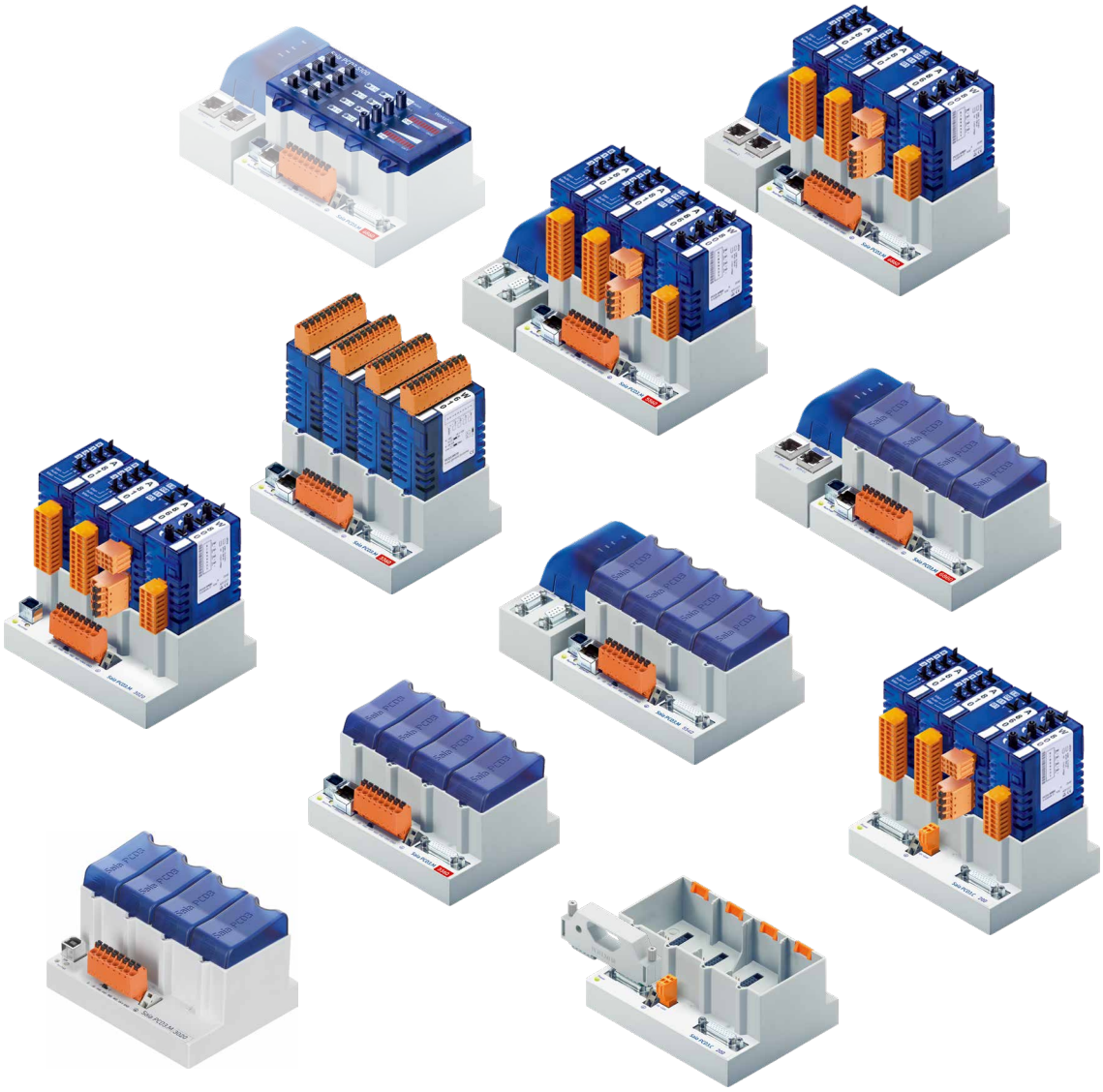
SAIA BURGESS CONTROLS



Series PCD3

Document 26-789 | Edition ENG20 | 2019-08-08

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0.1 Document versions

Version	Date	Updated	Comments	Chapter
ENG02	03-11-2003	-	- Translation	
ENG03	15-08-2004	01-10-2004	- Revision	
ENG04	01-10-2004	-	- Training CPU	
ENG05	31-01-2005	-	- Amendments	
ENG06	01-07-2005	15-11-2005	- Incorporation of new modules, order according to price list, further updates and changes	
ENG07	01-10-2006	10-07-2007	- Further detailed amendments and changes	
ENG08	10-07-2007	15-07-2007	- Further detailed amendments and changes	
ENG09	05-01-2009	15-01-2009	- Further changes	
ENG10	 21-01-2010 05-03-2010 24-03-2010	23-10-2009 21-01-2010 05-03-2010 24-03-2010	- Deletion of DIN40040 - Configuation Port #3 PCD3.M5430 - List of discontinued I/O modules - Pin assignment of port #10, pin 6 - Resolution A/D converter PCD3.W525	3 6.1.6 3.10 6.13.1
ENG11	17-05-2010 12-07-2010 26-07-2010	26-07-2010 26-07-2010 26-07-2010	- Buffer time supercap - Connection concept for PCD3.F180 - Connection concept for PCD3.W2x0	3.4 3.12 8.1 5.5.6 6.8.1
ENG12	10-11-2010 10-11-2010	10-11-2010 10-11-2010	- Professional S-Net 1.5 Mbps not with M5340 - Ground connection PCD3.W3x0	3.4 6.8.2
ENG13	28-06-2011	28-06-2011	- External + 24V power supply and Ethernet full duplex	3, 5, 6
ENG14	22-09-2011	23-09-2011	- Using the SBC S-Bus	5
	29-09-2011 25-10-2011		- New CPU types PCD3.Mxx**6**0 - Label-Creator replaced with: Label editor of the device configurator	
ENG15	05-04-2012 13-04-2012 22-11-2012 10-05-2013	20-11-2012 20-11-2012 22-11-2012 10-05-2013	- Storage temperature changed from -20 to -25 ° C - Addresses changed - Chapter deleted - Behaviour of the diagnostic LED	3.2 A.5 9 3.14
ENG16	06-12-2013 07-02-2014	- 07-02-2014	- Change of Logo Internet security advice	
ENG17	07-08-2014	16-09-2014	- Chapter Ch06 I/O modules moved to manual 27-600	6
ENG18	08-01-2015	08-01-2015	- RS-485 interface port 3 on PCD3.M5xx0	3.10
ENG19	2017-04-04 2018-01-09 2018-10-29	 2018-01-09 2018-10-29	- New CPU PCD3.Mxx60 - New 10 pin connector - Memory on PCD3 - General revision - PCD3.W800 can be used with base address 240 - Harmonized couours and fonts	3 all 3.18 all 3.15 all
ENG20	2019-08-08	2019-08-08	- Specifications “vibration resistance” adjusted - References to obsolete manuals changed	3.2 4.5

0.2 Trademarks

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Technical changes based on the current technical state of the art.

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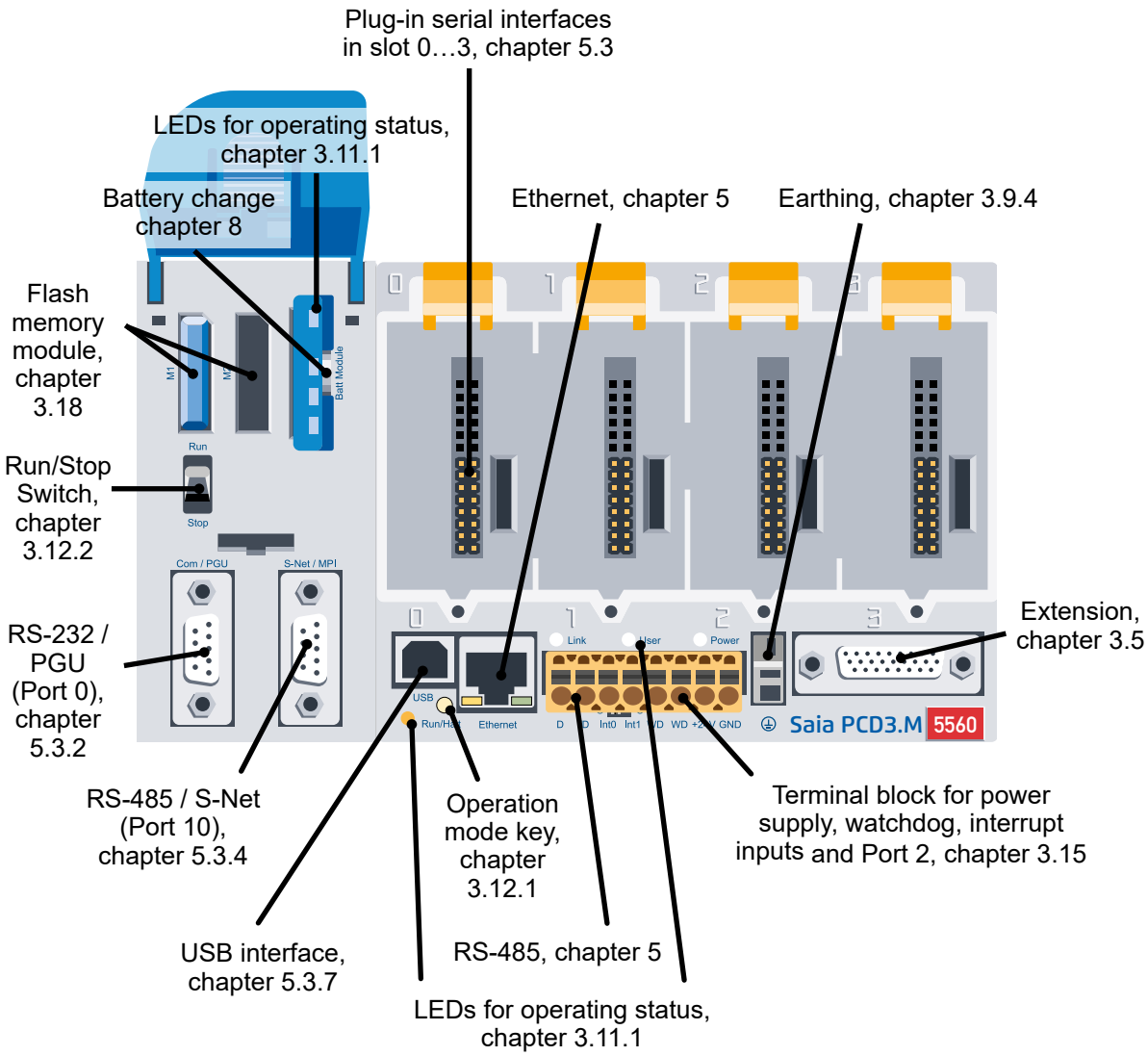
1 Graphical table of contents

The graphical table of contents picks out some key aspects of the hardware manual of the PCD3 series and allows you to jump to the appropriate chapter by clicking on the labeled frame or directly on the component/connector. From the table of contents you can jump to all chapters.



2 Orientation guide

2.1 Introduction
2.2 Connection of Saia PCD® controllers to the internet
2.3 ePlan® macros
2.4 Planning an application
2.5 E/A module cabling
2.6 Series cabling
2.7 Addressing
2.8 Labeling of the module carriers and I/O slot modules

2.1 Introduction

Symbols used in this manual for notes, definitions for the serial interfaces, explanation of terms (glossary) and the company address and address for repairs are added to the appendix.

You are welcome to submit supplements and suggested improvements to the following e-mail address support@saia-pcd.com

This manual explains the technical aspects of the PCD3 components. The following terms are commonly used:

CPU	Central processing units: the heart of the Saia PCD®
RIOs	Remote I/Os: inputs and outputs that are connected to the CPU via a fieldbus such as Profibus
LIOs	Local I/Os: these are connected to the CPU or RIO via the I/O bus (i.e. using very short cables)
Modules	Input/output modules mounted in a housing matched to the PCD3 system
Module holders	CPU, RIOs or LIOs that can hold modules

The purpose of this chapter is to demonstrate the essentials in the planning and installation of control systems with PCD3 components.

The following topics are relevant in this regard:

Planning of an application (chapter 2.4)

I/O module cabling (chapter 2.5)

Series cabling (chapter 2.6)

Addressing (chapter 2.7)

Details about hardware, software, configuration, maintenance, and troubleshooting are described in separate chapters.

All PCD3 I/O modules are described in the 27-600 Manual I/O Modules PCD2 and PCD3.

The aforementioned manual and further documentation can be found on our homepage under documentation or at the respective system groups: www.sbc-support.com/en/documents/manuals/

2.2 Connection of Saia PCD® controllers to the internet

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

PCD controllers include simple, integrated protection features. However, secure operation on the internet is only guaranteed using external routers with a firewall and encrypted VPN connections.

For more information, please refer to our support site:
www.sbc-support.com/security

2.3 ePLAN® macros

ePLAN® macros are available for project planning and engineering.

The ePLAN® electric P8 macros are available on the support page
www.sbc-support.com

The macros and article data are also provided on the ePLAN® data portal.
www.eplandataportal.de

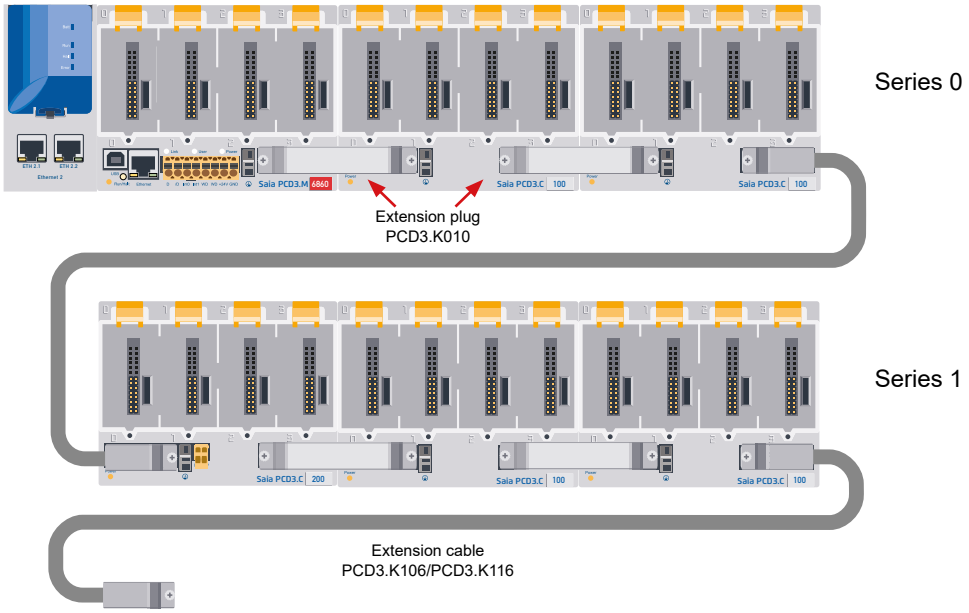
2.4 Planning an application

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 RIO type specifies the maximum number of module carriers and modules
- After five PCD3.C100 module carriers, use a PCD3.C200 base unit as I/O bus amplifier.
- In keeping with lean automation, it is recommended to leave the first slot in the CPU basic module free for any subsequent expansions. Both simple I/O modules and communication modules can be used in this slot.
- The total length of the I/O bus is limited to 15 LIO modules 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 (24V)) to a module segment.
Please note the following rules:

- Do not use more than six PCD3.C200s in a single configuration, or the time delay will exceed the I/O access time.
- A maximum of five cables PCD3.K106 / .K116 may be used.



- Insert a PCD3.C200 after each cable (at the start of a row).
  Exception: In a small configuration with no more than 3 PCD3.C1xxs, these can be supplied from the PCD3.Mxxxx. A PCD3.C200 is not required.

- If an application is mounted in a single row (max. 15 module holders), then after five PCD3.C100 a PCD3.C200 must be used to amplify the bus signal (unless the configuration ends with the fifth PCD3.C100 or PCD3.C110).
- If the application is mounted in multiple rows, the restricted length of cable means that only three module holders (1× PCD3.C200 and 2× PCD3.C100) may be mounted in one row.

The following procedure is recommended to plan an application:

❶ Select the I/O modules according to the requirements.
For digital PCD3 I/O modules, if possible use those with 16 connections, these have one LED per digital I/O.

❷ Calculate the required number of module carriers according to the number of I/O modules. Check if the number of module carriers is permitted:

PCD3.Mxxxx	3020 3120 3160	3320 3330 3360	5xx0	6xx0
I/O bus connector for extensions	No	Yes		
Number of inputs / outputs or I/O module slots	64[1] 4	1023[1] [2] 64		

1) When using digital I/O modules with PCD3.E16x or A46x with 16 I/Os each
2) The address 255 is reserved for the watchdog on all PCD3. The I/O reserved for the watchdog can not be used by the user, and analog and H modules must not be deployed with the slots with base address 240

❸ Arranging the module carrier in series according to the available mounting surface and thereby determining the connection material:

Arrangement	Required connection material
With a PCD3.Mxxx0, the LIOs in a row max. 15 × PCD3.LIO's in series, without extension cable, only with connector PCD3.K010	n × PCD3.K010 connection plug between PCD3 module carriers
With a PCD3.Mxxx0, the LIOs in several rows. Max. 3 PCD3.LIOs side by side and one row below the other, with extension cables for the rows underneath (max. 15 × PCD3.LIOs)	n × PCD3.K106/116 extension cable for connecting the last PCD3 module carrier of a row to the first PCD3 module carrier of the next series. n × PCD3.K010 connector between PCD3 module carriers.
Arranging a RIO node with the LIOs side by side. Max. 3 × PCD3.LIOs total	1…3 PCD3.K010 connector between PCD3 module carriers

The easiest way to compile this is with the Device Configurator of the PG5 Saia Project Manager (SPM).

❹ Calculate the load current at the internal + 5 V supply with the table in the 27-600 I / O Modules for PCD1 / PCD2 manual under chapter Power consumption of the modules.
Comment: Use the worst or highest values.

❺ Verify if the max. supply current of the CPU, RIO or PCD3.C200 is sufficient. To supply one module segment separately, use PCD3.C200 instead of PCD3.C1xx. Verify whether the load current of all segments does not exceed the max. supply current of the CPU / RIO / PCD3.C200. The max. supply currents can be found in chapter 3.9.2 Internal power supply

❻ Calculate current consumption at 24 V supply. The current consumption of the PCD3 configuration can be determined in chapter 3.6.2 power consumption of the modules (use the worst or highest values)

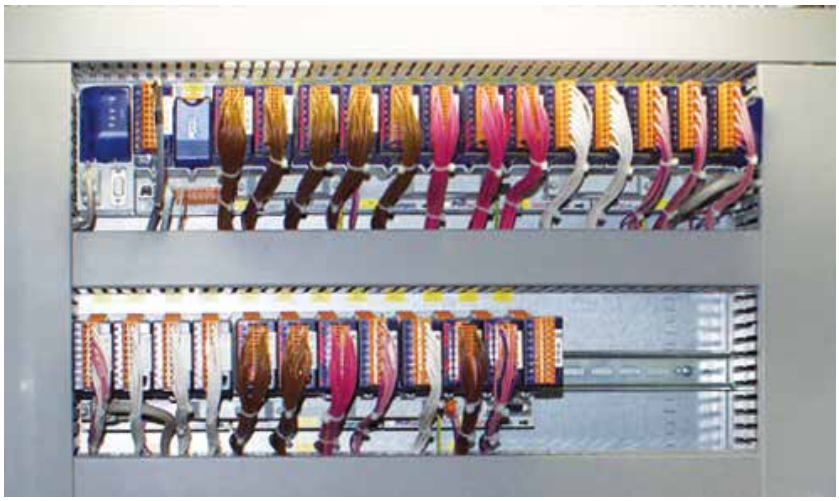
❼ Determine the corresponding connection cables for the module carriers

❽ Calculate the number of required connector blocks for the I/O modules and order them separately. Screw terminals or spring terminals can be ordered as required. Not all modules require the same type of connectors.

Please note that in most applications, the load currents of the outputs are the heaviest burden on the 24 V supply. With 16 outputs with a load current of 0.5 A each, this is already 8 A, if all outputs are switched on.

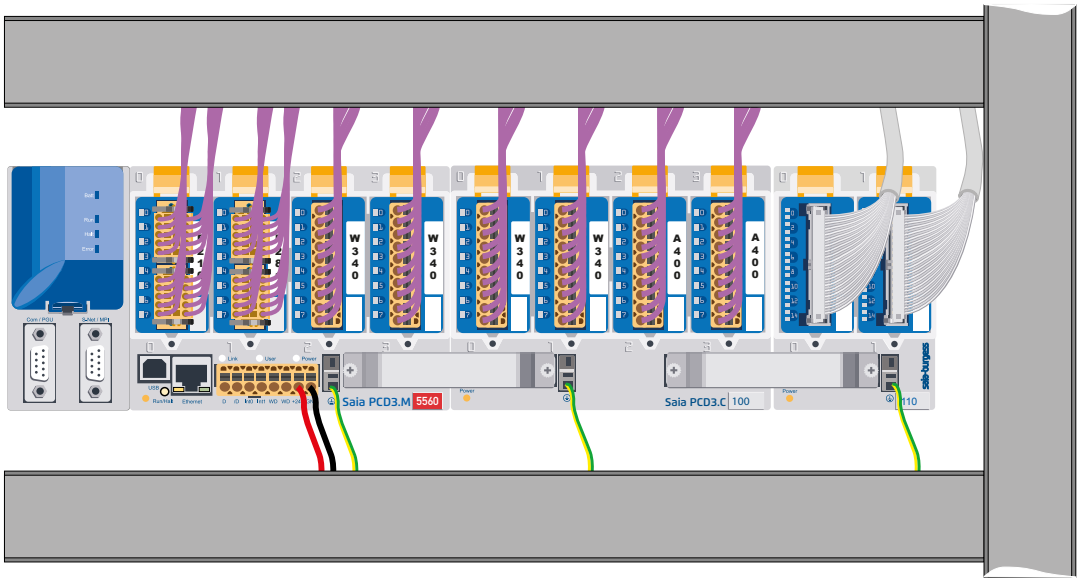
2.5 E/A module cabling

It is recommended to wire the I/O modules from a cable duct.



2.5.1 Cable layout

In order to have enough space, a distance of at least two fingers between the module carrier and the cable channel is recommended. This is very helpful in troubleshooting (wiring) and a possible module change.



In particular cables to connections on the lower part of the module carrier (supply, grounding) should preferably be wired under the module carriers with a cable duct.

Following these rules ensures the visibility of the LEDs and access to the bus ports.

2.5.2 Cable routing

230 V supply lines and signal lines must be laid in separate cables with a minimum distance of 10 cm. It is also advisable to ensure a spatial separation of the mains and signal lines within the control cabinet

Digital signal lines / bus lines and analog signal lines / sensor lines must be laid in separate cables

It is recommended to use shielded cables for the analog signal cables

The shield must be earthed at the control cabinet entry or exit point. The shields must be laid with the shortest route and with the largest possible cross section. The central earthing point is to be connected to the protective conductor PE by >10 mm² by the shortest route

As a rule, the shield is only placed on one side of the control cabinet, unless there is an equipotential bonding, which has much lower impedance than the shield resistance

Inductors installed in the same cabinet, e.g. contactor coils must be provided with suitable interference suppression circuits (RC elements)

Control cabinet parts with high field strengths, e.g. transformers or frequency inverters should be shielded with dividing plates that have a good ground connection.

2.5.3 Overvoltage protection for long distances or external cables

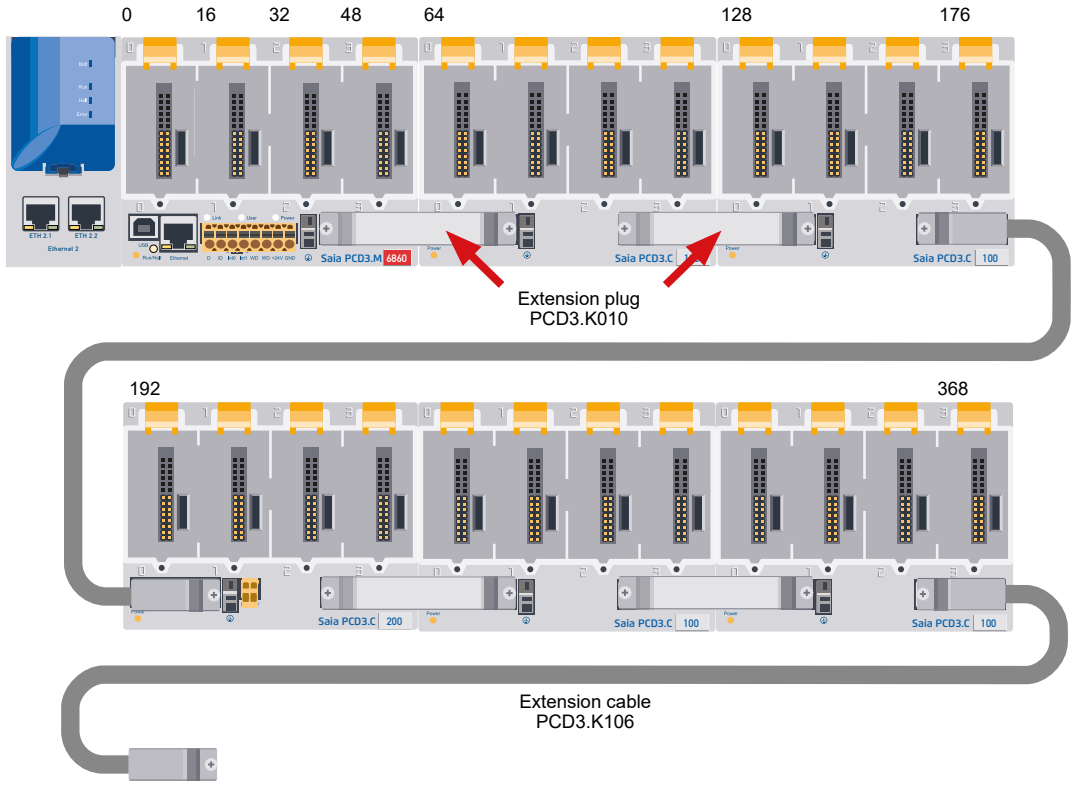
If cables are laid outside the building or over longer distances, suitable overvoltage protection measures must be provided. Especially with bus cables, these measures are indispensable.

In the case of cables laid outside, the shield must be current-carrying and grounded on both sides.

The surge arresters must be installed at the entrance to the control cabinet input.

2.6 Series cabling

While the expansion connector connects the module carriers neighbourly, the extension cables take over the connection of the module carriers at the right end of one series with the first module carrier on the left side of the next series.



Ordering information:

Type	Description
PCD3.K010	Extension plug
PCD3.K106	Extension cable 0.7 m
PCD3.K116	Extension cable 1.2 m

2.7 Addressing

The address of an I/O slot module is determined by its module slot in the configuration.

Each PCD3 I/O slot module has 16 addresses (numbered from 0 to 15), regardless of the actual number of inputs / outputs (16, 8, 6 or 4).

CPU: CPUs serve LIOs as well as RIOs.
The addressing of the modules on a CPU looks like this:
Module slot 0 has the base address 0 (zero)
Module slot 1 has the base address 16
Module slot 2 has the base address 32
Module slot 3 has the base address 48
Each slot provides 16 addresses, regardless of the number of inputs / outputs (16, 8, 6 or 4) per module. Additionally, 64 addresses are available for the 4 slots.

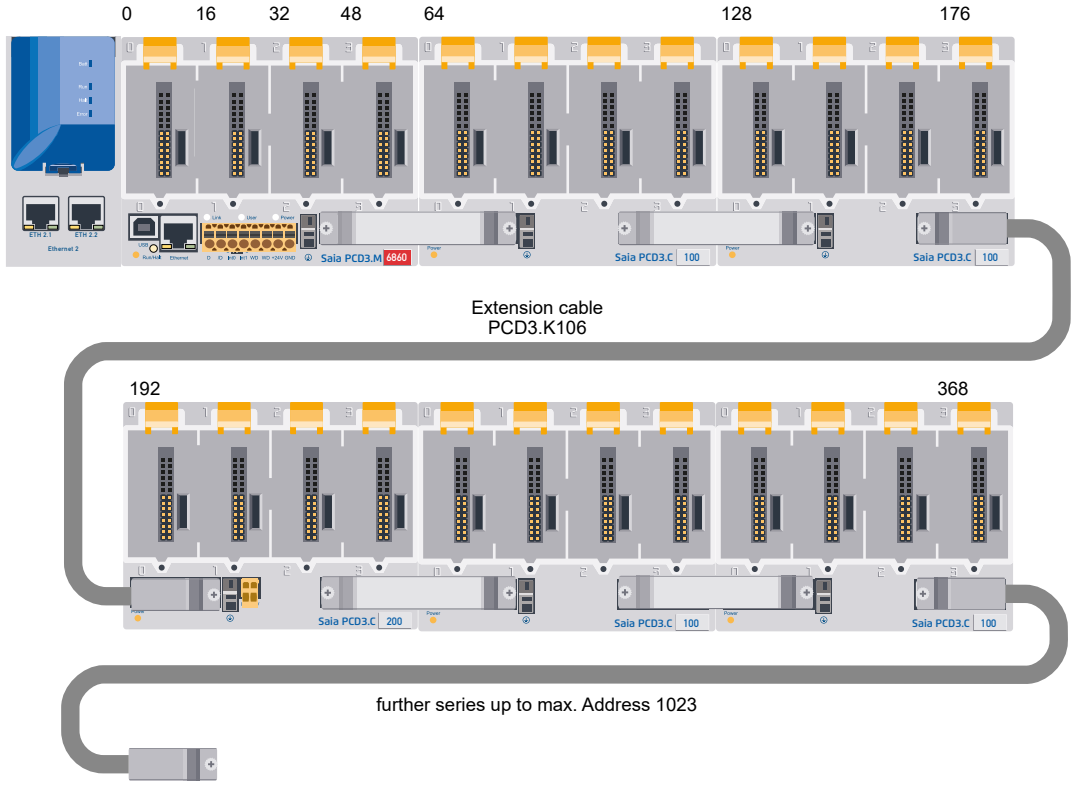
RIOs: RIOs are module carriers with standalone functions and are detatched from the CPU through a network.
There is no direct access to the I/Os.
The configuration of the RIO is communicated (defined) by the PG5 network configurator of the CPU.
RIOs receive their function from the CPU over the network and can use LIOs.
Addressing:
For addressing, the same applies as described under CPU.

LIOs: LIOs are supplementary module carriers (PCD3.C100 / C110 / C200) to a CPU or a RIO, thus expanding the number of module slots.

The address of the slot module is determined by the base address of the module carrier within a configuration and its location on the module carrier itself.

Addressing:

Module slot number	>= 4
I/O base address	>= 64



The address of the first module in a second or third series is determined by the address of the last module in the previous series +16.

For easier wiring, the module slots of the PCD3 module carriers are labeled with the numbers 0 to 3. For more precise addressing, each module carrier and also each module additionally has an address field in the lower right corner of the housing. How these address fields are used is described in the next chapter.

Address 255 is reserved for the watchdog relay. Modules using this address must not be inserted in module slot 16. For additional details, please see chapter 3.15.3 Hardware watchdog.

Each additional module carrier PCD3.C100 / C200 offers space for 4 additional I/O modules, at the end of the bus a PCD3.C110 provides space for 2 additional I/O modules. The connection to the next series is made via the 26-wire extension cable PCD3.K106 / K116.

Forces that occur at too small radii of the cable (smaller than the natural radius, so buckling), can cause damage to the connector!

The extension cables must not be connected or disconnected while the controller is under voltage!

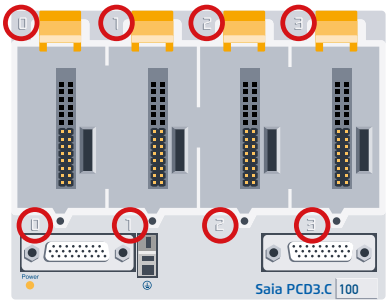
2.8 Labeling of the module carriers and I/O slot modules

2.8.1 Module carrier

The I/O module slots in the module carrier are labelled with highlighted digits:

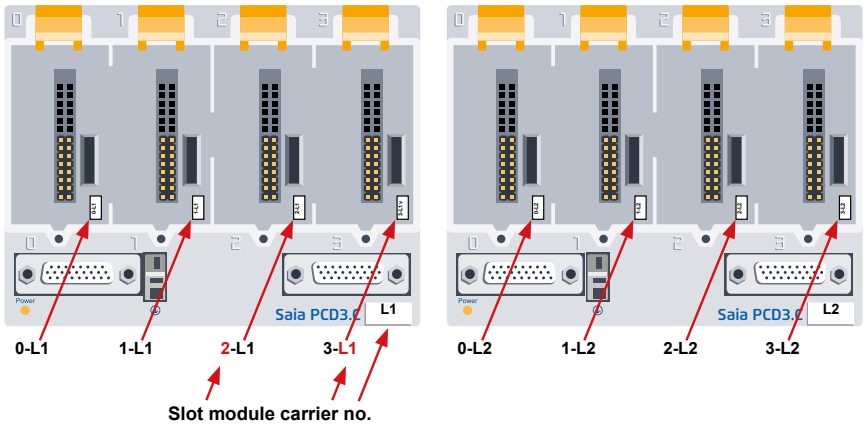
0…3 (PCD3.Mxxxx, /T76x, /T66x, /C200, /C100)

0…1 (PCD3.C110



Viewed from the front, each module carrier housing and each module slot has an address field in the lower right corner.

Example:



All PCD3 module carriers and the extension cable PCD3.K106 / 116 are accompanied by a matching set of labels as an additional option for labeling.

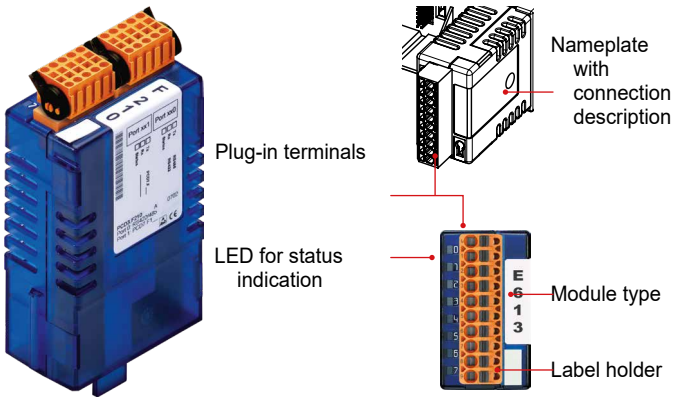
64	64	80	96	112	0
128	128	144	160	176	0
192	192	208	224	240	16
256	256	272	288	304	32
320	320	336	352	368	48
384	384	400	416	432	
448	448	464	480	496	
512	512	528	544	560	
576	576	592	608	624	
640	640	656	672	688	
704	704	720	736	752	
768	768	784	800	816	
832	832	848	864	880	
896	896	912	928	944	
960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

4 310 8686 0

2.8.2 I/O slot module

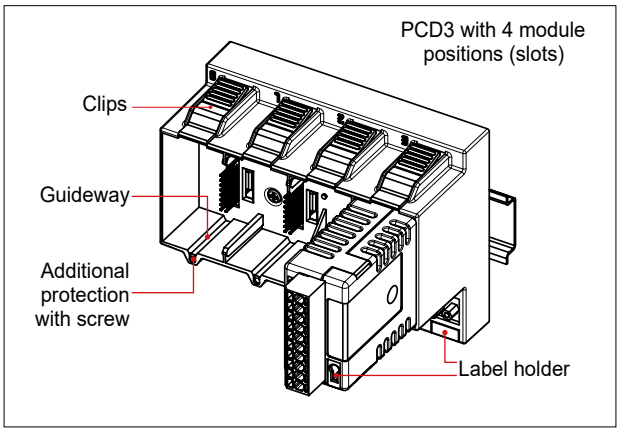
Saia PCD3 input and output modules in cassette design

The functions of the Saia PCD3 can be expanded as required using a wide range of plug-in I/O modules and can be adapted to specific requirements. This not only ensures that a project can be implemented quickly, but also provides the option of expanding or modifying the system at any time.



System properties

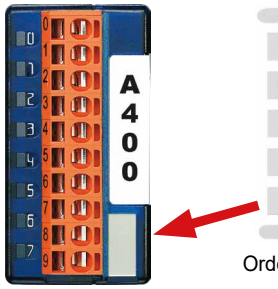
- Slot direct in the Saia PCD3 basic CPU or in the module holder
- Full integration in the Saia PCD3 housing
- Stable cartridge construction
- Numerous variants available
- Connection to the I/O level via plug-in spring terminal blocks or ribbon cables and adapters
- I/O terminal blocks are supplied as standard
- No tools required for replacing modules

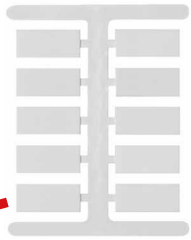


2

The small label holders (see outside right) are plugged into the front of the I/O module at the bottom right and serve as an address field.

With the labels shown on the right (4 310 8686 0), the modules can be assigned according to their module slot.





Order type 4 329 48191

Since mid-2005, all PCD3 I/O modules have been fitted with a mounting option for a labeling clip. The clips can be equipped with pre-punched labels and snapped on the right of the connector.

Additional labelling on the front

The clips including pre-punched labels (A4 sheet) are available as accessories under the order type 4 310 8723 0.

With clip

Order type 4 310 8723 0

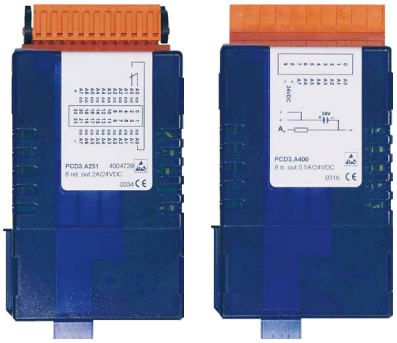
Older module housing <u>without</u> clip mounting option

New module housing <u>with</u> clip mounting option

2

Module labelling on the side

The circuit diagram printed on the side of each I/O module makes wiring easier and also helps during commissioning.

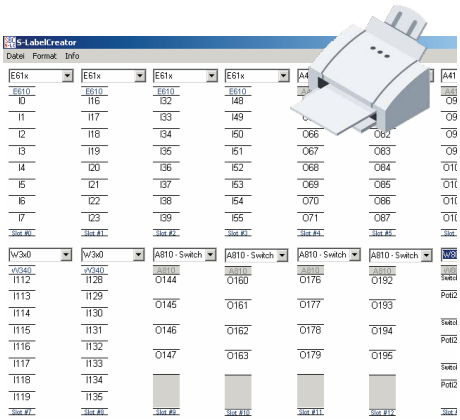


On the opposite side of the module, it is possible to attach individual labels using the supplied non-printed adhesive labels.

The pre-punched labels can be labeled using the device configurator of the PG5 programming tool from version V2.0 onwards.

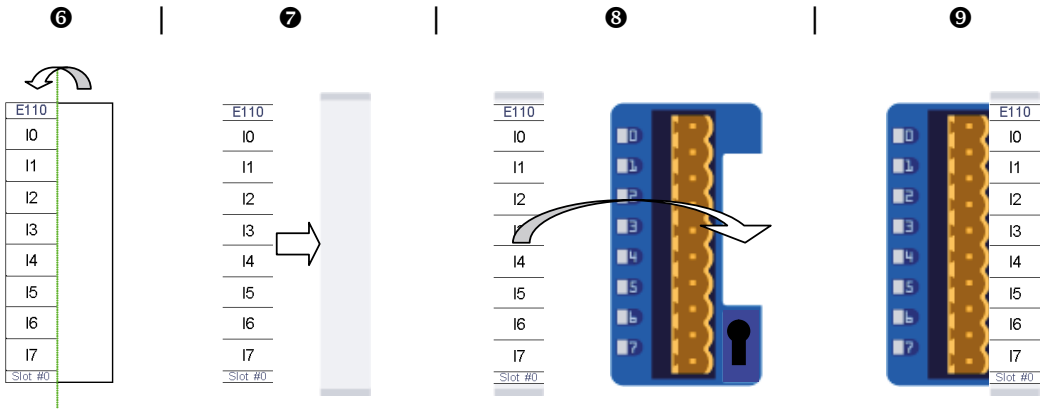
Fast labeling of I/O modules with the LabelEditor

This software tool is used to label PCD3 label clips efficiently.



Procedure:

1. Starting the PG5
2. Starting of the Device Configurator in the Device menu
3. Opening of the LabelEditor in the Tools menu
4. Select I/O module and modify the text according to your own preferences (font, color, frame, etc.)
5. Print the pre-punched labels on the supplied A4 sheet.
6. Break off the label from the A4 sheet
7. Slide the broken off label from the left under the transparent clip
8. Snap on the clip to the right of the plug of the PD3 I/O module
9. Attach connector plug
10. Finished.



Ordering information:

Type	Description
4 310 8686 0	Pre-printed self-adhesive strips for snap-on label holder
4 329 4819 1	Snap-on label holders for the PCD3 module marking / set of 10 pieces
4 310 8723 0	Labelling set: 10 transparent snap-on label holder 2 pages neutral inscription labels (DIN A4)

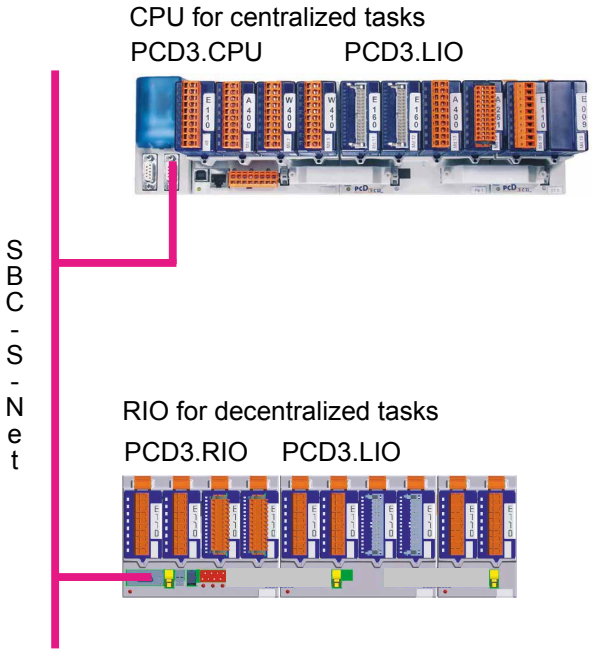
3 PCD3.Mxxx0 Classic CPU and module carrier

3.1 System overview
3.2 General technical data
3.3 System resources
3.4 PCD3 CPU
3.5 Extension with PCD3 components
3.6 Module carrier
3.7 Installation of the CPU and module carrier
3.8 Dimensions
3.9 Power supply and connection plan
3.10 Data retention in the event of power failure
3.11 Operating states
3.12 Operating mode (Run/Stop)
3.13 Manual control and emergency operation
3.14 Connections of the PCD3.Mxxx0
3.15 Connections on orange terminal block
3.16 Software watchdog
3.17 Hardware Clock (Real Time Clock)
3.18 Storage space on the PCD3

xx7

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

3.1 System overview



3.1.1 SBC S-Net networking concept

SBC S-Net is the name of the new flexible networking concept for innovative and economical automation solutions with SaiaPCD.

Based on the open standards Ethernet-TCP/IP (Ether S-net) and Profibus (Profi S-net): Utilization of existing network infrastructure ➔ no double cabling required

Supports multivendor and multi-protocol operation:
Reduce costs for project planning, programming, commissioning and maintenance thanks to end-to-end use of Ethernet TCP / IP and Profibus with S-Net for the Private Control Network (PCN) for SaiaPCD

Consistent use of web technologies via Ethernet TCP / IP and Profibus for commissioning, operation, monitoring and diagnostics

Integrated programming and commissioning via Ethernet TCP / IP and Profibus

Integrated network connections in the base unit Profibus interface integrated in the operating system of the new PCD3 controllers and PCD3 RIO (included in the base unit at no extra cost)

Profi-S-Net with optimized protocols and services for the efficient operation of PCD3 RIO and PCD3 controllers on Profibus

Multi-protocol operation:
The new PCD3 controllers and PCD3 RIOs support Profibus-DP and S-Net on the same connector

Continuity and investment protection:
Alle Saia PCD systems can be integrated in the concept with the existing Profibus and Ethernet TCP / IP connections.

3.1.2 Saia PCD® Web server

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

Web browser as a tool for commissioning, service and visualization:
Access to the SBC web server is via standard web browsers such as Internet Explorer. As a result, the web browser, which can be operated intuitively by anyone, is used as a standard tool for commissioning, service, support and visualization of machines, devices and systems. The user can access predefined device and system-specific HTML pages and has access to all controller and RIO data. Graphical elements (pictures, graphics, etc.) as well as text documents (operating and repair instructions) can also be integrated in the HTML pages and make a personalized user interface possible

Continuous access via any interfaces and networks:
Access to the web server can be achieved not only over Ethernet TCP / IP but also via cost-effective standard serial interfaces (RS-232, RS-485, modem, etc.) and via Profibus networks and consistently across different network levels. This means that web technology can be used economically even in the smallest applications for operator control and monitoring

The Saia PCD web server is integrated with all products:
Thanks to the standard integrated web server, there is no need for run-time licenses or additional modules. In all new PCD3 controllers and PCD3 RIOs, the web server is already included in the base units at no extra cost.

3.2 General technical data

Supply (external and internal)		
Supply voltage	24 VDC –20… + 25% smoothed or 19 VAC ± 15% two way rectified (18 VDC)	
Loss/power consumption[1)]	typically 15 W for 64 I/Os	
Load capacity of internal 5 V Bus[2)]	600 mA	
Load capacity of internal + V Bus (16..24 V)[2)]	The load capacity of the + V bus depends on the load of the 5V bus as follows (the more accurate the 24V, the higher the possible load):	
	24 V	$^{-25\ \%}_{+30\ \%}$: 100 [mA]
	24 V	$^{-20\ \%}_{+25\ \%}$: $150 - \frac{I_{bus\ 5\ V}}{15}$ [mA]
	24 V	$^{-10\ \%}_{+10\ \%}$: $260 - \frac{I_{bus\ 5\ V}}{4.8}$ [mA]
1) The loads and other loads connected to the outputs are usually more important for sizing the feed than the internal power dissipation of the controller 2) When planning PCD3 systems, it must be checked whether the two internal power supplies are not overloaded. This control is particularly important when using analog, counting and positioning modules, as these sometimes have a fairly large power consumption. To calculate the power consumption, we recommend using the Device Configurator, which is part of the PG5 V2.0.		

Climatic conditions		
Operating environment temperature	0 … +55 °C 0 … +40 °C	When mounted on a vertical surface with vertically arranged connection terminals. Reduced temperature range in all other mounting positions.
Storage temperature	–25…+85 °C	
Relative humidity	10…95%	Without condensation

Vibration resistance	
Swing - Sine Vibration	according to IEC 60068-2-6:2007, Test Fc 5…8.4 Hz constant amplitude ±3.5 mm 8.4…150 Hz constant acceleration (1 g) Test duration: 10 sweeps per axis, along 3 axes

Electrical safety	
Protection type	IP 20 according to EN60529
Clearances and creepage	according to EN61131-2 and EN50178 between circuits and bodies as well as between isolated circuits according to overvoltage category II, pollution degree 2
Test voltage	VAC 350 V / 50 Hz for nominal device voltage 24 VDC

Electromagnetic compatibility	
Electrostatic discharge	according to EN61000-4-2: 8 kV: Contact discharge
Electromagnetic fields	according to EN61000-4-3: Field strength 10V/m, 80...1000 MHz
Fast transients (burst)	according to EN61000-4-4: 4 kV on DC supply lines, 4 kV on I/O signal lines, 1 kV on interface lines
Interference emission	according to EN61000-4-6: Limit class A (for industrial environment). A guide to the correct use of these controls in the residential or living area is available at www.sbc-support.com (additional measures)
Immunity	according to EN61000-6-4

Mechanics and assembly		
Housing material	Module holders: I/O-module: Rest Hinge: Light guide:	PC/ABS, light grey, RAL7035 PC, transparent blue PAM, orange, RAL2003 PC, crystal clear
Mounting rail	DIN rail according to DIN EN60715 TH35 (formerly DIN EN50022) (1 × 35mm)	

Connections						
Terminal blocks	Spring-clamp 10-pin, 4-pin	Screw clamps 10-pin	Spring-clamp 14-pin, 12-pin, 8-pin	Spring-clamp 24-pin, 6-pin	Ground terminal 1-pin	Spring terminal 2-pin power supply
Cross-section **fine-stranded** **solid**	0.5…2.5 mm² 0.5…2.5 mm²	0.5…2.5 mm² 0.5…2.5 mm²	0.5…1.5 mm² 0.5…1.5 mm²	0.5…1.0 mm² 0.5…1.0 mm²	0.08…2.5 mm²	0.5…1.5 mm²
	The terminal blocks may only be inserted 20 times. After that they have to be replaced to guarantee a reliable contact.					
Stripping length	7 mm	7 mm	7 mm	7 mm	5…6 mm	7 mm

Standards/approvals	
EN/IEC	EN / IEC61131-2 Programmable logic controllers
Shipbuilding	ABS, BV, DNV, GL, LRS, PRS. Veify at www.sbc-support.com, whether the selected product is listed in the list of relevant test centers.
cULus-listed	Veify at www.sbc-support.com, whether the selected product already has a relevant certificate. The condition for cULus approval is listed on the product flyer or can be downloaded from www.sbc-support.com.

3.3 System resources

More detailed descriptions of the following three subsections can be found in manual 26-732.

3.3.1 Program blocks

Type	Number	Addresses	Notes
Cyclical organization blocks (COB)	32 (16)*	0…31 (0...15)*	Main program components
Exception/system dependent organization blocks (XOB)	32	0…31	Accessed by the system
Program blocks (PB)	1000 (300)*	0...999 (0…299)*	Subprograms
Function blocks (FB)	2000 (1000)*	0...1999 (0…999)*	Subprograms with parameters
Sequential blocks (SB) a total of 6000 steps and 6000 transitions **(with PG5 ≥ 1.3 and firmware version ≥** 1.10.16)	96 (32)*	0…95 (0…31)*	For Graftec programming of sequential processes

* This information is valid for firmware 1.10.16 and later versions. Prior to this release, 16 COBs, 300 PBs and 1000 FBs were supported.

3.3.2 Value range of the number types

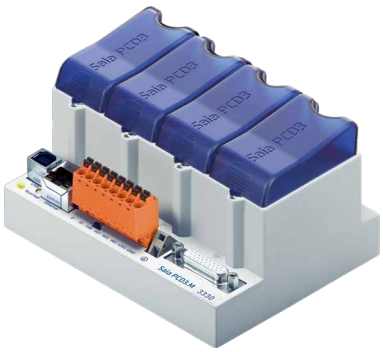
Type	Range	Notes
Whole numbers	– 2'147'483'648 to + 2'147'483'647	Format: Decimal, binary, BCD or hexadecimal
Floating point numbers	$-9.223'37 \times 10^{18}$ to $-5.421'01 \times 10^{-20}$ $+9.223'37 \times 10^{18}$ to $+5.421'01 \times 10^{-20}$	Commands for converting values in SBC (*Motorola Fast Floating Point*, FFP) format to IEEE 754 format and vice versa are available

3.3.3 Media

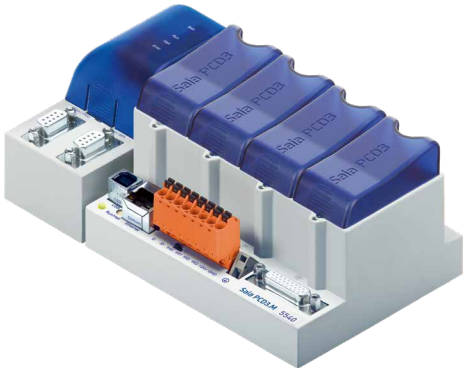
Type	Number	Addresses	Notes
Flags (1 bit)	*14'336 (8192)	F0…14'335 (F0…8191)	By default, all flags are non-volatile, but a volatile range starting at address 0 can be configured
Register (32 bit)	16'383	R 0…16'383	For integer or flow point values
Text/data blocks	8191	X or DB 0…8191	Texts 0…3999 are always stored in the same memory area as the user program. If the user memory is expanded, the base memory can be configured to store RAM texts and DBs. The available texts and DBs have addresses ≥ 4000
Timer/counter (31 bit)	1600[1)]	T/C 0…1599	The breakdown of timers and counters can be configured. The timers are periodically decremented by the operating system, the time base can be set in the range of 10 ms to 10 s
Constants with media code K	Any		Value range 0…16'383 can be used in commands instead of registers
Constants without media code	Any		Value range –2'147'483'648 to +2'147'483'647. Can only be loaded into a register with an LD command and not used in place of registers in commands

1) The number of timers should only be configured as high as necessary, otherwise there will be an unnecessary CPU load.
** From firmware 1.14.23, 14'336 flags are supported, prior to that is was 8192. To use more > 8191 flags, PG5 2.0.150 is required.

3.4 PCD3 CPU



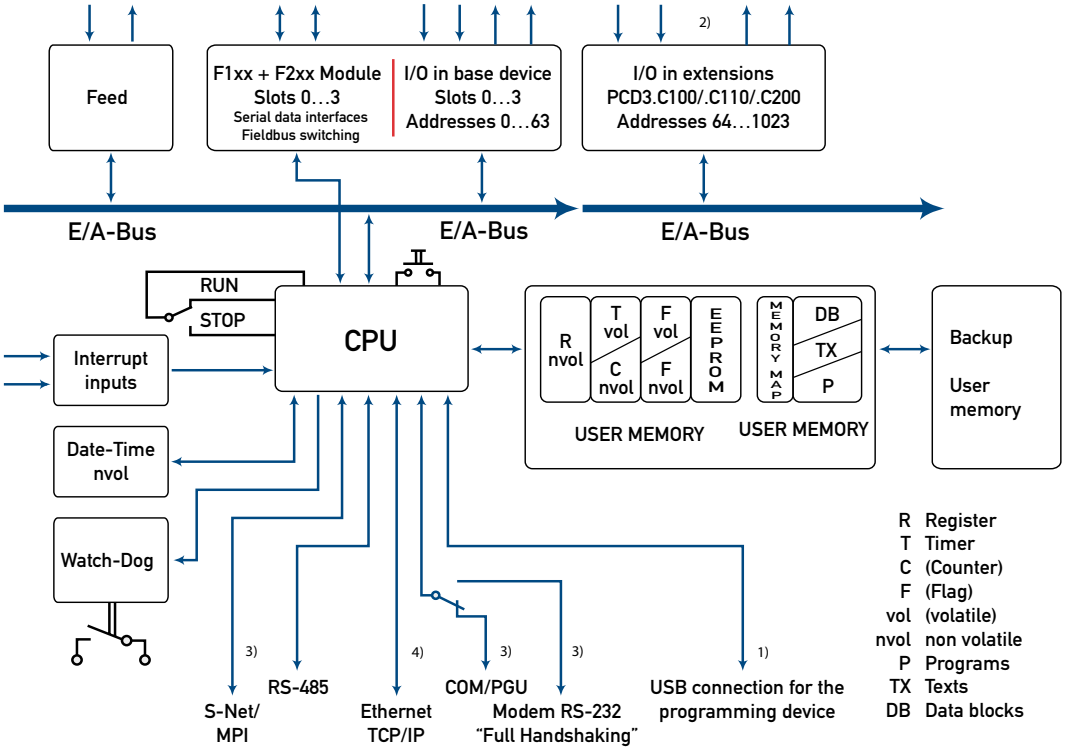
PCD3.M3xxx



PCD3.M5xxx and PCD3.M6xxx

The redundant CPU PCD3.M6880 and the matching smart RIO PCD3.T668 are described in the manual 27-645 Standby Controllers.

3.4.1 Block diagram PCD3.Mxxx0

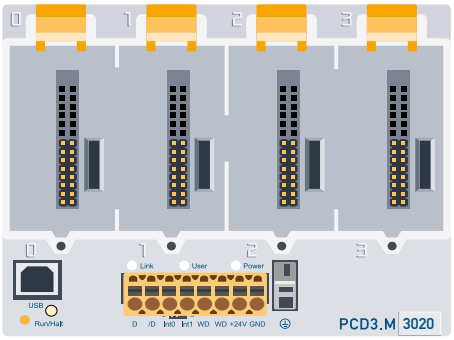


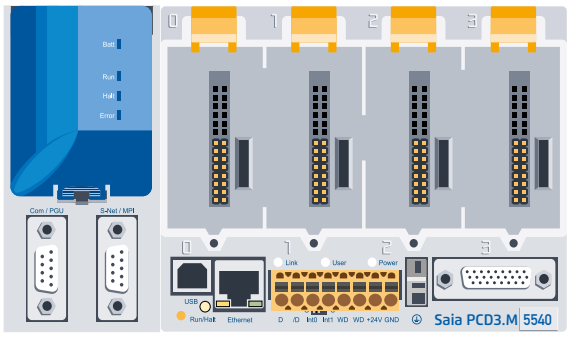
1) Connection for the programming unit
2) except PCD3.M3020/3120
3) only PCD3.M5xx0/PCD3.M6xx0
4) with PCD3.M3330 or PCD3.M5540

I/O modules and I/O terminal blocks may only be pulled out or inserted when the Saia PCD® is in a de-energised state. The external +24 V power supply of the modules must also be switched off.

To avoid data loss, a battery change must be carried out with the power switched on.

3.4.2 PCD3.M3x20 / PCD3.M3x30 and PCD3.M5x40 / PCD3.M6x40





Difference of the PCD3 basic devices	Basic		Extended		CAN	Profibus DP Master
PCD3.M.	3020	3230	5340	5440	6240	6440
PCD3.M.	3120	3330		5540	6340	6540
General features						
I/O bus extension	-	✓				
In-/Outputs or I/O module slots	to 64[1] 4	bis 1023[1] [2] 64				
Processor (Motorola)	CF 5272 / 66 MHz					
Processing time Bit command word command	0.3…1.5 µs[3] 0.9 µs[3]					
Firmware update	Download with PG5 possible					
Can be programmed 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
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)			
Date-clock accuracy	✓, better than 1 min./month					
Data backup	4 hours with Super Cap (after 10 minutes of charging time)		Lithium Battery Renata CR 2032 1-3 years [5]			
Interrupt inputs max. Input frequency	2 1 kHz [6]					
Interfaces						
Programming interface	**USB** [7]					
Programming interface (PGU) or as a serial interface	-		**Port 0** RS-232 to 115 kBit/s			
Optional serial data interfaces	**Port 1** RS-232, RS-422/485 or TTY current loop 20mA, pluggable (PCD3.F1xx modules), up to 115 kBit / s					

Difference of the PCD3 basic devices	**Basic**		**Extended**		**CAN**	**Profibus DP Master**
PCD3.M.	**3020**	**3230**	**5340**	**5440**	**6240**	**6440**
PCD3.M.	**3120**	**3330**		**5540**	**6340**	**6540**
Serial data interface	**Port 2** RS-485 to 115 kBit/s					
Profi-S-Net interfece	**Port 2** to 187.5 kBit/s			**Port 10** to 1.5 MBit/s	**Port** 2 to 187.5 kBit/s	
Ether S-Net interface	only M3120	only M3330	✓	only M5540	only M6340	only M6540
Fieldbus connections						
Serial S-Net	✓					
Profi S-Net	✓					
Ether-S-Net (TCP/IP)	only M3120	only M3330	✓	only M5540	only M6340	only M6540

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

2) The address 255 is reserved for the watchdog on all PCD3. The I/O reserved for the watchdog can not be used by the user, and analog and H modules must not be deployed with the slots with base address 240

3) Typical values, the processing time depends on the load on the communication interfaces

4) From HW version D and the matching FW, see detailed explanation in chapter 3.19

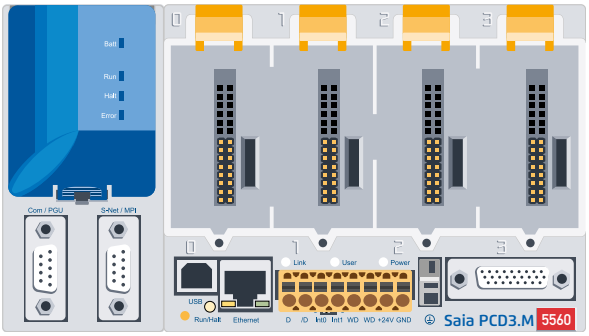
5) The specified duration is a buffer time, it depends on the ambient temperature (a higher temperature means a shorter buffer time)

6) The 1kHz apply to a pulse/pause ratio of 1:1 and refer to the sum of the frequencies of the two inputs

7) The USB port is of type USB 1.1 Slave Device 12 MBit/s and can only be used for programming and in combination with certain software products (Web-Connect, ViSi-PLUS with S-Driver) as S-Bus slave. The download works twice as fast with a USB 2.0 hub.

   Can also be used as serial data interface e.g. used for connecting a terminal, however, this makes the commissioning and debugging with the debugger difficult.

3.4.3 PCD3.Mxx60



Difference of the PCD3 basic devices	Basic		Extended		Profibus DP Master	2 × Ethernet
PCD3.M	**3160**	**3360**	**5360**	**5560**	**6560**	**6860**
General features						
I/O bus extension	-	✓				
In-/Outputs or I/O module slots	to 64[1)] 4	to 1023[1) 2)] 64				
Processor (Freescale ex. Motorola)	MCF 5373					
Processing time Bit command word command	0.1…0.8 µs[3)] 0.3 µs[3)]					
Firmware, firmware update (firmware memory soldered)	Download from the PG5 environment possible					
Can be programmed with PG5	from version 2.2.130			from version SP2 2.0.200		
Program memory, DB/text (FLASH)	512 kByte		2 MByte			
User memory, DB/text (RAM)	128 kB	512 kB	1 MByte			
Flash memory (S-RIO, configuration and backup)	128 MByte 128 MBytes					
User flash file system (INTFLASH)	128 MByte 128 MBytes					
Date-clock accuracy	✓ better than 1 min./month					
Data backup	4 hours with Super Cap (after 10 minutes of charging time)		Lithium battery Renata CR2032 1-3 years [4)]			
Interrupt inputs max. Input frequency	2 1 kHz [5)]					
Interfaces						
Programming interface	**USB** [6)]					
Programming interface (PGU) or as a serial interface	-		**Port 0** RS-232 to 115 kBit/s			
Optional, serial data interfaces	**Port 1** RS-232, RS-422/485 or TTY current loop 20mA, pluggable (PCD3.F1xx modules)					

Difference of the PCD3 basic devices	Basic		Extended		Profibus DP Master	2 × Ethernet
PCD3.M	**3160**	**3360**	**5360**	**5560**	**6560**	**6860**
Serial data interface	Port 2 RS-485, to 115 kBit/s					
Profi-S-Net interfece	Port 2 to 187.5 kBit/s			Port 10 to 1.5 MBit/s	Port 10 to 12 MBit/s	Port 2 to 187.5 kBit/s
Ether S-Net interface	-	✓				
Fieldbus connections						
Serial S-Net	✓					
Profi S-Net	✓					
Ether-S-Net (TCP/IP)	-	✓				

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

2) The address 255 is reserved for the watchdog on all PCD3. The I/O reserved for the watchdog can not be used by the user, and analog and H modules must not be deployed with the slots with base address 240

3) Typical values, the processing time depends on the load on the communication interfaces

4) The specified duration is a buffer time, it depends on the ambient temperature (a higher temperature means a shorter buffer time)

5) The 1 kHz apply to a pulse/pause ratio of 1:1 and refer to the sum of the frequencies of the two inputs

6) The USB port is of type USB 1.1 Slave Device 12 MBit/s and can only be used for programming and together with certain software products (Web-Connect, ViSi.Plus with S-Driver) as S-Bus Slave. The download works twice as fast with a USB 2.0 hub

Can also be used as serial data interface e.g. used for connecting a terminal, however, this makes the commissioning and debugging with the debugger difficult.

3.4.4 Hardware and firmware versions of the PCD3.Mxxx0

The firmware versions of the PCD3.Mxxx0 are usually downward compatible in terms of hardware, so that even old CPUs can be equipped with new firmware to benefit from new functions. This property is highly valued, and we try to keep it as long as possible; however, we cannot guarantee it.

The firmware of the PCD3.Mxxx0 is stored in a flash EPROM, which is soldered to the motherboard. A firmware update is possible by downloading a new version with the PG5. The procedure is as follows:

- Download the current firmware version from www.sbc-support.com
- Establish a connection between the PG5 and the CPU, as for the download of an application (depending on the available options such as serially with PGU cable, modem[1)], USB, Ethernet)
- Open the online configurator and go offline
- In the Tools menu, select Download Firmware, then use the browse function to select the path to the file of the new firmware version. Make sure only one file is selected for download
- Start the download
- After the download, the power supply of the Saia PCD® must not be interrupted for 2 minutes (CPLD programming sequence). Otherwise it may happen that the CPU is blocked in such a way that it has to be returned to the factory. While the Run/Stop LED flashes slowly, the download process is not yet completed. Only when it flashes fast, the programming is finished.

1) A modem connection is not reliable. It may be that a modem is blocked in such a way that remote access is no longer possible. In such cases, local intervention will be necessary. The other connection options are preferred.

3.5 Extension with PCD3 components

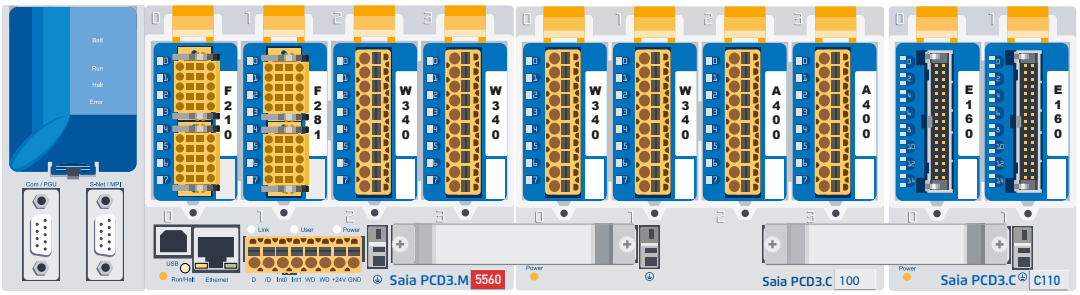
The PCD3.Mxxxx can be extended with extension module carrier PCD3.Cxxx so that additional module slots are available (chapter 3.6 Module carrier).
Up to 15 PCD3.Cxxx module carriers with PCD3.K010 connectors and/ or PCD3.K106 or PCD3K116 cables can be connected to the PCD3.Mxxx0 (PCD3.M3020 / 3120 are not expandable). This allows the user to connect a maximum of 64 I/O modules or 1023 digital inputs/outputs.

PCD3.M..	3020 3120	3230 3330	5xx0 6xx0
Maximum number of inputs / outputs or I/O module slots of the system:	64[1)] 4	1023[1) 2)] 64	1023[1) 2)] 64

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

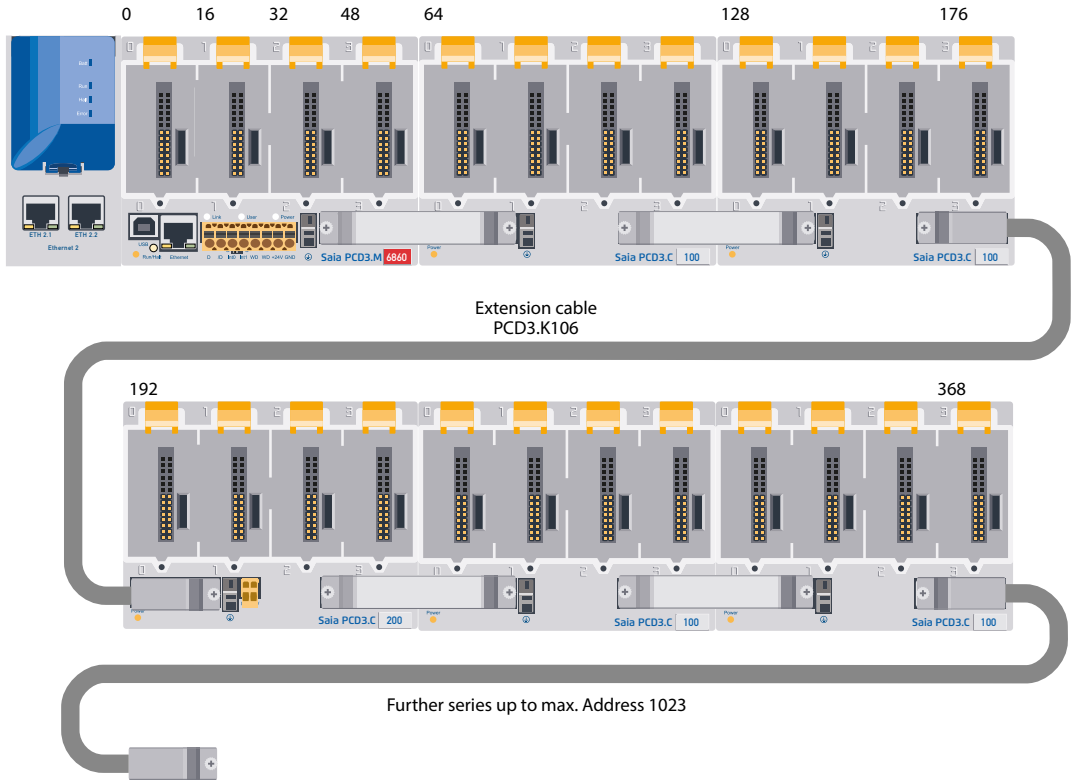
2) The address 255 is reserved for the watchdog on all PCD3. The I/O reserved for the watchdog can not be used by the user, and analog and H modules must not be deployed with the slots with base address 240

PCD3.M5560 **PCD3.C100** **PCD3.C110**



For details see 3.6 Module carrier

Addressing



For local expansion, the PCD3 LIOs (Local I/O) modules are used.

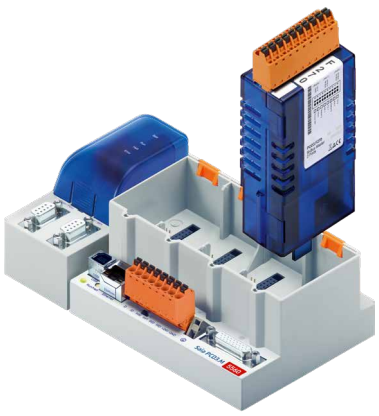
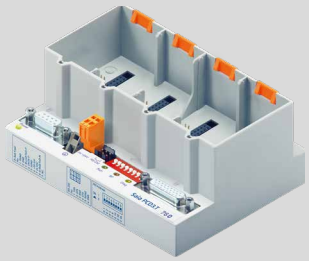
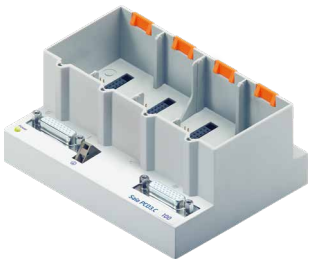
For remote expansion via Profibus the PCD3 RIOs (Remote I/O) modules are used.

The maximum number of I/Os depends on the controller used.

When selecting the I/O modules, care must be taken that the internal 5 V and + V supply are not overloaded (see chapter 3.9.2).

3.6 Module carrier

Overview of the module carriers

Short name	Advertised	Type	Example image
CPU	Central Processor Unit	PCD3.Mxxxx	
RIO	Remote Input Output (see chapter 4)	PCD3.Txxx	
LIO	Local Input Output	PCD3.Cxxx	

3.6.1 The module carriers (LIO)

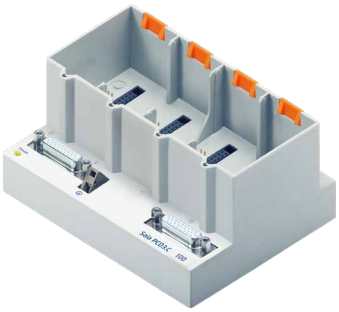
The PCD3.LIO (Local Input/Output = LIO) is used to acquire central I/O signals. The compact PCD3.LIO snap onto a 35 mm DIN rail and can be equipped with PCD3 I/O modules. PCD3.LIOs can be connected as an I/O extension to a PCD2 CPU, PCD3 CPU or PCD3.RIO.

Three different module carriers are available for receiving I/O modules:

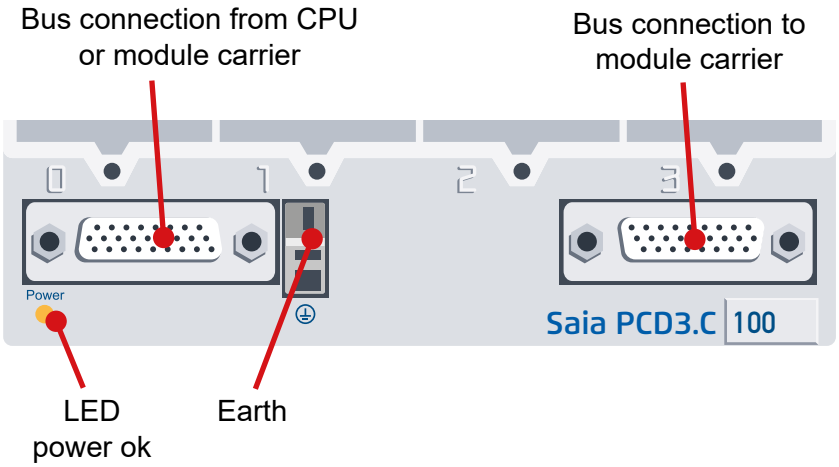
Module carrier / LIO	PCD3.C100	PCD3.C110	PCD3.C200
Number of module slots	4	2	4
Description	4 I/O modules	2 I/O modules	4 I/O modules, serves as I/O bus repeater and internally provides + 5 V and V + for one segment of I/O modules (for calculation of possible load see 3.18.3)
Ext. Supply	-	-	24 VDC
Int. Supply I to +5 V	10 mA	10 mA	-

PCD3.C100 for 4 modules

- For 4 pluggable PCD3 I/O modules (freely selectable)
- Can be connected to PCD2.Mxxx, PCD3.Mxxx0, PCD3.RIO and PCD3.LIO
- Expandable with further PCD3.LIO (PCD3.C100 /... C110 /... C200)

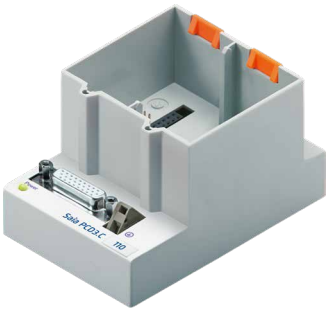


Connections PCD3.C100 for 4 modules

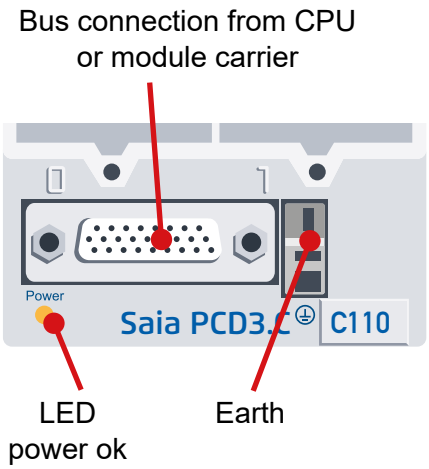


PCD3.C110 for 2 modules

- For 2 pluggable PCD3 I/O modules (freely selectable)
- Can be connected to PCD2.Mxxx, PCD3.Mxxx0, PCD3.RIO and PCD3.LIO
- Not expandable



Connections

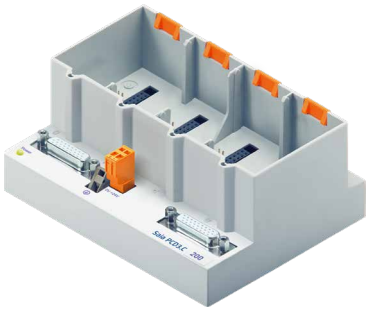


PCD3.C200 for 4 modules with power supply

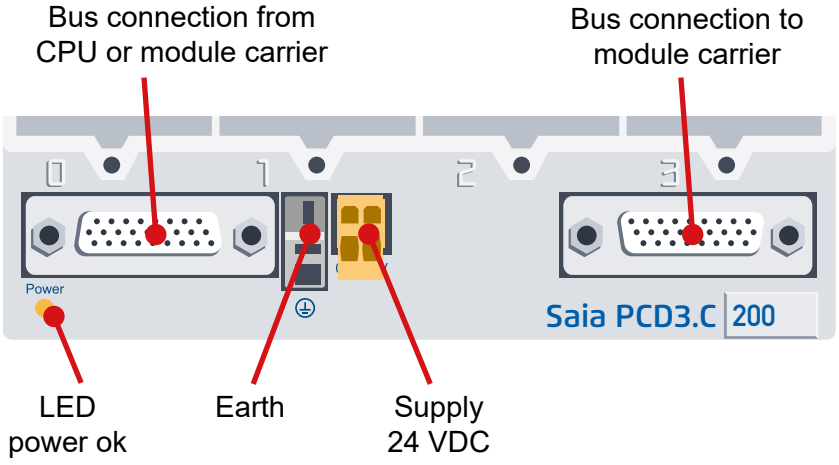
The PCD3.C200 supplies the following module carriers PCD3.C100 and PCD3.C110 with current up to a certain load limit. The load is calculated by the power consumption of the I/O modules used. If this load is exceeded, a PCD3.C200 I/O Bus Repeater will continue to help to secure the internal +5 V and V + for another I/O bus segment.

Comment: The term I/O bus segment refers to all module carriers from the current CPU or PCD3.C200 to another PCD3.C200 repeater.

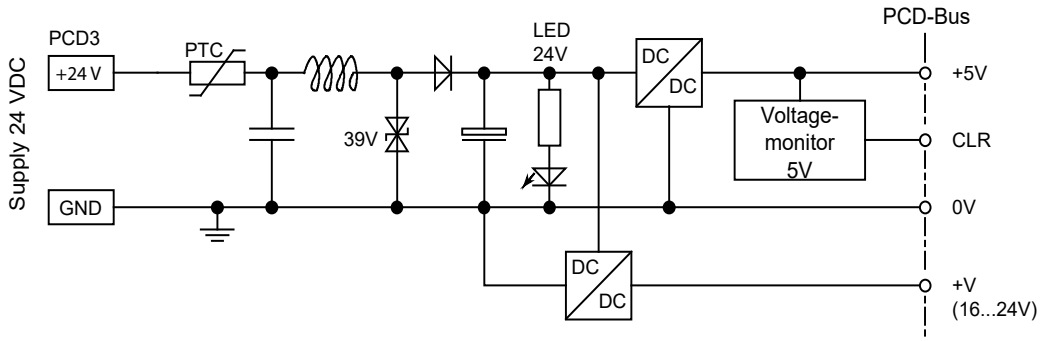
- For 4 pluggable PCD3 I/O modules (freely selectable)
- Can be connected to PCD2.Mxxx, PCD3.Mxxx0, PCD3.RIO and PCD3.LIO
- Expandable with PCD3.LIO (PCD3.C100, .C110, .C200)
- Serves as a bus repeater and internally provides + 5 V and V + for a segment of I/O modules



Connections



Internal supply of the LIO module carrier PCD3.C200



The PCD3.C200 module carriers provide the following internal supply currents for the plugged or connected modules:

Type	+ 5V	V + The load capacity of the + V bus depends on the load of the 5 V bus as follows (the more precisely the 24 VDC are maintained, the higher the possible load)
PCD3.C200 HW version A and B	1000 mA	100 mA
PCD3.C200 HW version C	1500 mA	24 V $^{-25\%}_{+30\%}$: 200 [mA] 24 V $^{-20\%}_{+25\%}$: $310 - \frac{I_{5\ V\ Bus}}{15}$ [mA] 24 V $^{-10\%}_{+10\%}$: $630 - \frac{I_{5\ V\ Bus}}{3.8}$ [mA]

When planning PCD3 systems, it must be checked whether the two internal power supplies are not overloaded. This control is especially important when using analog, counting, and positioning and other special modules, as some of them consume a relatively large amount of power.

It is recommended that you use the PG5 Device Configurator

3.6.2 Calculation of the possible load

The PG5 Device Configurator automatically calculates the load of the power supplying devices through the I/O modules used. This indicates whether one or more I/O bus repeaters PCD3.C200 should be used.

Comment: I/O bus segment means all module carriers from the current CPU or PCD3.C200 to another PCD3.C200 repeater.

3.6.3 Module carrier connections

To connect the module carriers with each other, the following plug connections should be used.

Ordering information:

Extension plug and cables		
PCD3.K010	Extension plug	
PCD3.K106	Extension cable 0.7 m	
PCD3.K116	Extension cable 1.2 m	

3.7 Installation of the CPU and module carrier

3.7.1 Mounting position and ambient temperature

Normally, a vertical surface is used to mount the module carriers, and the I/O connections of the modules also run vertically. In this mounting position, the ambient temperature may be 0 ° C to 55 ° C.

In all other positions, the air convection works less efficiently, therefore an ambient temperature of 40 ° C must not be exceeded.

3.7.2 Assembly / disassembly

The PCD3 CPU and module carrier are snapped onto a mounting rail according to DIN EN60715 TH35 (formerly DIN EN50022, DIN rail 1 × 35mm).

Mounting on DIN rail

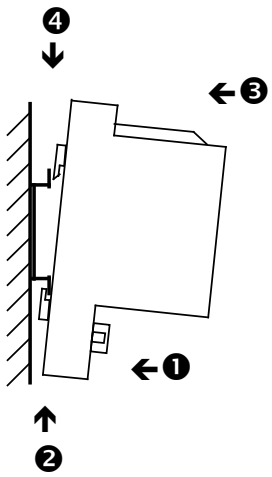
❶ Press lower part of housing onto mounting rail

❷ Push up against the spring force up to the stop

❸ Hook in over the upper edge of the mounting rail and yield to the spring force.

❹ For safety, push the housing into the mounting rail from top to bottom

❺ Check if the device is securly fixed.



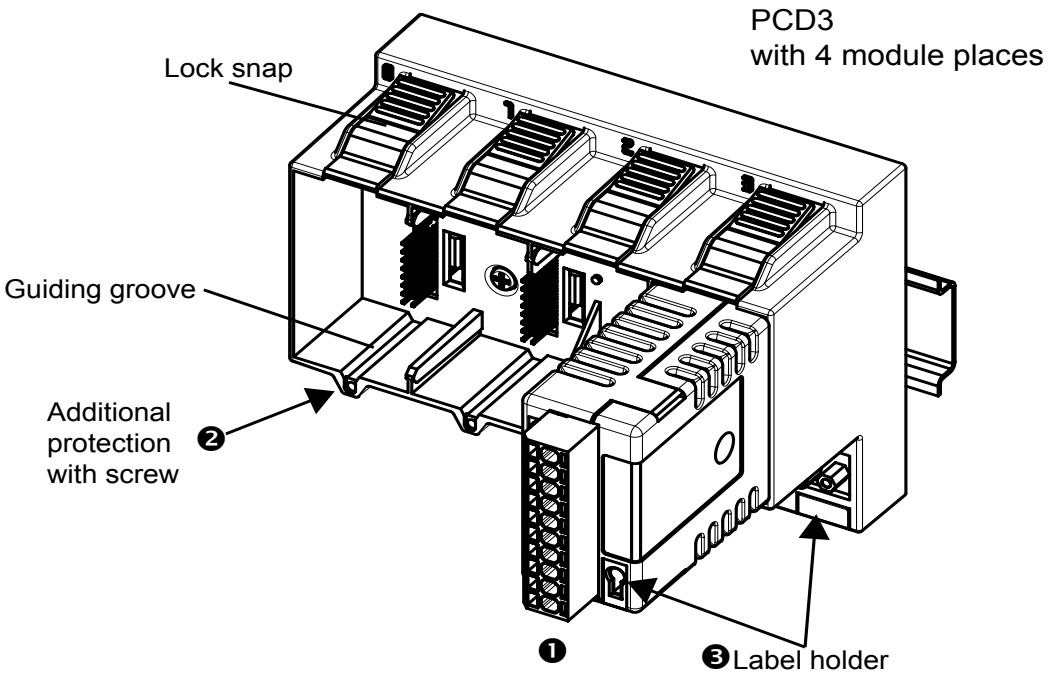
Dismounting from DIN rail

❷ Push the housing upward to unhook and pull it forwards

❸ Disconnect above the upper edge of the mounting rail and yield to the spring force.

❹ Disconnect the lower part of the housing from the mounting rail from top to bottom.

3.7.3 Insertion of I/O modules



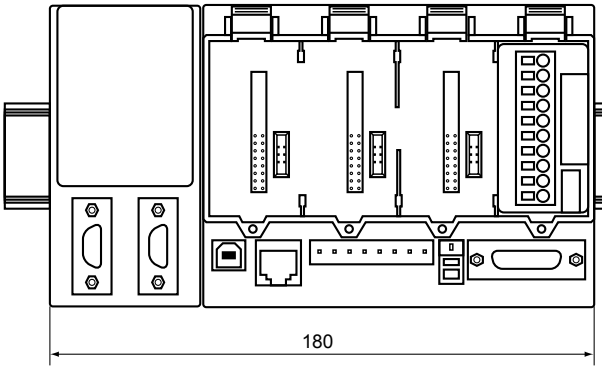
❶ Insert the module in the appropriate module slot and press until the bottom of the housing of the CPU or the module carrier is reached. Make sure that the orange latch is engaged

❷ For safety, a guide groove is provided to prevent the module from being inserted the wrong way round. In difficult environmental conditions, the modules can be additionally secured with a screw. Screw type: self-tapping 3 × 8 mm, standard type available in the metal trade

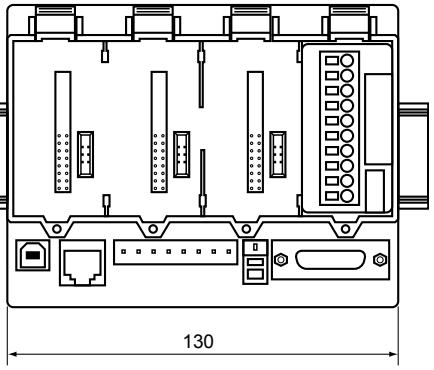
❸ Number of module slots in the module carrier:
- 4 places (labeling 0, 1, 2 and 3) PCD3.Mxxx0, C100 / C200 / T760
- 2 places (label 0 and 1). The PCD3.C110 can only be used as the last module carrier in the bus

3.8 Dimensions

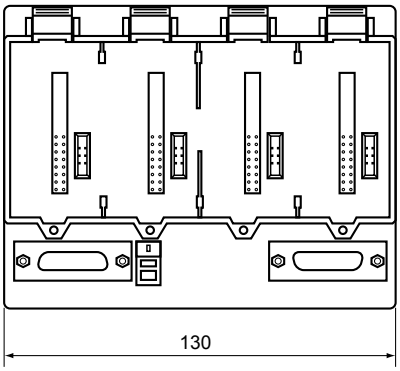
PCD3.M5xx0/M6xx0



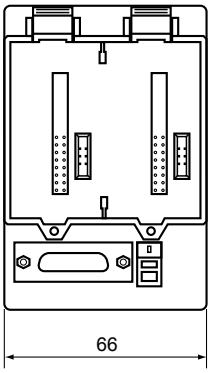
PCD3.M3xx0

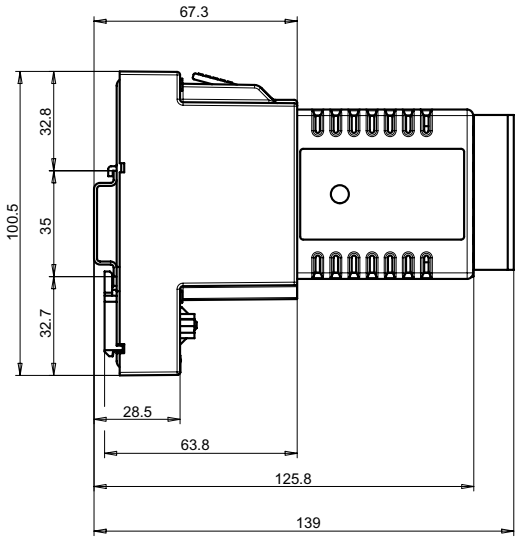


PCD3.C100/C200/T76x



PCD3.C110





3.9 Power supply and connection plan

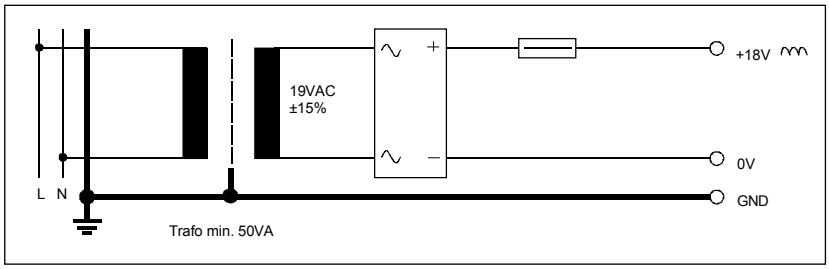
Difference external and internal power supply

- **External**
  External power supply means the feeding of the inputs and outputs at the terminal block of the respective module or compact CPU, (analog, relay, transistor etc.). This common method allows far higher currents than would be possible within the controller and does not necessarily require qualitative stabilization.

- **Internal**
  Internal power supply means the supply of the CPU, RIOs and the switching electronics of the I/O plug-in modules without inputs/outputs on the terminal block of the module. The advantage of the internal supply unit is its more advanced processing and therefore the quality of the DC voltage as it would have to been supplied via the external, since the user does not have to worry about the quality of a clean power supply. Except for fast counter and stepper motor modules of type PCD3.Hxxx.

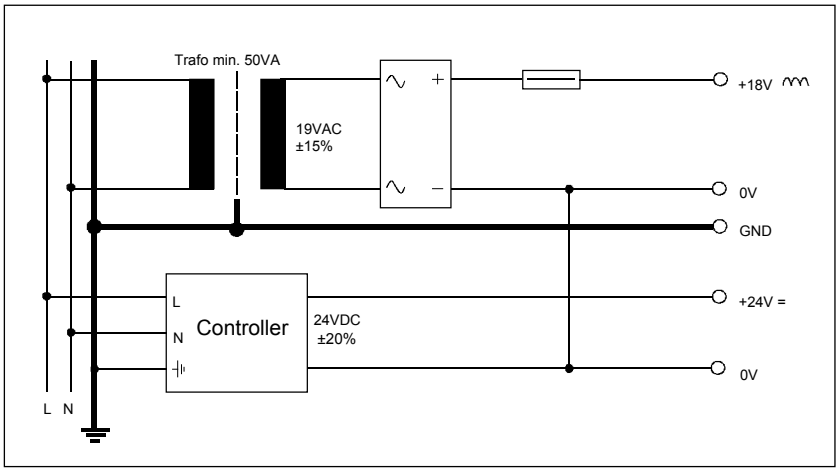
3.9.1 External power supply

Simple little installations



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

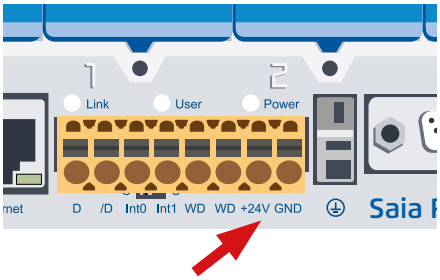
Small to medium installations



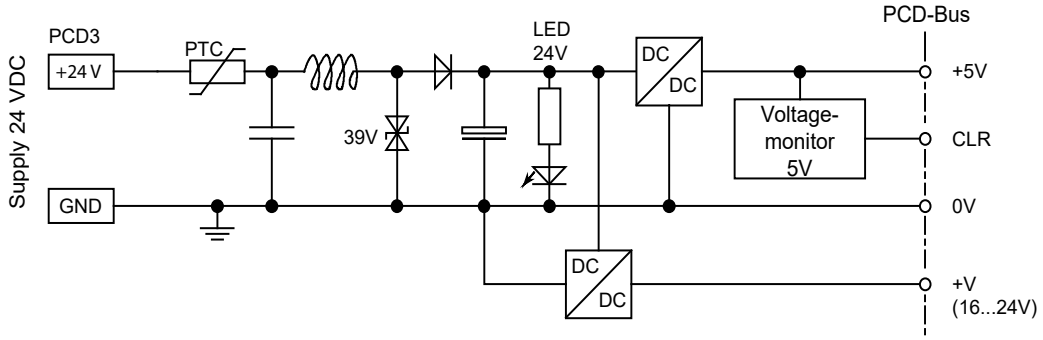
- Sensors — Electromechanical and proximity switches, photoelectric barriers
- Actuators — Relays, lamps, displays, small valves with switching currents <0.5 A
- Suitable for PCD3.Mxxxx module
  PCD3. E1xx, E5xx, E6xx, A2xx, A4xx, B1xx
  PCD3.W1xx, W2xx, W3xx, W4xx, W5xx, W6xx
  PCD3. H1xx*), H2xx*), H3xx*)
  PCD7.D2xx*)

*) These modules must be powered with smoothed 24VDC

3.9.2 Internal power supply



Terminals for power supply 24 VDC



Resilience of the internal power supply

+5 V	600 mA
+V (16…24V)	100 mA (the Device Configurator included in the PG5 helps to determine the exact possible current loads).

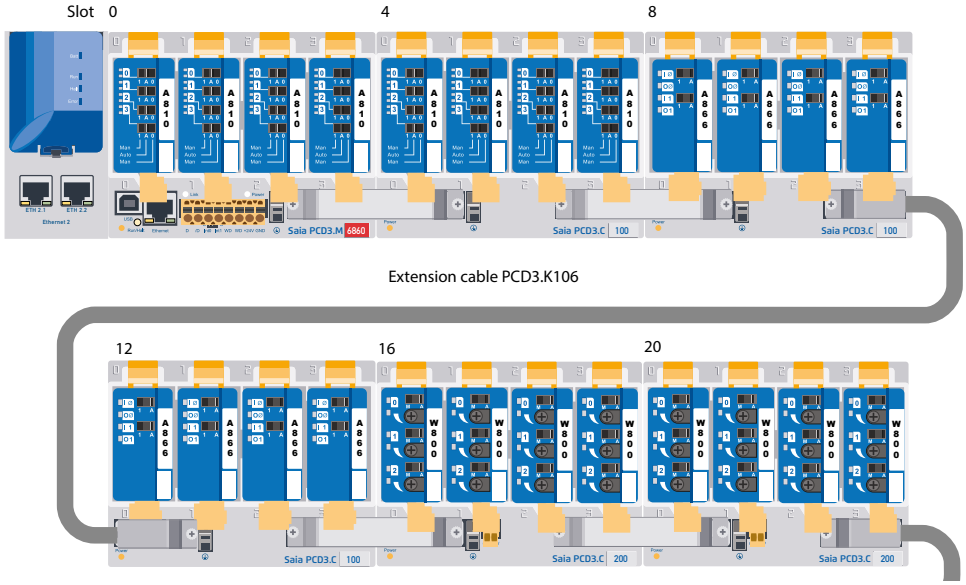
3.9.3 Internal power supply for more than one module carrier

The power supplies of the CPU and RIOs are intended for internal electronics. The internal power supply of the I/O plug-in modules does not apply to the assignment and supply of the outputs of any kind. These must be supplied per I/O module at the terminal block.

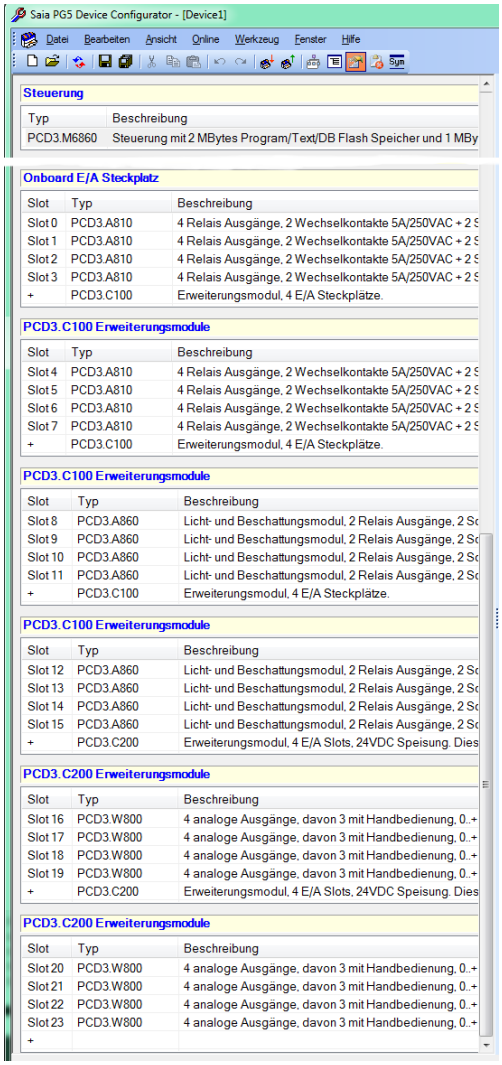
As soon as the number of inputs / outputs exceeds the four module slots per CPU or RIO, the additional power requirement for the planned expansion must be calculated for expansion with module carriers.

The PG5 Device Configurator helps to calculate how many PCD3.C200 module carriers should be used per system.

The PCD3.C200 module carriers have a power supply that is generally sufficient for its plug-in modules and 1 to 2 module carriers, depending on which I/O plug-in modules are used. If the system structure increases again, additional PCD3.C200s need to be deplayed.
Generally, 1 to 2 module carriers of type PCD3.C100 and/or PCD3C110 can be supplied with power per PCD3.Mxxx, RIO PCD3.T6xx and PCD3.C200 CPU, depending on the I/O module types used.

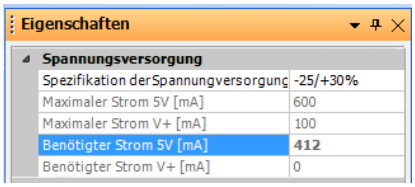


The example shown above looks in the Device Configurator regarding internal power supply as follows:



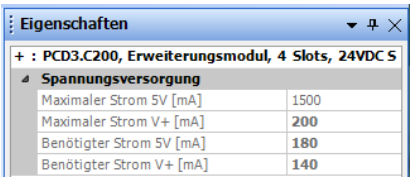
The Device Configurator shows the power consumption according to the modules used.

Total current of the I/O modules in the CPU and all following in the PCD3.C100 or PCD3.C110 module carriers.
As soon as a PCD3.C200 module carrier with power supply is used, the calculation starts again until the next PCD3.C200 etc.
Once the current limit is exceeded, the configurator will reports this.



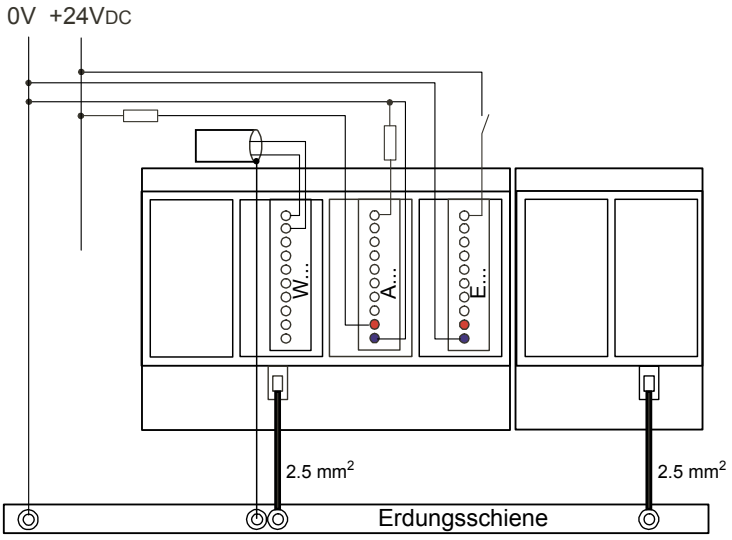
❶ The CPU supplies slot 0 ... 11 (with two PCD3.C100), i.e. a total of 12 I/O modules with internal current of 412 mA [5V].
188 mA are reserve.

❷ The last entry in the module carrier stands for the following, in this case, a power-supplying PCD3.C200 module carrier.
The configurator displays the power consumption of the next I/O modules up to another PCD3.C200.



❸ The module carriers have 2 or 4 slots.
The last, empty line with only a +, indicates that no further module carrier follows, i.e., the end of the system structure.

3.9.4 Grounding and connection concept



The lower part of the PCD3 module housing contains a shielding and grounding plate. Combined with the shielding and earthing plate in the module carrier, this forms the common, large-area user mass for all I/O modules and the external power supply.

When inserting a module into the module carrier, a reliable multi-point contact with the corresponding module carrier is produced via a metal tongue on the module housing.

The zero potential (negative pole) of the 24 V supply is connected to the negative terminal of the supply. This should be connected to the ground bar with the shortest possible wire (< 25 cm) of 1.5 mm^2. The same applies to the negative connection to the PCD3.F1xx or the interrupt terminal.

Any shielding of analog signals or communication cables should also be brought to the same grounding potential, either via a negative terminal or via the ground bar.

All negative connections are linked internally. For flawless operation, these connections should be reinforced externally by short wires with a cross section of 1.5 mm^2.

3.10 Data retention in the event of power failure

The resources (registers, flags, timers, counters, etc.) and partly, also the user program and texts/DBs, are stored in the RAM. To ensure that they do not get lost during a power failure and (if any) the hardware clock continues to run, the PCD3 is equipped with a buffer capacitor (SuperCap) or a buffer battery:

CPU type	Buffer type	Buffer time
PCD3.M3xx0	Super Cap (soldered, maintenance free)	4 hours[1)]
PCD3.M5xx0/M6xx0	Lithium battery Renata CR 2032	1-3 years[2)]

1) The total charge time is about 10 minutes. For buffer times> = 4 hours, see battery module PCD3.R010.
2) Depending on the ambient temperature, the higher the temperature, the shorter the buffering time

For new controllers, the batteries are included in the package and must be used during commissioning. Note the polarity of the batteries:
The positive pole symbol + of the button batteries Renata CR 2032 must be visible!

The CPU with lithium batteries are not maintenance free. The battery voltage is monitored by the CPU.

For the following criteria the LED BATT is activated and the XOB 2 is called:
- the battery voltage is less than 2.4 V
- the battery is discharged or has an interruption
- the battery is missing

To avoid data loss, it is recommended to change the battery while the Saia PCD® is under voltage.

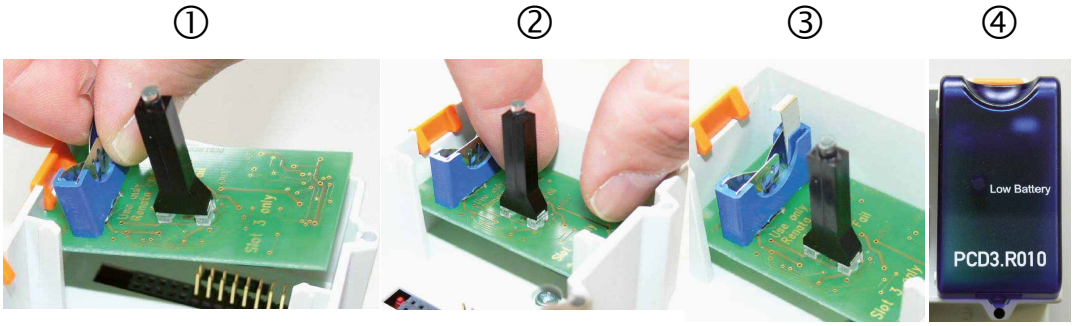
3.10.1 Battery module PCD3.R010 for PCD3.M3xxx

Since the PCD3.M3xxx is only buffered by the Super Cap (up to 4 hours), a battery module that has the same buffer time as the batteries in the PCD3.M5xxx/M6xxx is optionally available. The battery module may only be plugged into slot #3 of the PCD3.M3xxx. The other slots do not cover RAM (Program/Data Memory) or Clock. This can damage the Saia PCD®.

Internal current draw: 10 mA an +5 V

Warning: When unpacking and during assembly
- Do not touch the power circuit board (PBC) at the LED holder!
- Do not touch the electronic side of the PCB!
- Before plugging the PCB into the Saia PCD®, switch off the PCD!

Installation rules:



1. Place PCB over slot #3 (battery holder up)
2. Insert PCB horizontally. Make sure that the connector pins are inserted correctly into the corresponding connector of the slot
3. Press PCB all the way to the stop (1 cm distance between the PCB and the base of the grey Saia PCD® housing)
4. Insert the battery and place the battery I/O cover on slot #3.

Battery monitoring:

A red LED light on the module indicates a low battery that needs replacing. It still has a residual capacity, but only for a few days. A low battery also creates an entry in the history list and calls the XOB 2 (if programmed).

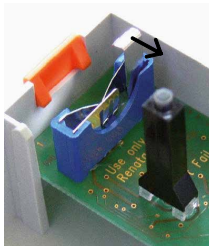
If the base address of the PCD3.R010 is read (= 48 for slot #3), the battery status is read out:

0 for low battery (or module error or module not present ...)
1 for battery OK

Insert or replace the battery:

The battery change (not module change) takes place while under voltage[1)]
(XOB2 is called)

- Pull the lock clip slightly in the direction of the arrow
- Remove the battery
- Insert the CR 2032 Renata button cell so that the positive pole makes contact with the locking clip



1) Replacing the battery with the Saia PCD® off does not result in program/data loss as long as the Saia PCD® Supercap has not been depleted.

Ordering information:

Type	Description
PCD3.R010	Battery module for PCD3.M3xxx
4 507 4817 0	Battery type CR 2032 Renata lithium, shelf life 1-3 years [2)]

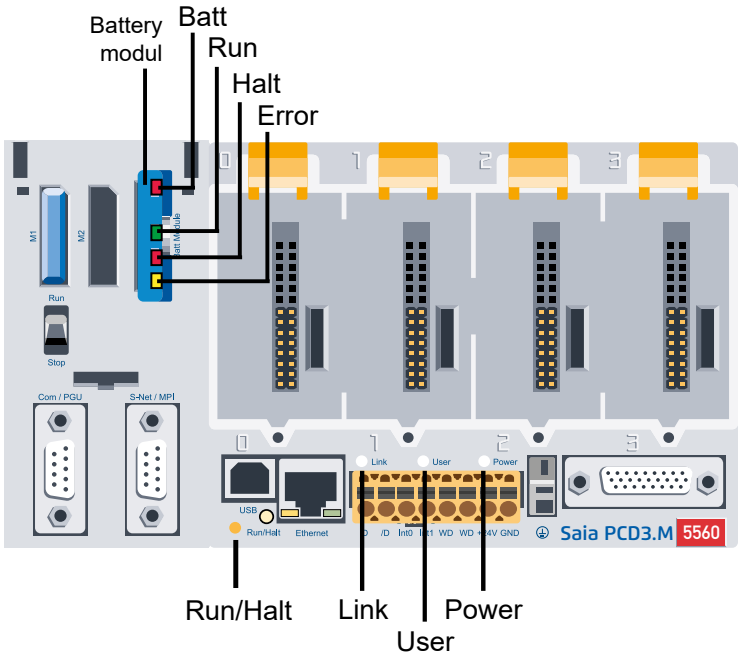
2) Depending on the ambient temperature, the higher the temperature, the shorter the buffering time

3.11 Operating states

The CPU knows the following operating states:

Operating condition	Short description
Start	Self-diagnosis during approx. 1s after starting up or after a restart
Run	Normal execution of the user program after start. If a programming device is connected via a PCD8.K11x in PGU mode (for example, PG5 in PGU mode), the CPU does not automatically go to the Run status for safety reasons, but to the Stop status instead
Run conditional	Conditional run operation. A condition was set in the debugger (Run Until...) that has not yet been fulfilled
Run with error	Same as under Run, but with an error message
Run conditional with error	Same as under conditional run, but with error message
Stop	The Stop status occurs in the following cases: - Programmer connected in PGU mode when starting up the CPU - PGU stopped with programmer - A conditional run requirement has been fulfilled
Stop with error	Same as under Stop, but with error message
Stop	The stop status occurs in the following cases: - Command stop processed - A fatal error in the user program - Hardware error - No program loaded - Missing communication mode for a S-Bus PGU or Gateway Master Port
System diagnostics	If the PLC does not enter RUN mode after 2 minutes, it must be returned for repair
Reset	The reset status has the following causes: - Supply voltage is too low - Firmware does not start

3.11.1 LEDs and their meaning



CPU type	PCD3.Mxxxx							
Operating condition	Battery module				Only these LEDs with the PCD3.M3xx0			
LED	**Batt**	**Run**	**Stop**	**Error**	**Run/Halt**	**Link**	**User**	**Power**
Colour	red	green	red	yellow	bi-colour	yellow	yellow	yellow
Run	o	●	o	o	●	o	o	○
Run cond.	o	●/o	o	o	●/o	o	o	○
Run with error	o	●	o	○	●	o	○	○
Run cond. w. error	o	●/o	o	○	●/o	o	○	○
Stop	o	o	o	o	o	o	o	○
Stop with error	o	o	o	○	o	o	○	○
Stop	o	o	●	o	●	o	o	○
System diagnostics	o	●/o	●/o	○/o	●/o	○/o	○/o	
Batt./Super Cap voltage is missing	●	o	o	o	o	o	o	o
Communication						○		

o = LED off ● = LED on ●/o = LED flashing

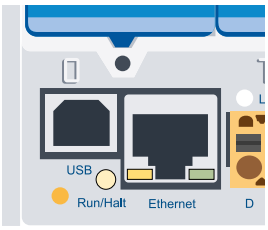
3.12 Operating mode (Run/Stop)

3.12.1 Run/Stop push-button

Behaviour at ..

.. start up

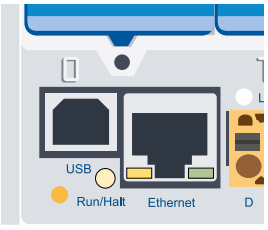
- If the Run/Stop push-button is pressed during start-up and released during one of the sequences described below, the following actions can be started:



LED sequence	Action
Orange	None
Green, flashing (1 Hz)	Changes to the boot status and waits for FW download
Red, flashing rapidly: from FW > V01.08.45 (4 Hz)	The system starts as if with discharged Super CAP or missing battery. i.e. Medias (flags, registers, ...), user program, HW settings are deleted. The clock is set to 00:00:00 01.01.1990. The backup on the onboard flash will not be deleted. If a backup exists, the program will be restored.
Red, flashing slowly (2Hz)	The PLC does not start and goes into stop mode.
Run/Stop-LED: flashing in orange (2 Hz) Batteriehalter-LED: Red/green, flashing (2 Hz)	Saved data is deleted. i.e. Medias (flags, tabs, ...), user program, HW settings and the backup on the onboard flash are deleted. If an external flash card is inserted (with a backup), the backup will not be deleted; but the program will be restored and copied to the onboard flash.

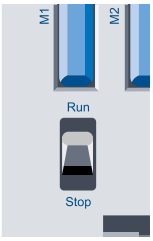
.. during operation

- If the push-button is pressed in the operating mode for more than half a second and less than three seconds, the control will enter the stop mode and vice versa.
- If the push-button is pressed for more than 3 seconds, the last saved user program is loaded from the flash.



The operating mode can be changed at any time.

3.12.2 Run/Stop switch



With the PCD3.M5xx0 it is furthermore possible to influence the operating status with a switch accessible on the front under the blue cover.

If the control is switched to Stop, this results in a change from Run to Stop. When switching to Run, a cold start is executed.

To enable the switch, check the options in the hardware settings of the PG5.

3.13 Manual control and emergency operation

The manual control and emergency operation required in building automation can be implemented with a PCD3.C200[1)] module carrier and the PCD3.A810 (digital) and PCD3.W800 (analog) manual control modules. These manual control modules are based on digital and analog output modules, which can be activated either via the user program or via the manual switch.

- For emergency operation, the manual control modules must be operated in a PCD3.C200 module carrier with external power supply. The external power supply is required in order to continue operating the manual control modules in emergency operation in the event of a cable break or during maintenance work on the CPU.
- In this module carrier PCD3.C200 (from HW version C) and possibly other module carriers, manual control modules may be operated mixed with other data point modules!
- When configuring a PCD3 system, attention must be paid to the power requirements of the data point modules in the PCD3.C200 and the following module carriers.
  It is recommended to use the PG5 Device Configurator for this purpose.

Manual control modules

(for a detailed description, see 27-600 Manual I/O Modules PCD2 and PCD3)

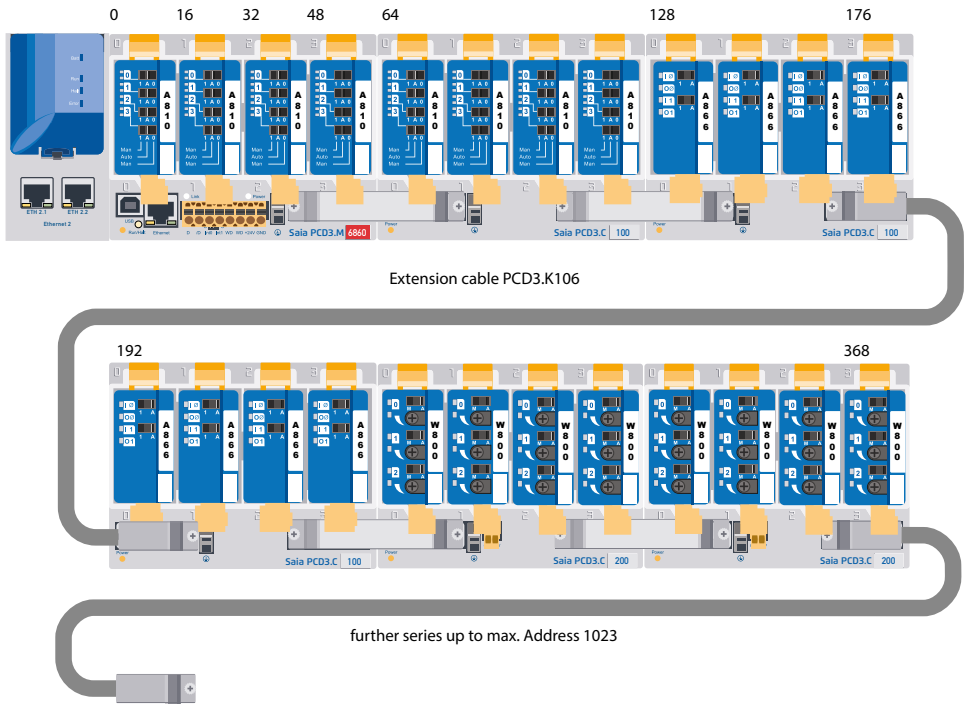
PCD3.A810
Digital local control module with 4 relays outputs
- 2 ‘changeover’ contacts
- 2 ‘make’ contacts
Connection with PCD3.K810
(connector type F included)

PCD3.A860
Light and shade control module with
- 2 relays outputs 250 VAC/12 A
- 2 digital inputs 24 VDC
Connection with PCD3.K86x
(connector type G and H included)

PCD3.W800
Analogue local control module with 4 channels
- 3 outputs 0…10 V with local control
- 1 output 0…10 V without local control
Connection with PCD3.K800
(connector type J included)

3

Application example

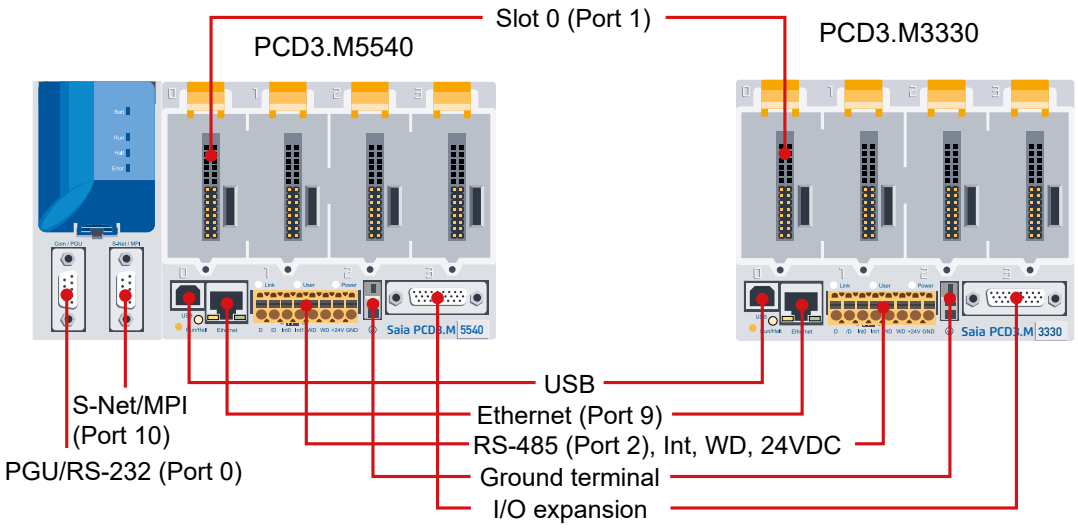


[1]) **from HW version C:** no restrictions

HW version A and B:

- see restrictions regarding power consumption, chapter 3.9.2 Internal power supply
- PCD3.C200 only at the end of the I/O bus
- PCD3.C200 for emergency operation and any other module carriers may only be operated with manual control modules

3.14 Connections of the PCD3.Mxxx0

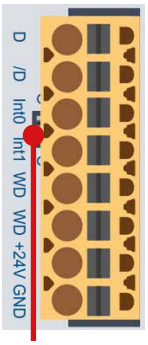


Details about the connections

Connection	Port	Chapter	Titel
PGU/RS-232	0	5.3.2	RS-232 connector (port 0) as communication interface and as programmer connection (only PCD3.M5xx0/M6xx0)
S-Net/MPI	10	5.3.3	RS-485/RS-422
USB	---	5.3.7	USB PGU interface for programming device connection
Ethernet	9	5.3.8	Ethernet RJ-45
RS-485	2	5.3.9	RS-485 / Profi-S-Net/DP Slave
Ground terminal	---	3.9.4	Grounding and connection plan
I/O expansion	---	3.5	Expansion with PCD3 component
Slot 0	1	5.4.2	Serial Interfaces on I/O Module Slot #0

3.15 Connections on orange terminal block

For all CPU types

Terminal block(Item no. 440549950) for power supply, watchdog, interrupt inputs and port 2				Profibus	
	Pin	Signal	Explanation	Signal	Wiring
	1	D	Port 2 RS-485 up to 115.2kbit / s as free user interface or Profi-S-Bus up to 187.5kbits / s (except PCD3.M5440 and PCD3.M5540)	RxD/TxD-N	A green
	2	/D		RxD/TxD-P	B red
	3	Int0	2 interrupt inputs 24VDC or 1 quick counter 24 VDC		
	4	Int1			
	5	WD	Watchdog		
	6	WD			
	7	+24V	Power supply		
	8	GND			

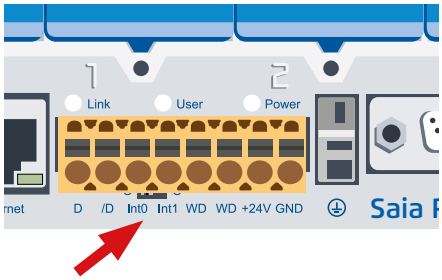
RS-485 terminator switch

Switch position	Description	Explanation
left	O	without terminators
right	C	with terminators

3.15.1 RS-485 (Port 2)

See chapter 5.3.9 General information and chapter 5.1 General information.

3.15.2 Interrupt inputs



Terminal 3 and 4 for interrupts inputs Int0 and Int1

Basics

The digital input modules are not suitable for immediate reaction to events or fast counting because of the input filters and the influence of the cycle time of the user program. Most CPUs have 24 VDC interrupt inputs for this purpose.

Two interrupt inputs are located on the main PCB and can be connected via the 8-pin, pluggable terminal block (terminals 3 and 4). Source operation is used.

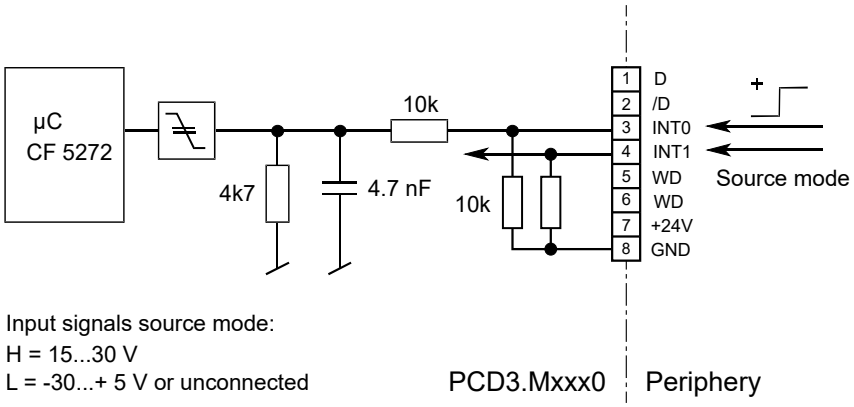
Interrupt inputs	Called XOB on positive edge	Plug terminal	Direct input query	
			Base and standard CPU	Power CPU PCD3.Mxx60
INT0	XOB 20	3	I 8100	---*
INT1	XOB 21	4	I 8101	---*

* available via media mapping in the device configurator

An associated XOB is called (e.g. XOB 20) on a positive edge on the interrupt input. The code in this XOB determines how the event responds, e.g. by incrementing a counter.

The code in XOBs, which are called by interrupt inputs, must be kept as short as possible so that sufficient time remains between the interrupts to process the rest of the user program.

Many FBoxes are intended for cyclic calling and are therefore not or only partially suitable for use in XOBs.
Exception: The FBoxes of the Graftec family (standard library) are well suited.



Do not connect to D and /D. The RS-485 interface works with 5VDC and can thus be destroyed!

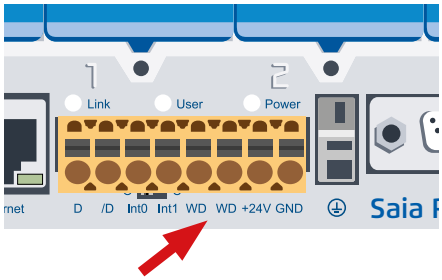
Function description:
With a positive edge at the input **INT0** the **XOB 20** is called. The reaction time up to the call of XOB 20 is a maximum of 1 ms. The code of these XOBs determines how to respond to the events, e.g. by incrementing a counter (input frequency max. 1 kHz with pulse / pause 50% each, sum of the two frequencies (INT0 and INT1) max. 1 kHz). Regardless of whether the XOB is programmed, input 8100 is set (the same applies to INT1 with XOB21 and input 8101, see table above).

The interrupt inputs to the following CPU do not work directly:

PCD3.M3160	PCD3.M5360	PCD3.M6360
PCD3.M3360	PCD3.M5560	PCD3.M6560
		PCD3.M6860

Both Interrupt inputs can be mapped to 2 flags in the *Device Configurator*.

3.15.3 Hardware Watchdog



Terminal 5 and 6 for watchdog relay contact

The PCD3 CPU are equipped with a hardware watchdog as standard. A relay can be triggered on the I/O address 255 which remains energized as long as the state of the O 255 changes periodically at least every 200 ms.

FBoxes are available in the PG5 FBoxes for this purpose.

Function

If for some reason the program part with the Watchdog FBox is no longer processed in sufficiently short intervals, the watchdog relay drops out. For further details abour these FBoxes, please read the online help.

The same function can also be realized with AWL. This example works **regardless 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       ; flash watchdog output 255
:       :
:       :
ECOB
```

With the code, according to the example, the watchdog drops out in the case of infinite loops caused by the programmer. The following, however, must be observed with regard to the cycle time of the user program:

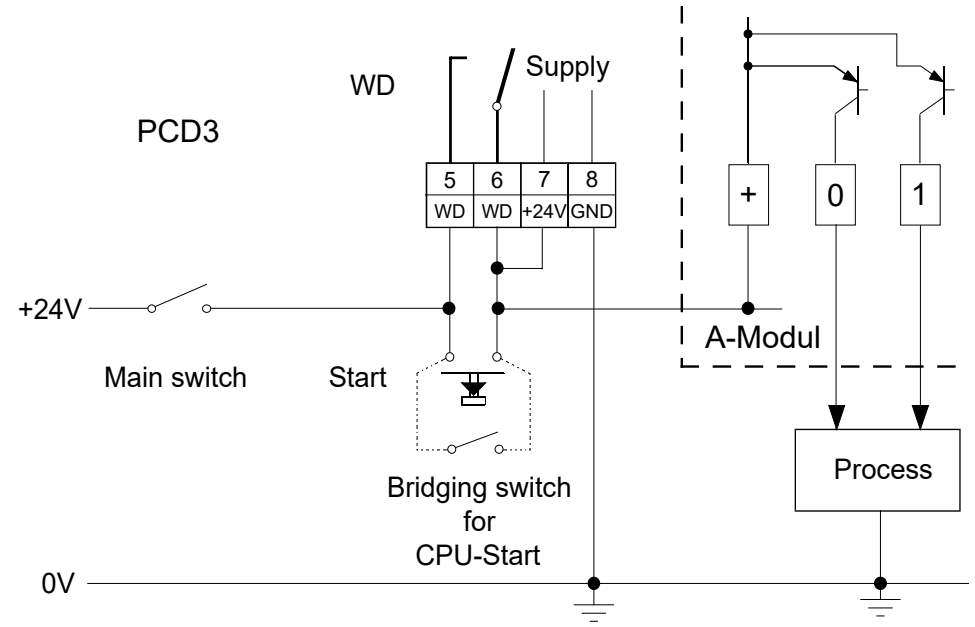
For cycle times of more than 200 ms, the code sequence must be repeated several times in the user program to prevent the Watchdog from dropping in normal mode.

Restrictions

Since the address 255 is in the normal I/O range, there are restrictions regarding the permissible I/O modules in certain slots:

Typo	Restrictions
PCD3.Mxxx0	1. No analog, counting and positioning modules in the slot with base address 240 (except PCD3.W3x5, PCD3.W6x5 and PCD3.W800, these are not influenced by the watchdog) 2. Output 255 can not be used for digital I/O modules either

Watchdog - connection scheme



1) Switching power of the Watchdog contact: 1 A, 48 VAC/DC

The status of the watchdog relay can be read in via I 8107.
Status: 1 = watchdog relay energized (Not with the Power CPUs).

With the Power CPU PCD3.Mxx60 as of firmware version 1.28.xx, the status of the watchdog relay can be read via media mapping.

3.15.4 Supply

See also under 3.9 Power supply and connection concept!

3.16 Software watchdog

The hardware watchdog provides a maximum of safety. For uncritical applications, a software watchdog can be adequate, whereby the processor monitors itself and the CPU is restarted in the case of a faulty function or a loop.

The core of the software watchdog is the SYSWR K 1000 command. The software watchdog function is activated when it is first called up. Thereafter, the named command must be called at least every 200 ms, otherwise the watchdog triggers and restarts the control.

Command: **SYSWR** **K 1000** ; Software watchdog command

R/K x ; Parameters according to the table below,
; K-Konstante oder Wert in Register

; x = 0 The software watchdog will be deactivated

; x = 1 The software watchdog will be activated; if the command is not repeated within 200ms, a cold start takes place

; x = 2 The software watchdog will be activated; if the command is not repeated within 200ms, the XOB 0 will be called up first, followed by a cold start.
XOB 0 call-ups are entered in the Saia PCD® history as follows:

“XOB 0 WDOG START”	if XOB 0 was called by the software watchdog
“XOB 0 START EXEC”	if XOB 0 was called because of a supply error

3.17 Hardware Clock (Real Time Clock)

The PCD3 CPU are equipped with a hardware clock on the basis print:

The presence of a hardware clock is imperative when using the timers HVAC library.

3.18 Storage space on the PCD3

3.18.1 Storage types in the Saia PCD® systems

A user program may contain various data types. This includes data that is relevant for a fast regulation process and data records that must be collected over a long period or saved permanently. Data and web pages to the PCD internal web server are also to be stored. A backup function for program and data is also important, e.g. in the file system.

All these data types have different requirements in terms of hardware. For example, a regulation-relevant process requires a fast memory to calculate and provide current values.
However, historical data records require sufficient remanent mass memory to cover a long period of time.

Depending on the PCD system, storage is available for all this data in the form of RAM, FRAM, SRAM, Flash (see glossary in the appendix for details) system-internally and in the form of pluggable memory.

User memory = RAM

The user memory, which ensures fast access for reading and writing, contains time-critical content such as media, RAM-DB and RAM texts. However, this memory is not a programmable read-only memory (PROM) and is buffered by a battery.

Flash memory

To prevent the loss of the program, a flash memory for the backup of the User Program Memory is available as standard onboard each PCD3 CPU.

It is also possible to save DBs to Flash during runtime (data backup or extension memory backup). Thus, important values of registers and flags can be saved to the fash memory at runtime and than later be reloaded.

On Flash, a file system may exist, which is available for web pages and log files (CSV).

In addition to the flash memory installed on-board, a corresponding flash memory for the user backup memory can also be used (see chapter 3.19.1 Optional memory expansions). The use of these cards makes it possible to transfer the user program as well as the configuration from one controller to another.

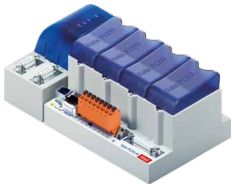
Despite backup to the flash card, the source files of the project must be retained, as the application is only stored in machine code in the Saia PCD®.

If the RAM memory is corrupted when the PCD3 starts up (for example, after a power failure with a discharged or missing battery), the application is automatically reloaded from the flash backup memory. This can be checked with the STL Test instruction and the 400 operand.

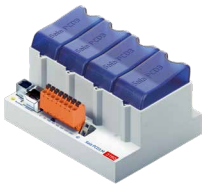
All hardware settings are also stored on the Flash Backup Memory (onboard or on a Flash Card) during a backup.

3.18.2 Memory management (PCD3 without integrated µSD flash card)

In the case of automation devices with no integrated µSD card and which are equipped with the COSinus system, the user application is copied directly to the user memory from Saia PG5®. If no valid program is detected in the user program when the controller is started up, a search is executed for a backup program in the onboard flash or an optional memory module.

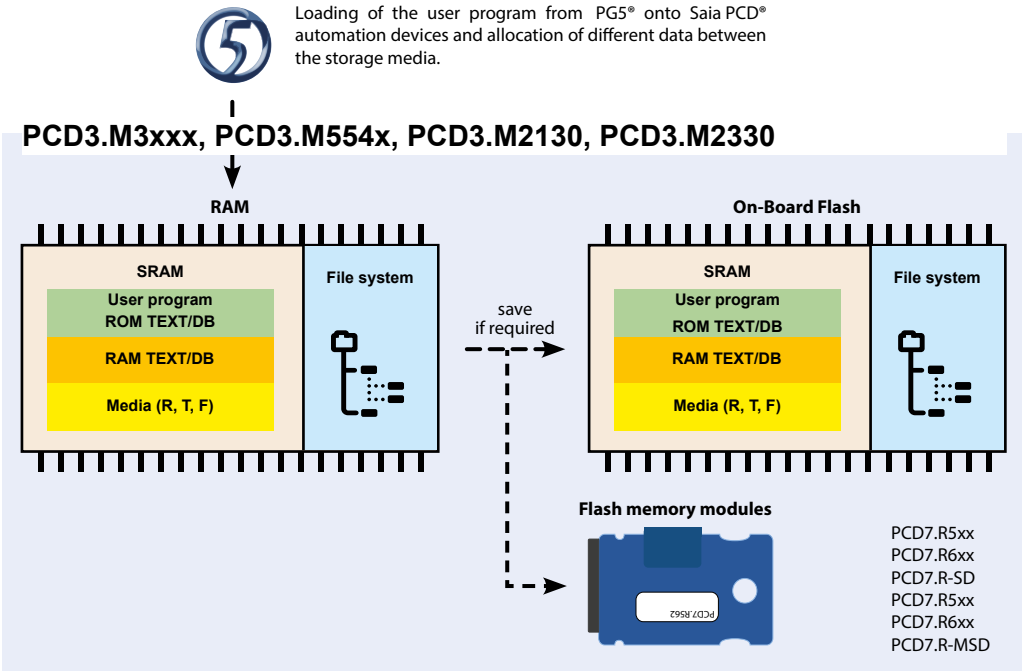


PCD3.Mxx4x



PCD3.M3xxx

PCD3.M2x30



Memory = User Program Memory (RAM)

In these systems, the User Program Memory consists of a RAM (Random Access Memory) and includes the program code and a range of text and DB memory (addresses 0…3999). Furthermore, it contains the extension memory, which also contains texts and DBs (addresses ≥ 4000) as well as the media R, T, F.

All texts and DBs are always in RAM on this PCD3. The main difference between the texts and DBs in the text/DB memory segment and those in the extension memory is the higher maximum capacity of the DBs and texts.

Element	Media	Operand	Operand extension memory	DATA
TEXT DATABLOCK	**X DB**	**0** … **3999**	**4000** … **8191**	per data block max. 383 register (Each DB in the extension store can hold 16383 registers)

To run an application on this PCD3, it is sufficient to load only the User Program Memory. Since this is RAM, the program and the contents of the texts and DBs (as well as the other medias, registers, flags, etc.) may be lost if there is no voltage and the battery is empty or not inserted. If no battery module is present, such data loss can also occur with a discharged supercap.

Splitting of the user backup memory

User backup memory is divided into two parts for these systems:

- The first part is available for the user program backup and is always present. In the PG5 hardware configurator, this memory is accordingly called User Program Backup.
- The second part, optionally configurable in the PG5 called extension memory backup (data backup), can be used to back up DBs and texts to the Flash at runtime.

If a part of the backup memory is used as an extension memory backup, the available user program backup memory will be reduced by twice the size of the extension memory backup used. In parallel with the reduction of the user program backup memory, the user program memory is also adjusted, so that the entire User Program Memory can always be copied to the Backup Flash.

Available user backup memory on the onboard memory

The different versions of the PCD3 CPU have different sized user program memories (and accordingly also user backup memories). The actually usable memories are inherently PCD3 type dependent. As the available memory on the PCD3 has been increased over time, there is a dependency on hardware and firmware version (the larger memory is configurable from version 030).

Available user memory with FW version <030

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

Available user memory with FW version ≥ 030 as well as 1.xx.yy

System	HW Rev.	RAM user program memory	Flash user back-up (prg + data)	Default memory configuration
M3020 M3120	-	128 Kbytes	256 Kbytes	12 k prg lines, 16 k txt, 64 k ext.
M3230 M3330	-	512 Kbytes	512 Kbytes	48 k prg lines, 64 k txt, 256 k ext.
M5340 M5440	HW < D	512 Kbytes	512k onboard 1024k FlashCard[1)]	48 k prg lines, 64 k txt, 256 k ext.
M5540 M6340 M6540	HW ≥ D M5440 [3)]	1024 Kbytes [2)]	1024 Kbytes[2)]	96 k prg lines, 128 k txt, 384 k ext.

1) If a Flash Card for Flash User Backup is used on a PCD3.M5xx0 or M6xx0 with HW version < D, the 512 KB user program backup can be saved on the Flash and 256 KB are additionally available for the backup of DBs runtime.

2) For a PCD3.M5xx0 to be configured with hardware version ≥D and firmware version ≥030, PG5 SP1.4.120 or higher is required!

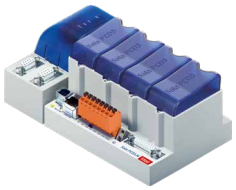
3) The PCD3.M5440 has from HW version D with modification 2 8 over 1024 Kbytes user backup memory.

It should be noted that in the default memory configuration each program line requires 4 bytes.

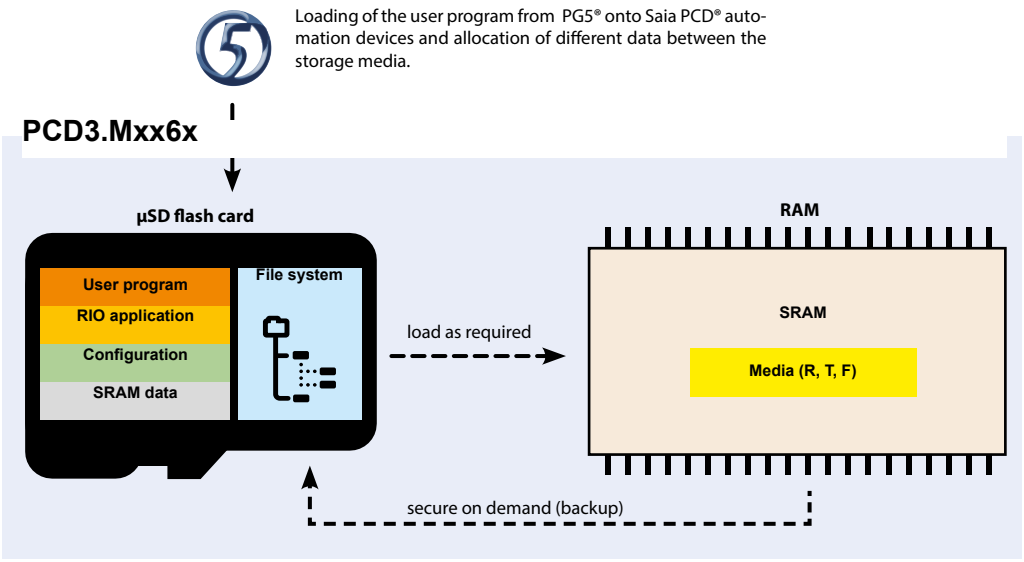
3.18.3 Memory management (PCD3 with integrated µSD flash card)

The µSD flash card on the system board must not be removed under any circumstances (it includes the firmware etc.)!

The Saia PCD3 Plus automation devices (red type plate, PCD3.Mxx60) are equipped with an onboard µSD flash card. When loading a user application with Saia PG5®, all the necessary files are stored on the µSD card.


Saia PCD3.Mxx6x

If the operating voltage is connected to the automation device and there is no executable program in the user memory, COSinus attempts to load a valid program from the µSD flash card into the main memory on startup.



User memory= RAM text/DB memory

In these systems, the RAM (Random Access Memory) includes text and DB memory as well as the media (R, T, F). The address of the first RAM text/DB is set in the PG5 build options.

All texts and DBs have a maximum size of 16383 elements (DBs) respectively 65535 bytes.

ROM text/DB cannot be written to the PCD3 power CPUs, whereas it was still possible on earlier systems. The program is always loaded on these systems on flash in the PCD and is therefore always available even if there is no battery The program is always loaded on these systems on flash in the PCD and is therefore always available even if there is no battery.

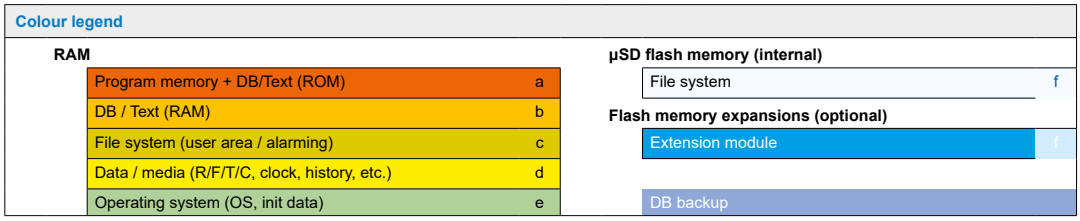
If the contents of the RAM are lost due to an empty battery/SuperCap in the event of a power failure, the media, texts and DB are initialized with the current backup values before startup.

Available extension memory backup (data backup) size

The extension memory backup can be used to copy contents of DB and texts to Flash during runtime (using the instructions SYSWR K 3x00).

The size of the extension memory backup is independent of the size of the user program and is always available. The maximum size of the DBs that can be copied to it is half of the extension memory backup size.

3.18.4 Memory structure of the SaiaPCD3 systems



The sizes of the colour blocks on this page and on the next page do not match the effective memory size ratio!

PCD3.M2130V6

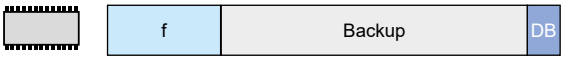
RAM SRAM

Flash memory internally

PCD3.M2330 A4T5 WAC

RAM SRAM

Flash memory



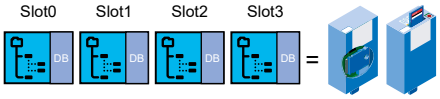
Flash memory extensions

PCD3.M3120, PCD3.M3330

RAM SRAM

Flash memory internally

Flash ROM expansions

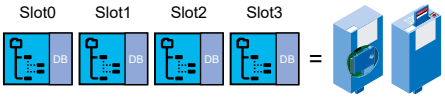


PCD3.M3160, PCD3.M3360

RAM SRAM

Flash memoryµSD card internal

Flash ROM expansions



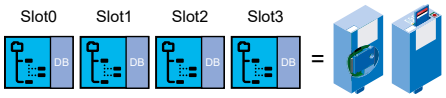
PCD3.M5x40

RAM
SRAM

Flash memory
internally

Flash memory
extensions
(e.g. Slot M1 / M2)

Flash ROM
expansions



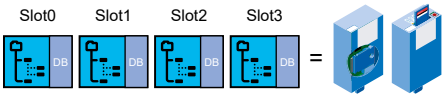
PCD3.M5x60, PCD3.M6x60, PCD3.M6880

RAM
SRAM

Flash memory
µSD card internal

Flash memory
extensions
(e.g. Slot M1 / M2)

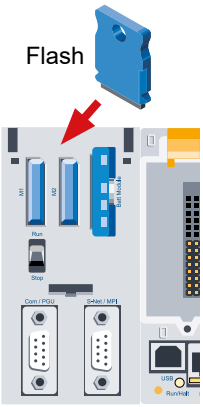
Flash ROM
expansions



3.19 Optional memory upgrades

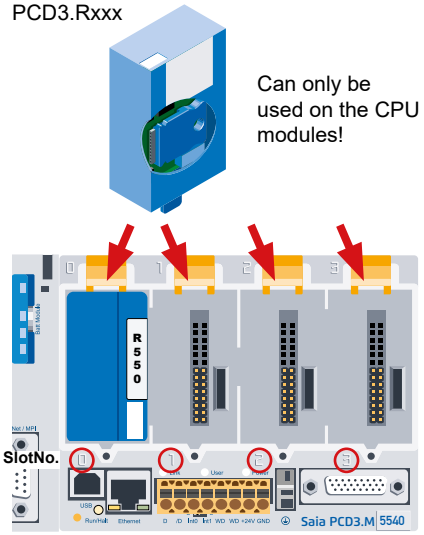
Flash memory module

For the PCD3, different flash memory modules exist for different applications. Partly, these modules are explicitly intended for one purpose (e.g. file system memory). There are modules which provide different types of memory (e.g. the PCD7.R562, which includes 1 Mbyte of disk space for the DB backup, 128 Mbytes for the file system, and memory for BACnet).



Most flash memory modules exist as a simple card (PCD7.Rxxx) which can be plugged into slot M1 or M2 on a PCD3.M5xx0 or PCD3.M6xx0 communication extension.

To enable use on a PCD3.M3xx0, the memory modules PCD3.Rxxx are available, which contain a PCD7.Rxxx and can be plugged into an I/O slot (0 … 3) of a PCD3 CPU.



Any flash memory module that is suitable for user program backup (such as a PCD7.R500) can be used as a flash card. If several suitable modules are plugged in, the first module from the left is used for backup (slot M1, M2, I/O slots 0, 1, 2, 3).

Flash memory module for file system

In addition to the above flash memories for backing up the user program memory and DBs, another type of flash memory is available for files. These memory modules can store PC readable files such as web pages, images or log files. The content of these flash memory modules can be accessed through the web server, the FTP server (only for PCD3 with Ethernet interface) and the user program.

Flash memory module for BACnet

If the controllers PCD3.M5560, PCD3.M5540, PCD3.M3360, PCD3.M3330, PCD3.M3160 or PCD3.M3120 are equipped with a flash memory module for BACnet, the controllers also have a BACnet stack. These modules contain the firmware extension for the BACnet. In addition, the configuration of the BACnet server and client is stored on these modules.

3.19.1 Overview

Module	Description	for PCD3.. System	DB backup**	File system	BACnet	LON-IP	Slot
PCD7.R500* 	Flash card module as backup for the user program.	M5xx0 / M6xx0 (except Mxx6x)	1 MByte				M1 / M2
PCD3.R500* 	Flash memory module as backup for the user program. The module contains a PCD7.R500.	Mxxx0 (except Mxx6x)	1 MByte				I/O Slot 0...3
PCD7.R550M04* 	Flash card module with file system. Storage of files e.g. for the web server. The files can be accessed via the FTP or HTTP direct server of the PCD3. The Saia PCD® can also write PC readable files (*.csv files) directly to the module.	M5xx0 M6xx0		4 MByte			M1 / M2
PCD3.R550M04* 	Flash memory module with file system. Storage of files e.g. for the web server. The files can be accessed via the FTP or HTTP direct server of the PCD3. The Saia PCD® can also write PC readable files (*.csv files) directly to the module. The module contains a PCD7.R550M04.	Mxxx0		4 MByte			I/O Slot 0...3
PCD7.R551M04* 	Flash Card Module with file system and as backup for the user program. The files can be accessed via the FTP or the web server of the PCD3. The Saia PCD® can also write PC readable files (*.csv files) directly to the module.	M5xx0 M6xx0	1 MByte	3 MByte			M1 / M2
PCD3.R551M04* 	Flash memory module with file system and as backup for the user program. The files can be accessed via the FTP or the web server of the PCD3. The Saia PCD® can also write PC readable files (*.csv files) directly to the module. The module contains a PCD7.R551M04.	Mxxx0	1 MByte	3 MByte			I/O Slot 0...3
PCD7.R560* 	Flash card module with BACnet FW. The module contains both the FW extension for BACnet and the configuration files for the BACnet application.	M5xx0, M6xx0			✓		M1 / M2
PCD3.R560* 	Flash memory module with BACnet FW. The module contains both the FW extension for BACnet and the configuration files for the BACnet application. The module contains a PCD7.R560.	Mxxx0			✓		I/O Slot 0...3

Module	Description	for PCD3.. System	DB backup**	File system	BACnet	Lon-IP	Slot
PCD7.R561* 	Flash memory module with BACnet FW. The module contains both the FW extension for BACnet and the configuration files for the BACnet application, as well as a file system, and it serves as a backup for the user program.	M5xx0 ,M6xxx0 with TCP/IP	1 MByte	1 MByte	✓		M1 / M2
PCD3.R561* 	Flash memory module with BACnet FW. The module contains both the FW extension for BACnet and the configuration files for the BACnet application, as well as a file system, and it serves as a backup for the user program. The module contains a PCD7.R561.	Mxxx0	1 MByte	1 MByte	✓		I/O Slot 0...3
PCD7.R562 	Flash memory module with BACnet FW. The module contains both the FW extension for BACnet and the configuration files for the BACnet application, as well as a file system, and it serves as a backup for the user program.	M5xx0 ,M6xxx0 with TCP/IP	1 MByte	128 MByte	✓		M1 / M2
PCD3.R562 	Flash memory module with BACnet FW. The module contains both the FW extension for BACnet and the configuration files for the BACnet application, as well as a file system, and it serves as a backup for the user program. The module contains a PCD7.R562.	Mxxx0	1 MByte	128 MByte	✓		I/O Slot 0...3
PCD7.R580* 	Flash memory module with Lon-IP FW. The module contains both the FW extension for Lon-IP and the configuration files for the Lon-IP application.		1 MByte			✓	M1 / M2
PCD7.R582 	Flash memory module with Lon-IP FW. The module contains both the FW extension for Lon-IP and the configuration files for the Lon-IP application, as well as a 128 MByte file system and serves as a backup for the user program.		1 MByte	128 MByte		✓	M1 / M2
PCD3.R582 	Flash memory module with BACnet FW. The module contains both the FW extension for BACnet and the configuration files for the BACnet application, as well as a file system, and it serves as a backup for the user program. The module contains a PCD7.R582.	Mxxx0	1 MByte	128 MByte	✓		I/O Slot 0...3
PCD3.R600 	Basic module for the SD flash memory card. The card contains a file system and serves as a backup for the user program. The files can be accessed via the FTP or the web server of the PCD3. The Saia PCD® can also write PC readable files (*.csv files) directly to the module. The module can use PCD7.R-SD256 or R-SD512 flash memory cards.	Mxxx0	1 MByte	to 1 GByte			I/O Slot 0...3

Module	Description	for PCD3.. System	DB backup**	File system	BACnet	Lon-IP	Slot
PCD7.R-SD256 **PCD7.R-SD512** **PCD7.R-SD1024** 	SBC SD flash memory card with 256 or 512 MBytes file system for PCD3.R600. This card can be read a on a PC with a card reader and the corresponding SW (SBC file system explorer).						PCD3.R600
PCD7.R610 	Adapter module for microSD flash memory card (without µSD-card).	Mxxx0					M1 / M2
PCD7.R-SD1024 	MicroSD memory card 1 GB, PCD formatted	Mxxx0	1 MByte	1 GByte			PCD7.R610

* no longer available

** at FW before version 1.16.xx the user progam backup was also found in the partition labeled DB backup.

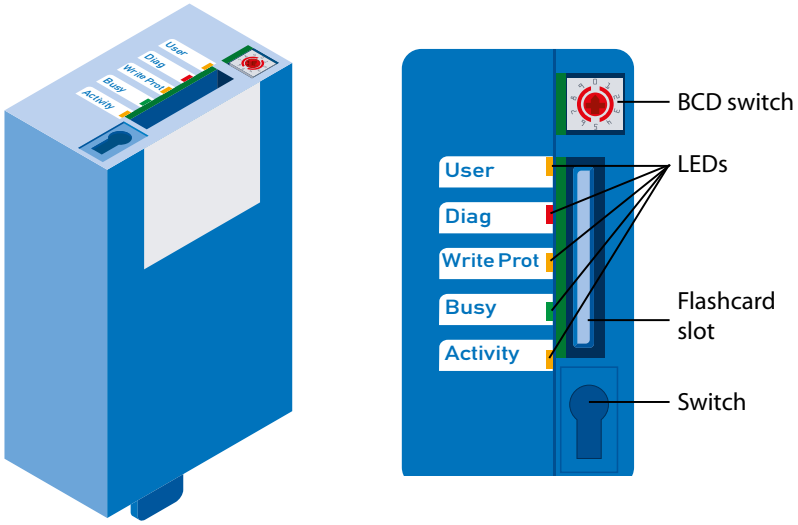
3.19.2 Storage module PCD3.R600 for Flash cards (FC)

System overview

PCD3.R600 is an I/O module for industrial Secure Digital (SD) Flash card applications, which can be plugged into the I/O slots 0 … 3 of a PCD3.Mxxxx. The SD cards can be replaced under voltage.

The SD cards can be accessed in three different ways:

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



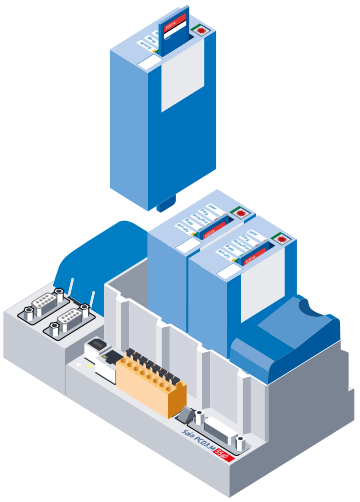
Technical data

PCD3.R600 module	
Power consumption without SD flash card	15 mA
Max. Power consumption incl. SD flashcard	100 mA
Display	5 LEDs
Operating mode setting	BCD Switch
Card holder and detection switch	With labeling clip
SD Flashcard required properties (as verified by SBC)	
Supported capacity	128, 256, 512 MB, 1 GB
Technology	Single level cell
Durability	600,000 or more program/delete cycles
Data retention	5 years or more
Operating temperature	–25 °C…+85 °C or better
MTBF	1,000,000 hours or better

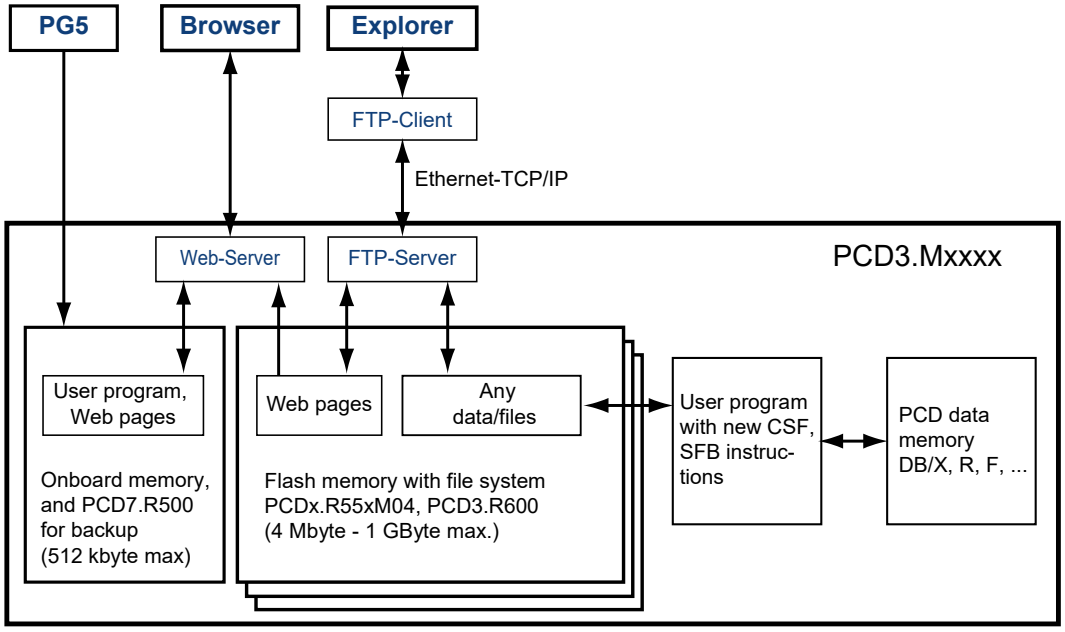
Operation

The PCD3.R600 are intended for the I/O slots 0…3 in a PCD3.Mxxxx. The modules do not work in the module carriers PCD3.C1xx, PCD3.C2xx or PCD3.Txxx.

Up to 4 PCD3.R600 can be used in a PCD3 system.



Data access



FTP server and file system access can only be achieved with the pluggable flash memory module. Access via FTP server can only take place via the Ethernet TCP/IP interface.

Due to given requirements SBC uses its own file system. The SBC file system is embedded in a FAT (PC compatible file system) framework to visualize the restricted processes when used in a commercial SD card reader/writer with standard PC tools. The SBC file system is named SBCNTFS.FFS.

Access to individual files in SBCNTFS.FFS is possible with a SBC-provided software tool for PCs.

Since 10% of the SD card capacity is reserved for the FAT, this extraction PC tool can be copied there. In this way, data stored in the SBC file system can be quickly executed on any PC that is equipped with a standard SD card reader. The SBC PC tool also executes any copies of SBCNTFS.FFS on any drive. The remaining FAT memory can be used to store documentation or for other purposes.

The PCD3.R600 can be used as PCD3 program backup in the same way as the PCD7.R500. The PCD3 program backup is stored in the file backup.sei in a defined area and marked as a hidden read-only file in the FAT.

With the SD card inserted in the PCD3, files can not be accessed in the FAT area, except for the files SBCNTFS.FFS and backup.sei. During formatting, a file containing SD card properties is created in the FAT area. File access in a commercial SD card reader/writer is faster than in a PCD3.

LED

The storage module is equipped with 5 LEDs:

LED	Meaning
User	User LED is switched on by the user program with the base address of the module (SET = off; RES = on)
Diag	The diagnostic LED turns on when the SD card is not recognizable (for example, SD card not formatted with FT16, bad boot sector or badly plugged in). Once the SD card is properly inserted, it may take 5 seconds for the LED to turn off
Write Prot	Active when a read-only condition is detected (SD switch, BCD switch or software read-only)
Busy	Do not pull the module while this LED is lit
Activity	Function as with a hard disk drive, flashes during data processing

Operating mode switch

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

BCD Position	Meaning
0	***normal read/write*** **
1	Reserve
2	Reserve
3	Reserve
4	Reserve
5	***format * / *****
6	Reserve
7	Reserve
8	Reserve
9	***normal read only***

* Starts after plugging in; pull, then plug in again

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

Note

- A PC file system FAT (FAT16) must be present on the card, so that the SD card can be formatted with the SBC file system
- First, all FAT files are deleted, then the SBC file system is installed when inserting the card and BCD switch position 5
- If the BCD switch is in the 0 position, the SBC file system (SBCNTFS.FFS) will be installed if it is not already present and the card is empty. Therefore, if a new card is inserted, it does not need to be formatted with position 5
- Not all flashcards have a write-protect switch
- The card is in a so-called push-push socket (push to pull and plug in)
- All operations except formatting are disabled when the label clip is removed
- Do not pull the card while the busy LED is lit.

3.19.3 SD flash memory cards

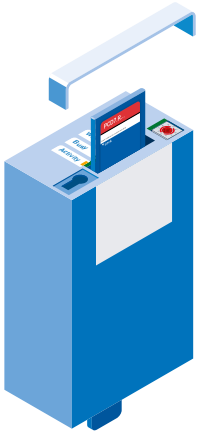
The SD Flash cards are not part of the PCD3.R60x and must be ordered separately.
It is important that the SD cards are of good quality (industry standard, as tested by SBC). Other flash cards can also be used, however they are not supported and are excluded from any warranty.

To increase the lifetime, the flash cards should be filled in read-only applications to not more than 80%. For read/write applications, it should not be more than 50% of the disk space.

The PCD3 uses a non-standard file system (SBC FS). Therefore, the flash cards need to be formatted before first use. This happens automatically when a new FAT 16 flash card is inserted in the PCD3.R60x.

Flash cards handling

The card is in a so-called push-push socket (to pull and plug in), which is located under the label clip.
It can be pulled out without switching off the PCD3.



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

A mechanism detects the removal of the label clip. If necessary, unsaved data is saved to the flash card. The busy LED will light up.

Insert the flash card

When inserting the flash card, press until resistance is felt, a soft click might sound. Relieve pressure until the card is at the same height as the slot.

Removal of the flash card

If the busy LED is off, press the card into the module housing until resistance is felt. Decrease the pressure until the flash card slides out.

User programm backup on flash card

It is possible to save a backup of the user program (see chapter 3.13.1) to the flash card in the PCD3.R60x.

The storage locations for the user program (save and recall) are queried in the following order:

1. M1 slot
2. M2 slot
3. I/O Slot 0…3
4. Onboard flash memory (if available)

I/O bus functions

Some states are recognized by the user program.

I/O Bus offset	Write	Read	Meaning
+0	User LED	BCD switch position bit 0 (lsb)	Position (non-inverted) of the BCD switch
+1	do not use	BCD switch position bit 1	
+2	do not use	BCD switch position bit 2	
+3	do not use	BCD switch position bit 3 (msb)	
+4	do not use	/Labeling clip available	1 = removed
+5	do not use		-
+6	do not use	/Flash card available	1 = card removed
+7	do not use	SD write-protect switch	1 = SD locked/removed 0 = MMC or SD released

Ordering information

Ordering information	Description	Weight
PCD3.R600	Basic module with slot for SD flash memory cards PCD7.R-SDxxx (up to 4 modules in I/O slots 0…3 on a PCD3)	60 g
PCD7.R-SD256	SD memory flash card 256 MB	2 g
PCD7.R-SD512	SD memory flash card 512 MB	2 g
PCD7.R-SD1024	SD memory flash card 1 GB	2 g

3.19.4 Micro-SD flash memory card PCD7.R-MSD1024

At this point the same applies as under the previous chapter 3.19.3 SD flash memory cards, except for the one mentioned below.

Type	Description	Image
PCD7.R-MSD1024	Micro SD memory card with 1 GB memory, PCD formatted, with PC adapter.	
PCD7.R610	Adapter module for Micro-SD card PCD7.R-MSD1024 for use in the appropriate SD slots of the PCD families.	

The micro SD card PCD7.R-MSD1024 requires a PCD7.R610 adapter module for use in the appropriate SD slots of the PCD families.

4 RIO (Remote Input Output) head stations

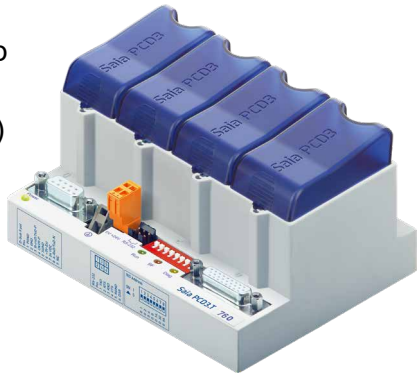
4.1 The RIO (Remote Input Output) head stations
4.2 Internal power of the PCD3.T76x head stations
4.3 Connections of the RIO head station PCD3.T76x for 4 modules
4.4 Diagnosis Information of the RIOs
4.5 Terminating resistors of Profibus-DP or Profi S-net network

4.1 The RIO (Remote Input Output) head stations

The PCD3.RIO (Remote I/Os =RIOs) are used to acquire decentralized I/O signals. PCD3.RIOs communicate with Profibus-DP with any master PLC, the .gsd file is included in the Saia PG5® (version 1.2 or higher) or can be found at support@saia-pcd.com.

The integrated web server in the PCD3.RIO provides the user with the greatest usage for commissioning, diagnosis and service. Access is via a widely known, easy-to-operate standard web browsers. The states of all I/O signals (digital/ analog/counters) can easily be checked, and the output states can be modified selectively.

PCD3.T760*



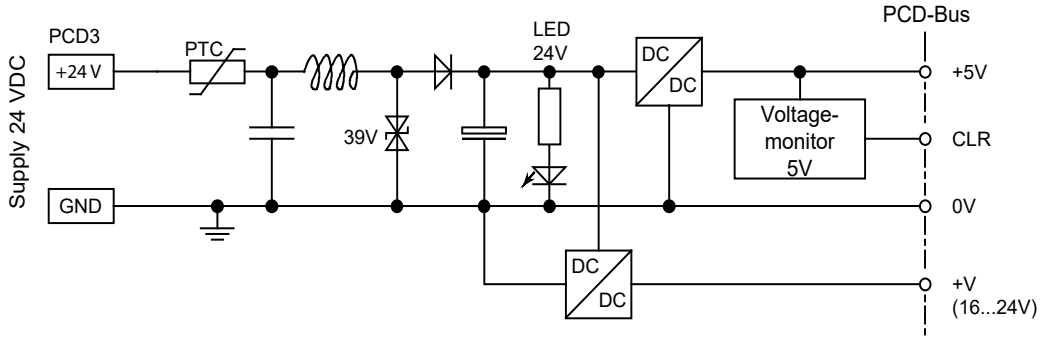
- Integrated Profibus DP and S-Net connection up to 1.5 MBit/s
- 4 pluggable PCD3 I/O modules (freely selectable)
- Expandable with PCD3.LIO
- Web server for, diagnostics, service and commissioning
- Provides internally + 5V and V + for the I/O modules on the PCD3.T760 and the connected PCD3.C1x0

RIO head stations	Module places	Description	External power supply
PCD3.T760	4	for 4 I/O modules with Profibus DP and S-Net interface. Power supply for integrated + 5V and V + bus for one segment of I/O modules available (for calculation of possible load see 4.2)	24 VDC

Max. RIO head station extension option with up to 3 LIOs	
Number of inputs/outputs or I/O module slots	256 16

*outphased: this product is no longer produced.

4.2 Internal power of the PCD3.T76x head stations

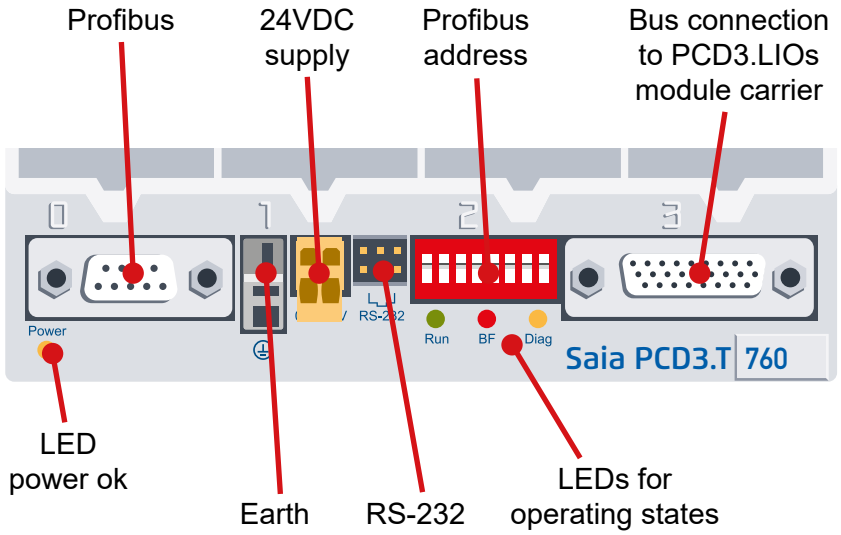


The PCD3.T76x head stations provide the following internal supply currents for the plugged or connected modules:

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

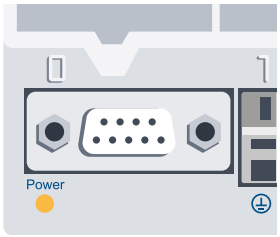
When planning PCD3 systems, it must be checked whether the two internal power supplies are not overloaded. This control is particularly important when using analog, counting and positioning modules, as these sometimes have a fairly large power consumption.
It is recommended to use the PG5 device configurator.

4.3 Connections of the RIO head station PCD3.T76x for 4 modules



4.3.1 Meaning of the connections

Network connection Profibus DP or Profi S-Net

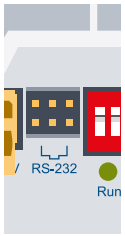


The bus is designed for a baud rate of up to 1.5 Mbps. More detailed specifications of the Profibus communication can be found in the manual 26/765, Profibus DP.

On a PCD3.M3 or PCD3.M6 (orange terminal block) the /D corresponds to pin 3 (RxD / TxD-P, red) and D to 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	24 VDC
8	A = RxD/TxD-N | green = **D**
9	NC

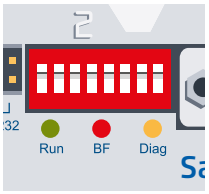
Serial interfaces RS-232



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

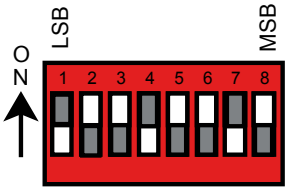
1	TXD
2	RTS
3	RXD
4	CTS
5	PGND
6	DSR

Profibus address



The Profibus address is set to binary on the PCD3.T76x by means of a DIP switch.

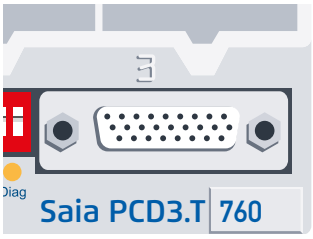
The numbers on the DIP switch are assigned the following values :



Valence	1	2	4	8	16	32	64	Unused
No.	1	2	3	4	5	6	7	8

Example for address 73:
DIP switch no. 1 + 4 + 7 on ON.

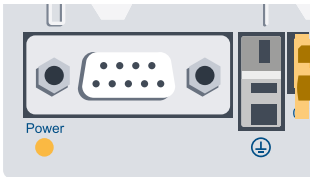
Expansion connection



This connector can be used to add up to 3 LIO module carriers to the RIO (with PCD3.K010 connector). This way, 256 I/Os can be realized per RIO.

4.3.2 Power LED

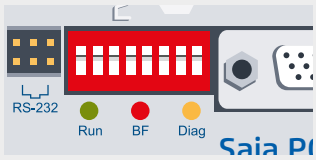
Supply



● = LED on = supply available, OK

4.4 Diagnosis Information of the RIOs

4.4.1 LED meaning



The three LEDs on the PCD3.T76x head station indicate the operating states such as errors, alarms, diagnostics etc.
The LEDs mean:

Diag = Diagnosis is running:
permanently on - more than 4 I/O modules configured, but no PCD3.Cxxx
- Profibus address is 0
2 × flashing Load EPROM with configuration
5 × flashing A min. I/O is locked

BF = bus failure

Run = RIO processor running

RUN	BF	DIAG	Explanation
●	○	○	RIO works correctly
●	○	●	Diagnosis / alarm from the slave
●	○	●/○ 2×	Applied configuration derives from the EEPROM, master has the same configuration and is connected
○	●	○	Bus error, slave not assigned to a master
○	●	●	Bus error, slave not assigned to master, but configured and in diagnostic state
○	●	●/○ 2×	Applied configuration derives from the EEPROM or web server
X	X	●/○ 5×	At least one lock is active

○ = LED off ● = LED on ●/○ = LED flashes X = on or off

DP diagnosis

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

*) In DIN 19245 a byte is called octet, therefore the same expression is used here.

Standard diagnosis

Byte	Bit	Abbreviation	Explanation
1	0	non_exist	Slave does not exist (master set)
	1	station_not_ready	Slave not ready for data exchange
	2	cfg_fault	Configuration data of master and slave differentiate
	3	ext_diag	Extended diagnostic bytes
	4		Reserve
	5	invalid_slave_response	Always set to 0 by the slave
	6	prm_fault	Wrong parameter
	7	master_lock	Slave parameterized by a master
2	0	prm_req	Slave must be reparameterized
	1	stat_diag	Static diagnosis
	2		Always 1
	3	wd_on	Watchdog monitoring active
	4	freeze_mode	Freeze instruction active
	5	sync_mode	Sync instruction active
	6		Reserve
	7	slave_deactivated	1 when slave deactivated by master
3	0 … 6		Reserve
	7	ext_diag_overflow	Diagnostic data overflow in the master or slave
4		Master address	
5, 6		ID (0xCD32)	

Extended diagnosis

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

Byte	Bit	Explanation
7	0x02	Device related diagnostics, 2 bytes (including the 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 diagnosis, 3 bytes (including the header byte)
8 (10)	0 : 7	Error accessing module 0 : Error accessing module 7
9 (11)	0 : 7	Error accessing module 8 : Error accessing module 15

It is possible that both diagnostic messages are sent in the same telegram. In this case, the entries described above are packed into a frame, e.g. the identification-related diagnosis starts with octet 9 and ends with octet 11.

4.4.2 Diagnosis module

In addition to the DP-compliant diagnostic information, the PCD3.RIO also supports a diagnosis module used in the DP configuration. This slave diagnostic information is stored in the master resources. The use of a diagnosis 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 diagnosis module). It requires 4 input bytes and 4 output bytes. The exact definition of request and answer is as followed:

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
			Query

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
			Reply

The contents of bytes 0 to 2 depend on the request command. The master always checks if the response command matches the request command, ensuring that the data is correct and belongs to the requested information.

NOP command (command 0)

This command is for synchronization only. The RIO returns the received data bytes without modification.

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

Query firmware version (command 1)

This function returns the current firmware version of 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

Query RIO status (command 2)

This function returns 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 due
6	Set, in the event of power failure on the external I/O-bus
5	Set if valid configuration exists in EEPROM
4	Set, when a clear com from the slave is due
3	Set, as soon as a lock is active
2	Reserve
1	Reserve
0	Reserve

Coding of the bits in status 1 and 2 are not yet defined.

Status of the outputs in the event of a bus fault (command 3)

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
Value MSB	Value LSB	Module slot	3

RIO→Master

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

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

- the connection to the bus is interrupted
- the master is in the STOP/PAUSE state

The status is 0 if the selection was accepted, otherwise it contains 0xFF.

The coding of the module space field is the following:

Bit	Meaning
0…3	Module space (0…15)
4…6	Channel number (0…7) For analog outputs, this is the analogue channel number
7	When set to (continue), the last status of the outputs is retained. In which case bytes 0 and 1 are irrelevant.

Example: Module position = 0x82 → The outputs (if 16 digital outputs, then the 8 LSBs) of module position 2 (3rd place) are retained.

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

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

Reset the preferred switch-off state of the outputs (command 4)

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 of all outputs to a predetermined value, e. g. 0

Save I/O configuration to EEPROM (command 5)

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 saves the configuration to the EEPROM, so that users can go online with the web browser after having turned on the power without a master and can test the configuration without redefining it first.

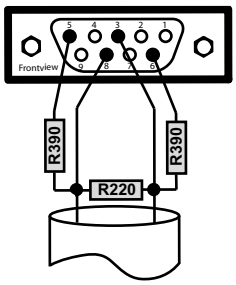
This asynchronous function takes a few milliseconds, depending on the extend of the configuration. While writing to the EEPROM, the value 0x85 is displayed in the diagnostic module. During command processing, no new command is accepted.

4.5 Terminating resistors of Profibus-DP or Profi S-net network

To avoid reflections at the line ends, each segment must be terminated where its physical line ends.
As a result, the lines are also biased to a rest potential.
According to the Profibus standard, this must not be done directly on the Profibus devices, but must be achieved by means of external components.

Both the termination box PCD7.T16x or standard 9-pin Profibus D-sub connectors are suitable here.
For further information,
see manual 26-740 "installation components for RS-485 networks"
and manual 26-860 "Profibus-DP".

The network termination must look like this:



1 Shield
3 RxD/TxD-P
4 CNTR-P
5 DP GND
6 DP +5V
8 RxD/TxD-N
9 CNTR-N

Supplier of 9-pin Profibus D-Sub connectors for connection of Saia PCD® Controllers with Profibus networks:

ERNI Elektroincs AG, Brüttisellen Zurich, Switzerland
http://www.erni.com → search for Erni reference number:

ER*bic* connection, horizontal grey: (Connection equipped with series inductions of 110 nH)	Erni Ref. 103648
ER*bic* connection, horizontal, gray with PG connector: (Connection equipped with series inductions of 110 nH)	Erni Ref. 103663
ER*bic* termination, horizontal yellow: (Connection equipped with series inductances of 110 nH plus termination resistors of 390 Ω and 220 Ω)	Erni Ref. 103649

ERNI ER*bic* connector

5 Communications interfaces

5.1 General
5.2 Serial interface logs
5.3 Onboard interfaces
5.4 Plug-in interface modules on I/O slot 0 - 3
5.5 LIO and RIO

5.1 General

SBC S-Net, the network concept by Saia Burgess Controls, is based on the open standard Profibus and Ethernet. Ethernet includes layers 1 and 2 of the ISO/OSI layer model. Based on layer 2, a variety of different protocols and applications can be operated in parallel in the same network.

Additionally, the Profibus layer 2 (*Field Data Link*, FDL) also allows parallel operation of various application protocols such as DP, FMS and others. By using this option, Profi-S-Net can create a Private Control Network (PCN) on the Profibus. This will make all SBC devices active network participants.

Profibus Layer 2 (FDL) is integrated in the operating system of the CPU PCD3.Mxxx0 and the RIOs PCD3.T76x. These devices thereby have a professional S-Net connection with transfer rates of up to 1.5 Mbit/s.

The devices support Profibus DP and S-Net on the same port. This allows setting up networks based on Profibus in a cost-effective and flexible manner (more detailed information can be found in the TI PP26-381).

Since the summer of 2010, the full-duplex mode and Auto-MDIX can be operated via the Ethernet connection of the PCD3 family (PCD3.M2xxx, PCD3.M3xxx, PCD3.M5xxx and PCD3.M6xxx).

The easiest way to determine if your PCD3 already supports these functions, is to verify that the RJ-45 connectors are equipped with LEDs. If this is tha case, the Saia PCD® supports the full-duplex mode and auto-MDIX (auto-crossing of the signals).

The following hardware version or higher is required for full Duplex and Auto MDIX support:

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

Using the SBC S-Bus

The SBC S-Bus is essentially designed for communication with engineering and debugging tools and to connect the management levels/process control systems.

It is not suitable or approved for connecting the field devices of other manufacturers. An open, manufacturer-independent field bus is the purpose here.

5.2 Serial interface logs

Protocol overview and support by the firmware through the different CPUs	Purpose	Supported on			
		PCD3.M3020, /M3230	PCD3.M3120, /M3160, PCD3.M3330, /M3360	PCD3.M5440, /M6440	PCD3.M5340, /M5360, PCD3.M5540, /M5560, PCD3.M6540, /M6560
S-Bus PGU on USB plug with USB or PGU port	Programming, debugging, visualization. Also allows access via gateway to stations in another S-Bus network	✓	✓	✓	✓
S-Bus PGU on the PGU-RS-232 connector	PGU Stecker **pin 6** (DSR) on **logic 0** (data, full protocol) [1] programming, debugging, visualization. Also allows access via gateway to stations in another 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]	Sending of characters or texts via serial interfaces, basis for the creation of own protocols in the user program	✓	✓	✓	✓
Profi-S-Bus protocol	Data exchange with multimaster communication between controllers. Also allows access with PG5 programmer, SBC OPC server or web browser	✓	✓	✓	✓
Profi-S-IO protocol	For the operation of the PCD3.T760. Allows configuration and diagnostics.	✓	✓	✓	✓
Ether-S-Bus protocol	Data exchange with multimaster communication between controllers. Also allows access with PG5 programmer, SBC OPC server or web browser.	×	✓	×	✓
Ether-S-IO protocol [5]	For the operation of the PCD3.T66x. Allows configuration and diagnostics.	×	✓	×	✓
MPI	Multi-point protocol for data exchange with other devices (SBC-xx7 controllers, HMI, SCADA systems)	×	×	✓	✓

1) Requires the use of the programming cable PCD8.K111
2) Requires a corresponding configuration in the hardware settings
3) Requires an assignment of the port in the user program (SASI). For new applications, the data mode should always be selected.
4) RS-485 with immediate release of the data line after sending the last character
5) In preparation
6) S-Bus parity master mode (SM1) not supported on ports 2 and 3 (from FW 010)

5.2.1 Serial S-Net

Supports the S-Bus protocol on serial interfaces (RS-232, RS-485/422, modem) in master/slave operation. The SBC S-Bus S-Bus with its simple and secure protocol is already available as standard on all Saia PCD®s.

Technical data

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

5.2.2 Profi S-Net

Private Control Network (PCN) includes all protocols and services for the operation of SBC devices (PLC, RIO, HMI, PG) on Profibus. Multi-protocol operation is supported on the same connector and cable.

Technical data

Transmission rates:	up to 1.5 Mbit/s
Number of stations:	up to 124 stations in segments of 32 stations each
Logs:	Profi S-Bus, Profi S-I/O, DP slave, HTTP
Port in the PG5:	2 and 10

5.2.3 Ether S-Net

Private Control Network (PCN) includes all protocols and services for the operation of SBC devices (PLC, RIO, HMI, PG) on Ethernet supports multi-protocol operation (S-Bus, S-IO, HTTP, SMTP) on the same connector and cable.

Technical data

Connection:	10 Base-T/100 Base TX (RJ-45)
Speed:	10/100 MBit/s (autosensing)
Logs:	TCP/IP or UDP/IP, Ether S-Bus, Ether-S-I/O, HTTP, SMTP
Port in the PG5:	9

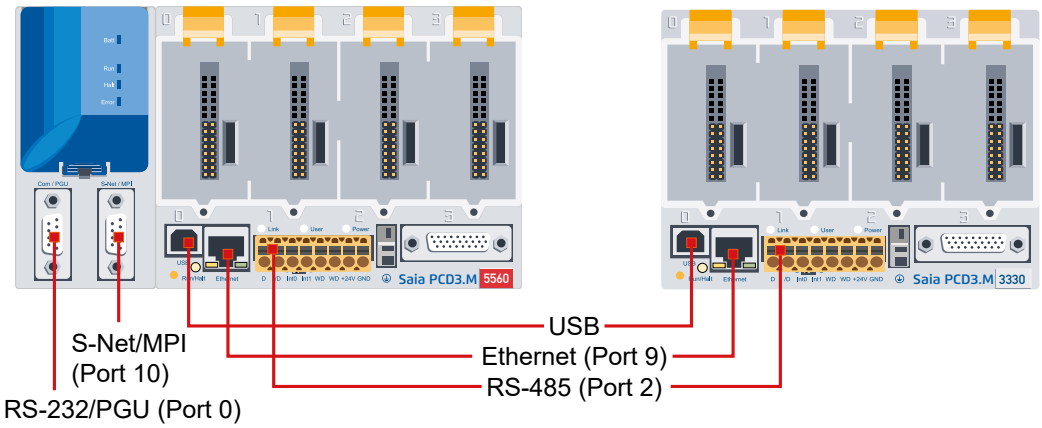
5.2.4 Logs implemented in the user program

Based on the character mode, various protocols can be implemented (with very good knowledge of STL programming).

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

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

5.3 Onboard interfaces

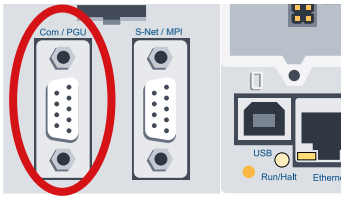


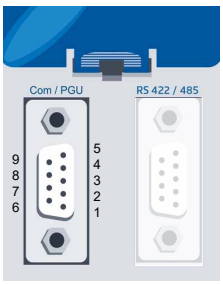
5.3.1 Summary table

Connection type	D-Sub #1 (PGU)	D-Sub #2					Terminal block		Ethernet	USB
Onboard interfaces	RS-232	RS-485 (serial)	RS-422 (serial)	Profi S-Net/ DP slave	CAN	Profibus DP Master	RS-485	Profi S-Net/ DP slave		USB 1.1 slave (PGU)
PortNo	0	3	3	10	10	10	2	2	9	
Max. baud rate	115.2 kbit/s	115.2 kbit/s	115.2 kbit/s	1.5 Mbit/s		12 Mbit/s	115.2 kbit/s	187 kbit/s	10/100 Mbit/s	
PCD3.M3020							■	■		■
PCD3.M3120							■	■	■	■
PCD3.M3160							■	■	■	■
PCD3.M3230							■	■		■
PCD3.M3330							■	■	■	■
PCD3.M3360							■	■	■	■
PCD3.M5340	■	■	■				■	■	■	■
PCD3.M5360	■	■	■				■	■	■	■
PCD3.M5440	■	■		■			■			■
PCD3.M5540	■	■		■			■		■	■
PCD3.M5560	■	■		■			■		■	■
PCD3.M6240	■				■		■	■		■
PCD3.M6340	■				■		■	■	■	■
PCD3.M6440	■					■	■	■		■
PCD3.M6540	■					■	■	■	■	■
PCD3.M6560	■					■	■	■	■	■
PCD3.M6860							■	■	2×	■

5.3.2 RS-232 connector (port 0) as communication interface and as programmer connection (only PCD3.M5xx0 / M6xx0)

This interface is routed to a 9-pin D-sub connector (female) and is of type RS-232.



		PCD3.M5xx0 PCD3.M6xx0			
		RS-232/PGU Port 0			
		D-Sub pin	Signal	Meaning	
		1	DCD	Data carrier detect	Data carrier detected
		2	RXD	Receive data	Receive data
		3	TXD	Transmit data	Send data
		4	DTR	Data terminal ready	Terminal ready
		5	GND	Signal ground	Signal ground
		6	DSR	PGU Connected	PGU detection
		7	RTS	Request to send	Start up transmitter
		8	CTS	Clear to send	Ready to send
Port 0	Port 10	9	n.c.	not connected	---

[1] Obligatory signals (it is imperative that the user makes this available)
[2] The signal is provided by the controller

The interface can be used for the following purposes:

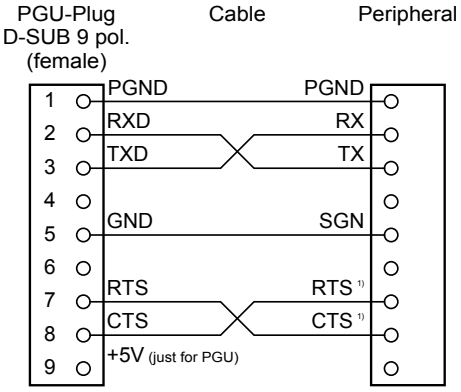
(see next page)

Option 1 Configuration with the desired protocol (S-Bus PGU configuration)

Option 2 Assignment (SASI) in the user program (the port must not be configured as S-Bus PGU port)

If a programming device is connected again instead of the peripheral device during operation, the mode is automatically switched over to PGU (pin 6 logic 1 (DSR), in PGU mode: DSR PING = 1)

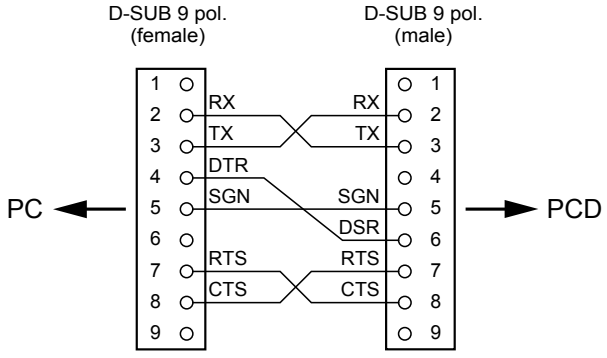
In order to be able to use the interface again for the connection of a peripheral device, Port 0 must be reconfigured with the SASI command



1) When communicating with terminals, check whether certain connections are to be bridged or to be set by the command SOCL on 1 or 0. Generally the use of handshake (RTS / CTS) is recommended (see also manual 26/795, series PCD7. D23x, graphics terminals).

Option 3 Port 0 can also be used as a modem interface with a 1 to 1 cable. As described in chapter 7.1.2 Hardware options, the check box Full RS-232 handshaking on port 0 must be selected.

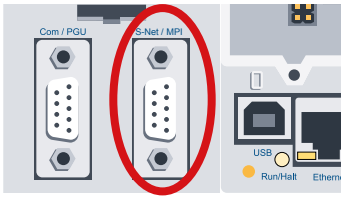
Option 4 With connection cable PCD8.K111, this interface can be used as a programming device connection.

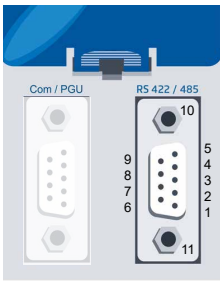


Connection cable PCD8.K111

5.3.3 RS-485 / RS-422 (port 3)

This interface is routed to a 9-pin D-sub connector (socket) and is of type RS-485 / RS-422.

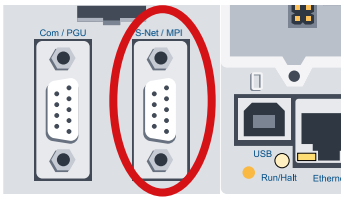


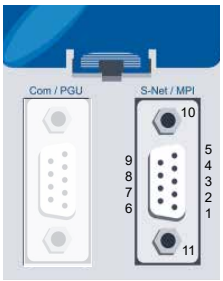
		PCD3.M5340, PCD3.M5360				PCD3.M5xx0	
		RS-422 Port 3				RS-485 Port 3	
		D-Sub pin	Signal	Explanation		Signal	Explanation
		1	/RXD	Receive data -		---	---
		2	/CTS	Ready to send -		---	---
		3	/TXD	Send data +		/RxD /TxD	Receive/Send +
		4	/RTS	Send request -		---	---
		5	PGND	Data ground		PGND	Data ground
		6	RXD	Receive data +		---	---
		7	CTS	Ready to send +		---	---
		8	TXD	Send data -		RxD TxD	Receive / Send -
		9	RTS	Send request +		---	---
Port 0	Port 3	10/11*)	PGND	Shield dimensions		PGND	Shield dimensions *)

*) Mounting screws of the D-Sub female connector housing

5.3.4 RS-485 / S-Net / MPI (port 10)

This interface is routed to a 9-pin D-sub connector (female) and is of type RS-485.

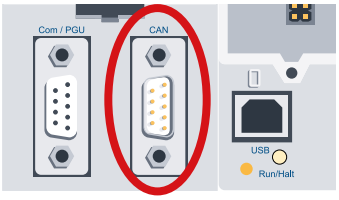


		PCD3.M5xx0 (except PCD3.M5340 and PCD3.M5360)		
		S-Net/MPI/RS-485 Port 10		
		D-Sub pin	Signal	Explanation
		1	GND	GND
		2	M24	0V of the 24V power supply
		3	RxD/TxD-P[1)]	Receive/Transmit data pos.
		4	CNTR-P	Control signal for repeaters (direction control)
		5	DGND[1)]	Data transmission potential (volume to 5V)
		6	VP[2)]	Supply voltage of the terminating resistors-P
		7	P24	Output voltage plus 24V
		8	RxD/TxD-N[1)]	Receive/Transmit data neg.
		9	n.c.	---
Port 0	Port 10	10/11*)	PGND	Shield dimensions *)

*) Mounting screws of the D-Sub female connector housing
[1)] Obligatory signals (it is imperative that the user makes this available)
[2)] The signal is provided by the controller

5.3.5 CAN (port 10)

This interface is connected to a 9-pin D-sub (plug) connector and is of type RS-485.

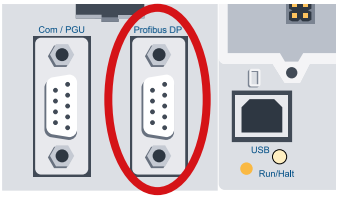


PCD3.M6240, PCD3.M6340 and PCD3.M6360				
		CAN Port 10		
		D-Sub pin	Signal	Explanation
		1	n.c.	---
		2	CAN_L[1)]	Receiving/sending neg.
		3	GND	Data transfer pot. Dimensions
		4	n.c.	---
		5	n.c.	---
		6	n.c.	
		7	CAN_H[1)]	Receiving/sending pos.
		8	n.c.	---
Port 0	Port 10	9	n.c.	---

[1)] Electrically isolated

5.3.6 Profibus DP Master (port 10)

This interface is routed to a 9-pin D-sub connector (socket) and is of type RS-485.

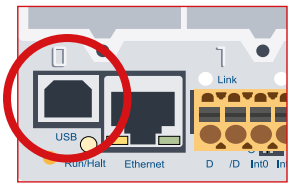


PCD3.M6440, PCD3.M6540 und PCD3.M6560				
		Profibus DP Master Port 10		
		D-Sub pin	Signal	Explanation
		1		---
		2	GND[2)]	Shield dimensions
		3	B red	Receiving/sending pos.
		4	En	---
		5	GND_BUS	For terminators
		6	+5 V_BUS	For terminators
		7	24 V[2)]	---
		8	A green	Receiving/sending neg.
Port 0	Port 10	9	n.c.	---

[2)] not electrically isolated

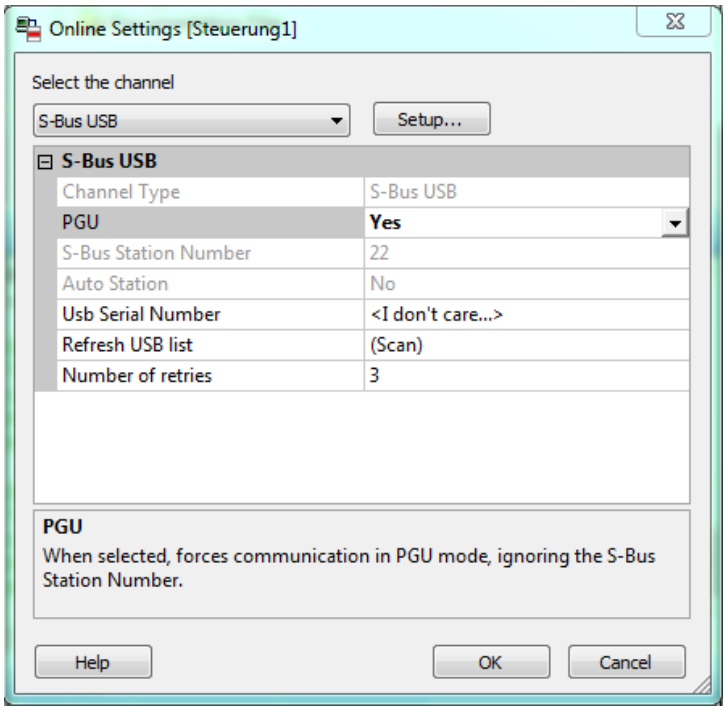
5.3.7 USB PGU interface for programming device connection

For the USB interface (type B) of the PCD3.Mxxx0 to be used, PG5 version 1.3.100 or later must be installed.



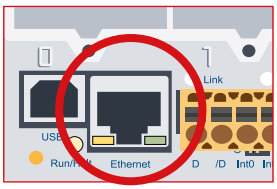
When a PCD3.Mxxxx is connected to a PC for the first time via the USB interface, the operating system of the PC automatically installs the relevant USB driver.

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



The activation of the PGU option ensures that the PCD3.Mxxxx connected directly to the PC can be communicated independently of the configured S-Bus address.

5.3.8 Ethernet RJ-45 and Profibus



SBC S-Net, the network concept by Saia Burgess Controls, is based on the open standard Profibus and Ethernet. Ethernet includes layers 1 and 2 of the ISO/ OSI layer model. Based on layer 2, a variety of different protocols and applications can be operated in parallel in the same network.

Additionally, the Profibus layer 2 (*Field Data Link*, FDL) also allows parallel operation of various application protocols such as DP, FMS and others. By using this option, Profi-S-Net can create a Private Control Network (PCN) on the Profibus. This will make all SBC devices active network participants.

Profibus layer 2 (FDL) is integrated in the operating system of the CPU PCD3.Mxxx0 and the RIOs PCD3.T76x. These devices thereby have a Profi-S-Net connection with transfer rates of up to 1.5 Mbit/s.

The devices support Profibus DP and S-Net on the same port. In this way networks based on Profibus can be set up in a cost-effective and flexible way (detailed information can be found in TI 26-381).

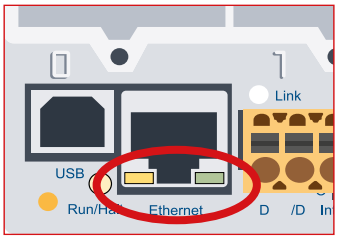
Since the summer of 2010, the full-duplex mode and Auto-MDIX can be operated via the Ethernet connection of the PCD3 family (PCD3.M2xxx, PCD3.M3xxx, PCD3.M5xxx and PCD3.M6xxx).

The easiest way to determine if your PCD3 already supports these functions, is to verify that the RJ-45 connectors are equipped with LEDs. If this is tha case, the Saia PCD® supports the full-duplex mode and auto-MDIX (auto-crossing of the signals).

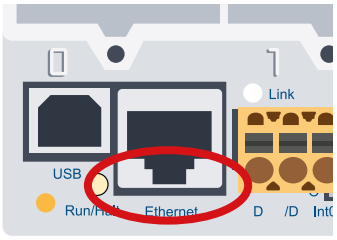
The following hardware version or higher is required for full Duplex and Auto MDIX support:

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

Devices with Ethernet full-duplex mode can be recognized by the two LEDs on the RJ-45 connector (left image).



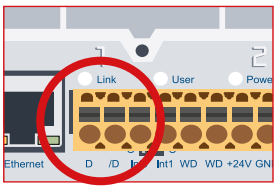
Ethernet connection equipped with LEDs



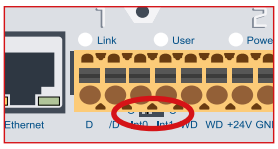
Ethernet connection without LEDs

5.3.9 RS-485 / Profi S-net/DP slave (port 2)

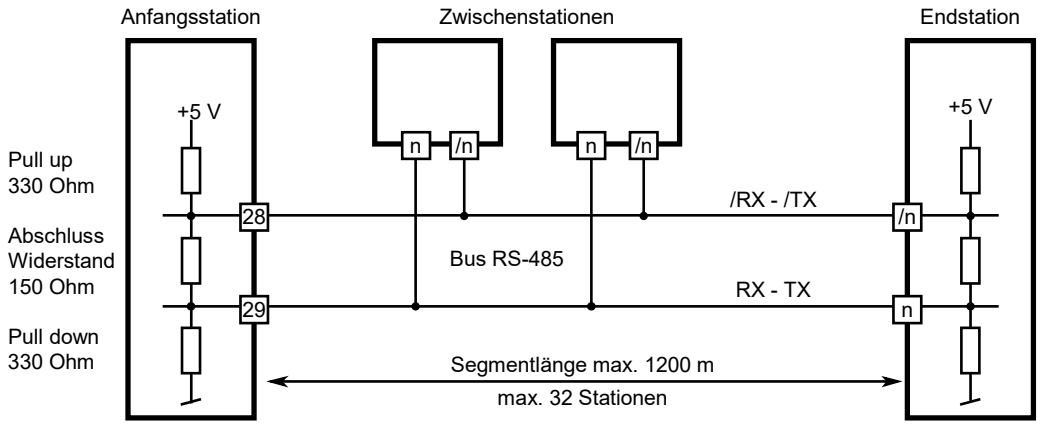
On the same terminal block for power supply, the port 2 interface with two terminal connections (D and /D) is arranged on the left side of the plug.



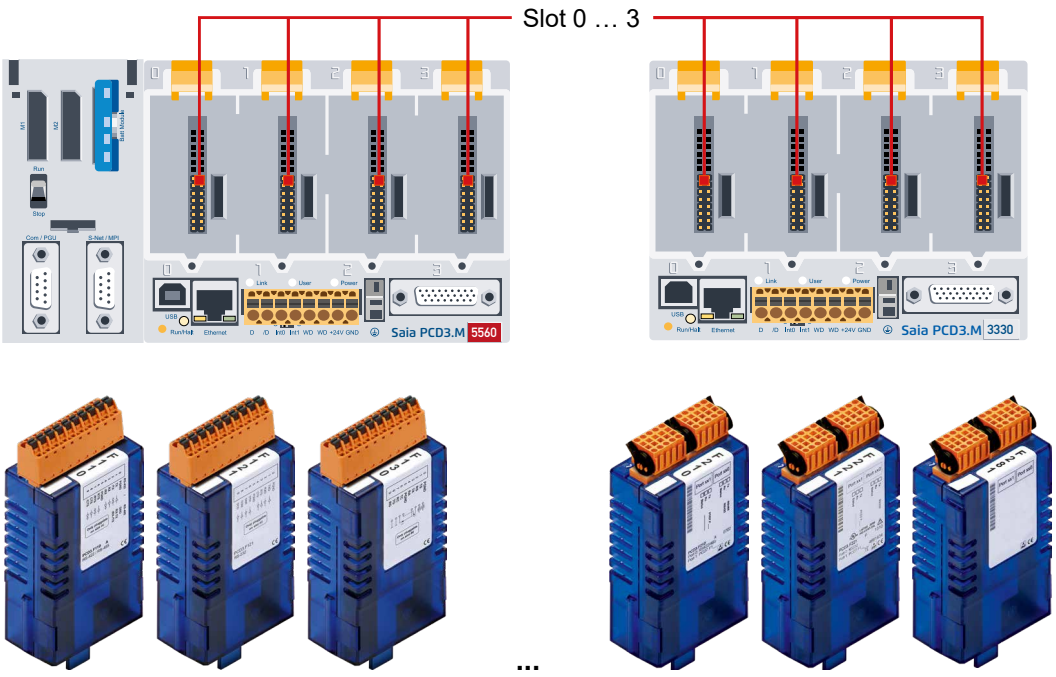
For all CPU types					
Terminal block (item no. 440549950) for power supply, watchdog, interrupt inputs and port 2				Profibus	
Cabel	Pin	Signal	Explanation	Signal	Wiring
Rx - Tx	1	D	Port 2 RS-485 to 115.2 kbit/s as a free user interface or Profi S-bus up to 187.5kbits/s (except PCD3.M5440 and PCD3.M5540)	RxD/TxD-N	A green
/Rx - /Tx	2	/D		RxD/TxD-P	B red
	3	Int0	2 interrupt inputs 24VDC or 1 quick counter 24 VDC		
	4	Int1			
	5	WD	Watchdog / closed relay contact		
	6	WD			
	7	+24V	Power supply		
	8	GND			

RS-485 terminating resistors			
Switch position	Description	Explanation	
left	O	without terminators	
right	C	with terminators	

Example of a RS-485 network setup with terminating resistors:

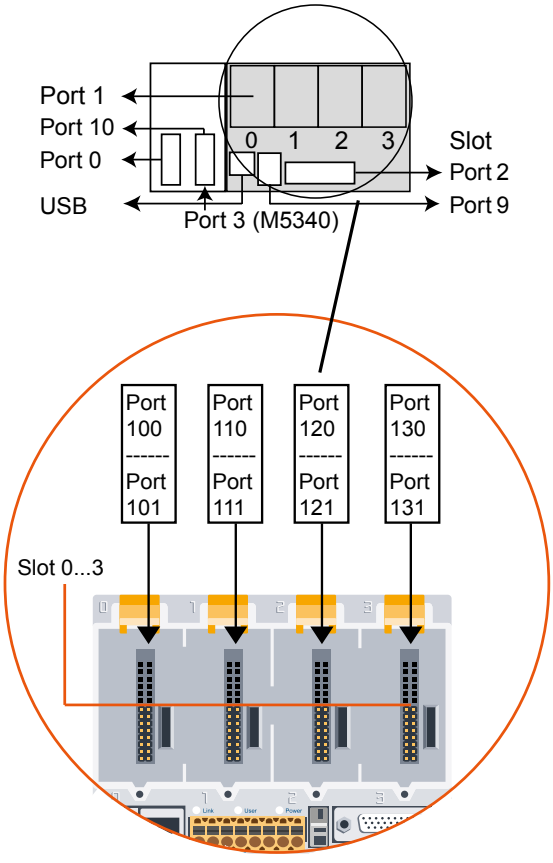


5.4 Plug-in interface modules on I/O slot 0…3



5.4.1 Overview slot interface modules

I/O communication modules	on slot ..			
	0	1	2	3
PCD3.F110 PCD3.F121 PCD3.F130 PCD3.F150 PCD3.F180	Port1			
PCD3.F210 PCD3.F221 PCD3.F24x PCD3.F26x PCD3.F27x PCD3.F281	Port100…101	Port110…111	Port120…121	Port130…131



Slot interface modules made for the following control units

Module (excluding Ethernet)*	Module	Power module	RIO
PCD3.M3020*	PCD3.M3120	PCD3.M3160	PCD3.T660
PCD3.M3230*	PCD3.M3330	PCD3.M3360	PCD3.T664
	PCD3.M5340	PCD3.M5360	PCD3.T665
PCD3.M5440*	PCD3.M5540	PCD3.M5560	PCD3.T666
	PCD3.M6340	PCD3.M6360	
	PCD3.M6540	PCD3.M6560	
		PCD3.M6860	
		PCD3.M6880	PCD3.T668

* not recommended for new projects

5.4.2 Serial Interfaces on I/O module slot 0 (port 1)

RS-232 / RS-422 / RS-485, Belimo, current loop 20 mA with PCD3.F1xx

The communication modules PCD3.F1xx are described in manual:
26-857 PCD3.F1xx and PCD3.F2xx serial interface modules.

5.4.3 Serial interfaces on the I/O module slots 0 - 3

RS-232 / RS-422 / RS-485, Belimo, current loop 20 mA on PCD3.F2xx

The communication modules PCD3.F2xx are described in manual:
26-857 PCD3.F1xx and PCD3.F2xx serial interface modules.

DALI interface module PCD3.F261

The Dali communication modules are described in manual:
27-606 DALI modules PCD2.F2610 & PCD3.F261.

The description of the software library can be found in manual:
27-607 StarterGuide DALI-F26x,

LON interface module PCD3.F240

The LON communication modules are described in the manual:
27-636 LON communication module for TP / FT-10 channel

Relevant manual
26-767 LonWorks® networks with Saia PCD®

M-Bus interface module PCD3.F27x

The M-Bus communication modules are described in the manual:
27-603 M-Bus Master Interface Module PCD2.F27x0 and PCD3.F27x

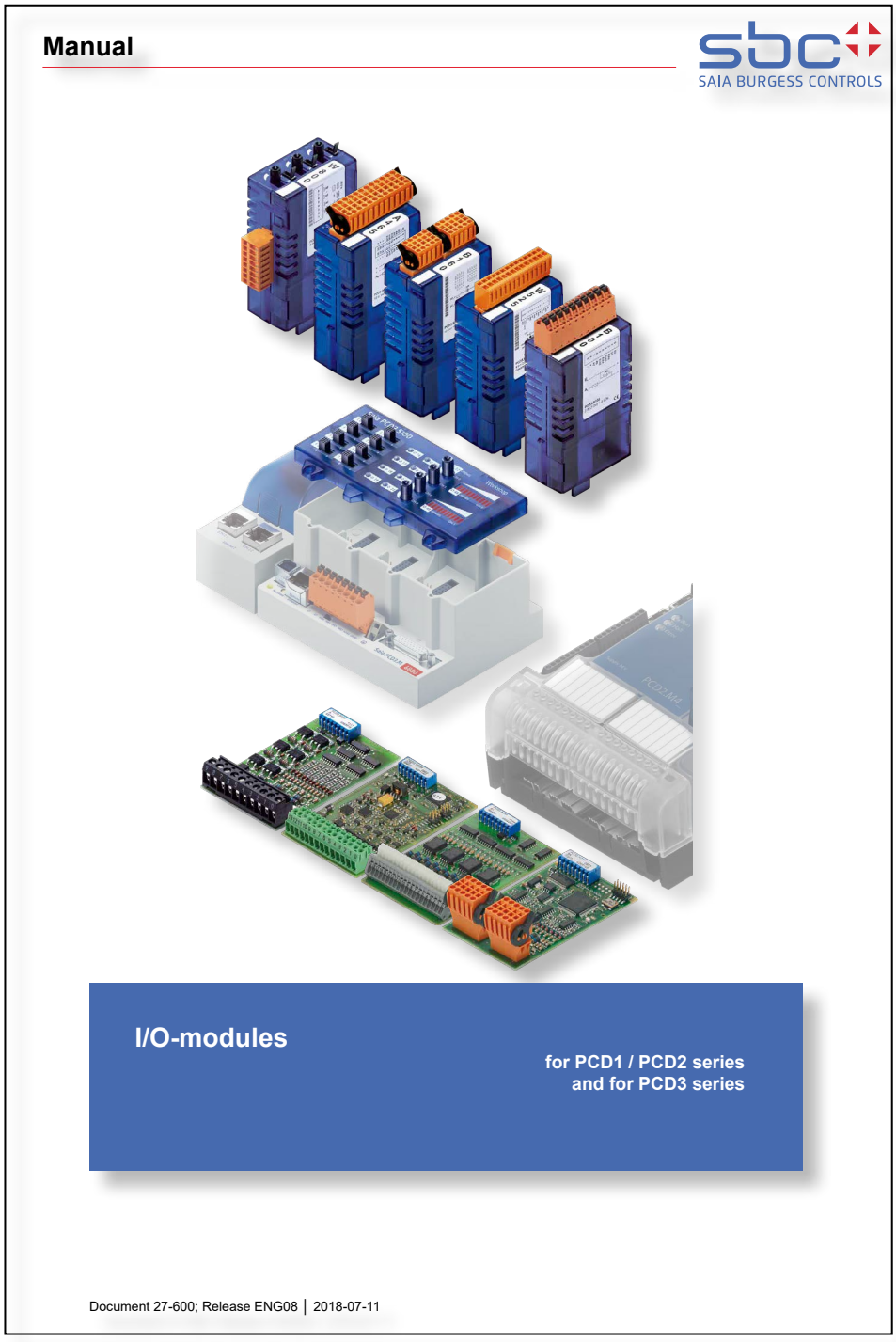
5.5 LIO and RIO

5.4.1 Interfaces of PCD3.Cxxx and PCD3.Txxx

The description of the interfaces of the PCD3.Cxxx and PCD3.Txxx are included in the chapters of this manual:

Extension with PCD3 components	Chapter 3
RIO (Remote Input Output) head ends	Chapter 4

6 Input/output (I/O) modules



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

7 Configuration

7.1 CPU processor units
7.2 RIO - Remote Input Output module carrier PCD3.T76x
7.3 Smart-RIO PCD3.T665 and PCD3.T666

7.1 CPU processor units

The commissioning of the PCD-CPU is described in 26-732 PG5 User Manual, which is included in the PG5 software package as a PDF file.

After the standard installation of the PG5 package on the local computer, the manuals are usually found in four languages under the following directory path

c:\Program Files (x86)\SBC\PG5 Version\Manuals\

The shortest route is via PG5 itself.

Programmstart PG5 -> Help -> PG5 User Manual

7.2 RIO - Remote Input Output module carrier PCD3.T76x*

Commissioning instructions for a PCD3.T7xx can be found in 26-732 PG5 User Manual under chapter 15 Profi-S-IO.

Another more up-to-date option is the PG5 help of the latest PG5 suite under S-Net Network Configurator Introduction.

* outphased. This product is no longer produced.

7.3 Smart-RIO PCD3.T665 and PCD3.T666

A quick start guide for configuring, programming and commissioning the Smart RIOs (PCD3.T665 and PCD3.T666) with PCDx.Mxxxx Smart Automation Managers can be found in document 26-892 Smart-RIO PCD3.T66x.

Further details can be found in the PG5 help of the latest PG5 suite under RIO Network Configurator.

8 Maintenance

8.1 Battery change at the PCD3.M5xx0/M6xx0
8.2 Battery change at the PCD3.M3xx0 with PCD3.R010

8.1 Battery change at the PCD3.M5xx0/M6xx0

PCD3 components are maintenance-free, except for a few CPUs (PCD3.Mxxx0), where the battery needs to be replaced from time to time.

PCD3 components contain no parts that can be replaced by the user. If hardware problems occur, the components should be returned to Saia Burgess Controls.

The resources (registers, flags, timers, counters, etc.) and partly, also the user program and texts/DBs, are stored in the RAM. To ensure that they do not get lost during a power failure and (if any) the hardware clock continues to run, the PCD3 is equipped with a buffer capacitor (SuperCap) or a buffer battery:

CPU type	Puffer	Buffer time
PCD3.M3xx0	Super Cap (soldered, maintenance free)	4 hours[1)]
PCD3.M5xx0/M6xx0	Lithium Battery Renata CR 2032 + Super Cap (soldered in)	1…3 years[2)]

1) The total charge time is about 10 minutes

2) Depending on the ambient temperature, the higher the temperature, the shorter the buffering time

8

- For new controllers, the batteries are included in the package and must be used during commissioning. Note the polarity of the batteries:
- Insert button batteries CR 2032 from Renata so that the positive pole is visible

The CPU with lithium batteries are not maintenance free. The battery voltage is monitored by the CPU.

The LED BATT lights up and the XOB 2 is activated when:

- the battery voltage is below 2.4 V or higher than 3.5 V
- the battery is discharged or has an interruption
- the battery is missing

We recommend changing the battery while the Saia PCD® is live, so no data loss occurs.

Ordering information:

Type	Description
4 507 4817 0	Lithium battery for PCD processor units (RENATA button type CR 2032) [2)]

[2)] Shelf life 1…3 years. Depending on the ambient temperature, the higher the temperature, the shorter the buffering time

8.2 Battery change at the PCD3.M3xx0 with PCD3.R010

The resources (registers, flags, timers, counters, etc.) and partly, also the user program and texts/DBs, are stored in the RAM. To ensure that they do not get lost during a power failure and (if any) the hardware clock continues to run, the PCD3 is equipped with a buffer capacitor (SuperCap) or a buffer battery:

- For new controllers, the batteries are included in the package and must be used during commissioning. Note the polarity of the batteries:
- Insert button batteries Renata CR2032 so that the positive pole is visible

The CPU with lithium batteries are not maintenance free. The battery voltage is monitored by the CPU.

The LED BATT lights up and the XOB 2 is activated when:

- the battery voltage is below 2.4 V or higher than 3.5 V
- the battery is discharged or has an interruption
- the battery is missing

We recommend changing the battery while the Saia PCD® is live, so no data loss occurs.

Ordering information:

Type	Description
PCD3.R010	Battery module for PCD3.M3xxx, plug-in onto I/O Slot #3
4 507 4817 0	Lithium battery for PCD processor units (RENATA button type CR 2032) [2)]

[2)] Shelf life 1…3 years. Depending on the ambient temperature, the higher the temperature, the shorter the buffering time

A Appendix

A.1 Symbols for notes etc.
A.2 Definitions for the serial interfaces
A.3 Glossary
A.4 Contact, support and repair addresses

A

A.1 Symbols for notes etc.

A.1.1 Note symbols

This symbol refers the reader to further information in this or another manual or in technical information brochures.
There is generally no direct link to these documents.

This symbol appears next to instructions that require strict compliance.

This symbol warns the reader of the risk of electric discharge upon contact.
Recommendation: You should at least touch the negative terminal (PGU port casing) on the system before coming into contact with the electronic components. It is preferable to be permanently connected to an earthing lug on the wrist with the negative terminal.

The explanations next to this symbol are valid for the Saia PCD® Classic series only.

The explanations next to this symbol are valid for the Saia PCD® xx7 series only.

A

A.1.2 Mass designation, symbols and meaning

Description	Symbol	Meaning
GND	⊥	Ground *(ground)*
DGND	⊥D	digital galvanic isolated ground *(digital galvanic isolated ground)*
AGND	⊥A	analog galvanic isolated ground *(analog galvanic isolated ground)*
SGND	⊥S	signal ground *(signal mass)*

A.2 Definitions for the serial interfaces

A.2.1 RS-232

Designation of the signal lines

Data lines	TXD	Transmit data	Send data
	RXD	Receive data	Receive data
Signal and message lines	RTS	Request to send	Activate transmitter
	CTS	Clear to send	Ready to send
	DTR	Data terminal ready	Terminal ready
	DSR	Data set ready	Ready
	RI	Ring indicator	Incoming call
	DCD	Data carrier detect	Partner ready

Signals to RS-232

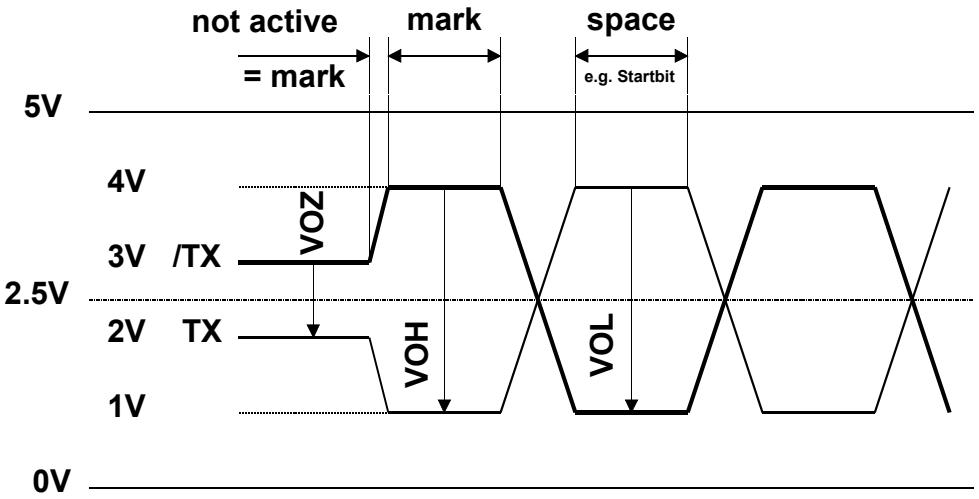
Signal type	Logical status	Setpoint value	Nominal value
Data signal	0 (space) 1 (mark)	+3 V to +15 V -15 V to -3 V	+7 V -7 V
Control/ message signal	0 (off) 1 (on)	-15 V to -3 V +3 V to +15 V	-7 V +7 V

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

A

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

RS-422 is in active condition in mark position

A

RS-422

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

RS-485

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

RS-485 wiring

Depending on the manufacturer, there are different names for the connection allocation.

Converter

Products from other manufacturers (RS-232 - RS-485) are usually presented in reverse. Therefore, the data lines must be crossed in certain cases.

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

Profibus and Profi-S I/O

Profibus	Colour	PCD7.T160	D-Sub 9-pin 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 allocation, therefore the data lines must be crossed in certain cases.

A

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

The drivers work with 5 VDC. If a higher voltage is applied, the drivers may be destroyed!

A.2.3 TTY/current loop

Signals to TTY/current loop

Connection 1	TS	Transmitter source	Sender
Connection 3	TA	Transmitter anode	
Connection 6	TC	Transmitter cathode	
Connection 8	TG	Transmitter ground	
Connection 2	RS	Receiver source	Receivers
Connection 4	RA	Receiver anode	
Connection 7	RC	Receiver cathode	
Connection 9	RG	Receiver ground	

Signal type	Setpoint value	Nominal value
Current for logical L (space)	–20 mA to + 2 mA	0 mA
Current for logical H (mark)	+12 mA to +24 mA	+20 mA
No-load voltage on TS, RS	+16 V to +24 V	+24 V
Short circuit current on TS, RS	+18 mA bis +29.6 mA	+23.2 mA

The idle status for data signals is mark.
The operator uses wire bridges on the screw terminal blocks to select the switching type active or passive.

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

A

A.3 Glossary

AWL	Statement list (program code line for line).
Backup	Data backup (for example, copy to additional data carriers)
Basic address	First numeric address of the IO module slot.
Buffer battery	The buffer battery supplies the energy for maintaining memory contents and to enable the clock to continue working after switching off the power supply.
Builder	Combines different work steps to load a programme in the PCD.
Compiler	A compiler is a program that translates the source code of a program into the strings understandable to the target computer.
CPU	Central Processing Unit. Here the main housing with central unit is designed for the Saia PCD® family.
Device	Device → controller (part of a project in the Saia PG5® Project Manager).
Download	Abbr. DnLd → Save data in PCD
Element	Here, the inputs and outputs, flag, register, counter, timer, etc. are designed for the Saia PCD® family.
Flash memory	Digital, non-volatile memory. Retains its data in the off state.
FRAM	Ferroelectric Random Access Memory (requires no power supply for data retention)
IL	Instruction list → PCD program code
Linker	After the compiler has done its work, the linker merges the individual data for a program.
LIO (Local Input Output)	Inputs/outputs on the CPU board (on-board).
Media	This indicates inputs/outputs, flag, register, etc. in the PCD family.
Media mapping	Software assignment of digital and analog I/O electronics to flags and registers.
Module holders	CPU, LIO or RIO devices that can accept I/O modules (e.g. PCD3.C100, etc.)
Modules	Carrier cards for input/output electronics with suitable connection technology.
Motherboard	Main board (CPU)
NT	New technology → subsequent generation of the first PCD generation.
On-Board	Denotes as much as permanently installed “on the CPU motherboard”.
Parse	A parser is a program which, in computer engineering, is responsible for the decomposition and conversion of any input (text, e.g. AWL) into a format useful for further processing.
PCD3.M6xxx	x in the product description stands for a number 0...9. In this case, it is an additional three-digit number, e.g. PCD3.M6560.
PGU	Programmable Unit
PLC	Process Logic Controller
Port	Interface description
PWM	PWM stands for Pulse Width Modulation. Pulse width modulation works with a constant pulse rate and a constant pulse amplitude, only the pulse width is variable. Because the pulse rate is constant, but the pulse width changes, the pulse duty factor changes. With a PWM output, it is possible to output analog values without expensive A / D converters

A

RAM	Random Access Memory → digital, volatile RAM of the computer. Loses its data in the off state.
Resources	Resources → Inputs/outputs, flag, register, counter, timer, etc.
Restore	Load saved data from the backup data carrier.
RIO	Remote Input Output → Inputs/outputs on module carriers that can be accessed by the CPU via profibus/ethernet lines.
ROM	Read only memory → Digital memory which keeps its data in the off state.
SD card	Secure Digital Memory Card → Digital memory which keeps its data in the off state.
Sink operation	Ground switching with DC
Slot	Slot for I/O, communication and memory modules.
Source operation	Plus switching with DC
Source text or source code	With an ASCII editor created (original) program, therefore no word processing program. Word processing programs include characters for bold text etc., which a compiler might misinterpret.
SPM	Saia PG5® Project Manager, main program of the Saia PG5® software package.
SRAM	Static Random Access Memory
SuperCap	Electronic component (capacitor) that can store electrical energy. Preservation of memory contents and clock function after switching off the power supply for a few hours to days.
Terminated	Electrical reflections at the line ends are prevented using termination (e.g. with terminating resistors).

A

A.4 Contact, support and repair addresses

Contact

Saia-Burgess Controls AG
Bahnhofstrasse 18
3280 Murten, Switzerland

Telephone switchboard ..... +41 26 580 30 00
Telephone SBC Support ..... +41 26 580 31 00
Fax ..... +41 26 580 34 99

Support

E-mail Support: ..... support@saia-pcd.com
Support site: ..... www.sbc-support.com
SBC site: ..... www.saia-pcd.com

International representations &
SBC sales companies: ..... www.saia-pcd.com/contact

A

Repair

Postal address for customers to return products in Switzerland:

Saia-Burgess Controls AG
After sales service
Bahnhofstrasse 18
3280 Murten, Switzerland