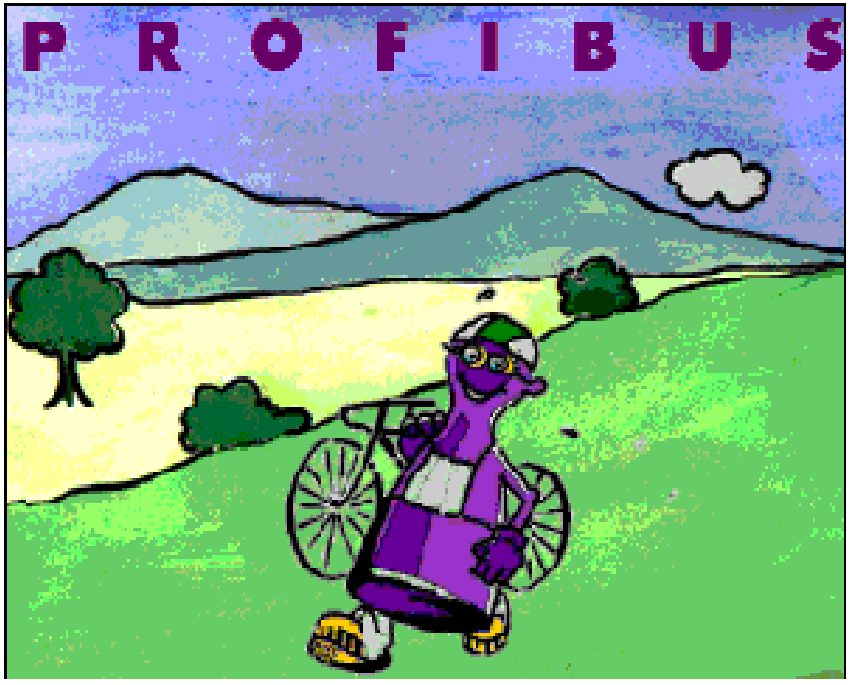
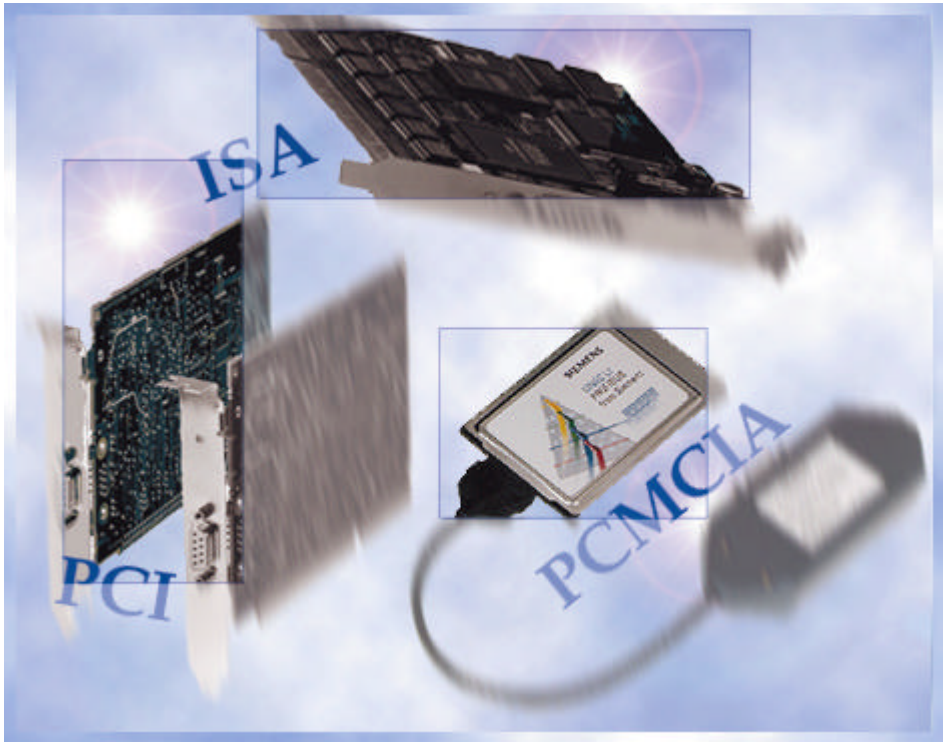
PC-Based Control & Siemens PROFIBUS

- Overview
  - Hardware
  - Software
  - PC-Based Control
- Chapter 3 - DP Interface
- Chapter 4 - OPC Interface



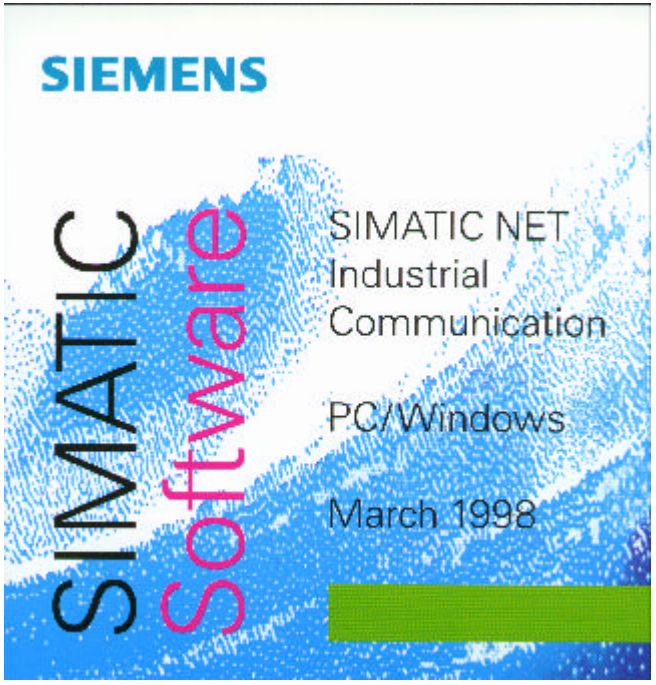
Hardware

- **Softnet**
  - **CP 5411 (ISA)**
  - **CP 5511 (PCMCIA)**
  - **CP 5611 (PCI)**
- **Hardnet**
  - **CP 5412(A2) (ISA)**
  - **CP 5613 (PCI)**
  - **CP 5614 (PCI)**



Software

- SIMATIC NET Industrial Communication CD (PC/Windows March 1998)
  - Com PROFIBUS v.3.3
  - PROFIBUS
    - DP, SOFTNET, FMS, S7, PG
  - Industrial Ethernet
    - SOFTNET, TF, S7, PG
  - OLE/DDE Manager
    - DP, FMS, S7, TF
  - OPC Server
    - DP-OPC, S7-OPC
  - Manuals



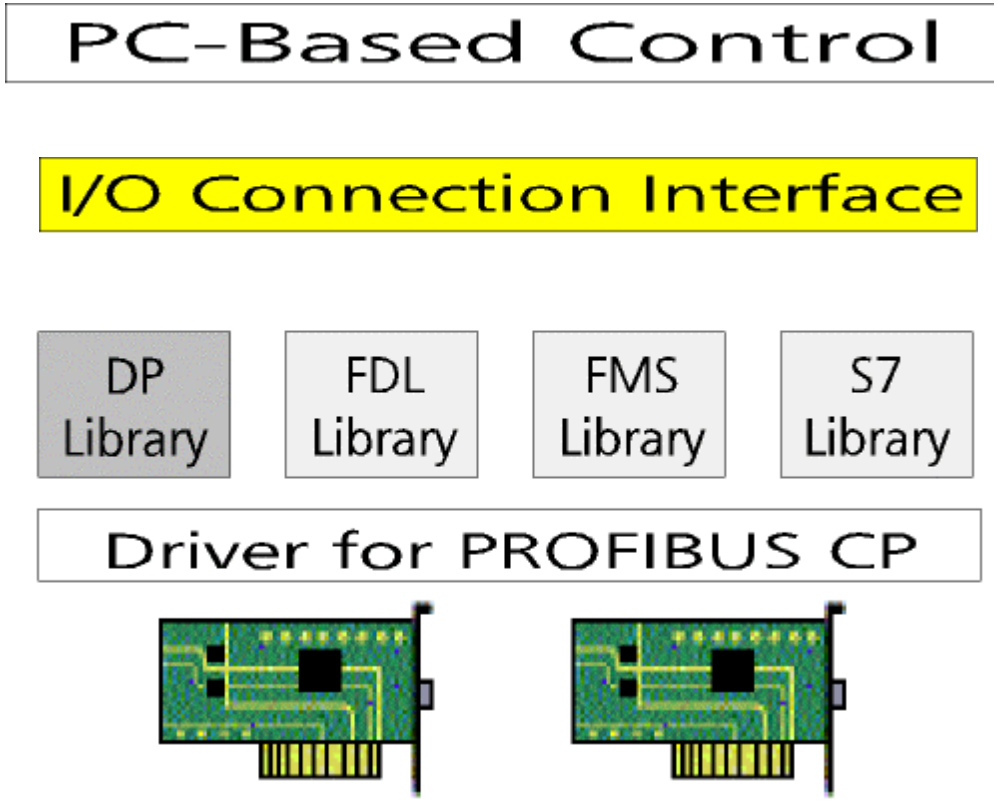
PC-Based Control

- What does the PROFIBUS user **want** from PC-based Control?
  - The reliability of a PLC
  - A user-friendly interface.
  - An IEC 1131 development environment (RLL, SFC, etc..)
  - The ability to configure their network
  - The ability to monitor or manipulate network I/O
  - The ability to monitor network diagnostics and react immediately

- What does the PROFIBUS user **get** from …
  - PC-based Control?
  - Siemens SIMATIC NET

DP Interface & PC-Based Control

- How do I connect my PC-Based Control to Siemens SIMATIC NET PROFIBUS DP?



I/O Connection Code for the Programmer

- Configuration Code
  - Code for Configuring the Master Parameters
  - Code for Configuring each Slave Parameters
    - Type of Slave
    - Station Id
    - Slot Id
  - Code for Configuring Bus Parameters
    - Baud Rate
    - Bus Timing
- Run-Time Code
  - Code for Starting/Stopping Board
  - Code for Data Transfer
    - Write output data from the on-board RAM
    - Read input data from the on-board RAM
  - Code for Diagnostics
    - Monitor the state of the Master
    - Monitor the states of the Slaves (including extended diagnostics)
  - Code for Control Functions

Why use the DP Interface

- Develop code once for multiple platforms and hardware
  - Windows NT 4.0, Windows 95
  - ISA (CP5412(A2)), PCI (CP5611), PCMCIA (CP5511)
- Complete control by PC-based controller
  - Ability to change the configuration database dynamically
  - Access to all important DP-specific functions (Sync, Freeze, AUTOCLEAR, etc…)
- Simple linking of PC-based control
  - Range of functions in the form of a library (dplib.lib)
  - All functions have a uniform structure

How to use the DP Interface

- The DP Interface consist of …
  - 18 functions
  - 3 structures
- Each function accepts a pointer to a structure as the parameter
- The structure is then updated by the function

Structures

The DP Interface Structure

- struct dpn_interface
- { reference - reference of application
- stat_nr - station number
- length - length of user_data[]
- error-code - error identification
- slv_state - status of the DP slave
- sys_state - status of the DP master
- sys_event - event messages (AUTOCLEAR, Watchdog)
- user_data[] - data field (ptr for multiple functions) }

Three Phases of the DP Interface

- **Initialization Phase**
  - **Initialization Functions - 2 functions**
  - **Database Functions - 5 functions**
- **Productive Phase**
  - **Diagnostic Functions - 2 functions**
  - **Data Transfer - 5 functions**
  - **Control Functions - 3 functions**
- **Close Phase**
  - **Close Function - 1 function**

Three Phases of the DP Interface

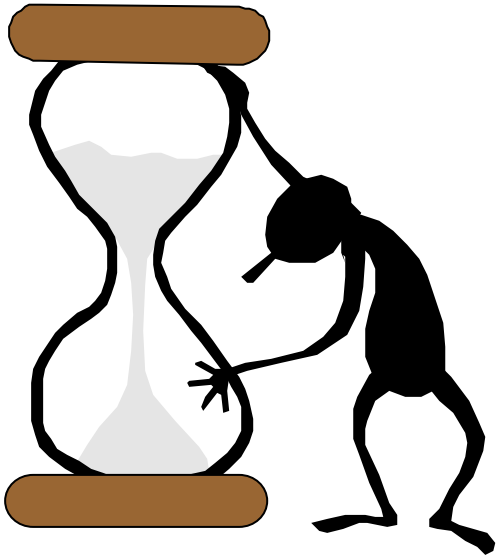
- Initialization Phase
  - Initialization Functions
  - Database Functions

Initialization Phase
Init Functions

- **dpn_init() - mandatory**
  - **Log on a DP application at the DP interface**
  - **Set all access rights of the slaves (Read or Write/Read)**
  - **Return a reference handle for all following functions**

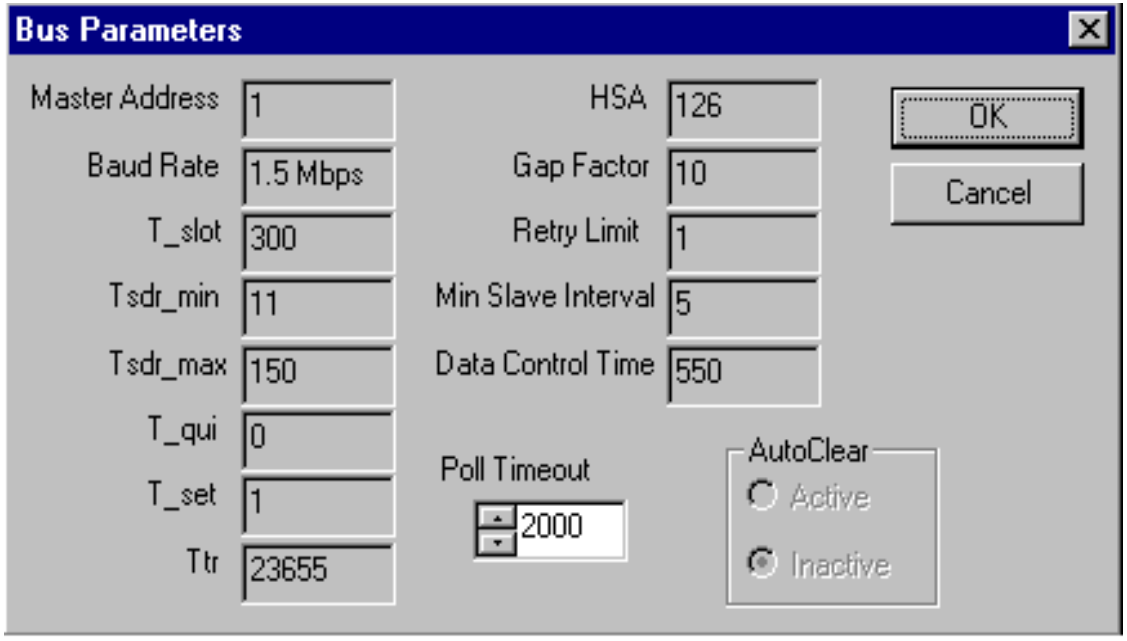
Initialization Phase
Init Functions

- **dpn_wd() - optional**
  - **Application WatchDog**
  - **Activate monitoring of the DP application**
  - **CP checks whether the application executes a function call within the time supplied**



Initialization Phase Database Functions

- **dpn_read_bus_par() - optional**
  - **Read the Bus Parameters from the database**
  - **Baudrate, Master Address, Min. Slave interval, etc..**



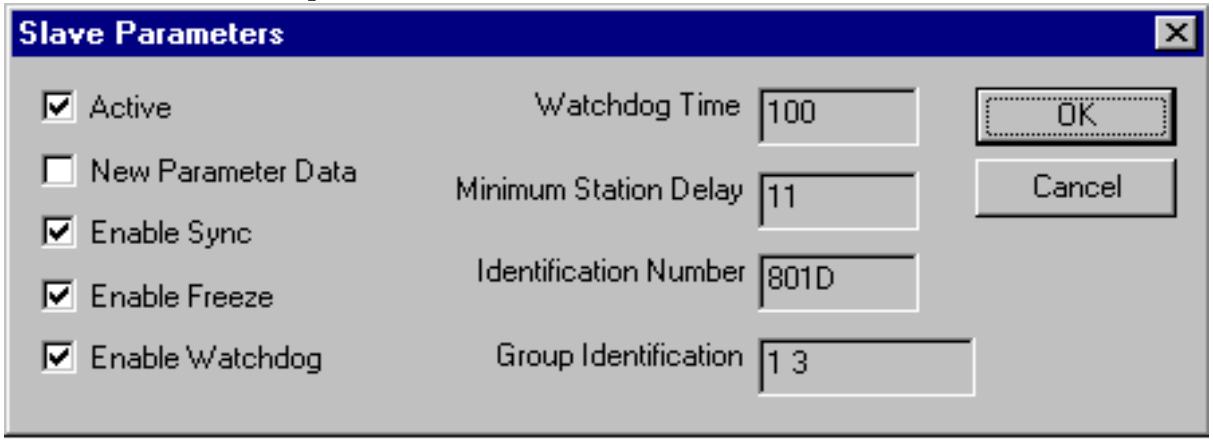
Initialization Phase Database Functions

- **dpn_load_bus_par() - optional or not allowed**
  - **Modify DP-specific parts of the bus parameters**
  - **Set AUTOCLEAR**
    - **If AUTOCLEAR is enabled, and all activated slaves are not taking part in the data exchange, the DP master changes to the CLEAR mode**
  - **Set Poll-Timeout**
    - **The Poll-Timeout is used to monitor the communication with a DP master Class 2**

Initialization Phase Database Functions

dpn_read_slv_par() - optional

- Read slave parameters



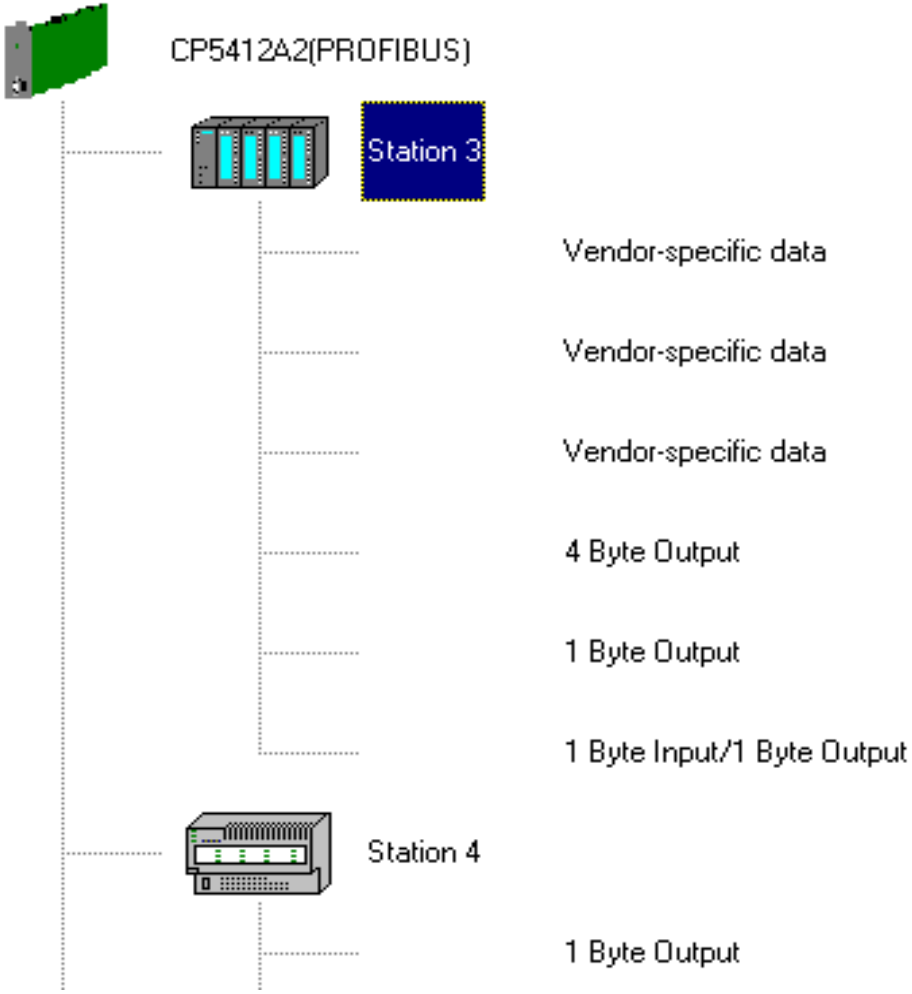
- Slave/module length
- Slave/module type (word or byte)
- Slave/module consistency
- Slave/module direction (Input, Output or Both)

Initialization Phase Database Functions

- **dpn_set_slv_state() - optional**
  - **Activate/deactivate a slave in the database**
  - **Dynamic activation or deactivation of a slave**

Initialization Phase Database Functions

- **dpn_read_cfg() - optional**
  - **Read the complete DP configuration**
  - **This includes the number and type of slaves**



Three Phases of the DP Interface

- Initialization Phase
  - Initialization Functions
  - Database Functions
- Productive Phase
  - Diagnostic Functions
  - Data Transfer
  - Control Functions

Productive Phase Diagnostic Functions

- **dpn_slv_diag() - optional**
  - **Request a slaves diagnostics**
  - **All standard diagnostics**
  - **Master Address and Ident Number**
  - **Extended Diagnostics**

Station Status 1

- [x] Station Not Existent
- [ ] Station Not Ready
- [ ] Configuration Fault
- [ ] Extended Diagnostics
- [ ] Not Supported
- [ ] Invalid Slave Response
- [ ] Parameter Fault
- [ ] Master Lock

Station Status 2

- [ ] Parameter Request
- [ ] Static Diagnostics
- [ ] Watchdog On
- [ ] Freeze Mode
- [ ] Sync Mode
- [ ] Deactivated

Device-related

bit 0 device related
bit 8 device related
bit 16 device related
bit 24 device related
bit 32 device related
value 2 (bit0-3 byte6 dev.rel.)
value 0 (bit4-7 byte6 dev.rel.)

Identifier-related

ID# 1 with diag. info
ID# 3 with diag. info

Channel-related

ID# 7, Input
  Channel# 6, 1 bit
  Upper limit value exceeded
ID# 1, Input
  Channel# 7, 1 bit
  Lower limit value exceeded
ID# 1, Input
  Channel# 0, 1 bit
  Error

Productive Phase Diagnostic Functions

- **dpn_read_sys_info() - optional**
  - **Read the system information**
  - **Determine the current state of the Master**
  - **Determine the current state of all Slaves in the configuration**

Productive Phase Data Transfer

- **dpn_out_slv() - optional**
  - Send output to a single slave
- **dpn_out_slv_ext() - optional**
  - Send output to several slaves
- **dpn_read_slv() - optional**
  - Read local output data of a single slave

Device	Diagnostics	Input	Output
Slave #3	Ready	00	2F 2F 2F 2F 2F 2F
Slave #4	Ready	00	2F

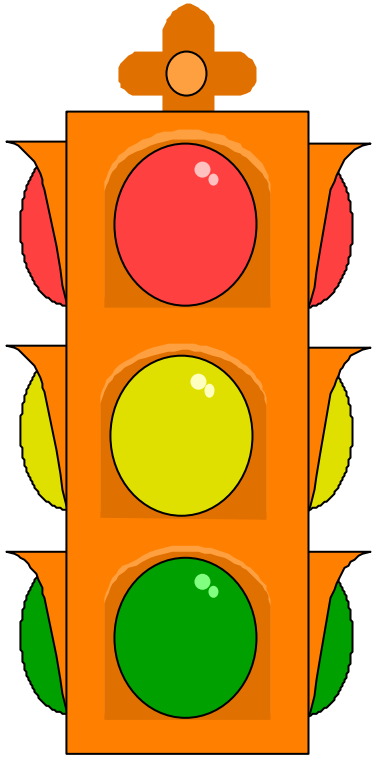
Productive Phase Data Transfer

- **dpn_in_slv() - optional**
  - Read input from a single slave
- **dpn_in_slv_ext() - optional**
  - Read input from several slaves

Device	Diagnostics	Input
Slave #4	Station Not Existent	00 00
Slave #5	Ready	---
Slave #6	Ready	00 FFFB FFFC 00

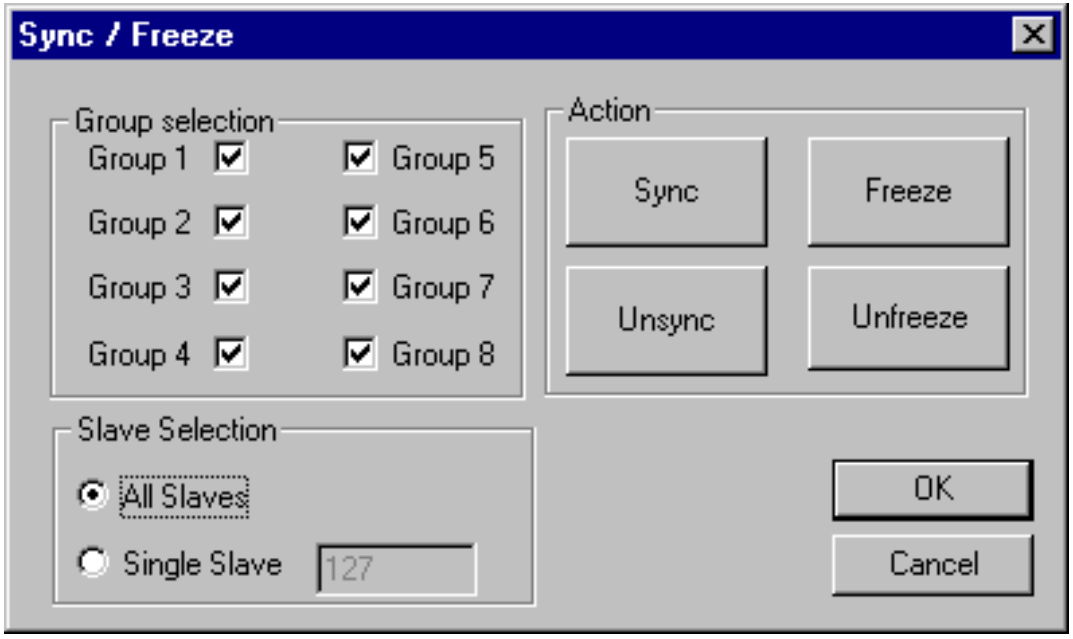
Productive Phase Control Functions

- **dpn_set_mode() - mandatory or not allowed**
  - Set the DP mode
- **dpn_get_mode() - optional**
  - Read out the current DP mode
- **Modes of the DP Master**
  - Offline
  - Stop
  - Clear
  - Operate



Productive Phase Control Functions

- **dpn_global_ctrl() - optional or not allowed**
  - Send control commands to all groups or a control group
  - Sync/Unsync - Synchronize outputs
  - Freeze/UnFreeze - Freeze inputs



Close Phase
Close Functions

- **dpn_reset() - mandatory**
  - **Log off a DP application at the DP interface**

DP Interface

- OK! Siemens offers ...
  - Hardware that customers need
    - PCI, PCMCIA, ISA
  - Software for multiple protocols and Platforms
    - Windows NT, Windows 95/98
  - Interfaces that give my PC-based controller ...
    - an Easy-to-Implement Connection to PROFIBUS
    - Complete control of a PROFIBUS network
- But, give me one more reason to connect using Siemens Simatic Net DP for PROFIBUS?
  - The DP interface directly follows the PROFIBUS DP Standard EN 50170

Questions?