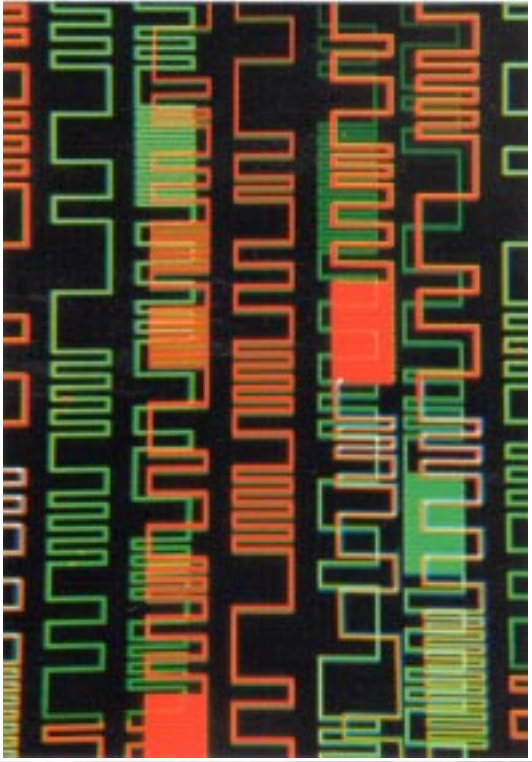


STW
Competence in measurement technology and CAN-Bus systems.

ESX

The Outdoor standard controller
- easy to adapt hardware and software
- field proven in a multitude of applications
- TÜV-certified safety

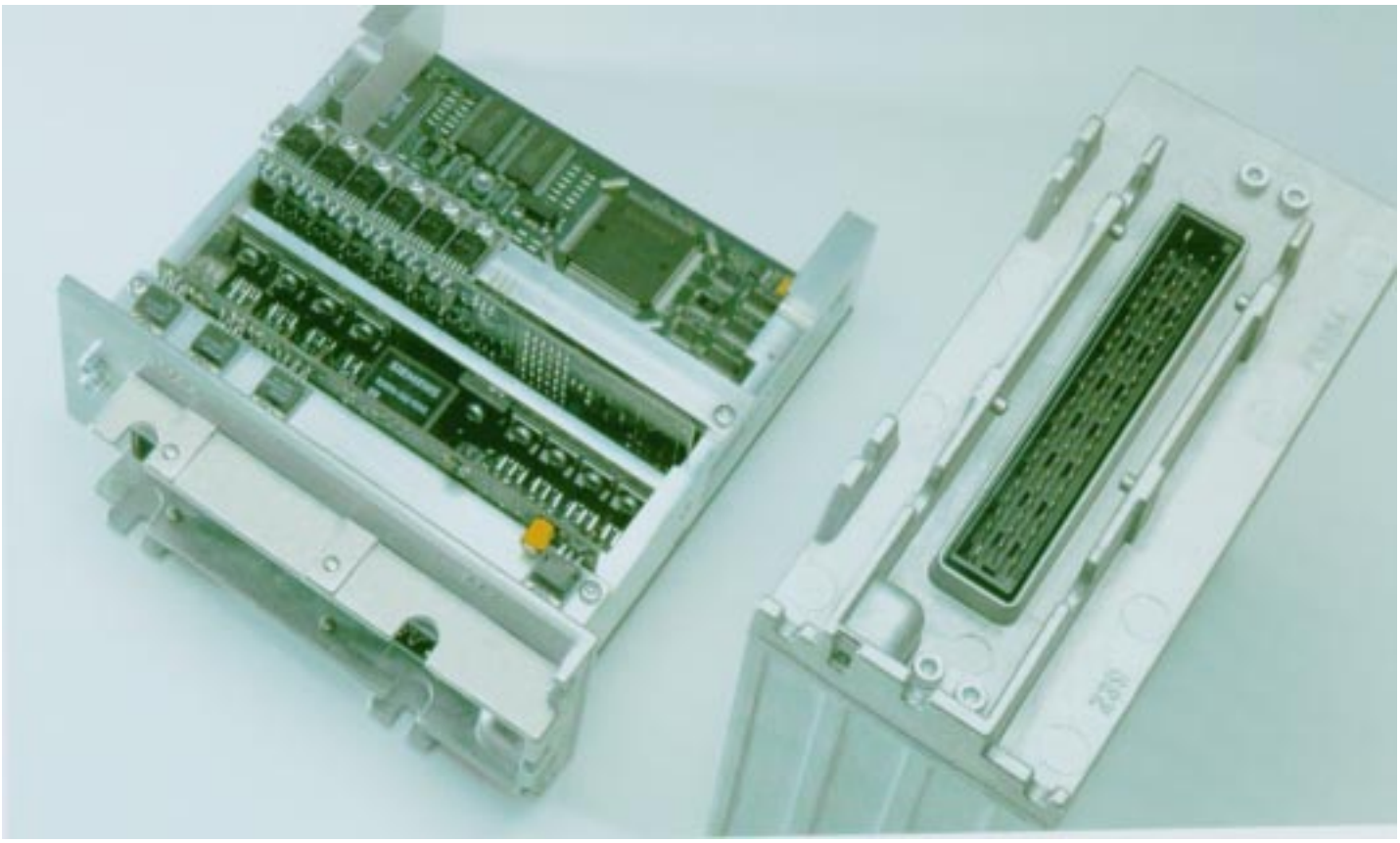
freely programmable

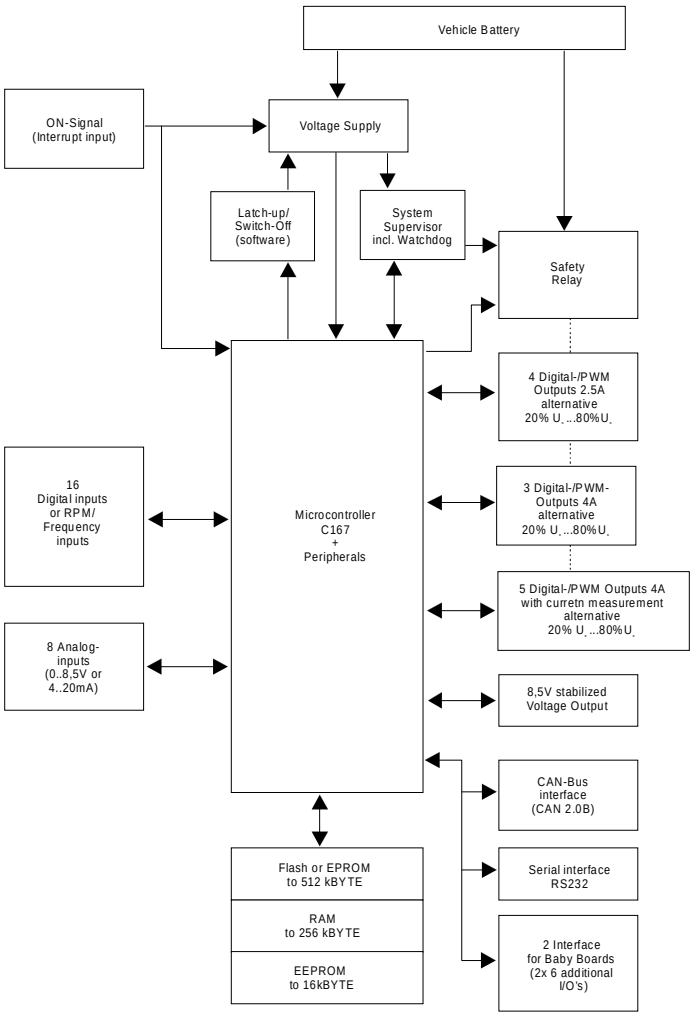
controllers

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 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 detection 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.

Applications in mobile commercial machines

- controller for the complete hydraulics of mobile commercial machines (farm and construction machines, community service and special purpose vehicles)
- electronic/hydraulic steering systems (steering-by-wire)
- hydrostatic vehicle drive controller (drive-by-wire) with anti-lock braking system (ABS) and anti-slip regulation (ASR)
- motor management (rotational speed control)
- automatic gear shift controller
- controller for inclination and fluid level

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 "Anforderungsklasse 4" (Requirement Class 4) of the DIN V VDE 0801 and DIN V 19250, to Category 3 of EN 954-1 and to Safety Integrity Level 2 of IEC 61508 standards 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 functions

Data exchange with other intelligent units is made possible with the RS 232 or the CAN-Bus (complies with CAN specification 2.0 B) interfaces. Both standard and extended format are supported. The CAN-Bus is thereby capable of connecting a number of controllers into a network. Modules with further CAN interfaces may be built into the ESX, allowing it to take on a bridge function, and allowing multiple independent busses to communicate freely. The transceiver chip PCA82C251 (Philips) which acts as the physical connection (physical layer) to the bus wires has ISO 11898 - 24 V compliance (short circuit protection in 24 V systems) and can attain transfer rates of up to 1Mbit/s.

Expansion boards

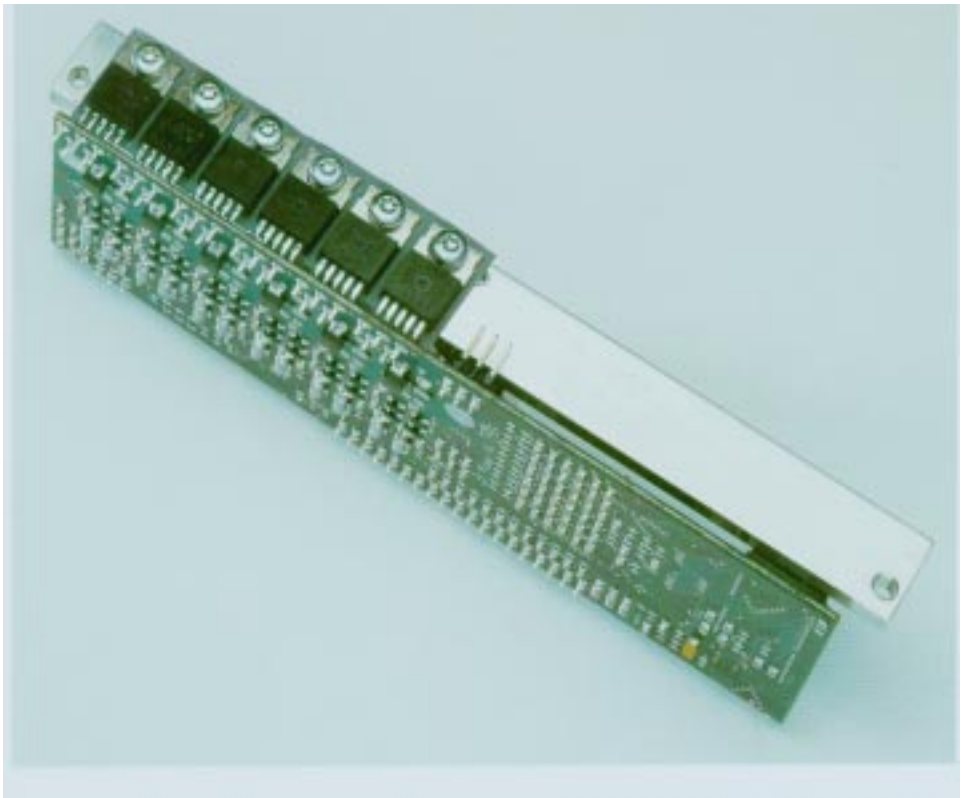
The electronic controller ESX may be expanded using the two standard internal interfaces and various modules to provide up to 12 additional input or output ports. The type of port is not restricted. These modules may also include further design features (e.g. real time clock) making the ESX ideally suited 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 EEPROM. Using an editor software, this data may be accessed on the CAN bus or on 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.



**Programming,
speedy (IEC 1131-3)
or special (”C”)**

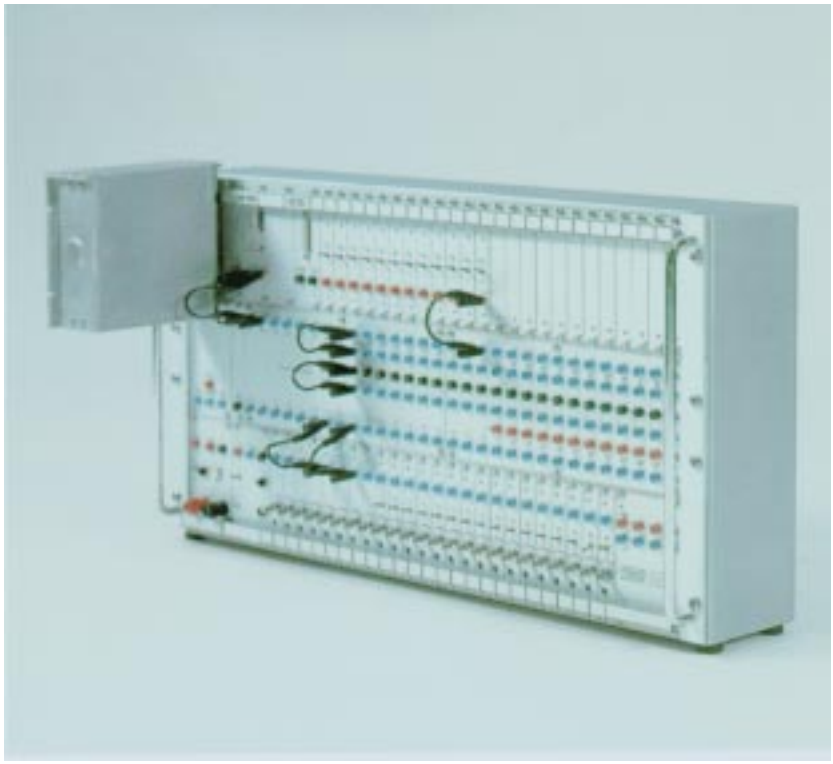
The software can be programmed in the high level language ”C”, or using an IEC 1131-3 graphical user interface with the following choice of languages:

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

The function library with ready-to-use function components provides the possibility to quickly and easily program application software. IEC 1131-3 may even be used without previous knowledge of any high level languages. For special, more complex applications, the programmer is encouraged to program at a more fundamental system level using ”C” and our BIOS software.
The software may be downloaded into the flash memory using both CAN or RS 232 interfaces. STW has an extensive library available with programming and configuration functions as well as debug and diagnostic tools and upon request will develop a complete software for customer applications.

**Simulation
of all inputs and outputs**

To facilitate the programming and testing of ESX software, STW offers a test box in 19” rack format 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 as required. The voltage supply has separate fuses for the processor and for the driver electronics. Special boards for monitoring extension features (customer specific designs) are available.



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 11898). Components for CAN-based systems are available in large quantities at very reasonable prices due to their wide spread use.

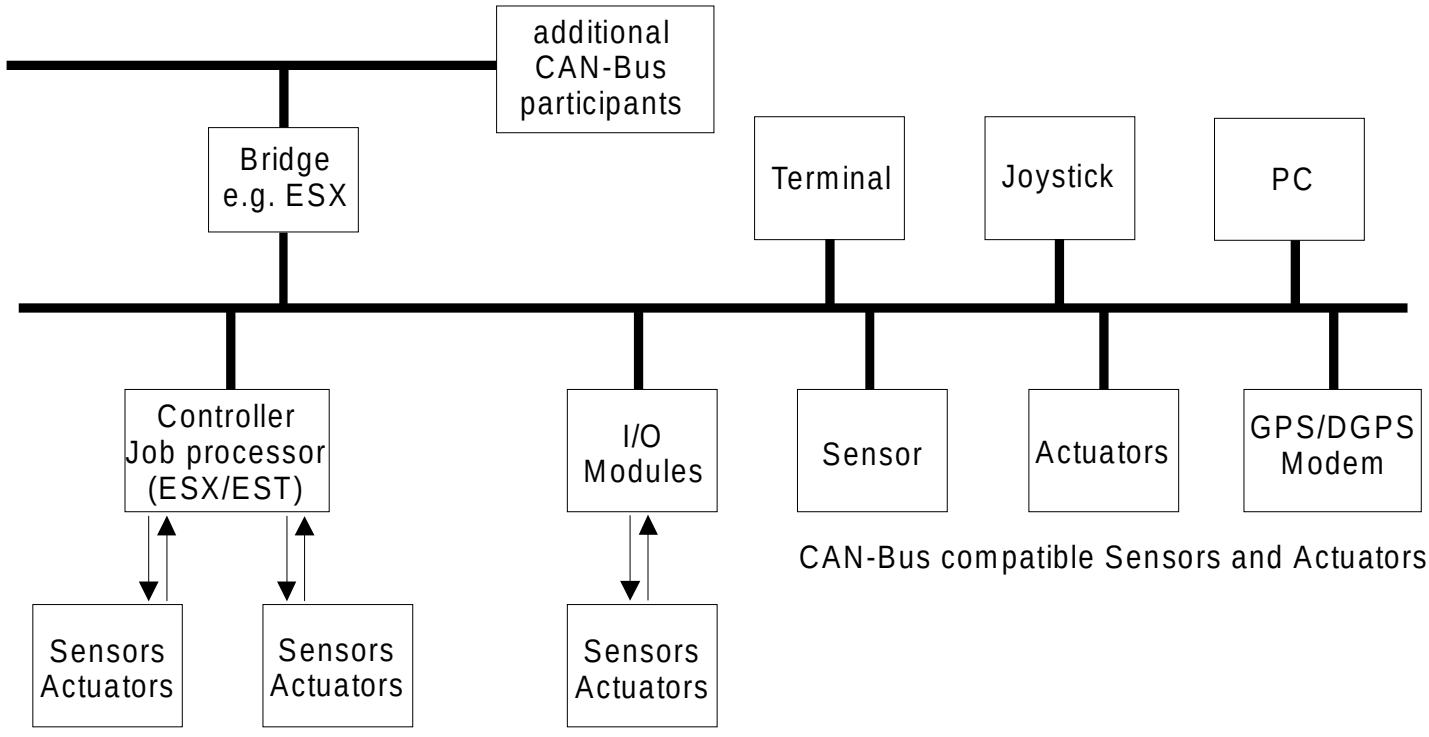
CAN-Bus systems exhibit high transfer rates (CAN low-speed up to 125 Kbit/s, CAN high-speed to 1Mbit/s) and high data transmission reliability. A number of different capabilities (CRC, frame checking, acknowledgment, bit monitoring and bit stuffing) enable the CAN protocol to recognize errors in transmitted 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 try 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).



CAN-Bus compatible Sensors and Actuators

- **ESX** - a rugged standard controller proven in mobile applications with sensor-actuator management through integrated measurement, control and driver devices offer real time data processing of multiple independent or linked tasks.
- Freely programmable (in high level language ”C” or using IEC 1131-3 graphical interface)
- adequate 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 circuiting to ground or to supply voltage for all inputs and outputs
- Safety relay as alternative switch off
- TÜV certified to ”Anforderungsklasse 4” for safety relevant applications, also European Category 3 or Safety Integrity Level 2
- Direct driving of proportional valves saves expensive driver and/or controller boards

Technical Data ESX

Processor system	Siemens C167, 16 bit, f_{CPU}=20 MHz, Flash to 512 Kbytes, RAM to 256 Kbytes, EEPROM to 16 Kbytes
CAN-Bus interface	Full CAN, CAN 2.0 B (29-bit identifier), low or high speed to 1Mbit/s
RS 232 C interface	programmable baud rate (max. 19200 baud)
Digital or RPM inputs	16, high/low active (software configurable), frequency to 6.5 kHz, short circuit protected
Analog inputs	8, 4...20mA or 0...8.5 V (software configurable), 10-bit, f_{CUTOFF} = 1 kHz, short circuit protected
PWM / Digital outputs	3 x 4 A, high side switch, 0...100%, short circuit protected 4 x 2.5 A, high side switch, 0...100%, short circuit protected
PWM / Digital outputs with current measurement (proportional valve drivers)	5 x 4 A, high side switch, 0...100%, clock frequency adjustable from 5...250Hz, short circuit protected
alternatively: Outputs for driving Danfoss proportional valves (PVG)	12, (20%... 80% of supply voltage)
Constant voltage output	1 x 8.5V, stabilized voltage supply, short circuit protected
Additional modules	internal interface for 2 modules (also customer specific) with up to 6 inputs or outputs each or internal functions; 12 pins on the connector are free for specific applications
Supply voltage	12 V (9...16V) DC, 24 V (10...32V) DC operates on vehicle power supply
Current requirements	approx. 0.5 A without load, total current up to 30 A Stand-by < 1 mA
Connector	68 pin connector, automotive standard, with latch
Chassis	IP 65 (opt. IP 67), cast aluminum, GORE-TEX Ò breathing filter for pressure equalization and high moisture protection
EMC, environmental requirements	certified according to automotive, agricultural and construction industry standards; C conformity
Operating temperature	-40 °C ... +85 °C (chassis)
Weight	approx. 2 kg
Size	170 mm x 195 mm x 72 mm (6.69” x 7.68” x 2.83”)

Sensor-Technik Wiedemann GmbH
Steuer- und Regelelektronik

Am Bärenwald 6, D-87600 Kaufbeuren
Phone ++49(0)8341/9505-0
Fax ++49(0)8341/9505-55
e-mail info@senor-technik.de
Internet http://www.senor-technik.de