

STW.products

Making mobile machines perform.



"Through our dedication to innovation, we create solutions for mobile machines that embody our vision: A fusion of advanced technology and sustainable work processes, helping create a positive future full of potential for everyone."

Sonja Wiedemann
STW Managing Director

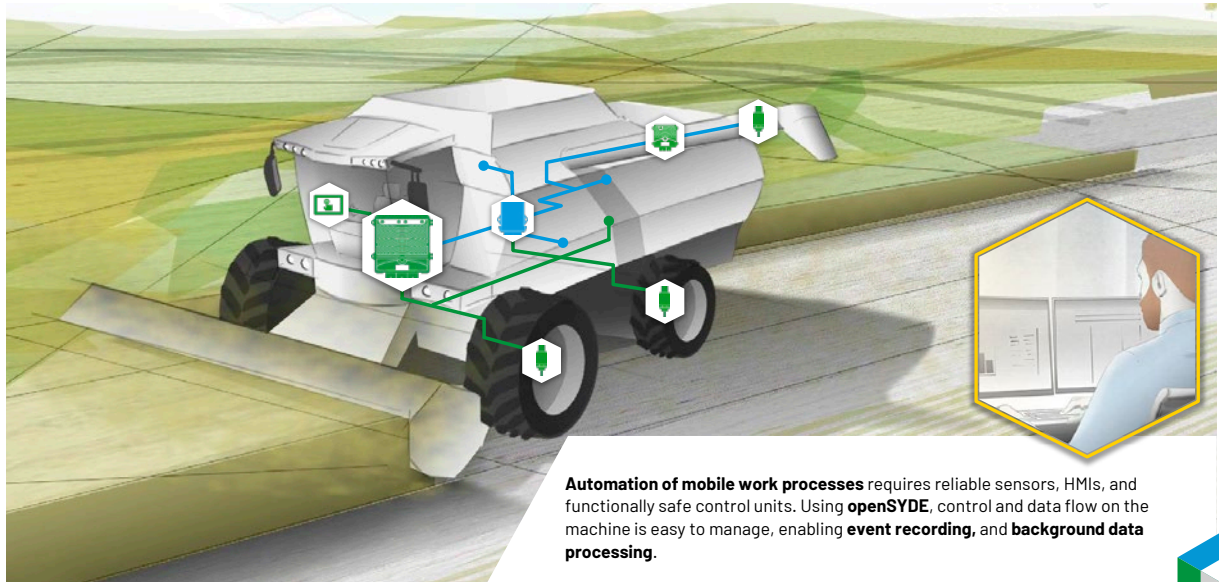


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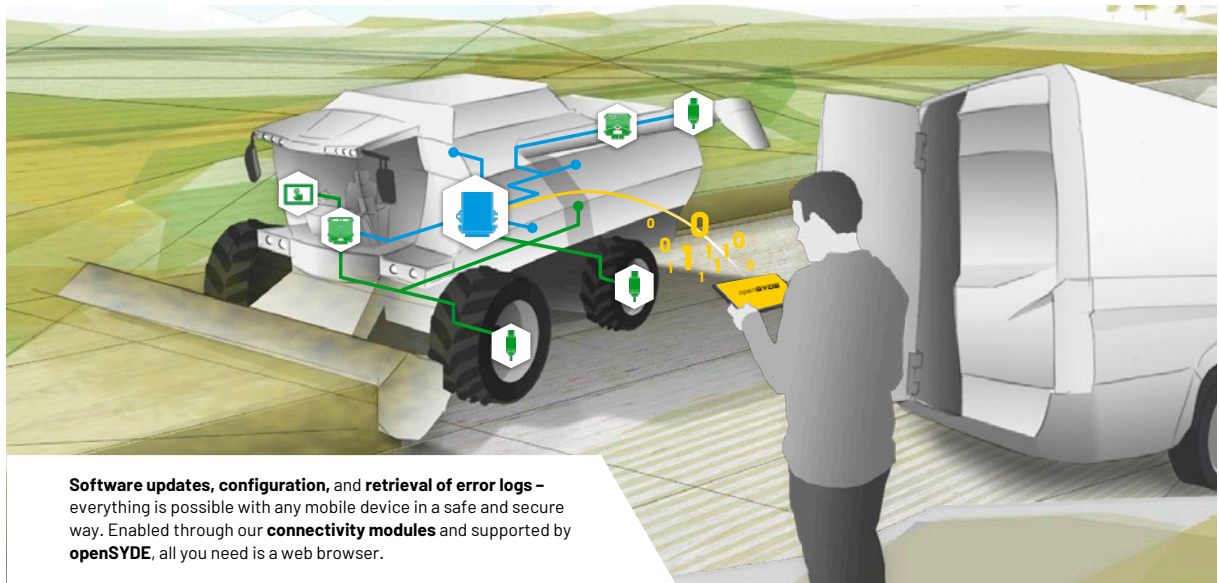
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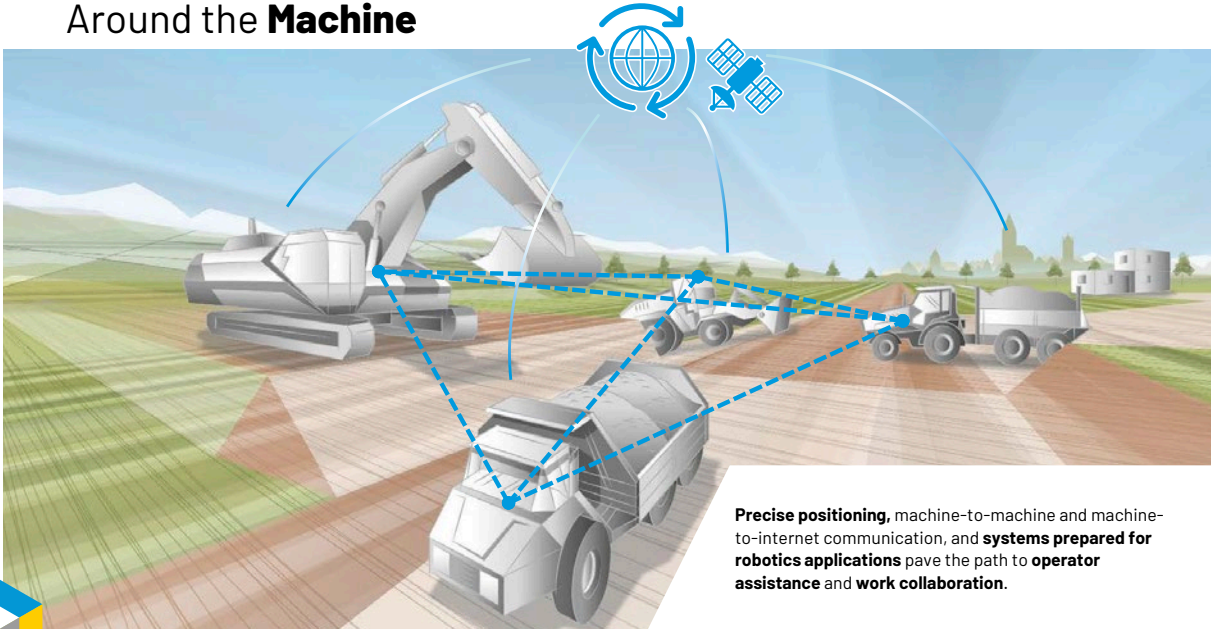
On the **Machine**



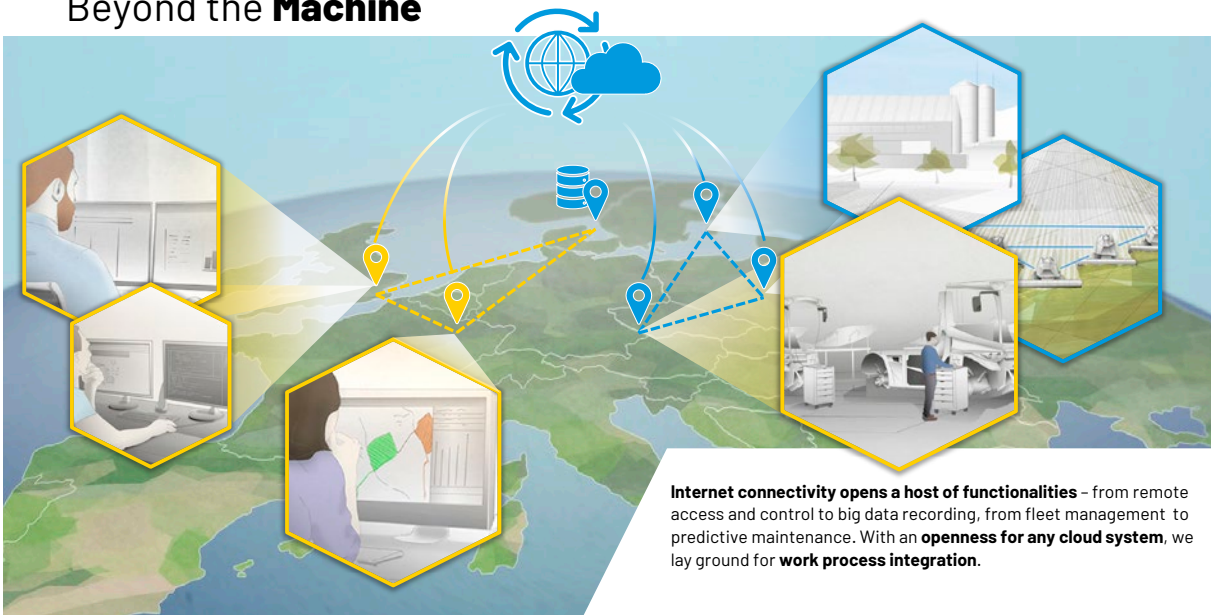
At the **Machine**



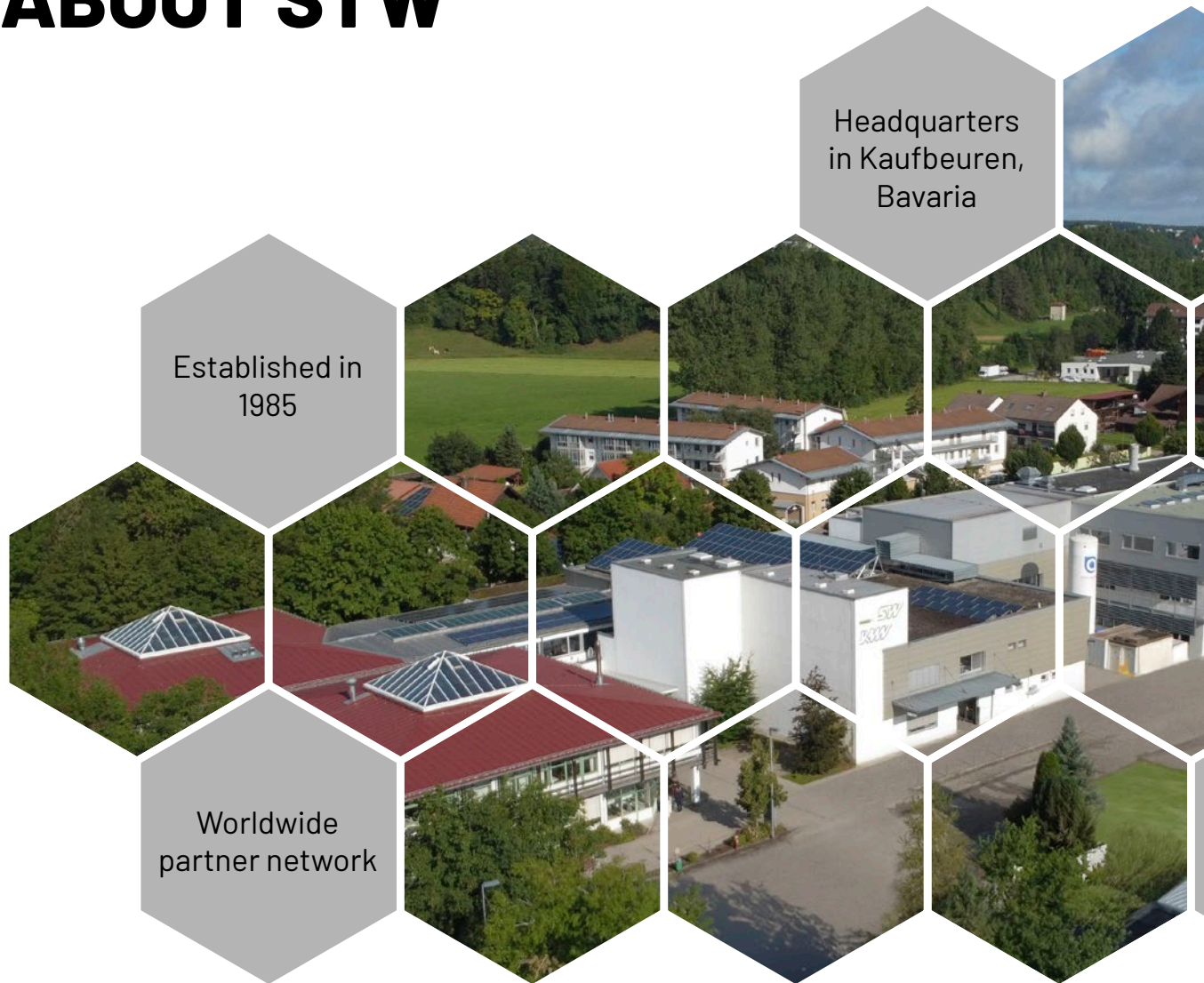
Around the **Machine**



Beyond the **Machine**

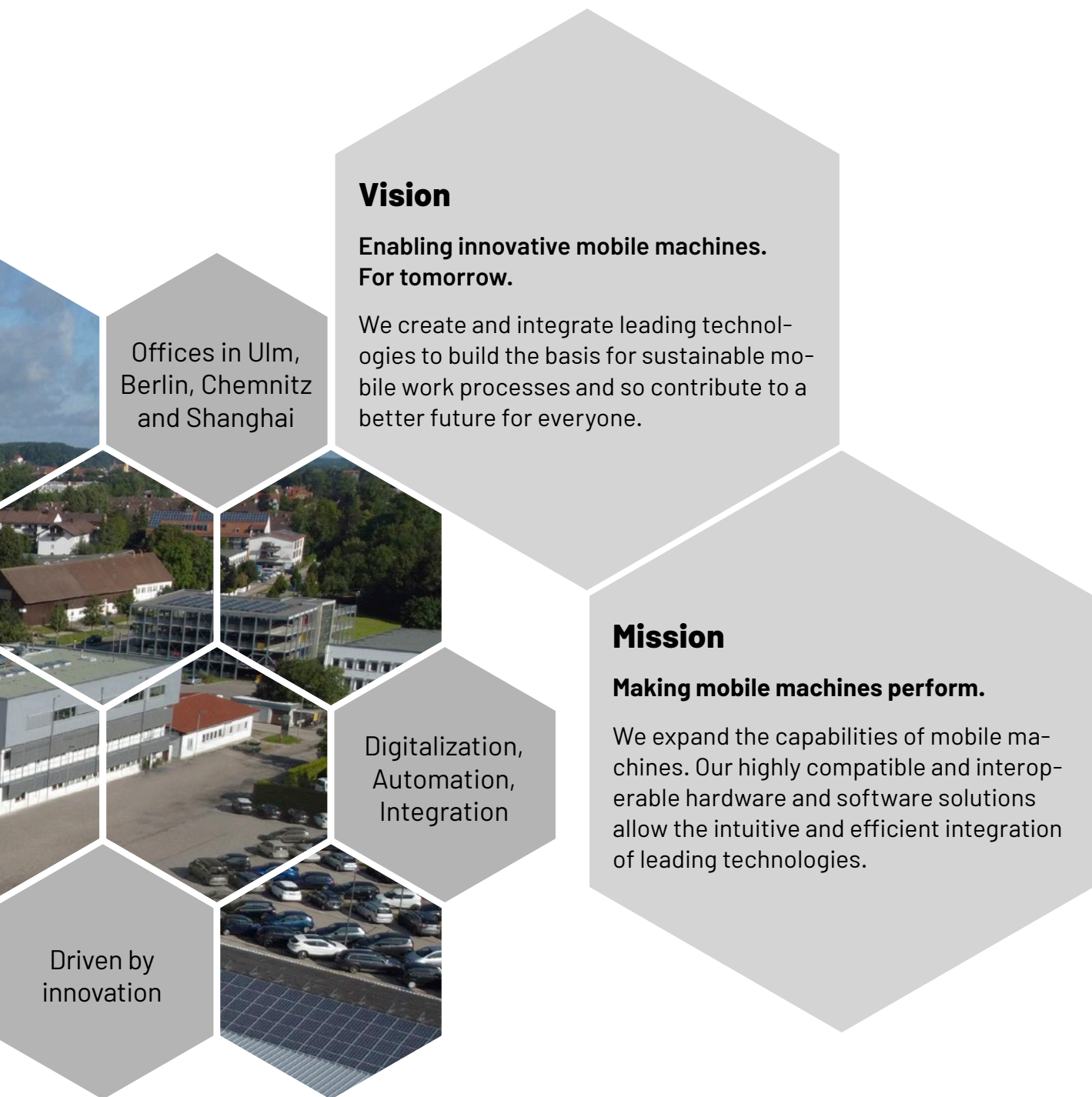


ABOUT STW



As an internationally working company headquartered in the greater Munich Metropolitan Area, we stand for high-quality solutions in the digitalization and automation of mobile machines for 40 years. With a modular system of generic and tailor-made products, systems, and software solutions, we support our customers on their way to making their machines the best in the world with the most innovative technology.

Compatible products and systems from our global partner network complement our STW modular system. We accompany our customers as partners in the engineering and integration processes. With our hardware and extensive software platform, we help medium-sized companies and large OEMs improve the performance and efficiency of their machines in a user-friendly way. We help enhance safety and prepare our customers to



meet the engineering challenges of the future. Our connectivity solutions enable machine-to-X communication and so provide networking with cloud platforms and the integration of mobile machine operations directly into business processes.

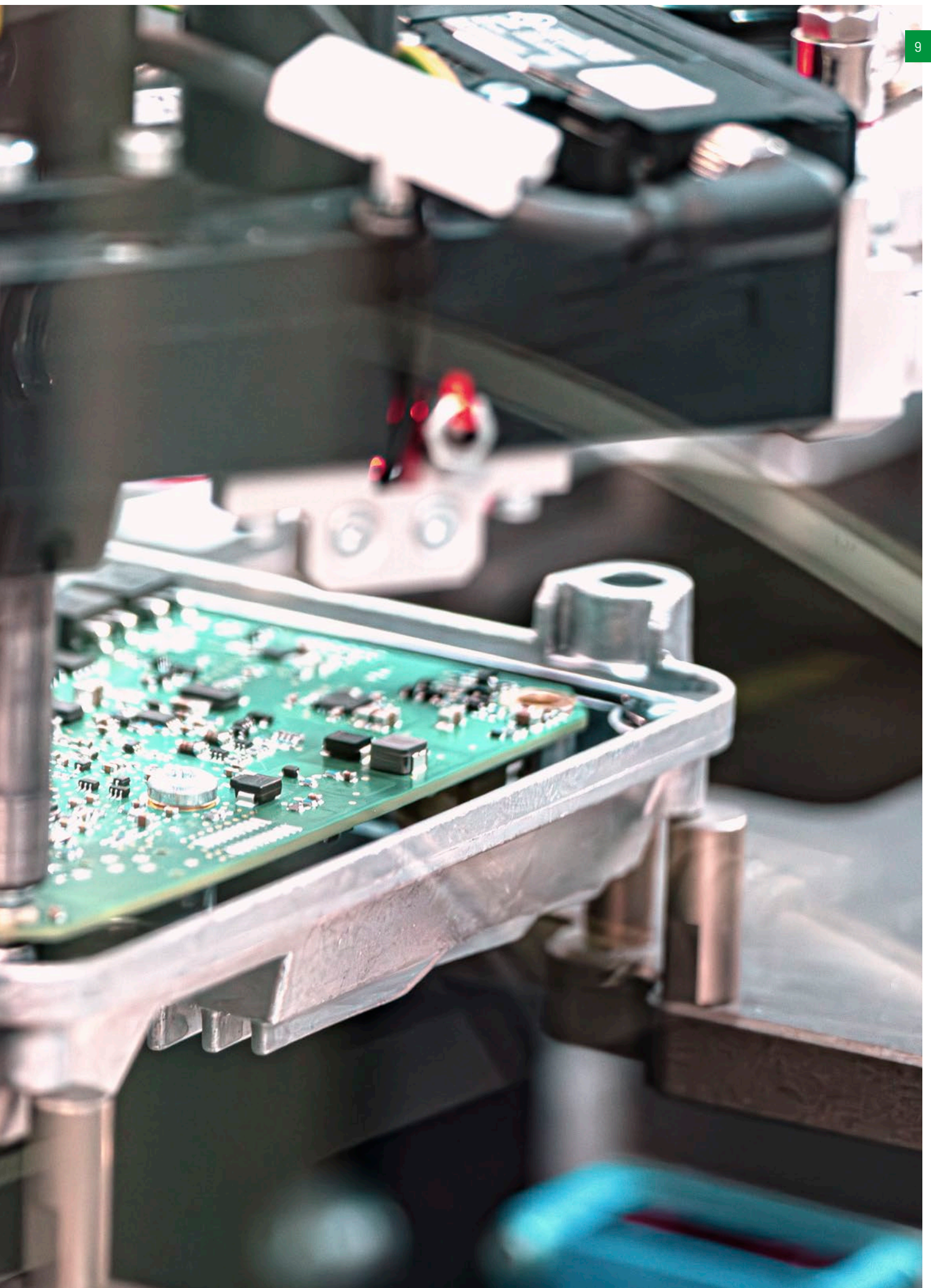
We are an independent family company, we value and support our employees, and

we take our responsibility towards the environment and society seriously. Together with our customers and partners, we are actively involved in important future topics, including the Internet of Things (IoT), Industry 4.0, semi- and fully autonomous operations, and e-mobility.



MOBILE CONTROLLERS

Automation and growing autonomy of mobile machines involve a range of components, depending on the complexity of the machine. Central and decentralized processing, human machine interfaces, energy distribution and safety monitoring components interact to ensure control of the drivetrain and the work functions. High-performance computing platforms with AI capabilities provide environmental awareness, object recognition, distance measurement, and operator assistance based on environmental conditions and current machine operating status.



HIGH PERFORMANCE PLATFORM

- Simple integration of safety-relevant functions
- Robust design for use in harsh environments
- Scalable hardware and software platform for flexible applications
- Support of specialized development environments for AI, video processing and model-based design
- Embedded Linux, Docker and ROS2 support
- Flexible programming with hardware acceleration
- Maximum energy efficiency without active coolings

STW is developing a new product family: the High Performance Platform for mobile machines – HPX for short. The HPX marks the start of a new generation of powerful vehicle control electronics for mobile machines, enabling highly automated or autonomous applications. The platform combines the robust STW ESX product family's advantages with more computing power and a new device architecture in a single device.

The HPX.ai-vision is a platform for environment detection and process automation in mobile machines. As automation and complexity grow, advanced solutions are needed to support operators and enhance safety, especially in challenging environments with limited visibility.

Using a multiprocessor system, HPX.ai-vision processes environmental data with integrated AI algorithms, handling inputs from cameras, lidar, and radar sensors. Cameras provide a 360° or top-down view, lidar and ToF cameras detect hidden objects, and stereo cameras offer precise distance measurements.

With a dedicated Linux processor, users can easily share data with controllers, displays, or connectivity modules for communication with cloud solutions or other machines—without requiring in-depth AI knowledge. HPX.ai-vision also supports user-driven AI implementations, with STW providing development environments and support.



HPX.ai-vision

NEW

- High-performance multiprocessor system
- Artificial Intelligence hardware accelerator
- Wide range of communication interfaces such as CAN, Ethernet, RS232
- Up to 8 GMSL2 camera interfaces
- Multifunctional inputs and outputs
- Integrated camera and sensor supply
- Optional integrated surround view functionality

ESX PRODUCT OVERVIEW

		Processor	Frequency	Internal flash	Internal RAM	External RAM	External EEPROM	i.MX 6 co-processor	Number of inputs & outputs	Number of inputs	IDAC12V	IDA12_35V	IDSACV	IDA5V	IDA35V	IDA35V_4CT	IACV	IDACV	MFI	IMID	Number of outputs	OPHSP2A	OPHSP4A	ODH2A	ODH4A
Controllers	ESX.4cl-ag	Aurix TC399 Multicore 32 bit	300 MHz	16 MB	6 MB		256 kB ¹⁾	1 ¹⁾	117	58	16	30	12								59	16	8	20	8
	ESX.4cl	Aurix TC299 Multicore 32 bit	300 MHz	8 MB	2 MB		32 kB	1 ¹⁾	113	60				8	16		24	12			53	36	12		
	ESX.4cm-ag	Aurix TC399 Multicore 32 bit	300 MHz	16 MB	6 MB		256 kB ¹⁾		59	34	8	16	8							2	25	8	2	8	2
	ESX.4cm-a	Aurix TC299 Multicore 32 bit	300 MHz	8 MB	2 MB		32 kB		63	34				8	8		16			2	29	16	4		
	ESX.4cs-gw	Aurix TC299 Multicore 32 bit	300 MHz	8 MB	2 MB		32 kB		16	12				4	4		4				4		4		
	ESX.4ct	Aurix TC367 Multicore 32 bit	300 MHz	4 MB	576 kB		64 kB		27	14			4	2 ¹⁾	6	12 ¹⁾	4				13			4 ¹⁾	3 ¹⁾
	ESX.3cm	TriCore TC1798 32 bit	300 MHz	4 MB	288 kB	8 MB	32 kB		56	28				8	12		8				28				
	ESX.3cs	TriCore TC1798 32 bit	300 MHz	4 MB	288 kB	8 MB	32 kB		33	18				8	4		4			2	15				
I/O modules	ESX.4iol								113	60				8	16		24	12			53	36	12		
	ESX.iom								63	34				8	8		16			2	29	16	4		
	ESX.3ios								33	18				8	4		4			2	15				
	ESX.iot								29	14			4	2 ¹⁾	6	12 ¹⁾	4				13			4 ¹⁾	3 ¹⁾
Inputs	IDAC12V	Input: digital, analog • Voltage 0 ... 12 V • Current input 0 ... 24 mA • Digital input (high- or low-active) • Frequency • Incremental	IDA12_35V	Input: digital, analog • Voltage 0 ... 12 V • Voltage 0 ... 35 V • Digital input (high- or low-active) • Frequency • Incremental • Namur	IDSACV	Input: digital, analog • Voltage 0 ... 5 V • Voltage 0 ... 12 V • Voltage 0 ... 35 V • Current input 0 ... 24 mA • Digital input (high- or low-active) • Frequency • Incremental • Namur • SENT	IDA5V	Input: digital, analog • Voltage 0 ... 5 V • Digital input (low-active) • Frequency • Incremental • SENT ¹⁾	IDA35V	Input: digital, analog • Voltage 0 ... 35 V • Digital input (high- or low-active) • Switchable pull-up • Frequency • Incremental • Namur • SENT ¹⁾	IDTA35V_4CT	Input: digital, analog • Voltage 0 ... 35 V • Digital input (high- or low-active) • Programmable threshold (1.5 ... 9 V) • Switchable pull-up • Frequency	IACV	Input: analog • Voltage 0 ... 12 V • Current input 0 ... 24 mA • Digital input (via software)	IDACV	Input: digital, analog • Voltage 0 ... 12 V • Current input 0 ... 24 mA • Digital input (high- or low-active) • Frequency • Incremental • Namur									
	OPHSP2A	Output: high-side switch • High-side switch • Ampacity 2.5 A • Switchable pull-up • Digital output • PWM output • Current controlled PWM output	OPHSP4A	Output: high-side switch • High-side switch • Ampacity 4 A • Switchable pull-up • Digital output • PWM output • Current controlled PWM output	ODH2A	Output: high-side switch • High-side switch • Ampacity 2.5 A • Current feedback • Digital output • PWM output	ODH4A	Output: high-side switch • High-side switch • Ampacity 4 A • Current feedback • Digital output • PWM output	OPL2A	Output: low-side switch • Low-side switch • Ampacity 2.5 A • Current feedback • Current controlled PWM output	OPL4A	Output: low-side switch • Low-side switch • Ampacity 4 A • Current feedback • Current controlled PWM output	OPL0A5	Output: low-side switch • Low-side switch • Ampacity 0.5 A	OAV10V	Output: analog • Voltage 0 ... 10 V • Voltage feedback									

1) The quantity depends on the product variant.

2) Similar input/output type.

	OPL2A	OPL4A	OPL0A5	OAV10V	OP2A	OP4A	OD2A	4A digital output	OPHB4A	OPHB10A	PVG	Memory	FRAM, 512 kBit	Data flash 16 MB external	Sensor supply	Sensor supply voltage 5 V	Sensor supply voltage 8.5V	Sensor supply voltage 5 ... 12 V	Communication	CAN	100Base-T1	100Base-TX	1000Base-T1	1000Base-TX	RS232	LIN	RS485	Safety	Housing size	
		4	1						2				1 ¹⁾	1 ¹⁾		2		4		6	1	1	2		1 ¹⁾	1 ¹⁾		x	264 mm x 260 mm x 55 mm	
		4	1										1 ¹⁾	1 ¹⁾		3		3		6	2	3		1	1 ¹⁾	1 ¹⁾		x	264 mm x 260 mm x 55 mm	
		2	1						2				1 ¹⁾	1 ¹⁾		1		3		4	2 ¹⁾	1	1		1 ¹⁾	1 ¹⁾		x	231 mm x 162 mm x 43 mm	
4	4	1											1 ¹⁾	1 ¹⁾		2		2		4	2	2			1 ¹⁾	1 ¹⁾		x	231 mm x 162 mm x 43 mm	
													1 ¹⁾	1 ¹⁾		1		1		6	1	5 ¹⁾		1 ¹⁾	1	1		x	169 mm x 163 mm x 40 mm	
								8 ²⁾										1		3 ¹⁾						1 ¹⁾	1 ¹⁾			174 mm x 117 mm x 36 mm
					16	4	8 ¹⁾				8 ¹⁾					1	1	1		4		1			1		1 ¹⁾	x		138 mm x 217 mm x 51 mm
2			1	8			4									1		1		2		1 ¹⁾			1 ¹⁾	1 ¹⁾		x		169 mm x 139 mm x 40 mm
		4	1													3		3		1						1 ¹⁾		x		264 mm x 260 mm x 55 mm
4	4	1														2		2		1						1 ¹⁾		x		231 mm x 162 mm x 43 mm
2			1	8			4									1		1		1								x		169 mm x 139 mm x 40 mm
								8 ²⁾										1		1						1 ¹⁾	1 ¹⁾			174 mm x 117 mm x 36 mm

	IMID	MFI
al, analog ... 5 V ... 12 V ... 35 V put 0 ... 24 mA ut (high- or e) y tal	Input: module identifier • Voltage 0 ... 5 V • External resistor identification • Up to 8 different states	Input: multifunctional input • Voltage 0 ... 10 V • Voltage 0 ... 35 V • Digital inputs (high - or low active) • Current input 0 ... 20 mA • Frequency

	OP2A	OP4A	OD2A	OPHB4A	OPHB10A	PVG	4A Digital output
log voltage	Output: high-side switch	Output: high-side switch	Output: high-side switch	Output: half-bridge	Output: half-bridge	Output: Proportional valve group	Output: high-side switch
... 10 V eedback	- High-side switch - Ampacity 2.5 A - Switchable pull-up - Digital output - PWM output - Current controlled PWM output	- High-side switch - Ampacity 4 A - Switchable pull-up - Digital output - PWM output - Current controlled PWM output	- High-side switch - Ampacity 2.5 A - Current feedback - Voltage feedback	- Current controlled half-bridge - Up to 20 kHz for motor control - Ampacity 4 A - PWM output	- Current controlled half-bridge - Up to 20 kHz for motor control - Ampacity 10 A - PWM output	Output controls proportional valves	- High-side switch - Ampacity 4 A - Current feedback

ESX CONTROLLERS

- Standard portfolio of controllers
- Future-proof due to modular construction on common platform
- STW software platform for programming support
- Cross-variant development of safety-relevant applications
- Real-time Ethernet, Single Pair Ethernet, Ethernet switch, and CAN FD
- Cost-optimized derivation of customer-specific variants

The ESX control device family includes robust and efficient safety and non-safety controllers.

For the realization of safety applications, the controllers are either equipped with a multicore processor (fourth generation) or with a second, additional processor (third generation). In both cases, different system voltages and the program sequence are internally monitored. If required, all outputs are switched off via a second shut-down method or the controller is reset. Digital and analog feedback for almost all signal branches permits comprehensive diagnosis for the system including the inputs and outputs.

In order to separate safety and non-safety application sections, in fourth-generation controllers one processor core is used purely for the safety application. In third-generation controllers, a memory protection unit is provided for the sep-

aration of safety and non-safety (feedback-free) application sections.

Two controllers, the ESX.4cl and the ESX.4cm, are also available in "ag" versions for agriculture. They are characterized by larger memory, extended support of single-pair Ethernet for future high-speed ISOBUS use and additional certification according to AgPL d Cat 2.

The application software for the ESX controllers can be highly efficiently created either in "C" or also according to IEC61131. In addition, depending on the control unit, Matlab support packages are available. In the programming interface, numerous convenient functions such as current controllers and ramp functions for outputs or frequency averaging for inputs are integrated. Various supplementary libraries, for example for CANopen, J1939 or error handling simplify the system integration.



ESX.4cl-ag

- SIL 2, PL d, AG PL d, ASIL B¹⁾
- Aurix™ TC399 Multicore, 32 bit, 300 MHz
- 6 MB RAM, 256 kByte EEROM
- 16 MB internal Flash, 16 MB external Flash
- Optional Coprocessor i.MX6 Ultralite
- 6 CAN Interfaces, LIN or RS232 Interface
- Ethernet (1 x 100Base-TX, 1 x 100Base-T1, 2 x 1000Base-T1)
- 58 Inputs (SENT Support)
- 59 Outputs (Low-Side, High-Side, 10A Half-Bridges)

1) Scheduled feature



ESX.4cl

- SIL 2, PL d, ASIL B¹⁾
- Aurix™ TC299 Multicore 32 bit, 300 MHz
- 2 MB RAM, 32 kB EEPROM
- 8 MB internal Flash, 16 MB external Flash
- Optional Coprocessor i.MX6 Ultralite 696 MHz
- 6 CAN interfaces, LIN or RS232 interfaces
- Ethernet (3 x 100BaseTx, 1 x 1000BaseTx, 2 x 100BaseT1)
- 60 Inputs (SENT support)
- 59 Outputs (Low-Side, High-Side, Sensor supply)

1) Scheduled feature



ESX.4cm-ag

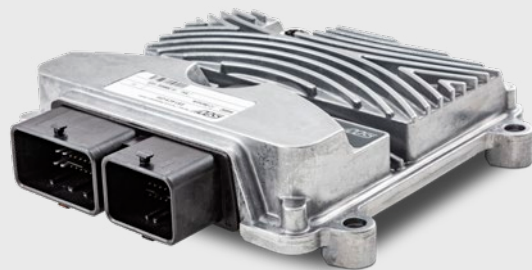
- SIL 2, PL d, AG PL d, ASIL B¹⁾
- Aurix™ TC399 Multicore, 32bit, 300MHz
- 6 MB RAM, 256 kByte EEROM
- 16 MB internal Flash, 16 MB external Flash
- 4 CAN Interfaces, LIN or RS232 Interface
- Ethernet (1x 100Base-TX, 1x 100/1000Base-T1, 2x 100Base-T1)
- 34 Inputs (SENT Support)
- 17 Outputs (Low-Side, High-Side, 10A Half-Bridges, Sensor supply)

1) Scheduled feature



ESX.4cm-a

- SIL 2, PL d, ASIL B
- Aurix™ TC299 Multicore 32 bit, 300 MHz
- 2 MB RAM, 32kByte EEPROM
- 8 MB internal Flash, 16 MB external Flash
- 4 CAN interfaces, LIN or RS232 interfaces
- 4 Port Ethernet Switch (2x 100BaseTx, 2x100BaseT1)
- 34 inputs (with SENT support)
- 29 outputs (Low-Side and High-Side)



ESX.4cs-gw

- SIL 2, PL d, ASIL B¹⁾
- Aurix™ TC299 Multicore 32 bit, 300 MHz
- 2 MB RAM, 32 kB EEPROM
- 24 MB Flash
- 6 CAN interfaces, 1 RS232 interface and up to 5 Ethernet interfaces
- 4 x 100 Mbit/s, optionally 1 x 1 Gbit/s
- 12 inputs (SENT support) und 6 outputs

1) scheduled feature



ESX.4ct

- Safety Level PL b
- Aurix™ TC367 32 bit, 300 MHz
- RAM: 576 kB internal
- Flash: 4 MB internal
- User-EEPROM: 32 kB
- 2 CAN interfaces, CAN FD ready, ISOBUS ISO 11783-3
- 1 RS232 or LIN Spec. 2.2A interface
- Inputs: 14/18/22 (12 bit, SENT & NAMUR support)
- Outputs: 13/9/5 (half bridges with PVG support, high side switches)
- Options: 6-axis inertial measurement unit (IMU), accelerometer & gyroscope, Bluetooth LE v5.1 with internal antenna, 3rd CAN interface (instead of 2 inputs)



ESX.3cm

- SIL 2, PL d
- TriCore TC 1798 32 bit, 300 MHz
- 288 kB SRAM internal, 8 MB SDRAM external
- 4 MB Flash internal
- 32 kB EEPROM
- 4 CAN interfaces (CAN 1 with wake-up function), 1 RS232
- 1 Ethernet interface 10/100BASE-TX
- 28 inputs (SENT support)
- 28 outputs



ESX.3cs

- SIL 2, PL d
- TriCore TC 1798 32 bit, 300 MHz
- Internal: 288 kB SRAM, 4 MB Flash
- External: 8 MB SDRAM
- 32 kB EEPROM
- 2 CAN Interfaces
- 1 Ethernet interface 10/100BASE-TX or Bluetooth 5.1 (optional)
- 1 RS232 or LIN
- 18 inputs (SENT support)
- 17 outputs

ESX I/O MODULES

- Controlled via CAN bus
- Inputs and outputs with diagnostic capabilities
- Automatic connection port detection
- Configurable using software

I/O modules form the logical extension of controllers. They increase the number of inputs and outputs or provide special functions.

They also simplify the wiring inside a mobile machine through the connection and

control using the CAN bus. I/O modules are positioned close to the appropriate actuators and sensors. The position in the machine can be identified via hardware encoding; the modules can be configured using software.



ESX.ioI

SOON

- SIL 2, PL d
- 1 CAN interface
- 60 inputs for measurements
- 2 inputs for identification
- 53 outputs
- CANopen safety protocol



ESX.iom

- 1 CAN interface
- 32 inputs for measurements
- 2 inputs for identification
- 29 outputs
- CANopen safety protocol
- SIL 2, PL d



ESX.iOS

- 1 CAN interface
- 16 inputs
- 15 outputs
- CANopen safety protocol
- SIL 2, SIL CL 2, PL d

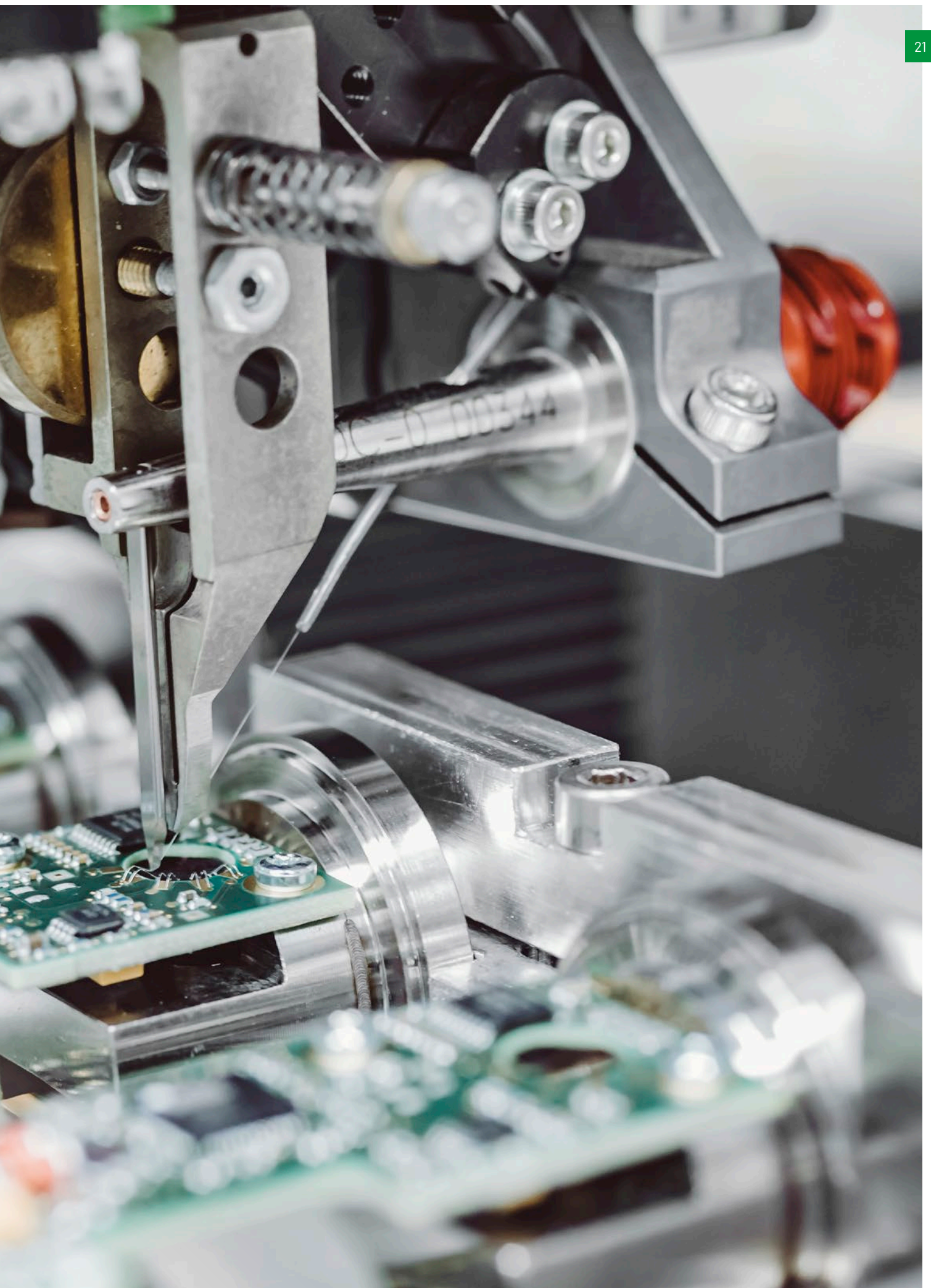


ESX.iot

- 1 CAN interface, CAN FD ready, wake-up, HW compliant to ISOBUS ISO 11783-3, LIN Spec 2.2A (optional)
- Variants with 16, 20, 24 or 28 inputs
- Variants with 13, 9, 5 or 0 outputs
- Up to 8 half bridges supporting PVG valves
- 1 sensor supply
- 6-axis accelerometer & gyroscope (optional)

SENSORS

Our sensors record physical parameters and convert them into electrical signals. In this way, various parameters in mobile machines such as the temperature, pressure, strain, inclination, and angular speed can be measured and further processed. The measurement values serve amongst other things the monitoring and control of the drive as well as the working function or the energy management of mobile machines, and can also be provided on the internet, for example for predictive maintenance measures. Over and above this, our sensors are characterized by their particular resilience and durability.



PRESSURE SENSORS & SWITCHES

(SAFETY / NON-SAFETY)

Our pressure sensor lineup offers a versatile modular system for measuring pneumatic and hydraulic pressures. Pressure connection, range, electrical setup, and output signal can be flexibly combined. All sensors are equipped with an E1 certification and have been developed for tough environments and stringent requirements of hydraulic or brake systems in mobile machinery.

We offer extensive customization and provide OEM solutions as well. High-pressure applications employ welded stainless-steel

measuring cells, commonly used in mobile machines, while silicon cells are suitable for low pressure. Sensors resist non-aggressive gases and liquids based on cell type and material. 316L variants cater to hydrogen, CNG, and LPG applications. For applications requiring functional safety, we provide a F02 Safety variant alongside the standard M01 version.

In addition to our pressure sensors, with the P01 we also offer a highly flexible and modular system of pressure switches.



SMX.pt-ma1

NEW

- Pressure sensor
- Nominal pressure from 100 to 800 bar (relative), welded stainless steel measurement cell, incl. vacuum
- Overload pressure at least twice the nominal pressure
- Media temperatures up to 125 °C / 257 °F
- Protection class IP67
- Analog output (current/voltage)



M01

- Pressure sensor
- Nominal pressure from 0.1 to 7 bar (relative and absolute), silicon measurement cell, incl. vacuum
- Nominal pressure from 5 to 2000 bar (relative), welded stainless steel measurement cell, incl. vacuum
- Overload pressure at least twice the nominal pressure
- Media temperatures up to 150 °C / 302 °F
- Protection class IP67 and IPX9K
- CAN enabled: CANopen, SAE J1939, STW proprietary
- SENT variant: SAE J2716 APR2016 (Rev. 4) supported
- All common analog output signals available



F02 Safety

- Safety pressure sensor
- Pressure ranges from 0 ... 10 bar to 0 ... 1200 bar (relative) with welded stainless steel measurement cell
- Operating temperature range -40 ... +85 °C / -40 ... +185 °F with media temperatures up to +125 °C / +257 °F
- Redundant inverse output signal (either analog current or ratiometric voltage)
- Protection class IP67 and IPX9K
- Welded stainless steel measurement cell



P01

- Pressure switch
- Pressure ranges from 0 ... 0.1 bar to 0 ... 7 bar (relative and absolute) with silicon measurement cell
- Pressure ranges from 0 ... 10 bar to 0 ... 2000 bar (relative) with welded stainless steel measurement cell
- High overload pressure
- Media temperatures up to 150 °C / 302 °F
- Protection class IP67/IPX9K (depending on connector type)
- NPN and PNP output available

TEMPERATURE SENSORS

The main challenge for temperature sensors used in mobile machines is the direct measurement of the medium and the fast recording of temperature changes. In the T01, the wetted parts are made of stainless steel. In combination with the welded temperature element, this ensures maxi-

mum media compatibility and corresponding response times.

With the best EMC characteristics and high levels of shock and vibration resistance, the T01 can be used in demanding applications, such as mobile hydraulics.



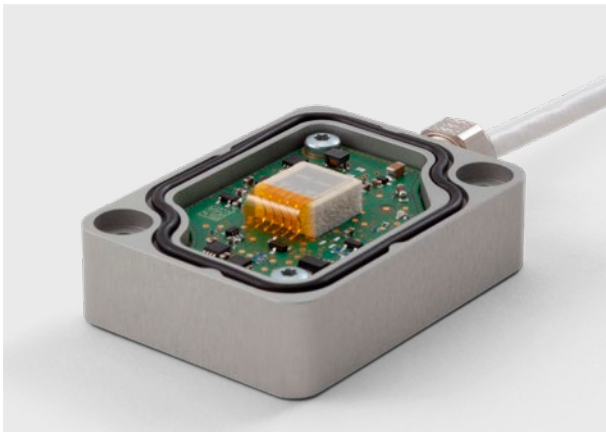
T01

- CAN bus temperature sensor for measurement directly in medium
- Measuring range -40 ... +150 °C / -40 ... +302 °F
- Support of CANopen or SAE J1939 protocol
- Configurable digital filter (CANopen)
- Fast response times
- Protection class IP67/IPX9K
- High media compatibility
- Designed for OEM needs
- With ECE type approval
- UL-Listed

STRAIN SENSORS

Measuring deflections like steel arm movements, strain sensors indirectly capture forces, weights, and vibrations. Installing conventional strain sensors is complex. The SMX.dms-a simplifies this with optimized connection technology, integrat-

ing it into mobile machine production. It comes mountable or preassembled with a carrier plate that is easily replaceable on-site for servicing. Configuration data transfer allows quick replacement without realignment, minimizing downtime.



SMX.dms-a

- Measurement span adjustable in steps from 120 $\mu\text{m/m}$ up to 2000 $\mu\text{m/m}$, with configurable offset and measurement range within $\pm$ of the selected span
- Operating temperature range $-40 \dots +85 \text{ }^{\circ}\text{C}$ / $-40 \dots +185 \text{ }^{\circ}\text{F}$
- CAN interface, current loop interface (optional)
- High signal to noise ratio (SNR) of output signals
- Protection class IP6K5 / IPX7 / IPX9K (when installed or pre-mounted on carrier plate)



SMX.dms-a on carrier plate

- Also available on carrier plate for quick replacement without realignment. Optimized assembly technology for easy commissioning directly at the production line

IMUS & INCLINATION SENSORS (SAFETY / NON-SAFETY)

The sensors are used to measure the accelerations, rotation rates, and tilt angles of an object in relation to the earth's gravity field. They provide the functionality of an inertial measurement unit (IMU). Data is recorded for all three spatial axes. Outstanding sensor technology and intelligent filters used in combination with

compact and robust housings are ideal for dynamic applications in mobile machines and harsh environmental conditions. The measured values are made available via a digital CAN interface. This provides the possibility for easy integration of the sensor into existing systems. Sensor variants with functional safety are also available.



SMX.igs-a

- PL b and PL d variants available
- Acceleration measurement range $\pm 3 \text{ g}$
- Gyroscope measuring range $\pm 125^\circ/\text{s} \dots 4000^\circ/\text{s}$
- Configurable inclination measurement range $\pm 90^\circ$ or 360° , respectively pitch and roll
- Temperature range -40°C a $+85^\circ\text{C}$
- Configurable interfaces: CANopen Safety, CAN, CANopen or SAE J1939
- Status LED
- Protection class IP6K5/IPX7/IPX9K



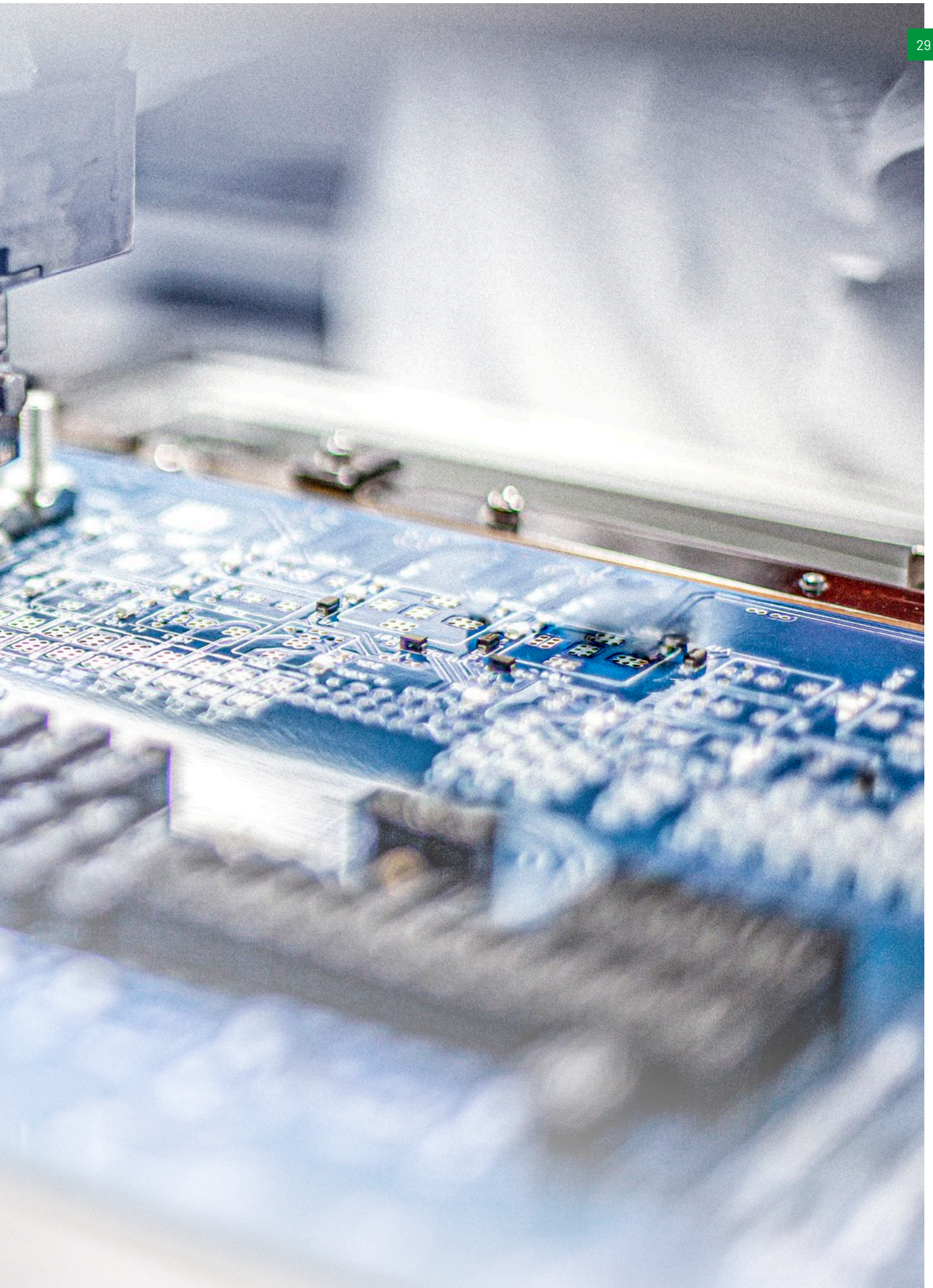
SMX.igs-e

- Acceleration measurement range $\pm 2 \text{ g}$
- Gyroscope measurement range $\pm 1000^\circ/\text{s}$
- Configurable inclination measurement range $\pm 90^\circ$ or 360°
- Temperature range -40°C to $+85^\circ\text{C}$
- Configurable interfaces: CAN, CANopen, or SAE J1939
- Status LED
- Protection class IP6K5/IPX7/IPX9K

POWER DISTRIBUTION

Our central electrics and body control units are the core of every electrical system. They are available both as standard products and as customer-specific developments, and are characterized by their operationally-safe, compact and economic design. It is possible to select between decentralized or central power distributors depending on the vehicle architecture. Using these, machine functions can be safeguarded, switched and diagnosed. Reliability, efficiency and flexibility are only some advantages of our products. Our standard variants are characterized by their fast availability and can easily be used for the expansion of existing systems.

Over and above this, we offer our customers individually-tailored variants which we can configure optimally from a modular system featuring different connectors, fuses, relays and power elements. On request, we offer specially-designed solutions for connectors, relay and fuse sockets as well as for power elements.



BCX BODY CONTROL UNITS

- Power distribution
- Switching and safeguarding
- Different interfaces
- Inputs and outputs
- Diagnostics function
- Freely programmable

The BCX body control units provide intelligent power distribution and are available as a standard product as well as in customer-tailored development. They can be used in various machine sizes and, among other things, function as cabin control units.

The product spectrum of body control units can be subdivided into two development stages based on the know-how of the passive central electrics:

1. BCX - I/O expansion (passive central electrics + I/Os)

Our body control units with I/O expansion are equipped as a standard mea-

sure with wake-up inputs and semiconductor outputs. All fuses and relays are equipped with diagnostic functions. The relays can also be switched via the controller. This permits full integration into the vehicle network.

2. BCX - active / intelligent body control unit (passive body control system + I/O expansion + intelligence)

Our active and intelligent body control units combine a controller and a central electric system to form a single electric system. Customer-specific developments can also be realized for intelligent central electric systems.



BCX.4cs-ag

- 32 bit Infineon Aurix TC367 Multicore CPU, 300 MHz
- 672 kB internal RAM
- 4 MB internal Flash
- 16 MB external data Flash
- 1 CAN interface
- 2 supply voltages
- 12 inputs
- 20 outputs

ZEX CENTRAL ELECTRICS

- Power distribution
- Switching and safeguarding
- Suitable for small and large current and voltage ranges
- Wide product range of connectors as well as fuse and relay holders in press-fit technology
- Operating temperature: -40 °C to +85 °C

The key tasks for central electrics are the distribution of electrical energy, safeguarding, and switching. As solutions get more and more sophisticated, advanced functions comprise diagnostics and failure recognition, connection to bus systems, or handling of input sensors. A typical application is cabin control on both small and large machines. As part of the electronic system in a machine, pre-assembled and tested modules prevent time-consuming commissioning, reduce assembly time, and reduce the number of harnesses and connectors. With a compact design, they can be installed even in the smallest corners, while board labeling allows for easy orientation.

While we offer purely passive central electrics for nearly every application, the focus of our proposition is on customized designs with active functionality that reflect the requirements of our customers' machines.

Customized Solutions

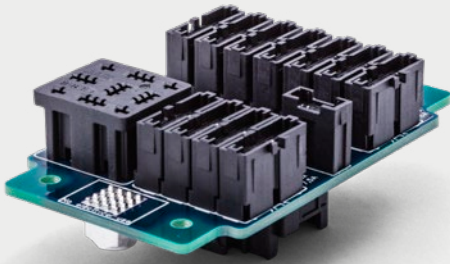
Our in-house services range from complete design based on a requirement list up to pure manufacturing services. We support testing, qualifications, and certifi-

cations necessary for construction, agriculture, or related applications.

We have expertise in individual requirements for central electrics and body control units, experience in project management, a platform concept for both hardware and software, and the option to choose from a wide range of flexible press-fit components:

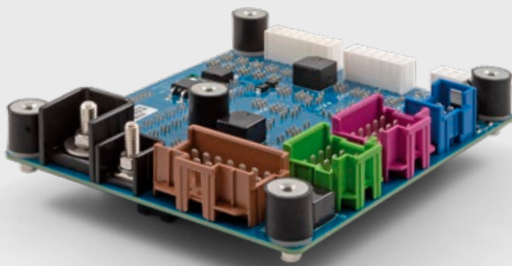
- Color- and form-coded plug-in connectors with different pole numbers
- Relay sockets in T or Maxi form
- Fuse holders in the construction forms Mini, ATO, and Maxi
- Power bolts produced with solid press-fit technology (used for current consumption)

Press-fit technology avoids not only the thermal load on the circuit board. It also allows a high packaging density due to double-sided assembly. All connections can be made on one board with a long-term stability. Furthermore, the replacement of components within a flexible press-fit zone is possible.



ZEX Variants

- Max. supply current: Up to 80 A or 2x 70 A (depending on product version)
- Outputs per Variant:
 - ZEX.0112-a: 3-row, 18-pole plug-in connector, JPT/MCP compatible
 - ZEX.0202-a: 3-row, 6-pole plug-in connector, JPT/MCP compatible
 - ZEX.0209-a: 3-row, 18-pole plug-in connector, JPT/MCP compatible
 - ZEX.0016-a: 3-row, 21-pole plug-in connector, JPT/MCP compatible
- Recommended cable cross-section for plug-in connectors:
 - For currents ≤ 15 A: 7.5 A per mm²
 - For currents > 15 A: 5 A per mm²

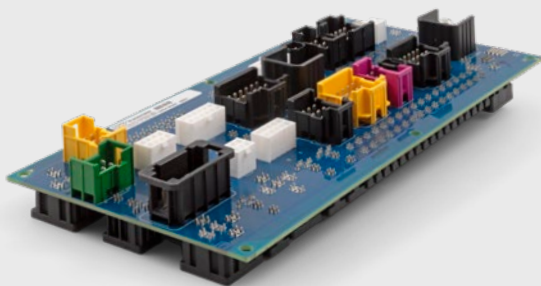


ZEX Customized Solutions

The ZEX product family offers flexible customization options to match specific application requirements. Various configurations allow seamless integration into different system architectures. Whether for power distribution, signal processing, or specialized connectivity, ZEX solutions can be adapted to meet diverse demands.

With a modular approach, the ZEX platform enables customer-specific configurations, ensuring optimal functionality and efficiency. From connector layouts to interface adaptations, STW provides tailored solutions to support a wide range of applications.

See example pictures for possible configurations.



CONNECTIVITY & DATA MANAGEMENT

The networking of mobile machines in connection with modern data management forms the basis for digitalization. The interaction of hardware, software and services permits the realization of both simple and complex applications in fleet management as well as services for all interested parties involved with the machine.



TCG DATA MODULES

- Embedded Linux for fast and easy development of applications
- Wide-ranging support through generic software tools and libraries
- Compatible with major cloud platforms
- Compliance with standards for the automotive, agricultural, and construction machinery industries
- Robust, reliable, and field-tested

Our TCG modules take the digitalization of your mobile working processes to the next level – on and at the machine, as well as around and beyond the machine. On the machine, the wired Ethernet and CAN interfaces facilitate the exchange of data with controllers, displays, and sensors. The direct interface to the user is realized through USB, Bluetooth, or Wi-Fi. M2M, or generally M2X, networks ensure communications with other machines via Wi-Fi or Bluetooth. Access to the internet, and therefore even to dedicated servers or cloud solutions (IoT), is also provided via Wi-Fi or a cellular network (4G).

Fulfilling these prerequisites for communication, the TCG modules can unfold their full strength, which is based on a powerful

processor system running embedded Linux. Ready-to-use tools provided by STW and running on this Linux system provide users with everything they need for standard configurations.

For experienced users with deeper IT integration needs, a freely available development environment, a large user community, and access to the comprehensive STW software packages and examples are the right way forward. With our Telematics Application Framework (TAF) right up to cloud connectors, we offer a range of additional libraries and tools that allow data logging, edge computing, cloud connectivity, remote access, and over-the-air (OTA) updates, fulfilling nearly all requirements.



TCG-4

- i.MX 6UL @696 MHz 32 GB Flash / 1GB RAM
- 4G/3G/2G communication
- GPS/GLONASS/BEIDOU/GALILEO
- Wi-Fi 2.4/5 GHz / Bluetooth 4.2
- 4 CAN interfaces
- 4 Multifunctional inputs / 2 Digital outputs
- Ethernet 10/100BASE-TX / Single Pair Ethernet 100BASE-T1
- USB 2.0



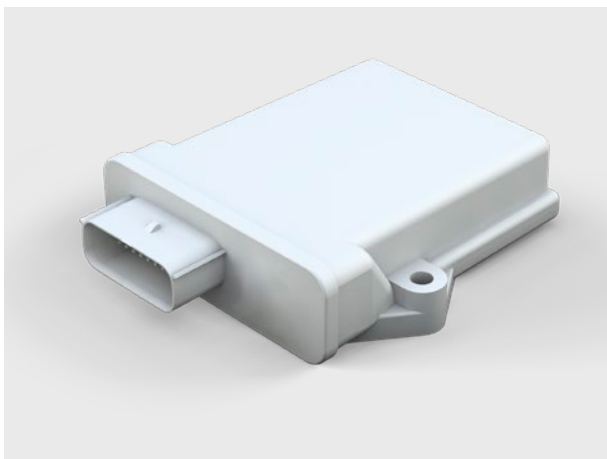
TCG.5

SOON

Next-Generation Linux-Based Connectivity Controller

The TCG.5 is a high-performance and future-proof hardware solution for a wide range of connectivity and edge computing applications. Equipped with multiple communication interfaces and state-of-the-art wireless technology, it enables seamless and flexible networking.

Available in various configuration levels and with extensive expansion options, the TCG.5 ensures an optimal balance between performance and cost efficiency.



TCG.nano

SOON

Cost-Optimized Linux-Based Connectivity Platform

The TCG.nano is a compact and cost-efficient connectivity platform with extended data logging capabilities. Featuring global 4G connectivity (optional 5G) and versatile programming options, it enables seamless and straightforward integration with cloud systems.

SOFTWARE SOLUTIONS

- Product, software, and service from a single source
- Linux: diverse configuration and programming options
- Telematics Application Framework (TAF) streamlines hardware access
- Future-proof and investment-secure through an open-source approach
- MACHINES.insight: web tool for configuration & diagnostics
- STW IoT Solutions: seamless cloud connectivity

TCG variants provide flexible configuration options for both developers and service-focused users. Using advanced tools or our toolchain with libraries from the Target Support Package, the TCG can be tailored to specific requirements.

All TCG units run on embedded Linux, supporting C/C++, Python, and ROS. A wide range of algorithms and tools simplifies application development. The Telematics Application Framework ensures seamless access to Bluetooth, Wi-Fi, and cellular modem connectivity, while wired options like CAN bus Layer 2, CANopen, J1939, TCP/IP, and UDP/IP are fully programmable.

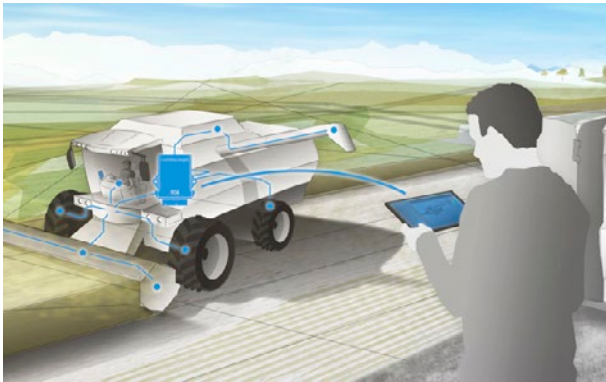
With flexible interfaces, training resources, and support from our FAE team, users can maximize the TCG's potential. As an open-source system, Linux ensures a future-proof investment.

For non-programmers, MACHINES.insight offers an intuitive web interface to con-

figure, visualize, diagnose, and update the TCG. Wi-Fi connectivity enables easy access via a web browser, supporting cyclic and event-driven data logging. Logged data can be stored locally or transmitted via cellular or Wi-Fi to a cloud service.

STW's IoT services extend these capabilities, enabling secure machine-to-cloud connectivity. The Basic IoT Bundle provides an out-of-the-box solution for collecting and transmitting sensor data. With encrypted communications and certified security, it meets privacy requirements and supports compliance with the Cyber Resilience Act (CRA).

AWS integration offers scalable processing and storage, supporting real-time monitoring, predictive maintenance, and customizable dashboards. Over-the-air updates ensure continuous software improvements for long-term digital machine solutions.



MACHINES.insight

- CAN logging
- Interface configuration
- Error diagnostic
- Update mechanism
- Realtime function



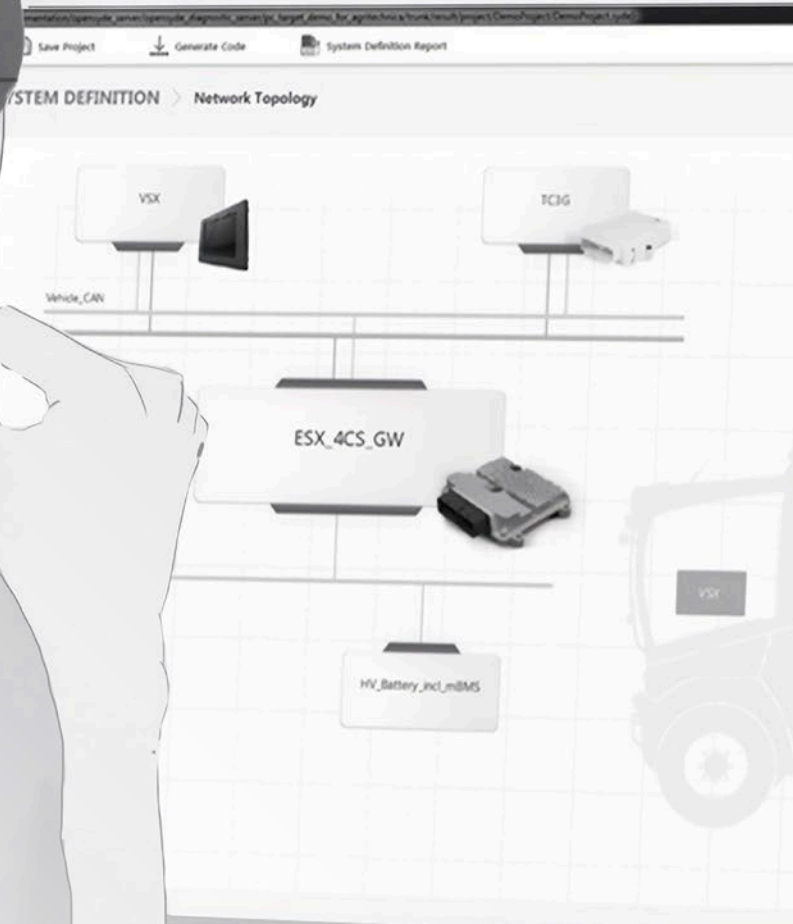
Basic IoT Bundle

- Secure recording, transmission and analysis of machine data
- Real-time monitoring and predictive maintenance
- Over-the-air updates for easy software updates
- High safety standards, CRA-compliant



MACHINES.cloud

- Visualizations
- Alarming
- Historical & real-time data
- Geo features
- Process support



INTEGRATION

The capability of our products and solutions is huge. Whenever this seems too challenging our integration services are right in place and our harmonized tool-chain ensures a smooth workflow. Making your machine perform is our common mission.



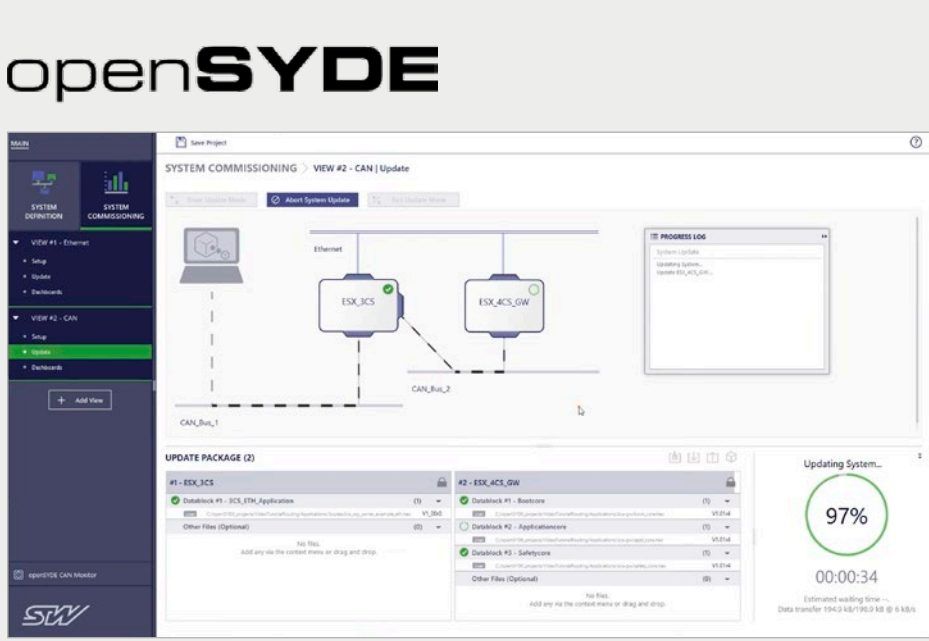
openSYDE

openSYDE is the open-source software platform by STW for the time- and cost-saving implementation, commissioning, and analysis of control systems for mobile machinery. In addition, openSYDE offers all teams involved, from development and production to service, a user-friendly interface with state-of-the-art design.

The software suite impresses with consistency throughout the entire product lifecycle of your machine – from variable definition to system documentation and support. The entire system definition, configuration, maintenance and documentation can be managed centrally throughout the entire product lifecycle. All system-relevant data and information is available in a uniform format at all times. Redundant data storage and the time-consuming data maintenance in different systems can be easily eliminated.

Thanks to the open approach (open source), proprietary formats are a thing of the past and adaptations and extensions are easily possible. Third-party devices can also be easily integrated. Open interfaces to complementary toolchains enable, for example, the seamless integration of requirements engineering, continuous integration, and test environments for fully automated software integration tests. In combination with the automation platform Neuron Power Engineer (IEC 61131-3, formerly logi.CAD 3), a highly efficient development and runtime environment without vendor lock-in is available.

TÜV certification and the safety protocol ECeS (ESX CAN efficient Safety), specially developed by STW, also make openSYDE suitable for safety applications up to SIL 2 / PL d.



The screenshot displays the openSYDE software interface. On the left is a dark sidebar with navigation options like 'MAIN', 'SYSTEM DEFINITION', and 'SYSTEM COMMISSIONING'. The main area is titled 'SYSTEM COMMISSIONING' and 'VIEW #2 - CAN | Update'. It features a network diagram with components like 'ESX_3CS', 'ESX_4CS_GW', and 'CAN_Bus_1'. Below the diagram is a table for 'UPDATE PACKAGE (2)' with columns for component, version, and status. On the right, a 'PROGRESS LOG' window shows update details, and a large circular progress indicator shows '97%' completion with a timer at '00:00:34'.

Watch our free openSYDE video tutorials to gain a better understanding of how openSYDE can support your professional activities.



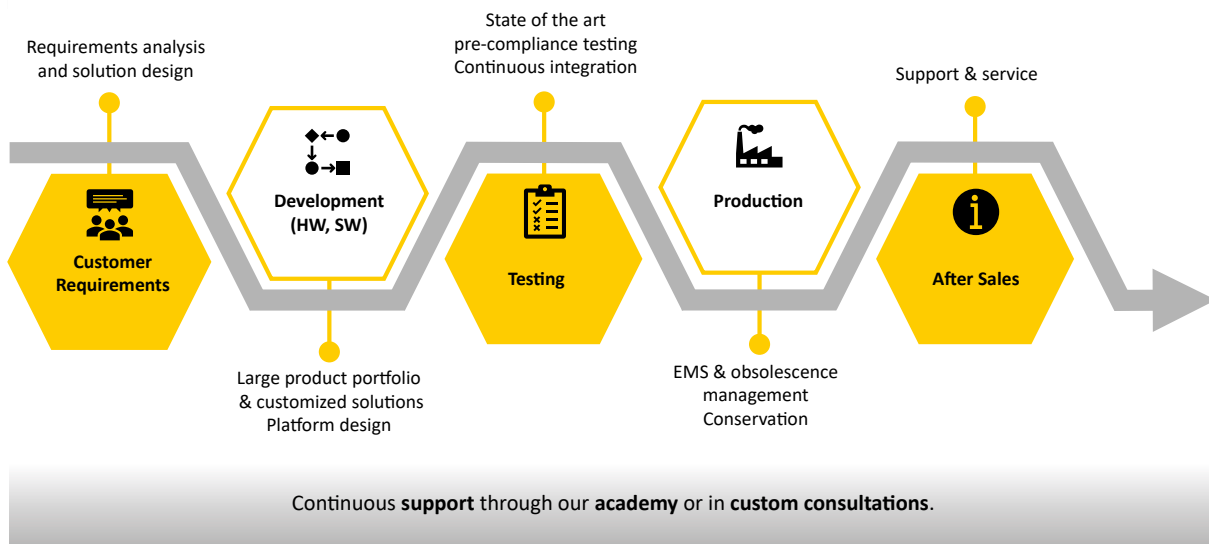
SERVICES

At STW, we provide a seamless journey for our customers. Beginning with a detailed analysis of customer requirements, we craft customized solutions to precisely meet their needs. Our proficiency spans hardware and software development, offering a diverse product range and, thanks to the specialized platform design, a huge ability to create customer-specific solutions.

Benefit from our vast experience and expertise to get the most out of your investment while not compromising on functional safety, approvals and innovation. Rigorous pre-compliance testing and

continuous integration ensure the highest quality and adherence to standards. Within our state-of-the-art production plant, we offer Electronics Manufacturing Services (EMS) coupled with obsolescence management, guaranteeing longevity and support. Post-sale, our commitment endures through dedicated support and service.

We have also established an academy to facilitate knowledge transfer, and we offer continuous customer consultations to ensure that our solutions evolve with their changing needs.



CYBER SECURITY FOR MOBILE MACHINES

Future-proof and compliant Solutions for OEMs

New EU regulations such as the Cyber Resilience Act (CRA), the Machinery Regulation (MVO), and the Radio Equipment Directive Delegated Act (RED-DA) are setting new cyber security standards for manufacturers of machinery and equipment. For OEMs, these directives introduce additional responsibilities – and create opportunities to strengthen the security and transparency of their machine systems.

RED-DA focuses on the cyber security of connected devices using WLAN, cellular or Bluetooth interfaces.

MVO requires secure control systems and software to protect machines from hacking and manipulation.

CRA extends cyber security across the entire product lifecycle, including mandatory updates and incident reporting.

Together, these regulations create a unified cyber security framework across Europe. Early preparation ensures not only compliance but also a sustainable competitive advantage.

Challenges for Machine Manufacturers

Meeting these new requirements is not always straightforward. Most existing vehicle and system architectures are optimized for longevity and functional safety, not for dynamic software lifecycle management. Redesigning such systems

would require cost-intensive redevelopment and re-certification of critical safety components. In addition, standardized, plug-in solutions for secure updates and traceability are often unavailable or incompatible with existing platforms.

Without a scalable and compliant approach, manufacturers face approval delays, development limitations, and potential liability in the event of cyber security incidents.



Cyber Security Over-the-Air Update Bundle

The cyber security Over-the-Air (OTA) Bundle from STW addresses these challenges. It enables secure, regulation-compliant software updates – without redesigning existing architectures. The bundle provides version control, traceable update processes, and verifiable vulnerability management across the machine lifecycle.

With its modular and integration-ready design, the OTA Bundle supports compliance with current EU cyber security regulations (RED-DA, MVO, CRA) and helps maintain the functional safety of existing system architectures.

STW – Your Partner in Cyber Security

At STW, we understand the technical and organizational complexity behind these new cyber security requirements. Our experts support you in developing and implementing effective, regulation-compliant cyber security strategies – from concept to operation. Whether you need technical consulting, process evaluation, or practical implementation, STW provides the expertise to make your machines secure, compliant, and ready for the future.

STW – securing your machines for today and tomorrow.



Making mobile machines perform.

As a globally operating company headquartered in the greater Munich Metropolitan Area, we have been delivering high-quality solutions for the digitalization and automation of mobile machines for 40 years. With a modular system of standardized and customer-specific products, systems, and software solutions, we empower our customers to make their machines the best in the world through cutting-edge technology.

www.stw.technology