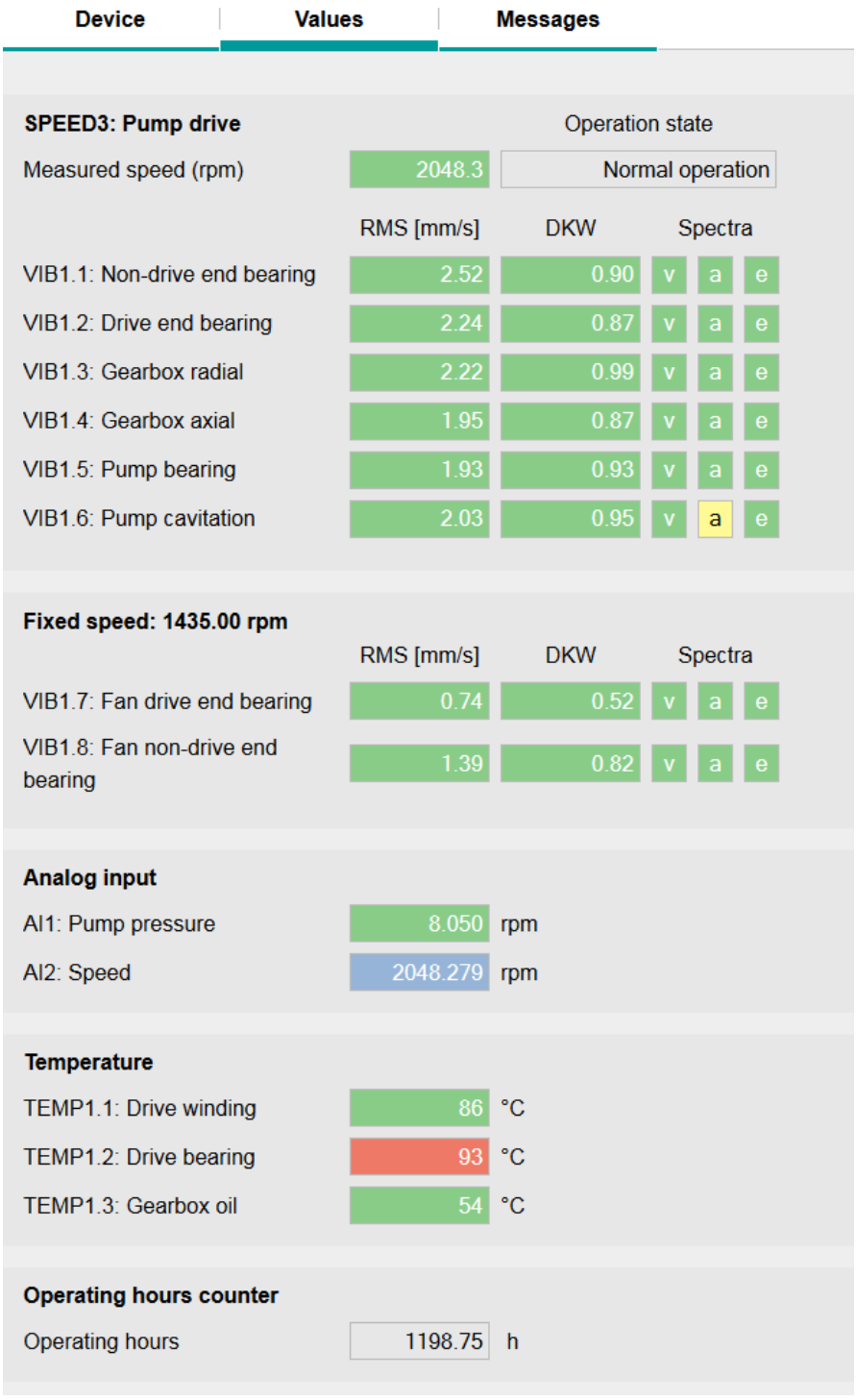
Display of information about the device itself, about the current operating state of the device, as well as information as to whether current messages are pending.



Values

On the "Values" page, you can read the current measured values of the system.

All the variables selected in the hardware configuration are displayed.



Messages

On this page, you can view the active, or in other words, currently pending messages.

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11.1 Firmware installation

11.1.1 Firmware update

The firmware for the device is supplied as the file "cms2000.cab" on request. Use the communciation channels specified under Service & support (Page 250) to do this.

Back up all files before installing a firmware update

Before updating the firmware, back up all the data (files) on the device using the export function in accordance with Section Download (Page 189). When backing up, you can restore the original condition of the firmware and device. The raw data recordings (*.wav files), however, do not have to be backed up.

Update the firmware

To update the firmware, proceed as follows:

1. Put the device in the STOP mode.
2. Copy the "cms2000.cab" file into the device update directory.
   Use the upload options described in Section Data transfer over WebDAV (Page 80) and/or Data exchange via FTP (Page 82).
   The process can take several minutes.
   You can display the status of the copying process by pressing the <F5> key.
3. The device must be restarted using a pushbutton or the "Restart..." button on the "Administration > General" web page.
   The new firmware will be automatically installed during the restart. This can also take several minutes.

Note

Make sure during the firmware update that the power supply is not interrupted since this could result in incomplete/inconsistent firmware in the device.

Update successful

You can recognize successful completion of an update by the following:

- LEDs are no longer flashing on the device,
- The device can be accessed via the web pages again
- The new firmware version is displayed on the home page.

Note

If the original firmware version is still shown on the home page, this may be due to the caching mechanisms of your browser. Remedy: Clear the browser cache and reload the home page.

Update unsuccessful

If an error occurs, the device will enter the "ERROR - System not ready" state (see Section "ERROR - System not ready" mode (Page 228)). In this case, perform the update procedure again.

Notes on the firmware update facility

Update from V1.0 to V4.0	Not supported (upload V1.1 initially as intermediate step)
Update from V1.1 to V4.0	**Parameter:** • Device parameters (e.g. IP address) are retained • Bearing data is retained • Hardware configuration and monitoring parameters are reset to default values **Logged historical data:** • Messages are deleted • Trend recordings are deleted • Fingerprints are deleted • Teaching values (RMS/DKW) are deleted • Raw data records are retained
Update from V2.x to V4.0	**Parameter:** • Device parameters (e.g. IP address) are retained • Bearing data is retained • Hardware configuration and monitoring parameters are reset to default values **Logged historical data:** • Messages are retained • Trend recordings are deleted • Fingerprints are retained • Teaching values (RMS/DKW) are deleted • Raw data records are retained
Update from V3.0 to V4.0	**Parameter:** • Device parameters (e.g. IP address) are retained • Bearing data is retained • Hardware configuration and monitoring parameters are retained **Logged historical data:** • Messages are retained • Trend recordings are deleted • Fingerprints are retained • Teach values (RMS/DKW) are retained • Raw data records are retained

11.1.2 Firmware downgrade

A firmware downgrade, that is loading a previous firmware version onto the CMS2000 device is supported in principle. The older firmware version will, however, normally be incompatible with a database that was created by more recent firmware, so after loading an older firmware version the device will be inoperable.

Requirements for a firmware downgrade

For the device to be functional following a firmware downgrade, you will need the database that was associated with the older firmware. Chapter Firmware update (Page 211) describes how to back up the database before a firmware update.

Downgrading the firmware

If you want to return to the original firmware version, perform the downgrade as follows, using WebDAV (Page 80) or FTP (Page 82) for the data access:

1. Enter the STOP status.
2. Delete all files in the /config and /history folders.
3. Import the previous firmware version into the folder /update (see Section Firmware update (Page 211)).
4. Import the files for the device that were previously backed up and contain the older firmware version into the folders /config and /history.
5. Reboot the device.

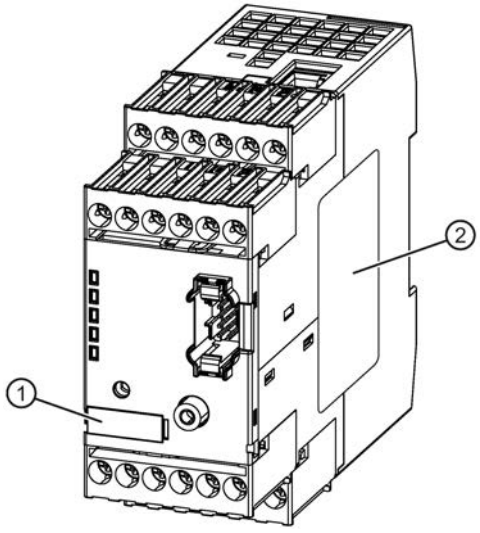
The device is now functional again with the original firmware version and the compatible database.

11.2 Replacing the label

The label serves to identify the device. The label can be replaced.

Procedure

1. Insert a screwdriver in the small gap in the device frame at the edge of the label and lever it out.
2. Use your finger to press the new label onto the module.



①	Label
②	Rating plate

Reordering labels

The ordering data for additional labels (20 mm x 7 mm, light turquoise) can be found in Chapter 7 of the following catalog:

Low-Voltage Controls and Distribution SIRIUS - SENTRON - SIVACON
Catalog LV 1

Order No. E86060-K1002-A101-A9

11.3 Replacing system components

The work steps for expanding the Basic Unit VIB or an expansion module are described below.

Only remove the terminals when replacing devices

Note

You can conveniently replace SIPLUS CMS2000 components by removing the removable terminals along with the wiring from the components. You do not have to remove the wiring of the terminals.

Procedure

1. Switch off the fuse outlet in the distribution board, and secure this against being switched back on.
2. Remove the terminal blocks from the device.
3. Remove the device from the DIN rail. Proceed in the reverse order to that described in Section Mounting the Basic Unit VIB and expansion modules (Page 93).
4. Send the Basic Unit VIB to the Returns Center in Fürth.

11.4 Recycling and disposal

The Basic Unit VIB of the CMS2000 and the VIB-MUX expansion module can be recycled because the low proportion of pollutants they contain.

NOTICE

- Disposal of the products described in this manual must be in accordance with the applicable statutory requirements.
- For environmentally compliant recycling and disposal of your discarded device, including the battery contained in the basic device, please only contact a company approved for the disposal of electronic waste.
  Battery type used in basic unit: Panasonic BR-2330/GAN button cell

The device cannot be returned to Siemens.

For further questions regarding disposal and recycling, please contact your local Siemens contact. You will find the contact details in our database on the Internet at: http://www.automation.siemens.com/partner

Process and system messages, error handling 12

12.1 Basic Unit VIB

12.1.1 LED status indicator on the Basic Unit VIB

The device has 5 LEDs on the front:

- READY (green)
- RUN (green)
- NORMAL (green)
- WARNING (yellow)
- ALARM (red)

LED function groups

The LEDs can be divided into two function groups:

- Information on the device status: READY, RUN
- Information on the monitored plant components. NORMAL, WARNING, ALARM

READY green	RUN green	NORMAL green	WARNING yellow	ALARM red	Meaning
○	○	○	○	○	Power OFF, device switched off
✸	○	○	○	○	Transitory state: Device is in a state of limited functionality (e.g. startup or firmware update), RUN and application monitoring are not possible.
✸ 2 Hz	○	○	○	○	Error that makes it impossible to switch to READY
●	X	X	X	X	Device ready Access possible via PC.
●	○	○	○	○	STOP status: No measuring or monitoring mode
●	✸	○	○	○	Mode change from STOP to RUN
●	✸ 2 Hz	○	○	○	Mode change from STOP to RUN has failed due to an error.
●	●	○	○	○	RUN, measuring mode or incomplete/faulty monitoring mode (e.g. acquisition error on vibration channel)
●	●	●			RUN, complete and faulty monitoring mode; LEDs behave as described in Section Digital outputs for controlling a signaling column (Page 218).
●	●	●	●		
●	●	●		●	

Symbol	Meaning
○	Off
●	On
✸	Flashing at 0.5 Hz, unless specified otherwise
X	Any

12.1.2 Digital outputs for controlling a signaling column

The three digital outputs DO1 to DO3 are permanently assigned to the process statuses Normal, Warning, and Alarm in monitoring mode. When a signaling column is connected to these digital outputs and configured appropriately, the process status is indicated by the following LED colors:

LED color	Process status
Green	Normal
Yellow	Warning
Red	Alarm

Possible combinations on a signaling column (traffic light)

LED "green" / DO1	LED "yellow" / "DO2	LED "red" / DO3	Meaning	
			Process status: **Warnings and alarms for the monitored plant components**	**System state:** **Monitoring of the plant via CMS2000 channels**
●	○	○	No warnings and no alarms are active	All channels are being monitored. No faults are pending. (e.g. recording errors on vibration channel)
○	X	X	No statement is possible, because the plant is not being fully monitored.	Incomplete/faulty monitoring mode At least one fault is pending. (e.g. recording errors on vibration channel)
●	●	X	At least one warning is currently active.	All channels are being monitored. No faults are pending.
●	X	●	At least one alarm is currently active.	All channels are being monitored. No faults are pending.
●	✸	X	"Flashing" option for LEDs is set, and at least one unacknowledged warning is active. Note: Only the LED flashes, output DO2 is set during this time.	All channels are being monitored. No faults are pending.
●	X	✸	"Flashing" option for LEDs is set, and at least one unacknowledged alarm is active. Note: Only the LED flashes, output DO3 is set during this time.	All channels are being monitored. No faults are pending.

Symbol	Meaning
○	Off
●	On
✸	Flashing at 0.5 Hz, unless specified otherwise
X	Any

12.1.3 Messages

Error messages

Message text	Cause	Remedy
Client command response timeout.	A client command could not be executed within a defined period.	The device is temporarily overloaded. Wait and see whether the command is nevertheless executed. Otherwise, repeat the command.
Client command not possible in current application state.	A client command cannot be performed in the current operating mode. Deletion of data (cleanup), for example, is only possible in STOP state.	Change to the operating mode in which the command is permitted and then execute the command.
Database file missing: ***.cmsdb	The required database file is missing from the device.	Reboot the device. The missing file will be generated automatically. Then check your parameter assignment.
Database file corrupt: ***.cmsdb	A database file that is required is damaged on the device and cannot be used.	Delete the specified file using WebDAV or via FTP and reboot the device.
Illegal scaling of VIB1 vibration sensor.	An invalid value was entered for the sensor sensitivity on channel 1 or on a channel of VIB-MUX 1.	Enter a valid value for "Sensor sensitivity" on the "Hardware configuration" page.
Illegal scaling of VIB2 vibration sensor.	An invalid value was entered for the sensor sensitivity on channel 2 or on a channel of VIB-MUX 2.	Enter a valid value for "Sensor sensitivity" on the "Hardware configuration" page.
Invalid configuration for speed acquisition.	A vibration channel shows an invalid speed source.	Check all parameters connected with speed acquisition on the "Hardware configuration" page.
Wrong order of warning and alarm levels for / in ...	The limits for warning and alarm are not plausible for the specification monitoring function.	It is important to note when setting parameters that alarm limits must be higher than warning limits when upper limits are monitored. Conversely, when monitoring lower limits, the alarm limits must lie below the warning limits.
Absolute hysteresis for … larger than warning / alarm level.	In the specified monitoring function, the value of a parameterized hysteresis is greater than the value of the associated limit.	When setting the parameters, ensure that the hysteresis values do not exceed the associated limits.
No limit band selected for velocity / acceleration / envelope spectrum monitoring.	No limit band has been selected for the specified spectrum monitoring function.	Select a limit band for each monitored vibration channel under "Velocity spectra / Acceleration spectra / Envelope spectra".
No bearing type selected for envelope spectrum monitoring.	No bearing type has been selected for bearing-related monitoring of the envelope spectrum.	Choose a bearing type under the limit band used.

Message text	Cause	Remedy
Open driver <name> failed.	During device start-up, a driver could not be started.	Reboot the device. If the problem is not rectified, update the firmware.
Vibration channel to be recorded no longer set.	Ongoing raw data recording could not be completed since a vibration channel to be recorded on the VIB-MUX is no longer set. The data recorded up to this point are rejected. This situation can occur when X-Tools carries out channel switching on the VIB-MUX when the interface is active.	Carry out the desired raw data recording manually, if applicable, via the Web page "Current Values".
System in STOP / no more raw data available for recording.	The system has been moved to the STOP state; an ongoing raw data recording could not be completed. The data recorded up to this point are rejected.	Change to the RUN state, if applicable, and carry out raw data recording via the Web page "Current Values".
State transition is currently not possible due to raw data recording.	The operating mode cannot be changed because raw data is being recorded.	Try again a short time later.
Firmware update failed. For details see update.log.	The last firmware update included errors, or was terminated prematurely by the system. Details can be found in "update.log".	Repeat the firmware update.

Message texts

Note

The messages below contain variable texts that are identified by pointed brackets (e.g. <Cause>). In the case of a fault, the cause is normally given; in the case of limit transgressions, the current measured value, limit, frequency (for vibration analyses) and the current speed is specified.

Message text	Description	Remarks
System startup.	Start-up message from the device.	--
Operating mode RUN-Monitoring <cause>.	Change to RUN-Monitoring mode	--
Operating mode RUN-Measuring <cause>.	Change to RUN-Measuring mode	--
Operating mode RUN-Monitoring: inhibit <On/Off>.	Changeover between RUN-Monitoring and RUN-Monitoring inhibited.	--
Operating mode STOP <cause>.	Change to STOP mode.	--
System shutdown <cause>.	Shutdown message of the device (followed by a restart)	--
System initialization failed (system not ready): <cause>.	The device is in the ERROR state. System not ready.	See Section "ERROR - System not ready" mode (Page 228)
Auto-RUN failed: <cause>	Automatic changeover to RUN during start-up has failed.	--
Transition in RUN-Monitoring failed: <Cause>.	Change to RUN-Monitoring mode has failed.	--
Transition in RUN-Measuring failed: <Cause>.	Change to RUN-Measuring mode has failed.	--
System bus is starting up...	The connection between the Basic Unit and the expansion modules via the system interface is being initialized.	--
System bus unstable.	The connection between the Basic Unit and the expansion modules via the system interface is unstable.	--
VIB-MUX channel fault: VIB<number> could not be set.	The VIB-MUX expansion module was unable to set the specified channel.	Switch to RUN-Measuring mode and configure only the specified vibration channel. If the message is still present, restart the system. If it is still impossible to set the channel in RUN-Measuring mode, the VIB-MUX must be defective.
Battery for RTC nearly exhausted.	Battery-supported data (time and operating hours counter) is no longer valid and has been set to default values.	--

Message text	Description	Remarks
Disk space for historical data critical! Memory utilization: <Memory utilization> (Available memory: <available memory> / Free memory: <free memory>)	The memory space for historical data is almost full (more than 90%).	--
Message jitter on: <Message text>	The specified message is alternately incoming and outgoing at very short intervals ("message jitter"). Entry of the message in the message log is temporarily suppressed to reduce the load on the system. This will not have a negative impact on the monitoring functions of the device.	Use hysteresis for monitoring process values against limits, where appropriate, to prevent a message avalanche.
Message jitter off: <Message text>	The specified message is no longer changing at very short intervals and is therefore quire normally entered in the message log.	See previous message "Message jitter on: <Message text>"
SPEED<number><channel name>: Acquisition failed (<cause>).	Acquisition of the speed <number> failed.	--
VIB<number><channel name>: Acquisition failed (<cause>).	Acquisition of the vibration on vibration channel <number> <channel name> has failed.	The cause "Value suspect" indicates failure of the 24 V process supply voltage.
AI<number><channel name>: Acquisition failed (<cause>).	Acquisition of the analog value on analog channel <number><channel name> has failed.	The cause "Value suspect" indicates failure of the 24 V process supply voltage.
TEMP<number><channel name>: Acquisition failed (<cause>).	Acquisition of the temperature on temperature channel <number><channel name> has failed.	--
VIB-MUX modules: Actual configuration <> target configuration.	The ACTUAL configuration of the VIB-MUX modules differs from the TARGET configuration.	Example: Two VIB-MUX modules have been configured but only one module is installed.
Temperature modules: Actual configuration <> target configuration.	The ACTUAL configuration of the temperature modules differs from the REFERENCE configuration.	Example: Two temperature modules have been configured, but only one module exists.
<channel>: Upper warning level violated (<actual value> > <limit>). Operation state <operation state>(<speed>).	On the specified speed/analog or temperature channel, the upper warning limit has been violated.	The current measured value, the value of the overshot limit, the current operation state, and the current speed.
<channel>: Lower warning level violated (<actual value> < <limit>). Operation state <operation state>(<speed>).	On the specified speed/analog or temperature channel, the lower warning limit has been violated.	The current measured value, the value of the undershot limit, the current operation state, and the current speed.
<channel>: Upper alarm level violated (<actual value> > <limit>). Operation state <operation state>(<speed>).	On the specified speed/analog or temperature channel, the upper alarm limit has been violated.	The current measured value, the value of the overshot limit, the current operation state, and the current speed.

Message text	Description	Remarks
<channel>: Lower alarm level violated (<actual value> < <limit>). Operation state <operation state>(<speed>).	On the specified speed/analog or temperature channel, the lower alarm limit has been violated.	The current measured value, the value of the undershot limit, the current operation state, and the current speed.
<VIB channel>: RMS warning level violated (<actual value> > <limit>). Operation state <operation state>(<speed>).	The RMS warning limit has been violated on the specified vibration channel.	The current RMS value, the value of the overshot limit, the current operation state, and the current speed.
<VIB channel>: RMS alarm level violated (<actual value> > <limit>). Operation state <operation state>(<speed>).	The RMS alarm limit has been violated on the specified vibration channel.	The current RMS value, the value of the overshot limit, the current operation state, and the current speed.
<VIB channel>: Warning <message text> on acceleration spectrum. Limit violated at <frequency> (<actual value> > <limit>). Operation state <operation state>(<speed>).	A warning limit has been violated on an acceleration spectrum in the specified operation state on the specified vibration channel.	The parameterized message text, the position (frequency) in the spectrum, the amplitude (actual value), the overshot limit, and the current speed.
<VIB channel>: Alarm <message text> on acceleration spectrum. Limit violated at <frequency> (<actual value> > <limit>). Operation state <operation state>(<speed>).	An alarm limit has been violated on an acceleration spectrum in the specified operation state on the specified vibration channel.	The parameterized message text, the position (frequency) in the spectrum, the amplitude (actual value), the overshot limit, and the current speed.
<VIB channel>: Warning <message text> on velocity spectrum. Limit violated at <frequency> (<actual value> > <limit>). Operation state <operation state>(<speed>).	A warning limit has been violated on a velocity spectrum in the specified operation state on the specified vibration channel.	The parameterized message text, the position (frequency) in the spectrum, the amplitude (actual value), the overshot limit, and the current speed.
<VIB channel>: Alarm <message text> on velocity spectrum. Limit violated at <frequency> (<actual value> > <limit>). Operation state <operation state>(<speed>).	An alarm limit has been violated on a velocity spectrum in the specified operation state on the specified vibration channel.	The parameterized message text, the position (frequency) in the spectrum, the amplitude (actual value), the overshot limit, and the current speed.
<VIB channel>: Warning <message text> on envelope spectrum. Limit violated at <frequency> (<actual value> > <limit>). Operation state <operation state>(<speed>).	A warning limit has been violated on an envelope spectrum in the specified operation state on the specified vibration channel.	The parameterized message text, the position (frequency) in the spectrum, the amplitude (actual value), the overshot limit, and the current speed.
<VIB channel>: Alarm <message text> on envelope spectrum. Limit violated at <frequency> (<actual value> > <limit>). Operation state <operation state>(<speed>).	An alarm limit has been violated on an envelope spectrum in the specified operation state on the specified vibration channel.	The parameterized message text, the position (frequency) in the spectrum, the amplitude (actual value), the overshot limit, and the current speed.
<VIB channel>: Timeout for the RMS calculation.	On the vibration channel specified, the RMS calculation could not be carried out for an extended period.	Possible causes: • Vibration acquisition faulty • VIB-MUX channel switchover is by means of X-Tools, the channel dwell time being too short for the respective calculation.

Message text	Description	Remarks
<VIB channel>: Timeout for the DKW calculation.	On the vibration channel specified, the DKW calculation could not be carried out for an extended period.	Possible causes: • Vibration acquisition faulty • VIB-MUX channel switchover is by means of X-Tools, the channel dwell time being too short for the respective calculation.
<VIB channel>: Timeout for calculation of the acceleration spectrum.	On the vibration channel specified, calculation of the acceleration spectrum could not be carried out for an extended period.	Possible causes: • Vibration acquisition faulty • VIB-MUX channel switchover is by means of X-Tools, the channel dwell time being too short for the respective calculation.
<VIB channel>: Timeout for calculation of the envelope spectrum.	On the vibration channel specified, calculation of the envelope spectrum could not be carried out for an extended period.	Possible causes: • Vibration acquisition faulty • VIB-MUX channel switchover is by means of X-Tools, the channel dwell time being too short for the respective calculation.
<VIB channel>: Timeout for calculation of the speed spectrum.	On the vibration channel specified, calculation of the speed spectrum could not be carried out for an extended period.	Possible causes: • Vibration acquisition faulty • VIB-MUX channel switchover is by means of X-Tools, the channel dwell time being too short for the respective calculation.
<VIB channel>: RMS monitoring failed.	On the vibration channel specified, the RMS monitoring could not be carried out for an extended period.	Possible causes: - Speed not acquired - Speed too unstable - Speed not in the range 120 - 24000 rpm - Vibration acquisition disturbed
<VIB channel>: DKW monitoring failed.	On the vibration channel specified, the DKW monitoring could not be carried out for an extended period.	Possible causes: - Speed not acquired - Speed too unstable - Speed not in the range 120 - 24000 rpm - Vibration acquisition disturbed
<VIB channel>: Monitoring of acceleration spectrum failed.	On the vibration channel specified, monitoring of the acceleration spectrum could not be carried out for an extended period.	Possible causes: - Speed not acquired - Speed too unstable - Speed not in the range 120 - 24000 rpm - Vibration acquisition disturbed

Message text	Description	Remarks
<VIB channel>: Monitoring of velocity spectrum failed.	On the vibration channel specified, monitoring of the speed spectrum could not be carried out for an extended period.	Possible causes: - Speed not acquired - Speed too unstable - Speed not in the range 120 - 24000 rpm - Vibration acquisition disturbed
<VIB channel>: Monitoring of envelope spectrum failed.	On the vibration channel specified, monitoring of the envelope curve spectrum could not be carried out for an extended period.	Possible causes: - Speed not acquired - Speed too unstable - Speed not in the range 120 - 24000 rpm - Vibration acquisition disturbed
Clock + Calendar: Time was set to <Date / time>.	The time for the device was set by the user.	--
Set SNTP: Setup error!	The parameters for time synchronization could not be set.	--
Recording of raw data <Operation> <Further information>	Raw data recording was started, has failed, etc.	--
Recording of raw data in progress: trigger = <trigger>, duration = <recording duration>, file = <file name>	Raw data is being recorded. The file name, recording duration [s], and trigger for recording are also stated.	From this message it can be detected whether raw data is being recorded or has already been completed.
E-mail transfer failed: <Cause>	An attempt to send an e-mail has failed.	The cause indicates whether there is a problem with the SMTP server or with authentication.
Internal error: E-mail transfer client unreachable!	The internal e-mail transfer service is not functioning correctly, e-mails cannot be sent.	Rebooting the device may rectify the problem.
Sending cyclic Ethernet telegram failed.	Cyclic sending of Ethernet telegrams has failed.	Check that the communication partner is ready to receive telegrams, whether a network connection exists, and whether the IP address and port of the recipient have been correctly parameterized.

Message text	Description	Remarks
The system will restart due to serious internal errors: <Cause>	The system will restart due to internal errors.	--
The vibration signal is disturbed by fast rise-time digital speed pulses. A solution to this problem is to supply the digital speed sensor via the terminals 2P24 / 2M24 (instead of E_P24 / E_M24). The vibration signal is rechecked after an operating mode transition from STOP to RUN.	With speed measurement via a digital pulse encoder (BERO), steep edges at the speed input can influence the received vibration signal and thus also the calculated characteristic values and spectra. Actions: 1. Change the power supply of the digital speed sensor as recommended in the message. 2. Then, change the operating mode of the device from STOP to RUN to trigger a recheck of the vibration signal. If the message still appears, contact Technical Support (Page 250).	In general, the message must be acknowledged. Once the message has been acknowledged, it disappears.

12.1.4 "ERROR - System not ready" mode

Causes of errors

During startup, the following error conditions can occur:

- Error during self tests (e.g. RAM test).
- Booting or ramping up of the operating system has failed (so the web server is not available).
- The monitoring application cannot be started.
- The monitoring application could be started, but has detected a serious error during start-up.

Fault status

If one or more of these errors occur, the device will be in "ERROR - System not ready" mode (see also Section Operating modes (Page 55)). The "READY" LED flashes at 2 Hz in this state. In this fault state, the device will automatically restart repeatedly, at first at short intervals (approx. 1 min.), then every 60 minutes.

Remedy

You have the following options:

- If the web server is available, go to the "Pending messages (Page 140)" page. Messages may be active here that explain the error condition in greater detail (e.g. a specific driver could not be started). The actual messages for the "ERROR - System not ready" state are listed in Section Messages (Page 220).
- In some instances, a firmware update may have to be performed (see Section Firmware update (Page 211)).
- Reimporting the firmware with the version already installed may remedy the problem.
- The device can be restarted with a voltage reset, or by holding down the pushbutton on the front for approximately 10 s.

12.2 VIB-MUX expansion module

12.2.1 LED status indicator VIB-MUX

The device has a "READY" LED on the front:

Meaning of the LED displays

READY green		Meaning
○	Off	Power OFF, device off Power supply too low
●	On	Device ready, system interface active
✸	Flashes	Device ready, system interface is not active (e.g. in the STOP state of the Basic Unit)

Technical data

13

13.1 Basic Unit VIB

13.1.1 Technical specifications Basic Unit VIB

General technical data:	
product brand name	SIPLUS
Product designation	SIPLUS CMS2000 Basic Unit VIB
Protection class IP	IP20
physical measuring principle	Vibration acceleration
Browser software required	Webbrowser Mozilla Firefox, Google Chrome or Microsoft Internet Explorer
Storage capacity total	1 Gibyte
Material of the enclosure	plastic
Hardware configuration	modular construction, basic unit can be expanded by means of expansion modules
Vibration frequency measuring range	
• initial value	2 Hz
• Full-scale value	10 000 Hz
Scanning frequency maximum	46 875 Hz
Ambient temperature	
• during storage	85 ... -25 °C
• during operation	-20 ... +65 °C
• during transport	-25 ... +85 °C
Relative humidity without condensation during operation	
• minimum	5 %
• maximum	95 %
Power loss [W] total typical	2.6 W
Overvoltage category	II
Equipment marking	
• acc. to DIN 40719 extended according to IEC 204-2 acc. to IEC 750	P
• acc. to DIN EN 61346-2	P
Degree of pollution	2
Weight	300 g

Supply voltage:	
Type of voltage of the supply voltage	DC
Supply voltage 1 at DC rated value	24 V
Supply voltage at DC	
• minimum	19.2 V
• maximum	28.8 V
Installation/ mounting/ dimensions:	
Installation altitude at height above sea level maximum	1 500 m
Mounting position recommended	vertical
Mounting type	standard rail
Width	45 mm
Height	106 mm
Depth	124 mm
Inputs/ Outputs:	
Number of sensor inputs	
• for IEPE sensors	2
• for MEMS sensors	0
Number of disable inputs	1
Input voltage	
• at disable input at DC 24 V	Yes
• at trigger input at DC 24 V	Yes
• at speed input	
– DC 24 V digital	Yes
– -10 V ... 10 V	No
• at the analog input at DC	-10 ... +10 V
Number of trigger inputs	1
Number of speed inputs	1
Number of analog inputs	2
Product function	
• monitoring of sensor inputs	Yes
• removable terminal for main circuit	Yes
• removable terminal for auxiliary and control circuit	Yes
• Bus communication	Yes
• Diagnostics via email	Yes
Number of signaling outputs	3
Type of switching output of the signaling outputs	electronic

Connections:	
Type of electrical connection	
• of the inputs and outputs	screw terminal
• for auxiliary and control current circuit	screw-type terminals
Connectable conductor cross-section for auxiliary contacts	
• single or multi-stranded	0.5 ... 4 mm²
• finely stranded	
– with core end processing	0.5 ... 2.5 mm²
– without core end processing	0.5 ... 2.5 mm²
Communication:	
Type of data transmission	Exporting of raw data as WAV file for further analyses (e.g. using SIPLUS CMS X-Tools) can be downloaded via browser
Design of the interface	
• SIMOCODE interface	Yes
• Ethernet interface	Yes
Service	
• as web server HTTP	Yes
• for open IE communication TCP/IP	Yes
Certificates/ approvals:	
Certificate of suitability	CE, UL 508, CSA C22.2 Nr.142, C-Tick (RCM)

13.1.2 Dimension drawing Basic Unit VIB

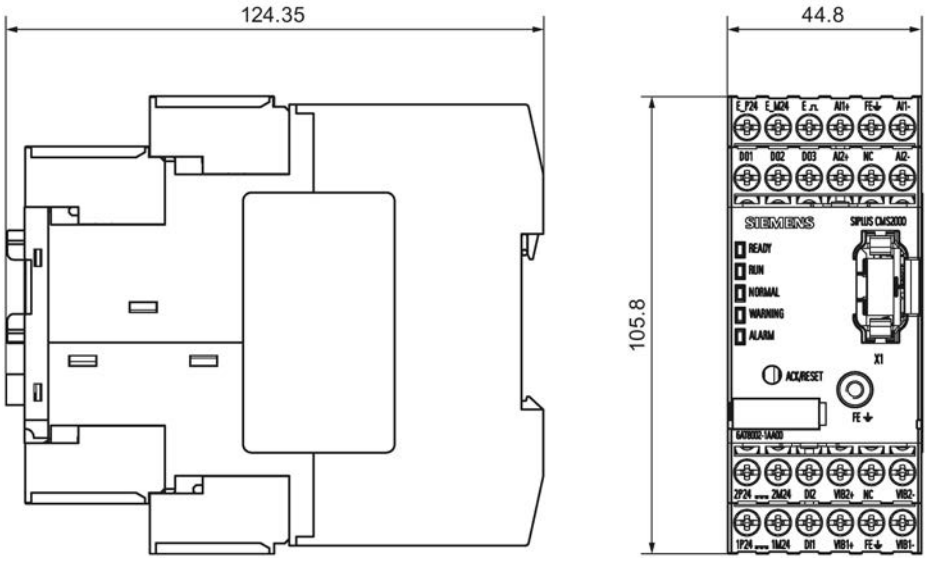


Image 13-1 Dimension drawing SIPLUS CMS2000 Basic Unit VIB

All dimensions in mm

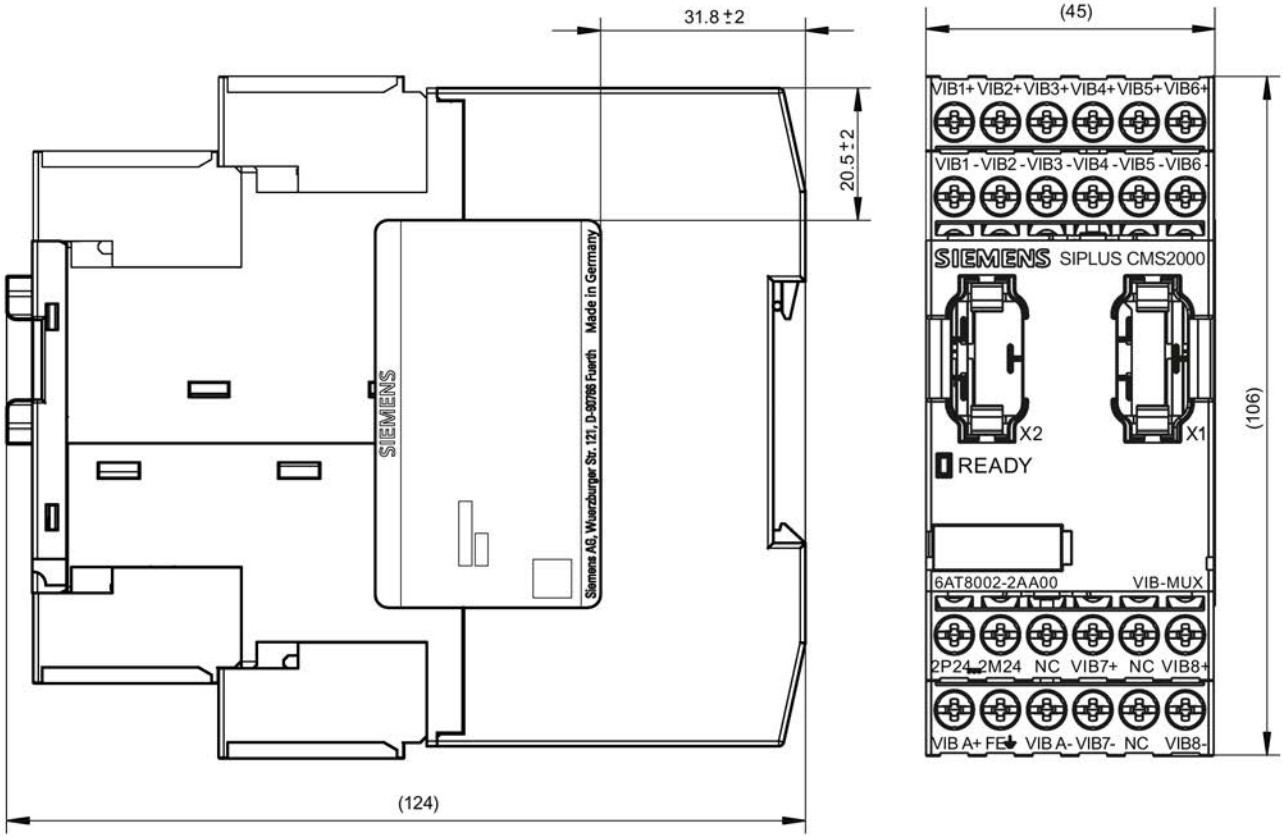
13.2 VIB-MUX expansion module

13.2.1 Technical specifications VIB-MUX

General technical data:	
product brand name	SIPLUS
Product designation	SIPLUS CMS2000 VIB-MUX
Product description	Up to two SIPLUS CMS2000 VIB-MUX expansion modules can be connected to the SIPLUS CMS2000 Basic Unit VIB. Up to 8 IEPE vibration channels can be connected for each expansion module.
Protection class IP	IP20
Manner of function	Multiplexing of analog IEPE signals
physical measuring principle	Vibration acceleration
Material of the enclosure	plastic
Vibration frequency measuring range	
• initial value	2 Hz
• Full-scale value	10 000 Hz
Ambient temperature	
• during storage	-25 ... +85 °C
• during operation	-20 ... +65 °C
• during transport	-25 ... +85 °C
Relative humidity without condensation during operation	5 ... 95 %
Equipment marking	
• acc. to DIN 40719 extended according to IEC 204-2 acc. to IEC 750	P
• acc. to DIN EN 61346-2	P
Weight	0.27 kg
Supply voltage:	
Type of voltage of the supply voltage	DC
Supply voltage 1 at DC rated value	24 V
Consumed active power maximum	2.4 W
Installation/ mounting/ dimensions:	
Mounting position recommended	vertical
Mounting type	standard rail
Width	45 mm
Height	106 mm
Depth	124 mm

Inputs/ Outputs:	
Number of sensor inputs	
• for IEPE sensors	8
• for MEMS sensors	0
Number of outputs	1
Connections:	
Type of electrical connection	
• of the inputs and outputs	screw terminal
• for auxiliary and control current circuit	screw-type terminals
Product function	
• removable terminal for main circuit	Yes
• removable terminal for auxiliary and control circuit	Yes
Connectable conductor cross-section for auxiliary contacts	
• single or multi-stranded	0.5 ... 4 mm²
• finely stranded	
– without core end processing	2.5 ... 0.5 mm²
– with core end processing	0.5 ... 2.5 mm²
Communication:	
Design of the interface SIMOCODE interface	Yes
Certificates/ approvals:	
Certificate of suitability	CE, UL 508, CSA C22.2 Nr.142, C-Tick (RCM)

13.2.2 Dimension drawing VIB-MUX



All dimensions in mm

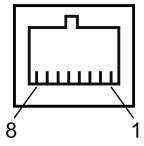
Image 13-2 Dimension drawing CMS2000 VIB-MUX

Appendix

A

A.1 Interface pin assignments

A.1.1 Pin assignment for Industrial Ethernet interface

Industrial Ethernet (on reader side)	Pin	Pin assignment
	1	Transmit Data (+)
	2	Transmit Data (-)
	3	Receive Data (+)
	4	Terminated
	5	Terminated
	6	Receive Data (-)
	7	Terminated
	8	Terminated

Note

It is only permitted to connect shielded CAT5 cables (or cables of a higher standard) to the Ethernet socket.

A.2 Definition of Ethernet telegrams that can be sent cyclically

The current data of the CMS2000 device can be sent cyclically via Ethernet telegrams (see "Ethernet (Page 183)."

The telegram formats used in each case are defined here:

- The telegram frame format (Page 241) of the telegrams that can be sent via Ethernet
- The structure of the user data for the "compact telegram" (Page 242) as well as an example for a "compact telegram"
- The composition of the user data in an "Extended telegram" (Page 244)

All data is transmitted in "Little Endian" byte-order format.

The following abbreviations are used for the frequency spectra:

v(f)	Velocity spectrum
a(f)	Acceleration spectrum
env(f)	Envelope spectrum of acceleration

A.2.1 Telegram frame format

The telegram frame format of the telegrams that can be sent via Ethernet is shown in the table below.

Table A- 1 Basic telegram structure for cyclic sending via TCP/IP

Length [Bytes]	Designation	Data type	Description
4	Time stamp	unsigned long	Current relative time in µs (0…3600000000)
4	User data length	unsigned long	Length of user data in bytes (without the fields "Time stamp", "Length of user data", "Index" and "End code")
4	Index	unsigned long	Serves to distinguish the contents of the user data: 1 = User data of the compact telegram 2 = User data of the extended telegram
x	User data	Structure	User data of the telegram • For the compact telegram: Data structure according to Table (Page 242) • For extended telegram: Data structure according to Table (Page 244)
4	End code	unsigned long	End identifier: 0x7FFFFFFF

A.2.2 User data for the compact telegram

Table A- 2 Structure of user data for the compact telegram

Length [Bytes]	Designation	Data type	Description
1	Operating mode	unsigned char	Operating mode of the SIPLUS CMS2000 device: 3 = Error condition ("System not ready") 4 = STOP ("System ready") 5 = RUN-Measuring 7 = RUN-Monitoring inhibited 8 = RUN-Monitoring Note: Telegrams are sent in all these operating modes. Temporary operating modes, such as startup and shutdown, are not specified here, because telegrams are not sent in these modes.
1	Status LED/DO "Normal" (green)	unsigned char	Current status of the LED and digital output "Normal" (green): 0 = Off 1 = On
1	Status LED/DO "Warning" (yellow)	unsigned char	Current status of the LED and digital output "Warning" (yellow): 0 = Off 1 = On 2 = LED flashes slowly (0.5 Hz), output is "On"
1	Status LED/DO "Alarm" (red)	unsigned char	Current status of the LED and digital output "Alarm" (red): 0 = Off 1 = On 2 = LED flashes slowly (0.5 Hz), output is "On"
1	Active process alarms	unsigned char	Number of current active process alarms
1	Active system alarms	unsigned char	Number of current active system alarms
1	Active process warnings	unsigned char	Number of current active process warnings
1	Active system warnings	unsigned char	Number of current active system warnings
1	Process messages to be acknowledged	unsigned char	Number of process messages to be acknowledged that have not yet been acknowledged
1	System messages to be acknowledged	unsigned char	Number of system messages to be acknowledged that have not yet been acknowledged
6	Reserve	unsigned char[6]	Fields reserved for future use

Table A- 3 Example for compact telegram structure (fixed length: 32 bytes)

Byte	Designation	Value	Description/explanation
00…03	Time stamp	123456000	Current relative time in µs (0…3600000000)
04…07	User data length	16	Length of user data in bytes (without the fields "Time stamp," "Length of user data," "Index," and "End code")
08…11	Index	1	1 = User data of compact telegram
12	Operating mode	8	8 = RUN
13	Status LED/DO "Normal" (green)	1	1 = on
14	Status LED/DO "Warning" (yellow)	0	0 = off
15	Status LED/DO "Alarm" (red)	0	0 = off
16	Active process alarms	0	No active process alarms
17	Active system alarms	0	No active system alarms
18	Active process warnings	0	No active process warnings
19	Active system warnings	1	System warning active
20	Process messages to be acknowledged	0	No process messages to acknowledge
21	System messages to be acknowledged	1	A system message must be acknowl-edged
22…27	Reserve	0	Reserved fields
28…31	End code	0x7FFFFFFF	End identifier

A.2.3 Structure of user data for the extended telegram

Table A- 4 Structure of user data for the extended telegram

Length [Bytes	Designation	Data type	Description	
16	User data of the compact telegram	Structure	Data structure according to Table (Page 242)	
256	Measured values	float[64]	Field with 64 measured values/characteristic values in IEEE 32-bit floating point format; for indexation, see table below (referred to as "Measured values" below)	
128	Measured value status	unsigned short[64]	Field with 1 status word (16 bit) for each measured value; for indexation, see table below; assignment as follows:	
			Bit 0	0 = Measured value not configured 1 = Measured value configured
			Bit 1	0 = Signal not acquired, or faulty 1 = Signal correctly acquired
			Bit 2	0 = Measured value not calculated / not valid 1 = Measured value calculated and valid
			Bit 3	0 = "not green" 1 = "green": Measured value being monitored, no limit violation
			Bit 4	0 = "not yellow" 1 = "yellow": Measured value being monitored, warning limit violated
			Bit 5	0 = "not red" 1 = "red": Measured value being monitored, alarm limit violated
			Bit 6	0 = Warning acknowledgement not required 1 = Warning for this measured value must be acknowledged
			Bit 7	0 = Alarm acknowledgement not required 1 = Alarm for this measured value must be acknowledged
			Bit 8 ... Bit 15	Reserved

Length [Bytes	Designation	Data type	Description	
128	Spectrum status	unsigned short[64]	Field with 1 status word (16 bit) for each spectrum v(f) / a(f) / env(f); for indexation, see table below; assignment as follows:	
			Bit 0	0 = Spectrum not configured 1 = Spectrum configured
			Bit 1	0 = Vibration signal not acquired or incorrectly acquired 1 = Vibration signal correctly acquired
			Bit 2	0 = Spectrum not calculated / not valid 1 = Spectrum last calculated is valid
			Bit 3	0 = "not green" 1 = "green": Spectrum being monitored, no limit violation
			Bit 4	0 = "not yellow" 1 = "yellow": Spectrum being monitored, warning limit violated
			Bit 5	0 = "not red" 1 = "red": Spectrum being monitored, alarm limit violated
			Bit 6	0 = Warning acknowledgement not required 1 = Warning for this spectrum must be acknowledged
			Bit 7	0 = Alarm acknowledgement not required 1 = Warning for this spectrum must be acknowledged
			The bit assignment in the high byte depends on the type of spectrum. For env(f), the following applies:	
			Bit 8…11	Reserved
			Bit 12	0 = Bearing inner race unaffected 1 = W/A limit for bearing inner race violated
			Bit 13	0 = Bearing outer race unaffected 1 = W/A limit for bearing outer race violated
			Bit 14	0 = Bearing cage unaffected 1 = W/A limit for bearing cage violated
			Bit 15	0 = Bearing rolling element unaffected 1 = W/A limit for bearing rolling element violated
			For v(f) and a(f), the following applies:	
			Bit 8…15	Reserved

Table A- 5 Indexation of the measured values or measured value status information in the above fields

Index	Measured value	Index	Measured value	Index	Measured value	Index	Measured value
0	SPEED[1)]	16	*Reserved*	32	VIB 2.5: RMS	48	VIB 2.3: DKW
1	OPR_HOURS	17		33	VIB 2.6: RMS	49	VIB 2.4: DKW
2	AI 1	18	VIB 1: RMS	34	VIB 2.7: RMS	50	VIB 2.5: DKW
3	AI 2	19	VIB 1.1: RMS	35	VIB 2.8: RMS	51	VIB 2.6: DKW
4	TEMP 1.1	20	VIB 1.2: RMS	36	VIB 1: DKW	52	VIB 2.7: DKW
5	TEMP 1.2	21	VIB 1.3: RMS	37	VIB 1.1: DKW	53	VIB 2.8: DKW
6	TEMP 1.3	22	VIB 1.4: RMS	38	VIB 1.2: DKW	54	Reserved
7	TEMP 2.1	23	VIB 1.5: RMS	39	VIB 1.3: DKW	55	
8	TEMP 2.2	24	VIB 1.6: RMS	40	VIB 1.4: DKW	56	
9	TEMP 2.3	25	VIB 1.7: RMS	41	VIB 1.5: DKW	57	
10	*Reserved*	26	VIB 1.8: RMS	42	VIB 1.6: DKW	58	
11		27	VIB 2: RMS	43	VIB 1.7: DKW	59	
12		28	VIB 2.1: RMS	44	VIB 1.8: DKW	60	
13		29	VIB 2.2: RMS	45	VIB 2: DKW	61	
14		30	VIB 2.3: RMS	46	VIB 2.1: DKW	62	
15		31	VIB 2.4: RMS	47	VIB 2.2: DKW	63	

1) Explanation of SPEED: If all vibration channels use an identical speed source or an identical fixed speed, this shared speed is entered in this field. If different speed sources are configured for the vibration channels, the speed measured via the speed input (Bero input) is entered here.

Table A- 6 Indexation of the spectrum status information in the above field

Index	Measured value	Index	Measured value	Index	Measured value	Index	Measured value
0	VIB 1: v(f)	16	VIB 2.7: v(f)	32	VIB 2.5: a(f)	48	VIB 2.3: env(f)
1	VIB 1.1: v(f)	17	VIB 2.8: v(f)	33	VIB 2.6: a(f)	49	VIB 2.4: env(f)
2	VIB 1.2: v(f)	18	VIB 1: a(f)	34	VIB 2.7: a(f)	50	VIB 2.5: env(f)
3	VIB 1.3: v(f)	19	VIB 1.1: a(f)	35	VIB 2.8: a(f)	51	VIB 2.6: env(f)
4	VIB 1.4: v(f)	20	VIB 1.2: a(f)	36	VIB 1: env(f)	52	VIB 2.7: env(f)
5	VIB 1.5: v(f)	21	VIB 1.3: a(f)	37	VIB 1.1: env(f)	53	VIB 2.8: env(f)
6	VIB 1.6: v(f)	22	VIB 1.4: a(f)	38	VIB 1.2: env(f)	54	Reserved
7	VIB 1.7: v(f)	23	VIB 1.5: a(f)	39	VIB 1.3: env(f)	55	
8	VIB 1.8: v(f)	24	VIB 1.6: a(f)	40	VIB 1.4: env(f)	56	
9	VIB 2: v(f)	25	VIB 1.7: a(f)	41	VIB 1.5: env(f)	57	
10	VIB 2.1: v(f)	26	VIB 1.8: a(f)	42	VIB 1.6: env(f)	58	
11	VIB 2.2: v(f)	27	VIB 2: a(f)	43	VIB 1.7: env(f)	59	
12	VIB 2.3: v(f)	28	VIB 2.1: a(f)	44	VIB 1.8: env(f)	60	
13	VIB 2.4: v(f)	29	VIB 2.2: a(f)	45	VIB 2: env(f)	61	
14	VIB 2.5: v(f)	30	VIB 2.3: a(f)	46	VIB 2.1: env(f)	62	
15	VIB 2.6: v(f)	31	VIB 2.4: a(f)	47	VIB 2.1: env(f)	63	

A.3 Certificates, approvals, standards

Note

Approvals are only valid when marked on the product

The specified approvals apply only when the corresponding mark is printed on the product. You can check which of the following approvals have been granted for your product by the markings on the type plate.

CE marking

The SIPLUS CMS2000 device complies with the requirements and safety objectives of the EU directive below.

EMC Directive 2014/30/EU

The product is designed for use in an industrial environment.

EMC requirements:

Field of application	Noise emission requirements	Immunity to interference
Industrial area	EN55011:2009 + A1:2010	EN 61000-6-2:2005

The product meets these requirements if you adhere to the installation guidelines and safety instructions included in these operating instructions during installation and operation.

Declaration of Conformity

The EU Declaration of Conformity is kept available for the responsible authorities in accordance with the above-mentioned EU Directive at the following address:

SIEMENS AG
DF FA SE R&D
BRESLAUER STR. 5
90766 FUERTH
GERMANY

Approvals

- UL 508
- CSA C22.2 No. 142
- RCM
- EAC
- KC

Further applied standards

- DIN / EN 61131-2, Programmable Controllers
- EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use.
  The SIPLUS CMS2000 condition monitoring system is intended for measurement category 0 according to EN 61010.

A.4 Licenses

Use of open source software (OSS)

The SIPLUS CMS2000 uses open source software modified by us and in its unmodified form. Mandatory licensing information and sources are listed in the "SIPLUS_CMS2000_Readme_OSS.pdf" file in the Basic Unit. This file can be accessed in the "Download software license information" section on the "Download (Page 189)" web page.

Sources under the GNU General Public License are provided to you free of charge on request. Use the communciation channels specified under Service & support (Page 250) to do this.

A.5 Service & support

Technical Support

You can access Technical Assistance as follows:

- Phone: + 49 (0) 911 895 7222
- E-mail (mailto:siplus-cms.industry@siemens.com)

Contact address

SIEMENS AG

DF FA SE

Breslauer Strasse 5

90766 FÜRTH

GERMANY

Siemens Industry Online Support

You can find various services on the Support homepage (http://support.industry.siemens.com) on the Internet.

There you will find the following information, for example:

- The correct documents for you via product-related search functions
- Online support request form
- You local representative
- Information about on-site service, repairs, and spare parts.
- A forum for global information exchange by users and specialists.
- Our newsletter containing up-to-date information on your products.

Online catalog and ordering system

The online catalog and the online ordering system can be found on the Industry Mall homepage (https://mall.industry.siemens.com).

SIPLUS CMS Condition Monitoring Systems on the Internet

Current information on SIPLUS CMS Condition Monitoring Systems are provided as part of our online presence (http://www.siemens.com/siplus-cms).

Glossary

Alarm threshold

A limit can be set for each of the measured or calculated values, such as speed, RMS or DKW. When it is exceeded, the device will output an alarm.

CMS

Condition monitoring system for monitoring mechanical components as part of preventive maintenance.

CMS X-Tools

CMS2000 offers an interface to the CMS X-Tools analysis software. CMS X-Tools offers a comprehensive function library for simple and optimized analysis, diagnostics, and condition monitoring as a useful addition to automation.

Diagnostic procedure

Sequence of events comprising the acquisition of process data via the input channels, evaluation and recording of process data as well as triggering responses in the case of limit overshoot.

Diagnostic task

Actual configuration of a diagnostic procedure by the user.

DKW

Diagnostic characteristic value in accordance with the K(t) procedure based on VDI 3832.

Fault frequency

The fault frequency is the rate at which the ball of the bearing passes a damage location. The fault frequencies can either be determined from the bearing geometry and the speed, or they can be directly entered on the basis of a reference speed.

FE (functional ground)

Low-impedance connection to ground potential

FFT

Fast Fourier Transform

Fingerprint

A "Fingerprint" is created for the purpose of recording the good condition of a monitored bearing. Characteristic values are either measured using configurable measuring procedures or calculated by averaging the measured values over a definable period, and saving them in the device.

High/low limit

Some measured values are monitored for overshooting a high limit (for both warning and alarm) as well as for undershooting a low limit (for both warning and alarm).

Historical memory

Non-volatile memory area in which the recorded historical data is stored in the device

IEPE sensor

IEPE sensors are piezo-electric sensors with integrated electronics.

ISO 10816-3

Title: Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts - Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 rpm and 15 000 rpm when measured in situ (ISO 10816-3:2009)

ISO 10816-7

Title: Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts - Part 7: Rotodynamic pumps for industrial applications (ISO 10816-7:2009).

Limit band

A limit band is a dataset that contains frequencies or frequency ranges (depending on the analysis technique selected) and the limits to be monitored in each case.

Parameter memory

Non-volatile memory area in which the parameter set of the device is stored.

Parameter set

The full set of all parameters (set values and data) that specify the actual operating profile of a SIPLUS CMS2000 device. The parameters include the module configuration (e.g. definition of the measuring channels used), analysis methods, diagnostic parameters such as limits and limit bands, information regarding compression density, teach values, bearing data and fingerprints.

Raw data

The measured values acquired on the input channels of the device for further processing.

RMS

Root mean square

SIPLUS CMS

SIPLUS CMS is the name for the condition monitoring product family from Siemens. Mechanical wear, imbalance, damage to rolling contact bearings and other damage in machines can cause an unplanned plant stoppage. SIPLUS CMS detects such damage early and therefore ensures plant availability.

SIPLUS CMS2000

Modular and parameterizable condition monitoring system from the SIPLUS CMS product family from Siemens. With SIPLUS CMS2000, visualization and parameterization is performed without the need for additional software, simply via a web browser. Handling has therefore been considerably simplified for the service personnel, both locally as well as in remote operation. Modular expansion of SIPLUS CMS2000 is possible using VIB-MUX expansion modules as well as temperature modules from the SIMOCODE product spectrum.

Teach values

Teach values comprise RMS as well as DKW reference values. Both types of values are determined by the system in measuring mode (RUN-Measuring) by measuring the relevant process variables and applying the appropriate process algorithms. The teach values are used as guide values for the user in determining the RMS limits or the speed-dependent DKW reference values.

Warning limit

A limit can be set for each of the measured or calculated values, such as speed, RMS or DKW. When it is exceeded, the device will output a warning.

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