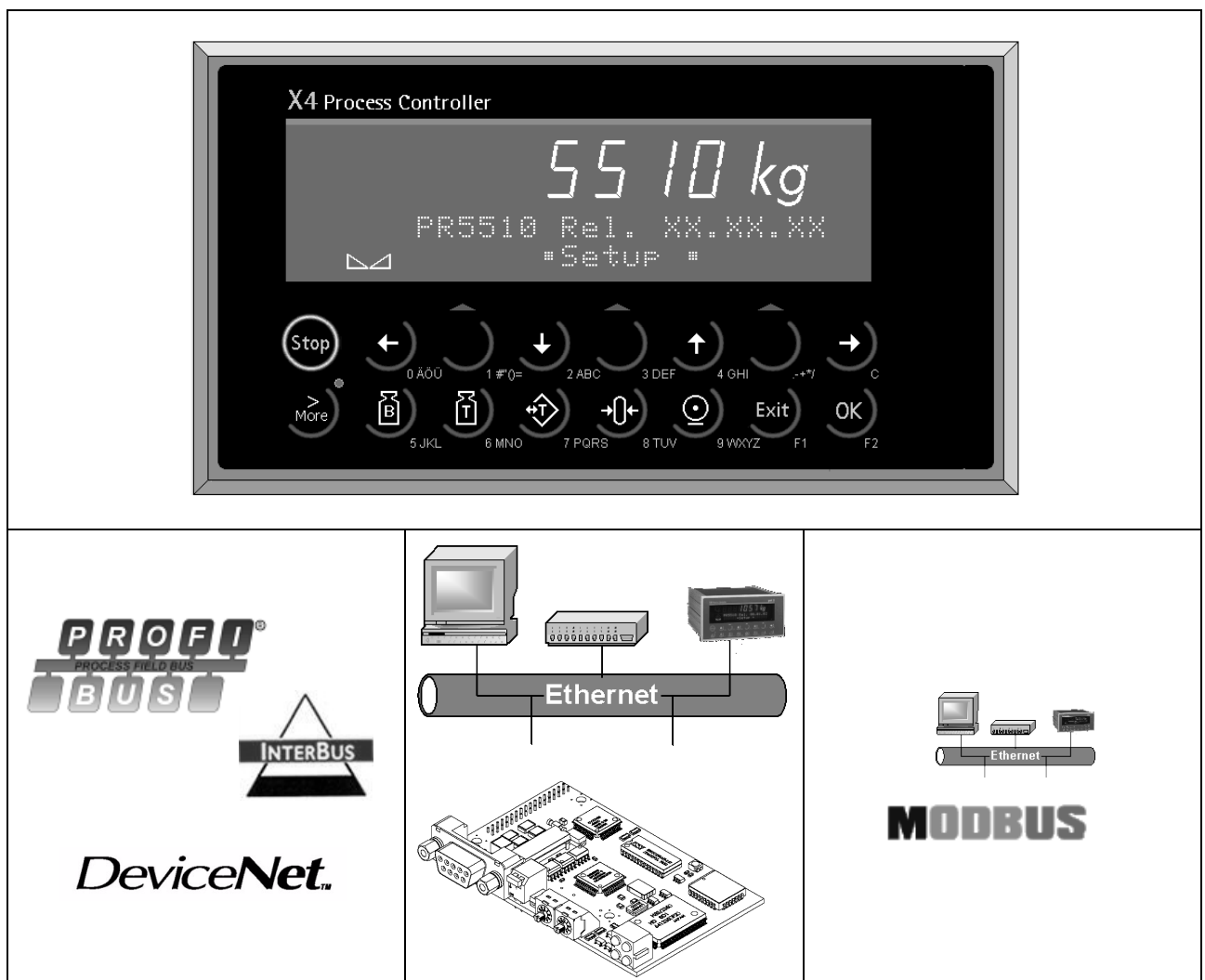




Installation Manual

X4 Network/Fieldbus

PR5510/14, PR1721/31, -/32, -/34, -/36, -/37



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Table of Contents

1	Selection of Network protocols	5
1.1	PR1721/31 ProfiBus-DP (Slave)	6
1.1.1	Display and Controls	7
1.1.2	Basic Function	8
1.1.3	General Bus-Topologie	9
1.1.4	9-Pole D-Sub Socket Allocation	9
1.1.5	Twisted Pair Cabling	10
1.1.6	Bus Termination	10
1.1.7	PR5510 Fieldbus Parameter	11
1.1.8	GSD File	11
1.2	PR1721/32 InterBus-S (Slave)	12
1.2.1	Display and Controls	13
1.2.2	Basic Function	14
1.2.3	General Bus-Topologie	15
1.2.4	9-Pole D-Sub Connector Allocation	16
1.2.5	Twisted Pair Cabling	16
1.2.6	PR5510 Fieldbus Parameter	17
1.3	PR1721/34 DeviceNet (Slave)	18
1.3.1	Display and Controls	19
1.3.2	Basic Function	20
1.3.3	General Bus-Topologie	21
1.3.4	5-pole terminal block Allocation	21
1.3.5	Twisted Pair Cabeling	21
1.3.6	PR5510 Fieldbus Parameter	22
1.3.7	EDS File	22
1.4	PR1721/36 ProfiNet I/O	23
1.4.1	Display and Controls	23
1.4.2	Network Parameter	24
1.4.3	Fieldbus Parameter	24
1.4.4	XML File	24
1.5	PR1721/37 EtherNet-IP	25
1.5.1	Display and Controls	26
1.5.2	Network Parameter	27
1.5.3	Fieldbus Parameter	27
1.5.4	EDS File	27

1.6	PR5510/14 Ethernet-TCP/IP	28
1.6.1	Display and Controls.....	29
1.6.2	Applications.....	30
1.6.3	Pin Allocation	30
1.6.4	Twisted Pair Cabeling.....	31
1.6.5	Hub	33
1.6.6	Switch	33
1.6.7	Transfer Rate Mbit/s.....	33
1.6.8	Addressing	34
1.6.9	PR5510 Network Solutions	36
1.6.10	Test tool: Ping Command.....	39
1.6.11	PR5510 Network Parameter	40
1.7	ModBus-TCP.....	41
1.7.1	„Message frame format'.....	41
1.7.2	PR5510 Cross Communication.....	42
1.7.3	PR5510 Network Parameter at Cross Communication.....	44
2	Fieldbus Data-Interface	45
2.1	Configuration	45
2.2	Interface Handling	46
2.2.1	Write window (Input area).....	47
2.2.2	Read window (Output area).....	47
2.2.3	Data Reading and Writing.....	48
2.3	Read Data (overview).....	49
2.4	Write Data (Overview).....	50
2.4.1	Combination of Write and Simultaneously Read.....	51
2.5	Data Formats.....	51
2.5.1	Intel Format.....	51
2.5.2	Motorola Format	51
2.5.3	Various Data Formats.....	52
2.5.4	Configuration of Databus Width.....	53
2.6	Description of Read/Write-windows (IO-databus).....	56
2.6.1	Output Area	56
2.6.2	Input Area.....	57
2.6.3	Register Read and Write.....	58
2.6.4	Access to the Fieldbus Interface via ModBus-TCP	63
2.6.5	PR1750 (IEC 61131 Program).....	65
2.6.6	Fieldbus Test.....	66
2.6.7	PC Master Simulator.....	67
3	Appendix.....	68
3.1	Additional manuals.....	68
3.2	Customer Setup	68
4	Glossar.....	69
5	Index.....	71

1 Selection of Network protocols

By inserting various options cards into Slot 4 of PR5510, the instrument hardware

- is integrated into LocalAreaNetwork LAN s by means of protocol TCP/IP or
- extended to fieldbus-participant (slave) with Sartorius-fieldbus-data interface.

All plug-in modules are provided with an own microprocessor, which handles the complete bus protocol independently. The standard interface between the module and the PR5510 electronics forms a 2-kbyte dual-port RAM. It handles the pure "netdata" only between module and PR5510 instrument electronic.

PR1721/31	fieldbus card (slave)	protocol: ProfiBus-DP	
PR1721/32	fieldbus card (slave)	protocol: InterBus-S	
PR1721/34	fieldbus card (slave)	protocol: DeviceNet	
PR1721/36	fieldbus card (slave)	protocol: ProfiNet I/O	
PR1721/37	fieldbus card (slave)	protocol: EtherNet/IP	
PR5510/14	EtherNet-TCP/IP	protocol: ModBus-TCP	and internal EW-Comm-Vx

This software provides an identically handled fieldbus interface for the instruments:

Configurable data bus width (write/read window): [8]-16-20-24-32-4-byte I/O

According to the handshake procedure for write and read purposes described here. Only for selected, pre-defined data types, which are described here

from the general firmware	04...14	weight*: G/N/T... incl. status
from the loaded application BATCH, FLOW, etc.	20...199	see rel. application manual
from additional special IEC programming	from 200	see rel. project description

Thereby, one or several scales can be integrated under a communication master, e.g.

Siemens S7:	ProfiBus-DP
Phoenix:	InterBus-S
Rockwell:	DeviceNet
AllenBradley:	ModBus

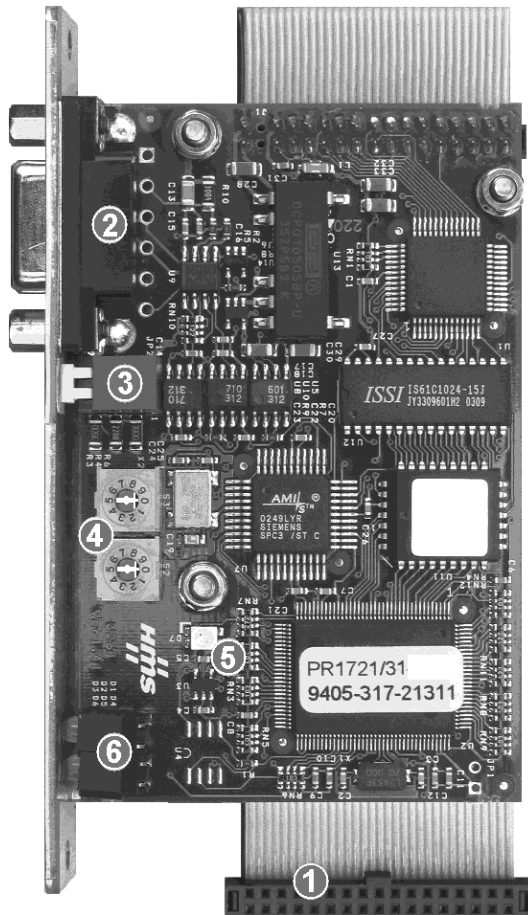
Note: Data at the fieldbus are handled at intervals of 20 ms in the internal PR 5510 PLC.

The fieldbuscards are not suitable for active connection of I/O-modules, but only as a passive fieldbus data interface, see Chapter 2.2 and 2.5.

1.1 PR1721/31 ProfiBus-DP (Slave)

It is a plug-in card for installation in the instrument, with standard 9-pole D-Sub socket for Profibus connection. The module contains powerful circuitry for connection to ProfibusDP according to IEC61158, ASIC SPC3 chip technology with transfer rates up to 12Mbit/s.

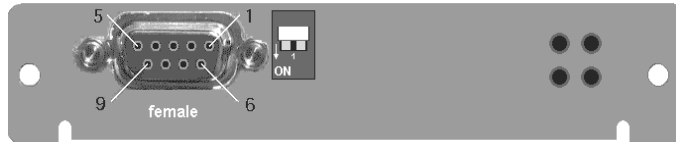
The module is mounted mechanically in rear panel cut-out 1 or 2, and inserted electrically into Slot 4 on the main circuit board by means of the flat cable, see instrument manual.



Slot-4

Connection type (internal) 34-pin connector ① on flat cable for Slot 4

Connection type (external) 9-pole D-Sub socket ② in the mounting plate



Transfer rate 9.6 kbit/s up to 12 Mbit/s, baud rate auto-detection

Connection mode Profibus-Network , Connect/disconnect without to other stations

Protocol ProfiBus-DP-V0 SLAVE to EN 50 170 (DIN 19245)
Mono- or multi-master systems are supported.
Master and slave devices, max. 126 knots are possible.
Watch-Dog Timer

Configuration GSD file (PR1721/31 specific)

Cable 'Special' Profibus, colour: violet twisted pair, common screening

Cable impedance 150 Ω

Bus termination Yes, DIL-switch from outside activable.

Certificates Profibus Test-center Comdec in Germany and PNO (Profibus User Organisation)
industrial suitable CE, UL & cUL

Dimensions (LxWxH) 87 x 55 x 15 mm **Potential isolation** Optocoupler in lines A and B (RS-485)

Weight 125 g. **Cable length** Max. distance 200 m can with 1.5 Mbit/s extendable with additional repeater.



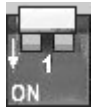
Caution!

Before installation of the ProfiBus-DP card already existing data must be saved, calibration and configuration data are not lost!

After installation of the card, a [COLD] start is required; otherwise, a continuous beep will be output.

Note: The ProfiBus card is supported from PR5510 firmware release 3.12.
Using PR1721/31 is not possible, if another option is already fitted on Slot 4.

1.1.1 Display and Controls



The terminating resistors can be switched on and off by pressing switch ③, see Chapter 1.1.6.



Rotary switches ④ for mode address 1...99 are not supported here. Adjust via [Setup]-[Fieldbus Parameter].



Caution!

Make sure that the two rotary switches ④ are set to position 0!

⑤	Watchdog LED
Flashing 1 Hz green	Module initialized and running without problems.
Flashing 2 Hz green	Module not initialized.
Flashing 1 Hz red	RAM check error
Flashing 2 Hz red	ASIC and FLASH ROM check error
Flashing 4 Hz red	ProfiBus-DP RAM check error

Front panel display: [Setup]-[IO-Slots] `+Slot 4: PR1721/3101`
`LED: -1- -2- -3- -4-`
 or mounting plate (rear panel):

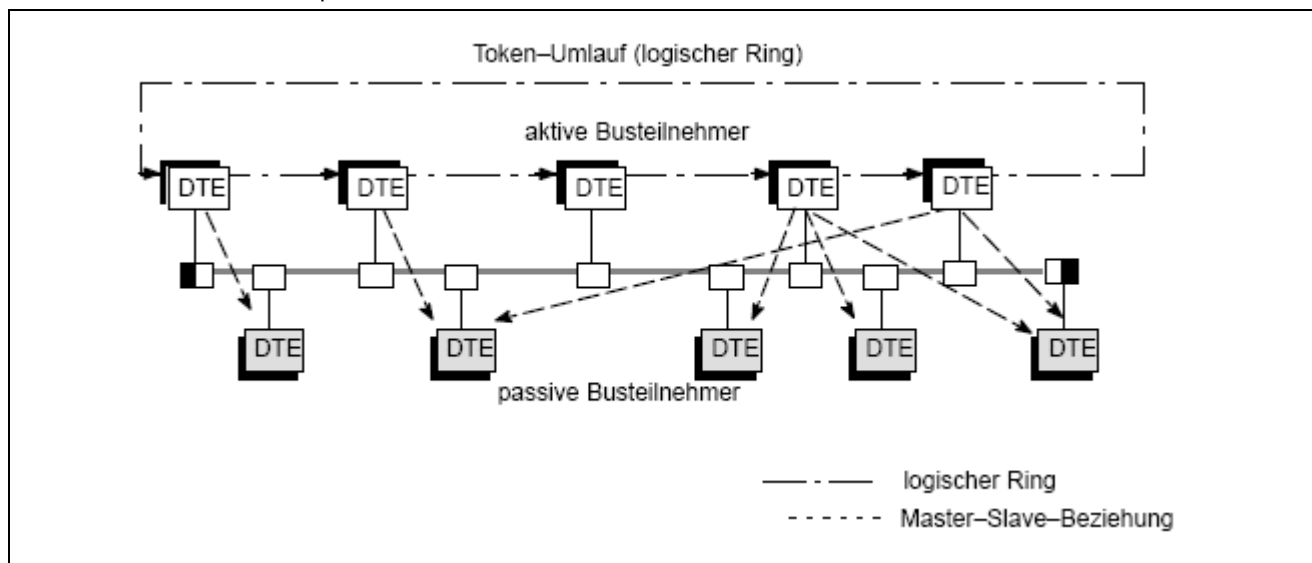
⑥	LED 1	LED 2	LED 3	LED 4
Off	Not used			No diagnosis provided
Lighted green		Module is online, Data exchange is possible		
Lighted red				Modul is offline.
Flashing 1 Hz red			Error in config IO-length	
Flashing 2 Hz red			Error in param Data length	
Flashing 4 Hz red			Error in ASIC Communication	

1.1.2 Basic Function

The bus module is optimized for use in powerful automation equipment such as drives, operating terminals, industrial scales and control systems.

The embedded Profibus module is a complete Profibus-DP slave. It includes all the analog and digital components for a powerful Profibus link. The module is certified and has been tested for interoperability with all leading Profibus master modules. The on-board microprocessor handles the entire Profibus communication automatically, thus relieving the main processor of the automation unit completely from the workload due to Profibus protocol handling. Characteristic for the basic functions of Profibus-DP is a centrally oriented data exchange between master and slaves. The so-called Class-1 master DPM1 (e.g. automation system such as a PLC) handles the cyclical exchange of process data with the slaves (actuators, I/O) in a fixed sequential order, whereby the data to be exchanged are pre-projected.

With Profibus, the network access corresponds to the 'token bus' method for active stations and to the 'master-slave' method for passive stations, as defined in EN 50170, volume 2.

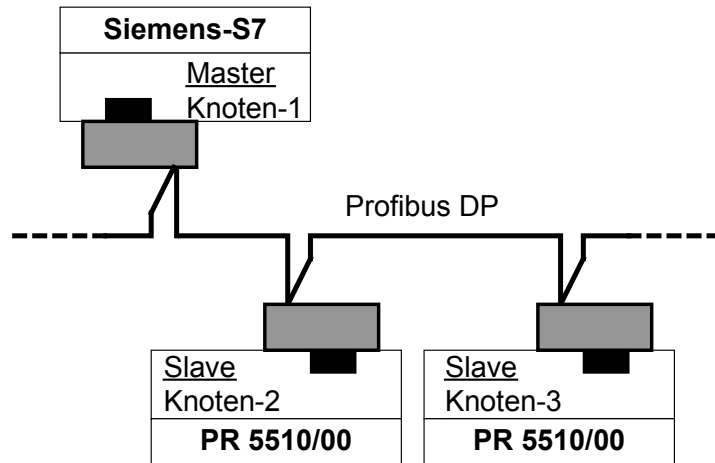


Legend

Token-Umlauf (logischer Ring)	Token cycle (logic ring)
aktiver Busteilnehmer	active bus participants
passiver Busteilnehmer	passive bus participants
logischer Ring	logic ring
Master-Slave-Beziehung	Master-slave relationship

Note: We recommend using the relevant technical literature, or consultation of a Profibus specialist.

1.1.3 General Bus-Topologie



Master (file ,GWT_5610.GSD' loaded)

- Special Profibus-Connector (In/Out-Loop)
- Bus-Termination-resistors (switchable)

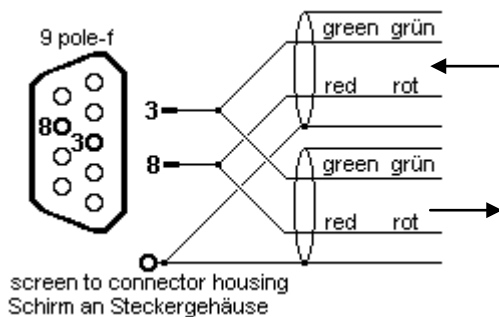
- Special-Profibus-cable (colour: violet)
- Transmission (EIA RS-485)

- Special Profibus-Connector (In/Out-Loop)
- Bus-Termination-resistors (switchable)

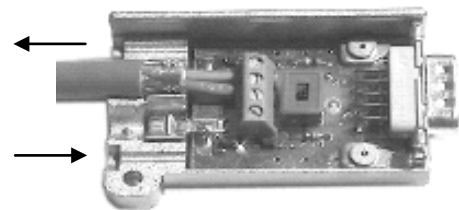
Slaves

[Setup]-[Fieldbus Parameter]

1.1.4 9-Pole D-Sub Socket Allocation



e.g.: SIMATIC NET PROFIBUS FAST CONNECT



Pin allocation to EN 50170	Signal	Color	Description
Housing -----	Screen		
1	n.c		not connected
2	n.c		not connected
3 -----	B-line	green	positive RxD/TxD to RS485 specification
4 if needed	RTS		Request To Send (only for use of a repeater)
5 -----	GND Bus		GND isolated from RS-485
6 -----	+5 V Bus		+5 V isolated from RS-485
7	n.c.		not connected
8 -----	A-line	red	negative RxD/TxD to RS485 specification
9	n.c		not connected

1.1.5 Twisted Pair Cabling

Note: Use only professional network components: e.g. SIMATIC NET PROFIBUS FAST CONNECT

Special two-wire cable

Cable sheath: violet (Profibus id. color)

Screen: Meshed sheathing

Conductor:

Signal B red (only recommendation)

Signal A green (only recommendation)

The segment length dependent on transfer rate and cable type (note manufacturer specifications) must be taken into account.

1.000 m for transfer rates up to 93.75 kBit/s

800 m for a transfer rate of 187.5 kBit/s

400 m for a transfer rate of 500 kBit/s

200 m for a transfer rate of 1.5 MBit/s

100 m for a transfer rate of 3, 6, and 12 MBit/s

With longer cables, a repeater must be used.

1.1.6 Bus Termination

The end nodes in a Profibus-DP network must be fitted with termination resistors, to prevent reflections in the bus cable.



Bus termination switch ③ in mounting plate

Bus termination switch 'ON'

Bus termination switched on.

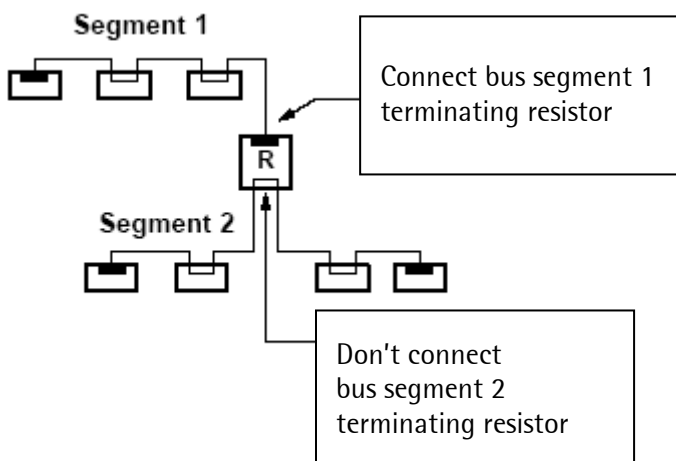
If the module is the last one or the first one in the network, this switch must be set to 'ON', or an external terminating resistor in the connector must be used.

Bus termination switch ,OFF'

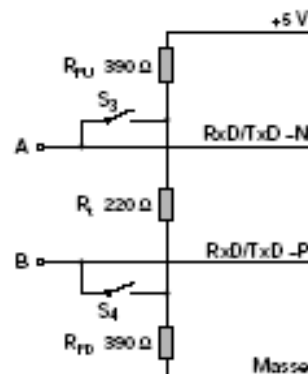
Bus termination switched off.

When using an external termination in the Profibus connector, the switch in the mounting plate must be in position 'OFF'.

Example: when using a repeater



Bus termination resistors



1.1.7 PR5510 Fieldbus Parameter

After [Erase], the following settings for the [Setup]-[Fieldbus Parameter] must be entered:

Setup *Fieldbus Parameter*		Selection: fieldbus configuration.
I/Os # Byte I/O	Selection: [8], 16, 20, 24, 32, 64	
*Profibus-DP address 1	Selection: 1...126	Specify unique node address for slave.
Scale-interface # disable	Selection: disable, [WP-A]	disable = Scale interface* deactivated => no weights G/N/T, no status bits
Save Fieldbus conf ? YES # ---- # NO	NO YES saving fieldbus conf	Prompt for storage? All entries are cancelled! Store in non-volatile EAROM.
Warmstart run Fieldb	Only with YES selected.	Activate the config data.

* [standard] setting, IEC61131 special programming required!

Notes: Independent of the adjusted I/O data bus width, the contained information must always be transmitted consistently (see also GSD file in Chapter 1.1.8).
With e.g. a Siemens PLC, this is organized by System function modules SFC14 und SFC15.
Load the relevant GSD file for adjustment of the 'master'!

1.1.8 GSD File

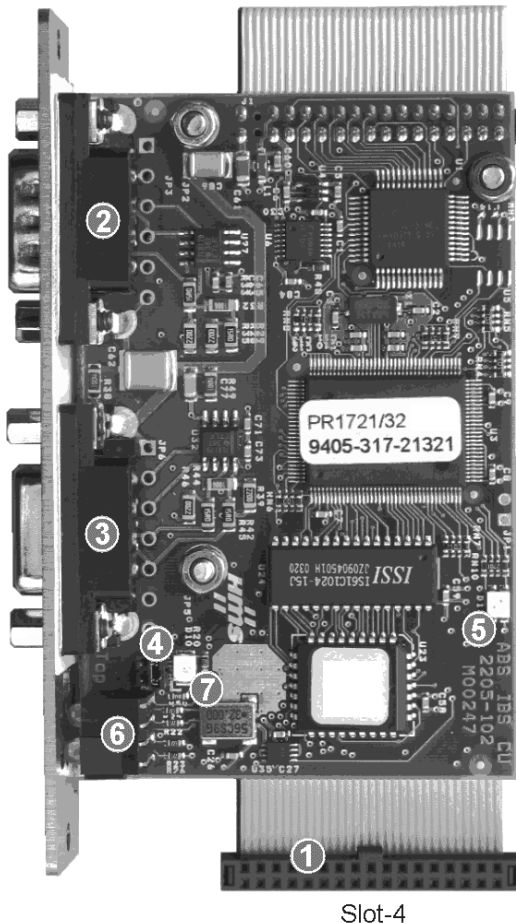
For commissioning of the PR1721/31-slaves, the relevant approved GSD file must be loaded into the master. The file is edited/editable in ASCII text format, the ident is approved by the PNO.

Note: The file is stored on the CD (directory 'Fieldbus' of the according instrument) supplied with the unit. The current file is also available for download via the Internet:
<http://www.sartorius-mechatronics.com> [Downloads]

1.2 PR1721/32 InterBus-S (Slave)

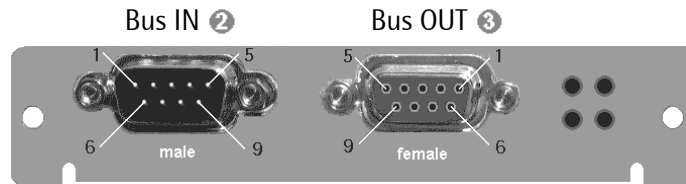
It is a plug-in card for installation in the instrument, with 2 x standard 9-pole D-Sub socket + plug for InterBus connection. The module is based on the latest Interbus chip technology with transfer rates of 500 kbits/s and 2 Mbits/s.

The module is mounted mechanically in rear panel cut-out 1 or 2, and inserted electrically into Slot 4 on the main circuit board by means of the flat cable, see instrument manual.



Connection type (internal) 34-pin connector ① on flat cable for Slot 4

Connection type (external) Standard IBS 9-pole D-Sub socket_OUT and plug_IN in the mounting plate



Transfer rate 500 kbit/s or 2 Mbit/s, selectable

Topology Point_to_point, as a closed ring

Protocol InterBus-S master-slave fixed telegram length, deterministic cyclical process data transmission with max. 10 words I/O.

Cable Interbus , colour: green
3x 2 twisted pairs, common screening

Cable impedance 150 Ω

Bus termination Not necessary because it is an active ring

Certificates By the INTERBUS CLUB e.V.:
compatible with the Interbus standard
Standard IEC 61158 (parts 3 to 6)
EN 50254 (DIN 19258)
industrial suitable CE, UL & cUL

Dimensions (LxWxH) 87 x 55 x 15 mm

Weight 125 g.

Potential isolation Yes, optocoupler and DC/DC converter

Cable length 400 m (between two units connected on the field bus) total length: 13 km



Caution!

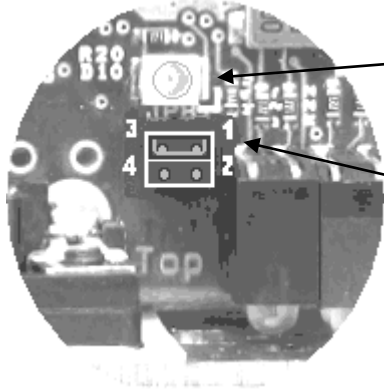
Before installation of the InterBus-S card already existing data must be saved, calibration and configuration data are not lost!

After installation of the card, a [COLD] start is required; otherwise, a continuous beep will be output.

Note:

The InterBus-S card is supported from PR5510 firmware release 3.12.
Using PR1721/32 is not possible, if another option is already fitted on Slot 4.

1.2.1 Display and Controls




LED 7 is lit, when the operating voltage is applied.

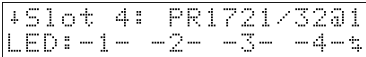
The transfer rate is selected using the 2-pole jumper 4.


3 – 1 = 2 Mbit/s

4 – 2 = 500 kbit/s

The position (selected transfer rate) is saved only by supply voltage switch-on.

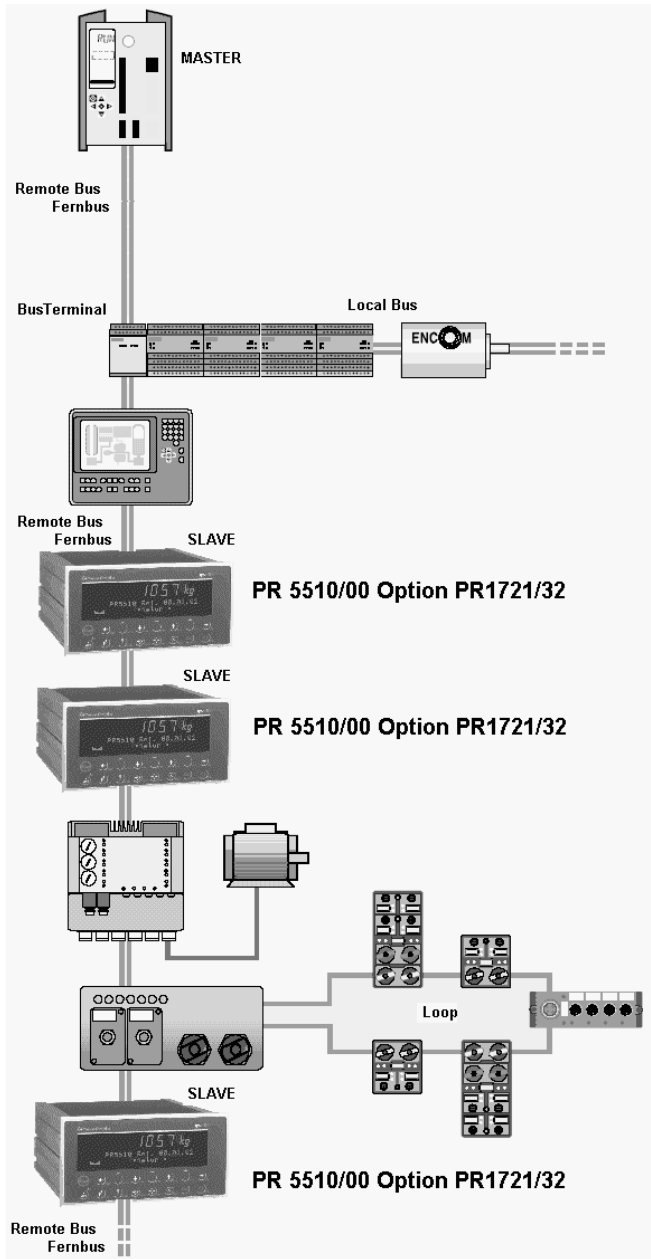
 5	Watchdog LED
Flashing 1 Hz green	Module initialized and running without problems.
Flashing 2 Hz green	Module not initialized.
Flashing 1 Hz red	RAM check error
Flashing 2 Hz red	ASIC and FLASH ROM check error
Flashing 4 Hz red	ProfiBus-DP RAM check error

Front panel display: [Setup]-[IO-Slots] 
 or mounting plate (rear panel):

 6	LED 1 CC/RC	LED 2 BA	LED 3 RD	LED 4 TR
Off				
Lighted green	Cable OK, no RESET mode in the master	Bus is active.		PCP communication is active, hold = 500 ms
Lighted red			Remote bus is not active.	

1.2.2 Basic Function

The InterBus module is a complete Interbus-S slave. It contains all analog and digital components for connection into a powerful InterBus system for cable-bound RS-422 transmission. The module is certified and tested for interoperability with leading Interbus master modules, e.g. made by Phoenix Contact. The on-board microprocessor handles the overall Interbus communication automatically, i.e. the PR5510 main processor is completely discharged from protocol handling.



The Interface module is the master (generation G3 or G4 today), which controls data communication. The module transfers the output data to the corresponding modules, receives input data and monitors the data transfer. Moreover, diagnosis messages are displayed and error messages are output to the host system.

The Anschaltbaugruppe is connected with the other units on the bus via the remote bus. A branch thereof is called a remote bus tap. Remote bus units can be special bus terminals, defined I/O modules, or instruments such as robots, motor actuators or operating units or PR1721/32 slaves.

The bus terminal is connected to the remote bus. The decentral local busses with the I/O modules, which provide the connection between INTERBUS and sensors or actuators, branch off from the bus terminal. The bus terminal regenerates the data signal (repeater function) and ensures potential isolation between bus segments.

The local bus branches from the remote bus via a bus coupler module. It provides the connection between units connected on the local bus. Branches at this level are not permitted.

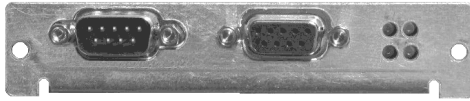
Sensors and actuators distributed decentrally at machines or systems are connected into a network by means of the InterBus loop (only with G4 master).

InterBus is the only bus system which uses only one protocol frame for the messages of all bus units according to the 'Summenrahmenverfahren'.

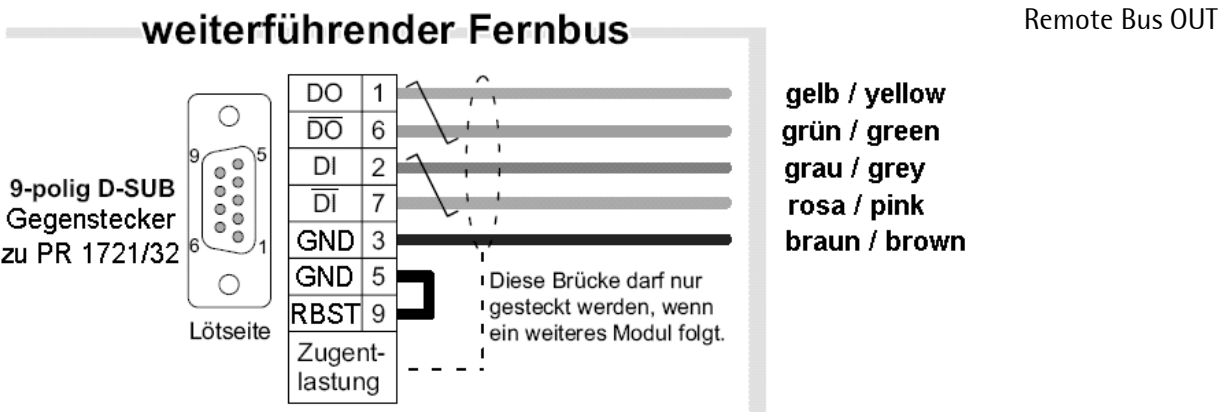
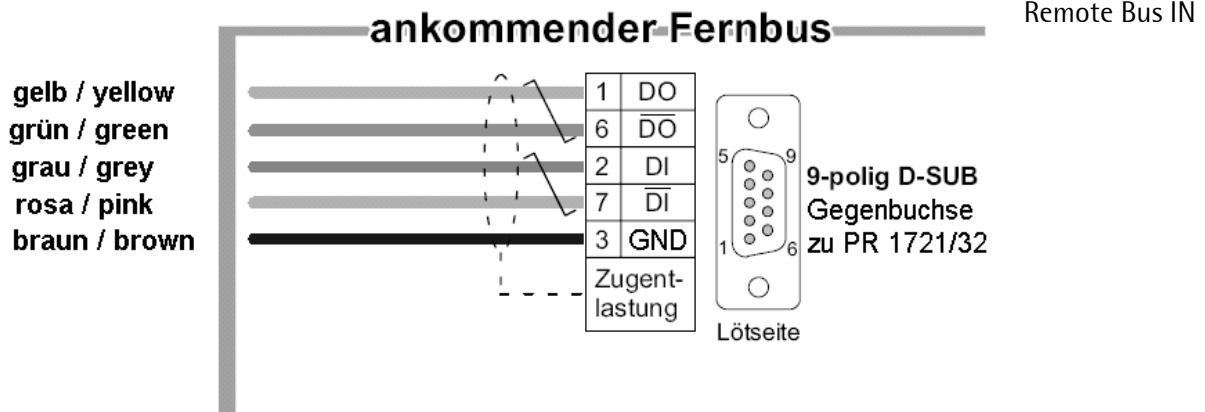
Note: We recommend using the relevant technical literature, or consultation of a InterBus specialist.

1.2.3 General Bus-Topologie

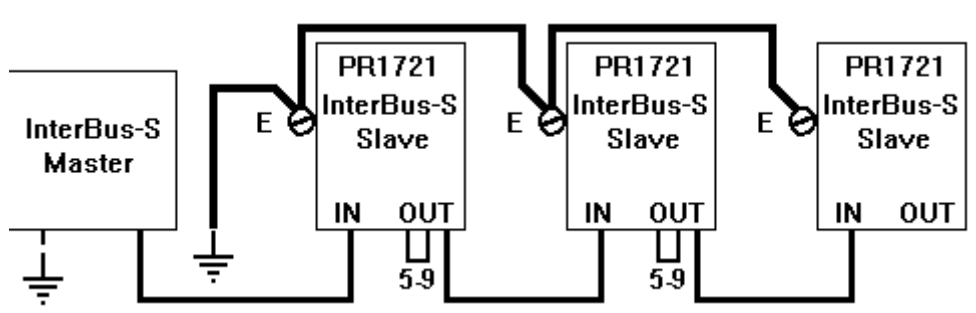
Bus IN-remote-Bus OUT



Pin allocation:
remote bus
input/output loop



The bus signal is looped through every module (ring topology). The input and the output side should be connected. The bus arrives on pin no. 2-7 and continues at 1-6. A jumper (5-9) in the output informs the instrument that the bus is continued.



Caution!

Take care that the potential compensation between the PR instruments (slaves) and the Anschaltbaugruppe (master) is ensured!

Bus cabling with screened, twisted-pair cable (3x 2) inclusive of screened D-Sub connectors (metal housing). Pre-fabricated cables in standard lengths are available.

Recommendation: Use special IBS cable (available from special dealers).

1.2.4 9-Pole D-Sub Connector Allocation

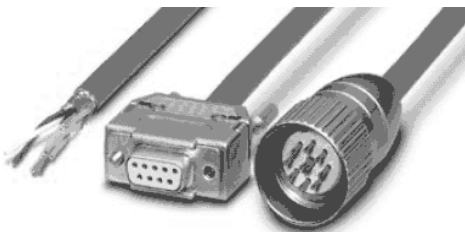
e.g. Phoenix Contact IBS RTC-T

Pin allocation to DIN 41642	Signal	Color DIN 47100	Description
Cable sheath		green	special InterBus cable (certified)
Housing -----	Screen		
1 -----	DO2	yellow	not inverted data output
2 -----	DI2	grey	not inverted data input
3 -----	GND	brown	Signal - ground
4	n.c		not connected
5 ----- * only if necessary	GND		Signal - ground (continuation jumper: 5-9)
6 -----	/DO2	green	inverted data output
7 -----	/DI2	pink	inverted data input
8	n.c	red	not connected
9 ----- * only if necessary	RBST		(continuation jumper: 5-9)

1.2.5 Twisted Pair Cabling

Note: Use only professional Interbus components: e.g. Phoenix Contact IBS RTC-T

Non-prefabricated and prefabricated versions Remote bus cable, sheath: green to RAL 6017



standard:
 3 x 2 x 0,22 mm²
 twisted in pairs
 common screening
 Colour codes:
 DIN 47100



Caution!
 Remove insulation according to connector standard.
 Conductor pairs must remain twisted directly up to the connecting terminals!

1.2.6 PR5510 Fieldbus Parameter

After [Erase], the following settings for the [Setup]-[Fieldbus Parameter] must be entered:

Setup *Fieldbus Parameter*		Selection: fieldbus configuration.
*I/Os * 8 Byte I/O*	Selection: [8], 16, 20, 24, 32, 64	For InterBus my allowed only until max. 20 byte IO.
*Scale-interface * disable*	Selection: disable, [WP-A]	disable = Scale interface* deactivated => no weights G/N/T, no status bits
Save Fieldbus conf ? YES * --- * NO	Leave with [Exit] key. NO YES saving fieldbus conf	Prompt for storage? All entries are cancelled! Store in non-volatile EAROM.
Warmstart run Fieldb	Only with YES selected.	Activate the config data.

* [standard] setting, IEC61131 special programming required!

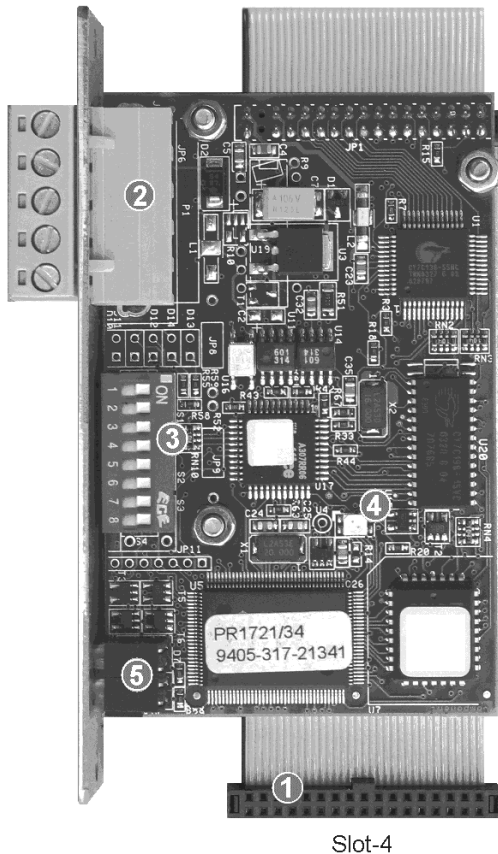
Data allocation to the units on the bus is by means of the physical location of the units in the Interbus system rather than by determination of a bus address by means of DIL or rotary switch. Accordingly, provisions during software configuration in [Setup-fieldbus param] of the PR instruments are omitted!

Only the transfer rate (default = 500 kbit/s) must be selected by means of a jumper (default = 4-2) on the PR 1721/32 module itself, see Chapter 1.2.1. It is indispensable to do this before switching on the instrument. The value to be selected is determined by the Anschaltbaugruppe (G3 or G4 master).

Note: Check, or adjust the transfer rate during installation and before shutting the instrument. The setting will be taken over only when the supply voltage of PR1721/32 is switched on for the next time.

1.3 PR1721/34 DeviceNet (Slave)

It is a plug-in card for installation in the instrument, with 5-pole plug-in terminal block for DeviceNet connection. It is a complete DeviceNet adaptor (slave) with CAN controller and transfer rates up to 500kbits/s. The module is mounted mechanically in rear panel cutout-1 or 2, and inserted electrically into Slot 4 on the main circuit board by means of the flat cable, see instrument manual.



Slot-4

Connection type (internal) 34-pin connector ① on flat cable for Slot 4

Connection type (external) 5-pole screw terminal block ② (plug-in type) in the mounting plate.



Transfer rate 125, 250 and 500 kbit/s

Topology Point_to_point, parallel bus

Protocol DeviceNet master-slave polling method (Polled IO)
CRC error detection to IEC62026 (EN50325)
max. 64 station nodes
max. data width 512 bytes Input&Output

Configuration EDS file (PR1721/34 specific)
MAC-ID (1...62)

Certificates/ conformity Compatible with DeviceNet specification Vol 1: 2.0, Vol 2: 2.0
ODVA certificate according to conformity test software version A-12
industrial suitable CE, UL & cUL

Cable DeviceNet color: petrol-green
2x 2 twisted pairs, screened

Cable impedance 150 Ω

Bus termination 120 Ω at the lead ends required

Dimensions (LxWxH) 87 x 55 x 15 mm **Busload** 33 mA

Weight 125 g **Potential isolation** Yes, optocoupler and DC/DC converter



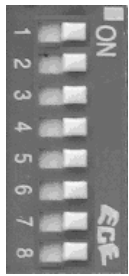
Caution!

Before installation of the DeviceNet card already existing data must be saved, calibration and configuration data are not lost!

After installation of the card, a [COLD] start is required; otherwise, a continuous beep will be output.

Note: The DeviceNet card is supported from PR5510 firmware release 3.12.
Using PR1721/34 is not possible, if another option is already fitted on Slot 4.

1.3.1 Display and Controls




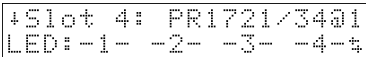
The DIL switch ④ is not supported here. Adjust via [Setup]-[Fieldbus Parameter].




Caution!

Make sure that the switches 1...8 are set to position 'ON' before and after installation!

 ④	Watchdog LED
Flashing 1 Hz green	Module initialized and running without problems.
Flashing 2 Hz green	Module not initialized.
Flashing 1 Hz red	RAM check error
Flashing 2 Hz red	ASIC and FLASH ROM check error
Flashing 4 Hz red	ProfiBus-DP RAM check error

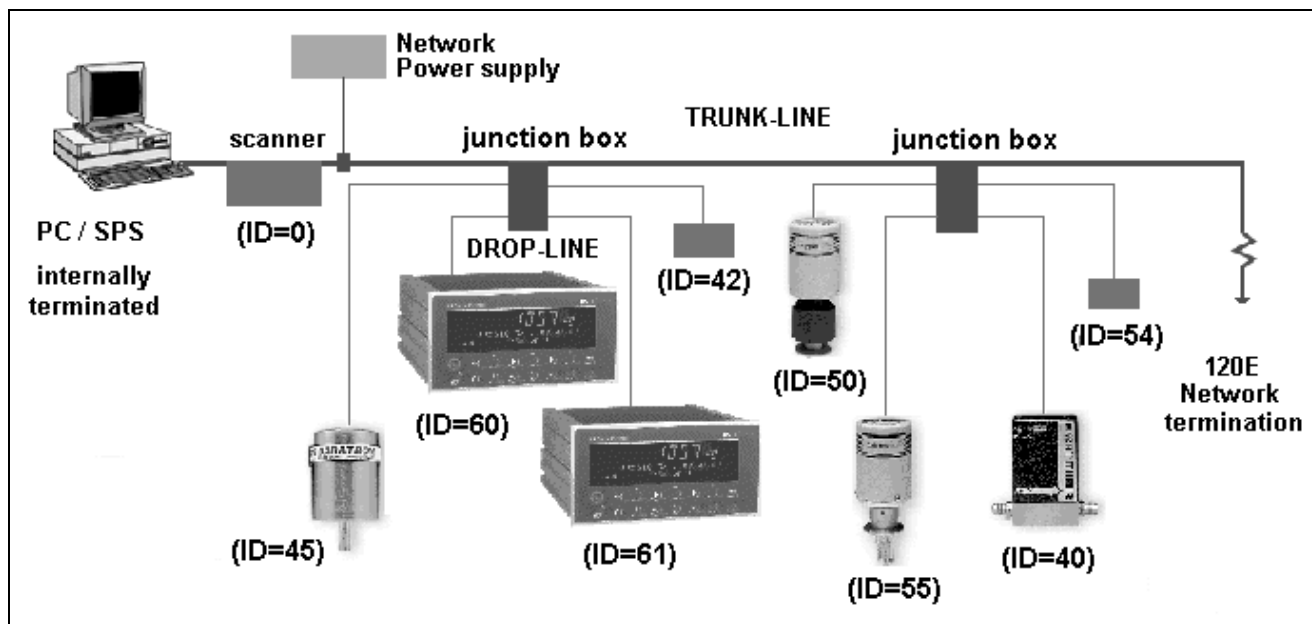
Front panel display: [Setup]-[IO-Slots] 
 or mounting plate (rear panel):

 ⑤	LED 1	LED 2	LED 3	LED 4
	Not used	Network status	Not used	Module status
Off		No power supply		
Lighted green		Link detected, online, connected		Device operational
Flashing green		Critical link failure		data length >configuration
Lighted red		Online, not connected		Unrecoveral fault
Flashing red		Connection time-out		Minor fault

1.3.2 Basic Function

The DeviceNet module is a complete DeviceNet adaptor (slave). It contains all analog and digital components for connection into a powerful DeviceNet system. The module is ODVA-certified and tested for interoperability with all leading DeviceNet MasterScanner modules. The on-board microprocessor handles the overall DeviceNet bus communication automatically, i.e. it discharges the PR 5510 main processor completely of the DeviceNet protocol handling.

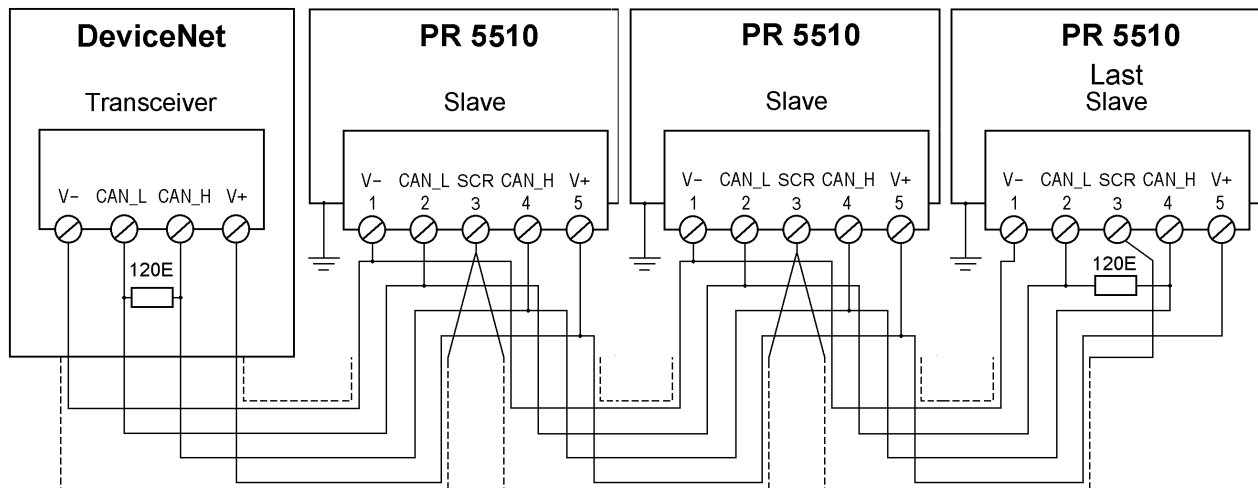
DeviceNet is a worldwide CANbus-based open fieldbus, developed by Allen-Bradley (Rockwell Automation). The DeviceNet specification is available from the independent open user organization "Open DeviceNet Vendor Association" (ODVA).



In addition to the data signals, the TRUNK-LINE also includes the supply voltage for all connected units. Therefore, the overall current consumption to be provided by the central network power supply must be taken into account. There are two types of special TRUNK lines for different installation conditions: full or thin.

Note: We recommend using the relevant technical literature, or consultation of a DeviceNet specialist.

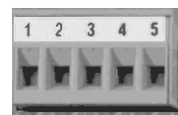
1.3.3 General Bus-Topologie



PR1721/34 is energized with 33 mA from the DeviceNet bus supply.

1.3.4 5-pole terminal block Allocation

e.g. Phoenix Contact IBS RTC-T

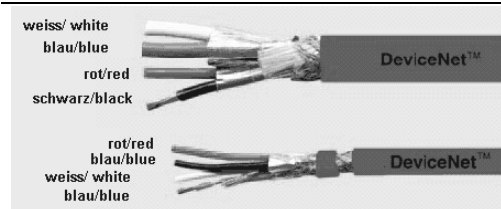


	Signal	Color	Description
Cable sheath			special DeviceNet cable (certified)
1 -----	V-	black	negative supply
2 -----	CAN_L	blue	CAN_L bus signal
3 -----	Schirm		cable screen
4 -----	CAN_H	white	CAN_H bus signal
5 -----	V+	red	positive supply

1.3.5 Twisted Pair Cabeling

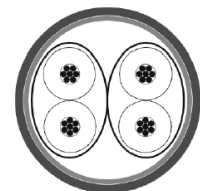
Note: Use only professional DeviceNet components.

Max length:	500 m at 125 kbit/s 250 m at 250 kbit/s 100 m at 500 kbit/s	TRUNK line Sheath: petrol-green to RAL 5018	2x 2 twisted pairs overall screen (+extra wire)
-------------	---	---	--



full 8 A

thin 4 A



Max length:	6 m at 125...500 kbit/s	DROP line	
-------------	-------------------------	-----------	--

Bus wiring with screened, twisted cable (2x 2).

Bus termination at the two ends by a 120 Ω resistor.



Caution!

The module itself does not have a switchable terminating resistor.

1.3.6 PR5510 Fieldbus Parameter

After [Erase], the following settings for the [Setup]-[Fieldbus Parameter] must be entered:

Setup *Fieldbus Parameter*		Selection of the fieldbus configuration
↑I/Os ↑ * 8 Byte I/O*	Selection: [8], 16, 20, 24, 32, 64	[8 Byte IO] must be set for DeviceNet.
↑DeviceNet baudrate ↑ * 250k*	Selection:[250], 125, 500	Note e.g. permissible cable length!
↑DeviceNet MAC-ID ↑ * 1	Selection: 1..62	Select a unique module address.
↑Scale-interface ↑ * disable*	Selection: disable, [WP-A]	disable = Scale interface* deactivated => no weights G/N/T, no status bits
	Leave with [Exit] key.	Prompt for storage?
Save Fieldbus conf ? YES # ---- # NO	NO YES saving fieldbus conf	All entries are cancelled! Store in non-volatile EAROM.
Warmstart run Fieldb	Only with YES selected.	Activate the config data.

* [standard] setting, IEC61131 special programming required!

Standard adjustment of data bus width = [8 byte IO] (>8 byte for future extensions)

Note: Weight values such as gross, net, tare... are DINT data (4 bytes wide) and can be transmitted with this 'standard' data bus width, incl. the relevant status bits. For this, setting Scale-Interface = WP-A is required.
Characteristic with DeviceNet: Intel dataformat, see Chapter 2.5.

1.3.7 EDS File

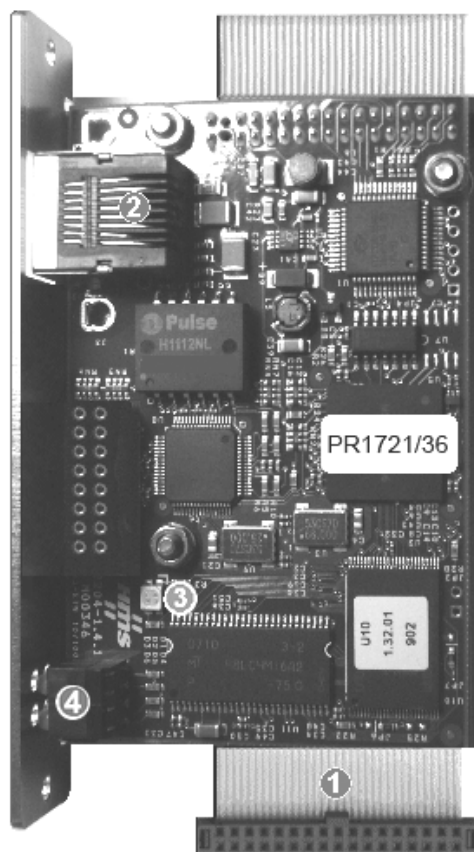
For PR1721/34 slave commissioning, load the relevant approved EDS (Electronic Data Sheet) into the master. These files are edited/editable as ASCII text format. The ident is ODVA-approved and available in the bus after completing the fieldbus parameter configuration.

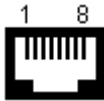

Note: The file is stored on the CD (directory 'Fieldbus' of the according instrument) supplied with the unit. The current file is also available for download via the Internet:
<http://www.sartorius-mechatronics.com> [Downloads]

1.4 PR1721/36 ProfiNet I/O

It is a plug-in card for installation in the instrument, with a standard RJ-45 socket for network connection. The module contains a powerful UDP/IP connecting circuitry with transfer rates of 10 and 100 Mbit/s.

The module is mounted mechanically in rear panel cut-out 1 or 2, and inserted electrically into Slot 4 on the main circuit board by means of the flat cable, see instrument manual.



Connection type (internal)	34-pin connector ① on flat cable for Slot 4
Connection type (external)	② RJ-45 connecting socket in holding plate
	
Transfer rate	10 Mbit/sec and 100 Mbit/s, Autodetection (10/100, HalfDX/FullDX)
Connection mode	Network
Protocol	ProfiNet/IO
Configuration	XML file (PR1721/36 specific)
Cable	Twisted pairs, screened e.g. patch cable CAT5 Autolink (straight oder crossover)
Cable impedance	150 Ω
Cable length to HUB	Max. 115 m
Certificate	ProfiBus Nutzerorganisation e.V. for HMS Industrial Networks AB Certificate No.: Z10006 Report: PN005-1, 12.02.2007.
Potential isolation	Yes
Dimensions (LxWxH)	87 x 55 x 15mm
Weight	125 g




Caution!

Before installation of the ProfiNet I/O card already existing data must be saved, calibration and configuration data are not lost!

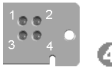
After installation of the card, a [COLD] start is required; otherwise, a continuous beep will be output.

Note: The ProfiNet I/O card is supported from PR5510 firmware release 3.40. Using PR1721/36 is not possible, if another option is already fitted on Slot 4.

1.4.1 Display and Controls

	Watchdog LED
Flashing 1 Hz green	Module initialized and running without problems.
Flashing 2 Hz green	Module not initialized.
Flashing red	RAM, ROM or ASIC check error

Front panel display: [Setup]-[IO-Slots] +Slot 4: PR1721/3601
LED: -1- -2- -3- -4-
or mounting plate (rear panel):

	LED 1	LED 2	LED 3	LED 4
Off	No connection (HW)	Off line, no connection	Not used	Not initialized
Lighted green	Connection (HW)	Online, connection established		Initialized, no error
Flashing green 1 Hz	Receiving/Transmitting data	Online, in STOP		
Flashing green 4 Hz				Used by engineering tool for identification
Flashing red				Configuration error No station name or IP-Address, internal error

1.4.2 Network Parameter

The IP address for the ProfiNet I/O card must be entered manually or automatically, see Chapter 1.6.11.

1.4.3 Fieldbus Parameter

After [Erase], the following settings for the [Setup]-[Fieldbus Parameter] must be entered:

Setup *Fieldbus Parameter*		Selection: fieldbus configuration.
+I/Os * 8 Byte I/O*	Selection: [8], 32	
+Scale-interface * disable*	Selection: disable, [WP-A]	disable = Scale interface* deactivated => no weights G/N/T, no status bits
	Leave with [Exit] key.	Prompt for storage?
Save Fieldbus conf ? YES # --- # NO	NO YES saving fieldbus conf	All entries are cancelled! Store in non-volatile EAROM.
Warmstart run Fieldb	Only with YES selected.	Activate the config data.

* [standard] setting, IEC61131 special programming required!

1.4.4 XML File

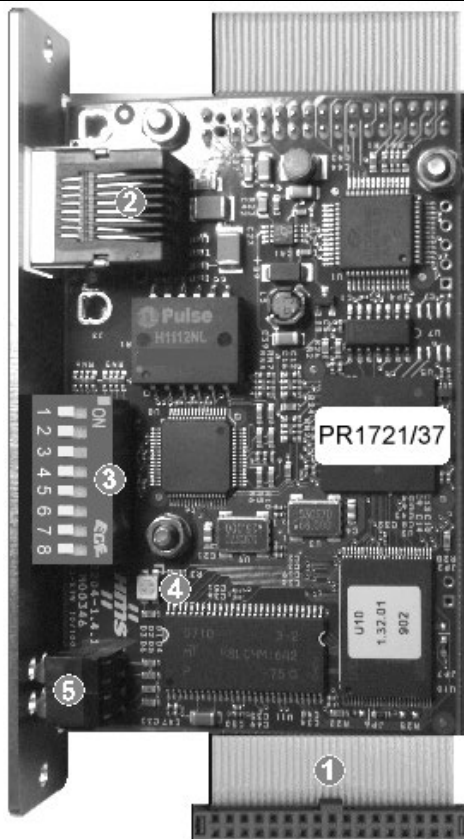
For commissioning of the PR1721/36-slaves, the relevant approved XML file must be loaded into the master. The file is edited/editable in ASCII text format, the ident is approved by the PNO.

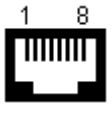

Note: The file is stored on the CD (directory 'Fieldbus' of the according instrument) supplied with the unit. The current file is also available for download via the Internet:
<http://www.sartorius-mechatronics.com> [Downloads]

1.5 PR1721/37 EtherNet-IP

It is a plug-in card for installation in the instrument, with a standard RJ-45 socket for network connection. The module contains a powerful TCP/IP and EtherNet-IP connecting circuitry with transfer rates of 10 and 100 Mbit/s.

The module is mounted mechanically in rear panel cut-out 1 or 2, and inserted electrically into Slot 4 on the main circuit board by means of the flat cable, see instrument manual.



Connection type (internal)	34-pin connector ① on flat cable for Slot 4
Connection type (external)	② RJ-45 connecting socket in holding plate
	
Transfer rate	10 Mbit/sec and 100 Mbit/s, Autodetection (10/100, HalfDX/FullDX)
Connection mode	Network
Protocol	EtherNet-IP
Configuration	EDS file (PR1721/37 specific)
Cable	Twisted pairs, screened e.g. patch cable CAT5 Autolink (straight oder crossover)
Cable impedance	150 Ω
Cable length to HUB	Max. 115 m
Certificate	EtherNet-IP Specification ODVA File No. 10286 Test Date: 06.09.2005 Vendor ID 90 See also: www.odva.org Tested according to: CE, UL & cUL
Potential isolation	Yes
Dimensions (LxWxH)	87 x 55 x 15mm
Weight	125 g



Caution!

Before installation of the EtherNet-IP card already existing data must be saved, calibration and configuration data are not lost!

After installation of the card, a [COLD] start is required; otherwise, a continuous beep will be output.

Note:

The EtherNet-IP card is supported from PR5510 firmware release 3.30.

Using PR1721/37 is not possible, if another option is already fitted on Slot 4.

1.5.1 Display and Controls




The DIL switch ④ is not supported here.
Adjust via [Setup]-[Network Parameter].




Caution!

Make sure that the switches 1...8 are set to position 'OFF' before and after installation!

 ④	Watchdog LED
Flashing 1 Hz green	Module initialized and running without problems.
Flashing 2 Hz green	Module not initialized.
Flashing red	RAM, ROM or ASIC check error

Front panel display: [Setup]-[IO-Slots] `+Slot 4: PR1721/3701`
`LED:-1- -2- -3- -4-`
 or mounting plate (rear panel):

 ⑤	LED 1	LED 2	LED 3	LED 4
Off	No connection (HW)	No power		No power o. No IP Address
Lighted green	Connection (HW)	Controlled by a scanner		Online, connection established
Flashing green		Not configured or scanner in idle state	Packet is received or transmitted.	Online, no connection established
Lighted red		Major unrecoverable fault		IP Address double, fatal error
Flashing red		Minor recoverable fault		Connection timeout
Alternat. red/green		Self test in progress		Self test in progress

1.5.2 Network Parameter

The IP address for the EtherNet-IP card must be entered manually or automatically, see Chapter 1.6.11.

1.5.3 Fieldbus Parameter

After [Erase], the following settings for the [Setup]-[Fieldbus Parameter] must be entered:

Setup *Fieldbus Parameter*		Selection: fieldbus configuration.
I/Os 8 Byte I/O	Selection: [8], 32	
Scale-interface disable	Selection: disable, [WP-A]	disable = Scale interface* deactivated => no weights G/N/T, no status bits
	Leave with [Exit] key.	Prompt for storage?
Save Fieldbus conf ? YES * ---- * NO	NO YES saving fieldbus conf	All entries are cancelled! Store in non-volatile EAROM.
Warmstart run Fieldb	Only with YES selected.	Activate the config data.

* [standard] setting, IEC61131 special programming required!

1.5.4 EDS File

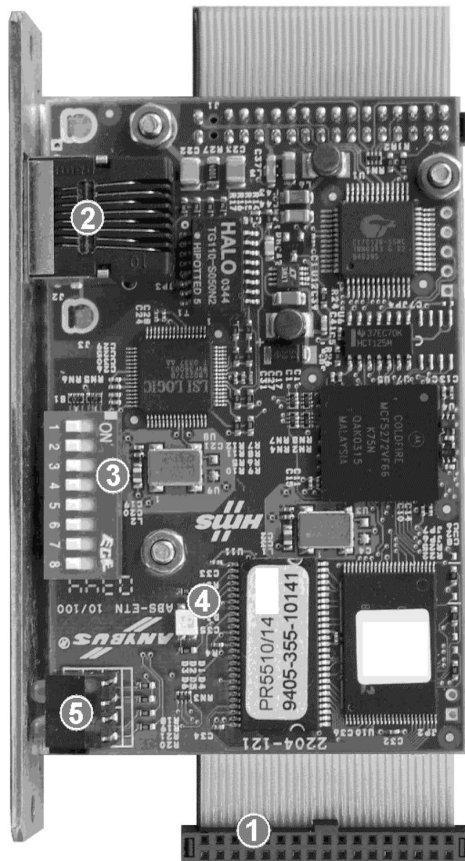
For PR1721/37 slave commissioning, load the relevant approved EDS (Electronic Data Sheet) into the master. These files are edited/editable as ASCII text format. The ident is ODVA-approved and available in the bus after completing the fieldbus parameter configuration.

Note: The file is stored on the CD (directory 'Fieldbus' of the according instrument) supplied with the unit. The current file is also available for download via the Internet:
<http://www.sartorius-mechatronics.com> [Downloads]

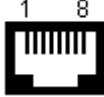

1.6 PR5510/14 Ethernet-TCP/IP

It is a plug-in card for installation in the instrument, with a standard RJ-45 socket for network connection. The module contains a powerful TCP/IP and ModBus-TCP connecting circuitry with transfer rates of 10 and 100 Mbit/s.

The module is mounted mechanically in rear panel cut-out 1 or 2, and inserted electrically into Slot 4 on the main circuit board by means of the flat cable, see instrument manual.



Slot-4

Connection type (internal)	34-pin connector ① on flat cable for Slot 4
Connection type (external)	② RJ-45 connecting socket in holding plate
	
Transfer rate	10 Mbit/sec (10BaseT , Ethernet) and 100 Mbit/sec (100BaseTx, Fast Ethernet) Autodetection (10/100, HalfDX/FullDX)
Connection mode	Network
Protocol	EW_COMM, Modbus/TCP
Cable	Twisted pair, screened e.g. patch cable CAT5 dependent on application (straight/crossover)
Cable impedance	150 Ω
Cable length to HUB	Max. 30 m
Certificate	Compatible acc. to Modbus organization to ModBus-TCP standard industrial suitable CE, UL & cUL
Potential isolation	Yes, optocoupler and DC/DC converter
Dimensions (LxWxH)	87 x 55 x 15mm
Weight	125 g



Caution!

Before installation of the Ethernet-TCP/IP card already existing data must be saved, calibration and configuration data are not lost!

After installation of the card, a [COLD] start is required; otherwise, a continuous beep will be output.

Note:

The Ethernet-TCP/IP card is supported from PR5510 firmware release 3.12.

Using PR5510/14 is not possible, if another option is already fitted on Slot 4.

1.6.1 Display and Controls




The DIL switch ④ is not supported here. Adjust via [Setup]-[Network Parameter].




Caution!

Make sure that the switches 1...8 are set to position 'OFF' before and after installation!

 ④	Watchdog LED
Flashing 1 Hz green	Module initialized and running without problems.
Flashing 2 Hz green	Module not initialized.
Flashing 1 Hz red	RAM check error
Flashing 2 Hz red	ASIC and FLASH ROM check error
Flashing 4 Hz red	Ethernet-RAM check error

Front panel display: [Setup]-[IO-Slots] `+Slot 4:PR5510/14+01`
 or mounting plate (rear panel): `LED:-1- -2- -3- -4-*`

 ⑤	LED 1	LED 2	LED 3	LED 4
Off				
Lighted green	Connection (Link)			
Flashing 1 Hz green		IP- address not supported*	Bi-directional package traffic busy	Number of units detected on the ModBus
Lighted red		IP-address double		
Flashing 1 Hz red		Invalid MAC address		
Flashing 2 Hz red		[Ethernet config] loading error		
Flashing 4 Hz red		internal error (Fatal)		

* No errors possible, DIL switch setting is not supported for PR5510.

1.6.2 Applications

Typical for transmission of large quantities of data with high throughput.

Applicable for the following Sartorius products in specific Sartorius applications:

- PR8400 ProBatch Plus,
- PR1750 development tool,
- PR1791 DDE server, PR1792 OPC server
- PR8001 Powertools (DisplayIt, AccessIt, FlashIt)
- PR5510 instrument cross communication
- ModBus-TCP (as a field bus interface)

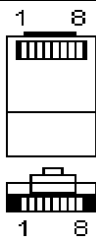
1.6.3 Pin Allocation

According to ISO/IEC 11801, EN 50173, EIA/TIA 568 A and B

,Direct' connection: PR5510 <-1-> PR5510 or PC (≥ -1- ,crossover' cable type)

,crossover'	RJ-45	Signal	Pair	Conductor color		Signal	RJ-45
	1	1a - TPTX	2	white/orange	or red	2a - TPRX	3
	2	1b - TPTXn	2	orange	or orange	2b - TPRXn	6
	3	2a - TPRX	3	white/green	or black	1a - TPTX	1
	4		1	blue	or white		4
	5		1	white/blue	or blue		5
	6	2b - TPRXn	3	green	or green	1b - TPTXn	2
	7		4	white/brown	or yellow		7
	8		4	brown	or brown		8

,Indirekt' connection: PR5510 <-1-> HUB etc. <-2-> PC (≥ -1,2- ,straight-through' cable type)

'straight-through'	RJ 45	Signal	Pair	Conductor color		Signal	RJ-45
	1	1a - TPTX	2	white/orange	or red	1a - TPTX	1
	2	1b - TPTXn	2	orange	or orange	1b - TPTXn	2
	3	2a - TPRX	3	white/green	or black	2a - TPRX	3
	4		1	blue	or white		4
	5		1	white/blue	or blue		5
	6	2b - TPRXn	3	green	or green	2b - TPRXn	6
	7		4	white/brown	or yellow		7
	8		4	brown	or brown		8

1.6.4 Twisted Pair Cabeling



Double screened patch cable

(buy pre-fabricated 0.5...20 m, note cable type)

Zur Verbindung mit Hubs/Switches/Routern oder Netzwerkkarten:

- Frequency range CAT 5 to 100 MHz 10/100BASE-T
- RJ-45 connector (on both ends)
- Outer foil/meshed screening, category 5 certified.
- Pin allocation to EIA/TIA 568 A and B.

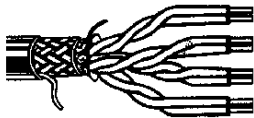


Non-prefabricated network cable (to be installed by the customer)

For connection with hubs/switches/routers or network cards:



- RJ-45 connector, screened
- Network cable
- Frequency range CAT 5 to 100 MHz
- 4 twisted pairs, screening consisting of an extra wire and foil
- Wire cross section 7 x 0,16 x AWG 26/7
- Max. cable length 100 m per network segment



Use 'twisted pair' standard cable (10BaseT or 100 BaseTx). Initially, this was an 8-core telephone cable. The conductors are twisted pairwise, whereby the screening is improved. Additionally, the overall cable is screened from the outside by a metal foil.



Caution!

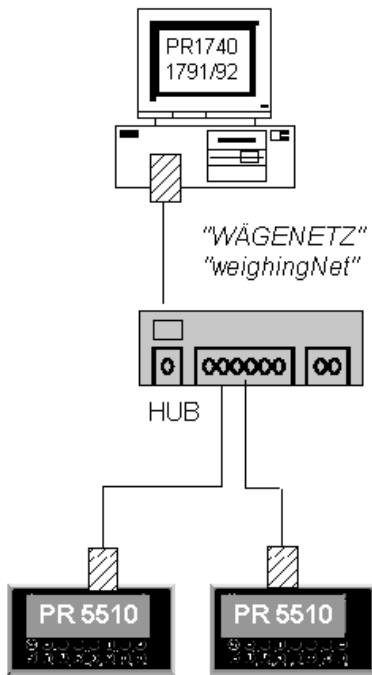
When using the cable for a 'Fast Ethernet application, the pairs may be untwisted by max. 13 mm at the connecting terminals!

Note:

For 'twisted pair', the following restrictions are applicable:

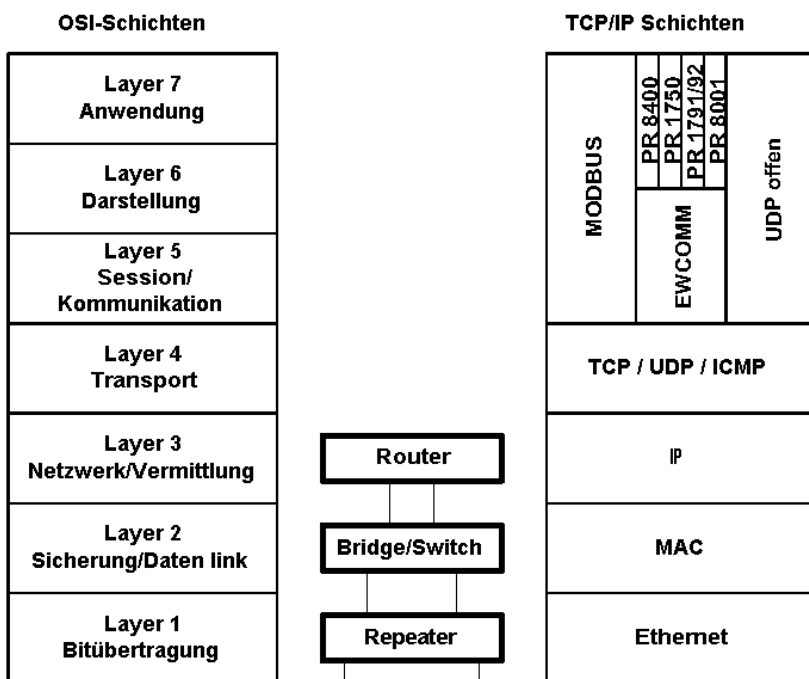
Maximum overall cable length: 100 m per segment
(with longer cables, a 'repeater' must be used).

Maximum transmission rate: 100 Mbit/s



Unlike outdated BNX/coax cabling, twisted pair cabling also requires a different cable topology.

The cable is not looped through, but the connecting ends are always in an active component, mostly a hub/switch. Starting from this hub, the cables are laid in a star-shaped configuration. The difference between bus and star topology only relates to cable laying, electrically, this is also a bus. Imagine that the connections are only grouped in the hub and that each computer is provided with its own segment.

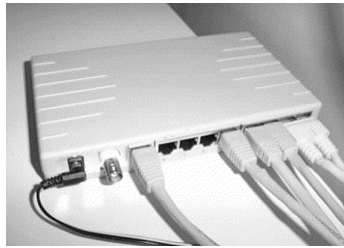


Open System Interconnection (OSI) is a basic model, which is divided into seven layers. However, most protocols (e.g. TCP/IP) can be oriented roughly at this model.

The MAC address (Media Access Control) of a network card is a fixed, burnt-in 6-byte value.

Network cabling is located below the layers, starting with the network card components for bit transmission.

1.6.5 Hub



A hub is the central exchange point in a star-shaped cable system, where the connections run together. Related to the network properties, a hub is also a repeater or a switch (unless it is of cheap quality).

I.e. the number of hubs is limited to 4.

The two RJ-45 connections on the left have the same number. The difference is that the left connection is crossed and the other one isn't. This means the use of crossed cables can be saved, if several hubs should be connected in a cascade. Some hubs also have a switch for 'cross/straight'.

When connecting repeaters in a cascade, the 5-4-3 rule must be followed:

5 Max. **five** segments may be between any two nodes.

4 Max. **four** repeaters may be between any two nodes.

3 Max. **three** coaxial segments may be between any two nodes, the rest must be UTP.

Note: In a network with 100 Mbit/s, note also that the separation between two hubs connected in cascade must not exceed 5 m.

1.6.6 Switch

A switch is just a bridge with several ports. The switch has the capacity of direct, simultaneous switching of several connections between ports, whereby the overall network is discharged accordingly.

Modern switches have an own internal bus (backplane), which can work with clearly higher transmission rates than the external connections. Today, high-quality hubs are mostly designed also as switches.

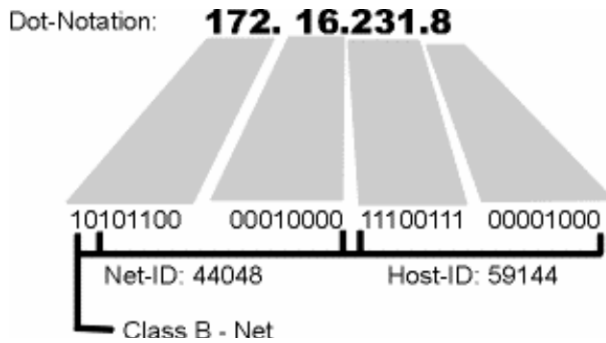
1.6.7 Transfer Rate Mbit/s

Outdated ISA cards are suitable only for max. 10 Mbit/s, which also applies to the outdated BNC wiring. These include also combined cards (both BNC + RJ-45 connection provided)

State-of-the-art PCI cards are mostly able to handle both 10 Mbits/s and 100 Mbits/s.

Note: All 100Mbits/s cards can also handle 10Mbits/s, but not vice versa.
,Autosense' determines the max.speed itself, but it does not always function correctly.
Fixed equal speed types in the network are preferable.

1.6.8 Addressing



The IP address is composed of network and host ID. The number of bits which are used for network and host ID is dependent on the IP network class.

The ranges given below for network and host ID for the relevant classes follow from the definition:

Class	Lowest Net-ID	Highest Net-ID	default mask
A	1.0.0.0	126.0.0.0	255.0.0.0
B	128.0.0.0	191.255.0.0	255.255.0.0
C	192.0.1.0	223.255.255.0	255.255.255.0
D	224.0.0.0	239.255.255.255	
E	240.0.0.0	247.255.255.255	

This classification isn't relevant any more today. Today, CIDR Classless Inter-Domain Routing is used:

IP addresses used by packages are examined in conjunction with an associated mask (logic AND) as a criterion for distinction of various networks and routed, handled or discarded.

Generally fixed network IDs are reserved for internal use, which are called private addresses. According to definition, these addresses are never 'routed' to the Internet!

Network dot-ID	used bits	default mask (dot)	default mask (Bits)	max. permissible IP addresses result from the AND logic: (IP-Adr AND default-Mask)
10.0.0.0	/8	255.0.0.0	11111111.00000000.00000000.00000000	10.0.0.1 ... 10.255.255.254
172.16.0.0	/12	255.240.0.0	11111111.11110000.00000000.00000000	172.16.0.1 ... 172.31.255.254
192.168.0.0	/16	255.255.0.0	11111111.11111111.00000000.00000000	192.168.0.1...192.168.255.254
169.254.0.0 *	/16	255.255.0.0	11111111.11111111.00000000.00000000	169.254.0.1...169.254.255.254

* WIN2000 (APIPA) default setting

1.6.8.1 SubNet Mask

These "special" IP address ranges are limited by a combination with a "default mask", i.e. they are considered as subnets, independent partial networks, monitored by an address filter (mask), which permits only permissible IP addresses in the subnet.

The existing "default mask" is the minimum filter of IP addresses for the subnet. However, it can also be changed, i.e. filtered by changing existing 0 bits into 1 bits (always left-adjusted from left to right). The maximum filter of IP addresses is provided by mask 255.255.255.254, i.e. only one host is possible, and mask 255.255.255.255 does not make sense.

1111 1111 =	128+64+32+	16 + 8+4+2+1	= 255		binary/decimal
182	14	48	0	/20	Associated subnet (e.g. IT)
1011 1000	0000 1110	0011 0000	0000 0000		Basic IP address
					/20 bits result in:
255	255	240	0		(dot) default mask
1111 1111	1111 1111	1111 0000	0000 0000		(bit) mask 20 x 1-bit d=12bit
					,bit' AND results in:
1011 1000	0000 1110	0011 0000	0000 0000		max. IP address range
182	14	48 xxxx	xxxx xxxxx	Subnet address = portion before the first 0-bit (left->right)	182.14.48.1 ... 182.14.63.254
				x device/host-addresses	Number = 4094
		255-240 d = 15	255-1 d = 254		
		48+15 = 48...63	1...254		

Rules

- IP addresses must be different in min. one digit, which may be one of the last three digits. In the SubNet mask, the digits which are different must be 0 or unequal to 255, the other digits must be 255.
- The last digit of the IP-address should not be 0 or 255.
- With two different networks, the second or third digit must be different. This digit must be marked with 255 in the SubNet mask.
- Each physically isolated network requires an own broadcast address. This means the address part identified by SubnetMask 255 must be unambiguous and unique.
- Nothing else than the IP of the local network must be specified in the standard/default gateway!

A unique IP address (4 octet dot) in the permissible range must be allocated to each instrument in a subnet and all instruments must be provided with the same subnet (4 octet dot) mask.

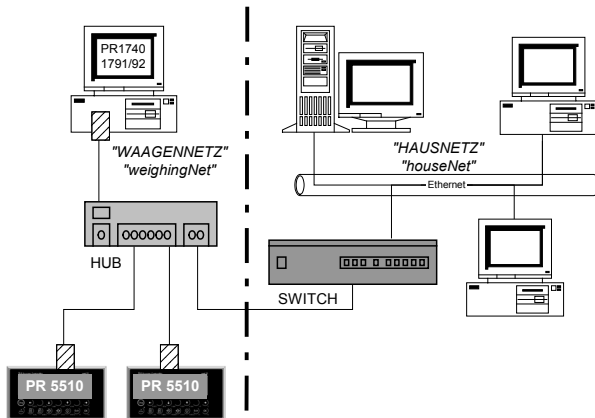
For access to the instrument from the local network e.g. via the Internet, a gateway address must be specified additionally. With Sartorius instruments, all three entries are configurable in the [SETUP-Network parameter]. After ERASE, the instruments return to the default setting.

1.6.8.2 Default Gateway

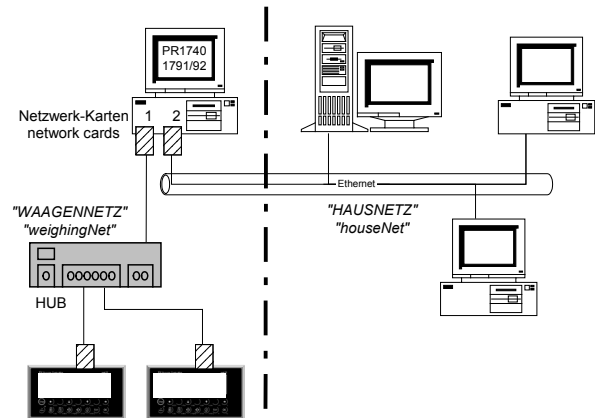
Instruments/computers in a subnet can only communicate with each other. For communication of an instrument from the subnet into another network/subnet, or vice versa, the instrument must send its data via a gateway/router. The IP number of the gateway/router must also be specified during configuration.

1.6.9 PR5510 Network Solutions

bridge

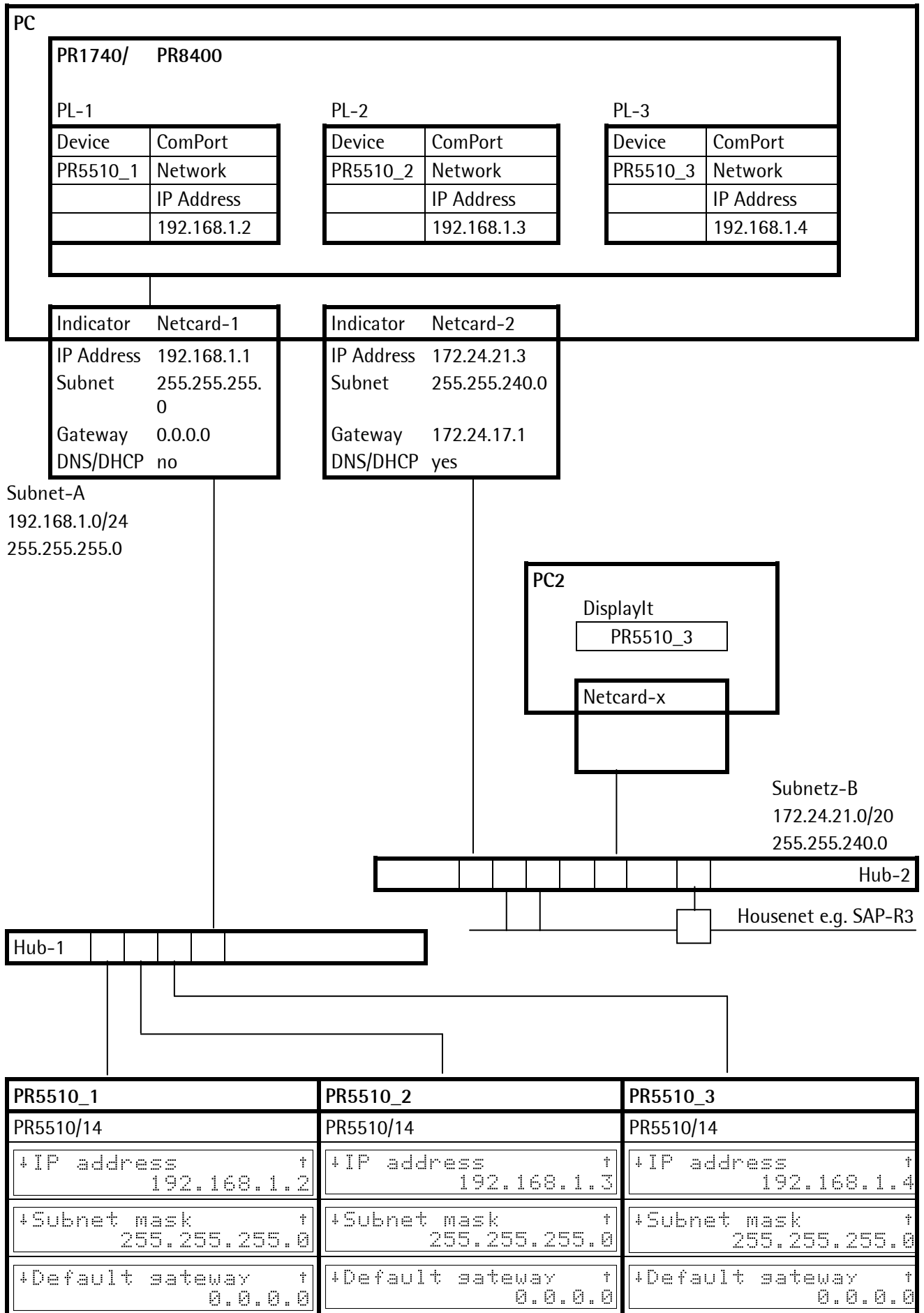


two network cards



Note: We recommend using technical literature or consultation by a network specialist. This is compulsory when connecting weighing instruments to an existing local network. Hereby the 'weighing technology' must fit into the existing LAN configuration, i.e. suitable central allocation is necessary. Free definition of settings or IP addresses is only possible for completely private LAN 'Weighing instruments'. These addresses are connected neither with the local network nor with the global Internet.

Build up independent LANs for 'weighing' and keep them away from the local network load by using corresponding instrumentation (routers, bridges, switches...) or our recommendation, by a 2nd independent network card in the PC, especially for the 'weighing' LAN.



Example

from WIN2000 PC

to the local network (IT)	172.24.21.3/20	via Ethernet adapter 1	,LAN-connection'
at the private weighing network	192.168.1.1/24	via Ethernet adapter 2	,LAN-connection 2'
x pieces Sartorius instruments	192.168.1.2, 192.168.1.3 ... 192.168.1.254		

The current network data setting can be displayed e.g. under WIN2000 by command <IPCONFIG /all> Select task in desktop:

- Click ,Start'.
- Choose with doubleclick 'Execution'.
- Under this type in <cmd> or <command> (windows 9x/ME).
- In the opened comand-window type in: <ipconfig/all>

```
E:\Proj1750_2\Save>ipconfig /all

Windows 2000-IP-Konfiguration

    Hostname . . . . . : hhw04040w2k
    Primäres DNS-Suffix . . . . . :
    Knotentyp . . . . . : Hybridadapter
    IP-Routing aktiviert . . . . . : Nein
    WINS-Proxy aktiviert . . . . . : Nein
    DNS-Suffixsuchliste . . . . . : gwt.com

Ethernetadapter "LAN-Verbindung":

    Verbindungsspezifisches DNS-Suffix: gwt.com
    Beschreibung . . . . . : 3Com EtherLink XL 10/100 PCI f3r vol
Iständige PC-Verwaltung-NIC (3C905C-TX)
    Physikalische Adresse . . . . . : 00-04-76-A2-36-7A
    DHCP-aktiviert . . . . . : Ja
    Autokonfiguration aktiviert . . . . . : Ja
    IP-Adresse . . . . . : 172.24.21.3
    Subnetzmaske . . . . . : 255.255.240.0
    Standardgateway . . . . . : 172.24.16.1
    DHCP-Server . . . . . : 172.24.17.2
    DNS-Server . . . . . : 172.24.17.2
    . . . . . : 172.24.17.1
    Primärer WINS-Server . . . . . : 172.24.17.2
    Sekundärer WINS-Server . . . . . : 172.24.17.1
    Lease erhalten . . . . . : Montag, 19. April 2004 08:04:09
    Lease läuft ab . . . . . : Montag, 10. Mai 2004 08:04:09

Ethernetadapter "LAN-Verbindung 2":

    Verbindungsspezifisches DNS-Suffix:
    Beschreibung . . . . . : Realtek RTL8029(AS)-PCI-Ethernetadap
ter
    Physikalische Adresse . . . . . : 00-20-18-54-15-17
    DHCP-aktiviert . . . . . : Nein
    IP-Adresse . . . . . : 192.168.1.1
    Subnetzmaske . . . . . : 255.255.255.0
    Standardgateway . . . . . :
    DNS-Server . . . . . :
```

1.6.10 Test tool: Ping Command

Note: MS-Windows accessory Programm.

A ping is intended for network checking and can be used as a tool for general communication testing (3 lower layers of the OSI model) by sending a "Broadcast". It is also used to measure the reliability of a network connection and the response time of a server. Thereby, a server (e.g. computer in the Internet) is contacted on its ping port via a client (software on your computer). As soon as the server replies, the client calculates the elapsed time in milliseconds. Determination if pings, i.e. small data packages, were lost is also made.

For making a "Ping" on any IP address u.x.y.z, you can select task in desktop:

- Click 'Start'.
- Choose with doubleclick 'Execution'.
- Under this type in <cmd> or <command> (windows 9x/ME).
- in the opened comand-window type in: <ping> followed by the required target IP address:

```

Eingabeaufforderung
P:\>ping 172.24.22.48

Ping wird ausgeführt für 172.24.22.48 mit 32 Bytes Daten:

Antwort von 172.24.22.48: Bytes=32 Zeit<10ms TTL=30
Antwort von 172.24.22.48: Bytes=32 Zeit<10ms TTL=30
Antwort von 172.24.22.48: Bytes=32 Zeit<10ms TTL=30
Antwort von 172.24.22.48: Bytes=32 Zeit<10ms TTL=30

Ping-Statistik für 172.24.22.48:
    Pakete: Gesendet = 4, Empfangen = 4, Verloren = 0 (0% Verlust),
    Ca. Zeitangaben in Millisek.:
        Minimum = 0ms, Maximum = 0ms, Mittelwert = 0ms

P:\>
  
```

IP address 172.24.22.48 was selected. Displayed data mean:

- 32 data bytes were sent.
- The response time was 10 milliseconds.
- The time-to-live (TTL) was 249, i.e. the time during which a data package can roam through the network before it is discarded. (Every receiver with a longer reach decrements the TTL counter, with TTL=0 the package is discarded).

```

Eingabeaufforderung
Ungültige Option /.

Syntax: ping [-t] [-a] [-n Anzahl] [-l Größe] [-f] [-i Gültigkeitsdauer]
[-v Diensttyp] [-r Anzahl] [-s Anzahl] [[-j Hostliste] |
[-k Hostliste]] [-w Zeitlimit] Zielliste

Optionen:
-t          Sendet fortlaufend Ping-Signale zum angegebenen Host.
            Geben Sie STRG-UNTRBR ein, um die Statistik anzuzeigen.
            Geben Sie STRG-C ein, um den Vorgang abzubrechen.
-a          Löst Adressen in Hostnamen auf.
-n n Anzahl Anzahl zu sendender Echoanforderungen
-l Länge   Pufferlänge senden
-f          Setzt Flag für "Don't Fragment".
-i TTL     Gültigkeitsdauer (Time To Live)
-v TOS     Diensttyp (Type Of Service)
-r Anzahl  Route für Anzahl der Abschnitte aufzeichnen
-s Anzahl  Zeiteintrag für Anzahl Abschnitte
-j Hostliste "Loose Source Route" gemäß Hostliste
-k Hostliste "Strict Source Route" gemäß Hostliste
-w Zeitlimit Zeitlimit in Millisekunden für eine Rückmeldung

P:\>
  
```

Unless these parameters are specified, the 'ping' is called up with standard parameters:

- Selection of further function parameters.
- Increase the package size after making the first connection (32 bytes = smallest package) with parameter -l
- The 'ping' is called up repeatedly with parameter -n

Note: Use <Ping> for pre-test, if generally a network-connection to PR 5510 is established.

The ping sends a broadcast, whereby the subnet mask settings are not checked, i.e. the actual connection may be not possible because of e.g. a too narrow subnet mask.

1.6.11 PR5510 Network Parameter

After [Erase], the following settings for the [Setup]-[Network Parameter] must be entered:

<pre>Setup *Network Parameter *</pre>	Selection Network-Configuration	
<pre>↑DHCP ↑ * OFF*</pre>	<p>ON: the system IP address is displayed. OFF: enter the following parameters.</p>	automatic IP number assignment
<pre>↑IP address ↑ 192.168.0.1</pre>	<p>So-called 'private' network, 192.168.... not routed to internet</p>	Choose a unique module address.
<pre>↑Subnet mask ↑ 255.255.255.0</pre>	254 Subnets, 254 Hosts	Take over without change.
unless specified otherwise by administrator (local network)		
<pre>↑Default gateway ↑ 0.0.0.0</pre>	Specify the router, here only with communication via the Internet.	Otherwise, take over without change.
<pre>↑Device address ↑ 0</pre>	Only with PR5510 cross communication, 0 = disabled	Otherwise, take over without change.
Leave with [Exit] key. Prompt for storage?		
<pre>Save network conf ? YES # ---- # NO</pre>	NO YES saving network conf	All entries are cancelled! Store in non-volatile EARAM.
<pre>saving network conf</pre>	Only with YES selected.	Activate the config data.

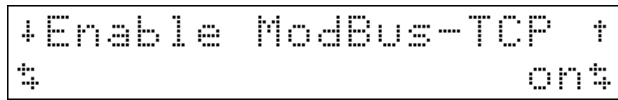
1.7 ModBus-TCP



Caution!

Already existing data must be saved; calibration and configuration data are not lost!
 After this a [COLD] start is required; otherwise, a continuous beep will be output.

Now, the following menu item in the [Setup] appears:
 [Setup-Fieldbus Parameter]



Press [on] to enable the ModBus TCP function and save it in EAROM with [Save]. [Exit] is followed automatically by a warm start for initialization of the function.

Realization on Modbus/TCP server is according to Modbus/TCP specification V1.0.

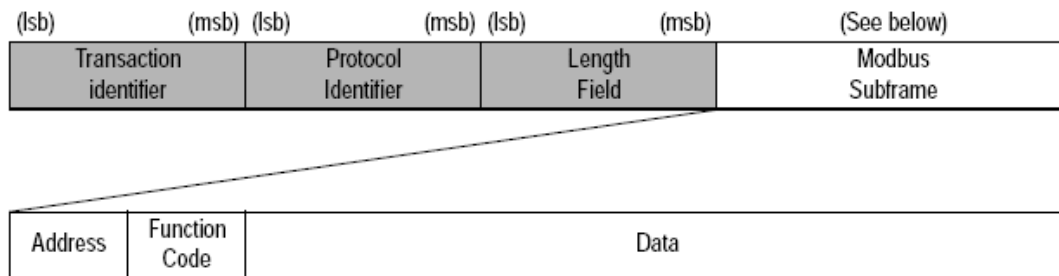
All commands are realized according to class 0 and class 1. Some commands are realized according to class 2. The module can handle 8 simultaneous connections.

Note: Direct SPM accesses* via this TCP/IP interface are not provided, but only as a fieldbus data interface (see Chapter 2.2).

* Direct SPM accesses are available alternatively via serial interfaces RS-232 or RS-485 ModBus protocol.

1.7.1 'Message frame format'

The Modbus-TCP protocol is a realized TCP/IP based 'standard ModBus protocol'. The same function codes and address types are used.

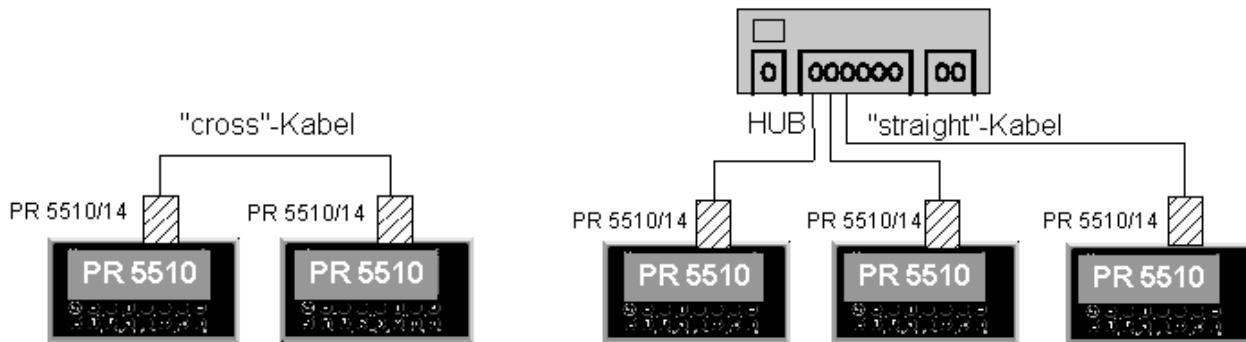


Note: ModBus-TCP message frames do not contain a CRC field as defined in ModBus, because the TCP/IP frame format contains already highly developed error checks.
 For detailed information on the Modbus-TCP protocol, refer to the Open Modbus Specification V 1.0

1.7.2 PR5510 Cross Communication

IEC61131 programmable instruments such as PR5510, can exchange with each other 64-bit SPM write and read data via Ethernet connection under TCP/IP.

Note: Presently, cross communication can be realized only within PR5510/14 Ethernet cards, i.e. PR5510/00 instruments. Instruments with older EtherNet cards such as PR1713/14 or PR1730/14 are precluded. These cards operate with multicast function in cross communication, which is not possible with PR 5510/14.



Only for signals/data with duration longer than >500 msec, not suitable for fast process signals!
 Not suitable for fast or safety-relevant process signals!

Note: IEC61131 special programming with PR 1750 is required.
 Instruments to be connected need an optional Ethernet card and, dependent on whether the connection is direct or via hub, 'cross' or 'straight' connecting cables (see Chapter 1.6.3 and 1.6.4).
 The interface behaves like an IO port in Slot 4. Slot 4 is always the unique EtherNet socket on all instruments, with the exception of PR1730 with Slot 9.

Write according to IEC61131 notation [Slot.Device.OFFSET] =

AT %QD 4.x.0 DINT write	(1Dword -2words-4bytes-32bits)
AT %QD 4.x.1 DINT read	(1Dword -2words-4bytes-32bits)
AT %QD 4.x.2 DINT write	(1Dword -2words-4bytes-32bits)
AT %QD 4.x.3 DINT read	(1Dword -2words-4bytes-32bits)
x = DeviceAdresse 1...4	

The following procedure must be met:

PR5510/Device-1

I for 'myself' (e.g. deviceNo=1) write my data to my own port = Slot-4 with target_Device-No=1

E.g. write Out_command: SPMvarA1 AT %QD 4.1.0

E.g. write Out_command: SPMvarA3 AT %QD 4.1.2

PR5510/Device-2

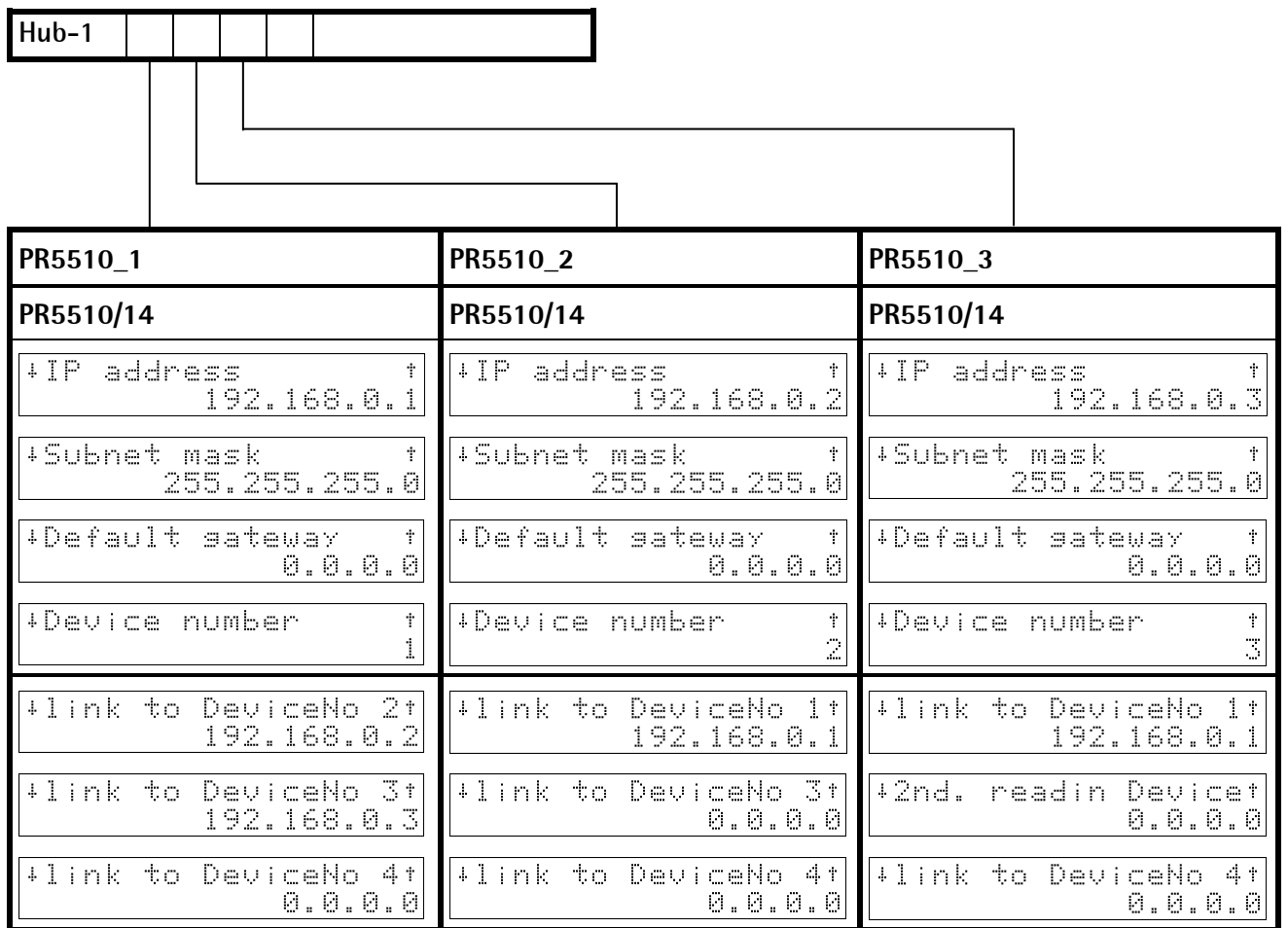
'Other' could read my provided data with under "my" DevNo (e.g. deviceNo=1)

e.g. write Out_command: SPMvarB1 AT %QD 4.2.0

e.g. read In_command: SPMvarB2 AT %ID 4.1.0 SPMvarA1 from device-1

e.g. write Out_command: SPMvarB3 AT %QD 4.2.2

e.g. read In_command: SPMvarB4 AT %ID 4.1.2 SPMvarA3 from device-1



sends to:	Dev-2 and Dev-3	sends to:	Dev-1	sends to:	Dev-1
receives from	Dev-2 and Dev-3	receives from	Dev-1	receives from	Dev-1

1.7.3 PR5510 Network Parameter at Cross Communication

The following adjustments in [SETUP-Network Parameter] are required:

<pre>+IP address † 192.168.0.1</pre>	<p>Each instrument gets a unique IP address 192.168.0.x</p>
<pre>+Subnet mask † 255.255.255.0</pre>	<p>Take over without change.</p>
<pre>+Default gateway † 0.0.0.0</pre>	<p>Take over without change.</p>
<p>PR5510/14 SPM cross communication:</p>	
<pre>+Device number † 0</pre>	<p>Write data onto own DEV Select: 1, 2, 3, 4, 0 kein Querv. unique device number, e.g. #=2 used as IEC out: AT %QD 4.#.0-3</p>
<p>3/4 entries, exception:own DEV#</p>	<p>with device number unequal 0 i.e. cross comm. was selected</p>
<pre>+Link to DeviceNo 1† 0.0.0.0</pre>	<p>Wait for data from other DEV with unequal to 0.0.0.0 IP package contains relevant DEV# Used as IEC inp: AT %ID 4.#.0-3</p>
<pre>+Link to DeviceNo 2† 0.0.0.0</pre>	
<pre>+Link to DeviceNo 3† 0.0.0.0</pre>	
<pre>+Link to DeviceNo 4† 0.0.0.0</pre>	<p>Wait for data from other DEV with unequal to 0.0.0.0 Only if participating, otherwise IP address 0.0.0.0 not linked</p>

2 Fieldbus Data-Interface

The pure 'net data' of all used fieldbus types are all handled with a functionality specified by Sartorius in a fieldbus interface described here. Accordingly, this is also applicable for the EtherNet-TCP/IP LAN interface, because this interface can be used only for the described Sartorius specific applications.

2.1 Configuration

Configuration parameter in menu [Setup]-[Fieldbus Parameter]:

[Protocol]	Determined by hardware option PR 1721/3x
[Scale Interface]	For using the fieldbus interface according to the description in this manual, parameter [Scale Interface] must be set to WP-A.
[Adresse]	Select a unique address, if necessary.
[Baudrate]	Dependent on protocol standard.

Note: All required protocol parameters must be adjusted via software in the [Setup-Fieldbus Parameter] configuration. The corresponding hardware adjustments on the modules (DIL/rotary switches) are ignored, or must be set to defined 'dummy' position before installation.

2.2 Interface Handling

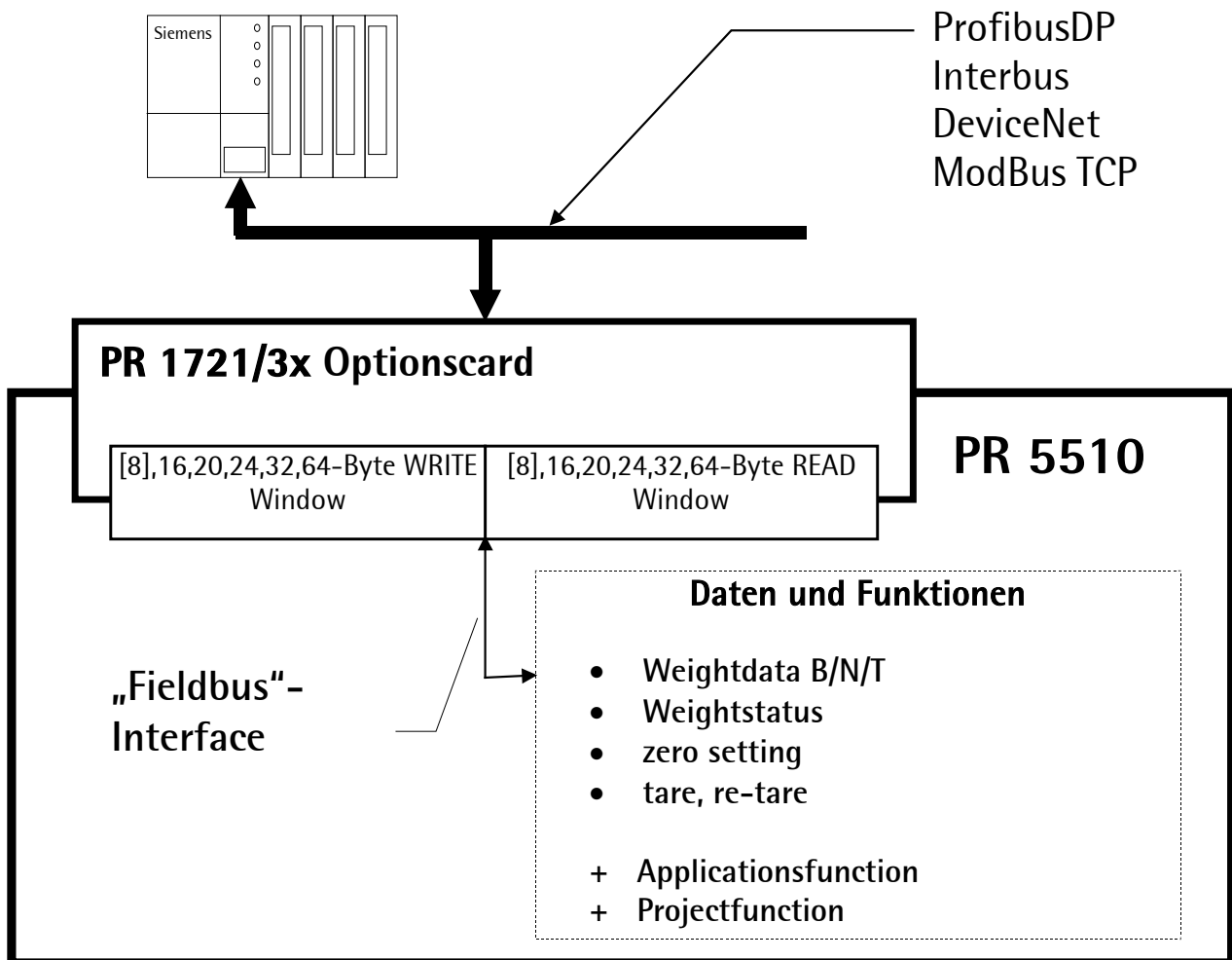
The interface works "in default" with an 8-byte write window and an 8-byte read window.

From firmware release 3.12 are they configurable [Setup-Fieldbus parameter]

by selection: 8-16-20-24-32-64 byte IO (pay attention by limitations of the diff. protocols).

The windows are related to the weighing points (remark: in PR5510 exists only one internal WP-A).

The fieldbus exchanges its data cyclically from each slave. This means: in each cycle, 8 bytes are written and 8 bytes are read also if the data contents are unchanged.



The described application protocol is independent from chosen fieldbus type and from side of master displayed.

Note: Only the general and functional firmware fieldbus components are described in this manual. Additional functions are provided with Sartorius applications such as BATCH, FLOW, TRUCK etc.

2.2.1 Write window (Input area)

In this window, data are transmitted from master to slave (PR5510).

The first four bytes are used only for writing a data value. The type of these data or parameters is written in byte 5.

Bytes 6 and 7 contain bits in direct access independent of the write data. After a 0-1 transition of the relevant bit, the command is executed.

Byte 0	Write data* :
Byte 1	"
Byte 2	"
Byte 3	Write data* :
Byte 4	Read_Value_Select
Byte 5	Write_Value_Select
Byte 6	Direct control bits
Byte 7	Direct control bits

* Byte0-3: MSB-LSB for Prof/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol (see Chapter 2.5).

2.2.2 Read window (Output area)

In this window, data are transmitted from slave (PR5510) to master.

The first four bytes are used for reading a data value.

The type of these data or parameters is mirrored by the write window in byte 4, when the data are available.

Bytes 5, 6 and 7 contain status bits independent of the read data.

Byte 0	Read data* :
Byte 1	"
Byte 2	"
Byte 3	Read data* :
Byte 4	Read_Value_Selected
Byte 5	General system bits: - Write_Active - power_fail - analog error...
Byte 6	Status bits
Byte 7	Status bits

* Byte0-3: MSB-LSB for Prof/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol (see Chapter 2.5).

2.2.3 Data Reading and Writing

The number of data exceeds the size of the write/read windows by far. Therefore, the parameters are addressed with 'Write_Value_Select' and 'Read_Value_Select'. For this purpose, the first six bytes of the write window and the first five bytes of the read window are required. Thus the master can describe data in PR5510: e.g. a limit value shall be set to 100 kg. Weight values or other data can also be read out of the PR5510 by the master. For this, the write and the read window are always required. Thereby, safe data exchange is ensured by a write and a read procedure.

For reading status bits and writing direct control bits, however, no procedure is required. The general system bits and the status bits are always present and need not be requested. The direct control bits are also continuously available.

2.2.3.1 Parameter Reading

Procedure

- Write the type of data/parameters into byte 4 of the **write window** as a 'Read_Value_Select'.
- Wait, until in the byte 4 of the **read window**, the 'Read_Value_Selected' is equal to the 'Read_Value_Select' in the byte 4 of the write window.
- Now, the value is available in byte 0 to 3.

2.2.3.2 Parameter Writing

Procedure

- Wait, until 'Write_Active' = 0 in the **read window** (ready to receive new data).
- Write value in byte 0 to 3.
- Write data type in byte 5 ('Write_Value_Select').
- Wait, until 'Write_Active' = 1 (acknowledges data reception).
- Write 0 into byte 5 ('Write_Value_Select') -> 'Write_Active' will go to 0.

2.3 Read Data (overview)

All read value will be addressed by read-datatyp_request ,Read_value_select'.

*Byte 0...3	Read_value
-------------	------------

* byte 0-3: MSB-LSB for Prof/Interbus/Modbus Protocol, LSB-MSB for DeviceNet protocol (see Chapter 2.5).

Byte 4		
Read_value_select		loading register [Read_value_selected]
Dez	Hex	description
0	00	reserved
1	01	reserved
2	02	reserved
3	03	reserved
4	04	Exponent/Einheit/Schrittweite
8	08	gross [DINT]
9	09	net [DINT]
10	0A	tare [DINT]
12	0C	gross x100
14	0E	Fullscale (FSD) [DINT]
15	0F	reserved
24	18	This address range will be used from the applications like BATCH, FLOW, TRUCK etc.
199	C7	
ab 200	C8	This address range will be reserved for customized IEC-programming. Will stay unused in future by firmware or any application program.

Pay attention for some more reserved internal firmwarefunction registers:

$12 + n \cdot 32$ $n =$ 'Read_value_select', e. i. $12 + 01 \cdot 32 = 44, 76, 108, 140, 172, 204, 236, 268 \dots$

Fixfunctions can be activated with bits of the bytes 6 and 7 as shown in following table.

	bit 7	bit 6	Bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Byte 5	Write activ	Power fail						
Byte 6	Cmd Busy	Cmd Error				Tare Active	Cal changed	Test Active
Byte 7	Dimmed	Stand- Still	Inside ZSR	Center Zero	Below Zero	Overload	Above FSD	Adu Error

Note: The grey marked addresses and controlbits are forced by firmware and are only available with setting: [Scale-interface] = [WP-A] Unmarked bits are maybe forced by any loaded applications (see applications-manual).

All signals are edgetriggert, means the controller reacts only with changes.

2.4 Write Data (Overview)

All write values will be addressed by write datatype ,write_value_select'. The WP specific data are available in different write-windows (instances).

Byte 0..3	Write_value
------------------	--------------------

Byte 0..3: MSB-LSB for Prof/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol

Byte 5 write_value_select		Quell-Register [write_value_select]
Dez	Hex	description
0 bis 15	00 bis 0F	reserved
24 57	18 39	This address range will be used from the applications like BATCH, FLOW, TRUCK etc.
112	70	transition-controlled: set gross to zero
113	71	taring
114	72	re-taring
115	73	start ADU-Test
116	74	reset ADU-Test
117	75	reset Powerfail
120 ... 199	78 ... C7	This address range will be used from the applications like BATCH, FLOW, TRUCK etc.
Ab 200	Ab C8	This address range will be reserved for customized IEC-programming. Will stay unused futurly by firmware or any application program.

Direkte Kontrollbits (Schreibbits für den Feldbus-Master)

	bit 7	bit 6	bit 5	bit 4	bit 3	Bit 2	bit 1	bit 0
Byte 6								
Byte 7			Res Power	Res Test	Set Test	Res Tare	Set Tare	Set Zero

Note: The grey marked addresses and controlbits are forced by firmware and are only available with setting: [Scale-interface] = [WP-A]. Unmarked bits are maybe forced by any loaded applications (see applications-manual).

All controlbits are reacting only with a 0-1 change. To detect a change, the status must be hold for about 40 ms.

2.4.1 Combination of Write and Simultaneously Read

E.g. gross reading and set tare:

Value in Byte 4	read-dattyp_request	read_value_select	=	08
Value in Byte 5	write-dattyp_request	write_value_select	=	113

Beispiel

Byte 4	Byte 5	
read_value_select	write_value_select	
08	113	gross reading and set tare
08	114	gross reading and reset tare

2.5 Data Formats

Note: Dependent on protocol, the data format is different. This applies to all data types consisting of more than one byte INT, DINT, LINT.

2.5.1 Intel Format

This format is the exchanged format of a 16-bit value.

Another description is 'big-endian' or 'most-significant byte' (MSB)

Internal format of a byte:	7 6 5 4 3 2 1 0
Internal format of a 16-bit value:	7 6 5 4 3 2 1 0 15 14 13 12 11 10 9 8

Used only for DeviceNet

e.g. write/read window		DINT field for e.g. weight 7598.1 kg = 000128CDhex
Byte 0	Write data: LSB	CD hex
Byte 1	"	28 hex
Byte 2	"	01 hex
Byte 3	Write data: MSB	00 hex

2.5.2 Motorola Format

Die verdrehte Darstellung von Intel wurde später von Motorola korrigiert.

Die Bezeichnungen für das Motorola Format sind 'little-endian' bzw. 'least-significant byte' (LSB).

Interne Darstellung eines Byte:	7 6 5 4 3 2 1 0
Interne Darstellung eines 16 Bit- Wertes:	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Used for: ProfiBus-InterBus-ModBus

e.g. write/read window		DINT field for e.g. weight 7598.1 kg = 000128CDhex
Byte 0	Write data: MSB	00 hex
Byte 1	"	01 hex
Byte 2	"	28 hex
Byte 3	Write data: LSB	CD hex

2.5.3 Various Data Formats

DINT

Most data values are transmitted in the form of a four-byte double-integer value; 32-bit values with polarity sign.

Example: write the fixtare weight value 844

Write window:	Byte number	0	1	2	3	4	5	6	7
	Value	00	00	03	4C		1F		

Beispiel: lese negatives Bruttogewicht -2

Read window:	Byte-Nummer	0	1	2	3	4	5	6	7
	Wert	FF	FF	FF	FE	08			

Note: Depending on scale configuration, weights are always DINT (double word integer) in 'kg' or 'lb'.

UINT

Positive 16-bit value.

Example: line number = 1, 2, 3...65535

Write window:	Byte number	0	1	2	3	4	5	6	7
	Value			00	1A		9D		

USINT

Positive 8-bit value.

Example: restart mode = 0, 1, 2, 3 or 4

Write window:	Byte number	0	1	2	3	4	5	6	7
	Value				01		87		

Characters

ASCII characters; 8-bit number.

Example: recipe names [characters 1...4] = 52_H, 45_H, 43_H, 31_H for name 'REC1'

Write window:	Byte number	0	1	2	3	4	5	6	7
	Value	52	45	43	31		96		

The REAL format to IEEE 754 ; IEC 60559

REAL: 32 bit = 1 bit sign, 8 bit exponent bias 127, 23 bit mantissa

Example: 200 = 43 48 00 00

4 3 4 8 0 0 0 0

0100 0011 0100 1000 0000 0000 0000 0000

s| | |

eee eeee e |

1.mmm mmmm mmmm mmmm mmmm mmmm

Sign = 0

Exponent = 10000110 = 134 - bias 127 = 7

Mantissa = 1.100 1000 0000 0000 0000 0000 = 1,5625 * 2⁷ = 200

,String' is always 20 characters long and transmitted in portions of 5 * 4 characters.

2.5.4 Configuration of Databus Width

The databus-width can be increased in „special cases“ e.g. if transmission for datalength taller then the 'standard' 4byte window is. Herewith the transmission speed will be increased, because longer data have not to send sequently in multi-sequences and need not to be devided and added again with additional programming.

In [SETUP-Fieldbus Parameter] selctable:

Setup *Fieldbus Parameter*	Select the fieldbus-setup
+I/Os ‡ ‡ 8 Byte I/O‡	Select:[8], 16, 20, 24, 32, 64 Pay attention for protocol limitations [x] = standard used PR 1721/3x modul install

,Default' for the PR5510

+I/Os ‡ ‡ 8 Byte I/O‡	Weightvalues are DINT-data (4 byte 0...3 width) plus statusbits from byte 6,7 means a 8 byte write/read-window is large enough
+Scale-interface ‡ WP-A	Forces from firmwareside weight G/N/T and related statusbits. PR5510 has only one internal weighingpoint = WP-A.

In other cases of 'defaults' IEC61131-specialprogramming is necessary!

E.g. dtatyp=08 GROSS reading in 'standard'-Config:

+I/Os ‡ ‡ 8 Byte I/O‡	standard	
+Scale-interface ‡ WP-A	standard	
WP-A	Readwindow	Writewindow
	Byte	Read data * :
	Byte1	"
	Byte2	"
	Byte3	Read data * :
	Byte4	Read_value_selected
	Byte5	Status Bits
	Byte6	Status Bits
	Byte7	Status Bits
	Byte0	Write data* :
	Byte1	"
	Byte2	"
	Byte3	Write data * :
	Byte4	Read_value_select
	Byte5	Write_value_select
	Byte6	direct control-bits
	Byte7	direct control-bits

* Byte0-3: MSB-LSB for Prof/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol.

e.g. Datayp=08 Gross reading in 'special'-config:

<pre> +I/Os + +-----+ + + 16 Byte I/O + +-----+ + </pre>	special	Extended to 16 byte write/read-window		
<pre> +Scale-interface + +-----+ + + WP-A + +-----+ + </pre>	standard	byte 0... 7 = WP-A Data byte 8... 15 = WP-B Data		
Instance WP-A	Readwindow		Writewindow	
	Byte0	Readdata*:	Byte0	Writedata*:
	Byte1	"	Byte1	"
	Byte2	"	Byte2	"
	Byte3	Readdata*:	Byte3	Writedata*:
	Byte4	Read_value_selected	Byte4	Read_value_select
	Byte5	Status Bits	Byte5	Write_value_select
	Byte6	Status Bits	Byte6	direct control-bits
	Byte7	Status Bits	Byte7	direct control-bits
Instance WP-B*=> empty does not exist				
	Byte 8	empty/unwritten	Byte 8	empty/unwritten
	Byte 9	empty/unwritten	Byte 9	empty/unwritten
	Byte10	empty/unwritten	Byte10	empty/unwritten
	Byte11	empty/unwritten	Byte11	empty/unwritten
	Byte12	empty/unwritten	Byte12	empty/unwritten
	Byte13	empty/unwritten	Byte13	empty/unwritten
	Byte14	empty/unwritten	Byte14	empty/unwritten
	Byte15	empty/unwritten	Byte15	empty/unwritten
Instance WP-C*=> empty does not exist				
If selection: >16, = 20...64 byte I/O	here will be byte 16 ... 63		here will be byte 16 ... 63	

* Byte0-3: MSB-LSB for Prof/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol.

Note: Not valid for PR5510, because only one internal WP exists. The [Scale interface] shows it also with the only selection can be made [WP-A] beside [disable].

Reason for such a 'special'-config e.g.:

It should be read a LINT var-xyz (long integer = 4words=8byte), additional and at same time it is possible to read another value DINT var-abc in freely 4 byte field (Byte 0...3 of scalefunction), because with this special-data 201 the gross-function 08 is not requested and the datafields are 'free'.

new creation e.g. Project-datatyp = 201

↓ I/Os ↑ 16 Byte I/O	special		
↓ Scale-interface ↑ WP-A	standard		
VAR abc DINT in Byte 0...3	Readwindow	Writewindow	
	Byte0 Readdata*:	Byte0	Writedata*:
	Byte1 "	Byte1	"
	Byte2 "	Byte2	"
	Byte3 Readdata*:	Byte3	Writedata*:
	Byte4 Read_value_selected	Byte4	Read_value_select
	Byte5 Status Bits	Byte5	Write_value_select
	Byte6 Status Bits	Byte6	direct control-bits
	Byte7 Status Bits	Byte7	direct control-bits
VAR xyz LINT in Byte 8...15			
	Byte 8 Readdata* :	Byte 8	Writedata* :
	Byte 9 "	Byte 9	"
	Byte10 "	Byte10	"
	Byte11 "	Byte11	"
	Byte12 "	Byte12	"
	Byte13 "	Byte13	"
	Byte14 "	Byte14	"
	Byte15 Readdata* :	Byte15	Writedata*
If selection: >16, = 20...64 byte I/O	here will be byte 16 ... 63	here will be byte 16 ... 63	

* Byte0-3: MSB-LSB for Prof/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol.

Remark: In extension of IEC61131-application-program for the specialfunction in POU: FBUSWDAT implementation of CASE 201 with preparing the needed data in wanted format: data (DINT)= var-abc (DINT), datax (LINT)= var-xyz (LINT)
The transfer parameters of the function FBUSWDAT var-INPUT have to be extended.
The function-call from PLC-driver in POU: FBUS_PLC must be adapted to this.

2.6 Description of Read/Write-windows (IO-databus)

2.6.1 Output Area

Data are transferred from PR5510 to the master via the output area. The PR5510 has writing access, the master has reading access.

Byte	Name								Description
0	Read_Value*								e.g. gross value
1	...								"
2	...								"
3	Read_Value*								"
4	Read_Value_Selected								e.g. gross
5	Write Active	Power Fail							Status
6	Cmd Busy	Cmd Error				Tare Active	Cal changed	Test Active	Command status
7	Dimmed	Stand-Still	Inside ZSR	Center Zero	Below Zero	Over-load	Above FSD	Adu Error	Indicator status
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	

* Byte0-3: MSB-LSB for Profi/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol.

Variable	Function
Read_Value	The weight value is transferred as 32bit binary number with sign. Datatype: DINT
Read_Value_Selected	Acknowledgement of transferred value.
Write_Active	The function selected with Write_Value_Select is executed once. This bit is erased if Write_Value_Select is set to 0.
Power_Fail	Will be set at power on of the Indicator. Will be reset at 0-1 transition of ResPower.
Cmd_Busy	The Indicator is busy with executing a command. (e.g. the Indicator got a taring command and is waiting for StandStill).
Cmd_Error	The Indicator has interrupted the execution of a command (e.g. within the defined TareTimeout duration StandStill could not be reached) The error number can be read at Lasterror. It is only set if an action is executed!
Tare_Active	The Indicator has been tared.
Cal_Changed	The Indicator is/has been configured. If this bit is 1, the scale parameters (Expo/Unit/Step) have to be read again. Will be set after Power on and reset after reading of FSD.
Test_Active	The Indicator is executing the ADU-Test. The weight value read is not the gross value but the testvalue.
Dimmed	Above-FSD or Below-Zero
StandStill	The Indicator is in stand still.
InsideZSR	The weight value is within zero set range.
CenterZero	The weight value is within center zero ($ABS(Gross) \leq 0,25d$)
BelowZero	The weight value is negative ($Gross < -0,25d$)
Overload	The weight value has exceeded the measuring range, no valid weight data are given ($Gross > FSD + Overload$).
AboveFSD	The weight value has exceeded FSD, but is still within $FSD + Overload$ ($Gross \leq FSD + Overload$).
AduError	Error in AD conversion (Details are available at register 1, Read_Value_Select = 1).

2.6.2 Input Area

Data are transferred via the input area from the master to the PR5510 (slave).

The master has got writing access, the slave has got reading access.

Byte	Name								Description
0	Write_Value (MSB)*								e.g. limit value
1	:::								"
2	:::								"
3	Write_Value (LSB)*								"
4	Read_Value_Select								e.g. gross weight
5	Write_Value_Select								Write: Limit 1 On
6	free	Res M 3	Res M 2	Res M 1	free	Set M 3	Set M 2	Set M 1	Reset/set marker
7	Get FixTare	Set FixTare	Res Power	Res Test	Set Test	Res Tare	Set Tare	Set Zero	Control byte, response to 0->1 transition
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 3	Bit 1	Bit 0	

* Byte0-3: MSB-LSB for Profi/Interbus/Modbus protocol, LSB-MSB for DeviceNet protocol.

The control byte activates the corresponding action in the instrument with a set bit.

After execution of the operation, the bit should be reset.

Variable	Function
Write_Value	The weight value is transferred as 32bit binary number with sign. Datatype: DINT
Read_Value_Select	To select the value, which has to be sent from the Indicator.
Write_Value_Select	To select the function to be carried out by the Indicator.
Res M 1...3	Reset marker 1...3.
Set M 1...3	Set marker 1...3.
GetFixTare	The gross weight is copied into the fixtare memory.
SetFixTare	Taring is performed using the value stored in the fixtare memory.
ResPower	Gross will be copied to the fixtare memory
ResTest	Taring is done with the value stored in the fixtare memory
SetTest	The bit Power_Fail in the output area will be erased
ResTare	The Test mode will be finished
SetTare	The Test mode will be started
SetZero	Tare will be reset

2.6.3 Register Read and Write

2.6.3.1 Data Read: Read_Value, Read_Value_Select, Read_Value_Selected

If the master shall read from the Indicator, then the type of data ins transferred in Read_Value_Select in the input area. The result will be indicated in the output area with Read_Value_Selected.

Master action	Indicator action
Write registerno. to Read_Value_Select	
	Write selected register in Read_Value
	Copy Read_Value_Select to Read_Value_Selected
Wait until Read_Value_Selected = Read_Value_Select	
Read_Value lesen	

2.6.3.2 Data Write: Write_Value, Write_Value_Select, Write_Active

If the master shall write to the Indicator, then the required action will be transferred with Write_Value_Select together with the data in the input area. The execution will be indicated with the bit Write_Active in the output area.

Master action	Indicator action
Write value in Write_Value	
Write selection in Write_Value_Select	
	Write Write_Value to selected register
	Set bit Write_Active
Wait until Write_Active is set	
Write 0 in Write_Value_Select	
	Reset bit Write_Active

2.6.3.3 Set bit: Action_Select, Write_Active

Single bits can be set or reset directly with Write_Value_Select.

To set, the bit number (80...127) is written to Write_Value_Select.

To reset, the bit number + 128 (208...255) is written to Write_Value_Select.

The Write_Value itself is not relevant.

Master action	Indicator action
Write selection in Write_Value_Select	
	Write Write_Value to selected register
	Set bit Write_Active
Wait until Write_Active is set	
Write 0 in Write_Value_Select	
	Reset bit Write_Active

Taring, zero setting

For handling scale functions such as taring and zero setting, the individual bits in byte 7 of the write window are used (assignment). The relevant function is handled by a 0-1 transition of the corresponding bit. For detecting the transition, the respective status has to be present for at least 40 ms.

Signification of bits in write byte 7:

- Bit 7 Set the fixtare value to the actual weight
- Bit 6 Tare the scale with the fixtare value
- Bit 5 Reset power fail flag
- Bit 4 Deactivate analog test
- Bit 3 Activate the analog test
- Bit 2 Reset tare
- Bit 1 Set tare
- Bit 0 Set the scale to zero, when the weight is within the zero set range

Example: When the scale is within the permitted zero set range, this function is handled once.

Write window:	Byte number	0	1	2	3	4	5	6	7
	Value								01

2.6.3.4 Read Bit

Reading of single bits is only possible by reading a register. The sequence is the same as in chapter 2.6.3.1.

2.6.3.5 Indicator Control Byte Write

Some Indicator functions can be executed by directly setting bits in the input area.

Master action	Indicator action
Set bits in IndicatorControl Byte. The bit has to be set for at least 100 ms.	Action is executed.
Reset bits in IndicatorControl Byte.	

2.6.3.6 Waiting for Result of Action

If an action which takes longer time has been triggered, the end of execution can be waited for after the triggering.

Master action	Indicator action
Set bit.	Acknowledges set-bit. Set bit CmdBusy. Action is executed.
	If error occurs: Set bit CmdError and byte LastError. Reset bit CmdBusy.
Wait until CmdBusy is reset.	
Test bit CmdError.	
If set, LastError read.	

This is valid for taring, standstill, zero setting.

2.6.3.7 Register [1]: Scale Status (read)

(dynamic status) Only reading is allowed.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DIM	STND	INZSR	CZERO	BELOW0	OVL	>FSD	ADUERR
Byte 1					E6	E1	E3	E7
Byte 2						PowerFail	ActionActiv	CmdError
Byte 3						TareActiv	CalChanged	TestActiv

Byte 0 corresponds to byte 7 in the output area, for weight errors see table.

ADUERR	Error in analog conversion/ load cell circuitry (OR-function of bits E1,E3,E7)
>FSD	gross value larger FSD (german SKE), scale range exceeded
OVL	scale overloaded, gross > FSD + Overload, Error 2
BELOW0	Gross weight negative (< 0-1/4 d)
CZERO	Center of zero, weight within 1/4d range
INZSR	Gross weight is within zeroset range
STND	Scale is in stand still
DIM	Gross weight has exceeded the scale range (0-1/4 d >weight >FSD + overload), (OR-funktion of bits BELOW0, OVL).
E7	Measuring signal is negative (inverse conversion), Error 7
E6	Sense voltage missing / too low, Error 6
E3	Measuring signal is > 36mV (no end of conversion), Error 3
E1	Arithmetic error (overflow), Error 1
CmdError	Error during execution (cmdError), e.g. action 'taring' is not executed as there is no standstill. In LastError (register 4) the error is specified. With ResetError register 89/89+128 or register 121 the bit is reset again.
ActionActiv	Action will be executed, is still processed
PowerFail	Power failure, will be set at each power-on. With bit ResetPWF register 85/85+128 or register 117) 'Power failure reset' the bit PowerFail is reset.
TestActiv	Analog test is aktive
CalChanged	Calibration mode is active or calibration data have been changed. FSD has to be read again to reset this bit.
TareActiv	Indicator has been tared

2.6.3.8 Register [4]: Calibration information, error byte (read)

Only reading is allowed.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	EXPO							
Byte 1	UNIT							
Byte 2	STEP							
Byte 3	LASTERROR							

EXPO	One byte for position of decimal comma/point (Exponent), content in decimal representation 0...255 0 = 0000 no decimalpoint 1 = 000.0 2 = 00.00 3 = 0.000
UNIT	One byte for the weight unit, content in decimal representation 0...255 1 = mg milligram 2 = g gram 3 = kg kilogram 4 = t ton 5 = lb pound 6 = l liter
STEP	One byte for the stepwidth, content in decimal representation 0...255 1 = stepwidth '1' 2 = stepwidth '2' 5 = stepwidth '5' 10 = stepwidth '10' 20 = stepwidth '20' 50 = stepwidth '50'
LASTERROR	Last Error Byte, see also bit CmdError ,number of 'last error': 31 = stand still not reached (e.g. at taring, calibrating) 33 = negative weight at taring and W&M on 35 = weight exceeds allowed range 40 = CAL-Schalter 'locked' 41 = Indicator not in calibration mode 42 = calibration active, Indicator is in calibration mode 46 = tare active (can occur at start calibration) 47 = zero set not executed, weight is not within zero set range

Exponent, weight unit and step width are normally unchanged with a scale and need to be read only once (initially) by type 4.

Example:

Write window:	Byte number	0	1	2	3	4	5	6	7
	Value					04			
Read window:	Byte number	0	1	2	3	4	5	6	7
	Value	02	03	02	00	04			

- 1) Register [08] weight-value Byte 0...3 als Real 4532
- 2) Register [04] formatting of the value has to follow
 - Byte 0 [02]: 45.32
 - Byte 1 [03]: 45.32 kg
 - Byte 2 [02]: 45.32 kg last digit 0, 2, 4, 6, 8
 - Byte 3 [00]: 45.32 kg in standstill, valid

2.6.3.9 Register [5]: Indicator Type and Version (read)

Only reading is allowed.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	TYPE MSB							
Byte 1	TYPE LSB							
Byte 2	MAINVERSION							
Byte 3	SUBVERSION							

e. g. 5510 Rel 3.12 = 55100312_{hex}

2.6.3.10 Register [6]: Serial Number (read)

Only reading is allowed.

2.6.3.11 Register [8 ...14]: Weight Data G/N/T (read)

Register 8	Actual gross value
Register 9	Actual net value, if tared, else gross
Register10	Actual tare value, if tared, else 0
Register11	Reserved
Register12	Gross X 100 in cd (centi d)
Register13	Reserved
Register14	Full scale deflection FSD
Register15	Reserved (free)

Only reading is allowed.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	WEIGHT							
Byte 1	...							
Byte 2	...							
Byte 3	WEIGHT							

Byte 0-3: MSB-LSB for Profi/Interbus/ModBus protocol, LSB-MSB for DeviceNet protocol.

Are stored as DINT-fixed point. The real datavalue is derived from DINT and EXPO as follows:

$$\text{Value}_{\text{Real}} = \text{Readout}_{\text{DINT}} * 10^{(-\text{EXPO})}$$

EXPOnent reading, see register 4 in Chapter 2.6.3.8.

For reading weights, only the required weight type must be written into byte 4 of the write window (read data type request). When the weight value is available, the type is returned in byte 4 of the read window. If the weight request remains unchanged, the most recent weight is always updated.

Write window:	Byte number	0	1	2	3	4	5	6	7
	Value					08			

Read window:	Byte number	0	1	2	3	4	5	6	7
	Value	00	00	11	B4	08			

The displayed numeric value is read out without units and digits behind the decimal point.

Negative values are represented in 2 complement.

Example: Negative weight is -12

Read window:	Byte number	0	1	2	3	4	5	6	7
	Value	FF	FF	FF	F4	08			

Analog part/weight status

Display	Error 3	Error 7	negative	0 ↓	positive	FSD (SKE) ↓		Error 2	Error 3
				←±0,25d→			←overload→		
Bit	E3	E7	Below0	CZERO			aboveFSD	E2	E3
InZSR	←DeadLd±InsideZSR→								
ADUERR	ADUERR								ADUERR
W&M off	-	-	-	-	-	-	DIMM	-	-
W&M on	-	-	DIMM	-	-	-	DIMM	-	-

Error 6: no sense voltage

2.6.3.12 Register [112...117]: Action Bits Transition Controlled (write)

Register 112	SetZero	Set gross to zero
Register 113	SetTare	Edit taring
Register 114	ResetTare	Reset tare
Register 115	SetTest	Start ADU test
Register 116	ResetTest	Exit ADU test
Register 117	Reset PWF	Reset Powerfail-bit (register 1, bit will be set with each power ON)

Set bits

As soon as the bit is set, it is reset internally and the action is executed, it is transition triggered (for writing once).

The bit is set with the shown number as Write_Value_Select.

2.6.4 Access to the Fieldbus Interface via ModBus-TCP

ModBus uses 'word' (2 bytes, 16 bits) rather than 'byte' transfer. These are termed 'registers'.

Master Read/readfunction of PR5510/14 slave in Slot 4

Read-window	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
from slave	%QB 4.0	%QB 4.1	%QB 4.2	%QB 4.3	%QB 4.4	%QB 4.5	%QB 4.6	%QB 4.7
	ReadValue				Read_ Value_ Selected	I/O Status	Cmd Status	Indicator Status

to master	Register 0	Register 1	Register 2	Register 3
-----------	------------	------------	------------	------------

Master Write/writefunction of PR5510 slave in Slot 4

from Master	Register 1024			Register 1025		Register 1026		Register 1027	
Writewindow	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	
to slave	%IB 4.0	%IB 4.1	%IB 4.2	%IB 4.3	%IB 4.4	%IB 4.5	%IB 4.6	%IB 4.7	
	WriteValue				Read_ Value_ Select	Write_ Value_ Select	Appl_ Control_ Bits	Indicator_ Control_ Bits	

Write/read window structure also in IEC 61131 notation, otherwise the same structure as with other protocols is used.

Read Data -> register 0 ... register 3 each read one 16-bit word 2¹⁶ (256)

Algorithm: [Register 0]*256 + [Register 1]*1 = ReadValue

Byte 0	Byte 1	Byte 2	Byte 3	
Reg 0		Reg 1		ReadValue als DINT
[2161]		[264]		2161*256 + 264*1= 553 480 dez

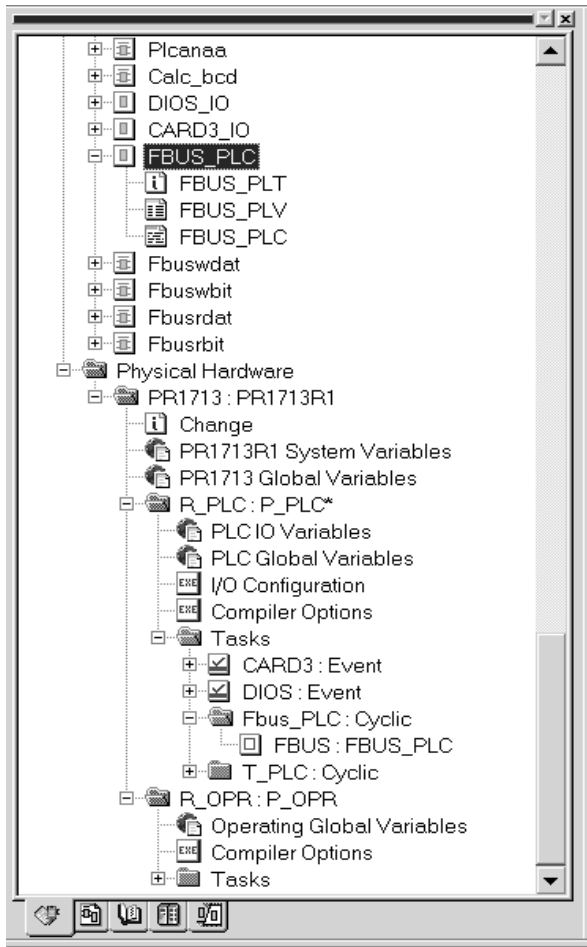
Write Data -> Register 1024 ... 1027

Algorithm: Register 1026: = [ReadValueSelect]*256 + [WriteValueSelect]*1

Byte 4	Byte 5	Register 1026	
ReadValue- Select	WriteValue- Select	Value	Action
08	00	08*256 + 00*1 = [2048]	Read gross
08	113	08*256 + 113*1 = [2161]	Read + tare gross
09	00	09*256 + 00*1 = [2304]	Read Net
08	114	08*256 + 114*1 = [2162]	Read gross + reset tare

2.6.5 PR1750 (IEC 61131 Program)

Note: PR1750NT release 2.32 or better must be used for all PR5510 fieldbus cards.



Application and special programming

The following separate fieldbus parts exist in the applications:

- logical-POUs (FBUS... program and function blocks)
- ein extra TASK (FBUS... cyclisch 2*10 msec = 20 msec)
- and an I/O configuration

CASE 01...23

are not defined here, but directly in the firmware , i.e. the are reserved, as long as Scale-Interface = WP-A is selected.

With Scale interface = disable this range can also be used freely.

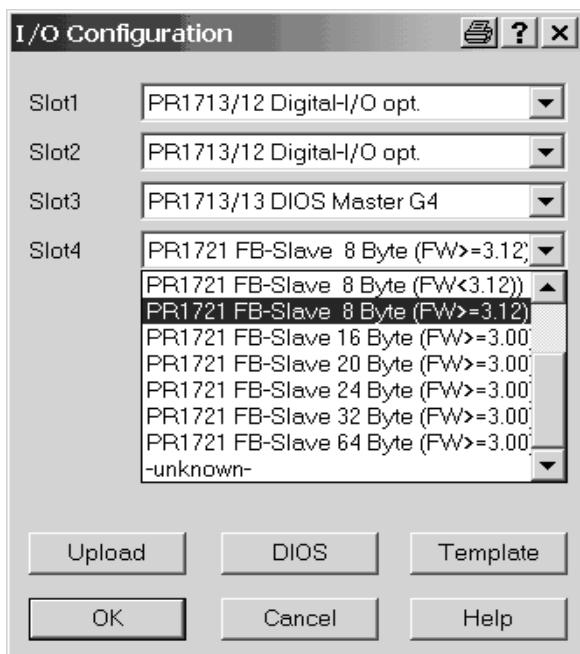
Note that only those of the relevant status bits in bytes 6, 7 which are not described here are available for free use.

CASE 24...199

is reserved and used by the applications.

CASE ab 200

is provided for additional project-specific data types and an I/O configuration selectable dependent on the required I/O data bus width



In applications BATCH, FLOW etc., [PR1721 FB-Slave 8 Byte (FW>=3.12)] is selected. (Please, note special case PHASE CONTROLLER)

This setting is required only for the application-dependent fieldbus parts.

The programs and data definitions must be adapted accordingly.

The firmware-dependent fieldbus parts are adjustable directly via [Setup-Fieldbus parameter] I/Os.

The file ,gwt_5610.gsd' covers all I/O configurations and can be used accordingly in the master.

2.6.6 Fieldbus Test

At the PR5510 slave

Select the front panel display [Setup-I/O Slots]:

```
+Slot 4: PR1721/31a1
PDP-SLv Data aktiv %
```

Data active.

```
+Slot 4: PR1721/31a1
IN:000000000008000000%
```

00 01 02 03 04 05 06 07 displayed bytes 0-7
 01 02 03 04 05 06 07 08 or in notation 1-8
 IN: 00 00 00 00 08 00 00 00 data bus#8

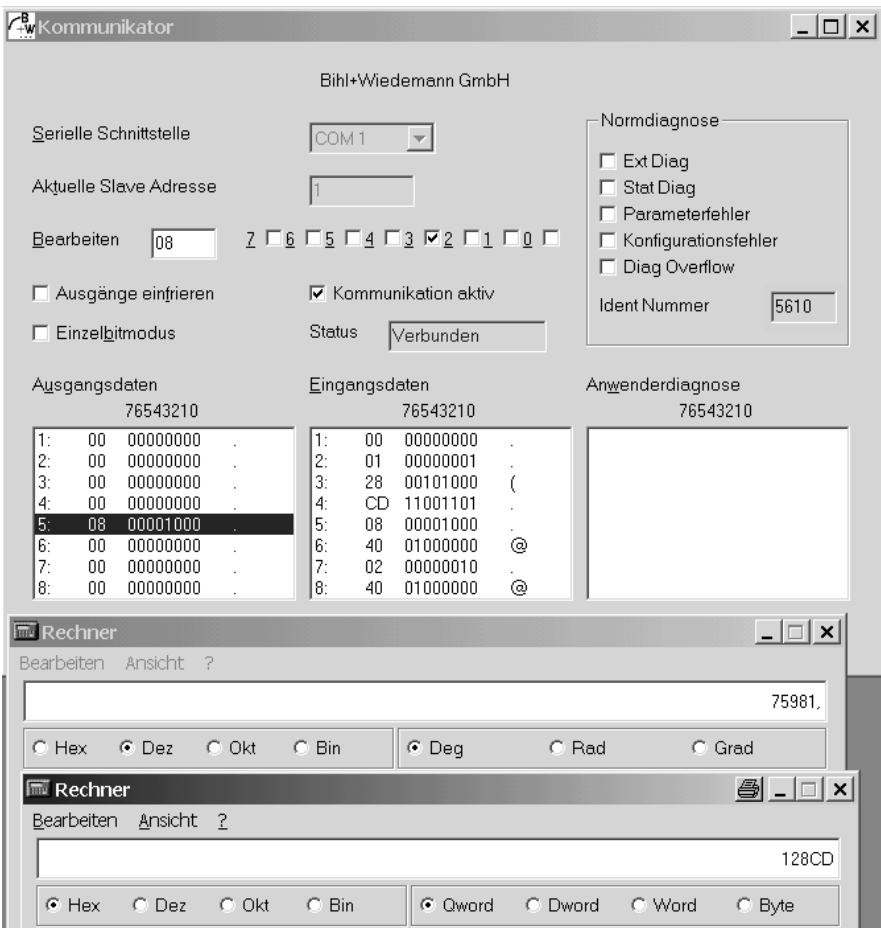
```
+Slot 4: PR1721/31a1
OT:000128CD08400240%
```

00 01 02 03 04 05 06 07 displayed bytes 0-7
 01 02 03 04 05 06 07 08 or in notation 1-8
 OT: 00 01 28 CD 08 40 02 40 data bus#8

```
+Slot 4: PR1721/31a1
LED: -- 3rn -- --%
```

Status LEDs 1-2-3-4 are mirrored in the mounting plate.

At the PC master simulator



Example:

Request for gross weight
 Data type=08 hex
 sent by the master

WDATA in byte 1-4
 DTYP(r) in byte 5
 CMND in byte 7-8

received:

RDATA in byte 1-4
 DTYP(e) in byte 5
 STATUS in byte 6-8
 40 = bit powerfail
 02 = bit CAL chang
 40 = bit standstill

Example with

GROSS weight display:
 7598.1 kg (dec)

00 01 28 CD (hex)
 msb - lsb byte 1-4

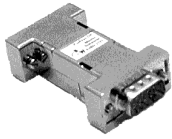
Byte with 8 bits:

bit 7- 6 - 5 - 4-3-2-1-0
 80-40-20-10-8-4-2-1

2.6.7 PC Master Simulator

As a simple PC test tool, we recommend:

BW 1257 DP V0 and DP V1



Ausgangsdaten		Eingangsdaten	
76543210		76543210	
1:	00 00000000 .	1:	00 00000000 .
2:	00 00000000 .	2:	01 00000001 .
3:	00 00000000 .	3:	28 00101000 (
4:	00 00000000 .	4:	CD 11001101 .
5:	08 00001000 .	5:	08 00001000 .
6:	00 00000000 .	6:	40 01000000 @
7:	00 00000000 .	7:	02 00000010 .
8:	00 00000000 .	8:	40 01000000 @

PC as Profibus master->RS232 interface->->B&W-Uart->->cable-> PR instrument with PR1721/31 option
 Same PC-testtool for DeviceNet-protocol is available from the same company
 Internet: <http://www.bihl-wiedemann.de>

For the fieldbus, cards from a well-known manufacturer for Anybus-S products are used:

HMS Industrial Networks AB			
Germany	+49- 721 - 96472 - 0	sales-ge@hms-networks.com	
Japan	+81- 45 - 478 - 5340	sales-jp@hms-networks.com	
Sweden	+46- 35 - 17 29 20	sales@hms-networks.com	
U.S.A	+1- 773 - 404 - 2271	sales-us@hms-networks.com	

Internet: <http://www.hms-networks.de>

3 Appendix

3.1 Additional manuals

The respective operating manuals for the applications (e.g. Batch, PRO etc.) are delivered on the CD in German and English.

3.2 Customer Setup

Plug ins – Fieldbus PR5510

I/O Slot	Option	Protocol	Conneted to	Hardware adjustments
Slot 4	PR5510/14	EtherNet-TCP/IP - EW-COMM-Vx - ModBus-TCP		none, all « default »
Slot 4	PR1721/31	ProfiBus-DP		none, all « default »
Slot 4	PR1721/32	InterBus-S		none, all « default » Exception: Baudrate-Jumper 500 kbit/s: 3-1 2 Mbit/s : 4-2
Slot 4	PR1721/34	DeviceNet		none, all « default »
Slot 4	PR1721/36	ProfiNet I/O		none, all « default »
Slot 4	PR1721/37	EtherNet/IP		none, all « default »

Serialnumber	Boardnumber Show Boardnumber	License [enabled] License setup	Licensenumber
LO		PR1791/13 or PR1792/13	

Network parameter		
	defaults	
DHCP	OFF	
IP address	192.168.0.1	
Subnet mask	255.255.255.0	
Default gateway	0.0.0.0	
Device address	0	

Fieldbus parameter		
	defaults	
I/Os	8 byte I/O	
Profibus DP addres	1	
DeviceNet baudrate	250 kBit/s	
DeviceNet MAC-ID	1	
Scale interface	Disable/WP-A	

4 Glossar

The following terms are used in this document:

ADC	Analog digital converter, internal ADC (LC signal converter)
CAL	Single in line switch for data protection
KALTstart	(COLD) All programs and tables loaded in the RAM are erased
Warmstart	Initialization, all data remain unchanged
DDE	Microsoft communication protocol (Dynamic Data Exchange)
OPC	Microsoft communication protocol (Dynamic Data Exchange)
PR1791	Additional product: DDE server
PR1792	Additional product: OPC server
Hyperterminal	Microsoft terminal emulation (VT100) (accessory range)
EW protocol	Serial communication protocol for batching systems, version V1/ V2/ V3
Flash	Program loading (also parts)
PR8001	Additional product: Powertool
Flashlt	Additional product as part of P8001: operating program loading tool
Displaylt	Additional product as part of P8001: front-panel display
Recoverlt	Additional product as part of P8001: tool for data saving
Layoutlt	Additional product as part of P8001: report format tool +NiceLabelExpress (SAG)
Translatelt	Additional product as part of P8001: prompt text translation tool
Accesslt	Additional product as part of P8001: tool for database loading/reading in *.mdb-file
FSD	Fullscale
GND	Zero potential, ground or earth connection
InBatch	Wonderware Batch Control System
Interbus-S	Standard communication protocol
ISA S88.01	ISA standard for Batch Control (phase control, single comp. batching)
IEC 61131	Standard PLC programming language for resources PLC, OPR, REC
PR1750	Additional product: programming tool for internal PLC of PR 5510 acc. to IEC61131
ProfiBus-DP	Standard communication protocol
DeviceNet	Standard communication protocol
Recipe	Recipe (see ISA S88)
PR8400	Additional product: recipe and report manager
SPM	Scratch Pad Memory area of the internal PLC
EAROM	Non-volatile special memory for calibration, configuration and license data
RAM/SRAM	Volatile working memory (with back-up battery)

TCP (Transport Control Protocol)

The end points of a TCP-connection form two tuples consisting of IP address and port number. A virtual connection between the two end points is built up. The communication is full duplex, i.e. the two communication partners can send and receive data simultaneously.

The protocol is transparent for the application. Data transmitted to the TCP interface arrive at the receiver without change. The package sizes are selectable freely. The whole range from one byte to several Mbytes is permitted (unless there are restrictions due to the hardware).

UDP (User Datagram Protocol)

Instead of TCP, the UDP protocol (User Datagram Protocol) can be used also for data transmission. Its performance characteristics are limited to the separation of application communication channels. The delivery of datagrams in the network is not safeguarded. The protocol isn't a warranty for compliance with the package order. A UDP-based Internet application must ensure safeguarding of data transmission itself. Therefore, UDP is suitable for applications with own protective mechanisms. It saves protocol "overhead" and offers higher transmission rates than TCP. Mechanisms for building up and removing the connection are omitted.

One of the decisive advantages compared with TCP is the possibility of 'multipoint' connections. Independent of status, data can be sent to many communication partners.

IP (Internet Protocol)

The Internet protocol defines the basis of data communication at the lower level. It enables many different network and hardware architectures to be composed into a complete network, without consideration of the physical medium. The Internet protocol ensures data transmission by unwarranted transport without direct connection to a communication partner. Safety mechanisms are provided by superordinate protocols such as TCP.

IP address

Unique address for a computer. Must be identical with the broadcast address of the network segment.

MAC address

The MAC address (Media Access Control) of a network card is a fixed, burnt-in 6 byte number, which is mostly specified in hexadecimal form with separator.

Routing

Further transmission of packages (questions, answers) between several networks.

Broadcast address

The address which specifies which computers are included in a subnet, or in which net this computer is located; determined from IP and SNM.

SubNet mask (SNM)

Required for the broadcast address and routing decisions.

5 Index

A

Analog part/weight status 63

C

Calibration information 60

CC-Link 5

Customer Setup 68

D

Data Formats 51

DeviceNet 5, 18

E

Error 1 3 6 7 60

EtherNet/IP 25

EtherNet-IP 5

EtherNet-TCP/IP 5, 28

F

Fieldbus 5

Fieldbus Test 66

I

Indicator Control Byte 59

Input Area 57

InterBus-S 5, 12

Interface Handling 46

K

Konfiguration 45

M

ModBus-TCP 41

O

Output Area 56

P

PR1750 65

ProfiBus-DP 5, 6

ProfiNet I/O 5, 23

R

Read window 47

Read-data 49

Register Read 58

Register Write 58

S

Scale Status 60

Special Programming 65

W

Weight Data 62

Write Data 50

Write window 47

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