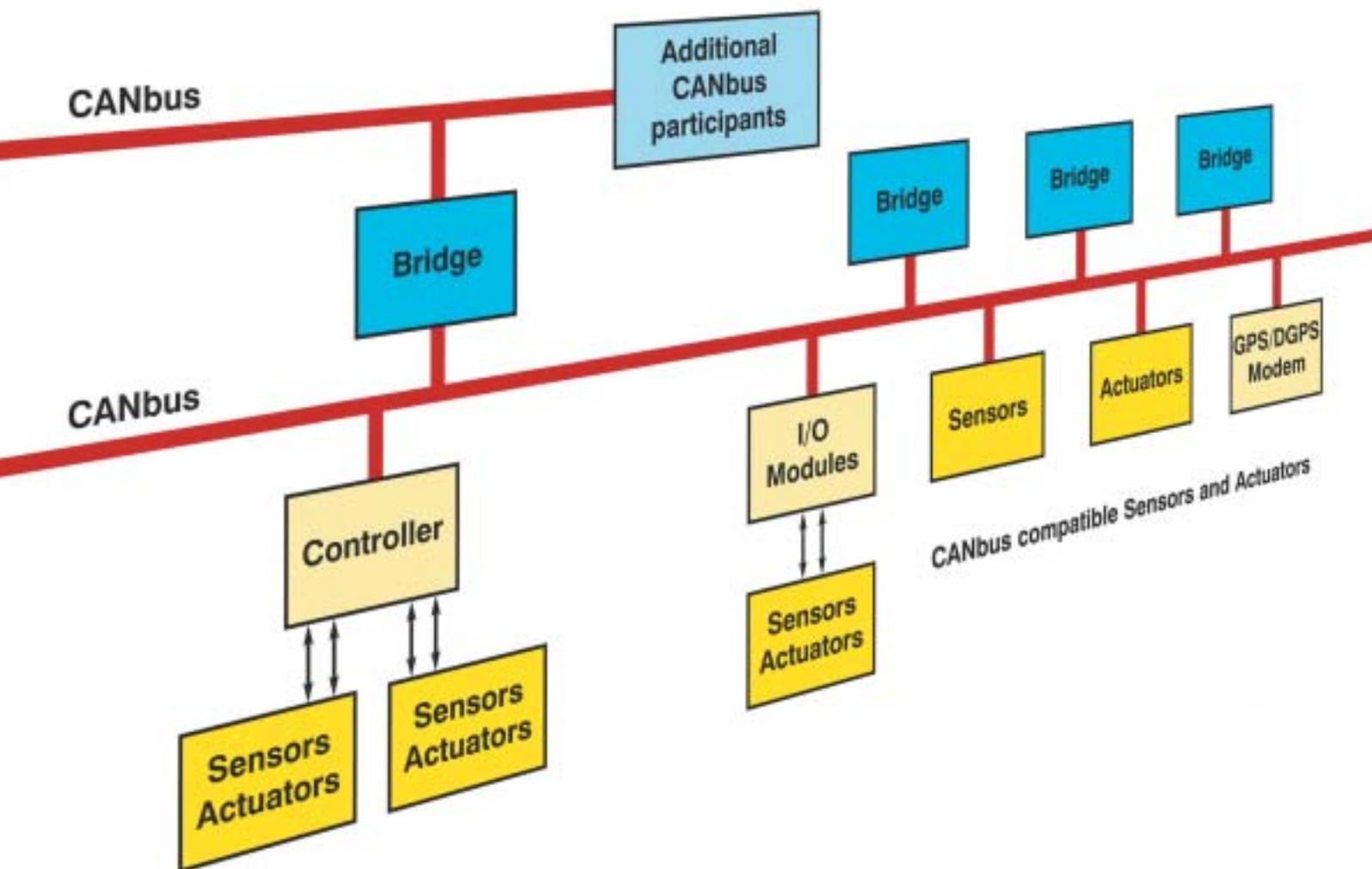


## The Engineer's Guide to CANbus



# Why CANbus?

Data sheets, brochures and even websites can't explain the full advantages of moving to CANbus

21st Century vehicles where modular sensors and controls are connected to a network backbone are now possible thanks to the widely used CANbus. You can throw away the wiring loom – and replace it with two wires! Smart gauges

and sensors can be directly connected to the CANbus. Control modules can read/send data, display systems can read/log data and because it is a network, it is irrelevant where components are physically located.



Information display panels show the driver/operator what he needs to know. Logging of information feeds the service system and panels display information where required, for example next to the valves on a tanker. CANbus also has the bandwidth to cope with real-time control as well as data collection.

Feature	Benefit
Software set-up	Flexible, lower production cost
Standard protocol	Able to connect to different equipment
Communication	Communicate with other equipment
Fault diagnostic	Error detection for faulty components
Data logging	No more false warranty claims
Monitoring	Misuse protection
Memory	Repeat working functions
Information	Operator can make decisions Improved logistics
Electronic controls	Better operator working conditions Longer working hours
Hydraulic remote	No vibration, no hazards Better viewing
Single system	Combined controls Information servicing, etc.
Safety	Close down facility and error protection
Standard units	International regulations and laws approved
Fewer mechanical parts	High reliability, minimum failure rates
Standard hardware	Exclusive to Sensor-Technik
Lower cost	Reduced wiring, weight Low servicing costs, fast repair

# The benefits of CANbus

- Lower cost production, one set of software, one system and one supplier on a standard communication system giving you flexibility: The same assembly can be set-up via the software to individual customer applications without having to change any hardware.
- Communication systems: Different CANbus controllers are able to communicate with each other over the same bus, i.e engine to transmission, to the operator panel or to any other controller.
- Easily controlled and consistently precise work: CAN Controllers can be linked together. For example, a controller on one vehicle can talk to another – you can add machinery on a tractor and it will work together. Repeat working functions can be logged by simple selection, giving high repeatable quality of work.
- Better operator working conditions and longer working hours: Push switches and joysticks replace heavy or difficult levers, giving better driver comfort and better viewing as valve blocks, pipes etc are eliminated from the cab. No vibration, mechanical shocks, fatigue, white finger etc., and the operator interface can be set up to individual applications.
- Reduced mechanical components, minimum failures: As the operator panel electronically talks to the controller, the removal of the hydraulics in the driver cab can be achieved – desirable as new European regulations come into force. The controller can be mounted close to the hydraulic system, allowing pipework to be reduced.
- Eliminating ‘being in the wrong place’; remote viewing: CANbus can be linked with other equipment such as remote controls, video cameras and GPS (Global Positioning System) to track a vehicle and to ensure it only works where it has been allocated.
- Information – the key to improvement and saving money: CANbus can bring together several systems, such as weighing systems, information logging, statistics, servicing reports, time per job and others.
- Fast and low cost servicing and backup: No more wasted investigation into why a vehicle has a problem; the fault diagnostic with complete error message will highlight the problem – and it’s also available by mobile telephone.
- Low cost servicing, fewer warranty claims: Safety features/error detection can be added to ensure equipment cannot be overloaded or misused and only correct commands are executed. In the event of misuse the process will be stopped and logged.
- High reliability where it counts, use of standard sensors at low cost, no need for special sensors or new technology: The input/output modules allow you to use your already proven sensors which are tried and tested – although you can of course combine them with up-to-date CANbus sensors too!

Making the move to bus-based control is a big step, but it needn't be a difficult one. Whether you need fully approved components with a proven track record or complete system designs, we can meet your requirements. And we'll be with you every step of the way

## What can CANbus do?

Applications include:

- Engine management
- Electro-hydraulic steering systems (steering-by-wire)
- Hydrostatic drive control (driving-by-wire)
- All control functions of working hydraulics
- Transmission control
- Automatic levelling and positioning of platforms

CANbus control units and HMIs (Human Machine Interfaces) are used in a wide variety of functions in mobile and stationary applications. Via the various configurable inputs and outputs it is possible to connect all types of sensors and actuators directly to the control unit; the user-programmed controller monitors the system inputs and allows either closed loop or open loop control of the outputs. This way, components such as proportional valves can be controlled directly.

Together with extended diagnostics functions and the CAN interface, the system offers unmatched in-service facilities. In case of failure (such as broken cables or short circuits) it allows users to restore the vehicle to safe conditions and provides service staff with the right tools for quick and easy diagnostics. With the additional

possibility of remote (wireless) maintained diagnostics, CANbus is capable of making a significant contribution to increased vehicle availability and productivity.

More and more vehicle manufacturers and automotive component suppliers are realising the benefits of the CANbus system. This technology has now reached a stage where internationally agreed standards exist, so that different manufacturers' electronics can communicate together. A typical modern truck might have separate electronic modules controlling engine, automatic gearbox, ABS brakes and on-board hydraulic control. The engine module has a sensor reading RPM. All the other modules, such as the gearbox, need to know the engine RPM to operate correctly. The engine module will broadcast the engine RPM message on the CANbus, and a module connected to the bus can receive the message and use that information. This means that the engine RPM sensor need only be connected to one of the modules.

The versatility of CANbus modules is evident from the wide range of applications in which they are used: specialised civil engineering; mobile cranes; agricultural/harvesting machinery; forklift trucks; refuse collection vehicles; steamrollers; aircraft towing vehicles; road sweepers; excavators; fire engines; military equipment; boats; shipyard cranes; diggers; and many others



# High performance

The Controller Area Network (CAN) was originally developed by Bosch for use in the automotive industry, but has established itself as the standard bus system for mobile applications, and is defined under ISO 11898. CANbus systems exhibit high transfer rates up to 1Mbit/sec and high data transmission reliability. A number of different capabilities (CRC, frame checking, acknowledgement, bit monitoring and bit stuffing) enable the CAN protocol to recognise errors in the transmitted data (caused for example by electromagnetic disturbances) and to correct them. This correction takes place with very little loss of time, making CANbus extremely reliable in demanding applications.

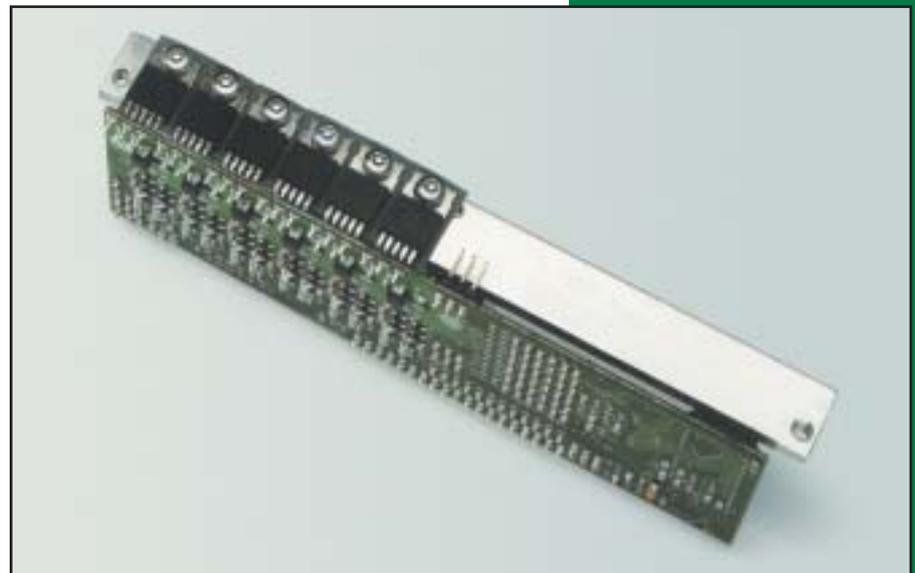
A pair of wires forms the transmission medium. The length of the network can be up to 40m for the maximum 1Mbit/sec transmission speed, but networks can be up to 1000m in length without the need for repeaters and are practical for transmission rates of 80Kbit/sec or less. The number of nodes on the network is unlimited in theory, but in practice depends on the type of chip used. With commonly used chips, 32, 64 or up to 110 nodes per network are possible (or 128 with restrictions), whilst further nodes can be accommodated by using repeaters or bridges.

CAN is a 'multi-master 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 (such as temperature, rotational

speed or linear speed). All participants check out the identifier being transmitted and decide if the type of message is relevant to themselves. 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. Should a number of participants try to access the bus simultaneously, the higher priority message is guaranteed to gain bus access.

Standard format (11-bit identifier) and extended format (29-bit identifier) are two different message formats that can exist on the same physical CANbus. The CAN 2.0 B specification supports both formats, while CAN 2.0 A only allows frames with 11-bit identifiers.

Through content-oriented identifiers in the message, the system achieves a high degree of configuration flexibility and allows a simple extension of the network to include further devices.



Networks of up to 40m will support transfer rates of 1Mbit/sec

Networks up to 1000m in length without repeaters are practical with rates of 80Kbit/sec or less

# A protocol with a pedigree

In February of 1986, Robert Bosch introduced the CAN serial bus system at the SAE congress in Detroit. It was designed to handle short messages, support multi-master access, and offer a high degree of reliability. In mid 1987, Intel delivered the first CAN chip, and today more than 20 chip manufacturers produce devices that offer CAN interfaces.

CAN quickly gained a dominating position among bus protocols. In 1999 close to 60 million CAN controllers made their way into applications; more than 100 million CAN devices were sold in the year 2000.

A big advantage of the CAN bus compared to other network solutions is the price/performance ratio. Price wise, CAN is the most affordable network next to a regular serial channel.

With CAN being a pure data link layer implementation, higher level application layers have been developed to increase CAN's suitability for use in specific areas of different applications...

## SAE J1939

As a real-time CAN solution for heavy duty applications, J1939 is suited for equipment used in industries ranging from agriculture, construction, and fire/rescue to forestry, materials handling, and on- and off-highway.

Communication systems designed according to J1939 standards are EMI/RFI tolerant, free of connection

wires, easy to install, and feature log, record, remote access, and self-diagnosis capabilities. The J1939 standards family is maintained to ensure CAN device interoperability.

## CANopen

CANopen is a network technology optimised for use in industrial control environments, in machine internal networks and in embedded systems (any control unit deeply 'embedded' in a device with electronics). In industrial control terms CANopen is a 'fieldbus'.

Some fieldbus applications use derivations from RS485 for similar embedded networks. However, with RS485 the network designer/developer needs to invent many communication routines. CANopen, on the other hand, features a pre-defined set of network communication functionality.

## What's ahead for CAN?

Although the CAN protocol is now 15 years old, it is still being enhanced. For example, at the beginning of 2000 an ISO task force involving a number of companies defined a protocol for the time-triggered transmission of CAN messages.

In addition, other standards are being formed to enable new items of equipment to be connected – for example allowing simple data transmission between new machinery and a tractor. Also, different industries are generating their own specifications, increasing the scope of CAN as a universal interface.

There are a number of higher protocols such as LBS, OSEK, SAE J1939, CAL (CAN Application Layer – the basis for the communications profile CANopen), DeviceNet and others which have been standardised. These are available on the so-called 'application layer'

# Freely programmable

Lots of manufacturers will tell you that their products are freely programmable, but what do they really mean? More often it means 'freely programmable' with the software that they supply. In effect, they're locking you into their products.

With Sensor-Technik's CANbus products, you can use whatever software best suits your needs – a standard programming language like C, or an IEC 1131-3 compliant graphical program, including Function Block Diagram, Ladder Diagram, Instruction List, Structured Text or Sequential Function Chart. That means you can buy products from many different manufacturers, but put your system together using a single software package.

Sensor-Technik offers an extensive function library of ready-to-use components, making it quick and simple to develop even complex applications. Debug and diagnostic tools are also available on

request. Alternatively, Sensor-Technik can develop your complete software application for you.

## Software safety

Our freely programmable software is already approved by international standards and, used together with approved hardware, will save time and money associated with getting approvals after the project is completed, if that is even possible.

Safety standards are particularly important. The safety standards authority TÜV has already certified some of the proprietary CAN-based safety systems and the software used to program them. CANopen-Safety is the first standardised CAN solution to earn a tentative BIA approval. Also, approval of the CANopen framework for maritime applications by one of the leading classification societies worldwide – Germanischer Lloyd – is in preparation.

## J1939 compliant configuration software

Many products in Sensor-Technik's range are also SAE J1939 compliant, and there is associated configuration software. This simple-to-use software with familiar Windows interface allows generation and editing of user-specific graphics, text and pages. It dramatically simplifies the generation of tables of variables, and of linking these to graphics and to real-world text messages. It has been designed to be easy to learn and use so that you can be configuring your systems within minutes.

The editor has been equipped with a special WYSIWYG interface for the representation of

the operating panel display. This means that the character set of the device is presented on screen in exactly the way it will appear on the device. The same applies to graphics, which are shown in exactly the way they will appear on the LCD display.

To simplify data generation, different colours are assigned to individual functions. Thus, the different entries can be easily identified on the display. In configuration mode, the J1939 software provides views of the editor with J1939 connection, the table of variables, and the graphic representation of the connected equipment.

Program your application in:

- Function Block Diagram
- Ladder Diagram
- Instruction List
- Structured Text
- Sequential Function Chart
- C

Single package for generation of graphics, text and pages:

- Simple programming
- WYSIWYG technology interface

# CANbus in action... Hydraulic Machinery... • Rail Industry ...

## Root crop harvester



Standen has saved significant costs, mainly due to reductions in commissioning time

### **Brief given**

As agricultural machines have developed in complexity and sophistication, customers have demanded more operator control. The latest version of a potato harvester from Standen featured 55 individual switching signals, with which the operator can control 30 individual functions. In development, it was realised that the practical limits of hard-wiring had been reached.

### **The solution**

Standen's main hydraulic valve supplier proposed a CANbus system using the robust and proven ESX control modules from Sensor-Technik, with software written by the supplier's electronic division.

### **Implementation**

The driver interface control unit has a membrane fascia, interfaced to the bus with a 56-channel input and 32 LED indicator output module. To allow the operator to view and set

defaults for flow rates, delay and response times and to monitor pressures in circuits, a Wachendorff OPUS Light four-line operator display panel is inset in the fascia. The system drives between 18 and 24 valves, depending on the customer specification for the machine.

Functions which previously could only have been manually preset on the harvester can now be set in-cab by the operator as required, allowing far greater control on the quality of the crop sample produced by the harvester. Optional automatic sensors for machine levelling, discharge elevator height, depth control and axle steering position can be plugged into the main ESX processor.

### **Conclusion**

Standen has saved significant costs, mainly due to reductions in commissioning times. The simplicity of the wiring loom allowed Standen to bring the wiring in-house, delivering additional cost savings.



## Bale trailer manufacture



Operators have far greater control of the operations and the manufacturer has a unique competitive advantage

### **Brief given**

Farmers are under constant pressure to improve productivity and cut costs. Hence every machine has to be more accurate and efficient in order to meet ever more stringent targets, such as minimising size and weight.

One manufacturer needed a display unit to pick up CANbus signals and display them to the operator. It also had to make it easy for the operator to make adjustments to keep the vehicle running constantly. Further, the display unit package had to look unique for the customer.

### **The solution**

The solution was a standard Graf model AT3 CANbus HMI that had all the functions required for this application. It was supplied with freely-programmable software – including

graphics – and was re-packaged in the customer's own housing.

### **Implementation**

What was required was to specify the signals that needed to be displayed and the control signals that were needed by the operator in order to control the trailer. Once this was determined, implementation was simply a question of setting up the unit to display with the appropriate graphical and functional screens. The program was simple to write in standard Graf C software, and the images uploaded in JPEG format.

### **Conclusion**

With simple modifications to a standard product, the customer gained a piece of hardware that was unique in its mechanical style but which provided all the functionality required.

- Agricultural Machinery...
- Municipal Equipment...
- Construction Equipment...
- Military Vehicles...

**Brief given**

Goldhofer manufactures a range of load carrying platforms, including heavy duty modules capable of transporting enormous structures weighing many hundreds of tonnes. Among its range are multi-axis hydrostatic self-driving units which can be used either singly or with multiple units in tandem. Controlling a single module is a challenge – controlling and synchronising multiple units is extraordinarily demanding.

**The solution**

CANbus was selected as the communications bus for the on-board steering, hydraulic level adjustment and diesel engine drive functions. It was also suggested as the best means of synchronising multiple platforms.

**Implementation**

Each platform includes a CANbus ESX host computer and a further ESX axis control module. The ESX host communicates both with the axis control module, and also with other ESX host modules on as many other platforms are required, delivering tight synchronisation of

movement in a multi-platform system. The ESX host computer controls the steering on each platform directly, based on information from the other ESX host modules, and from angle feedback signals from the wheels delivered via the ESX axis control module.

The axis control module also monitors the speed of each wheel and feeds this information back to the ESX host for automatic throttle adjustment. The CANbus controllers also monitor and control the proportional valves for the hydraulic level adjustment system.

**Conclusion**

Cost-effective cross-linking of all the CANbus controllers makes it possible to design a fully modular, decentralised control system. With a pair of wires forming the basis of the transmission medium, cabling is kept to an absolute minimum. The high transfer rates of CANbus with excellent transmission reliability ensure all platforms in a system receive control signals at exactly the same time, giving tight synchronisation of movement.



**Brief given**

Access platform fire fighters need to be able to park their vehicle very accurately. Get it wrong and either the platform won't reach or, if the platform has to extend too far, the vehicle could fall over due to lever effects.

**The solution**

A CANbus controller and HMI unit were selected to control the hydraulics for the outside stabiliser feet, applying more pressure where needed to adapt the balance as the platform is rotated. The system also controls the extension of the platform, with fail-safes for overload conditions. The system interfaces to the existing engine CANbus system to speed up or slow down the hydraulic pump.

**Implementation**

The biggest issue here was to set up the HMI to show the operator the exact position of the platform, indicating at the same time how much more extension was possible before any overload, so that an early decision could be made about whether to move the vehicle. Safety considerations included using the CANbus system to first test the ground under the vehicle to ensure that the surface is sound enough to support the vehicle.

**Conclusion**

Fire engines can now be positioned and used within minutes of arriving on the scene, allowing fires to be tackled more quickly and with a higher degree of safety.

Multiple tandem self-driving platforms



The CANbus implementation allows the whole system to be designed in modular fashion for ultimate flexibility

Fire fighting vehicles



CANbus is allowing fire fighting vehicles to get into position more quickly and to be used more safely

## STW



The ESX family of freely programmable controllers from STW is specially designed for mobile applications such as agricultural machinery, construction equipment, man and material lifts and many other demanding tasks. Robust cast-aluminum housings with an IP65 rating (optionally IP67) offer a high degree of safety in terms of EMC and the extremes of outdoor environments.

The ESX family also offers controllers that meet the requirements of safety norms such as AK 4 (DIN V VDE 0801, DIN V 19250), Category 3 (EN 954-1) and SIL 2 (IEC 61508).



With all ESX family controllers, the inputs and outputs are freely programmable. The user is able to realise 'H-Bridge' functionality to control motor functions. Via RS232 and CANBus interfaces, bridge and gateway functionality can also be realised.



The range of CAN controllers includes high performance standard controllers, compact controllers, micro controllers, controllers with data logging capabilities, and controllers offering remote data transfer via GMS/GPRS or the internet. STW also supplies an extensive range of I/O modules and baby board I/O cards, test and simulation boxes, simple displays, and dedicated CANbus cables.

### About STW

Founded by Katharina and Wolfgang Wiedemann in 1985, STW is driven by a passionate and enduring pursuit of new technologies, especially when it comes to solving complex technical problems. The original product focus – sensors and measurement – was expanded to include mobile controllers in 1989.



The high quality standard products of the STW group, combined with the local market knowledge and applications understanding of Sensor-Technik UK, gives us a formidable strength in resolving problems and providing systems solutions and makes us a reliable, long-term partner for our customers.

**ESX Controller** A rugged standard controller for sensor-actuator management, capable of executing a number of tasks in real time. It has been developed especially for use under harsh conditions and extreme temperatures, functioning from  $-40$  to  $+85^{\circ}\text{C}$  in vehicles and machines. Freely programmable in C or IEC 1131-3 graphical interface.

**ESX-LT Controller** A more compact version of the standard controller for sensor-actuator management, without compromising on capability or functionality. It has been developed for use under harsh conditions and extreme temperatures, functioning from  $-40$  to  $+85^{\circ}\text{C}$  in vehicles and machines. Freely programmable in C or IEC 1131-3 graphical interface.

**ESX Micro Controller** The newest addition to the ESX controller family is a highly compact product capable of acting as an independent controller or as a slave in a network. Its compact size means it is ideally suited for speciality machines because of its compact design.

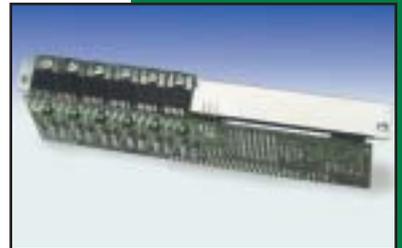
**ESX-C2C Controller** The freely programmable ESX-C2C module not only provides data logging capabilities for mobile machines, but also enables remote diagnosis of systems via an internal GSM modem for enhanced customer support services. Data transfer is via GSM/GPRS or internet, and the module can automatically send SMS text messages. Text message alarms can be user-defined. The module provides bridge and gateway functionality.

**ESX-DIOS/DIOM I/O Modules** These I/O modules for mobile applications extend the I/O capability of a CANbus master controller.

**ESX Baby Boards** The ESX can be equipped with up to two internally mounted extension modules called Baby Boards. Four different basic module types exist, on each of which 6 I/Os are available. These four basic types can again be varied through altering the hardware assembly. On the Baby Board B it is possible to specify the type of some inputs or outputs with software.

**ESX Test/Simulation Box** A test box in 19-in rack format which provides monitoring circuits and indicators for all inputs and outputs, as well as a connector for the ESX, to facilitate programming and testing of ESX software. All inputs and outputs may be switched as desired or connected to simulators for sensors and actuators.

**ESX- $\mu$ HMI** The ESX- $\mu$ HMI reads in CANbus messages and displays them for fast and easy diagnosis of system related hardware and software states. Error codes and information codes, defined during program development, can be assigned to each machine and/or failure mode. Two push buttons on the display allow the operator to scroll through messages and implement simple system actions.



## RTS



Riegger Telemetrie Systeme (RTS) has developed a range of innovative telemetry systems for the agricultural market, enabling remote diagnostics and maintenance, data acquisition, fleet management and theft protection. As well as offering a range of standard products, RTS is adept at developing individual telemetry projects to meet the needs of individual customers.



RTS products are CAN-based systems, built around STW's ESX-C2C CAN controller and teleservice communications module. Systems collect data from both office and machinery, and transmit it to a central PC over GSM or Bluetooth. GPS is also employed for vehicle position monitoring and site mapping.

### About RTS

Riegger Telemetrie Systeme has been at the forefront of agricultural engineering for more than 50 years. Today RTS leads the world in solutions to enable precision farming, e-farming, and to facilitate and simplify government department inspection. The company's solutions are tailored to meeting the needs of local markets, drawing on the very latest technologies.



**MoDaSys** Under EU Directive 178/2002, farmers are required to record all production data. The RTS MoDaSys data logging system helps to fulfil this task, simply and cost-effectively. MoDaSys monitors the machinery functions, plus machine data such as engine speed, vehicle speed and idle time, presenting the data as real-time graphs or daily overviews. MoDaSys also monitors area covered, distance covered and the route travelled, as well as detailing the hours of work. MoDaSys transfers data wirelessly via Bluetooth or GSM.



Supplied complete with comprehensive agricultural software, MoDaSys is the essential tool for farm managers or fleet management service partners.

## Wachendorff

The Opus family from Wachendorff provides an extremely high quality range of displays, HMIs and operator panels, developed with commercial vehicle applications in mind. Attractively designed and expertly finished, these control interfaces for CANbus systems are sealed to IP65 and feature backlighting that adjusts automatically to ambient light.

The Opus range includes rugged operator terminals – equivalent to a powerful industrial PC – with which a whole range of different automotive applications can be controlled in parallel. The panels combine the latest technology with rugged workmanship. SD flash memory cards make it easy to transfer project data to specific operator panels from a PC. Ease of operation is considerably enhanced thanks to the modular way in which the user interface can be constructed.

Opus operator panels have been used in a raft of applications across the globe. For example, used as an information and command centre in Fendt tractors, the OPUS Thor controls a variety of accessory equipment and tractor functions. In Kässbohrer's Pisten-Bully range of special purpose vehicles, the Opus Thor works just as reliably in the freezing snow of the Alps as in the burning desert sands of Dubai. In Bucher road sweepers the Opus 21 combines the roles of control centre and instrument panel.

### About Wachendorff

Wachendorff has been manufacturing electronic devices for automation and process optimisation of machines, plants and mobile machines for over 25 years. Every panel is comprehensively tested, with Wachendorff having in-house facilities for salt spraying, full enclosure testing, EMV testing for vibration resistance, and climatic testing.

**Opus A1** Full VGA TFT display operator interface for use in demanding commercial vehicle applications. The diecast aluminium housing provides flange mounting on the rear.

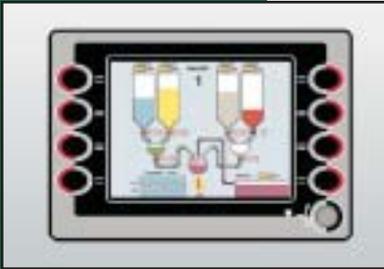
**Opus A2** Colour or monochrome operator interface for use in demanding commercial vehicle applications.

**Opus A21** Control interface for CANbus systems, with IP65 ABS injection moulded, housing and 1/4 VGA TFT.

**Opus Thor** Attractively-designed operator interface for arduous in-vehicle applications, with fully programmable graphic computer display and CANbus interface. The housing is cast aluminium, powder coated.

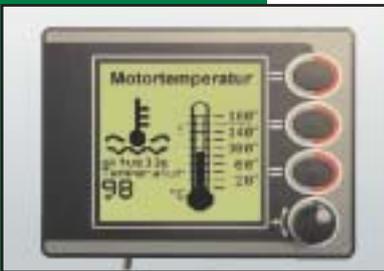


## Graf-Syteco



Graf-Syteco offers the industry's most complete range of CANbus enabled operator panels, for general industrial, building management and mobile vehicle applications. The products are available in a range of sizes and with different levels of functionality to allow the precise needs of the application to be met with the most cost-effective solution.

The units are also available with additional built-in control functionality and with additional on-board I/O to provide direct control of external CANbus nodes. Further, the units can be supplied without the operator panel to provide compact, standalone CAN nodes.



The products can be supplied to meet demanding environmental conditions. Front panels are protected to IP64, and the panels are suitable for use in extreme temperatures from  $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ .

Graf-Syteco has also developed associated programming software which provides the simplest means of setting up a system. Easy to use, the software guides even the novice programmer through application development and operator-interface design. Graf-Syteco offers comprehensive, free telephone support, and provides regular updates.



### About Graf-Syteco

Graf-Syteco has more than 20 years experience in the electronics industry and more than 10 years in mobile applications. The company's products are supplied all over the world to a variety of applications. Graf-Syteco is a small-to-medium sized company that is family owned, run by Mr and Mrs Graf. As such, the company can service both small orders and high volume product runs, with the ability to tailor products to customer requirements without large associated costs.

As well as developing high quality hardware, Graf-Syteco has its own in-house software department. This not only means that the standard software programming package is of the highest standard, it also means that the company can develop customer-specific applications and projects both quickly and cost-effectively, in contrast to other companies which have to out-source their software development or employ expensive consultancies.

**AT8-Series** The AT8-Series is a very efficient TFT colour graphics control unit, designed for rough environmental industrial and vehicle applications. The control unit has eight freely programmable function keys and a digital input potentiometer for easy one-handed operation. A dual CAN port option allows the unit to communicate to the engine and to other equipment on the system simultaneously without upsetting the CANbus. The unit is available for panel mounting or as a complete enclosure.



**AT3-Series** The AT3-Series is an operator panel with full graphical display capability on its LCD, accepting any standard graphical image formats such as JPEG and Tiff. The unit can function as a complete CANbus controller; the addition of input and output slave modules enable you to build up a low cost, simple CANbus system. The unit is available for panel mounting or as a complete enclosure.



**AT2-Series** The AT2-Series is an operator panel with character capability, available as an LCD with LED-backlight or VF display. It has been developed for use in arduous environments such as vehicles, building machines and plant construction equipment. The operator panel has a CAN interface. The user-interface is simplified by the addition of an integrated digital potentiometer and it is possible to input characters without an additional keyboard.

**AT3-Series HMI and CAN Controller** The AT3-Series operator panel is also available with built-in control function and direct I/O, allowing the unit to take direct control of any external nodes. The outputs are able to drive solenoid valves, proportional valves or relays directly.



**Control Units with I/O** The AT2-Series and AT3-Series operator panels are also available with built-in control function and direct I/O, but without the graphic display, to form compact standalone CAN nodes. The outputs are able to drive solenoid valves, proportional valves or relays directly.

**AT6 and AT7 Series Industrial Terminals** These operator panels provide a lower cost alternative to PCs for industrial applications. They are delivered in several standard finishes. A CAN interface is provided as standard, with other bus systems available, plus RS232 or RS422 serial interfaces.

**J1939 compliant configuration software** All Graf-Syteco AT-Series products are SAE J1939 compliant, and the company offers associated configuration software, ITE6E18. This simple to use software with familiar Windows interface allows generation and editing of user-specific graphics, text and pages.

# The UK's CANbus specialist

Making the move to a bus-based control system is a big step, but it needn't be a difficult one. Whether you require fully-approved components with a track record, or complete system design, Sensor-Technik has the answer. And we'll be with you every step of the way.

CANbus provides the ideal system for integrating electronic controls into vehicles and machinery, particularly because it's a system which is to ISO standard and which is supported by so many different manufacturers.

The Sensor-Technik ESX controller and its variants have been specified for use in vehicles and machinery. This proven, reliable system has found applications in engine management, 2- and 4-wheel steering, drive-by-wire systems, anti-lock braking, anti-slip regulation, automatic gear shifting and hydraulic control of mobile machinery.

Sensor-Technik can also provide all the relevant accessories, from operator interfaces to the complete control system and interface package.

Most importantly, with Sensor-Technik you can specify standard, fully approved and tested products which will save you having to obtain many approvals yourself.

## **Sensor-Technik UK Ltd**

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