PROFIBUS solutions from ABB

Reap all the benefits of proven digital technology
Industrial IT from ABB – dramatically improving enterprise connectivity and the quality of the information you acquire and use. Empowering you to access real-time information on a unified enterprise model – so you can make faster, more informed decisions and effectively and successfully implement them for profitable growth.

Understanding your needs.

You face many challenges in achieving more efficient plant-wide and global operations. While your business is unique, it consists of a multiplicity of processes that can span marketing, design, supply chain, manufacturing, quality, sales and distribution. Processes that are dependent on trouble-free access to accurate, up-to-the-minute, reliable information.

And as knowledge is the most precious commodity in business today, the challenge is to have the relevant information available at the right time in the right form for the right people.

The information needs of the people who manage, control, operate and administer an enterprise are all different but each has a common goal – increasing enterprise-wide productivity.

A powerful portfolio that makes automation easier.

IndustrialIT integrates automation systems in real-time – right across the enterprise. It provides business information from initial order through production to delivery and to payment. ABB has aligned its products, services and people to create compatible IndustrialIT building blocks that provide real-time automation and information solutions – with one common architecture. This provides a consistent infrastructure for data, operations, configuration and maintenance right across your enterprise. The suite of integrated IndustrialIT solutions address the problems that you face in today’s e-business environment. The unified architecture improves productivity, provides higher asset optimization and allows for more informed decision-making.

Turning the vision into reality

ABB Aspect Objects™ provides the information framework that keeps all asset information together. By capturing real-time information from an instrument – such as maintenance records, performance records and cost of ownership and utilising this information to create a model, Aspect Objects eases integration and lowers costs. It allows information to be utilised for control, faceplate, graphics, report and trending purposes. Ultimately it gives immediate access to all relevant information from any instrument within a plant – within all contexts and all with the click of a mouse.
# Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Introduction</strong></td>
<td>4</td>
</tr>
<tr>
<td>1.1 Application areas and advantages of the Fieldbus technology</td>
<td>4</td>
</tr>
<tr>
<td>1.2 Automation fieldbusses and standards</td>
<td>4</td>
</tr>
<tr>
<td>1.3 User Requirements</td>
<td>5</td>
</tr>
<tr>
<td>1.4 User Benefits</td>
<td>5</td>
</tr>
<tr>
<td>1.5 The position of ABB</td>
<td>5</td>
</tr>
<tr>
<td><strong>2 Basics – PROFIBUS</strong></td>
<td>6</td>
</tr>
<tr>
<td>2.1 General definition: Fieldbus in process automation</td>
<td>6</td>
</tr>
<tr>
<td>2.2 The PROFIBUS family</td>
<td>6</td>
</tr>
<tr>
<td>2.3 Protocol architecture, protocol functions, profiles and interoperability</td>
<td>7</td>
</tr>
<tr>
<td>2.4 Transmission technology</td>
<td>8</td>
</tr>
<tr>
<td>2.5 Bus topologies and installation notes</td>
<td>9</td>
</tr>
<tr>
<td>2.6 FISCO model</td>
<td>10</td>
</tr>
<tr>
<td>2.7 Bus access procedures and bus network configuration</td>
<td>11</td>
</tr>
<tr>
<td><strong>3 Configuring and observing field devices</strong></td>
<td>12</td>
</tr>
<tr>
<td>3.1 The FDT/DTM technology – Integration of field devices in standalone tools and process control systems</td>
<td>12</td>
</tr>
<tr>
<td>3.2 Engineer IT – Standalone Tool</td>
<td>13</td>
</tr>
<tr>
<td>3.3 Engineer IT – Process control systems with integrated fieldbus technology</td>
<td>14</td>
</tr>
<tr>
<td><strong>4 Optimize IT – Asset Optimization</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>5 The ABB PROFIBUS pilot plant</strong></td>
<td>18</td>
</tr>
<tr>
<td>5.1 Description of the plant</td>
<td>18</td>
</tr>
<tr>
<td>5.2 Transfer rates</td>
<td>20</td>
</tr>
<tr>
<td>5.3 Planning criteria and design</td>
<td>20</td>
</tr>
<tr>
<td>5.4 Tips on the most frequently asked installation issues</td>
<td>21</td>
</tr>
<tr>
<td><strong>6 Prospects</strong></td>
<td>22</td>
</tr>
<tr>
<td><strong>7 Summary/Conclusion</strong></td>
<td>22</td>
</tr>
</tbody>
</table>
1 Introduction

Fieldbus for process automation offers a digital only method of communication between the field and process control system. It has allowed a partly shift in the hierarchy of control functions from the system towards the field device with the opportunity to take better advantage of Asset Optimization functions at the higher system level. In this regard fieldbus technology is assuming a greater importance throughout industry.

This document provides an overview of the fieldbus technology, here PROFIBUS to help you draw your own conclusions as to its suitability for your applications.

1.1 Application areas and advantages of the Fieldbus technology

As fieldbus technology matures, the focus has shifted from development to implementation issues in concrete process automation projects and to the supply of all the necessary devices and peripherals.

By the essential improvement during the last few years regarding true interoperability between devices and control systems of different manufactures and in streamlining the engineering effort, fieldbus technology has acquired a momentum of its own. Its acceptance in the market has much improved and its implementation scope has moved from pilot plants to large-scale processes.

The existing benefits in installation costs, engineering and commissioning are now supplemented by those related to asset optimization. Digital communication enables real time access and transfer of much field resident information, previously unavailable to the control system. Advanced procedures for preventive maintenance are now possible and fieldbus is open for future new requirements.

1.2 Automation fieldbusses and standards

PROFIBUS and FOUNDATION Fieldbus are the accepted Fieldbus standards for the automation industry. Both busses (PA/H1) can offer power over the bus for field devices and provide pure digital communications between the field and the control systems.

In terms of Fieldbus organization they are similar with many user groups and support worldwide by the major manufacturers. The PROFIBUS International User Organization has its headquarters in Karlsruhe Germany and Fieldbus FOUNDATION has its headquarters in Austin Texas. Both systems are part of IEC 61158.

The technologies of PROFIBUS and FOUNDATION Fieldbus are different in several important areas although the installation guidelines of PROFIBUS PA and FOUNDATION-H1 are similar as they share the same physical layer (see section 2.3 ISO/OSI model).

PROFIBUS

PROFIBUS has evolved from the high-speed busses required between PLC and I/O racks (PROFIBUS FMS and DP). This has resulted in a large well-developed range of DP devices. Support for automation was completed with the extension of DP to intelligent field devices via the PROFIBUS PA protocol. PA can supply power over the bus for devices such as Transmitters and Positioners which can be extended into Ex-(Haz.) areas (EEx i). PA segments are connected to the DP-Line via segment coupler or Linking Devices. PA devices are available for almost every measurement requisition.

PROFIBUS operates as Master Slave protocol with the master as typically a DP device and the slaves being either DP or PA devices. The cyclic access (V0 protocol) of the line can be optimized already during the planning phase (real-time behavior). Acyclic commands (V1 protocol, engineering interaction) are allowed for a part of the network bandwidth and the direct Slave-to-Slave communication (V2 protocol) in the last expansion stage for the present.

Device Interoperability is via the use of profiles and certified products.

FOUNDATION Fieldbus

FOUNDATION has evolved from the intelligent fieldbus level with devices becoming available from 1999. This is the FOUNDATION Fieldbus-H1 level and can supply power over the bus for devices such as Transmitters and Positioners and can be extended into Ex(Haz.) areas (EEx i). FOUNDATION Fieldbus-HSE is the high-speed bus based upon Ethernet technology and requires a Linking Device to connect to the H1 level. Ethernet was chosen to enable the use of readily available and low cost networking components and will become the method of choice for the connection of complex externally powered devices to FOUNDATION systems.

FOUNDATION Fieldbus devices use the decentralized function distribution with following features

1. Alarm stamping at source
2. Deterministic communications between the field devices (AI, AO, PID etc.)
3. Device to Device communication.

Field devices contain standard function blocks in the User Layer. These function blocks include AI, AO, PID but can also provide for manufacturer innovation. Interoperability is via Device Descriptions (DD), Capability Files (CFF) and independent testing – device registration.

For more information about FOUNDATION Fieldbus please read the brochure: FOUNDATION Fieldbus solutions from ABB.

Standards

PROFIBUS® and FOUNDATION Fieldbus™ are now world-wide standardized as a result of the IEC fieldbus standards committee decision to append other protocols to its IEC 61158 standard. In all there are now 8 protocols to be appended to this standard. They are shown below.

<table>
<thead>
<tr>
<th>FOUNDATION Fieldbus</th>
<th>IEC 61158</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Standard</td>
<td>DD238</td>
</tr>
<tr>
<td>Euro Standard</td>
<td>EN 50170</td>
</tr>
<tr>
<td>US Standard</td>
<td>ISA S50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROFIBUS DP and PA</th>
<th>IEC 61158</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Standard</td>
<td>BS EN 50170</td>
</tr>
<tr>
<td>Euro Standard</td>
<td>EN 50170</td>
</tr>
<tr>
<td>US Standard</td>
<td>None</td>
</tr>
</tbody>
</table>

Fig. 121 Protocols

4
1.3 User Requirements
As an all-encompassing communication technology for process automation, fieldbus meet the stringent requirements of the process industry. These can be grouped in three categories.

On the concept and standardization side, the general requirements are:
- Standardization of the communication technology
- Comprehensive product availability in terms of both diversity of suppliers and required functionality
- Availability of engineering implementation tools and services, planning aids, technical training, maintenance services
- Standardized engineering interface for transportability of device configuration and engineering effort to different systems environments

On the technical performance side, fieldbus products and solutions match the performance achieved by traditional analogue methods for signal exchange between control system and field devices:
- Reliable and timely transfer of information
- Complete data transfer redundancy
- Intrinsic safety and field devices power supply on the signal lines
- On line equipment substitution without interfering with plant operations
- Protection from electromagnetic interference from the environment
- Possibility to expand the control system with the freedom of choice of field device supplier
- Interoperability of field devices from different suppliers, between themselves and with control systems

The following points ensure the decisive added value by fieldbus technology:
- Significant plant life cycle cost reductions for planning, procurement, components, engineering, installation, operation and maintenance
- Integration of available field device based information for deployment of maintenance strategies.
- Integration into the fieldbus architecture of installed I/O signals, whether conventional analogue or HART

1.4 User Benefits
The application of fieldbus technology provides benefits throughout total plant lifetime. Cost savings from planning to commissioning stage vary between 25 % and 43 % depending on the layout and the technology used as a reference, with Operational and Asset Optimization benefits following thereafter.

Be aware of claims for higher cost savings, these are typically a result of extremely long cable runs and are not representative, however they make good headlines!

Pre-Commissioning
Savings here are generally made by reduced plant documentation costs.

Installation & Commissioning
In this case savings are possible due to:
- Reduced cable quantities
- Reduced peripheral equipment such as IS barriers – I/O cards – Marshalling cabinets etc.
- Reduced engineering time by ability to cut and paste standardized applications and parameterization of all Fieldbus devices from a central location (FDT/DTM technology)

Operation and Management
A better overview of process conditions – Asset Management – will allow operation closer to plant design limits. Maintenance is no longer bound to fixed intervals and passes over to predictive dynamic maintenance cycles. Unscheduled plant standstills are reduced drastically.

Fig. 141  Fieldbus savings potential

Statement of Wilfried Schmieder and Thomas Tauchnitz, Aventis Pharma Deutschland GmbH and Sven Seintsch, Infraserv GmbH & Co Höchst KG, Germany:
"The project acceleration can lead to a definitely higher value than the complete investment saving" (Fieldbus and Remote I/O – a system comparison – chapter 5.1 in atp magazine 12/44 (2002) FuRios).

1.5 The position of ABB
ABB supports both the major automation fieldbusses, namely PROFIBUS and FOUNDATION fieldbus and also LON for medium and low voltage systems.

We are an active driving force at all levels of Fieldbus FOUNDATION and PROFIBUS policy and technical development.
2 Basics – PROFIBUS

2.1 General definition: Fieldbus in process automation

Fieldbus systems are used as a means of communications for serial data exchange between decentralized devices on the field level and the Controller of the process supervision level (Fig. 221).

In addition to intelligent Transmitter and Actuators with a direct connection to the fieldbus, intelligent Remote I/Os are also used as interface systems for conventional 4...20 mA or HART field devices to record process data on the field level.

All relevant signals such as input and output data, parameters, diagnostic information, configuration settings and – for a wide range of applications (PA/H1) – the power required for operation can be carried over two wires. If a PA/H1 field device has a high-power requirement, then this device can be powered externally.

The unambiguous specification of the communications protocol makes it possible to keep the fieldbus open for all providers who use the protocol for their devices. As a result, the interchangeability common for 4...20 mA devices is maintained for fieldbus devices.

This, along with other conditions mentioned in 1.3, is the essential requirement for using fieldbus systems with the potential to provide significant benefits to users.

2.2 The PROFIBUS family

PROFIBUS is a manufacturer-independent fieldbus standard for applications in manufacturing, process and building automation. PROFIBUS technology is described in fixed terms in DIN 19245 as a German standard and in EN 50170 / IEC 61158 as an international standard. The PROFIBUS standard is thus available to every provider of automation product.

The PROFIBUS family is composed of three types of protocol, each of which is used for different tasks. Of course, devices with all three protocols can communicate with each other in a complex system by means of a PROFIBUS network.

The three types of protocols are: PROFIBUS FMS, DP, PA. Only the two protocol types DP and PA are important for process automation.

PROFOBUS DP: the bus for the Decentralized Periphery

The PROFIBUS DP (RS 485) is responsible for communication between the Controller level of a process automation system (PLC) and the decentralized periphery in the field, also intrinsic safety (RS485-IS) via DP-Ex barriers into hazardous area. One feature of PROFIBUS DP is its high speed of transmission up to 12 Mbit/s.

PROFIBUS PA: extension for Process Automation

This Profibus variant was developed for the process industry. Communication and power supply to Transmitter and Positioners are handled direct via one 2-line cable and correspond to IEC Standard 61158-2 (named also as MBP, MBP-LP). Intrinsc safety (EEx i) (MBP-IS) installations in Zone 1 / Div.1 are possible.

---

Fig. 221 PROFIBUS layout
Coupling components (segment couplers, Linking Devices) are used to integrate PA bus lines into the PROFIBUS DP network. This ensures that all information is available in a continuously connected network through the complete PROFIBUS system (DP and PA).

Presently the basic and extended functions are:
Basic function (V0):
- Cyclic data transfer
- Diagnostic
- Configuration via GSD files

Extended function V1:
- Acyclic data transfer
- Alarm handling
- FDT/DTM and EDD device management
- Function blocks acc. IEC 61131-3

Extended function V2:
- Device-to-Device communication
- Time and time stamp
- Equidistant Bus cycle
- Up- and Download functions
- PROFIsafe

All functions and the PA profile are used both for PA and DP field devices. Both types of devices can be operated with the aid of simple couplers on a bus system.

**Protocol functions and profiles**

The function block model, which corresponds to international guidelines, is used for profiles. One of the function blocks is the "Analog Input" block (Fig. 232). It provides the physical limit, measurement range and measurement value of the measurement converter, two upper and two lower threshold values as well as the corresponding status messages and alarms. These parameters and status messages can be similarly and effectively used with all measurement transformers. The analog input block of the Profile thus represents the basic functionality linking all sensors. Profile version V3.0 is presently most up to date.

**Profile distinction** is made between the Physical Block (hardware), the Transducer Block (parameters of physical measurement size, present multiple times for multi-function sensors) and the Function Block (functions from the point of view of the PLC or DCS, for example analog input for sensors or analog output for actuators). The dynamic process values of a "Analog Input" Function Block consisting of the measured value (4 Byte) and the assigned status (1 Byte) are read or written cyclically by a PLC and/or DCS. The profile parameters of all blocks can only be read and/or written acyclically.

The extended functions of PROFIBUS DP are required to set parameters and operate the system. The characteristics of devices and their behavior are described in profiles and are specified in the standard. These extended functions are optional so that it is still possible to continue using older PROFIBUS DP devices.
A part of these data has to be realized in any case, others are optional. Parameters, which cannot be found in the profile belong to the manufacturer-specific group. To be able to configure also these parameters, including the profile parameters, the open FDT/DTM Device Management Tool is used today.

2.4 Transmission technology
The transfer method of PROFIBUS DP is RS 485, which has been used successfully for many years. This technology can always be used to advantage if high transfer rates and a simple method of installation are required.

A twisted, shielded two-wire copper cable (Type A) is used as the transfer medium. Depending on local conditions, the shield should be connected on one or both ends of the cable segment to the potential equalization system. The bus structure makes it possible to add devices step by step and also to extend or limit the number of subscribers in operation on the system.

You can select a transfer rate between 9.6 kBit/s and 12 MBit/s. When selecting transfer rates for a DP line you should take into consideration that the usual distances of 500 m to 1000 m are only possible in PROFIBUS by reducing the transfer rates or using bus amplifier (Repeater). The maximum length of the line can be increased by using as many as approx. 5 Repeaters. For applications in strong electro-magnetic interference fields or at a very long distance, fiber optical cables can be used.

Interoperability / Interchangeability
Using PROFIBUS PA profiles makes devices interoperable, in other words devices of different manufacturers can be physically connected to a single bus and are able to communicate with each other and with foreign host. In addition to this, however, they are also interchangeable, which means devices of different manufacturers with standard GSDs can be exchanged one for another without engineering effort to change the configuration in the process automation system.

In addition to the general requirements such as transfer security, range and transfer rate, additional requirements must be fulfilled for two-line measurement transformers. These include: power and data transmission through a common cable and in addition, for the chemicals and petro-chemicals area, the requirement of explosion protection (intrinsic safety). These requirements are satisfied by the transfer technology of PROFIBUS PA (MBP – Manchester Bus Powered, IEC-61158-2).
The transfer takes place according to the following basic principles:

- In each segment there is only one feed-in source, for example in the DP/PA Linking Device.
- Field devices do not feed any output into the bus.
- In steady state, current consumption is constant for each field device.
- Field devices behave like current sinks.
- Subscribers transmit by changing modulation ± 9 mA relative to the basic current.

A twisted two-wire, shielded copper cable (Type A) must again be used as the transfer medium. It is also possible to exchange and extend devices during operation. The fixed, uniform transfer rate is 31.25 kBit/s. At this rate, cable lengths per segment of up to 1900 m are possible in non Ex(Haz.) case, or 1000 m in Ex(Haz.) cases. In practice these max. lengths are reduced considerably by the voltage drop on the line, the limited feed current and the number of PA transmitters. By selecting a cable with a larger diameter it will be compensated to a certain extent.

2.5 Bus topologies and installation notes

When a PROFIBUS DP network is installed, boundary conditions of RS 485 transfer technology must be observed. All subscribers are connected in a line-shaped bus. To avoid reflections, the line structure must be terminated by a bus termination resistor network at either end (Fig. 251). This network must be provided with a ground-free voltage of 5 volts. Frequently the required bus termination is already integrated into the device so that it can be inserted into the circuit easily if the device is located at the beginning or end of the line structure. According to the rules of certification, a DP device must be available at a minimum of 5 V.

Subscribers should preferably be connected to the bus via 9-pin D-sub connectors. For transmission rates ≤ 1.5 Mbit/s stub lines by limits (max. 0.3 m) possible, above 500 kBit/s, stub lines not allowed. In this case the incoming and outgoing cable must be switched through in the connector. In this manner it is possible to ensure that communication with subscribers downstream is properly maintained if the device is replaced.

Up to 126 DP or PA field devices can be addressed (address 0..125) by PROFIBUS DP with a connecting circuit of an PLC or a DCS. One additional restriction on the number of subscribers results from the fact that each subscriber on the bus weakens the bus signal.

If there are more than 32 subscribers (including the master), a bus Repeater must therefore be used to maintain the viability of the bus signal (Fig. 252). The bus lines that are separated by bus repeaters are called segments. Each individual segment must again be closed off on both sides by a resistor network.

![Fig. 251 RS 485 Transmission technology](image)

![Fig. 252 Network structures](image)
PROFIBUS PA networks are connected to PROFIBUS DP segments via Linking Devices (Segment Couplers). The Linking Devices convert the physical nature of the RS 485 transfer to the MBP (IEC) physical characteristics. They also make an optionally intrinsically safe supply current available for powering field devices. In contrast to the PROFIBUS DP, the physical features of the PROFIBUS PA bus also allow network topologies with long stub lines, such as tree structures (Fig. 254).

The tree structure is comparable with the traditional field installation technique. Signals from the field devices are collected via stub lines in sub-distributors (Multi Barriers) and are connected to the main PA cable in parallel. A passive line terminator (RC member) must be provided at both ends of the main PA cable for all topologies.

The number of subscribers that can be connected to a segment is also limited to 32. An additional restriction in the Ex (Haz.) area results from the limited supply current that is available, which is determined by the type of explosion protection selected. In addition to the basic currents of the field devices, the modulation signal of 9 mA, the maximum current in the case of error of the device with the greatest power consumption and a reserve for dynamic power on procedures when the power is restored to the DP/PA Linking Devices must all be taken into account for calculating the required current.

The assumption is also made here that the devices are equipped with an electronics system for limiting the current (FDE = Failure Detection Electronics). The maximum length of the line is restricted by the type of explosion protection and the drop in current over the bus line. The drop in current may result in a further limitation to the number of subscribers.

2.6 FISCO model

In the past, it was necessary to create time-consuming intrinsic safety audit trails in order to obtain permission to operate plants in Ex (Haz.) areas. Now, thanks to the use of the FISCO model (Fieldbus Intrinsically Safe Concept), you can easily design and operate your PROFIBUS PA system in Ex (Haz.) areas in no time at all.

Requirements are:
- Devices certified acc. to FISCO (IEC type attestation of conformity)
- \( U, I \) and \( P \) acc. to EN 50 020
  \( U_1 \geq U_0, I_1 \geq I_0, P_1 \geq P_0 \) for field devices
- Cable parameters observed (\( R, L, C \))
  (By using PROFIBUS PA cable type A)
- Bus termination existing and correct
- Total length of the PA segment, incl. stubs, to be kept
  - when using passive T-junction \( \leq 1000 \) m
  - when using Multi Barrier \( \leq 1900 \) m

A system certification no longer required for a PA segment in the Ex (Haz.) area!

When using passive T-junction in the Ex (Haz.) area acc. FISCO 6 up to max. 8 PA devices per segment are placeable, by using Multi Barrier up to 32 PA devices. The currently available DP/PA Linking Devices /Segment Coupler correspond to the FISCO Model.
2.7 Bus access procedures and bus network configuration

All PROFIBUS variants use a uniform bus access protocol. All data backup as well as handling of transfer protocols are included in this. The PROFIBUS protocol facilitates a cyclical real-time based exchange of data between the active bus connecting circuit, the master as it is called and the passive bus subscribers, which are also designated as slaves. The bus access control system of the master determines the point in time at which a slave may send data to the master. Only one subscriber may have authorization to transmit for this master/slave access procedure at any given time. The master, which has authorization to transmit, thus has the possibility of transmitting messages to the assigned slaves or of retrieving messages from the slaves. The cyclical transfer of user data between master and slaves allows for transfer of up to 244 bytes (DPV0), 224 bytes (DPV1) or 218 bytes (DPV2) each of input and output data per telegram.

A cyclical master can transfer its bus access authorization to another master (token passing procedure). In this manner several masters can retrieve messages over a PROFIBUS network from the slaves that are assigned to them (multi-master principle). Master of Class 1 includes for example Controller of process automation systems. Masters of Class 2 (non-cyclical masters) include tools for programming, configuring and setting parameters. They are used for placing bus networks in service and for setting parameters of bus subscribers. Class 2 functionality today be integrated into Controller of the process automation systems, or may be available as a standalone tool.

Profibus telegram formats ensure a high level of security for transfers. As a result of special start and end-characters, parity bits and control bytes as well as secure synchronization, a Hamming distance of HD = 4 is ensured.

Bus network configuration

For a PROFIBUS slave to be able to communicate cyclically with a master, it must first receive an address in the range 0...125. The address assignment is generally performed with the network configuration device of the Class 1 master. The network configuration device also determines the communication parameters of the master and the slaves and, along with them, the cycle time in the network.

The different communication parameters of the individual devices (slaves) are documented in the device-specific data files (GSD files). This data describes the individual communication features of a device. This includes, for example, manufacturer and device name, the hardware and software version, baud rate as well as the number and nature of input and output procedures, status and diagnostic messages.

The PROFIBUS user organization assigns device ID numbers and manages the associated GSD's. All files are available for download at no cost on the World Wide Web Server of the Profibus User Organization (http://www.profibus.com).

The file format being determined, the network configuration tool is now able to read the GSD files. In this manner, all special features of the devices that have been described are automatically taken into configuration.
### 3 Configuring and observing field devices

#### 3.1 The FDT/DTM technology –
Integration of field devices in standalone tools and process control systems

With the proliferation of intelligent field devices with digital interfaces such as HART and PROFIBUS, there is a requirement for configuration tools using these protocols. It is desirable for this configuration tool to have a rich graphic user interface whilst provide access to devices from multiple manufacturers.

A common proposal for a solution has been worked out in a work group “Field Device Tool (FDT)”. The goal is not a new device description language, but rather a device-independent interface. This allows for the integration of a device-specific software component (DTM) into each engineering tool.

Similar to the driver software for a printer, a DTM (Device Type Manager) belongs to a field device. The DTM corresponds to the FDT interface, uses for example the ActiveX or COM/DCOM technology that has been introduced by Microsoft and is totally multimedia capable. The actual field device manufacturer makes the DTM available, since only the manufacturer knows the details of the device that go beyond the profile. A DTM might include all device parameter, user dialogs and plausibility checking for parameters.

The DTM includes the complete configuration software for the cyclic and acyclic operation and thus replace same. For PROFIBUS these are the GSD file, the profile parameter and the EDDs, for HART the HART Universal commands and the DDs.

You only have to put the question: “Does my Engineering environment have an FDT interface?”

Learning only one uniform ergonomic configuration system and a common representation for standard PC applications increases efficiency in working with the devices. Thus same DTM is used during commissioning in Standalone Tools (e.g. SMART Vision) or in engineering software in the process control system (e.g. Fieldbus Builder, Control Builder, Composer) in running plants. It is only necessary to learn to use the device with DTM once. It looks like 100 % equal in every engineering environment. This helps to reduce costs in administering and handling devices, tasks that often significantly exceed the investment costs for the devices themselves.

Communication and configuration of field devices has previously been characterized by a large number of individual solutions. Each manufacturer had its own application, which generally used RS 232 or RS 485 interfaces. All possible protocols and designs of the user interface in terms of appearance and operating philosophy were used, and this was exacerbated by the fact that different operating systems served as platforms. The result was a high cost for the user in terms of purchasing and using these tools including updates that were necessary and training for personnel. To put an end to these unfavorable circumstances, efforts were made to introduce standardization, which have led to clear, acceptable results for the hardware, the protocols and the user interfaces.

In order to achieve a uniform design of a user interface with field devices, a working committee has worked out guidelines in the context of the GMA which have been set forth in VDI/VDE 2187, GMA = German Organization for Measurement and Automation Technology (Gesellschaft für Mess- und Automatisierungstechnik).
The specification for the protocols and corresponding profiles has served as the basis for developing communication with field devices from different manufacturers. Since no one communication standard emerged as the optimal one for all requirements, a communication software package must support the most important communication methods (HART, PROFIBUS, Fieldbus FOUNDATION).

The next two sections present engineering software packages that addressed all these requirements.

3.2 Engineer IT – Standalone Tool

SMART VISION is an intelligent software package for complete field device management. Whether the task is configuration, parameterization, calibration, commissioning, diagnostics or maintenance, this is a Standalone Tool for all devices – independent of the manufacturer. As frame application with the standardized, open FDT interface all available DTMs are running. This ensures continuous compatibility – today and in the future.

SMART VISION allows for communication between field devices through the following communication protocols:
- HART communication
  - Via FSK modems with point-to-point or multi-drop operation
  - Via FSK bus
  - Via HART multiplexer
- PROFIBUS communication
  - With the help of DP/PC adapters (USB, PCM/CIA, ISA, ..)
  - Directly to PROFIBUS DP devices
  - Via Remote IO systems (e.g. S900) as a PROFIBUS DPV1 node to HART field devices
  - Via Linking Devices to PROFIBUS PA devices
- FOUNDATION Fieldbus communication
  - Presently not with DTMs
  - With the help of H1/PC adapters (USB, PCM/CIA, ISA, ..)
  - Direct to FOUNDATION Fieldbus-H1 devices

The Standalone Tool and the field device DTMs offer all device data online. The main areas of usage are clearly the devices and therefore:
- Diagnosis of field devices and calling up status reports
- Online display of device parameters (graphical/text) or printout.
- Storage of device configuration, device measurement and status data.
- Configuration or parameterization of field devices.
- Management of device data and planning and administration of device measurement stations
- Visual overview as a representation of devices connected to the system.

Working with field devices for users becomes less complicated, more effective and reliable. It is no longer necessary to learn several device management applications provided by individual device manufacturers.

The application areas are the commissioning phase, service activities, in the plant being in operation or in the workshop, which are speeded up considerably as well as in old plants with a PROFIBUS Master Class 1. For the acyclic data traffic, SMART VISION is used as Master Class 2 during continuous operation. SMART VISION will save time, and thereby money.

SMART VISION and the field device DTMs support the entire ABB portfolio of devices, including flow, temperature, pressure measurement devices, remote I/Os, analyzers, positioners, actuators, etc. Device DTMs from other manufacturers can be integrated, too.
3.3 Engineer IT – Process control systems with integrated fieldbus technology

The fieldbus also opens up new horizons for process control. The requirements already stipulated in chapter 1.4 and the primary goal – important cost savings for the entire plant life cycle and process optimization through asset management – are analogously valid for the use of fieldbus systems. The standardized fieldbus opens the process control system for devices from different vendors, i.e. I/O units or data acquisition devices do not necessarily have to be purchased from the control system vendor. Smart and advanced field devices provide much more information than the measuring values. However, you can only fully utilize this extended device functionality and data for decision taking if they are available on the process control level and in the management system, not only locally in the field device.

In the past, the individual tools from different device vendors had to be integrated in the process control system, requiring a lot of time-consuming work. Today, consistent integration of fieldbuses and devices in the process control systems is achieved through the FDT/DTM standard described in chapter 3.1. FDTs/DTMs are an essential part of the overall automation concept and provide an interface between the process control and the device world. The FDT (Field Device Tool) eliminates the need for a superfluous variety of individual and incompatible applications and realizes overall solutions through standardization.

Fig. 331   Industrial IT – Topology of a process control system
Field Device Tool (FDT) defines a vendor-independent and protocol-independent interface for integrating field devices in the engineering tools of process control systems. The principle is similar to the familiar procedure used in the IT world: a driver (e.g. printer driver) installed in the operating system integrates the device in the system environment and ensures reliable access. The FDT approach transfers this principle to the world of process automation.

A device driver (DTM = Device Type Manager) provided by the device vendor is installed in the process control system to establish communication and data access to the device. This type of integration allows performing of all software-related tasks in the life cycle phases, such as engineering, commissioning, operation, diagnosis and maintenance from a central workstation. As the relevant data reside in a central database used by both the control system and the field devices, data consistency throughout the entire plant is ensured, allowing for central data backup without the risk of mismatches and data loss. Data access is realized directly from the control room, without the need for extra cables (e.g. service bus) or additional hardware.

The device drivers (DTMs) co-operate and exchange data with the engineering tools via the interfaces specified by FDT in an optimum way. The DTM provides the device data to the control system via a convenient graphical user interface. Nowadays, many companies develop a rapidly increasing number of products complying with the FDT standard. Among these are device DTMs and FDT frame applications like the engineering tools of process control systems.

The engineering tools Composer for the Melody System, Fieldbus Builder PROFIBUS/HART for the AC 800M Controller, and Control Builder F for Freelance and the AC 800F Controller integrate PROFIBUS and HART field devices on the basis of the FDT/DTM technology in the ABB process control systems and, thus, are an integral part of ABB’s Industrial IT concept.

**Conclusion:**

The FDT standard is the basis for integrated solutions that focus on centralized information linking the field to the tools and methods of the company’s MES (Manufacturing Execution Systems) and ERP (Enterprise Resource Planning). The standardization of fieldbus protocols allows for openness and interoperability in the communication between smart field devices and systems. FDT provides the same openness and interoperability of field devices and control systems for engineering, diagnosis, and asset management tasks. Now the user can efficiently utilize the multitude of information provided by fieldbus technology.

Due to the standardized graphical user interface every user can easily configure and commission various field device types from the process control system level, without the need for deep fieldbus knowledge.

The user can directly access the field devices from any workstation with FDT environment. He can call the graphical user interface and online help systems required for the relevant application. For example, easily comprehensible diagnostic data are provided for maintenance tasks. An operator can call the current measured values, and a commissioning engineer can initiate a loop test via the DTM. Any configuration changes of the field device are logged and archived in the process control system via an integrated audit trail. Additionally, all parameter definitions of the field device are stored in the system. In case of a device failure requiring replacement, this data can be downloaded into the new device immediately, without the need to adapt the parameter definitions. This means real “plug and produce” capability realized in fieldbus technology.
4 Optimize IT – Asset Optimization

Companies are constantly striving to optimize the life cycle costs of their operating investments. They search for ways to reduce the maintenance expense, to increase the service life of important components and field devices and to increase the usage of existing systems, thereby raising the availability and productivity of the entire operation. There is always great demand on managers to examine operations and to continuously inquire into key aspects such as:

- Efficiency
- Operating costs and trends associated with them
- Current operating conditions and their effects on service life
- Possibilities for simplifying the maintenance plan without safety and efficiency suffering as a result
- Predictive maintenance.

ABB is conscious of this challenge and that customers expect a comprehensive solution from their automation suppliers. As part of the Industrial IT program, ABB offers Asset Optimization, a connection between the best knowledge databases in the industry and the most extensive portfolio of devices and tools, combined with suggestions for increasing productivity and return on assets.

Asset optimization is one way in which companies can move forward together with ABB, this maximize production while minimizing costs. ABB’s experience in designing and manufacturing technical equipment – along with its leading position in process automation – is your guarantee for its capability of optimizing, analyzing and monitoring the output capacity of all operating plants.
ABB has developed an innovative automation solution that uses cutting-edge technologies, including integrated fieldbus solutions, to create communication possibilities and products that facilitate access to all of the data in systems. ABB also offers a series of applications that facilitate the decision making process for optimizing systems through their entire life cycle. These additional applications allow for the optimization of operating systems, beginning with the operating design, through maintenance and until the end of service life.

What is the strength of this architecture? First, it supports the requirements of the customer for monitoring and optimization of systems in real time. The paradigm of today’s business world, namely the “Internet Era” is slowly penetrating through to plant owners. If managers are not conscious of increasing production costs and correspondingly rising revenues they will be at a disadvantage in the wide-open future markets characterized by stiff competition.

Secondly, this solution quickly and easily detects differences in performance between two or more similar systems (for example heat exchangers with comparable capacity) or groups of systems (for example production systems with similar structure). This "early warning system" avoids production downtime and makes it possible for operators to work closer to the limit, which it turns makes it possible to maximize the overall effectiveness of the equipment (OEE, Overall Equipment Effectiveness) and profit.

Third, this architecture delivers the necessary infrastructure for monitoring and recording the physical and financial performance capacity of systems as measured by their total service time. The collected information and knowledge forms the basis of to decide when it is justified to take a system out of operation, since it is based on reliable performance data. Thanks to this information, managers now have the opportunity of striking out on new paths with ABB and setting new performance and profitability goals for the future.

Wide range of products
ABB has developed intelligent Fieldbus devices with individual features that track the device performance and enable preventive maintenance, since decreasing output capability can be detected early on. This becomes possible by the transmission of status (cyclic) and diagnosis (spontaneously, acyclic) information from the PROFIBUS or FOUNDATION Fieldbus field devices together with the measured values.

In the area of automation systems, ABB has created a unique modern object-oriented infrastructure for the company’s automation platform that can be used to improve the industrial IT program.

ABB’s Optimize IT tool exploit the wealth of field resident information accessible to “Objects” and linked “Aspects” (i.e. attributes) through Fieldbus and higher level systems (Aspect-Object Industrial IT system).

These value-enhancing application products, which will be available, include:

- **IFS Maintenance Interface**: Tightly integrated with the CMMS system, the IFS Maintenance Interface takes over and tracks Work Orders through their normal cycle, from issue to closure.

- **Maintenance Trigger**: Monitor and interpret devices signals to alert the user a service needs. The trigger initiates the maintenance process by generating a Work Order Request. An additional trigger development toolkit allows any supplier of low level, high level and intangible assets to develop triggers (e.g. corrosion, consumption of lubricant, lifetime of the heater exchanger as well as other trigger in this environment) for their specific device or equipment.

- **Audit Assistant**: Automatically retrieves all asset-related events and data (i.e. status and process alarms, device failures and maintenance events) for diagnostics and root cause analysis of process upsets and instrument failures.

- **Documentation Organizer**: Provides quick access to all relevant asset-related information (Aspects), such as diagrams, procedures, configurations, etc.

- **Process Optimization Solution**: Focused on increasing asset utilization and on optimal management of plant capacity, Process Optimization Solutions enable the modeling of sophisticated processes and apply advanced solution techniques to resolve optimization challenge.

Examples include: model predictive control / maintenance, real-time dynamic optimization, data mining and analytical tools.

![Maximize life cycle of a plant](image)
In the area of communication systems, ABB supports the customer's freedom to select the field devices and linked communication protocols that best fit the application. Thus, customers can select the solution that corresponds to their own needs. Fieldbus is a high-performance technology which operators can make use of the benefits of asset organization. ABB supports the Fieldbus Standards (PROFIBUS, FOUNDATION Fieldbus, LON and HART) and offers compatible products (field devices, systems and engineering tools). The fieldbus architecture is only one possibility for implementing the many advantages of asset optimization; much can already be achieved with conventional 4...20 mA related to HART communication. For this the HART protocol is transmitted to the automation system by means of the FDT/DTM technology via a Remote I/O System (e.g. S900, S800) and the acyclic service of the PROFIBUS DPV1. That means it is possible to configure and parameterize thousands of HART field devices from a central point, up to an explosive environment without having to be on site.

Information management is essential; for understanding and achieving the highest level of performance capacity in a system and for developing procedures that contribute to optimizing the system throughout its entire life cycle. ABB has a series of applications that provide different levels of support to asset optimization throughout the entire life cycle.

ABB has long been well known in industry-specific application and The next way of thinking. Asset optimization and other structural elements of the Industrial IT systems have led to a unique solution for automation questions. ABB is the leading supplier of automation systems and offers operations managers the experience, the resources, a wide range of "Industrial IT enabled" products and the global organization that are necessary to address the challenges of the next decade.

5 The ABB PROFIBUS pilot plant

The pilot plant gives an example of how a PROFIBUS system can be planned and set up. Just as would be expected in a typical application, field devices can be operated in an intrinsically safe and non-intrinsically safe area. On the field level, in addition to PROFIBUS PA devices, PROFIBUS DP devices also Remote I/O systems can be connected.

The system description indicates components that are typically required, as well as boundary conditions that must be observed. With just a few modifications, the pilot system presented here can be adapted or expanded to different applications.

5.1 Description of the plant

A Controller (3) is used for process automation. The processing station function as a Class 1&2 master and reads process values from the connected sensors and actuators cyclically. Actuators that are connected, such as Positioner, also receive their set-point through this cyclical communication. In addition to the actual measurement and set values, information related to the device status is also transmitted continuously. The Controller itself can be installed in an electrical cabinet or in the control room and connected via a two-wire PROFIBUS DP cable (5) by a SUB-D plug, incl. switchable bus termination (2.1). The transfer is based on RS 485 physical requirements.
By means of the DTMs all field devices are parameterized and configured in acyclic operation (DPV1). This may be either a central engineering tool with an FDT interface (e.g. Fieldbus Builder) running on a PC (1.1) in the control room or optionally a standalone tool with an FDT interface (e.g. SMART VISION). The standalone tool is installed typically on a Notebook (1.2), which is connected to the PROFIBUS DPV1 directly via an USB/Master Class 2 Module (15) and a SUB-D connector (2.1). This makes it possible to monitor the individual field devices and set their parameters in parallel with the ongoing cyclical operation of the Controller.

Different bus topographies are possible based on the Controller. In this example, the PROFIBUS DP cable (5) connects to a switch box DP/PA Linking Device (9.1) (e.g. Head Station LD 800P system) via a SUB-D plug (2.2) and is distributed from there.

In the non-intrinsically safe area, devices that receive their power supply remotely and which are equipped with an RS 485/DP connection can be directly connected to the bus. These include, for example, actuators (7.3), which have got their own switchable bus termination or flow meters (7.2), which are connected via a DP T-junction (14) with limited spur length (≤ 0.30 m). Decentralized remote I/O systems such as the S800 (7.1) are also usually connected to the DP bus or the S900 (7.4) directly in Ex (Haz.) Zone 1 via a DP/DP-Ex barrier (8) that collects binary and conventional analog process variables in the field and transmit them to the Controller. This also makes it possible to install a mix of fieldbus devices and conventional analog (4...20 mA) or HART devices. All Remote I/Os and Ex barriers are connected to PROFIBUS DP with SUB-D plugs, either in the middle of a segment without bus termination (2.2) or at the end/start with switchable bus termination (2.1).

A DP/PA Linking Device (9.x) (e.g. Head Station LD 800P system) is required for the physical connection of PROFIBUS PA acc. MBP (IEC 61158-2) to PROFIBUS DP. The Linking Device have a galvanic separation between the DP and the PA segments and serves simultaneously to feed power to the field transmitters (14.x) connected to the two-wire line. Up to 32 field devices can be used per Power Link module (9.2) of the LD 800P system for non-explosion protected applications. Acc. FISCO max. 8 field devices (depending on the requirement for current and voltage) can be used in the Ex (Haz.) area by using passive T-junction (13) and can be installed directly on a Power Link module (9.3).

One can increase to max. 32 the number of PA field devices on a Power Link module (9.2) that can be operated in the Ex (Haz.) area, with Multi Barriers (NMB204-EX) (16) and explosion protection type EEx m [ia] e. The PA bus line (10.2) is designed in explosion protection type EEx e and each of the 4 stubs (10.1) to the field devices are designed in explosion protection type EEx ia. Up to 16 Multi Barriers can be set up in series per PA Bus segment, with a total length (= Lg + ΣLg) of up to 1900 m (depending on the type of cable and the requirement for current and voltage). The short-circuit proof PA stub outputs (10.1) of the multi-barriers prevent a failure of the entire PA bus segment in case of field device failure.
5.2 Transfer rates

Different requirements and limits must be observed when planning and commissioning a PROFIBUS fieldbus system.

One significant requirement has to do with the uniqueness of the transfer rates in a PROFIBUS application. A DP master is always able to transmit only at an adjusted transfer speed. It is not possible to mix DP devices with different transfer speeds. This means that the slowest DP component within a master/slave control circuit determines the transfer rate, and all other DP components must be set to this transfer rate.

The transfer rate of field devices whose power is supplied by the bus (PROFIBUS PA) with transfer technology based on MBP (IEC 61158-2) is fixed at 31.25 kBit/s. A Linking Device is therefore required to connect to the Controller with PROFIBUS DPV1. Only one rigid conversion of the transfer rates is permitted when using “passive” segment couplers. The transmission rate is assigned in this case on the DPV1 side at 45.45 or at 93.75 kBit/s. This determines the transmission rate for the remainder of the DP bus at 45.45 or at 93.75 kBit/s. For “active” segment couplers, the PROFIBUS DPV1 transmission rate can be adjusted up to 12 Mbit/s. This is referred to as a DP/PA Linking Device.

The time required for a complete cycle of data exchange depends essentially on the baud rate, the number of subscribers and the size of the measurement (Value) and status values to be transmitted cyclically. Delay times, which arise through the Linking Devices and the field devices itself, must be taken into consideration as well. For a total of 1 x 24 (1 PA Master with 1 Power Link module [9.2]) or 3 x 8 PA field devices (3 PA Master each with 1 Power Link module [9.2/9.3]) and at a transmission rate of 31.25 kBit/s on the PA side and 1.5 Mbit/s on the DP side, it is possible to obtain the following PROFIBUS cycle time per line:

<table>
<thead>
<tr>
<th>Quantity of cyclical measurement data per field devices</th>
<th>PROFIBUS cycle time with 1 x 24 PA field devices</th>
<th>PROFIBUS cycle time with 3 x 8 PA field devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 variable (5 bytes)</td>
<td>310 ms</td>
<td>120 ms</td>
</tr>
<tr>
<td>2 variables (10 bytes)</td>
<td>340 ms</td>
<td>130 ms</td>
</tr>
<tr>
<td>5 variables (25 bytes)</td>
<td>430 ms</td>
<td>160 ms</td>
</tr>
</tbody>
</table>

Table 521 Minimal system response time with 1 x 8 / 3 x 8 subscribers, 31.25 kBytes (PA) and 1.5 Mbit/s (DP).

5.3 Planning criteria and design

In addition to the transmission rate, the permissible cable length also plays a significant role in planning PROFIBUS systems. The entire length of the cable or the extent of the network within a PA segment is limited on the basis of the transmission and attenuation properties of the cable. Stub lines ($L_S$) and main lines ($L_G$) are added together and are included in this calculation. Table 531 shows an overview of “Type A” cables as determined by MBP (IEC 61158-2) and their maximum extent in the network ($= L_G + \Sigma L_S$) per segment.
The number of DP or PA subscribers per fieldbus segment is limited to a maximum of 32, also to prevent reflections and weakening of the signal.

If power is supplied to field devices via the PA bus, partial voltage drops on the bus lines must also be taken into consideration. These depend on the type of cable, the length of the line and the power consumption. For non-intrinsically safe applications, a typical 24 V DC power supply is used, and there are only very minimal limitations on the total length of the line. For intrinsically safe applications, the voltage of the power supply is approx. 12.8 V DC (LD 800P). The resulting permissible line lengths must be observed so that the necessary minimum operating voltage to the devices is not exceeded (ABB data sheet 10/63-0.46 EN). The optimum design of a fieldbus segment requires detailed calculation of the partial voltage drops.

We refer you here to the literature published by the Profibus User Organization (PNO/PI) for detailed planning and design of Profibus systems (PROFIBUS PA Introduction to Commissioning: Part No. 2.091).

ABB offers a planning tool based on Excel for creating a PROFIBUS layout (DTD100). It is used to calculate the bus cycle time and cable length and contains information on PROFIBUS devices and network components.

### 5.4 Tips on the most frequently asked installation issues

**Are multiple devices with the default address 126, or with the same address connected to the bus?**
- Make certain that there are no instances of multiple devices on the bus simultaneously with the same address. In case of doubt, attach one device after the other to the bus and assign the address you desire to each device, with a software tool, for example. It is best to note the address on the device. If you proceed according to this method in assigning the address, make certain you can assign the installation location to the address.

**Have you made note of the polarity for PROFIBUS DP?**
- In contrast to PROFIBUS PA, you must ensure the correct polarity for PROFIBUS DP. When using a 9-pin D-SUB connector, the connector assignment is Pin No. 3 RxD/TxD-P (Receive/Transmit data-Plus) and Pin No. 8 RxD/TxD-N (Receive/Transmit data-N). If the question comes up, simply try switching polarity.

**Are the bus connections present and active?**
- Make certain that the bus segments are present on both sides in each segment. (See also Section 2.5 Bus topographies and installation notes).

**Do you have the appropriate GSD/DTM for your device?**
- Please use the GSD that was delivered with your device or the respected DTM. This will ensure optimal support for your device in all functions.
6 Prospects

With further development in the direction of intrinsic safety and power supply via bus, fieldbus technology has now made considerable advances in the area of process technology. User requirements are largely satisfied. Fieldbus technology can thus already be used today in procedural plants. Nothing but the shared experiences of suppliers and users helped to fully exploit the innovative potential of this technology in the midst of a revolution (see Asset Optimization).

The savings on input/output cards in the controller, marshalling racks and sub-distributers, signal conditioning level, main cable and creating the plant documentation (Fig. 531) are faced with expenses for accurate planning in proper time, new engineering structures and staff training. The build up of fieldbus know-how by further projects that goes hand-in-hand with the proliferation of fieldbus technology will bring with it the desired savings.

The next steps in development and standardization of PROFINET technology (DPV2) have shown, that also answers are given for time stamping and redundancy. Sufficiently high transfer rates on the DP and thus reasonable cycle times in a PROFIBUS system is achieved with the active segment couplers (Linking Devices) that have already been available on market.

While it was previously believed that savings had to be achieved by reducing copper lines and hardware, overall plant costs (Life-cycle-costs) are the center of attention today. The higher level of transparency is achieved through fieldbus technology, the greater content of information in signals (Field device diagnostic) and the thorough configuration and parameterization on the field device level (FDT/DTM technology) are answers of this requirement.

With the FDT interface (Field Device Tool) and DTM (Device Type Manager) as device drivers, a great stride has been made for unified engineering and the operation of entire systems from the control room through to field devices. The complete graphical multimedia support for all field devices from the central engineering tool of the automation system and access to maintenance information of individual field devices from the control room is thus possible. Asset Optimization, with the goal of reducing life cycle costs of the entire plant is thus available for field device.

7 Summary/Conclusion

The hard cost savings from fieldbus technology are estimated at about 24 % for large installations (about > 3000 I/O points). In the presently largest PROFIBUS plant (ThyssenKrupp Stahl coking plant in Germany) with approx. 25,000 PROFIBUS I/Os, 6,000 of which are PA field devices incl. FDT/DTM technology it became evident that the saving potential during the whole lifetime of a plant is not utopian.

Competition between different fieldbus standards remains dynamic, but stable and the development of new products goes ahead. For intelligent devices in the process control area, the decisive standards are PROFIBUS DP/PA and FOUNDATION Fieldbus. Of these, PROFIBUS has a credible installed base while FOUNDATION Fieldbus are starting, and vying for installations. FOUNDATION Fieldbus has High Speed Ethernet (10…100 Mbit/s), as a sub-system integration.

Sensor-Actor busses (ASi) will continue to survive for low level applications such as bulk I/O because of their simplicity and low cost. They will be linked to PROFIBUS and FOUNDATION Fieldbus through gateways.

LON will find applications in electrical equipment such as switchgear and motor control centers. Therefore, a multi-fieldbus strategy will provide customers with the best choice of product.

Abbreviations used

CMMS Computerized Maintenance Management System
DD Device Description
DDL Device Description Language
DTM Device Type Manager
DP PB Protocol type for Decentralized Peripherals
FDT Field Device Tool
FF FOUNDATION Fieldbus (name of the fieldbus) or Fieldbus FOUNDATION (name of the organization)
FIP Factory Instrumentation Protocol
FISCO “Fieldbus Intrinsically Safe Concept”.
GSD-File Gerätestammdaten – Device Communication Database File for PROFIBUS devices
H1 FF Protocol type for process automation
HART Highway Addressable Remote Transducer
HSE FF Protocol type for High Speed Ethernet
IEC International Electrotechnical Commission
ISO International Standards Organization
ISP Interoperable Systems Project
LON Local Operating Network
MBP Manchester Bus Powered
OSI Open System Interconnection
PA PB Protocol type for Process Automation
PB PROFIBUS
PI PROFIBUS International Organization
PNO PROFIBUS Nutzerorganisation e.V.