Pioneering new technologies
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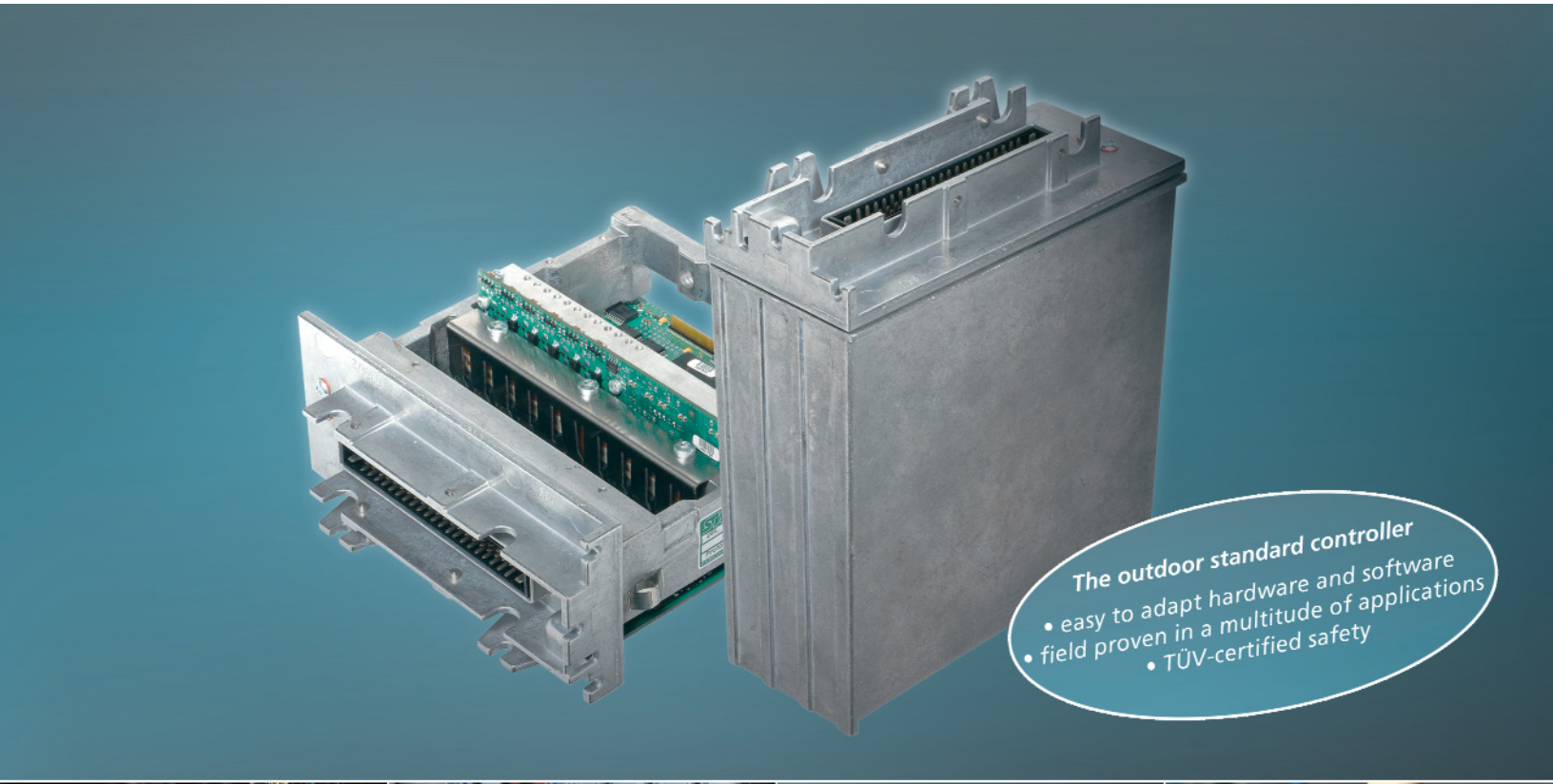
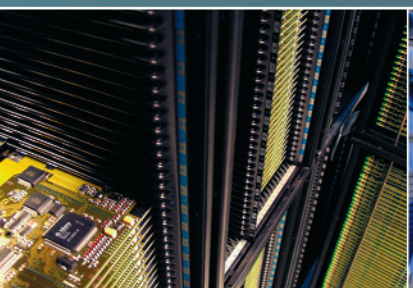
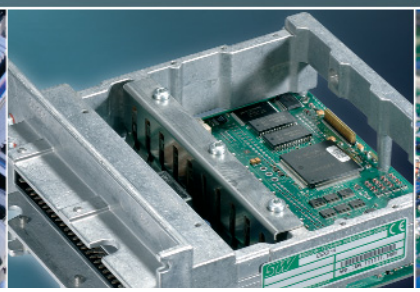
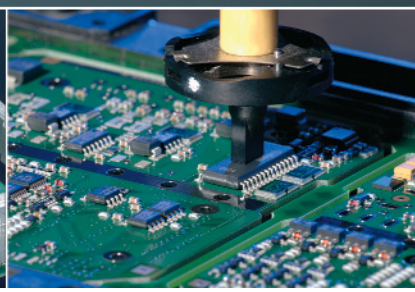
STW Technic, LP
Mobile Controllers and Measurement Technologies

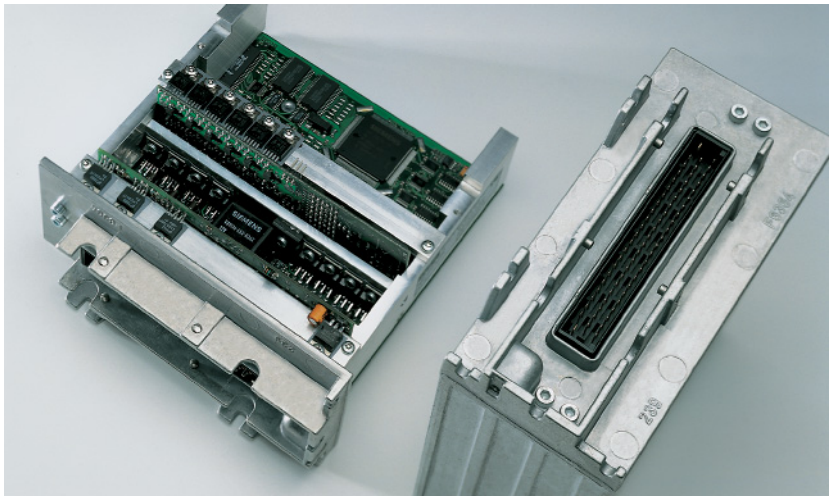
ESX®



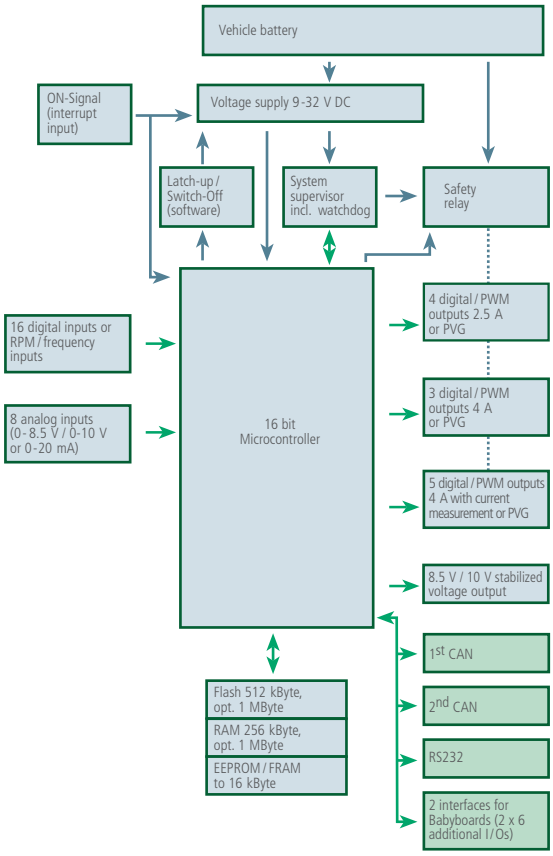


Freely programmable controllers for
vehicles and machines with CAN-BUS



Description

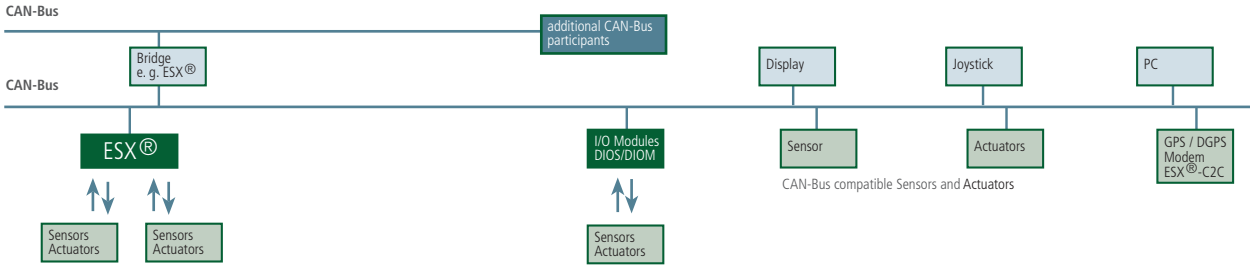


The freely programmable controller ESX® works independently as a measuring, driving or controlling device for sensor-actuator management and is capable of executing a number of separate or related tasks in real time.

The ESX® was developed especially for use under harsh conditions and extreme temperatures, functioning from -40 to +85°C (-40 to 185°F) in vehicles and machines.

All inputs and outputs are protected against short circuit to ground or to voltage overload and have a built-in diagnostic capability.

Proportional valves can be driven without expensive amplifier or controller cards. Either a PWM (pulse width modulated) output with internal current measurement or a special output for proportional valves with integrated circuitry may be used.
A robust cast aluminum housing (protection grade IP65, optionally IP67) with a GORE-TEX® breathing filter offers high immunity to electromagnetic disturbances and protects against mechanical stressing.



CAN-Bus

The "**C**ontroller **A**rea **N**etwork" (CAN), originally developed by Bosch for use in the automotive industry, has established itself as the standard bus system for mobile applications (international norm ISO 1898). Components for CAN-based systems are available in large quantities at very reasonable prices due to their wide spread use.

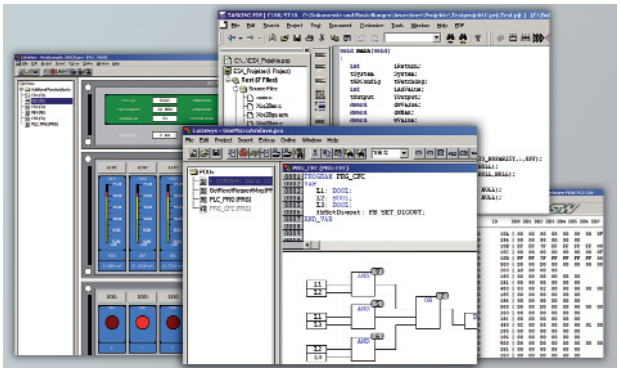
CAN-Bus systems exhibit high transfer rates (CAN low-speed up to 125 Kbit/s, CAN high-speed to 1 Mbit/s) and high data transmission reliability. A number of different capabilities (CRC, frame checking, acknowledgment, bit monitoring and bit stuffing) enables the CAN protocol to recognize errors in transmitted data caused for example by electromagnetic disturbances, and to correct them (transmission stop with error flag and automatic repetition of the message). Since the length of the data packages are limited to max. 8 bytes of information per message, correction takes place with very little loss of time.

A pair of wires suffices as transmission medium (ease of wiring). The length of the network can be up to 40 m with transfer rates of 1Mbit/s. Networks without repeaters up to 1000 m in length are practical with rates of 80 Kbit/s or less. The number of participants per network (in theory unlimited) depends on the type of chip used (transceiver, physical layer). With commonly used chips, 32, 64 or up to 110 (with restrictions up to 128) nodes per network are possible (further extensions require repeaters or bridges).

CAN is a "multimaster system" with line topology and real time capability. Unique "identifiers" contain information not directly related to the address of a participant, but to the contents of a message (i.e. temperature, rotational or linear speeds). All participants check out the identifier being transmitted and decide if the type of message is relevant to themselves (acceptance filtering). In this way all messages can be received from many or all of the participants simultaneously. The unique identifier also determines the priority of the message relating to bus access. In case a number of participants tries to access the bus simultaneously, the higher priority message is guaranteed to gain bus access (prevention of bus accessing conflicts through bitwise arbitration). For these reasons it is important to incorporate functional procedures and safety requirements into the process of defining identifiers. Standard format (11-bit identifier) and extended format (29-bit identifier) are two different message formats which can coexist on the same physical CAN-Bus. The specification CAN 2.0 B supports both formats, while CAN 2.0 A only allows frames with 11-bit identifiers.

Through content oriented identifiers in a message, the system achieves a high degree of configuration flexibility and allows a simple extension of the network to include further devices. There are a number of higher protocols such as LBS (**L**andwirtschaftliches **B**us **S**ystem), SAE J 1939, OSEK, CAL (**C**AN **A**pplication **L**ayer, the basis for the communications profile CANopen), DeviceNet and others which have been normed or standardized. These are available on the so called "application layer".

The various semiconductor manufacturers offer CAN controllers with differing functionalities: one common type has one data buffer for transmitting and one for receiving - here the receive buffer is followed by a shadow buffer and the message filtering function utilizes the associated microprocessor ("BasicCAN"). Another type has a number of buffers for managing and filtering multiple messages simultaneously ("Full CAN", reduces workload on CPU). In addition there are so called SLIO (serial linked I/O) devices, which require no further microprocessor but function only as CAN slave modules (for I/O extension).



Programming Simulation

Rapid software development with CoDeSys or C

The software can be programmed using CoDeSys (IEC 61131-3), a graphical user interface with the following choice of languages:

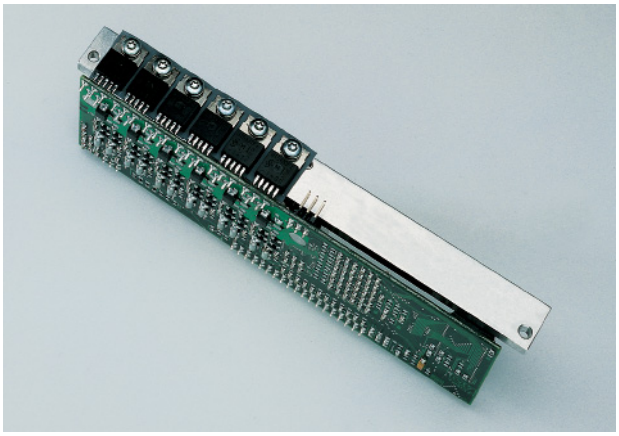
- Function Block Diagram (FBD)
- Ladder Diagram (LD)
- Instruction List (IL)
- Structured Text (ST)
- Sequential Function Chart (SFC)

CoDeSys may even be used without previous knowledge of any high level languages. Altium's Tasking IDE may also be used for programming in the high level language C.

STW has an extensive library available with programming and configuration functions including debug and diagnostic tools. These components provide the possibility to quickly and easily program application software. ESX®-KEFEX, STW's PC based software, can be used to create stand-alone diagnostic, service and "end of line" configuration tools. Upon request STW can develop complete software solutions for customer applications.

Simulation of all inputs and outputs

To simulate your vehicle and speed development, STW offers a test box, which provides monitoring circuits and indicators for all inputs and outputs as well as a connector for the ESX®. These may be switched as desired or connected to simulators for sensors or actuators. The test box also includes an integrated termination for the CAN network if required. The voltage supply has separate fuses for the processor and for the driver electronics. Special boards for monitoring customer specific design features may be plugged into the available slots.



Applications in vehicles:

- Electrohydraulic steering systems (steer-by-wire)
- Electronically controlled hydrostatic drives (drive-by-wire)
- Hydraulic control
- Engine management
- Transmission control
- Automatic levelling and positioning of platforms

Reliable TÜV certified safety

All standards required for CE conformity are met with the ESX®. Over and above these, the varying branch specific requirements and standards of the automotive, agricultural or construction industries are also met.

For safety relevant applications (e.g. waste disposal vehicles, hoists) the ESX® has been developed to perform to Safety Integrity Level 2 of IEC 61508 standards or Category 3 of EN 954-1 respectively.

All input and output channels of the control systems are diagnosable, meaning that short circuits or open circuits can be detected by the software. In addition, a continuous software diagnosis of the internal hardware is performed.
A safety relay provides a second means of switching off the digital and PWM outputs.

Networking with CAN-Bus

Data exchange with other intelligent units is made possible with CAN (CAN 2.0 B) interfaces. Both standard and extended format are supported. The CAN is capable of connecting a number of controllers into a network. Modules with additional CAN interfaces may be built into the ESX®, allowing it to take on a bridge function, and allowing multiple independent buses to communicate freely at transfer rates of up to 1 Mbit/s.

Expansion boards

The electronic controller ESX® may be expanded, using two standard internal interfaces and various modules to provide up to 12 additional input or output ports. The type of I/O is not restricted. These modules may also include further design features (e.g. real time clock) making the ESX® ideally suited for quick adaptation to customer demands.

Configuration, calibration and parameter setting

Characteristics, calibration data and critical parameters for sensor-actuator management as well as controller configuration can all be stored in a non-volatile FRAM/ EEPROM. Using an editor software, this data may be accessed via CAN bus or the RS 232 interface.

Comprehensive external and internal error diagnostics

STW offers a line of software tools for reading the error buffer, system diagnostics, visualization and maintenance or repair services. Communication is established using the standard CAN-Bus or the RS 232 interface.

- **ESX® -** a rugged standard controller proven in mobile applications with sensor-actuator management through integrated measurement, control and driver devices offers real time data processing of multiple independent or linked tasks.
- Freely programmable, using CoDeSys (IEC 61131-3) or in high level language C
- Advanced measures for EMC and a robust housing for all automobile environments
- An ingenious grounding scheme provides separate analog ground for sensors
- Internal diagnostics, protection against voltage overload and protection against short circuit to ground or to supply voltage for all inputs and outputs
- Safety relay as emergency switch off
- TÜV certified to Safety Integrity Level 2 or Category 3 for safety relevant applications
- Direct driving of proportional valves (saves expensive driver and/or controller boards)

Technical Data ESX®

Processor system	
Processor	16bit controller, 20Mhz/40MHz, system supervisor with programmable watchdog
RAM	256 kByte, opt. 1 MByte
Flash	512 kByte, opt. 1 MByte
EEPROM	16 kByte
Interfaces	
CAN	1st CAN, optional 2nd CAN, 2.0B (11 bit and 29 bit identifier), full CAN, low-/high-speed up to 1 Mbit/s
RS232	programmable baud rate
Babyboard	for expansions
In-/Outputs	
Digital or RPM inputs	**max. 16 digital or RPM inputs**, software configurable, active high/low switchable, cut-off-frequency 6.5 kHz, short circuit protected
Analog inputs	**max. 8 analog inputs**, 4-20 mA or 0-8.5 V/0-10 V,software configurable, 10 bit, cut-off-frequency 1 kHz, short circuit protected
Digital / PWM outputs	**max. 3 x 4 A**, high side switch, 0 - 100 % diagnosable, short circuit protected **max. 4 x 2.5 A**, high side switch, 0-100 % diagnosable, short circuit protected
Digital / PWM outputs with current measurement	**max. 5 x 4 A**, high side switch, 0 - 100 % diagnosable, PWM-frequency from 5 - 250 Hz, short circuit protected
PVG outputs	**max. 12x PVG**, used for Danfoss valves (20 % U_B - 80 % U_B)
Constant voltage output	**8.5/10 V stabilized voltage** supply, load current up to 1 A, short circuit protected
Additional modules	**max. 2 modules**, with up to 6 inputs or outputs each, e.g. digital or analog I/O, encoder inputs, CAN or customer specific designed
System data	
Voltage supply	9-32 V DC
Current requirements	operational about 0.5 A without external load, stand-by < 1 mA, max. total current up to 30 A
Physical characteristics	
Connector	68 pin automotive type (AMP)
Chassis	IP 65, optional IP 67, die-cast aluminum, GORE-TEX® breathing filter for pressure equalization
Weight	approx. 2 kg (4.4 lbs)
Dimension	approx. 170 mm x 195 mm x 72 mm (6.69" x 7.68" x 2.83")
EMC, Environmental requirements	
Requirements	According to automotive, agricultural and construction industry standards; CE-conformity
Operating temperature	-40° C to +85° C (-40° F to 185° F) chassis temperature

Sensor-Technik Wiedemann GmbH
Steuer- und Regelelektronik
Am Bärenwald 6
D-87600 Kaufbeuren
GERMANY
Telephone +49 (0) 8341-9505-0
Telefax +49 (0) 8341-9505-55
E-Mail info@sensor-technik.de
Internet www.sensor-technik.de

STW-TECHNIC, LP
MOBILE CONTROLLERS AND
MEASUREMENT TECHNOLOGIES
3000 Northwoods Pkwy. Suite 260
Norcross, GA 30071 USA
Telephone +1 (770)242-1002
Telefax +1 (770)242-1006
E-Mail sales@stw-technic.com
Internet www.stw-technic.com

Sensor-Technik UK Ltd.
Unit 10, The Granary
Mill Road, Sharnbrook
Bedfordshire MK44 1NN
ENGLAND
Telephone +44 (0) 12 34-7820-49
Telefax +44 (0) 12 34-7820-56
E-Mail sales@sensor-technik.co.uk
Internet www.sensor-technik.co.uk

20061130 US