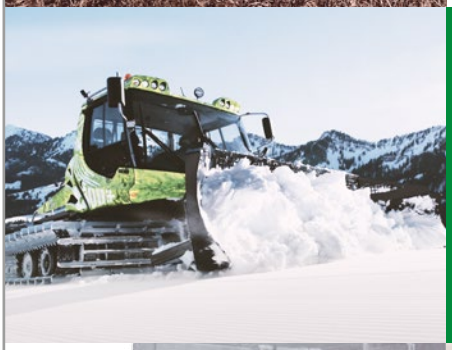
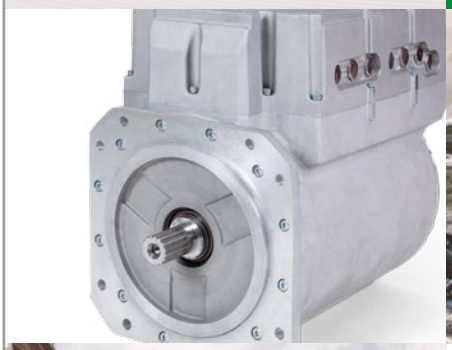
SOLUTIONS FOR

Mobile Machines



Automation
Connectivity
Electrification
Measurement Systems and Sensors



Product and Solutions Catalog 2016

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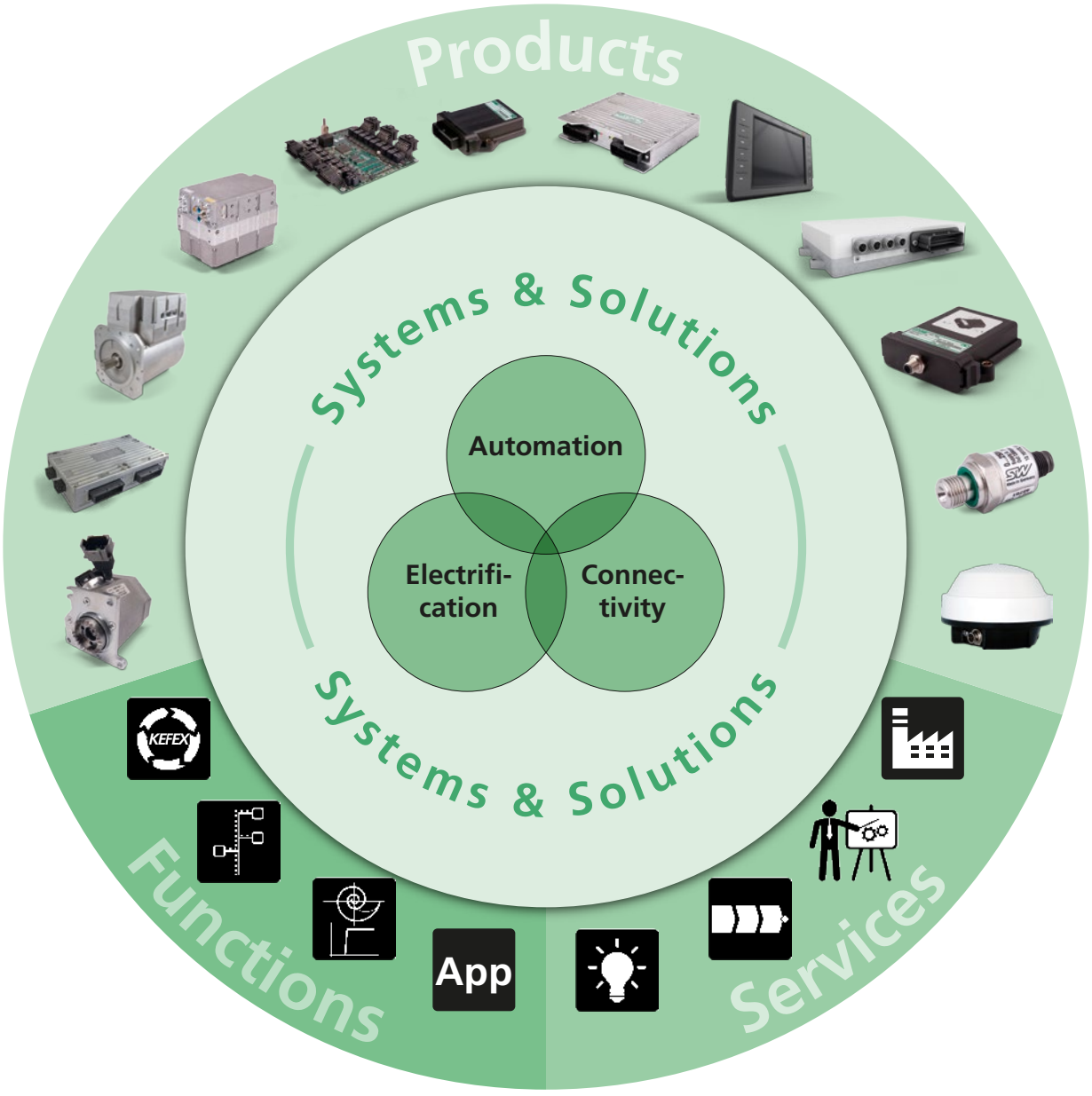


Sensor-Technik Wiedemann

Sensor-Technik Wiedemann GmbH (STW) is a manufacturer of sophisticated electronics solutions in the fields of automation, data management and connectivity as well as power electrification. Founded in 1985, STW has developed into an internationally active company and today employs a staff of 440, which serve small and medium-sized companies as well as leading OEMs. During the development and production of the OEM solutions, STW utilises its existing know-how, its technology and its infrastructure, to deliver both small batch quantities and to full serial production.

The standard product range comprises control unit solutions, displays and operator units, data management and telematics modules, solutions for power distribution, power electrification and e-Mobility and sensors and measuring technology which are all introduced in this catalogue. The portfolio is complemented by according software support comprising BIOS, hardware abstraction layer, telematics applications framework and protocols and cloud based IoT solutions. Beyond this we support our customers with training, during deployment and while monitoring and maintaining their products.

Our proposition is focused on the mobile machine market. For specific requirements we offer engineering and development services for variants and introduce compatible or supplementing products of selected partners. We also develop and manufacture solutions for other markets such as industry or medical technology - tailored to the individual requirements of our customers. In collaboration with our partners, we also realize projects in the fields of sensors, micro and power electronics, and embedded as well as application software programming. Naturally, we also deliver safety certified solutions.

Our headquarter is based in Kaufbeuren, Germany. To ensure close customer relations we rely on two independent STW companies in the USA and the United Kingdom as work with system integrators and sales partners in more than 15 countries.

Being an independent company we support our employees and acknowledge our responsibility for the society and the environment.

ESX-3CM – A new member for the established ESX Central Control Units

Developed and manufactured for use in harshest environment the ESX-3CM combines the advantages of the 32 bit ESX family of central control units with the typical configuration requirements of mobile working machines. With a total of 56 analog and digital inputs and outputs in its standard configuration the freely programmable central control unit is designed for sensor and actor management. Of course, the tried and tested development environments for the programming language “C” as well as for CODESYS are also available for the ESX-3CM. Further support comes with STW’s analysis, configuration and update tool KEFEX. The ESX-3CM complies to the CE and E1 standards and the standards of the automotive, agriculture and construction machinery. For 2016 another variant for safety oriented applications according to PL d (DIN EN ISO13489-1 2008-12) or SIL 2 (IEC 61508 Edition 2.0 2010-04) is planned.

Smart and Safe Operator Terminal for mobile working machines

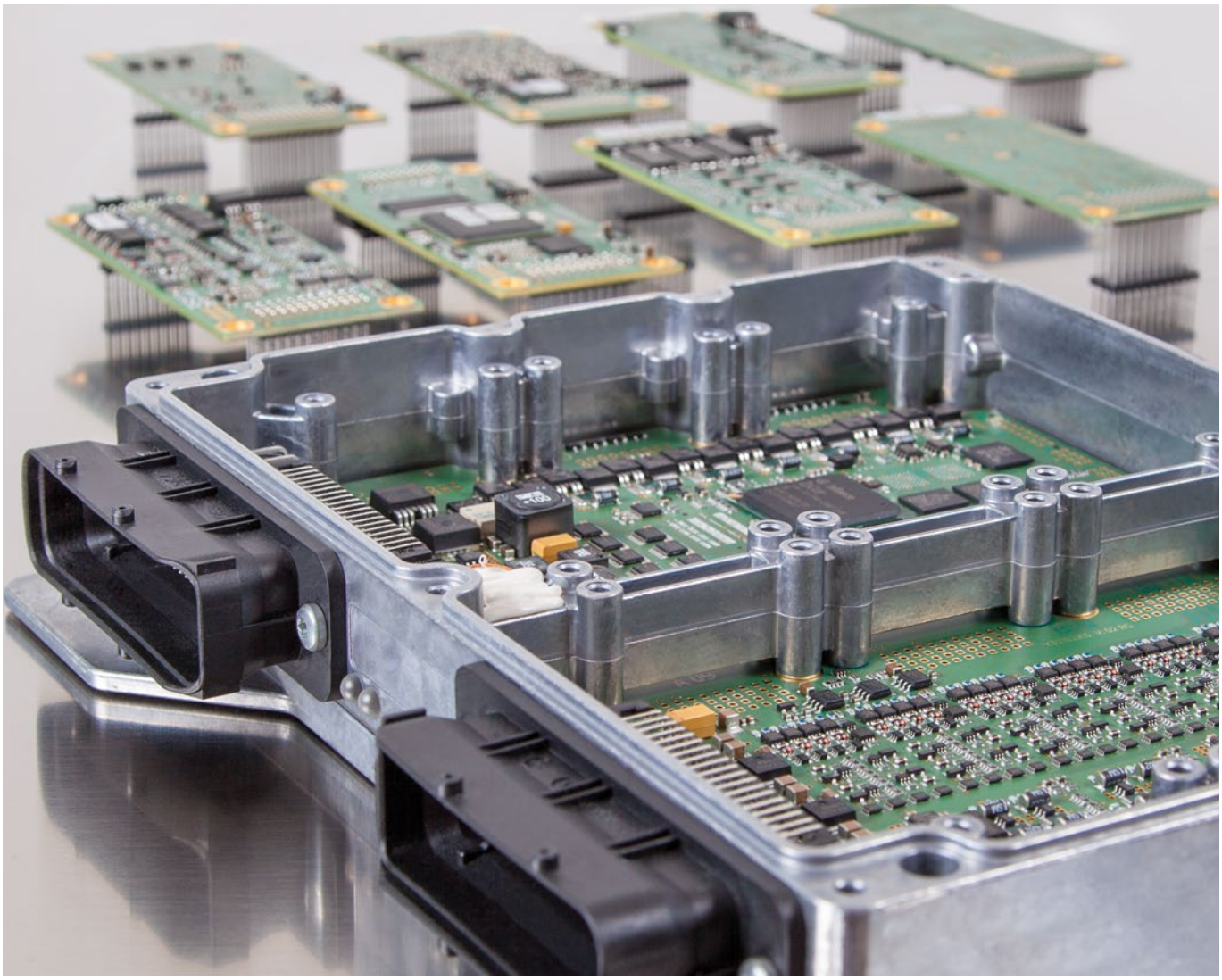
New to STW’s product portfolio are intelligent operator terminals, the interACT VSX display family. With support of safety related application according to SIL2, available in different sizes and with a sophisticated toolchain for graphical programming the new VSX display family not only offers an innovative HMI generation but also scalable functionality for the application without compare. The new family was created in close cooperation with a technology leader in displays which has worked as a pioneer for safety related displays in railway applications. Adding their wide expertise and experience both companies benefit mutually in this technology and production partnership.

Vehicle Electric Centers – Useful and intelligent

Vehicle electric centers or power boards are responsible for the protection and safeguarding, the distribution, the switching and controlling of electrical energy in a vehicle. Beyond protecting single circuits higher loads can be switched and controlled directly. By combining proven connector and press fit technology and the deep knowledge in control electronics regarding design and series production STW can today offer intelligent vehicle electric centers that meet customer requirements towards performance and quality in the market of mobile working machines and automotive applications. Standard products but also customer specific designs lead to solutions with field-proven technology that are functionality and cost optimized.

Data Management and Connectivity newly defined

Based on on-board platforms such as the TC3G, the TC1 or the EB07 STW offers its customers solution oriented possibilities to efficiently manage machine and process data. The solutions make use of the freely programmable Linux environment and on STW's Telematics Application Framework (TAF) which are available on all on-board modules. STW's Vehicle Data Management System VDS allows the configuration, collection and visualization of machine data. By using predefined and certified "connectors" the platforms extend to off-the-shelf solutions which can be effortlessly adapted to partner or customer solutions. This works also with STW's solution "machines.cloud" which allows the easy horizontal and vertical integration in process landscapes and lays ground for a fast and cost-efficient deployment of new business models.



SOLUTIONS FOR AUTOMATION

ESX Solution Overview

For the automation of functions in working machines it is necessary to implement the safe and reliable detection of different states, the interaction with the operator and the management of the resulting control and regulation tasks of these machine functions.

With the product groups out of STW's portfolio all automation jobs can be realized:

Central and Compact Control Systems

For this STW offers a wide range of central and compact control systems with 16 and 32 bit processors.

Central control systems are used for the central control of complex machines and the decentralized control of complex machine parts. In addition they work as the central node for the connection of operator and display terminals, of decentral control units and of additional I/O units via BUS systems. It goes without saying that a direct or BUS-based connection of sensors and actors via the interfaces of the central unit is possible, too.

Compact control units can be found in more simple machines or for the decentralized control of complex machines.

STW's 32-bit control units are complemented by proven and established 16-bit platforms.

The control units of the two families are capable of supporting safety-relevant applications and reach SIL 2 according to IEC 61508 and PL d according to DIN EN ISO13489.

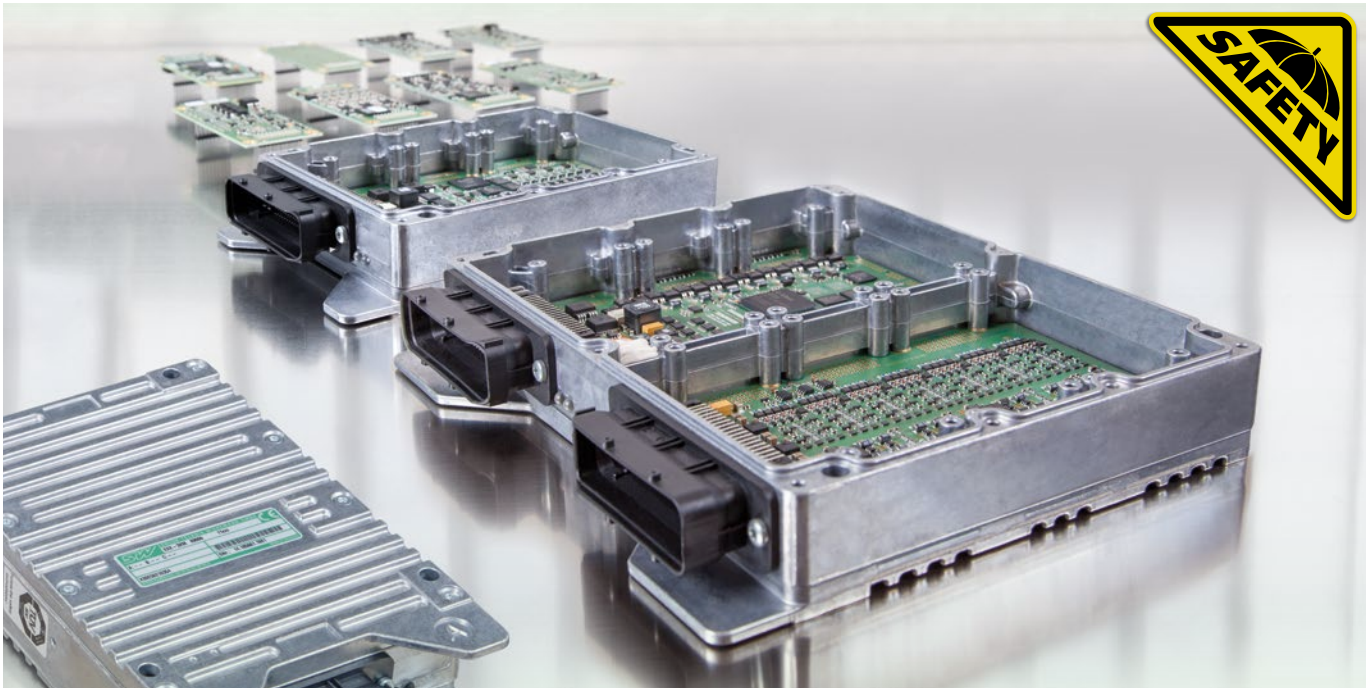
I/O Modules

I/O modules extend the input and output functionality of central and compact controllers. They are connected to the control units by bus protocols and reduce the efforts for cabling between sensors, actors and the control units.

Display and Control Panels

Displays show the operation status of mobile machines and offer possibilities for the operator to interact with the machine via touchscreen or keys.

Central Controllers ESX-3



The ESX-3XL and the ESX-3XM can be individually adapted regarding number and type of I/Os or communication interfaces to a multitude of requirements using expansion boards. The pre-configured ESX-3CM is the cost-efficient entry into the world of 32 bit control units.

Central Controllers for free configuration

	ESX-3XL Safety basic version	ESX-3XM Safety basic version
Expansion Boards (EB)	6 Slots for expansion boards	3 Slots for expansion boards
Processor	32 bit TriCore @ 150 MHz Separate system supervisor with programmable watchdog	
Memory	SRAM (Processor internal): 80 kB SRAM (external): 4 MB Flash (Processor internal): 2 MB Flash (external): 4 MB EEPROM: 32 kB	
Interfaces	4 x CAN	
In-/Outputs	28 x multifunction inputs *3 8 x digital / PWM Out (4 A) with current measurement 16 x digital / PWM Out (2.5 A) with current measurement	15 x multifunction inputs *3 8 x digital / PWM Out (2.5 A) with current measurement
In-/Outputs Non-Interfering	Expandable up to 136 I/Os with various expansion boards *1	Expandable up to 56 I/Os with various expansion boards *1
Safety	SIL 2 according to IEC 61508 PL d according to EN 13849	SIL 2 according to IEC 61508 PL d according to EN 13849
Programming	„C", CODESYS V3.x	„C", CODESYS V3.x

Expansion boards for ESX-3Xx family

	Expansion Board	STW Article ID	Interfaces	In-/Outputs	Data memory	Number of required slots	Particularities
I/O Safety Expansion	**EB06**	37176		10 x digital Out (2 A) 6 x PWM Out (2 A) 1 x analog Out (0 ... 20 mA or 5 ... 10 V) 16 x digital or voltage inputs (0 ... 40 V) 2 x digital or current inputs (0 ... 20 mA) 2 x digital inputs or resistance measurement (500 ... 2500 Ω)		3	No combination with other EBs except EB06 possible
I/O Expansion	**EB02**	33022		12 x digital or voltage inputs (0 ... 40 V), max. 3 pairs as incremental input 1 x digital Out (4 A) *1		1	
	EB04	35770		12 x digital Out (2.5 A) *1		1	
	EB04	35950		12 x PVG Out *1		1	
	EB05	35771		8 x PWM Out (4 A) 4 x digital or voltage inputs (0 ... 40 V) *1		1	
	EB05	5439		8 x PWM Out (0 ... 150 mA) 4 x digital or voltage inputs (0 ... 40 V) *1		1	
	EB08	50777		8 x digital Out Low-Side (2.5 A) 4 x digital or voltage inputs (0 ... 40 V) *1		1	
	EB08	50778		8 x PWM Out Low-Side (2.5 A) 4 x voltage inputs *1		1	
	EB09	55168		12 x multifunction inputs *1, *2		1	
	EB11	60619		6 x analog In (0 ... 5/10/40 V / 4 ... 20 mA / 6.5 kOhm) 6 x analog Out (0 ... 10 V / 4 ... 20 mA) 1 x Stabilized sensor supply (2.0 ... 10.5 V) *1		1	
I/O + Communication Expansion	**EB03**	33021	2 x RS232 RTC *1	4 x digital or voltage inputs (0 ... 40 V) *1	1 MB Flash	1	
	EB03	54512	2 x RS485 RTC *1	4 x digital or voltage inputs (0 ... 40 V) *1	1 MB Flash	1	
Communication Expansion	**EB10**	62458	4 x CAN 1 x RS232 *1			1	
	EB07	47349	1 x CAN 1 x RS232 1 x Ethernet 1 x USB RTC *1		1 GB Flash	1	Programmable via mainboard BIOS functions or Linux on MPC5200B controller. See also EB07 under Data Management and Connectivity Solutions.

Customer specific expansion boards on request.

*1) Non-Interfering I/Os / Interfaces can be used for non-secure application parts and do not affect the safe application part.
*2) To expand the Safety I/Os. Redundant input pairs per motherboard + Expansion Board EB06.
*3) Measurement of voltage or frequency / speed. Use as a digital input or in pairs as incremental input.

Preconfigured Central Controllers ESX-3XL

	ESX-3XL Safety & Communication	ESX-3XL Safety Max
	With expansion boards configured to optimize communication capabilities through various interfaces and to increase the number of important inputs and outputs.	With expansion boards configured to maximize the inputs and outputs.
Expansion Boards (EB)	EB07, EB03, EB10, 2 x EB04, EB09	2 x EB06
Processor	32 bit TriCore @ 150 MHz Separate system supervisor with programmable watchdog	
Memory	SRAM (Processor internal): 80 kB SRAM (external): 4 MB Flash (Processor internal): 2 MB Flash (external): 4 MB EEPROM: 32 kB	
	Data Flash: 1 GB (EB07) Data Flash: 1 MB (EB03)	
Interfaces	4 x CAN, 1x RS232	
	Additionally due to non-interfering EBs *1 1 x CAN (EB07) 4 x CAN (EB10) 1 x Ethernet (EB07) 1 x USB (EB07) 1 x RTC (EB07) 2 x RS232 or RS485 (EB03) 1 x RS232 (EB10)	
In-/Outputs	28 x multifunction inputs *3 8 x digital/PWM Out (4 A) with current measurement 16 x digital/PWM Out (2.5 A) with current measurement	
	additionally due to non-interfering EBs *1 4 x Uin (EB03) 24 x digital Out (2.5 A) (2 x EB04) 12 x multifunction inputs (EB09)	additionally due to 2 x EB06 *2 20 x digital Out (2 A) 12 x PWM Out (2 A) 2 x analog Out (0 ... 20 mA or 5 ... 10 V) 32 x digital or voltage input (0 ... 40 V) 4 x current input (4 ... 20 mA) 4 x resistance measuring (500 ... 2500 Ω)
Safety	SIL 2 according to IEC 61508 PL d according to EN 13849	
Programming	„C“, CODESYS V3.x	

Preconfigured Central Controllers ESX-3XM

	ESX-3XM Safety & Communication	ESX-3XM Safety Max
	With expansion boards configured to optimize communication capabilities through various interfaces and to increase the number of important inputs and outputs.	With an expansion board configured to maximize the inputs and outputs.
Expansion Boards (EB)	EB07, EB03, EB10	EB06
Processor	32 bit TriCore @ 150 MHz Separate system supervisor with programmable watchdog	
Memory	SRAM (Processor internal): 80 kB SRAM (external): 4 MB Flash (Processor internal): 2 MB Flash (external): 4 MB EEPROM: 32 kB	
	Data Flash: 1 GB (EB07) Data Flash: 1 MB (EB03)	
Interfaces	4x CAN	
	Additionally due to non-interfering EBs *1 1 x CAN (EB07) 4 x CAN (EB10) 1 x Ethernet (EB07) 1 x USB (EB07) 1 x RTC (EB07) 2 x RS232 or RS485 (EB03) 1 x RS232 (EB10)	
In-/Outputs	15 x multifunction inputs *3 8 x digital/PWM Out (2.5 A) with current measurement	
	additionally due to non-interfering EBs *1 4 x Uin (EB03)	additionally due to EB06 *2 10 x digital Out (2 A) 6 x PWM Out (2 A) 1 x analog Out (0 ... 20 mA or 5 ... 10 V) 16 x digital or voltage input (0 ... 40 V) 2 x current input (4 ... 20 mA) 2 x resistance measuring (500 ... 2500 Ω)
Safety	SIL 2 according to IEC 61508 PL d according to EN 13849	
Programming	„C", CODESYS V3.x	

*1) Non-Interfering I/Os / Interfaces can be used for non-secure application parts and do not affect the safe application part.
*2) To expand the Safety I/Os. Redundant input pairs per motherboard + Expansion Board EB06.
*3) Measurement of voltage or frequency / speed. Use as a digital input or in pairs as incremental input.

Central Controllers ESX-3

Integrated Central Controller ESX-3CM

	ESX-3CM
Processor	32 bit TriCore @ 300 MHz Separate system supervisor with programmable watchdog
Memory	SRAM (Processor internal): 288 kB SDRAM (external): 8 MB Flash (Processor internal): 4 MB EEPROM: 32 kB
Interfaces	4 x CAN or 3 x CAN and 1 x RS485 1 x RS232 1 x Ethernet (optionally)
In-/Outputs	8 x analog input 8 x multifunction inputs 5 V *4 12 x multifunction inputs 35 V *5 4 x digital / PWM output 4 A with current measurement 16 x digital / PWM output 4 A with current feedback 8 x digital outputs
Safety	Safety variant SIL 2 / PL d in preparation
Programming	„C“, CODESYS V3.x

*4) Measurement of voltage or frequency / speed. Use for edge detection, as digital input or as SENT interface.
*5) Measurement of voltage or frequency / speed. Use for edge detection, as digital input or as NAMUR interface. Use in pairs as incremental input.


GROVE
GROVE
GROVE GMK5110-1

Central Controllers ESX-2

The ESX-2-4 can be extended with additional I/Os using expansion boards. Other members of the 16 bit control unit family are available in plenty of hardware variations that have been optimized to different use cases. The variants have been created either with additional (optional) or other (alternative) hardware components. In a given hardware configuration it is possible to configure the hardware by software in different ways.

Freely configurable Central Controller ESX-2-4

	ESX-2-4
Expandable	2 Slots for expansion boards
Processor	16 bit C167 @ 20 / 40 MHz Separate system supervisor with programmable watchdog
Memory	RAM: 256 kB/1 MB Flash: 512 kB/1 MB EEPROM/FRAM: 8 kB
Interfaces	1 x / 2 x CAN 1 x RS232
In-/Outputs	16 x digital or speed input 8 x analog inputs (4 … 20 mA / 0 … 8.5 V) 5 x digital / PWM outputs (4A) with current measurement 3 x digital / PWM outputs (4A) with current measurement 5 x digital / PWM outputs (2.5A) with current measurement alternatively up to 12 x PVG outputs Expandable up to 48 I/Os with various expansion boards
Safety	PL d according to EN ISO 13849-1:2008 SIL 2 according to EN 61508-1/2/3:2002 Cat.3 according to EN 954-1:1997
Programming	„C" and CODESYS V2.x

Expansion boards for ESX-2-4

	STW Article ID	Interfaces	In-/Outputs
Type A	3911		6 x digital outputs (HS 4A)
	8769		6 x voltage inputs (0 … 8.5V)
	10017		6 x voltage inputs (0 … 10V)
	10158		6 x digital inputs
	11770		6 x voltage inputs (0 … 32V)
	17806	RTC	6 x digital outputs (HS 4A)
	21036		6 x digital outputs (LS 4A)
	21138	CAN non-interfering	2 x digital outputs (HS 4A) 2 x digital outputs (LS 4A)
Type B	6333		6 x PWM outputs (HS 4A) with current measurement / PVG / Voltage input 8.5V / 32V
	7232	CAN non-interfering	4 x PWM outputs (HS 4A) with current measurement / PVG / Voltage input 8.5V / 32V
Type C	9064		4 x current input (0...20 mA) 1 x incremental input / counter
	9085		3 x incremental input / counter
	11365		6 x voltage inputs (0 … 5V) 12 bit-ADC
	11366		6 x voltage inputs (0 … 10V) 12 bit-ADC
Type I	11687		6 x analog output (0 … 10V) 12 bit-DAC / 6 x voltage inputs (0 … 10V)
	14423		6 x analog output (0 … 130 mA) 12 bit-DAC / 6 x analog input (0 … 10V / 0 … 130 mA)
	17777		6 x analog output (0 … 10V / 0 … 20 mA) 12 bit-DAC / 6 x analog input (0 … 10V / 0 … 32V)
	22998		6 x analog output (0 … 10V / 0 … 20 mA) 12 bit-DAC / 6 x analog input (0 … 10V / 0 … 20 mA)
	26546		6 x analog output (0 … 10V / 0 … 20 mA) 12 bit-DAC / 6 x analog input (0 … 32V / 0 … 20 mA) 15 bit-ADC

All expansion boards are non-interfering.

Integrated Central Controller ESX-LT

	ESX-LT
Processor	16 bit C167 @ 20 / 40 MHz Separate system supervisor with watchdog
Memory	RAM: 256 kB / 1 MB Flash: 512 kB / 1MB EEPROM / FRAM: 8 kB
Interfaces	1 x CAN, alternatively 2 x CAN 1 x RS232
In-/Outputs	Maximum 28: 8 x digital or speed inputs 8 x multifunction inputs *6 4 x digital / PWM outputs (4 A) with current measurement, alternatively 4 x PVG outputs 4 x digital / PWM outputs (2.5 A) with current detection 4 x Low Side Digital / PWM outputs (1.5 A) Sensor supply 10 V
Programming	„C" and CODESYS V2.x

*6) Measurement of voltage, current, frequency / speed or use as a digital input.

Integrated Central Controller ESX-LTplus

ESX-LTplus	Option 1	Option 2	Option 3
Processor	16 bit C167 @ 40 MHz Separate system supervisor with watchdog		
Memory	RAM: 512 kB Flash: 1 MB EEPROM/FRAM: 8 kB		
Interfaces	1 x CAN, alternatively 2 x CAN 1 x RS232		
In-/Outputs	4 x voltage inputs 0 … 32 V 8 x current inputs 4 … 20 mA 4 x frequency input up to 8.9 kHz 4 x digital / PWM output 3.6 A with current measurement 12 x digital / PWM output 3.6 A with current detection	8 x current inputs 4 … 20 mA 4 x frequency input up to 8.9 kHz 20 x digital / PWM output 3.6 A with current detection	8 x current inputs 4 … 20 mA 4 x digital / PWM output 3.6 A with current measurement 20 x digital / PWM output 3.6 A high side, with current detection or 12 x digital / PWM output 3.6 A high side, with current detection 8 x digital / PWM output 3.6 A low side, with current detection
Configurability	Maximum 24 voltage inputs 0 … 32 V, if digital / PWM outputs are configured as inputs		
Programming	„C" and CODESYS V2.x		

Integrated Central Controller ESX-C

ESX-C	Option 1	Option 2	Option 3
Processor	16 bit ST10 @ 40 MHz Separate system supervisor with watchdog		
Memory	RAM: 512 kB Flash: 832 kB EEPROM/FRAM: 8 kB		
Interfaces	2 x CAN 1 x RS232		
In- / Outputs	8 x digital / speed inputs max. 7.2 kHz 8 x digital / voltage inputs 0 … 32 V 8 x analog inputs 0 … 10 V, 0 … 25 mA 1 x digital / PWM outputs 3 A 4 x digital / PWM outputs 2.5 A with current feedback 5 x digital / PWM outputs 3 A with current measurement 1 x sensor supply 8.5 V / 10 V	8 x digital / speed inputs max. 7.2 kHz 10 x digital / voltage inputs 0 … 32 V 8 x analog inputs 0 … 10 V, 0 … 25 mA 1 x digital / PWM outputs 3 A 8 x digital / PWM outputs 2.5 A with current feedback 2 x digital / PWM outputs 5 A with current feedback 11 x digital / PWM outputs 3 A with current feedback 1 x sensor supply 8.5 V / 10 V	8 x digital / speed inputs max. 7.2 kHz 10 x digital / voltage inputs 0 … 32 V 8 x analog inputs 0 … 10 V, 0 … 25 mA 1 x digital / PWM outputs 3 A 8 x digital / PWM outputs 2.5 A with current feedback 2 x digital / PWM outputs 5 A with current feedback 3 x digital / PWM outputs 3 A with current measurement 8 x PVG outputs 1 x sensor supply 8.5 V / 10 V
Programming	„C" and CODESYS V2.x		

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Compact Controllers

Compact Controller ESX-IOXp

ESX-IOXp	Option 1		Option 2		Option 3
Processor	16 bit XC2287 @ 80 MHz Separate system supervisor with watchdog				
Memory	SRAM: 1 MB Flash: 768 kB EEPROM/FRAM: 8 kB				
Interfaces	2 x CAN 1 x RS232				
In-/Outputs	2 x digital inputs 6 x RPM / digital inputs max. 7 kHz	Configurable as incremental inputs in pairs (max. 4)	1 x digital input 3 x RPM / digital inputs max 7 kHz	Configurable as incremental inputs in pairs (max. 2)	
	6 x voltage / digital inputs 0 … 10 V, low active 8 x current inputs 4 … 20 mA 4 x PWM outputs 3 A high side with current measurement 1 x sensor supply 5 V / 10 V		6 x voltage / digital inputs 0 … 10 V, low active 8 x current inputs 4 … 20 mA 4 x PWM outputs 3 A high side with current measurement		6 x voltage / digital inputs 0 … 10 V, low active 8 x current inputs 4 … 20 mA 4 x PWM outputs 3 A high side with current measurement
			4 x digital / PWM outputs 0.5 … 4 A high side with current feedback 1 x sensor supply 5/10 V		8 x digital / PWM outputs 0.5 … 4 A high side with current feedback 4 x digital outputs 4 A low side 1 x sensor supply 5 / 10 V
			Alternatively:		
			4 x PVG outputs 1 x sensor supply 10 V		4 x PVG outputs 4 x digital / PWM outputs 0.5 … 4 A high side with current feedback 1 x sensor supply 10 V
Configurability	All outputs can be configured as inputs for voltage measurement				
Programming	"C" and CODESYS V2.x				

Compact Controller ESX-micro

	ESX-micro
Processor	16 bit ST10F269 @ 40 MHz Separate system supervisor with watchdog
Memory	SRAM: 512 kB Flash: 256 kB, alternatively 1 MB EEPROM/FRAM: 8 kB
Interfaces	1 x CAN, alternatively 2 x CAN 1 x RS232
In-/Outputs	Maximum 10: up to 4 x analog inputs 4 … 20 mA or 0...10 V up to 4 x voltage inputs 0 … 10 V up to 2 x RPM inputs max. 6.5 kHz up to 8 x digital inputs active high / low, threshold configurable up to 2 x digital inputs active high / low up to 4 x digital / PWM outputs 2 A high side or 2 x digital / PWM outputs 4 A high side with current feedback up to 2 x digital / PWM outputs 2 A high side up to 6 x PVG outputs up to 2 x voltage outputs 0 ... 10 V up to 2 x current outputs 4 ... 20 mA 1 x motor bridge (3.5 A) two half bridges or full bridge with current measurement

SOLUTIONS FOR AUTOMATION
Controller Modules

For extending third party products with control functionality e. g. power boards in versions Expert and Expert Plus

Controller Module ESX-CM2

	ESX-CM2
CAN Interface	Yes
Programming	"C", CODESYS
Protocol	SAE J1939
Processor	16 bit ST10F269 @ 40 MHz Separate system supervisor with watchdog
Memory	SRAM: 512 kB Flash: 256 kB, alternatively 1 MB EEPROM/FRAM: 8 kB
Interfaces	1 x CAN, alternatively 2 x CAN 1 x RS232
In-/Outputs	up to 17 x Low Side outputs 250 mA up to 4 x analog inputs 4 ... 20 mA up to 26 x voltage inputs 0 ... 40 V up to 4 x RPM inputs max. 6.5 kHz up to 4 x digital / PWM Out 3 A high side with current feedback up to 10 x digital / PWM Out 2 A high side
Connection	Pin-and-socket / press-fit connectors

Another option is the use of the processor board of the ESX-3CM with according specifications.

SOLUTIONS FOR AUTOMATION
I/O Modules

STW offers I/O modules in different housings and protection classes. Products with digital and analog inputs and outputs with different switching capacity and a motor bridge form this product family.

ESX I/O Modules

	ESX-IOX	ESX-MBC	ESX-DIOS	ESX-DIOM
				
Interface	CAN	CAN	CAN	CAN
Protocol	CANOpen	J1939	CANOpen	CANOpen
In-/Outputs	Maximum 28: 2 x digital / RPM inputs up to 12 x digital / analog inputs (0 … 32V) up to 6 x digital / analog inputs (0 … 10V) 8 x analog inputs (4 … 20 mA) up to 4 x digital / PWM outputs (3A) with current measurement optionally 4 x additionally equipped LS-Switch (4A) alternatively 4 x PVG outputs up to 8 x digital / PWM outputs (4A) with current measurement	4 x multifunction inputs (digital high / low active, RPM 0.6 Hz … 1 kHz, 0 … 10V / 0 … 35V, 0 … 20 mA) 4 x PWM half bridges 10A with current measurement 2 x digital outputs 4A with current measurement 1 x digital output 200 mA 1 x sensor supply 5 … 12V	Maximum 8: up to 8 x digital inputs up to 4 x digital / PWM outputs (4A) with current measurement up to 8 x digital outputs (4A)	Maximal 24: up to 24 x digital inputs up to 12 x digital / PWM outputs (4A) with current measurement up to 24 x digital outputs (4A)
Maximum Current	11A	30A	30A	70A

SOLUTIONS FOR AUTOMATION

interACT Overview

For interaction between humans and machines STW offers a multitude of different units. One can find customer-specific developments as well as STW standard products and products by STW partners.

The units allow input for operation either via keys or touchscreens and outputs for visualization. The communication to the control units works through BUS systems.

interACT VSX Product Family

STW's new VSX display family is a Linux based platform for IP65 operator terminals with display sizes from 7" to 15". The models VSX 7W, 8W (W for widescreen), 10 and 12 will become available as standards. More variants can be realized quickly due to the underlying platform concept.

The operation works via touch and / or soft keys. The units can be integrated into a dashboard or mounted separately using a VESA mount.

Intuitive programming is done with the graphical development kit.

All units reach SIL2 for visualization, touchscreen and soft key operation, video and communication.

Display and Control Panels

		VSX-7W	VSX-8W	VSX-10	VSX-12	VSX-8	VSX-10W	VSX-12W	VSX-15
		Samples in Q4 / 2016 Series planned for Q2 / 2017		Samples available Series planned for Q4 / 2016		Available on request			
Processing Core	**Processor**	Cortex A9 DualCore 800 MHz							
	Main Memory	512 MB DDR3 RAM 16 bits optionally 1 GB DDR3 RAM 32 bits, ECC available							
	NAND Memory	512 MB Flash with ECC optionally 2 GB Flash with ECC							
	FRAM Memory	256 kbit FRAM optionally 1 Mbit FRAM							
	uSD	optionally available (Expansion Board)							
Display	**Size**	7.0" 15:9	8.0" 15:9	10.4" 4:3	12.1" 4:3	8.4" 4:3	10.6" 15:9	12.1" 16:10	15.0" 4:3
	Resolution	800 x 480	800 x 480	1024 x 768	1024 x 768	1024 x 768	1280 x 768	1280 x 800	1024 x 768
	Viewing Angles	H +/- 80° V +80° / -60° IPS version on request	H +/- 80° V +/- 80°	H +/- 85° V +/- 85°	H +/- 80° V +/- 80°	H +/- 80° V +80° / -60°	H +/- 85° V +/- 85°	H +/- 80° V +80° / -60°	H +/- 80° V +80° / -60°
	Brightness	1500 cd/m²	1200 cd/m²	1000 cd/m²	1300 cd/m²	1000 cd/m²	1000 cd/m²	1500 cd/m²	1500 cd/m²
	Contrast	600:1	700:1	700:1	800:1	600:1	1000:1	700:1	800:1
	MTTH	100,000h	100,000h	100,000h	100,000h	100,000h	100,000h	100,000h	60,000h
User Interface	**Keys**	optionally available							
	Encoder	on request							
	Touch	**Without Touchscreen** optionally Standard 3H touch optionally GFG 7H rugged with glass surface							
	Sound In/Out	optionally available (Expansion Board)							
Interfaces	**Ethernet 1**	1 x 10 / 100 Mbit / s							
	Ethernet 2	optionally available (Gigabit Ethernet)							
	CAN 1	**CAN1 without galvanic isolation** optionally CAN1 with galvanic isolation							
	CAN 2	**CAN 2 without galvanic isolation** optionally CAN2 with CAN WakeUp							
	CAN 3	**Without CAN3** optionally CAN3 without galvanic isolation							
	CAN 4	**Without CAN4** optionally CAN4 without galvanic isolation							
	USB Host	1 x USB 2.0							
	CCTV1	1 out of 2 displayable		CCTV1 (PAL / NTSC)				2 out of 4 displayable	
	CCTV2			CCTV2 (PAL / NTSC)					
	CCTV3			optionally CCTV3 (PAL / NTSC)					
	CCTV4			optionally CCTV4 (PAL / NTSC)					
	Digital I / O	4 x IN (NPN / PNP) ; 2 x IN (NPN) 2 x OUT (1 A)							

		VSX-7W	VSX-8W	VSX-10	VSX-12	VSX-8	VSX-10W	VSX-12W	VSX-15
		Samples in Q4 / 2016 Series planned for Q2 / 2017		Samples available Series planned for Q4 / 2016		Available on request			
Others	**Real Time Clock**	With Goldcap (24h), optionally battery backed (10 years, externally)							
	Buzzer	Buzzer							
	Streaming Ethernet Video	H.264 Hardware accelerated 4x4CIF							
	OpenGL Graphical Effects and 3D Graphics	Optionally OpenGL ES 1.1 GPU Hardware acceleration							
Connectivity	**WLAN**	IEEE 802.11 a,b,g,n,d,e,I compliant, 2.4 and 5 GHz, optionally available (Expansion Board)							
	Cellular nets	GSM / GPRS / EDGE Quad Band, UMTS / HSPA+ Five Band, optionally available (Expansion Board)							
	GSM Telephony	on request							
	GPS/GLONASS	GLONASS and GPS simultaneously, optionally available (with "Cellular nets" Expansion Board)							
	Bluetooth	optionally available (Expansion Board)							
Safety	**Safe HW Version**	SIL 2 HW Version, optionally available							
	Safe SW Platform	SIL 2 Platform, optionally available							
	Safe Visualisation	yes, SIL 2 (with safe hardware and software)							
	Safe Touchscreen	yes, SIL 2 (with safe hardware and software)							
	Safe Keys	yes, SIL 2 (with safe hardware and software)							
	Safe Video	yes, SIL 2 (with safe hardware and software)							
	Safe Communication	yes, SIL 2 (with safe hardware and software)							
Toolchain	**Programming**	Graphical Programming Interface and toolchain							
	CODESYS Support	planned for Q2 / 2017							
	Safe Toolchain	available, fully SIL2 qualified for all safety functions							
Mechanics	**Housing Material Front**	Plastic / Aluminum-composite							
	Housing Material Rear	Aluminum							
	Mounting Options	RAM / VESA or Panel mount							
Environment	**Supply Voltage Range**	9VDC - 32VDC continuous, e1 voltage variations							
	Operating Temperature	-30° C to +70° C full device -40° C to +80° C electronics Self-Heating below -30° C							
	Storage Temperature	-40° C to +80° C							
	Ingress Protection	IP65 and IP67							

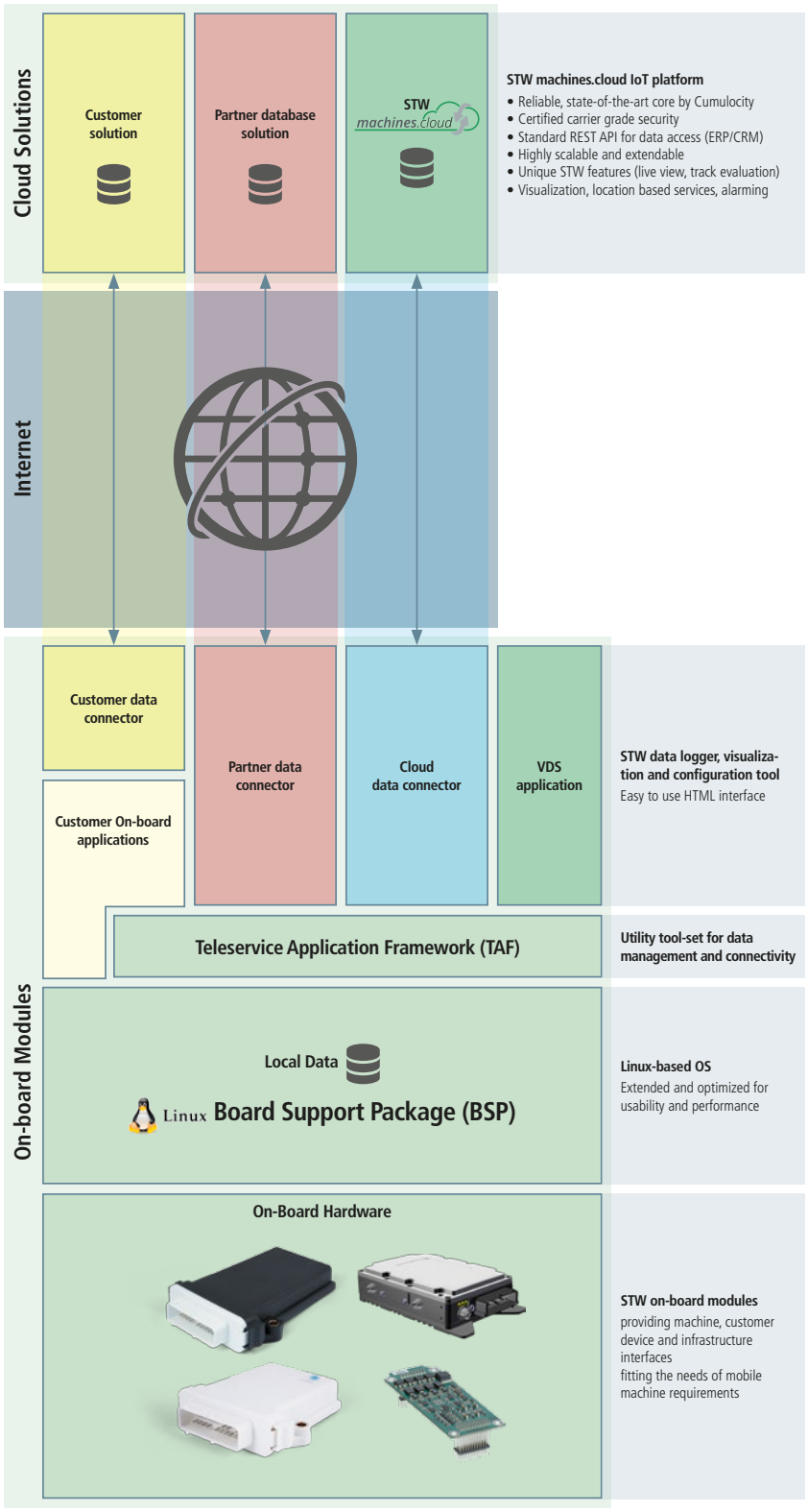
DATA MANAGEMENT AND CONNECTIVITY SOLUTIONS

System Overview

STW offers a multitude of solutions for data management and connectivity based on off-the-shelf on-board modules. These modules are made for the vehicle, adapted to the environmental conditions and use for data management and connectivity in mobile working machines, and equipped with a Linux computer. They provide data connectivity within the vehicle (CAN), between vehicles (M2M), with a network (WiFi, cellular), and with local user and service devices (WiFi, Ethernet, USB). The modules add integrated sensor information such as position and movement information and allow a direct connection with sensors (CAN, LIN). On top their computing power can be used for data conversion (gateway) and processing for assistance and infotainment applications.

System Overview

For machine monitoring machine data are collected on the modules and either locally or remotely presented for diagnose, service and development purposes.



To complete its proposition STW cooperates with providers of proprietary or standardized data base and cloud service software solutions. The available data (machine and operation data, other sensor data) are collected, presented or connected with higher level systems such as ERP or FMIM thus supporting the work process in which the machines are used.

DATA MANAGEMENT AND CONNECTIVITY SOLUTIONS
On-Board Modules

The product family comprises the on-board modules DMM, TC3G and TC1 with integrated wireless communication technology for data transmission and GPS/GLONASS sensors for positioning. The Telematics Application Framework is an integral part for programming data collection, storage, connectivity and alarming.

The expansion board EB07 covers the functionality of these modules for the control units ESX-3XL and ESX-3XM, just without wireless communication or GPS/GLONASS sensors.

On-Board Hardware

	DMM (Concept)	TC3Ge/TC3Gi	TC1	EB07
				
Required Controller	None	None	None	ESX-3XL/3XM
Performance	1 GHZ - QuadCore Processor (single /dual - option) – Freescale i.MX6 ARM Cortex A9 platform	400 MHz Processor Freescale MPC5200B platform	400 MHz Processor Freescale MPC5200B platform	400 MHz Processor Freescale MPC5200B platform
Memory	512 kB … 2 GB DDR3 RAM 8 … 64 GB eMMC Flash Memory 128 MB NOR Flash (optionally) 2 x 64 KB EEPROM	128 MB SRAM 1 GB NAND Flash 64 MB NOR Flash 2 x 8 KB EEPROM	128 MB SRAM 1 GB NAND Flash 64 MB NOR Flash 8 KB EEPROM	128 MB SRAM 1 GB NAND Flash 64 MB NOR Flash 2 x 8 KB EEPROM

On-Board Modules

	DMM (Concept)	TC3Ge/TC3Gi	TC1	EB07
Radio Technologies	2G/3G/4G (global coverage) optionally: CDMA WLAN 2.4/5 GHz (Access point, WiFi-Direct and infrastructure mode) Bluetooth (V2.1 + EDR) & BLE M2M (regional variations) 169 MHz - (max 500 mW) - up to 10 km 868 MHz - (max 500 mW) - up to 10 km 915 MHz - (max 500 mW) - up to 10 km Satellit - Iridium	2G/3G (worldwide coverage) WLAN 2.4/5 GHz (Access point, WiFi-Direct and infrastructure mode) Bluetooth (V2.1 + EDR) & BLE	TC1-Mobile: 2G/3G (worldwide coverage) TC1-WiFi/TC1-WiFi+: WLAN 2.4/5 GHz (Access point, WiFi-Direct and infrastructure mode) Bluetooth (V2.1 + EDR) & BLE (Bluetooth Low Energy)	
Interfaces	3x Ethernet/BroadR Reach 1 … 3 x Industrial Ethernet 10/100 MBit 1 … 2 x Automotive Ethernet (BroadR Reach = single twisted pair ethernet) 1 x USB2.0 (OTG - on the go) host and device mode 4 x Serial Interfaces 1 … 4 x RS232 Interfaces 1 … 2 x RS485 Interfaces	1 x Ethernet 1 x USB1.1 host interface (for service) 1 x RS232 interface	1 x Ethernet 1 x RS232 interface	1 x Ethernet 1 x USB1.1 host interface (for service) 1 x RS232 interface
Machine BUS	4 x CAN Bus (2 x galvanically isolated) 1 x LIN Bus	2 x CAN Bus	2 x CAN Bus	2 x CAN Bus
Sensors	GPS + GLONASS (10 Hz) NFC Communication 3D accelerometer 3D inclinometer Internal temperature sensor U_{BAT}/I_{BAT} Measurements (for Power Management)	GPS + GLONASS 3D accelerometer Internal temperature sensor	TC1-Mobile/TC1-WiFi+: GPS + GLONASS TC1-Mobile/TC1-WiFi/TC1-WiFi+: Internal temperature sensor	
I/O	8 x analog inputs (voltage: 0 … U_B, 0 … 24 mA or digital) 4 x digital inputs 1 x digital High-Side output	1x digital input 1x digital High-Side output	1x digital input 1x digital High-Side output	
Wakeups	Ignition Movement (accelerometer) RTC (time and interval triggered) CAN-Bus (CAN Message triggered) U_B spike (starter events) USB (plugin of additional load) BroadR reach (network traffic)	Ignition Movement (accelerometer) RTC (time and interval triggered)	Ignition RTC (time and interval triggered)	via ESX-3XL/3XM
MMI	Keyboard Buzzer 2 x bicolor LEDs 1 x LVDS interface (display)	Buzzer 1x tricolor LED		
Future-Proof	ESIM card Expansion board 8 x digital High-Side output SD card slot Battery Pack option PCIe - SSD memory expansion	Optionally ESIM Card		
Annotations	Internal or external antennas (mix possible)	Internal or external antennas SIM card slot integrated in the connector	External antennas TC1-Mobile: SIM card slot integrated in the connector	Available for ESX-3XL / 3XM

Customer specific variants on request.

DATA MANAGEMENT AND CONNECTIVITY SOLUTIONS
On-Board Software

The STW on-board modules are delivered with the Telematics Application Framework for ease of programming.

Teleservice Application Framework (TAF)

	Teleservice Application Framework (TAF)	
		**Develop your own telematics solution based on the powerful, robust and scalable telematics framework by STW.**
Daemons	Collect data	Define and manage your consistent database for all your applications.
	Data storage	Data are written on certain trigger events by the daemon into a file.
	Connectivity	Stay online, the daemon connects your vehicle to the Internet through the appropriate interface.
	Localization	Quick access to the current position.
	Alarming	Pre- and user-defined events will trigger alarms.
	Programming language	The daemons can be configured by configuration files.
Libraries	libtaf	Adding the Library to your own application, the functions of deamons are made available.
	CANopen J1939	The Library provides access to CAN protocols.
	HTTP	Simple communication with the server.
	Programming language	C
		Script based

DATA MANAGEMENT AND CONNECTIVITY SOLUTIONS
Machine Monitoring

For machine monitoring one can use either the on-board software VDS locally or for remote access the STW VPN solution. With a VPN tunnel the advantages of the local VDS can be used via a central server remotely. An administration concept (see “machines. cloud” page 36ff) with different roles and rights for users allows the separation of the data by companies and users.

Alternatively proprietary solutions for different industry sectors and data usage concepts with a defined scope of functions are available. STW’s on-board modules are an integral part of these solutions.

VDS/VDS-R

			VDS
			Local solution for data management and connectivity
			
			Worldwide unique solution that allows local access to the devices in the field that are running a Web server on the STW control unit.
Functions	Data storage		√
	Data backup		√
	Real-time display		√
	Update		√
	Reports		√
	Localization		√*6
Hosting	Customer specific		not necessary
	STW Hosting		not necessary
	Provider Hosting		not necessary
Device configuration	Local access		√
	Remote access		√ via VPN managed by "machines.cloud"
Security	User management	Individual permissions assignment	√ via "machines.cloud"
	Device communication	http	√
		https	√
		Security certificates	√
		VPN support	√
Fees	Operating costs		–
Infrastructure			Client based solution
Supported Platforms	DMM (concept)		√
	TC3G		√
	TC1		√
	EB07		√

*6) Local access via log data.

DATA MANAGEMENT AND CONNECTIVITY SOLUTIONS
Data and Process Management

Solutions for data and process management offer functions for further processing of collected data in different ways along with interfaces to higher-level systems. STW's on-board modules are certified for these solutions.

IoT Platform machines.cloud

Data are collected by compatible STW modules and transmitted to machines.cloud. There they are stored, presented, processed or forwarded to higher-level systems with ERP, billing or other functionality.

By defining certain events activities in the final system can be triggered.

Data and process management are supported with predefined function blocks (mapping, alarming, reporting, etc.) and can be extended in a customer-specific way using plug-ins.

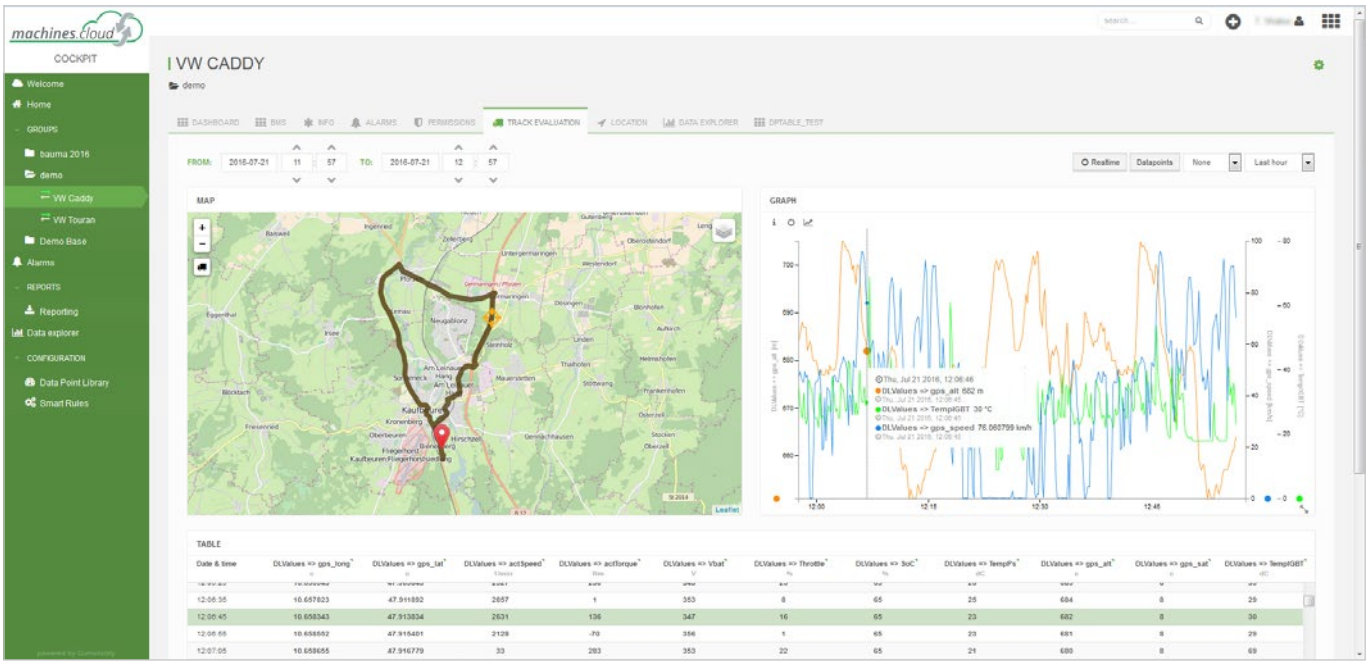
The characteristics of the platform are defined by STW, by the user or by using an already existing solution powered by Cumulocity (such as the "Cloud der Dinge" by Deutsche Telekom).

machines.cloud

The Device and Application Management Portal for Your Machines

Until today the use of telematics systems is mostly limited to visualizing machine data remotely. We go a step further and offer you our IoT platform “machines.cloud”. With “machines.cloud” you gain access to the right infrastructure for the integration and automation of your business processes. Very often you have to implement conformity requirements and legal directives in a timely manner. With the well-described interfaces of “machines.cloud” you create a connection to your ERP or CRM system thus obtaining insight and control of your KPI’s (Key Performance Indicators). Your time-to-market for new services and business models will decrease drastically. This allows an early ROI (Return on Investment). A multitude of standard tools as well as a flexible and open ecosystem with connectors to 3rd-parties and services build the basis to deploy even short-lived business models with minor effort at reduced risk. The open, “no-vendor-lock-in” approach guarantees the necessary security of investment. Together with our established network of partners we are ready to advise and consult you along your projects, services and business models.

Increase your efficiency, profitability and flexibility of your enterprise now!



machines.cloud Basic Features

Visualisation
- Widgets
- Dashboards
- Data Analysis
- Track Evaluation
- Data To Area

Location Based
- Positioning
- Routing
- Geo Fencing

Notification
- Alarm Management
- Notification
- Escalation Management

Servicing
- Device Configuration
- Software Update
- Service Monitoring
- Shell
- Command History
- Device Control

Device Admin
- Plug & Use Registration
- Grouping

System Admin
- User & User Group Administration
- Tenant Dashboard
- Repository Management

Extension Functionality
- Smart Rules
- Smart Apps
- Customer Apps

machines.cloud Extended Features

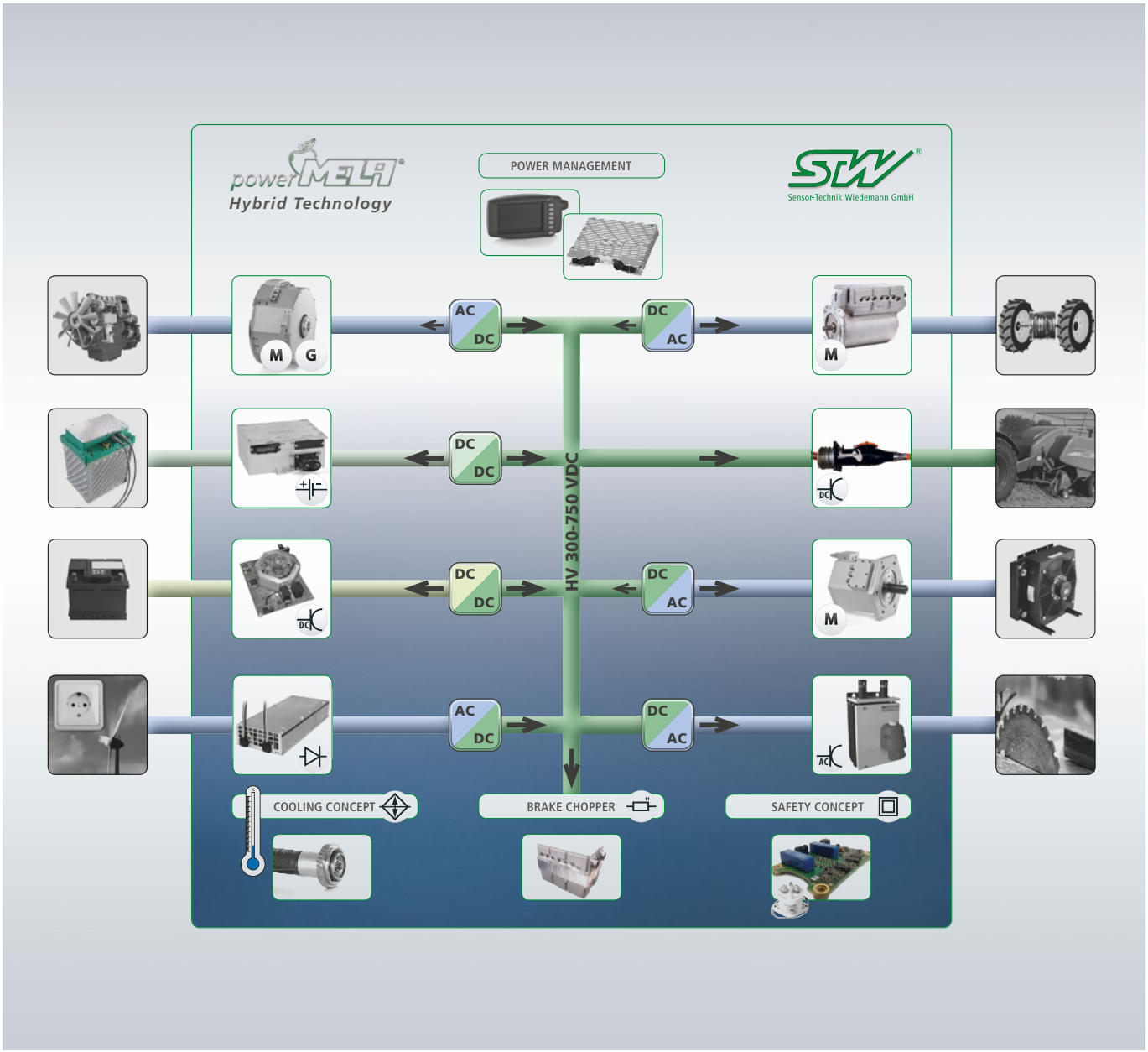
Live View
- Set single / multiple device(s) live
- Up to 1 second update period
- Transient storage of incoming data

CAN Configuration
- Use DBC files to import CAN bus data
- Change CAN data rate

CAN Logging
- Create multiple logger jobs with individual settings
- Assign any CAN variable to any logger job
- Log non-CAN data

Firmware Update
- Standardized debian based package management system
- Single / bulk update
- Add pre- and post-scripts

Extended Shell
- Configurable whitelist of allowed shell commands
- Manage user shell access rights



ELECTRIFICATION SOLUTIONS

powerMELA Solution Overview

The solutions for power electrification include all components to generate, switch, distribute, store, supervise and convert electrical energy for the high voltage power electrification and for the low-voltage board electrical system (12 V / 24 V).

ELECTRIFICATION SOLUTIONS
Drive Train

The drive train is realized with motors of the product family of integrated powerMELA E-drives. These motors distinguish themselves with an integrated inverter which allows four-quadrant-operation. They have been developed with focus on use in mobile working and special machines with a high voltage DC traction net of up to 800 V. Two power classes with 80 kW and 140 kW continuous power are available.

E-drives and inverters are available as separate components, too.

E-Drives powerMELA-C

	powerMELA-C 140 kW	powerMELA-C 80 kW
	Integrated E-Drives	
		
Power [kW]	140	80
Rated torque [Nm]	450	250
Rated voltage [VDC]	650	650
Number of phases	2 x 3	1 x 3
Rated Speed [RPM]	3000	3000
Protection class	IP6K9K	IP6K9K

Inverter powerMELA-WR C

	powerMELA-WR C Inverter		
			
Setup	80 kW	2 x 80 kW	160 kW
Rated power [kW]	80	160	160
DC input voltage range [V]	300 … 800	300 … 800	300 … 800
AC output voltage [V_{eff}]	0 … 650 (UDC = 800V)	0 … 650 (UDC = 800V)	0 … 650 (UDC = 800V)
Nominal (maximum) output current per phase [A_{eff}]	120 (160)	120 (160)	120 (160)
Switching frequency [kHz]	2 … 10	2 … 10	2 … 10
Output frequency [Hz]	0 … 500	0 … 500	0 … 500
Locator	Resolver, SinCos, Absolute Encoder	Resolver, SinCos, Absolute Encoder	Resolver, SinCos, Absolute Encoder
Control Interface	2 x CAN	2 x CAN	2 x CAN
Cooling	Transformer oil up to +65° C / 50 l/min	Transformer oil up to +65° C / 50 l/min	Transformer oil up to +65° C / 50 l/min
Temperature range [° C]	–40... +85	–40... +85	–40... +85
Protection class	IP65 / IP67	IP65 / IP67	IP65 / IP67
Weight [kg]	ca. 22	31	31
Dimensions L x W x H [mm]	TBD	521 x 296 x 192	521 x 296 x 192

The electrical energy generated while breaking can be turned into thermal energy using the brake chopper powerMELA-BC in case it can't be stored in other components such as the battery management system along with according batteries.

Brake Chopper powerMELA-BC

	powerMELA-BC Brake chopper 50 kW
	
Size (resistance)	3x2R2
Rated power [kW]	50 @ 600 Vdc continuous
Rated voltage DC [V]	Up to 800 VDC
Safety class	Safety Class II
Number of phases	1 x 3
Resistance characteristic	0.7 Ohm @ 100% PWM
PWM properties [%]	1 - 99
Power overload [%]	1000 for 2 seconds
Efficiency [%]	100
Construction	Frame mount
Dimensions L x W x H [mm]	494 x 295 x 324
Weight [kg]	35
Protection class	IP6k9k
Temperature range [° C]	–40 … +85

ELECTRIFICATION SOLUTIONS
Power Generation and Distribution

All STW drives are designed as four-quadrant-drives and therefore usable as motor or generator. The classical, compact structural shape is connected to the drive train via a gearbox. The fly wheel generators powerMELA-FW are designed for direct mount to the crank shaft housing.

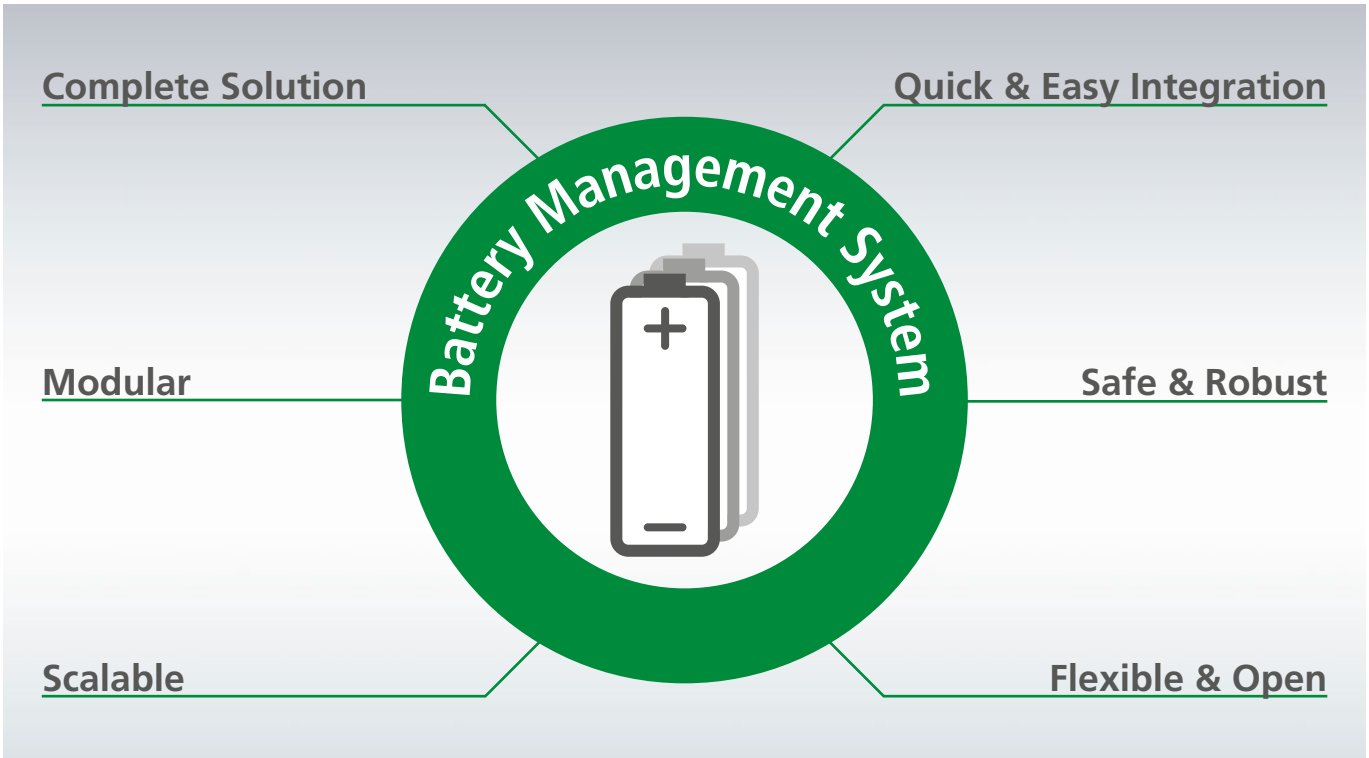
Generator powerMELA-FW

	powerMELA-FW
	
Rated capacity [kW]	130
Rated torque [Nm]	615
Rated voltage [V]	600
Number of phases	2 x 3
Rated RPM [min^{-1}]	2100
Safety class	2
Protection class	IP65

With the devices of the converter product family the voltages 12 V, 24 V and 48 V are provided from the high voltage net for the respective board nets.

Converter powerMELA-DC/DC

	powerMELA-DC/DC converter 3kW		
			
	MDA 12	MDA 24	MDA 36
Maximum Power [kW]	3	3	3
Voltage supply [V]	400-800	400-800	400-800
Maximum output current [A]	8	8	8
Output voltage [V]	9-14	18-28	36-56
Maximum output current [A]	217	110	55
Programming/Diagnosis	CAN	CAN	CAN
Protection class	IP67 / IP69k	IP67 / IP69k	IP67 / IP69k
Dimensions L x W x H [mm]	292 x 203 x 69	292 x 203 x 69	292 x 203 x 69

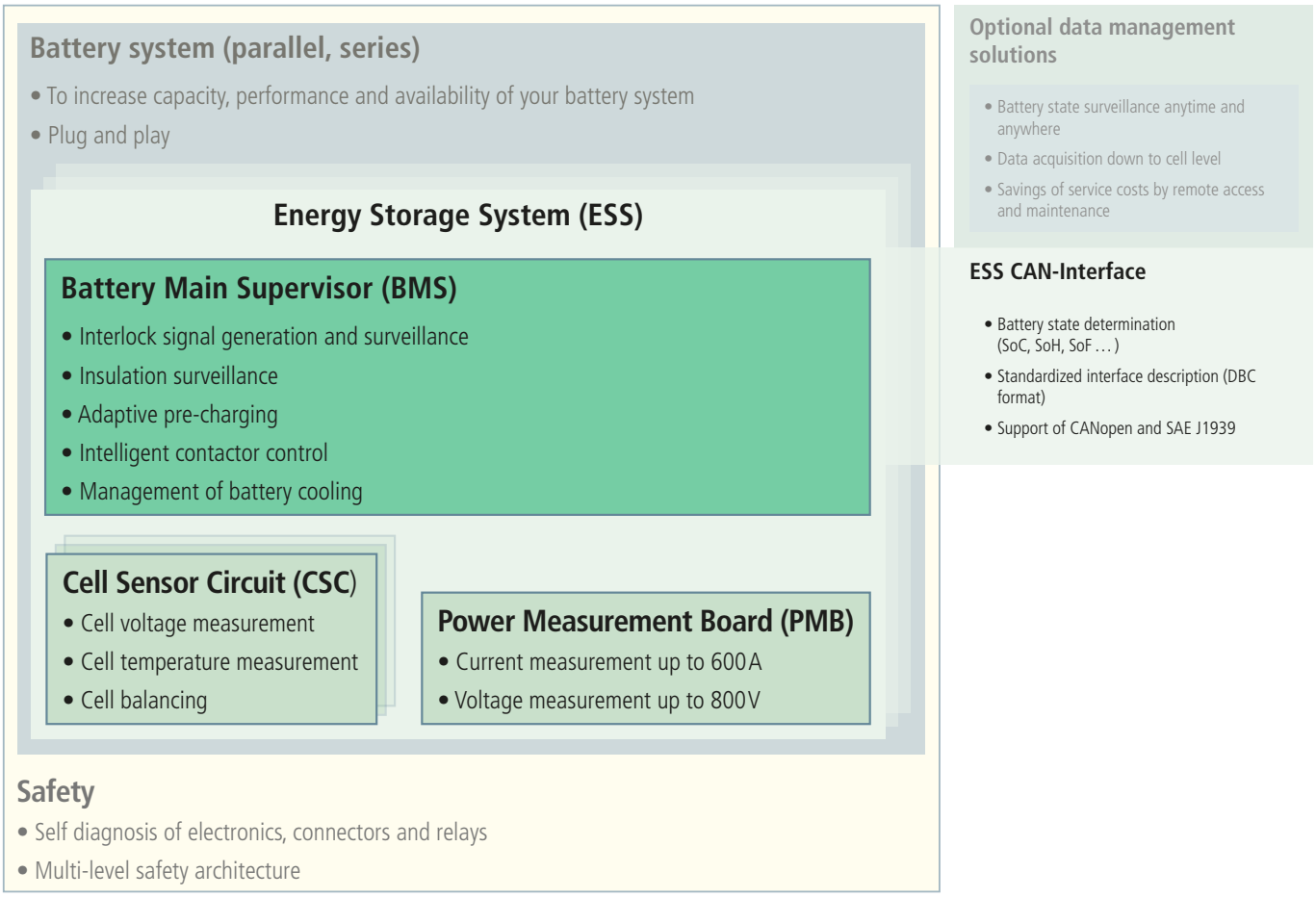


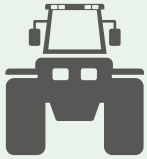
ELECTRIFICATION SOLUTIONS
Battery Management

Customer specific and standardized Lithium-Ion batteries are the energy storage of choice for modern drive systems. The battery management system powerMELA-mBMS fits ideally to the drives of the powerMELA product family. The mBMS supports all kinds of popular cell chemistries within the Lithium-Ion family: LFP, NMC and LTO.

The powerMELA-mBMS is a mature and complete solution for your battery. It covers all electrical functions of a Lithium-Ion battery:
• from the sensors to status supervision of the storage.
• from balancing the cells to self-diagnosis of the electronics to an insulation guard.

STW will support you when deploying your battery system. If you plan a customer specific adaptation STW offers cost-efficient development and series production based on the mBMS reference design – the fastest and easiest way to a sophisticated, tailored solution.





Agricultural

Railway

Transportation

Maritime

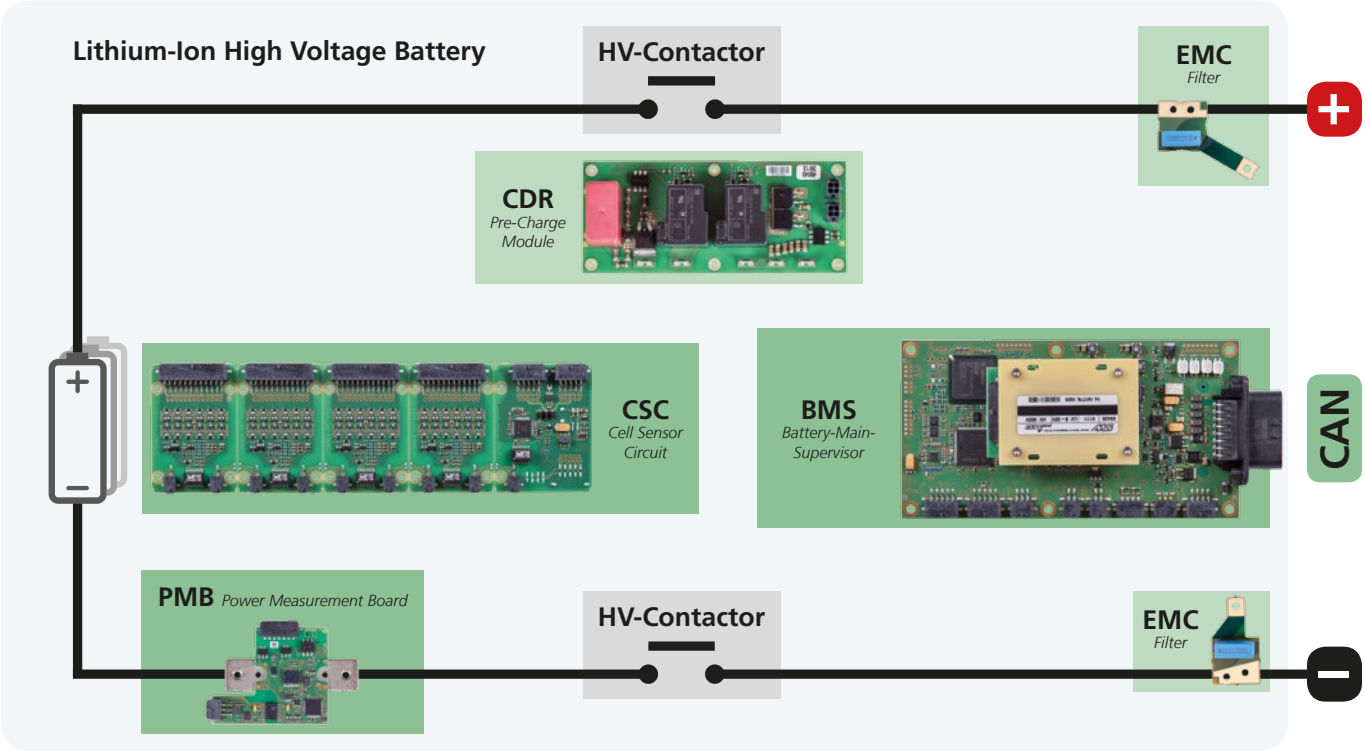
Automotive

Stationary

ELECTRIFICATION SOLUTIONS
powerMELA-mBMS Components

powerMELA-mBMS components for realization of your complete solution

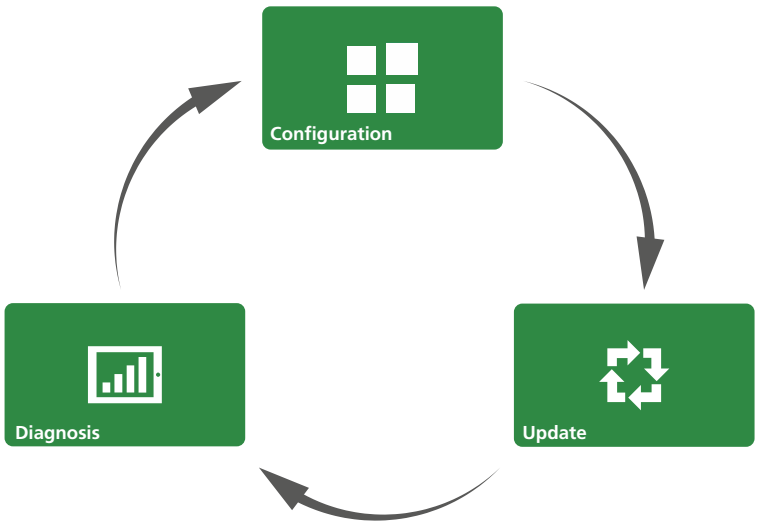
The Battery Main Supervisor (BMS) is the central control unit of the battery system. It includes three processors for highest levels of reliability and safety. It collects all information from the sensor modules, from the Cell Sensor Circuits and from the Power Measurement Board, calculates the status of the battery system and controls the HV contactors.



powerMELA-mBMS Components

Component	BMS – Battery Main Supervisor	PMB – Power Measurement Board	CSC – Cell Sensor Circuit
			
Dimensions (approx.)	212 x 100 x 33 mm (8.3″ x 3.9″ x 1.3″)	95 x 61 x 15 mm (3.7″ x 2.4″ x 0.6″)	300 x 75 x 13 mm (11.8″ x 3.0″ x 0.5″)
Weight (approx.)	230 g (0.51 lbs.)	100 g (0.22 lbs.)	260 g (0.57 lbs.)
Temperature range	–40° C ... +80° C (–40° F ... 176° F) environment temperature		
Connector	23-pole AMPSEAL (TE connectivity)	Micro-Fit (Molex)	Micro-Fit (Molex)
Power supply	8 ... 32 V DC	powered by the BMS	powered by the BMS and battery cells
Power consumption (in operation)	350 mA @ UB = 12 V	included in the BMS consumption	10 mA @ Ucell = 4.2 V
Power consumption (sleep mode)	< 0.1 mA @ UB = 12 V	–	< 0.01 mA @ Ucell = 4.2 V
Communication Interfaces	4 x CAN 2.0 B CAN Wakeup	1 x CAN 2.0 B	1 x CAN 2.0 B
I/O's	3 x 2 A digital outputs 1 x analog input Interlock detector & driver	Shunt for current measurement 3 inputs for high voltage measurement	48 x cell voltage measurement inputs 16 x Temperature sensor inputs (10k NTC)
Operation	Coolant temperature measurement Range: –55 … +125 ° C (–67 ... 257 °F) Accuracy: ±2 K plus sensor tolerance Insulation measurement Range: 1 ... 4500 kΩ Accuracy: 0 … –5 kΩ @ 1 … 20 kΩ 0 … –25 % @ 20 … 1000 kΩ	Current measurement Range: ± 1000 A (1 s), ± 600 A (10 s) @ 100 µΩ ± 2000 A (1 s), ± 900 A (10 s) @ 50 µΩ Accuracy: Offset ±0.1 A, gain 1 % High voltage measurement Range: 0 … 800 V Accuracy: Offset ±0.1 V, Gain 1 %	Cell voltage measurement Range: 1 … 5 V Accuracy: 2.5 mV @ 2.5 … 4.3 V Cell temperature measurement Range: –55 … +125° C (–67 ... 257 °F) Accuracy: ±2 K plus sensor tolerance Cell balancing (passive) Current: 120 mA @ Ucell = 3.6 V

ELECTRIFICATION SOLUTIONS
powerMELA-mBMS Software



The powerMELA-mBMS toolchain provides the straightforward solution to configure, update and diagnose your battery system.

powerMELA-mBMS Toolchain

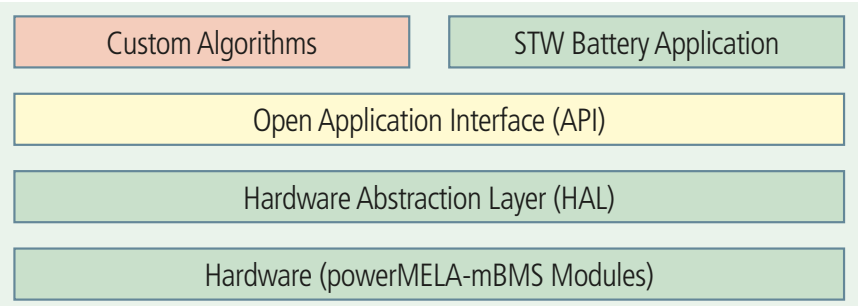
powerMELA-mBMS Toolchain		
Configuration	Configuring the mBMS to suit your application.	
	Safety parameters	Define and manage system security limits
	Application parameters	Illustration of cell characteristics Define the battery application strategy
Update	Software update of the complete energy storage system (ESS)	
	One-Click-Update	Simple and convenient system update
	Version Management	Software packages for easiest version management

powerMELA-mBMS Toolchain		
Diagnosis	Allows easy and quick commissioning of the energy storage system (ESS)	
	Battery data	Running mBMS functions and displaying battery data
	Failure diagnosis	Supports fault diagnosis by visualization of all sensor data

powerMELA-mBMS Diagnostic Tool

Open Architecture

With the help of an open code basis (Standard ANSI-C99 API) the battery application can be adapted to individual requirements. Specific functions and algorithms (SoC, SoH, ...) can be integrated in a flexible way.



ELECTRIFICATION SOLUTIONS
Power Management Solutions

Power Management Solutions
Customer specific and standardized power boards or vehicle electric centers are electronic units for intelligent control and supervision of the distribution and switching of electrical energy. Power boards or vehicle electric centers reduce the cabling effort and allow flexibility in machine variants and accessory options, combined with diagnostic capabilities.

To solve the power management tasks STW offers three approaches:

Intelligent Vehicle Electric Centers
STW offers modular power management systems together with our partner ERNI. Standardized building blocks for switching and distributing electrical energy are complemented with intelligent, standardized control modules.

Modular Power Management
A modular approach adds a degree of freedom for the design. The structural shape of the unit as well as the dimensioning of the circuit components for switching the electrical energy, such as the plug-in relays, can be defined together with the customer. To complete the solution STW offers intelligent modules with a defined performance.

Integrated Power Management
In this open approach STW works closely with the customer to jointly specify and develop the perfect solution. The final product will be a vehicle electric center combined with intelligent modules for control and connectivity within a single unit.

The performance characteristics of the intelligent modules, type, number and characteristics of the inputs and outputs are adapted to the requirements. Even special components such as motor bridges or stepper motor drivers can be implemented.

The structural shape of the unit and the circuitry components for switching relays, such as plug-in relays, are defined according to the desired type, number and required characteristics.

Integrated Power Management	Customer specific requirements for power boards / vehicle electric center and controller	**STW Development** →				Integrated customer specific intelligent power board / vehicle electric center
Modular Power Management	Customer specific passive power board / vehicle electric center	+	ESX Controller Module	=		Customer specific intelligent power board / vehicle electric center
Intellignet Power Baords / Vehicle Electric Centers	Standard passive power board / vehicle electric center	+	ESX Controller Module	=		Intelligent power board / vehicle electric center

		VEC Expert Plus*1	VEC Expert*1	VEC Basic*1
Inputs 150 A (M8)		2		
Relay outputs 70 A		2		
Relay outputs group 1 25 A		12		
Relay outputs group 2 25 A		7		
Highside outputs 3 A	Automation module	4	4	–
Lowside outputs 250 mA	Automation module	3	3	–
CAN Interface	Automation module	Yes (Slave)	Yes (Slave)	–
Fuse / relay status	Automation module	Yes	Yes	–
Programming	Automation module	C	C	–
Protocol	Automation module	SAE J1939	SAE J1939	–
TE Automotive MCP-Series Connector 21-way		3		
Power elements Output terminal M6		2		
Capacity		Maximum 300 A		
Operating temperature		-40° C … +85° C (-40° C … +125° C on request)		
Protection class		IP69	IP20	IP20

*1) Possible versions.


FENDT

MEASUREMENT SYSTEMS AND SENSORS

digiSENS Solution Overview

digiSENS Solution Overview

To measure different physical variables such as pressure, temperature, strain, angle of inclination, angular velocity and position STW offers single sensors and measurement systems.

All components are designed to survive in the harsh environment of mobile working machines.

Different output signals and protocols on the CANbus interface make the measured values available for further processing.

With our vast experience on the field of sensors and measurement systems STW is able to solve many customer-specific measurement problems. Also outside the standard product portfolio specially adapted solutions can be developed, realized and manufactured.

digiSENS Sensors

	digiSENS-M01	digiSENS-M02	digiSENS-P01
			
Function	Pressure	Pressure	Pressure
Transducer / Switch	Transducer	Transducer	Switch
Safety			
Measurement range	0 … 0.25 bar 0 … 2000 bar	0 … 10 bar 0 … 3500 bar	0 … 10 bar 0 … 2000 bar
Media connection	G 1/4 1/4 NPT G 1/4 with manometer pin 9/16 … 20 UNF (SAE 4) 9/16 … 18 UNF (SAE 6)	G 1/4	G 1/4 1/4 NPT G 1/4 with manometer pin 9/16 - 20 UNF (SAE 4) 9/16 - 18 UNF (SAE 6)
Electrical connection	M12 DIN-Bayonet (per DIN 72585) DT04 3-pole DT04 4-pole AMP-SuperSeal 1.5 Cable output	M12 (5 Pin) stainless steel	M12 DIN-Bayonet (per DIN 72585) DT04-3P Cable output
Linearity [%FS]	< 0.5	< 0.5	< 0.5
Overall accuracy at operating temperature [%FS]	≤ 1.0 (0 … +80° C) ≤ 1.5 (–25 … +100° C) ≤ 2.5 (–40 … +125° C)	≤ 1.0 (0 … +80° C) ≤ 1.5 (–25 … +100° C) ≤ 2.5 (–40 … +125° C)	≤ 1.0 (0 … +80° C) ≤ 1.5 (–25 … +100° C) ≤ 2.5 (–40 … +125° C)
Long-run stability [%FS p.a.]	< 0.2	< 0.2	< 0.2
Analog output signal	4 … 20 mA (2-wire) 0 / 4 … 20 mA (3-wire) 0 … 10 V 0 … 5 V 1 … 6 V 10 … 90 % VCC (ratiometric)	0 … 10 V 0.5 … 4.5 V 4 … 20 mA	1 x PNP 2 x PNP 1 x NPN 2 x NPN (Output current up to 500 mA)
CAN output protocol	CANopen SAE J1939		
Voltage supply	9 … 36 VDC 14 … 36 VDC (0–10 V voltage output) 5 V ± 10 % VDC (ratiometric output)	9 … 36 VDC 14 … 36 VDC (0–10 V voltage output) 5 V ± 10 % VDC (ratiometric output)	9 … 36 VDC
Protection class	IP67 / IP69K	IP67	IP67 / IP69K
Certifications	E1 CE	E1 CE	CE
Special features	Millions of combinations CAN support	M12 Stainless steel electrical connector	Pressure switch

	digiSENS-F01	digiSENS-F02	digiSENS-T01
			
Function	Pressure	Pressure	Temperature
Transducer / Switch	Switch	Transducer	Transducer
Safety	PL d (Cat. 2)	PL d (Cat. 2)	
Measurement range	0 … 50 bar 0 … 1000 bar	0 … 10 bar 0 … 1200 bar	–40 … +150° C
Media connection	G 1/4	G 1/4	G 1/4
Electrical connection	M12	M12 M12 stainless steel	M12 M12 stainless steel
Linearity [%FS]	< 0.5	< 0.5	
Overall accuracy at operating temperature [%FS]	≤ 2.5 (–40 … +85° C)	≤ 1.0 (0 … +80° C) ≤ 1.5 (–25 … +0° C) ≤ 2.5 (–40 … –25° C)	0.6 (–40° C … +150° C) 0.4 (–40° C … +85° C)
Long-run stability [%FS p.a.]	< 0.2	< 0.2	
Analog output signal	1 x PNP (max. 200 mA) + 0/4 … 20mA (3-wire) 2 x PNP (max. 200 mA)	2 x 4 … 20 mA (3-wire)	
CAN output protocol			CANopen
Voltage supply	8 … 35 VDC	9 … 32 VDC	9 … 36 VDC
Protection class	IP67	IP67	IP76
Certifications	E1 CE	E1 CE	E1 CE
Special features	Safety pressure switch	Safety pressure transducer	Temperature transmitter with CAN support

digiSENS Measurement Systems

	digiSENS-IVDMS	digiSENS-NGS2	digiSENS-FELIX
			
Function	Strain	Angular velocity Inclination angle	Position
Transducer / Switch	Transducer	Transducer	Transducer
Measurement range	± 2200 µm/m	± 50°/s ± 180° (CAN) / ± 90° (analog)	0 … 20 mm
Electrical connection	1m cable	M12 (5 pin) (CAN) 8 pin (CAN and analog)	3 pin plug, AMP-Superseal 1,5
Linearity [%FS]	< 0.5	< 0.5	± 0.8 mm
Operating temperature	–25° C … +85° C	–40° C … +85° C	–30° C … +120° C
Analog output signal	4 … 20 mA	0 … 20 mA 0 … 10 V	4 … 20 mA (3-wire)
CAN output protocol	CANopen	CANopen	
Voltage supply	8 … 32 VDC	9 … 36 VDC 14 … 36 VDC (at 0–10 V output)	8 … 30 VDC
Protection class	IP65	IP67	IP67

Measurement Systems

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