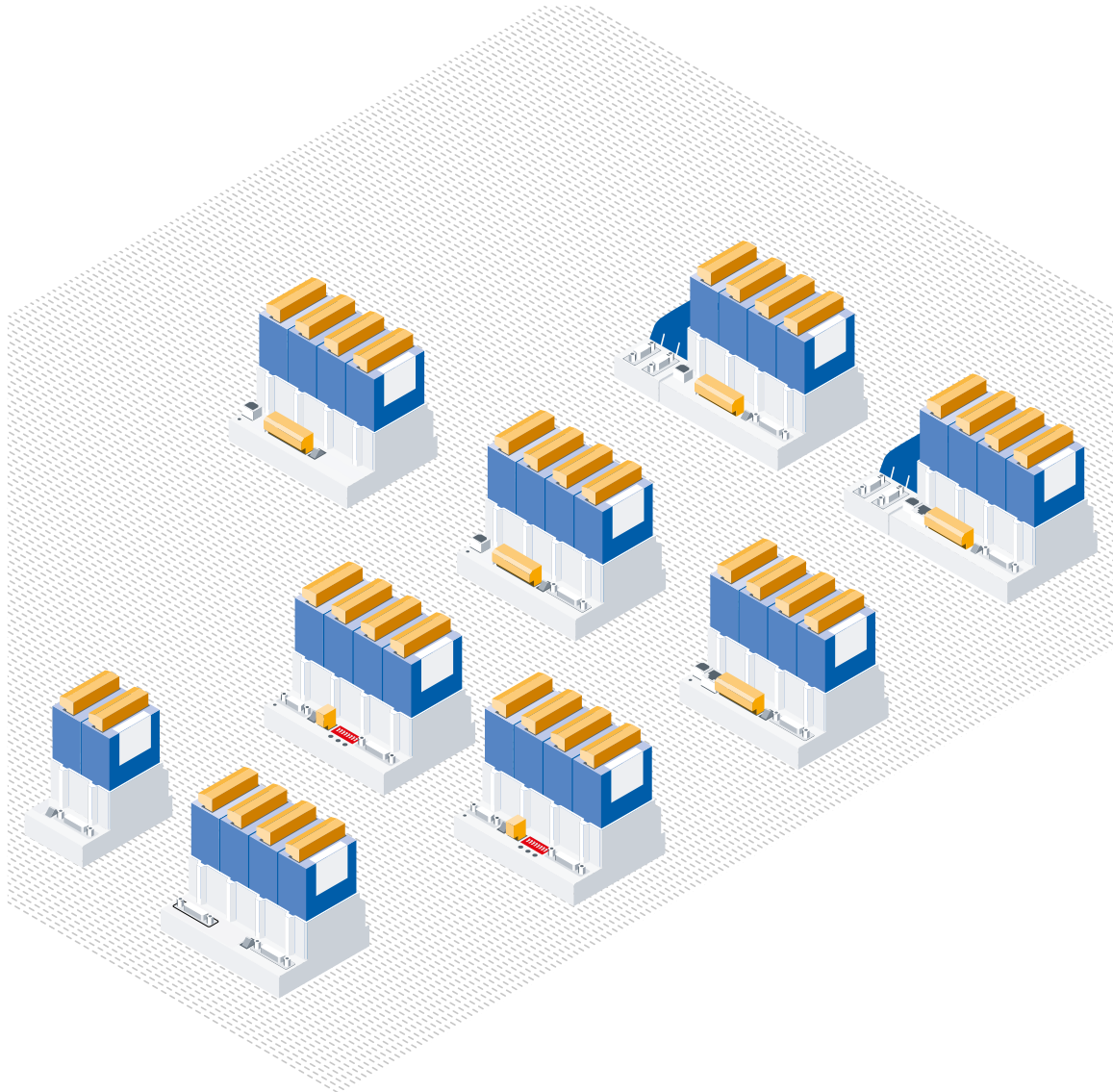




PCD3 series

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0.1 Document History

Version	Date	Changed	Remarks
EN02	2003-11-01	-	Translation
EN03	2004-08-15	2004-10-01	Revision
EN04	2004-10-01		Incorporation of CPUs
EN05	2005-01-31	-	Changes
EN06	2005-07-01	2005-11-15	Incorporation of new modules, sequence as per price list, other additions and changes
EN07	2006-10-01	2007-07-10	Further detailed additions and changes
EN08	2007-07-10	2007-07-15	Further detailed additions and changes
EN09	2009-03-01	2009-03-15	Further changes
EN10	2010-01-21	2009-10-09	- 3 Removed the DIN40040
		-	- 3.10 Port #3 of the PCD3.M5430
	2010-03-05	-	- 6.1.6 List of outphased I/O-modules
	2010-03-24	-	- 3.10 configuration of Port #10, Pin 6 - 6.13.1 Resolution A / D converter W525
EN11	2010-05-17	2010-07-26	- 3.2, 3.12 Buffer time "Super Cap"
	2010-07-12	2010-07-26	- 5.5.6 Wiring concept PCD3.F180
	2010-07-26	-	- 6.8.1 Wiring concept PCD3.W2x0
EN12	2010-11-10	2010-11-10	- 3.4 Profi-S-Net 1,5 MBit/s not for the M5340
	2010-11-10	2010-11-10	- 6.8.2 Ground connection of PCD3.W3x0
EN13	2011-06-28	-	- Chapters 3, 5 and 6: External 24V power supply and Ethernet + «full duplex»
EN14	2011-09-22	2011-09-23	- Ch5 Using the SBC S-Bus
	2011-09-29		- New CPU-types PCD3.Mxx60
	2011-10-25		- "Label-Creator" replaced by the "Label-Editor" of the "Device-Configurator"
EN15	2012-04-05	2012-11-21	- Ch3.2 Storage temp. change -20 to -25 °C
	2012-04-13	2012-11-21	- ChA.5 Address changed
	2012-11-15	2012-11-21	- Ch9 Chapter deleted
	2012-11-20	2012-11-22	- Ch8.1 Buffer time "Super Cap" reduced
	2013-05-10		- Ch3.14 Behavior of the Diagnostic LED
EN16	2013-12-06	-	- new Logo and new company name
	2014-02-07	2014-02-07	- Ch2 Internet Security
EN17	2014-08-07		- Chapitre 6 externalisé à 27/600
	2014-09-16	2014-09-16	- Ch3.21.1 fraction bar has been shifted

0.2 Brands and trademarks

Saia PCD® and Saia PG5®
are registered trademarks of Saia-Burgess Controls AG.

Technical modifications are based on the current state-of-the-art technology.

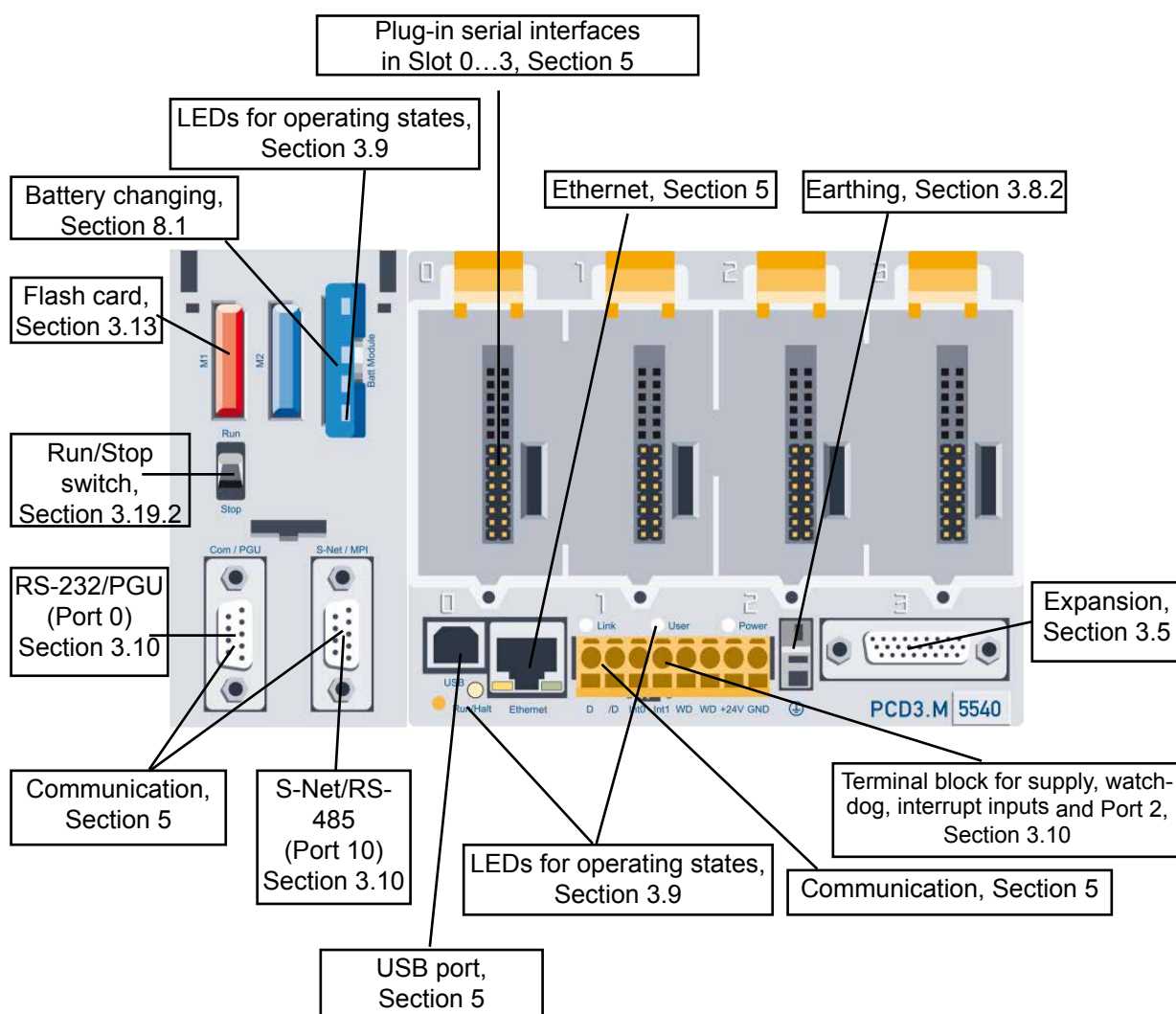
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Published in Switzerland

1 Graphical index

The graphical index singles out some highlights from the Hardware manual for the PCD3 Series, and allows you to click on the text frames or directly on a component/connector to jump straight to the corresponding section. The facility to jump to any section from the table of contents is still to be completed.

1



2 Overview

2.1 Introduction

This manual covers the technical aspects of the PCD3 components. The following terms are used frequently:

- CPU Central processing unit: the heart of the Saia PCD®
- RIOs Remote I/Os: inputs and outputs connected to the CPU via a field bus such as Profibus
- LIOs Local I/Os: these are connected to the CPU via the I/O bus or a RIO (i.e. with the shortest possible cables)
- Modules Input/output elements, mounted in a housing, matched to the PCD3 system
- Module holder CPU, RIO or LIO, to which modules may be attached

The aim of this section is to present the essentials of planning and installing control systems with PCD3 components. It covers the following topics:

- [Planning an application](#)
- [Cabling](#)
- [Addressing and cabling rows](#)

Details of hardware, software, configuration, maintenance and troubleshooting are described in separate sections. The Appendix contains an explanation of the icons used, and the company address.

2.2 Instructions for connecting Saia-PCD® controllers to the internet



When Saia PCD controllers are connected directly to the internet, they are also a potential target of cyber attacks. For secure operation, appropriate protective measures must always be taken.

PCD controllers include simple, built-in protection features. However, secure operation on the internet is only ensured if external routers are used with a firewall and encrypted VPN connections.

For more information, please refer to our support site:

www.sbc-support.com/security

2.3 Planning an application

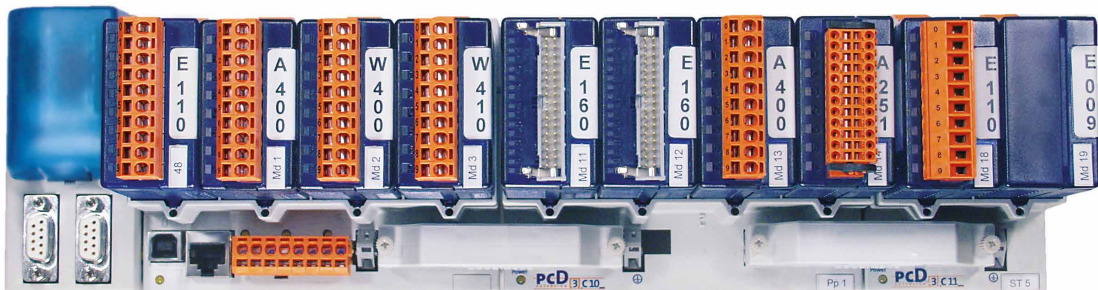
The following aspects should be considered when planning PCD3 applications:

- The internal load current taken by the I/O modules from the +5V and V+ supply must not exceed the maximum supply current specified for the CPUs, RIOs or LIOs (PCD3.C200)
- The CPU or the RIO type determines the maximum number of module carriers
- The total length of the I/O bus is limited by technical factors; the shorter, the better



The PCD3.C200 is used to extend the I/O bus or for the internal power supply (+5V and V+) to a module segment. Please note the following rules:

- Use no more than **six** PCD3.C200s in one configuration, or the time delay will exceed the I/O access time
- Use a maximum of **five** PCD3.K106/116 cables
- After each cable (at the start of a row), insert a PCD3.C200
Exception: In a small configuration with no more than 3 LIOs, these can be supplied from the PCD2.Mxxx. A PCD3.C200 is not needed
- Where an application is mounted in a single row (max. 15 LIOs), after every **five** PCD3.C100s a PCD3.C200 must be inserted to amplify the bus signal (unless the configuration ends with the fifth PCD3.C100)



- If the application is mounted in multiple rows, the restricted length of cable means that only **three** LIOs (1x PCD3.C200 + 2x PCD3.C100) may be mounted in one row

When planning an application, we recommend the following procedure:

- ❶ Select the I/O modules according to your requirements. Where possible, use PCD3 I/O modules with 16 connections; these have 16 red LEDs.
- ❷ From the number of I/O modules, calculate the required number of module holders. Check that the number of module holders is allowed:

2

PCD3	M3020 M3120	M3320 M3330	M5xx0	M6xx0
I/O bus connection for expansion units	no	yes		
Number of inputs/outputs or I/O module sockets:	64 ¹⁾ 4	1023 ^{1) 2)} 64		

1) Using digital I/O modules PCD3.E16x or A46x with 16 I/Os each

2) On all PCD3 units, address 255 is reserved for the watchdog. The I/Os reserved for the watchdog cannot be used, and no analogue and H modules can be used on the sockets with base address 240

- ❸ Arrange module holders in row(s) according to the mounting area available

Connecting material required

Arrangement with one PCD3.Mxx0; LIOs in one row

Max. 15 × PCD3.LIO's in a row, no extension cable, with PCD3.K010 connector only

Connecting material for this arrangement:

n × PCD3.K010 connectors between PCD3 module holders

Arrangement with one PCD3.Mxx0; LIOs in multiple rows

Max. 3 PCD3.LIOs side-by-side and one row beneath the other, with extension cables for the rows beneath (max. 15 PCD3.LIOs)

Connecting material for this arrangement:

n × PCD3.K106/116 extension cables to connect the last PCD3 module holder in one row with the first PCD3 module carrier in the next row; n × PCD3.K010 connectors between PCD3 module holders

Arrangement of a RIO node with the LIOs side-by-side

Max. 3 × PCD3.LIOs total

Connecting material for this arrangement:

n × PCD3.K010 connectors between PCD3 module holders

For all arrangements: After every five PCD3.C100 module holders, insert a PCD3.C200 base unit as an I/O bus amplifier

- ④ Use the table in the section on ["Current consumption of the modules"](#) to calculate the load current on the internal +5V supply (use the worst-case / highest values)
- ⑤ Check that the max. supply current is sufficient for the CPU, RIO or PCD3.C200. To supply a module segment separately, use a PCD3.C200 instead of a PCD3.C1xx. Check that the load current for all segments does not exceed the max supply current for the CPU/RIO/PCD3.C200. The max. supply current can be found in the section on ["Internal supply"](#)
- ⑥ Calculate consumption from the 24 V supply. The current consumption for the PCD3 configuration can be determined from the section on ["Current consumption of the modules"](#) (use the worst-case / highest values)

2



Note that in most applications the outputs place the heaviest load on the 24 V supply. For 16 outputs with a load current of 0.5 A each, the loading will be 8 A with all outputs connected.

- ⑦ Do not forget the appropriate connecting cables for the module holders
- ⑧ Calculate the number of terminal blocks required for the I/Os, and order separately. Screw or spring clamp terminal blocks can be ordered as required. Not all modules require the same type of socket connection.

2.4 Cabling

2.4.1 Cable layout

It is advisable to wire the I/O modules from a cable channel.



2

Cables to connections on the lower part of the module carriers (supply, earth) should preferably be wired from a cable channel below the module holders.

Following these rules will ensure that the LEDs are visible and the bus connections remain accessible.

2.4.2 Cable routing

- 230 V supply lines and signal lines must be laid in separate cables at least 10 cm apart. Even within the switching cabinet, it is advisable to leave space between power and signal lines.
- Digital signal / bus lines and analogue signal / sensor lines should be laid in separate cables
- It is advisable to use shielded cables for analogue signal lines.
- The shield should be earthed at the entry or exit to the switching cabinet. The shields should be as short as possible and of the largest possible cross-section. The central earthing point should be $> 10 \text{ mm}^2$ and connected to the PE ground wire by the shortest route
- The shield is generally connected to one side of the switching cabinet only, unless there is a potential equalization with significantly lower resistance than the shield resistance
- Inductivities installed in the same switching cabinet, e.g. contactor coils, should be provided with suitable suppressors (RC elements)
- Switching cabinet components with high field intensity, e.g. transformers or frequency inverters, should be shielded with separator plates with a good ground connection.

Surge protection for long distances or external lines

- Where lines are laid outside the building, or over longer distances, suitable surge protection measures should be applied. For bus lines in particular, these measures are essential.
- With lines laid outside, the shield must have adequate current-carrying capacity and be earthed at both ends.
- The surge conductors should be installed at the input to the switching cabinet.

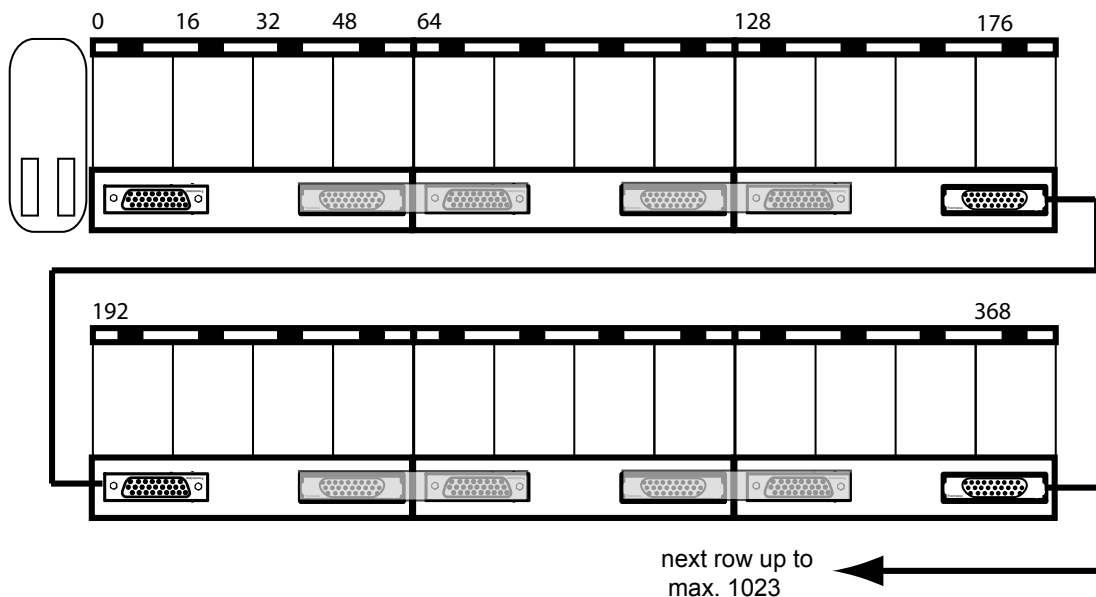
2.5 Addressing and cabling rows

The address of a module is determined by its module position in the configuration.

PCD3 CPUs: Module addresses begin with base address 0 (zero) on socket 1 (addresses 0 to 15) and go up in increments of 16 to address 63 on socket 4, regardless of the number of inputs/outputs (16, 8 or 4)

PCD3 LIOs: Determined by the module position in the configuration; go up in increments of 16

PCD3 RIOs: There is no direct access to the I/Os; the entries are defined by the network configurator.



Extension cables connect the module holder at the right-hand end of a row with the first module holder at the left of the next row. The address of the first module in a second or third row equals the address of the last module in the previous row +16.

To simplify cabling, the module locations for the PCD3 module holders are labelled 0 to 3. For more precise addressing, each module holder and each module also has an address field in the bottom right corner of the housing. The use of these address fields is described in the next section.



Address 255 is reserved for the watchdog relay. Modules that use this address must not be installed in module position 16. For more details, please refer to [the section on the "Hardware watchdog"](#).

Each additional PCD3.C100/C200 module holder provides space for 4 further I/O modules; at the end of the bus, a PCD3.C110 provides space for 2 further I/O modules. The connection to the next row is via the PCD3.K106/116 26-core extension cable.



Forces arising with too small cable radii (smaller than the natural radius) may damage the plug connection.

2

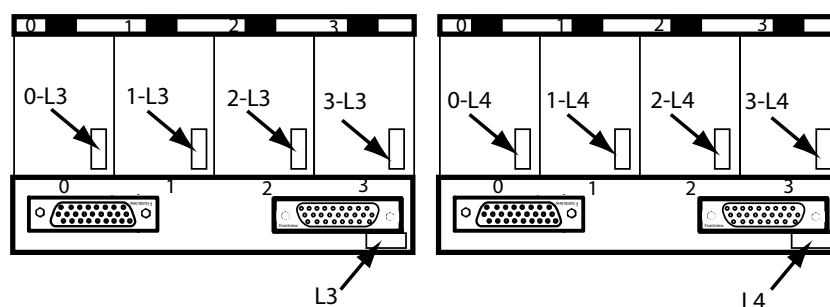
The extension cables must not be plugged in or removed with the controller connected to the power supply.

2.5.1 Labelling module holders and modules

The sockets for the PCD3 module holders are labelled 0 to 3.

Every module holder has an address field in the bottom right corner of the housing

Example:



All PCD3 module holders and the PCD3.K106/116 extension cable are provided with a matching set of labels for additional markings.

64	64	80	96	112	0
128	128	144	160	176	0
192	192	208	224	240	16
256	256	272	288	304	32
320	320	336	352	368	48
384	384	400	416	432	
448	448	464	480	496	
512	512	528	544	560	
576	576	592	608	624	
640	640	656	672	688	
704	704	720	736	752	
768	768	784	800	816	
832	832	848	864	880	
896	896	912	928	944	
960	960	976	992	1008	

4 310 8686 0

Since the middle of 2005, all PCD3 I/O modules have been fitted with a means of attaching a label clip. These clips can be snapped on to the right or left (e.g. where there are no LEDs) of the connector. Prepunched labels can be inserted into the clips. The clips, including prepunched labels (A4 sheets) are available as accessories under item-number 4 310 8723 0.

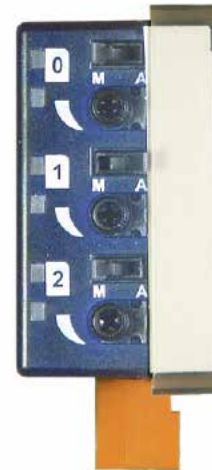
2



Older module housings without attachment facility

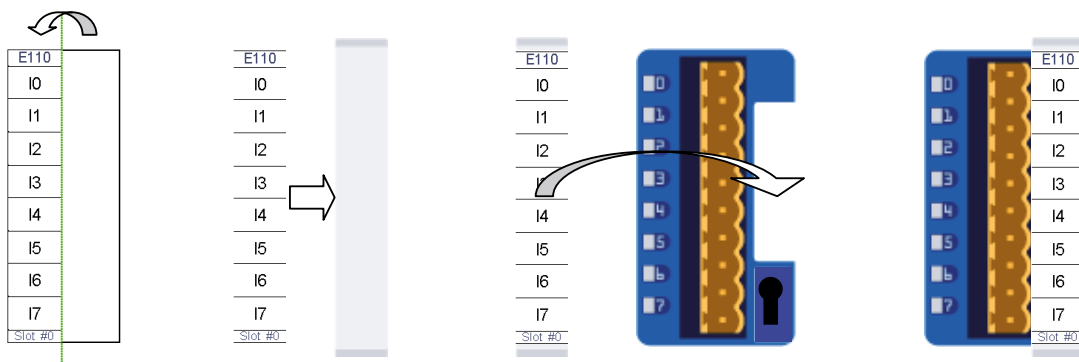


New module housings with attachment facility



The prepunched labels can be edited using a the “Device Configurator” from PG5 V2.0:

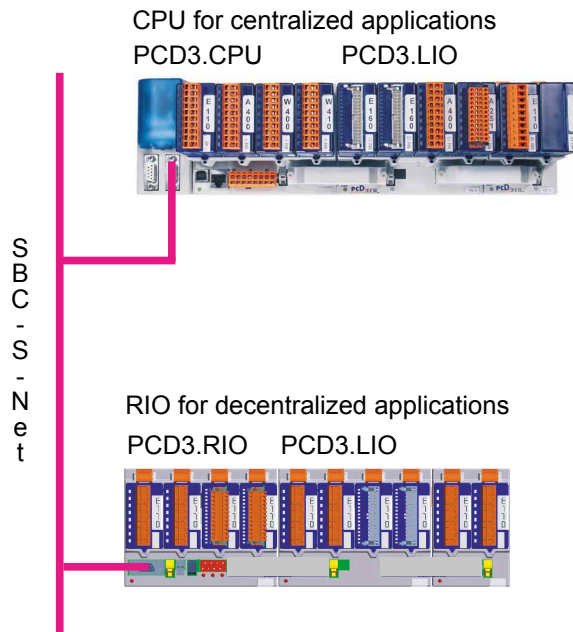
- Open the programming tool PG5 V2.0
- Start the “Device Configurator” from the menu “Device”
- Open the “Label Editor” from the menu “Tools”
- Select I/O module and edit preset text to your own requirements (font, colour, borders etc.)
- Print the prepunched labels on the A4 sheets provided
- Peel label off the A4 sheet
- Push the label under the transparent clip from left to right



3 PCD3.Mxxx0 Classic CPUs and module holders

The CPUs in the xx7 series are described in a separate manual.

3.1 System overview



SBC S-Net networking concept

SBC S-Net is the name of the new, flexible networking concept for innovative and economical automation systems with Saia PCD®s.

- Based on the Ethernet-TCP/IP (Ether-S-Net) and Profibus (Profi S-Net) open standards: use of existing network infrastructure → no duplicate cabling required
- Supports multi-vendor and multi-protocol operation:
Reduced costs for project planning, programming, commissioning and maintenance by general use of Ethernet TCP/IP and Profibus with S-Net, the Private Control Network (PCN) for Saia PCD®s
- General use of web technologies via Ethernet TCP/IP and Profibus for commissioning, operation, monitoring and diagnostics
- General programming and commissioning via Ethernet TCP/IP and Profibus
- Network connections integrated into the base unit; Profibus interface integrated into the operating system of the new PCD3 controllers and PCD3 RIOs (included in the base unit, at no extra charge)
- Profi S-Net with optimized protocols and services for efficient operation of PCD3 RIOs and PCD3 controllers on the Profibus
- Multi-protocol operation:
The new PCD3 controllers and PCD3 RIOs support Profibus-DP and S-Net on the same socket
- Continuity and security of investment:
All Saia PCD® systems can be integrated into the design using existing Profibus and Ethernet TCP/IP connections

Saia PCD® web server

All PCD3 controllers and PCD3 RIOs come with an integrated web server as standard:

- Web browser as a tool for commissioning, support and visualization:
Access to the SBC web server is via standard web browsers such as Internet Explorer and Netscape Navigator. This makes the web browser, which can be operated intuitively by anyone, the standard tool for commissioning, service, support and visualization of machines, units and installations. The user can retrieve pre-defined device and system-specific HTML pages, giving access to all data on controllers and RIOs. Graphical elements (images, diagrams etc.) as well as text documents (operating and repair manuals) can also be integrated into the HTML pages, to provide a personalized user interface.
- General access to any desired interfaces and networks:
Access to the web server is available not only via Ethernet TCP/IP, but also via cost-effective standard serial interfaces (RS-232, RS-485, modem etc.) and via Profibus networks, throughout the system and at different levels in the network. This makes it economical to use web technology to operate and monitor even the smallest applications.
- The Saia PCD® web server is integrated into all products:
Having a web server integrated as standard eliminates the cost of run-time licenses or additional modules. In all new PCD3 controllers and the PCD3 RIOs, the web server is already included in the base units, at no extra cost.

3.2 General technical details

Supply (external and internal)	
Supply voltage	24 VDC $\pm$ 25% smoothed or 19 VAC $\pm$ 15% full-wave rectified (18 VDC)
Power consumption ¹⁾	typically 15 W for 64 I/Os
Capacity of internal 5 V bus ²⁾	600 mA
Capacity of internal +V bus (16...24 V) ²⁾	The capacity of the +V bus depends on the capacity of the 5V bus, as follows (the more precisely the 24 V are maintained, the higher the possible capacity): $24 \text{ V } \begin{matrix} -25 \% \\ +30 \% \end{matrix} : 100 \text{ [mA]}$ $24 \text{ V } \begin{matrix} -20 \% \\ +25 \% \end{matrix} : 150 - \frac{I_{5 \text{ V Bus}}}{15} \text{ [mA]}$ $24 \text{ V } \begin{matrix} -10 \% \\ +10 \% \end{matrix} : 260 - \frac{I_{5 \text{ V Bus}}}{4.8} \text{ [mA]}$
1) The loads handled by the outputs and other consumers are generally more important for sizing the supply than the internal power leakage of the control 2) When planning PCD3 systems, it is essential to check that the two internal supplies are not overloaded. This check is especially important when using analogue, counter and positioning modules, as these may have a very large power consumption. It is advisable to use the "Device Configurator" from PG% V2.0, for calculation the power consumption of the moduls.	
Atmospheric conditions	
Ambient temperature	When mounted on vertical surface with vertically aligned terminals: 0...+55 °C In all other mounting positions, a reduced temperature range of 0...+40 °C applies
Storage temperature	-25...+85 °C
Relative humidity	10...95% without condensation
Vibration resistance	
Vibration	according to EN/IEC61131-2: 5...13.2 Hz constant amplitude (1.42 mm) 13.2...150 Hz, constant acceleration (1 G)
Electrical safety	
Protection type	IP 20 according to EN60529
Air/leakage paths	according to EN61131-2 and EN50178: between circuits and bodies and between electrically isolated circuits: surge category II, fouling level 2
Test voltage	350V / 50Hz AC for nominal unit voltage 24 VDC
Electromagnetic compatibility	
Electrostatic discharge	according to EN61000-4-2: 8 kV: contact discharge
Electromagnetic fields	according to EN61000-4-3: field intensity 10 V/m, 80...1000 MHz
Bursts	according to EN61000-4-4: 4 kV on DC supply lines, 4 kV on I/O signal lines, 1 kV on interface lines
Noise emission	according to EN 61,000-4-6: Class A (for industrial areas) Guidance on the correct use of these controls in residential areas can be found at www.sbc-support.com (additional measures).
Noise immunity	acc. to EN61000-6-4

Mechanism and mounting	
Housing material	Module holder: PC/ABS, light grey, RAL7035 I/O modules: PC, transparent blue Clips: PAM, orange, RAL2003 Fibre optics: PC, crystal-clear
Mounting rail	Top-hat rail according to DIN EN60715 TH35 (formerly DIN EN50022) (1 × 35 mm)

Connections						
Terminal blocks	Spring terminals 10-pole, 4-pole	Screw terminals 10-pole	Spring terminals 14-pole, 12-pole, 8-pole	Spring terminals 24-pole, 6-pole	Earth terminal	Terminal 2-pole supply
Section stranded single wire	0.5...2.5 mm ² 0.5...2.5 mm ²	0.5...2.5 mm ² 0.5...2.5 mm ²	0.5...1.5 mm ² 0.5...1.5 mm ²	0.5...1.0 mm ² 0.5...1.0 mm ²	0.08... 2.5 mm ²	0.5... 1.5 mm ²
The terminal blocks may only be plugged onto 20 times. They must then be replaced, to guarantee a reliable contact						
Length of insulation	7 mm	7 mm	7 mm	7 mm	5...6 mm	7 mm

Standards / approvals	
EN/IEC	EN/IEC61131-2 "Programmable controllers"
Shipbuilding	ABS, BV, DNV, GL, LRS, PRS. Please verify if your chosen product is mentioned in the list of corresponding Type-Approval-Company under www.sbc-support.com .
cULus-listed	Please verify if your chosen product is listed in the corresponding Certificate under www.sbc-support.com . The condition for cULus Compliance are mentioned on the sheet annexed to the product or can be required under www.sbc-support.com .

3.3 System resources

3.3.1 Program blocks

Type	Quantity	Addresses	Remarks
Cyclic organization blocks (COB)	32* (16)	0...31* (0...15)	Main program elements
Exception/system-dependent organization blocks (XOB)	32	0...31	called from the system
Program blocks (PB)	1000* (300)	0...999* (0...299)	Sub-programs
Function blocks (FB)	2000* (1000)	0...1999* (0...999)	Sub-programs with parameters
Sequential blocks (SB) total 6000 steps and transitions each (with PG5 ≥ 1.3 and firmware version ≥ xxx)	96	0...95	for Graftec programming of sequential processes

* This information is valid for firmware 1.10.16 and newer versions. Before this version 16 COBs, 300 PBs and 1000 FBs were supported.

3.3.2 Computation ranges for count types

Type		Remarks
Integers	– 2,147,483,648 to + 2,147,483,647	Format: decimal, binary, BCD or hexadecimal
Floating point numbers	– $9.223,37 \times 10^{18}$ to – $5.421,01 \times 10^{-20}$ + $9.223,37 \times 10^{18}$ to + $5.421,01 \times 10^{-20}$	Instructions are provided to convert values held in SBC format (Motorola Fast Floating Point, FFP) to IEEE 754 format and vice versa.

3.3.3 Media

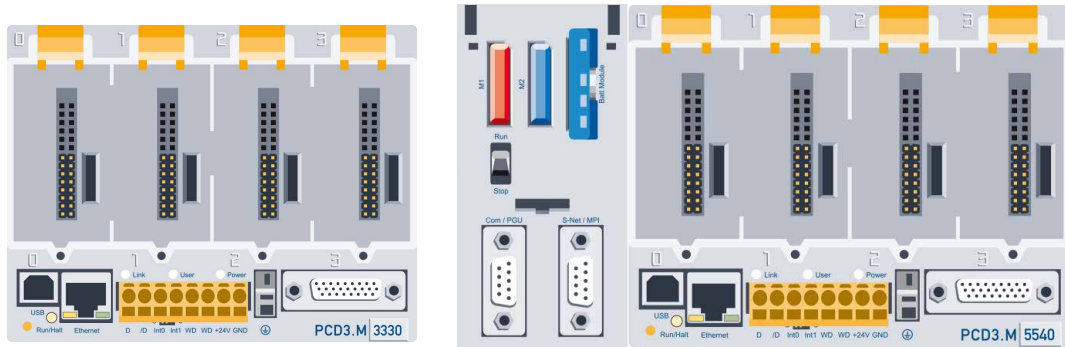
Type	Quantity	Addresses	Remarks
Flags (1 bit)	14'336 (8192)	F0...14'335 (F0...8191)	By default, flags are not volatile, but a volatile range can be configured, beginning with address 0
Registers (32 bit)	16383	R 0...16383	For integer or floating point values
Text/data blocks	8191	X or DB 0...8191	The texts 0..3999 are always written to the same memory area as the user program. Where the user memory has been extended, the base memory can be configured to hold RAM texts and DBs. The texts and DBs held in this way have addresses ≥ 4000
Timers/counters (31 bit)	1600 ¹⁾	T/C 0...1599	The breakdown of timers and counters is configurable. Timers are periodically decremented by the operating system; the basic time unit can be set between 10 ms and 10 seconds
Constants with media code K	any		Values 0...16383; may be used in instructions instead of registers
Constants with no media code	any		Values -2,147,483,648 to +2,147,483,647. Can only be loaded into a register with an LD command, and cannot be used in instructions instead of registers.

1) The number of timers configured should be only as many as required, to prevent unnecessary CPU loading

** Since firmware 1.14.23 14'336 flags are supported, before it was 8192. In order to use flags > 8191 PG5 2.0.150 is required.

3.4 PCD3 CPUs

3.4.1 PCD3.M3xx0 and PCD3.M5xx0/PCD3.M6xx0

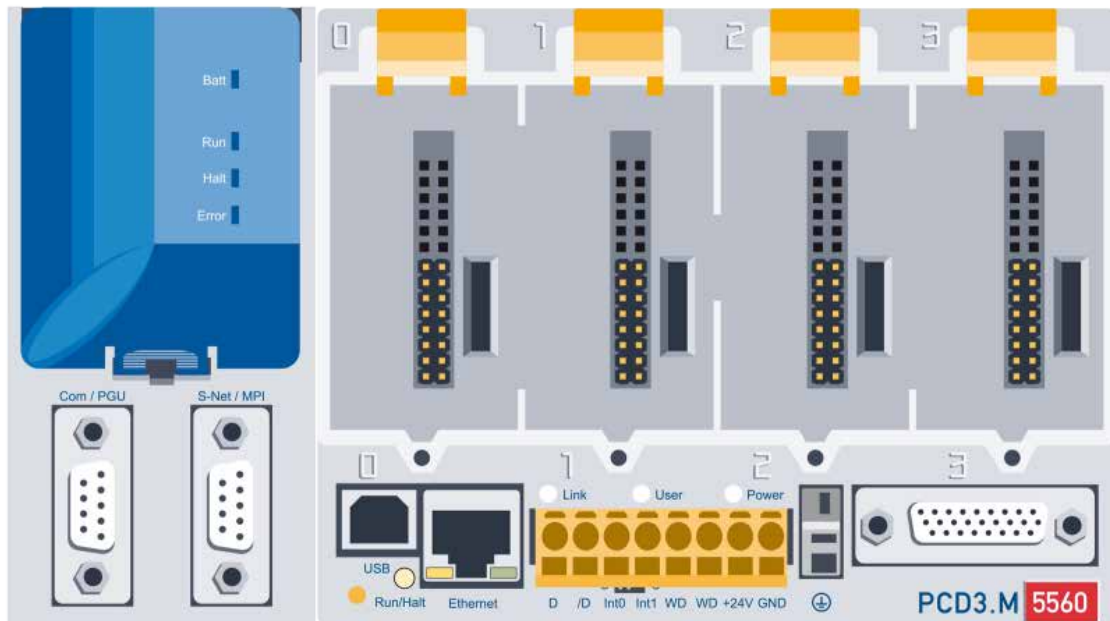


Differentiation of PCD3 base units PCD3.M	Basic		Extended		CAN	Profibus DP Master
	3020	3230		5440	6240	6440
	3120	3330	5340	5540	6340	6540
General features						
I/O bus extension	no	yes				
Number of inputs/outputs or I/O module sockets	up to 64 ¹⁾ 4	up to 1023 ^{1) 2)} 64				
Processor (Motorola)	CF 5272 / 66 MHz					
Processing time	0.3...1.5 µs ³⁾ 0.9 µs ³⁾					
Bit instruction						
Word instruction						
Firmware, firmware update (firmware memory soldered on)	Downloadable from the PG5 environment					
Programmable with PG5	from 1.3.1002 M3120 from 1.4.100		from 1.4.120	from 1.3.1002	from 1.4.100	from 1.4.120
Main memory for user program, text, DB (RAM)	128 KByte	512 KByte ⁴⁾	1 MByte ⁴⁾			
Backup memory onboard (Flash)	128 KByte	512 KByte ⁴⁾	1 MByte ⁴⁾ 1 MByte flash card (optional)			
Hardware clock Accuracy	Yes, better than 1 min/month					
Data backup	4 hours with Super Cap (after 10 mins)		CR 2032 lithium battery 1-3 years ⁵⁾			
Interrupt inputs Max. input frequency	2 1 kHz ⁶⁾					
Interfaces						
Programming interface	USB ⁷⁾					
Optional serial port Port 1	1 x RS-232, RS-422/485 or TTY current loop 20 mA pluggable (PCD3.F1xx modules)					

Differentiation of PCD3 base units PCD3.M	Basic		Extended		CAN	Profibus DP Master
	3020	3230		5440	6240	6440
	3120	3330	5340	5540	6340	6540
Port 0 (PGU) also available as RS-232 interface, up to 115 kbps			✓			
Serial data port RS-485, up to 115 kBit/s	Port 2					
Profi-S-Net interface	Port 2 up to 187.5 kbps			Port 10 up to 1.5 Mbps	Port 2 up to 187.5 kbps	
Ether-S-Net interface	M3120 only ✓	M3330 only ✓	✓	M5540 only ✓	M6340 only ✓	M6540 only ✓
Field bus connections						
Serial-S-Net	✓					
Profi-S-Net	✓					
Ether-S-Net (TCP/IP)	M3120 only ✓	M3330 only ✓	✓	M5540 only ✓	M6340 only ✓	M6540 only ✓

- 1) Using digital I/O modules PCD3.E16x or A46x with 16 I/Os each
- 2) On all PCD3 units, address 255 is reserved for the watchdog. The I/Os reserved for the watchdog cannot be used, and no analogue and H modules can be used on the sockets with base address 240
- 3) Typical values; the processing time is dependent on the load on the communication ports
- 4) From hardware version D and matching firmware, see detailed notes in section 3.13.1
- 5) The period given is a buffer time; it is dependent on the ambient temperature (a higher temperature means a shorter buffer time)
- 6) The 1kHz applies with a pulse/pause ratio of 1:1 and refers to the total frequencies of the two inputs
- 7) The USB port is type "USB 1.1 Slave Device 12 Mbps" and can only be used for programming and as an S-Bus Slave, together with certain software products (Webconnect, ViSi-PLUS with S-Driver).
With a USB 2.0 hub, the download runs twice as fast
Can also be used as a serial data port, e.g. to connect a terminal; but this hampers commissioning and trouble-shooting with the debugger

3.4.2 PCD3.Mxx60



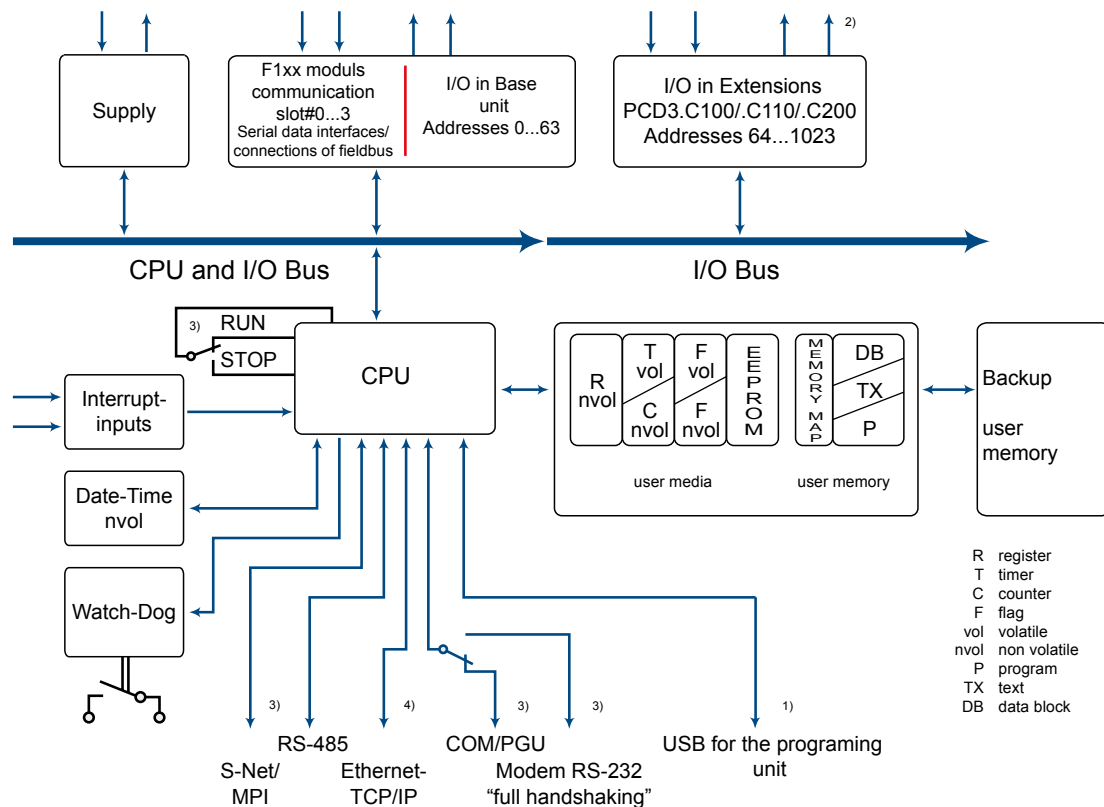
3

Differentiation of PCD3 base units PCD3.	Extended	CAN	Profibus DP Master
	M5560	M6360	M6560
General features			
I/O bus extension	yes		
Number of inputs/outputs or I/O module sockets	up to 1023 ^{1) 2)} 64		
Processor (Motorola)	MCF 5373		
Processing time	0.1...0.8 μ s ³⁾		
Bit instruction	0.3 μ s ³⁾		
Word instruction			
Firmware, firmware update (firmware memory soldered on)	Downloadable from the PG5 environment		
Programmable with PG5	from version SP2 2.0.200		
Main memory for user program (FLASH)	2 MByte		
Main memory for text (FLASH)	1 MByte		
Backup memory onboard (Flash)	16 MByte		
Hardware clock	Yes, better than 1 min/month		
Accuracy			
Data backup	CR 2032 lithium battery 1-3 years ⁵⁾		
Interrupt inputs	2		
Max. input frequency	1 kHz ⁶⁾		
Interfaces			
Programming interface	USB ⁷⁾		
Optional serial port	1 ×		
Port 1	RS-232, RS-422/485 or TTY current loop 20 mA pluggable (PCD3.F1xx modules)		

Differentiation of PCD3 base units PCD3.	Extended	CAN	Profibus DP Master
	M5560	M6360	M6560
Port 0 (PGU) also available as RS-232 interface, up to 115 kbps	✓		
Serial data port RS-485, up to 115 kBit/s	Port 2		
Profi-S-Net interface	Port 10 up to 1.5 Mbps	Port 2 up to 187.5 kbps	
Ether-S-Net interface	✓		
Field bus connections			
Serial-S-Net	✓		
Profi-S-Net	✓		
Ether-S-Net (TCP/IP)	✓		

- 1) Using digital I/O modules PCD3.E16x or A46x with 16 I/Os each
- 2) On all PCD3 units, address 255 is reserved for the watchdog. The I/Os reserved for the watchdog cannot be used, and no analogue and H modules can be used on the sockets with base address 240
- 3) Typical values; the processing time is dependent on the load on the communication ports
- 5) The period given is a buffer time; it is dependent on the ambient temperature (a higher temperature means a shorter buffer time)
- 6) The 1kHz applies with a pulse/pause ratio of 1:1 and refers to the total frequencies of the two inputs
- 7) The USB port is type "USB 1.1 Slave Device 12 Mbps" and can only be used for programming and as an S-Bus Slave, together with certain software products (Webconnect, ViSi-PLUS with S-Driver).
With a USB 2.0 hub, the download runs twice as fast
Can also be used as a serial data port, e.g. to connect a terminal; but this hampers commissioning and trouble-shooting with the debugger

3.4.3 Block diagram for PCD3.Mxx0



1) Connection for the programming unit

2) Except PCD3.M3020/3120

3) PCD3.M5xx0/M6xx0 only

4) With PCD3.M3330 or PCD3.M5540



I/O modules and I/O terminal blocks may only be plugged in and removed when the Saia PCD® and the external +24 V are disconnected from the power supply.



To prevent loss of data, batteries should be changed with the power switched on.

3.4.4 Hardware and firmware versions for the PCD3.Mxxx0

The firmware versions for the PCD3.Mxxx0 are generally upwardly compatible in terms of hardware, so old CPUs can be fitted with new firmware, in order to take advantage of new functions. This feature is highly valued, and we will try to retain it for as long as possible; however, we cannot guarantee this.

The firmware for the PCD2.Mxxx0 is stored in a Flash EPROM, soldered to the motherboard. A firmware update can be applied by downloading a new version with the PG5. The procedure is as follows:

- Go to www.sbc-support.com and download the latest firmware version
- Establish a connection between PG5 and the CPU, as when downloading an application (according to the facilities available, serial with PGU cable, modem¹⁾, USB, Ethernet)
- Open the Online Configurator and go offline
- From the Tools menu, select "Download Firmware", then use the Browse function to select a path to the file for the new firmware version. Ensure that only one file is selected for download
- Start the download
- After the download, the power supply to the Saia PCD® must not be interrupted for 2 minutes (CPLD programming sequence). Otherwise, the CPU may be blocked in such a way that it has to be returned to the factory.
While the Run/Halt LED is flashing slowly, the download is not yet complete. Only when it starts flashing fast is the programming finished.

1) A modem connection is not always reliable. A modem may become blocked in such a way that remote access is no longer possible. In such cases, an on-site visit will be necessary. Other connection options are preferable.

3.5 Expansion with PCD3 components

The PCD3.Mxxxx controllers can be expanded with PCD3.Cxxx components, making additional module sockets available. On the PCD3.Mxxx0, up to 15 PCD3.Cxxx module holders can be attached (PCD3.M3020/3120 cannot be expanded). This allows the user to attach a maximum of 64 I/O modules, or 1023 digital inputs/ outputs.

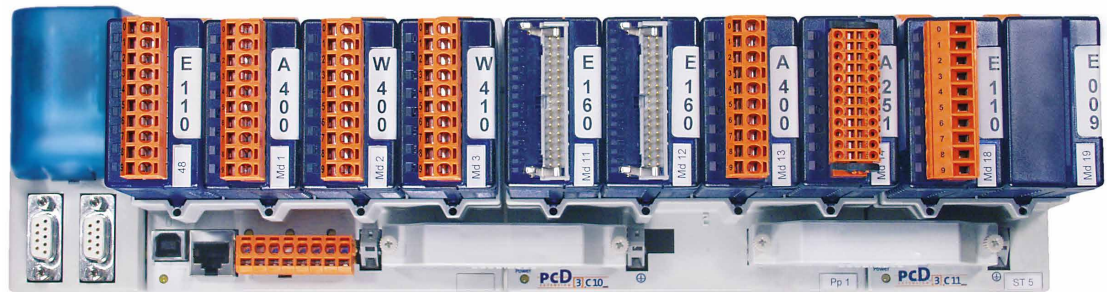
Type	M3020 M3120	M3230 M3330	M5xx0 M6xx0
Maximum number of inputs/outputs or I/O module sockets for the system:	64 ¹⁾ 4	1023 ^{1) 2)} 64	1023 ^{1) 2)} 64

- 1) Using digital I/O modules PCD3.E16x or PCD3.A46x with 16 I/Os each
2) On all PCD3 units, address 255 is reserved for the watchdog. The I/Os reserved for the watchdog cannot be used, and no analogue and H modules can be used on the sockets with base address 240

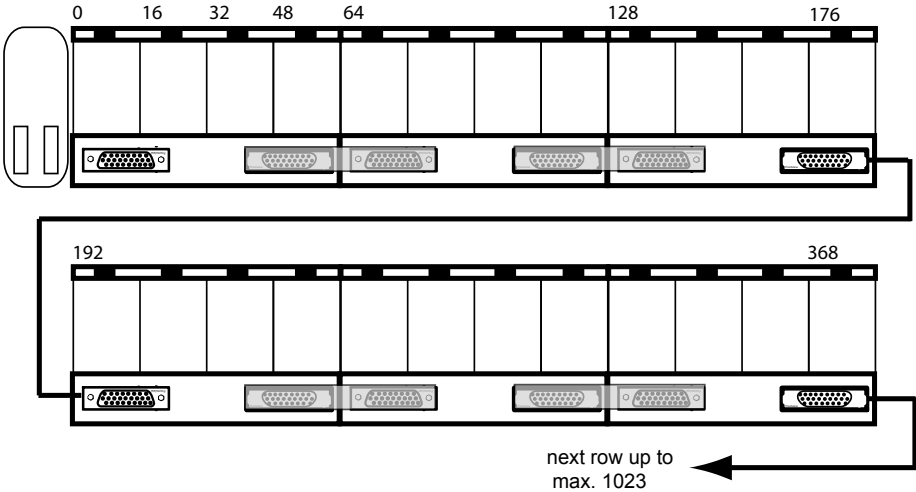
PCD3.M5540

PCD3.C100

PCD3.C110



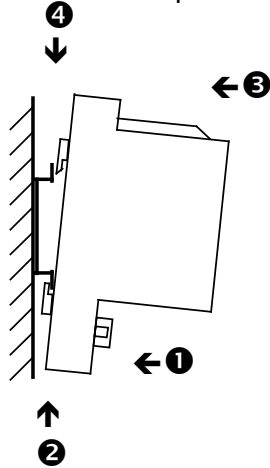
Addressing



For local expansion, the PCD3 LIO (local I/O) modules can be used.
For decentralized expansion using Profibus, the PCD3 RIO (remote I/O) modules can be used:
The maximum number of I/Os is dependent on the controller being used:
When selecting I/O cassettes, ensure that the internal 5V and +V supply is not overloaded.

3.6 Mounting CPUs and module holders

The PCD3 CPUs and module holders can be snapped onto a 35 mm Top-hat rail according to DIN EN60715 TH35 (formerly DIN EN50022). (Remember: the PCD2 needs two top-hat rails).



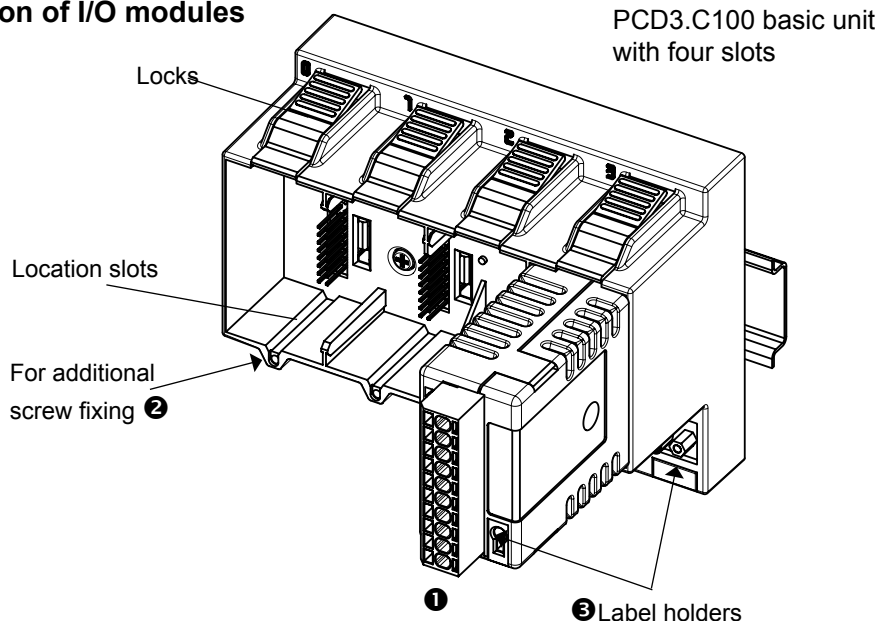
Mounting the PCD3 on the top-hat rail

- ❶ Press bottom of housing onto the mounting surface
- ❷ Press upwards against the top-hat rail
- ❸ Press top of housing against the mounting surface and snap into place
- ❹ Push the housing down onto the top-hat rail to ensure that it is secure

Removal

To remove the housing, push upwards and pull out.

Insertion of I/O modules

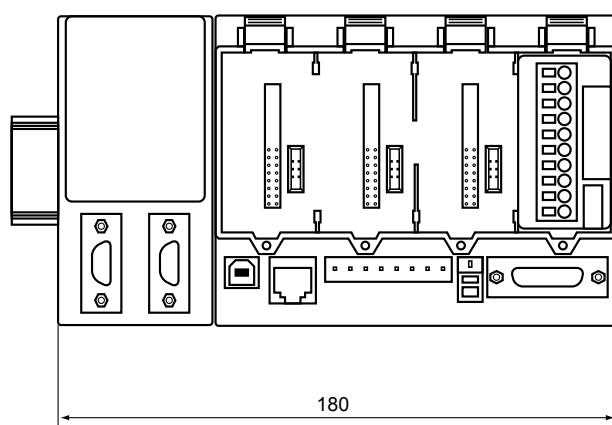
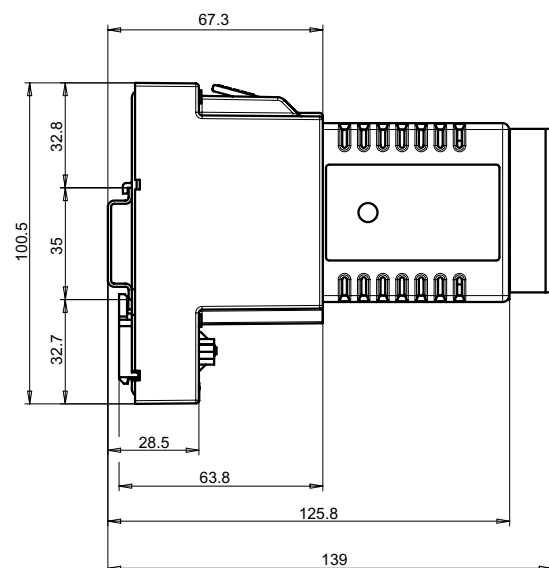
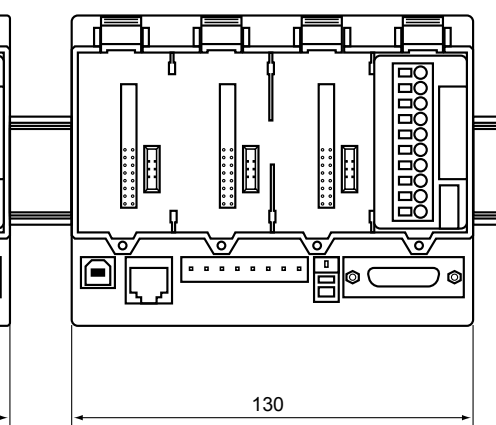


- ❶ Insert the module into the appropriate module location and press down to the bottom of the CPU or module holder housing; ensure that the orange clip is engaged
- ❷ For security, a guideway is provided to prevent the module being inserted the wrong way round. In awkward positions, the modules can also be secured with a screw.
Screw type: self-tapping 3x8mm, standard type obtainable from hardware stores
- ❸ Number of module slots in the module holder:
 - 4 positions (labelled 0, 1, 2 and 3) PCD3.Mxxx0,C100/C200/T760
 - 2 positions (labelled 0 and 1). The PCD3.C110 can only be used as the last module holder in the bus

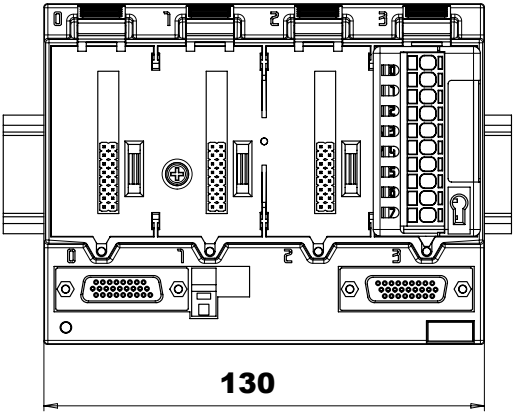
3.6.1 Mounting position and ambient temperature

A vertical surface is normally used to mount the module carrier; the I/O connections to the modules then also run vertically. In this mounting position, the ambient temperature may be from 0 °C to 55 °C. In all other positions, air convection works less well, and an ambient temperature of 40 °C should not be exceeded.

3.7 Dimensions

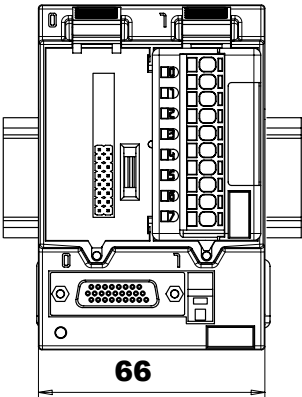
PCD3.M5xx0/M6xx0**PCD3.M3xx0**

PCD3.C100/C200/T76x



3

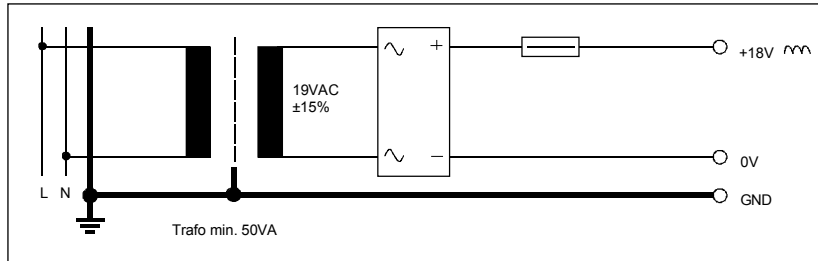
PCD3.C110



3.8 Power supply and connection plan

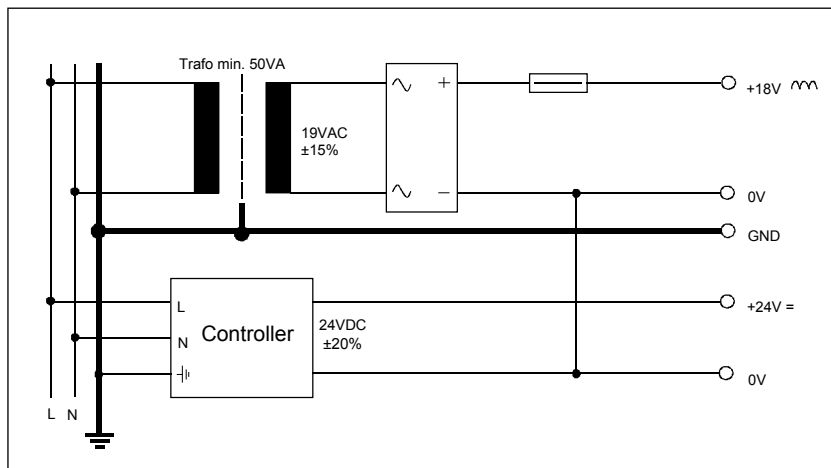
3.8.1 External power supply

Simple, small installations



- Sensors: Electro-mechanical switches
- Actuators: Relays, lamps, small valves with < 0.5A switching current
- Suitable for modules: PCD3.Mxxxx
PCD3.E1xx, E5xx, E6xx, A2xx, A4xx, B1xx
PCD3.W1xx, W2xx, W3xx, W4xx, W5xx, W6xx

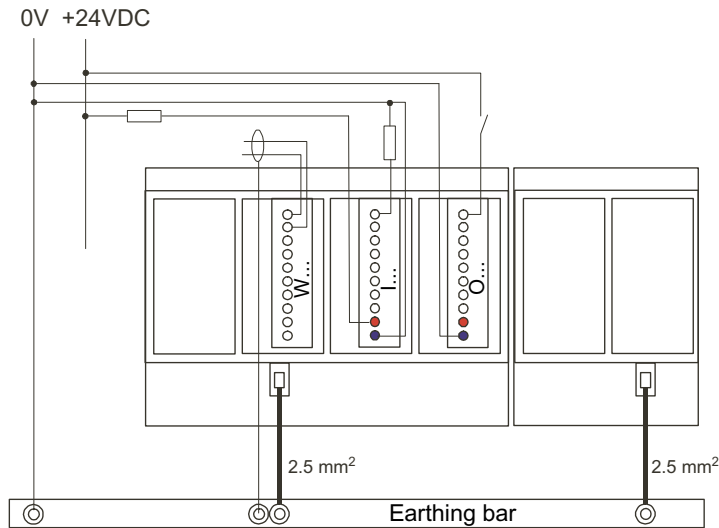
Small to medium installations



- Sensors: Electro-mechanical and proximity switches, photoelectric barriers
- Actuators: Relays, lamps, displays, small valves with < 0.5A switching current
- Suitable for modules: PCD3.Mxxxx
PCD3. E1xx, E5xx, E6xx, A2xx, A4xx, B1xx
PCD3.W1xx, W2xx, W3xx, W4xx, W5xx, W6xx
PCD3. H1xx^{*)}, H2xx^{*)}, H3xx^{*)}
PCD7.D2xx^{*)}

^{*)} These modules must be connected to a smoothed 24 VDC supply

3.8.2 Earthing and connection plan



In the bottom part of the PCD3 module housing there is a shielding and earthing plate. Together with the shielding and earthing plate in the module holder, this constitutes the common, large-area ground for all I/O modules and for the external power supply.

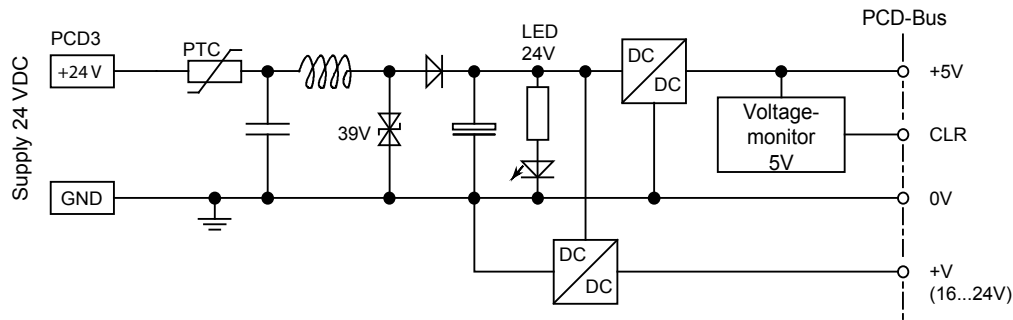
When a module is plugged into the module holder, a metal tab on the module housing creates a reliable multi-point contact to the module carrier concerned.

The zero-potential (Minus pole) of the 24 V supply is connected to the Minus terminal of the supply. This should be connected to the earthing bar with the shortest possible wire (< 25 cm) of 1.5 mm². The same applies to the Minus connection to the PCD3.F1xx or the interrupt terminal.

Any shielding of analogue signals or communication cables should also be brought to the same earth potential, either via a Minus terminal or via the earthing bar.

All Minus connections are linked internally. For problem-free operation, these connections should be reinforced externally with short wires of 1.5 mm².

3.8.3 Internal power supply



Capacity of internal power supply

From the base units, the following currents are available for the plug-in modules:

+5 V : 600 mA

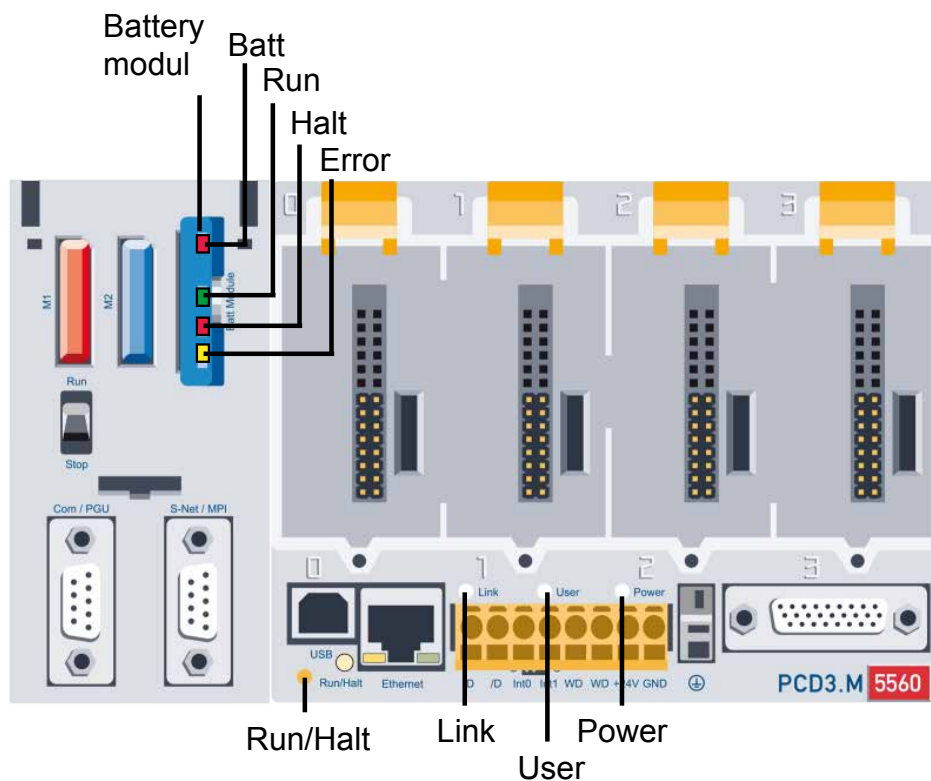
+V (16...24 V) : 100 mA (the exact loads should be taken or calculated from the technical details in section 3.2, or you are advised to use the calculation table at www.sbc-support.com).

3.9 Operating states

The CPU can assume the following operating states:

Run, Run conditional, Run with error, Run cond. with error, Stop, Stop with error, Halt and System Diagnostics

The display uses the LEDs shown below:

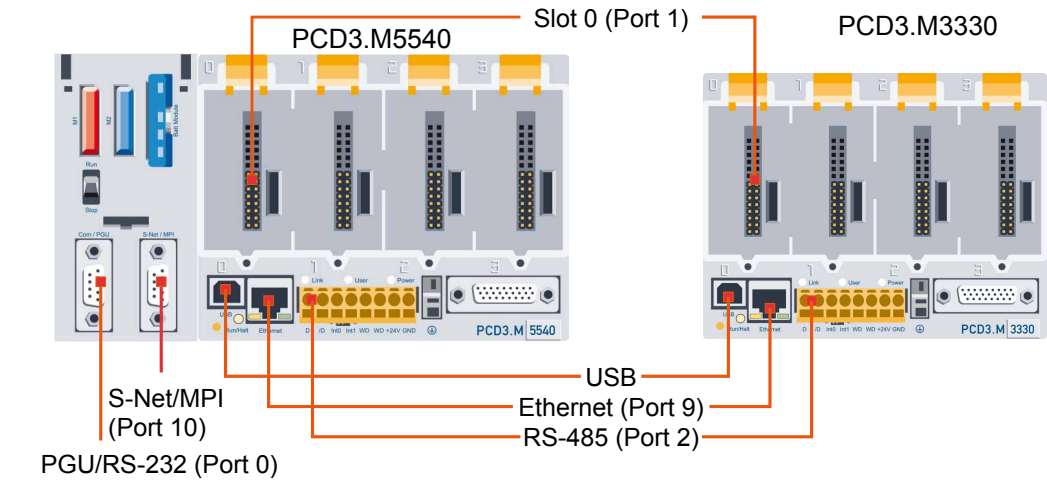


CPU type	PCD3.Mxxxx							
	Battery module				For PCD3.M3xx0, these LEDs only			
LED	Batt	Run	Halt	Error	Run/ Halt	Link	User	Power
Colour	Red	Green	Red	Yellow	bi-colour	Yellow	Yellow	Yellow
Run	○	●	○	○	●	○	○	●
Run cond.	○	●/○	○	○	●/○	○	○	●
Run with error	○	●	○	●	●	○	●	●
Run cond. with error	○	●/○	○	●	●/○	○	●	●
Stop	○	○	○	○	○	○	○	●
Stop with error	○	○	○	●	○	○	●	●
Halt	○	○	●	○	●	○	○	●
System diagnostics	○	●/○	●/○	●/○	●/○	●/○	●/○	
Batt./Super Cap voltage absent	●	○	○	○	○	○	○	○
Communi- cation						●		

○ LED off ● LED on ●/○ LED flashing

Start	Self-diagnosis for approx. 1 sec. after switching on or after a Restart
Run	Normal processing of the user program after Start. Where a programming unit is connected via a PCD8.K11x in PGU mode (e.g. PG5 in PGU mode), the CPU automatically goes into the Stop state and not the Run state; this is for safety reasons
Run conditional	Conditional Run state. A condition has been set in the debugger (Run until...), which has not yet been met
Run with error	Same as Run, but with an error message
Run cond. with error	Same as conditional Run, but with an error message
Stop	The Stop state occurs in the following cases: • Programming unit in PGU mode connected when the CPU was switched on • PGU stopped by programming unit • Condition for a COND.RUN has been met
Stop with error	Same as Stop, but with an error message
Halt	The Halt state occurs in the following cases: • Halt instruction processed • Serious error in user program • Hardware fault • No program loaded • no communication module on an S-Bus PGU or Gateway Master port
System diagnostics	If the PLC doesn't go to RUN after 2 minutes, you have to send it for repair
Reset	The RESET state has the following causes: • Supply voltage too low • Firmware not starting up

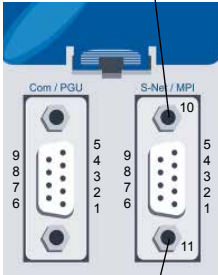
3.10 Connections to the PCD3.Mxxx0



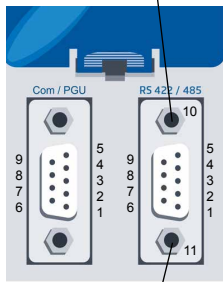
3

		PCD3.M5xx0 and PCD3.M6xx0		PCD3.M5xx0 (except PCD3.M5340)		
		RS-232/PGU Port 0		S-Net / MPI / RS-485 Port 10		
		D-Sub pin	Signal	D-Sub pin	Signal	Explanation
		1	DCD	1	GND	GND
		2	RXD	2	M24	0V of 24V supply
		3	TXD	3	RxD/TxD-P ¹⁾	Receive/transmit data positive.
		4	DTR	4	CNTR-P	Control signal for repeater (direction control)
		5	GND	5	DGND ¹⁾	Data communication potential (earth to 5V)
		6	DSR	6	VP ²⁾	Supply voltage to P line termination resistors
		7	RTS	7	P24	Output voltage plus 24V
		8	CTS	8	RxD/TxD-N ¹⁾	Receive/send data negative
Port 0	Port 10	9	not used	9	n.c.	not connected

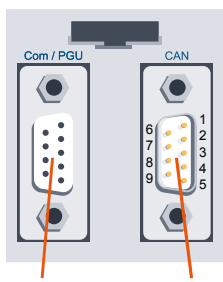
¹⁾ Mandatory signals (must be provided by the user).
²⁾ The signal is provided by the control system.

		PCD3.M5xx0 (except PCD3.M5340)		
		RS-485 Port 3		Explanation RS-485
		D-Sub pin	Signal	
	Port 0	1		
		2		
		3	/RxD /TxD	Receive/send +
		4		
		5	PGND	Data ground
		6		
		7		
		8	RxD TxD	Receive/send -
		9		
Port 0	Port 3	10/11	PGND	Protective ground *)

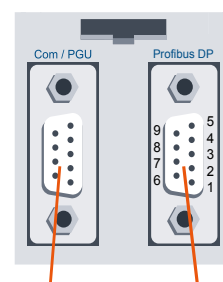
^{*)} Fixing screws on the D-Sub socket housing

		PCD3.M5340	
		RS-422 Port 3	
		D-Sub pin	Signal
		1	/RXD
		2	/CTS
		3	/TXD
		4	/RTS
		5	PGND
		6	RXD
		7	CTS
		8	TXD
		9	RTS
Port 0	Port 3	10/11	PGND
		Protective ground ¹⁾	

¹⁾ Fixing screws on the D-Sub socket housing

		PCD3.M6240, PCD3.M6340 und PCD3.M6360	
		CAN Port 10	
		D-Sub pin	Signal
		1	
		2	CAN_L ¹⁾
		3	GND
		4	
		5	
		6	
		7	CAN_H ¹⁾
		8	
Port 0	Port 10	9	

¹⁾ Electrically isolated

		PCD3.M6440, PCD3.M6540 und PCD3.M6560	
		Profibus DP Master Port 10	
		D-Sub pin	Signal
		1	
		2	GND ²⁾
		3	B red
		4	En
		5	GND_BUS
		6	+5V_BUS
		7	24V ²⁾
		8	A green
Port 0	Port 10	9	

²⁾ Not electrically isolated

For all types				Profibus signal	Profibus wiring	
Terminal block for supply, watchdog, interrupt inputs and Port 2						
	Pin	Signal	Explanation	RxD/TxD-N	A green	
	1	D	Port#2; RS-485 up to 115.2 kbit/s usable as free user interface or (except PCD3.M5440 and PCD3.M5540) Profi-S-Bus up to 187.5 kbits/s	RxD/TxD-P	B red	
	2	/D				
	3	Int0	2 interrupt inputs 24 VDC or 1 rapid counter 24 VDC			
	4	Int1				
	5	WD	Watchdog			
	6	WD				
	7	+24V	Voltage supply			
8	GND					
RS-485 terminator switch						
Switch position	Designation	Explanation				
left	O	without termination resistors				
right	C	with termination resistors				

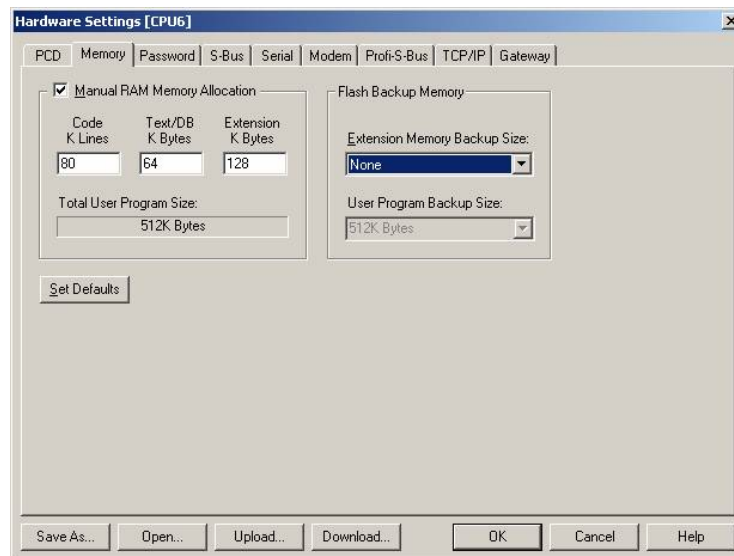
3.11 Partitioning options for user memory

In the PG5 hardware configuration, the user memory is partitioned by default into lines of code and texts/DBs, in a way that suits most applications.

In the case of a large program with few texts/DBs or a very small program with many texts/DBs, the user can partition the memory manually. In order to choose an appropriate breakdown, the following should be noted:

- the partitioning is into "kBytes lines of code" and "kBytes text/DBs", where the "kBytes lines of code" can only be changed in 4 kByte steps, as every line of code occupies 4 bytes
- the result of the formula $(4 \times \text{"kBytes program cells"}) + \text{"kBytes texts/DBs"}$ must equal the effectively available user memory, e.g. $4 \times 24 \text{ kBytes} + 32 \text{ kBytes} = 128 \text{ kBytes}$
- each character of a text occupies 1 byte
- each 32-bit element of a DB occupies eight bytes in the address range 0..3999, and the header of the DB takes up a further three bytes
- We recommend always using DBs with addresses ≥ 4000 . These can hold more elements (16384 instead of 384), take up less space (only 4 bytes instead of 8 bytes per element, but NB, 8 bytes instead of 3 for the header) and the access time is substantially shorter.

Example of manual partitioning:



3.12 Data storage in case of power failure

The resources (registers, flags, timers, counters etc), and possibly the user program and the text strings/DBs, are stored in RAM. To ensure that they are not lost and that the hardware clock (where present) continues to run when there is a power failure, the PCD3s are equipped with a buffer capacitor (SuperCap) or a buffer battery.

CPU type	Buffer	Buffer time
PCD3.M3xx0	Super Cap (soldered, maintenance-free)	4 hours ¹⁾
PCD3.M5xx0/M6xx0	Renata CR2032 lithium battery	1-3 years ²⁾

1) The total charging time is approx. 10 minutes

2) Depending on the ambient temperature; the higher the temperature, the shorter the buffer time



With new controllers, the batteries are packaged with the units, and have to be inserted on commissioning. Observe the polarity of the batteries:

- Insert CR2032 coin cells in such a way that the Plus pole is visible



CPUs with lithium batteries are not maintenance-free. The battery voltage is monitored by the CPU. The BATT LED lights up and XOB 2 is called if

- the battery voltage is less than 2.4 V
- the battery is flat or shows an interrupt
- the battery is missing

We recommend changing the batteries with the Saia PCD® attached to the power supply, to avoid any loss of data.

3.12.1 Battery module PCD3.R010 for PCD3.M3xxx

As the PCD3.M3xxx is only buffered by the Super Cap (max. 4 hours.), and optional battery module is available with the same buffer time as the batteries in the PCD3.M5xxx/M6xxx. The battery module may only be plugged into Slot#3 on the PCD3.M3xxx. The other slots do not support RAM (program/data memory) or the clock. This may cause damage to the Saia PCD®.

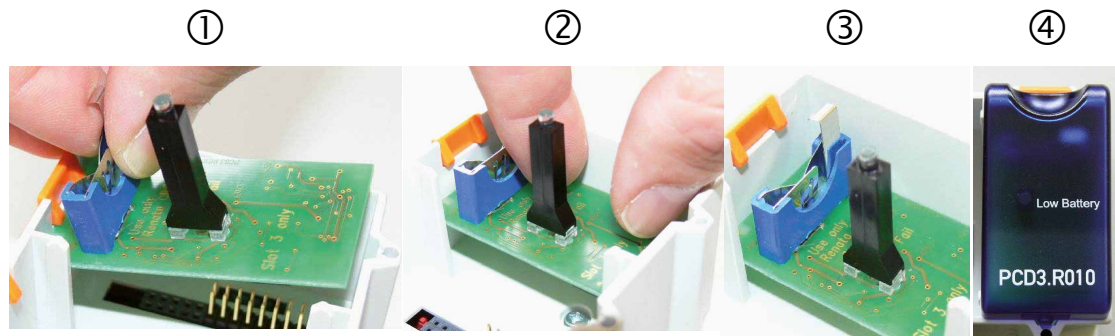
Unpacking and mounting

- Do not hold the circuit board by the LED holder
- Do not touch the electronic side of the circuit board
- Switch the Saia PCD® off before inserting the circuit board

Technical details:

Internal current consumption: 10 mA at +5 V

Installation rules:



3

1. Position circuit board over Slot#3 (battery holder upwards)
2. Insert circuit board horizontally. Ensure that the pins are correctly inserted into the right positions in the Slot
3. Push the circuit board in as far as it will go (1 cm clearance between the circuit board and the bottom of the grey Saia PCD® housing)
4. Insert battery and place battery I/O cover on Slot#3.

Battery monitoring:

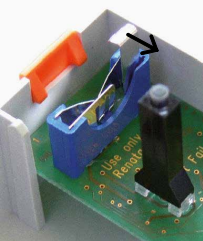
A red LED on the module indicates a weak battery that needs to be replaced. It does have capacity left for a few more days. A weak battery also generates an entry in the history list and calls XOB 2 (where this is programmed).

When the base address of the PCD3.R010 is read (=48 for Slot#3), the battery status is read off:

- “0” for a weak battery (or module error, or module not present, etc.)
- “1” for battery OK

Inserting or changing a battery:

The battery (but not the module) can be replaced with the power on¹⁾ (XOB 2 called)



- Pull the locking clip gently in the direction of the arrow
- Remove old battery
- Insert the Renata CR 2032 coin cell in such a way that the positive pole is in contact with the locking clip

CPU type	Buffer	Buffer time
PCD3.M3xxx	Renata CR2032 lithium battery	1-3 years ²⁾

- 1) Changing the battery with the Saia PCD® switched off will not cause any program or data loss provided that the Supercap for the Saia PCD® CPU is not flat.
- 2) Depending on the ambient temperature; the higher the temperature, the shorter the buffer time

3.13 Memory space on the PCD3

3.13.1 General

The PCD3 controllers are fitted with a user program memory and a matching user backup memory as standard. On the PCD3, both types are referred to as user memory.

User Program Memory (RAM)

The user program memory consists of a RAM (Random Access Memory) and contains the program code and a text and DB memory area. It also contains the extension memory, which also holds DBs and texts (addresses ≥ 4000). On a PCD3, all DBs and texts are always in RAM. The main difference between the texts and DBs in the text/DB memory segment and those in extension memory is the greater maximum size of DBs and texts.

To run an application on the PCD3, it is sufficient to load only the user program memory. As this is a RAM, the program and the contents of the texts and DBs (and the other media, registers, flags etc.) may be lost if there is no power and the battery is flat or not connected. On a PCD3.M3xxx with no battery module, this kind of data loss can also occur where the Supercap is exhausted.

Backup memory (Flash)

In order to prevent the loss of the program, every PCD3 CPU has onboard flash memory fitted as standard to back up the user program memory.

It is also possible to save DBs on this flash during runtime. This allows key values of registers and flags to be saved to the flash at runtime and reloaded later.

Along with the installed onboard flash memory, a flash card can also be used for the user backup program, e.g. PCD7.R500 or PCD3.R500. The use of this card allows the user program and the configuration to be transferred from one controller to another.



Even with backup to the flash card, the source files for the project must be retained, as the application is only stored in the Saia PCD® as machine code.



If it transpires when the PCD3 is started up that the RAM memory has been corrupted (e.g. after a power failure with a flat or missing battery), the application is automatically reloaded from the flash backup memory. The LIST command "Test" and operand "400" can be used to test this.



All hardware settings are also saved to the flash backup memory (onboard or on an equivalent flash card).

Partition of user backup memory

The user backup memory is split into two parts. The first is available for the user program backup and is always present. In the PG5 hardware configurator, this memory is referred to accordingly as "user program backup".

The second, optionally configurable part is referred to in PG5 as "extension memory backup" (data backup) and can be used to back up DBs and texts to the flash during runtime.



If part of the backup memory is used as "extension memory backup", the available "user backup memory" is reduced by twice the amount of "extension memory backup" used. In parallel with the reduction of the "user program memory backup", the user program memory is also adjusted, so the total user program memory can be copied to the backup flash.

3

Available user backup memory on the onboard memory

The various versions of the PCD3 CPUs have different sizes of user program memory (and hence of user backup memory). The effectively usable memory sizes are basically dependent on the PCD3 type. As the available memory size on the PCD3 has increased over time, there is a dependency on hardware and firmware versions (the larger memory is configurable from version 030 upwards).

Available user memory with firmware version < 030

System	H/w rev.	RAM user program memory	Flash user backup (prg + data)	Default memory configuration
M3020 M3120	-	128 Kb	Only flash onboard	12 k prg lines, 16 k txt, 64 k ext.
M3230 M3330	-	256 Kb	Only flash onboard	24 k prg lines, 32 k txt, 128 k ext.
M5340 M5440	-	256 Kb	Flash onboard	24 k prg lines, 32 k txt, 128 k ext.
M5540 M6340 M6540	-	512 Kb	Flash card required	48 k prg lines, 64 k txt, 256 k ext.

Available user memory with firmware version ≥ 030 and 1.xx.yy

System	H/w rev.	RAM user program memory	Flash user backup (prg + data)	Default memory configuration
M3020 M3120	-	128 Kb	256 Kb	12 k prg lines, 16 k txt, 64 k ext.
M3230 M3330	-	512 Kb	512 Kb	48 k prg lines, 64 k txt, 256 k ext.
M5340 M5440	H/w < D	512 Kb	512k onboard 1024k flash card ¹⁾	48 k prg lines, 64 k txt, 256 k ext.
M5540 M6340 M6540	HW ≥ D M5440 ³⁾	1024 Kb ²⁾	1024 Kb ²⁾	96 k prg lines, 128 k txt, 384 k ext.

¹⁾ If a flash card is used for flash user backup on a PCD3.M5xx0 or M6xx0 with hardware version < D, the 512 kB user program backup can be saved to the flash and a further 256 kB will be available to back up DBs at runtime.



²⁾ In order for a PCD3.M5xx0 with hardware version ≥ D and firmware version ≥ 030 to be configured, PG5 SP1.4.120 or higher is needed.

³⁾ The PCD3.M5440 from hardware version D with modification 2 8 has 1024 Kb of user backup memory.



Note that in the default memory configuration, each program line requires 4 bytes.



Any flash memory module suitable for user program backup (e.g. a PCD7.R500) can be used as a flash card. Where multiple compatible modules are connected, the first module from the left will be used (socket M1, M2, I/O Slot 0, 1, 2, 3).

Flash memory modules (optional)

For the PCD3, there are various flash memory modules for different applications. Some of these modules are explicitly designed for a particular use (e.g. the PCD7.R500 for user program backup). However, there are other modules available for various types of storage (e.g. the PCD7.R551M04, which contains 1 MB of memory space for the user program backup and 3 MB the file system).

Most flash memory modules are simple cards (PCD7.Rxxx), which can be plugged into a PCD3.M5xx0 or PCD3.M6xx0 on the communications extension in socket M1 or M2.

For use on a PCD3.M3xx0, there are the PCD3.Rxxx memory modules which contain a PCD7.Rxxx and can be inserted into an I/O slot (0...3) on a PCD3 CPU.

Flash memory modules for the file system (optional)

Apart from the flash memories mentioned above for backing up the user program memory and DBs, there is another type of flash memory available for files. These memory modules can be used to save "PC-readable" files such as web pages, images or log files. The content of these flash memory modules can be accessed via the web server, the FTP server (for PCD3 with Ethernet interface only) and the user program.

Flash memory modules for BACnet (optional)

When the PCD3.M5540, PCD3.M3330 and PCD3.M3120 controls are fitted with a flash memory module for BACnet, the controls also have a BACnet stack. These modules have the firmware extension for BACnet. The configuration of the BACnet server and client is also stored on these modules.

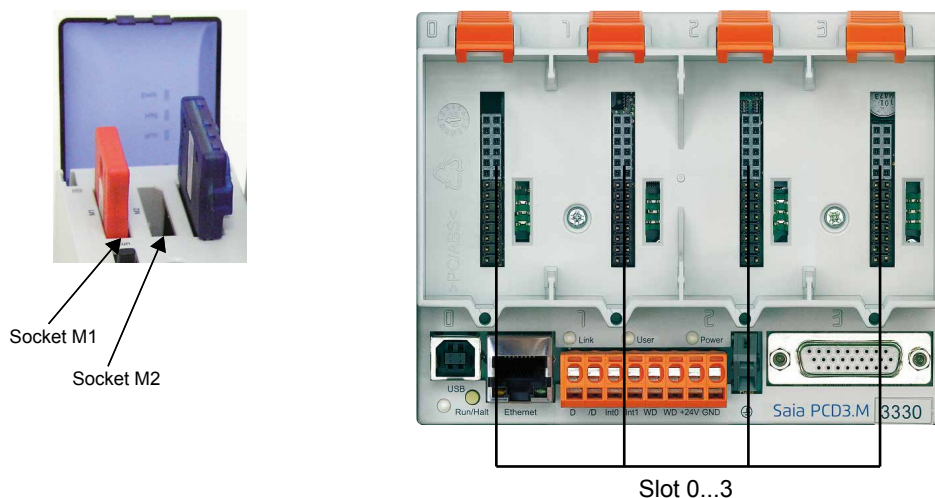
Memory module summary for PCD3.Mxxx0 CPUs

Module	Description	for PCD3 system	User backup	File system	BACnet	Socket
PCD7.R500 	Flash card modules as backup for the user program.	M5xx0 M6xx0	1 MB			M1 / M2
PCD3.R500 	Flash memory modules as backup for the user program. The module contains a PCD7.R500.	Mxxx0	1 MB			I/O slot 0...3
PCD7.R550M04 	Flash card modules with file system. To save files e.g. for the web server. The files can be accessed by the PCD3 via FTP or HTTP direct servers. The Saia PCD® can also write PC-readable files (*.csv) directly to the module.	M5xx0 M6xx0		4 MB		M1 / M2
PCD3.R550M04 	Flash memory modules with file system. To save files e.g. for the web server. The files can be accessed by the PCD3 via FTP or HTTP direct servers. The Saia PCD® can also write PC-readable files (*.csv) directly to the module. The module contains a PCD7.R550M04.	Mxxx0		4 MB		I/O slot 0...3
PCD7.R551M04 	Flash card modules with file system and as backup for the user program. The files can be accessed by the PCD3 via FTP or web servers. The Saia PCD® can also write PC-readable files (*.csv) directly to the module.	M5xx0 M6xx0	1 MB	3 MB		M1 / M2
PCD3.R551M04 	Flash memory modules with file system and as backup for the user program. The files can be accessed by the PCD3 via FTP or web servers. The Saia PCD® can also write PC-readable files (*.csv) directly to the module. The module contains a PCD7.R551M04.	Mxxx0	1 MB	3 MB		I/O slot 0...3
PCD7.R560 	Flash card modules with BACnet firmware. The module contains both the firmware extension for BACnet and the configuration files for the BACnet application.	M5xx0, M6xxx0 with TCP/IP			✓	M1 / M2
PCD3.R560 	Flash memory modules with BACnet firmware. The module contains both the firmware extension for BACnet and the configuration files for the BACnet application. The module contains a PCD7.R560.	Mxxx0 with TCP/IP			✓	I/O slot 0...3

Module	Description	for PCD3 system	User backup	File system	BACnet	Socket
PCD7.R561 	Flash memory modules with BACnet firmware. The module contains both the firmware extension for BACnet and the configuration files for the BACnet application, plus a file system, and is used to back up the user program.	M5xx0, M6xxx0 with TCP/IP	1 MB	1 MB	✓	M1 / M2
PCD3.R561 	Flash memory modules with BACnet firmware. The module contains both the firmware extension for BACnet and the configuration files for the BACnet application, plus a file system, and is used to back up the user program. The module contains a PCD7.R561.	Mxxx0 with TCP/IP	1 MB	1 MB	✓	I/O slot 0...3
PCD3.R600 	Base module for the SD flash memory card. The card contains a file system and is used to back up the user program. The files can be accessed by the PCD3 via FTP or web servers. The Saia PCD® can also write PC-readable files (*.csv) directly to the module. In this module, PCD7.R-SD256 or R-SD512 flash memory cards can be used.	Mxxx0	1 MB	up to 1 GB		I/O slot 0...3
PCD7.R-SD256 PCD7.R-SD512 	SBC SD flash memory card with 256 or 512 MB file system for PCD3.R600. This card can be read with a card reader and the appropriate software (SBCFile System Explorer) installed on a PC.					PCD3.R600

Sockets for memory modules

The sockets/slots shown below are provided, among other things, to take the memory cards and memory modules.



3.13.2 Program backup and restore on backup flash

The user program memory (user program, text/DB memory and extension memory), including the hardware settings, can be copied from a PCD3 either to the onboard flash or to an appropriate memory module (e.g. PCD3.R500). The procedure for backup/restore to/from a flash card is identical to that for backup/restore using the onboard flash.

If a flash card is plugged into the PCD3 and a backup is run, this module is automatically written to and the backup is also created on the onboard flash (provided sufficient memory space is available).

With a restore with a memory module plugged in, the content of the flash module is restored and then (where possible) copied to the onboard flash.



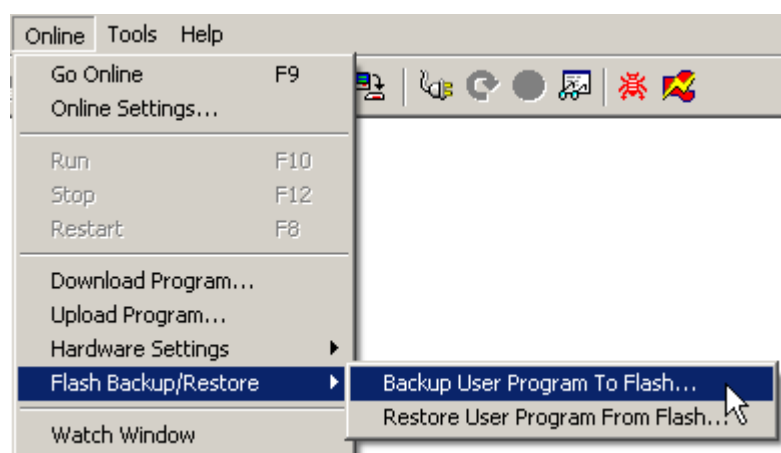
Where multiple flash modules suitable for backing up the user program memory are installed on the PCD3, the first from the left will be read/written to (sequence: M1, M2, I/O slot 0..3).



In order to copy to the backup flash, the control must be in a STOP state. Where necessary, a reminder message will appear. The copying process may take up to 30 seconds.

Program backup to backup flash

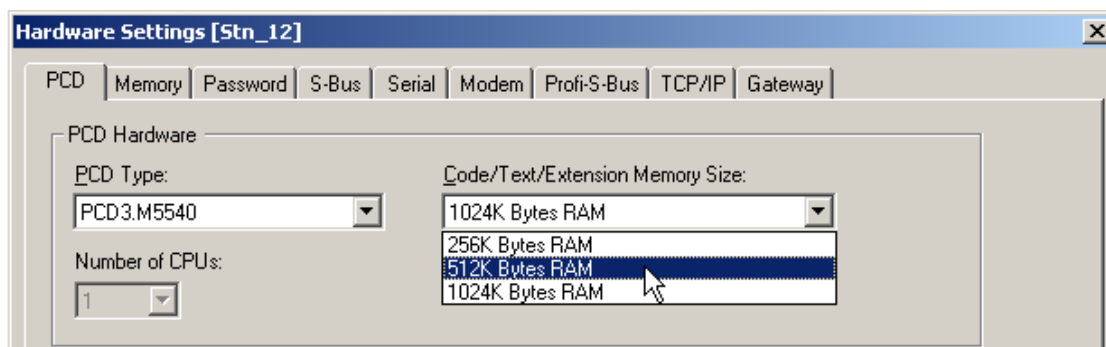
The user program memory can be loaded into flash using PG5. The relevant function can be found on the "Online" menu within the PG5 project manager or the online configurator.



Configuration for onboard backup of user program memory

The available memory space for the system memory backup to the flash memory can be configured in the hardware settings for the PCD3. This allows a configuration for backing up DBs and text contents (extension / data memory) to flash to be entered. By default, a setting with no memory space for extension memory backup (for "backup DB to flash") is configured.

Depending on the memory space available and required for the "backup DB to flash" functionality, the following fields should be set:

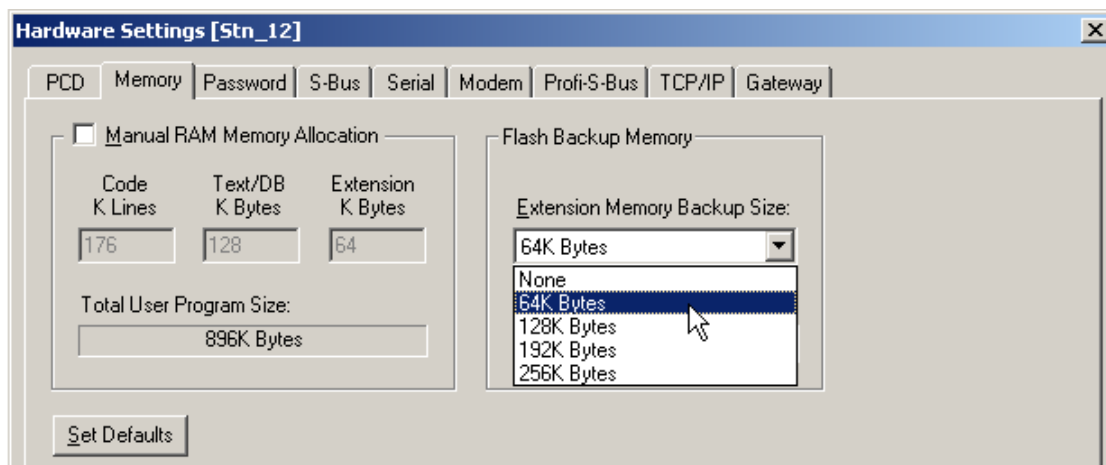
Saia PCD® tab

3

Code/Text/Extension Memory Size: The available user program memory (RAM). As the memory on a PCD3.M5xxx or PCD3.M6xxx is dependent on the hardware and firmware versions, several possibilities are displayed here. The following options are available:

- 256 kB RAM: For a PCD3.M5xxx or PCD3.M6xxx with hardware version < D, where 128 kB is required for DB backup and no memory card is installed.
- 512 kB RAM: For a PCD3.M5xxx or PCD3.M6xxx with hardware version < D, where no DB backup is being used and no memory card is installed, or for a PCD3.M5xxx/PCD3.M6xxx with hardware version < D, where 128 kB are required for DB backup and a memory card is installed
- 1024 kB RAM: For a PCD3.M5xxx/PCD3.M6xxx with hardware version ≥ D and firmware version ≥ 030 (or 1.xx.yy), whether a memory card is installed or not

For all other types of control, the memory should be configured according to the table on page xxx.

Memory tab

On the Memory tab, the Extension Memory Backup Size can be set. This memory size represents the memory space for the "backup DB to flash" function. On the left-hand side, the currently available memory space for the user program is displayed.



If the "extension memory backup size" is increased, the "user program backup size" will be automatically reduced (by twice the configured "extension memory backup size")

Program restore from backup flash

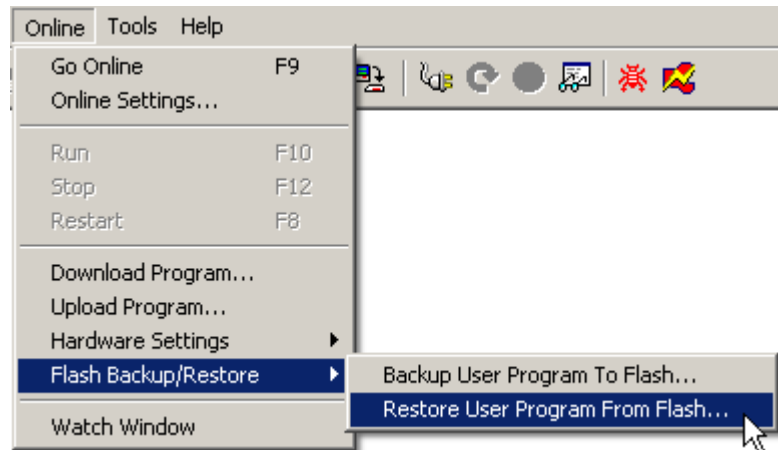
- **Automatic restore**

If no valid user program is loaded when the CPU is switched on, the CPU operating system checks whether there is a valid program in the onboard flash; if so, it is automatically loaded and executed.

An automatic restore is also run when an empty SuperCap is detected on a PCD3.M3xxx or no battery or a flat battery is found on a PCD3.M5xxx/PCD3.M6xxx

- **Manual restore with Saia PG5®**

PG5 can be used to write a valid program including configuration to the CPU from the onboard flash. This function can be found on the "Online" menu within the PG5 project manager or the online configurator:



- **Manual restore without PG5**

If the "run/halt" switch is pressed for more than 3 seconds (while the PCD3 is in a "Run" state), the user program will be loaded from the onboard flash.



During the "backup to flash" or "backup from flash" procedure, the run/halt LED on the PCD3 flashes alternately red and green. On a PCD3.M5xxx or PCD3.M6xxx, the "Run" and "Halt" LEDs also flash alternately.

3.13.3 Transferring an application with flash card

With the flash card, it is possible to transfer an application from a PCD3.M5xx0 to another controller of the same type:

- On the source controller, copy the application to the flash card as described in the preceding sections
- Remove the supply to the source controller, and unplug the flash card
- Send off the flash card where applicable
- Insert the flash card into the target controller (which should be switched off)
- Switch on controller.
- Press "Run/Halt" switch for more than 3 seconds; the LEDs will flash while the program is being copied from the flash card (control switches to "Halt" state)
- Restart the control with the "Run/Halt" switch



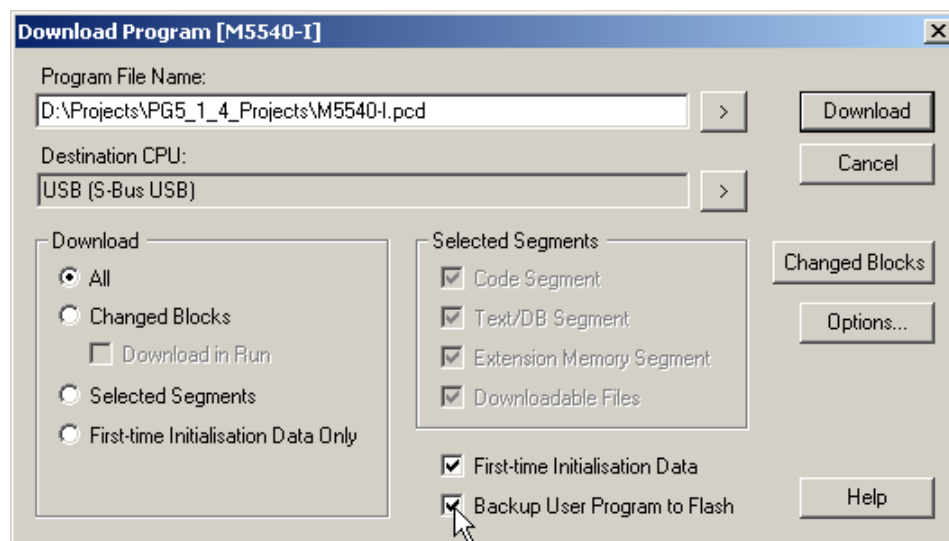
If the configuration does not match the options available on the controller (e.g. IP configuration on a controller without IP), the controller will switch to "Halt" state and an entry will be written to history.



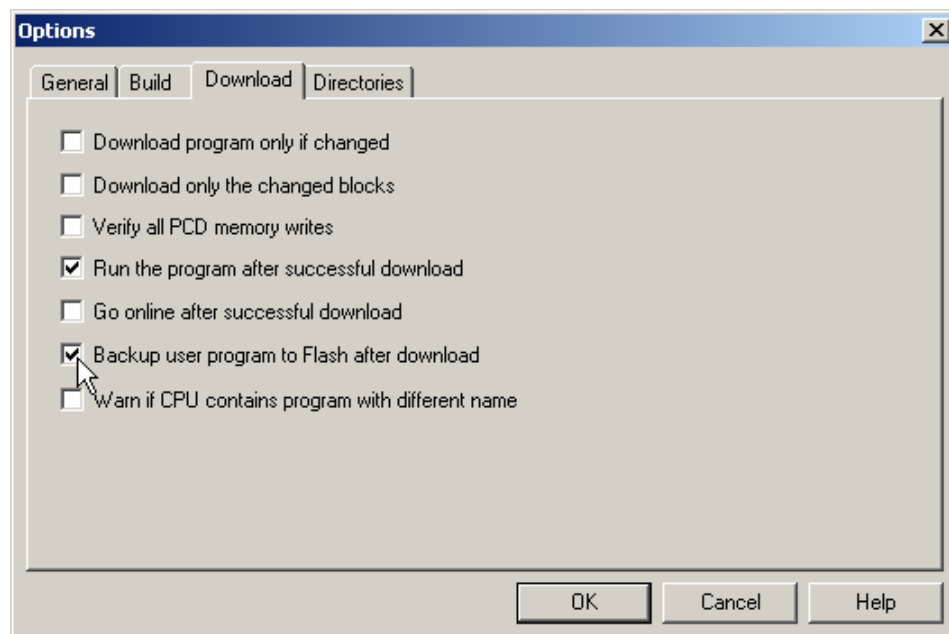
Loading the user program from the flash card will overwrite the user program backup on the onboard flash, provided there is sufficient space for the program on the backup flash.

3.13.4 Backup program after download option

In PG5, there is an option which copies the whole user program (HW configuration, code, Text/DB and extension memory) to flash after the program download. This can be found on the "Download Program..." screen:



It is also possible to activate this option by default. To do this, the corresponding option should be enabled in the PG5 project manager in the "Tools" menu → "Options...":



3.13.5 Backup/restore of RAM texts/DBs at run-time

As described above, the application can be copied to the flash card after downloading. In order to store process data gathered during operation, there is a facility to copy texts or DBs from extension memory (address ≥ 4000) to the flash card, or conversely, to copy the last state written to the flash card back in the text/DB in extension memory.

The memory space required to back up the DBs (extension memory backup) must be configured in the "Memory" tab in hardware settings. See section 3.13.3.

For storing texts/DBs on the flash card, restoring, deleting and running diagnostics, there are four SYSRD/SYSWR instructions provided, as described in detail below; these can be invoked **at a suitable place** in the user program. These instructions must be used with great care, to prevent any damage to the unit or the flash card.

Storing a text/DB on the flash card with SYSWR K 3000
Storing a text/DB on the onboard flash with SYSWR K 3100

Instruction:	SYSWR	K 3x00¹⁾	
		K number	; address of the texts/DBs as ; K constant or in a register, existing ; text/DB addresses in the range >= 4000 ; may be used
1) Alternatively, the value 3x00 can be passed in a register.			

Battery status after execution:

low:	the text/DB has been saved, and the flash card is ready for new SYSWR instructions
high:	the last instruction was not processed to completion; before further SYSWR K 3x0x instructions, a SYSRD K 3x0x must be executed to check the readiness of the flash card



When using the instruction SYSWR K 3x00, note the following:

- After any change of memory configuration, a "backup user program to flash" must be run, to ensure that the "backup DB to flash" will work (partitioning the flash). See section 3.13.4.
- The flash card can be written to a maximum of 100,000 times, so it is not permissible to invoke the instruction in a cyclical manner or at short intervals.
- It is strongly recommended to execute a SYSRD K 3x00 before this instruction, to test whether the flash card is available and ready.
- The processing time for the instruction may be up to 100 ms. At that point, there is no guarantee that all of the text/DB has been written (the process will continue in background). For this reason, the instruction must not be invoked in XOB 0 (XOB for a power failure) or during time-critical processes.
- If errors occur during processing, XOB 13 will be called where it is present, or the error LED will be set



- When starting the Saia PCD® after a loss of RAM memory, the state of the texts/DBs **after the last download** is restored, even where the SYSWR K 3x00 instruction has been used to store newer versions.
- Within the maximum number of write cycles, a text/DB can be stored any number of times, without the flash card becoming over-full.

Restoring a text/DB from the flash card with SYSWR K 3001

Restoring a text/DB from the onboard flash with SYSWR K 3101

Instruction:

SYSWR	K 3x01¹⁾	
	K number	; address of the texts/DBs as ; K constant or in a register, existing ; text/DB addresses in the range >= 4000 ; may be used

1) Alternatively, the value 3x01 can be passed in a register.

Battery status after execution:

low:	the text/DB has been restored and the process is complete, so further SYSWR K 3x0x instructions can be executed immediately
high:	the last instruction was not processed to completion; before further SYSWR K 300x instructions, a SYSRD K 3x00 must be executed to check the readiness of the flash card



When using the instruction SYSWR K 3x01, note the following:

- It is strongly recommended to execute a SYSRD K 3x00 before this instruction, to test whether the flash card is available and ready.
- If errors occur during processing, e.g. because no flash card is plugged in, XOB 13 will be called where it is present, or the error LED will be set

Deleting stored texts/DBs from the flash card with SYSWR K 3002

Deleting stored texts/DBs from the onboard flash with SYSWR K 3102

Instruction:

SYSWR	K 3x02¹⁾	
	K 0	; Dummy parameter, required to ; maintain the structure of the SYSWR ; instruction

1) Alternatively, the value 3x02 can be passed in a register.

Battery status after execution:

low:	the text/DB has been deleted and the process is complete, so further SYSWR K 3x0x instructions can be executed immediately
high:	the last instruction was not processed to completion; before further SYSWR K 3x0x instructions, a SYSRD K 3x00 must be executed to check the readiness of the flash card



When using the instruction SYSWR K 3x02, note the following:

- The deletion only affects text/DBs previously stored with SYSWR K 3x00. The contents of the extension memory stored after a download are retained
- It is strongly recommended to execute a SYSRD K 3x00 before this instruction, to test whether the flash card is available and ready.
- The processing time for the instruction may be several 100 ms. For this reason, it must not be invoked in XOB 0 (XOB for a power failure) or during time-critical processes.
- If errors occur during processing, e.g. because no flash card is plugged in, XOB 13 will be called where it is present, or the error LED will be set

Diagnostics of flash card with SYSRD K 3000

Diagnostics of onboard flash with SYSRD K 3100

Instruction:	SYSRD	K 3x00¹⁾	
		R_Diag	; Diagnostics register
1) Alternatively, the value 3x00 can be passed in a register.			

Battery status after execution (only where memory space available for "backup DB to flash" function):

low:	The flash card is ready, and SYSWR 3x0x instructions can be executed
high:	The Flash card is not available or not ready; the diagnostic register must be retrieved and the process retried later



When using the instruction SYSRD K 3x00, note the following:

- The battery is only set as described above where there is memory space available for the "backup DB to flash" function (i.e. is correctly configured). For this reason, the diagnostics register should also be checked. A decimal value of 0 means that the flash can be used.

Specification of diagnostic register		
Bit-no.	Description	Cause, where bit high
0 (LSB)	No backup possible	
1	Header not configured	No application on the flash card
2	No SYSWR access to flash card	The corresponding option has not been activated in the hardware configuration (reserved for text/DB etc.)
3	DB/text not present	In the last instruction, an incorrect DB/text number was used as a parameter
4	DB/text format invalid	The length of the DB or the text has been changed
5	Restored	Text/DB on the flash card has been restored, as an error occurred
6	Memory full	Too many texts/DBs, no more free memory space available
7	Already in progress	The last SYSWR 3x0x instruction was not yet completed when the next was started
8...31	Spare	

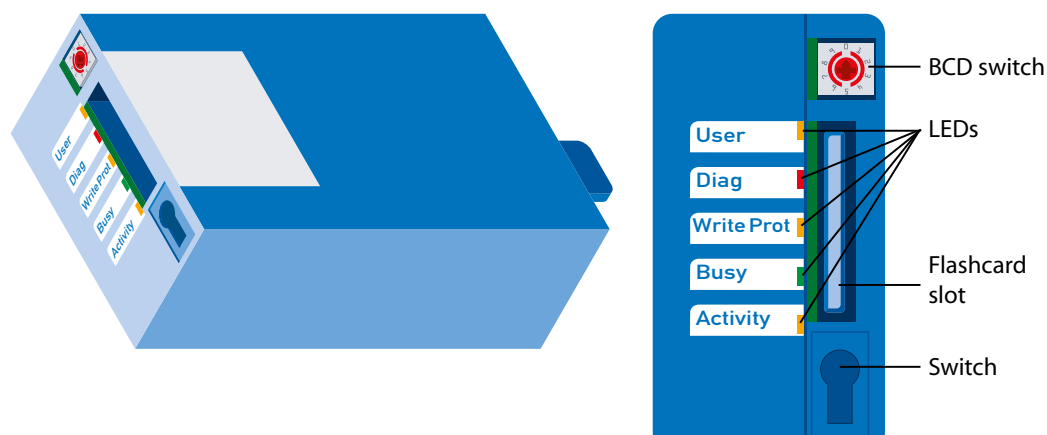
3.14 Memory module PCD3.R600 for flash cards (FCs)

3.14.1 System overview

The PCD3.R600 is an I/O module for industrial Secure Digital (SD) flash card applications, for which it can be inserted into I/O slots 0...3 on a PCD3.Mxxxx. The SD cards can be removed with the power on.

The SD cards can be accessed in 3 different ways:

- Via Ethernet TCP/IP with FTP server
- With a browser via Saia PCD® web server
- With the Saia PCD® program, using a file system library

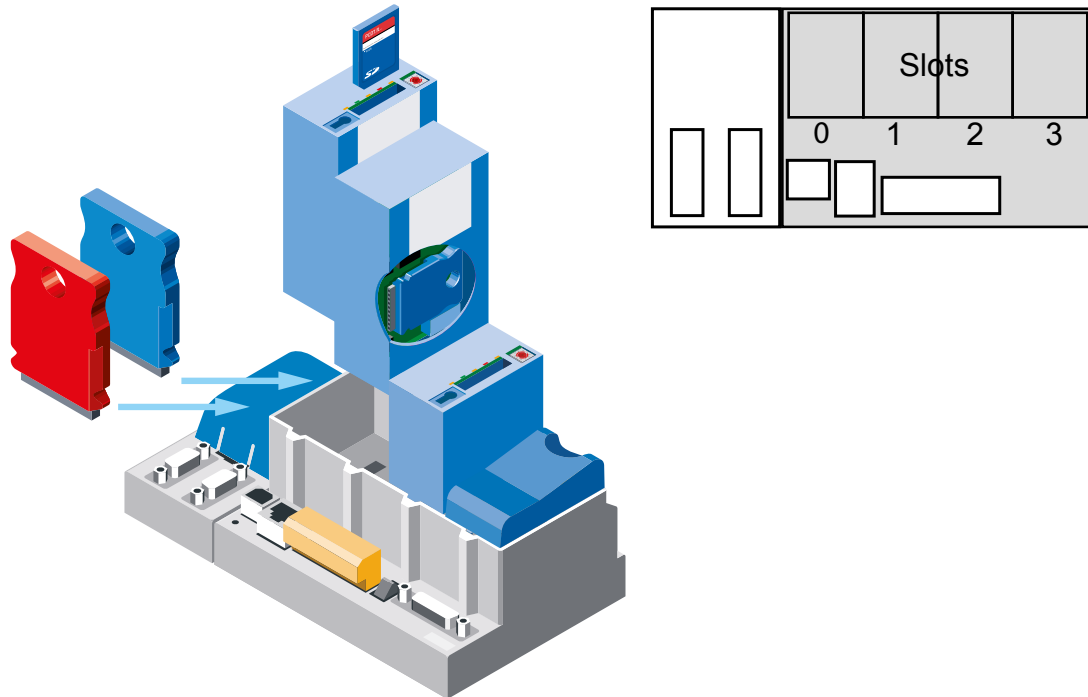


3.14.2 Technical data

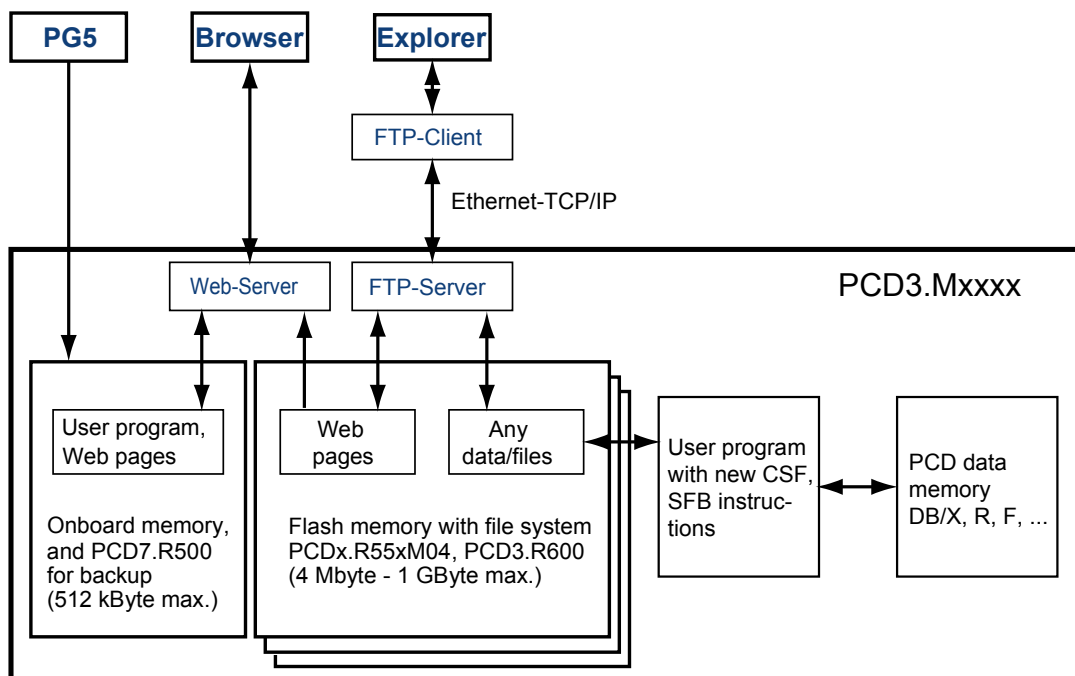
PCD3.R600 module	
Power consumption without SD flash card	15 mA
Max. power consumption incl. SD flash card	100 mA
Display	5 LEDs
Operating mode setting	BCD switch
Card holder and detection switch	With label clip
Required properties of SD flashcard (as tested by SBC)	
Capacity supported	128, 256, 512 MB, 1 GB
Technology	Single-level cell
Service life	600,000 or more programming/deletion cycles
Data retention	5 years or more
Operating temperature	-25 °C...+85 °C or better
MTBF	1,000,000 hours or better

3.14.3 Operation

The PCD3.R600 can only be inserted into I/O slot 0...3 on a PCD3.Mxxxx. The module cannot be plugged into the extension modules (PCD3.C1xx, PCD3.C2xx or PCD3.Txxx). Up to 4 PCD3.R600 units can be used in a PCD3 system.



Data access



FTP server and file system access can only be achieved with the plug-in flash memory module. Access via FTP server is only possible via the Ethernet TCP/IP interface.

Due to predetermined requirements SBC uses its own file system.

Based on the predefined requirements, SBC uses its own file system. The SBC file system is embedded in a FAT (PC compatible file system) framework, to make the restricted processes when used in a commercial SD card reader/writer visible with standard PC tools. The SBC file system is called SBCNTFS.FFS.

Individual files within SBCNTFS.FFS can be accessed with a software tool for PCs provided by SBC.

As 10% of the SD card capacity is reserved for the FAT, this extraction PC tool can be copied there. This allows data stored in the SBC file system to be accessed quickly on any PC with a standard SD card reader. The SBC PC tool can also make copies of SBCNTFS.FFS on any drive. Any remaining FAT storage space can be used to save documentation or for other purposes.

The PCD3.R600 can be used for PCD3 program backup in the same way as the PCD7.R500. The PCD3 program backup is written to the file backup.sei in a specified area and identified as a hidden read-only file in the FAT.

3



Apart from the SBCNTFS.FFS and backup.sei files, files in the FAT area cannot be accessed when the SD card is inserted into the PCD3. During formatting, a file is written to the FAT area containing the properties of the SD card. Data access is faster with a commercial SD card reader/writer than with a PCD3.

3.14.4 Displays and switches

The memory module is fitted with 5 LEDs:

LED	Meaning
User	User LED, set by the user program with the base address of the module (SET = off; RES = on)
Diag	The diagnostic LED is turned on when the SD card is not "visible" (eg SD card is not formatted with FAT16, poor "boot sector", or poorly plugged in). Once the SD card is inserted properly, it can take 5 seconds until the LED goes out
Write Prot	Active when a "write-protected" condition is detected (read-only SD switch, BCD switch or software)
Busy	Do not remove module when this LED is on.
Activity	Works as with a hard disk drive; flashes when data being processed

Setting of operating modes with the BCD switch:

Behind the label clip is a 10-position BCD switch which can be turned with a #0 screwdriver.

BCD position	Meaning
0	<i>normal read/write**</i>
1	Spare
2	Spare
3	Spare
4	Spare
5	<i>format*/**</i>
6	Spare
7	Spare
8	Spare
9	<i>normal read only</i>

* Starts after insertion; remove, then plug in again

** If the card itself is not write-protected (switch or software)



- There must be a PC FAT file system (FAT16) on the card in order for the SD card to be formatted with the SBC file system
- First, all FAT files are deleted, then the SBC file system is installed when the card is inserted and the BCD switch set to 5
- If the BCD switch is set to 0, the SBC file system (SBCNTFS.FFS) is installed if it is not already present and the card is empty, i.e. if a new card is installed, it does not have to be formatted with position 5.
- Not all flash cards have a "write-protect" switch
- The card is inserted into a so-called push-push socket (push to insert and remove)
- All operations apart from formatting are blocked when the label clip is removed
- Do not remove card when the "Busy" LED is on.

3.14.5 Flash card



The SD flash card is not part of the PCD3.R60x and has to be ordered separately.

The SD card must be of good quality (industry-standard, as tested by SBC). Other flash cards can also be used, but they will not be supported and are excluded from any warranty.

3

To increase service life, the flash cards should not be more than 80% filled for pure read applications. For read/write applications, no more than 50% of the memory space should be used.



On the PCD3, a non-standard file system (SBC FS) is used. This means that the flash cards have to be formatted before being used for the first time. This happens automatically when a new FAT 16 flash card is inserted into the PCD3.R60x.

Flash card handling

The card is inserted into a so-called push-push socket (push to insert and remove), located under the label clip.

It can be removed without switching off the PCD3.

To remove the label clip, first pull out the bottom end.

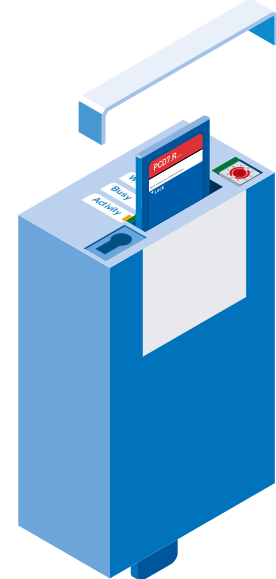
A mechanism detects when the label clip is removed. Where necessary, any unsaved data will be saved to the flash card. The "Busy" LED will flash while this is happening.

Inserting the flash card

When inserting the flash card, press until you feel some resistance; you may hear a soft click. Ease off the pressure until the card is at the same height as the slot.

Removing the flash card

If the "Busy" LED is off, push the card into the module housing until you feel some resistance. Ease off the pressure until the card slides out.



3.14.6 User program backup to the flash card

It is possible to back up the user program (see section 3.13.1) to the flash card in the PCD3.R60x.

The memory locations for the user program (to back up and restore) are queried in the following order:

1. M1 Slot
2. M2 Slot
3. I/O Slot 0...3
4. Onboard flash memory (where present)

I/O bus functions

Some states are detected by the user program.

I/O bus offset	Write	Read	Meaning
+0	User LED	BCD switch setting Bit 0 (lsb)	Position (non-inverted) of BCD switch
+1	do not use	BCD switch setting Bit 1	
+2	do not use	BCD switch setting Bit 2	
+3	do not use	BCD switch setting Bit 3 (msb)	
+4	do not use	/label clip present	1 = removed
+5	do not use		-
+6	do not use	/flash card present	1 = card removed
+7	do not use	SD write-protect switch	1 = SD blocked/removed 0 = MMC or SD released

3.14.7 Order details

Order code	Description	Weight
PCD3.R60x	Base module for SD flash memory cards, for I/O slot 0...3 (flash card not included)	60 g
PCD7.R-SD256	SD flash memory card 256 MB	2 g
PCD7.R-SD512	SD flash memory card 512 MB	2 g
PCD7.R-SD1024	SD flash memory card 1,024 MB	2 g

3.15 Hardware clock (Real Time Clock)

The PCD3 CPUs are fitted with a hardware clock on the motherboard:



The presence of a hardware clock is an absolute requirement where the HeaVAC library clock timers are used.

3.16 Hardware watchdog

3

PCD3 CPUs are fitted with a hardware watchdog as standard. A relay at I/O address 255 can be triggered; this remains activated as long as the status of O 255 changes periodically at least every 200 ms. Within PG5, FBoxes are provided for this purpose.

If for any reason the program component with the watchdog FBox is no longer being processed at sufficiently short intervals, the watchdog relay will drop out. Please read the online help for these FBoxes for more details.

The same function can also be implemented with IL (AWL) instructions. This variant works **independently of the cycle time** of the user program.

Example:

```

COB    0                ; or 1 ... 15
      0
STL    WD_Flag          ;Invert help flag
OUT    WD_Flag
OUT    O 255            ;Set output 255 to flashing
      :
      :
      :
ECOB

```

With the code shown in the example, the watchdog also drops out in the case of loops caused by the programmer. With regard to the cycle time of the user program, please note:

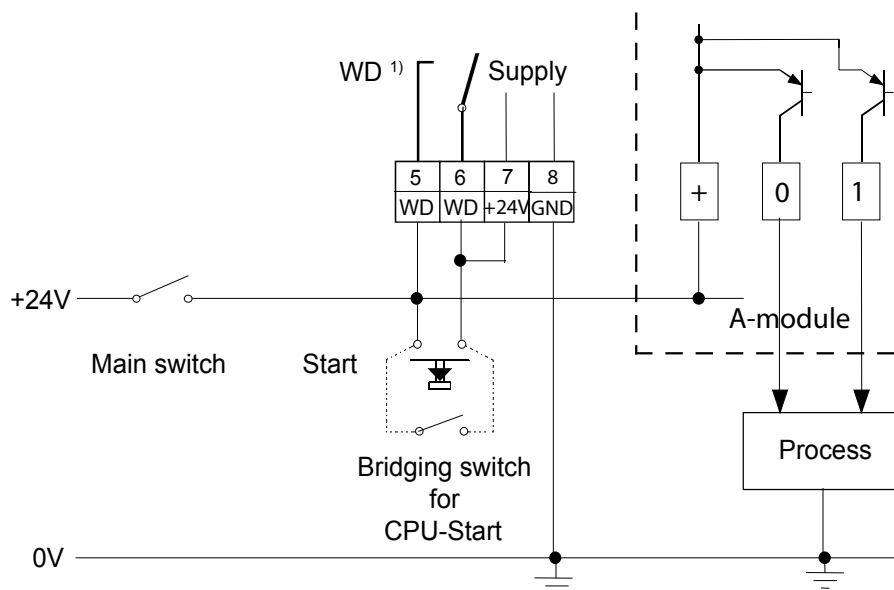
- With cycle times over 200 ms, the code sequence must be repeated several times in the user program, to prevent the watchdog dropping out in normal operation.



As address 255 is in the normal I/O range, there are restrictions on the permissible I/O modules in certain sockets:

CPU type	Restrictions
PCD3.Mxxx0	1) No analogue, counter and motion control modules on the socket with base address 240 (apart from PCD3.W3x5 and PCD3.W6x5, which are not affected by the watchdog) 2) Output 255 cannot be used for digital I/O modules

Watchdog - connection diagram



¹⁾ Switching capacity of the watchdog contact: 1 A, 48 VAC/DC



The status of the watchdog relay can be read via I 8107
 "1" = Watchdog relay on.

3.17 Software watchdog

The hardware watchdog provides maximum security. However, for non-critical applications, a software watchdog may be sufficient, whereby the processor monitors itself and the CPU is restarted in the event of a malfunction or a loop.

The core of the software watchdog is the instruction SYSWR K 1000. When this is first issued, the software watchdog function is activated. This instruction must then be issued at least every 200 ms, or the watchdog will trigger and restart the controller.

Instruction:

SYSWR	K 1000	; Software watchdog instruction	
	R/K x	; Parameters as per table below ; K constant or value in register	
x = 0	The software watchdog is deactivated		
x = 1	The software watchdog is activated; if the instruction is not repeated within 200 ms, there will be a cold start		
x = 2	The software watchdog is activated; if the instruction is not repeated within 200 ms, XOB 0 will be called and then there will be a cold start XOB 0 calls are entered in the Saia PCD® history as follows:		
	"XOB 0 WDOG START"	where XOB 0 has been invoked by the software watchdog	
	"XOB 0 START EXEC"	where XOB 0 has been invoked because of a supply fault	

3.18 Interrupt inputs

3.18.1 Basics

Because of the input filters and the effect of the cycle time, the digital input modules are not suitable for immediate reaction to events or for rapid counting processes. Some CPUs have interrupt inputs for this purpose.

When a positive edge is detected at the interrupt input, an associated XOB is called (e.g. XOB 20). The code in this XOB defines how the unit should react to the event, e.g. by incrementing a counter.



The code in XOBs called from interrupt inputs must be kept as brief as possible to allow enough time between the interrupts to process the rest of the user program.



Many FBoxes are intended for cyclic invocation and so not suitable for use in XOBs, or only in a limited way.

Exception: the FBoxes in the Graftec family (standard library) are well suited

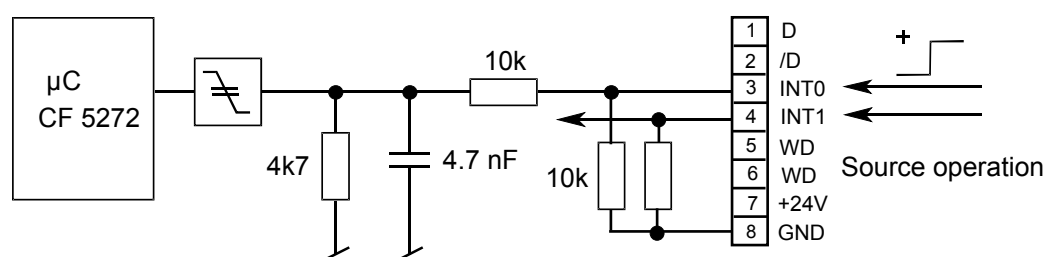
3.18.2 PCD3.Mxxx0 interrupt inputs 24 VDC

The two interrupt inputs are located on the motherboard and can be connected via the 8-pole, plug-in terminal block (terminals 1 to 8). Source operation is always used.

Interrupt input	XOB called in case of a positive edge	Direct input query
INT0	XOB 20	I 8100
INT1	XOB 21	I 8101

Operation:

When there is a positive edge at input **INT0**, **XOB 20** is called. The reaction time up to the XOB 20 call is a maximum of 1 ms. The code in these XOBs determines how the system should react to the events, e.g. by incrementing a counter (max. input frequency 1 kHz where pulse/pause ratio 1:1, total of the two frequencies max. 1 kHz). Regardless of whether the XOB is programmed, input 8100 is set (the same applies to INT1; see table above).



Input signals:

H = 15...30 V

L = -30...+ 5 V or not connected



Do not connect to D and /D. The RS-485 interface runs at 5 VDC and may be destroyed.

3.19 Operating mode switch (Run/Halt)

3.19.1 Run/halt push button



The operating mode can be changed while in use or at start-up:



At start-up:

- If the Run/Halt push button is pressed during start-up and then released again during one of the sequences described below, the following actions may be triggered:

LED sequence	Action
Orange	none
Green, flashing (1 Hz)	Goes into "boot" state and waits for f/w download
Red, flashing fast (4 Hz); from FW > V01.08.45	The system starts in the same way as with a flat Super CAP or missing battery, i.e. media (flags, registers etc.), user program and hardware settings are erased. The clock is set to 00:00:00 01.01.1990. The backup on the onboard flash is not deleted. If a backup is present the program will be restored.
Red, flashing slowly (2 Hz)	The PLC does not start up and goes into "Stop" mode.
Red/green flashing (2 Hz)	Stored data deleted, i.e. media (flags, registers etc.), user program, hardware settings and the backup on the on-board flash are erased. However, if an external flash card with a backup is present, the backup is not erased but the program is restored and copied on the onboard flash.

In operation:



- If the button is pressed in run mode for more than ½ second and less than 3 seconds, the controller changes to halt mode and vice versa.
- If the push button is pressed for longer than 3 seconds, the last user program saved will be loaded from flash memory.

3.19.2 Run/halt switch



Run

Stop

On the PCD3.M5xx0, it is also possible to influence the operating state with the switch accessible on the front of the unit under the blue cover.

If the controller is switched to stop mode, this will cause a change from run to stop; when it is switched to run, a cold start will be executed.

To release the switch, check the options in the hardware settings in PG5 (see also hardware settings in section 7.1).

3.20 Manual and emergency operation

The manual and emergency operation required in building automation can be provided with a PCD3.C200 module holder¹⁾ and the manual control modules PCD3.A810 (digital) and PCD3.W800 (analogue). These manual control modules are based on digital and analogue output modules, which can be activated either via the user program or by a manual switch.



- For emergency operation, the manual control modules must be used in a PCD3.C200 module holder with an external power supply. The external power supply is needed to continue to use the manual control module in emergency mode in case of a cable break or during maintenance work on the CPU.
- In this PCD3.C200 module holder (from hardware version C), and possibly others, manual control modules may be used in combination with other data point modules.
- When planning a PCD3 system, it is essential to consider the current requirements of the data point modules in the PCD3.C200 and of the subsequent module holders.

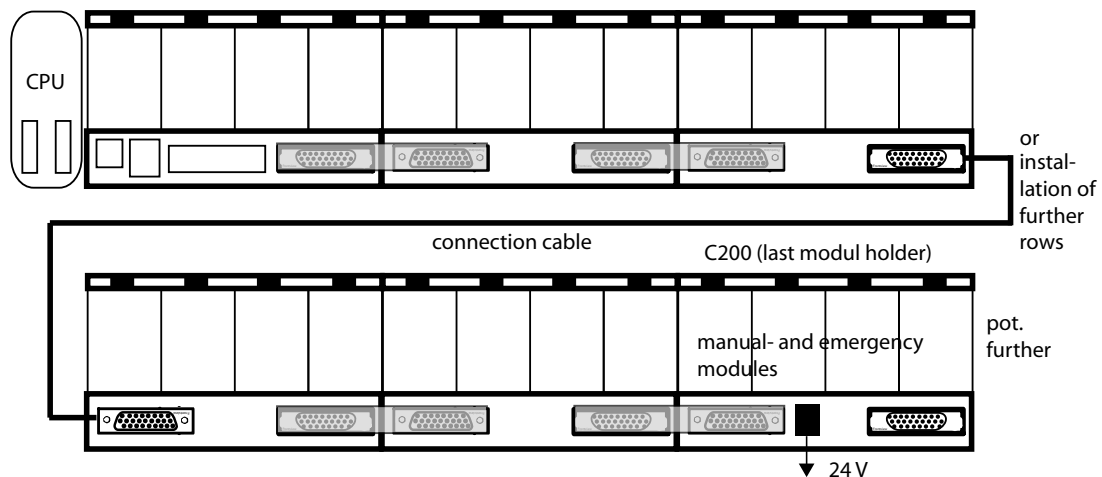
It is advisable to use the calculation table at www.sbc-support.com.

Manual control modules:

PCD3.A810, Digital manual control module with 4 relays, 2 with changeover contacts, 2 with make contacts (for detailed description, see Section 6.6)

PCD3.W800, Analogue manual control module with 4 output channels, 0...+10 V, 10 bit resolution (for detailed description, see Section 6.14)

Installation:



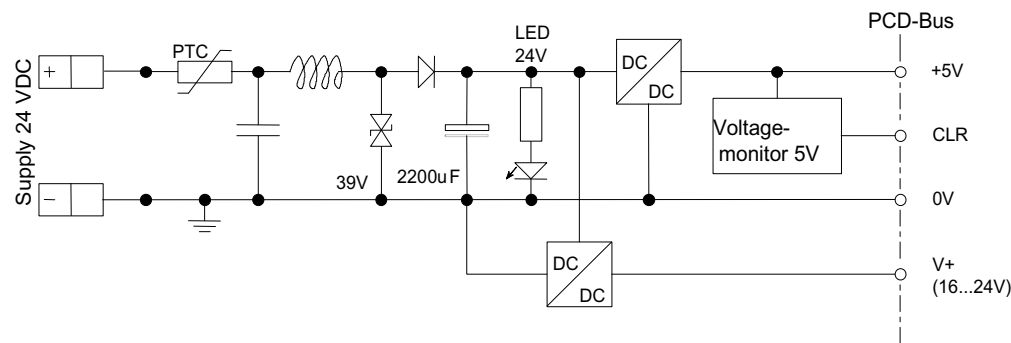
¹⁾ from hardware version C: no restrictions

Hardware versions A and B:

- see restrictions on current output, section 3.21.1
- PCD3.C200 at the end of the I/O bus only
- PCD3.C200 for emergency operation, and any other module holders, may only be used with manual control modules

3.21 Module holder

3.21.1 Internal supply to PCD3.C200 module holders



3

The PCD3.C200 module holders provide the following internal supply currents to the modules plugged in or connected to them:

Type	+5V	V+
		The capacity of the +V bus depends on the capacity of the 5V bus, as follows (the more precisely the 24 VDC are maintained, the higher the possible capacity):
PCD3.C200 Hardware versions A and B	1,000 mA	100 mA
PCD3.C200 Hardware version C	1,500 mA	$24\text{ V} \begin{smallmatrix} -25\% \\ +30\% \end{smallmatrix}: 200\text{ [mA]}$
		$24\text{ V} \begin{smallmatrix} -20\% \\ +25\% \end{smallmatrix}: 310 - \frac{I_{5\text{ V bus}}}{15}\text{ [mA]}$
		$24\text{ V} \begin{smallmatrix} -10\% \\ +10\% \end{smallmatrix}: 630 - \frac{I_{5\text{ V bus}}}{3.8}\text{ [mA]}$

When planning PCD3 systems, it is essential to check that the two internal supplies are not overloaded. This check is especially important when using analogue, counter and positioning modules, as these may have a very large power consumption. It is advisable to use the calculation table at www.sbc-support.com.

3.21.2 LIO module holders

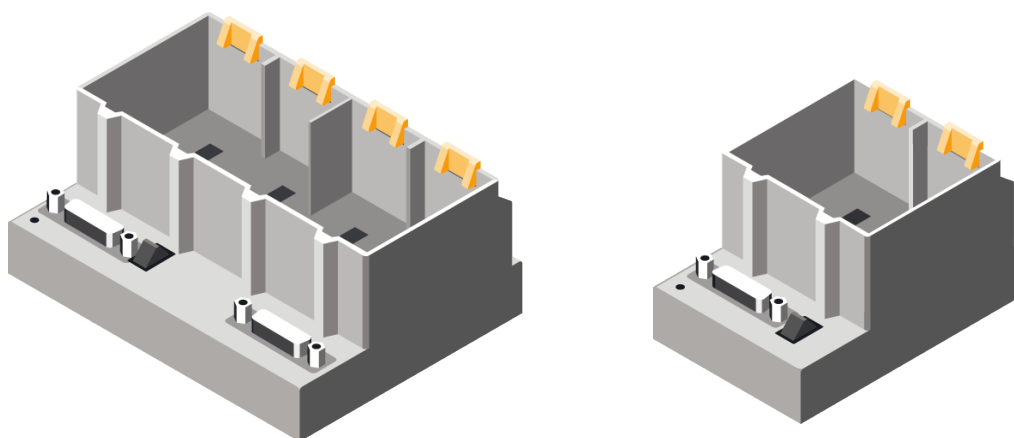
PCD3.LIOs (local I/Os) are used to capture central I/O signals. The compact PCD3.LIOs are snapped onto a 35-mm DIN rail and fitted with PCD3 I/O modules. PCD3.LIOs can be connected as an I/O extension to a PCD2 CPU, PCD3 CPU or a PCD3.RIO. Three different module holders are available to take the I/O modules:

LIO module holder	Module slots	Description	Ext. supply	Int. supply I at +5 V
PCD3.C100	4	for 4 I/O modules		10 mA
PCD3.C110	2	for 2 I/O modules		10 mA
PCD3.C200	4	for 4 I/O modules; acts as I/O bus repeater and provides internal +5V and V+ for a segment of I/O modules (for calculation of possible capacity, see 3.20.1).	24 VDC	

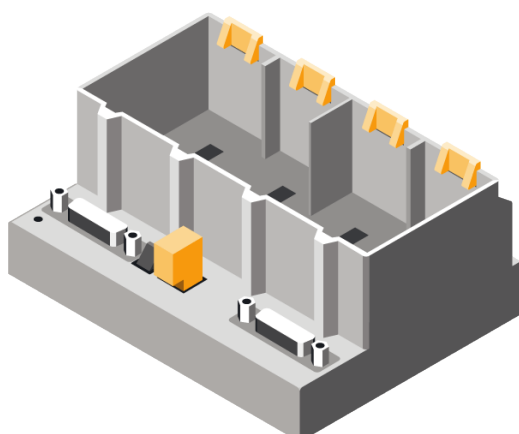
3

PCD3.C100/...C110

- 4 or 2 plug-in PCD3 I/O modules (selectable)
- May be connected to PCD2.Mxxx, PCD3.Mxxx0, PCD3.RIO and PCD3.LIO
- PCD3.C100 expandable with PCD3.LIO (C110, C200); PCD3.C110 not expandable

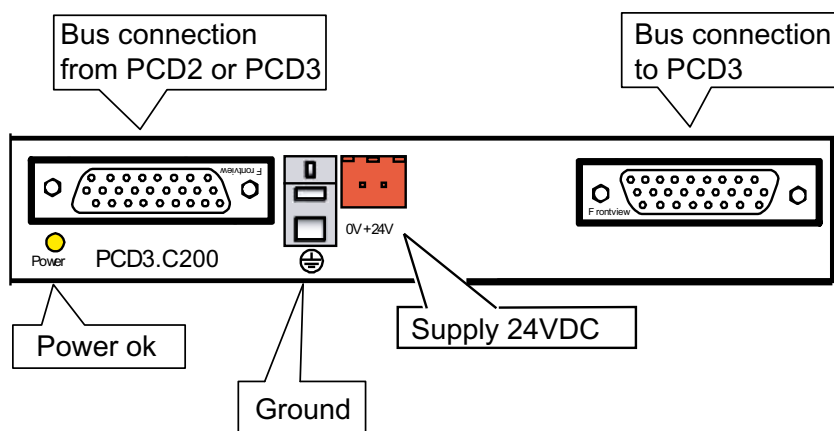
**PCD3.C200**

- 4 plug-in PCD3 I/O modules (selectable)
- May be connected to PCD2.Mxxx, PCD3.Mxxx0, PCD3.RIO and PCD3.LIO
- May be expanded with PCD3.LIO (C100, C110, C200)
- Serves as a bus repeater and provides + 5 V and V+ internally for a segment of I/O modules

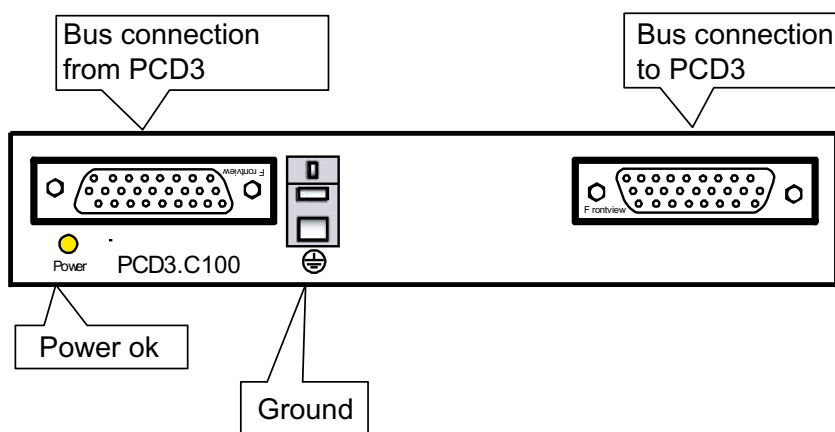


3.21.3 Connections to PCD3.Cxxx LIO module holders

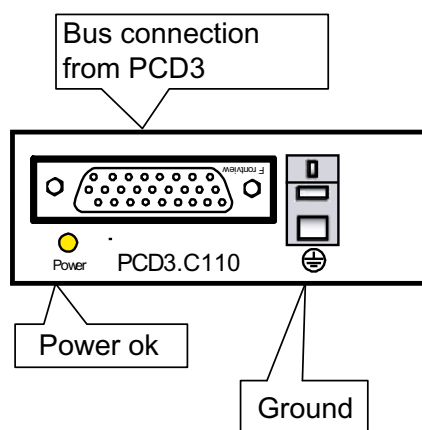
PCD3.C200 for 4 modules



PCD3.C100 for 4 modules

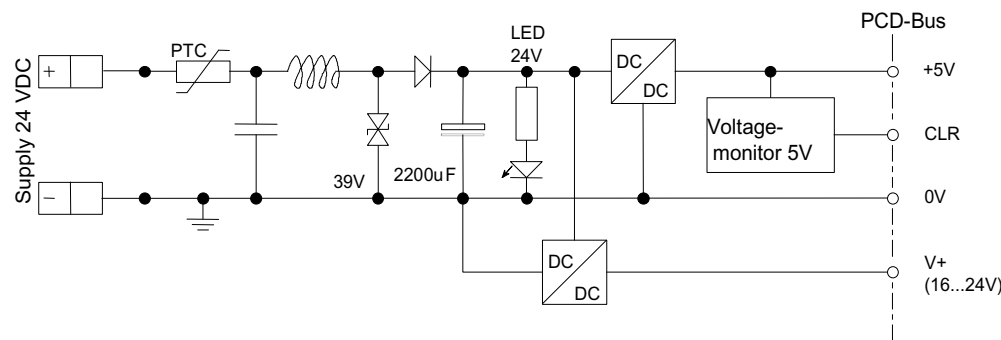


PCD3.C110 for 2 modules



4 RIO (remote input/output) head stations

4.1 Internal supply to PCD3.T76x head stations



4

The PCD3.T76x head stations provide the following internal supply currents to the modules plugged in or connected to them:

Type	+5V	V+
		The capacity of the +V bus depends on the capacity of the 5V bus, as follows (the more precisely the 24 VDC are maintained, the higher the possible capacity):
PCD3.T76x	650 mA	- 25 % 24 V +30 %: 100 [mA] - 20 % 24 V +25 %: $150 - \frac{I_{5V\ bus}}{15}$ [mA] - 10 % 24 V +10 %: $275 - \frac{I_{5V\ bus}}{4}$ [mA]

When planning PCD3 systems, it is essential to check that the two internal supplies are not overloaded. This check is especially important when using analogue, counter and positioning modules, as these may have a very large power consumption. It is advisable to use the calculation table at www.sbc-support.com.

4.2 RIO head station module holders

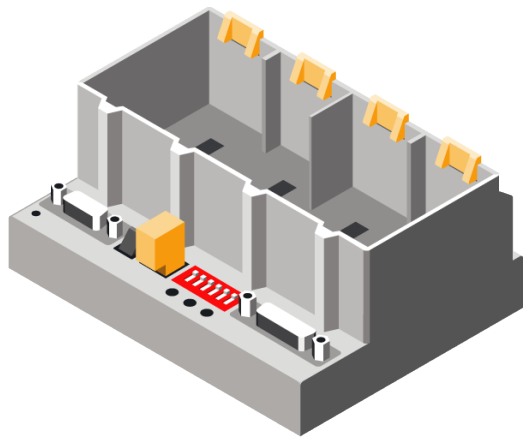
PCD3.RIOs (remote I/Os) are used to capture decentralized I/O signals. PCD3.RIOs communicate with Profibus-DP or any SPS Master; the .gsd file is included in Saia PG5® (version 1.2 or above), or it can be retrieved from www.sbc-support.com.

The web server integrated into PCD3.RIOs offers the user great benefits in commissioning, diagnostics and service. Access is via familiar easy-to-use standard web browsers. This makes it easy to check the states of all I/O signals (digital/analogue/counters), and to modify specific output states.

RIO head stations	Module slots	Description	Ext. supply
PCD3.T760	4	For 4 I/O modules with Profibus DP and S-Net connection Supply to integrated +5V and V+ Bus for a segment of I/O modules (for calculation of possible load, see 4.1)	24 VDC

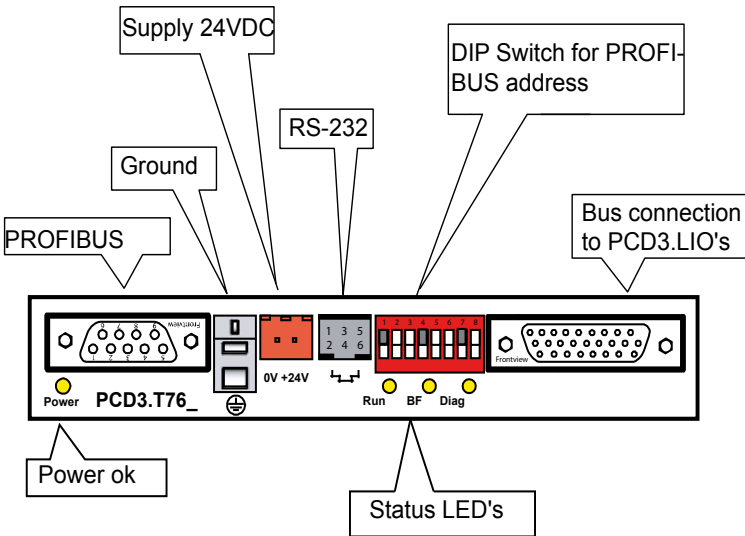
PCD3.T760

- Integrated Profibus DP and S-Net connection up to 1.5 Mbps
- 4 plug-in PCD3 I/O modules (selectable)
- May be expanded with PCD3.LIO
- Integrated web server for diagnostics, service and commissioning
- Provides internal +5V and V+ for the I/O modules on the PCD3.T760 and the attached PCD3.C1x0 units



Option to expand a RIO head station with up to 3 LIOs	
Number of inputs/outputs or I/O module sockets:	256 16

4.3 Connections to PCD3.T76x RIO head station for 4 modules



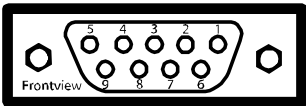
4

Meaning of connections

Profibus-DP or Profi-S-Net network connection

The bus is set up for baud rates up to 1.5 Mbps. More detailed specifications can be found in manual 26/765 "Profibus-DP".

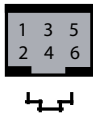
On a PCD3.M3 or PCD3.M6 (orange terminal block) corresponds **/D** to the pin 3 (RxD / TxD-P, red) and **D** to the pin 8 (RxD / TxD-N, green).



1	PGND
2	GND
3	B = RxD/TxD-P Red = /D
4	CNTR-P
5	SGND
6	+5V-Ext
7	24VDC
8	A = RxD/TxD-N Green = D
9	NC

Serial interface RS-232

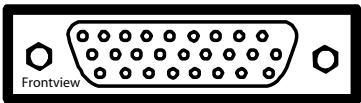
This connection supports configuration with a browser such as Internet Explorer or Netscape Navigator (with PCD3.K225 connecting cable).



1	TXD
2	RTS
3	RXD
4	CTS
5	PGND
6	DSR

Expansion connection

This connection allows the RIO to be expanded with up to 3 LIO module holders (with PCD3.K010 connector). This means that up to 256 I/Os can be set up per RIO.

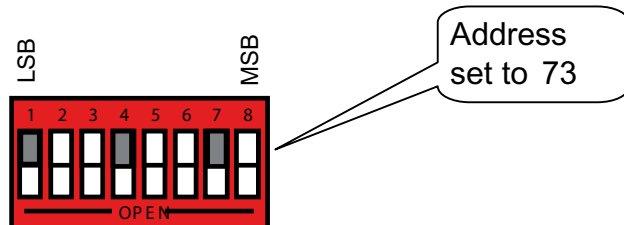


Setting the Profibus address

The Profibus address on the PCD3.T760 is set as a binary value using a DIP switch.

The numbers on the DIP switch have the following values assigned:

- 1 = 1
- 2 = 2
- 3 = 4
- 4 = 8
- 5 = 16
- 6 = 32
- 7 = 64
- 8 = not used



Example for address 73: DIP switch nos. 1 + 4 + 7 “ON”.

Meaning of LEDs

	Power yellow	Supply on
	Run green	RIO processor running
	BF red	Bus error
	Diag yellow	Diagnostics running: permanently on:- more than 4 I/O modules configured, but no PCD3.Cxxx - Profibus address is 0
		2 x flashing: Load EPROM with configuration
		5 x flashing: Min. one I/O is “locked”

4.4 Diagnostic information on RIOs

LEDs



These three LEDs on the PCD3.T76x head station display the operating states - error, alert, diagnostics etc. The LEDs are used as described in the table below.

RUN	BF	DIAG	Explanation
OFF	ON	OFF	Bus error, Slave not assigned to any Master
ON	OFF	OFF	Slave working correctly
ON	OFF	ON	Diagnostic / alert from Slave
OFF	ON	ON	Bus error, Slave not assigned to any Master, but configured and in a diagnostic state
X	X	flashing 5x	At least one "Lock" active
OFF	ON	flashing 2x	Current configuration comes from EEPROM or web server
ON	OFF	flashing 2x	Current configuration comes from EEPROM; Master has the same configuration and is connected

4

DP diagnostics

The PCD3.T76x provides Profibus-DP with standard diagnostics in octets*) 1...6. See also DIN 19245 part 3

*) In DIN 19245 a byte is called an octet, so the same term is used here.

Standard diagnostics:

Byte	Bit	Abbreviation	Explanation
1	0	non_exist	Slave does not exist (Master set)
	1	station_not_ready	Slave not ready to exchange data
	2	cfg_fault	Configuration data for Master and Slave differ
	3	ext_diag	Extended diagnostic bytes
	4		
	5	invalid_slave_response	Always set to "0" by Slave
	6	prm_fault	Incorrect parameter
	7	master_lock	Slave parameterized via a master
2	0	prm_req	Slave must be re-parameterized
	1	stat_diag	Static diagnosis
	2		Always "1"
	3	wd_on	Watchdog monitoring on
	4	freeze_mode	"Freeze" instruction on
	5	sync_mode	"Sync" instruction on
	6		Spare
	7	slave_deactivated	"1" when Slave deactivated by Master
3	0 ... 6		Spare
	7	ext_diag_overflow	Diagnostic data overflow in Master or Slave
4		Master address	
5, 6		ID (0xCD32)	

Extended diagnostics:

1) Power failure on a PCD3.C200 or defective cable to a PCD3.C1x0

Byte	Bit	Explanation
7	0x02	Device-related diagnostics, 2 bytes (incl. header byte)
8	0xFF	External power failure, defective cable to a PCD3.C1x0 or power failure in a PCD3.C200

2) Error accessing an I/O module

Byte	Bit	Explanation
7 (9)	0x43	Identification-related diagnostics, 3 bytes (incl. header byte)
8 (10)	0	Error accessing module 0
	.	.
	7	Error accessing module 7
9 (11)	0	Error accessing module 8
	.	.
	7	Error accessing module 15

4

Both diagnostic messages may be sent in the same telegram. In this case, the entries described above will be packed together in one frame, i.e. the identification-related diagnostic message will start with Octet 9 and end with Octet 11.

4.4.1 Diagnostic module

In addition to DP-compliant diagnostic information, the PCD3.RIO also supports a Diagnostic module integrated into the DP configuration. This Slave diagnostic information is stored in the Master resources. The use of a Diagnostic module is not mandatory. This Diagnostic module must however be configured after the last I/O module (exception: plug-ins must **be configured after** the Diagnostic module). It requires 4 input bytes and 4 output bytes. The precise definition of query and reply is as follows:

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
			Query

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
			Reply

The content of bytes 0 to 2 is dependent on the query instruction. The Master always checks that the reply instruction matches the query instruction and so ensures that the details are correct and belong to the information requested.

Instruction 0: NOP instruction

This instruction is used for synchronization. The RIO returns the data bytes unchanged.

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
X	Y	Z	0

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
X	Y	Z	0

4

Instruction 1: Query firmware version

This function is used to obtain the current firmware version for the RIO.

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	1

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
highest version	lowest version MSB	lowest version LSB	1

Instruction 2: Query RIO status

This function is used to obtain the current status of the RIO.

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	2

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
Status 0	Status 1	Status 2	2

Coding of bits in Status 0:

Bit	Explanation
7	DIAG LED: Set when diagnostic information is present
6	Set in case of power failure on the external I/O Bus
5	Set when valid configuration present in EEPROM
4	Set when "Clear" instruction received from Slave
3	Set when a "Lock" is on
2	Spare
1	Spare
0	Spare

4

Coding of bits in Status 1 and 2 not yet defined.

Instruction 3: State of outputs in case of bus error

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
Value of MSB	Value of LSB	Module position	3

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
Status	0	Module position	3

Function 3 defines the preferred state of the outputs. This preferred state is selected when

- the connection to the bus is broken
- the Master is in a STOP/HALT state

The status is "0" when the selection has been accepted; otherwise it is set to 0xFF.

The coding of the module position field is as follows:

Bits 0...3: Module position (0...15)

Bits 4...6: Channel number (0...7). On analogue outputs, this is the analogue channel

Bit 7: If set ("continue"), the last state of the outputs is retained. In this case, bytes 0 and 1 are irrelevant.

Example: Module position = 0x82→Retain the outputs (if 16 digital outputs, then the 8 LSBs) for module position 2 (3rd position).



In case of a bus error, or in STOP mode, the default switch-off status sets all outputs to "0".

For analogue outputs, this does not mean that the value of all outputs is "0".

Instruction 4: Resetting the preferred switch-off state of the outputs

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	4

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	4

Function 4 sets the preferred switch-off state for all outputs to a pre-defined value, e.g. "0"

4

Instruction 5: Store I/O configuration in EEPROM

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	5

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	0x85/0x05



Function 5 stores the configuration in EEPROM, so that the user can use the web browser to go online without a Master after switching on the power, and test his/her configuration without redefining it.

This asynchronous function takes a few milliseconds, depending on the scope of the configuration. While writing to the EEPROM, the value 0x85 is displayed in the Diagnostic module. While the instruction is being processed, no new instruction will be accepted.

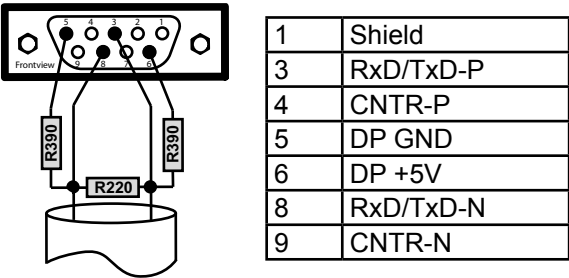
4.5 Profibus-DP or Profi-S-Net network line termination resistors

To prevent reflections at the line-ends, every segment must be terminated at the physical extremity of its line.
This means that the lines are biased at the equilibrium rest potential.
According to the Profibus standard, this must not be done directly on Profibus devices, but must be achieved by means of external components.

i Both the PCD7.T160 termination box and commercially available 9-pole Profibus D-Sub connectors are suitable for this purpose; for more details, see manual 26/740 "Installation components for RS-485 networks" and 26/765 "Profibus-DP".

4

Network termination should therefore be as follows:



Supplier for 9-pole Profibus D-Sub connectors to connect Saia PCD® controllers to Profibus networks:
ERNI Elektrotechnik AG, Brüttisellen, Switzerland:

- ERbic junction, horizontal grey: (junction fitted with series inductance of 110 nH) Erni Ref. 103648
- ERbic junction, horizontal grey: with PG connector: (junction fitted with series inductance of 110 nH) Erni Ref. 103663
- ERbic termination, horizontal yellow: (junction fitted with series inductance of 110 nH plus termination resistors of 390 Ω and 220 Ω) Erni Ref. 103649



ERNI ERbic connector

5 Communication interfaces

SBC S-Net, the networking concept from Saia Burgess Controls, is based on the Profibus and Ethernet open standards. Ethernet covers layers 1 and 2 of the ISO layer model. Based on layer 2, a variety of different protocols and applications can be run in parallel on the same network.

Layer 2 (Field Data Link-FDL) from Profibus also allows parallel running of different application protocols such as DP, FMS and others. The use of this facility allows Profi S-Net to be used to create a "Private Control Network (PCN)". This makes all SBC units into active network components.

Profibus Layer 2 (FDL) is integrated into the operating system of the PCD3.Mxxx0 CPUs and the PCD3.T76x RIOs, giving these units a Profi S-Net connection with transmission speeds up to 1.5 Mbps.

These units support Profibus DP and S-Net on the same port. In this way, Profibus can be used to construct networks cheaply and flexibly (detailed notes can be found in TI 26/381).

Since summer 2010 the PCD3 family (PCD3.M2xxx, PCD3.M3xxx, PCD3.M5xxx and PCD3.M6xxx) do support the „full-duplex mode“ and Auto-MDIX on the Ethernet port.

The easiest way to detect whether a PCD3 features the full duplex mode as well as Auto-MDIX is checking whether the RJ-45 plug is equipped with LEDs. If it is, the Saia PCD® supports the full duplex mode as well as the Auto-MDIX feature (auto-crossing the signals).

In detail the following hardware version or later are required in order to support full duplex and Auto-MDIX:

- The PCD3.M3xxx, PCD3.M5xxx and PCD3.M6xxx since hardware F.
- The PCD3.M2x30A4T1 and PCD3.M2x30A4T3 since hardware B.
- The PCD3.M2x30A4T5 since hardware C.

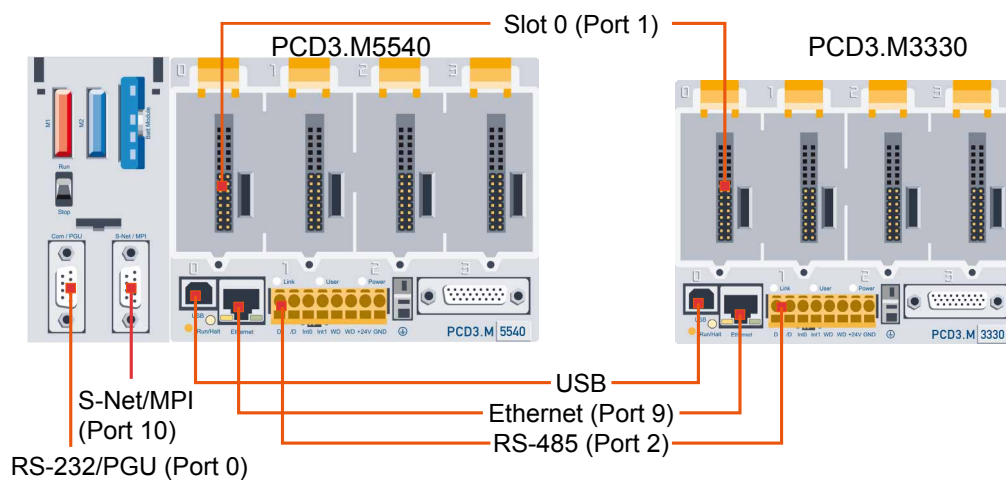
Using the SBC S-Bus



The proprietary SBC S-Bus has been designed essentially for communication with the engineering **and debugging tools, and for connecting the management level/process control systems.**

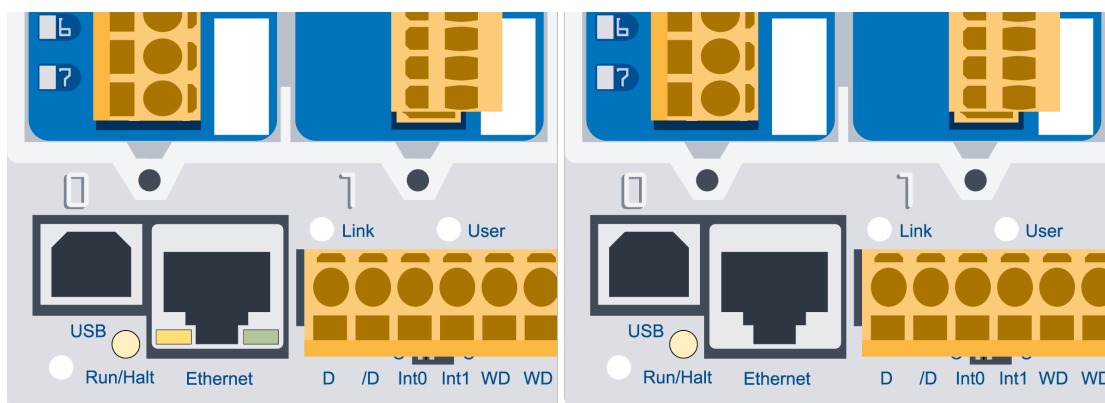
It is neither suitable nor approved for the connection of field devices from diverse manufacturers. An open, vendor-neutral fieldbus will be more effective in achieving this end.

5.1 Summary of onboard interfaces and plug-in interface modules



5

The easiest way to determine whether the device supports full-duplex mode or not, is to control if the RJ-45 connector is equipped with LEDs (left side in the picture).



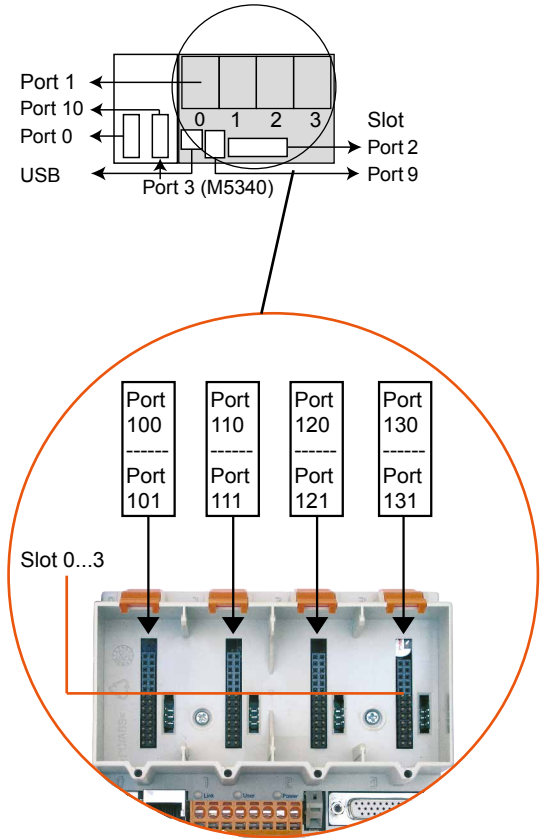
5.1.1 Onboard interfaces

Onboard interfaces	Port (in PG5)	max. baud-rate	PCD3.M3020	PCD3.M3120	PCD3.M3230	PCD3.M3330	PCD3.M5340	PCD3.M5440	PCD3.M5540	PCD3.M6240	PCD3.M6340	PCD3.M6440	PCD3.M6540
D-Sub #1 (PGU)													
RS-232	0	115.2 kBit/s					✓	✓	✓	✓	✓	✓	✓
D-Sub #2													
RS-485 (serial)	3	115.2 kBit/s					✓	✓	✓				
RS-422 (serial)	3	115.2 kBit/s					✓						
Profi-S-Net/DP Slave	10	1.5 MBit/s						✓	✓				
CAN	10									✓	✓		
Profibus DP Master	10	12 MBit/s										✓	✓
Terminal block													
RS-485	2	115.2 kBit/s	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Profi-S-Net/DP Slave	2	187.5 kBit/s	✓	✓	✓	✓	✓			✓	✓	✓	✓
Ethernet				✓		✓	✓		✓		✓		✓
USB 1.1 Slave (PGU)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

5.1.2 Plug-in communication interfaces

I/O communication modules	Slot			
	0	1	2	3
PCD3.F110 PCD3.F121 PCD3.F130 PCD3.F150 PCD3.F180	Port1			
PCD3.F210 PCD3.F221 PCD3.F281	Port100&101	Port110&111	Port120&121	Port130&131

Applies to all PCD3.CPUs



5.2 Protocols on serial ports

5.2.1 Protocols supported by the firmware

Protocol overview and firmware support for the different CPUs	Purpose	Supported by			
		PCD3.M3020 / M3230	PCD3.M3330 / M3120	PCD3.M5440 / M6440	PCD3.M5340 / M5540 / M6540
S-Bus PGU on USB connector with USB or PGU port	Programming, debugging, visualization. Also allows access via gateway to stations within a different S-Bus network	✓	✓	✓	✓
S-Bus PGU on the PGU RS-232 connector (with Pin 6 (DSR) of the PGU connector set to logical "0" (Data, Full Protocol)) ¹⁾	Programming, debugging, visualization. Also allows access via gateway to stations within a different S-Bus network	✗	✗	✓ 2)	✓ 2)
Serial S-Bus protocol (Data, Parity) ^{3) 6)}	Supports the S-Bus protocol on serial interfaces (RS-232, RS-485/422, USB, modem) in Master/Slave operation.	✓	✓	✓	✓
Character mode (MC0 to MC5) ⁴⁾	Transmission of characters or text over serial ports; basis for creating own protocols in the user program	✓	✓	✓	✓
Profi S-Bus protocol	Exchange of data with multi-master communication between controllers. Also allows access from PG5 programming unit, SBC OPC server or web browser	✓	✓	✓	✓
Profi S-IO protocol	For PCD3.RIO operation. Enables configuration and diagnostics, and management of C plug-ins	✓	✓	✓	✓
Ether S-Bus protocol	Exchange of data with multi-master communication between controllers. Also allows access from PG5 programming unit, SBC OPC server or web browser	✗	✓	✗	✓
Ether-S-IO protocol ⁵⁾	For PCD3.RIO operation. Enables configuration and diagnostics, and management of C plug-ins	✗	✓	✗	✓
MPI	Multi-point protocol for exchange of data with other devices (SBC xx7 controllers, HMI, SCADA systems)	✗	✗	✓	✓

1) Requires the use of programming cable PCD8.K111

2) Requires a corresponding configuration in hardware settings

3) Requires an assignment of the port in the user program (SASI). For new applications, Data mode should always be selected.

4) RS-485 with immediate release of data line after transmission of last character

5) In preparation

6) S-Bus Parity Master Mode (SM1) not supported on Port 0 and 3 (from FW 010)

5.2.2 Serial-S-Net

Supports the S-Bus protocol on serial interfaces (RS-232, RS-485/422, USB, modem) in Master/Slave operation. The SBC S-Bus with its simple and secure protocol is part of the basic set up of all Saia PCD®s.

Technical data

Transmission rates:	Up to 115 kbps on S-Bus protocol, high net data rates because of low protocol overhead
Number of stations:	Up to 254 stations in segments of 32 stations each
Port in PG5:	0, 1, 2, 3, 100, 101, 110, 111, 120, 121, 130, 131

5.2.3 Profi-S-Net

The "Private Control Network" (PCN) includes all protocols and services for operating SBC units (SPS, RIO, HMI, PG) on the Profibus. Supports multi-protocol operation on the same connector and cable.

Technical data

Transmission rates:	Up to 1.5 Mbps
Number of stations:	Up to 124 stations in segments of 32 stations each
Protocols:	Profi-S-Bus, Profi-S-I/O, DP Slave, HTTP
Port in PG5:	2 and 10

5.2.4 Ether S-Net

The "Private Control Network" (PCN) includes all protocols and services for operating SBC units (SPS, RIO, HMI, PG) on the Ethernet. Supports multi-protocol operation (S-Bus, S-I/O, HTTP, SMTP) on the same connector and cable.

Technical data

Terminals:	10 Base-T/100 Base TX (RJ-45)
Speed:	10/100 Mbps (auto-sensing)
Protocols:	TCP/IP or UDP/IP, Ether-S-Bus, Ether-S-I/O, HTTP, SMTP
Port in PG5:	9

5.2.5 Protocols implemented in the user program

Based on Character mode (and a very good knowledge of LI programming), any desired protocols can be implemented.

Our system partners have already done this for a large number of protocols, enabling our controllers to communicate with components from a variety of manufacturers, e.g. via Modbus, M-Bus etc.

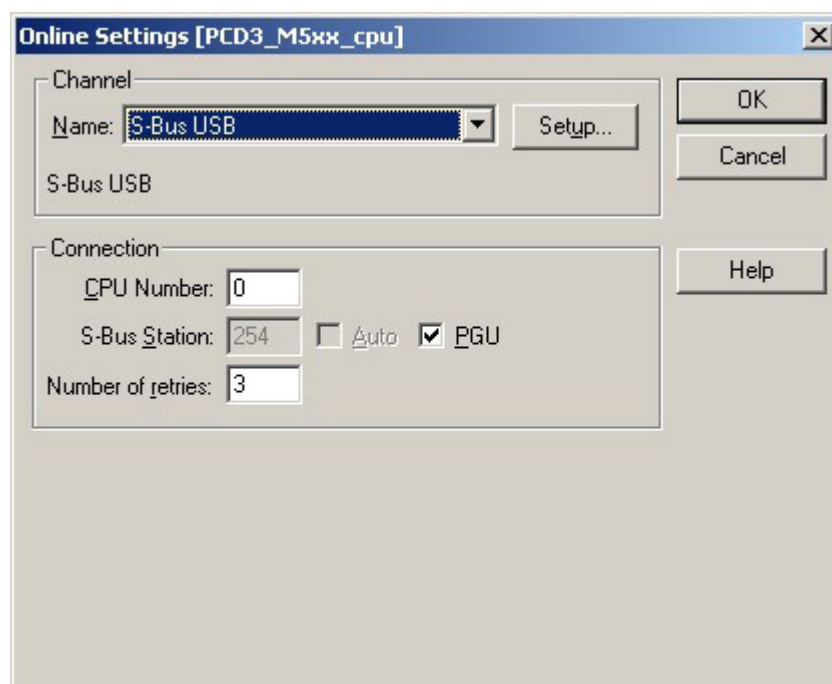
Please refer to the Links page at www.sbc-support.com for links to system partners.

5.3 USB PGU interface for connecting programming units

In order to use the USB interface (type B) on the PCD3.Mxxx0, PG5 version 1.3.100 or later must be installed.

When the PCD3.Mxxxx is first connected to a PC via the USB interface, the PC operating system automatically installs the appropriate USB driver

To establish a connection with a Saia PCD® via USB, the following settings must be entered in the online settings for the PG5 project:



5

Activating the PGU option ensures that the PCD3.Mxxxx connected directly to the PC can be reached, regardless of the S-Bus address that has been configured.

5.4 RS-232 connector (Port 0) as communication interface and as connection for programming unit (PCD3.M5xx0/M6xx0 only)

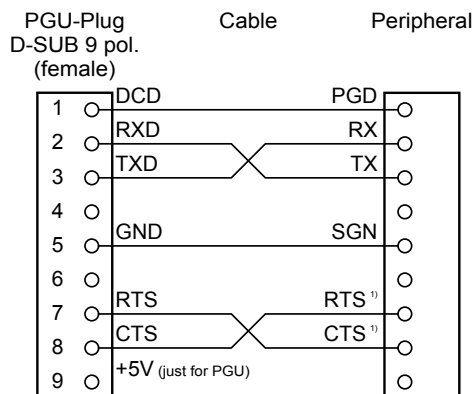
This interface is via a 9-pole D-Sub connector (female). The interface is of type RS-232.

The pin configuration and associated signals are:

Pin	Designation	Meaning	
1	DCD	Data carrier detect	
2	RXD	Receive data	[Empfangsdaten]
3	TXD	Transmit data	[Sendedaten]
4	DTR		
5	GND	Signal ground	[Signalerde]
6	DSR	PGU connected	[Erkennung PGU]
7	RTS	Request to send	[Sender einschalten]
8	CTS	Clear to send	[Sendebereitschaft]
9	n.c.	Not connected	[Not used]

The interface can be used for the following purposes:

- Option 1:** Configuration with desired protocol (S-Bus PGU configuration)
- Option 2:** Assignment (SASI) in the user program (the port must not be configured as an S-Bus PGU port)
- If another programming device is connected during operation instead of the peripheral device, the unit will switch over automatically to PGU mode (pin 6 logical "1" (DSR); in PGU mode: DSR PING = "1")
 - Before using the port to connect another peripheral device, Port 0 must be reconfigured by means of an SASI instruction.

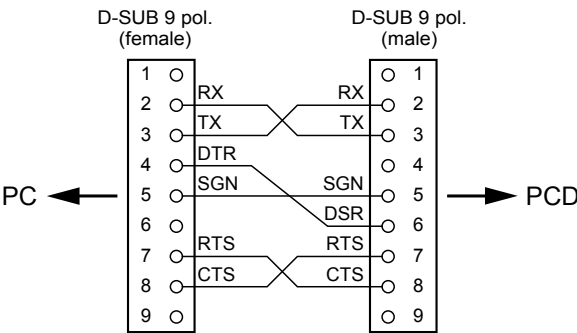


¹⁾ When communicating with terminals, check whether some connections are provided with bridges or need to be set to "1" or "0" with the "SOCL" instruction. It is generally recommended to use a handshake (RTS/CTS) (see also manual 26/795 "PCD7.D23x Series graphic terminals").

RS232 connector (Port 0) as communication interface

- Option 3:** Port 0 can also be used as a modem port with a 1-to-1 cable. For this, the “Full RS-232 handshaking on Port 0” should be ticked, as described in section 7.1.2 "Hardware options".
- Option 4:** With the PCD8.K111 connecting cable, this interface can be used to connect a programming unit.

PCD8.K111 connecting cable



5.5 Serial interfaces on I/O module Slot 0 (Port 1)

5.5.1 General remarks on the PCD3.F1xx

System properties of PCD3.F1xx modules:

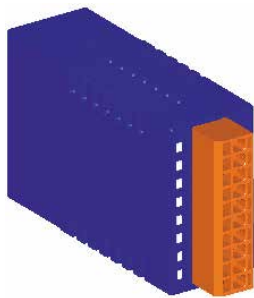
The following points must be observed when using the PCD3.F2xx interface modules:

- For each Saia PCD® system, 1 PCD3.F1xx module can be used on Slot 0.
- The PCD3 system has a powerful processor which handles the application as well as the serial interfaces. Processing of the interface modules requires the appropriate CPU capacity. To determine the maximum communication capacity per PCD3 system, note the following:
- The communication volume is determined by the peripheral devices connected. This will be the case, for example, where a PCD3 is used as an S-Bus slave station. If a PCD3 controller is bombarded with heavy telegram traffic at high baud rates, less CPU capacity will be left to handle the actual application.
- If the PCD3 is the initiator of the communication, the communication volume, and hence the communication capacity, will be determined by the user program in the PCD3 (PCD3 used as master station). Theoretically, all interfaces can be run at the maximum baud rate of 115 kbps.
However, the effective data throughput will be governed by the user program and the number of interfaces, and may be quite low. The crucial factor is that the peripheral devices connected can be run with the selected configuration and communication capacity.

Current consumption	+5 V bus
Module	[I in mA]
PCD7.F110	40
PCD7.F121	15
PCD7.F130	5
PCD7.F150	130
PCD7.F180	15

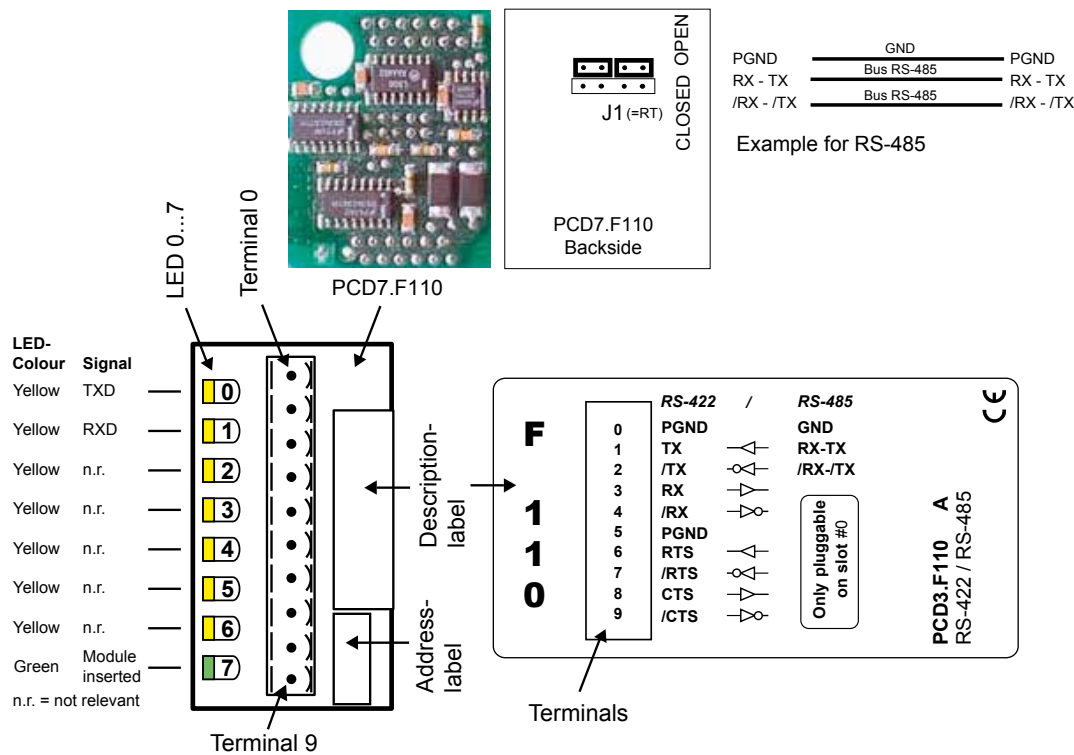
The PCD3.F1xx base module consumes < 10 mA.

5.5.2 RS-422/485 with PCD3.F110

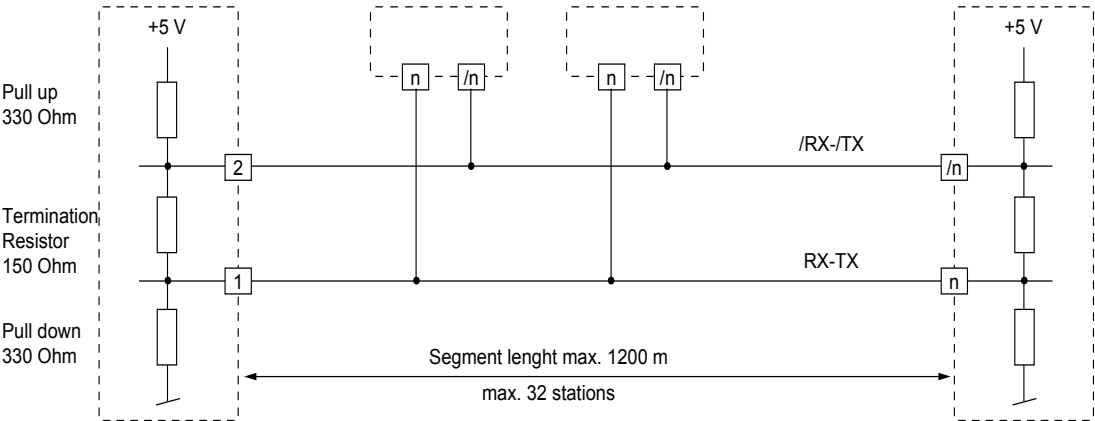


PCD7.F110:
RS-422 with RTS/CTS or RS-485 electrically connected, with line termination resistors capable of activation, for I/O module Slot A To move the jumper (activate line termination resistors), the module housing has to be opened, as described in section 6.1.5 “Open the module housing”, to reach the PCD7.F110 circuit board.

Connections and LEDs for RS-422/485



Choice of termination resistors





Not all manufacturers use the same connection configuration, so the data lines may need to be crossed



At the first and last stations, jumper J1 must be set to the "CLOSED" position. At all other stations, jumper J1 must be set to "OPEN" (factory setting). The jumper is on the connection side of the module.



For RS-422, each pair of receive lines is terminated with a 150 Ω line termination resistor. Jumper J1 must be left in the "OPEN" position (factory setting). The jumper is on the connection side of the module.

For details, see manual 26/740 "Installation components for RS-485 networks" and manual 26/795, "PCD7.D23x series graphics terminals".

5

If the PCD7.F110 is used on Port x.1 of a PCD3.F2xx, the pin allocation is as follows:

RS-422 mode

RS-422

0	PGND	Tx	1
2	/Tx	Rx	3
4	/Rx	PGND	5
6	RTS	/RTS	7
8	CTS	/CTS	9

10-pole spring terminal on PCD3.F2xx

Connection:

In RS-422 mode, the input signal lines on the PCD3.F210 must be terminated with 150 Ω resistors.

RS-485 mode

(Electrically connected RS-485 interface)

RS-485

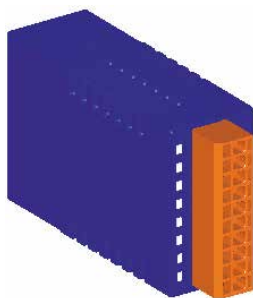
0	PGND	Rx-Tx	1
2	/Rx- /Tx		3
4		PGND	5
6			7
8	(SGD)		9

10-pole spring terminal on PCD3.F2xx



The network termination for Port x.0 can be enabled with a switch on the PCD3.F210. The switch is marked 'O' for OPEN and 'C' for CLOSED.

5.5.3 RS-232 with PCD3.F121 (suitable for modem)

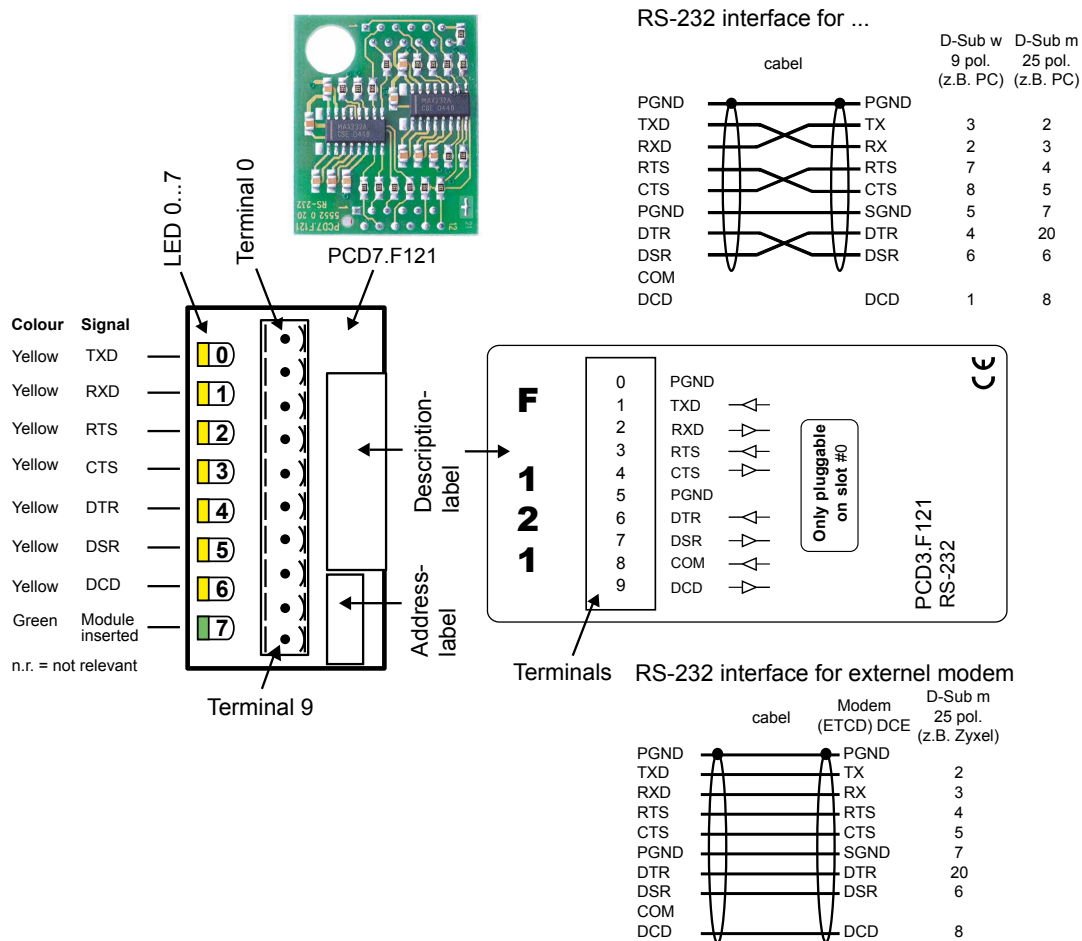


PCD3.F121:

RS-232 with RTS/CTS, DTR/DSR, DCD, suitable for modem connection, for I/O module Slot 0.

Connections and LEDs

5

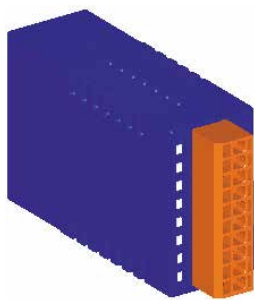


See also manual 26/795, "PCD7.D23x Series graphic terminals"

If the PCD7.F121 is used on Port x.1 of a PCD3.F2xx, the pin allocation is as follows (10-pole spring terminal on PCD3.F2xx):

RS-232			
0	PGND	TxD	1
2	RxD	RTS	3
4	CTS	PGND	5
6	DTR	DSR	7
8	COM	DCD	9

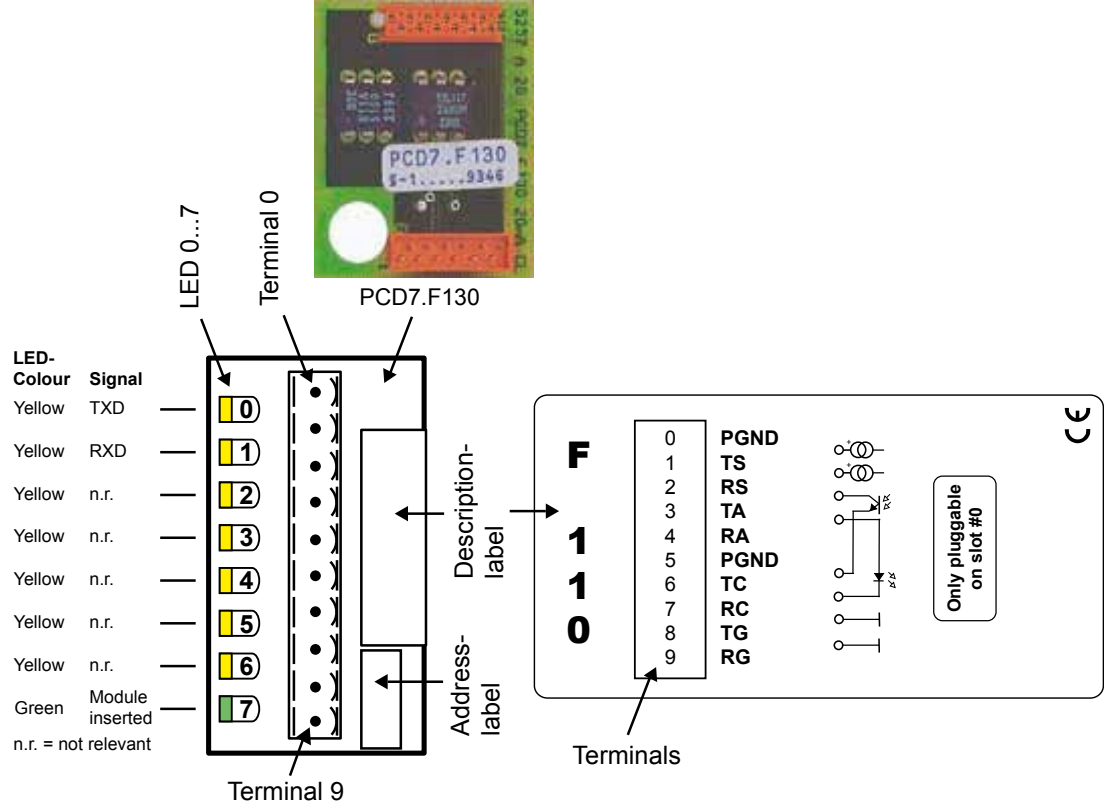
5.5.4 Current loop with PCD3.F130



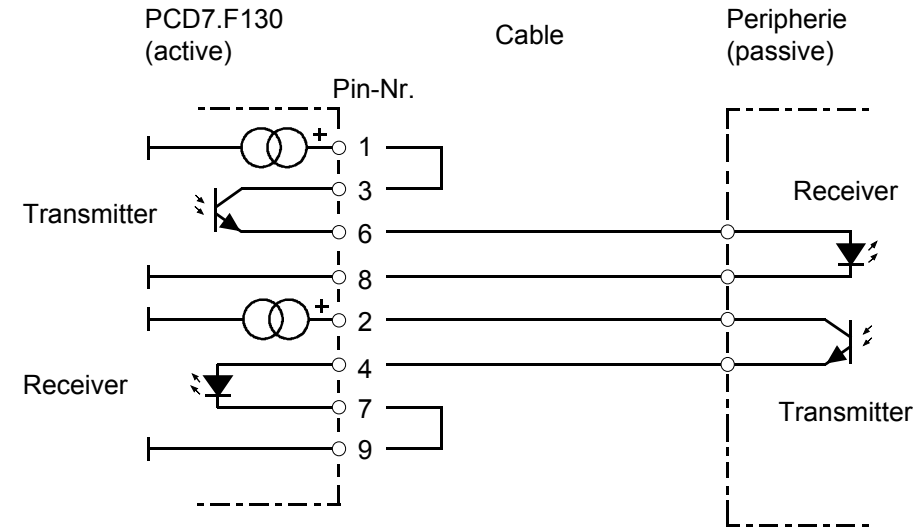
PCD3.F130:
TTY/current loop 20 mA (active or passive), for I/O module slot 0.

Connections and LEDs

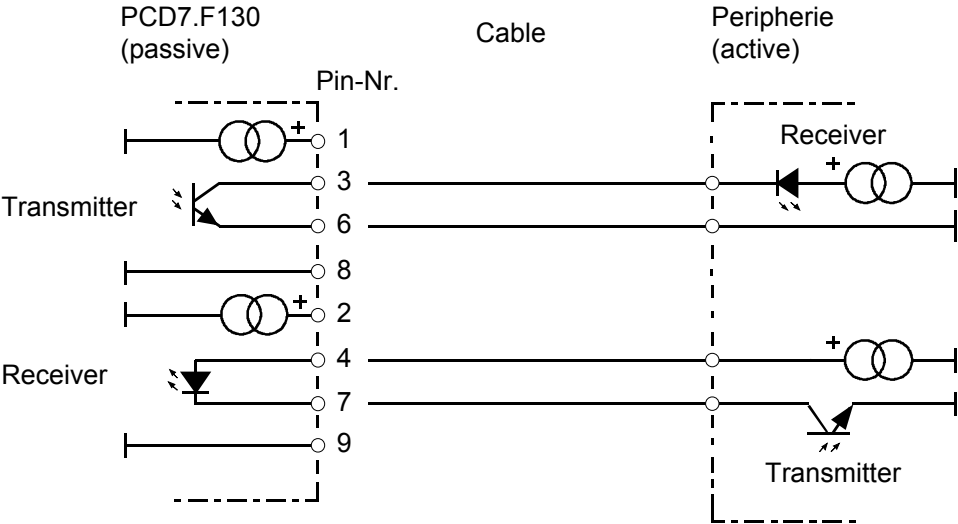
5



Saia PCD® active

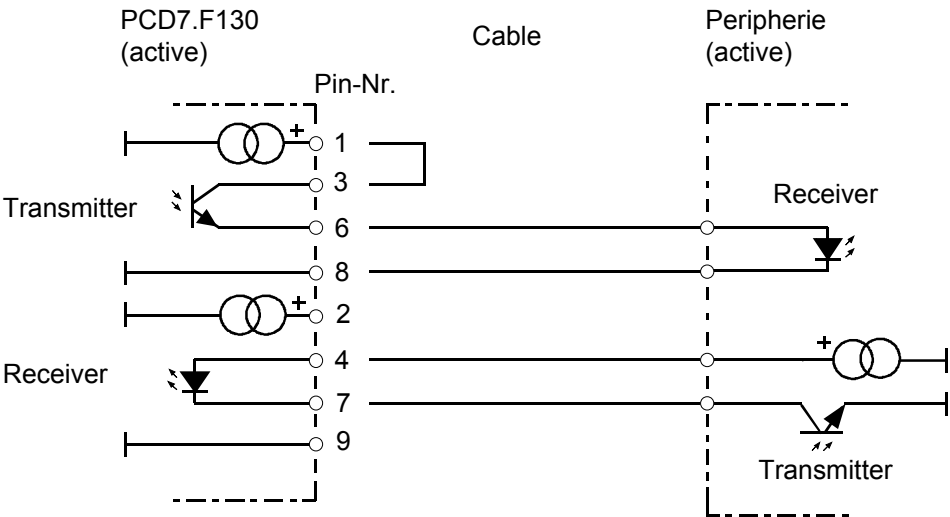


Saia PCD® passive



5

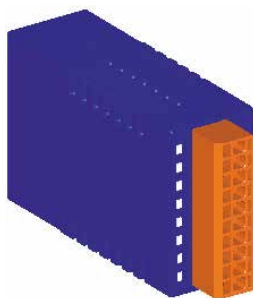
Saia PCD® and peripheral active



If the PCD7.F130 is used on Port x.1 of a PCD3.F2xx, the pin allocation is as follows (10-pole spring terminal on PCD3.F2xx):

TTY (CL)			
0	PGND	TS	1
2	RS	TA	3
4	RA	PGND	5
6	TC	RC	7
8	TG	RG	9

5.5.5 RS-485 with PCD3.F150



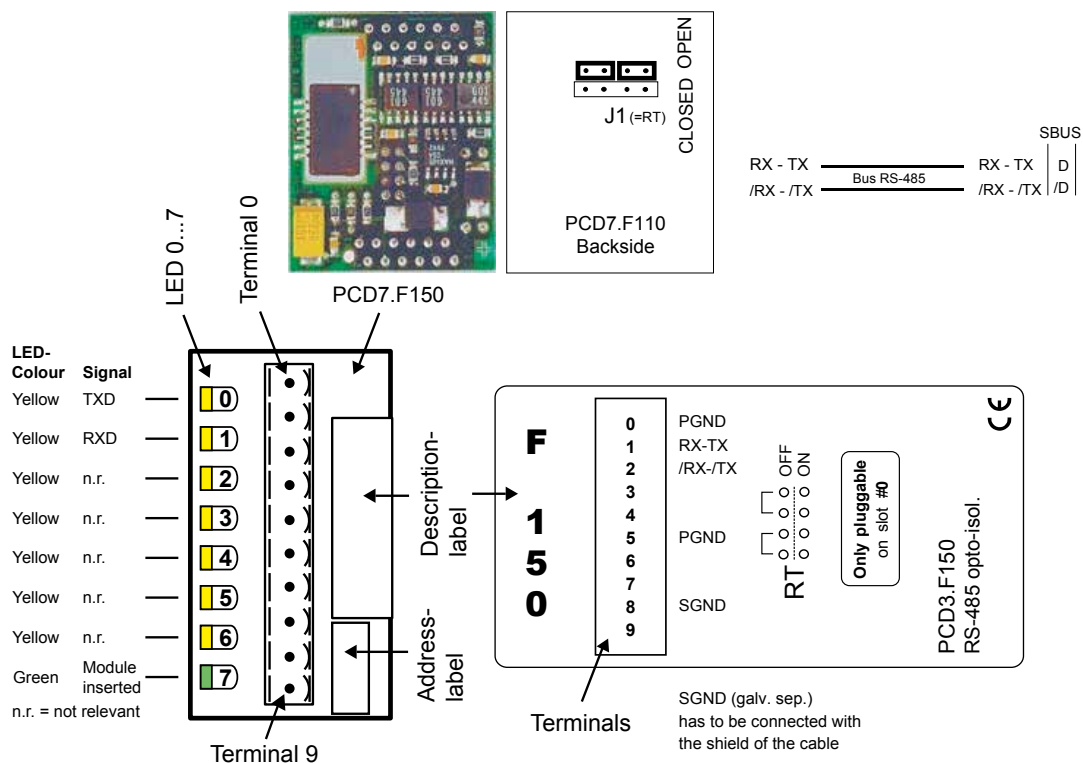
PCD3.F150:

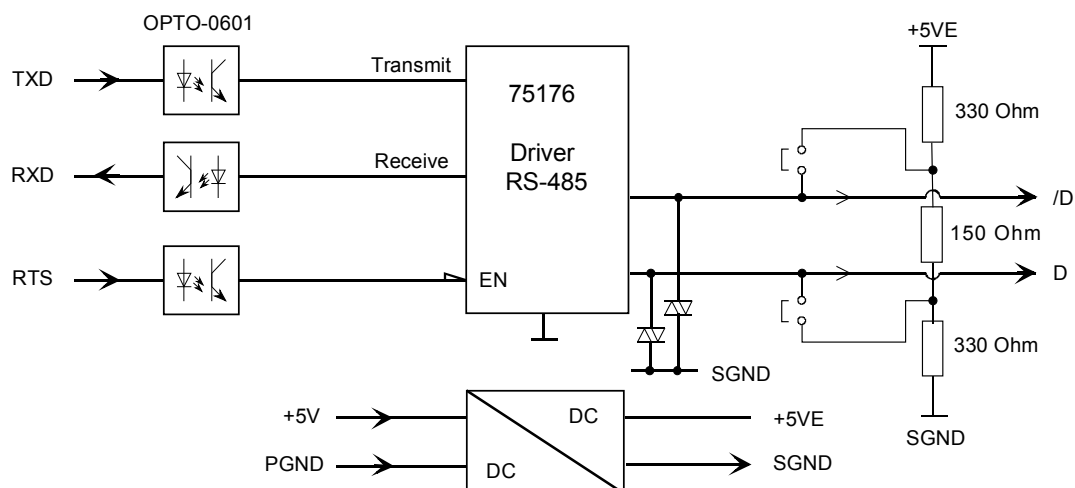
RS-485, electrically isolated, with line termination resistors capable of activation, for I/O module Slot 0. To change the jumper (activate line termination resistors), the module housing has to be opened, as described in section. 6.1.5 “Open the module housing”, to reach the PCD7.F150 circuit board.

The electrical isolation is achieved with 3 optocouplers and a DC/DC transducer. The data signals are protected against surges by a suppressor diode (10V). The line termination resistors can be connected/disconnected with a jumper.

5

Connections and LEDs



Block diagram:

5



Not all manufacturers use the same connection configuration, so the data lines may need to be crossed



The potential difference between PGND and the data lines Rx-Tx, /Rx-/Tx (and SGND) is limited to 50 V by a suppressor capacitor.



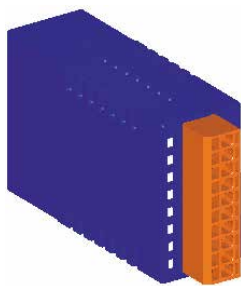
For installation details, see manual 26/740 "Installation components for RS-485 networks"

If the PCD7.F150 is used on Port x.1 of a PCD3.F2xx, the pin allocation is as follows (10-pole spring terminal on PCD3.F2xx):

RS-485

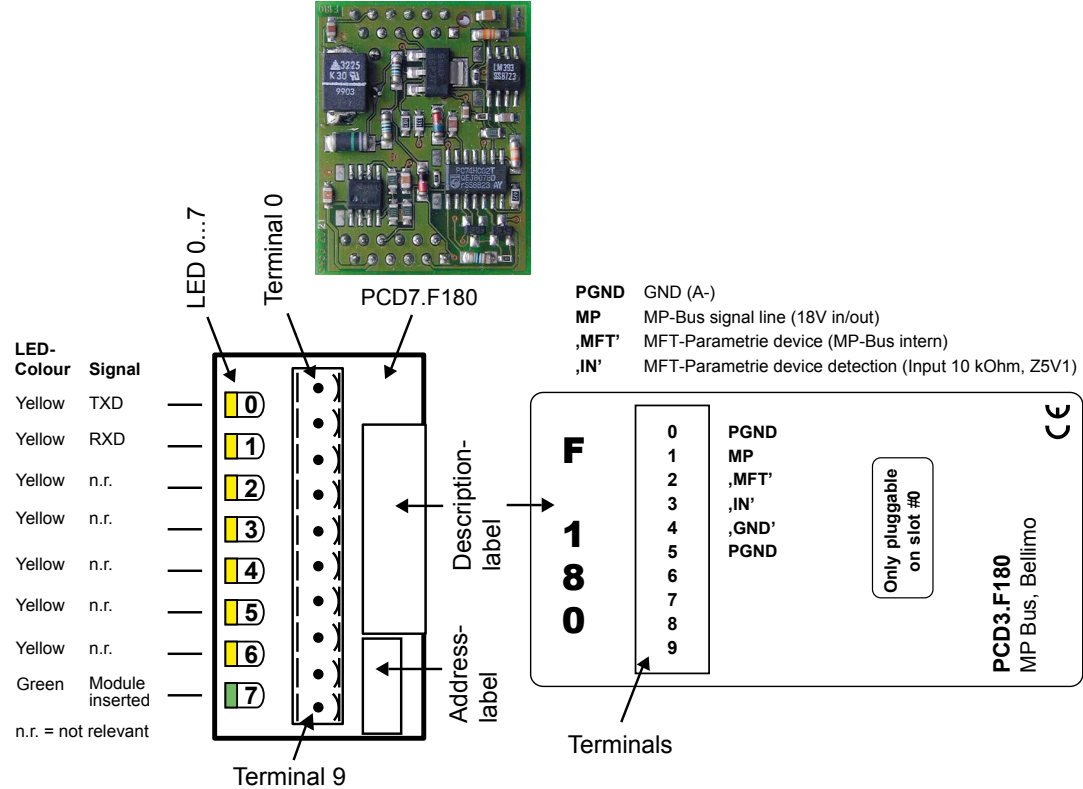
0	PGND	Rx-Tx	1
2	/Rx-/Tx		3
4		PGND	5
6			7
8	(SGD)		9

5.5.6 MP-Bus with PCD3.F180



PCD3.F180:
Switching module for MP bus, for I/O module slot 0.
The module has a facility to connect an MP-Bus line with 8 drives and sensors.

Connections and LEDs

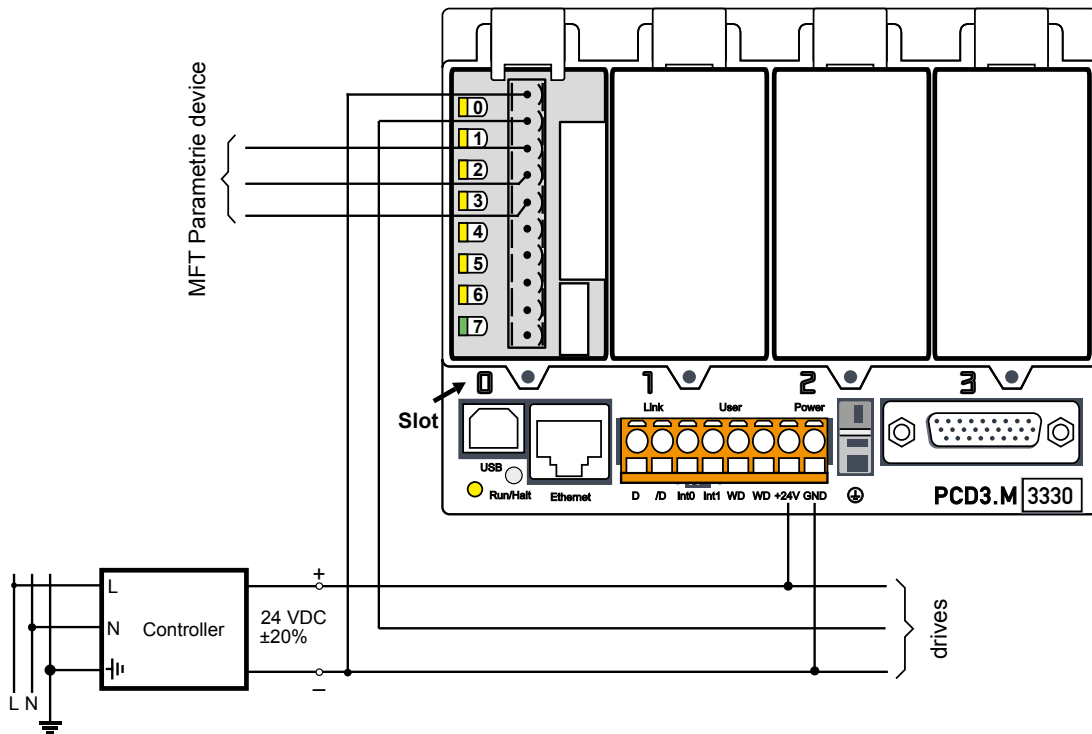


If the PCD7.F180 is used on Port x.1 of a PCD3.F2xx, the pin allocation is as follows: (10-pole spring terminal on PCD3.F2xx):

Bellimo MP bus			
0	PGND	MP	1
2	,MFT'	,IN'	3
4		PGND	5
6			7
8			9

Supply option

Common supply for control and drive



5



When using the PCD3.F180 connection module, the supply voltage to the PC control unit must be at least 24 VDC, $\pm 5\%$ (not the default tolerance of $\pm 20\%$).



With a separate DC or AC supply to the drives, it is especially important to ensure that the Saia PCD® control unit is connected to the earth (Minus pole) of the drive supply. The earth serves as a common base for communication.

5.6 Serial interfaces on I/O module slots 0 - 3

5.6.1 General remarks on the PCD3.F2xx

System properties of PCD3.F2xx modules:

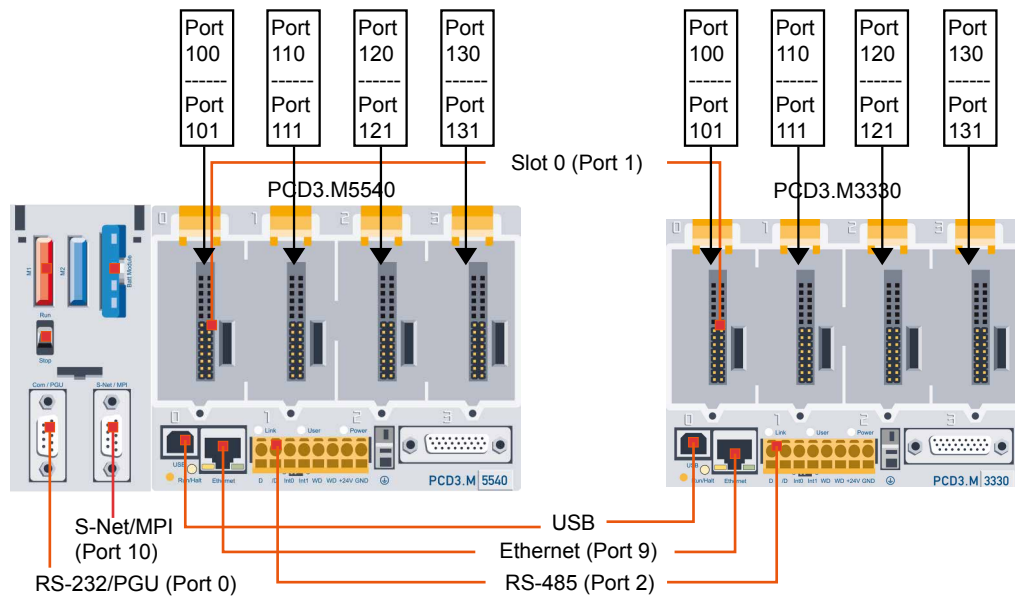
The following points must be observed when using the PCD3.F2xx interface modules:

- For each Saia PCD® system, up to 4 PCD3.F2xx modules (8 interfaces) can be used on slots 0...3.
- The PCD3 system has a powerful processor which handles the application as well as the serial interfaces. Processing of the interface modules requires the appropriate CPU capacity. To determine the maximum communication capacity per PCD3 system, note the following:
- The communication volume is determined by the peripheral devices connected. This will be the case, for example, where a PCD3 is used as an S-Bus slave station. If a PCD3 controller is bombarded with heavy telegram traffic at high baud rates, less CPU capacity will be left to handle the actual application. The following rules apply here: the use of 8 interfaces at 9.6 kbps takes approx. 50% of CPU capacity. Two interfaces at 57.6 kbps also take up approx. 50% of CPU capacity. Two interfaces at 115 kbps require approx. 60% of CPU capacity.
- If the PCD3 is the initiator of the communication, the communication volume, and hence the communication capacity, will be determined by the user program in the PCD3 (PCD3 used as master station). Theoretically, all interfaces can be run at the maximum baud rate of 115 kbps. However, the effective data throughput will be governed by the user program and the number of interfaces, and may be quite low. The crucial factor is that the peripheral devices connected can be run with the selected configuration and communication capacity.

5.6.2 Communication ports on the PCD3.Mxxxx

The PCD3.F2xx modules are designed to be mounted in I/O slots 0...3 on a PCD3.Mxxxx. As shown in the figure below, the I/O slots are designated as follows:

- I/O slot 0: Port 100 for the x.0 port on the PCD3.F2xx module
Port 101 for the x.1 port on the PCD3.F2xx module
- I/O slot 1: Port 110 for the x.0 port on the PCD3.F2xx module
Port 111 for the x.1 port on the PCD3.F2xx module
- I/O slot 2: Port 120 for the x.0 port on the PCD3.F2xx module
Port 121 for the x.1 port on the PCD3.F2xx module
- I/O slot 3: Port 130 for the x.0 port on the PCD3.F2xx module
Port 131 for the x.1 port on the PCD3.F2xx module

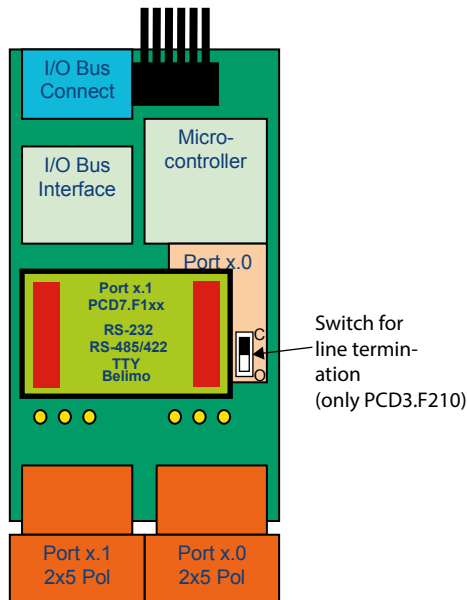


5

If a PCD3.F2xx module is inserted in I/O slot 0, port 1 cannot be used. Instead, the PCD3.F2xx occupies ports 100 and 101.

5.6.3 Module overview

The PCD3.F2xx communication modules are designed for the PCD3.Mxxxx systems. Each module has two serial ports, one fixed interface and a second that can be established by the use of a PCD7.F1xx module.



PCD3.F210

Serial communication module with two serial interfaces

Port x.0: RS-422 / RS-485
(fixed on PCD3.F210 module)

Port x.1: Slot for PCD7.F1xx module

PCD3.F221

Serial communication module with two serial interfaces

Port x.0: RS-232
(fixed on PCD3.F221 module)

Port x.1: Slot for PCD7.F1xx module

PCD3.F281

Serial communication module with two serial interfaces

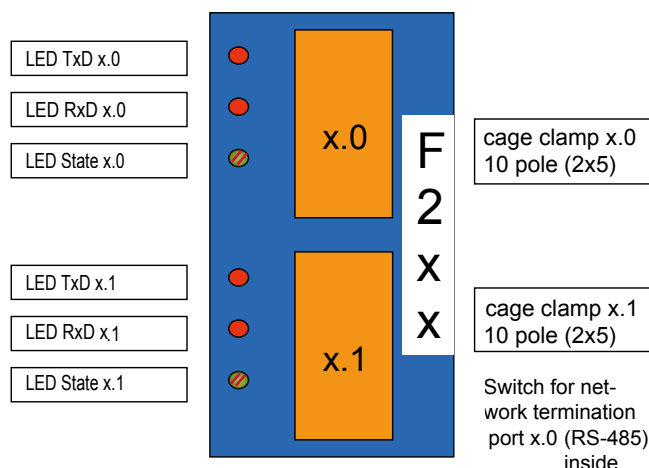
Port x.0: Belimo MP-Bus
(fixed on PCD3.F281 module)

Port x.1: Slot for PCD7.F1xx module

PCD7.F1xx modules (for connection to Port x.1 on the PCD3.F210/221/281)

- PCD7.F110 Serial interface module RS-422 / RS-485
- PCD7.F121 Serial interface module RS-232, for modem connection
- PCD7.F130 Serial interface module, current loop 20 mA
- PCD7.F150 Serial interface module, RS-485, electrically isolated
- PCD7.F180 Serial interface module for Belimo MP bus,
for max. 8 actuators and sensors

Connections and LEDs



5

Summary of connections

RS-232				RS-422				RS-485			
0	PGND	TxD	1	0	PGND	Tx	1	0	PGND	Rx-Tx	1
2	RxD	RTS	3	2	/Tx	Rx	3	2	/Rx-/Tx		3
4	CTS	PGND	5	4	/Rx	PGND	5	4		PGND	5
6	DTR	DSR	7	6	RTS	/RTS	7	6			7
8	COM	DCD	9	8	CTS	/CTS	9	8	(SGD)		9

TTY (CL)				Belimo MP bus			
0	PGND	TS	1	0	PGND	MP	1
2	RS	TA	3	2	,MFT'	,IN'	3
4	RA	PGND	5	4		PGND	5
6	TC	RC	7	6			7
8	TG	RG	9	8			9

Spring terminal block (supplied)

Each serial port has its own individual 10-pole spring terminal block. The F2xx module is fitted with two spring terminal blocks, the upper one for Port x.0 and the lower for Port x.1.

Maximum wire gauge: 1.0 mm² AWG 18

LEDs

LED TxD: Send data detection

LED RxD: Receive data detection

LED status: The "Status" LED displays the status of the serial port, 'green' means that the port is working properly

- Both LEDs permanently red: F2xx not running
- Both LEDs green 25% / red 75%: F2xx start-up procedure
- Both LEDs green 50% / red 50%: F2xx running, but no communication with PCD3.Mxxxx
- Status LED green 75% / red 25%: F2xxx running, Interface still not assigned by the program
- Status LED green 100%: F2xxx running, Interface assigned

Technical data**Communication modes supported:**

MC0 Character mode, no automatic handshake
 MC1 Character mode with RTS/CTS handshake
 MC2 Character mode with Xon/Xoff protocol
 MC4 Character mode for RS-485 interface
 MC5 As MC4 with rapid switching between sending and receiving

SM1 S-Bus master, parity mode
 SM2 S-Bus master, data mode
 SS1 S-Bus slave, parity mode
 SS2 S-Bus slave, data mode

GS1 S-Bus Gateway slave, parity mode
 GS2 S-Bus Gateway slave, data mode

GM S-Bus gateway master
 → Gateway always via PCD3.

Baud rates supported (bits/sec):

1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200

Current consumption:		+5 V bus	V+
Base module	Port x.1 config.	[I in mA]	[I in mA]
PCD3.F210	none	110	0
	PCD7.F110	150	0
	PCD7.F121	125	0
	PCD7.F130	190	22
	PCD7.F150	240	0
	PCD7.F180	125	15
PCD3.F221	none	90	0
	PCD7.F110	130	0
	PCD7.F121	105	0
	PCD7.F130	120	22
	PCD7.F150	225	0
	PCD7.F180	105	15
PCD3.F281	none	90	15
	PCD7.F110	130	15
	PCD7.F121	105	15
	PCD7.F130	115	15
	PCD7.F150	225	15
	PCD7.F180	105	30

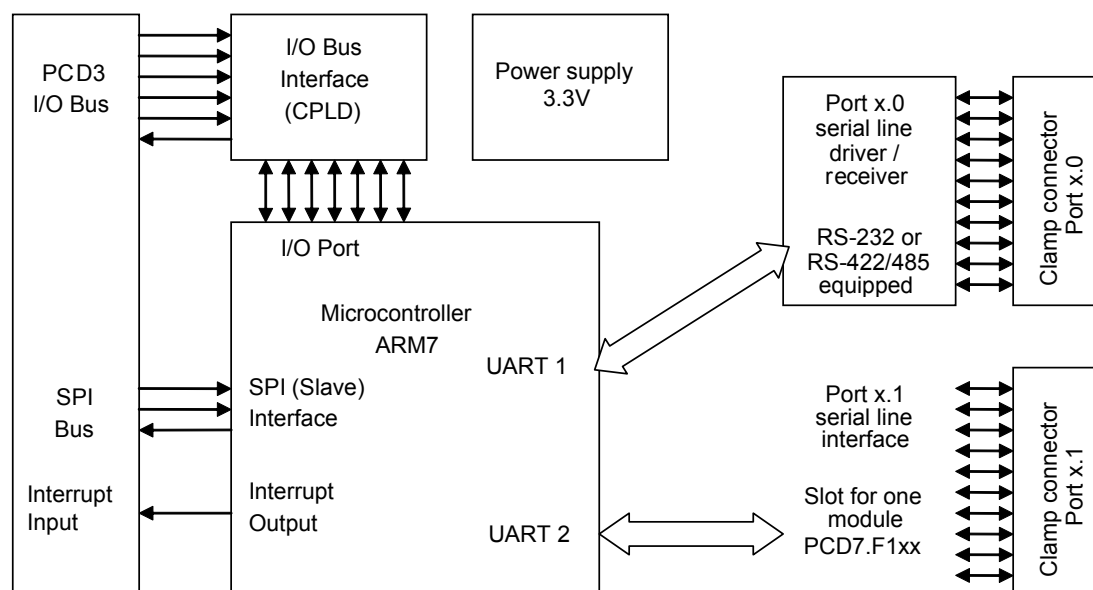
Restrictions:

The PCD3.F2xx modules for the PCD3 systems offer the possibility of implementing up to 8 additional serial interfaces. It should be noted that each additional interface adds to the load on the PCD3.Mxxxx CPU.

The use of these 8 ports is dependent on the type of communication, the baud rate required and the volume of data transferred. Other key factors are:

- Communication on the PCD3.Mxxxx, such as Profi-S-Net, Ether-S-Net, USB
- Use of the web server
- Data transfer from CPU to memory
- User program in the PCD3.Mxxxx

The exact system limits have still to be confirmed.

Block diagram

5

5.6.4 Port x.0: RS-422/485 auf Modul PCD3.F210

The PCD3.F210 module contains two different interface types on Port x.0: RS-422 with RTS/CTS and RS-485 (electrically connected). The line termination is integrated into the module and can be enabled by means of a switch on the module. To switch it on (activate line termination resistors), the module casing must be opened as described in section 6.1.5 “Open the module housing”.

RS-422 mode

RS-422				
0	PGND	Tx		1
2	/Tx	Rx		3
4	/Rx	PGND		5
6	RTS	/RTS		7
8	CTS	/CTS		9

10-pole spring terminal block

Line termination in RS-422 mode always uses 150 Ω resistor on the PCD3.F210.

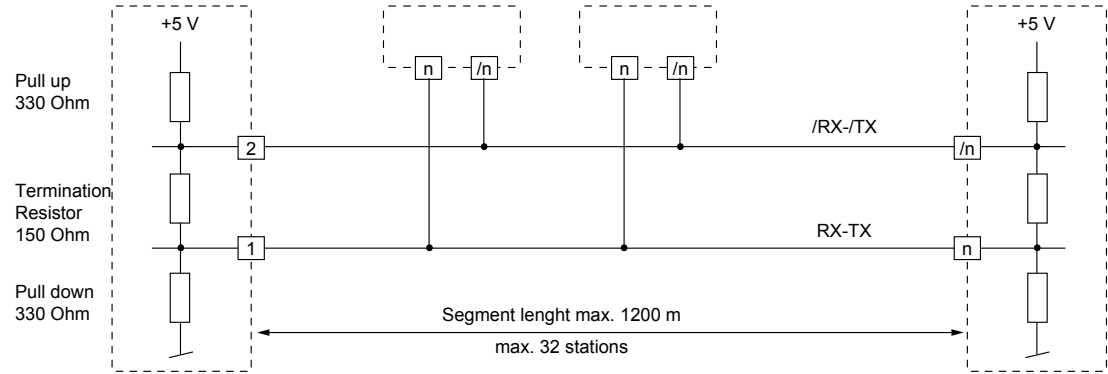
RS-485 mode

(Electrically connected RS-485 interface)

RS-485				
0	PGND	Rx-Tx		1
2	/Rx-/Tx			3
4		PGND		5
6				7
8	(SGD)			9

10-pole spring terminal block

Connection:



The line termination for Port x.0 is integrated into the module and can be enabled by means of a switch on the module. On the base plate next to the switch are the codes 'O' for OPEN and 'C' for CLOSED.

5.6.5 Port x.0: RS-232 on PCD3.F221 module (for modem)

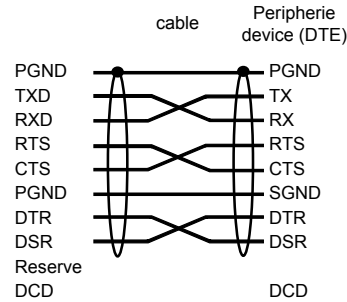
The PCD3.F221 module offers a complete RS-232 interface on Port x.0. This port is intended mainly for modem connections such as RTS/CTS, DTR/DSR and DCD.

RS-232 connection

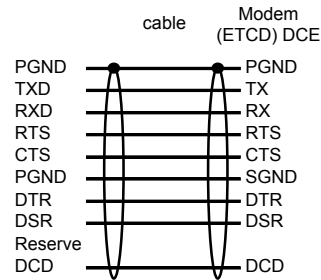
RS-232				
0	PGND	TxD		1
2	RxD	RTS		3
4	CTS	PGND		5
6	DTR	DSR		7
8	COM	DCD		9

10-pole spring terminal block

RS-232 connection to DTE:



RS-232 connection to DCE:



5.6.6 Port x.0: Belimo MP-Bus on module PCD3.F281

The PCD3.F281 module offers a complete Belimo MP-Bus interface on Port x.0. An MP-Bus with up to 8 drives and sensors can then be connected to Port x.0.

Belimo connection

Belimo MP bus

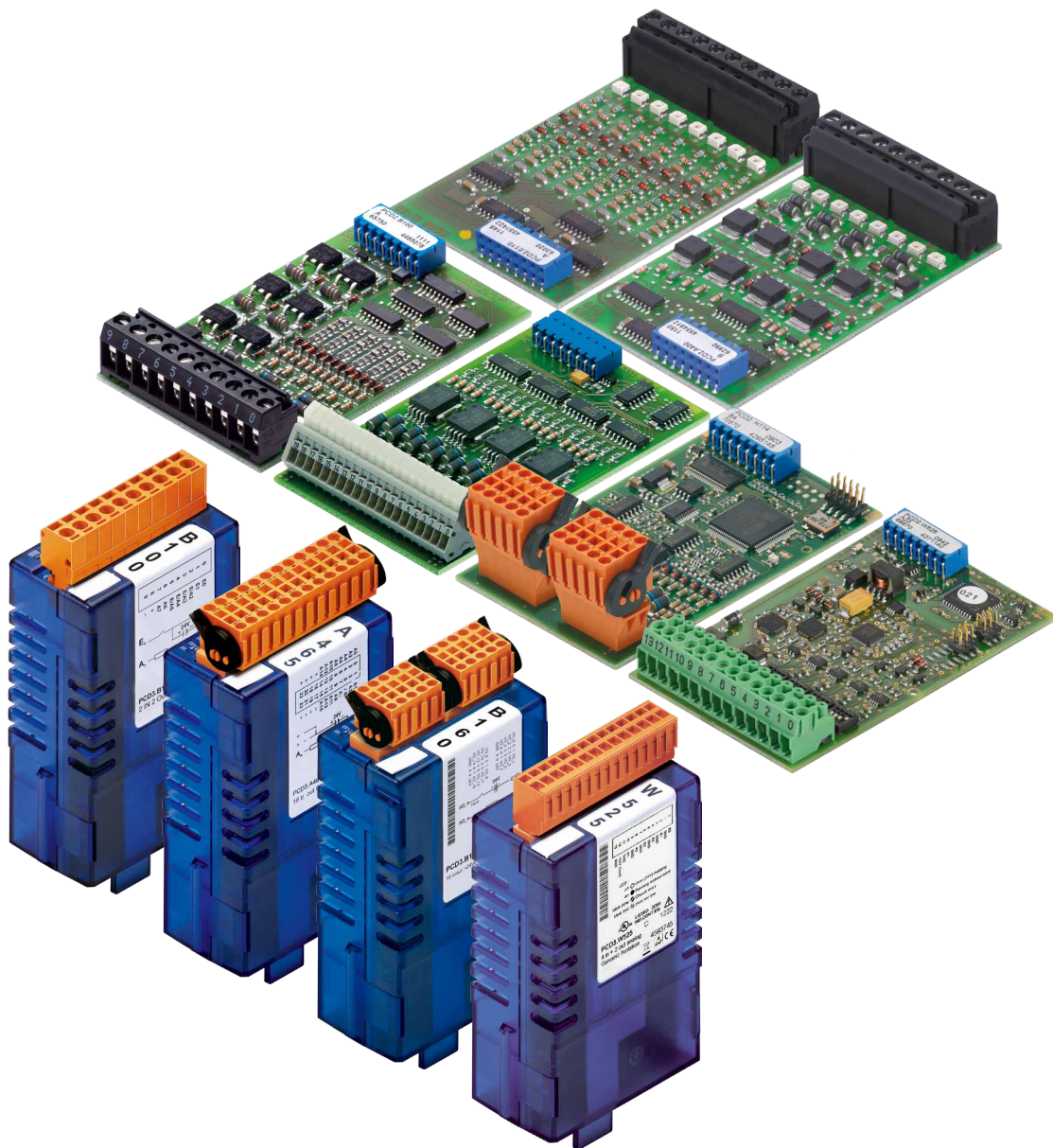
0	PGND	MP	1
2	,MFT'	,IN'	3
4		PGND	5
6			7
8			9

10-pole spring terminal block

5.7 LIOs and RIOs

The description of the interfaces for the PCD3.Cxxx and Txxx can be found in the sections on chapitre 3. "PCD3.Mxxxx Classic CPUs and extension housings" and chapter 4."RIO (remote input/output) head stations".

6 Input/output (I/O) modules



6

All I/O-modules for the series PCD1 | PCD2 and PCD3 are described in the manual 27-600.

7 Configuration

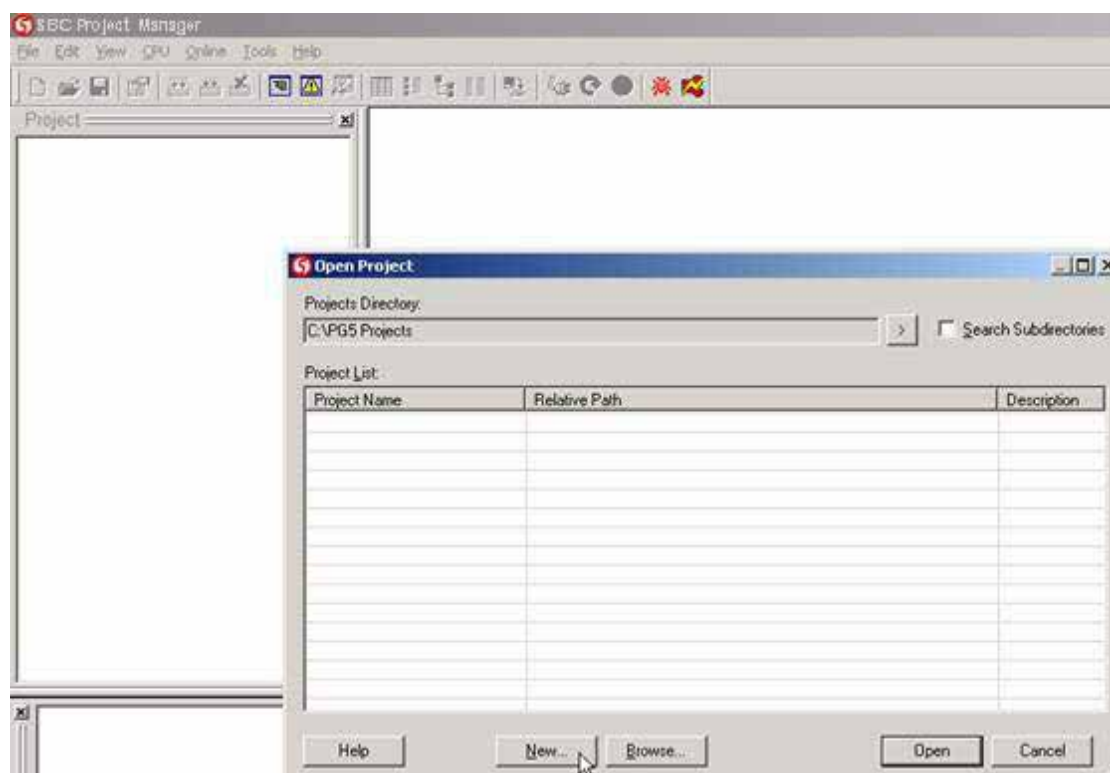
7.1 CPUs

This section assumes that the user is familiar with the PG5 software. If not, please refer to Manual 26/733 “PG5”.

7.1.1 Configuring the Saia PCD® with Saia PG5®

Connecting the Saia PCD® to the configuration with PG5:

- ❶ Start up PG5 1.3
- ❷ Create new project:
 - Click on “New...”



- The “New Project” dialogue is displayed

Creating and opening a new project.

The dialogue box is brought up via "File/New Project". The size of the dialogue box can be changed by dragging the bottom right corner or by dragging the frame.

Project Name

Name of the project to be created. This is used as the directory name for the project. It must not include any path or file extension.

Project Directory

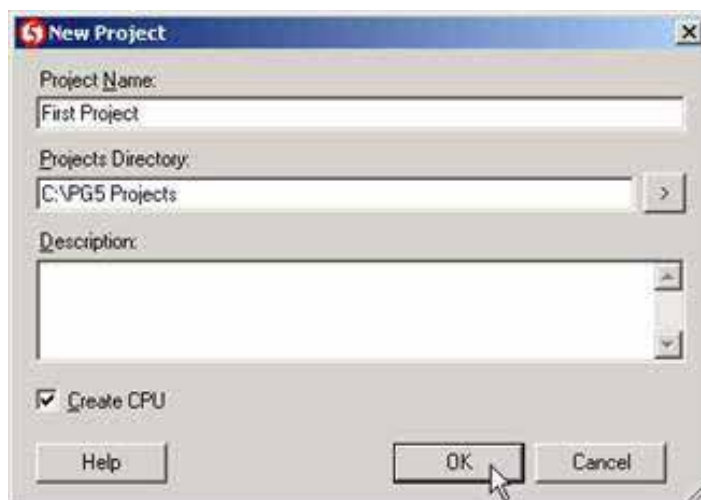
Directory containing the new project. The specified project directory is set up via "Options", "Directories page". The '>' button can be used to browse for a directory.

Description

May contain up to 2000 characters of free text. The first line of text is displayed in the "Description" window in the "Open Project" dialogue box.

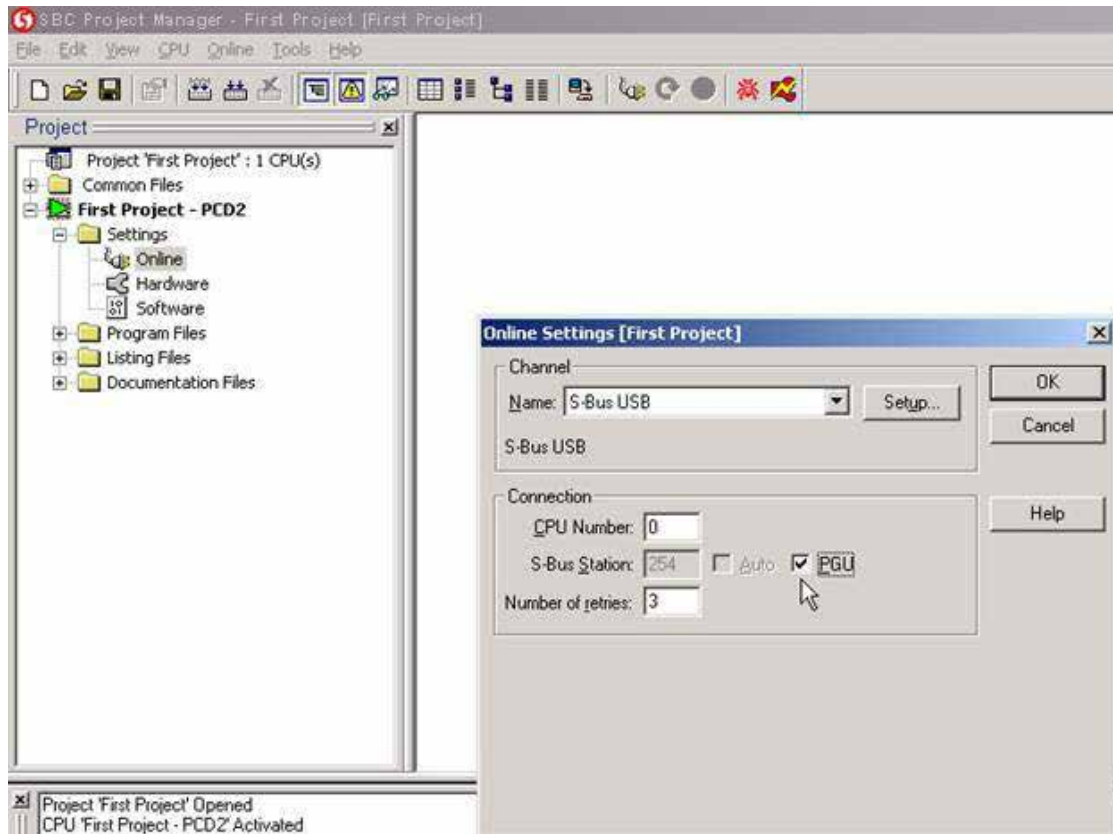
"Create CPU" box

If this box is ticked, a CPU with the same name is created automatically (the name can be changed later in CPU properties). This is useful for single CPU projects. If it is not ticked, a project will be created without any CPU. The "New CPU" command can be used to add a CPU.



- Enter project name, e.g. "First Project"
- Check "Create CPU" option
- Click "OK"

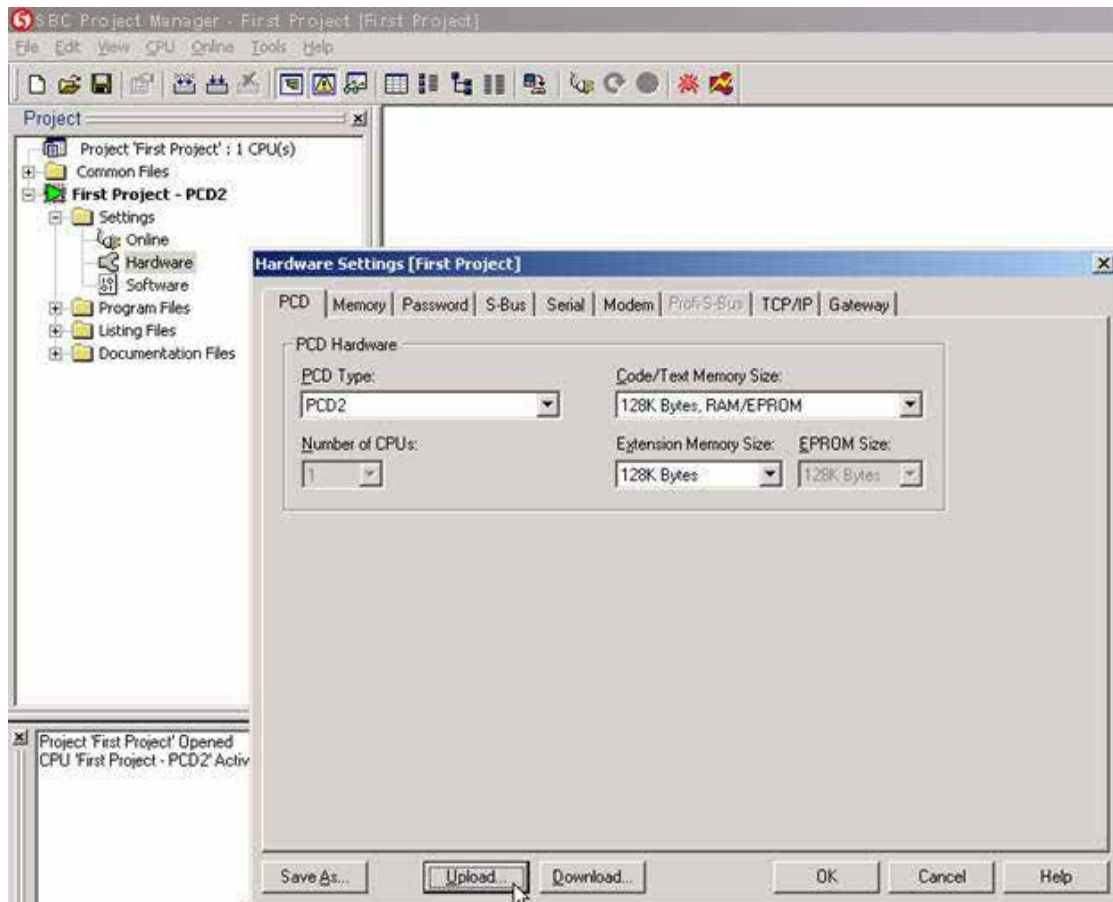
- ③ Go to "Online Settings" and select the following options:
 - Channel name: S-Bus USB
 - Tick PGU option
 - Click "OK"



7

- ④ Now connect the Saia PCD® to the PC via the USB cable. Ensure that the PCD is connected to the 24 VDC supply.

- 5 Go to “Hardware Settings”:
 - Click on “Upload...”, to copy the settings from the CPU.

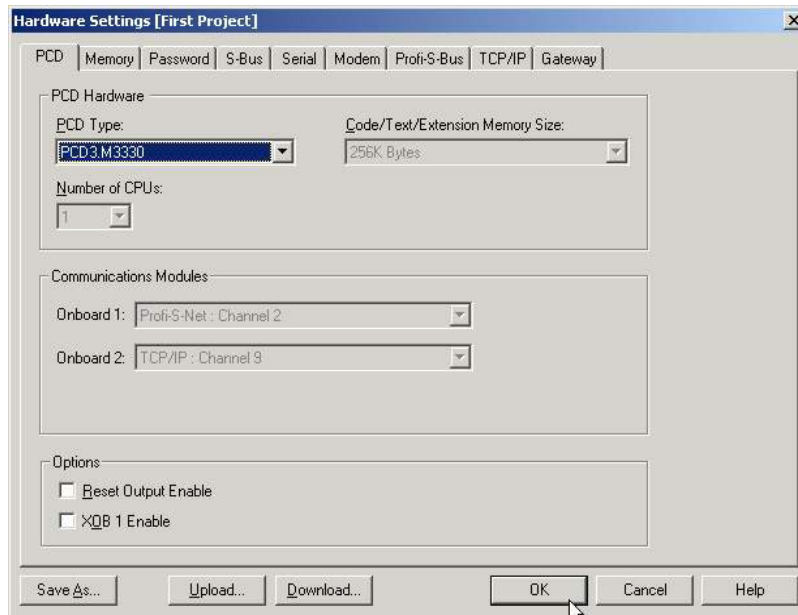


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- Click on “Upload...”



- Click “OK”



7

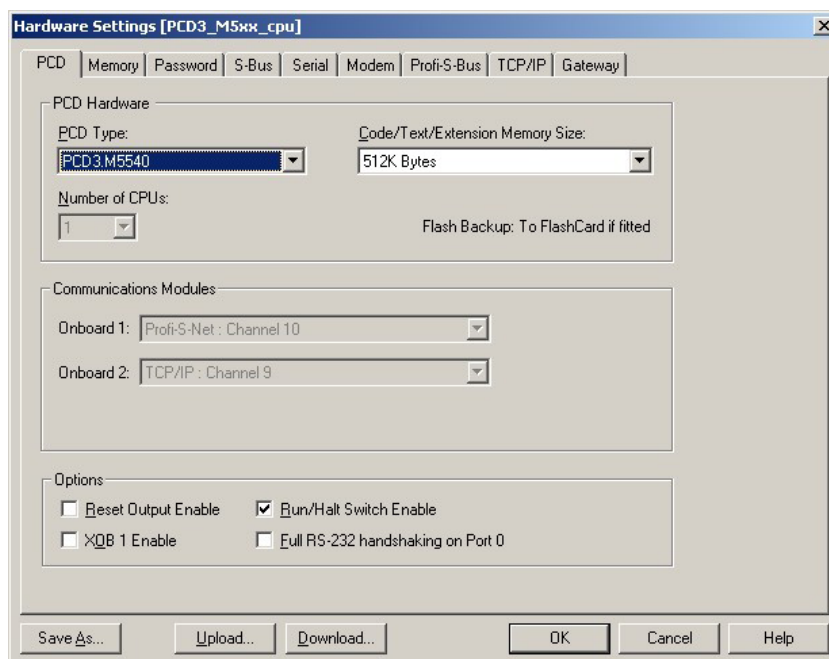
The connection of the Saia PCD® to the configuration with PG5 via the PC is complete. The hardware settings can now be changed and programming the application can begin.

7.1.2 "Hardware settings" option

The PCD3.Mxxxx CPUs do not have any "jumpers" to be set. As with earlier Saia PCD® systems, the settings are entered in PG5 on the "Hardware Settings" screen. After you have selected the desired settings, they will be loaded into the PCD3.Mxxxx when you click "Download...".

If "Upload..." is pressed, the current settings for the CPU will be displayed.

Example: PCD3.M5540 settings

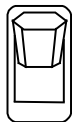


Reset Output Enable

If the CPU goes into Halt or Stop mode, all outputs are set to 0.

XOB 1 Enable

Where PCD3.Cxxxx module holders are used, a cable break or power outage is displayed by calling XOB 1.

Run/Halt Switch Enable

Run

Stop

The Run/Halt switch is activated. On the PCD3.M5xx0, it is thus possible to manipulate the operating mode with the switch that is accessible on the front of the CPU

Full RS-232 handshaking on Port 0

This allows Port 0 to be used as a normal serial port or as a modem interface.



If this option is enabled, it will no longer be possible to communicate with the CPU via the PGU port. This setting should only be used when the USB port or the Ethernet connection are being used for programming.



All these options are written to the “flash card” when the settings are backed up.

7.2 RIOs

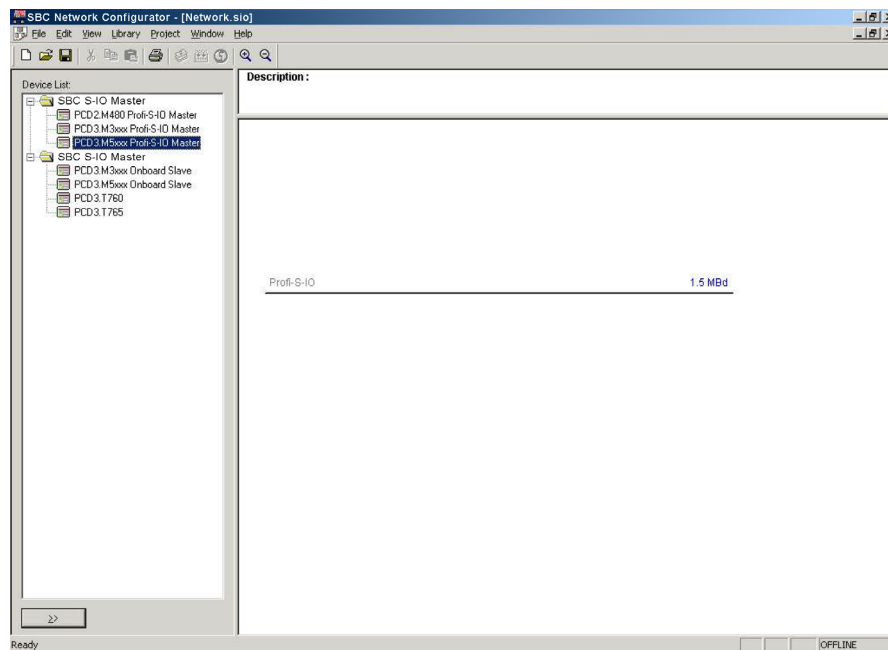
The following description assumes that the user is familiar with the PG5 software. If not, you are advised to read manual 26/733 "PG5".

7.2.1 Example project with Saia PG5® and Profibus-S-IO

- Launch the PG5 software
- Open a new project with the name "NETWORK"
- Select CPU with the name "Master"
- Hardware and software settings are dependent on the Saia PCD® selected.

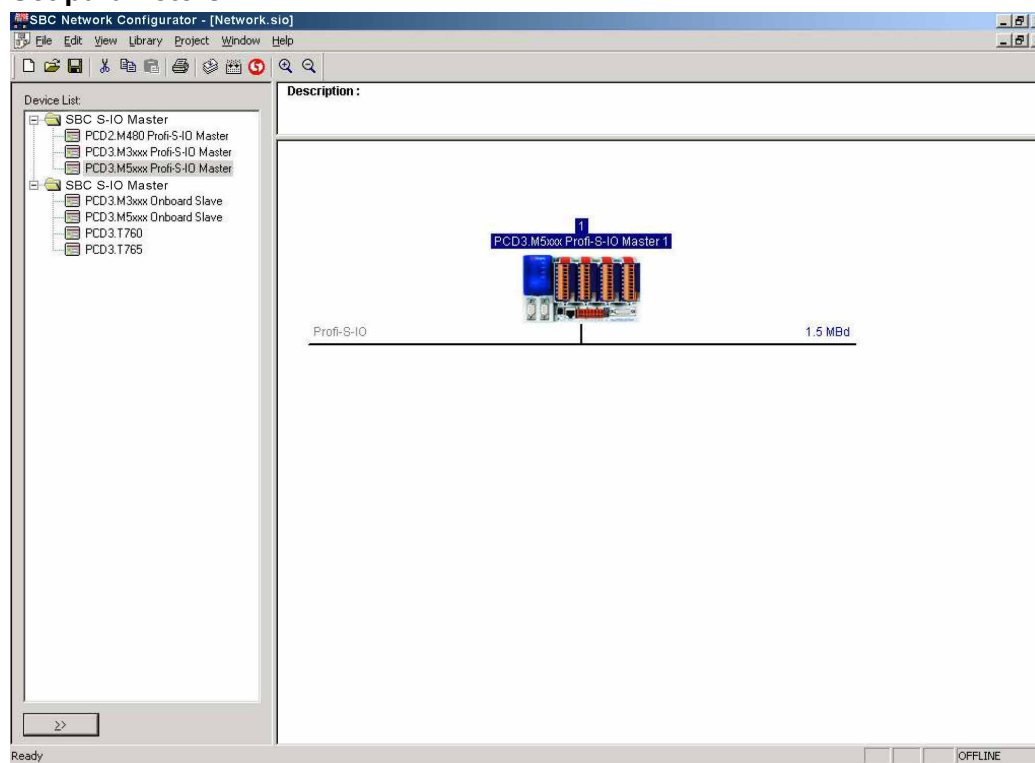
Definition of the "Master" PCD

First, the network structure has to be defined. Under "Program files", open a new file for the CPU concerned, with the name "NET_Topo.sio". The file extension *.sio identifies a Profibus-S-IO network file. After entering the file name and pressing "Enter", the "Network Configurator" window is displayed, with the relevant file name.



Here, a PCD3 has already been selected as "Master". By pressing

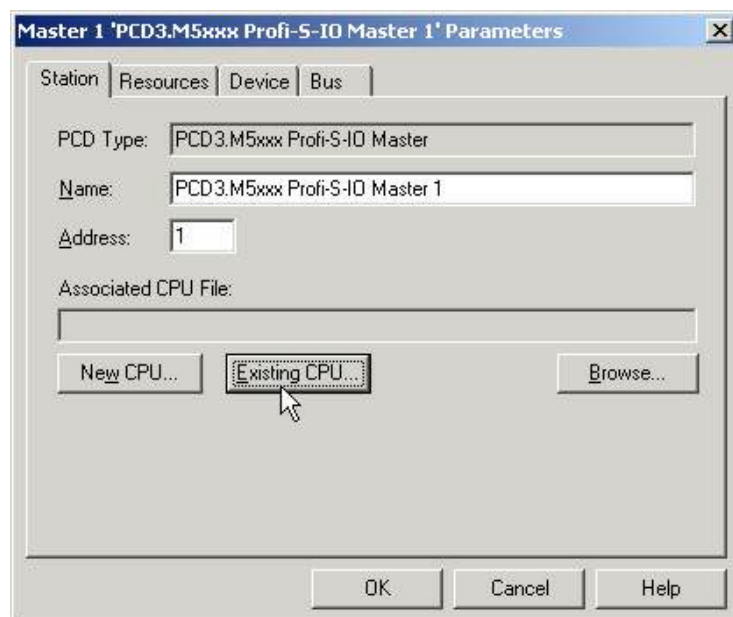
Set parameters



Double-clicking on the “PCD3.M5xxx Profi-S-IO Master 1” icon opens a configuration window with four tabs. The figure “1” above the name of the icon indicates the network address of the Saia PCD®.

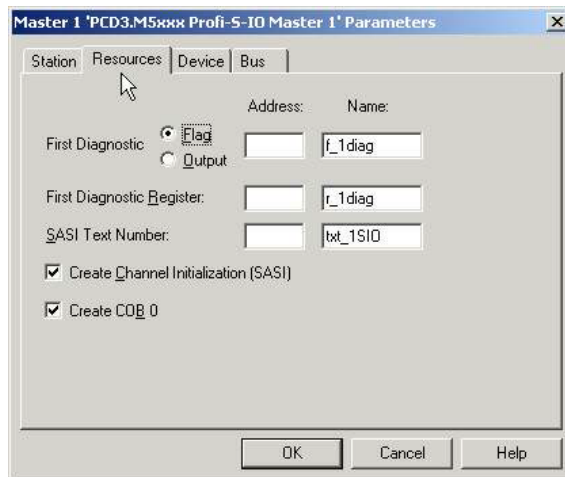
“Station” tab

The “Associated CPU File” field is used to enter the desired CPU name. By pressing the “Existing CPU...” button, a specific CPU can be selected from the list. This tells the Configurator which CPU should be mapped to the icon.



“Resources” tab

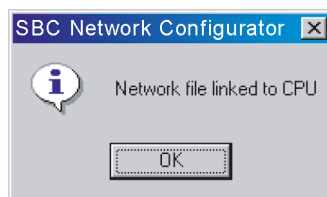
Every communication application in the Saia PCD® requires flags, registers and an initialization text. These elements can be specified here. The Configurator normally takes dynamic elements. Remember: “Project Manager”→“CPU”→“Settings”→“Software”→“Dynamic Space”.



7

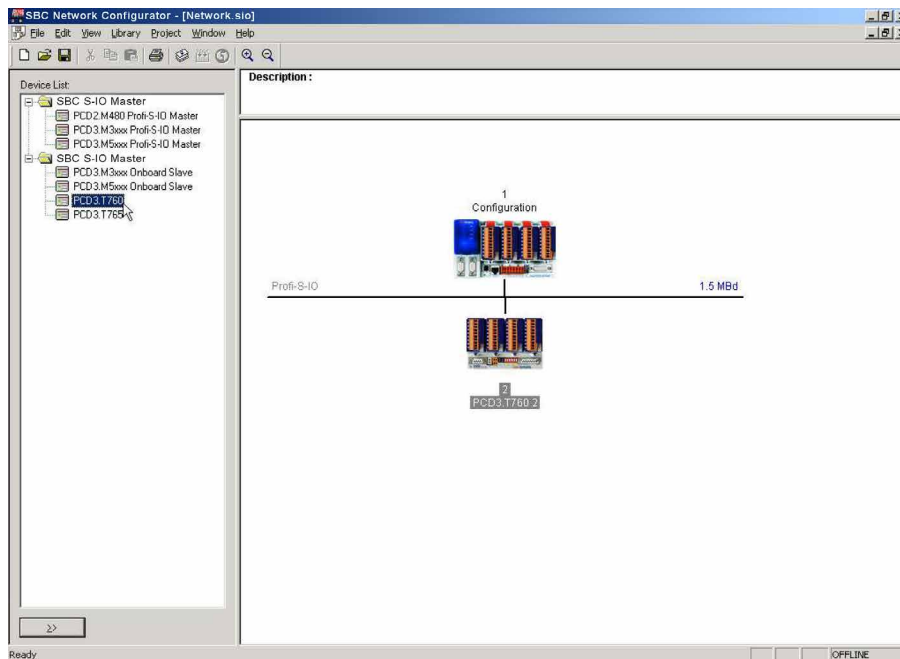
These are the entries for this CPU; click "OK" to finish.

Confirmation:



Definition of PCD3.RIO

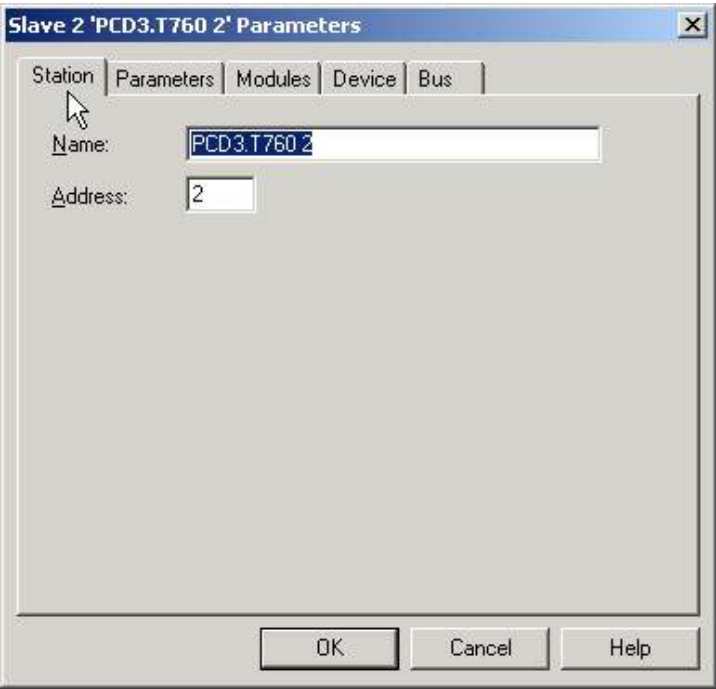
One PCD3.RIO has already been positioned in this window.



Double-click on the “PCD3.RIO DP Slave” icon.

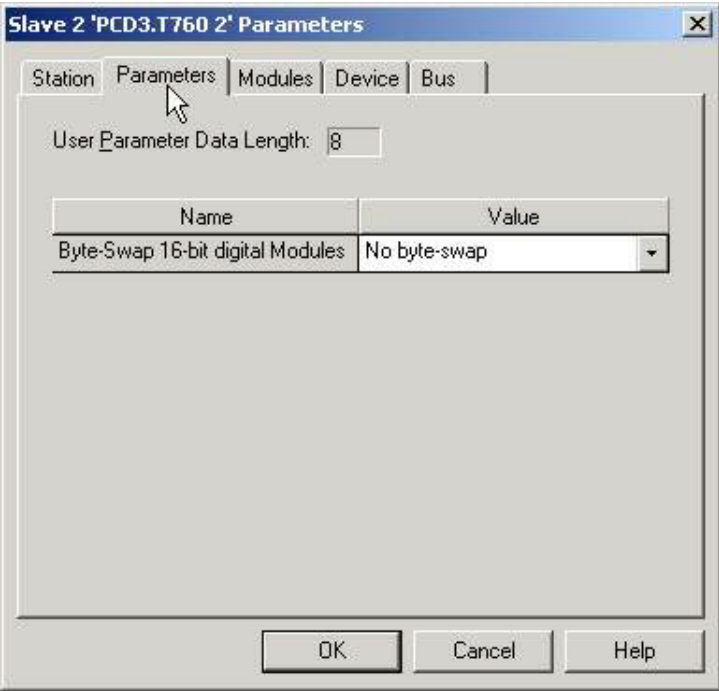
“Station” tab

Enter a meaningful name for the RIO node in the "Name" field. The “Address” field must contain the station address set on the RIO with the DIP switch.



7

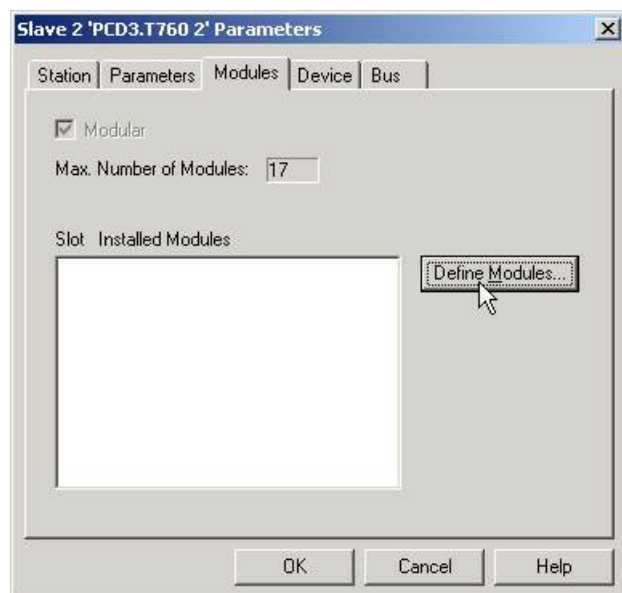
“Parameters” tab



Option to swap the “Low” byte with the “High” byte for a 16-channel I/O module.

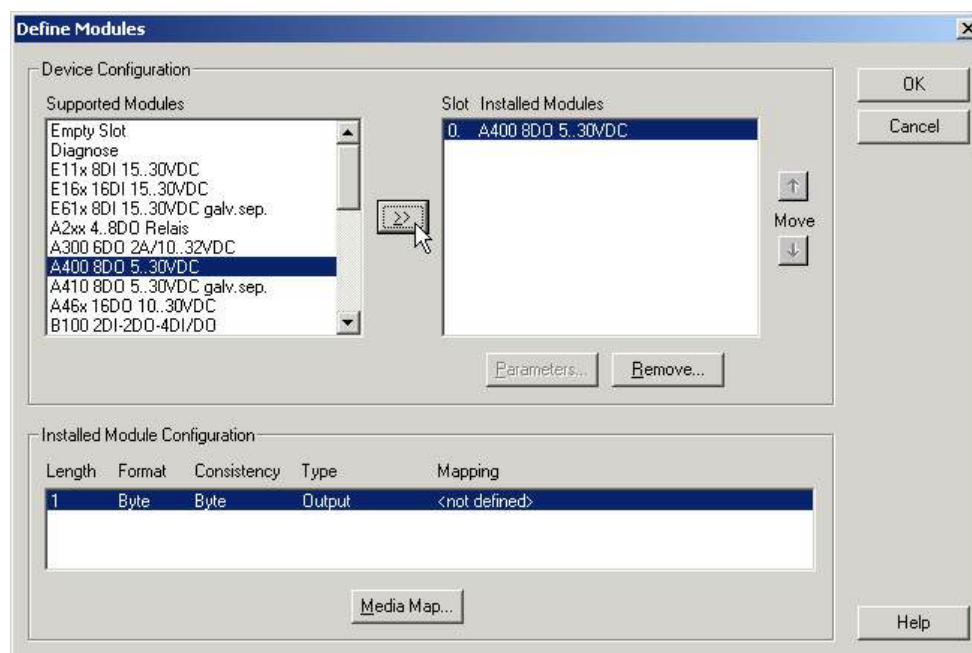
“Modules” tab

This window is used to define the I/O modules. At present, no module is defined; the "Define Modules..." button has to be selected.



7

Select a suitable module, e.g. a PCD3.A400, from the “Supported modules” field and copy to the right-hand field within the window.



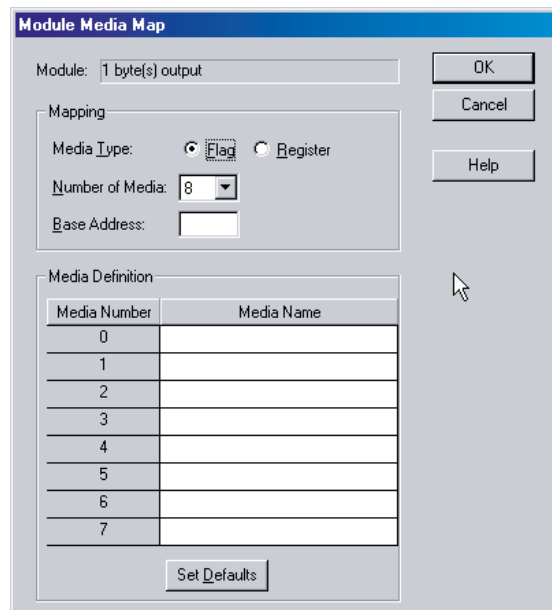
The bottom part of the window shows information on the copied modules under “Installed Module Configuration”.

Select next module.

As the exchange of data between Master (PCD3.CPU) and Slave (PCD3.RIO) is controlled by flags and registers, these must be mapped to the I/O modules.

The "diagnostic module" can be used to exchange diagnostic information between Master and RIO. The use of a Diagnostic module is not mandatory. This "diagnostic module" must be configured after the last I/O module:
detailed description in section 3.19.6.

Clicking on the “Media Map...” button opens a window with this name, where Saia PCD® elements and symbol names can be specified.



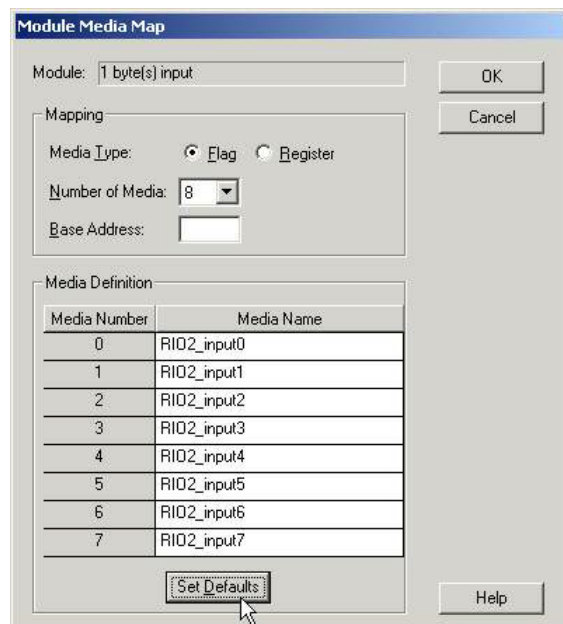
The dialog box is titled "Module Media Map". It has a "Module:" field set to "1 byte(s) output". There are "OK", "Cancel", and "Help" buttons on the right. The "Mapping" section includes "Media Type" with radio buttons for "Flag" (selected) and "Register", a "Number of Media:" dropdown set to "8", and a "Base Address:" field. The "Media Definition" section contains a table with 8 rows, each with a "Media Number" (0-7) and a "Media Name" field. A "Set Defaults" button is at the bottom.

Media Number	Media Name
0	
1	
2	
3	
4	
5	
6	
7	

7

The user either enters the “Base Address” for the number of elements defined in the “Number of Media” field, or enters the symbol names in the fields under “Media Name” (PG5 then takes the dynamic resources from the “Software Settings”).

More convenient: first define the symbol name for “Media Number 0”, and then press the “Set Defaults” button; the elements will be automatically numbered from 0 to 7.

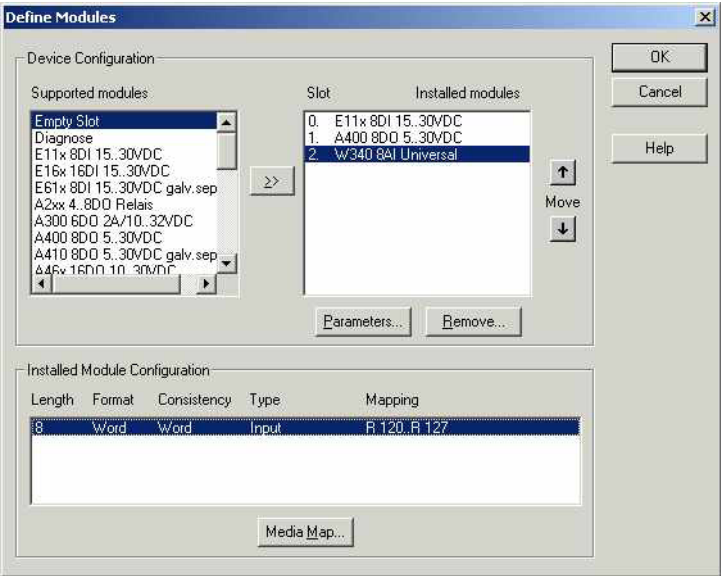


The dialog box is titled "Module Media Map". It has a "Module:" field set to "1 byte(s) input". There are "OK", "Cancel", and "Help" buttons on the right. The "Mapping" section includes "Media Type" with radio buttons for "Flag" (selected) and "Register", a "Number of Media:" dropdown set to "8", and a "Base Address:" field. The "Media Definition" section contains a table with 8 rows, each with a "Media Number" (0-7) and a "Media Name" field. A "Set Defaults" button is at the bottom.

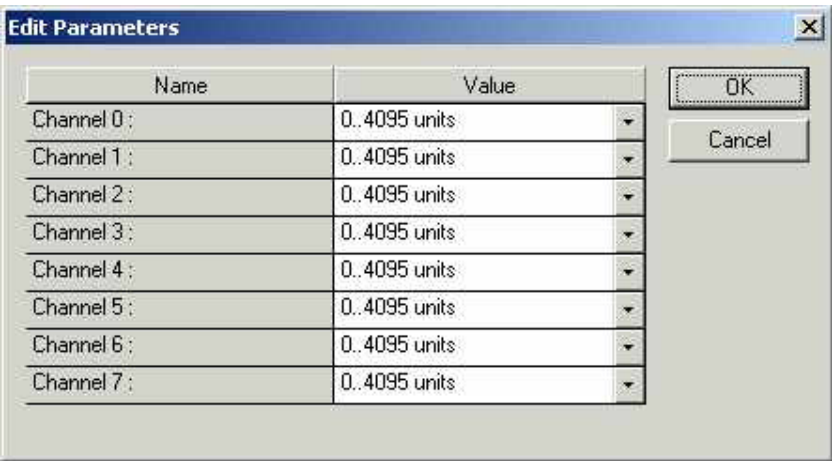
Media Number	Media Name
0	RIO2_input0
1	RIO2_input1
2	RIO2_input2
3	RIO2_input3
4	RIO2_input4
5	RIO2_input5
6	RIO2_input6
7	RIO2_input7

Further RIO I/O modules can be configured in the same way.

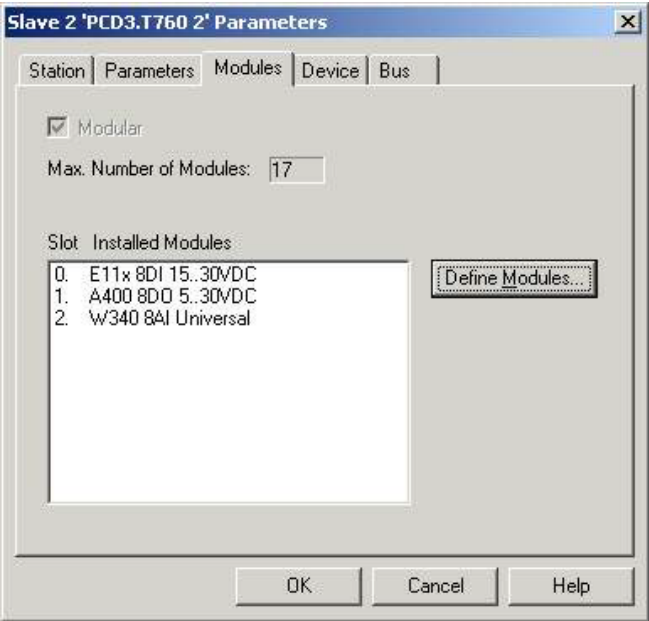
Some I/O modules can be parameterized. An example, with parameters for the PCD3.W340:



7



The result is a list of all the modules required in this example.



“Device” tab

Information on current RIO nodes

The screenshot shows the 'Device' tab of the 'Slave 2 PCD3.T760 2' Parameters dialog box. The tabs are Station, Parameters, Modules, Device, and Bus. The Device tab is active, displaying the following information:

Vendor Name:	Saia Burgess Controls AG
Model Name:	PCD3.T760
Revision:	V 1.03
Ident Number:	0xCD32
Protocol Ident:	0
Station Type:	0
Hardware Release:	Index A
Software Release:	V1.011
☐ Freeze Supported	
☐ Sync Supported	

At the bottom are buttons for OK, Cancel, and Help.

7**“Bus” tab**

Information on possible transmission rates

The screenshot shows the 'Bus' tab of the 'Slave 2 PCD3.T760 2' Parameters dialog box. The tabs are Station, Parameters, Modules, Device, and Bus. The Bus tab is active, displaying a table of supported baud rates and a watchdog time setting.

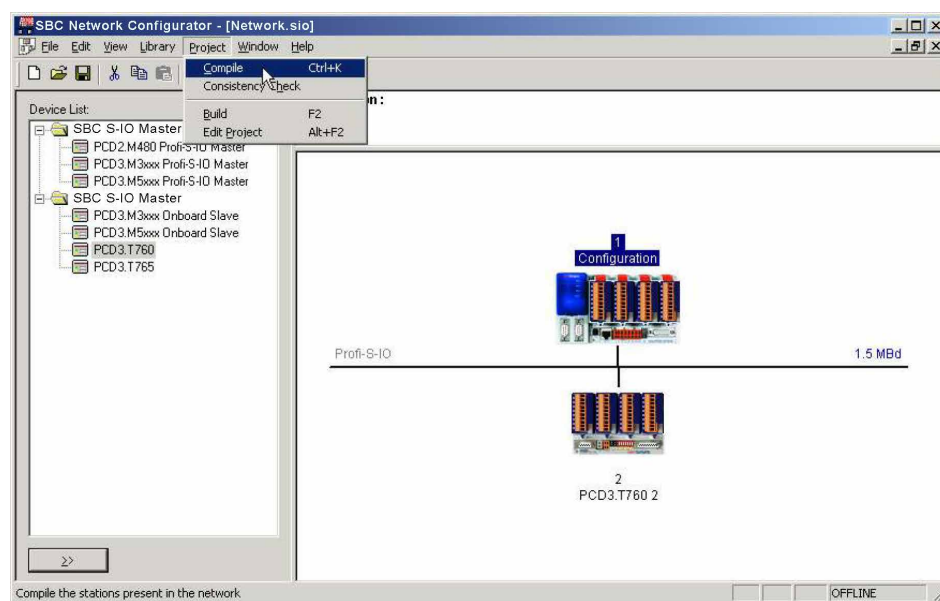
Supp. Baudrate	Max Tsd
☐ 9.6 kBd	
☐ 19.2 kBd	
☒ 93.75 kBd	60
☒ 187.5 kBd	60
☒ 500 kBd	100
☒ 1.5 MBd	350
☐ 3 MBd	
☐ 6 MBd	
☐ 12 MBd	

Below the table is a 'Watchdog Time' field with the value '9' and a multiplier of 'x 10ms'.

At the bottom are buttons for OK, Cancel, and Help.

Complete the configuration of the RIO node by pressing "OK".

The next step is to compile the configuration with the DP Configurator.

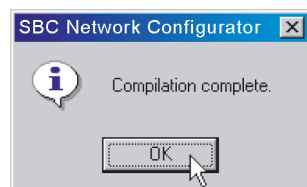


Acknowledge the message below with "Yes".

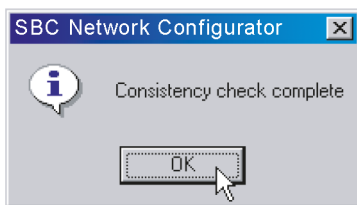
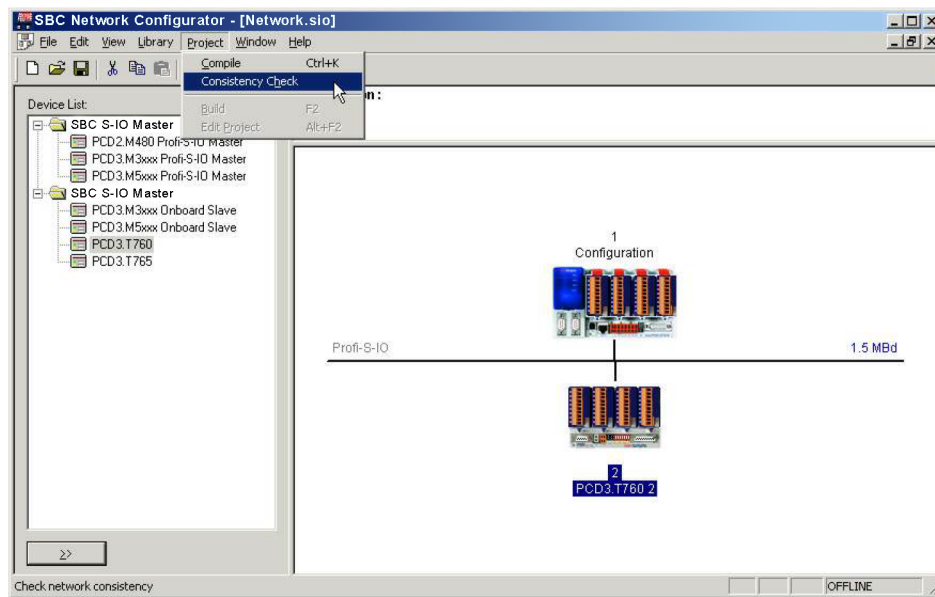


If an error message is returned during the compilation, all details entered for this example should be checked from the beginning.

If everything is OK:



The “Consistency check” function can be used to check for possible conflicts with other elements of the user program.



7.2.2 Web server

The PCD3.T76x has an integrated web server. This can be accessed via any standard web browser such as Internet Explorer or Netscape Navigator, and used for commissioning and diagnostics. The connection between web server and web browser is via RS-232 (connecting cable PC ↔ PCD3.T76x: PCD3.K225).

The web server can also be accessed via Profibus.

The web server contains predefined device-specific web pages. These pages can be used to check and manipulate the status of digital and analogue inputs and outputs. The web server can also be used to configure the PCD3.T76x and the modules connected to it. Further information on the web server can be found in manual 26/790 "Web server".

Special requirements for the web server on the PCD3.T76x

The device-specific web pages for the PCD3.T76x require some special Java functions covered by Java Machine V1.4. These Java functions are not supported by Microsoft®Internet Explorer. The Java Machine should therefore be installed on the PC running the Web Connect software.

7

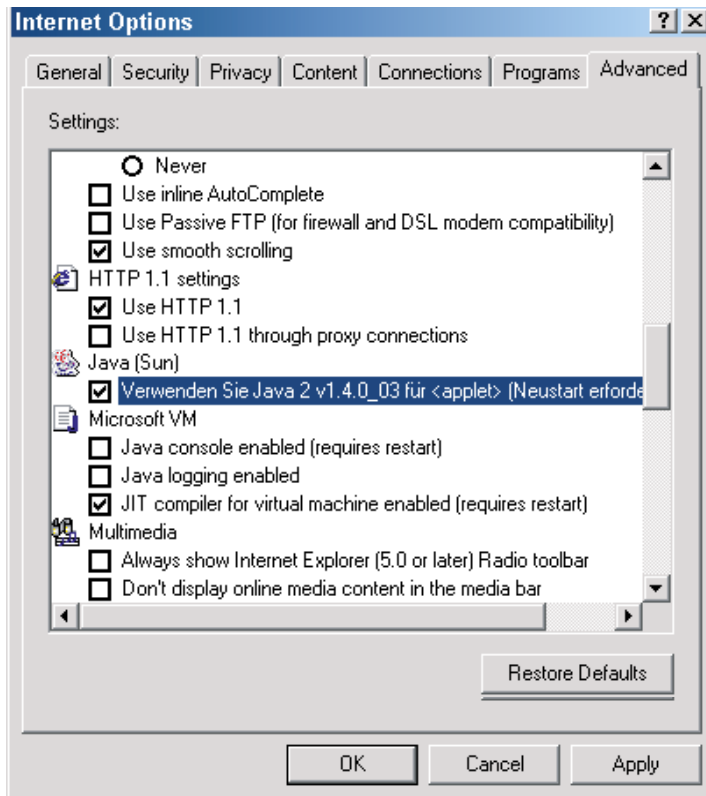
Java Machine

The software can be downloaded free of charge from Sun Microsystems, Inc at: <http://java.sun.com/getjava/index.html>; this also contains the whole installation procedure. The version must be V1.4 or higher; the file size is 8 MBytes. After installation, you will be asked whether the Java Machine is to be used with an Internet browser; reply "Yes".

To ensure that the installation has been executed correctly, launch Explorer, go to the "Tools" menu and select "Internet Options".



The window below will appear; select the "Advanced" tab and check that the JavaSun option is ticked:



The Java Machine installation was successful, and the Java applet can be used.

7.2.3 Device-specific web pages

Launch device-specific web pages

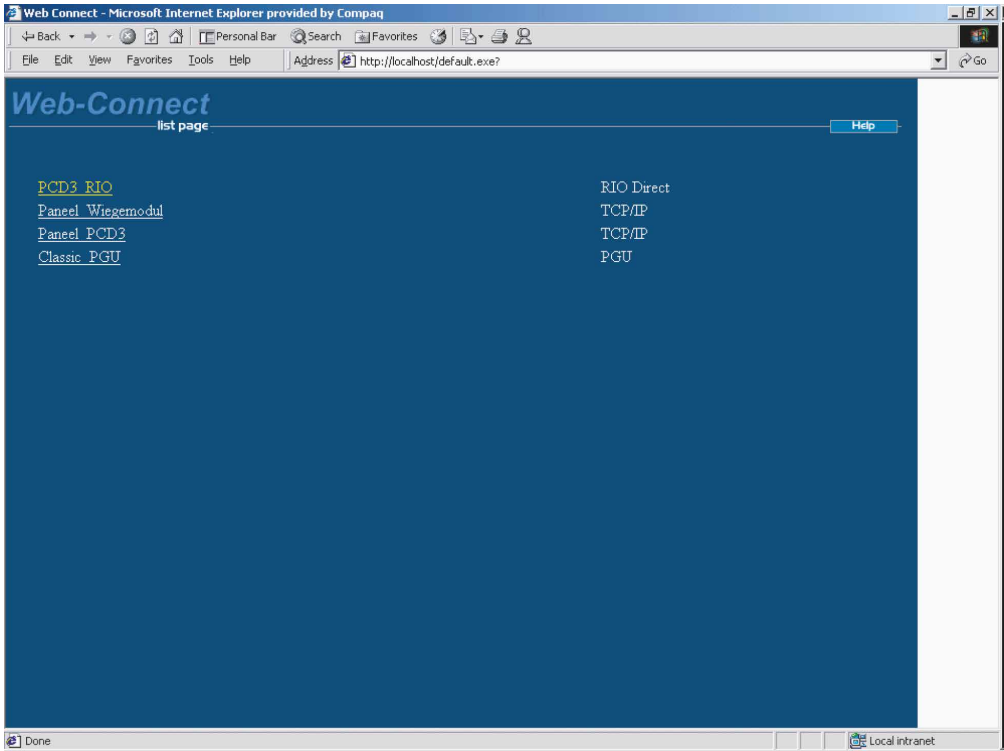
Connect the RS-232 interface on the PCD3.T76x to the PC with cable PCD3.K225. To access the web server on the PCD3.T76x, first launch the Web Connect software. For more detailed information, refer to the "Web Connect" section in manual 26/790 "Web server".



Once Web Connect is running, the device-specific web pages for the PCD3.T76x can be retrieved by starting up the web browser. Enter the correct URL in the address field within the web browser: `http://localhost/`

The screen will display a standard web page, similar to the page shown overleaf.

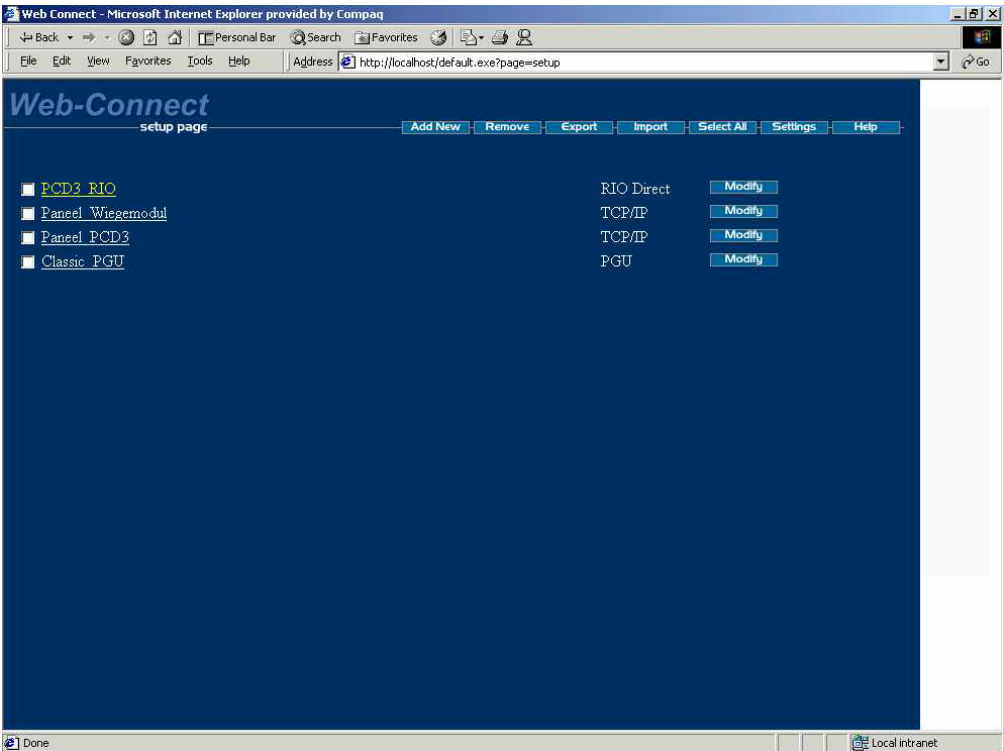
Now click on the link pointing to the PCD3.T76x.

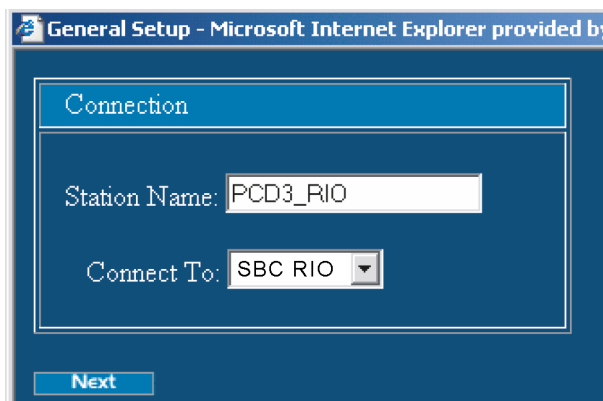


7



If no connection to the PD3.T76x has been defined, this can be rectified now, using the Setup page: <http://localhost/setup>





General Setup - Microsoft Internet Explorer provided by Saia-Burgess Controls AG

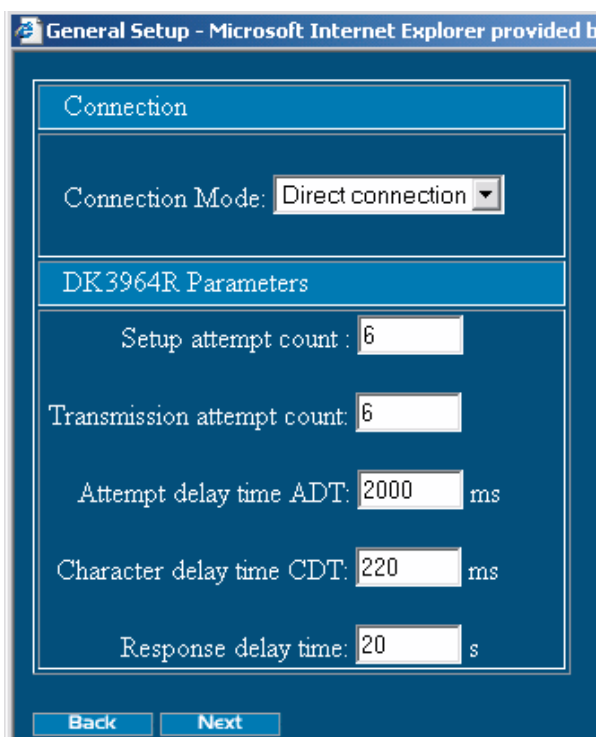
Connection

Station Name: PCD3_RIO

Connect To: SBC RIO

Next

Add new stations with the following parameters:



General Setup - Microsoft Internet Explorer provided by Saia-Burgess Controls AG

Connection

Connection Mode: Direct connection

DK3964R Parameters

Setup attempt count: 6

Transmission attempt count: 6

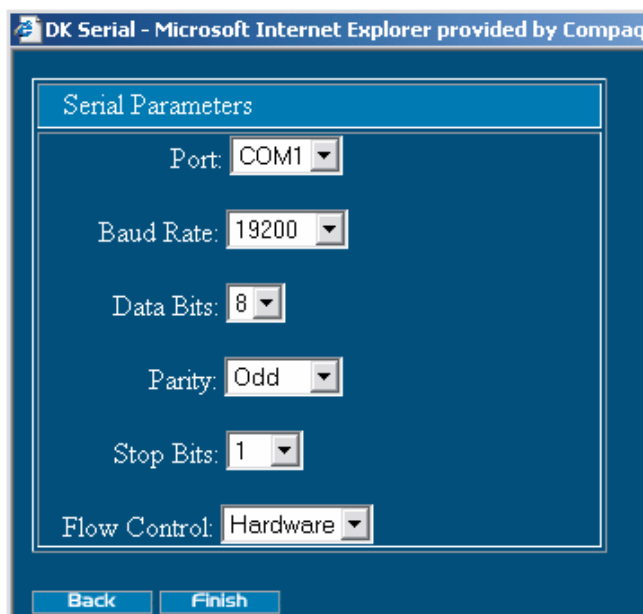
Attempt delay time ADT: 2000 ms

Character delay time CDT: 220 ms

Response delay time: 20 s

Back Next

7



DK Serial - Microsoft Internet Explorer provided by Saia-Burgess Controls AG

Serial Parameters

Port: COM1

Baud Rate: 19200

Data Bits: 8

Parity: Odd

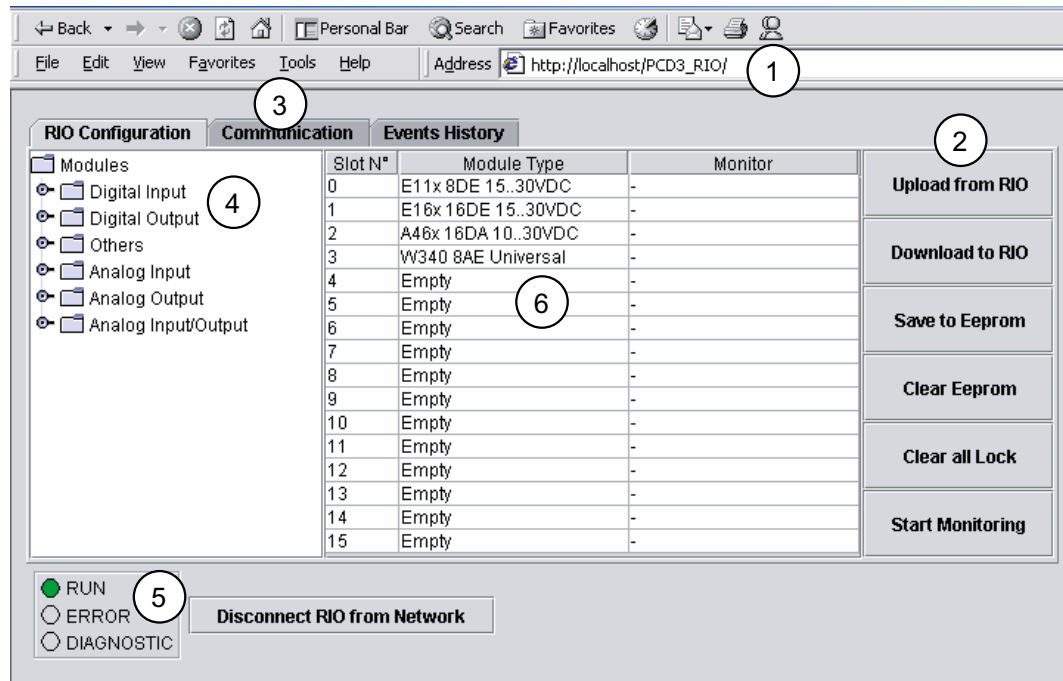
Stop Bits: 1

Flow Control: Hardware

Back Finish

Clicking on the PCD3.RIO causes the device-specific web page for the PCD3.T76x to be loaded into the web browser. Depending on the performance of the PC, this may take between 2 and 10 seconds.

Once the Applet is running, the screen displays a window like that below. Other I/O modules may be used, or there may be none installed as yet:



① URL to launch the device-specific web pages for the PCD3.T76x

② Command buttons

③ Tab selection

④ Directory tree

⑤ Control field

⑥ List of configured modules

- ① URL path from the browser to launch the device-specific web pages for the PCD3.T76x
- ② Command button field, with buttons for configuration upload and download, Start/Stop monitoring and EEPROM functionality.
- ③ Tab selection for communication or configuration.
- ④ Directory tree with all possible modules that can be plugged into the PCD3.T76x
- ⑤ Control field with status LEDs for the PCD3.T76x.
- ⑥ List of possible and already configured module positions on the PCD3.T76x (0-15)

Command buttons



- ① Loads the current configuration of the PCD3.T76x
- ② Loads the configuration displayed into the device-specific web pages for the PCD3.T76x
- ③ Saves the current configuration of the PCD3.T76x to the PCD3.T76x EEPROM
- ④ Clears the PCD3.T76x EEPROM
- ⑤ Clears all "locks" configured in the PCD3.T76x
- ⑥ Starts or stops Monitoring mode

7

① Upload function

This function loads the PCD3.T76x configuration and displays it in the configuration list within the device-specific web pages for the PCD3.T76x. This function is not available in Monitoring mode.

② Download function

This function loads the configuration from the configuration list into the PCD3.T76x. This function is not available in Monitoring mode.

Where a DP-Master is connected to the PCD3.T76x, the DP-Master configuration has priority. This applies when downloading or attempting to load a configuration into the PCD3.T76x. In this case, it is impossible to download without losing the connection to the Master. If the PCD3.T76x is disconnected from the network, the download can continue.



When attempting to download a configuration while still connected to the Master, the system displays a warning message offering the option either to disconnect from the Master and continue with the download, or to cancel the download.

③ Saving to EEPROM

This function is not available in Monitoring mode. The two configurations, in the PCD3.T76x itself and in the device-specific web pages for the PCD3.T76x, must be identical. This function saves the configuration from the PCD3.T76x to its EEPROM.



During the save, a pop-up window is displayed, allowing the user to specify which configuration has priority.

Selecting “Configuration from EEPROM has priority” means:

The PCD3.T76x will only start up if the configuration from the Master matches the configuration stored in EEPROM. This function allows a desired I/O configuration to be pre-defined and saved to the PCD3.T76x. The Master will only start up if it has the same I/O configuration as the PCD3.T76x.

Selecting “Configuration from Master has priority” means:

The PCD3.T76x will always start up with the configuration received from the Master. This function is normally used during commissioning, where no Master is yet connected to the PCD3.T76x. Saving the configuration (set up in the web server) to EEPROM allows more rapid commissioning.

The configuration stored in this way is taken as the default configuration when the unit is connected to the Master.

④ Clear EEPROM

This function is not available in Monitoring mode. This function clears the whole EEPROM, the PCD3.T76x configuration, the "lock" list and the EEPROM priority.

⑤ Clear all "locks"

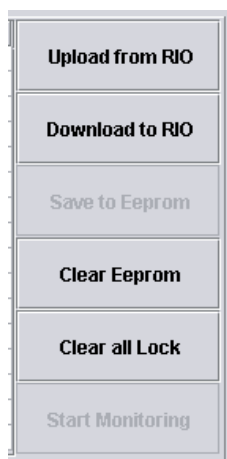
This function is not available in Monitoring mode. This function clears all "locks" in the PCD3.T76x RAM; the "lock" in EEPROM is retained.

⑥ Start/Stop monitoring

This button enables the user to switch to Monitoring or Configuration mode. Start/Stop monitoring is only available where the configuration in the device-specific web-pages for the PCD3.T76x matches that in the PCD3.T76x itself.

Synchronizing the configuration

This tool is based on a complicated mechanism that monitors whether the configuration in the PCD3.T76x matches that in the device-specific web pages for the PCD3.T76x. If the two configurations are not the same, some functions, such as “Start Monitoring” and “Save to EEPROM”, will not be available. In this case, the buttons for these functions will be blocked, as shown on the next page.



Tab selection (Configuration/Communication/Events History)

Tab selection allows the user to select within the main screen between the windows for "RIO Configuration", "Communication" (shown below) and "Events History".

7

RIO Configuration Communication Events History	
Baudrate	1500000
Device Address	2
HSA	126
The station is	Passive
Master address	1
WatchDog	20
Device type	PCD3.Txxx V0.106
Update	

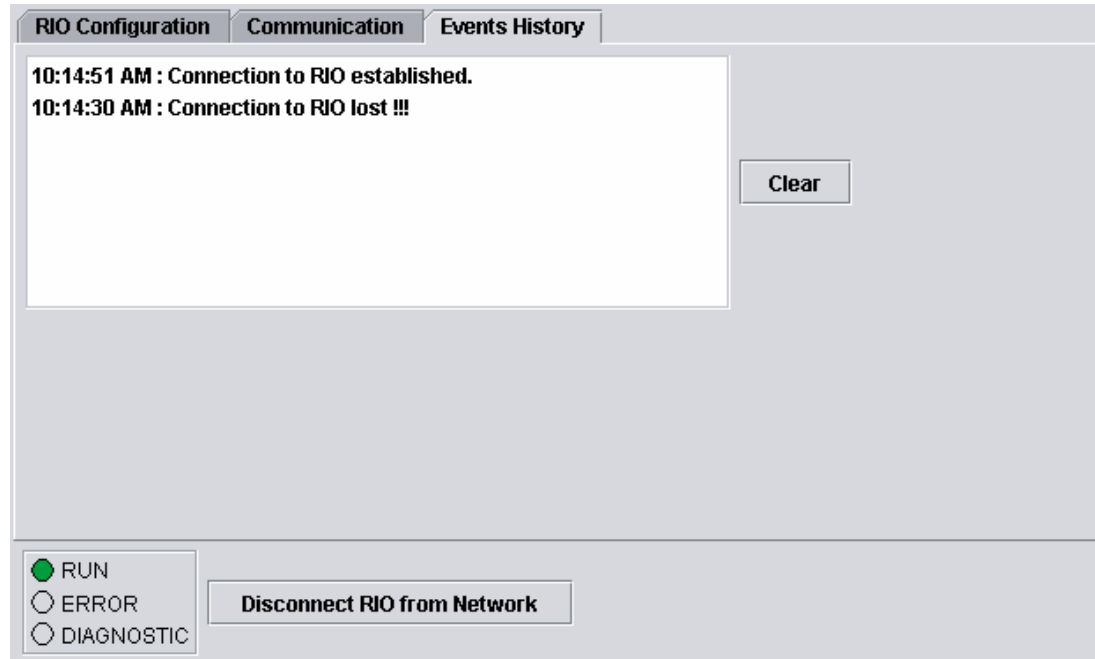
☒ RUN ☐ ERROR ☐ DIAGNOSTIC	
Disconnect RIO from Network	

This tab displays information on the communication status of the PCD3.T76x. Most of the information relates to Profibus-DP/Profi-S-Net communication. "Device type" shows the PCD3.T76x and its firmware version. The "Update" button is used to update this information.

The last field allows the user to switch the PCD3.T76x into "Firmware download mode". Typing "firmware" into this field and pressing Enter takes the PCD3.T76x into "Firmware update mode". To return to Operating mode, it is necessary to switch the power off and on again (POWER OFF and ON).

Events History tab

This tab displays possible disconnections between web server and web browser.



7

Control field

LEDs

The control field is mainly used to display the PCD3.T76x status LEDs. These show the current status of the PCD3.T76x; see also [section 4.4 "Diagnostic information on RIOs"](#).

Master connect/disconnect

This button to connect or disconnect the Master is mainly used to remove the PCD3.T76x from the network, so that it does not "see" either the Master or any other device.

This is used where a different configuration from the Master is required. To prevent conflicts, the Master must be disconnected.

The "Reconnect Master" button can be used to reconnect the PCD3.T76x to the network (where the PCD3.T76x is disconnected from the network, **it is not automatically reconnected**).

Two ways of reconnecting the PCD3.T76x to the network:

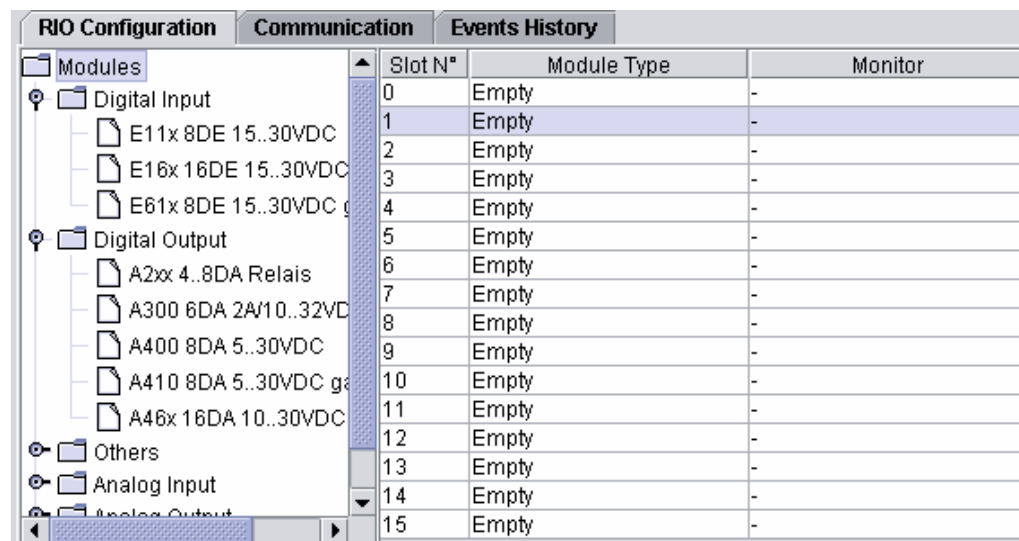
- "Reconnect Master" button
- Switching the supply to the PCD3.T76x off and on again. On POWER ON, the PCD3.T76x is reconnected to the Master (default setting).

Configuring the PCD3.T76x with the web server

The I/Os on the PCD3.T76x are normally configured in the Profibus Configurator for the Master PCD. The configuration details for the PCD3.T76x in the Master PCD are loaded into the PCD3.T76x when communication is started up.

However, it is also possible to configure the I/Os for the PCD3.T76x directly with the web server. This function is mainly used when commissioning an installation, where the Master PCD is not yet connected.

This configuration is not possible in Monitoring mode.



Slot N°	Module Type	Monitor
0	Empty	-
1	Empty	-
2	Empty	-
3	Empty	-
4	Empty	-
5	Empty	-
6	Empty	-
7	Empty	-
8	Empty	-
9	Empty	-
10	Empty	-
11	Empty	-
12	Empty	-
13	Empty	-
14	Empty	-
15	Empty	-

7

This is the Configuration tab. On the left-hand side is the directory tree, and on the right a list showing all the module positions on the PCD3.T76x. This can be used to insert, remove and parameterize the modules. The configuration can then be loaded into the PCD3.T76x; see section on "Command buttons". A configuration can also be uploaded, modified and then downloaded again.

Add module

Select module and hold down the left mouse button to drag it to the desired module position.

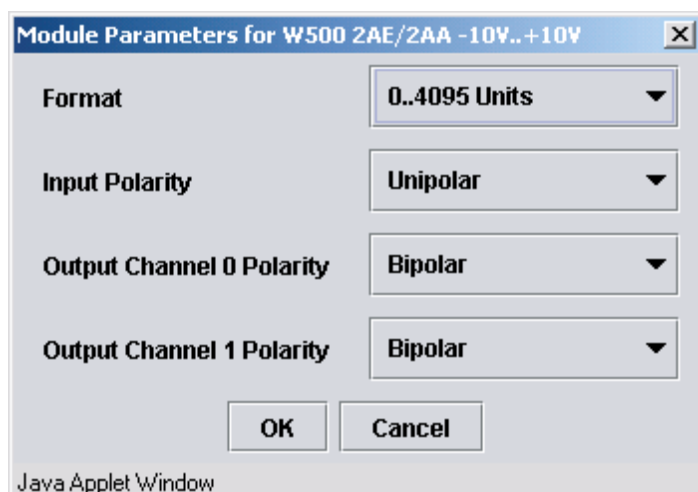
Remove module

Select module from the list and press "Delete" on the keyboard.

Set parameters for a module

Some modules have more functionality than others and need to be configured accordingly. This applies especially to analogue modules that are able to read in values in different formats, e.g. temperature for Pt1000, Ni1000, Pt100, Ni100, S7 format, etc.

To enter parameters, double-click on the module, or select the module and press "Enter" on the keyboard. This is the screen to parameterize a PCD3.W500 module.



When all the required parameters are set, click on "OK" to confirm or "Cancel" to undo a change.

7

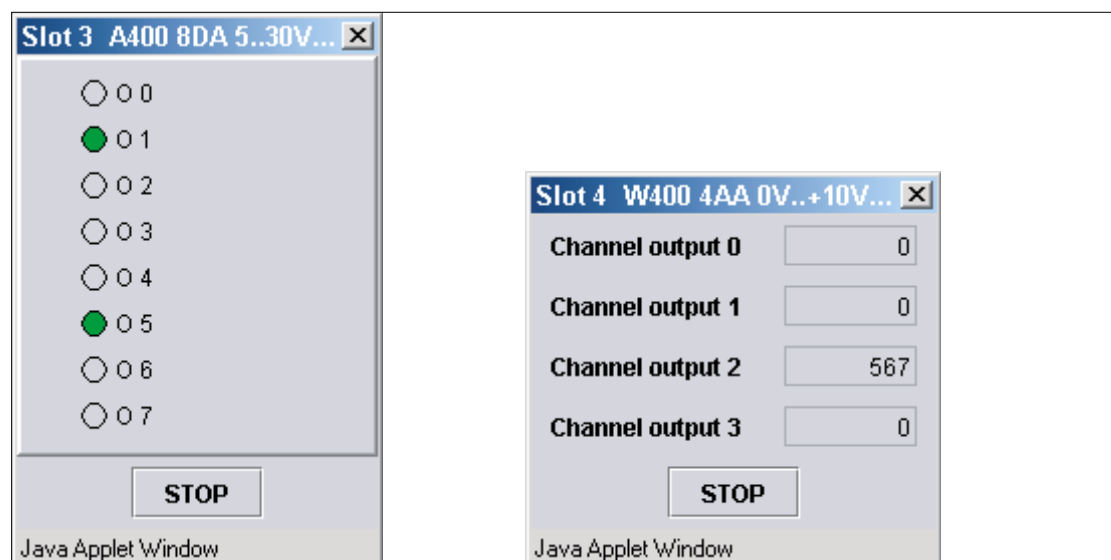
Monitoring mode

In order to enter Monitoring mode, a configuration must first be synchronized, to activate the "Start Monitoring" button; if it is not, synchronize the configuration via "Download" or "Upload".

In Monitoring mode, all configuration functionality is blocked: directory tree, parameterization, upload and download of the configuration.

It is only possible to monitor the status of the I/Os. This is done by double-clicking on the relevant module position. Depending on the module type, the modules are displayed in different ways.

Examples of digital and analogue output modules:



To switch off monitoring, press STOP or click on the cross in the top right corner of the window.

Write values to outputs

In Monitoring mode, values can be written to the outputs. This allows an application to be tested, provided the DP-Master is not yet connected. If the DP-Master is connected to the PCD3.T76x, this function is useless, as the Master will immediately overwrite all the values, and any changes made cannot be seen.

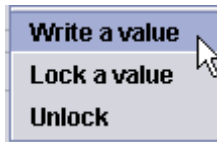
Write value:

Position the mouse over the output to be modified. Press the right mouse button to display a context menu. The menu is different for analogue and digital I/Os.

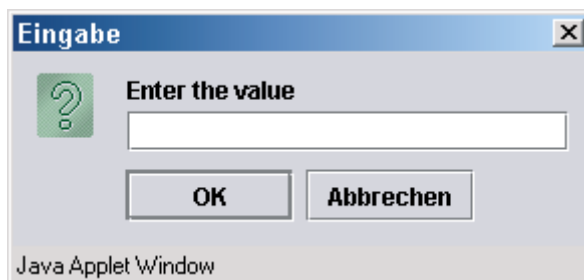
When the function and value have been selected, the operation is executed immediately and the value written to the output. The image is updated. There is no record of these commands.

Analogue module:

Context menu: select "Write a value".

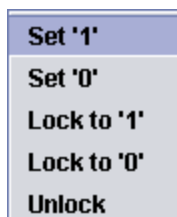
**7**

A new window opens, to enter the desired value.



Digital module:

The context menu can be used to switch the output on or off directly.



Set '1' or Set '0' option to write directly to the output

"Locking" inputs and outputs

The "Lock I/Os" function can be used to manipulate values at PCD3.T76x input or output, where the PCD3.T76x DP-Master is connected and sending values to the outputs. The locked value has the highest priority. The locks are stored in the PCD3.T76x RAM and/or EEPROM. If they are in EEPROM, they will be activated after every POWER OFF and ON.

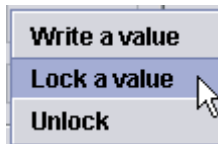
Lock inputs or outputs:

Position the mouse over the input or output to be locked. Press the right mouse button to display a context menu. The menu is different for analogue and digital I/Os.

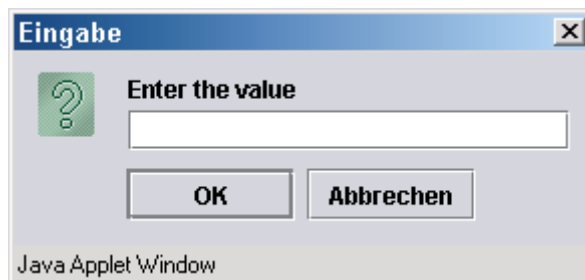
When the function and value have been selected, the operation is executed immediately and the value written to the input or output, regardless of what is transmitted from the Master. The locks are held in a list within the PCD3.T76x.

Analogue module:

Context menu: select "Lock a value".



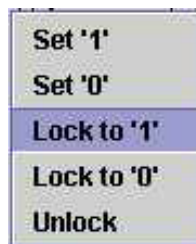
A new window opens, to enter the desired value to lock the input/output.



7

Digital module:

The context menu can be used to lock the input or output directly.



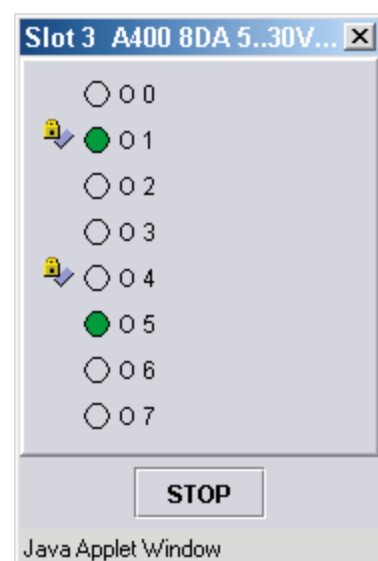
If an I/O is locked, its status can be viewed in the Monitoring window:

Output 1 locked "ON",
Output 4 locked "OFF",

Both have a "lock" icon to the left of the LED. For analogue I/Os, the same icon is used.

Unlock:

Position the mouse over the locked input or output. Press the right mouse button and select "Unlock" from the context menu. The lock is cleared from the PCD3.T76x lock list, and the "lock" icon disappears from the Monitoring window.



7.2.4 Application-specific web pages

The PCD3.T76x web server also allows application-specific web pages to be stored.
The description of the procedure for this is in preparation.

8 Maintenance

PCD3 components are maintenance-free, apart from some CPUs (PCD3.Mxxx0), where the battery needs to be changed occasionally.

PCD3 components do not contain any parts that can be swapped out by the user. If hardware problems arise, the components should be returned to Saia Burgess Controls.

8.1 Changing the battery on the PCD3.M5xx0/M6xx0

The resources (registers, flags, timers, counters etc), and possibly the user program and the text strings/DBs, are stored in RAM. To ensure that they are not lost and that the hardware clock (where present) continues to run when there is a power failure, the PCD3s are equipped with a buffer capacitor (SuperCap) or a buffer battery.

CPU type	Buffer	Buffer time
PCD3.M3xx0	Super Cap (soldered, maintenance-free)	4 hours ¹⁾
PCD3.M5xx0/M6xx0	Renata CR2032 lithium battery + Super Cap (soldered)	1-3 years ²⁾

1) The total charging time is approx. 10 minutes

2) Depending on the ambient temperature; the higher the temperature, the shorter the buffer time



With new controllers, the batteries are packaged with the units, and have to be inserted on commissioning. Observe the polarity of the batteries:

- Insert CR2032 coin cells in such a way that the Plus pole is visible



CPUs with lithium batteries are not maintenance-free. The battery voltage is monitored by the CPU. The BATT LED lights up and XOB 2 is called if

- the battery voltage is less than 2.4 V
- the battery is flat or shows an interrupt
- the battery is missing

We recommend changing the batteries with the Saia PCD® attached to the power supply, to avoid any loss of data.

A Annex

A.1 Icons

	In manuals, this symbol refers the reader to further information in this manual or other manuals or technical information documents. As a rule there is no direct link to such documents.
	This symbol warns the reader of the risk to components from electrostatic discharges caused by touch. Recommendation: Before coming into contact with electrical components, you should at least touch the Minus of the system (cabinet or PGU connector). It is better to use a grounding wrist strap with its cable permanently attached to the Minus of the system.
	This sign accompanies instructions that must always be followed.
	Explanations beside this sign are valid only for the Saia PCD® Classic series.
	Explanations beside this sign are valid only for the Saia PCD® xx7 series.

A.2 Definitions of serial interfaces

A.2.1 RS-232

Designation of signal lines:

Data lines	TXD	Transmit data
	RXD	Receive data
Signal and response circuits	RTS	Request to send
	CTS	Clear to send
	DTR	Data terminal ready
	DSR	Data set ready
	RI	Ring indicator
	DCD	Data carrier detect

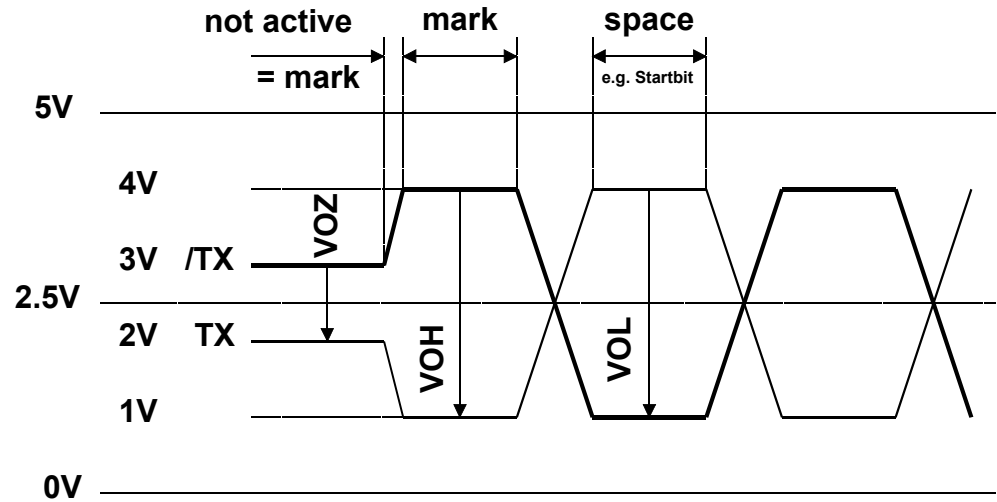
Signals to RS-232

Signal type	Logical state	Set-point	Nominal value
Data signal	0 (space)	+3 V to +15 V	-7 V
	1 (mark)	-15 V to -3 V	+7 V
Control/ message signal	0 (off)	-15 V to -3 V	-7 V
	1 (on)	+3 V to +15 V	+7 V

The idle state of the data signals = "mark"
of the control and message signals = "off"

A.2.2 RS-485/422

Signals to RS-485 (RS-422)



VOZ = 0.9 V min ... 1.7 V
VOH = 2 V min (with load) ... 5 V max (without load)
VOL = -2 V ... -5 V

In the idle state, RS-422 is in the “mark” position

RS-422:

Signal type	Logical state	Polarity
Data signal	0 (space) 1 (mark)	TX positive to /TX /TX positive to TX
Control/ message signal	0 (off) 1 (on)	/RTS positive to RTS RTS positive to /RTS

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RS-485:

Signal type	Logical state	Polarity
Data signal	0 (space) 1 (mark)	RX-TX positive to /RX-/TX /RX-/TX positive to RX-TX

RS-485 Wiring information

There are confusing screw terminal identifier terminologies around. Depending on the manufacturer the identifiers used are in conflict to the identifiers you can find in SBC manuals.

Converters

Some products form other manufacturers (p.e. RS-232 - RS-485 converters) are often inversly indicated. Therefore it is sometimes necessary to cross the wires.

Converter	PCD
Rx- Tx	/Rx- /Tx/
/Rx- /Tx/	Rx- Tx

Profibus and Profi-S-I/O

Profibus	color	PCD7.T160	D-Sub 9pin on PCD	Port 2 on PCD3.M3 and M6
A=RxD /TxD-N	green	D	pin 8	D
B=RxD /TxD-P	red	D/	pin 3	/D



Not all manufacturers use the same connection configuration, so the data lines may need to be crossed



To guarantee error-free operation of an RS-485 network, the network should be terminated at both ends. Cable and line termination resistors should be selected in accordance with manual 26/740 "Installation components for RS-485 networks".

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The drivers operate at 5 VDC. If a higher voltage is attached, the drivers may be destroyed.

A.2.3 TTY/current loop**Signals to TTY/current loop**

Terminal 1	TS	Transmitter Source	Sender
Terminal 3	TA	Transmitter Anode	
Terminal 6	TC	Transmitter Cathode	
Terminal 8	TG	Transmitter Ground	
Terminal 2	RS	Receiver Source	Recipient
Terminal 4	RA	Receiver Anode	
Terminal 7	RC	Receiver Cathode	
Terminal 9	RG	Receiver Ground	

Signal type	Set-point	Nominal value
Power for logic L (space)	-20 mA to +2 mA	0 mA
Power for logic H (mark)	+12 mA to +24 mA	+20 mA
Neutral voltage to TS, RS	+16 V to +24 V	+24 V
Short circuit power on TS, RS	+18 mA to +29.6 mA	+23.2 mA

The idle state of the data signals = "mark"

By wiring to the cable connector, the user selects either an "active" or "passive" circuit.



The max. transmission rate for TTY/current loops at 20 mA is 9600 bps.

A.3 Order details

Type	Description	Weight
Base units for 4 I/O modules		
PCD3.M3020	CPU with 128 KByte user program memory Backup with internal flash memory, USB port for PG5 max. 64 digital I/Os (not expandable), 2 interrupts, web server RS-485 for Profi-S-Net or S-Bus	400 g
PCD3.M3120	asPCD3.M3020 plus Ethernet TCP/IP	400 g
PCD3.M3230	CPU with 256 KBytes user program memory Backup with internal flash memory, USB port for PG5 max. 1,023 digital I/Os, 2 interrupts, web server RS-485 for Profi-S-Net or S-Bus	400 g
PCD3.M3330	asPCD3.M3020 plus Ethernet TCP/IP	400 g
PCD3.M5340	CPU with 1 MByte user program memory, 1 MByte onboard Flash memory for backup, up to 1,023 digital I/Os (with PCD3.Cxxx), 2 interrupts, web server USB port for PG5, RS-232, RS-485 for Profi-S-Net and RS-485 for S-Bus, Ethernet TCP/IP, Run/Stop switch, 2 sockets for PCD7.Rxxx, data backup 1...3 years with lithium battery	560 g
PCD3.M5440	CPU with 512 KBytes user program memory, with Run/Stop switch Backup option with PCD7.R500 flash card, USB port for PG5 max. 1,023 digital I/Os, 2 interrupts, web server RS-232, RS-485 for Profi-S-Net and RS-485 for S-Bus Data backup 1...3 years with lithium battery	560 g
PCD3.M5540	asPCD3.M5440 plus Ethernet TCP/IP	560 g
PCD3.M6240	CPU with 1 MByte user program memory, 1 MByte onboard Flash memory for backup, up to 1,023 digital I/Os (with PCD3.Cxxx), 2 interrupts, web server, USB port for PG5, RS-232, RS-485 for Profi-S-Net/MPI/S-Bus, CAN interface, Run/Stop switch, 2 sockets for PCD7.Rxxx, data backup 1...3 years with lithium battery	560 g
PCD3.M6340	asPCD3.M6240 plus Ethernet TCP/IP	560 g
PCD3.M6440	CPU with 1 MByte user program memory, 1 MByte onboard Flash memory for backup, up to 1,023 digital I/Os (with PCD3.Cxxx), 2 interrupts, web server, USB port for PG5, RS-232, RS-485 for Profi-S-Net/MPI/S-Bus, Profibus DP Master, Run/Stop switch, 2 sockets for PCD7.Rxxx, data backup 1...3 years with lithium battery	560 g
PCD3.M6540	asPCD3.M6440 plus Ethernet TCP/IP	560 g
Additional memory		
PCD3.R500	Flash module holder, 1 MByte program backup for PCD3.Mxxx0, I/O Slot 0,	
PCD7.R500	Flash module, 1 MByte program backup for PCD3.M5xx0/.M6xx0, Slot M1,	
PCD3.R550M04	Flash module holder, 4 MByte with file system for PCD3.M3xx0, I/O Slots 0...3	
PCD7.R550M04	Flash module, 4 MByte with file system for PCD3.M5xx0/.M6xx0, Slot M1 or M2	
PCD3.R551M04	Flash module holder, 1 MByte program backup + 3 MByte file system for PCD3.Mxx0, I/O Slots 0...3,	
PCD7.R551M04	Flash module, 1 MByte program backup + 3 MByte file system for PCD3.M5xx0/.M6xx0,, Slot M1/M2	
PCD3.R560	Bacnet Flash module holder, for PCD3.Mxxx0, I/O Slots 0...3	
PCD7.R560	Bacnet Flash module for PCD3.M5xx0/.M6xx0, Slot M1/M2	
PCD3.R561	Flash module holder, 1 MByte program backup + 1 MByte file system for PCD3.M3xx0, I/O Slots 0...3	
PCD7.R561	Bacnet Flash module, 1 MB program backup + 1 MB file system for PCD3.M5xx0/.M6xx0, Slot M1/M2	
PCD7.R600	PCD3 module holder to take SD Flash memory cards, plugs into I/O Slots 0...3,	
PCD7.R-SD256	Saia PG5® SD Flash card, 256 MByte with file system	
PCD7.R-SD512	Saia PG5® SD Flash card, 512 MByte with file system	
Spares		
4 104 7502 0	I/O slot cover	6 g
4 104 7493 0	PCD3.M5xxx covering cap	12 g
4 405 4995 0	1 for CPUs: Pluggable cage clamp terminal, 8-pole (up to 2.5 mm²)	12 g
PCD3.R010	Battery module for PCD3.M3xxx	30 g
4 639 4898 0	Battery module for PCD3.M5xxx/M6xxx	12 g
4 507 4817 0	Lithium battery	3 g

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Type	Description	Weight
Communication modules on I/O module Slot#0		
PCD3.F110	with RS 422/RS-485 interface (electrically connected)	80 g
PCD3.F121	with RS-232 interface (suitable for modem)	80 g
PCD3.F130	with interface for 20 mA current loop	80 g
PCD3.F150	with RS-485 interface (electrically isolated)	80 g
PCD3.F180	Belimo MP-Bus (based on RS-232))	80 g
Communication modules on I/O module Slot#0...3 (optional with PCD3.F1xx module)		
PCD3.F221	serial interface module, RS-232	80 g
PCD3.F210	serial interface module, RS-422/RS-485	80 g
Module holders for expansion units		
PCD3.C100	Module holder for for 4 I/O modules	350 g
PCD3.C110	Module holder for for 2 I/O modules	180 g
PCD3.C200	Module holder for 4 I/O modules, with 24V supply	350 g
PCD3 RIO head station		
PCD3.T760	Profibus RIO head station with 4 I/O module sockets Profibus DP/Profi-S-Net connection	370 g
PCD3.T765 (on request)	Profibus RIO head station with 4 I/O module sockets Profibus DP/Profi-S-Net connection + facility to implement user-specific software modules (plug-Ins)	370 g
Input/output modules		
Digital input modules		
with 8 inputs 24 VDC		
PCD3.E110	Input delay typically 8 ms (pulsed voltage possible)	60 g
PCD3.E111	Input delay typically 0.2 ms (smoothed voltage required)	60 g
PCD3.E112	Input delay typically 9 ms, 12 VDC (smoothed voltage required)	60 g
PCD3.E116	Input delay typically 0.2 ms, 5 VDC (smoothed voltage required)	60 g
with 16 inputs 24 VDC		
PCD3.E160	Input delay typically 8 ms (pulsed voltage possible, connection via 34-pole system cable)	65 g
PCD3.E161	Input delay typically 0.2 ms (smoothed voltage required, connection via 34-pole system cable)	65 g
PCD3.E165	Input delay typically 8 ms (pulsed voltage possible, connection via 24-pole spring terminal block)	65 g
PCD3.E166	Input delay typically 0.2 ms (smoothed voltage required, connection via 24-pole spring terminal block)	65 g
with 6 inputs 250 VAC, electrically isolated		
PCD3.E500	Input delay typically 20 ms (pulsed voltage possible)	65 g
with 8 inputs 24 VDC, electrically isolated		
PCD3.E610	Input delay typically 10 ms (pulsed voltage possible)	65 g
PCD3.E613	Input delay typically 10 ms, 48 VDC (pulsed voltage possible)	65 g
relay output modules		
PCD3.A200	with 4 make contacts 2 A/250 VAC or 2 A/50 VDC	85 g
PCD3.A210	with 4 break contacts 2 A/250 VAC or 2 A/50 VDC	90 g
PCD3.A220	with 6 make contacts 2 A/250 VAC or 2 A/50 VDC	90 g
PCD3.A251	with 6 changeover contacts and 2 make contacts 2 A/48 VAC or 2 A/50 VDC	90 g
PCD3.A300	with 6 outputs, 24 VDC/2 A	70 g
with Transistor outputs, 0.5 A/24 VDC		
PCD3.A400	8 outputs, 24 VDC/0.5 A	65 g
PCD3.A410	8 outputs 24 VDC/0.5 A, electrically isolated	65 g
PCD3.A460	16 outputs, connection via 34-pole system cable	65 g
PCD3.A465	16 outputs, connection via 24-pole spring terminal block	70 g
Manual control modules		
PCD3.A810	Manual control module, 2 changeover contacts + 2 make contacts, 2 A, 5(6) A	75 g
PCD3.A860	Light and shade module, 2 outputs 12 A/250 VAC, 2 inputs 24 VDC	75 g

Type	Description	Weight
PCD3.B100	Combined digital input and output module with 2 inputs and 2 transistor outputs, plus 4 selectable as inputs or outputs	70 g
	Analogue input modules with 8 input channels, 10 bit resolution	
PCD3.W200	8 input channels 0...10 V	60 g
PCD3.W210	8 input channels 0...20 mA	60 g
PCD3.W220	8 input channels for resistive temperature sensors Pt/Ni 1000 (2-wire), -50...+400 °C or +200 °C	65 g
PCD2.W220Z02	Analogue input module, 8 inputs, 10 bits, NTC10 temperature sensors	40 g
PCD2.W220Z12	Analogue input module, 10 bits, 4 inputs 0...10 V and 4 inputs Pt/Ni 1000	40 g
	with 8 input channels, 12 bit resolution	
PCD3.W300	8 input channels 0...10 V	65 g
PCD3.W310	8 input channels 0...20 mA	65 g
PCD3.W340	8 input channels, jumper selectable: 0...10 V, 0...20 mA or for resistive temperature sensor Pt/Ni 1000 (2-wire)	65 g
PCD3.W350	8 input channels for 2-wire resistive temperature sensor Pt 100 for -50...+600 °C or Ni 100 for -50...+250 °C	65 g
PCD3.W360	8 input channels for 2-wire resistive temperature sensor Pt 1000 for -50...+150 °C, resolution < 0.1 °C	65 g
	with 7 input channels, 12 bit resolution	
PCD3.W305	7 input channels 0...10 V	80 g
PCD3.W315	7 input channels 0...20 mA	80 g
PCD3.W325	7 input channels -10 V...+10 V	80 g
	Analogue output modules with 4 output channels, 8 bit resolution	
PCD3.W400	Single modules: 4 channels 0...10 V ($\geq 3 \text{ k}\Omega$)	60 g
PCD3.W410	General purpose modules: 4 channels 0...10 V ($\geq 3 \text{ k}\Omega$) 0...20 mA ($\leq 500 \text{ k}\Omega$) oder 4...20 mA ($\leq 500 \text{ k}\Omega$)	45 g
	with 6 (4) output channels, 10 bit resolution	
PCD3.W605	Single modules: 6 channels 0...10 V ($\geq 3 \text{ k}\Omega$)	80 g
PCD3.W615	Single modules: 4 channels 0...20 V ($\geq 500 \text{ k}\Omega$)	80 g
PCD3.W625	Single modules: 6 channels -10...+10 V ($\geq 3 \text{ k}\Omega$)	80 g
	with 4 output channels, 12 bit resolution	
PCD3.W600	Single modules: 4 channels 0...10 V ($\geq 3 \text{ k}\Omega$)	45 g
PCD3.W610	General purpose modules: 4 channels, jumper selectable, 0...10 V and -10...+10 V ($\geq 3 \text{ k}\Omega$) 0...20 mA ($\leq 500 \Omega$)	45 g
	Combined analogue input and output module	
PCD3.W500	2 input and 2 output channels for voltage signals	80 g
PCD3.W510	2 input and 2 output channels for current/voltage signals	80 g
PCD3.W525	4 analogue inputs, 14 Bit + 2 analogue outputs, 12 Bit	80 g
	Weighing and thermocouple modules	
PCD3.W720	2-channel weighing module for 4/6-wire weighing cells	80 g
PCD3.W745	4-channel thermocouple module for J, K... thermocouples	80 g
	Manual control module	
PCD3.W800	3 outputs 0...10 V with manual control, 1 output 0...10 V without	75 g
	Counting, measuring and motion control modules	
PCD3.H100	Counter module up to 20 kHz	80 g
PCD3.H110	General purpose counting and measuring module up to 100 kHz	80 g
PCD3.H150	SSI interface module	80 g
PCD3.H210	Motion control module for one stepper motor axis	80 g
PCD3.H310	Motion control module up to 100 kHz for servo-drives, 1 axis for 24 VDC encoder	80 g
PCD3.H311	Motion control module up to 100 kHz for servo-drives, 1 axis for 422 VDC encoder	80 g

Type	Description	Weight
Accessories		
PCD3.E009	Empty cassette	35 g
PCD3.K010	Connector PCD3 ↔ PCD3	40 g
PCD3.K106	Connecting cable 0.7 m PCD3 ↔ PCD3	70 g
PCD3.K116	Connecting cable 1.2 m PCD3 ↔ PCD3	70 g
PCD2.K106	Connecting cable 0.7 m PCD2 ↔ PCD3 (supplied with numeric labelling)	70 g
4 405 4954 0	1: Pluggable I/O spring terminal block, 10-pole (Type A)	12 g
4 405 4955 0	1: Pluggable I/O spring terminal block, 10-pole (Type B)	12 g
PCD2.K2xx	For connecting "ribbon cable to screw terminal" adapters with PCD2.K23x or PCD2.K22x cables (type D)	
PCD2.K3xx		
4 405 4956 0	1: Pluggable I/O spring terminal block, 24-pole (Type C)	12 g
4 405 4998 0	1: Pluggable I/O spring terminal block, 14-pole (Type E)	12 g
4 405 4936 0	1 for A810: Pluggable spring terminals, 12-pole (up to 1.5 mm ²), (Type F)	12 g
PCD3.K810	1 for A810: Pluggable spring terminals, 12-pole (as 4 405 4936 0, Type F with 12 grouped strands, numbered, 2.5 m long)	25 g
4 405 5027 0	1 for A860: Pluggable spring terminals, 4-pole (up to 2.5 mm ²), (Type G)	6 g
PCD3.K860	1 for A860: Pluggable spring terminals, 4-pole (as 4 405 5027 0, Type G), with 4 grouped strands, numbered, 2.5 m long	15 g
4 405 5028 0	1 for A860: Pluggable spring terminals, 6-pole (up to 1.0 mm ²), (Type H)	10 g
PCD3.K861	1 for A860: Pluggable spring terminals, 6-pole (as 4 405 5028 0, Type H), with 6 grouped strands, numbered, 2.5 m long	20 g
4 405 4934 0	1 for A800: Pluggable spring terminals, 8-pole (up to 1.5 mm ²), (Type J)	12 g
PCD3.K800	1 for A800: Pluggable spring terminals, 8-pole (as 4 405 4934 0, Type J), with 8 grouped strands, numbered, 2.5 m long	25 g
4 329 4819 0	Label plates, set of 10	2 g
4 310 8686 0	Preprinted tapes	2 g
PCD3.K225	Connecting cable 2.5 m PCD3 web server↔PC	70 g

A.4 Contact**Saia-Burgess Controls AG**

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