



INTERBUS BASICS





The INTERBUS fieldbus system is continuously growing in both the range of applications and in the number and different types of compatible products offered. Due to international standardization, INTERBUS is now a worldwide standard. As a result, we are often asked to provide information about INTERBUS basics and INTERBUS-compatible devices.

This guide provides an insight into the system and its method of operation, as well as a detailed overview of the components. It also provides an overview of the connection of products. As a user or manufacturer who is interested in technology, this guide provides you with the basics to make working with INTERBUS easier. If you have any other questions, please contact your local INTERBUS Club representative, or try our website.

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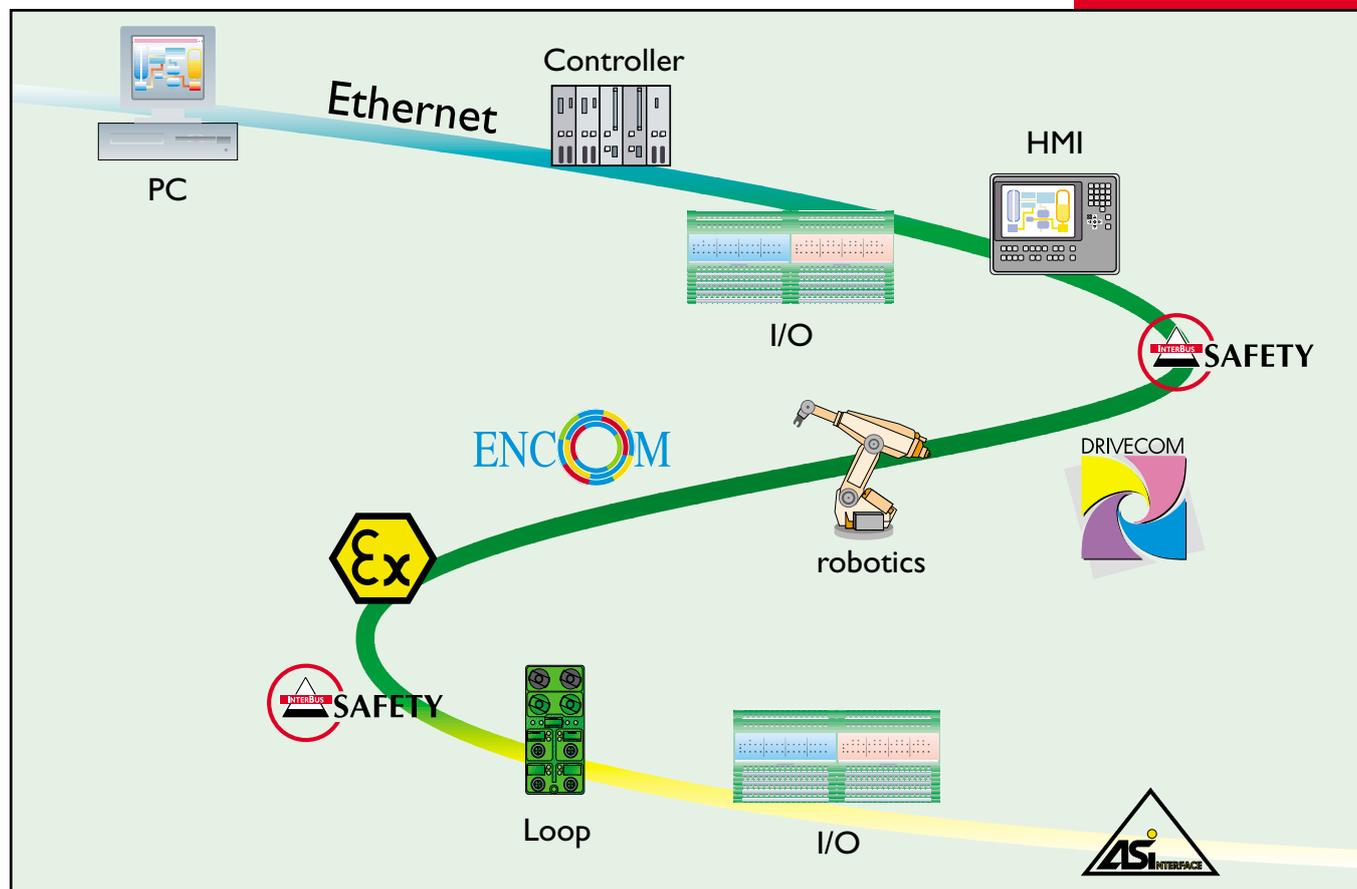
Why Fieldbus Technology?

The increased competition and pressure on prices that affects all areas of production and process engineering means that all opportunities for rationalization must be exploited in full. One practice that has proved effective is the automation of processes using fieldbuses with the simultaneous reduction system startup time, and the time required to adapt the system based on changing needs. Serial fieldbus technology offers numerous advantages compared with both parallel wiring, and vendor proprietary networks.

The growing degree of automation in machines and systems also increases the amount of cable required for parallel wiring due to the large number of I/O points. This brings with it increased effort for configuration, installation, startup, and maintenance. The cable requirements are often high because, for example, special cables are required for

the transmission of analog values. Parallel field wiring thus entails serious cost and time factors. In comparison, the serial networking of components in the field using fieldbus systems is much more cost-effective. The fieldbus replaces the bundle of parallel cables with a single bus cable and connects all levels, from the field to the control level. Regardless of the type of automation device used, e.g., programmable logic controllers (PLCs) from various manufacturers or PC-based control systems, the fieldbus transmission medium networks all components. They can be distributed anywhere in the field and are all connected locally. This provides a powerful communication network for today's rationalization concepts. There are numerous advantages to a fieldbus system in comparison to parallel wiring: The reduced amount of cabling saves time during planning and installation, while the cabling, terminal blocks, and the control cabinet dimensions are also reduced. Self-

diagnostics, which are carried out by the system using plain text displays, minimize downtimes and maintenance times. Improved reliability and increased availability due to short signal paths play an important role, especially for critical signals. There is even greater protection from faults for analog values. Open fieldbus systems standardize data transmission and device connection regardless of the manufacturer. The user is therefore independent of any manufacturer-specific standards. The system can be easily extended or modified, offering flexibility as well as investment protection.



[Figure 1] A single slim cable replaces heavy cable trees – one cable for all signal types, field devices, PLCs, and PCs

Selecting a Fieldbus System

Many criteria must be considered when selecting a fieldbus system. Various requirements must be met when optimizing the bus system for the specific task. These include multi-vendor support, electrical noise immunity, and determinism. Short and constant cycle times, a highly efficient transmission protocol, and easy operation and diagnostics are also very important.

process data only contain a few bits, are time-critical, present in the network in large numbers, and are cyclically transmitted. Parameters, that are used to program "intelligent" devices, are acyclic. This means that the information is only transferred if required. Parameter data transfers of 10's - 100's of bytes are typical.

Variety of Devices/ Integrating all Devices

An "open" fieldbus system is necessary to ensure the greater acceptance and

control systems. The standards for the bus system have been disclosed so that interfaces can be created for devices from various manufacturers. A wide range of field devices offers the user greater flexibility.

General Technical Requirements

The scan cycle time of the PLC, i.e., the time taken to process a direct data link, sets the standard for the cycle time.

Cycle Time

Fieldbus cycle time. In order to meet today's performance requirements, all process data in a network must be updated within one to five milliseconds.

Determinism

Deterministic i.e., predictable behavior is essential for open and closed-loop control tasks, as this is the only way to determine constant and predictable sampling intervals for setpoints and real time control. Deterministic networks allow the response time to be accurately known in advance, avoiding startup problems and delays.

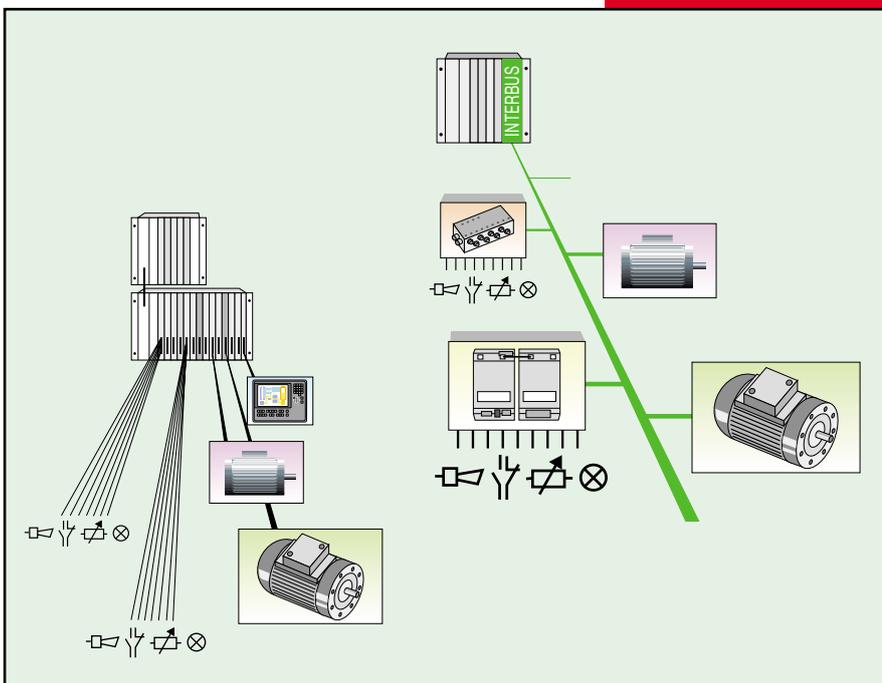
Protocol Efficiency

Data transmission adheres to certain rules known as the transmission protocol. The protocol transmits useful data (e.g., the status of a valve) and management data (e.g., addressing, command, data save) to the receivers. The efficiency of a transmission protocol indicates the percentage of useful data vs the total data that is transmitted. The value is the quotient of useful data in the total data transferred (user and frame data). This leads to low protocol efficiency when transferring cyclic process data, and high efficiency for long acyclic parameter blocks.

Message-based and summation frame methods differ. For the message-based transmission method, a complete

transmission protocol is processed for each request. This approach leads to lower protocol efficiency when transferring cyclic process data, and higher efficiency for long acyclic parameter blocks. The summation frame method combines the data from all the sensors

and actuators in a network into a single message. This is simultaneously sent to all the devices, so that management data is only transmitted once. The



[Figure 2] Division of the control cabinets – a single cable for the entire network through the complete company structure

Different Data and Devices

Seamless communication requires a single bus system, which can operate all connected devices. Control systems and computers are networked uniformly alongside basic and intelligent automation devices.

In this process, different data classes must be taken into account, which must be transferred simultaneously and without affecting one another.

In the field level, a distinction must be made between input/output (I/O) data, (e.g., setpoints, real time on/off data), and parameter data. I/O data and

availability of field devices. All PLCs are supported, regardless of manufacturer, and the system offers

connection to open computer systems such as PCs in addition to the entire range of field devices used in automation, e.g., drives, encoders, robots, sensors, etc. The I/O devices are independent of the type of control system. If the control system is changed, the field wiring remains the same, so that the user's training and experience are still valid. Programming, operation, and diagnostics should be the same for all



Requirements of a Sensor/Actuator Bus

Transmission of process data (I/O data) and parameters (messages) without adverse effects

- Cyclic updating of all data < 5 ms
- Length of information 8–16 bits/device
- Number of devices > 100
- Predictable access times
- Constant sampling intervals for the setpoint and actual value
- High protocol efficiency

protocol efficiency therefore rises with the number of network devices. This method is more efficient than the message-based method for a large number of devices. The summation frame method ensures fixed data lengths for devices and therefore constant transmission times. The determinism of this method is essential for the accurate calculation of the response time.

Security

When selecting a bus system, a high protocol efficiency allows high throughput application process data to be transmitted at transmission rates that provide greater protection against electromagnetic interference than systems using higher transmission



rates. Furthermore, the size of the entire system also affects the transmission speed for RS-485 transmission. The faster the system, the shorter the distance of the network.

Expansion

The ability to expand a system is determined by which combinations of speed, layout, and quantities of devices are allowed. When considering the initial or future expansion needs, the ability to use different wiring types (media) and the flexibility in mixing different media is often important.



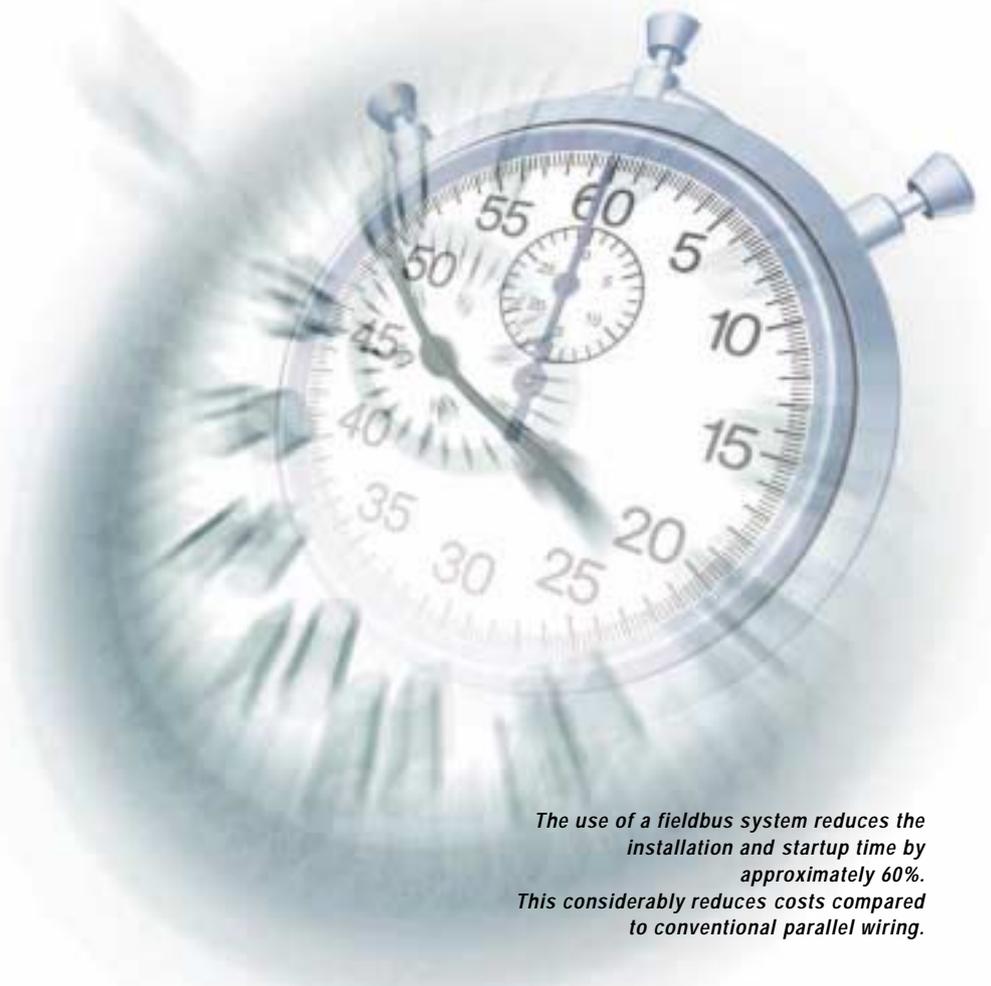
Diagnostics

Comprehensive system-specific diagnostic functions allow repairs to be carried out without the need for special

tools or training even when multiple levels of networks are interconnected. Faulty components can be replaced without any problems and without having to reset the device. Errors are localized and their causes determined quickly, which results in shorter downtimes, while statistical evaluations enable the implementation of preventative measures. Because devices from different manufacturers can be operated in an open network, user-friendly and above all manufacturer-independent startup and diagnostic tools in the form of a computer-supported user interface are particularly important.

Product Availability

In addition to technical factors, product availability is also of great importance. This is the only way to ensure that a single system can be adapted to meet all existing requirements and can be expanded for future requirements.



The use of a fieldbus system reduces the installation and startup time by approximately 60%. This considerably reduces costs compared to conventional parallel wiring.

Introduction to INTERBUS

INTERBUS is one of the world's most popular fieldbus systems. In order to appreciate the INTERBUS method of operation and its advantages, you must first understand the technical basics. The operation of INTERBUS is clearly summarized in the following sections.

The INTERBUS Fieldbus System

The open INTERBUS fieldbus system for modern automation seamlessly connects all the I/O and field devices commonly used in control systems. The serial bus cable can be used to network sensors and actuators, to control machine and system parts, to network production cells, and to connect higher-level systems such as control rooms.

Topology and Structure

In terms of topology, INTERBUS is a ring system, i.e., all devices are actively integrated in a closed transmission path. Each device amplifies the incoming signal and sends it on, allowing higher transmission rates at longer distances. Unlike other ring systems, the data forward and return lines in the INTERBUS system are led to all devices via a single cable. This means that the general physical appearance of the system is an "open" tree structure. A main line exits the bus master and can be used to form seamless subnetworks up to 16 levels deep. This means that the bus system can be quickly adapted

to changing applications.

Topology Flexibility

The INTERBUS master/slave system enables the connection of up to 512 devices, across 16 levels of networks. The ring is automatically closed by the last device.

Segmentation Flexibility

The point-to-point connection eliminates the need for termination resistors. The system can be adapted flexibly to meet the user's requirements by adding or removing devices. Countless topologies can be created. Branch terminals create branches, which enable the connection and disconnection of devices. The coupling elements between the bus segments enable the connection and disconnection of a subsystem and thus make it possible to work on the subsystem without problems, e.g., in the event of an error or when expanding the system.



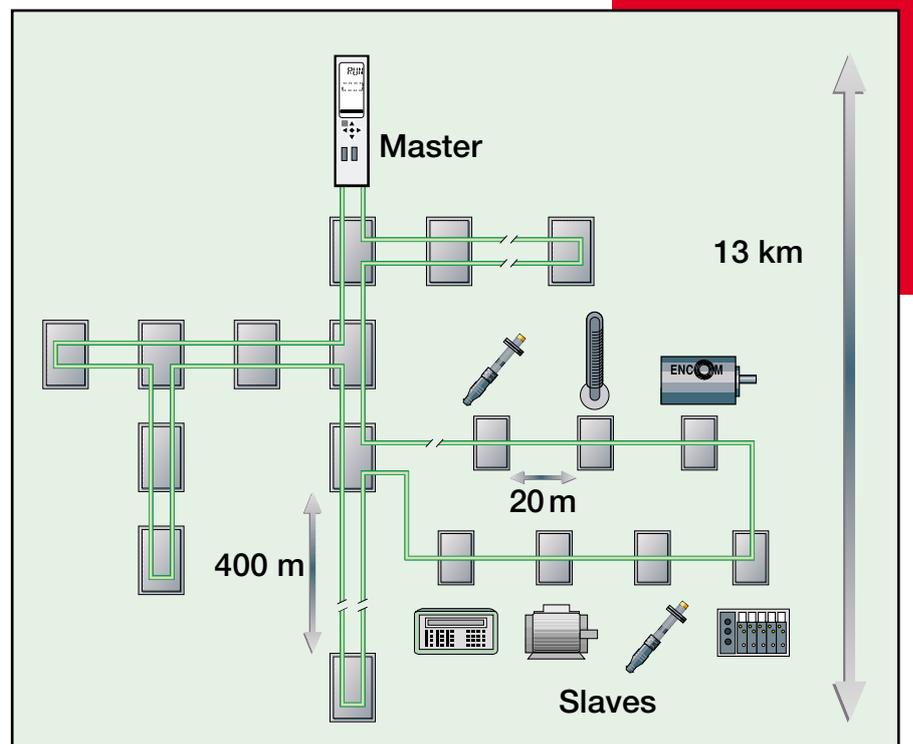
Physical Addressing

Unlike in other systems where data is assigned by entering a bus address using DIP or rotary switches on each individual device, in the INTERBUS system data is automatically assigned to devices using their physical location in the system. This plug and play function is a great advantage with regard to the installation effort and service-friendliness of the system. The problems and errors, which may occur when manually setting device addresses during installation and servicing, are often underestimated. The ability to assign "easy to understand" software names to the physical addresses, allows devices to be added or removed without re-addressing existing devices.

INFO

INTERBUS

- **Topology:** active ring
- **Master/slave, fixed telegram length, deterministic**
- **Ring; all remote bus devices include repeater functionality**
- **Transmission rate: 500 kbps**
- **4096 I/O points, maximum**
- **Bus length: 400 m (1312.336 ft.) between two remote bus devices, total length: 13 km (8.078 mi.)**
- **Typical fields of application: general sensor/actuator applications, machine and system production, process engineering**



[Figure 3]
INTERBUS topology

Basic Elements of INTERBUS

In order to meet the individual requirements of a system, various bus components must be used, e.g., local bus devices and bus terminal modules. The user should be familiar with the terminology for the basic elements that are found in every topology.

Controller Board

The controller board is the master that controls data traffic. It transfers output data to the corresponding modules, receives input data, and monitors data transfer. In addition, diagnostic messages are displayed and error messages are transmitted to the host system.

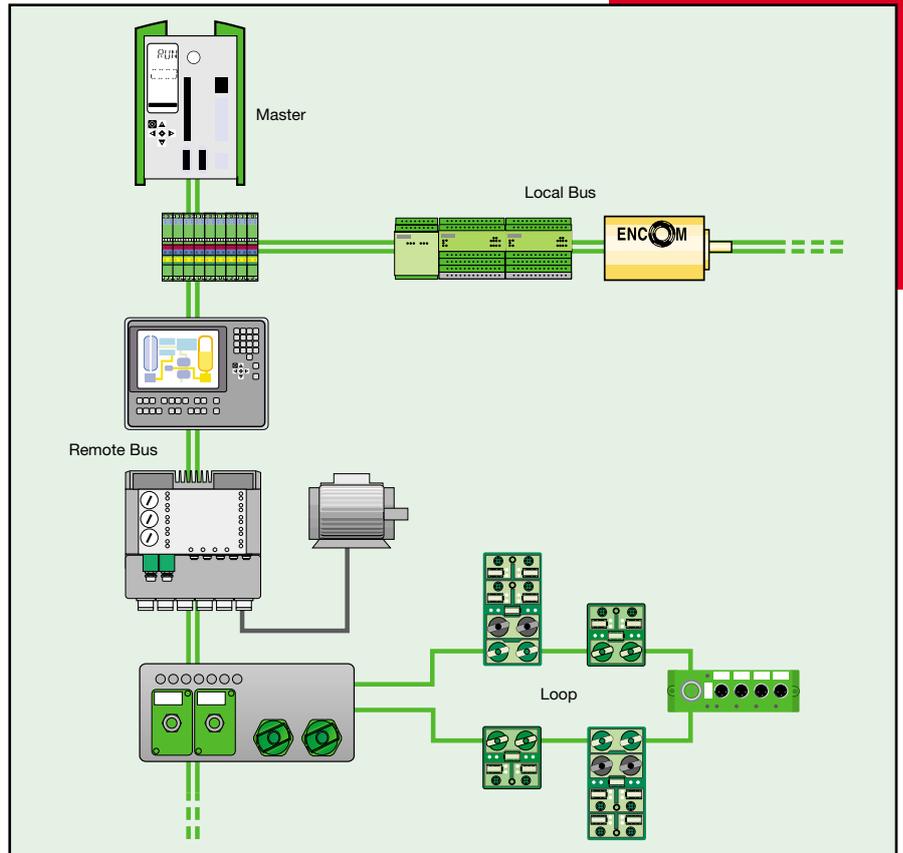
Technical Data for INTERBUS Loop

- At least 20 cm (7.874 in.) between 2 devices
- 20 m (65.617 ft.), maximum between 2 devices
- 200 m (656.168 ft.) total expansion
- 1.8 A current (can be expanded by PWR IN)
- 63 devices
- 19.2 V to 30 V
- Power & communications on a single cable

Remote Bus

The controller board is connected to the remote bus devices via the remote bus. A branch from this connection is referred to as a remote bus branch. Data can be physically transmitted via copper cables (RS-485 standard), optical fibers, infrared transmission paths, slip rings or other media. Special bus terminal modules and certain I/O modules or devices such as robots, drives or operating devices can be used as remote bus devices. Each has a local voltage supply and an electrically isolated outgoing segment.

In addition to the data transmission lines, the installation remote bus can also carry the voltage supply for the connected I/O modules and sensors, in addition to the data transmission lines.



[Figure 4] Individual components of an INTERBUS network

Bus Terminal

The bus terminal modules, or devices with embedded bus terminal functionality, are connected to the remote bus. The distributed local buses branch out of the bus terminal module with I/O modules, which establish the connection between INTERBUS and the sensors and actuators. The bus terminal divides the system into individual segments, allowing you to switch branches on/off separately during operation. The module electronics for the connected I/O modules can be supplied with power from this source. The bus terminal amplifies the data signal (repeater function) and electrically isolates the bus segments.



Local Bus

The local bus branches from the remote bus via a bus interface module and connects the local bus devices. Branches are not allowed at this level. The communications power is supplied by the bus terminal module, while the

switching voltage for the outputs is applied separately at the output modules. Local bus devices are typically I/O modules in a distributed substation structure.

Loop

Distributed sensors and actuators on machines or systems are networked with INTERBUS Loop. The two-wire, unshielded cable simultaneously transports data and supplies power to the connected devices. There are also various INTERBUS modules, which are tailored to specific tasks, such as motor starters.

Data Transmission With INTERBUS

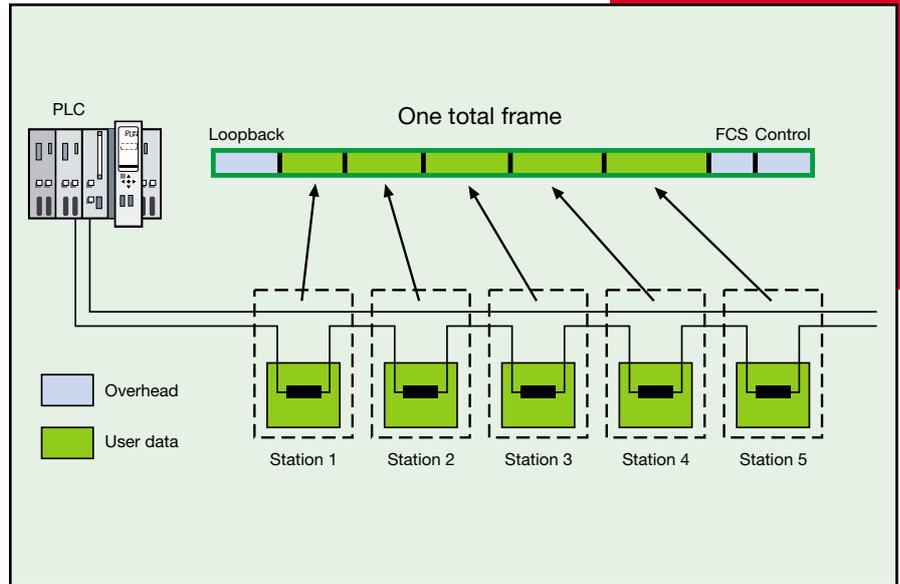
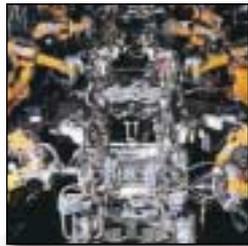
In bus systems, a distinction is made between the various access methods and physical transmission methods used. In addition to the bus systems commonly used in electronics and computer technology, the two systems illustrated below play a key role in automation technology.

Summation Frame Method – Master/Slave Structure

INTERBUS is the only bus system working according to the summation frame method that uses only one protocol frame for messages from all the devices. In this master/slave access method, the bus master acts as the coupling to the higher-level control or bus system.

The method provides a high level of efficiency during data transmission and enables data to be sent and received simultaneously (full duplex operation). With this data transmission method, INTERBUS ensures constant and predictable sampling intervals for setpoints and real time control values.

In summation frames, which consist of the header, the loop-back word, and data save and end information, data

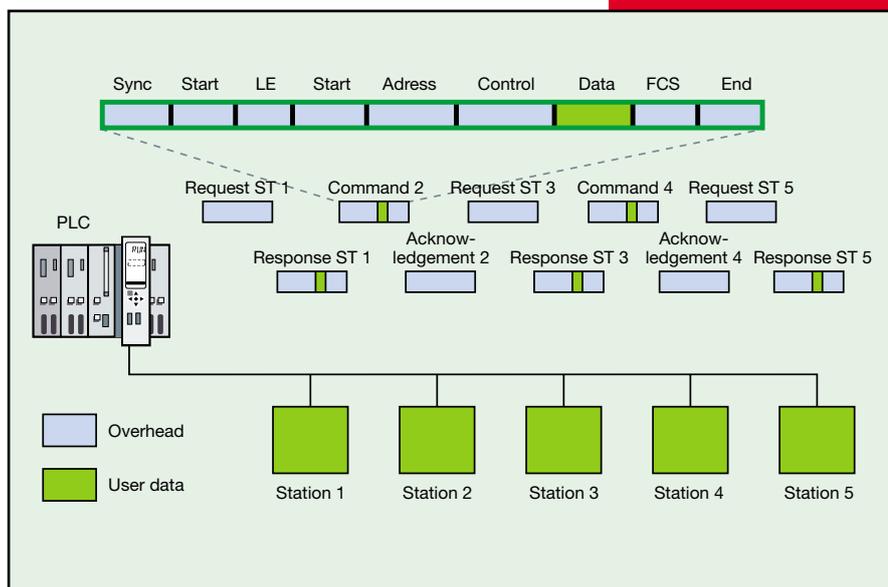


[Figure 5] Physical transmission method – summation frame method

from all the connected I/O devices is grouped together in a block. The additional information that is required is transmitted only once per cycle.

In practice, this method can be described as a register, which is formed by the devices that are connected in a ring system. In INTERBUS this consists of a number of binary memory cells, which push digital information from cell to cell to clock pulses. Each device has a certain number of buffers assigned to a preset

number of cells for different tasks, e.g., data input and output for the process. Additional registers monitor the data transmission for errors. An INTERBUS device contains three registers that are connected in parallel. I/O data is transferred using the data register. The type of INTERBUS device is defined in the identification register. This enables the bus master to identify the devices and the bus topology, as well as to carry out addressing. Data is saved using the CRC16 register (cyclic redundancy check), where correct data transmission is checked.



[Figure 6] Linear structure for message-based transmission

Cycle Time and Calculation

The cycle time, i.e., the time required for I/O data to be exchanged once with all the connected modules, depends on the amount of user data in an INTERBUS system. The cycle time increases linearly with the number of I/O points, because it depends on the amount of information to be transmitted. A certain amount of time is needed for each bit.



Because the summation frame has a set length, the cycle time also remains constant. In INTERBUS, the deterministic method of operation is provided by the summation frame method, which is essential for fast controllers.

Process data that is to be sent to the I/O devices is stored in the output buffer of the master in the physical order of the connected output stations. During data output, process information in the form of input data is simultaneously returned to the input buffer of the master. Once the entire summation frame has been sent and simultaneously read in again, all output data is correctly positioned in the individual devices. The data is made available to the host as defined by the user.

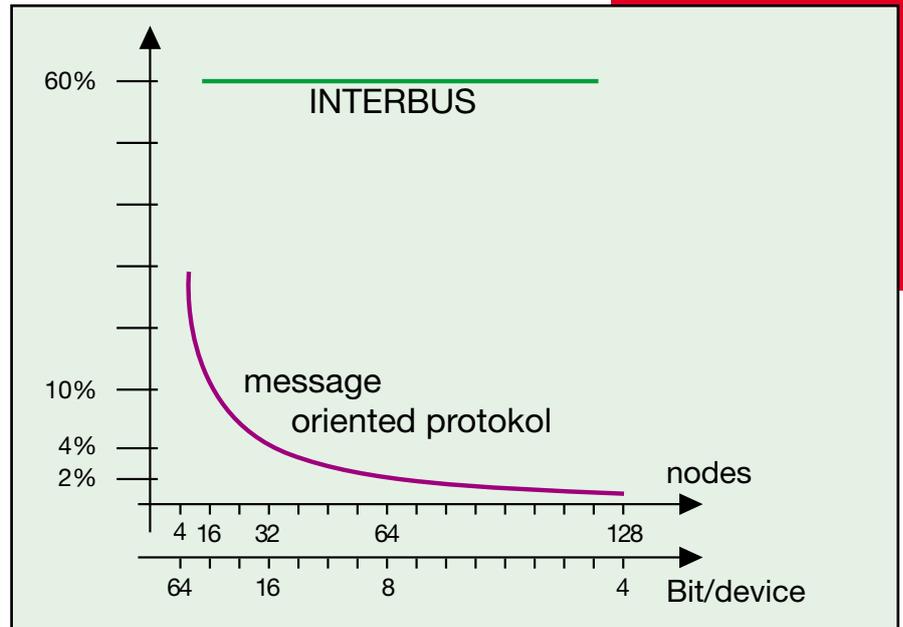
A network is established by connecting all the devices, whose length and structure corresponds exactly to the structure of the user data field in the summation frame telegram.

The amount of user data for the summation frame method is over 60%.

Bus access conflicts do not occur due to the master/slave structure. This means that potential error sources are avoided from the outset.

PCP Transmission

To transmit parameter data simultaneously as well as time-critical process data, the data format must be expanded by a certain time slot. In several consecutive cycles, a different part of the data is inserted in the time slot provided for the addressed devices. The PCP software (Peripherals Communication Protocol) performs this task. It inserts one part of the telegram in each INTERBUS cycle and recombines it at its destination. The parameter channels



[Figure 7]
Efficiency of different transmission methods

are activated if necessary and do not affect the transfer of I/O data. The longer transmission time for parameter data that is segmented into several bus cycles is sufficient for the low time requirements that are placed on the transmission of parameter information.

Transmission Reliability

The bus master ensures transmission reliability by using the loop-back word. This unique bit combination is executed in a calculated number of bus system cycles. If it has returned to the master input buffer after this time, the ring is closed.

Data is saved according to the CRC16 method. This information is attached to the data, and evaluated by the receiver.

Determinism

An important feature of INTERBUS is determinism, i.e., the guaranteed time in which cyclic data transfer is carried out between spatially distributed devices. The summation frame method also ensures that the process image for

all devices is consistent, because all the input data originates from the same point of scan time and all the output data is accepted by the devices simultaneously.

Optimum EMC Behavior

Unlike other bus protocols, the physical transmission speed of INTERBUS lowers the component and cabling costs while improving electrical noise immunity. INTERBUS provides high data throughputs without compensating for the protocol overhead by increasing transmission speeds, and noise susceptibility, which is common for conventional message-based systems.

Automation With INTERBUS

When planning and starting up a bus system for open and flexible control system architectures, a concept for uniform operation, regardless of the manufacturer, must be implemented for the entire life cycle of the system.

CMD – One Tool, All Control Systems

The introduction of Configuration, Monitoring, and Diagnostics (CMD) type software allows one integrated tool to be used with all control systems. The important features of this type of software.

The important features of this type of software are its independence from the control system used and its flexibility with regard to program extensions, new functions, and add-on programs. CMD is a tool, which is used for the entire life cycle of a system, from planning, configuration, and startup through

monitoring to the evaluation of diagnostic data during servicing. Planning an INTERBUS system is the first step towards creating a user-friendly system. Project planning starts with the specification of the number of process input/output points, the degree of protection required for the environmental conditions and any necessary special functions, e.g., counting or motor control.

Quick and easy installation of a system is ensured when using INTERBUS insulation displacement technology. After "plugging together" the entire plant, the system starts up automatically. Using CMD software, the user can specify the INTERBUS system configuration in the planning phase. Program addresses, which the control program will later use to access the distributed I/Os, can be assigned, while configuration and operation of the INTERBUS controller board is specified. Diagnostic data from the controller board can be read and evaluated of while the system is running. Functional tests can also be carried out on subsystems using a monitor function. All

INTERBUS project data is saved centrally under CMD and can be made available to all groups that are involved in system operation.

This reduces the time that users spend learning about and getting used to different software tools. During INTERBUS system operation, all data is constantly available and all areas can be tested for smooth operation.

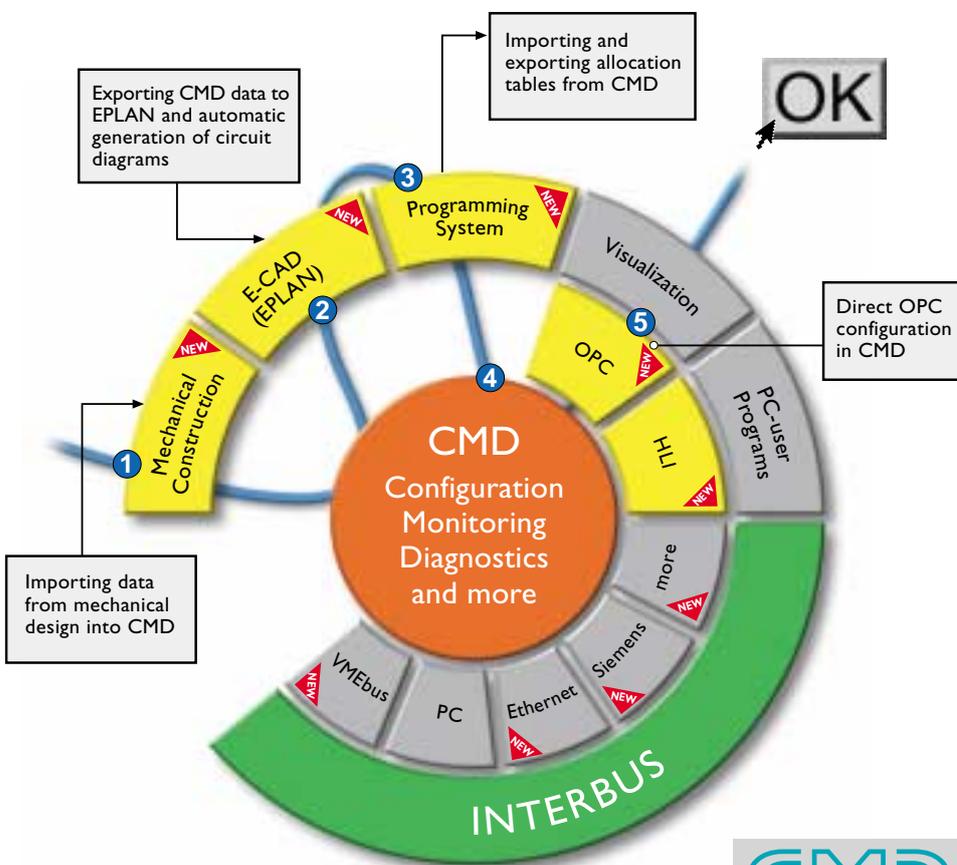


Process Data Preprocessing

Using the IEC 61131 programming language, Function Block Diagram, it is possible to program limited process data preprocessing directly on the controller board. Input signals can thus be connected to the controller board via logical blocks and can be directly transmitted to the output signals. Time-critical signals are processed quickly and the control system load is reduced.

Provision of Operating Data

CMD can be operated on any standard PC under the latest Windows operating system. This enables the operation of different controller boards and control systems with a single software tool. CMD data is available anywhere by using a serial interface.



[Figure 8]
Configuration, monitoring and diagnostics over the entire life cycle of a system



Operation and Maintenance

The INTERBUS system detects all connected devices, from the controller board to the sensors and actuators. Only INTERBUS uses the ring system for pinpoint error detection.

Clear Error Diagnostics

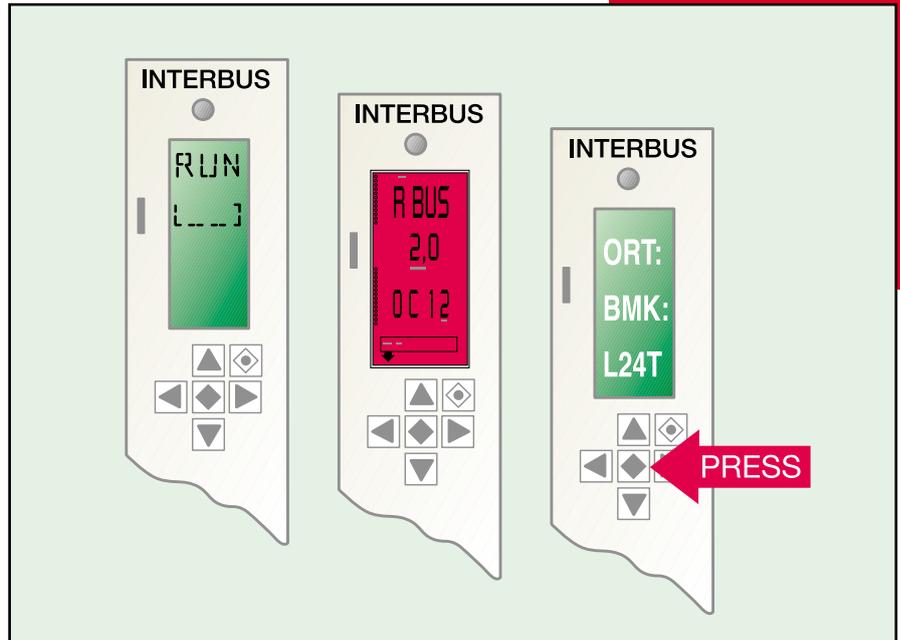
A ring system with active device coupling, such as that provided by INTERBUS, enables the segmentation of the entire system into electrically independent subsystems. In the event of a device error, short circuit or bus cable interrupt, communication only fails after the error location. The bus master can still locate the error, allowing service personnel to remove errors precisely and quickly. This is also the case in the event of serious errors such as a short circuit or loose contact.

Preventative Error Removal – Reducing Downtimes

During transmission pauses when no user data is sent by the master, the operating data flow is filled by status telegrams.

If there is a break in transmission of more than 25 ms, this is interpreted by all the devices as a system interrupt. The devices then switch to a defined and safe reset state. This means that in the event of a system interrupt or the failure of the master controller board, all the devices quickly switch to the safe state. Individual devices can also be specifically reset.

The same applies to sporadic transmission faults, which may be caused by sources of electromagnetic interference or faulty cabling. In an INTERBUS system, the active device coupling with monitoring of each individual transmission path also enables the clear localization of errors. This type of error detection is essential for minimizing system downtimes. INTERBUS offers the option of preventative error removal through the statistical evaluation of transmission quality. By evaluating the error statistics, component failures caused by normal wear, e.g., in trailing cables or slip rings can be detected at an early stage and production downtimes can be avoided.



[Figure 9]
INTERBUS diagnostic display

Evaluation of Optical Fiber Paths

The quality of the optical transmission medium in optical fiber systems can be monitored using a specific test pattern. This means that in the event of the fiber aging or if the optical fiber transmission medium becomes dirty, the transmission power will be increased. This ensures transmission without any errors. If the degree of pollution is so high that error-free communication cannot be maintained in the long term, an error message is generated to prompt the implementation of preventative measures. The comprehensive analysis of error types and locations provided by INTERBUS ensures that the INTERBUS system has a strong position within the fieldbus world.

Diagnostic Tools

Various types of system diagnostics are available to the user. Diagnostic functions are integrated in INTERBUS devices, front panel diagnostics are available on controller boards, and errors can also be detected on the PC using CMD type software.

Optical Fibers

- Immune to EMC disturbance
- No costly shielding
- Complete isolation
- Same topology – same configuration
- Problem-free creation of combined systems
- Use of different fibers for corresponding distances between 2 devices
- Polymer fibers: 70 m (229.659 ft.), maximum
- HCS fibers: 400 m (1312.336 ft.), maximum
- Glass fibers: 3600 m (11811.024 ft.), maximum

Automation Components in Detail

There are numerous transmission media, i.e., the cables and cabling methods that can be used and intermixed in an INTERBUS system. Whether it be copper cables, optical fibers or infrared transmission paths, there is a medium suited to every requirement.

Electrical Isolation of Different Media

In many cases, data from an INTERBUS system is transmitted via a copper cable using differential signal transmission according to RS-485. This means that a separate twisted-pair cable is required for the forward line and the return line. A fifth wire provides equipotential bonding between the modules, because

segments must be electrically isolated in INTERBUS. With a data transmission rate of 500 kbps, the RS-485 point-to-point transmission method covers a distance of 400 m (1312.336 ft.) between two devices. Due to the integrated repeater function in each device, the total expansion of the INTERBUS system can reach 13 km (8.078 mi.). When using optical fiber technology, the INTERBUS structure is the same as for copper technology because data is again transmitted by two fibers. The current must simply be converted into light and vice versa. This means that both copper and optical fiber cables can be mixed, between individual devices, in a single INTERBUS system, and optical fiber connection methods can also be retrofitted easily.



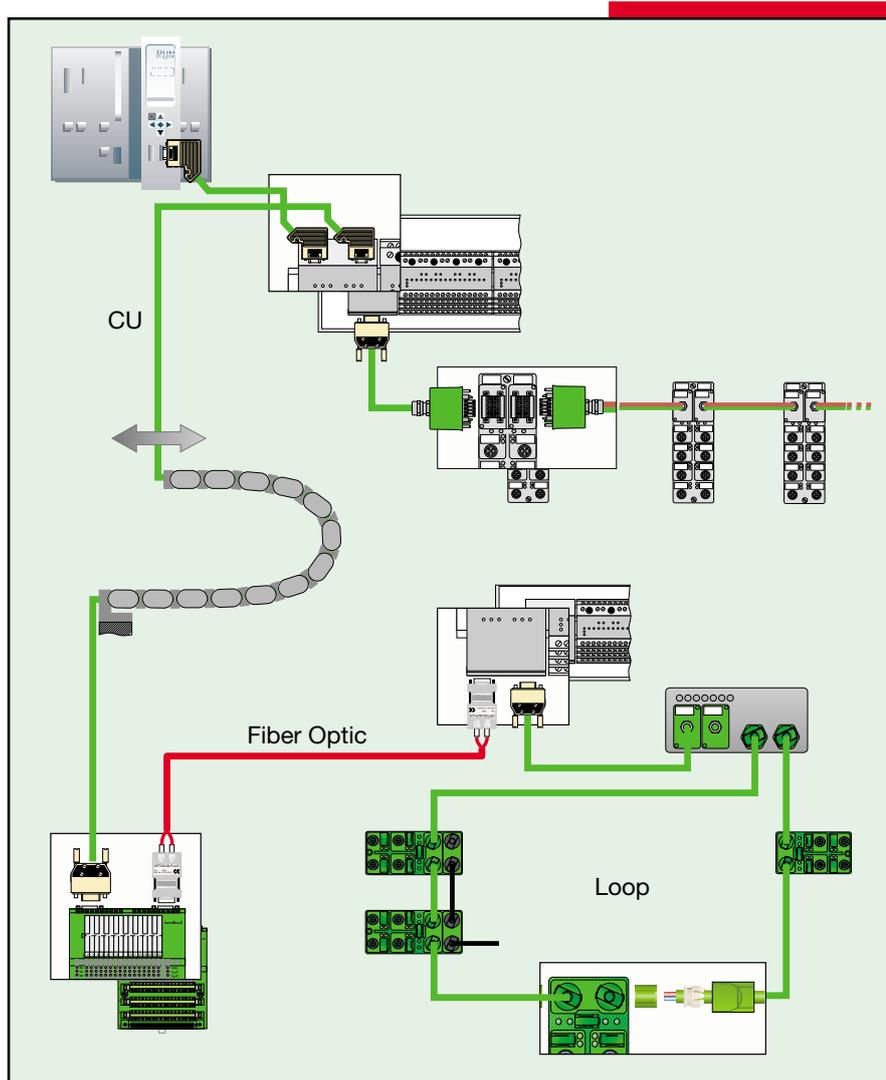
Combined Systems

The combined operation of different media in a single system does not pose any problems because user-friendly interface converters are available.

Optical fiber technology increases the robustness of the system. In an environment with a high level of electromagnetic interference, the optical fiber cables transmit all signals with interference immunity and without the need for costly shielding. The devices are completely isolated from one another

and equipotential bonding is not required. Cables can be assembled quickly and easily by using the correct tools.

Three types of optical fibers are used. They differ with regard to their transmission distances, which always depend on several parameters, e.g., the cable quality, the transmission power or the receiver sensitivity. The polymer fiber is the simplest version. Distances of up to 70 meters (229.659 ft.) can be covered between two devices. The HCS fiber (Hard Cladded Silicia) consists of a glass fiber core with plastic sheath. It typically covers up to 400 meters (1312.336 ft.). Glass fiber cables are suitable for distances of up to 3600 meters (11811.024 ft.). The low clock rate of INTERBUS also enables "basic" transmission media to be used without any problems. This means, for example, that infrared transmission paths can cover distances of up to 200 meters (656.168 ft.).



[Figure 10]
Optical fiber/copper – easy to connect

Field Components – The Best of Everything

More than 1000 manufacturers worldwide have made their knowledge of devices and sectors available by equipping their components with the INTERBUS interface. This means that users and control engineers can continue to use familiar products and that the entire range of automation components is available for INTERBUS.

Standard Interface

The basis for a manufacturer-independent open network is a standard interface available in various automation components. Manufacturers implement INTERBUS in their devices, which means that appropriate products can be selected to create the optimum solution for automation tasks. Because INTERBUS devices do not require configuration files based on vendor optional communication functions, startups with devices supplied by different vendors, proceed smoothly.



INTERBUS Implementation

The worldwide acceptance and establishment of the INTERBUS system has ensured that the majority of well-known manufacturers of automation technology products already offer the INTERBUS interface as standard. In keeping with the principle of providing an open system, all necessary development specifications are freely available.

Interface centers in Germany, Japan, and the USA provide development support as well as example circuit diagrams and component reference lists for the relevant INTERBUS interface.

PCP Functions

This refers to the wide selection and variety of functions for the field of application of a device. Intelligent devices can thus use the PCP channel to receive new parameters via the bus if required. These may include complex drive, robot, and welding controllers.

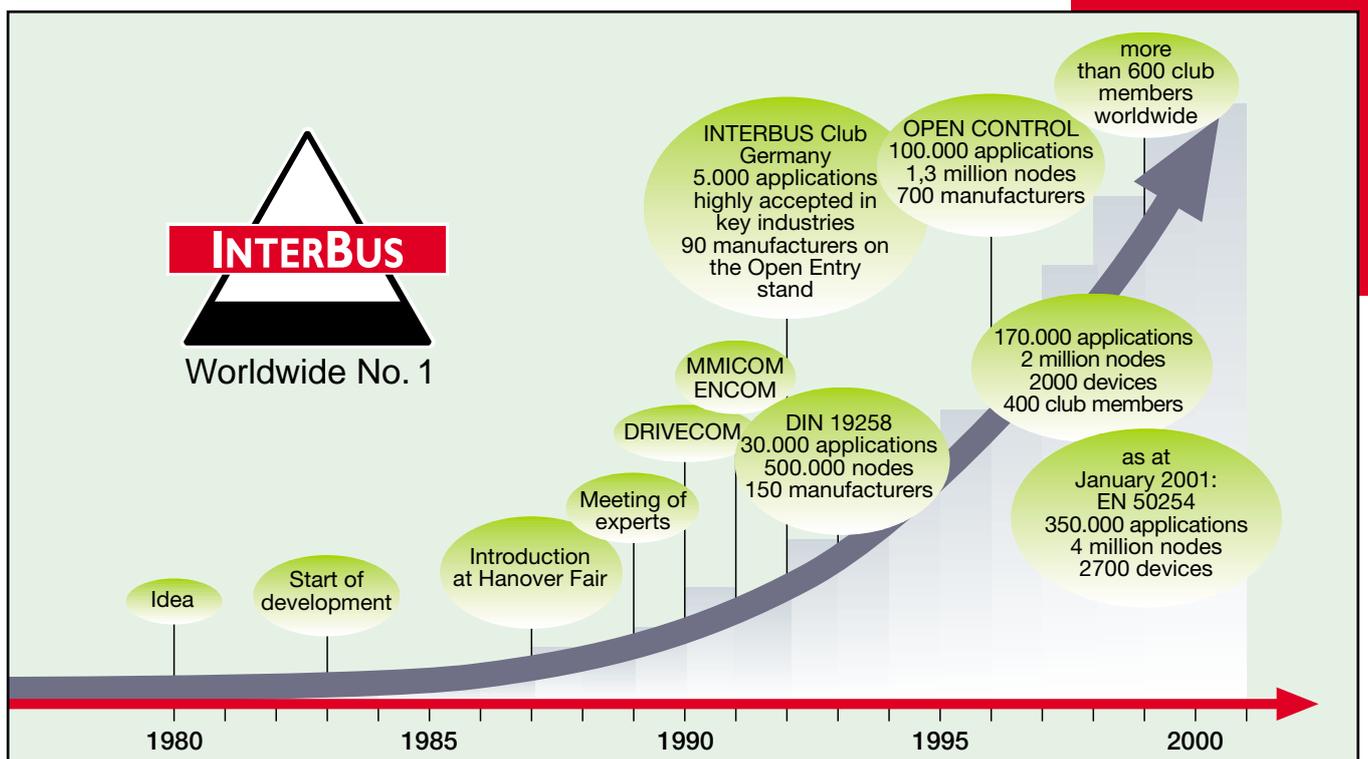
ID Code for Unique Identification

The individual components in the

INTERBUS network are recognized by their device functions. They use their unique ID codes for communicating with the master. Manufacturers also provide device data, which enables more detailed configuration, e.g., for integrating devices into CMD software. This provides a clear structure for the components used and their functions.

INTERBUS Implementation

In order to enable communication between different devices in an INTERBUS network, the devices must have a standard interface. When implementing an INTERBUS slave or master, there are a number of organizations that can provide development support. The Support Center provides the basis for this, offering everything for the relevant interface: from component lists and example circuit diagrams to finished printed circuit boards and plug-on boards. Most of the items are also scalable.



[Figure 11] Development of INTERBUS fieldbus systems and the INTERBUS Club

All Control Systems, One Bus – INTERBUS

Whether a PC or PLC – all I/O devices are independent of the type of control system when using INTERBUS. Depending on the type of automation task, a wide range of control system solutions can be implemented.

Control System Functions With INTERBUS

As with every other bus system – whether it be in a standard PC or an industrial automation system – INTERBUS also requires centralized intelligence. INTERBUS operates according to the master/slave method. This means that one master manages all the other devices within a network.

Master/Slave Method

Lower-level subsystems can also be created. The submaster behaves like a slave in the entire network and transfers its control system functions to "its" devices. In addition, coupling devices enable data transfers between two autonomous networks.

INTERBUS Master

The functions of an INTERBUS master depend on the automation task. However, all manufacturers must integrate certain functions in their masters. All INTERBUS masters offer basic diagnostic properties for easy error localization and enable the connection of higher-level software and visualization systems.

The master is only responsible for bus control and for monitoring telegrams sent and received by different automation components within the bus configuration. It is also the interface for the control program to be executed, regardless of what this is based on. A basic distinction is made between the conventional PLC program and PC-based control systems.

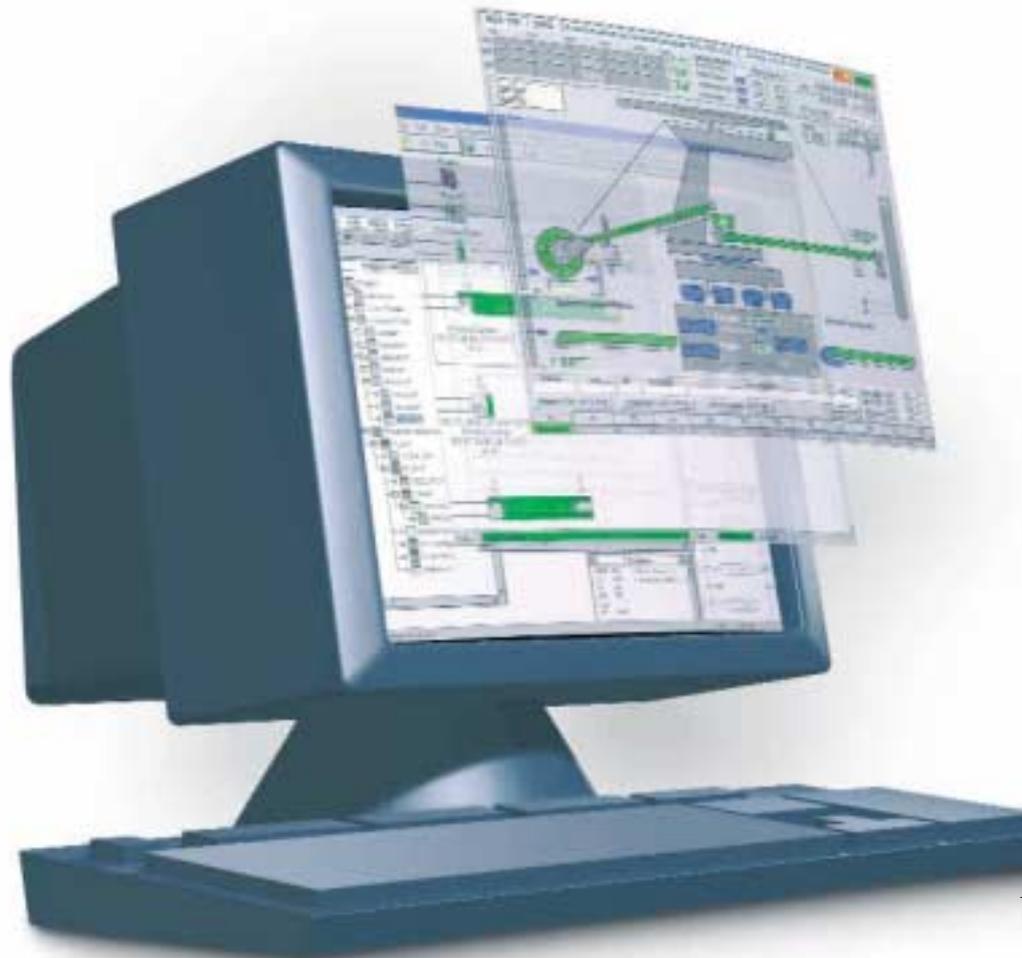


PLC or PC Card

In terms of hardware, this is either a controller board for the PLC that is used or a PC card for the host computer with the relevant drivers. The trend for future

automation systems is geared towards the PC. PLC systems lost ground due to various disadvantages. The gap between the hardware environment and the program platform is closing with the help of the industrial PC. Devices,

which are suited to harsh environmental conditions and have a manufacturer-independent programming language



[Figure 12]
PC-based control system

ensure the further decentralization of automation. The INTERBUS master function is provided by an appropriate interface. A scalable interface is available, ranging from a basic PC dongle to a PC card with its own coprocessor system.

Standardization and Security

To use INTERBUS is to perform automation tasks using a global standard. The existence of over 1000 manufacturers of different automation devices with an INTERBUS interface is one reason for the high level of acceptance among users. Together these manufacturers have developed profiles for practically all areas of application, which incorporate specific functions or operations.

Product Compatibility

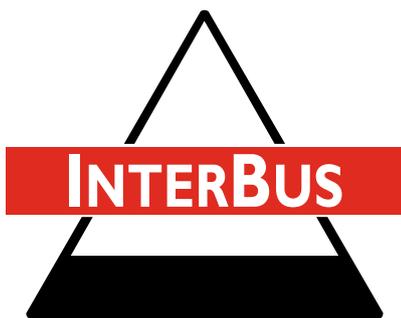
Product compatibility means uniform operation of different devices and ensures easy replacement as the products are compatible, and even manufacturer-independent. The development of profiles by users and manufacturers reduces the network startup time and increases system availability.



INTERBUS Certificate

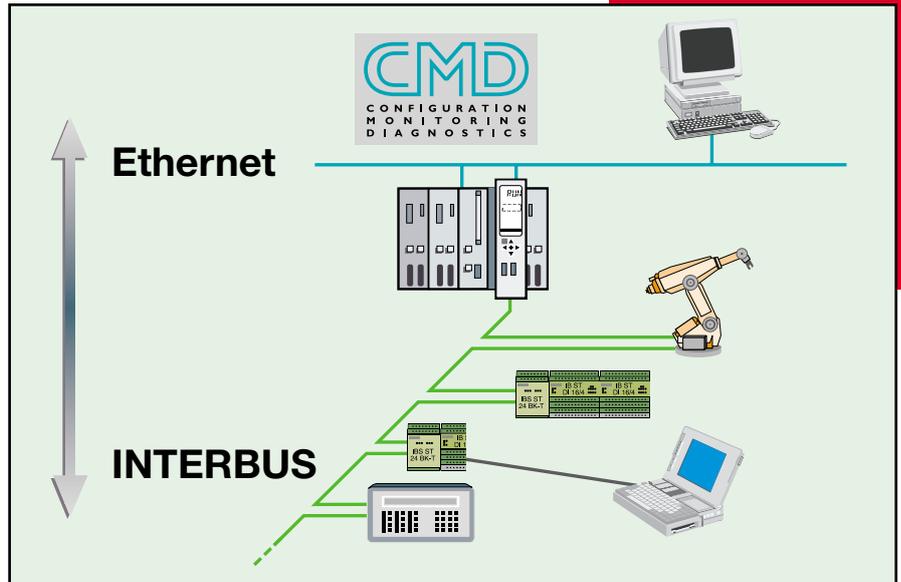
When selecting suitable components, the user is offered an increased level of security by using certified devices. Products with an

INTERBUS certificate have been tested thoroughly in an accredited test lab. This test examines the technical properties,



Certified!

noise immunity, and interoperability of products. The test object is operated in a network and the effects on or from other devices are logged. A product only receives the certificate from the



[Figure 13] Vertical integration – provision of data in all hierarchical levels

INTERBUS Club once all criteria have been met and the required measured values achieved.

Configuration and Startup

To ensure uniform configuration and startup, most manufacturers provide electronic device descriptions. This enables different manufacturers' components to be easily integrated in different programs. The basic requirements placed on an open network are reflected in the work of the user groups: functions provided by all manufacturers, which provide ease of operation and the highest level of security for the user. These groups also ensure that all the global standards currently required with regard to a fieldbus system specification are met and supported by INTERBUS, an added benefit for the user.

Software and Interfaces

The desire for the transparent web enabled factory in the production industry is stronger than ever. Process data is required in all levels of the company, from sensors to management.

The Web Enabled Factory

The vertical integration of data requires appropriate intercommunication between the various levels of a company. To achieve this, the seamless connection of the INTERBUS and Ethernet standards is being established to link the management level with the factory floor level.

INTERBUS Profiles

Members of the INTERBUS Club and numerous device specialists from various areas of application join together to develop INTERBUS profiles in user groups. This profile definition is a significant addition to standardized communication for the user and provides universal agreement on data content and device behavior. When using these standard parameters, devices from different manufacturers display the same behavior on the communication medium.

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Open Control Foundation

The Open Control Foundation is responsible for bringing these different versions together and providing internationally standardized interfaces. For example, to supply a frequency inverter with a setpoint value from an Excel table, various obstacles related to the software structures must be overcome. Standardization, and thus simplification, of devices is being addressed.

Distributed Intelligence

As early as the development stage, the manufacturers of products must ensure that the devices can later be incorporated in higher-level systems and that the necessary interfaces are made available for this purpose. This applies in particular to devices, which offer further decentralization because they have their own intelligence and control functions.

However, in the future these distributed units will be grouped with visualization systems to form central process control levels. INTERBUS is the optimal transport medium for this process.

Ethernet TCP/IP

The further merging of conventional office elements, e.g., Ethernet TCP/IP,

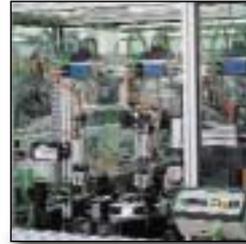
with INTERBUS creates further transparency. This means that the production level can be directly connected with other levels. Specific production processes can be archived or made available to other control levels. In this way, the web enabled factory increasingly becomes a reality.

Into The Future With INTERBUS

Like all other industrial branches, the world of automation is at the beginning of a new century. These significant dates are often associated with changes and restructuring for different functions. At present, the various communication protocols and their use in automation technology are frequently subjects for discussion.

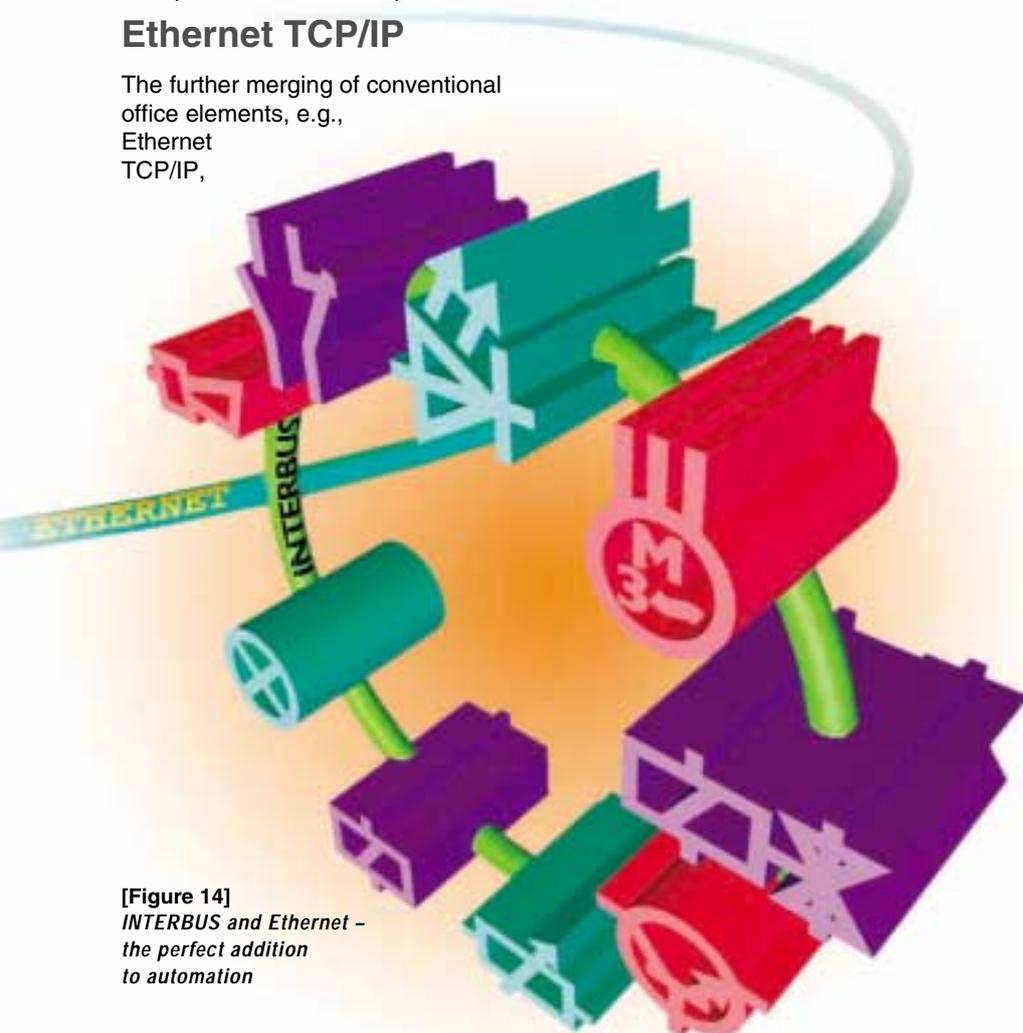
Communication Protocols

Whether fieldbus or Ethernet TCP/IP is the most suitable transmission medium depends on the requirements of an application. New standards have been defined and implemented in many sectors. This includes, for example, PC-supported systems, safety-oriented systems, distributed and optical fiber components, and web-based control systems. In the future, many of these functions will be considered during the system planning and configuration stages. This means that these functions must be integrated into fieldbus systems upfront.



Solutions for all Manufacturers

With the implementation of these additional features, the requirements of users for solutions that cover all manufacturers are once again the focal point. Especially in the safety and PC system sectors, high demands are placed on openness, e.g., when updating and gradually modernizing existing systems. However, certain requirements are also placed on other functions, which the fieldbus system must meet. Point-to-point connection is thus the only practical communication platform for high-speed networks and optical fiber structures. Therefore INTERBUS already has the capability to handle increasing future requirements.



[Figure 14]
*INTERBUS and Ethernet –
the perfect addition
to automation*

INTERBUS Club – A Strong Community

INTERBUS Club Deutschland e.V. was founded as a user organization in 1992 by leading companies in the automation sector. Today, the INTERBUS Club has over 600 member companies around the world, who all share the common goal of driving INTERBUS forward in terms of technology and its distribution in international markets.

At present, INTERBUS Clubs have been established in 16 countries across all the continents of the world. Each club addresses different key tasks and forms the interface between users and manufacturers of INTERBUS-compatible automation components. New technologies and trends in fieldbus technology are published and explained to users, e.g., at trade shows, conferences and exhibitions, as well as in the form of brochures and specialist articles. The international INTERBUS Clubs continuously provide pointers and information for the entire automation technology sector.

Manufacturers and users jointly develop new functions and profiles in working groups and user groups under the umbrella of the INTERBUS Club, to increase the competitiveness of products and thus the associated companies.

The INTERBUS Product Index

Another focal point of the INTERBUS Club is the provision of information on available products and services. Users and project planners are provided with the INTERBUS product and supplier index both on CD-ROM and in its latest form on the Club homepage at www.interbusclub.com. In addition to this, extensive information on INTERBUS technology, large amounts of documentation for downloading, and further links to INTERBUS Club websites around the world can be found on this website. The INTERBUS Club also organizes seminars and training, which provide a technical overview of INTERBUS functions, performance, and possible applications and offer information on new technologies. Sector-specific events focus on the special



requirements of the corresponding sector and introduce innovative solutions based on INTERBUS. To provide users with an increased level of security when selecting products, the INTERBUS Club offers the certification of INTERBUS-compatible devices through an independent test lab. The certificate awarded after successful testing confirms that the tested automation components meet the high requirements, which the INTERBUS



Club places on the operation and quality of devices.

INTERBUS Is Internationally Standardized

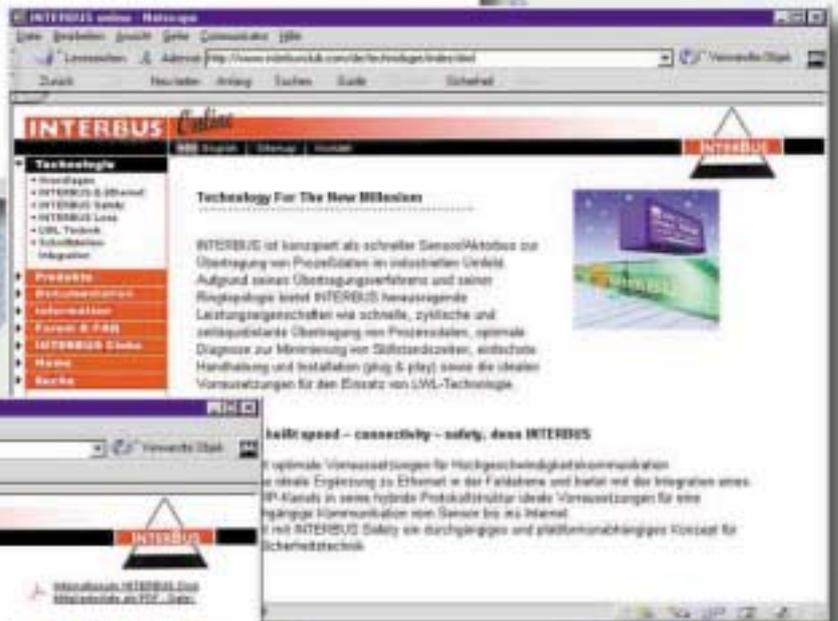
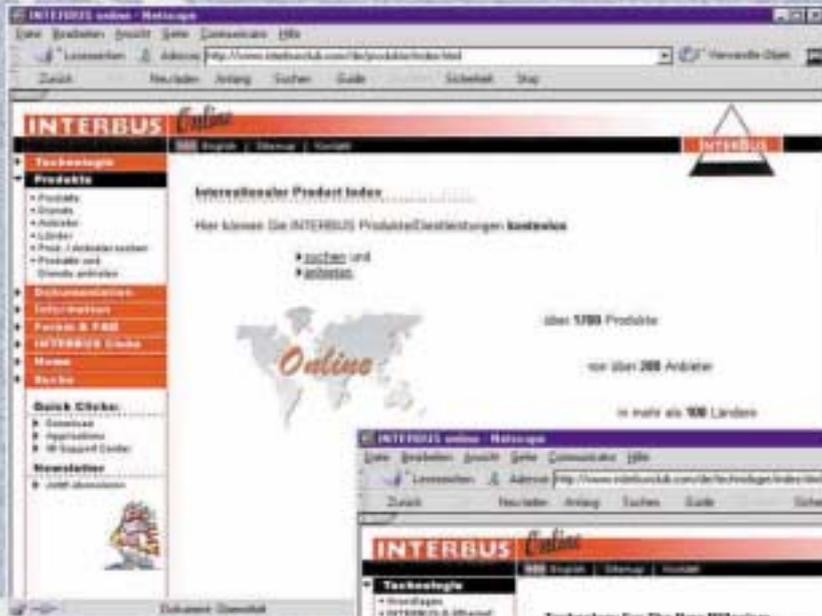
At the beginning of January 2000, the IEC in Geneva reported that their member countries had accepted the draft for an international fieldbus standard (IEC 61158 Parts 3 - 6) by a large majority. This draft includes INTERBUS and other leading fieldbus systems.

INTERBUS was first established as a national (DIN 19258) and later as a European standard (EN 50254). Becoming an international standard was the next logical step in its success story. Through international standardization, manufacturers and users are provided with long-term investment protection and a secure future for the further development and use of INTERBUS devices.

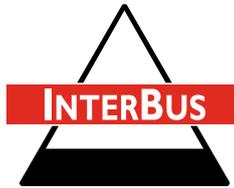
INTERBUS Club

The INTERBUS Club has been committed to providing all types of information about INTERBUS for many years. This includes the product database, available as a CD-ROM, in printed form, and on the Internet, which provides an overview of the numerous different automation components with an INTERBUS interface. Information regarding implementation, certification, standardization or general technical queries is provided on the Internet or available to download. Of course, your national contact will be happy to help you with any other INTERBUS questions.

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Visit our homepage:
www.interbusclub.com



INTERBUS Club Fax Hotline: +49 - 52 35 - 34 12 34

I would like more information about:

- The INTERBUS Product Index (CD-ROM)
- Implementation – INTERBUS Interfaces (CD-ROM)
- INTERBUS Applications
- Other: _____

- I am interested in joining the INTERBUS Club.

Company

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Department

Position

Address

Zip code, City, Country

E-mail

Phone

Fax

Location, Date

Company stamp, Signature