Introduction

PROFIBUS

Open Solutions for the World of Automations

Presented by

RPA South East Asia
Andreas Agostin, Richard Jennens, Volker Schulz
Overview PROFIBUS Technology

Welcome  18.45 – 19.00
- Mr. Jacky Chan – GM Siemens Pte Ltd – A&D
- Mr. TJ Kang – President ICS & MD Cegelec Pte Ltd

PROFIBUS Organization  19.00 – 19.45
- Mr. Andreas Agostin – PM Pepperl+Fuchs Pte Ltd

Standard & Technology  19.00 – 19.45

Break  19.45 – 20.00

Application Profiles  20.00 – 20.45
- Mr. Richard Jennens – PM Endress+Hauser S.E.A. Pte Ltd

Integration Technology  20.45 – 21.15
- Mr. Richard Jennens – PM Endress+Hauser S.E.A. Pte Ltd

PROFINET  20.45 – 21.15
- Mr. Volker Schulz – MM Siemens Pte Ltd – A&D

References
- Mr. Volker Schulz – MM Siemens Pte Ltd – A&D

Q&A Lucky Draw  21.15 – 21.30
# Overview Siemens Pte Ltd

## Medical
- Medical Solutions (Med)

## Information and Communication
- Information and Communication Networks (ICN)
- Information and Communication Mobile (ICM)
- Siemens Business Services Pte Ltd* (SBS)

## Automation & Control
- Automation and Drives (A&D)
- Industrial Solutions and Services (I&S)
- Siemens Dematic Pte Ltd* (SD)
- Siemens Building Technologies (SBT)
- Siemens Westinghouse Technical Services Pte Ltd*

## Lighting
- Osram Pte Ltd*

## Power
- Power Generation (PG)
- Power Transmission and Distribution (PTD)

## Transportation
- Transportation Systems (TS)
- Siemens VDO Automotive Pte Ltd*

## Financing & Real Estate
- Siemens Financial Services* (SFS)
- Siemens Real Estate (SRE)

*Groups with own legal structure
Overview A&D Solutions

- Programmable Logic Controllers
- Micro Automation
- PC-based Automation
- Industrial Software
- Distributed I/O
- SIMATIC based Technology
- Industrial Communication SIMATIC NET
- Human Machine Interface SIMATIC HMI
- MES Software SIMATIC IT
- Industrial PC
- Programming Devices
- Machine Vision
- Process Control System PCS7
- Field and Panel Instrumentation
- Process Analytics
- Weighing Systems SIWAREX

Manufacturing Industry

Process Industry
Overview A&D Solutions

- AC Motors
- DC Motors
- Distributed Drive Solution
- AC Converters
- DC Converters
- Engineering Software
- CNC Family SINUMERIK
- Motion Control System SIMOTION

The driving force behind A&D innovations is the need to save energy, boost performance and integrate into the world of automation. Intelligent concepts guarantee comprehensive drive solutions.

Drives
Overview A&D Solutions

- Safety Devices SIGUARD
- Proximity Switches BERO
- Protection Devices
- Push Buttons and Indicator Lights SIGNUM
- Relay Terminal SIMIREL
- Switchgear
- Fuse Systems
- Inline-Terminals
- Cubicle Systems SICUBE
- Transformers SIDAC T

Secure, user-friendly, economical and modern: controls and electrical installations from A&D for domestic, purpose-built and industrial applications.

Controls and Electrical Installations
Overview A&D Solutions

Mass Dynamics
Process Protection
Level
Controllers
Positioners
Recorders
Pressure
Temperature
Flow
Gas Chromatography
Gas Analytics
Liquid Analytics
Weighing
AltOptronic
AOTF
Laser Diode
Mass Spec
FT-NIR

THE NEW FORCE:
SIEMENS
Overview A&D Solutions
RPA S.E.A. – our next events in Singapore

PROFIBUS 30.09.2004
- FuRIOS (Fieldbus Remote I/O Study)
- PROFIBUS Design Standard & Technology
- Sponsored by Pepperl+Fuchs Pte Ltd

PROFIBUS 18.11.2004
- DP/PA integration with Diagnostic
- FDT/DTM Technology
- Sponsored by Endress + Hauser S.E.A. Pte Ltd

PROFIBUS 13.01.2005
- PROFIsafe
- Applications and technology
- Sponsored by Siemens Pte Ltd

Register for our bi-weekly update on PROFIBUS under southeastasia@profibus.com
Overview PROFIBUS Technology

Welcome 18.45 – 19.00
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PROFIBUS Organization 19.00 – 19.45
Standard & Technology
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PROFINET 20.45 – 21.15

References
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Q&A Lucky Draw 21.15 – 21.30

RPA S.E.A. Press Tour 2004
### Speaker - Andreas Agostin

#### Technological Knowledge
- In-depth knowledge about PROFIBUS due to seven years of experience in Pepperl+Fuchs Germany – R&D Department
- One year with Pepperl+Fuchs Kolleg (Seminar and documentation).
- 3 years with Pepperl+Fuchs Singapore as Product Manager and Business Development Manager for bus devices
- Certified PROFIBUS PA Engineer (2004)

#### Society experience
- Member of PROFIBUS Singapore Organization since 2001
- Member of Technical Committee RPA S.E.A.
- Member of FF Society Singapore since 2001

#### Public Relations
- Over 60 Fieldbus seminars in Australia, China, India, Korea, Singapore, Malaysia, Thailand, Philippines and Indonesia
- Seminars at ICS, CIA, IICA, JA, and many other societies and organizations
- Numerous publications for marketing and promotion
Overview PROFIBUS Technology

History, organization, market position
With wide range of application
- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology
- Transmission Technology
  - RS-485, RS-485-IS, MBP, MBP-IS, FOC
- Communication Technology
  - DPV0, DPV1, DPV2

Application Profiles
- Interoperability and Interchangeability
- PROFIsafe
- HART on PROFIBUS
- PROFIdrive
- Process Application

Integration Technology
- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

References
Changes in Automation Structures

From central automation systems
- with a central PLC and
- sensors/actuators
- based on 4-20 mA or 0-10 V technology

... over distributed automation systems
- with a PLC/IPC and
- distributed peripherals
- based on field bus technology
Changes in Automation Structures

... for automation technology with

- distributed intelligence (intelligent field devices)
- symbiotic interaction of field bus and Ethernet communication
- consistency right through to corporate management level and Internet

With integrated motion, safety and applications
### Milestones to Market Leadership (organizational)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>&quot;Field bus&quot; development/joint project leads to founding of the PROFIBUS User Organization e.V.</td>
</tr>
<tr>
<td>1992</td>
<td>PROFIBUS goes international (Switzerland, USA, ...)</td>
</tr>
<tr>
<td>1995</td>
<td>Founding of PROFIBUS International</td>
</tr>
<tr>
<td>1998</td>
<td>Deutsche Shell AG becomes the 200th member of PNO</td>
</tr>
<tr>
<td>1999</td>
<td>Founding of PROFIBUS Competence Center</td>
</tr>
<tr>
<td>2000</td>
<td>CERN becomes the 1000th member of PROFIBUS International</td>
</tr>
<tr>
<td>2001</td>
<td>Founding of 22nd regional PROFIBUS User Organization</td>
</tr>
<tr>
<td>2002</td>
<td>Founding of the first PROFINET Competence Center and Test Laboratory</td>
</tr>
</tbody>
</table>
### Milestones to Market Leadership (technical)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>PROFIsafe established at market</td>
</tr>
<tr>
<td>2002</td>
<td>PROFIBUS DP-V2 and PROFINET in IEC 61158 and IEC 61784, 10 profiles available</td>
</tr>
<tr>
<td>2001</td>
<td>Presentation of Ethernet-based PROFINET</td>
</tr>
<tr>
<td>2000</td>
<td>100,000 PROFIBUS devices in process automation</td>
</tr>
<tr>
<td>1999</td>
<td>Profile for safety technology - PROFIsafe</td>
</tr>
<tr>
<td>1998</td>
<td>Profile for process automation - PROFIBUS PA</td>
</tr>
<tr>
<td>1997</td>
<td>More than 1 million PROFIBUS devices installed, Profile for variable-speed drives PROFIdrive</td>
</tr>
<tr>
<td>1996</td>
<td>PROFIBUS becomes European Standard EN 50170</td>
</tr>
<tr>
<td>1995</td>
<td>1st application in process automation (PA)</td>
</tr>
<tr>
<td>1993</td>
<td>PROFIBUS DP becomes DIN 19245 (Part 3)</td>
</tr>
<tr>
<td>1991</td>
<td>PROFIBUS becomes DIN 19245 (Part 1 and 2)</td>
</tr>
</tbody>
</table>
PROFIBUS International

PROFIBUS International (PI)

- 24 Regional PROFIBUS Associations (RPA)
- 30 PROFIBUS Competence Center (PCC)
- 7 PROFIBUS Test Laboratories (PTL)

About 1.200 members worldwide

- Globally organized consortium
- Tasks: technological developments and marketing
Presence and Support Worldwide

- 24 Regional PROFIBUS Associations (RPA) worldwide
- 30 Competence Centers (PCC) in 13 countries
- 7 Test Laboratories (PTL) worldwide for certification tests

RPA = Regional PROFIBUS Association
PCC = PROFIBUS Competence Center
PTL = PROFIBUS Test Laboratory

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RPA S.E.A.
Press Tour
2004

PROFIBUS

Standard &
Technology

Application
Profiles

Integration
Technology

PROFINET

References

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International

PCC At Singapore Polytechnic

PA Plant
Coffee Maker
Arm Wrestler
Sorting Machine

Mixing plant with PA installations
Fast automation line
Members Worldwide

- Manufacturers
- Distributors
- Consultancies
- Integrators
- End users
- Institutes
- Training Centers

1200 members in 2002

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Regional PROFIBUS Associations S.E.A.

Manufacturers
- Valmet Instrumentation
- Samson Control
- Pepperl+Fuchs
- Hirschman Electronics
- Festo
- Buerkert Contromatics
- ABB
- Endress+Hauser
- Siemens
- Weidmueller
- MTL
- LAPP Logistics – new
- SMAR – new

End-Users
- Centre for Advanced Technology
- Flotech Control
- CMC
- German-Singapore Institute
- Messe Duesseldorf
- Power Seraya
- Singapore Polytechnic
- Total Automation
- Vector Info Tech
- DNR Process Solutions
- ICS
Internet

PROFIBUS on the Internet

- millions of hits for [www.profibus.com](http://www.profibus.com) per year

Banner advertising at [www.profibus.com](http://www.profibus.com)

- thousands of links per month; in isolated case up to 11,000

An efficient and cost-effective promotional exercise for our members!
Product Spectrum

More than 2000 products overall from more than 250 manufacturers available
A single consistent solution for all plant sections

PROFIBUS - Plant-Wide Implementation

Upstream Logistics

Mainstream

Downstream Logistics

PROFIBUS Automation Technology
Key Applications

Production automation
- Vehicle manufacture
- Bottling plants
- Warehousing systems
- Switchgear
- Hollow glass production

Process automation
- Chemical industry
- Petrochemical industry
- Paper and textile industry
- Foodstuffs
- Power stations
- Sewage plants

Drive technology
- Machine tools
- Packaging machines
- Pressing plants
- Paper production

Safety applications
- Vehicle assembly
- Machine tool building

1 million PROFIBUS systems implemented
For factory automation PROFIBUS is the undisputed No. 1 fieldbus technology worldwide.

Our strengths are:

- the large number of existing application profiles
- the leading position for safety applications
- proven and accepted solutions for drives and Motion Control applications
PROFIBUS for Process Automation

Process Automation is not a monolithic application. It is subdivided in discrete and continuous/batch applications:

- for discrete applications, the same fieldbusses can be used as we use for factory automation applications.

- only the continuous or batch applications segment requires a specific feature to connect process instrumentation devices (2-wire, bus powered transmission with or without intrinsic safety).

- FF H1 and PROFIBUS PA both offer an identical transmission interface for these applications, based on IEC 61158-2.
PROFIBUS for Process Automation

PROFIBUS is in an equivalent position with FF for process instrumentation devices

- FF is the leader in North America
- PROFIBUS PA is dominant in Europe
- In Asia both systems have similar market shares

The strengths of PROFIBUS are

- the technical fit for hybrid applications (primary and secondary processes as well as upstream and downstream)
- the high numbers of plants for low-end and mid-range applications like Water/Waste Water Treatment, Food & Beverage, Chemicals, Pharmaceuticals
Market Positioning

PROFIBUS is the universal solution for the entire spectrum of industrial automation.

- **Production**
  - **High Functionality**
    - DN=DeviceNet
    - CN=ControlNet
  - **Low Functionality**
    - AS-I=AS-Interface

- **Application**
  - **High Functionality**
    - IB-S=Interbus
    - FF=Foundation Fieldbus
  - **Low Functionality**
    - PROFIBUS

- **Process**
  - **High Functionality**
    - FF=Foundation Fieldbus
  - **Low Functionality**
    - AS-I=AS-Interface

DN=DeviceNet, CN=ControlNet, FF=Foundation Fieldbus, IB-S=Interbus, AS-I=AS-Interface
Fieldbusses in Process Applications

- **upstream** (inbound):
  - quality assurance (goods received)
  - storage (rolling in)
  - Inventory control
  - ...

- **mainstream** (primary/secondary processes):
  - Refinery
  - Oil & Gas
  - Chemicals
  - Water & Waste Recycling
  - Pharmaceutical
  - Cosmetics
  - Food & Beverage
  - Energy
  - Mining & Metal
  - Pulp & Paper
  - Electronics, Wafer Fab

- **downstream** (outbound):
  - quality assurance (goods issued)
  - storage (rolling out)
  - weighing, dosing, counting
  - filling, packaging
  - ...

**Fieldbusses in Process Applications**

- IEC 61158-2/ MBP-IS (PROFIBUS PA, FF H1)
- RS 485 (PROFIBUS, DeviceNet, …)
Market potentials for Fieldbus Systems

**FA**
Factory Automation Market

- RS 485 (PROFIBUS DP, Device Net, CC-Link, ...)
- e.g. hard-wired
- 60 - 65%

**PA**
Process Automation Market

- RS 485 (PROFIBUS DP, Device Net, CC-Link, ...)
- PROFIBUS PA, FF H1
- HART, 4...20 mA
- 78-80%
- 15%
- 5–7%
Regional Market Leader of Fieldbus Systems

- America
  - DeviceNet
  - PROFIBUS
  - CC-Link
  - FF
- Europe
  - RS 485
  - IEC 61158-2
  - Hart, 4…20 mA
- Asia
  - DeviceNet
  - PROFIBUS
  - CC-Link
  - FF

PROFIBUS
Standard & Technology
Application Profiles
Integration Technology
PROFINET
References
Installed Fieldbus nodes

- PROFIBUS, total
- PROFIBUS PA
- Fieldbus Foundation H1
- Interbus, total
- CC-Link, total
- DeviceNet, total
- DeviceNet, only Rockwell Automation

- Installed Fieldbus nodes
- PROFIBUS
- Standard & Technology
- Application Profiles
- Integration Technology
- PROFINET
- References

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PROFIBUS Position

PROFIBUS is the leading Fieldbus system with a superior position worldwide

Our strengths are:

- the fit for factory and process automation → lowest total cost of ownership!
- the international network of regional PROFIBUS organizations → worldwide qualified support!
- the large number of available PROFIBUS products and services → complete offering of different products!
- the large number of member companies → the freedom to select the right supplier!
Situation PROFIBUS

PROFIBUS as the leading Fieldbus system is the driver for the automation and communication technology and is the best practice for

- Drives and Motion Control applications
- Safety applications
- Engineering

Within the next 4 years we will double the installed PROFIBUS nodes to 20 Million!
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With wide range of application
- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology
- Transmission Technology
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  - DPV0, DPV1, DPV2

Application Profiles
- Interoperability and Interchangeability
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- HART on PROFIBUS
- PROFIdrive
- Process Application

Integration Technology
- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

References
Guaranteed Investment Protection

PROFIBUS provides investment protection

A single communications protocol for all applications
Standardized in IEC 61158 / IEC 61784

Innovations together with users
Fully compatible with existing technology
Binding specifications

Tried and tested technology through 10 million devices installed worldwide
PROFIBUS is a modular system
- The modules are arranged according to functions
- An application is implemented using a combination of modules
Transmission Technology

Specific application profiles

General application profiles

Communication technology (protocol)

Transmission technology

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PROFIBUS

Standard & Technology

Application Profiles

Integration Technology

PROFINET

References
Transmission Technology in the Production and Process Industry

Fiber-optic cable

Building 1

RS 485
Link Module
Link Module

Electrical isolation

EMC

Distance

Building 2

RS 485
Link Module
Link Module

RS 485

RS485

Production

Process

RS485

MBP

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Standard & Technology
Application Profiles
Integration Technology
PROFINET
References

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PROFIBUS International 2004.ppt
Transmission Technology RS-485/ RS-485-IS

<table>
<thead>
<tr>
<th>Transmission Rate [kBits/s]</th>
<th>RS-485 [m]</th>
<th>RS-485-IS [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.6; 19.2; 45.45; 93.75</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td>187.5</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>500</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>1500</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>3,000; 6,000; 12,000</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The values refer to cable type A with the following properties:
- Impedance: 135 to 165 Ω
- Capacity: ≤ 30 pF/m
- Loop resistance: ≤ 110 Ω/km
- Wire diameter: > 0.64 mm
- Core cross-section: > 0.34 mm²
Transmission Technology MBP/ MBP-IS

**MBP / MBP-IS**
2-wire cable with bus feeding and explosion-proof

<table>
<thead>
<tr>
<th></th>
<th>MBP</th>
<th>MBP-IS FISCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Rate [kBits/s]</td>
<td>31.25</td>
<td>31.25</td>
</tr>
<tr>
<td>Max. distance including stub lines</td>
<td>1900 m</td>
<td>1000 m</td>
</tr>
<tr>
<td>Max. numbers of devices</td>
<td>32</td>
<td>10</td>
</tr>
<tr>
<td>Max spur length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - 12</td>
<td>120 m</td>
<td>90 m</td>
</tr>
<tr>
<td>13 - 14</td>
<td>90 m</td>
<td>30 m</td>
</tr>
<tr>
<td>15 - 18</td>
<td>60 m</td>
<td></td>
</tr>
<tr>
<td>19 - 24</td>
<td>30 m</td>
<td></td>
</tr>
<tr>
<td>25 - 32</td>
<td>0 m</td>
<td></td>
</tr>
</tbody>
</table>

The values refer to cable type A with the following properties:
- Loop resistance: $44 \Omega/km$
- Core cross-section: $< 0.8 \text{ mm}^2$
- $R'$: 15 to 150 $\Omega/km$
- $L'$: 0.4 to 1 mH/km
- $C'$: 80 to 200 nF/km
Transmission Technology FOC

FOC
Fiber-optic cable
(EMC protection, long distances)

<table>
<thead>
<tr>
<th>Fiber Type</th>
<th>Core diameter [µm]</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimode glass fiber</td>
<td>62.5/125</td>
<td>2-3 km</td>
</tr>
<tr>
<td>Singlemode glass fiber</td>
<td>9/125</td>
<td>&gt;15 km</td>
</tr>
<tr>
<td>Plastic fiber</td>
<td>980/1000</td>
<td>&lt; 80 m</td>
</tr>
<tr>
<td>HCS® fiber</td>
<td>200/230</td>
<td>&lt; 500 m</td>
</tr>
</tbody>
</table>
# Transmission Technology Summary

<table>
<thead>
<tr>
<th></th>
<th>MBP</th>
<th>RS485</th>
<th>RS485-IS</th>
<th>Fiber Optic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data transmission</strong></td>
<td>Digital, bit-synchronous, Manchester encoding</td>
<td>Digital, differential signals according to RS485, NRZ</td>
<td>Digital, differential signals according to RS485, NRZ</td>
<td>Optical, digital, NRZ</td>
</tr>
<tr>
<td><strong>Transmission rate</strong></td>
<td>31.25 KBit/s</td>
<td>9.6 to 12,000 KBit/s</td>
<td>9.6 to 1,500 KBit/s</td>
<td>9.6 to 12,000 KBit/s</td>
</tr>
<tr>
<td><strong>Data security</strong></td>
<td>Preamble, error-protected, start/end delimiter</td>
<td>HD=4, Parity bit, start/end delimiter</td>
<td>HD=4, Parity bit, start/end delimiter</td>
<td>HD=4, Parity bit, start/end delimiter</td>
</tr>
<tr>
<td><strong>Cable</strong></td>
<td>Shielded, twisted pair copper</td>
<td>Shielded, twisted pair copper, cable type A</td>
<td>Shielded, twisted 4-wire, cable type A</td>
<td>Multimode glass fiber, singlemode glass fiber, PCF, plastic</td>
</tr>
<tr>
<td><strong>Remote feeding</strong></td>
<td>Optional available over signal wire</td>
<td>Available over additional wire</td>
<td>Available over additional wire</td>
<td>Available over hybrid line</td>
</tr>
<tr>
<td><strong>Protection type</strong></td>
<td>Intrinsic safety (EEx ia/ib)</td>
<td>None</td>
<td>Intrinsic safety (EEx ib)</td>
<td>None</td>
</tr>
<tr>
<td><strong>Topology</strong></td>
<td>Line and tree topology with termination; also in combination</td>
<td>Line topology with termination</td>
<td>Line topology with termination</td>
<td>Star and ring topology typical; line topology possible</td>
</tr>
<tr>
<td><strong>Number of stations</strong></td>
<td>Up to 32 stations per segment; total sum of max. 126 per network</td>
<td>Up to 32 stations per segment without repeater; up to 126 stations with repeater</td>
<td>Up to 32 stations per segment; up to 126 stations with repeater</td>
<td>Up to 128 stations per network</td>
</tr>
<tr>
<td><strong>Number of repeaters</strong></td>
<td>Max. 4 repeater</td>
<td>Max. 9 repeater with signal refreshing</td>
<td>Max. 9 repeater with signal refreshing</td>
<td>Unlimited with signal refreshing (time delay)</td>
</tr>
</tbody>
</table>
Communication Technology

Specific application profiles

General application profiles

Communication technology (protocol)

Transmission technology

RPA S.E.A. Press Tour 2004

PROFIBUS Standard & Technology

Application Profiles

Integration Technology

PROFINET

References
Communication Technology

PROFIBUS uses the master/slave procedure

Active station, master device

PROFIBUS DP protocol

Polling of passive stations (slave devices)
Each PROFIBUS system has at least one master
A maximum of 127 devices (masters + slaves) are permitted in a single system
Several masters can be integrated
Each Slave support up to 244 bytes of In/ Output and diagnostic data
Communication Technology

Token procedure for multimaster operation

Logical token ring between master devices

Active stations, master devices

PLC → PC → DCS

PROFIBUS DP protocol

Polling of passive stations (slave devices)
The PROFIBUS DP communications protocol
Graded functional scope

PROFIBUS DP

Data Exchange Broadcast
- Isochronous Mode
- Clock Synchronization, Time Stamps
- HART on DP
- Redundancy

Acyclic Data Exchange
- Engineering (EDD, FDT)
- Fail-Safe Communication
- Alarms

Cyclic Data Exchange
- DDBF, Configuration and Diagnosis
## Overview PROFIBUS Technology

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.45 – 19.00</td>
<td>Welcome</td>
<td>Mr. Jacky Chan – GM Siemens Pte Ltd – A&amp;D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. TJ Kang – President ICS &amp; MD Cegelec Pte Ltd</td>
</tr>
<tr>
<td>19.00 – 19.45</td>
<td>PROFIBUS Organization</td>
<td>Mr. Andreas Agostin – PM Pepperl+Fuchs Pte Ltd</td>
</tr>
<tr>
<td>19.45 – 20.00</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>20.00 – 20.45</td>
<td>Application Profiles</td>
<td>Mr. Richard Jennens – PM Endress+Hauser S.E.A. Pte Ltd</td>
</tr>
<tr>
<td>20.45 – 21.15</td>
<td>PROFINET</td>
<td>Mr. Volker Schulz – MM Siemens Pte Ltd – A&amp;D</td>
</tr>
<tr>
<td>21.15 – 21.30</td>
<td>Q&amp;A Lucky Draw</td>
<td></td>
</tr>
</tbody>
</table>
Speaker – Richard Jennens

Technological Knowledge
- In-depth knowledge about PROFIBUS due to 10 years of experience in Endress+Hauser S.E.A. for Project Engineering and Product Management
- 2 years as Product Manager – Digital Communications
- Certified PROFIBUS PA Engineer (2004)

Society experience
- Member of PROFIBUS Singapore Organization since 2001
- Member of Technical Committee RPA S.E.A.

Education Background
- M.Sc. Biochemical Engineering University College London, UK
- B.Sc. Hons Biochemistry and Genetics, University of Nottingham, UK

Public Relations
- Over 50 seminars in Singapore, Malaysia, Thailand, Philippines and Indonesia
- Seminars at MWA, AW and many other societies and organizations
- Numerous publications for marketing and promotion
Overview PROFIBUS Technology

History, organization, market position
With wide range of application
➢ Production Automation
➢ Process Automation
➢ Drive Technology
➢ Safety Application

Standard & Technology
➢ Transmission Technology
➢ RS-485, RS-485-IS, MBP, MBP-IS, FOC
➢ Communication Technology
  ➢ DPV0, DPV1, DPV2

Application Profiles
➢ Interoperability and Interchangeability
➢ PROFIsafe
➢ HART on PROFIBUS
➢ PROFIdrive
➢ Process Application

Integration Technology
➢ GSD
➢ EDD
➢ FDT/ DTM
➢ Diagnostic

PROFINET

References
General application profiles

Specific application profiles

Communication technology (protocol)

Transmission technology

PROFINET

Integration technologies

Application Profiles

Integration Technology

PROFINET

References

PROFIBUS

Standard & Technology

RPA S.E.A. Press Tour 2004
What Distinguishes a Profile?

Brand x
100W E27
changeable at any time

Brand y
100W E27
A profile enables the application-orientated interaction of devices of different manufacturers on PROFIBUS

**PROFIBUS Profiles**

- are vendor-independent specifications on homogeneous device behavior
- are documented in PROFIBUS guidelines
- can be optionally used

**PROFIBUS profiles describe**

- device classes, e.g. drives
- operating modes, e.g. redundancy
- application-specific requirements, e.g. process engineering

Devices developed according to profiles are

- interoperable at application level
- interchangeable
Interoperability Due to Profiles

Vendor-independent device interchanging

Similarly executed functions and parameters in all devices
General Application Profiles

Specific application profiles

- PROFIsafe
  Communication behavior of failsafe devices with safety controls

- Time Stamp
  Accurately timed allocation when recording time-dependent processes

- Redundancy
  Redundancy mechanism for slave devices

- HART on PROFIBUS
  Integration of HART devices in PROFIBUS systems

PROFIBUS DP communications protocol

Transmission technology
Key features of PROFIsafe

- Standard and failsafe functions over a single cable
- Cost cutting - no need for special bus; only one engineering environment
- One training course, one documentation, ...
- Certified to SIL 3, AK6 and CAT 4 to EN954-1
- Based on IEC 61508 and IEC 61511
Specific Application Profiles

- Specific application profiles
- General application profiles
- Communication technology (protocol)
- Transmission technology

Integration technologies

PROFIBUS

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PROFIBUS
Standard & Technology
Application Profiles
Integration Technology
PROFINET
References

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Specific Application Profiles

- **Production automation**
  - **PROFIdrive**
    - Device behavior and access procedure to data for variable-speed electric drives

- **Process automation**
  - **PA Devices**
    - Properties and behavior of devices in process engineering

- **General application profiles**
  - Ident, Semi, RIO, Weighing, ...
  - overall 12 different profiles

- **PROFINET**

- **PROFIBUS DP communications protocol**

- **Transmission technology**
Key features of the “PROFIdrive” profile

- Exact synchronization of different drives
- Standard and drive functions over a single cable
- Cost cutting - no need for special bus
- Only one engineering environment, one training course, one documentation, ...
- Suitable for (e.g.) wiring-, fiber spin and packaging machines
Motion Control with PROFIdrive (2)

PROFIdrive application profile (Version 3.1)
- Interoperability of drive technology products of different manufacturers in automated systems
- 6 application classes, from standard drives through to direct communication of distributed intelligent drives
- Special specifications also enable use in process engineering

PROFIBUS DP communications protocol (rating class V2)
- Clock synchronization for highly dynamic distribution of signals
- Lateral communication for direct communication between intelligent servo drives without activating the control system
- Acyclic parameter access during process for e.g. diagnostics

Key applications of Motion Control
The vendor-independent, consistent automation solution for drive technology with a single bus system for all tasks
- Savings on hardware, assembly, wiring and engineering
- Independent of manufacturer; investment protection
PROFIBUS and Motion Control

Production automation with variable-speed electric drives

PROFIdrive
"PA Devices" for Process Automation (1)

Key features of "PA Device" profile

- Interoperability; vendor-independent interchangeability of devices
- Process and "discrete" tasks over a single bus
- Cost cutting - no need for connection technology
- Only one engineering environment
- High plant availability through on-line diagnostics
- Wide product range
“PA Devices” for Process Automation (2)

PA Device application profile (Version 3.0)
- Interoperability of process devices of different manufacturers taking all device classes into account
- Standardized specification of functional steps from the sensor signal through to preprocessed process value

MBP-IS, MBP or RS485, RS-485-IS interface
- With 2-wire bus feeding (MBP), or without bus feeding (RS485)
- With intrinsic safety (MBP-IS), or without intrinsic safety (MBP, RS485)

PROFIBUS DP communications protocol (rating class V1)
- Access to devices during operation for parameterization, diagnostics and maintenance

Key features of PROFIBUS PA
Consistent solution for process automation, including operation in potentially explosive areas
- Cost cutting over all stages of a plant life cycle
- High plant availability through diagnostics and preventative maintenance
- Key contributions to asset management
Process automation devices for process engineering
Overview PROFIBUS Technology

History, organization, market position
With wide range of application
- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology
- Transmission Technology
  - RS-485, RS-485-IS, MBP, MBP-IS, FOC
- Communication Technology
  - DPV0, DPV1, DPV2

Application Profiles
- Interoperability and Interchangeability
- PROFIsafe
- HART on PROFIBUS
- PROFIdrive
- Process Application

Integration Technology
- GSD
- EDD
- FDT/ DTM
- Diagnostic

PROFINET

References
Integration Technologies

Two aims for device integration

Device integration in the master
- “What does the installation look like?”

Device integration in the engineering or maintenance system
- “How are the field devices set?”
- “What information is available for asset management?”
Device Integration in the Master

Device integration - What must the master know?

- Which devices are connected?
- What functionality does the devices have?
Device Integration in the Engineering System

Device integration – does the system engineering/maintenance have access to all parameters?

➢ Process information
➢ Maintenance and asset information

<table>
<thead>
<tr>
<th>Entry</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2380</td>
<td>Reset</td>
</tr>
<tr>
<td>e.g. mbar</td>
<td>Pressure unit</td>
</tr>
<tr>
<td>e.g. 0</td>
<td>Pressure for &quot;empty&quot;</td>
</tr>
<tr>
<td>e.g. 200</td>
<td>Pressure for &quot;full&quot;</td>
</tr>
<tr>
<td>&quot;horizontal cylinder&quot;</td>
<td>Operating mode</td>
</tr>
<tr>
<td>e.g. 0</td>
<td>Level for &quot;empty&quot;</td>
</tr>
<tr>
<td>e.g. 200</td>
<td>Level for &quot;full&quot;</td>
</tr>
<tr>
<td>e.g. hl</td>
<td>Level units</td>
</tr>
<tr>
<td>e.g. 300 hl</td>
<td>Level</td>
</tr>
</tbody>
</table>
Integration Technologies

PROFIBUS innovated device integration

Advantages for users
- Access to all devices and information from a single location
- Access to all devices using a uniform method
- Uniform data management with description of all assets

Conventional plant
- Specific operator tools
- No central device access
- No data consistency

PROFIBUS plant
- Standardization
- Data consistency
- Central access

Innovations through PROFIBUS
PROFIBUS offers three application-orientated graded technologies for device integration:

- **GSD technology**
  - Mandatory basic description for each PROFIBUS device
  - Integration in the master and exchange of measured values and manipulated variables

- **EDD technology**

- **FDT/DTM technology**

**GSD**

- Mandatory basic description for each PROFIBUS device
- Integration in the master and exchange of measured values and manipulated variables

**EDD and FDT/DTM**

- Used in addition to GSD (optional)
- Exchange of additional information with the master for e.g. diagnostics or asset management
Device Data Base File (GSD)

The GSD

- is an electronic data sheet made available by the device manufacturer
- is a *simple* text description of device properties for PROFIBUS communications
- is the basic description of a PROFIBUS device for its cyclic communications
- is used and interpreted in the network configuration tool of the engineering system

The GSD on its own is sufficient for device integration for the exchange of measured values and manipulated variables between field device and automation system.
Electronic Device Description (EDD)

The EDD

- is a text device description using a special language (EDDL) and is used parallel to GSD
- describes the *acyclic* communicated (application-orientated) functionalities, including graphical options
- is independent of the operating system of the engineering system
- is made available by device manufacturer
- is the basis for processing and presentation through an EDD interpreter

Preferably used for

- devices with standardized functionality
- a user interface with a uniform look and feel independent of device family and manufacturer
DTM (Device Type Manager)

The DTM

- is a device operating program in the form of a *software component* and is used parallel to the GSD
- has the standard interface FDT (Field Device Tool) to a frame application
- can run in all FDT frame applications (engineering tools) - like printer drivers
- is device-specifically programmed by the device manufacturer and forms a unit of responsibility with the device
- offers a device-specific user interface

**Preferably used for**

- utilization of specific device properties through individual program planning
- an individual and device-specific user interface
- routing through different networks using Com DTM
FDT (Field Device Tool) Interface

FDT

- is a vendor-independent, open interface specification (not a "tool")
- serves as the interface for the open connection of field devices of different manufacturers to tools and control systems using DTM
- defines the interaction between the DTMs and an FDT frame application in the engineering system

FDT (Field Device Tool) Interface
FDT (Field Device Tool) Interface

Field Device Tool (FDT)

- Open standardized technology independent of device or system supplier
- Independent of device type sensor, actuator, remote I/O, drives, etc.
- Full support of installed base
- Full device functionality
- Independent of communication protocol Ethernet, HART, PROFIBUS, Foundation Fieldbus (pending), etc.
- Vertical integration by nested communication
FDT/DTM – How it Works

Network topology built up with DTMs

CommDTM 1
CommDTM 2
CommDTM 3
DTM 4
DTM 5
DTM 6
DTM 7
FDT/DTM – HART via Profibus

- The same device, the same DeviceDTM
- Different infrastructures

FieldCare with Device DTMs
+ ComDTM for Profibus Card
+ ComDTM for Remote I/O
FDT/DTM – HART via Profibus via Ethernet

- The same device, the same DeviceDTM
- Different infrastructures

FieldCare with Device DTMs
+ ComDTM for Ethernet Card
+ ComDTM for Gateway
+ ComDTM for Remote I/O
FDT (Field Device Tool) Interface

Field Device Tool (FDT)
• The specifications and the direction of FDT/DTM are guided by the FDT Joint Interest Group which includes a broad range of companies:
PROFIBUS Diagnostic - Standard Device

**Diagnosis data (diagnosis messages) max. 244 bytes**

- Unconfirmed status messages, which report the current status of a slave. Each change prompts an update.

**Standard diagnosis data, 6 byte**
- State of cyclic connection

**User-specific diagnosis data**
- Messages of different content

**Channel-related**
- Identifier (module)-related
- Device related
  - Alarms
  - Status messages

Alarms for process, update, status, pulling/plugging of a module, ...
Status messages for preventative maintenance, evaluation of trends, ...
PROFIBUS Status Signal

Every PROFIBUS PA device transmits its process value in a floating point format conform to IEEE 754 with 4 Byte and an additional status byte.

<table>
<thead>
<tr>
<th>Process Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 1</td>
</tr>
<tr>
<td>Byte 2</td>
</tr>
<tr>
<td>Byte 3</td>
</tr>
<tr>
<td>Byte 4</td>
</tr>
</tbody>
</table>

- **process value range**
- conform IEEE 754
- decimal: ~ ± 10^{38.53}
- binary: ± (2^{-23})^{127}

<table>
<thead>
<tr>
<th>Status Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 2^7</td>
</tr>
<tr>
<td>Bit 2^6</td>
</tr>
<tr>
<td>Bit 2^5</td>
</tr>
<tr>
<td>Bit 2^4</td>
</tr>
<tr>
<td>Bit 2^3</td>
</tr>
<tr>
<td>Bit 2^2</td>
</tr>
<tr>
<td>Bit 2^1</td>
</tr>
<tr>
<td>Bit 2^0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>quality</td>
</tr>
<tr>
<td>quality + sub-status</td>
</tr>
<tr>
<td>limits</td>
</tr>
</tbody>
</table>

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## PROFIBUS Status Signal

### Status Signal (Byte 5)

<table>
<thead>
<tr>
<th>Bit 2⁷</th>
<th>Bit 2⁶</th>
<th>Bit 2⁵</th>
<th>Bit 2⁴</th>
<th>Bit 2³</th>
<th>Bit 2²</th>
<th>Bit 2¹</th>
<th>Bit 2⁰</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>quality</strong></td>
<td><strong>quality + sub-status</strong></td>
<td><strong>limits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**00 = BAD**
- Value can’t be used

- 0010 = Device Failure
- 0100 = Sensor Failure
- 0101 = No-Communication

**01 = Uncertain**
- Value is still utilisable

- 0001 = Last Usable Value
- 0100 = Sensor Conversion Not Accurate

**10 = Good**
- Value is good

- 0000 = OK
- 0010 = Active Advisory Alarm
- 0011 = Active Critical Alarm

**00 = Not Limit**
- No limit

- 01 = Low Limit
- 10 = Active Critical Alarm
- 11 = constant

- High limit

- Constant (process value independent)
PROFIBUS Status Signal

- Process value
- High alarm limit
- High warning limit
- Low warning limit
- Low alarm limit

Status values:
- $2^7 \ldots 2^0$
- $80_{H} 10000000$
- $8A_{H} 10001010$
- $8E_{H} 10001110$
- $8A_{H} 10001010$
- $89_{H} 10001101$
- $8D_{H} 10001011$
- $89_{H} 10001001$
- $80_{H} 10001000$
Plant-Wide Data Consistency

Information and data are continuously needed in a plant from the field devices

- at different times in the life cycle of the plant
- for the execution of different tasks (engineering, operation, asset management)

This requires

- Plant-wide data consistency
- Access to integration tools on this data management system

The integration tools of PROFIBUS fulfill these requirements
The modules in their entirety make PROFIBUS automation technology
Typical designations have become standard on the market for specific module combinations

<table>
<thead>
<tr>
<th>Typical designation</th>
<th>PROFIBUS PA</th>
<th>PROFIBUS DP</th>
<th>PROFINET</th>
<th>Motion Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Profile PA Devices</td>
<td>Profile None or e.g. Ident</td>
<td>Profile PROFINET</td>
<td>Profile PROFINET</td>
</tr>
<tr>
<td>Communication</td>
<td>DP-protocol</td>
<td>DP-protocol</td>
<td>DP-protocol</td>
<td>DP-protocol</td>
</tr>
<tr>
<td>Transmission technology</td>
<td>MBP-IS</td>
<td>RS485</td>
<td>RS485 MBP-IS</td>
<td>RS485</td>
</tr>
</tbody>
</table>
Overview PROFIBUS Technology

Welcome 18.45 – 19.00
- Mr. Jacky Chan – GM Siemens Pte Ltd – A&D
- Mr. TJ Kang – President ICS & MD Cegelec Pte Ltd

PROFIBUS Organization 19.00 – 19.45
- Mr. Andreas Agostin – PM Pepperl+Fuchs Pte Ltd

Break 19.45 – 20.00

Application Profiles 20.00 – 20.45
- Mr. Richard Jennens – PM Endress+Hauser S.E.A. Pte Ltd

Integration Technology 20.45 – 21.15
- Mr. Volker Schulz – MM Siemens Pte Ltd – A&D

PROFINET

References 21.15 – 21.30
- Mr. Volker Schulz – MM Siemens Pte Ltd – A&D

Q&A Lucky Draw 21.15 – 21.30
Speaker – Volker Schulz

**Technological Knowledge**
- In-depth knowledge about PROFIBUS due to 2 years of experience in G.E.P. Instruments in Thailand
- 6 ½ years with Endress+Hauser S.E.A. - Business Development Manager for Fieldbus and Solutions
- Technical Marketing Manager – PROFIBUS Siemens Pte Ltd
- Certified PROFITech Engineer (2003)
- Member of PCC Singapore

**Society experience**
- Founding Member of PROFIBUS Singapore Organization 1998
- Secretary of RPA S.E.A. since 2001
- Member of RPA S.E.A. Technical Committee
- Member of FF Marketing Society Singapore 1999 - 2002
- Vice President ISA Chapter Singapore (i.F.)

**Public Relations**
- Over 50 Fieldbus seminars in Vietnam, Singapore, Malaysia, Thailand, Philippines and Indonesia
- Seminars at ICS, CIA and many other societies and organizations
- Numerous publications for marketing and promotion
Overview PROFIBUS Technology

History, organization, market position
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  - Safety Application

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  - HART on PROFIBUS
  - PROFIdrive
  - Process Application

Integration Technology
  - GSD
  - EDD
  - FDT/DTM
  - Diagnostic

PROFINET

References
Quo Vadis Automation

Office communication
factory automation
move together

Does Ethernet replace fieldbusses?

Industrial IT:
future for production

The network acts as control unit

Is Microsoft Windows running stable for automation?
Why Ethernet in automation?

- Ethernet is already the office world standard
- Ethernet is already used for higher level communications in the automation world
- Ethernet may also be used for communication between controllers and field devices
- IT functionality could also be applicable to automation applications

**Advantage:**
- Vertical integration of field communications with Manufacturing Execution Systems (MES)

**Challenge:**
- Protect existing PROFIBUS investment
- Bring real time functionality to Ethernet
Mega Trends in Automation

Trend I: Control Systems

Trend II: Automation Structures
Mega Trends in Automation

Trend III: IT technologies and automation grow together

- Consistent communication for vertical integration
- Data access from the corporate management level (ERP) through to field level

Trend IV: Use of open standards in automation

- Fieldbus PROFIBUS
- Ethernet TCP/IP, UDP
- OPC, XML, COM/DCOM, ActiveX
- Object Oriented Design
- MS Office Applications

The Meea Trends are the Basis for PROFINET
Fieldbus technology defines the interface for data exchange, but no interface for engineering is defined.

No data and engineering interface at different bus systems available.
PROFIBUS and PROFINET are two complementary parts of PROFIBUS International automation technology.
How PROFINET Acts

- Mechanical
- Electrical/Electronics
- Logic/Software

Object Model for a PROFINET Component

Filling:
- Reset
- Run
- Clock
- End
- Ready
- Start
- Start
- Error
Generation and Interconnection of Components

Vendor Specific Programming and Configuration Tools

Vendor A
Vendor B
Vendor C

XML-File

PROFINET Connection Editor

Vendor Specific
Programming and
Configuration Tools

Vendor A
Vendor B
Vendor C

Componer Interface
Componer Interface
Componer Interface

PROFINET
Connection Editor

XML-File

PROFINET
Connection Editor

Vendor Specific
Programming and
Configuration Tools

Vendor A
Vendor B
Vendor C

Componer Interface
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Componer Interface

PROFINET
Connection Editor

XML-File

PROFINET
Connection Editor

Vendor Specific
Programming and
Configuration Tools

Vendor A
Vendor B
Vendor C

Componer Interface
Componer Interface
Componer Interface

PROFINET
Connection Editor

XML-File
The PROFINET Engineering: vendor independent, centralized, plant wide

PROFINET Connection Editor

Vendor specific

Vendor independent

Vendor specific

Vendor specific

Vendor B

Vendor A

Vendor C
How does PROFINET work

1. Open TCP/IP channel
   - Device parameterization
   - Reading of diagnostics data
   - Loading of interconnections
   - Negotiation of the communication channel for user data

2. Real-time channel RT
   - High-performance transfer
   - Cyclic data
   - Event-controlled signals

3. Real-time channel IRT
   - High-performance transfer
   - Data in isochronous mode
   - Jitter <1µsec
Real-time Ethernet in isochronous mode

Motion Control applications use separate time domains in one cycle for real-time and non-real-time data.

E.g. 1 ms position control cycle

- Synchronization
- Deterministic communication
- Open communication

IRT channel
Open channel (TCP/IP)
IRT channel
Open channel (TCP/IP)
Cycle 1
Cycle 2
Cycle n

TCP/IP data
IRT data
Real-time requirements for Automation

- Coexistent use of real-time and IT communication on one line
- Uniform real-time protocol for all requirements
- Scalable real-time communication from high-performance to isochronous
### Performance parameters IRT functionality

<table>
<thead>
<tr>
<th></th>
<th>Cycle time</th>
<th>Jitter</th>
<th>Number of nodes</th>
<th>Simultaneously transferable TCP/IP data *)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 msec</td>
<td>&lt;1µsec</td>
<td>70</td>
<td>9 MB/sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>150</td>
<td>6 MB/sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35</td>
<td>6 MB/sec</td>
</tr>
</tbody>
</table>

*) Standard length of the TCP/IP data packets from 64 to 1536 bytes

Max. data transmission rate on Fast Ethernet: 12 MB/sec
How does PROFINET compare?

<table>
<thead>
<tr>
<th></th>
<th>Ethernet/IP</th>
<th>FF HSE</th>
<th>Modbus TCP</th>
<th>PROFINET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit for Factory Automation*</td>
<td>✓</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fit for Process Automation</td>
<td>-</td>
<td>(✓)</td>
<td>-</td>
<td>(✓)</td>
</tr>
<tr>
<td>Fit for Motion Control</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
<tr>
<td>Integration of different Fieldbus systems</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓</td>
</tr>
</tbody>
</table>

* real-time functionality for cycle times in the range of 5 to 10 msec
The market penetration of Ethernet based systems will take some time due to the fact that Fieldbus systems ...

- are still cheaper
- are well proven
- have users trained to handle the technology

Also ...

- it needs time to adopt the advantages of Ethernet based systems like web technology, etc.
- some technical aspects still need to be solved (e.g. intrinsic safety)
Functionality and development of prices

- PROFIBUS
- Standard & Technology
- Application Profiles
- Integration Technology
- PROFINET
- References

size = functionality

1990 2000 2010

time

€

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Functionality and development of prices

- PROFIBUS
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- Integration Technology
- PROFINET
- References
Total cost of ownership

![Graph showing total cost of ownership for PROFIBUS and PROFINET vs functionality.](image)

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- Application Profiles
- Integration Technology
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Functionality and Milestones

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Migration of PB Applications

under planning

Safety

MC & IRT

under development

IO & RT

Component Model

2002 2003 2004 2005 2006 2007

availability of first products

availability of runtime-SW, specifications or ASIC
Fieldbus commitment to PROFINET

PROFINET

PROFIBUS

Interbus

PROFIBUS

Application Profiles
Integration Technology
References

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International
Success factor for an Ethernet solution

- The market will accept only those Ethernet solutions which are able to integrate existing Fieldbus installations!

- Thanks to open architecture and open standards, PROFINET allows this integration using PROXY technology.

- PROXIES can be developed to integrate PROFIBUS and every other Fieldbus solution!
Overview PROFIBUS Technology

History, organization, market position

With wide range of application

- Production Automation
- Process Automation
- Drive Technology
- Safety Application

Standard & Technology

- Transmission Technology
- RS-485, RS-485-IS, MBP, MBP-IS, FOC
- Communication Technology
  - DPV0, DPV1, DPV2

Application Profiles

- Interoperability and Interchangeability
- PROFIsafe
- HART on PROFIBUS
- PROFINdrive
- Process Application

Integration Technology

- GSD
- EDD
- FDT/ DTM
- Diagnostic

References
User Benefits

Total Cost of Ownership (TCoO)

Total Cost of Ownership

Planning
Engineering
Installation & start-up
Production

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Standard & Technology
Application Profiles
Integration Technology
PROFINET
References

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Faster Planning to Operation

Phases in the life cycle

- Planning
- Engineering
- Installation & IBS
- Production

Savings in the life cycle

- Reduction of time prior to start of production
- Reduction of costs
- Reduction of failure risk
Palleting Plant of a Packaging Machine

Production automation

Palleting plant

Netherlands

Master: 1
Slaves: 40 DP

CSi
Drinking Water Plant

Process automation
Water works
Netherlands

Master: 2
Slaves: 40 DP
Cable: standard + FO

Nuon Water

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Flower Conveyor

Master: 1
Slaves: 22 DP (app 1400 I/O)
Cable: 120 m

Production automation
Conveyor
Netherlands

Bloemenveiling
Flora

Flower Conveyor

Master: 1
Slaves: 22 DP (app 1400 I/O)
Cable: 120 m

Production automation
Conveyor
Netherlands

Bloemenveiling
Flora
PROFIBUS and the environment

Process automation
Sewage plant
Netherlands

Master: 1
Slaves: 36 DP / 15 PA

Rijkswaterstaat
PROFIBUS in Paint Manufacture

Process automation
Paint manufacture
Germany

Master: 2 x 11 (redundant)
Slaves: app 1100

Merck

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PROFIBUS in Chemical Engineering

Process automation
Chemical plant
Germany

Master: 1
Slaves: 4 DP and app 110 PA for 1 reactor
Application profiles: PA-Devices

Master: 1
Slaves: 4 DP and app 110 PA
for 1 reactor
Application profiles: PA-Devices

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Wacker
PROFIBUS is No. 1!
and, “10 Million nodes … and counting”
Why are we No.1?

- 10 Million installed nodes (2 Million in 2003)
- Great engineering solution
- Great configuration and diagnostic software
- Great Production Automation solution
- Great Process Automation solution
- Great Safety solution
- Great Drives + Motion Control solution
- Great organization
- Great Ethernet solution that embraces all the above
RPA S.E.A. – our next events in Singapore

PROFIBUS 30.09.2004
- FuRIOS (Fieldbus Remote I/O Study)
- PROFIBUS Design Standard & Technology
- Sponsored by Pepperl+Fuchs Pte Ltd

PROFIBUS 18.11.2004
- DP/PA integration with Diagnostic
- FDT/DTM Technology
- Sponsored by Endress + Hauser S.E.A. Pte Ltd

PROFIBUS 13.01.2005
- PROFIsafe
- Applications and technology
- Sponsored by Siemens Pte Ltd

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