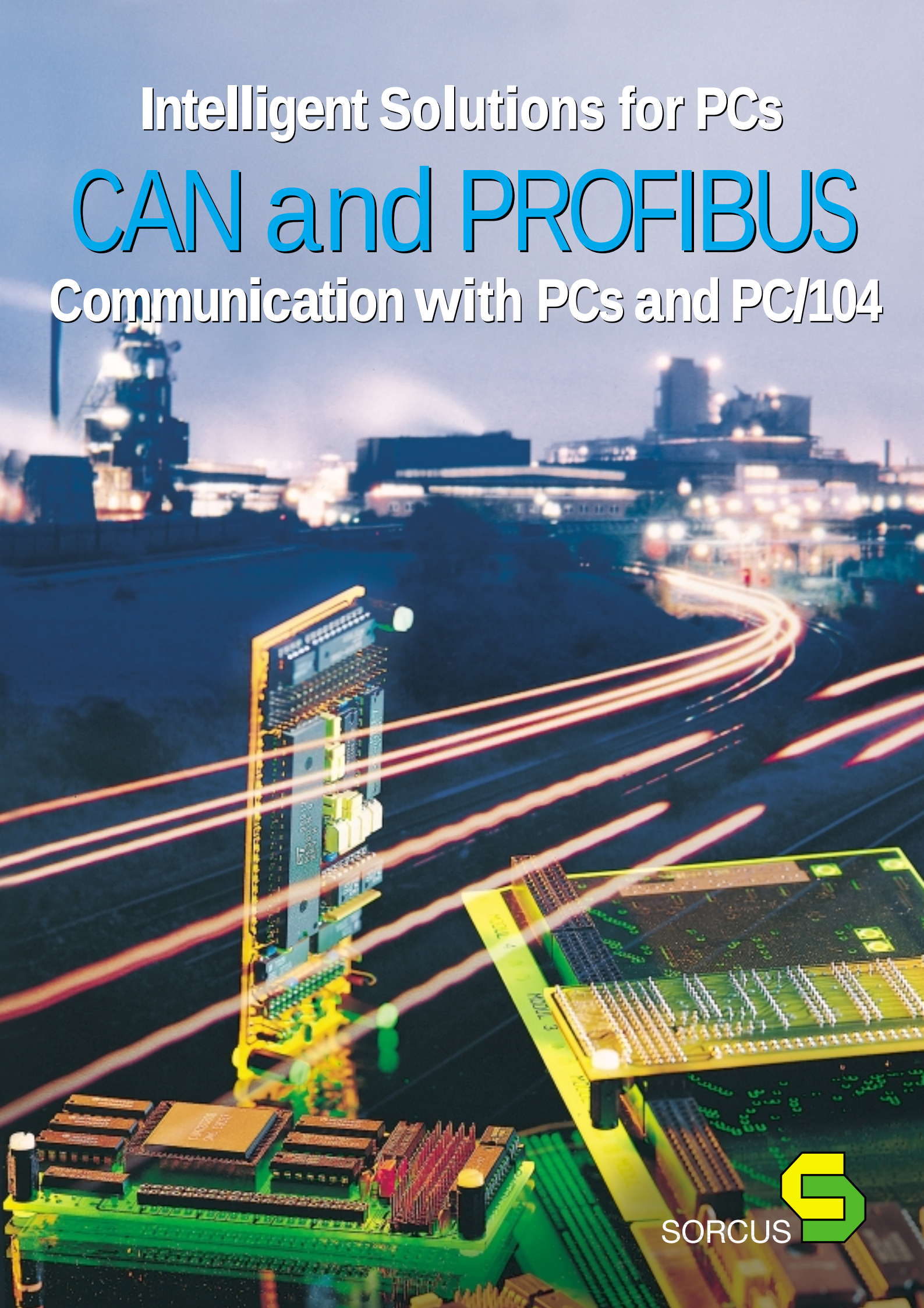
Intelligent Solutions for PCs

CAN and PROFIBUS

Communication with PCs and PC/104



SORCUS

Communication

with PROFIBUS and CAN-Bus

PROFIBUS:

The acknowledged standard for field bus applications

This open field bus standard has become the accepted choice in many sectors of industry, like automation systems for production lines, processes and buildings. Sensors and actuators from a variety of manufacturers communicate with each other over a standardized bus. The PROFIBUS-DP (decentralized peripherals) variant is particularly suitable for fast communication with decentralized peripherals.

The PROFIBUS master manages the activities taking place on the bus. PROFIBUS possesses multi-master capability. A master transmits messages (without an external request) to the passive slaves connected to the PROFIBUS, the slaves concerned receive data and commands and in turn transmit data to the master.

A PROFIBUS system consists of at least one master and up to 123 slaves. Slave stations for a host of widely varying automation applications are available from a large number of manufacturers. In addition to standard I/O slaves, like analog and digital inputs and outputs of the ET200 type (drives, valves, rotary transducers), complete PLC control systems (of the Siemens types S5 and S7) can also be connected, for instance.

CAN:

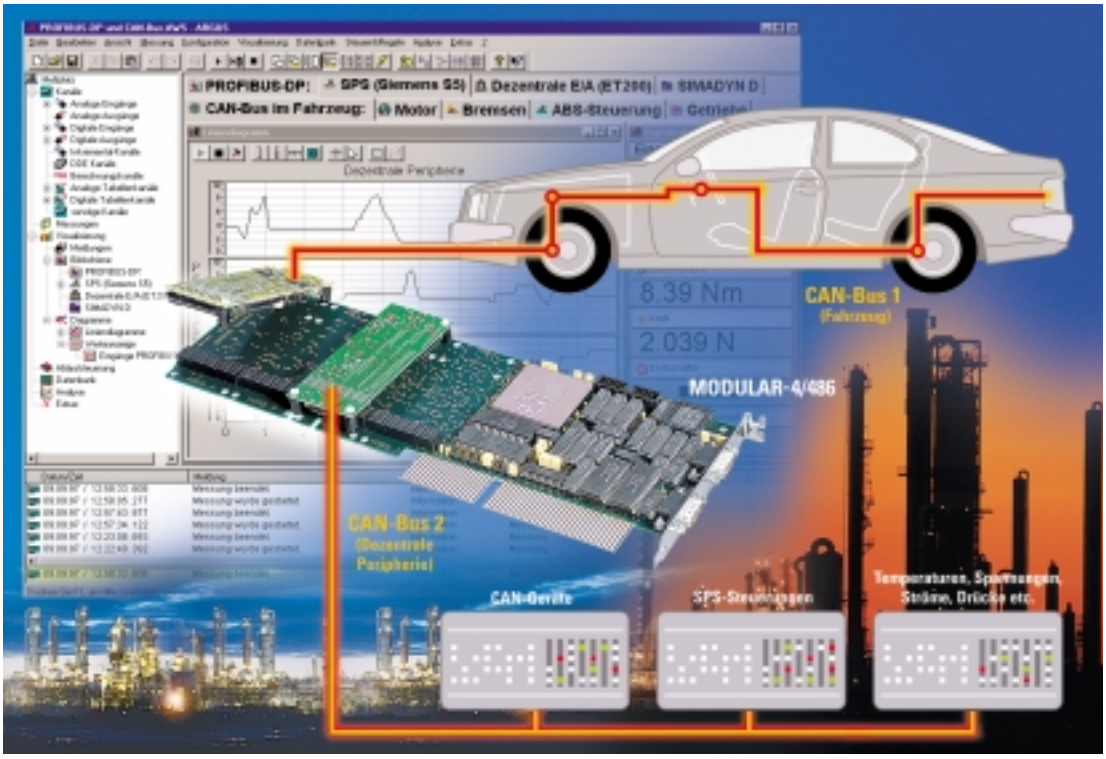
On the fast track even without a car

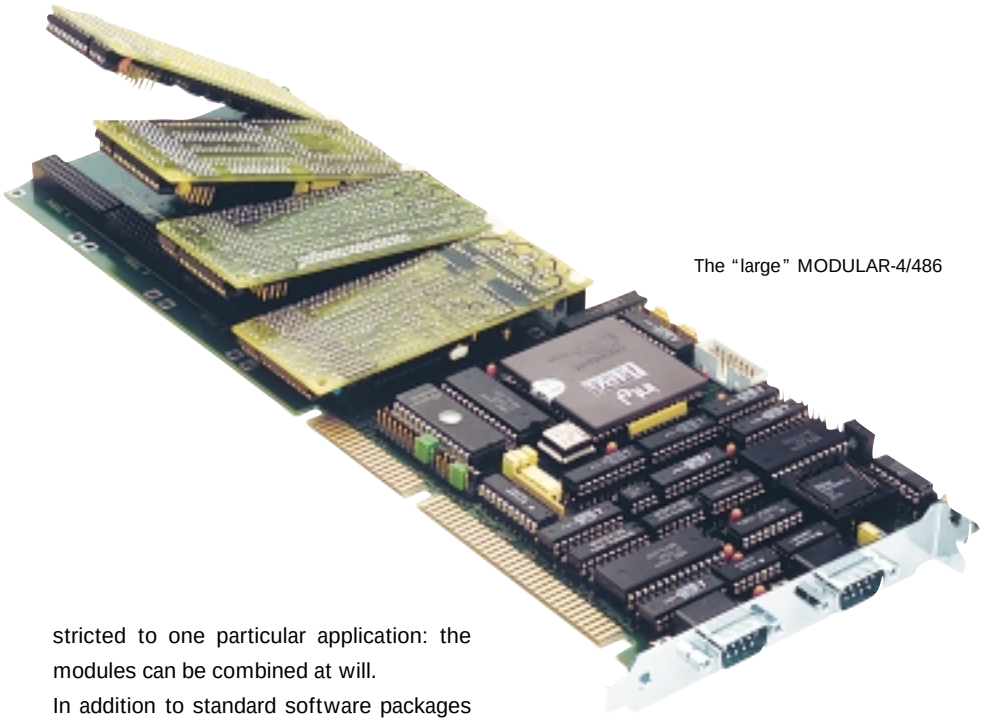
To get the ever increasing amount of electronics and cables in modern-day vehicles under control, the CAN (Controller Area Network) standard has been developed. This inexpensive message-driven network protocol has not only gained a firm foothold in the automotive industry but is also being increasingly used as a field bus system in automation engineering.

Setpoint and actual values, diagnostic data and other line/system parameters can be exchanged with the other nodes on the bus by means of CAN messages. Nodes are designated by what is called an identifier (ID). The user data are transmitted together with the identifier concerned. The nodes use the ID as a criterion to verify whether the message in question is of interest to them or not. The ID also specifies a message's priority on the CAN bus.

Serial communication

In addition to the genuine field bus components, SORCUS also offers standard interfaces like RS-232, RS-422, RS-485, 20 mA, optical-fiber-link interfaces, etc. for any desired synchronous and asynchronous communication tasks. Standard protocols, e.g. 3964/R, are likewise available.





The “large” MODULAR-4/486

The SORCUS concept: intelligent solutions

The SORCUS solutions are based on the intelligent MODULAR-4/486 carrier boards, which have proved their worth many times over in industrial applications, and on Multi-COM boards. A MODULAR-4/486 carrier board accommodates a complete computer with powerful hardware and software, plus a series of module slots enabling the boards to be customized for an extremely wide range of requirements: there are about 50 different I/O modules and communication modules for almost every application. A maximum number of 9 modules of this type can be plugged onto a MODULAR-4/486 board, for implementing sophisticated, multi-channel instrumentation and control jobs as well as high-performance communication tasks.

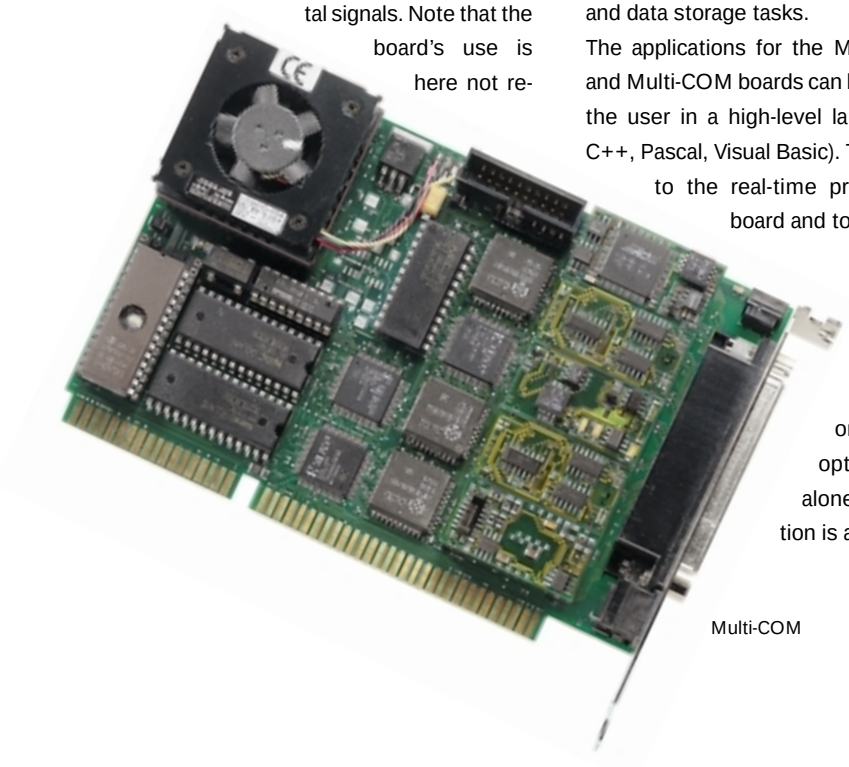
For example, a MODULAR-4/486 board can be expanded to become a PROFIBUS-DP master, a CAN node and/or a fast data-acquisition board for analog and digital signals. Note that the board’s use is here not restricted to one particular application: the modules can be combined at will.

In addition to standard software packages like ARGUS, DIAdem, DASYLab, etc., drivers and libraries are also provided, enabling users to create their own programs. The OsX multi-tasking real-time operating system from SORCUS runs on the board. There is an option for developing user-specific software both for the PC and for the real-time operating system of the MODULAR-4/486 or Multi-COM. Real-time programs free the PC entirely from all protocol-related, measuring and control tasks, since the boards’ integrated computer, which consists of a 486 or 586 CPU, a RAM, a ROM and other peripherals, works in complete independence of the PC.

The MODULAR-4/486 and the Multi-COM will convert any PC into a genuine parallel computer system, with the PC in this configuration handling visualization, evaluation and data storage tasks.

The applications for the MODULAR-4/486 and Multi-COM boards can be developed by the user in a high-level language (e.g. C, C++, Pascal, Visual Basic). This also applies to the real-time programs on the board and to PC programs.

You can use up to eight boards simultaneously in one PC. And an option for stand-alone board operation is also provided.



Multi-COM

MODULAR-4/486

- Intelligent PC board with its own CPU, RAM, ROM and peripherals
- The board’s local CPU works in parallel to the PC
- Available with 486 or 586 CPU, up to 133 MHz
- Up to 34 MByte RAM
- Real-time, multi-tasking OsX operating system on-board
- Option for stand-alone operation
- 2 serial RS-232 interfaces
- 2, 4 or 9 module slots
- 6 timers
- Real-time clock and date
- Drivers for all commonly used PC operating systems (DOS, Win 3.x, Win 95 and 98, Win NT)

Multi-COM

- Intelligent PC board with its own CPU, RAM, ROM and peripherals
- 6 serial interfaces, 5 of which can be configured by means of one S-Link per channel
- S-Links available for: RS-232, RS-422, RS-485, 20 mA, CAN, SSI (2 channels), optical-fiber links, in each case with or without electrical isolation
- The board’s local CPU works in parallel to the PC
- Available with 486 or 586 CPU, up to 133 MHz
- Up to 34 MByte RAM
- Real-time, multi-tasking OsX operating system on-board
- Option for stand-alone operation
- 10 timers
- Real-time clock and date
- Drivers for all commonly used PC operating systems (DOS, Win 3.x, Win 95 and 98, Win NT)

PROFIBUS

Modules and Configuration

The M-DPM-12 PROFIBUS master

- Intelligent PROFIBUS-DP master with 12 MBaud
- Conforms to the international EN 50170 standard
- CPU (C165) and ASPC2 PROFIBUS controller
- Baudrates from 9.6 kBaud to 12 MBaud RS-485 PROFIBUS interface, electrically isolated, pluggable with a C-Link
- 16-kB dual-ported RAM interface

The M-DPS-12 PROFIBUS slave

- 2 independent PROFIBUS-DP slaves with a Siemens SPC3 controller
- Dual-ported-RAM user interface
- Conforms to the international EN 50170 standard
- Automatic baudrate detection up to 12 MBaud
- One PROFIBUS interface per channel, RS-485, electrically isolated, pluggable with a C-Link

The "small" MODULAR-4/486 board

Intelligence synergized with high performance

The intelligent PROFIBUS-DP master module M-DPM-12 for MODULAR-4/486 carrier boards supports baudrates of up to 12 MBaud. It processes the PROFIBUS-DP protocol in complete independence of the carrier board, thus freeing the CPU on the MODULAR-4/486 board from all protocol-related tasks. The physical interface to the PROFIBUS (standard: RS-485, electrically isolated) is established by means of a micro-module, also referred to as a C-Link. C-Links are used on other communication modules for the MODULAR-4/486 board as well. The module incorporates a C165 micro-controller, an ASPC2 PROFIBUS controller, plus RAM, ROM and a FLASH memory for storing the system configuration. The interface provided for the user is a dual-ported RAM, over which all data and commands can be exchanged.

Multi-purpose allrounder

The M-DPS-12 module converts a MODULAR-4/486 into one or two multi-purpose PROFIBUS-DP slave stations. The physical interface to the PROFIBUS is plugged on by means of one C-Link for each channel. The module automatically detects the baudrate on the PROFIBUS, which can be between 9.6 kBaud and 12 MBaud. User and diagnostic data are transferred to the carrier board in the dual-ported RAM. The module library included in the scope of delivery supports the user in implementing a slave.

With this module, appropriate programming of the carrier board and the use of further modules define the function which a particular slave is to perform. The number of user and diagnostic data to be transmitted is specified by the user. For example, a multi-function slave with digital and analog inputs and outputs is one possible option. The real-time software on the MODULAR-4/486 board will then ensure that the user data are transferred from the slave to the output modules, and that the data acquired are transferred from the input modules to the slave.

P-DPM-12 PC/104 board

Further applications for the PROFIBUS modules

For example, two independent PROFIBUS systems can also be linked via an M-DPS-12 module. In this case, the MODULAR-4/486 board handles data interchange between the two PROFIBUS lines.

An additional CAN module makes the MODULAR-4/486 into a router between two different networks.

The MODULAR-4/486 board can be used to connect PCs with master and slave modules, to form a computer link with a high transmission rate (12 MBaud).

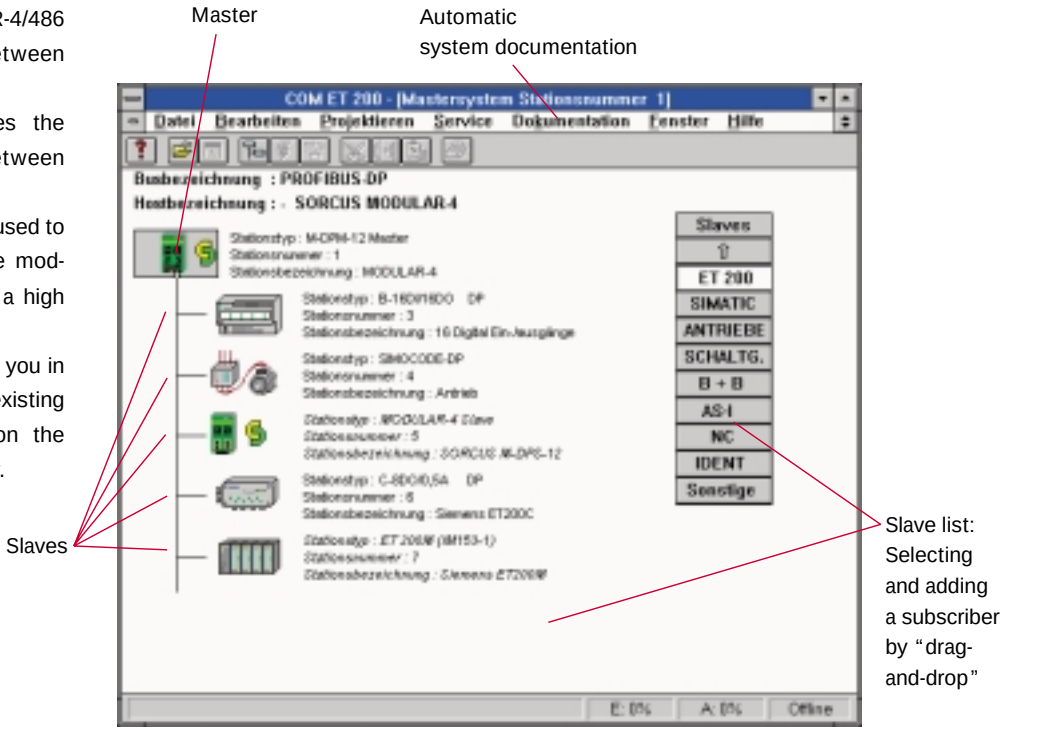
The limits to the options available to you in each case lie only in the number of existing PC slots and the module slots on the MODULAR-4/486 board respectively.

Configuring the PROFIBUS system Software

The PROFIBUS system is planned for maximized operator-friendliness, using a graphical user interface. With the COMET200 Windows software from Siemens, creation and documentation of the system are child's play. All you have to do is select the other slaves (e.g. SORCUS M-DPS-12, Siemens ET-200, etc.), "append" these to the master, and assign the station numbers. After that, you can parameterize and configure the slaves, and also set the parameters for the bus itself. The maximum settable baudrate is specified by the slowest slave.

For system documentation, the configuration created with COMET200 can be printed out or exported as a text file. Finally, COMET200 will generate a file for downloading onto the M-DPM-12 master module, where it is permanently stored in the FLASH memory. You have thus completed configuration of your system. As soon as the system is started, the master will cyclically address the slaves, and the user data can be exchanged over the dual-ported RAM of the master module on the MODULAR-4/486 board. This contains an updated image of the process peripherals (user data).

The module's scope of delivery includes a high-level-language library suitable both for PC programs and for real-time programs on the MODULAR-4/486 board. The library provides all functions required for operating the PROFIBUS system: in addition to read/write functions, these include various diagnostic functions as well.



CAN-Bus

Hardware and Programming

M-CAN-1 and S-Link SL-CANi

- 1-MBit/s CAN module with full CAN functionality
- Supports CAN specifications 2.0A and 2.0B (11-bit and 29-bit identifiers)
- Electrically isolated from the CAN bus
- Intel i82527 controller
- Bus terminating resistor can be switched in using the software

CAN Hardware

The M-CAN-1 module and the SL-CANi S-Link turn any MODULAR-4/486 resp. Multi-COM board into an active CAN node. Module and S-Link support the CAN specifications 2.0A and 2.0B. CAN messages can be transmitted and received in the standard CAN format with 11-bit and (in extended format) with 29-bit identifiers. The 82527 on-board controller from Intel looks after message formatting, error detection and handling, and largely frees the basic board from protocol handling. An electrically isolated interface to the CAN bus in conformity with ISO/DIS 11898 has been implemented with the 82C250 CAN transceiver from Philips. Configuration data are stored in the module's or S-Link's own EEPROM. The module is linked to the CAN bus over the 9-pole D-Sub plug connector (CiA Standard 102) integrated at the module. A bus terminating resistor can be switched in using the software.

CAN Software and Programming

A library is at the user's disposal, containing all the requisite functions for controlling the module and the S-Link. This library can be used both in PC programs (e.g. under DOS or Windows) and in real-time programs on the MODULAR-4/486 resp. the Multi-COM boards. Note that the library utilizes the driver program supplied, which must be installed on the board as an interrupt task. This driver program handles the entire module administration tasks.

All the message objects required (comprising identifier and user data) must be configured during application initialization. In this process, each message object is assigned an unambiguous ID and some other characteristics.

In addition, a user-defined service routine must be specified for each message object; this routine is called automatically whenever data for this message object have been received or successfully transmitted over the CAN bus. The system can thus react individually to every single message object.

One typical application for the module is diagnosis of an existing CAN network. In this way, you can listen in to all telegrams (messages) and log them, for instance (monitor mode).

In conjunction with the other modules available for the MODULAR-4 system, the CAN bus module can be used to implement a host of other systems above and beyond standard solution packages. In this context, the MODULAR-4/486 board can be expanded to become a multi-function communication and data-acquisition system. Since the MODULAR-4/486 board can handle the entire control functions for a system in real time, the PC is thus freed from these tasks, and can be used for visualization and data processing purposes.

Library Functions

· m049_bib_startup	Initialize module library
· m049_config_module	Configure module
· m049_config_msg_object	Configure new message object
· m049_set_acceptance_mask	Configure module as a CAN bus monitor
· m049_start_com	Start CAN bus communication
· m049_stop_com	Finish CAN bus communication
· m049_set_data	Set user data of a message object
· m049_get_data	Read user data of a message object
· m049_get_id	Read identifier value of a message object
· m049_send_data	Send data of a message object
· m049_send_data_request	Send data request for a message object
· m049_clear_msg	Deactivate an active message object
· m049_evaluate_srq	Evaluate service request of driver program
· m049_get_diagnosis	Read diagnostic message of driver program
· m049_set_dout	Set a digital output of the CAN interface

Programming

High-level-language libraries and real-time programming

High-level-language libraries

These libraries offer the operator a user-friendly interface for communicating from the PC with the MODULAR-4/486 and Multi-COM boards and are available for a variety of programming languages, like C, Pascal and BASIC, and for different operating systems, such as MS-DOS, Windows 3.x, Windows 95, 98 and Windows NT. You can serve up to eight boards from one library.

Since the boards constitute an autonomous computer system with its own integrated processor, communication with the PC entails some elaborate routines. This communication is handled entirely by the library, meaning that users need not bother themselves with the details involved, e.g.

- configuring the board
- loading real-time programs onto the board
- exchanging data between board and PC
- error handling

Portability

The functionality of the libraries is the same for the various PC operating systems, which means that a particular application program (once it has been developed) can easily be ported onto a different operating system.

Real-time programming

All SORCUS boards possess their own microprocessor running the OsX multi-tasking operating system, which provides real-time capabilities. This enables genuine parallel processing with the PC to be implemented, which is more or less essential if data are to be acquired and processed in real time, especially when modern-day PC operating systems like Windows NT or similar are being used. Data-acquisition and communication tasks can thus be run on the board in complete independence of the PC, thus freeing your PC to handle other tasks, like visualization and data storage.

Operating systems and programming languages supported

If the compiler you're using is not mentioned here, please contact SORCUS.

MS-DOS

- Borland C (as from Version 3.1)
- Microsoft C (as from Version 8.0)
- Watcom C (as from Version 10.0)
- Borland Pascal (as from Version 6.0); also Protected Mode

Windows 3.11

- Borland C (as from Version 3.1)
- Borland Pascal (Version 7.0)
- Borland Delphi (as from Version 1.0)
- Microsoft Visual Basic (as from Vers. 3.0)
- Microsoft Visual C (as from Version 1.0)
- Watcom C++ (as from Version 10.0)
- DASYLab

Windows 95, 98 and NT

- Microsoft Visual C++ (as from Vers. 4.0)
- Borland C++ (as from Version 5.0)
- Borland Delphi (as from Version 2.0)
- Microsoft Visual Basic (as from Vers. 4.0)
- DASYLab

Under preparation:

LabView drivers (1Q99)

Real-time programs, i.e. those programs running as tasks on the board, are very easy to program for you as the user, since you can access Borland's and Microsoft's standard PC compilers (Pascal or C++) during programming. A specific development environment is not necessary.

To develop your own real-time programs, you have to proceed in three steps:

1. **Enter and compile the real-time program concerned under Borland Pascal, Borland C++ or Microsoft C++.**
2. **Transfer the program onto the MODULAR-4/486 or Multi-COM board.**

The completely compiled real-time program can be transferred onto the board either with the PC utility programs supplied or from one of the user programs by means of the PC libraries provided.

3. **Test and debug the real-time program**

You can use the Turbo-Debugger from Borland for this purpose, for example. This enables a real-time program to be debugged just like a PC program, at the source level. All the Turbo-Debugger's features, such as breakpoints, watch variables, etc. are of course available for this purpose.

A real-time program's structure resembles that of a DOS program, except that the program code has been subdivided into what are called task procedures. These can subsequently be called from other tasks on the board or from the PC as well, e.g. to start or abort a data acquisition routine. In addition to the task procedures, the program also comprises a parameter area and a data area. The parameter area will normally contain configuration and parameterizing data definable by the user later on, like scan rate, number of measuring channels, etc. The data area can be used to accommodate the measured data obtained.

As with the task procedures, here too, other tasks on the board and the PC itself can very easily access parameters and data. Moreover, complete libraries are provided for addressing the various I/O functional units and the operating system's routines.

Overview

Communication boards and modules

MODULAR-4/486 PC boards and Modules			
The ”large“ MODULAR-4/486		Intelligent multi-function board with 4 slots (expandable to 9) for communication and I/O modules, 6 timers, real-time clock, watchdog, 2 RS-232 interfaces, multi-tasking operating system with real-time capabilities on-board	**PROFIBUS** **CAN** **Serial communication**
The ”small“ MODULAR-4/486		Intelligent multi-function board with 2 slots for communication and I/O modules, 6 timers, real-time clock, watchdog, 2 RS-232 interfaces, multi-tasking operating system with real-time capabilities on-board, up to 34 MByte RAM	**PROFIBUS** **CAN** **Serial communication**
M-DPM-12		PROFIBUS-DP master with its own intelligence, up to 12 MBaud	**PROFIBUS**
M-DPS-12		PROFIBUS-DP slave, 2 channels, up to 12 MBaud	**PROFIBUS**
M-CAN-1		CAN bus module, specification 2.0A and 2.0B	**CAN**
M-ETH-1		Ethernet module with 10 base-T (twisted pair) and AUI interface	**Communication**
M-COM-2		Serial communication module, 2 channels, configurable with C-Link for: RS-232, RS-422, RS-485, 20 mA, optical-fiber link	**Serial Communication**
M-COM-8		Serial communication module, 8 channels, RS-232	**Serial Communication**
M-IEC-1		IEC bus module, device or system controller	**Communication**
Multi-COM PC board and S-Links			
Multi-COM		Intelligent communication board with 6 serial interfaces: 5 configurable with S-Links: RS-232, RS-422, RS-485, RS-232 iso., RS-422 iso., RS-485 iso., 20 mA, CAN iso., 2 x SSI, 10 timers, real-time clock, watchdog, multi-tasking operating system with real-time capabilities on-board, up to 34 MByte RAM	**CAN** **Serial Communication**
SL-CANi		CAN bus S-Link, specification 2.0A and 2.0B	**CAN**
PC/104 boards			
MODULAR-104/486		Complete PC on a PC/104 module with 486 or 586 CPU up to 133 MHz, including interface for floppies and EIDE, 2 x serial, 1 x parallel, VGA (CRT and LCD), mouse port, etc.	**PC/104**
P-DPM-12		PROFIBUS-DP master with its own intelligence, up to 12 MBaud	**PROFIBUS** **PC/104**

Further modules for the MODULAR-4/486:
Analog I/O with 12 and 16 bits resolution, digital I/O, counter, incremental encoder, SSI interface, etc.

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