

SMART MONITORING SOLUTIONS



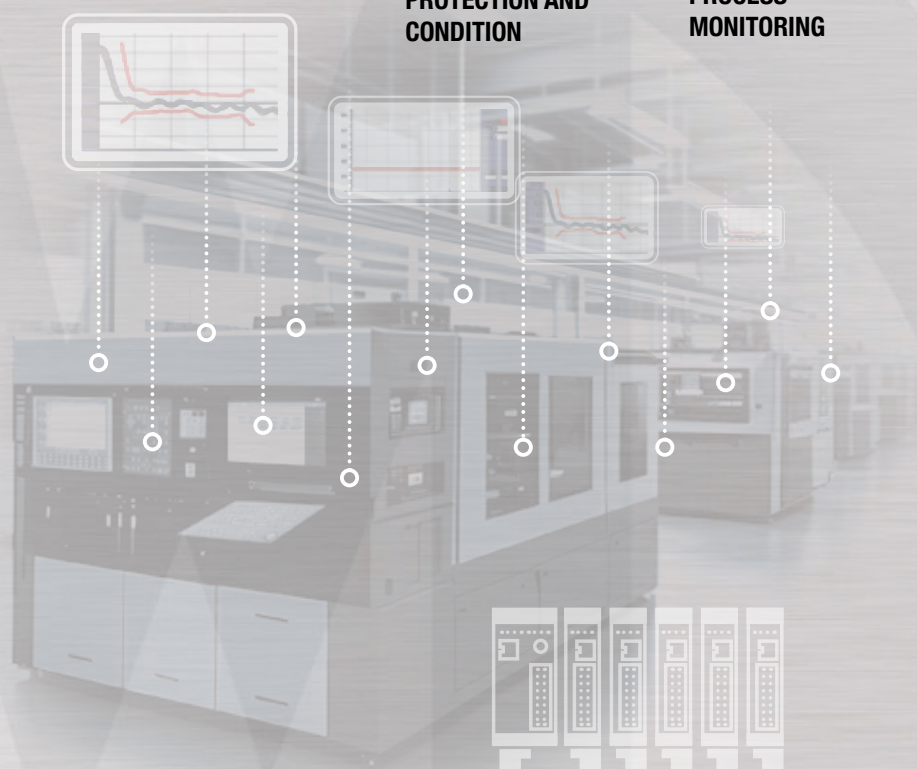
MACHINE
PROTECTION AND
CONDITION



WORKPIECE
PROCESS
MONITORING



FACTORY 4.0
DATA DRIVEN
MANUFACTURING



MARPOSS

WORKPIECE



MACHINE



FACTORY 4.0



SMART MONITORING SOLUTIONS

"A GOOD OVERVIEW OF PRODUCTION AND MACHINERY SAVES COSTS IN THE LONG TERM AND RELEASES RESOURCES FOR MORE SENSIBLE ISSUES"

- Keeping costs under control
- Increasing resilience in processes and supply chains
- Improving climate protection
- Safeguarding innovative strength for the future

REAL-TIME TOOL AND PROCESS MONITORING

- The GEMCPU module is used to monitor machines and systems - even without an existing CNC control.
- Violation of set limits results in the most rapid autonomous reactions (axis/spindle stop).
- The monitoring data can be traced via the onboard memory, a useful feature for short periods of time.

DATA DRIVEN MANUFACTURING

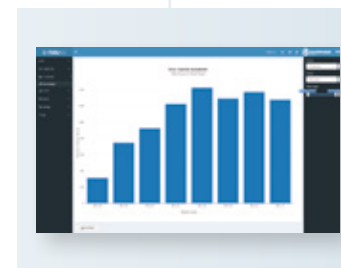
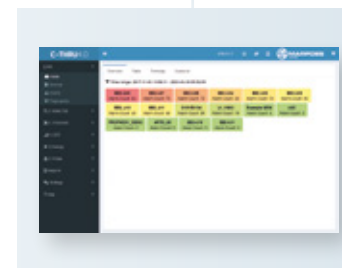
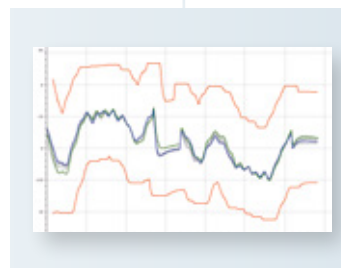
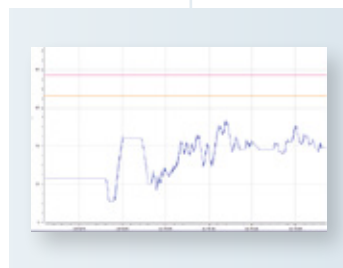
- Digital and analog sensors collect data in real time and save them in the autonomous GENIOR MODULAR evaluation unit (GEMCPU).
- Extensive monitoring data can be stored either locally or centrally via network.
- The web-based data management system **C-THRU4.0** enables detailed and transparent viewing of processing steps as well as the compilation of trends and reports.
- Additionally, the software also provides information on process quality, error diagnosis and offers indirect quality proofs for each individual workpiece and machining step.



MACHINE

PROCESS

PRODUCTION



MACHINE PROTECTION

- Permanent collision monitoring
- Prevention of unplanned machine downtimes
- Event memory (black box)

MACHINE CONDITION

- Detection of damage and wear
- Reliable data basis for preventive maintenance
- Analysis tool for diagnosis and optimization

PROCESS MONITORING

- Detection of tool breakage and wear
- Identifying deviations of set parameters
- Less rejects
- Unattended operation possible

PROCESS ANALYSIS

- Comparing, evaluating and reporting
- Predicting developments
- Making optimizations

PROCESS STATUS

- Overview of all monitoring systems (GEMCPUs)
- Recognition of critical processes/machines
- Prioritized actions possible

TOOL LIFE

- Wear behavior of different tools
- Comparing tools
- Determining costs

ENERGY CONSUMPTION

- Measuring consumption of machines and systems
- Comparing and displaying trends
- Showing deviations and determining costs

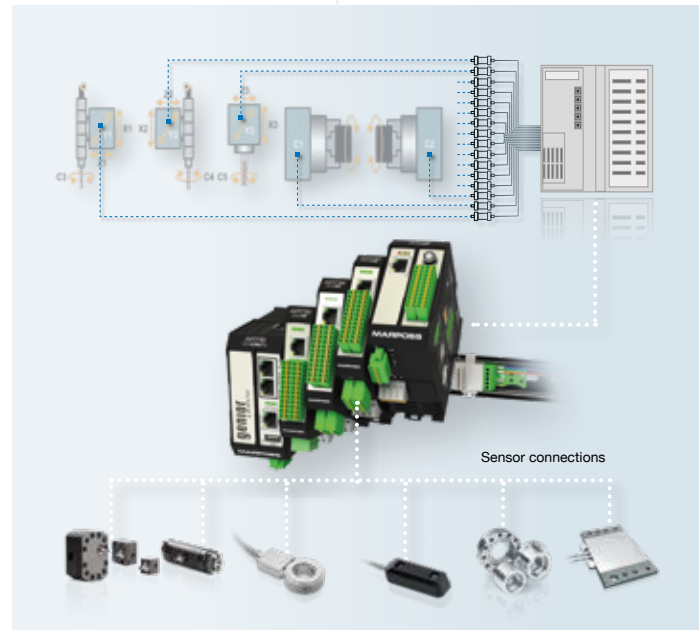
OEE KEY FIGURES

- Production time
- Production quantity
- Time lost due to errors or e.g. tool changes



GENIOR MODULAR SIMPLE INTEGRATION

A KEY FEATURE OF OUR TOOL AND PROCESS MONITORING SYSTEMS IS THEIR SIMPLE INTEGRATION WITH COMMUNICATION INTERFACE TO THE MACHINE AND THE MACHINE CONTROL.



INTEGRATION SOLUTION IN MACHINES AND CONTROLS

We provide the following types of integration:

- Machine protection with permanent monitoring – use of digital inputs and outputs
- Machine condition and process monitoring – mainly use of a fieldbus for process identification and sequence control
- Simple integration via Artis Integration Manager (AIM)
- Start and stop monitoring directly from the NC program
- Visualization and operation via machine operator interface (HMI) possible



INTEGRATION SOLUTION INTO THE MACHINE CONTROL WITHOUT PLC/PMC MODIFICATION

- AIM is a software solution that simplifies ARTIS system integration, even for technicians without experience with machine controls.
- Communication between NC/PLC and GENIOR MODULAR, previously managed by M-Codes, is now handled by a Windows®-based service running in the background. This service is configurable via a guided configurator and can be prepared offline.
- With AIM, GEMCPU and GEMCMS can be integrated accordingly.

GENIOR MODULAR PRODUCT MATRIX



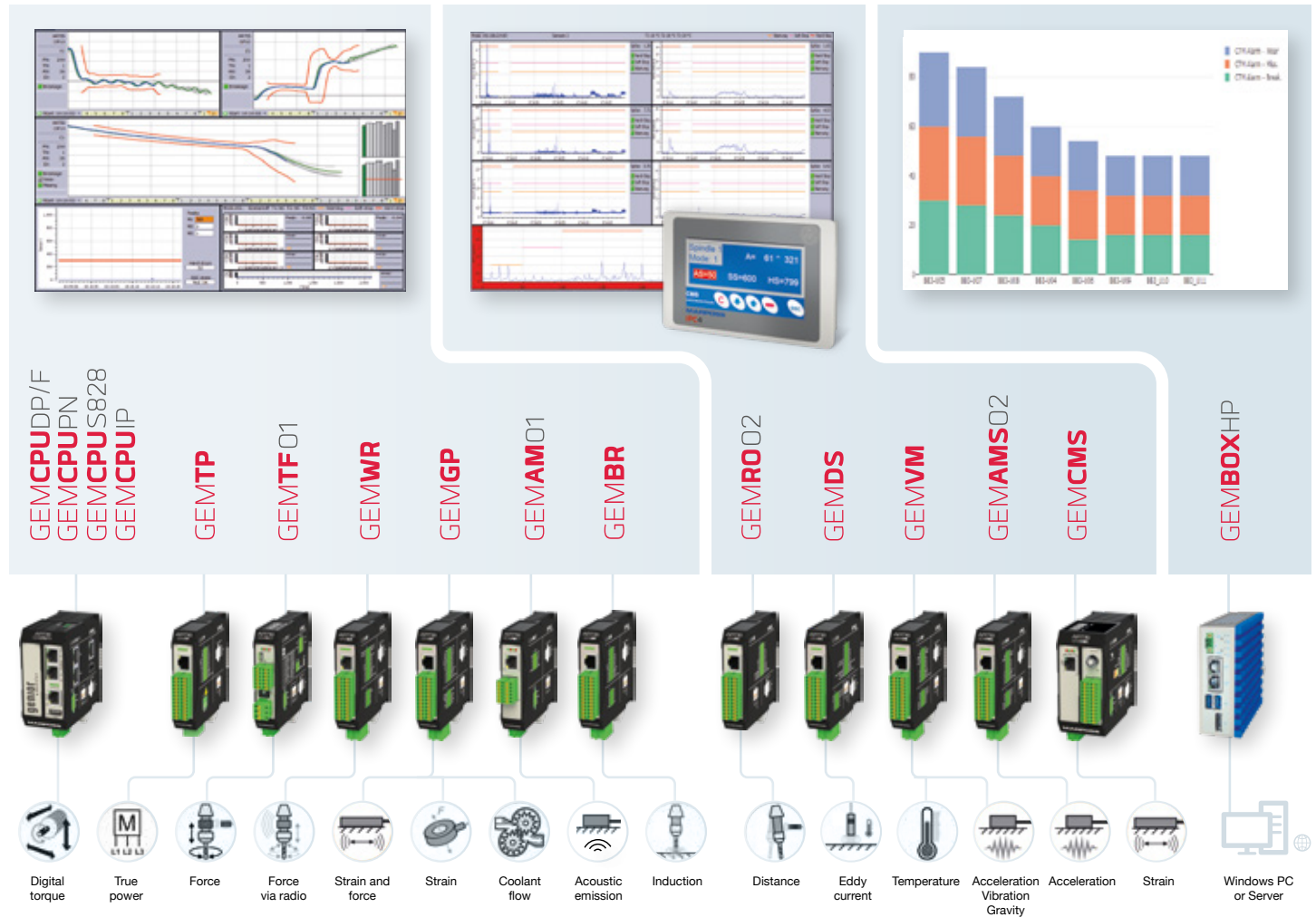
WORKPIECE
PROCESS
MONITORING



MACHINE
PROTECTION &
CONDITION



FACTORY 4.0
DATA DRIVEN
MANUFACTURING



In a manufacturing environment, the requirements for the fields of workpiece production, machine operation and production control are of different nature. The product matrix shows the structure and assignment of ARTIS products and systems. Depending on the monitoring requirements, the modules and sensors can be combined with corresponding software.

Intelligent GEMCPUs communicate with the base modules (e.g. GEMTP) via the CAN bus (rail). Most base modules can be operated stand-alone. Visualization and configuration are done via a corresponding Windows®-based VISU software.

WORKPIECE



MACHINE



FACTORY 4.0



GENIOR MODULAR TOOL AND PROCESS MONITORING

VERSATILE, AUTONOMOUS AND SMART

The GENIOR MODULAR system has been designed for use in machining production. Safe and reliable machining processes are the prerequisite for economically efficient production. GENIOR MODULAR makes the collected machine, operating and process data easily accessible and usable for the operator. In addition to real-time monitoring and protection of the machine, the tool and the process, the system offers a wide range of options for increasing availability and improving quality.

MODULAR AND SCALABLE

A core element of the system is its easy adaptation to customer-specific requirements and thus to dedicated systems, machines and production areas.

SYSTEM FOR DATA-DRIVEN MANUFACTURING

Measurement data is acquired digitally via the fieldbus interface or via base modules with connected sensors. Process data from several sensors can be used for monitoring strategies ("multi-criteria" evaluation). The system operates largely automatically, with the limits adapting themselves to the signals. Operator intervention is only required to a limited extent. Individual adjustments can be made using the Expert Mode. Acquired data is converted into intelligent data (information) that can be stored locally or on network devices for further evaluations such as analyses, trend curves, statistics or reports.

SPECIAL PROPERTIES

HARDWARE:

- GEMCPU and/or stand-alone modules: can be integrated via CAN bus
- Monitoring without sensors: up to 16 digital CNC signals
- Monitoring with any (additional) sensors: connection of up to 8 sensor modules
- GEMCPU with common fieldbus interfaces available (see graphic)
- Activatable MQTT interface protocol

OPERATION AND VISUALIZATION:

- Up to 16 signals: monitoring in real time
- Up to 10 monitoring channels: monitoring multiple NC channels
- Dashboard for overview of multiple CPU modules and channels

MONITORING STRATEGY:

- Automatic adjustment of limits: without operator intervention
- Modular: adaptable to different types of machines, processes and production areas
- Signal sampling rate: configurable from 2-20 ms
- Plug-ins (APPs): software modules for data evaluation
- Multi-Criteria: monitoring strategy considers multiple signals
- MultiView: fast error analysis with individually configurable display of multiple active monitoring windows
- Expert Mode: individual adaptations possible
- Adaptive Control (AC): Feed rate optimization option
- Data management and evaluation: permanent data transfer to a GEMBOXHP or customer-supplied storage media



4 CORE PROCESSOR TECHNOLOGY
4 GB FLASH DISK

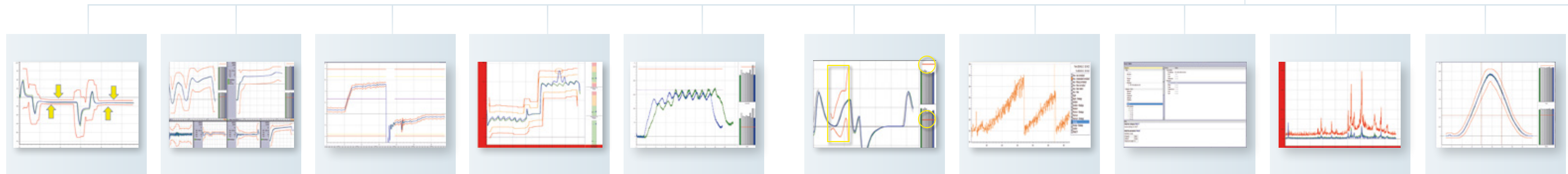
PROFIBUS / FANUC FOCAS
GEMCPU DP/F
PROFINET
GEMCPU PN
SIEMENS 828
GEMCPU S828
ETHERNET IP
GEMCPU IP

CAN BUS RAIL

ETHERNET (TCP/IP)

USB PORT

GEMCPU



AUTOMATIC ADJUSTMENT

of limits to the measuring signal

MULTIVIEW VISUALIZATION

of several measurement signals in parallel

LONG PROCESSES

monitoring and visualization of unlimited cutting processes

MACHINE CONDITION "FINGERPRINT"

with status indicator (green amber red)

AC-CONTROL

automatic adjustment of feed rate

EXPERT MODE

for manual adjustments

MODULE MEMORY

for trend curves, alarm lists, CSV data, etc.

MQTT

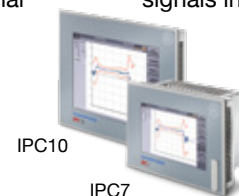
data sent to an MQTT broker are made available for any other application

FFT

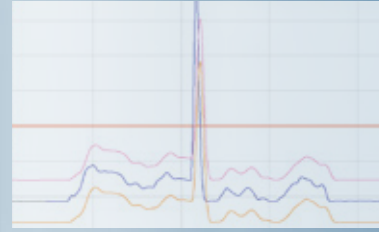
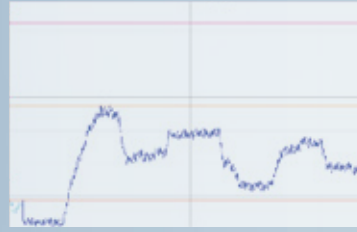
automatic monitoring of FFT-signals calculated by a GEMVM module

HOBBING

monitoring and visualization of gear cutting processes with hob tools (wear, tooth breakage)



WORKPIECE

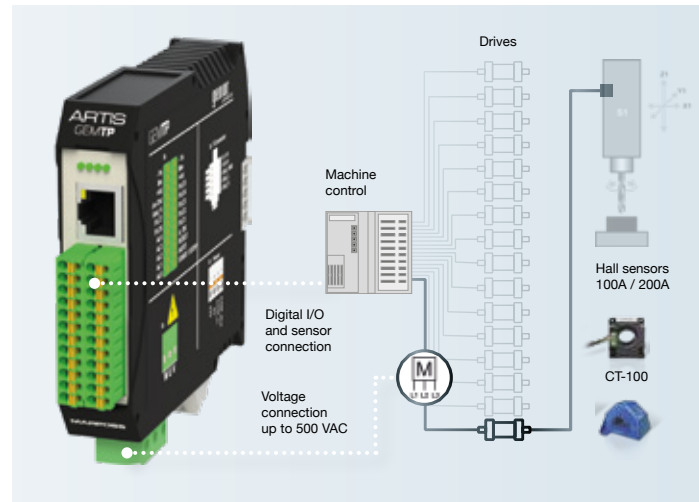


GENIOR MODULAR BASE MODULES

Sensors and signals (0-10 V) can be connected to the base modules and be monitored. Most of them will be operated autonomously in stand-alone mode. However, if integrated into a GEMCPU system, the

base module continues to run independently in parallel with its multiple monitoring strategies. Up to 127 cycles (learning curves) are available. For easy integration, these modules are equipped with digital I/Os and

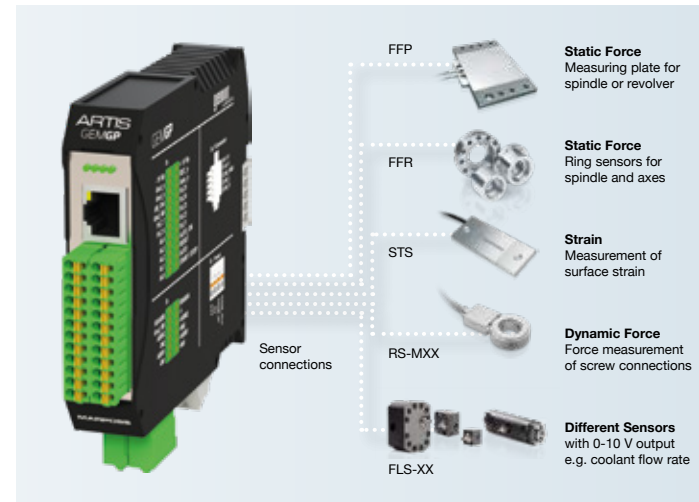
are visualized via the respective IP address or integrated into a network. Measurement data can be transferred as CSV file for analysis. Events are documented in the protected memory (black box).



GEMTP

TRUE POWER MODULE: MONITORING SOLUTION FOR INDIVIDUAL DRIVES

- For spindles, axes or motors of e.g. robots or chip conveyors
- Easy retrofitting, commissioning and operation
- Detection of exceeding set limits
 - Overload
 - Tool breakage and missing tools
 - Wear
 - Energy consumption



GEMGP

UNIVERSAL MONITORING MODULE

Depending on the machine design and requirements, up to two sensors can be connected (2 sensor signals, 1 NC channel).

The different sensors detect and monitor:

- Reaction forces of turrets
- Vertical forces in axes and spindles
- Strain/stress on machine parts
- Flow of coolant lubricant
- Special influencing variables via external sensors (0-10 V)



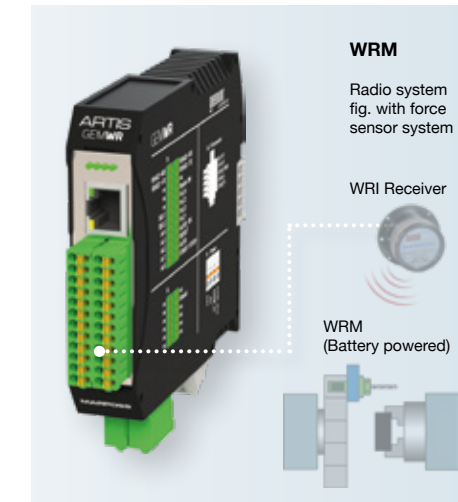
GEMTF01

TORQUE AND FORCE SENSOR SYSTEM

Capturing of sensor data directly in the tool holder (DDU Rotor) close to the process largely avoids the influences of machine dynamics. The system records even the smallest feed forces and torque via strain gauges and transmits them via telemetry to the evaluation module, which is operated together with the GEMCPU.

Applications:

- Thread cutting and forming processes
- Drilling processes
- Process analysis
- Stir friction welding



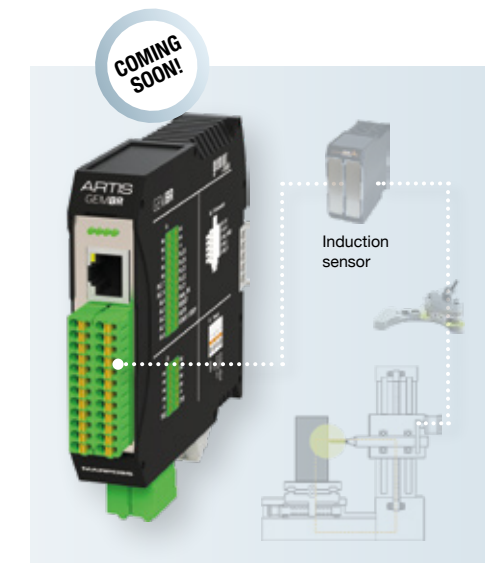
GEMWR

MONITORING MODULE FOR THE WRI RADIO SYSTEM

Wireless monitoring of sensors located on dynamic machine parts (e.g. turrets). Up to 4 sensors can communicate via the WRM transmitter. The module is able to monitor 16 different processes.

Applications:

- Measures process forces when roller burnishing
- Measures axial force when drilling



GEMBR

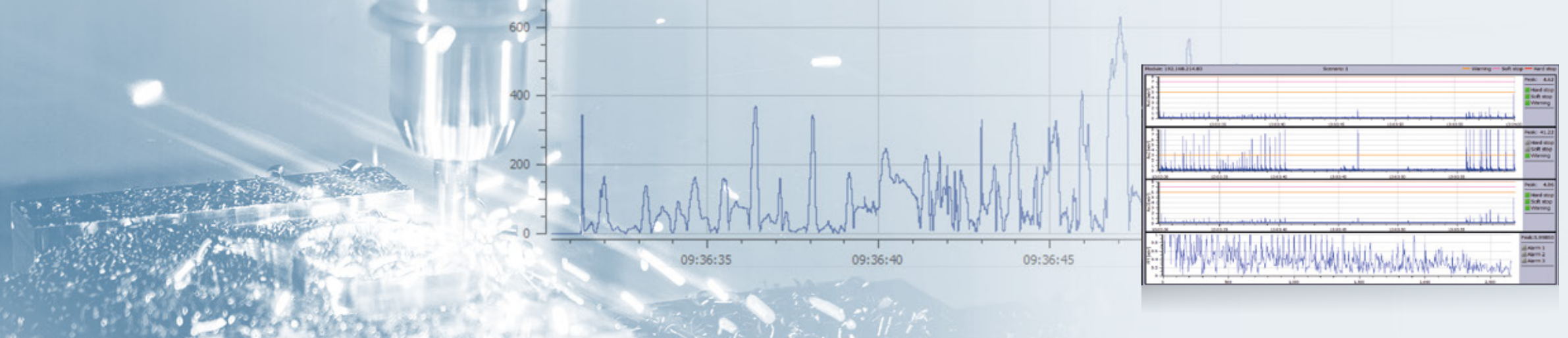
MONITORING SYSTEM FOR TOOL BREAKAGE AND MISSING TOOLS

Tiniest tool breakage during metal cutting can be detected by means of an inductive measuring method. The sensor is installed in the control cabinet.

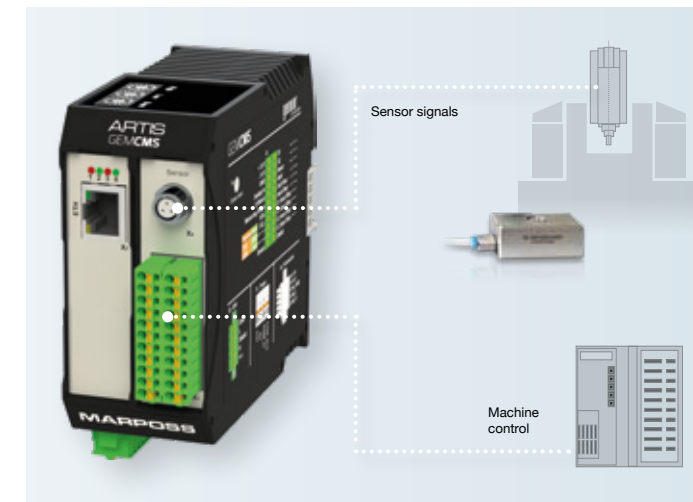
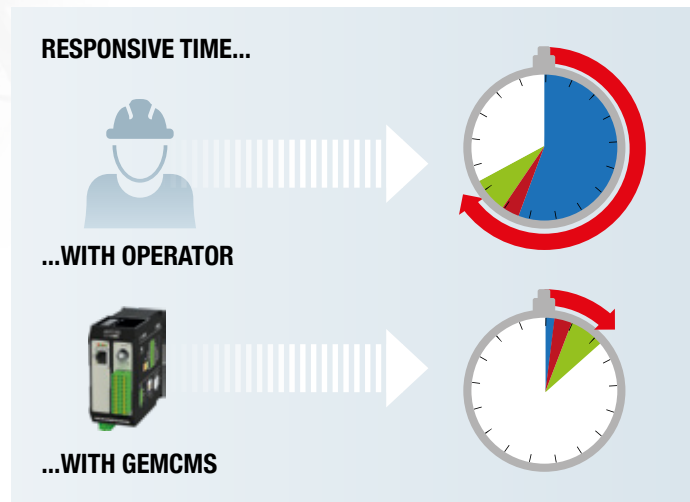
Applications:

- Monitoring of tool breakage and missing tools
- Even of very small tools (0.1 mm)
- Detection of material contact
- Monitoring of high-speed machining operations also possible

MACHINE



GENIOR MODULAR ACTIVE MACHINE PROTECTION / COLLISION DETECTION



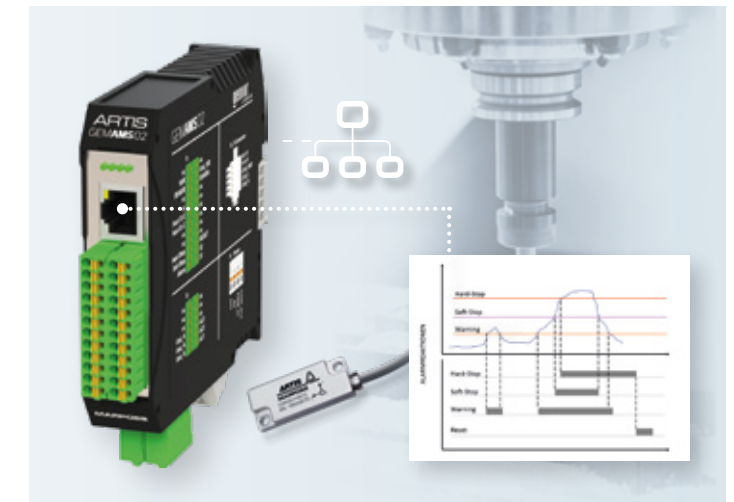
GEMCMS

FORCE MEASURING (QUASISTATIC)

GEMCMS detects both, dynamic and quasistatic collisions via the connected force sensors. If the set emergency limit is violated, an alarm output is set in < 1 ms. This prevents or at least minimizes damage to machines and transfer lines.

Special features:

- Sensor connection to the integrated load amplifier
- Additional load amplifiers allow sensor distances of more than 20 m
- Simple display and operation via the 4.3" IPC4 system – similar to the BRANKAMP CMS System
- Use of tool-related limits (ToolPlus) via PROFINET or PROFIBUS fieldbus modules



GEMAMS02

DYNAMIC COLLISIONS

GEMAMS02 detects dynamic collisions via the connected acceleration sensors. If the defined hard stop limit is violated, an alarm output is set in < 1 ms. This prevents or at least minimizes damage to machines and transfer lines.

Special features:

- Sensor connection for 1- to 3-axes acceleration sensors with standard IEPE interface
- Selection of 8 different scenarios
- 3 different limits per signal
- Frequency analysis via FFT evaluation
- 3 temperature sensors connectable
- Gravity evaluation (only with dedicated sensor)

Nowadays, machines are more and more complex, dynamic and fragile. Defects due to collisions cause production downtimes and thus costs and loss of sales. In the event of prolonged downtime due to a lack of spare parts or delayed repairs, there is a risk of reputational damage or loss of customers if planned deliveries are not made on time.

RISKS:

- Careless manual movement of the axes
- Incorrect entries
- Clamping of wrong tools
- Allowance fluctuations of the workpiece
- Incorrect clamping of the workpiece
- Tool overload (e.g. chip jam)

CONSEQUENCES:

- High costs for repair and spare parts
- Possible loss of machine accuracy
- Unplanned downtimes
- Increase of insurance rates and deductibles

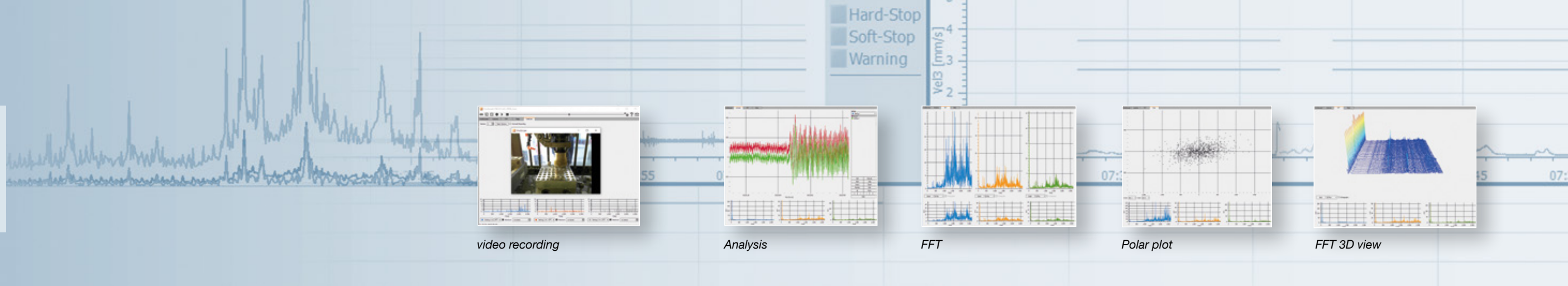
REQUIREMENTS

- Fast stop of the moving axis/axes
- Indication and logging of the event
- Evaluation of event and graphic data
- Weak point analysis based on the stored data

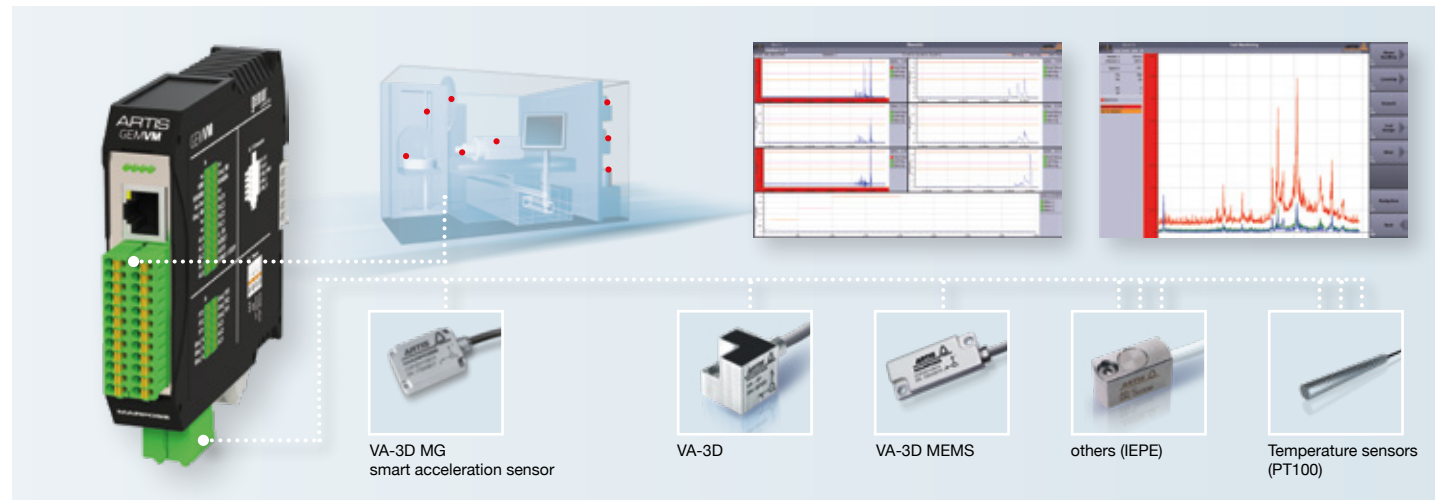
BENEFITS

- For use with all machine types, robots, assembly units etc.
- Simple machine integration, independent of machine controls
- Choice based on requirements (GEMAMS or GEMCMS)
- Permanent monitoring always active
- Event memory: date and time of limit violations
- Tracking and analysis of stored entries
- Fast alarm output for stopping the machine drives

MACHINE



MACHINE CONDITION VIA VIBRATION / DISTANCE MONITORING AND DIAGNOSIS



GEMVM

PRODUCTION APPLICATION

- Deviating vibrations during the machining process
- Simple tool and process monitoring based on available sensor signals and defined scenarios
- Analysis and optimization of (machining) processes online or in follow-up on the basis of the stored measurement data
- Tool unbalance detection
- Detection of dynamic collisions or crashes
- Reliable recording of events/alerts

MACHINE INTEGRATION

- Simple integration via physical I/O interface
- Operation with automatic limits for all graphs (GEMCPU)
- Individual limit parameters can be set for up to 8 processes (scenarios)
- Optional analog output 0-10 V
- Recording of alarm events (black box)

VISUALIZATION VIA GEMVM PLUG-IN

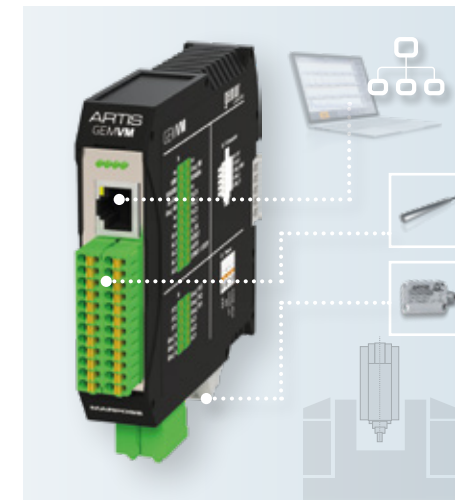
- All sensor signals and one FFT can be displayed
- 3 limits definable for each graphic window (3x acceleration, 3x vibration, 1x FFT)
- 3x temperature (1x for each sensor)

MAINTENANCE SOFTWARE TOOL

- Detection of spindle bearing damages
- Localization of wear and defects on drive axes
- Vibration recording of up to 3 axes
- Frequency analysis via FFT evaluation
- Failure forecast based on temperature rises
- Diagnosis for detection of bearing damage
- Detection of misalignment and wear of guides by including gravity signals
- Activation of individual limits for each signal and each FFT
- Data transfer in CSV-format
- VISUSCOPE analysis tool

OPTIMIZATION OF MACHINE AND PROCESS PARAMETERS

VisuScope is an ideal tool for the quality assurance of new machines and machines in operation. The software is part of GEMVM and works with WINDOWS on PCs or IPCs. It is suitable for online and post-machining evaluations.



GEMVM VISUSCOPE

SCOPE OF FUNCTIONS

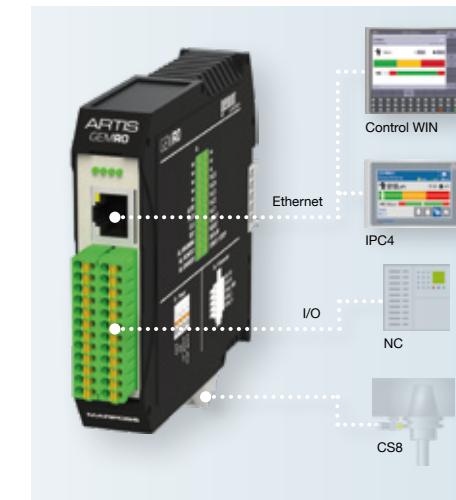
- Enhanced diagnosis of the collected GEMVM data - online or offline
- Detecting anomalies via signal filters (TP, HP, RMS, etc.)
- Display modes: FFT, PolarPlot, PSD, NDS, etc.
- Camera port for parallel video recording

TYPICAL APPLICATIONS

- Machine diagnosis and damage assessment
- Inspection after repairs, modifications or collisions
- Analysis of processes and influences from the environment
- Periodic comparisons of machine conditions

DETECTION OF TOOL HOLDER RUN-OUT

The GEMRO02 system offers ideal protection against unforeseen machining errors thanks to the fast and reliable identification of chips on the spindle chuck after ATC operation.



GEMRO02

SCOPE OF FUNCTIONS

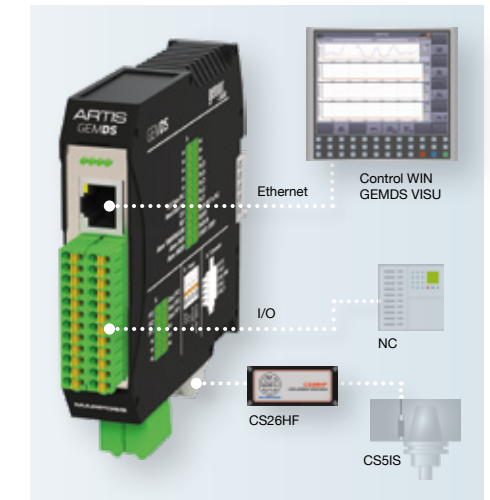
- Detection of deviations of the tool holder position in the spindle cone caused by dirt (chips) is possible from 10 µm chip thickness onwards
- No errors due to interrupted surface of the tool holder (notches)
- Distance measurement in 400 ms
- 2 deviation alarms (warning and error)
- Position monitoring of the sensor

TYPICAL APPLICATIONS

- Prevention of sporadic quality defects
- Inspection after each tool change
- Automatic troubleshooting possible without operator intervention; in the event of an ARTIS error message, the machine control can initiate tool removal and a new cleaning by air
- Use especially recommended for e.g. aluminum machining

SYSTEM FOR SPINDLE POSITION MONITORING

The GEMDS system provides real-time monitoring of the spindle position (of spindle growth) due to temperature changes or displacements caused by heavy loads on the Z-axis.



GEMDS

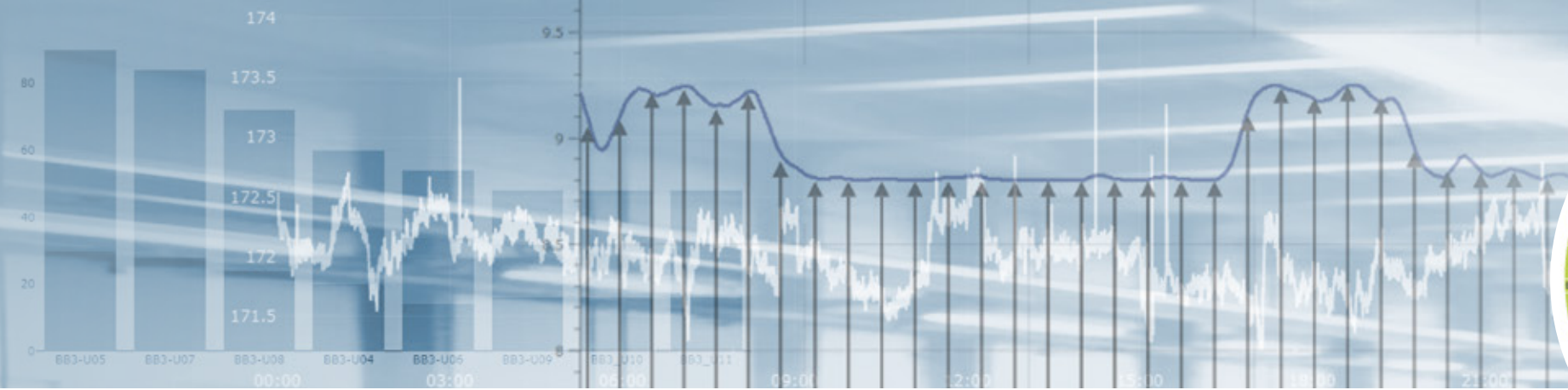
SCOPE OF FUNCTIONS

- The eddy current sensor measures distance and position changes
- The measuring range lies at 550 µm and the accuracy is +/- 0.2 µm
- Additionally, 3 temperature signals (PT-100) can be monitored
- The integration is done via digital I/Os

TYPICAL APPLICATIONS

- Machines and systems with high precision requirements
- Slight deviations in spindle position result in rejects or require costly rework
- Quick intervention in case of sporadic temperature variations possible (e.g. correction of cutting parameters)

FACTORY 4.0



C-THRU4.0 DATA MANAGEMENT



GENERATE USABLE INFORMATION FROM MONITORING DATA

ARTIS systems in machine tools provide the main benefit by detecting anomalies and reacting autonomously as quickly as possible. Operator intervention is only necessary to a limited extent. This means that monitored machines can also be operated unmanned during ghost shifts.

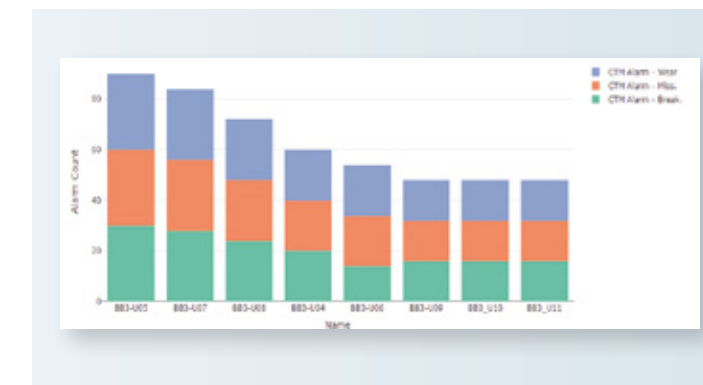
With the targeted use of ARTIS monitoring, concrete measurable results are automatically generated, which can be displayed and evaluated using the ARTIS **C-THRU4.0** system. Deviations and trends can thus be visualized over longer periods of time and approaches can be made to increase availability and better plan personnel and energy requirements. This has corresponding efficiency and cost benefits.

C-THRU4.0 helps to realize the SMART FACTORY in small steps without high investments and risks.

Application and benefit

- Transparency and overview of machines, tools and processes
- Data basis is generated automatically (no manual recording) and stored in an SQL database (internal or external medium)
- Recording of signal deviations is essential
- Trends and reports can be used to control activities and capacities in a targeted manner and to make well-founded decisions
- Paperless reports and documents can be generated easily and customer-specific
- Different interfaces enable data transfer to other systems (CSV, MQTT,...)

SOFTWARE MODULES EVALUATING ARTIS MONITORING DATA



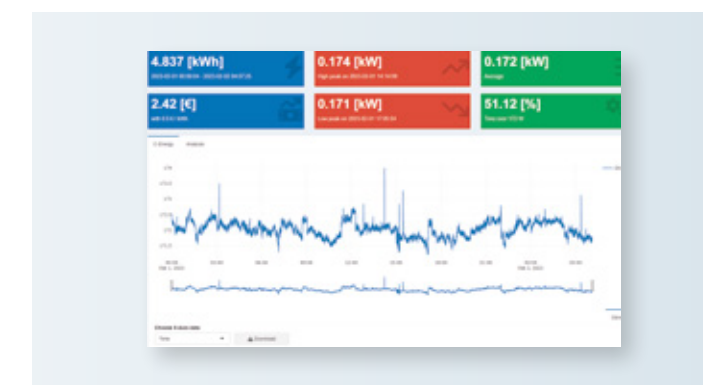
C-ANALYSE

All stored data from machines, tools and processes can be filtered and evaluated in relation to time periods. Different visualizations, reports and trends can be generated.



C-TOOLING

Using the tool numbers, an overview can show the consumption. A graphic shows the sum of the tool changes. The tool costs can thus be determined.



C-ENERGY

Energy costs now play a significant role in production costs. The module provides an overview of the energy consumption and peaks of machines or aggregates. With other monitoring data, savings potentials can be determined.



C-OEE

The automatically collected data is used to determine the OEE key figure. The factors are production time, tool change times, downtimes due to errors and alarms.



**EVERY CHIP HAS ITS STORY...
WE MAKE IT VISIBLE!**



www.marposs.com

For a full list of address locations, please consult the Marposs official website

ODN6421EN08 - Edition 05/2023 - Specifications are subject to modifications.
© Copyright 2023 MARPOSS Monitoring Solutions GmbH (Germany) – All rights reserved.

BRANKAMP, MARPOSS and Marposs product names/signs mentioned or shown herein are registered trademarks or trademarks of Marposs in the United States and other countries. The rights, if any, of third parties on trademarks or registered trademarks mentioned in the present publication are acknowledged to the respective owners.

Marposs has an integrated system for Company quality, environmental and safety management, with ISO 9001, ISO 14001 and OHSAS 18001 certification. Marposs has further been qualified EAQF 94 and has obtained the Q1-Award.



www.artis.de