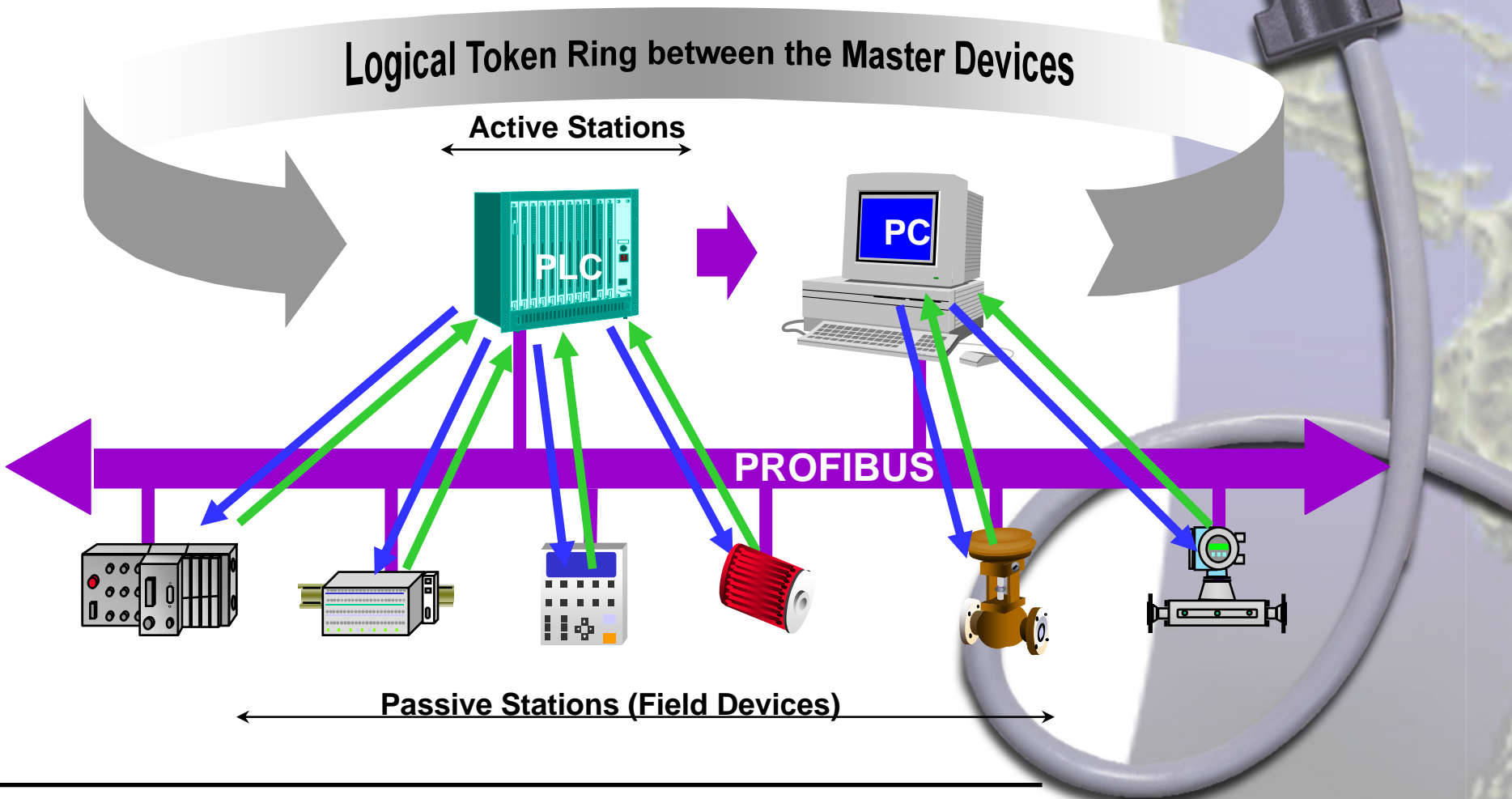
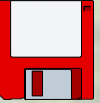
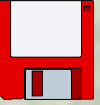


PROFIBUS Basics





PROFIBUS Basics



All PROFIBUS services

- ✓ High Speed Data Exchange
- ✓ Peer to Peer
- ✓ Hazardous Area

can be used together in one network

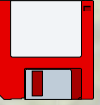
Therefore Communication is Transparent for the User

Same Cable and Components for High Speed Data Exchange and Peer to Peer



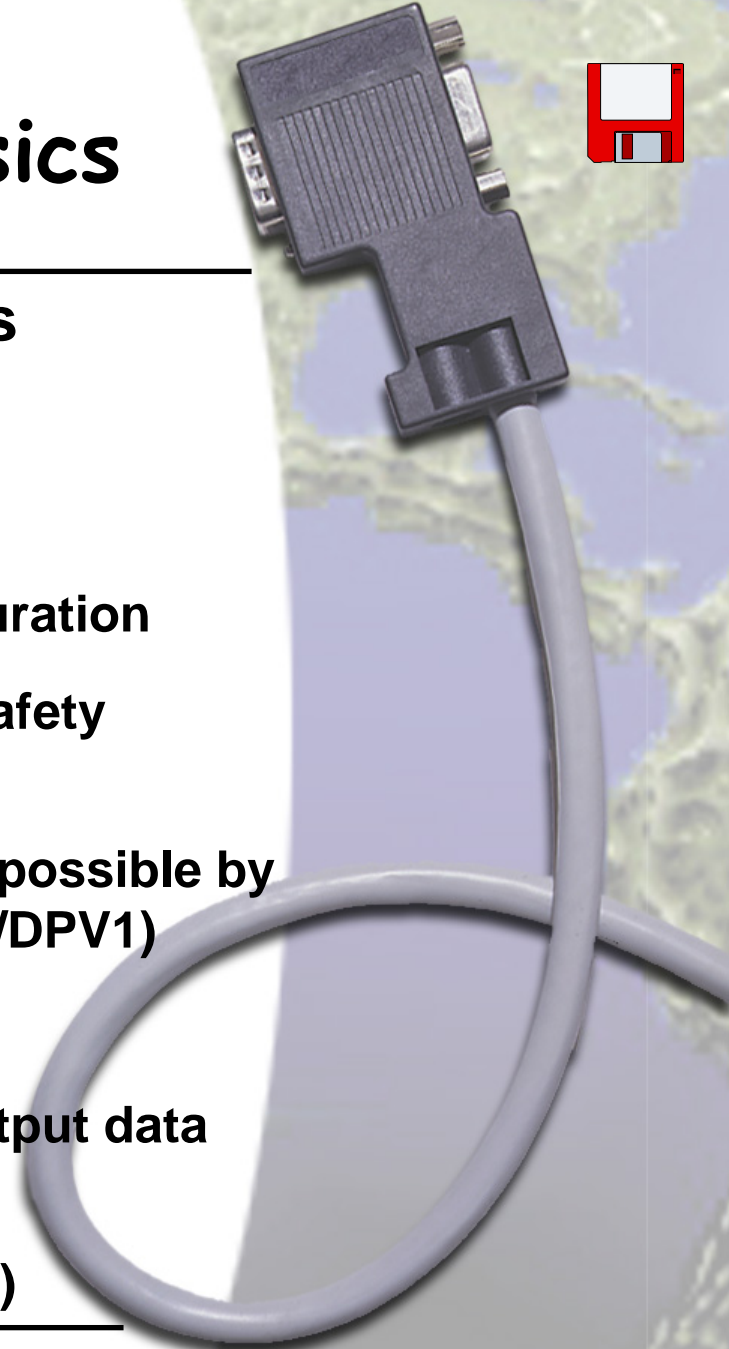


PROFIBUS Basics



❑ High-Speed Data Exchange Features

- ✓ Same priority for all field devices
- ✓ Communication is permanent & cyclic
- ✓ Amount of data specified during configuration
- ✓ Only one master can write to outputs (safety aspect)
- ✓ Acyclic communication to field devices possible by using extended functions (DP Extended/DPV1)
- ✓ Alarm acknowledgment
- ✓ Up to 244 bytes input **AND** 244 bytes output data per field device
- ✓ Fastest fieldbus system (up to 12Mbaud)



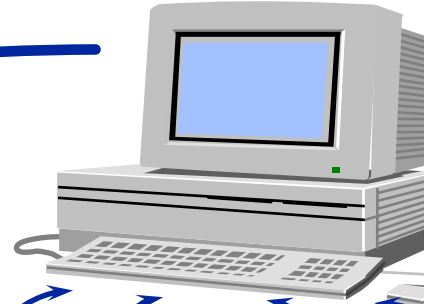
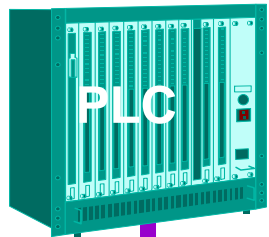
PROFIBUS Basics



❑ Plug & Play With Electronic Device Data Sheets

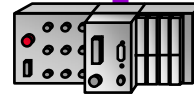
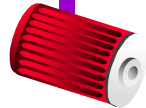
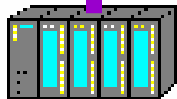
System Configuration

**PROFIBUS
Configuration Tool**

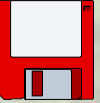


Electronic Device Data Sheets (GSD, GSE, GSF, GSG, GSI, GSP, GSS Files)

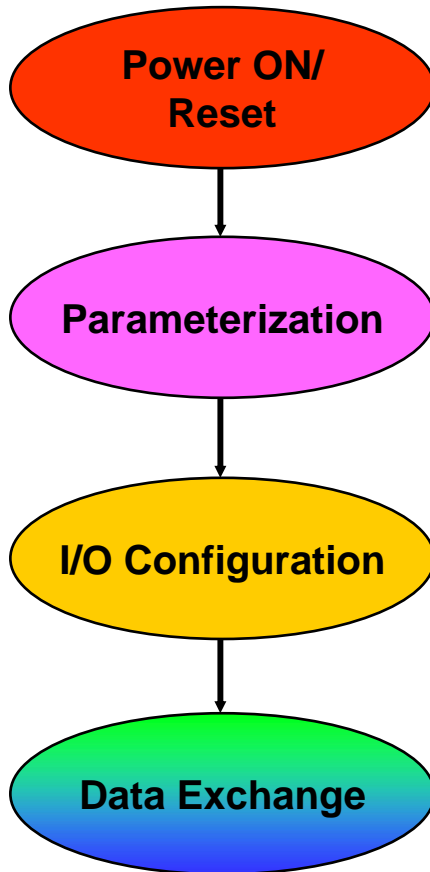
PROFIBUS



PROFIBUS Basics



❑ High-Speed Data Exchange - Startup Sequence

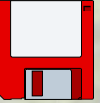


Power ON/Reset of Master or Slave

Download of Parameters into the Field Device (selected during Configuration by the User)

Download of I/O Configuration into the Field Device (selected during Configuration by the User)

Cyclic Data Exchange (I/O Data) and Field Device reports Diagnostics



High-Speed Data Exchange - Parameterization

Parameter Download (up to 244 bytes)



- Features Implemented in Device
- Described in GSD File
- Processed by Configuration Tool
- Selected at Configuration
- Examples:
 - ✓ Enable Channel Diagnostic
 - ✓ Operation Range for Analog Channels (e.g. ±10V or 0..10V)
 - ✓ Fail Safe Behavior (e.g. Hold Last Value)

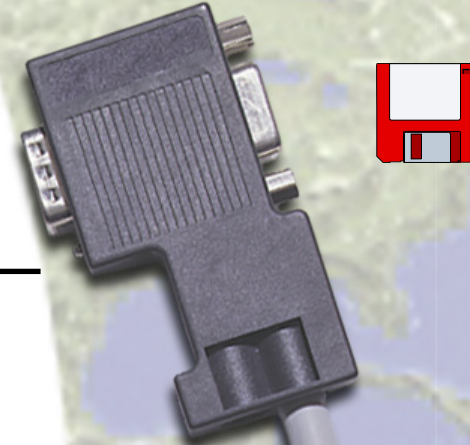


= Parameterization Data



= Confirmation (Data Received)

PROFIBUS Basics



❑ Parameterization (continued)

✓ Parameter selection with Configuration Tool

DP Slave properties

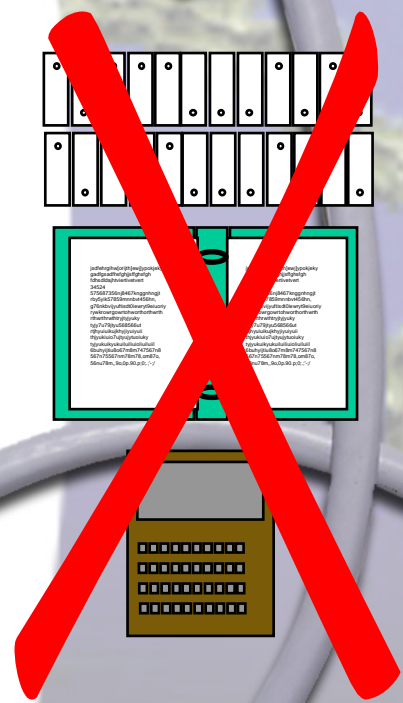
PROFIBUS address: 3
 Station name: DP slave<3>
 Station type: B-4AI-2 DP
 Order number: 6ES7 134-0HF01-0XB0

DP Meas. Type / Meas. Range CH 1

Channel Not Activated
 Voltage +/- 10 V
Voltage +/- 5 V
 Voltage +/- 2.5 V
 Voltage +/- 1.25 V
 Current +/- 20 mA

Parameter value: 22

Parameter name	Value
15.6 Diagnostics Alarm	enable
15.7 Limit Value Alarm	disable
17 Meas. Type / Meas. Range CH 0	Voltage +/- 10 V
18 Meas. Type / Meas. Range CH 1	Voltage +/- 10 V
19 Meas. Type / Meas. Range CH 2	Current 4 ... 20 mA
20 Meas. Type / Meas. Range CH 3	Current 0 ... 20 mA
21 Upper Limit Value CH 0	0
23 Lower Limit Value CH 0	0



**Fewer DIP Switches - NO Handheld - NO Extensive Additional Documentation
 User defines every Function in ONE Tool.**

PROFIBUS Basics



High-Speed Data Exchange - Configuration

Configuration Download (up to 244 bytes)

Master



Slave

- Possible I/O Selections described in GSD File
- Processed by Configuration Tool
- Selected at Configuration
- Examples
 - ✓ 8DI (1 Byte), 8DO (1 Byte)
 - ✓ 2AI (2 Words), 2AO (2 Words)
 - ✓ RS232 Interface, Counter Module



= Configuration Data



= Confirmation (Data Received)

PROFIBUS Basics



❑ Configuration Tool (continued)

✓ I/O selection with Configuration Tool

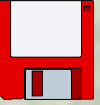
The screenshot shows the 'Configure: ET 200M (IM153-1) #4 <DP slave<4>>' window. It contains a table with columns for Identifier, Module, Comment, I address, and O address. Row 4 is highlighted with '067,003' in the Identifier column and '6ES7 321-1BL00-0AA0 32DI' in the Module column. An open dialog box titled 'Module selection for position 5' is overlaid on the table, showing a list of modules with '6ES7 321-1BL00-0AA0 32DI' selected.

Identifier	Module	Comment	I address	O address
1	004	Config for Slot1		
2	004	Config for Slot2		
3	004	Config for Slot3		
4	067,003	6ES7 321-1BL00-0AA0 32DI		
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				

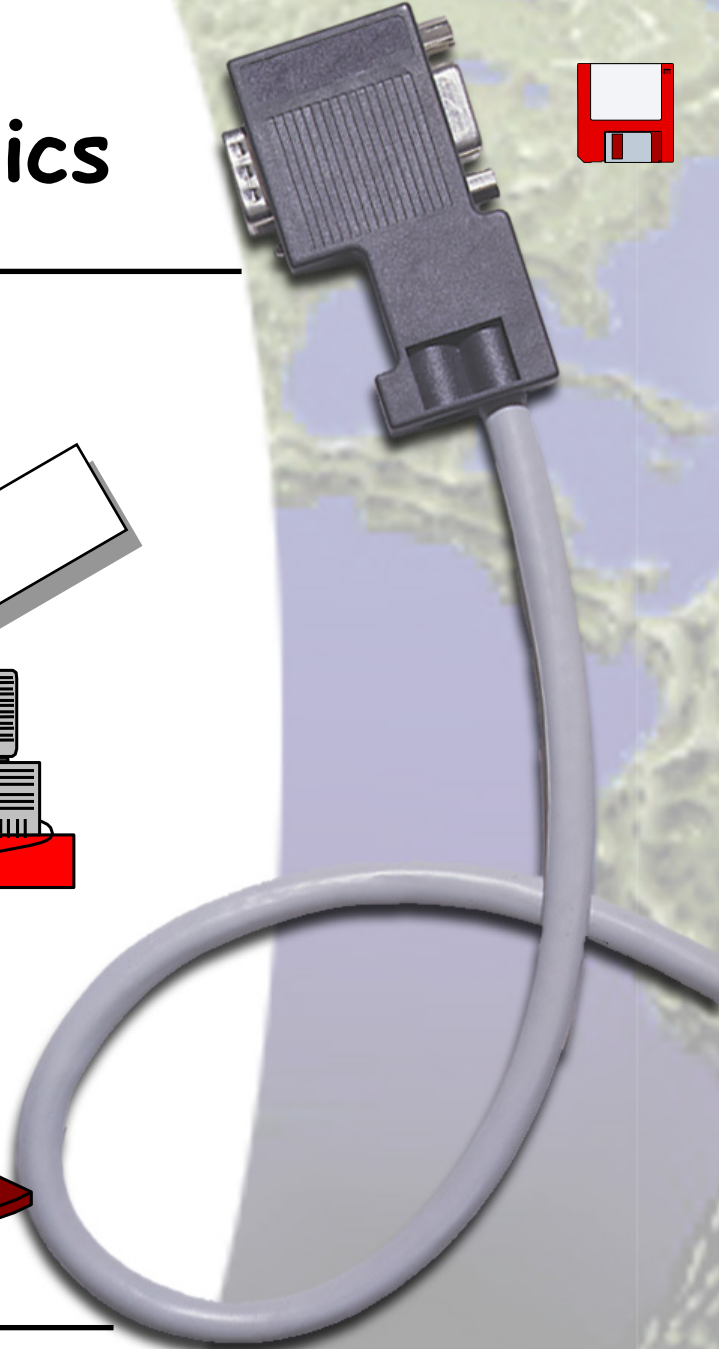
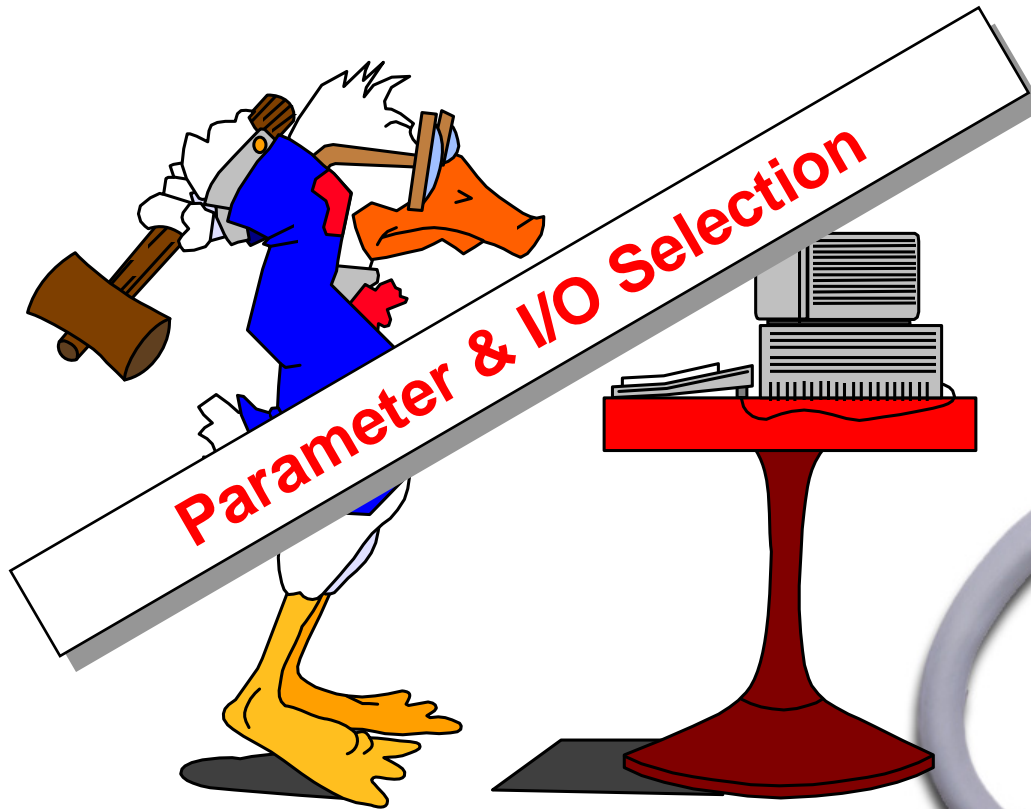
Module selection for position 5

6ES7 321-7RD00-0AB0	4DI
6ES7 321-1FF0*-0AA0	8DI
6ES7 321-1BH0*-0AA0	16DI
6ES7 321-1EH0*-0AA0	16DI
6ES7 321-1BH5*-0AA0	16DI
6ES7 321-1FF00-0AA0	8DI
6ES7 321-1FF01-0AA0	8DI
6ES7 321-1BH00-0AA0	16DI
6ES7 321-1BH*1-0AA0	16DI
6ES7 321-1EH00-0AA0	16DI
6ES7 321-1EH01-0AA0	16DI
6ES7 321-1BH50-0AA0	16DI
6ES7 321-7BH00-0AB0	16DI
6ES7 321-1BL00-0AA0	32DI
6ES7 321-1EL00-0AA0	32DI

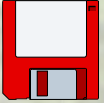
PROFIBUS Basics



□ PROFIBUS Demo



PROFIBUS Basics



High-Speed I/O - Data Exchange & Diagnostics

Data Exchange (up to 244 bytes)



Slave indicates diagnostics to report



= Output Data



= Input Data



= Diagnostic Indicator

PROFIBUS Basics



□ Data Exchange & Diagnostics (continued)

Diagnostic Request and Response (up to 244 bytes)

Master



Slave

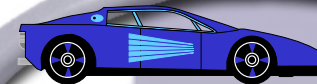


Data Exchange (up to 244 bytes)

Master



Slave



= Diagnostic Request



= Diagnostic Response

PROFIBUS Basics



□ Diagnostic Response (continued)



Up to 244 Bytes



6 Bytes
Mandatory

Device
Related
(Optional)

Identifier
Related
(Optional)

Channel
Related
(Optional)

e.g. wrong
configuration

e.g. no load
power

e.g. module #4
has diagnostic

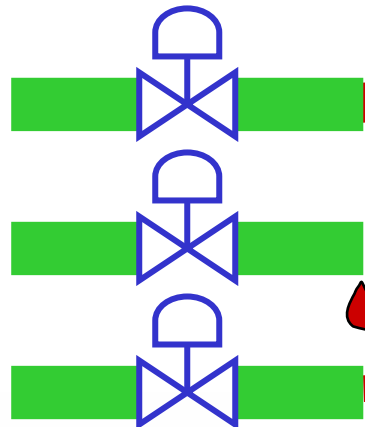
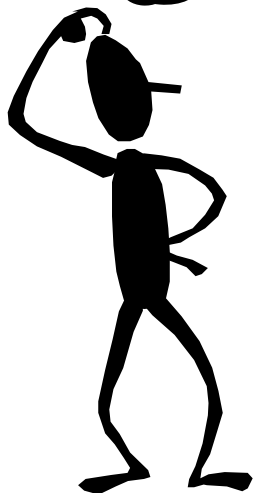
e.g. wire break or
short circuit

PROFIBUS Basics



High-Speed Data Exchange - Fail Safe

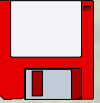
What happens if my bus fails:
valve open, valve closed,
valve 1/2 open...???



Optional feature Fail Safe specifies behavior of Outputs in case of Communication Loss

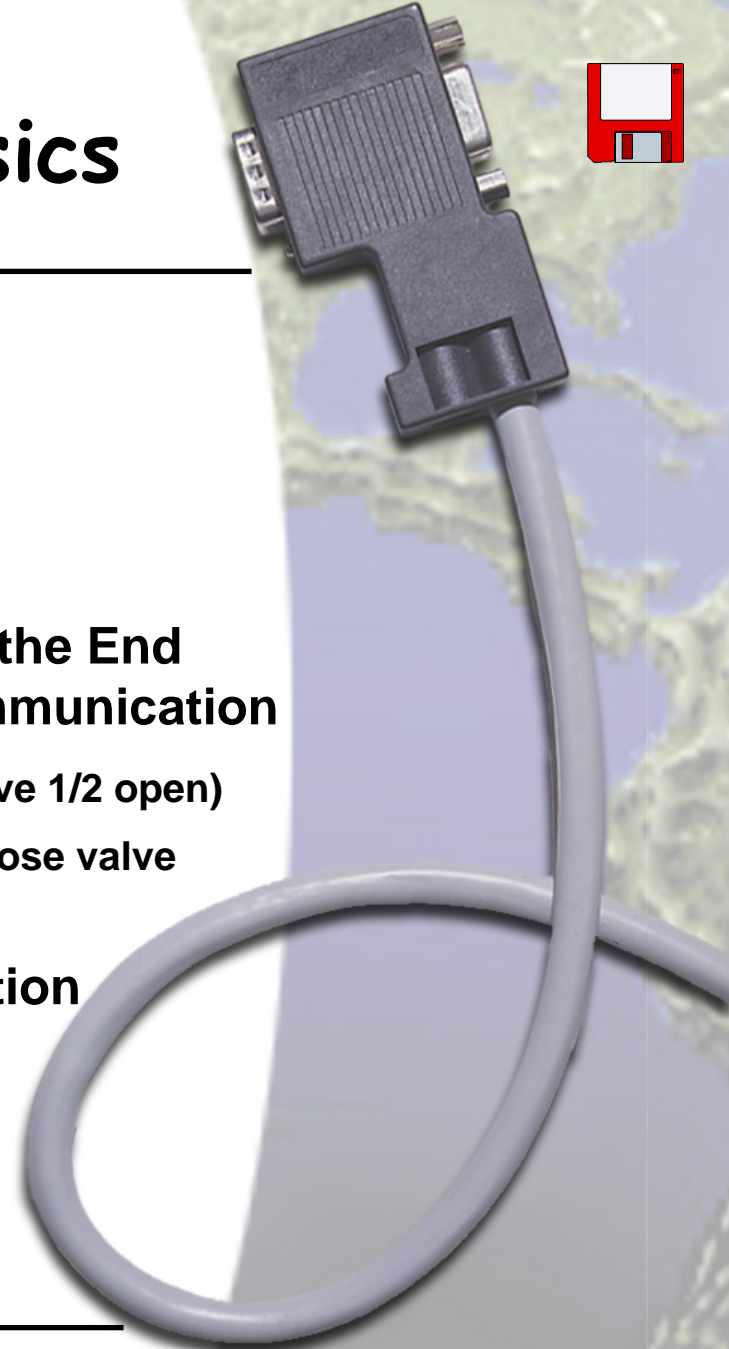


PROFIBUS Basics



❑ Fail Safe (continued)

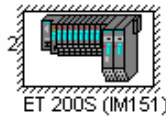
- ✓ Optional Feature for Field Devices
- ✓ Defined in Electronic Device Data Sheet
- ✓ Manufacturer has the capability to allow the End User to specify the action on loss of communication
 - × Hold outputs at the last value received (e.g. valve 1/2 open)
 - × Set outputs to a specified value (e.g. open or close valve completely)
- ✓ User defines action during Parameterization



PROFIBUS Basics



❑ Fail Safe (continued)



ET 200S (IM151)

1

DP Slave properties

PROFIBUS address:

DP Configure: ET 200S (IM151) #2 <DP slave<2>>

Identifier	Module	Comment	I address	O address
1 000	6ES7 138-4CA00-0AA0 PM-E DC24V			
2 8DO	6ES7 132-4BB00-0AB0 2DO DC24V			
3 000				

DP Parameterize: ET 200S (IM151) #2 <DP slave<2>>

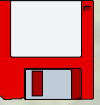
Parameter name	Value
23.4 Behavior at CPU-STOP	Switch substitute value
23.6 Substitute value O0	1
23.7 Substitute value O1	0
24.0 Diagnosis: Wire break O0	enable
24.1 Diag.: Short circuit to M O0	enable
24.2 Diagnosis: Wire break O1	disable
24.3 Diag.: Short circuit to M O1	disable

DP Behavior at CPU-STOP

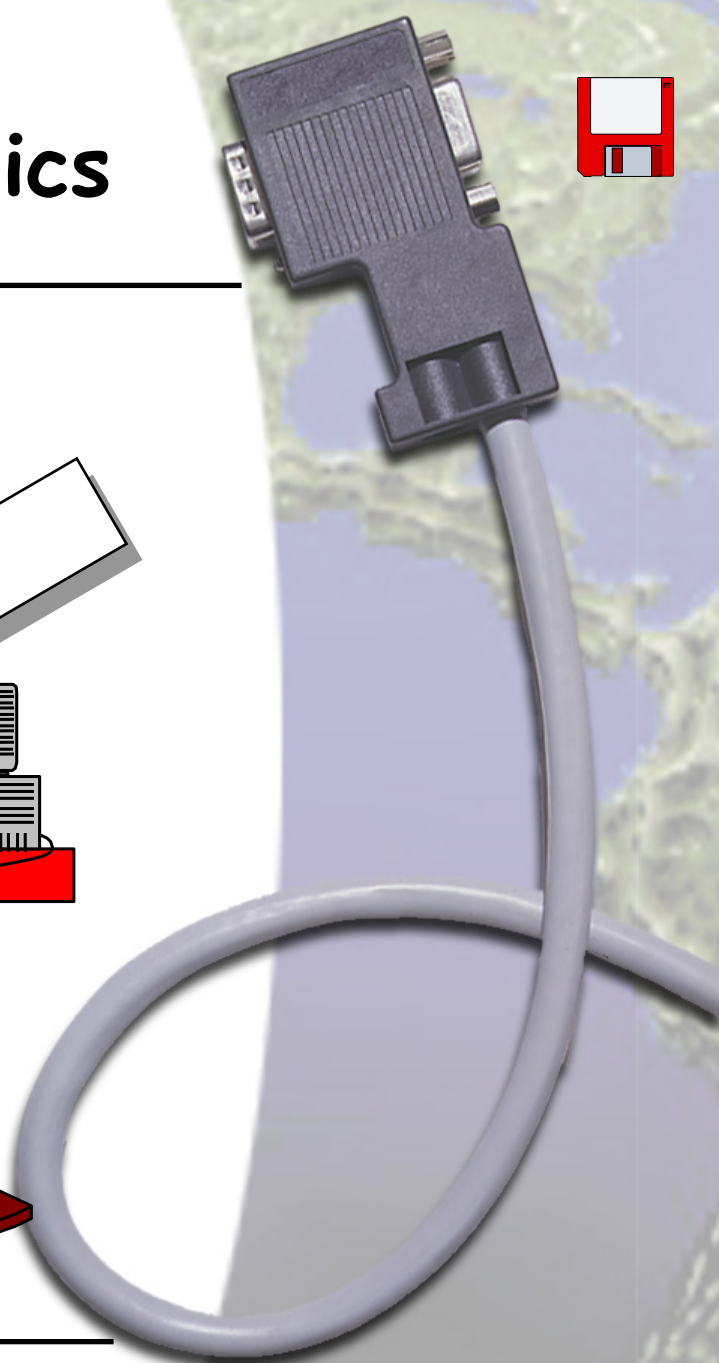
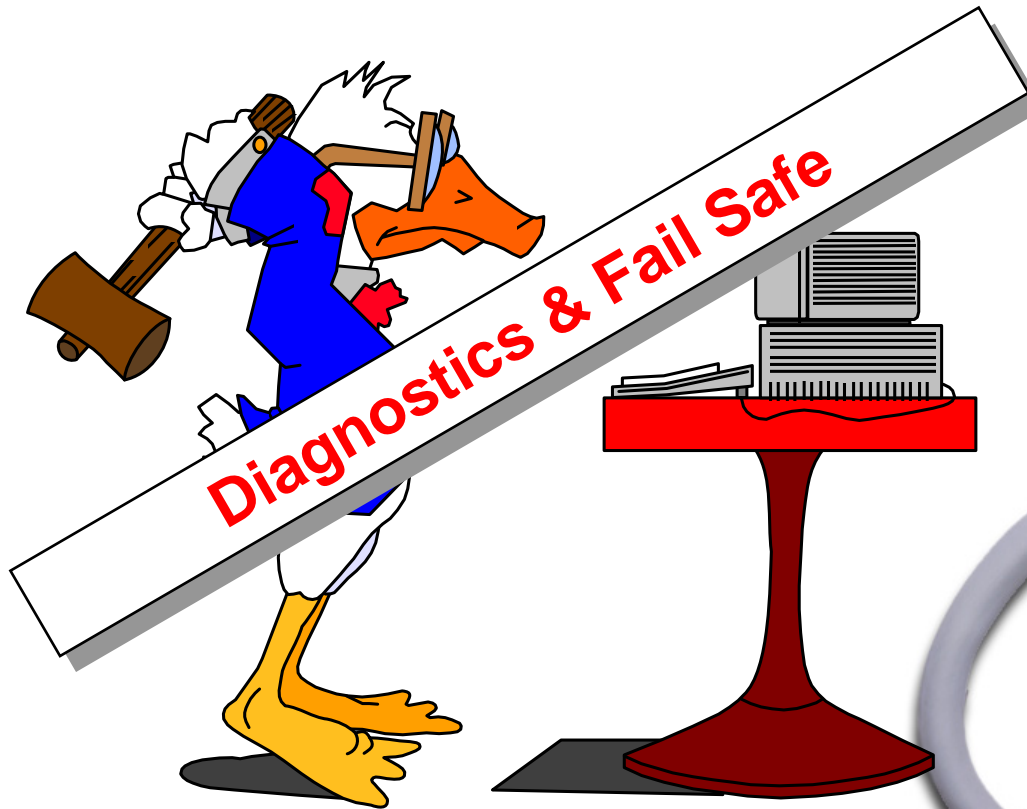
Switch substitute value
hold last value

Parameter value:

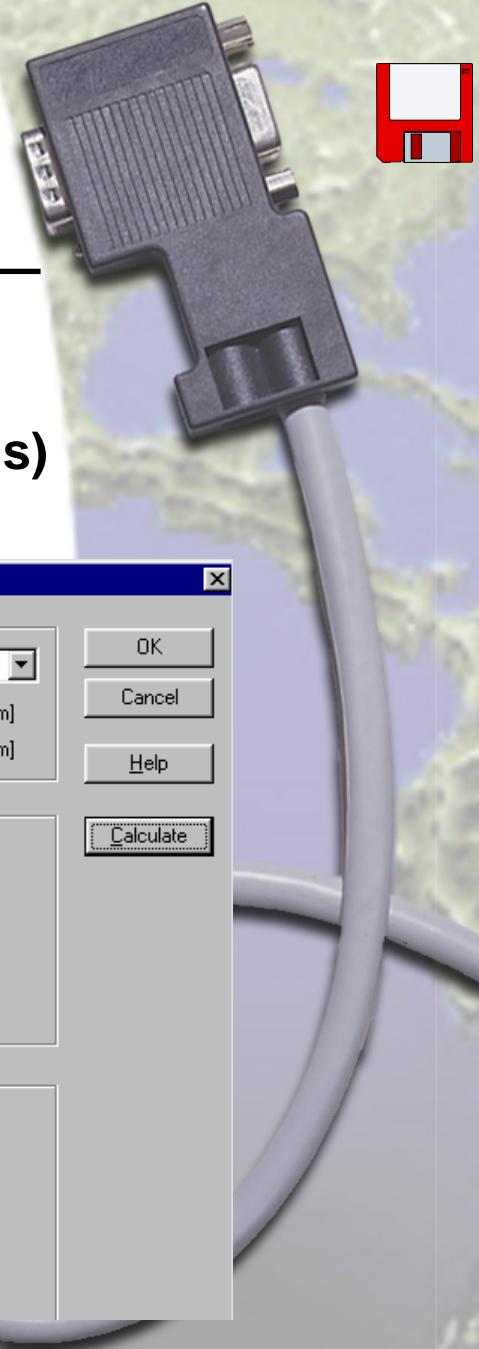
PROFIBUS Basics



□ PROFIBUS Demo



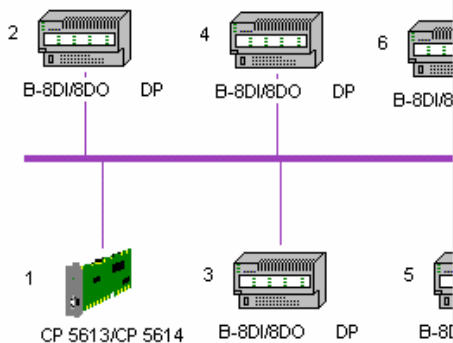
PROFIBUS Basics



High-Speed Data Exchange Timing

✓ 10 Stations With 2 Byte I/O (**160** In/Output Signals)

× Bus Cycle Time **0.8ms**



Bus Parameter Settings

Bus Mode: PROFIBUS DP

Bus Profile: PROFIBUS DP Baud Rate: 12000.0

Number of Repeaters: 0 Line Length CU: 0.000 [km]

Number of QLMs/OPTs: 0 Line Length EO: 0.000 [km]

Input Parameters

T_{gui}: 9 [t_bit] T_{sdr_min}: 11 [t_bit]

T_{set}: 21 [t_bit] T_{sdr_max}: 800 [t_bit]

T_{slot_init}: 1000 [t_bit] Gap Factor: 10

Retry Limit: 4 HSA: 126

Delta Ttr: 0 [t_bit] Correction Factor: 1.25

Calculated Parameters and Data Cycle Times

T_{td}: 99 [t_bit] Ttr: 88445

T_{rdy}: 11 [t_bit]

T_{id1}: 240 [t_bit] Typical Data Cycle Time: 0.0008 [s]

T_{id2}: 800 [t_bit] Maximum Data Cycle Time: 0.0074 [s]

T_{slot_eff}: 1000 [t_bit] Minimum Response Monitoring: 0.0157 [s]

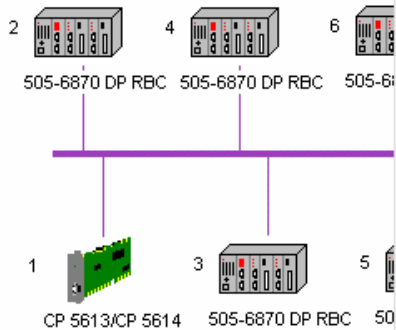
PROFIBUS Basics



High-Speed Data Exchange Timing

✓ 10 Stations With 128 byte I/O (**10,240** In/ Output Signals)

× Bus Cycle Time **2.0ms**



Bus Parameter Settings

Bus Mode: PROFIBUS DP Baud Rate: 12000.0

Number of Repeaters: 0 Line Length CU: 0.000 [km]

Number of DLMs/OPTs: 0 Line Length ED: 0.000 [km]

Input Parameters

T_gui: 9 [t_bit] T_sdr_min: 11 [t_bit]

T_set: 21 [t_bit] T_sdr_max: 800 [t_bit]

T_slot_init: 1000 [t_bit] Gap Factor: 10

Retry Limit: 4 HSA: 126

Delta Ttr: 0 [t_bit] Correction Factor: 1.25

Calculated Parameters and Data Cycle Times

T_td: 99 [t_bit] Ttr: 107545

T_rdy: 11 [t_bit]

T_id1: 240 [t_bit] Typical Data Cycle Time: 0.0020 [s]

T_id2: 800 [t_bit] Maximum Data Cycle Time: 0.0090 [s]

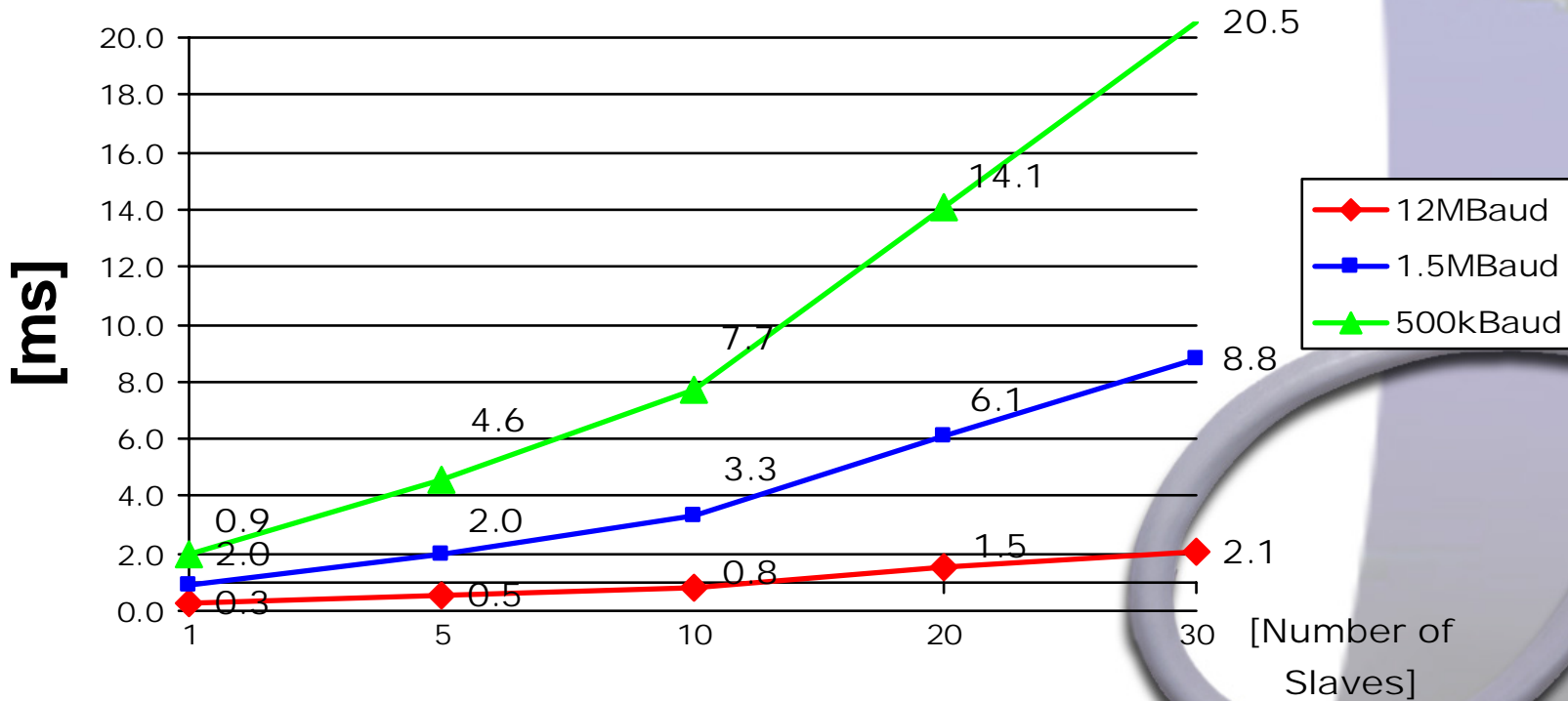
T_slot_eff: 1000 [t_bit] Minimum Response Monitoring: 0.0187 [s]

PROFIBUS Basics



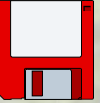
High-Speed Data Exchange Timing

✓ Typical Cycle Time - Each Station With 2 Byte I/O





PROFIBUS Basics



□ PROFIBUS Summary

- ✓ Extensive Parameterization Features
- ✓ Extensive Diagnostic Features
- ✓ Fail-Safe Behavior
- ✓ Deterministic
- ✓ Fast (Up to 12 MBaud)
- ✓ Safe and Reliable
- ✓ Easy Configuration
- ✓ Capabilities for Complete Plant Solution from Cell to Bit Level

