CAT III 1000V
CAT IV 600V

HV-Eingang
±1 kV isoliert

SMARTMini

Analog IN

DC In

IIII Edge & Cloud Solutions

Get started with

INDUSTRIAL DIGITISATION
WITH OPTIMEAS

Simple | Effective | Secure

OPTIMEAS

OPtiMEAS

OUTSTANDING. RELIABLE. HUMAN.

Contents

ABOUT US

» Founded in 2010
» Company headquarters in Friedrichsdorf im Taunus, Germany
» Interdisciplinary team of engineers and scientists
» Specialist for software, hardware and cloud solutions in industrial digitisation
» Service provider and manufacturer with production located in Europe
» Network of competent partners
» Certified in accordance with ISO 9001:2015

"
optiMEAS' vision is to use the digital networking of humans and machines to optimise corporate processes and products and make them more efficient for in the longterm."

Do you speak IoT?

The wave of digital transformation that is overtaking industry is unstoppable. While pioneers on the forefront of the trend are already presenting their solutions, other companies delay due to a lack of transparency about their expenses and costs, or because they simply do not have the resources they need. We want to support you with our many years of experience and expertise in digitisation. We can do so by acting as a guide and consultant, by delivering finished components, or by providing a custom-tailored blend of both of these services.

Digitisation offers companies across different industries lots of ways to optimise their operations. For instance, in mobile machinery these include remote diagnostics and teleservices, which help improve availability and lead to verifiable cost savings for manufacturers and operators alike. Using dynamic historical data makes it possible to improve product quality even during development. Intelligent analysis helps us identify trends and prepare forecasts for the purpose of predictive maintenance.

Digitisation creates opportunities and business models by building on past solutions. To bring these to market with predictable time and expense requirements and to limit your risk, you need the right partner to develop and implement appropriate digitisation concepts. IIII

Sincerely,
Burkhard Schranz

Managing Partner of optiMEAS

We don't just speak IoT, we live it!

For years, **optiMEAS** has been supporting production companies, service providers and customers in a wide range of industrial areas in successfully implementing ambitious IoT and Industry 4.0 applications.

As a technology partner offering a comprehensive approach, we can support your digital transformation from A to Z. Our active team will guide your project through to live operation. IIII

What if your
machines could talk?

You could ask each machine what it was doing - and how it was doing, too. You could use that knowledge to make better, faster decisions, take action sooner, save costs and resources, and even implement new, data-based business models.

We handle all of these issues for you.
We partner with you. We offer comprehensive, cloud-based IoT solutions for mobile data recording, tracking, monitoring & diagnostics.

DATA RECORDING & TRACKING   **CLOUD SOLUTIONS**   **MONITORING & DIAGNOSTICS**
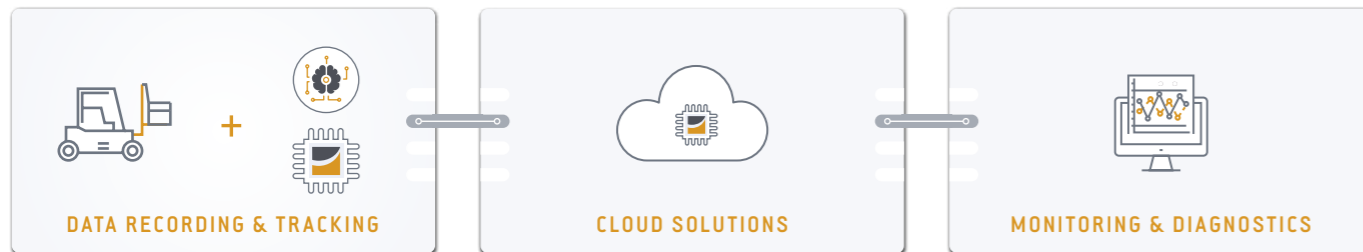
REAL TIME CONTROL FROM ANYWHERE IN THE WORLD

We network machines, vehicles, components or entire systems, and combine real-time data on their operating and usage states. This allows us to offer you a wide range of innovative IoT applications.
You can track the status or behaviour of your machines live, or review them in more detail later on. Then, you can draw key conclusions to your questions from all of this data. There's no need to reinvent the wheel! Instead, we offer a wide range of ready-to-use, tested products and solutions from our company. ||||

We bring your equipment into the conversation:

With coordinated IoT components, developed and manufactured in-house. We develop components based on our extensive expertise in measurement and automation technology.

1. EDGE SOLUTIONS
Intelligent Edge Devices with a gateway function for seamless data recording and transmission.

2. SMART I/O MODULES
To connect to almost all sensors.

3. CLOUD SOLUTIONS
IoT platform for data storage, real-time visualisation, diagnostics, alarms and analysis with interfaces to Business Integration and data and device management functions.

4. SOFTWARE FRAMEWORK SMARTCORE®
Patented embedded software for the implementation of individual IoT applications, suitable for any IoT hardware (included in Edge Devices from optiMEAS).
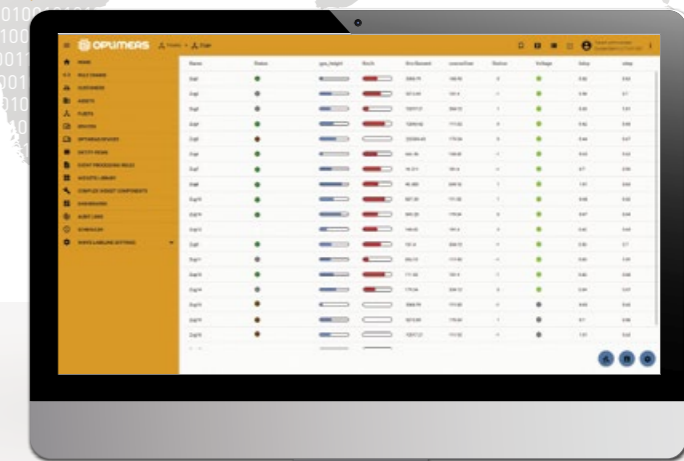
As a complete provider, we serve the entire digitisation chain, from sensors to cloud-based analysis. We create custom-tailored solutions, combined with individual advising and customer-specific services. ||||

What if you could turn measured values into measurable added value?

Use digitisation to increase your company's added value and secure your market position - Just like our customers from across different different industrial areas have done by having us create application- and industry-specific adapted solutions.

TESTED DIGITISATION SOLUTIONS FOR

» Construction and transportation sector
» Energy and environmental engineering
» Automotive & railway industries
» System technology & production

Generate true added value through cost savings and better efficiency on every level.

Digital networking offers potential improvements for every corporate area. As a specialist with a broad range of application expertise, we review different options and create an optimal system to achieve your business goals.

MONITORING
Increase availability and quality, while lowering costs.
Cloud-based monitoring is the foundation for our IoT solutions. You achieve complete control of your machines, components, and entire machine fleets, regardless of your location. Automated alarm functions alert you if limit values are violated, and remote access helps you avoid production stoppages, delivery delays and production errors. IIII

PREDICTIVE MAINTENANCE
Figure out today what will break down tomorrow.
Combined analysis of current and historical machine data helps identify contexts and trends. Complete maintenance and repair processes in a predictive manner, based on reliable forecasts of wear behaviour. This saves costs and resources. IIII

PRODUCT DEVELOPMENT
Avoid weak areas, accelerate time-to-market.
Real operating and usage data are essential to product development and optimisation. With **optiMEAS**, you can evaluate live and historical data and upload the results directly into your development. You can also use recorded data for comprehensive big data analysis. IIII

SMART SERVICES
Tap into new sources of income, and generate long-lasting customer loyalty.
Data-supported product services offer huge potential direct and indirect savings. For service providers and manufacturers who want to become service providers, as well as for operators who need to save investment costs and increase flexibility by using "as a service" offers. IIII

What if you could digitise without risk?

We are a member of your team. Use our commitment and expertise to save valuable resources.

Don't delay - start your transformation now. We are your experienced partner, and help you assess potential risks realistically. We use highly-scalable, flexible, and adaptable products to create solutions that will be a secure long-term investment.

EVERYTHING FROM A SINGLE SOURCE

Digitisation projects can be highly complex. We are more than just a contact providing thoughtful support to your project. From initial consultation to planning, implementation, and support for ongoing operations. IIII

MANUFACTURER QUALITY

Because we maintain our own production facility, our products fulfil the highest quality standards and offer long-term availability. We know our components, down to the smallest detail. IIII

IMPLEMENTATION EXPERTISE

Developing customer-specific hardware and software is one of our strengths. Proven methods shorten the time from pilot run to series production. IIII

POWER OF INNOVATION

We are continuously developing our products and solutions. This includes integrating forward-thinking technologies like artificial intelligence and machine learning. IIII

RELIABILITY

Extremely robust systems with sophisticated watchdog concepts guarantee one hundred percent failsafe reliability. IIII

PASSION

We aren't exaggerating when we say that digitisation is our passion. Utilise our expertise, instead of spending time building up in-house experience. IIII

⚠ CAT III 1000V
CAT IV 600V

HV-Eingang
±1 kV isoliert

DC In

SD

Analog IN

Mini SMARTMINI

optiMEAS

WHAT IS IMPORTANT TO US?

Sustainable, socially and ecologically responsible action. We don't consider environmental compatibility to be a nice side effect, but rather a central aspect in the quality of products and processes. We want to use our ideas and solutions to help industries save CO_2 and use resources more efficiently. IIII

Our core value is „business with heart." This is essential to our joint success.

We are convinced that the future world of work will be one where human and economic considerations are not in conflict - and where digitisation provides smart support and relief to human actors.

Both internally and in our collaborations with our customers and project partners, we value fair cooperation with personal, authentic engagement among equals. Our approach is *"business with heart"*, which we consider a key element of our corporate culture.

TECHNOLOGY IS MORE THAN JUST AN END IN ITSELF

Instead, we see technology as a way to make life better. We pursue this goal alongside our customers through long-term win-win relationships. IIII

business with heart
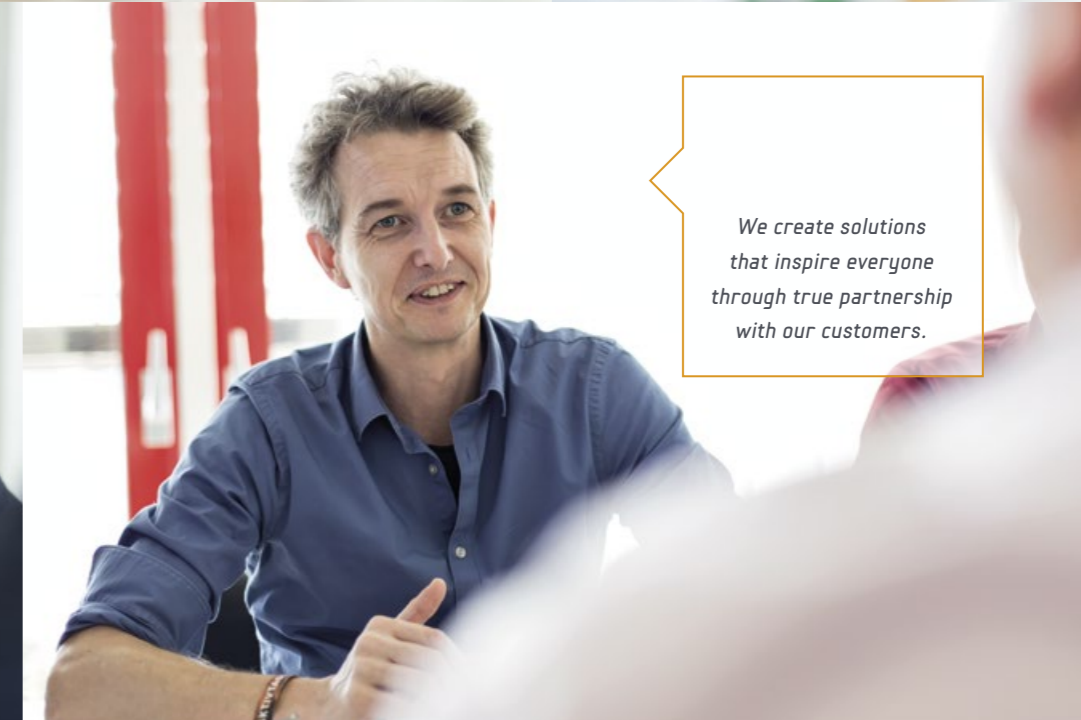
TRUSTWORTHY

SUSTAINABLE

FAIR

PARTNER-BASED

TRANSPARENT
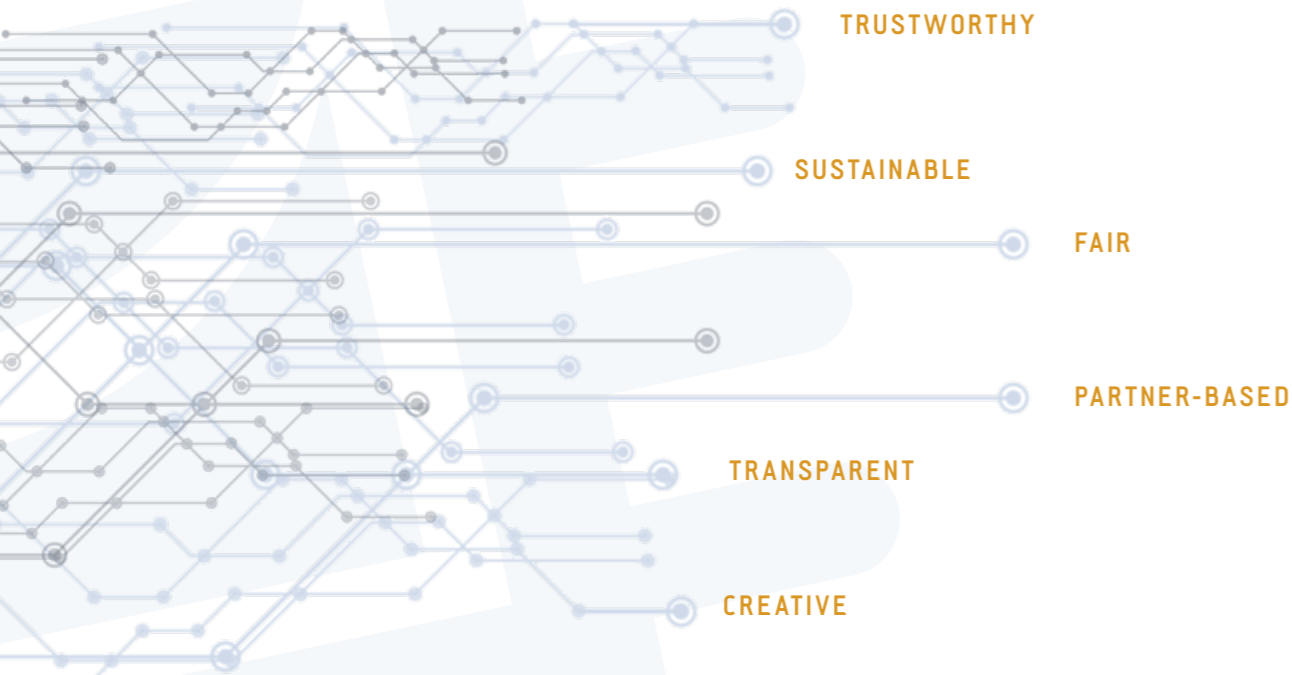
CREATIVE

For me, IoT means always connecting people to one another too.

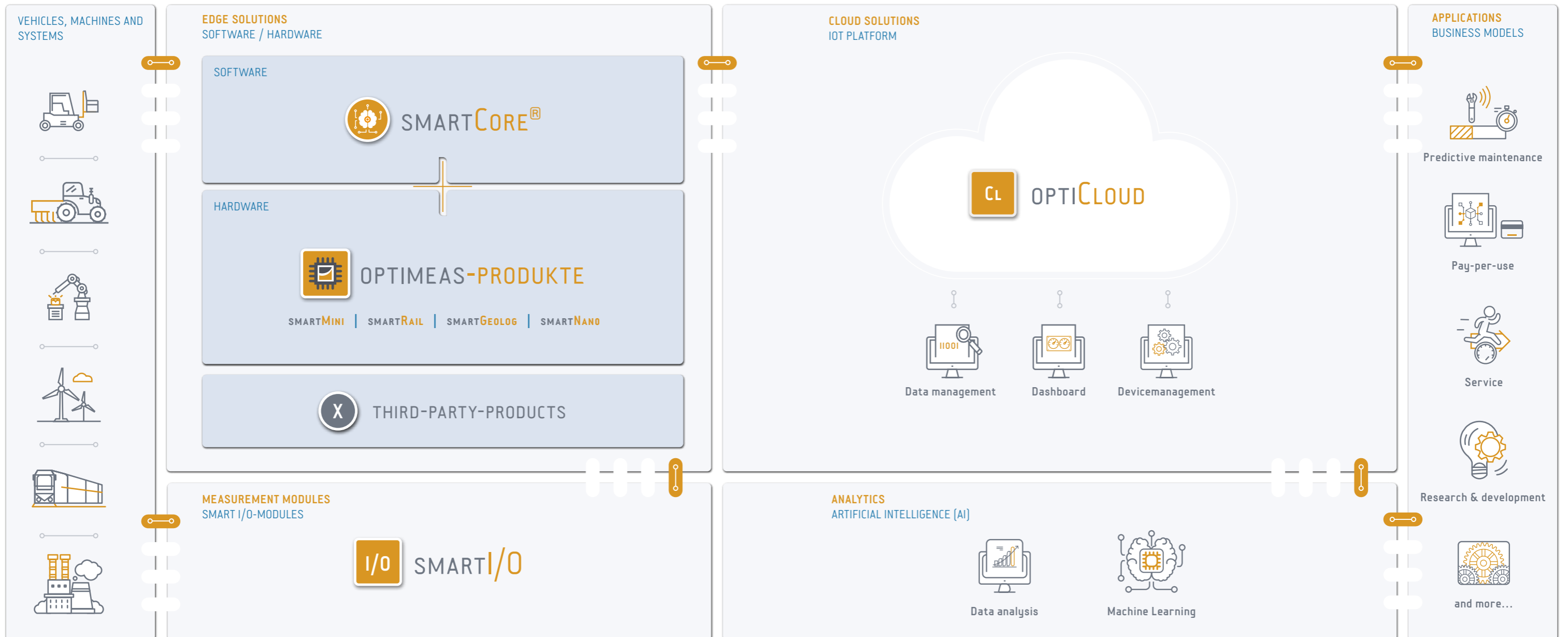Stand-up meetings are part of our agile approach.

We create solutions that inspire everyone through true partnership with our customers.

We will guide you through a collaborative and custom-tailored digital transformation

Benefit directly from our comprehensive product range that reflects the entire digitisation process. Use our product to create all-new business models for your enterprise, based on your core activities.

Components or complete systems: all components work perfectly together, or can be integrated seamlessly into existing structures and third-party environments. No matter your circumstances, we provide the best solution to meet your digitisation goal. IIII

VEHICLES, MACHINES AND SYSTEMS

EDGE SOLUTIONS
SOFTWARE / HARDWARE

SOFTWARE

SMARTCORE®

HARDWARE

OPTIMEAS-PRODUKTE

SMARTMINI | SMARTRAIL | SMARTGEOLOG | SMARTNANO

X THIRD-PARTY-PRODUCTS

CLOUD SOLUTIONS
IOT PLATFORM

CL OPTICLOUD

Data management   Dashboard   Devicemanagement

APPLICATIONS
BUSINESS MODELS

Predictive maintenance

Pay-per-use

Service

Research & development

MEASUREMENT MODULES
SMART I/O-MODULES

I/O SMARTI/O

ANALYTICS
ARTIFICIAL INTELLIGENCE (AI)

Data analysis   Machine Learning

and more...

optiMEAS
Edge solutions

optiMEAS offers a tailored solution for seamless data recording for your application.

For industrial networking to succeed, real machine and location data must be seamlessly recorded, intelligently processed, and transferred without loss where it is produced. We offer high-quality equipment produced in-house for this purpose, which also serves as a data logger and gateway. Two product series fulfil different requirements:

OUR STANDARD EQUIPMENT: OPTIMEAS SMART SERIES

Modular design, adaptable to many different applications. In addition to the **smartMINI** universal systems, specialised options are available for railway traffic **(smartRAIL)** and seismic measurement **(smartGEOLOG)**. Almost any kind of sensor can be integrated via analogue/digital converters **(smartI/O)**. IIII

SMARTNANO SERIES: FOR SPECIALISED DEMANDS

Developed on a microcontroller basis: small, autonomous, and completely flexible. The spectrum of available options ranges from pre-assembled products to complete, customer-specific solutions. IIII

WHAT DOES EDGE STAND FOR?
In IoT, the edge is the "edge" of the network itself, the transition point to real machines and systems.

MINI smartMINI

Scalable
Universal IoT device

The smartMINI compact data logger is the standard device for loss-free recording and transmission of machine and system data. **smartMINI** stands out for its high performance capabilities and robust design. It is easy to integrate into existing structures, and an outstanding choice even for applications with difficult installation and environmental conditions.
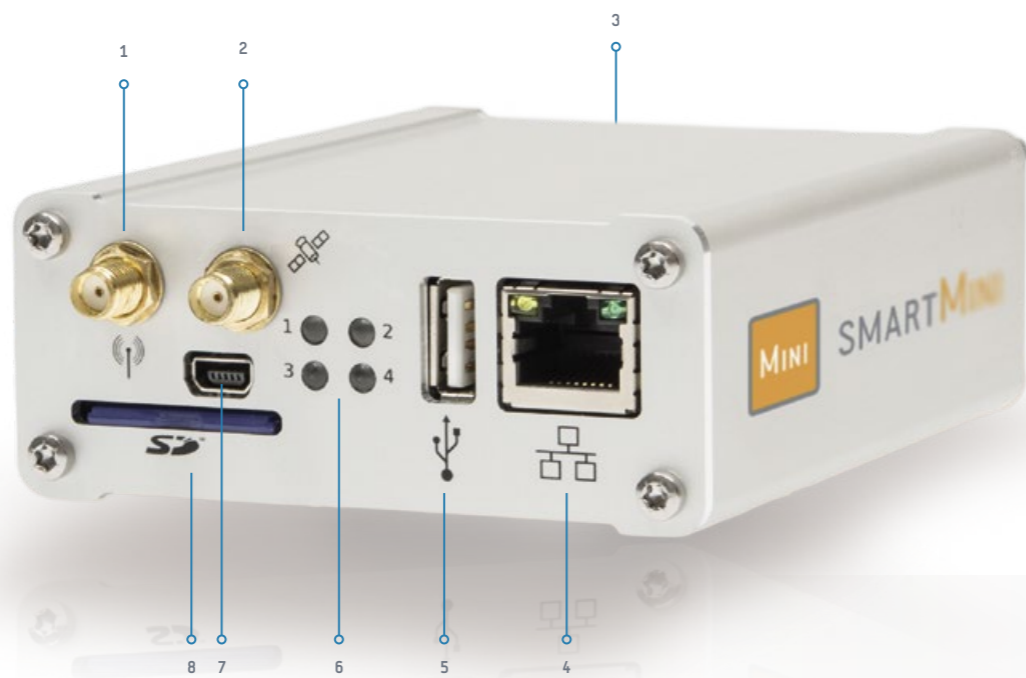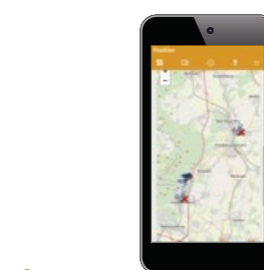
1. LTE
2. GPS
3. Digital In/Out
   Serial interface & 2 x CAN
4. Ethernet 100 MB
5. USB
6. Status LED
7. Service interface
8. SD card

Simple & smart
Each device delivers seamless, high-resolution measurement data & compact live data for your dashboard.

Real-time data on any mobile device.

www.optimeas.de

SMARTMINI COMPACT

» Continuous, loss-free
  data recording
» Global, stable, fast
  data transmission
» Integrated monitoring function
» Easy to handle, easy to integrate
» Extremely robust, temperature
  range -40° to +85°
» Security concept with watchdog
» Simple configuration and
  operation

MODULAR PRINCIPLE
Although it is a base device, **smartMINI** offers a complete IoT data logger with CAN, Modbus RTU/TCP, Ethernet, WLAN, multiple monitoring input and alarm outputs. Additional hardware and software modules make **smartMINI** a custom-tailored solution. ▪▪▪

INTEGRATED INTELLIGENCE
Flexible device function configuration via app. Standard apps for data recording, alarms if limit values are violated, and remote access are included in the basic equipment. Apps for application-specific measurement, monitoring, logging and automation functions can be added at any time, either via the PC operating software **optiCONTROL** or over the **optiCLOUD**. ▪▪▪

SEAMLESS DATA RECORDING
Recorded measurement data is transmitted over the cloud via LTE or ethernet based on specified time intervals in the **optiCloud** platform. Parallel data storage on an SD card protects against data loss if the wireless connection is interrupted. All real time and historical data is available for visualisation and analysis. ▪▪▪

OPTIMEAS
SECURITY CONCEPT
» Redundant real-time Linux distribution
» Power controller with watchdog function
» Secure data storage through
  specialised streaming processes
» SD card as a ring buffer
» Regular, automatic updates Over-the-Air
» Encrypted internet transmission
  via HTTPS and SSL

smartMINI

Mini

TYPICAL APPLICATIONS:

» Mobile machines, stationary systems, autonomous use

» Condition monitoring, remote diagnostics and teleservice

» Predictive maintenance

» Switching and control tasks

» Recording usage data, Smart Services

» Optimising operations, service, production, development

Success Story

Status monitoring and teleservice for mobile construction machinery
Zoomlion Cifa Deutschland GmbH

CIFA concrete pumps are complex, high-tech machines. This major manufacturer needed a teleservice system to minimise downtimes and optimise service.

They equipped their construction equipment with **smartMINI** systems that continuously record meaningful variables: the support geometry of the machine mast, pressures in the pump unit, the oil temperature, open or closed limit switches and other operating data. Service personnel can diagnose faults via remote diagnostics, order required replacement parts and initiate repairs. Differentiated analyses of real-time and historical data can be used to identify the causes of errors and carry out predictive maintenance measures. In addition, CIFA utilises its broad database to further develop its concrete pumps. IIII

Picture: CIFA S.p.A.

*Compared to the competition, **optiMEAS** essentially already offered ready-to-use solutions that exceed our needs. The device exceed all of our requirements very well, and is also small and easy to use".*

Martin Worch
Head of Service, Research and Development
Zoomlion Cifa Deutschland GmbH

Technical data sheet

smartMini		
Processor	CPU	NXP i.MX6S7 800 MHz, 1 Core
	DMIPS	2000
Memory	RAM	512 MB DDR3
Disk Space (Flash)	Embedded	4 GB eMMC, as RAID and Dual Boot for operating system and firmware
	µSD	Internal, optional emergency operating system
	SD	Externally accessible, buffering and storage of operating and measurement data, robust file system
I/O interfaces	Ethernet	10/100 MBps
	USB	USB 2.0, 1 x external (interference filter and overvoltage protection) + 1 x internal
	Serial	1 x RS232/RS485 (overvoltage protection, selectable via software)
	CAN 2.0B	2 x CAN-Bus, ISO 11898-2 (High-speed-CAN)
	Digital I/O	1 x digital inputs 5-36 V (isolated, wake-up function), 2 x digital output (50 mA; isolated)
Radio	Modem	Integrated 4G/CAT4 modem with QMI with Mini-SIM (25 x 15 mm)
	GPS	Integrated GPS, GLONASS, BeiDou, Galileo & QZSS (equipment variations, to 10 Hz, 2.5 m resolution)
Power supply	Input	9 -36 V
	Power intake	2.5 W open-circuit operation (5 W max)
Other	RTC	Yew (with gold cap buffering)
	Watchdog	Yes, separate microcontroller
	Sensors	Temperature, 3-axis acceleration sensor
	Measurement inputs	Supply voltage (1 Hz, 12 bit, battery monitoring)
	LEDs	4 (Power, WAN, GPS, App)
	Dual Boot	2 x separate operating system (with Watchdog and boot controller)
	Connections	Phoenix Mini CombiCon, RM 3,5 mm, USB-A
Environment	Protection rating	IP54 (alternatively IP68)
	Temperature	-40 °C to +85 °C (with anti-condensation protection)
Special standards		Certified in accordance with EN 50155:2007 - Climate §12.2.3, §12.2.4, §12.2.5 - Vibration IEC61373-9 - Shocks IEC61373-10 - Noise IEC61373-8 - EMC EN 50121-3-2: 2016, EN 61000-6-4 Fire protection EN 45545-2:2016-0 EMV06 interference to protect cab radio frequencies
Expansions		1 x internal slot for customer-specific expansions, currently available: - 2CAN FD: 2 x CAN FD with 2 x D-In (terminal 15 function) - MixedI/O: 3 x A-In (0-10 V), 2 x A-Out (0-10 V), 2 x D-In
Hardware expansion modules		
smartI/O module	USB/CAN	See "Smart I/O Module" chapter from page 36
J1708/J1587	CAN	External module for implementing J1708/J1587 on CAN
Ethernet	USB	External module - expands smartMINI with 2 ethernet interfaces, M12
RS232	USB	External module - expands smartMINI with 4 RS232 interfaces, M12
Customer-specific	USB/CAN/ETH	Customer-specific hardware expansions upon request
Included software		
OS		Yocto Linux with Kernel 4.4, PREEMPT_RT Realtime Patch, optimised for performance and package size
SDK		Yocto-based SDK in VM with Qt Creator, Remote Debugging Python 3.5 (LTS)
IoT Framework		smartCORE (embedded solution for collecting, recording, analysing and transmitting measurement and operating data. Includes cloud connection and device management. No programming required!)
Cloud features		Secure software and firmware updates over-the-air (FOTA), dashboards
PC software		optiCONTROL (device configuration), optiVIEW (measurement data display), optiMATOR (automated analysis & event search)
Optional software for data loggers and diagnostic operation		
CAN DBC		Data logger for recording and interpreting RAW-CAN data based on DBC files
CAN MTU		Data logger to connect to an MTU controller with complete data interpretation
J1939		Data logger based on the J1939 protocol
Distance counter		Odometer with location and speed
APP		Upon request, we are happy to create customer-specific apps or to integrate additional communication protocols

RAIL smartRAIL

Edge system
for railway applications

SmartRAIL offers a specialised device for condition monitoring and condition-based maintenance in railway transportation. It can monitor the status of individual components relevant to safety and availability, or complete railway vehicles or railway fleets. This makes it possible to initiate required measures early on and minimise problems.

1. Passive cooling
   Quad-core processor
2. RS485
3. Digital In/Out, 2 x CAN
4. GPS & LTE
5. USB
6. Power supply
7. Status LED
8. Ethernet 100 MB

SMARTRAIL COMPACT

- » Seamless, loss-free data recording
- » High computing power thanks to Quad-core processor
- » Requires little space, low current consumption
- » Non-reactive connection
- » M12 plug connector
- » Passive cooling concept to 85° Celsius

www.optimeas.de

COMPLETELY RAILWAY-CERTIFIED

smartRAIL is based on the smartMINI, and is adapted to railway-specific requirements. It uses the M12 plug connector designed for railway use, includes both a GPS and an acceleration sensor, and is easy to expand using external MVB adapters and IO modules. ||||

smartRAIL is certified in accordance with railway standard EN 50155, EN 45543 & IEC 61373.*

* For exact details, see the technical data sheet

SPECIALISED APPS

The logger functions are configured via intelligent apps that can be uploaded to the device software at any time. In addition to standard apps and an integrated odometer, smartRAIL offers pre-configured apps for railway applications:

- » Vibration measurements, specifically on freight cars
- » Recording torque and speed curves
- » Recording movement data
- » Monitoring battery and on-board voltage

WITHOUT DATA LOSS

smartRAIL is specifically tailored to the high demands of the railway industry Data is recorded seamlessly, and is not lost even if the wireless connection is interrupted. ||||

OPTIMEAS SECURITY CONCEPT

- » Redundant real-time Linux distribution
- » Power controller with watchdog function
- » Regular, automatic updates Over-the-Air
- » SD card as a ring buffer
- » Encrypted internet transmission via HTTPS and SSL

RAIL SMARTRAIL

Success Story

Testing railway components in the on-board network
DB Systemtechnik GmbH on behalf of DB Regio AG

Functional tests and performance measurements under real conditions are indispensable for the development and testing of traction vehicle components. In the on-board network, frequently activated parts with a high power consumption cause voltage peaks, high currents and large reactive power components. Additionally one faces micro-interruptions of the power supply at the pantograph as well as short sections of track without voltage.

On behalf of DB Systemtechnik, optiMEAS developed an IoT solution that monitors components in real operation. Equipped with smartRAIL and an external module for power measurement, the system continuously records functional and performance data which are being transferred without loss to the IoT platform optiCLOUD. Railway engineers are then able to access, filter and analyse the data as required.

smartRAIL is railway-certified, extremely robust and operates maintenance-free for months. Once installed, the device records valuable data without impairing the availability of the traction unit. The knowledge gained about network quality helps to increase the reliability of railway components. ||||

optiMEAS impresses with its technical expertise, failsafe systems, broad perspective and a flexible, solution-oriented team".

Felix Heim
Project Manager of Portfolio Development,
DB Systemtechnik GmbH

DB
DB Systemtechnik

Technical data sheet

smartRAIL		
Processor	CPU	NXP i.MX6QP7 800 MHz, 4 Core
	DMIPS	8000
Memory	RAM	2048 MB DDR3
Disk Space (Flash)	Embedded	4 GB eMMC, as RAID and Dual Boot for operating system and firmware
	µSD	Internal, optional emergency operating system
	µSD	Buffering and storage of operating and measurement data, robust file system
I/O interfaces	Ethernet	10/100 MBps
	USB	USB 2.0, 1 x external (interference filter and overvoltage protection)
	Serial	1 x RS232/RS485 (overvoltage protection, equipment variation)
	CAN 2.0B	2 x CAN-Bus, ISO 11898-2 (High-speed-CAN), with supply voltage transmission
	Digital I/O	1 x digital input 5-36 V (isolated)
Radio	Modem	Integrated 4G/CAT4 modem with QMI with Mini-SIM (25 x 15 mm)
	GPS	Integrated GPS, GLONASS, BeiDou, Galileo & QZSS (equipment variations, to 10 Hz, 2.5 m resolution)
Power supply	Input	9-36 VDC with input voltage protection and polyfuse
	Power intake	2.5 W open-circuit operation (10 W max)
Other	RTC	Yes (with gold cap buffering)
	Watchdog	Yes, separate microcontroller
	Sensors	Temperature, accelerometer
	Measurement inputs	Accelerometer
	LEDs	4 programmable, 2 x LAN
	Dual Boot	2 x separate operating system (with Watchdog and boot controller)
	Connections	M12
Environment	Protection rating	IP54 (alternatively IP68)
	Temperature	-40 °C to +85 °C (with anti-condensation protection)
Special standards		Certified in accordance with EN 50155:2017 - Climate §13.4.5.2, §13.4.5.3, §13.4.5.7 - Vibration §13.4.11.2 (IEC 61373 §9) - Shocks §13.4.11.3 (IEC 61373 §10) - Noise §13.4.11.4 (IEC 61373 §8) - EMC §4.3.6 (EN 50121-3-2, EN 61000-6-4) Fire protection EN 45545-2:2016-0 EMV06 interference to protect cab radio frequencies
Expansions		none
Hardware Expansion Modules		
smartI/O module	USB/CAN	See "Smart I/O Module" chapter from page 36
J1708/J1587	CAN	External module for implementing J1708/J1587 on CAN
Ethernet	USB	External module - expands smartRAIL with 2 ethernet interfaces, M12
RS232	USB	External module - expands smartRAIL with 4 RS232 interfaces, M12
Customer-specific	USB/CAN/ETH	Customer-specific hardware expansions upon request
Included Software		
OS		Yocto Linux with Kernel 4.4, PREEMPT_RT Realtime Patch, optimised for performance and package size
SDK		Yocto-based SDK in VM with Qt Creator, Remote Debugging Python 3.5, Oracle JAVA 8 (LTS)
IoT Framework		smartCORE (embedded solution for collecting, recording, analysing and transmitting measurement and operating data. Includes cloud connection and device management. No programming required!)
Cloud features		Secure software and firmware updates over-the-air (FOTA), dashboards
PC software		optiCONTROL (device configuration), optiVIEW (measurement data display), optiMATOR (automated analysis & event search)
Optional Software for data logging and diagnosis requirements		
CAN DBC		Data logger for recording and interpreting RAW-CAN data based on DBC files
CAN MTU		Data logger to connect to an MTU controller with complete data interpretation
J1939		Data logger based on the J1939 protocol
Distance counter		Odometer with location and speed
APP		Upon request, we are happy to create customer-specific apps or to integrate additional communication protocols

Geo SMARTGEOLOG

Monitoring system
for seismic measurements

The **smartGEOLOG** complete system is specially designed to take geological and geophysical seismic measurements in difficult environments. This means it is a great choice for real-time monitoring of construction work, and for long-term monitoring of buildings and other sources of seismic vibrations.
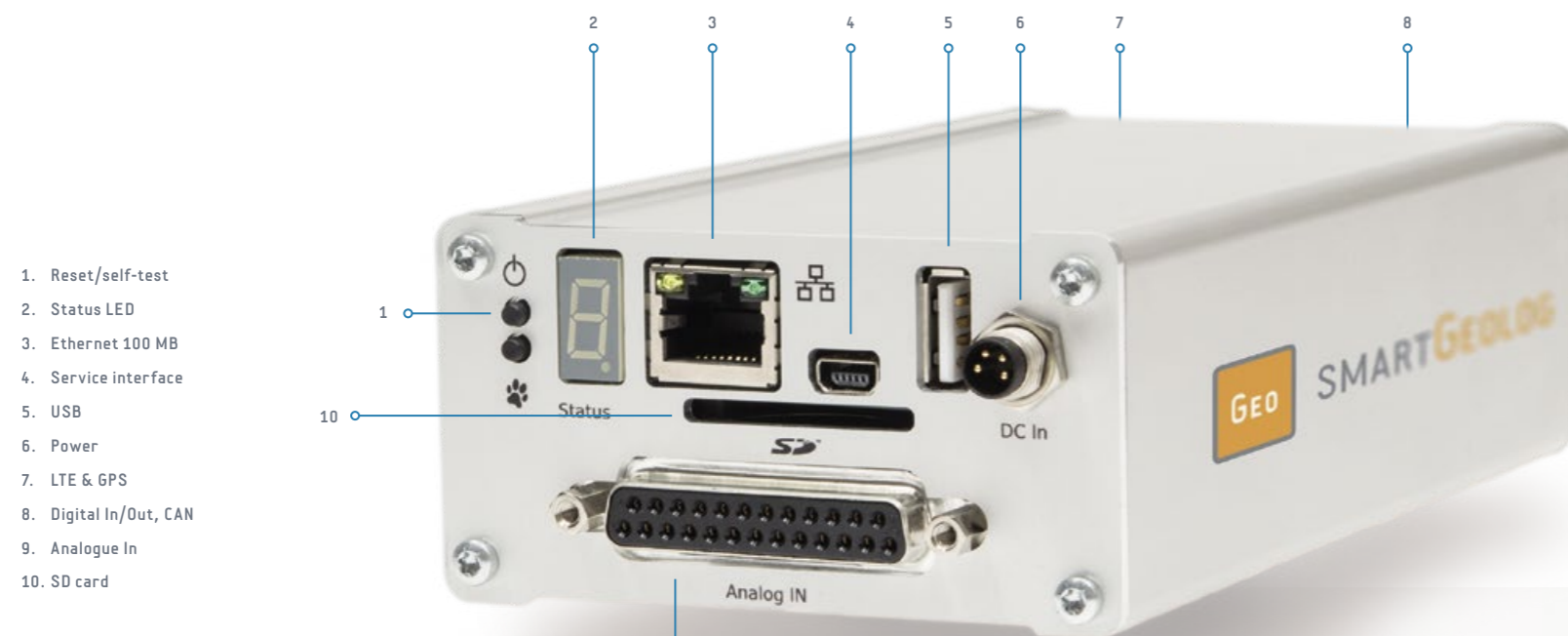
1. Reset/self-test
2. Status LED
3. Ethernet 100 MB
4. Service interface
5. USB
6. Power
7. LTE & GPS
8. Digital In/Out, CAN
9. Analogue In
10. SD card

Status

DC In

Analog IN

Location & alarm
smartGEOLOG brings vibrations to light.

www.optimeas.de

SMARTGEOLOG COMPACT

- » Seamless data recording
- » Integrated alarm function
- » Highly-precise synchronisation of distributed devices
- » High sampling rate up to 5 kHz
- » Robust, with low current consumption
- » DIN 4150 conforming

SMART SEISMOMETER

smartGEOLOG is based on the **smartMINI** and has been adapted to seismological measurement requirements through hardware and software. Integrated acceleration sensors record vibrations with a high level of precision. IIII

CONFORMS TO DIN 4150

DIN 4150 specifies how the influence of vibrations on buildings should be measured and analysed.
The binding specified limit values for short-term and long-term vibrations are

integrated directly into **smartGEOLOG** via an app. If these are exceeded, an alarm is triggered automatically. IIII

SYNCHRONISED AND INTELLIGENT

smartGEOLOG devices are distributed across a large area to record seismic events synchronously, with a resolution of better than ten microseconds. Intelligent settlement functions on a cloud server ensure that error events triggered by disruptive factors are reliably detected and eliminated. IIII

SEISMOSUITE SPECIALISED SOFTWARE

The **SeismoSuite** is an optimal addition to **smartGEOLOG**. Tailored to seismological monitoring, the software tool offers extensive analytic and alarm functions:

- » Input and adjustment of model and geometric data
- » Scripts for automatically determining the start of seismic waves
- » Localisation algorithms
- » Magnitude calculations
- » GeoMaps to display results
- » Alarm if threshold values are exceeded

Geo SMARTGEOLOG

TYPICAL APPLICATIONS:

» Mobile monitoring of vibration sources

» Localisation and qualification of seismic events

» Long-term monitoring of buildings and mining

» Emission protection in railway and street traffic

» Monitoring explosions and construction projects

Success Story

Prompt alarms during excavation in mining areas
K-UTEC AG Salt Technologies on behalf of LMBV mbH

Three people died during a landslide on the Concordia See, a partially-flooded, abandoned quarry near Nachterstedt, in 2009. In order to provide an alarm in case of unpredictable movements in the embankment, K-UTEC AG installed a network of robust **smartGEOLOG** systems on behalf of LMBV. They are used for seismological monitoring of the area, helping to keep the clean-up process safe.

Vibration sensors connected to the **smartGEOLOG** systems collect, record and analyse all seismic events with a very high level of resolution. If a threshold value is violated, an alarm is triggered automatically, sounding an acoustic signal and activating a traffic light. The early warning system serves to promptly warn personnel working in the danger zone before another landslide occurs. Recorded data is also used for further analysis. ▐▐▐▐

"

When developing the SeismoSuite, we had a solid work flow with set partners on both sides. We were able to contribute our ideas and requests for new software components. Combined with the expertise of optiMEAS, we were able to create a high-quality, state-of-the-art product".

Daniel Blumrich
Development at K-UTEC AG Salt Technologies

K-UTEC
SALT TECHNOLOGIES

Technical data sheet

smartGEOLOG		
Processor	CPU	NXP i.MX6S7 800 MHz, 1 Core
	DMIPS	2000
Memory	RAM	512 MB DDR3
Disk Space (Flash)	Embedded	4 GB eMMC, as RAID and Dual Boot for operating system and firmware
	µSD	Internal, optional emergency operating system
	SD	Externally accessible, buffering and storage of operating and measurement data, robust file system
I/O interfaces	Ethernet	10/100 MBps
	USB	USB 2.0, 1 x external (interference filter & overvoltage protection) + 1 x internal
	CAN 2.0B	2 x CAN-Bus, ISO 11898-2 (High-speed-CAN), isolated
	Digital I/O	4 x digital inputs 5-36 V (isolated, wake-up function) 4 x digital outputs (500 mA; isolated)
Radio	Modem/GPS	smartMODUL LTE/GPS, 4G/CAT4-Modem, GPS, GLONASS
Power supply	Input	10-36 V, isolated; alternative 17.5 to 36 V, not isolated
	Power intake	2.5 W open-circuit operation (5 W max)
Other	RTC	Yes (with gold cap buffering)
	Watchdog	Yes, separate microcontroller
	Sensors	Temperature
	Measurement inputs	1 x Pt100/NTC, 1 x Spannung ±25 V, 1 Hz, 10 bit smartMODUL 8U5K, 8 analogue inputs, ±10 V, 24 bit, 5 kHz sampling frequency, GPS-synchronized
	LEDs	7 segment display, 1 x buzzer, 2 x switch
	Dual Boot	2 x separate operating system (with Watchdog and boot controller)
	Connections	DSUB9, HDSUB15, USB-A
Environment	Protection rating	IP54
	Temperature	-40 °C to +70 °C (with anti-condensation protection)
Included Software		
OS	Yocto Linux with Kernel 4.4, PREEMPT_RT Realtime Patch, optimised for performance and package size	
SDK	Yocto-based SDK in VM with Qt Creator, Remote Debugging Python 3.5 (LTS)	
Cloud features	Secure software and firmware updates over-the-air (FOTA), dashboards	
PC software	optiCONTROL (device configuration), optiVIEW (measurement data display), optiMATOR (automated analysis & event search)	
Optional Software for data logging and diagnosis requirements		
GEO LOG	Application for recording geological signals and events	

smartNano

IoT microcontroller
for specialised systems

Microcontroller-based **smartNANO** devices are the optimal choice for specific requirements, small installation areas or when no power supply is available. Available as a pre-configured version or custom solution, they are an outstanding choice for applications in machines, vehicles and systems that require a robust device. Installation work is minimal, thanks to their extremely compact size.

1. Sensor connections
2. Charging jack/configuration/ firmware update
3. Integrated power supply

SMARTNANO COMPACT

» Autonomous use with optional battery operation
» Low power intake, long run time
» Compact design
» Cost efficiency through high volume
» Data storage on SD card
» Integrated wireless modem and GPS receiver
» Flexible, expandable

Ready to go
Once installed, **smartNANO** delivers measurement & GPS data, protects against theft & connects to the **optiCLOUD**.

CUSTOM-TAILORED

smartNANO is the smallest and most flexible platform for recording and transmitting measured data to the cloud, equipped with onboard sensors for location and acceleration.

Flexibly integrated interfaces, sensors, protocols and software allow **smartNANO** to adapt to any IoT requirement. Power can be supplied by either a power pack or conventional or rechargeable batteries.

Overview of device variations

SMARTNANO TRAC
Base device for simple tracking and logging requirements, with position detection and digital input, ideal for recording operating hours and for theft protection. IIII

SMARTNANO FMS
Also equipped with a standardised fleet management interface (FMI) for commercial vehicles to record usage and vehicle parameters. IIII

SMARTNANO CAN
Expanded base device with connection options for **smartI/O** modules and CAN interface, with logging for up to 40 commands. Optimal for recording analogue and digital signals. IIII

SMARTNANO UNI
Universal logger with CAN-Bus and four power and four temperature inputs. Excellent choice for connecting external sensors. IIII

SMARTNANO CUSTOM
Individually configured with interfaces, **I/O modules** and software as requested by the customer. This is a cost-efficient solution, particularly for large quantities. IIII

SMARTNANO MODBUS
Base device, with a configurable Modbus-RTU interface. Designed for use in energy and system technology. IIII

smartNano

Success Story

Security, controlling and optimised logistics for hazardous materials
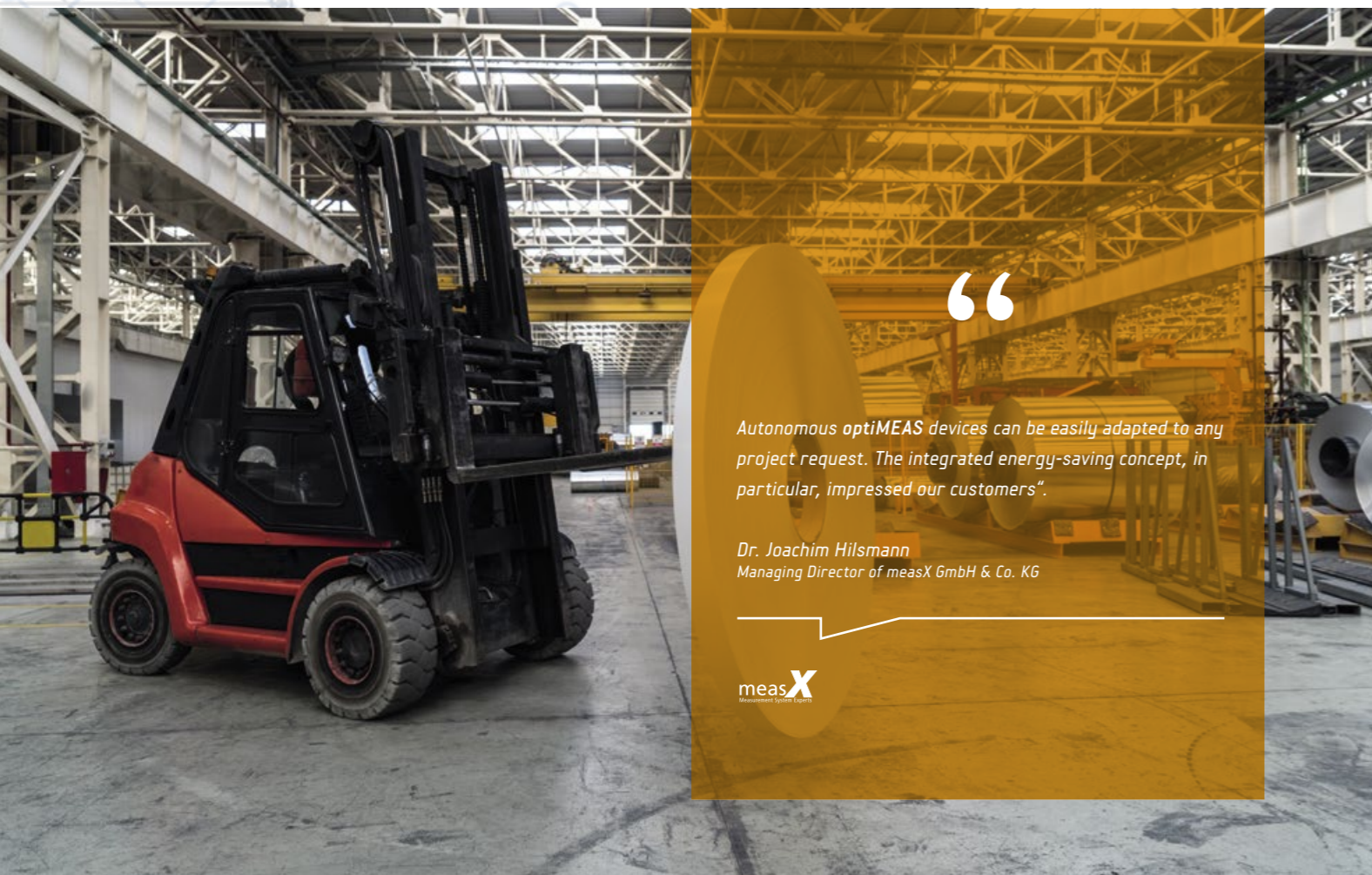**measX GmbH & Co. KG on behalf of an engine manufacturer**

Deep discharge, overload and mechanical damage can cause lithium-ion batteries to spontaneously combust. We developed an IoT system for a drive system manufacturer that provides continuous central monitoring for high-powered batteries during transportation and storage.

smartNANO-based autonomous devices are the first choice for applications in remote and difficult to access areas and transportation routes. They record data on the position and location of the batteries, their charge status, and on their temperatures and vibrations. To save energy and extend battery service life, data is transmitted to the **optiCLOUD** after long time intervals, or if sensor data changes significantly - for instance due to a movement.

All status information is available at all times over the **optiCLOUD**, regardless of location. If defined limit values are exceeded, the plant fire brigade is alarmed automatically. IIII

TYPICAL APPLICATIONS:

- » Theft protection
- » Position monitoring
- » Machine and equipment monitoring
- » Monitoring goods during transportation and storage
- » Recording operating hours
- » Environmental monitoring

"

Autonomous optiMEAS devices can be easily adapted to any project request. The integrated energy-saving concept, in particular, impressed our customers".

Dr. Joachim Hilsmann
Managing Director of measX GmbH & Co. KG

Technical data sheet

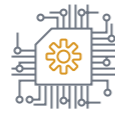| smartNANO	TRAC	FMS	CAN	MODBUS	UNI	CUSTOM
GSM 2G Modem	x	x	x	x	x	x
GSM 3G Modem	-	-	-	-	-	0
GPS, Glonass	x	x	x	x	x	x
Acceleration sensor	x	x	x	x	x	x
Connection for thermal element type K	-	-	-	-	-	0
Connection for Pt100, Pt1000	-	-	-	-	4	0
Digital In	-	-	-	-	x	0
Digital Out	-	-	-	-	x	0
Analogue In 0-10 V	-	-	-	-	4	0
Analogue In 0-20 mA	-	-	-	-	0	0
CAN interface	-	x	x	-	0	0
Serial interface	-	-	-	x	-	0
SPI, I2C, GPIO expansion slot	-	0	0	0	x	x
Battery-operated	0	0	0	0	0	0
Rechargeable battery-operated	-	-	-	-	0	0
External 12-36 V power supply	x	x	x	x	x	x
5V power supply	0	0	0	0	0	0
SD card	-	-	-	-	0	0
eMMC memory	100 MB	100 MB	100 MB	100 MB	100 MB	100 MB
USB connection (serial)	x	x	x	x	x	x
iButton	0	0	0	0	0	0

optiMEAS
Smart I/O modules

The **smartI/O** series is the most efficient solution for integrating analogue sensors into your IoT application.

Monitoring and diagnostics start with recording physical variables directly on a machine or in a process. Analogue-digital converters in the **smartI/O** series act as an interface between the sensor and measurement data processing to reliably translate analogue sensor signals into digital information. **I/O modules** are available for all common measurement requirements and sensors.

FLEXIBLE APPLICATIONS

I/O modules from **optiMEAS** are ideal for both centralised and decentralised synchronous measurement data recording. CAN, ethernet and many other interfaces make them easy to integrate and versatile to use – in industrial equipment, mobile machinery, test benches and laboratories. The modules can be connected directly to **optiMEAS** smart devices. However, they can also be combined with products from third-party providers. ▐▐▐▐

WHAT DOES I/O STAND FOR?
The abbreviation I/O stands for the input/output of signals.

I/O SMARTI/O

Measurement modules
for every need

From power to voltage, temperature, speed or strain gauge – the smart product series offers **I/O modules** for all signal inputs. These are each available in two versions: a stationary version for switch cabinet installation and an isolated version with M12 plug connectors for mobile use, for instance in railway engineering (certified in accordance with railway standards EN 50155, EN 45543 & IEC 61373).

1. CAN In/Out
2. Service interface
3. Status LED
4. Measurement inputs

SMARTI/O COMPACT

» Usable with different sensor types
» Version as requested by the customer
» Centralised or decentralised connection
» Expanded temperature range of -40° to 85°C
» Extremely robust, certified in accordance with EN 50155
» Simple integration through standard interfaces
» Can be configured and read out via USB
» Heartbeat
» Self-test with diagnostic messages

CUSTOMER-SPECIFIC SMARTI/O CUSTOM

In addition to our standard versions, **optiMEAS** also offers individually developed **I/O modules** which have a shape, sensor connections, or amplifier technology tailored to a specific customer application. This is often the most economical solution, especially for higher quantities. IIII

SIGNAL INPUTS FOR EACH SENSOR

» Voltage
» Current
» Strain gauge
» Speed
» Temperature
» Digital
» Serial interfaces

Technical data sheet

smartI/O...	8U12	8U16*	8I12	4U4I12	8TC	4RTD	16DI-HV
	U	U	I	U/I	<		
Number of channels	8	8	8	8		4	16
Sensor type/input	Voltage	Voltage	Current	Voltage/Current	Thermal element type K	RTD Pt100, 100 Ω Pt1000, 1 kΩ	Digital logic, High/low level programmable
Connection/input	2 wire, Differential	2 wire, Differential	2 wire, differential, internal shunt	2 wire, Differential	2 wire, Differential	3 wire, incl. feed	1 wire vs. COM Differential
Sensor feed			external			100 µA	
Measurement range (Available variants)	±10 V	±10 V	±20 mA, 4... 20 mA	1x ±150 V, 3x ±10 V, 4x 4... 20 mA	-270... 1800 °C	10 Ω... 4 kΩ -200... 850 °C (typ)	0... 125 V
Converter	12 bit	16 bit	12 bit	12 bit	12 bit	24 bit	Comparator
Resolution	5 mV	0,3 mV	10 µA	5 mV 10 µA	0,5 K	0,1 K	Logic level incl. Tristate and Instability
Input resistance	> 1 MΩ	> 1 MΩ	100 Ω	> 1 MΩ, 100 Ω			> 1 MΩ
Sampling rate	100 Hz	100 Hz	100 Hz	100 Hz	10 Hz	10 Hz	1 kHz
Offsetting					Neutralisation compensation		Time multiplex
Output rate	100 Hz	100 Hz	100 Hz	100 Hz	10 Hz	10 Hz	only during state changes, up to 1 kHz
Fieldbus	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B
Supply voltage	24 V (Standard) 9 V... 36 V (Rail)	9 V... 36 V	24 V (Standard) 9 V... 36 V (Rail)	9 V... 36 V	24 V (Standard) 9 V... 36 V (Rail)	9 V... 36 V	24 V
Self-diagnostics	yes	yes	yes	yes	yes	yes	yes
Temperature range	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... +85 °C
Version	Standard/Rail	Standard/Rail	Standard/Rail	Standard/Rail	Standard/Rail	Standard/Rail	Rail

smartI/O...	MIO1	2QENC*	XUART 422/485/232*	1HV16	4DMS FB*	4DMS HB*	BATMON
	U/I		Tx/Rx	U		<	
Number of channels	6 Analog In, 3 Digital Out	2 Quad-ENC or 4 MonoTrack	2x UART 3x USB 2.0	1	4	4	3 internal 2 external
Sensor type/input	Voltage, RTD, Relais	Quadrature encoder, Encoder, analogue pickup	Serial RS422/RS485 alternatively RS232	Voltage	Full bridge DMS	Half bridge DMS quarter bridge DMS	int.: battery voltage, current, temperature ext.: RTD, WakeUp-Input
Connection/input	2 wire, Differential RTD: 3 wire Relais: 3 wire	A/B-Track, Differential	Tx +/-, Rx +/-, Optional Termination & Bias	2 wire, Differential	6 wire, incl. feed	5 wire, incl. feed	RTD: 3 wire WU: 2 wire
Sensor feed	100 µA	external	5 V, 100 mA		1 V, RB >= 100 Ω	1 V, RB >= 100 Ω	100 µA
Measurement range (Available variants)	5x +150V Temperatures: -50 °C ... 150 °C Relais: 30 VDC, 2 A (resistive) 110 VDC, 0.3 A (resistive) 125 VAC, 0.5 A (resistive)	0... 125 V 750 kHz pulse frequency		±1000 V	5 mV/V... 100 mV/V Bias compensation	5 mV/V... 100 mV/V Bias compensation	Battery:0V... 150 V; 0A... 3A Temp.: -50 °C... 150 °C
Converter	12 bit			16 bit	24 bit	24 bit	isolated DC/DC-Powersupply
Resolution	0,2 V; 0,5 °C	Multiple period duration with 40 ns time basis		30 mV	20 nV/V	20 nV/V	0,2 V; 5,0 mA; 0,5 °C
Input resistance		> 1 MΩ		> 10 MΩ			
Sampling rate	1 kHz	1 Hz, 10 Hz, 100 Hz		1 kHz	100 Hz	100 Hz	variabel
Offsetting	Threshold value on Analogue signal Relais-Timeout	Frequency, speed		Min, Max, True-RMS			Battery undervoltage protection, cyclical wake-up
Output rate	10 Hz	1 Hz, 10 Hz, 100 Hz		1 kHz (raw data) 1 Hz (calculation)			10 Hz
Fieldbus	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	USB, screwable	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B	optiMEAS Interlink CAN 2.0B
Supply voltage	9 V... 36 V	9 V... 36 V	9 V... 36 V, extern	24 V	9 V... 36 V	9 V... 36 V	24 V... 110 V (for DC/DC-Power-supply, 24 V, 50 W); < 1 mA Stand-By-Current; 9 V... 36 V
Self-diagnostics	yes	yes		yes	yes	yes	yes
Temperature range	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... + 85 °C	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... +85 °C	-40 °C... +85 °C
Version	Standard/Rail	Standard/Rail	Rail	Rail	Standard/Rail	Standard/Rail	Rail

* in preparation

optiMEAS
Cloud solutions

The **optiCLOUD** IoT platform offers the quickest path to your digitisation success.

To turn machine data into true added value, the data must be centrally available and accessible for intelligent processing. This is where the **optiCLOUD** web platform from **optiMEAS** comes into play, as a highly scalable, universal central controller.

The **optiCLOUD** makes industrial digitisation simpler, faster, and more secure. It offers all the functions necessary to add transparency to machine and system processes, and to monitor and control them while implementing new business models.

You no longer need to worry about issues like memory volume, interfaces, or data security. The **optiCLOUD** is ready to use, established, and offers an extremely high level of data security. Each customer is protected individually with a verifiable security concept.

WHAT DOES CLOUD STAND FOR?
The **cloud** describes memory and computing services globally networked over the internet.

A STEP AHEAD
In contrast to traditional cloud platforms, the **optiCLOUD** provides more than just live system and machine data. Detailed, high-resolution measurement data streams offering deep insight into physical processes is also stored. This data allows users to make industrial processes smarter over the long-term with the aid of artificial intelligence and big data analysis, and detect things that otherwise couldn't be detected.   IIII

STEP BY STEP
The modular structure of the **optiCLOUD** offers maximum leeway. Language, appearance, operation and content can be customised quickly and easily. Functions can be added step by step as needed. **optiMEAS** will guide you through the entire process.   IIII

CL | optiCloud

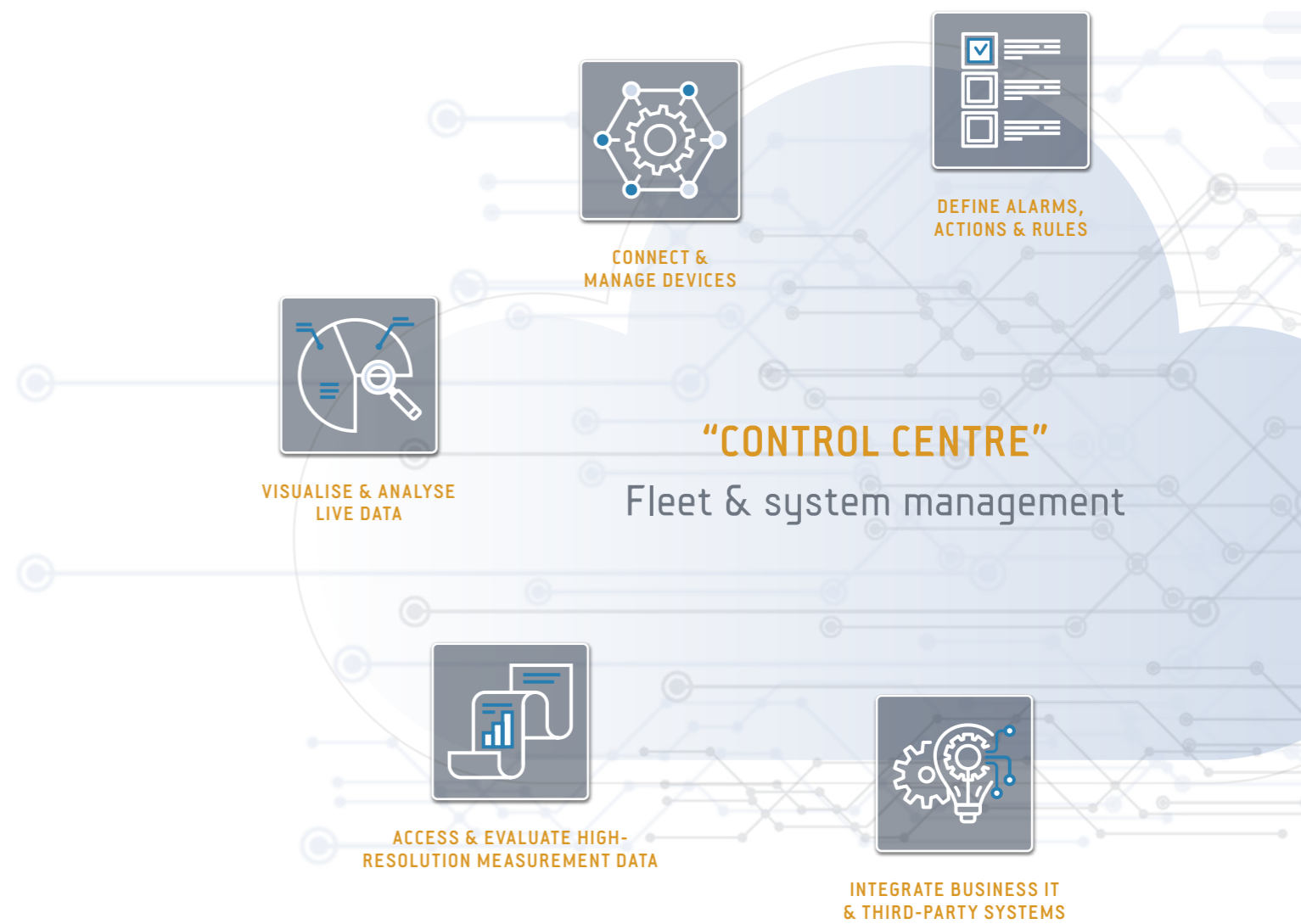# Highly scalable
IoT platform for industry

The **optiCLOUD** is the central storage, communication and control unit for a wide range of IoT applications. They collect high-resolution data recorded by Edge Devices and cyclically transmitted live data, process that data intelligently, and provide it to third-party systems. The **optiCLOUD** is also an optimal way to store and process large quantities of data produced over a short time period. Data and functions are available to authorised users via any web-capable device – anytime and anywhere.

1. Definition of alarm control chains, Notifications & actions
2. Fleet overview ("control centre")
3. Planner to automatically trigger control chains
4. Customer-specific settings, e.g. customised cloud interface
5. User administration
6. Device management
7. Customer-specific visualisation interface
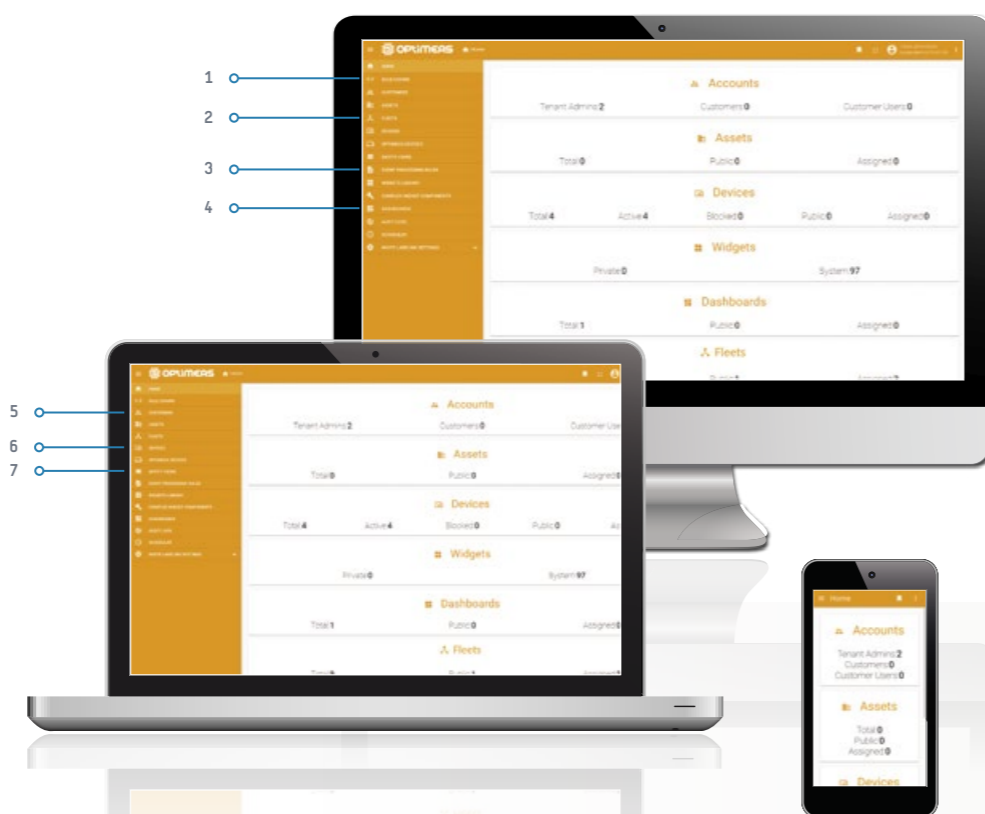
OPTICLOUD COMPACT

» For industrial applications
» Simple to use, simple look with a customised design
» Quick device connection
» Very large quantities of data
» Connect any third-party devices
» User-defined dashboards
» Trigger alarms and access statistics
» Automatic reports
» Direct access via REST API
» Automated software roll-outs
» Role-based user administration
» Hosting models SaaS, PaaS, On Premise

CONNECT & MANAGE DEVICES

DEFINE ALARMS, ACTIONS & RULES

VISUALISE & ANALYSE LIVE DATA

"CONTROL CENTRE"
Fleet & system management

ACCESS & EVALUATE HIGH-RESOLUTION MEASUREMENT DATA

INTEGRATE BUSINESS IT & THIRD-PARTY SYSTEMS

Simple & secure start-up: the **optiCLOUD** allows you to integrate any Edge Devices, measurement devices & data suppliers.

optiCLOUD and **optiMEAS** smart systems are perfectly tailored to work together. All devices can be connected with just a few clicks, even with no programming expertise. Integrating other "data suppliers" is also extremely easy: to connect live data, simply use the open message protocol MQTT (Message Queuing Telemetry Transport). This allows data to be delivered to or, if necessary, received from the **optiCLOUD** from any platform or any device – from smartphone apps or controller devices, as well as from Linux or Windows-based systems.

Other services such as transmitting measurement data, image or video files, firmware updates or new device configurations, are provided via secure HTTPS communication. Security is key here: each communication with the server is actively created. All (input) ports on the device remain closed. ||||

CL OPTICLOUD

Transparency
for machines & processes

Use live data for optimisation
Many IoT applications can be implemented directly in the cloud. The graphic, programmable Rule Engine can quickly define how to analyse live data streams and which events will automatically trigger set actions. Alarms can be triggered anytime there is a deviation from a limit value, or any other logic function can be integrated. ‖‖

Examples of automatic event processing
» Pre-calculation of live data
» Data filtering
» Alarm generated automatically if a limit value is exceeded
» Direct transmission of data values
» Automatic notifications and actions at defined triggers
» Geofencing
» Automatic report generation

Control machines and processes remotely
Because the optiCLOUD not only receives data, but also activates smart device digital outputs, the system is ideal for process controlling – both during service work and in live operation. It is activated interactively via the dashboard interface, or automatically via pre-defined processes. ‖‖

INTERACTIVE FLEET & SYSTEM MANAGEMENT

Complete fleet management
The fleet or system overview is the ideal starting point. Individually con-figurable list and map views present overarching information on the location, operating and usage status of networked machines, vehicles or components. Configurable dashboards visualise required detailed information on routes, statistics or trends. Devices can be activated directly via remote access. ‖‖

EASILY CONNECT BUSINESS IT & THIRD-PARTY SYSTEMS

Added value through optiCLOUD REST API
All cloud functions are available for other Industry 4.0 applications and business processes via open REST API. Machine and operating data can be integrated directly into ERP and other business systems – for maintenance planning with requirements-based replacement part orders, and for usage-based invoicing in pay-per-use models. ‖‖

QUICKLY CONNECT & MANAGE DEVICES

Plug & Play
Providing, managing and configuring as many recording systems as necessary is extremely easy. Each new smart device and each device used to support integration can be connected to the optiCLOUD in just a few minutes, and can transmit both live data and high-resolution measurement data files to the cloud. ‖‖

Global access anytime
Devices can be remotely activated and configured both individually, or across multiple devices at once. Apps for logger, alarm and other functions and firmware and software updates can easily be uploaded over-the-air (OTA), ensuring they are always up to date. ‖‖

ACCESS & EVALUATE HIGH-RESOLUTION MEASUREMENT DATA

Develop valuable process expertise
Analyses of unfiltered measurement data deliver valuable, detailed information on dynamic, physical processes within the machine. Artificial intelligence and required domain knowledge can be used to identify patterns and dependencies. Rules derived from this in-formation can be transferred to algorithms and device apps for new IoT applications. ‖‖

Direct analysis with optiCONTROL and optiMATOR
The optiCONTROL software delivered with each smart device offers easy access to measurement data files and numerous functions for interactive data review and analysis. The optiMATOR software is specialised for automated analytic processes like routine calculation of relevant key figures. The plug-in based concept allows for the integration of freely defined analytic processes (such as Python scripts). ‖‖

Open for specialised analytic tools
Proven standard software can be connected via REST API, such as X-Frame/DIAdem (measX/NI), MATLAB (MathWorks) or FAMOS (imc). All data collected in the optiCLOUD is quickly imported and directly available for statistical and further analysis. ‖‖

VISUALISE & ANALYSE LIVE DATA TO MEET YOUR NEEDS

Informative dashboards
Clear dashboards provide users the real-time information they need for their tasks around the clock. They can react immediately as needed, minimising errors and downtimes. ‖‖

Customised look & feel
Dashboards can be adapted easily and quickly to individual requests and requirements. A range of over 80 widgets is available for configuration: graphic elements like traffic lights, dial gauges, status and scatter diagrams, progress displays and trend illustrations are available, along with interactive operating elements for switching and control tasks on the recording device. ‖‖

CL OPTICLOUD

Success Story

Data analysis and predictive maintenance for railway vehicles
DB SYSTEMTECHNIK GMBH

Each year, Deutsche Bahn transports well over 100 million passengers on national and international long-distance trips. The company is getting ready for the future with comprehensive digitisation.

DB Systemtechnik GmbH has been working with **optiMEAS** to develop a predictive maintenance system, with the goal of predicting the "health" of relevant drive components of ICEs and planning targeted maintenance work in depots and workshops.

Mathematical and physical models are required to develop these predictive maintenance algorithms and describe regular equipment behaviour. Component operating data must be recorded to compare these models with real conditions. smartRAIL recording systems in conjunction with **smartI/O** modules from **optiMEAS** have been installed in different Deutsche Bahn ICE trains for this purpose.

Measured data is recorded at high sampling rates and provided in the central cloud (**optiCLOUD**, called FALKOS at DB) as historical data for analytic purposes.

Around 50 gigabytes of data are recorded each day. The DB uses a Hadoop-based analytic cluster for parallel processing, in order to evaluate this quantity of "big data" according to models. Current methods for machine and deep learning and for identifying the parameters of neural networks are used for this purpose. These are technologically-based on open-source frameworks like Tensorflow or Keras.

Perhaps the most important component for effectively implementing artificial intelligence in practice is domain knowledge from the departments and workshops. Engineers at DB systems engineering think so too: only a combination of mathematics, IT and application knowledge makes it possible to identify patterns that can be used to detect anomalies and provide maintenance recommendations. ||||

Technical data sheet

optiCLOUD	
Licenses	SaaS, PaaS, On Premise
Transport Protocols	MQTT, HTTP-REST, COAP, TCP, UDP (Additional Protocls can be added)
Live Data Formats	JSON, MSGpack, Protobuf, XML, Images, Files
Hist. Data Formats	OSF, CSV, Parquet
Device Data	Telemetry, RPC, Alarms, Firmware/Software Update over the Air
Environments	Cloud Native Support, AWS, Google Cloud, Azure, On-Premise
Integration	Device Management, Fleet Management, Dashboards, Reports
Data Export	CSV, XLSX, OSF, Parquet
Customization	Multi Tenancy, White Labeling
Features	Task Planning, Customizable Data Flow
Security	SSL/TLS, Token or X509 based authentication, OAuth2.0
Scalability	Full horizontal scalability
Device Communication	Bidirectional Device Communication Support via HTTPs, RPC

"

*We have already learned a lot about the vehicles through our collaboration with **optiMEAS**; we can use this knowledge for maintenance planning and to improve fleet quality and availability".*

Rico Gottschald
physicist and data analyst, DB Systemtechnik GmbH

DB Systemtechnik

optiMEAS
smartCORE®

Implement your IoT application quickly and securely with smartCORE®.

No matter what specific digitization goal you are pursuing - in order to record and process machine data as required, you need the right hardware as well as suitable software.

The turnkey embedded software **smartCORE®** ensures reliable data acquisition and processing in the field and helps you to realize your IoT project in the shortest time possible.

PATENTED AND INDUSTRY PROVEN
smartCORE® brings the necessary intelligence to any edge hardware and transforms it in no time into a flexible measurement device with cloud connection, a data logger, a gateway, a control system or a predictive maintenance device. Specifically tailored to your needs.

Designed as a framework, **smartCORE®** is maximally adaptable and uncomplicated to configure. Thanks to the no/low code approach, you can get started effortlessly.

smartCORE® is already included in the **optiMEAS** edge devices.
As a user, you can start directly. ▮▮▮

WHAT DOES EMBEDDED SOFTWARE MEAN?
An "embedded" software is a stand-alone software for a specific device hardware.

smartCore®

Why is smartCORE®
the turbo for your project?

You minimise risk, save time and money.

GET UP AND RUNNING QUICKLY

Implement an IoT solution in the shortest possible time. Basic tools for data acquisition and transmission, cloud connectivity, bus interfaces, remote function, alarming in case of threshold violation and other intelligent functions are already provided by smartCORE®.   IIII

CONFIGURING INSTEAD OF PROGRAMMING

Simply implement standard applications yourself in the no-code environment without any programming knowledge, thus saving time and resources. If required, you can go deeper and develop individual code for your task.   IIII

ROBUST AND PROVEN

Rely on a proven solution. smartCORE® is patented and successfully used in many industries. In the field of mobile machines and rail vehicles as well as in large plants in the environmental or energy industry.   IIII

LOW HARDWARE REQUIREMENTS

Don't invest more than necessary. Thanks to a sophisticated software architecture, smartCORE® can even run on small, energy-saving microcomputers.   IIII

HIGH PERFORMANCE IN THE FIELD

Compute and evaluate real-time data without latencies directly in the field. Designed for industrial applications, smartCORE® offers high computing power – made for applications in the kilohertz range as well as for processing a high number of signals as common in rail vehicles for example. Data does not have to be transmitted to the cloud first. This saves time and bandwidth.   IIII

FUTURE-PROOF

Benefit from modular software that can be easily adapted to new requirements. You can either develop specific extensions yourself or work with external experts. smartCORE® is absolutely flexible and constantly being developed and maintained.   IIII

TYPICAL APPLICATIONS:

» Monitoring of mobile machines and stationary plants
» Condition monitoring, remote diagnosis and teleservice
» Predictive maintenance
» Switching and control tasks
» Collection of usage data, smart services
» Optimization of operation, service, production, development

WORKS WITH ANY HARDWARE

Combine smartCORE® with your desired hardware. The software already supports the systems of numerous manufacturers and can be easily adapted for further components.

We offer the complete package

The smartCORE® software is already included in every smart device from optiMEAS by default - without additional licensing costs and an update guarantee for five years. You benefit from a high-quality solution with optimally matched hardware and software components and integrated cloud connection.   IIII

smartCORE®

smartCORE®
Ready to use.
Modular.
Scalable.

Building blocks for intelligent features & services

INTEGRATION OF POPULAR DATA SOURCES
You can easily connect any acquisition device via standardized industrial interfaces and communication protocols. Among others, CAN, Modbus, MVB, J1939, J1587 and GPS are already supported. However **smartCORE®** is flexibly expandable. IIII

RELIABLE DATA ACQUISITION
You can rely on **smartCORE®** to acquire the entire measurement and operational data and store it temporarily on the device without loss. A software watchdog monitors the system and ensures that it automatically resets itself to its regular, error-free state if necessary. IIII

MANUFACTURER-INDEPENDENT CLOUD CONNECTION
You are completely free to choose your cloud platform. **smartCORE®** is optimally adapted to **optiCLOUD** from **optiMEAS**, but connects an IoT device just as stable and securely to any other platform. IIII

LOSSLESS DATA TRANSFER
Even if the server connection is unstable or interrupted, you will not lose any information. As soon as the cellular connection is restored, captured measurements and operational data is seamlessly transferred from the local data storage to the cloud. IIII

REAL-TIME OVERVIEW
You can use the measurement and operational data of your machines and systems in a variety of ways. Secure cloud services provide live data via the widely used IoT transmission protocol MQTT in addition to the high-resolution raw data files. IIII

ALERTING IN CASE OF FAILURES
React quickly to faults and threshold violations. **smartCORE®** monitors the status and operating data of sensors and machines. It automatically alarms in case of irregularities and faults via MQTT, e-mail or SMS. IIII

DATA PREPROCESSING & REDUCTION
Transfer only relevant data to the cloud, for example average values or threshold deviations. Using integrated calculation functions, **smartCORE®** filters and pre-processes machine data locally on the edge device. IIII

SECURE REMOTE ACCESS
Parameterize all devices centrally from a distance. Integrated interfaces simplify remote features from afar. IIII
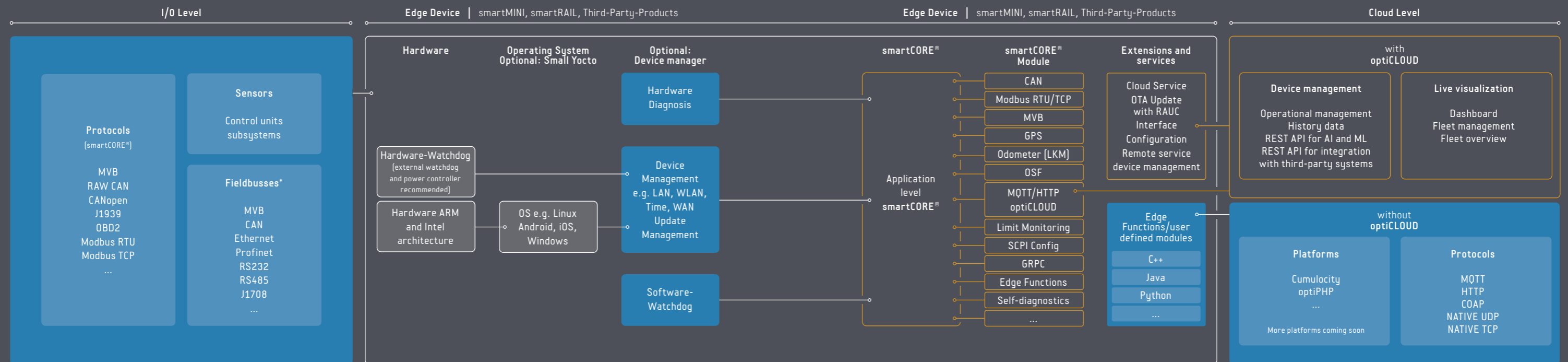
SMARTCORE® COMPACT

- » Works with any hardware
- » No-code approach for standard applications
- » Lossless data acquisition
- » High performance (Qt/C++ as basis)
- » Integrated alarm center
- » Intelligent data preprocessing
- » Cloud connectivity
- » Remote interface
- » Security concept with watchdog
- » Stable and highly accessible
- » Included in devices from **optiMEAS**

smartCore®

Edge or cloud computing?
smartCORE® is the data hub
for both.

smartCORE® optimally controls the flow of your data - from the sensor to the cloud. If required, you can analyse real-time data directly in the field. Thanks to integrated cloud services, you also have all the options to process data cloud-based, monitor and control IoT devices remotely. Leverage all the benefits of edge and cloud computing in an environment that is optimally engineered for it.

Modular, clear system structure

| I/O Level | | Edge Device | smartMINI, smartRAIL, Third-Party-Products | | Edge Device | smartMINI, smartRAIL, Third-Party-Products | | Cloud Level |

Hardware

Operating System
Optional: Small Yocto

**Optional:
Device manager**

smartCORE®

**smartCORE®
Module**

**Extensions and
services**

**with
optiCLOUD**

Protocols
(smartCORE®)

MVB
RAW CAN
CANopen
J1939
OBD2
Modbus RTU
Modbus TCP
...

Sensors

Control units
subsystems

Fieldbusses*

MVB
CAN
Ethernet
Profinet
RS232
RS485
J1708
...

Hardware-Watchdog
(external watchdog
and power controller
recommended)

Hardware ARM
and Intel
architecture

OS e.g. Linux
Android, iOS,
Windows

Hardware
Diagnosis

Device
Management
e.g. LAN, WLAN,
Time, WAN
Update
Management

Software-
Watchdog

Application
level
smartCORE®

CAN
Modbus RTU/TCP
MVB
GPS
Odometer (LKM)
OSF
MQTT/HTTP
optiCLOUD
Limit Monitoring
SCPI Config
GRPC
Edge Functions
Self-diagnostics
...

Cloud Service
OTA Update
with RAUC
Interface
Configuration
Remote service
device management

Edge
Functions/user
defined modules

C++
Java
Python
...

Device management

Operational management
History data
REST API for AI and ML
REST API for integration
with third-party systems

Live visualization

Dashboard
Fleet management
Fleet overview

**without
optiCLOUD**

Platforms

Cumulocity
optiPHP
...

More platforms coming soon

Protocols

MQTT
HTTP
COAP
NATIVE UDP
NATIVE TCP

SMARTCORE®

Ready to go, individually scalable

The IoT toolkit for individual application development

smartCORE® is a modular software. All features are realized via modules, so that an IoT solution can be expanded limitlessly and optimally maintained.
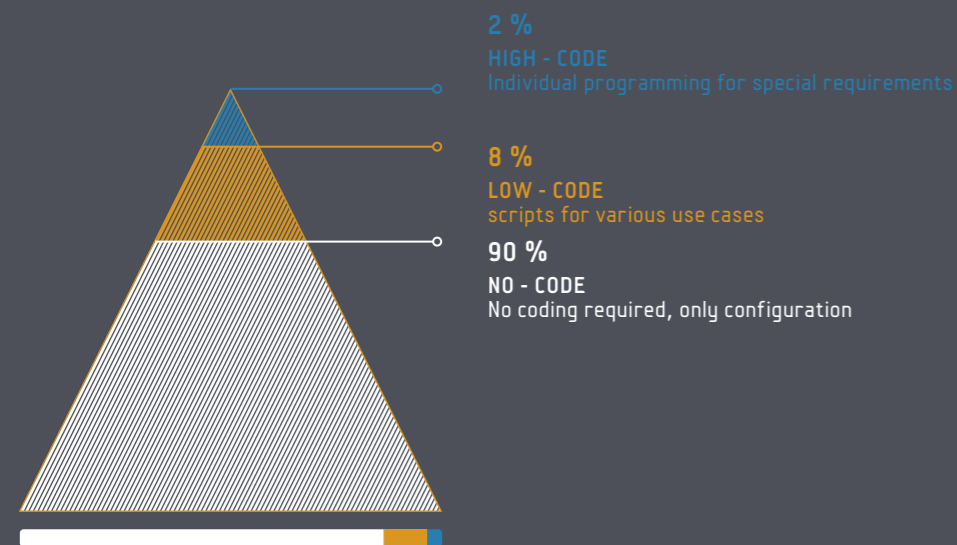
From standard functions based on existing modules to freely programmed modules, **smartCORE®** offers all possibilities for an individual implementation.

The majority of all IoT tasks can be solved by simply configuring the system, thanks to permanently integrated modules for data acquisition at standard interfaces such as CAN, Modbus or MVB.

For specific requirements, such as accessing additional data sources or protocols, the user-friendly programming interface can be leveraged. Extensive libraries for programming, testing and implementation in Java, C++, Python and other programming languages simplify the development of project-specific modules.

This also applies to the integration of edge functions, such as arithmetic and statistical calculations or signal analyses.

No-/Low-Code approach simplifies the first steps

2 %
HIGH - CODE
Individual programming for special requirements

8 %
LOW - CODE
scripts for various use cases

90 %
NO - CODE
No coding required, only configuration

Technical data sheet

smartCORE®	
System Architecture & Features	modular & extendable software architecture (plug-in architecture)
	Development of customer-specific modules possible at any time
	Connection of third-party modules possible via GRPC
	Focus is on lossless data acquisition with high data quality
Supported device platforms	optiMEAS device family (smartMini and smartRAIL)
	Raspberry Pi
	PC with standard Debian
	Other platforms on request
Operating systems	optiMEAS Yocto Linux (ARM platform and x86)
	Others on request
Supported protocols & interfaces	CAN-Bus (DBC, OBD2, J1939, FMS)
	Digital input/output
	USB/UART
	Modbus RTU/TCP
	OPC-UA-server
	Serial interfaces (RS232 and RS485)
	MQTT
	HTTPS
	GRPC
	Ethernet (various TCP and UDP protocols)
Available smartCORE® modules	CAN DBC
	OBD2
	GPS (position + altitude, speed, diagnostic data)
	Geofencing
	Odometer/kilometer count
	optiCLOUD server connection (MQTT)
	Modbus RTU/TCP
	MVB (Duagon Box)
	Storage of measurement data
	GRPC
	wake up (allows the complete system to be put to sleep or restarted via DINO)
	Alert control center (collects alarms/warnings reported by other modules, processes and sends them)
	Numerous customer-specific modules
Technology	C/C++, Java, Python

smartCore®

Success Story

Cloud-based monitoring for the powertrain
CORE SENSING GMBH

The smooth performance of standard components such as shafts, gears and bearings has a major influence on the quality and efficiency of machine processes. In order to better understand the current conditions and avoid both machine failures and unnecessary maintenance, knowledge of the underlying physical processes is crucial. The startup core sensing developed a novel, component-integrated sensor solution for this purpose and relies on **optiMEAS** for the cloud connection.

The wireless sensor package, which can also be completely integrated into rotating components, consists of force and torque sensors as well as powerful measurement electronics. It records the forces, torques and mechanical stresses inside the component, as well as speed, acceleration, vibration and temperature. Integrated intelligence analyses whether the component and adjacent processes are functioning correctly. The data is wirelessly transmitted to an industrial gateway, which serves as an interface.

The **smartCORE®** software from **optiMEAS**, which is installed by default on the **smartMINI** IoT device, connects the smart drive components to the cloud and controls the data flow. A small expansion module was all that was needed to integrate the data sources. As a data logger, **smartCORE®** stores all values seamlessly on an SD card and transmits them via the cellular network to the **optiCLOUD**. Here they are available for more in-depth and long-term investigations. The configurable dashboard visualizes the live data of various sensors providing a real-time overview.

Via built-in standard interfaces, **smartCORE®** enables the integration and real-time processing of further data and signals. For example data from the machine control system is processed at a rate of almost 4,000 values per second. The IoT and cloud connection of the smart components thus opens up extensive possibilities for analysing, monitoring and optimizing both the individual components and the overall system. ||||

> *In no time at all, our smart sensors were connected to the cloud. With optiMEAS, we met experts who were able to implement this quickly. Through the extended measurement chain, our solution offers additional added value, for example for mobile applications and long-term measurements."*
>
> *Markus Hessinger*
> *CTO, core sensing*

CORE SENSING

READY FOR A PERSONALISED CONSULTATION?

OptiMEAS

GERMANY

optiMEAS
Measurement und Automation Systems GmbH
Software Solutions GmbH

Phone: +49 61 72/99 77 12-0
Email: info@optimeas.de
www.optiMEAS.de

Am Houiller Platz 4/B
61381 Friedrichsdorf

SWISS

optiMEAS GmbH

Phone: +41 52 74 72 00-0
Email: info@optimeas.ch
www.optiMEAS.ch

Talstrasse 33
8477 Oberstammheim (ZH)

OptiMEAS