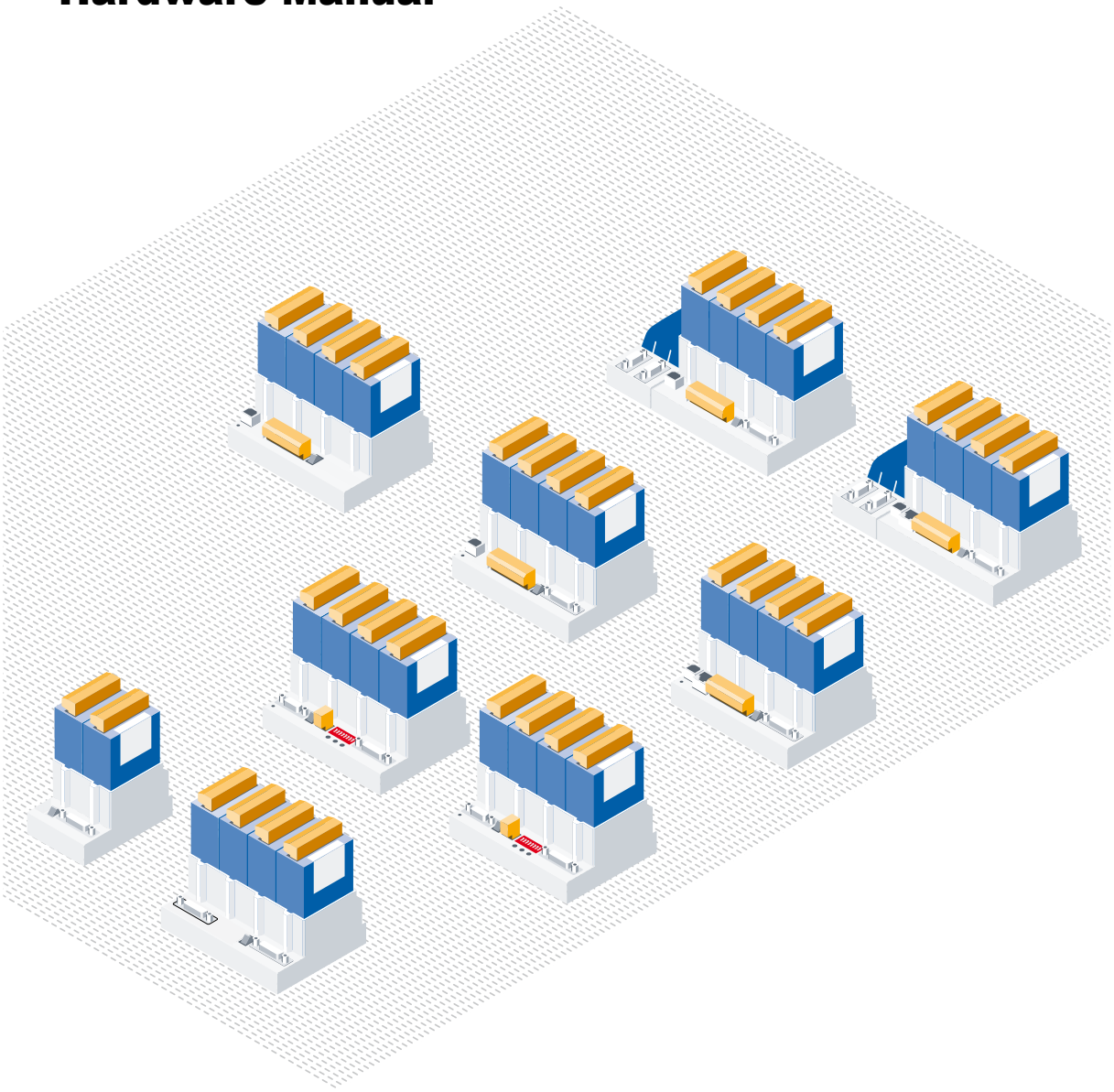
Hardware Manual



saia-burgess

Control Systems and Components

for the PCD3 series

Controls Division

Document 26/789; Version EN12 | 2010-11-10

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A Annex

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0.1 Document-History

Version	Changed	Published	Remarks
EN2	01.11.2003	01.11.2003	Translation
EN3	15.08.2004	01.10.2004	Revision
EN4	01.10.2004		Incorporation of CPUs
EN5	31.01.2005	31.01.2005	Changes
EN6	01.07.2005	15.11.2005	Incorporation of new modules, sequence as per price list, other additions and changes
EN7	01.10.2006	10.07.2007	Further detailed additions and changes
EN8	10.07.2007	15.07.2007	Further detailed additions and changes
EN9	2009-03-01	2009-03-15	Further changes
EN10	 2010-01-21 2010-03-05 2010-03-24 2010-05-17	2009-10-09 2010-01-21 2010-03-05 2010-03-24	- 3 Removed the DIN 40 040 - 3.10 Port #3 of the PCD3.M5430 - 6.1.6 List of outphased I/O-modules - 3.10 configuration of Port #10, Pin 6 - 6.13.1 Resolution A / D converter W525 - 3.2, 3.12, 8.1 Buffer time “Super Cap”
EN11	2010-05-17 2010-07-12 2010-07-26	2010-07-26 2010-07-26 2010-07-26	- 3.2, 3.12, 8.1 Buffer time “Super Cap” - 5.5.6 Wiring concept PCD3.F180 - 6.8.1 Wiring concept PCD3.W2x0
EN12	2010-11-10 2010-11-10	2010-11-10 2010-11-10	- 3.4 Profi-S-Net 1,5 MBit/s not for the M5340 - 6.8.2 Ground connection of PCD3.W3x0

0.2 Trademarks

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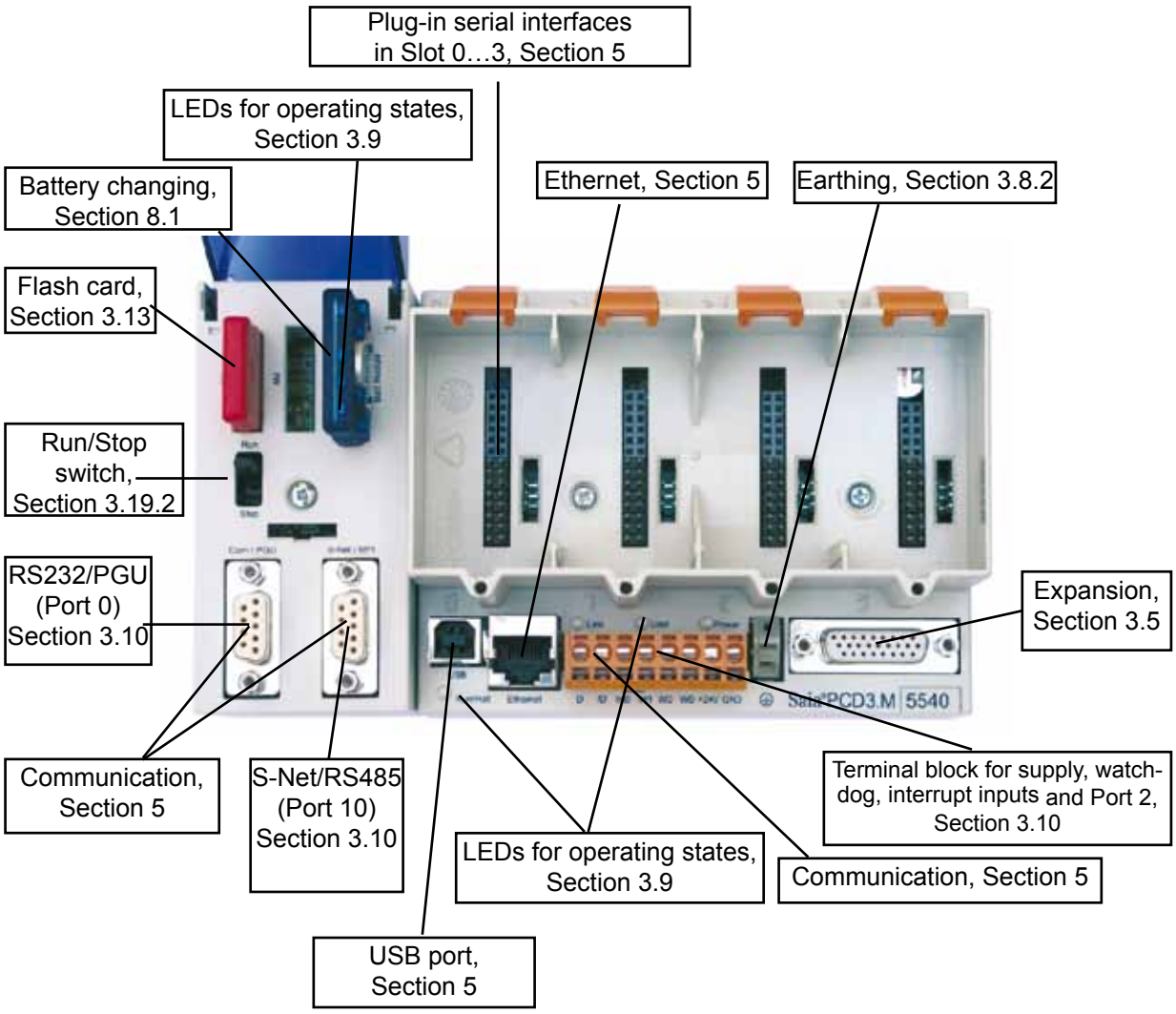
Technical changes are subject to the state of technology

Published in Switzerland

1 Graphical index

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



2 Overview

2.1 Introduction

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

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

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

- Planning an application
- Cabling
- Addressing and cabling rows

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

2.2 Planning an application

The following aspects should be considered when planning PCD3 applications:

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

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

- Use no more than **six** PCD3.C200s in one configuration, or the time delay will exceed the I/O access time
- Use a maximum of **five** PCD3.K106/116 cables
- After each cable (at the start of a row), insert a PCD3.C200
  Exception: In a small configuration with no more than 3 LIOs, these can be supplied from the PCD2.Mxxx. A PCD3.C200 is not needed
- Where an application is mounted in a single row (max. 15 LIOs), after every **five** PCD3.C100s a PD3.C200 must be inserted to amplify the bus signal (unless the configuration ends with the fifth PCD3.C100)

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

When planning an application, we recommend the following procedure:

❶ Select the I/O modules according to your requirements. Where possible, use PCD3 I/O modules with 16 connections; these have 16 red LEDs.

❷ From the number of I/O modules, calculate the required number of module holders. Check that the number of module holders is allowed:

PCD3	M3020	M3xx0	M5xx0	M6xx0
I/O bus connection for expansion units	no	yes		
Number of inputs/outputs or I/O module sockets:	64[1)] 4	1023[1) 2)] 64		

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

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

Connecting material required

Arrangement with one PCD3.Mxx0; LIOs in one row
Max. 15 x PCD3.LIO's in a row, no extension cable, with PCD3.K010 connector only

Connecting material for this arrangement:
n x PCD3.K010 connectors between PCD3 module holders

Arrangement with one PCD3.Mxx0; LIOs in multiple rows
Max. 3 PCD3.LIOs side-by-side and one row beneath the other, with extension cables for the rows beneath (max. 15 PCD3.LIOs)

Connecting material for this arrangement:
n x PCD3.K106/116 extension cables to connect the last PCD3 module holder in one row with the first PCD3 module carrier in the next row; n x PCD3.K010 connectors between PCD3 module holders

Arrangement of a RIO node with the LIOs side-by-side
Max. 3 x PCD3.LIOs total
Connecting material for this arrangement:
n x PCD3.K010 connectors between PCD3 module holders

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

❹ Use the table in the section on "Current consumption of the modules" to calculate the load current on the internal +5V supply (use the worst-case / highest values)

❺ Check that the max. supply current is sufficient for the CPU, RIO or PCD3.C200. To supply a module segment separately, use a PCD3.C200 instead of a PCD3.C1xx. Check that the load current for all segments does not exceed the max supply current for the CPU/RIO/PCD3.C200. The max. supply current can be found in the section on "Internal supply"

❻ Calculate consumption from the 24 V supply. The current consumption for the PCD3 configuration can be determined from the section on "Current consumption of the modules" (use the worst-case / highest values)

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

❼ Do not forget the appropriate connecting cables for the module holders

❽ Calculate the number of terminal blocks required for the I/Os, and order separately. Screw or spring clamp terminal blocks can be ordered as required. Not all modules require the same type of socket connection.

2.3 Cabling

2.3.1 Cable layout

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

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

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

2.3.2 Cable routing

- 230 V supply lines and signal lines must be laid in separate cables at least 10 cm apart. Even within the switching cabinet, it is advisable to leave space between power and signal lines.
- Digital signal / bus lines and analogue signal / sensor lines should be laid in separate cables
- It is advisable to use shielded cables for analogue signal lines.
- The shield should be earthed at the entry or exit to the switching cabinet. The shields should be as short as possible and of the largest possible cross-section. The central earthing point should be > 10 mm² and connected to the PE ground wire by the shortest route
- The shield is generally connected to one side of the switching cabinet only, unless there is a potential equalization with significantly lower resistance than the shield resistance
- Inductivities installed in the same switching cabinet, e.g. contactor coils, should be provided with suitable suppressors (RC elements)
- Switching cabinet components with high field intensity, e.g. transformers or frequency inverters, should be shielded with separator plates with a good ground connection.

Surge protection for long distances or external lines

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

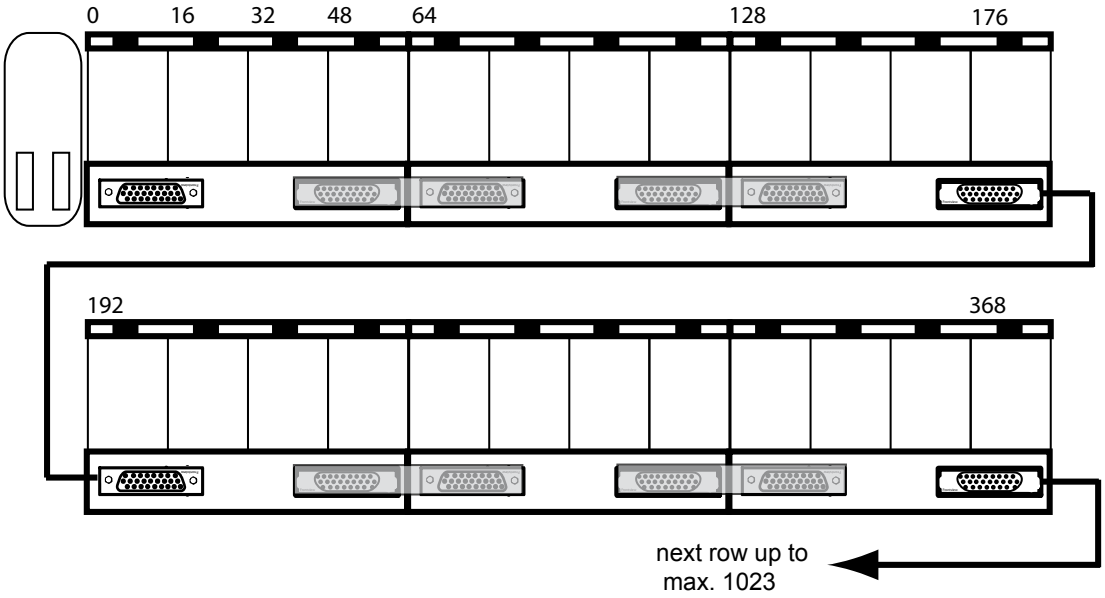
2.4 Addressing and cabling rows

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

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

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

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



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

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

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

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

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

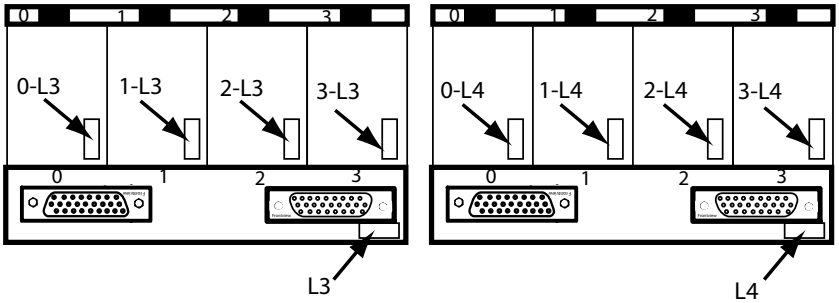
The extension cables must not be plugged in or removed with the controller connected to the power supply.

2.4.1 Labelling module holders and modules

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

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

Example:



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

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

4 310 8686 0

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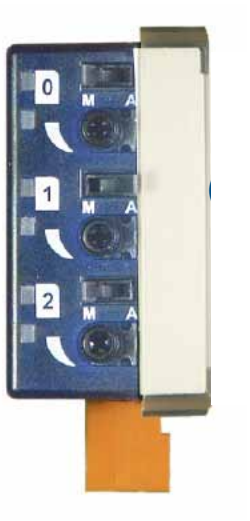
Since the middle of 2005, all PCD3 I/O modules have been fitted with a means of attaching a label clip. These clips can be snapped on to the right or left (e.g. where there are no LEDs) of the connector. Prepunched labels can be inserted into the clips. The clips, including prepunched labels (A4 sheets)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

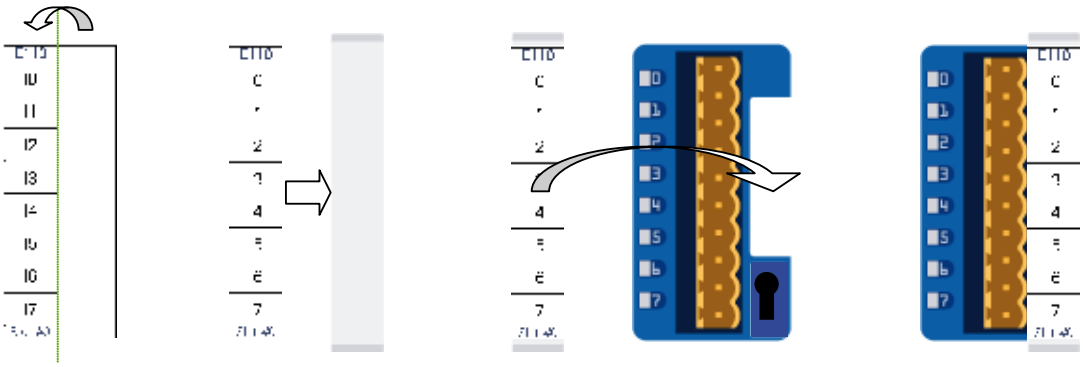
Older module housings without attachment facility

New module housings with attachment facility



The prepunched labels can be edited using a program:

- Download S-Label Creator from the support site http://www.sbc-support.ch/pcd3/S-LabelCreator.htm
- Start the program
- Select I/O module and edit preset text to your own requirements (font, colour, borders etc.)
- Print the prepunched labels on the A4 sheets provided
- Peel label off the A4 sheet
- Push the label under the transparent clip from left to right



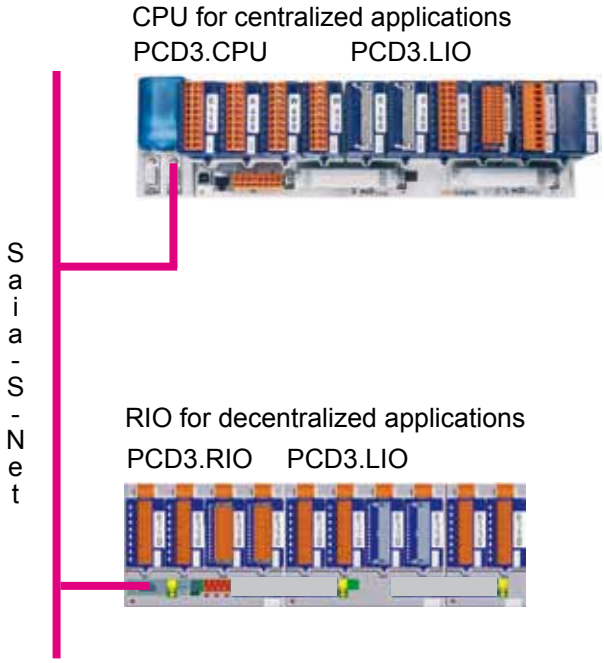
Software tools - restrictions

The S-Label Creator software requires the Framework Redistributable package from Microsoft®. This can also be found on our support site (see above).

3 PCD3.Mxxx0 Classic CPUs and module holders

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

3.1 System overview



Saia® S-Net networking concept

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

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

Saia® PCD web server

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

- Web browser as a tool for commissioning, support and visualization:
  Access to the Saia® web server is via standard web browsers such as Internet Explorer and Netscape Navigator This makes the web browser, which can be operated intuitively by anyone, the standard tool for commissioning, service, support and visualization of machines, units and installations. The user can retrieve pre-defined device and system-specific HTML pages, giving access to all data on controllers and RIOs. Graphical elements (images, diagrams etc.) as well as text documents (operating and repair manuals) can also be integrated into the HTML pages, to provide a personalized user interface
- General access to any desired interfaces and networks:
  Access to the web server is available not only via Ethernet TCP/IP, but also via cost-effective standard serial interfaces (RS232, RS485, modem etc.) and via Profibus networks, throughout the system and at different levels in the network. This makes it economical to use web technology to operate and monitor even the smallest applications.
- The Saia® PCD web server is integrated into all products:
  Having a web server integrated as standard eliminates the cost of run-time licenses or additional modules. In all new Saia® PCD3 controllers and the Saia® PCD3 RIOs, the web server is already included in the base units, at no extra cost.

3.2 General technical details

Supply (external and internal)	
Supply voltage	24 VDC ±+25% smoothed or 19 VAC ±15% full-wave rectified (18 VDC)
Power consumption[1)]	typically 15 W for 64 I/Os
Capacity of internal 5 V bus[2)]	600 mA
Capacity of internal +V bus (16…24 V)[2)]	The capacity of the +V bus depends on the capacity of the 5V bus, as follows (the more precisely the 24 V are maintained, the higher the possible capacity): 24 V $^{-25\,\%}_{+30\,\%}$: 100 [mA] 24 V $^{-20\,\%}_{+25\,\%}$: $150 - \frac{I_{5\,V\,bus}}{15}$ [mA] 24 V $^{-10\,\%}_{+10\,\%}$: $260 - \frac{I_{5\,V\,bus}}{4.8}$ [mA]
1) The loads handled by the outputs and other consumers are generally more important for sizing the supply than the internal power leakage of the control 2) When planning PCD3 systems, it is essential to check that the two internal supplies are not overloaded. This check is especially important when using analogue, counter and positioning modules, as these may have a very large power consumption. It is advisable to use the calculation table at www.sbc-support.ch.	
Atmospheric conditions	
Ambient temperature	When mounted on vertical surface with vertically aligned terminals: 0…+55 °C In all other mounting positions, a reduced temperature range of 0..+40 °C applies

Storage temperature	-20…+85 °C
Relative humidity	10…95% without condensation
Vibration resistance	
Vibration	according to EN/IEC61131-2: 5…13.2 Hz constant amplitude (1.42 mm) 13.2…150 Hz, constant acceleration (1 G)

Electrical safety	
Protection type	IP 20 according to EN60529
Air/leakage paths	according to EN61131-2 and EN50178: between circuits and bodies and between electrically isolated circuits: surge category II, fouling level 2
Test voltage	350V / 50Hz AC for nominal unit voltage 24 VDC

Electromagnetic compatibility	
Electrostatic discharge	according to EN61000-4-2: 8 KV: contact discharge
Electromagnetic fields	according to EN61000-4-3: field intensity 10 V/m, 80…1000 MHz
Bursts	according to EN61000-4-4: 4 KV on DC supply lines, 4 kV on I/O signal lines, 1 kV on interface lines
Noise emission	according to EN 61,000-4-6: Class A (for industrial areas) Guidance on the correct use of these controls in residential areas can be found at www.sbc-support.ch (additional measures).
Noise immunity	acc. to EN61000-6-4

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

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

3.3 System resources

3.3.1 Program blocks

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

3.3.2 Computation ranges for count types

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

3.3.3 Media

Type	Quantity	Addresses	Remarks
Flags (1 bit)	8192	F0…8191	By default, flags are not volatile, but a volatile range can be configured, beginning with address 0
Registers (32 bit)	16383	R 0…16383	For integer or floating point values
Text/data blocks	8191	X or DB 0…8191	The texts 0..3999 are always written to the same memory area as the user program. Where the user memory has been extended, the base memory can be configured to hold RAM texts and DBs. The texts and DBs held in this way have addresses ≥ 4000
Timers/counters (31 bit)	1600[1)]	T/C 0…1599	The breakdown of timers and counters is configurable. Timers are periodically decremented by the operating system; the basic time unit can be set between 10 ms and 10 seconds
Constants with media code K	any		Values 0..16383; may be used in instructions instead of registers

Constants with no media code	any		Values - 2,147,483,648 to +2,147,483,647. Can only be loaded into a register with an LD command, and cannot be used in instructions instead of registers.

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

3.4 PCD3 CPUs

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

Differentiation of PCD3 base units PCD3.M	Basic		Extended		CAN	Profibus DP Master
	3020	**3230**		**5440**	**6240**	**6440**
	3120	**3330**	**5340**	**5540**	**6340**	**6540**
Programming interface	USB [7]					
Optional serial port Port 1	1 x RS232, RS422/485 or TTY current loop 20 mA pluggable (PCD3.F1xx modules)					
Port 0 (PGU) also available as RS232 interface, up to 115 kbps			✓			
Serial data port RS485, up to 115 kBit/s	Port 2					
Profi-S-Net interface	Port 2 up to 187.5 kbps			Port 10 up to 1.5 Mbps	Port 2 up to 187.5 kbps	
Ether-S-Net interface	M3120 only ✓	M3330 only ✓	✓	M5540 only ✓	M6340 only ✓	M6540 only ✓
Field bus connections						
Serial-S-Net	✓					
Profi-S-Net	✓					
Ether-S-Net (TCP/IP)	M3120 only ✓	M3330 only ✓	✓	M5540 only ✓	M6340 only ✓	M6540 only ✓

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

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

3) Typical values; the processing time is dependent on the load on the communication ports

4) From hardware version D and matching firmware, see detailed notes in section 3.13.1

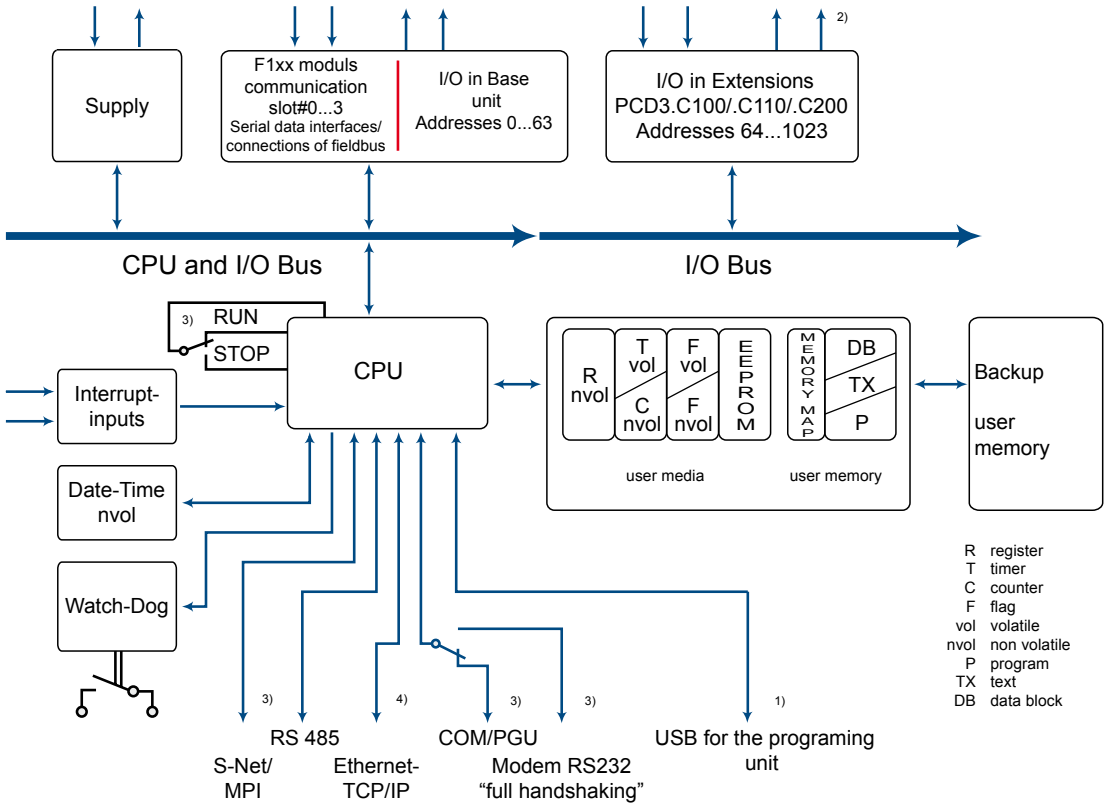
5) The period given is a buffer time; it is dependent on the ambient temperature (a higher temperature means a shorter buffer time)

6) The 1kHz applies with a pulse/pause ratio of 1:1 and refers to the total frequencies of the two inputs

7) The USB port is type "USB 1.1 Slave Device 12 Mbps" and can only be used for programming and as an S-Bus Slave, together with certain software products (Webconnect, ViSi-PLUS with S-Driver).
With a USB 2.0 hub, the download runs twice as fast

Can also be used as a serial data port, e.g. to connect a terminal; but this hampers commissioning and trouble-shooting with the debugger

3.4.1 Block diagram for PCD3.Mxx0



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

No changes (e.g. plugging/unplugging I/O modules) should be made with the power switched on.

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

3.4.2 Hardware and firmware versions for the PCD3.Mxxx0

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

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

- Go to www.sbc-support and download the latest firmware version
- Establish a connection between PG5 and the CPU, as when downloading an application (according to the facilities available, serial with PGU cable, modem[1)], USB, Ethernet)
- Open the Online Configurator and go offline
- From the Tools menu, select “Update Firmware”, then use the Browse function to select a path to the file for the new firmware version. Ensure that only one file is selected for download
- Start the download
- After the download, the power supply to the PCD must not be interrupted for 2 minutes (CPLD programming sequence). Otherwise, the CPU may be blocked in such a way that it has to be returned to the factory.
  While the Run/Halt LED is flashing slowly, the download is not yet complete. Only when it starts flashing fast is the programming finished.

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

3.5 Expansion with PCD3 components

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

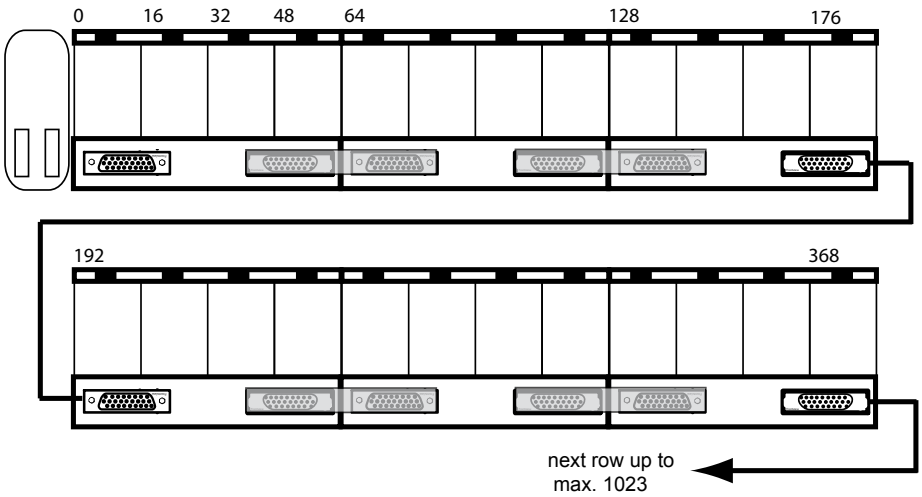
Type	M3020 M3120	M3230 M3330	M5xx0 M6xx0
Maximum number of inputs/outputs or I/O module sockets for the system:	64[1)] 4	1023[1) 2)] 64	1023[1) 2)] 64

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

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

PCD3.M5540 **PCD3.C100** **PCD3.C110**

Addressing



For local expansion, the PCD3 LIO (local I/O) modules can be used.

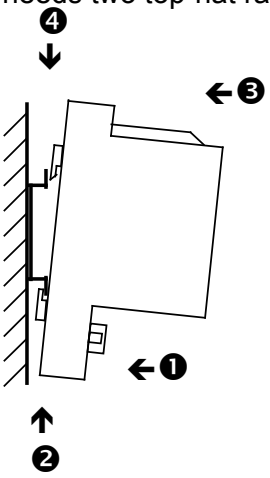
For decentralized expansion using Profibus, the PCD3 RIO (remote I/O) modules can be used:

The maximum number of I/Os is dependent on the controller being used:

When selecting I/O cassettes, ensure that the internal 5V and +V supply is not overloaded.

3.6 Mounting CPUs and module holders

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



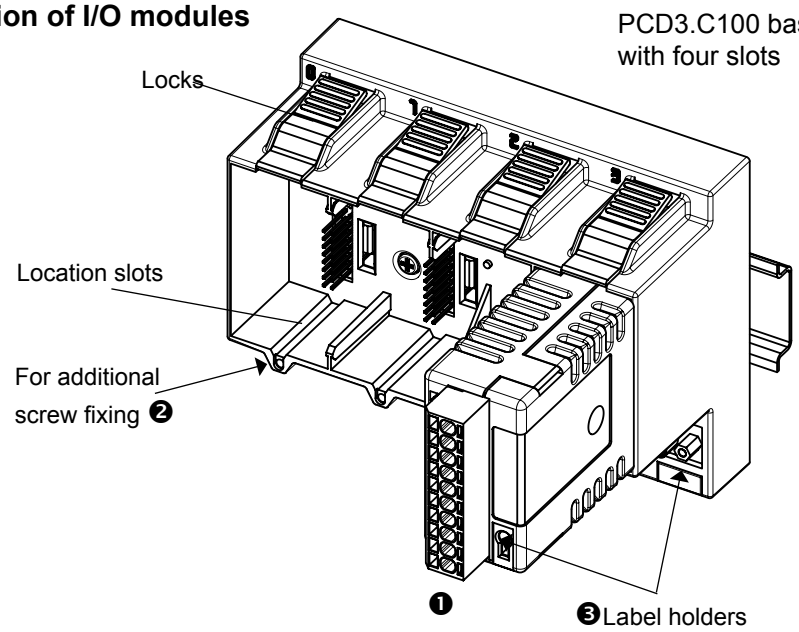
Mounting the PCD3 on the top-hat rail

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

Removal

To remove the housing, push upwards and pull out.

Insertion of I/O modules



❶ Insert the module into the appropriate module location and press down to the bottom of the CPU or module holder housing; ensure that the orange clip is engaged

❷ For security, a guideway is provided to prevent the module being inserted the wrong way round. In awkward positions, the modules can also be secured with a screw.
Screw type: self-tapping 3x8mm, standard type obtainable from hardware stores

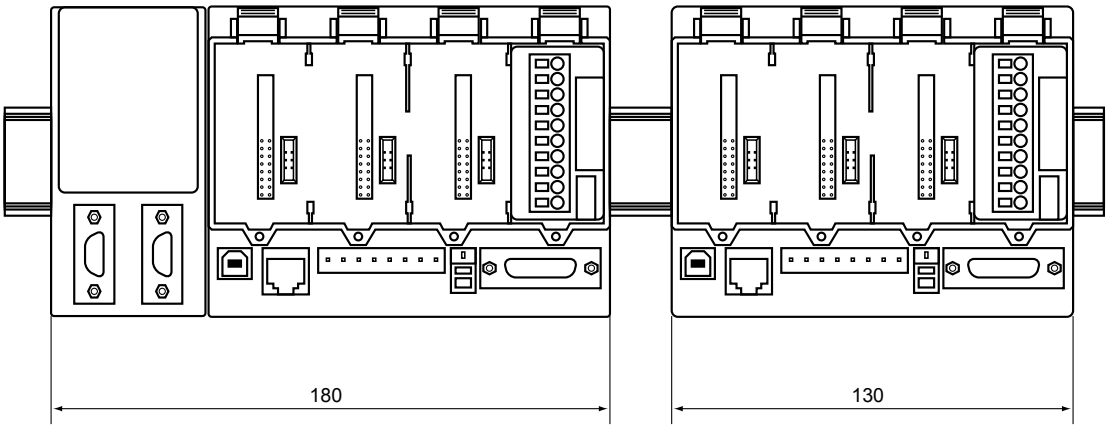
❸ Number of module slots in the module holder:
- 4 positions (labelled 0, 1, 2 and 3) PCD3.Mxxx0,C100/C200/T760
- 2 positions (labelled 0 and 1). The PCD3.C110 can only be used as the last module holder in the bus

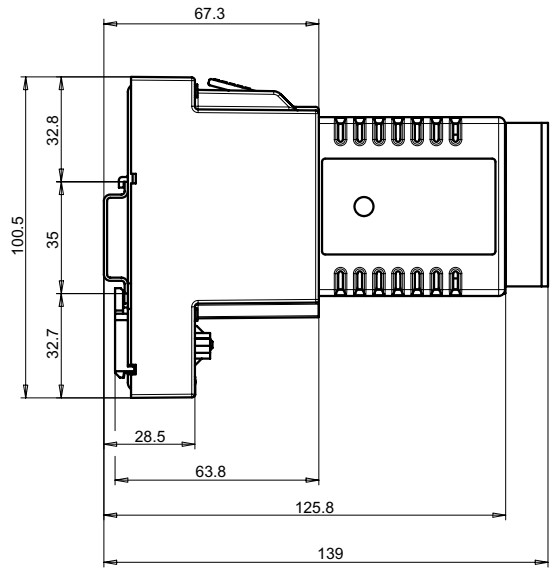
3.6.1 Mounting position and ambient temperature

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

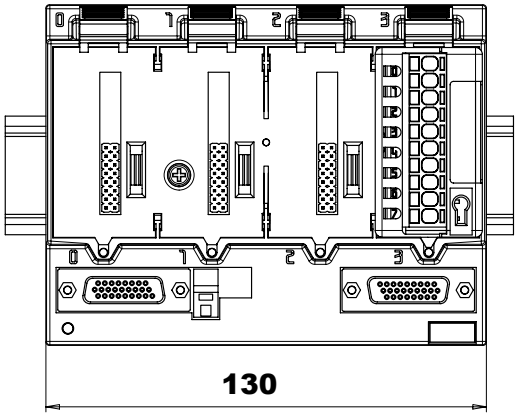
3.7 Dimensions

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

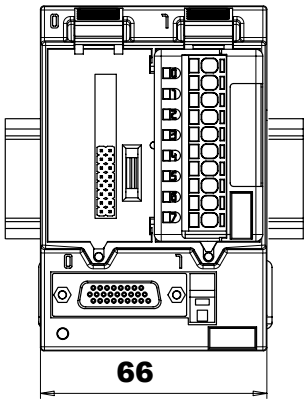




PCD3.C100/C200/T76x



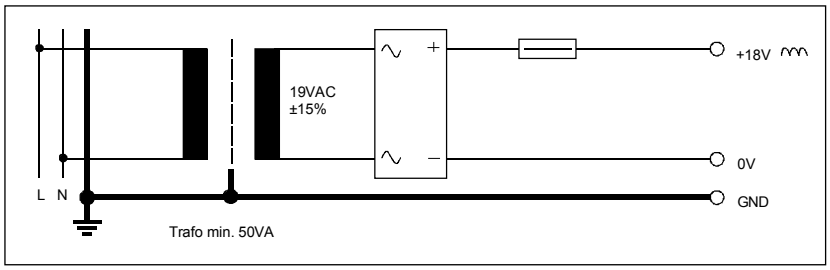
PCD3.C110



3.8 Power supply and connection plan

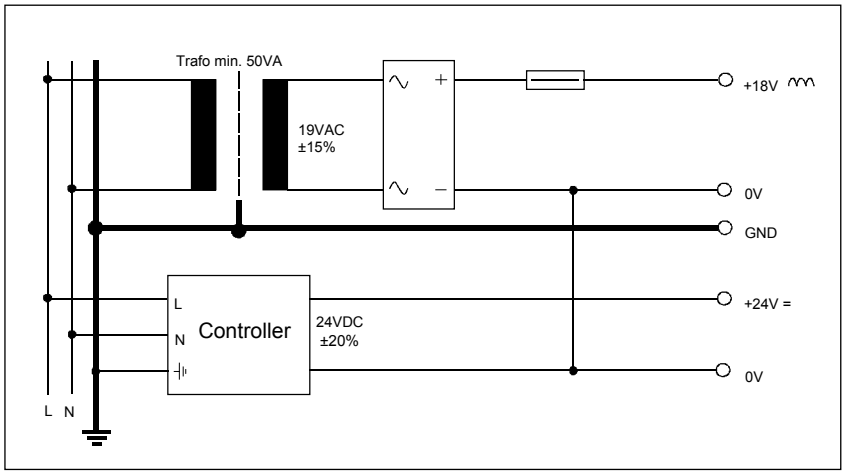
3.8.1 External power supply

Simple, small installations



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

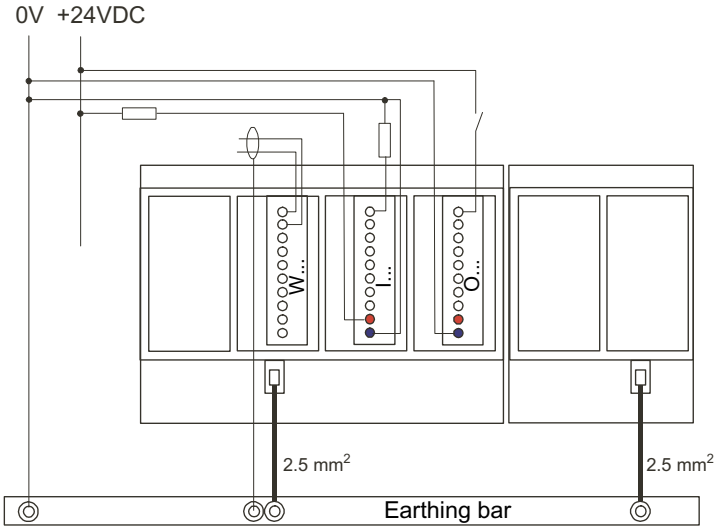
Small to medium installations



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

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

3.8.2 Earthing and connection plan



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

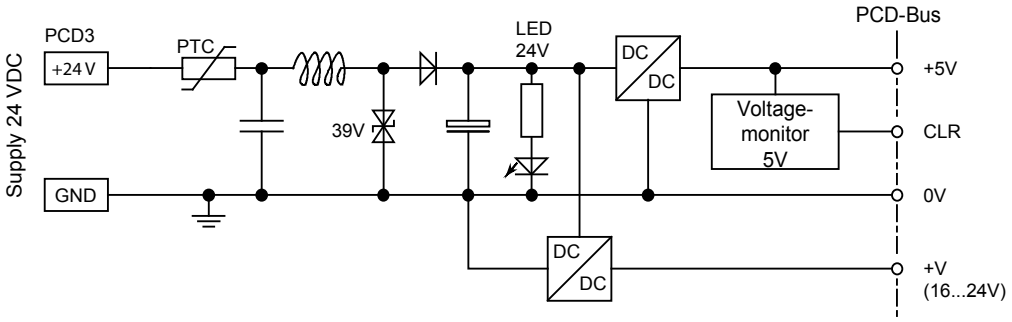
When a module is plugged into the module holder, a metal tab on the module housing creates a reliable multi-point contact to the module carrier concerned.

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

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

All Minus connections are linked internally. For problem-free operation, these connections should be reinforced externally with short wires of 1.5 mm^2.

3.8.3 Internal power supply



Capacity of internal power supply

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

+5 V : 600 mA

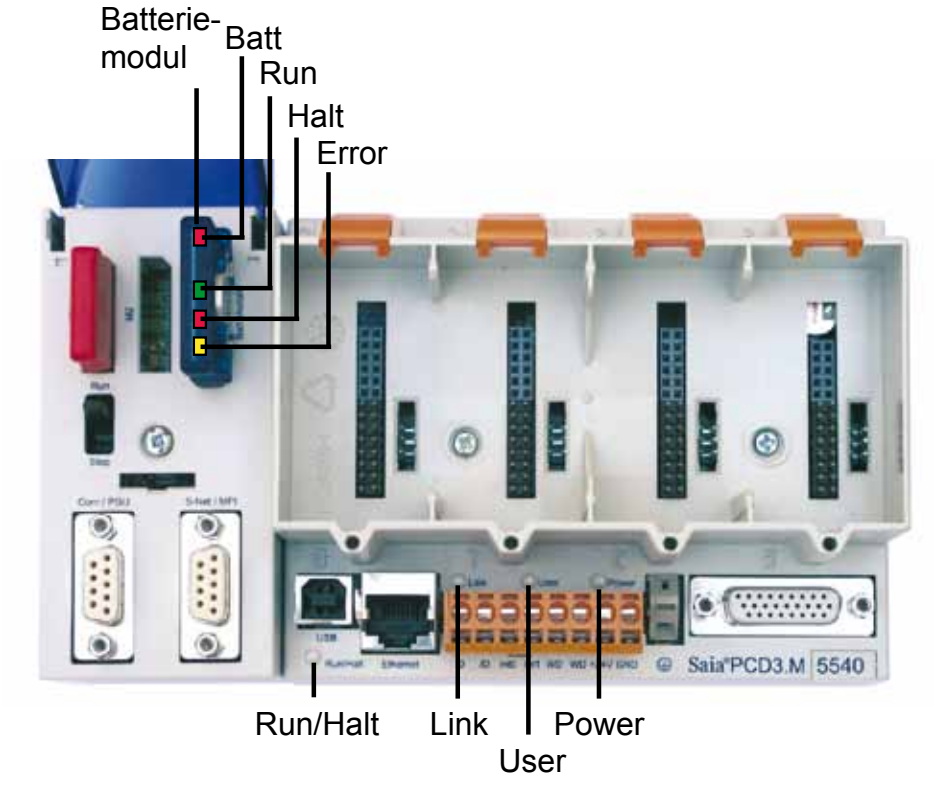
+V (16…24 V) : 100 mA (the exact loads should be taken or calculated from the technical details in section 3.2, or you are advised to use the calculation table at www.sbc-support).

3.9 Operating states

The CPU can assume the following operating states:

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

The display uses the LEDs shown below:

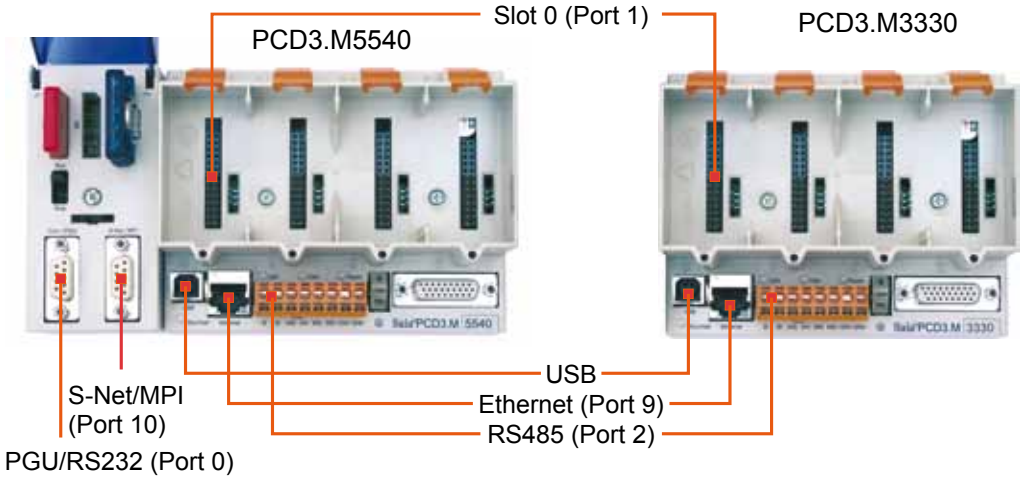


CPU type	PCD3.Mxxxx							
	Battery module				For PCD3.M3xx0, these LEDs only			
LED	**Batt**	**Run**	**Halt**	**Error**	**Run/ Halt**	**Link**	**User**	**Power**
Colour	Red	Green	Red	Yellow	bi-colour	Yellow	Yellow	Yellow
Run	○	●	○	○	●	○	○	●
Run cond.	○	●/○	○	○	●/○	○	○	●
Run with error	○	●	○	●	●	○	●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

○ LED off ● LED on ●/○ LED flashing

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

3.10 Connections to the PCD3.Mxxx0

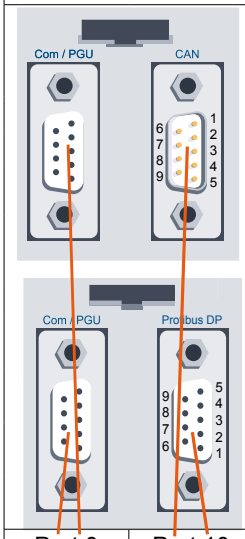


		PCD3.M5xx0 and PCD3.M6xx0		PCD3.M5xx0 (except PCD3.M5340)		
		RS232/PGU Port 0		S-Net/MPI/RS485 Port 10		
		D-Sub pin	Signal	D-Sub pin	Signal	Explanation
		1	DCD	1	GND	GND
		2	RXD	2	M24	0 V of 24 V supply
		3	TXD	3	RxD/TxD-P[1])	Receive/transmit data positive.
		4	DTR	4	CNTR-P	Control signal for repeater (direction control)
		5	GND	5	DGND[1])	Data communication potential (earth to 5 V)
		6	DSR	6	VP[2])	Supply voltage to P line termination resistors
		7	RTS	7	P24	Output voltage plus 24 V
		8	CTS	8	RxD/TxD-N[1])	Receive/send data negative
Port 0	Port 10	9	not used	9	n.c.	not connected

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

		PCD3.M5340		PCD3.M5xx0			
PGND  PGND		RS422 Port 3		RS485 Port 3		Explanation	
		D-Sub pin	Signal	D-Sub pin	Signal	RS422	RS485
		1	/RXD	1		Receive data -	
		2	/CTS	2		Ready to send.-	
		3	/TXD	3	/RxD /TxD	Send data -	Receive/send -
		4	/RTS	4	RTS	Send request -	Send request
		5	DGND	5	DGND	Data ground	Data ground
		6	RXD	6		Receive data+	
		7	CTS	7		Ready to send.+	
		8	TXD	8	RxD TxD	Send data+	Receive/send +
		9	RTS	9		Send request +	
Port 0	Port 3		PGND		PGND	Protective ground *)	

*) Fixing screws on the D-Sub socket housing



	PCD3.M6240 and PCD3.M6340		PCD3.M6440 PCD3.M6540			
	CAN Port 10		Profibus DP Master Port 10			
	D-Sub pin	Signal	D-Sub pin	Signal	Explanation CAN	Explanation Profibus DP
	1		1			
	2	CAN_L[1]	2	GND[2]	Receive/send neg.	Protective ground
	3	GND	3	B red	Data transfer potential ground	Receive/send pos.
	4		4	In		
	5		5	GND_BUS		For terminal resistors
	6		6	+5V_BUS		For terminal resistors
	7	CAN_H[1]	7	24V[2]	Receive/send pos.	
	8		8	A green	.	Receive/send neg.
Port 0 / Port 10	9		9			

[1] Electrically isolated

[2] Not electrically isolated

For all types

Terminal block for supply, watchdog, interrupt inputs and Port 2				Profibus signal	Profibus wiring
	Pin	Signal	Explanation		
	1	D	Port#2; RS485 up to 115.2 kbit/s usable as free user interface or (except PCD3. M5440 and PCD3.M5540) Profi-S-Bus up to 187.5 kbits/s	RxD/TxD-N	A green
	2	/D		RxD/TxD-P	B red
	3	Int0	2 interrupt inputs 24 VDC or 1 rapid counter 24 VDC		
	4	Int1			
	5	WD	Watchdog		
	6	WD			
	7	+24V	Voltage supply		
	8	GND			

RS485 terminator switch		
Switch position	Designation	Explanation
left	O	without termination resistors
right	C	with termination resistors

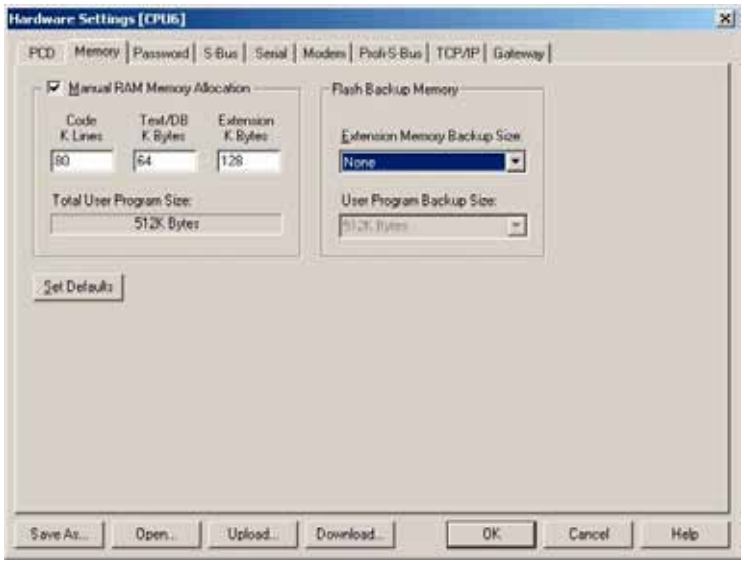
3.11 Partitioning options for user memory

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

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

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

Example of manual partitioning:



3.12 Data storage in case of power failure

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

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

1) The total charging time is approx. 10 minutes
2) Depending on the ambient temperature; the higher the temperature, the shorter the buffer time

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

- Insert CR 2032 coin cells in such a way that the Plus pole is visible

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

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

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

3.12.1 Battery module PCD3.R010 for PCD3.M3xxx

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

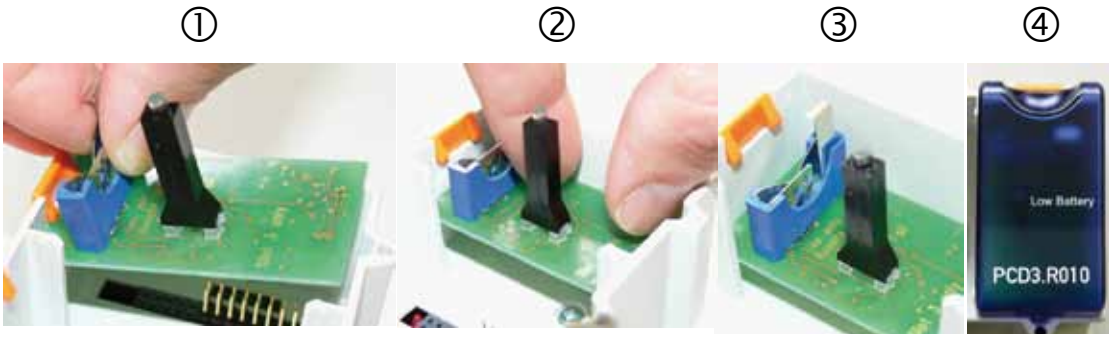
Unpacking and mounting

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

Technical details:

Internal current consumption: 10 mA at +5 V

Installation rules:



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

Battery monitoring:

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

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

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

Inserting or changing a battery:

The battery (but not the module) can be replaced with the power on[1)] (XOB 2 called)

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

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

1) Changing the battery with the PCD switched off will not cause any program or data loss provided that the Supercap for the PCD CPU is not flat.

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

3.13 Memory space on the PCD3

3.13.1 General

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

User Program Memory (RAM)

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

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

Backup memory (Flash)

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

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

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

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

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

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

Partition of user backup memory

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

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

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

Available user backup memory on the onboard memory

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

Available user memory with firmware version < 030

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

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

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

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

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

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

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

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

Flash memory modules (optional)

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

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

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

Flash memory modules for the file system (optional)

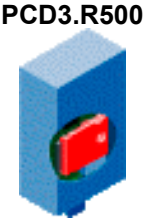
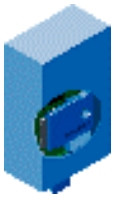
Apart from the flash memories mentioned above for backing up the user program memory and DBs, there is another type of flash memory available for files. These memory modules can be used to save "PC-readable" files such as web pages, images or log files. The content of these flash memory modules can be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

Flash memory modules for BACnet (optional)

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

3

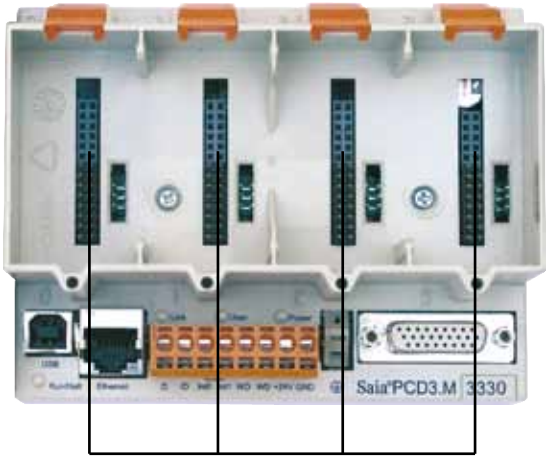
Memory module summary for PCD3.Mxxx0 CPUs

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

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

Sockets for memory modules

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



3.13.2 Program backup and restore on backup flash

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

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

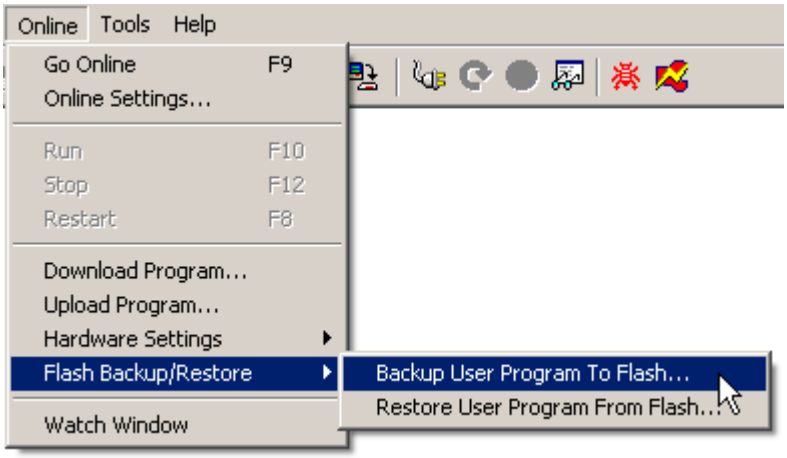
With a restore with a memory module plugged in, the content of the flash module is restored and then (where possible) copied to the onboard flash.

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

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

Program backup to backup flash

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

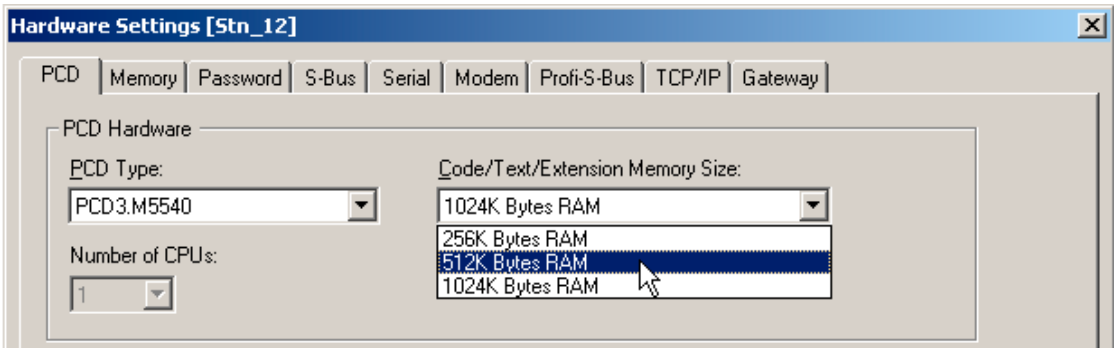


Configuration for onboard backup of user program memory

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

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

PCD tab

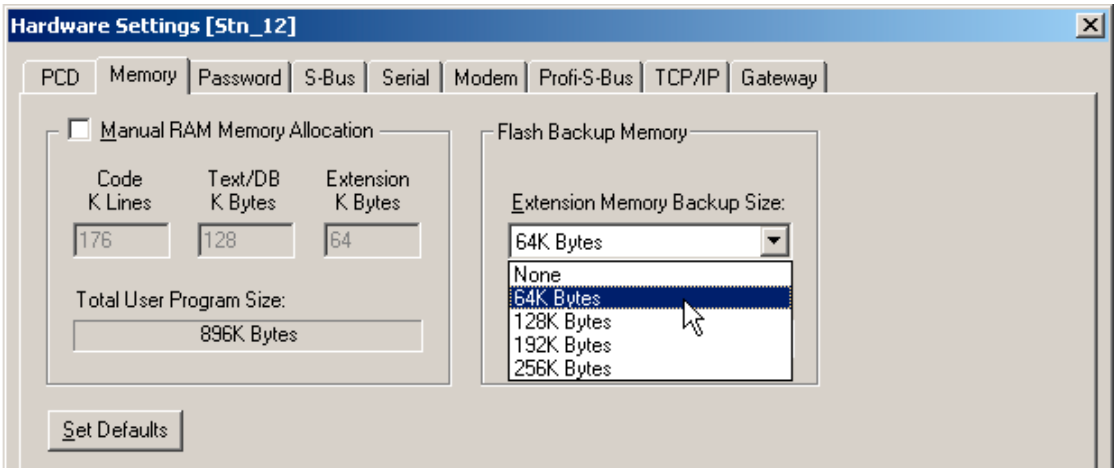


Code/Text/Extension Memory Size: The available user program memory (RAM). As the memory on a PCD3.M5xxx or PCD3.M6xxx is dependent on the hardware and firmware versions, several possibilities are displayed here. The following options are available:

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

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

Memory tab

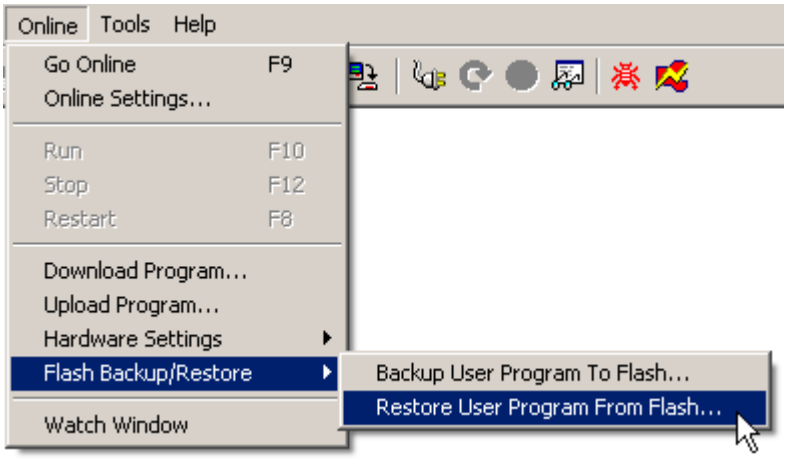


On the Memory tab, the Extension Memory Backup Size can be set. This memory size represents the memory space for the "backup DB to flash" function. On the left-hand side, the currently available memory space for the user program is displayed.

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

Program restore from backup flash

- ***Automatic restore***
  If no valid user program is loaded when the CPU is switched on, the CPU operating system checks whether there is a valid program in the onboard flash; if so, it is automatically loaded and executed.
  An automatic restore is also run when an empty SuperCap is detected on a PCD3.M3xxx or no battery or a flat battery is found on a PCD3.M5xxx/ PCD3.M6xxx
- ***Manual restore with PG5***
  PG5 can be used to write a valid program including configuration to the CPU from the onboard flash. This function can be found on the "Online" menu within the PG5 project manager or the online configurator:



- ***Manual restore without PG5***

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

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

3.13.3 Transferring an application with flash card

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

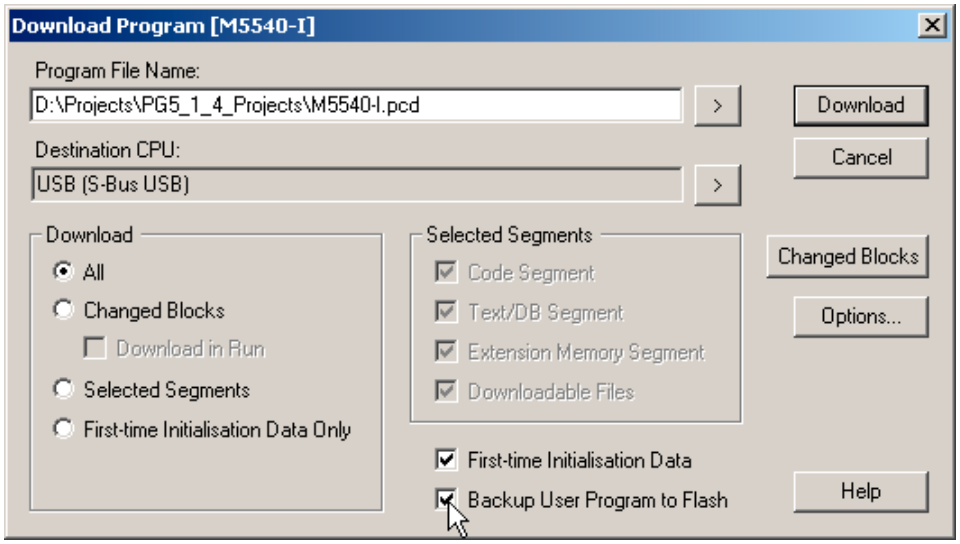
- On the source controller, copy the application to the flash card as described in the preceding sections
- Remove the supply to the source controller, and unplug the flash card
- Send off the flash card where applicable
- Insert the flash card into the target controller (which should be switched off)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

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

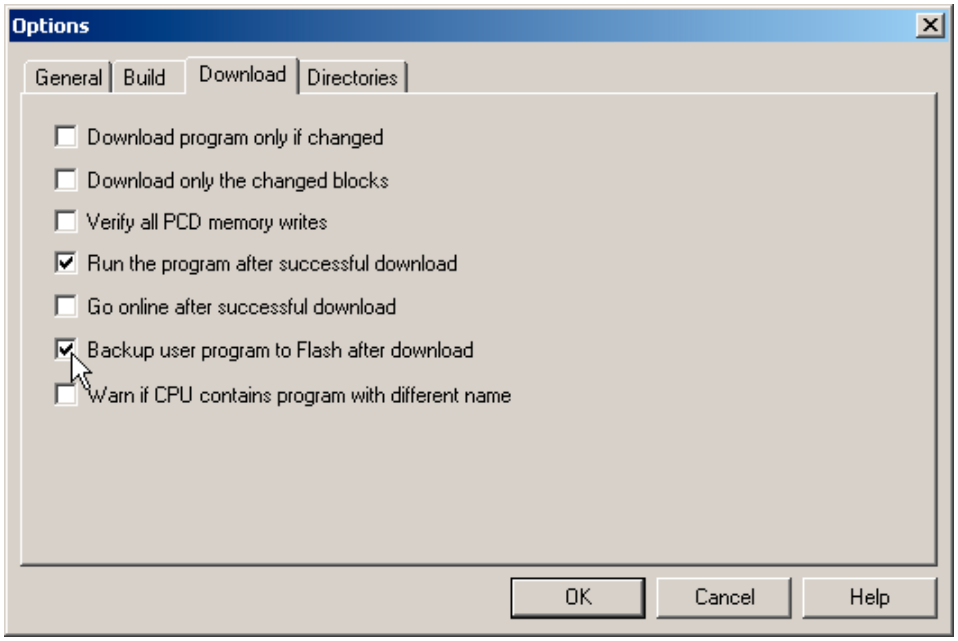
Loading the user program from the flash card will overwrite the user program backup on the onboard flash, provided there is sufficient space for the program on the backup flash.

3.13.4 Backup program after download option

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



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



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

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

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

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

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

Instruction:

SYSWR	**K 3x00**[1)]	
	K number	; address of the texts/DBs as ; K constant or in a register, existing ; text/DB addresses in the range >= 4000 ; may be used

1) Alternatively, the value 3x00 can be passed in a register.

Battery status after execution:

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

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

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

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

Restoring a text/DB from the flash card with SYSWR K 3001
Restoring a text/DB from the onboard flash with SYSWR K 3101

Instruction:

SYSWR	**K 3x01**[1)]	
	K number	; address of the texts/DBs as ; K constant or in a register, existing ; text/DB addresses in the range >= 4000 ; may be used

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

Battery status after execution:

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

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

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

Deleting stored texts/DBs from the flash card with SYSWR K 3002
Deleting stored texts/DBs from the onboard flash with SYSWR K 3102

Instruction:

SYSWR	**K 3x02**[1)]	
	K 0	; Dummy parameter, required to ; maintain the structure of the SYSWR ; instruction

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

Battery status after execution:

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

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

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

Diagnostics of flash card with SYSRD K 3000
Diagnostics of onboard flash with SYSRD K 3100

Instruction:

SYSRD	**K 3x00**[1)]	
	R_Diag	; Diagnostics register

1) Alternatively, the value 3x00 can be passed in a register.

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

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

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

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

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

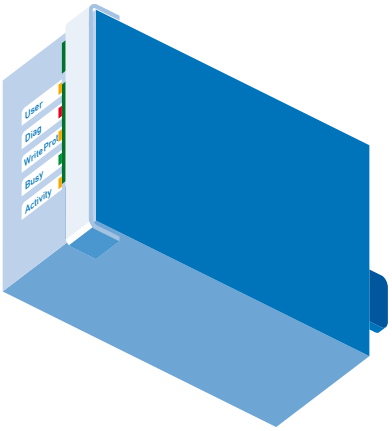
3.14 Memory module PCD3.R600 for flash cards (FCs)

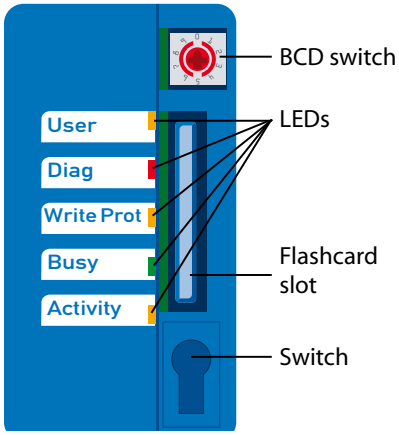
3.14.1 System overview

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

The SD cards can be accessed in 3 different ways:

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



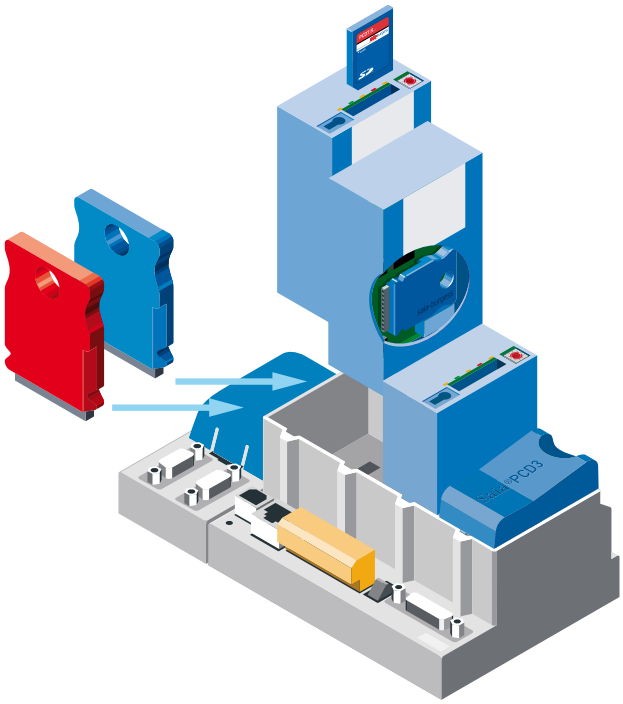


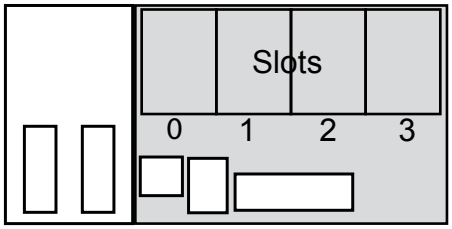
3.14.2 Technical data

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

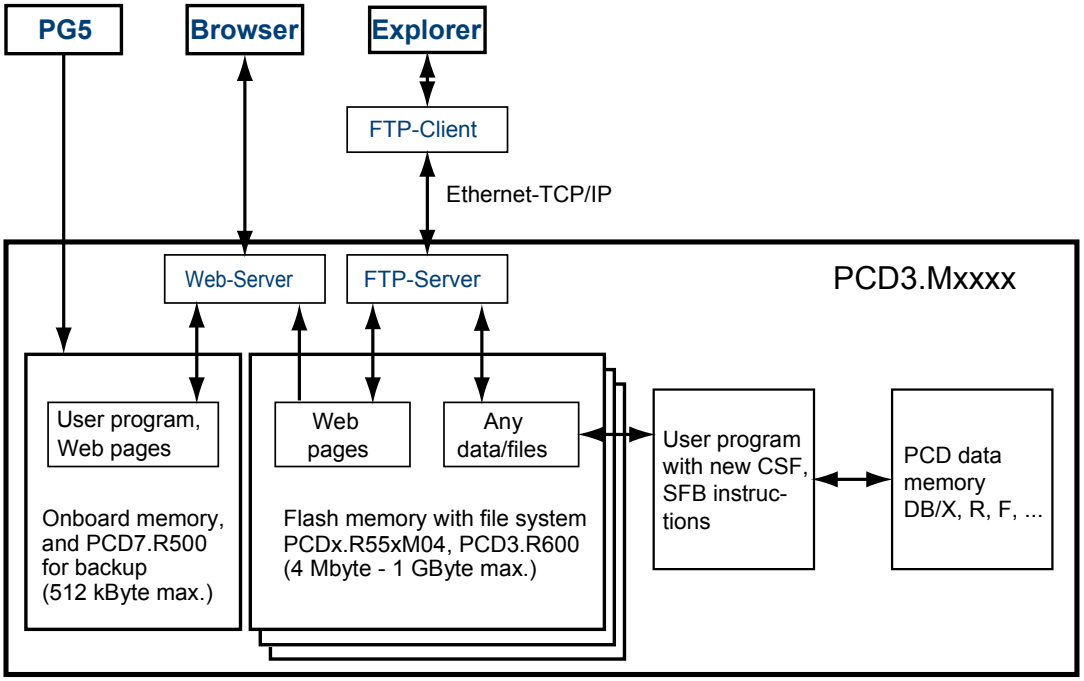
3.14.3 Operation

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





Data access



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

Due to predetermined requirements Saia uses its own file system.

Based on the predefined requirements, Saia uses its own file system. The Saia file

system is embedded in a FAT (PC compatible file system) framework, to make the restricted processes when used in a commercial SD card reader/writer visible with standard PC tools. The Saia file system is called SAIANTFS.FFS.

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

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

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

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

3.14.4 Displays and switches

The memory module is fitted with 5 LEDs:

LED	Meaning
User	User LED, set by the user program with the base address of the module (SET = off; RES = on)
Diag	Flashes when there is an error message
Write Prot	Active when a "write-protected" condition is detected (read-only SD switch, BCD switch or software)
Busy	Do not remove module when this LED is on.
Activity	Works as with a hard disk drive; flashes when data being processed

Setting of operating modes with the BCD switch:

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

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

* Starts after insertion; remove, then plug in again

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

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

3.14.5 Flash card

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

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

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

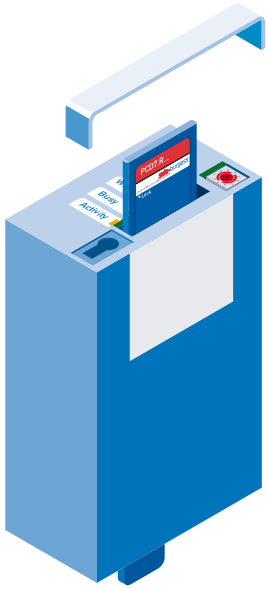
On the PCD3, a non-standard file system (Saia FS) is used. This means that the flash cards have to be formatted before being used for the first time. This happens automatically when a new FAT 16 flash card is inserted into the PCD3.R60x.

Flash card handling

The card is inserted into a so-called push-push socket (push to insert and remove), located under the label clip.
It can be removed without switching off the PCD3.

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

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



Inserting the flash card

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

Removing the flash card

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

3.14.6 User program backup to the flash card

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

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

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

I/O bus functions

Some states are detected by the user program.

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

3.14.7 Order details

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

3.15 Hardware clock (Real Time Clock)

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

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

3.16 Hardware watchdog

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

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

The same function can also be implemented with IL (AWL) instructions. This variant works **independently of the cycle time** of the user program. In the event of loops caused by the programmer, the watchdog does not drop out.

Example:

```
ACC   H          ;Invert output 255
COM   O 255
```

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

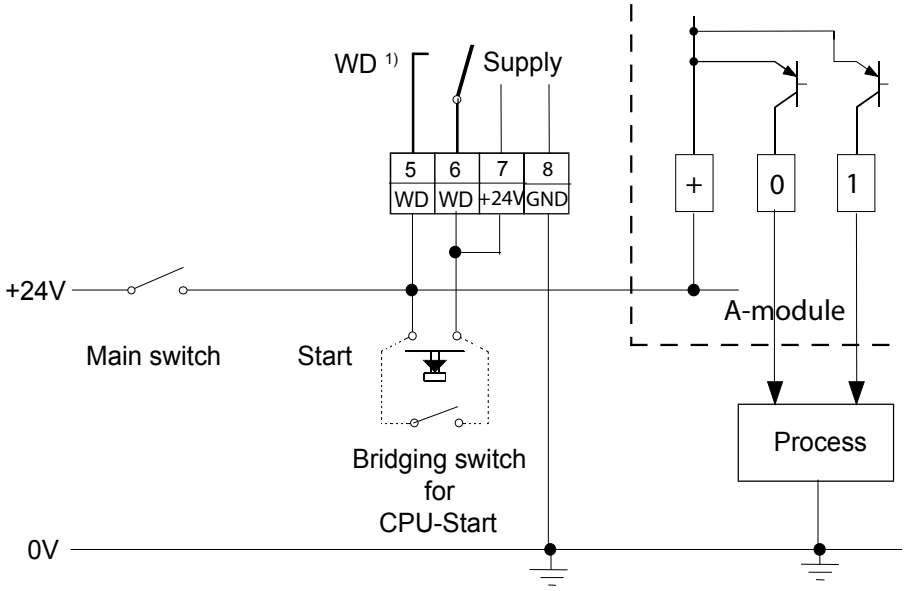
- With cycle times over 200 ms, the code sequence must be repeated several times in the user program, to prevent the watchdog dropping out in normal operation.

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

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

3

Watchdog - connection diagram



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

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

3.17 Software watchdog

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

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

Instruction:

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

3.18 Interrupt inputs

3.18.1 Basics

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

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

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

Many FBoxes are intended for cyclic invocation and so not suitable for use in XOBs, or only in a limited way.
Exception: the FBoxes in the Graftec family (standard library) are well suited

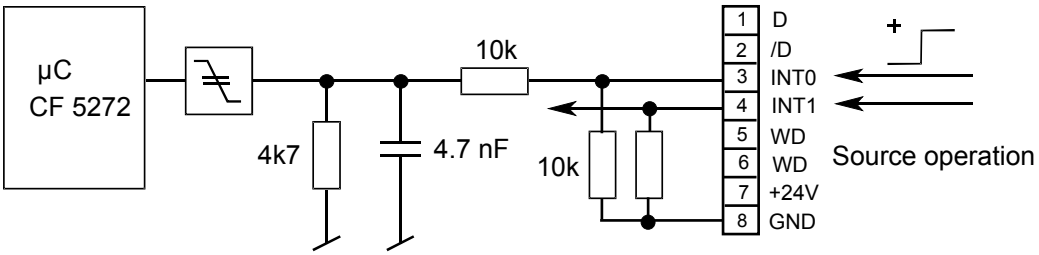
3.18.2 PCD3.Mxxx0 interrupt inputs 24 VDC

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

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

Operation:

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



Input signals:
H = 15...30 V
L = -30...+ 5 V or not connected

Do not connect to D and /D. The RS485 interface runs at 5 VDC and may be destroyed.

3.19 Operating mode switch (Run/Halt)

3.19.1 Run/halt push button

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

At start-up:

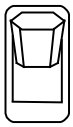
- If the Run/Halt push button is pressed during start-up and then released again during one of the sequences described below, the following actions may be triggered:

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

In operation:

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

3.19.2 Run/halt switch



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

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

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

3.20 Manual and emergency operation

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

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

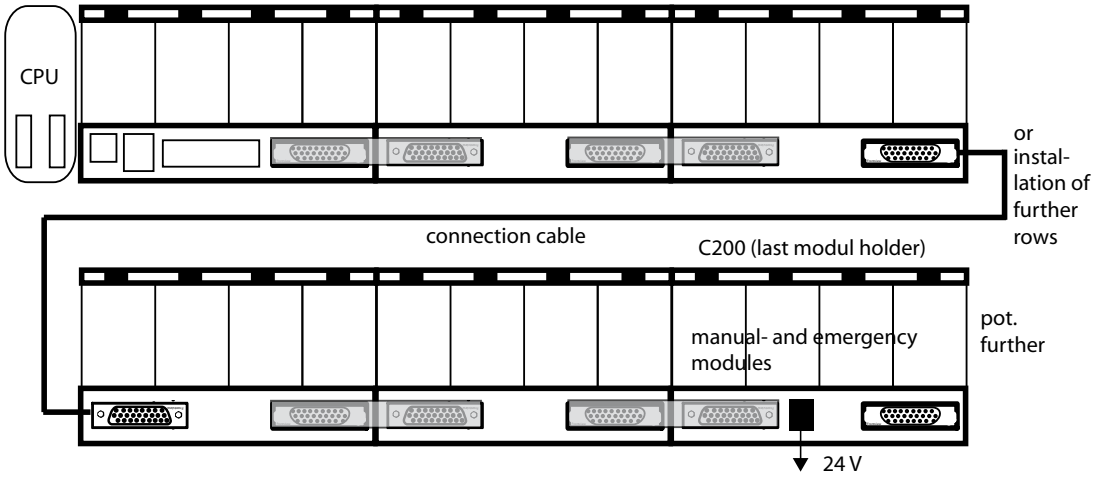
  It is advisable to use the calculation table at www.sbc-support.ch.

Manual control modules:

PCD3.A810, Digital manual control module with 4 relays, 2 with changeover contacts, 2 with make contacts (for detailed description, see Section 5.3)

PCD3.W800, Analogue manual control module with 4 output channels, 0…+10 V, 10 bit resolution (for detailed description, see Section 5.5)

Installation:

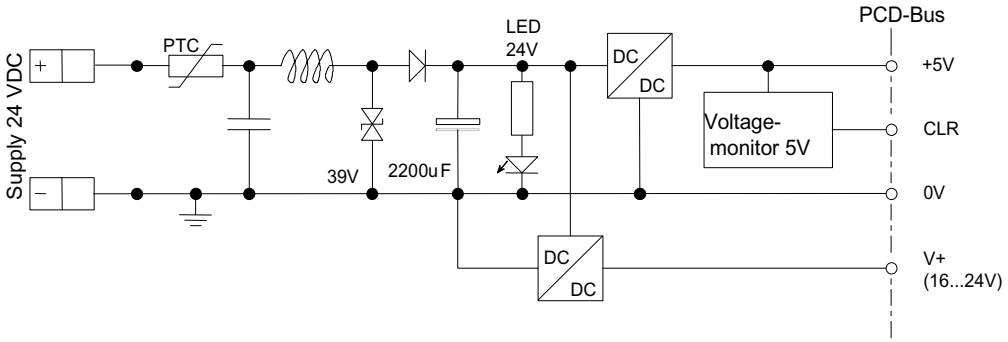


[1]) **from hardware version C:** no restrictions

Hardware versions A and B:
- see restrictions on current output, section 3.20.1
- PCD3.C200 at the end of the I/O bus only
- PCD3.C200 for emergency operation, and any other module holders, may only be used with manual control modules

3.21 Module holder

3.21.1 Internal supply to PCD3.C200 module holders



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

Type	+5V	V+ The capacity of the +V bus depends on the capacity of the 5V bus, as follows (the more precisely the 24 VDC are maintained, the higher the possible capacity):
PCD3.C200 Hardware versions A and B	1,000 mA	100 mA
PCD3.C200 Hardware version C	1,500 mA	$24\ V\ ^{-25\ \%}_{+30\ \%}$: 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 is essential to check that the two internal supplies are not overloaded. This check is especially important when using analogue, counter and positioning modules, as these may have a very large power consumption.
It is advisable to use the calculation table at www.sbc-support.ch.

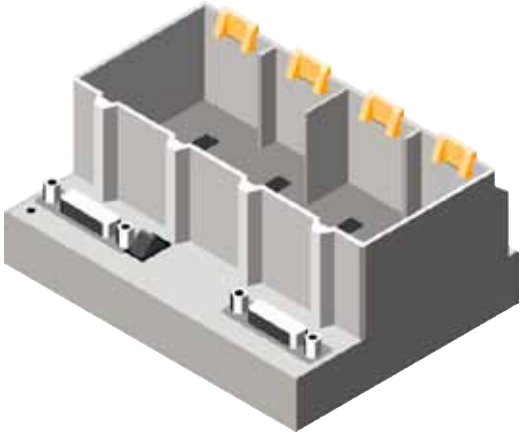
3.21.2 LIO module holders

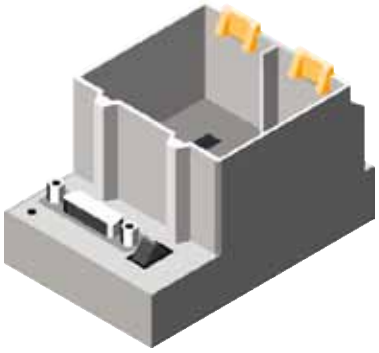
PCD3.LIOs (local I/Os) are used to capture central I/O signals. The compact PCD3.LIOs are snapped onto a 35-mm DIN rail and fitted with PCD3 I/O modules. PCD3.LIOs can be connected as an I/O extension to a PCD2 CPU, PCD3 CPU or a PCD3.RIO. Three different module holders are available to take the I/O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

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

PCD3.C100/…C110

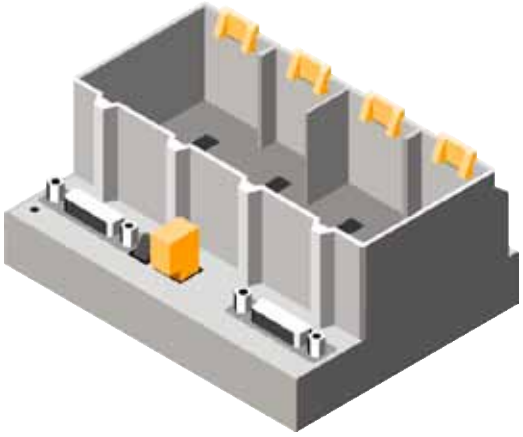
- 4 or 2 plug-in PCD3 I/O modules (selectable)
- May be connected to PCD2.Mxxx, PCD3.Mxxx0, PCD3.RIO and PCD3.LIO
- PCD3.C100 expandable with PCD3.LIO (C110, C200); PCD3.C110 not expandable





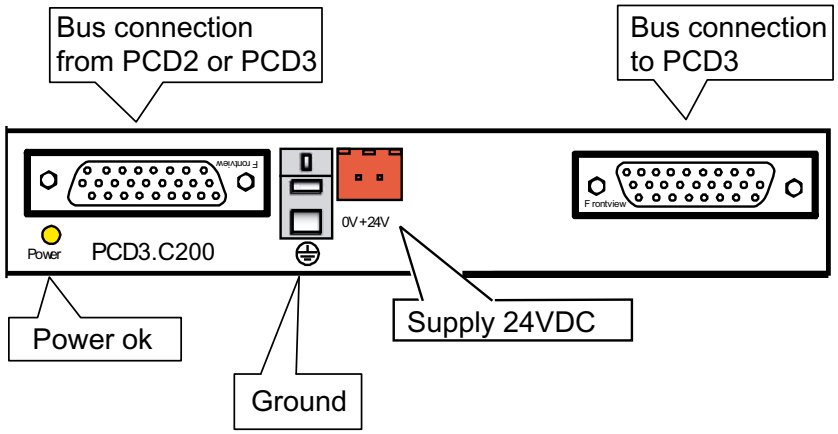
PCD3.C200

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

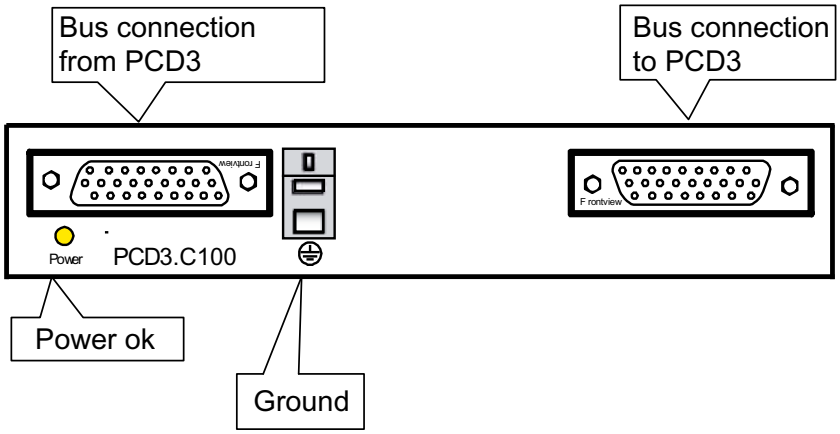


3.21.3 Connections to PCD3.Cxxx LIO module holders

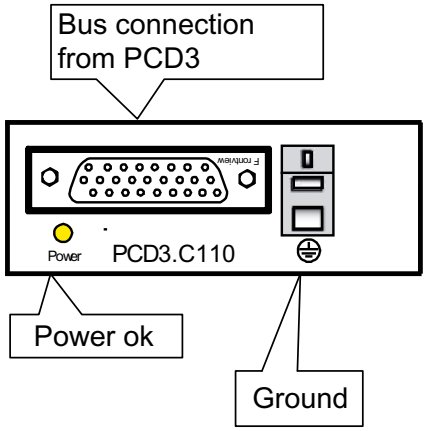
PCD3.C200 for 4 modules



PCD3.C100 for 4 modules

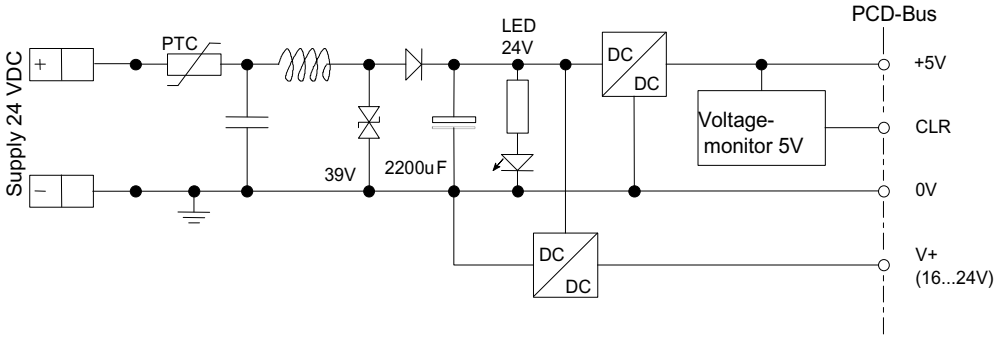


PCD3.C110 for 2 modules



4 RIO (remote input/output) head stations

4.1 Internal supply to PCD3.T76x head stations



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

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

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

4.2 RIO head station module holders

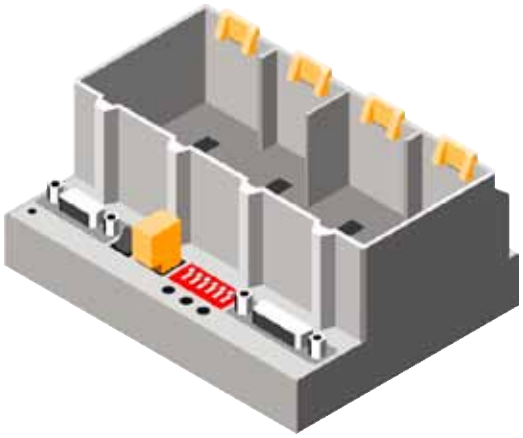
PCD3.RIOs (remote I/Os) are used to capture decentralized I/O signals. PCD3.RIOs communicate with Profibus-DP or any SPS Master; the .gsd file is included in PG5 (version 1.2 or above), or it can be retrieved from www.sbc-support.ch.

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

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

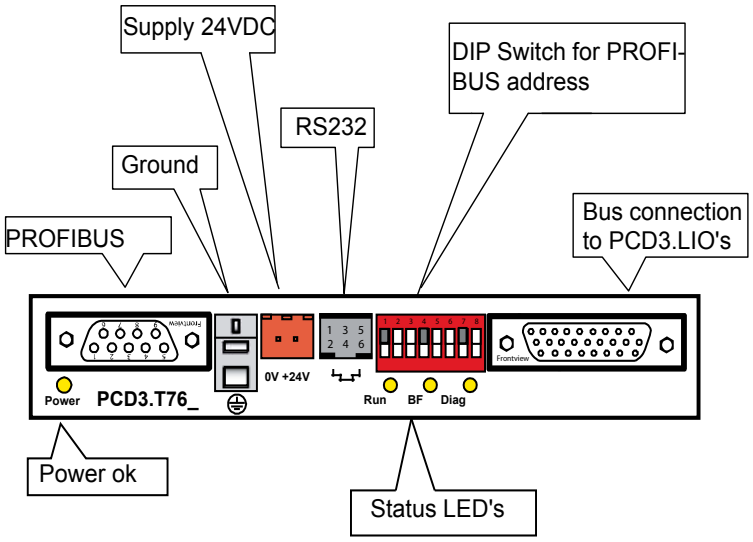
PCD3.T760

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



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

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

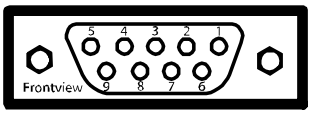


Meaning of connections

Profibus-DP or Profi-S-Net network connection

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

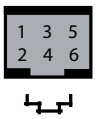
On a PCD3.M3 or PCD3. M6 (orange terminal block) corresponds **/D** to the pin 3 (RxD / TxD-P, red) and **D** to the pin 8 (RxD / TxD-N, green).



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

Serial interface RS232

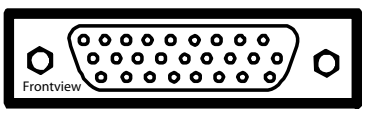
This connection supports configuration with a browser such as Internet Explorer or Netscape Navigator (with PCD3. K225 connecting cable).



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

Expansion connection

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

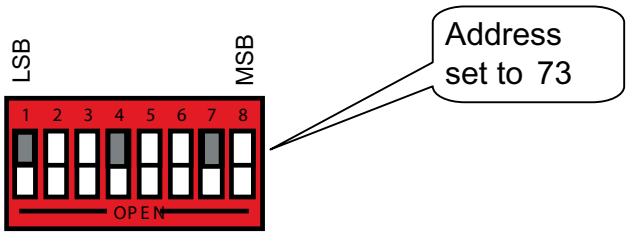


Setting the Profibus address

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

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

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



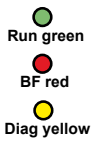
Example for address 73: DIP switch nos. 1 + 4 + 7 “ON”.

Meaning of LEDs

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

4.4 Diagnostic information on RIOs

LEDs



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

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

DP diagnostics

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

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

Standard diagnostics:

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

Extended diagnostics:

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

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

2) Error accessing an I/O module

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

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

4.4.1 Diagnostic module

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

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
			Query

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
			Reply

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

Instruction 0: NOP instruction

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

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
X	Y	Z	0

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
X	Y	Z	0

Instruction 1: Query firmware version

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

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	1

RIO→Master

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

Instruction 2: Query RIO status

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

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	2

RIO→Master

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

Coding of bits in Status 0:

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

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

Instruction 3: State of outputs in case of bus error

Master→RIO

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

RIO→Master

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

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

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

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

The coding of the module position field is as follows:

Bits 0…3: Module position (0…15)
Bits 4…6: Channel number (0…7). On analogue outputs, this is the analogue channel
Bit 7: If set (“continue”), the last state of the outputs is retained. In this case, bytes 0 and 1 are irrelevant.

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

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

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

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

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	4

RIO→Master

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	4

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

Instruction 5: Store I/O configuration in EEPROM

Master→RIO

Byte 0	Byte 1	Byte 2	Byte3
irrelevant	irrelevant	irrelevant	5

RIO→Master

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

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

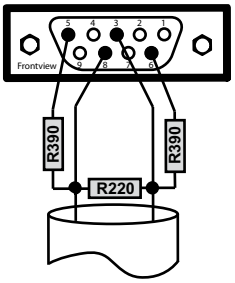
This asynchronous function takes a few milliseconds, depending on the scope of the configuration. While writing to the EEPROM, the value 0x85 is displayed in the Diagnostic module. While the instruction is being processed, no new instruction will be accepted.

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

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

Both the PCD7.T160 termination box and commercially available 9-pole Profibus D-Sub connectors are suitable for this purpose; for more details, see manual 26/740 "Installation components for RS485 networks" and 26/765 "Profibus-DP".

Network termination should therefore be as follows:



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

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

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

ERNI ER*bic* connector

5 Communication interfaces

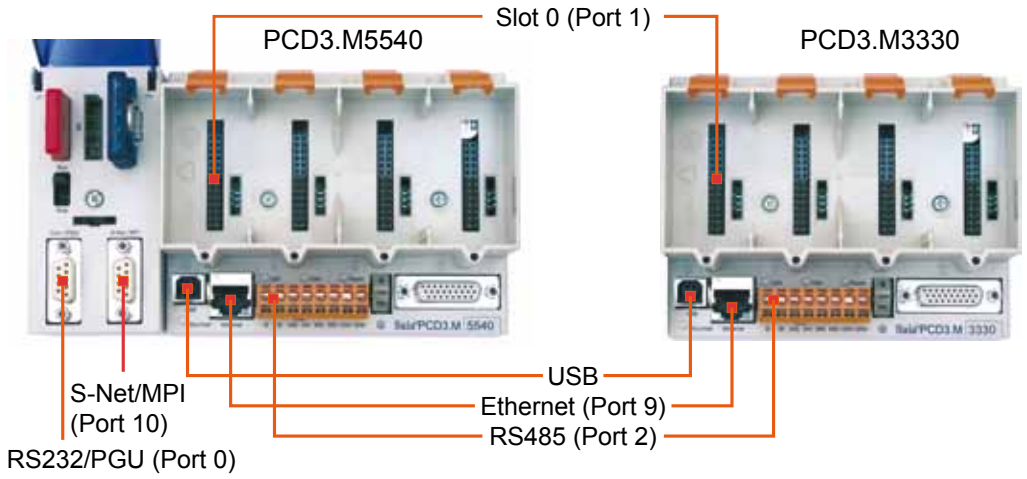
Saia® S-Net, the networking concept from Saia-Burgess Controls, is based on the Profibus and Ethernet open standards. Ethernet covers layers 1 and 2 of the ISO layer model. Based on layer 2, a variety of different protocols and applications can be run in parallel on the same network.

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

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

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

5.1 Summary of onboard interfaces and plug-in interface modules



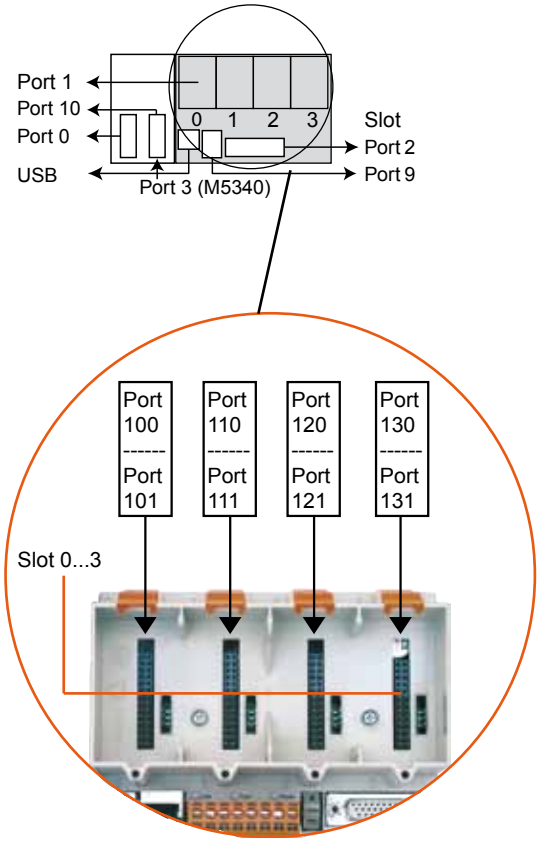
5.1.1 Onboard interfaces

Onboard interfaces	Port (in PG5)	max. baud-rate	PCD3.M3020	PCD3.M3120	PCD3.M3230	PCD3.M3330	PCD3.M5340	PCD3.M5440	PCD3.M5540	PCD3.M6240	PCD3.M6340	PCD3.M6440	PCD3.M6540
D-Sub #1 (PGU)													
RS232	0	115.2 kBit/s					✓	✓	✓	✓	✓	✓	✓
D-Sub #2													
RS485 (serial)	3	115.2 kBit/s					✓	✓	✓				
RS422 (serial)	3	115.2 kBit/s					✓						
Profi-S-Net/DP Slave	10	1.5 MBit/s						✓	✓				
CAN	10									✓	✓		
Profibus DP Master	10	12 MBit/s										✓	✓
Terminal block													
RS485	2	115.2 kBit/s	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Profi-S-Net/DP Slave	2	187.5 kBit/s	✓	✓	✓	✓	✓			✓	✓	✓	✓
Ethernet	9	10/100 MBit/s		✓		✓	✓		✓		✓		✓
USB 1.1 Slave (PGU)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

5.1.2 Plug-in communication interfaces

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

Applies to all PCD3.CPUs



5.2 Protocols on serial ports

5.2.1 Protocols supported by the firmware

Protocol overview and firmware support for the different CPUs	Purpose	Supported by			
		PCD3.M3020 / M3230	PCD3.M3330/ M3120	PCD3.M5440 / M6440	PCD3.M5340 / M5540 / M6540
S-Bus PGU on USB connector with USB or PGU port	Programming, debugging, visualization. Also allows access via gateway to stations within a different S-Bus network	✓	✓	✓	✓
S-Bus PGU on the PGU RS232 connector (with **Pin 6** (DSR) of the PGU connector set to **logical "0"** (Data, Full Protocol)) [1]	Programming, debugging, visualization. Also allows access via gateway to stations within a different S-Bus network	×	×	✓ [2]	✓ [2]
Serial S-Bus protocol (Data, Parity) [3] [6]	Supports the S-Bus protocol on serial interfaces (RS232, RS485/422, USB, modem) in Master/Slave operation.	✓	✓	✓	✓
Character mode (MC0 to MC5) [4]	Transmission of characters or text over serial ports; basis for creating own protocols in the user program	✓	✓	✓	✓
Profi S-Bus protocol	Exchange of data with multi-master communication between controllers. Also allows access from PG5 programming unit, Saia® OPC server or web browser	✓	✓	✓	✓
Profi S-IO protocol	For PCD3.RIO operation. Enables configuration and diagnostics, and management of C plug-ins	✓	✓	✓	✓
Ether S-Bus protocol	Exchange of data with multi-master communication between controllers. Also allows access from PG5 programming unit, Saia® OPC server or web browser	×	✓	×	✓
Ether-S-IO protocol [5]	For PCD3.RIO operation. Enables configuration and diagnostics, and management of C plug-ins	×	✓	×	✓
MPI	Multi-point protocol for exchange of data with other devices (Saia® xx7 controllers, HMI, SCADA systems)	×	×	✓	✓

1) Requires the use of programming cable PCD8.K111

2) Requires a corresponding configuration in hardware settings

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

4) RS485 with immediate releae of data line after transmission of last character

5) In preparation

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

5.2.2 Serial-S-Net

Supports the S-Bus protocol on serial interfaces (RS232, RS485/422, USB, modem) in Master/Slave operation. The Saia® S-Bus with its simple and secure protocol is part of the basic set up of all PCDs.

Technical data

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

5.2.3 Profi-S-Net

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

Technical data

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

5.2.4 Ether S-Net

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

Technical data

Terminals:	10 Base-T/100 Base TX (RJ45)
Speed:	10/100 Mbps (auto-sensing)
Protocols:	TCP/IP or UDP/IP, Ether-S-Bus, Ether-S-I/O, HTTP, SMTP
Port in PG5:	9

5.2.5 Protocols implemented in the user program

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

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

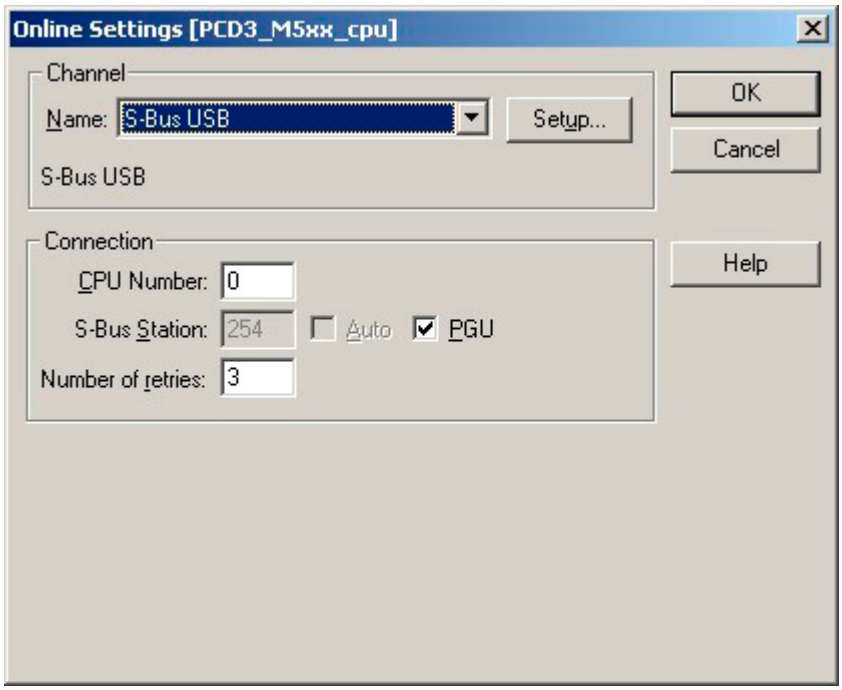
Please refer to the Links page at www.sbc-support.ch for links to system partners.

5.3 USB PGU interface for connecting programming units

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

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

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



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

5.4 RS232 connector (Port 0) as communication interface and as connection for programming unit (PCD3.M5xx0/M6xx0 only)

This interface is via a 9-pole D-Sub connector (female). The interface is of type RS232.

The pin configuration and associated signals are:

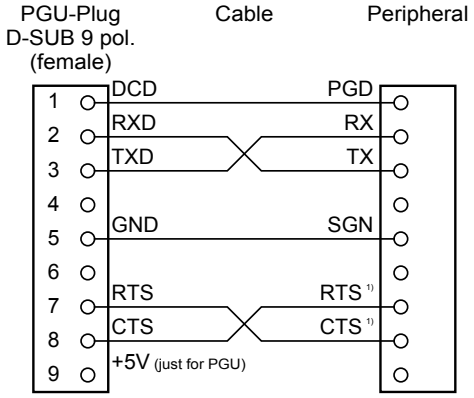
Pin	Designation	Meaning	
1	DCD	Data carrier detect	
2	RXD	Receive data	[Empfangsdaten]
3	TXD	Transmit data	[Sendedaten]
4	DTR		
5	GND	Signal ground	[Signalerde]
6	DSR	PGU connected	[Erkennung PGU]
7	RTS	Request to send	[Sender einschalten]
8	CTS	Clear to send	[Sendebereitschaft]
9	n.c.	Not connected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

The interface can be used for the following purposes:

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

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

- If another programming device is connected during operation instead of the peripheral device, the unit will switch over automatically to PGU mode (pin 6 logical “1” (DSR); in PGU mode: DSR PING = “1”)
- Before using the port to connect another peripheral device, Port 0 must be reconfigured by means of an SASI instruction.

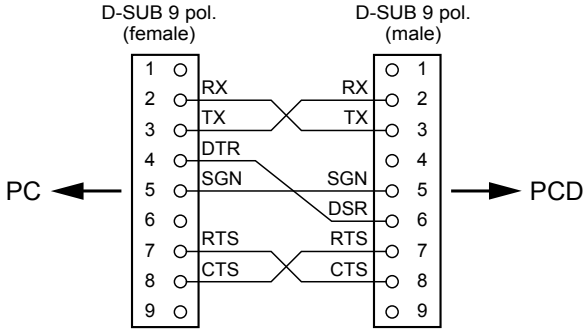


[1]) When communicating with terminals, check whether some connections are provided with bridges or need to be set to "1" or "0" with the "SOCL" instruction. It is generally recommended to use a handshake (RTS/CTS) (see also manual 26/795 "PCD7.D23x Series graphic terminals").

Option 3: Port 0 can also be used as a modem port with a 1-to-1 cable. For this, the “Full RS-232 handshaking on Port 0” should be ticked, as described in section 3.18 "Hardware options".

Option 4: With the PCD8.K111 connecting cable, this interface can be used to connect a programming unit.

PCD8.K111 connecting cable



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

5.5.1 General remarks on the PCD3.F1xx

System properties of PCD3.F1xx modules:

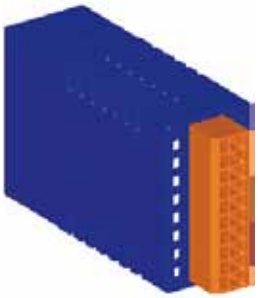
The following points must be observed when using the PCD3.F2xx interface modules:

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

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

The PCD3.F1xx base module consumes < 10 mA.

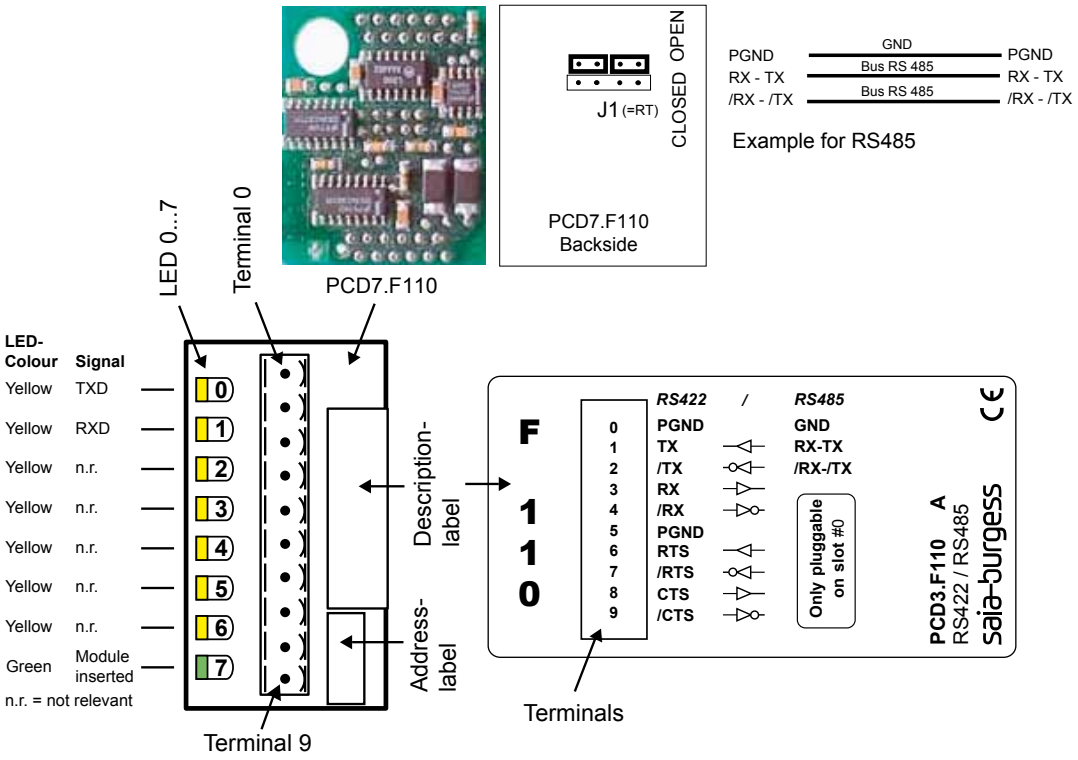
5.5.2 RS422/485 with PCD3.F110



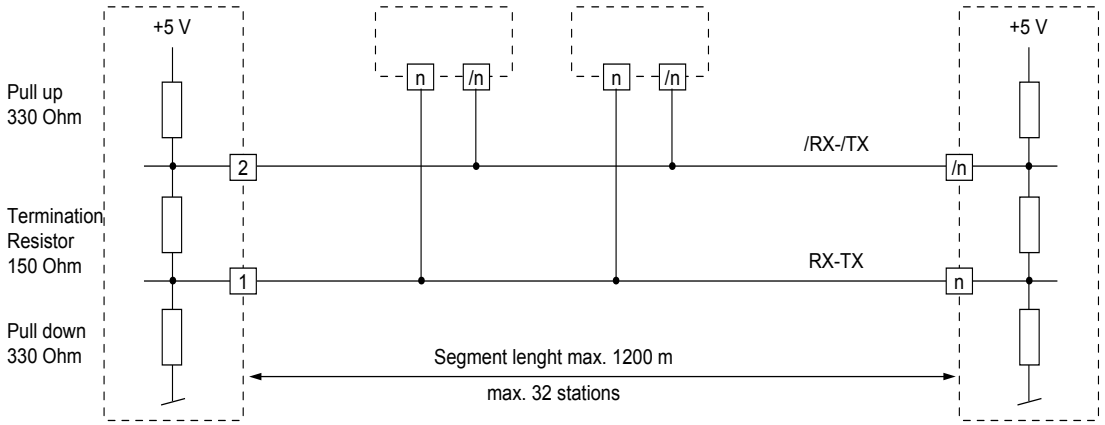
PCD7.F110:
RS422 with RTS/CTS or RS485 electrically connected, with line termination resistors capable of activation, for I/O modiule Slot A To move the jumper (activate line termination resistors), the module housing has to be opened, as described in section 6.1.5, to reach the PCD7. F110 circuit board.

5

Connections and LEDs for RS422/485



Choice of termination resistors



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

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

For RS422, each pair of receive lines is terminated with a 150 Ω line termination resistor. Jumper J1 must be left in the “OPEN” position (factory setting). The jumper is on the connection side of the module.

For details, see manual 26/740 "Installation components for RS485 networks" and manual 26/795, "PCD7.D23x series graphics terminals".

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

RS422 mode

RS422

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

10-pole spring terminal on PCD3.F2xx

Connection:

In RS422 mode, the input signal lines on the PCD3.F210 must be terminated with 150Ω resistors.

RS485 mode

(Electrically connected RS485 interface)

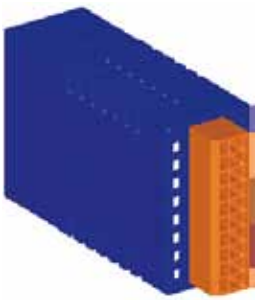
RS485

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

10-pole spring terminal on PCD3.F2xx

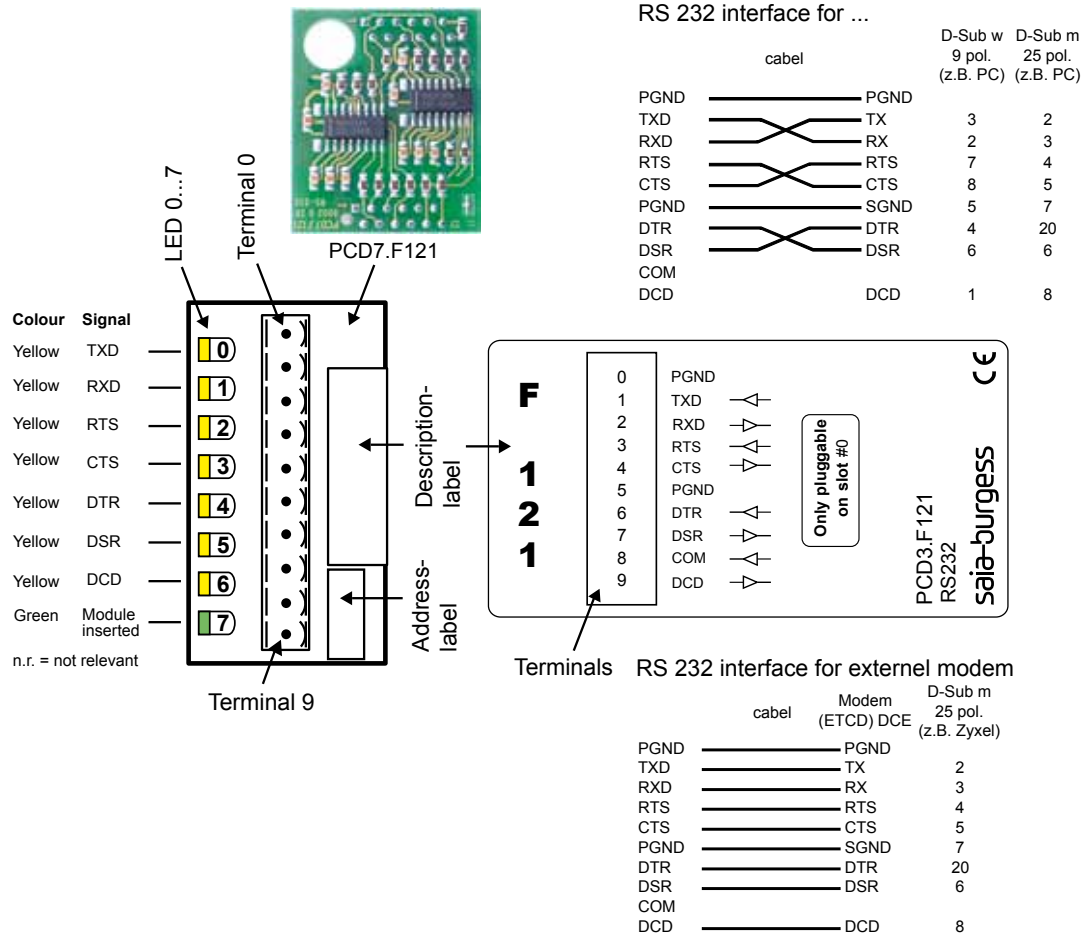
The network termination for Port x.0 can be enabled with a switch on the PCD3.F210. The switch is marked 'O' for OPEN and 'C' for CLOSED.

5.5.3 RS232 with PCD3.F121 (suitable for modem)



PCD3.F121:
RS232 with RTS/CTS, DTR/DSR, DCD, suitable for modem connection, for I/O module Slot 0.

Connections and LEDs



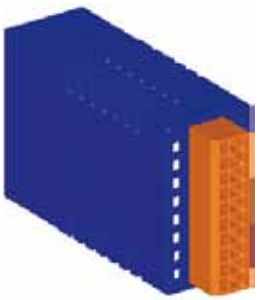
See also manual 26/795, “PCD7.D23x Series graphic terminals”

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

RS232

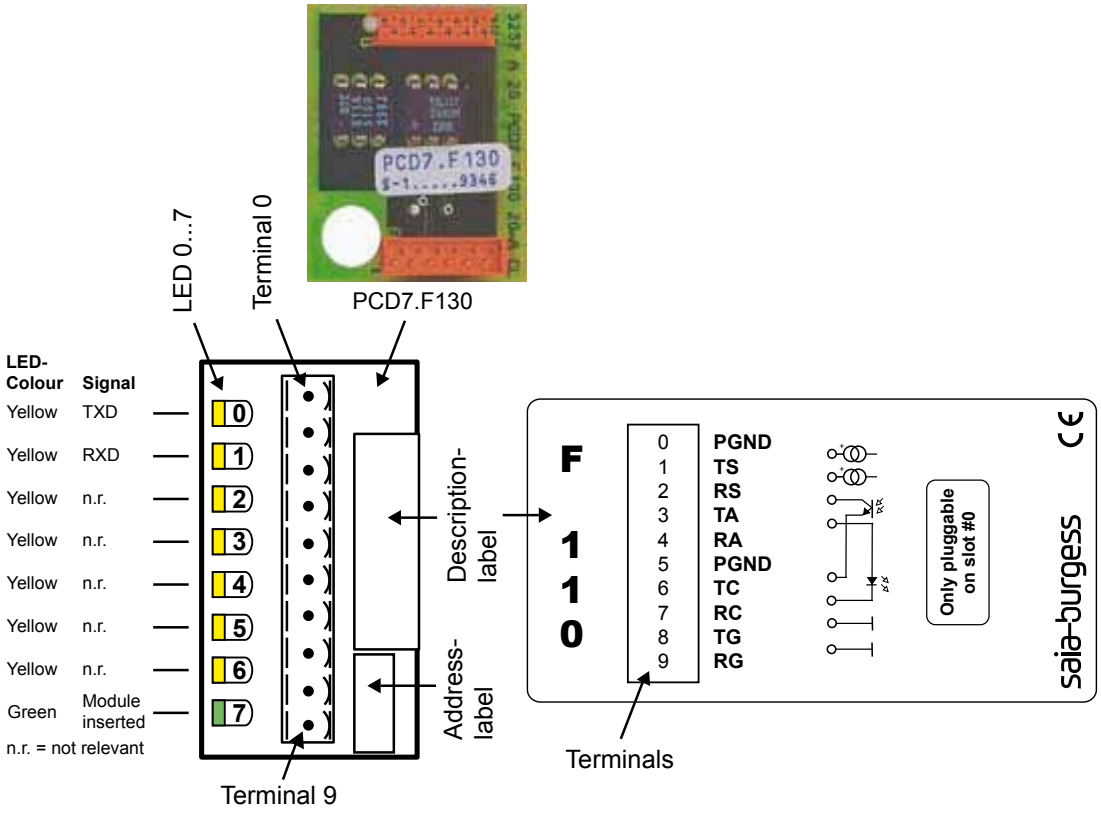
0	PGND	TxD	1
2	RxD	RTS	3
4	CTS	PGND	5
6	DTR	DSR	7
8	COM	DCD	9

5.5.4 Current loop with PCD3.F130

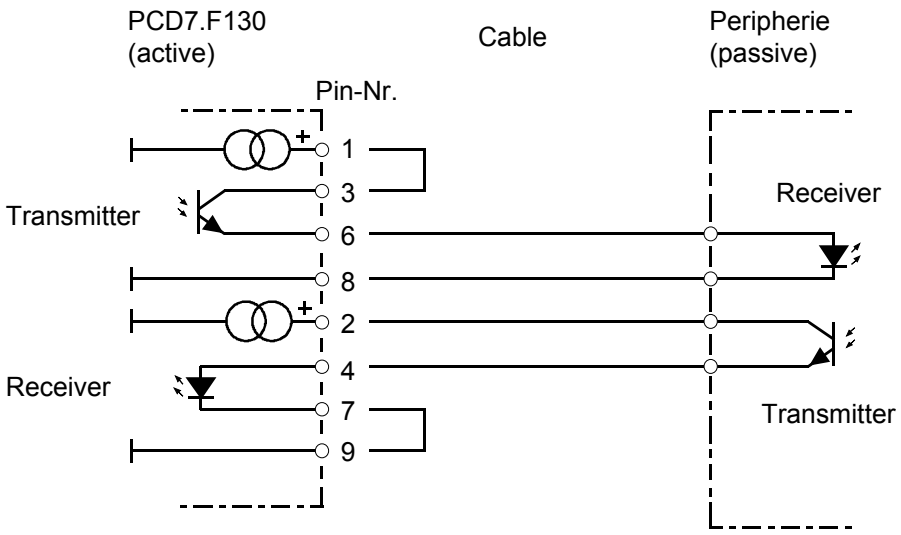


PCD3.F130:
TTY/current loop 20 mA (active or passive), for I/O module slot 0.

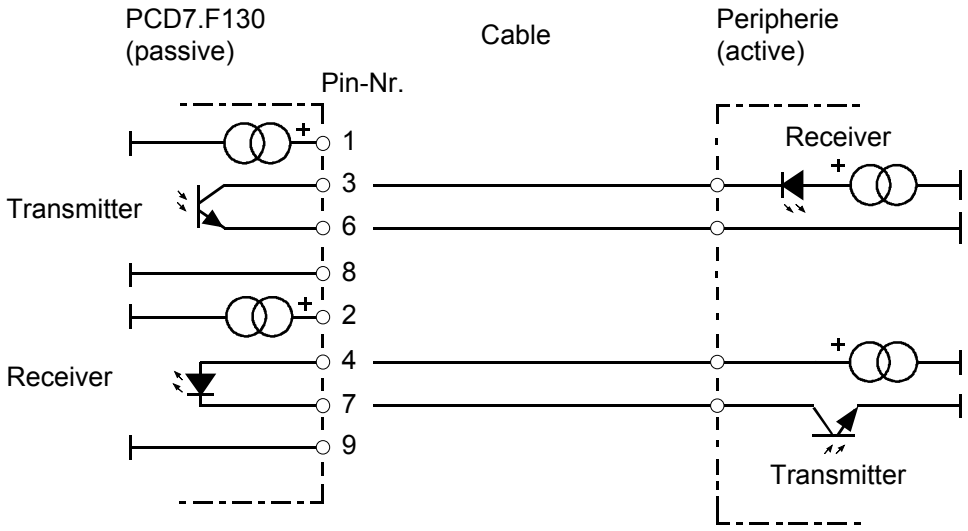
Connections and LEDs



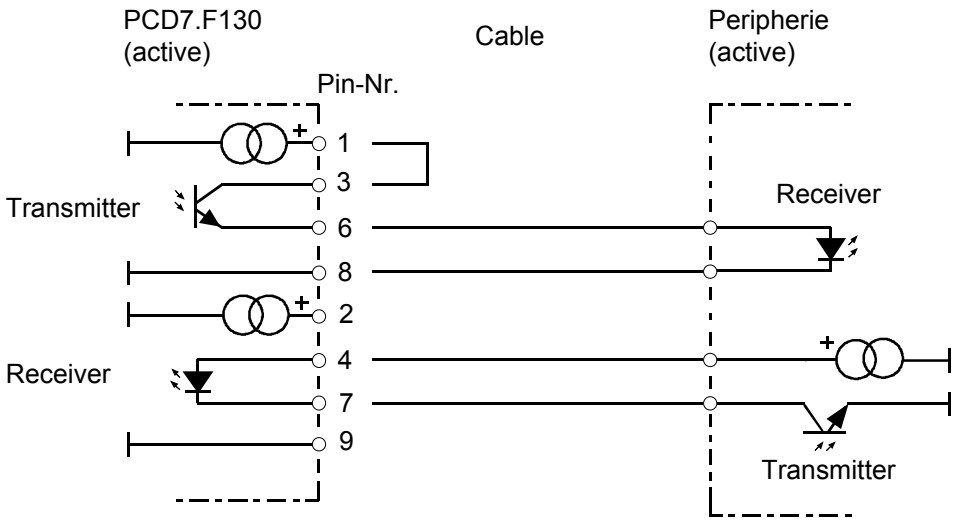
PCD active



PCD passive



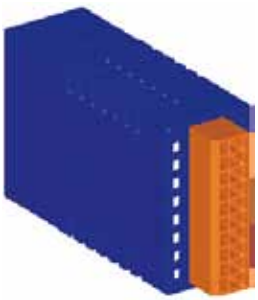
PCD and peripheral active



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

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

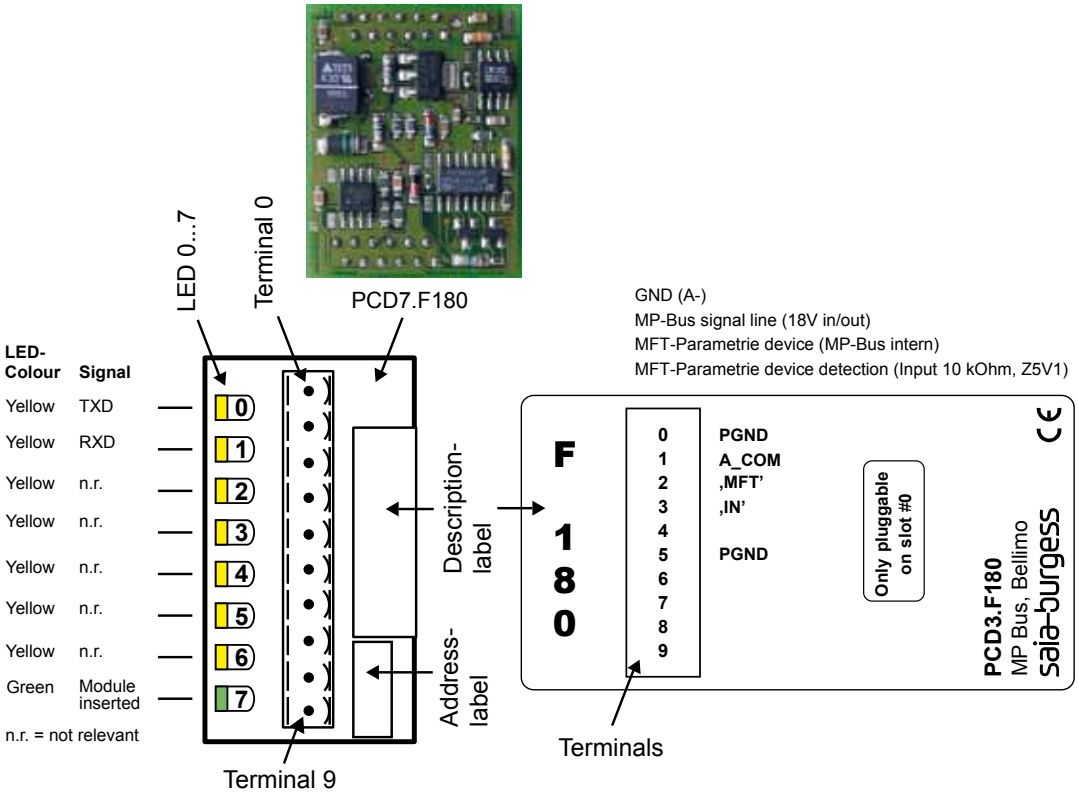
5.5.5 RS485 with PCD3.F150



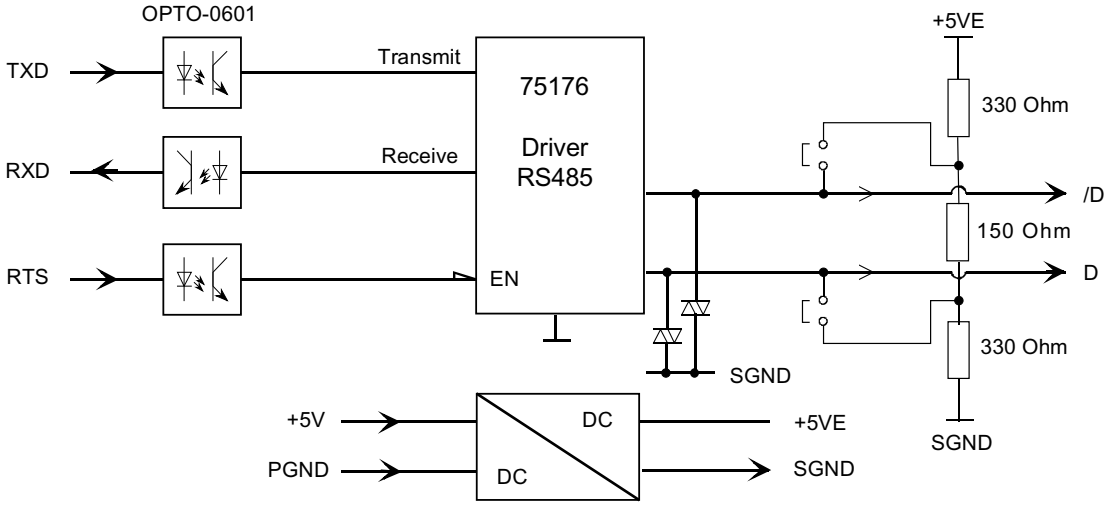
PCD3.F150:
RS485, electrically isolated, with line termination resistors capable of activation, for I/O module Slot 0. To change the jumper (activate line termination resistors), the module housing has to be opened, as described in section. 6.1.5, to reach the PCD7.F150 circuit board.

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

Connections and LEDs



Block diagram:



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

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

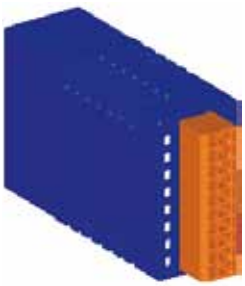
For installation details, see manual 26/740 “Installation components for RS485 networks”

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

RS485

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

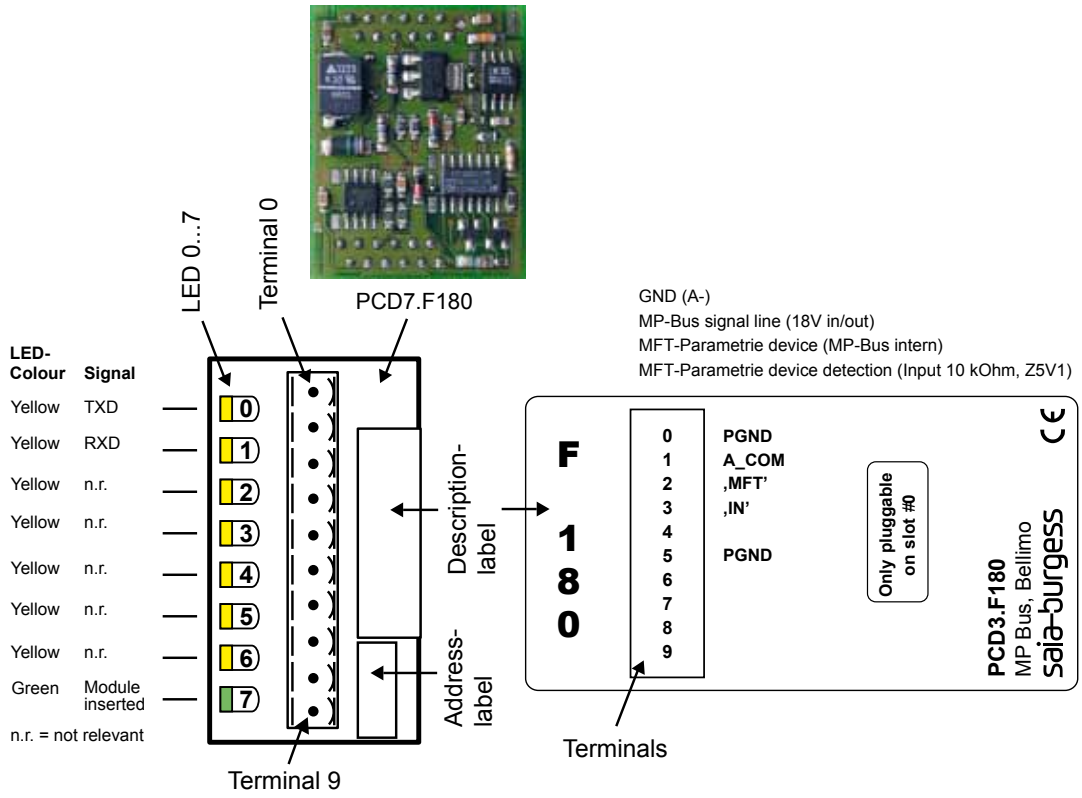
5.5.6 MP-Bus with PCD3.F180



PCD3.F180:
Switching module for MP bus, for I/O module slot 0.

The module has a facility to connect an MP-Bus line with 8 drives and sensors.

Connections and LEDs



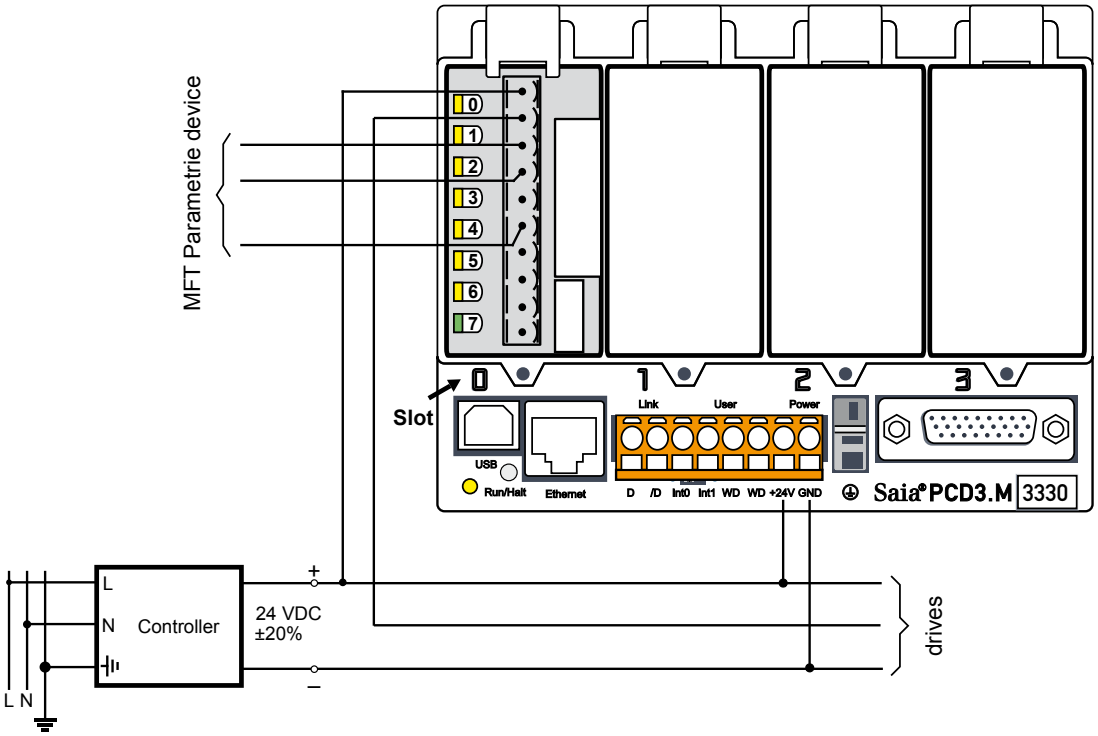
If the PCD7.F180 is used on Port x.1 of a PCD3.F2xx, the pin allocation is as follows: (10-pole spring terminal on PCD3.F2xx)**:**

Belimo MP bus

0	PGND	Acom	1
2	MFT	IN	3
4		PGND	5
6			7
8			9

Supply option

Common supply for control and drive



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

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

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

5.6.1 General remarks on the PCD3.F2xx

System properties of PCD3.F2xx modules:

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

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

5.6.2 Communication ports on the PCD3.Mxxxx

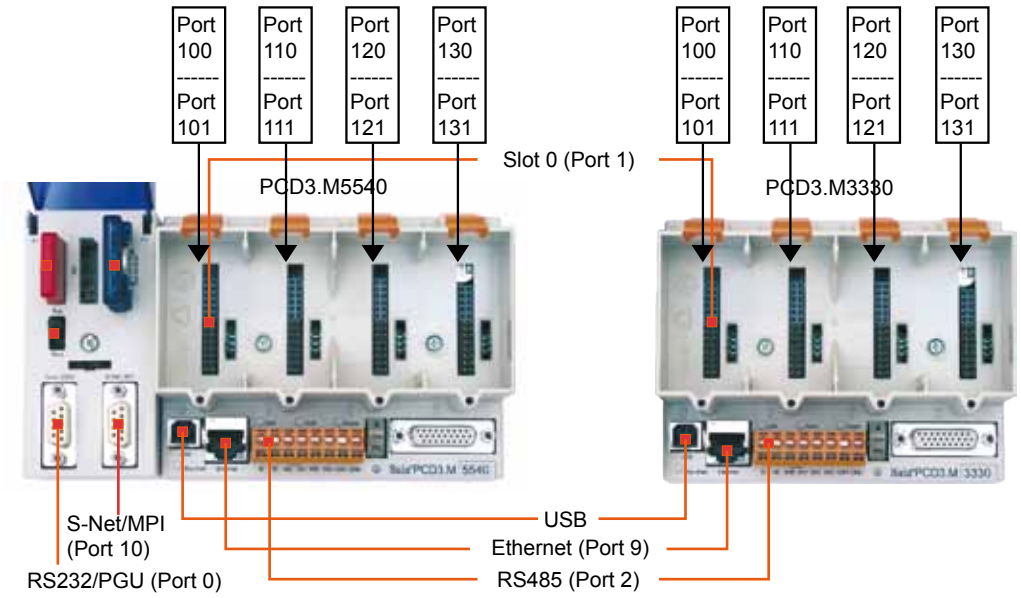
The PCD3.F2xx modules are designed to be mounted in I/O slots 0…3 on a PCD3. Mxxxx. As shown in the figure below, the I/O slots are designated as follows:

I/O slot 0: Port 100 for the x.0 port on the PCD3.F2xx module
Port 101 for the x.1 port on the PCD3.F2xx module

I/O slot 1: Port 110 for the x.0 port on the PCD3.F2xx module
Port 111 for the x.1 port on the PCD3.F2xx module

I/O slot 2: Port 120 for the x.0 port on the PCD3.F2xx module
Port 121 for the x.1 port on the PCD3.F2xx module

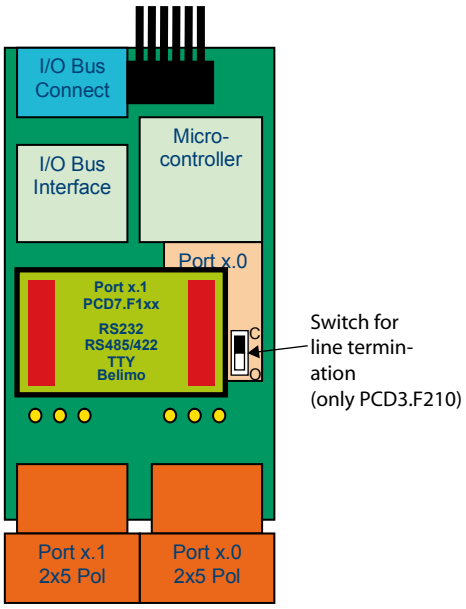
I/O slot 3: Port 130 for the x.0 port on the PCD3.F2xx module
Port 131 for the x.1 port on the PCD3.F2xx module



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

5.6.3 Module overview

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



PCD3.F210
Serial communication module with two serial interfaces
Port x.0: RS422 / RS485
(fixed on PCD3.F210 module)
Port x.1: Slot for PCD7.F1xx module

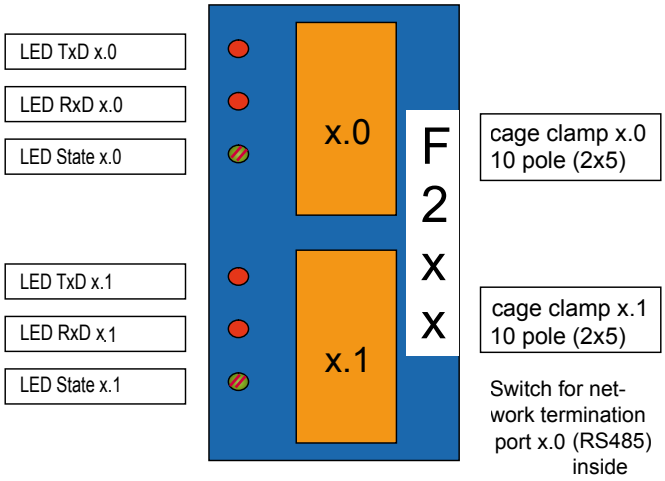
PCD3.F221
Serial communication module with two serial interfaces
Port x.0: RS232
(fixed on PCD3.F221 module)
Port x.1: Slot for PCD7.F1xx module

PCD3.F281
Serial communication module with two serial interfaces
Port x.0: Belimo MP-Bus
(fixed on PCD3.F281 module)
Port x.1: Slot for PCD7.F1xx module

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

PCD7.F110 Serial interface module RS422 / RS485
PCD7.F121 Serial interface module RS232, for modem connection
PCD7.F130 Serial interface module, current loop 20 mA
PCD7.F150 Serial interface module, RS485, electrically isolated
PCD7.F180 Serial interface module for Belimo MP bus, for max. 8 actuators and sensors

Connections and LEDs



Summary of connections

RS232

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

RS422

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

RS485

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

TTY (CL)

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

Belimo MP bus

0	PGND	Acom	1
2	MFT	IN	3
4		PGND	5
6			7
8			9

Spring terminal block (supplied)

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

Maximum wire gauge: 1.0 mm^2 AWG 18

LEDs

LED TxD: Send data detection
LED RxD: Receive data detection
LED status: The "Status" LED displays the status of the serial port, ‘green’ means that the port is working properly

- Both LEDs permanently red: F2xx not running
- Both LEDs green 25% / red 75%: F2xx start-up procedure
- Both LEDs green 50% / red 50%: F2xx running, but no communication with PCD3.Mxxxx
- Status LED green 75% / red 25%: F2xx running, channel closed
- Status LED green 90% / red 10%: F2xx running, channel open with error
- Status LED green 100%: F2xx running, channel open OK

Technical data

Communication modes supported:

MC0 Character mode, no automatic handshake
MC1 Character mode with RTS/CTS handshake
MC2 Character mode with Xon/Xoff protocol
MC4 Character mode for RS485 interface
MC5 As MC4 with rapid switching between sending and receiving

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

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

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

Baud rates supported (bits/sec):

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

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

Restrictions:

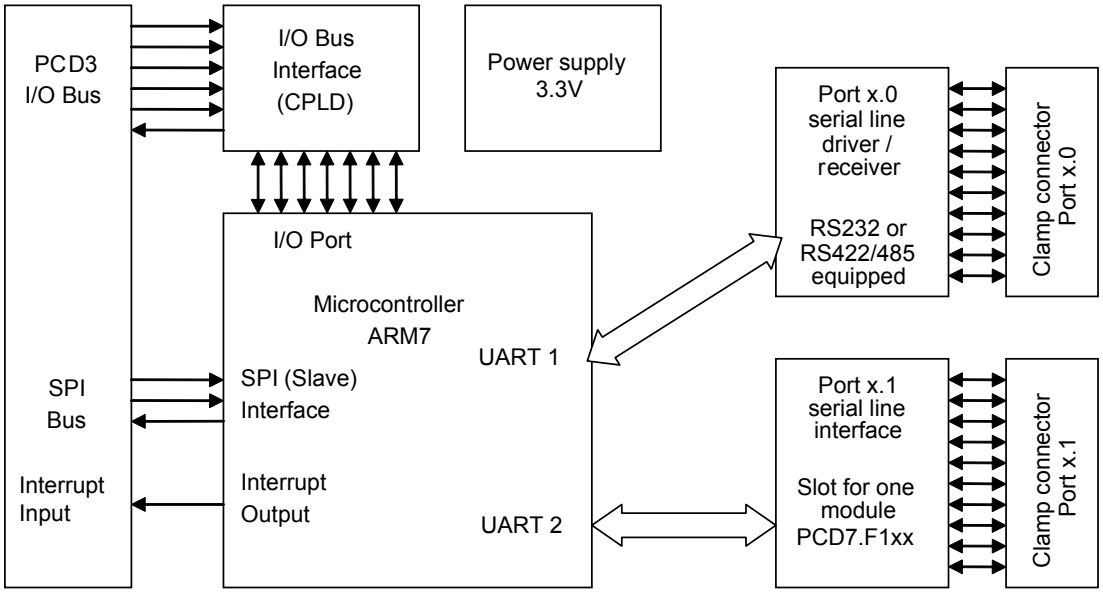
The PCD3.F2xx modules for the PCD3 systems offer the possibility of implementing up to 8 additional serial interfaces. It should be noted that each additional interface adds to the load on the PCD3.Mxxxx CPU.

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

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

The exact system limits have still to be confirmed.

Block diagram



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5.6.4 Port x.0: RS422/485 auf Modul PCD3.F210

The PCD3.F210 module contains two different interface types on Port x.0: RS422 with RTS/CTS and RS485 (electrically connected). The line termination is integrated into the module and can be enabled by means of a switch on the module. To switch it on (activate line termination resistors), the module casing must be opened as described in section 6.1.5

RS422 mode

RS422

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

10-pole spring terminal block

Line termination in RS422 mode always uses 150 Ω resistor on the PCD3.F210.

RS485 mode

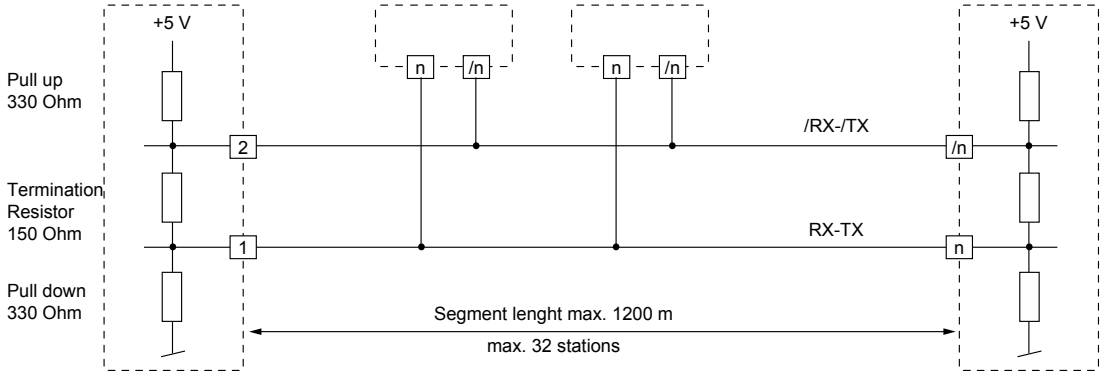
(Electrically connected RS485 interface)

RS485

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

10-pole spring terminal block

Connection:



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

5.6.5 Port x.0: RS232 on PCD3.F221 module (for modem)

The PCD3.F221 module offers a complete RS232 interface on Port x.0. This port is intended mainly for modem connections such as RTS/CTS, DTR/DSR and DCD.

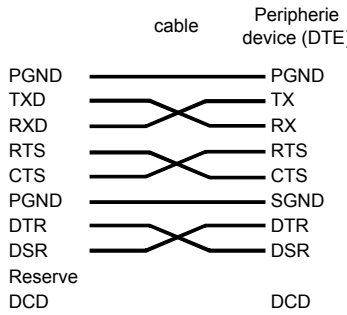
RS232 connection

RS232

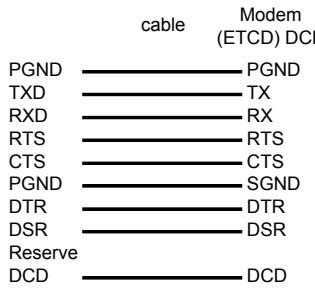
0	PGND	TxD	1
2	RxD	RTS	3
4	CTS	PGND	5
6	DTR	DSR	7
8	COM	DCD	9

10-pole spring terminal block

RS232 connection to DTE:



RS232 connection to DCE:



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

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

Belimo connection

Belimo MP bus

0	PGND	Acom	1
2	MST	IN	3
4		PGND	5
6			7
8			9

10-pole spring terminal block

5.7 LIOs and RIOs

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

6 Input/output (I/O) modules

6.1 Introduction to I/O modules

There are over 50 I/O modules available for digital and analogue I/Os, counters etc. If they are connected to a PCD, programming (FBs and FBoxes) is done in the usual way. If they are connected to a RIO system, nothing particular needs to be programmed on the Master PCD. The RIO sends the correct values to the Master.

Type	I/Os	Description	Input/ output signal range	I/O connector type [3]	Page
Digital input modules					
PCD3.E110	8 I	8 inputs 8 ms	24 VDC	A / B	6-11
PCD3.E111	8 I	8 inputs 0.2 ms	24 VDC	A / B	6-11
PCD3.E112	8 I	8 inputs 9 ms	12 VDC	A / B	6-11
PCD3.E116	8 I	8 inputs 0.2 ms	5 VDC	A / B	6-11
PCD3.E160	16 I	16 inputs 8 ms, connection via 34-pole ribbon connector	24 VDC	D [7])	6-13
PCD3.E161	16 I	16 inputs 0.2 ms, connection via 34-pole ribbon connector	24 VDC	D [7])	6-13
PCD3.E165	16 I	16 inputs 8 ms, connection via 24-pole cage clamp terminal block	24 VDC	C	6-15
PCD3.E166	16 I	16 inputs 0.2 ms, connection via 24-pole cage clamp terminal block	24 VDC	C	6-15
Digital input modules, electrically isolated from the I/O Bus					
PCD3.E500	6 I	6 inputs 20 ms, electrically isolated	115/230 VAC	A / B	6-18
PCD3.E610	8 I	8 inputs 10 ms, electrically isolated	24 VDC	A / B	6-20
PCD3.E613	8 I	8 inputs 0.2 ms, electrically isolated	48 VDC	A / B	6-20
Digital output modules					
PCD3.A300	6 O	6 outputs 2 A	24 VDC	A / B	6-23
PCD3.A400	8 O	8 outputs 0.5 A	24 VDC	A / B	6-25
PCD3.A460	16 O	16 outputs 0.5 A, connection via 34-pole ribbon connector	24 VDC	D [7])	6-27
PCD3.A465	16 O	16 outputs 0.5 A, connection via 24-pole spring terminal block	24 VDC	C	6-29
Digital output modules, electrically isolated from the I/O Bus					
PCD3.A200	4 O	4 make contacts 2A	250 VAC 50 VDC	A / B	6-32
PCD3.A210	4 O	4 break contacts 2A	250 VAC 50 VDC	A / B	6-34
PCD3.A220	6 O	6 make contacts 2A	250 VAC 50 VDC	A / B	6-36
PCD3.A251	8 O	6 changeover + 2 make contacts 2 A, connection via 24-pole spring terminal block	48 VAC 50 VDC	C	6-38
PCD3.A410	8 O	8 outputs 0.5 A, electrically isolated	24 VDC	A / B	6-40
Digital output modules for manual operation					
PCD3.A810	4 O	Manual control module, 2 changeover contacts + 2 make contacts, 2 A, 5(6) A	50 VDC 250 VAC	F	6-43
PCD3.A860	2I+2O	Light and shade module, 2 outputs 12 A/250 VAC, 2 inputs 24 VDC	250 VAC 24 VDC	G H	6-47

Type	I/Os	Description	Input/ output signal range	I/O connector type [3]	Page
Digital combined input/output modules					
PCD3.B100	2I+2O +4 I/O	2 inputs, 2 outputs, 4 selectable as inputs or outputs	24 VDC	A / B	6-54
Analogue input modules					
PCD3.W200	8 I	8 inputs 10 bit	0…10 V	A / B	6-58
PCD3.W210	8 I	8 inputs 10 bit	0…20 mA	A / B	6-58
PCD3.W220	8 I	8 inputs 10 bit	Pt/Ni1000	A / B	6-58
PCD3.W300	8 I	8 inputs 12 bit	0…10 V	A / B	6-64
PCD3.W310	8 I	8 inputs 12 bit	0…20 mA	A / B	6-64
PCD3.W340	8 I	8 inputs 12 bit, jumper selectable	0…10 V, 0…2.5 V 0…20mA, Pt/Ni1000	A / B	6-64
PCD3.W350	8 I	8 inputs 12 bit	Pt/Ni 100	A / B	6-64
PCD3.W360	8 I	8 inputs 12 bit, resolution ‹ 0.1 °C	Pt1000	A / B	6-64
Analogue input modules, electrically isolated from the I/O Bus					
PCD3.W305	7 I	7 inputs 12 bit, electrically isolated	0…10 V	E	6-73
PCD3.W315	7 I	7 inputs 12 bit, electrically isolated	0…20 mA	E	6-73
PCD3.W325	7 I	7 inputs 12 bit, electrically isolated	-10 V…+10 V	E	6-73
Analogue output modules					
PCD3.W400	4 O	4 outputs 8 bit	0…10 V	A / B	6-78
PCD3.W410	4 O	4 outputs 8 bit, jumper selectable	0…10 V, 0…20 mA, 4…20 mA	A / B	6-78
PCD3.W600	4 O	4 outputs 12 bit	0…10 V	A / B	6-82
PCD3.W610	4 O	4 inputs 12 bit, jumper selectable	0…10 V, -10 V…+10 V 0…20 mA, 4…20 mA, Pt1000	A / B	6-82
Analogue input modules, electrically isolated from the I/O Bus					
PCD3.W605	6 O	6 outputs 10 bit, electrically isolated	0…10 V	E	6-88
PCD3.W615	4 O	4 outputs 10 bit, electrically isolated	0…20 mA	E	6-88
PCD3.W625	6 O	6 outputs 10 bit, electrically isolated	-10 V…+10 V	E	6-88
Analogue combined input/output modules					
PCD3.W500	2I+2O	2 inputs 12 Bit, 0…10 V, -10…+10 V + 2 outputs 12 Bit	0…10 V	A / B	6-93
Analogue combined input/output modules, electrically isolated					
PCD3.W525	4 I + 2 A	4 analogue inputs 14 bit + 2 analogue outputs, 12 bit	0…10 V, 0(4)…20 mA Pt500/1000, Ni1000 0…10 V, 0(4)…20 mA	E	6-98

Type	I/Os	Description	I/O connector type [3]	Page

Analogue output module for manual operation

PCD3.W800	4 O	Manual control module 3 outputs 0…10 V with manual control, 1 output 0…10 V without	J	6-104

Weighing modules

PCD3.W720	2 I	2 weighing systems, up to 6 weighing cells 18 bit [2])	E	6-108

Universal temperature measurement module

PCD3.W745	4 I	Thermocouple module for J, K…thermocouples	[8])	6-109

Counting and motion control modules

PCD3.H100		Counter module up to 20 kHz	A / B	6-111
PCD3.H110		Counter module up to 100 kHz	A / B	6-116
PCD3.H150		SSI interface module	A / B	6-118
PCD3.H210		Motion control module for stepper motors [2])	A / B	6-121
PCD3.H310		Motion control module for servo-motors 1-axis encoder 24 VDC [2])	A / B	6-124
PCD3.H311		same as H310, with 1-axis encoder 5 VDC [2]), [9])	A / B	6-124

Input/output simulator unit

PCD3.S100		Input/output simulator for PCD3.M/C/T	-	6-129

[2]) These I/O modules cannot currently be used with the PCD3 RIO head station
[3]) I/O connectors are not provided with the I/O modules and must be ordered separately
[4]) Current consumption from internal 5 V bus, capacity max. 600 mA for the PCD3.Mxxx0, max. 650 mA for the PCD3.T76x and max. 1000 mA for the PCD3.C200
[5]) Current consumption from internal 24 V bus, capacity max. 100 mA for the PCD3.Mxxx0, for the PCD3.T76x and for the PCD3.C200
[6]) On request
[7] Pluggable system cable with connector on PCD to connect via 34-pole ribbon connector: The preconfigured cables with connectors on the PCD allow many I/O points to be connected quickly and easily. The system cables are described in the PCD1/2 manual, Document-no 26/737.
[8]) Non-pluggable cage clamp terminals
[9]) Up to max.300 mA for the encoder, this current also loads the +5 V bus on the module

Accessories

Type	Description
PCD3.E009	Empty module for unused module slots
4 104 7515 0	Socket cover
PCD3.K010	Connector PCD3↔PCD3, directly side to
PCD3.K106	Connecting cable 0.7 m PCD3 ↔ PCD3
PCD3.K116	Connecting cable 1.2 m PCD3 ↔ PCD3
PCD3.K225	Connecting cable 2.5 m PCD3 web server↔PC
4 310 8686 0	Preprinted tapes
4 329 4819 0	Labelling plates
4 310 8723 0	Snap-on clips incl. generic labels, Set of 10

6.1.1 Connector types

Type	Quantity	Description	Connector type
4 405 4954 0	1	Pluggable cage clamp terminals, 10-pole (up to 2.5 mm²)	Type A
4 405 4956 0	1	Pluggable cage clamp terminals, 24-pole (up to 1.0 mm²)	Type C
4 405 4955 0	1	Pluggable screw terminals, 10-pole (up to 2.5 mm²)	Type B
PCD2.K22x PCD2.K23x		Ready-made system cable to connect "ribbon cable to screw terminal" adapters	Type D
4 405 4998 0	1	Pluggable cage clamp terminals, 14-pole (up to 1.5 mm²)	Type E
4 405 4936 0	(1 for A810)	Pluggable cage clamp terminals, 12-pole (up to 1.5 mm²)	Type F
PCD3.K810	(1 for A810)	Pluggable cage clamp terminals, 12-pole (as 4 405 4936 0), with 12 grouped strands, numbered, 2.5 m long	Type F
4 405 5027 0	(1 for A860)	Pluggable cage clamp terminals, 4-pole (up to 2.5 mm²)	Type G
PCD3.K860	(1 for A860)	Pluggable cage clamp terminals, 4-pole (as 4 405 5027 0), with 4 grouped strands, numbered, 2.5 m long	Type G
4 405 5028 0	(1 for A860)	Pluggable cage clamp terminals, 6-pole (up to 1.0 mm²)	Type H
PCD3.K861	(1 for A860)	Pluggable cage clamp terminals, 6-pole (as 4 405 5028 0), with 6 grouped strands, numbered, 2.5 m long	Type H
4 405 4934 0	(1 for W800)	Pluggable cage clamp terminals, 8-pole (up to 1.5 mm²)	Type J
PCD3.K800	(1 for W800)	Pluggable cage clamp terminals, 8-pole (as 4 405 4934 0), with 8 grouped strands, numbered, 2.5 m long	Type J

6

I/O module terminal blocks (ordered separately)


4 405 4954 0 (Typ A)


4 405 4955 0 (Typ B)


4 405 4956 0 (Typ C)


4 405 4998 0 (Typ E)


4 405 4936 0 (Typ F)


4 405 5027 0 (Typ G)


4 405 5028 0 (Typ H)

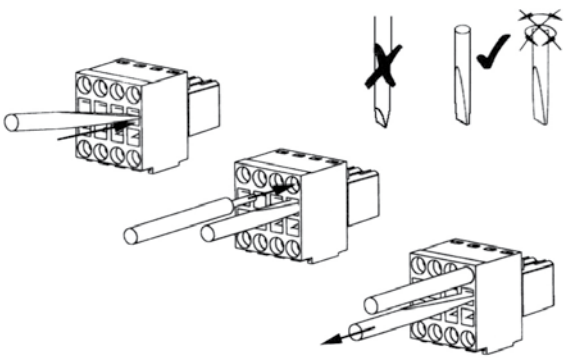

4 405 4934 0 (Typ J)

PCD3.K010

Connectors between module holders


PCD3.K106/116

Plug-in cage clamp terminals



The plug-in cage clamp terminals simplify the installation significantly. The cage clamp terminals support cable diameters from 1.0 mm² through 1,5 mm² to 2.5 mm².

Screwdrivers of type SDI 0.4 x 2.5 x 80 should be used (max. width: 2.5 mm).

6.1.2 Current consumption of the modules

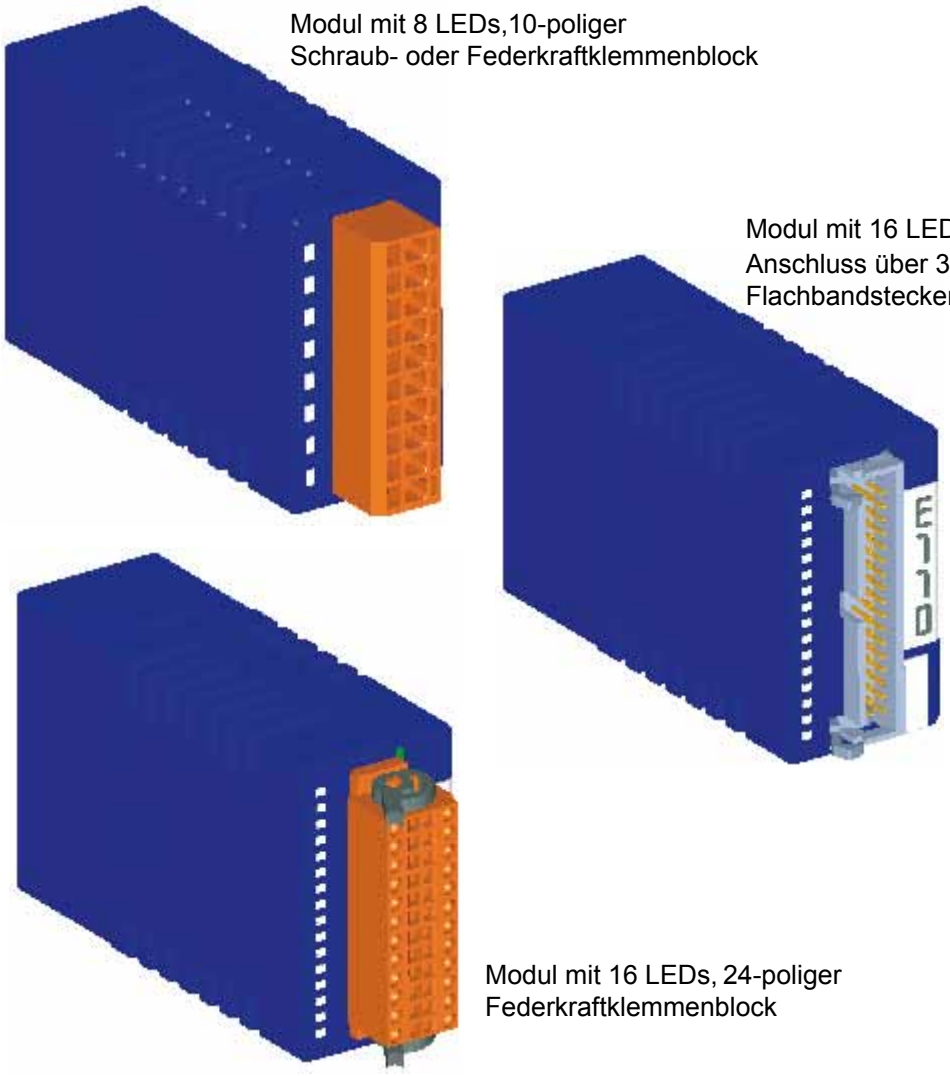
Type PCD3…	Internal current consumption I from +5 V [mA]	Internal current consumption I from V+ [mA]	External current consumption I from 24 VDC
E11x	1…24	--	max. 48 mA
E16x	1…10	--	max. 64 mA
E500	1	--	--
E61x	1…24	--	max. 40/30 mA
A200	1…15	--	max. 32 mA
A210	1…15		max. 32 mA
A220	1…20	--	max. 48 mA
A251	1…25	--	max. 64 mA
A300	1…20	--	Load current
A400	1…25	--	Load current
A410	1…24	--	Load current
A46x	max. 10	--	Load current
A810	40	--	--
A860	18	--	--
B100	1…25	--	Load current
W200/210	8	5	--
W220	8	16	--
W300/310	8	5	--
W340/360	8	20	--
W350	8	30	--
W3x5	60	--	--
W4x0	1	30	100 mA (W410)
W600	max. 4	20	--
W610	max. 110	--	max. 100 mA
W6x5	110/55 (W615)	90 (W615)	max. 90 mA (W615)
W500	max. 200	--	--
W525	40	0	--
W720			
W745	200	--	
W800	45	35	
H100	90	--	CCO output, load current
H110	90	--	Load current
H150	25	--	Load current
H210 [1])	85	--	Load current
H31x [1]), [2])	140	--	max. 15 mA

[1]) These I/O modules cannot currently be used with the PCD3 RIO head station
[2]) for H311: up to max.300 mA for the encoder, this current also loads the +5 V bus on the module

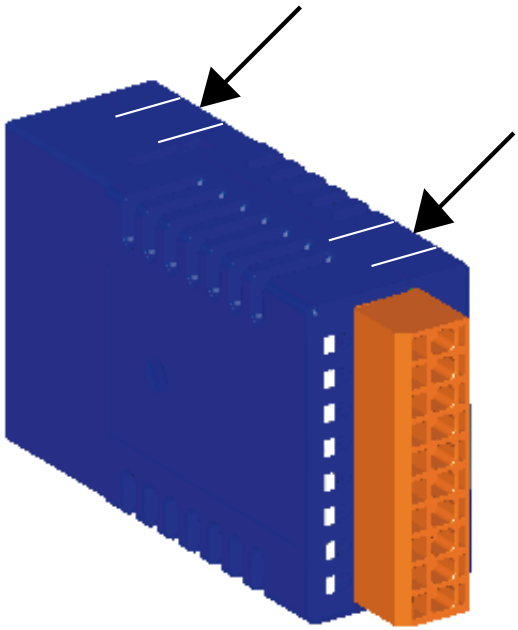
6.1.3 External input voltage

Type	Description	External input voltage or voltage range
Digital input modules		
PCD3.E110	8 inputs 8 ms	24 VDC smoothed or pulsed
PCD3.E111	8 inputs 0.2 ms	24 VDC smoothed, max.ripple 10%
PCD3.E112	8 inputs 9 ms	12 VDC smoothed, max.ripple 10%
PCD3.E116	8 inputs 0.2 ms	5 VDC smoothed, max.ripple 10%
PCD3.E160	16 inputs 8 ms	24 VDC smoothed or pulsed
PCD3.E165	16 inputs 8 ms	24 VDC smoothed or pulsed
PCD3.E166	16 inputs 0.2 ms	24 VDC smoothed or pulsed
PCD3.E500	6 inputs	115/230 VAC
PCD3.E610	8 inputs 10 ms	24 VDC smoothed or pulsed
PCD3.E613	8 inputs 10 ms	48 VDC smoothed or pulsed
Digital output modules		
PCD3.A200	4 make cont. 2A	250 VAC, 50 VDC
PCD3.A210	4 break contacts 2A	250 VAC, 50 VDC
PCD3.A220	6 make cont. 2A	250 VAC, 50 VDC
PCD3.A251	6 ch/over + 2 make cont.	48 VAC, 50 VDC
PCD3.A300	6 outputs 2 A	5…32 VDC smoothed, or 10…25 VDC pulsed
PCD3.A400	8 outputs 0.5 A	5…32 VDC smoothed, or 10…25 VDC pulsed
PCD3.A410	8 outputs 0.5 A	5…32 VDC smoothed, or 10…25 VDC pulsed
PCD3.A460	16 outputs 0.5 A	10…32 VDC smoothed, max.ripple 10%
PCD3.A465	16 outputs 0.5 A	10…32 VDC smoothed, max.ripple 10%
PCD3.A810	4 outputs	250 VAC, 50 VDC
PCD3.A860	2 inputs, 2 outputs	250 VAC, 24 VDC
PCD3.B100	2 I, 2 O, 4 selectable I/O	24 VDC smoothed or pulsed
Analogue input modules		
PCD3.W200	8 inputs 10 bit	
PCD3.W210	8 inputs 10 bit	
PCD3.W220	8 inputs 10 bit	
PCD3.W300	8 inputs 12 bit	
PCD3.W310	8 inputs 12 bit	
PCD3.W340	8 inputs 12 bit	
PCD3.W350	8 inputs 12 bit	
PCD3.W360	8 inputs 12 bit	
PCD3.W3x5	7 inputs 12 bit	
Analogue output modules		
PCD3.W400	4 outputs 8 bit	
PCD3.W410	4 outputs 8 bit	24 VDC smoothed or pulsed
PCD3.W600	4 outputs 12 bit	
PCD3.W610	4 outputs 12 bit	24 VDC smoothed or pulsed
PCD3.W6x5	6/4 outputs 10 bit	24 VDC smoothed or pulsed
PCD3.W500	2 O 12 bit + 2 I 12 bit	
PCD3.W525	4 O 12 bit + 2 I 14 bit	
PCD3.W720	Weighing module	
PCD3.W745	Thermocouple module	
PCD3.W800	Manual control module	
Counting and motion control I/O modules		
PCD3.H100	Counting module	5…32 VDC smoothed, max.ripple 10%
PCD3.H110	Counting module	5…32 VDC smoothed, max.ripple 10%
PCD3.H150	SSI interface module	10…32 VDC smoothed, max.ripple 10%
PCD3.H210	Motion control module	5…32 VDC smoothed, max.ripple 10%
PCD3.H310	Motion control module	24 V (19…32 VDC smoothed, max.ripple 10%)
PCD3.H311	Motion control module	5 VDC

6.1.4 Example I/O modules



6.1.5 Open the module housing



Open
On each of the two narrow sides of the housing are two snap-in clips. Lift these gently with your fingernails on one side then the other and separate the two parts of the housing.

Close
To close the housing, lay the bottom part on a flat surface (table etc.). Ensure that the circuit board is precisely located in this part of the housing. Press top part onto bottom until you hear the snap-in clips engage. Ensure that all four clips are correctly engaged.

6.1.6 Outphased I/O-moduels PCD2

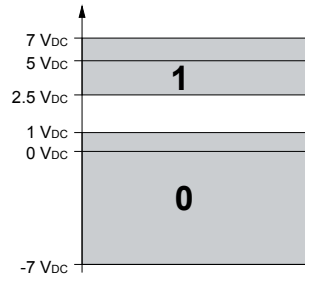
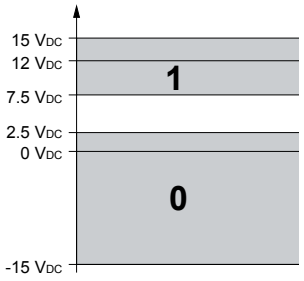
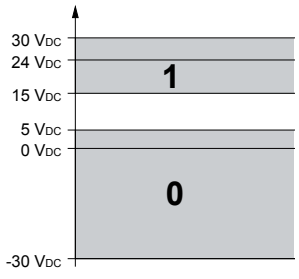
Article	Active	Not recommended for new projects	Outphased (no longer produced)
PCD3.A200	×		
PCD3.A210	×		
PCD3.A220	×		
PCD3.A251	×		
PCD3.A300	×		
PCD3.A400	×		
PCD3.A410	×		
PCD3.A460	×		
PCD3.A465	×		
PCD3.A810	×		
PCD3.A860	×		
PCD3.B100	×		
PCD3.E110	×		
PCD3.E111	×		
PCD3.E112	×		
PCD3.E116	×		
PCD3.E160	×		
PCD3.E161	×		
PCD3.E165	×		
PCD3.E166	×		
PCD3.E500	×		
PCD3.E610	×		
PCD3.E613	×		
PCD3.H100	×		
PCD3.H110	×		
PCD3.H150	×		
PCD3.H210	×		
PCD3.H310	×		
PCD3.H311	×		
PCD3.W200	×		
PCD3.W210	×		
PCD3.W220	×		
PCD3.W220Z03		×	
PCD3.W220Z12		×	
PCD3.W300	×		
PCD3.W305	×		
PCD3.W310	×		
PCD3.W315	×		
PCD3.W325	×		
PCD3.W340	×		
PCD3.W350	×		
PCD3.W360	×		
PCD3.W400	×		
PCD3.W410	×		

Article	Active	Not recommended for new projects	Outphased (no longer produced)
PCD3.W500			×
PCD3.W510			×
PCD3.W525	×		
PCD3.W600	×		
PCD3.W610	×		
PCD3.W605	×		
PCD3.W615	×		
PCD3.W625	×		
PCD3.W710			×
PCD3.W720	×		
PCD3.W745	×		
PCD3.W800	×		

6.2 Digital input modules

PCD3.E110	**8 inputs 8 ms, 24 VDC**
PCD3.E111	**8 inputs 0.2 ms, 24 VDC**
PCD3.E112	**8 inputs 9 ms, 12 VDC**
PCD3.E116	**8 inputs 0.2 ms, 5 VDC**
PCD3.E160	**16 inputs 8 ms, connection via 34-pole ribbon connector**
PCD3.E161	**16 inputs 0.2 ms, connection via 34-pole ribbon connector**
PCD3.E165	**16 inputs 8 ms, connection via 24-pole spring terminal block**
PCD3.E166	**16 inputs 0.2 ms, connection via 24-pole spring terminal block**

Definition of input signals

for 5 VDC	for 12 VDC	for 24 VDC
PCD3.E116	PCD3.E112	PCD3.E110, PCD3.E111, PCD3.E160…E166
		

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.2.1 PCD3.E110/111/112/116, 8 digital inputs

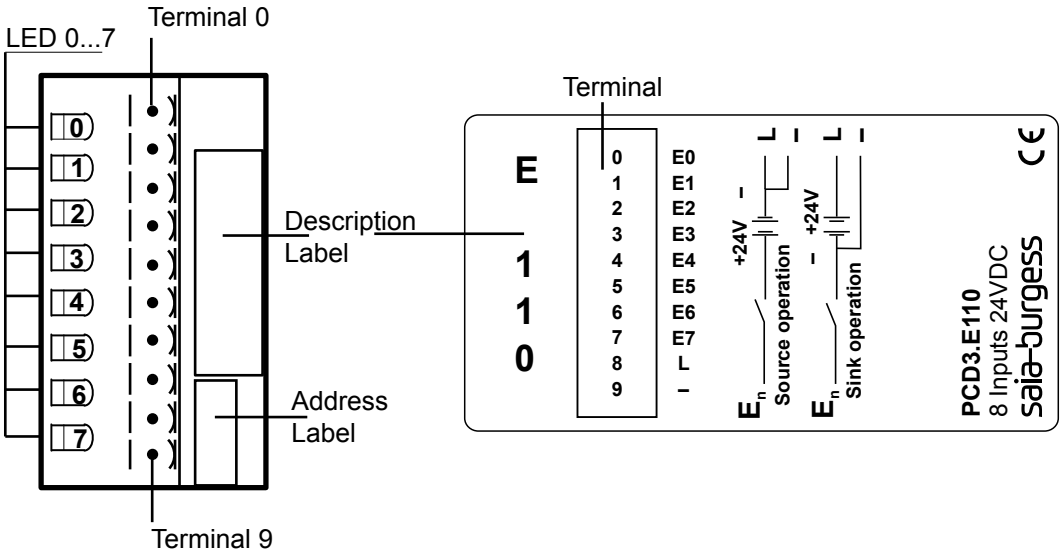
Application

Low-cost input module for source or sink operation with 8 inputs, electrically connected. Suitable for most electronic and electromechanical switching elements at 24 VDC. The PCD3.E111 differs from the PCD3.E110 in its shorter input delay of typically 0.2 ms; the PCD3.E112 and the PCD3.E116 also differ in their lower input voltages of 12 VDC and 5 VDC.

Technical data

Number of inputs:		8 electrically connected, source or sink operation
Input voltage	E110:	24 VDC (15…30 VDC) smoothed or pulsed
	E111:	24 VDC (15…30 VDC) smoothed, max. 10 % ripple
	E112:	12 VDC (7.5…15 VDC) smoothed, max. 10 % ripple
	E116:	5 VDC (1…7 VDC) smoothed, max. 10 % ripple
	Special:	Further values on request
Input current:		6 mA at 24 VDC
Input delay	E110:	typ. 8 ms
	E111:	typ. 0.2 ms
	E112:	typ. 9 ms
	E116:	typ. 0.2 ms
Resistance to interference: acc. to IEC 801-4		2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)		1…24 mA typ. 12 mA
Internal current consumption: (from V+ bus)		0 mA
External current consumption:		max. 48 mA (all inputs = 1) from 24 VDC
Terminals:		Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

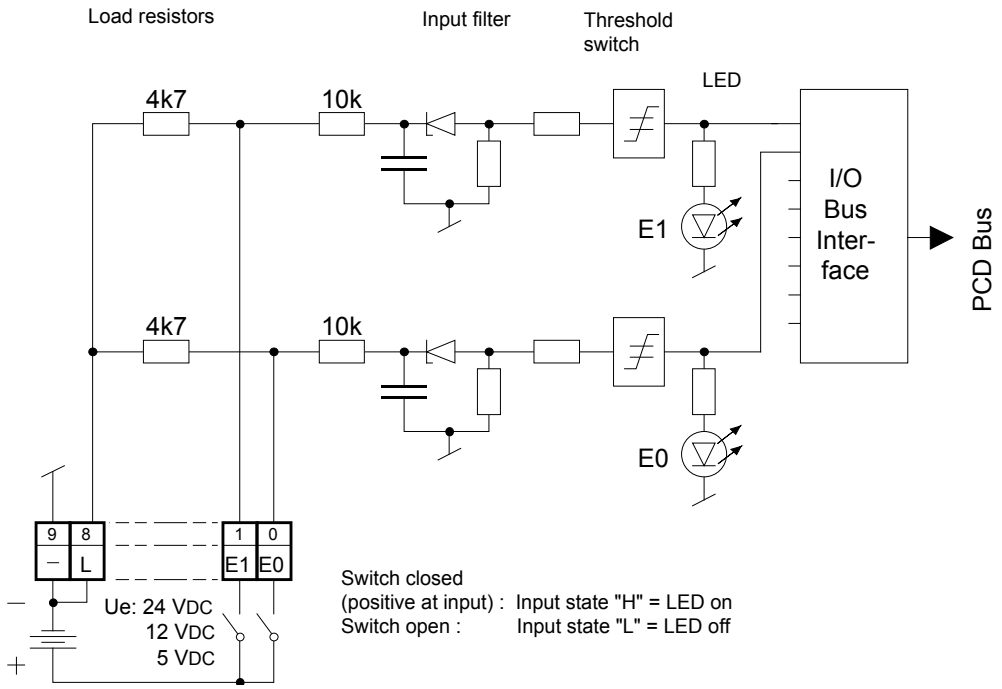
LEDs and connection terminals



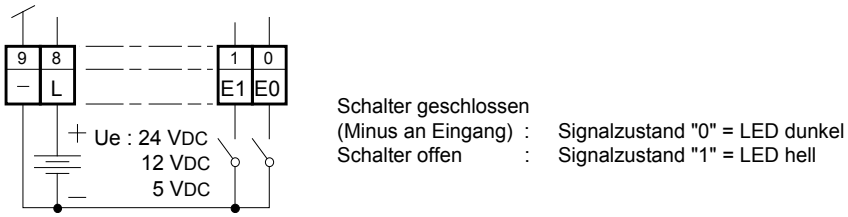
Input circuits and terminal designation

Depending on external wiring, this module may be used for source or sink operation.

Source operation (positive logic):



Sink operation (negative logic):



Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.2.2 PCD3.E160/161, 16 digital inputs, ribbon cable connector

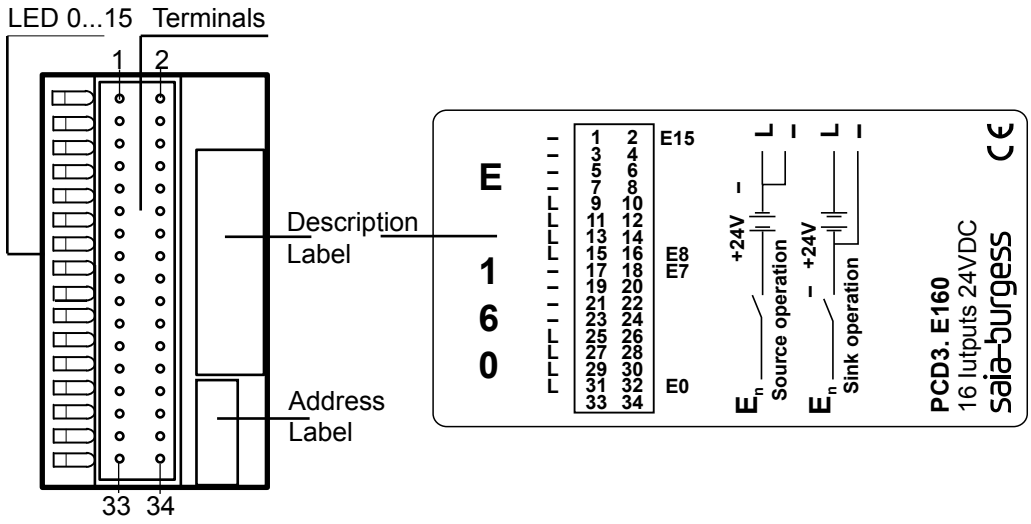
Application

Module for source or sink operation with 16 inputs, electrically connected. Suitable for most electronic and electromechanical switching elements at 24 VDC. The PCD3.E161 has a shorter input delay of typically 0.2 ms.

Technical data

Number of inputs:		16 electrically connected, source or sink operation
Input voltage	E160: E161:	24 VDC (15…30 VDC) smoothed or pulsed 24 VDC (15…30 VDC) smoothed max. 10 % ripple
Input current:		4 mA per input at 24 VDC
Input delay	E160: E161:	typically 8 ms typically 0.2 ms
Resistance to interference: acc. to IEC1000-4-4		2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)		1…10 mA typically 8 mA
Internal current consumption: (from V+ bus)		0 mA
External current consumption		max. 64 mA (all inputs=1) at 24 VDC
Terminals:		34-pole ribbon cable connector

LEDs and connection terminals



Saia-Burgess Controls provides a wide range of pre-configured cables with a 34-pole ribbon connector at one or both ends.

These connection cables can be plugged at one end into the PCD3.E160 I/O module and at the other end into an I/O terminal adapter.
The following adapters are obtainable from Saia-Burgess Controls: terminal adapters for connecting 3-wire sensors to individual terminals for Signal, Plus and Minus; terminal adapters for connecting 16 I/Os with and without LED and relay interface; and terminal adapters with changeover contacts for signal conversion for digital output modules.

Further information can be found in the Manual on *"System cables and connection system"* 26/792.

The following materials can be ordered from ‘3M’:

- Socket connector 34-pole Type 3414-6600
- (Metal strain relief) *) Type 3448-2034
- (Handle for socket connector 34-pole) *) Type 3490-3

Matching cables can be ordered in reels from '3M':

- Ribbon cable 34-pole, grey with pin 1 identification Type 3770/34 or 3801/34
- Round cable 34-pole, grey with pin 1 identification Type 3759/34

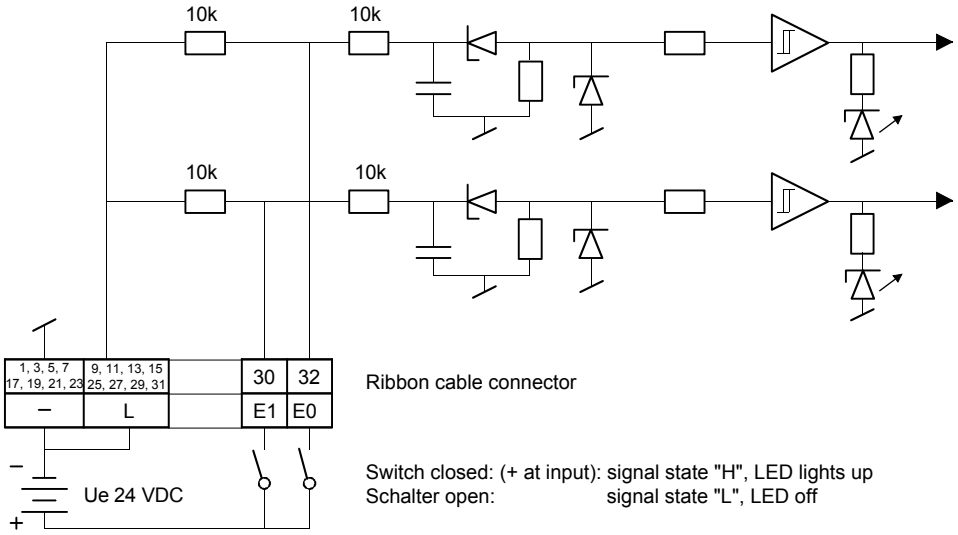
*) optional

Input circuits and terminal designation

Depending on external wiring, this module may be used for source or sink operation.

6

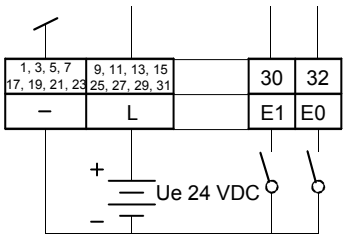
Source operation (positive logic):



Ribbon cable connector

Switch closed: (+ at input): signal state "H", LED lights up
Schalter open: signal state "L", LED off

Sink operation (negative logic):



Ribbon cable connector

Switch closed: (- at input): signal state "L", LED off
Switch open: signal state "H", LED lights up

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.

For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.2.3 PCD3.E165/166, 16 digital inputs, cage clamp terminal connectors

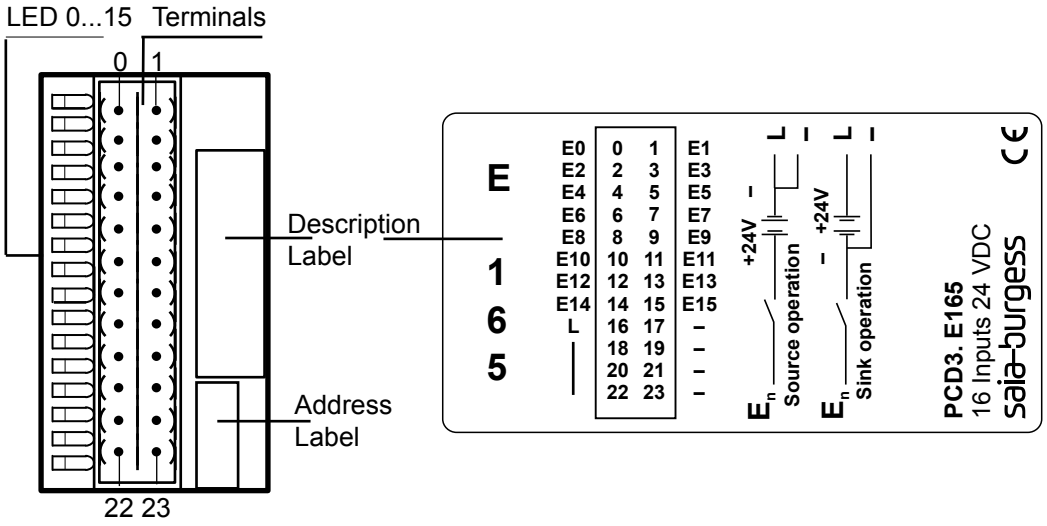
Application

Low-cost input module for source or sink operation with 16 inputs, electrically connected. Suitable for most electronic and electromechanical switching elements at 24 VDC. The PCD3.E166 differs from the PCD3.E165 in its shorter input delay, typically 0.2 ms.

Technical data

Number of inputs:		16 electrically connected, source or sink operation
Input voltage	E165: E166:	24 VDC (15…30 VDC) smoothed or pulsed 24 VDC (15…30 VDC) smoothed max. 10 % ripple
Input current:		4 mA per input at 24 VDC
Input delay	E165: E166:	typically 8 ms typically 0.2 ms
Resistance to interference: acc. to IEC1000-4-4		2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)		1…10 mA typically 8 mA
Internal current consumption: (from V+ bus)		0 mA
External current consumption		max. 64 mA (all inputs=1) at 24 VDC
Terminals:		Pluggable 24-pole spring terminal block (4 405 4956 0), for Ø up to 1 mm²,

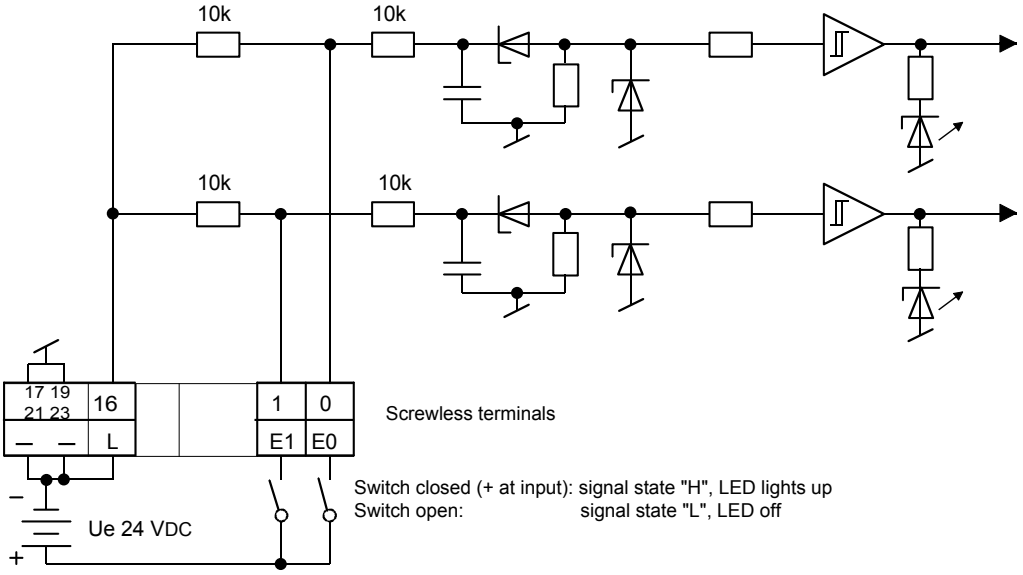
LEDs and connection terminals



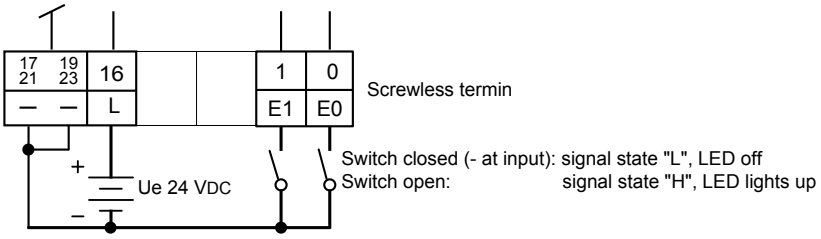
Input circuits and terminal designation

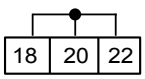
Depending on external wiring, this module may be used for source or sink operation.

Source operation (positive logic):



Sink operation (negative logic):





internal connected,
may be used as "distributor",
together max. 500 mA !

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.

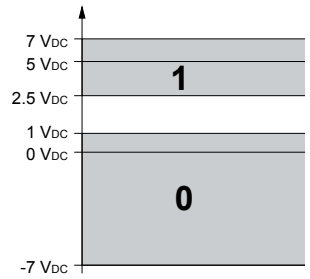
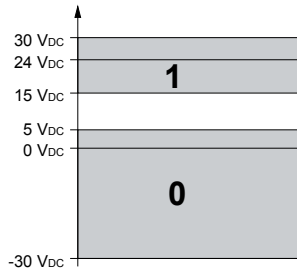
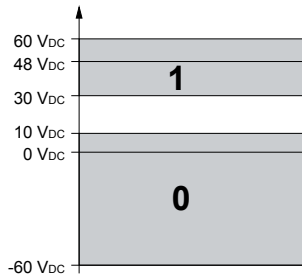
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

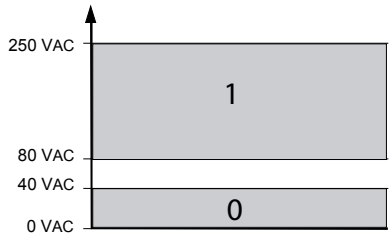
6.3 Digital input modules, electrically isolated from the I/O Bus

PCD3.E500	**6 inputs for 115 … 230 VAC**
PCD3.E610	**8 inputs 24 VDC, 10 ms**
PCD3.E613	**8 inputs 48 VDC, 9 ms**

Electrical isolation of inputs to the PCD.
The channels are not isolated from each other

Definition of input signals

for 5 VDC	for 24 VDC	for 48 VDC
(on request)	PCD3.E610	PCD3.E613
		

for 115 – 230 VAC
PCD3.E500


Installation instructions

For reasons of safety it is not permissible to connect low voltages (up to 50V) and higher voltages (50…250 V) to the same module.

If a PCD module is connected to a higher voltage (50…250 V), approved components for this voltage must be used for all elements that are electrically connected to the system.

Using higher voltage (50…250V), all connections to the relay contacts must be connected on the same circuit, i.e. in such a way that they are all protected against one AC phase by one common fuse. Each load circuit may however be fused individually.

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.3.1 PCD3.E500, 6 digital inputs, electrically isolated from the I/O Bus

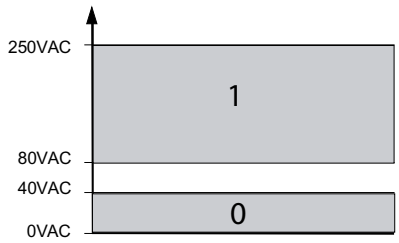
Application

Module with 6 electrically isolated inputs for alternating current. The inputs are set up for source operation and have one common "COM" terminal. Only the positive half-wave of the alternating current is used.

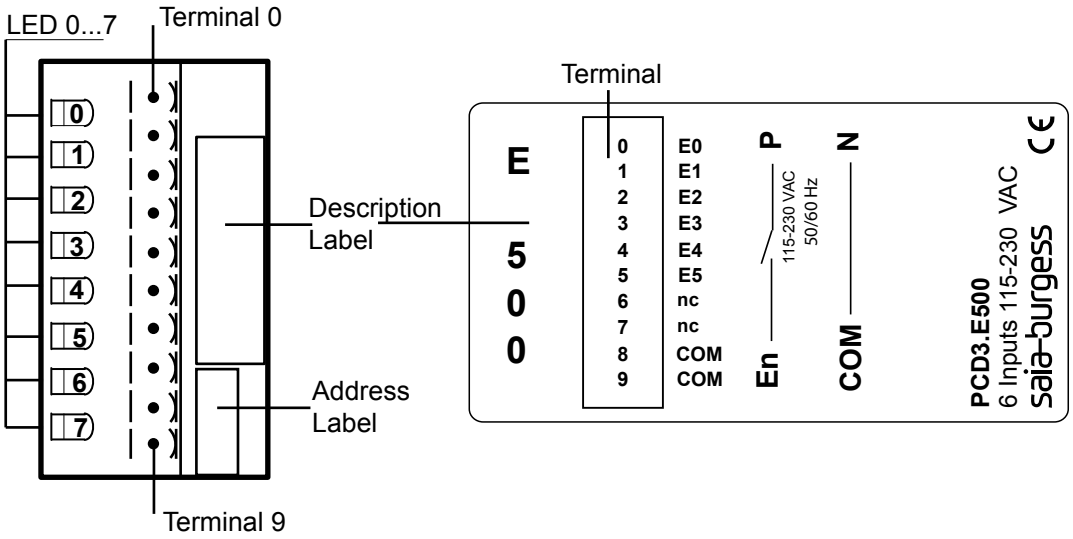
Technical data

Number of inputs	6 electrically isolated from the CPU, source operation, all inputs to the module in the same phase
Input voltage	115/230 V 50/60 Hz, sinusoidal (80 to 250 VAC)
Input current	115 VAC: 5…6 mA (wattless current) 230 VAC: 10…12 mA (wattless current)
Input delay switch-on: switch-off:	 typ. 10 ms; max. 20 ms typ. 20 ms; max. 30 ms
LED	supplied directly from input current
Resistance to interference acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Electrical isolation voltage	2000 VAC, 1 min
Electrical isolation resistance	100 MΩ / 500 VDC
Optocoupler isolation voltage	2.5 kV
Internal current consumption: (from +5 V bus)	< 1 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	0 mA
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

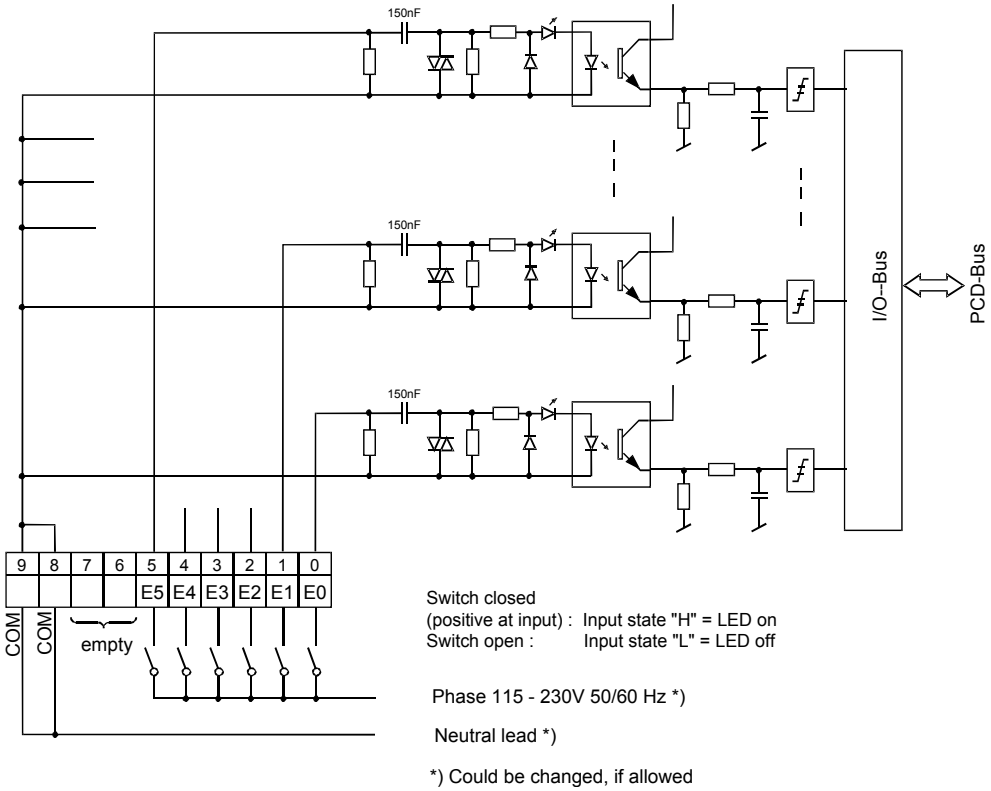
Switch on/off level:



LEDs and connection terminals



Input circuits and terminal designation



Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.3.2 PCD3.E610/613, 8 digital inputs, electrically isolated from the I/O Bus

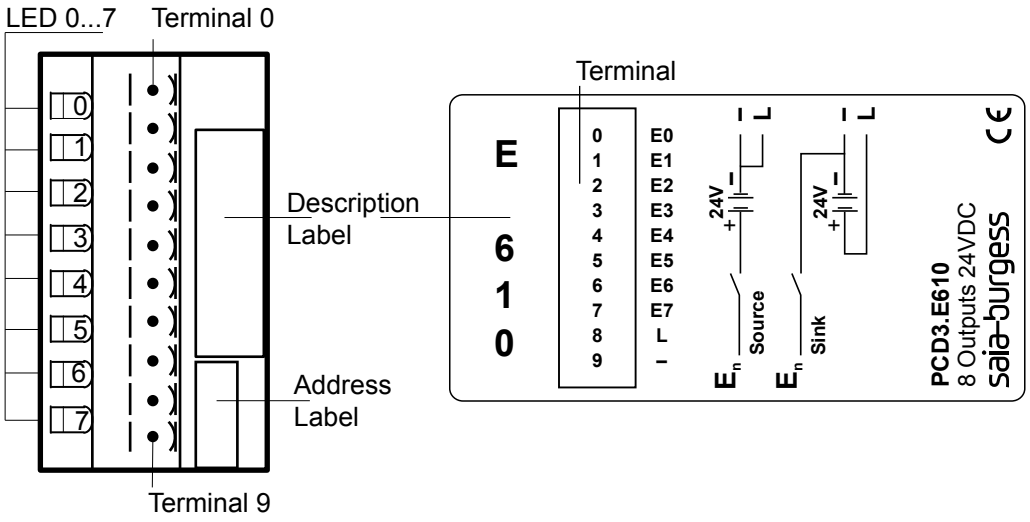
Application

Input module for source or sink operation with 8 inputs, electrically isolated by optocoupler. Suitable for most electronic and electromechanical switching elements at 24 VDC.

Technical data

Number of inputs:		8 electrically isolated by optocoupler, source or sink operation, all inputs to the model in the same phase
Input voltage	E610: E613:	24 VDC (15…30 VDC) smoothed or pulsed 48 VDC (30…60 VDC) smoothed max. 10 % ripple
Supply voltage: for source operation: for sink operation:		E610: E613: min. 15 V 30 V min. 18 V 36 V
Input current: (at input voltage) for source operation: for sink operation:		E610: E613: (24 VDC) (48 VDC) 5 mA 2 mA 3.7 mA 1.5 mA
Input delay (0-1/1-0):		E610: E613: incl. 10 ms 9 ms excl. 10 ms 9 ms
Resistance to interference: acc. to IEC 801-4		4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Electrical isolation voltage: Optocoupler isolation voltage:		1000 VAC, 1 min. 2.5 kV Electrical isolation of outputs to the PCD. The channels are not isolated from each other
Internal current consumption: (from +5 V bus)		1…24 mA typ. 12 mA
Internal current consumption: (from V+ bus)		0 mA
External current consumption:		max. 40 mA (all inputs=1) at 24 VDC, (source operation), max. 18 mA (sink operation)
Terminals:		Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

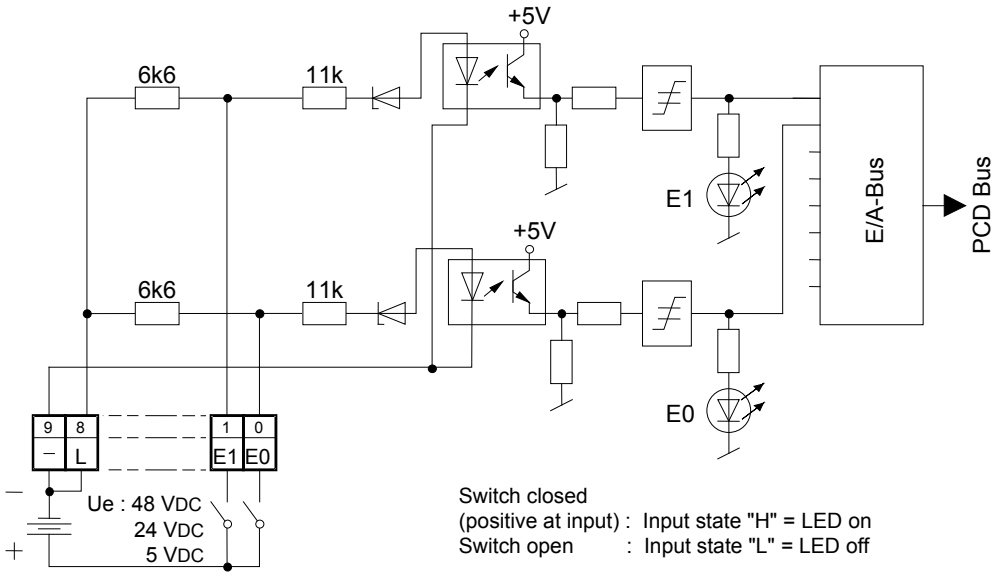
LEDs and connection terminals



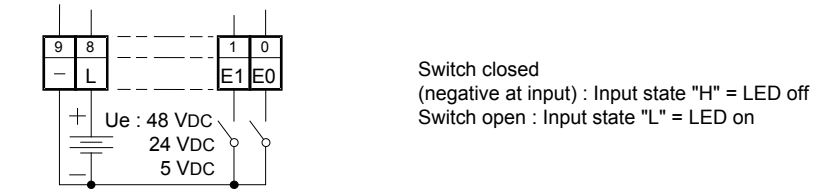
Input circuits and terminal designation

Depending on external wiring, this module may be used for source or sink operation.

Source operation (positive logic):



Sink operation (negative logic):



Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD2 components.

6.4 Digital output modules

PCD3.A300	**6 outputs 2 A**
PCD3.A400	**8 outputs 0.5 A**
PCD3.A460	**16 outputs 0.5 A, connection via 34-pole ribbon connector**
PCD3.A465	**16 outputs 0.5 A, connection via 24-pole spring terminal block**

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.4.1 PCD3.A300, 6 digital outputs for 2 A each

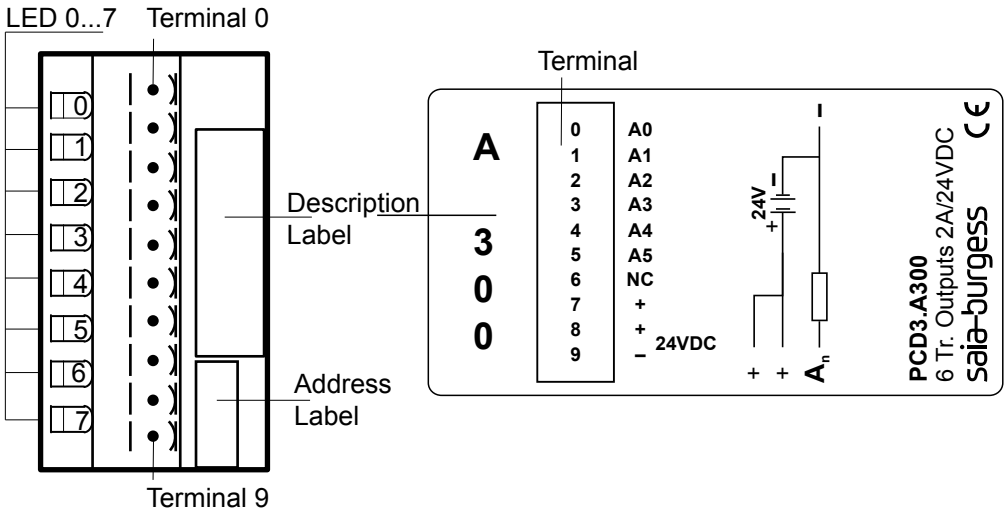
Application

Low cost output module with 6 transistor outputs 5 mA…2 A, without short-circuit protection. The individual circuits are electrically connected; the voltage range is 10…32 VDC.

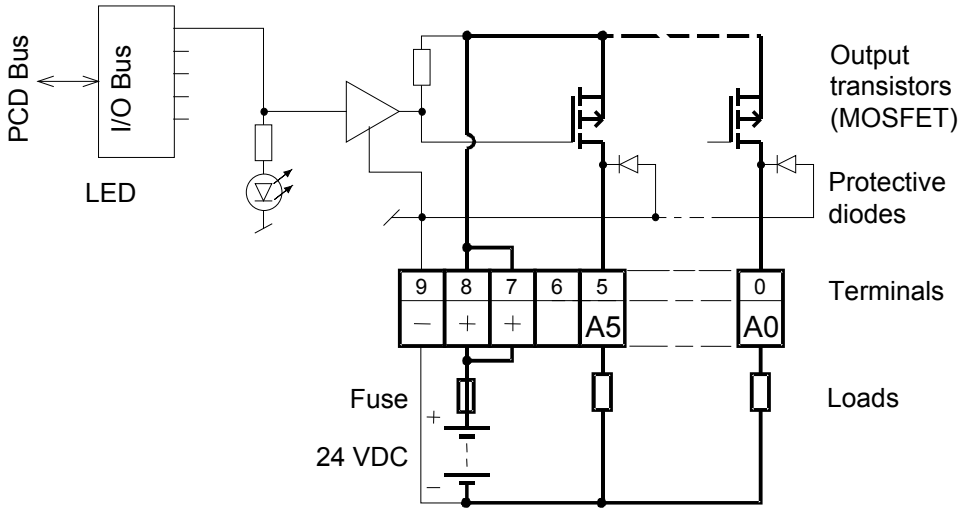
Technical data

Number of outputs:	6, electrically connected
Output current:	5 mA…2 A (leakage current max. 0.1 mA)
Total current per module:	6×2 A = 12 A (on 100% duty cycle)
Operating mode:	Source operation (positive switching)
Voltage range:	10…32 VDC, smoothed 10…25 VDC, pulsed
Voltage drop:	0.2V at 2 A
Output delay:	Switch-on delay <1 µs Switch-off delay <200 µs with inductive loads the delay is longer, because of the protective diode.
Isolation voltage:	1000 VAC, 1 min
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…20 mA typically 12 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	Plug-in 10-pole spring terminal block(4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



Output circuits and terminal designation



Output conducting (set): LED on
Output disconnected (reset): LED off

Fuse: It is recommended that each module should be separately protected with a fast-blow (S) fuse of max. 12.5 A.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD2 components.

6.4.2 PCD3.A400, 8 digital outputs for 0.5 A each

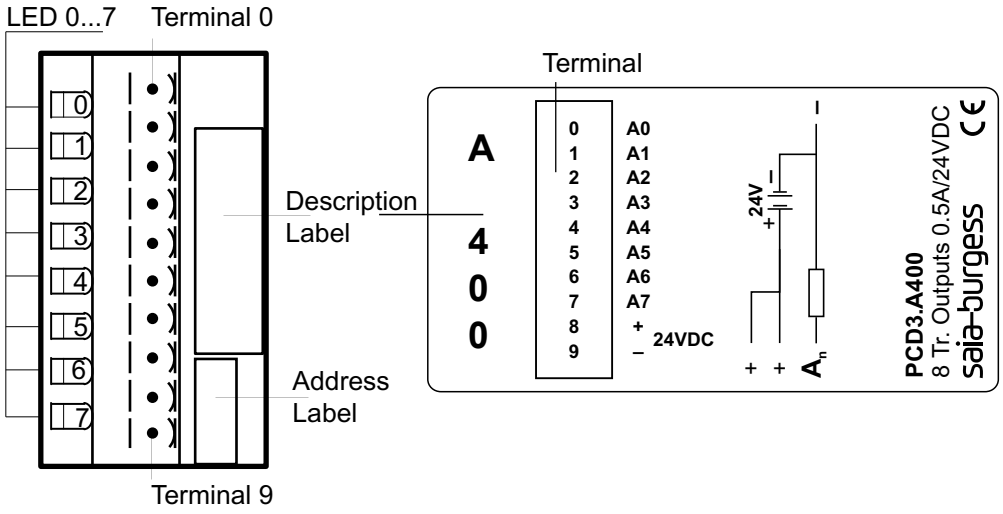
Application

Low cost output module with 8 transistor outputs 5…500 mA, without short circuit protection. For non-isolated circuits in the voltage range 5…32 VDC.

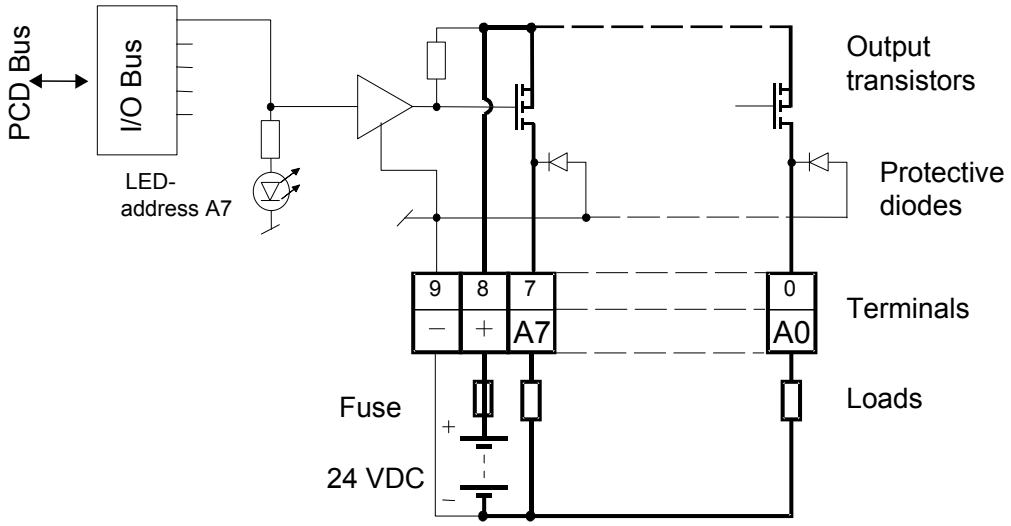
Technical data

Number of outputs:	8, electrically connected
Output current:	5…500 mA (leakage current max. 0,1 mA) Within the voltage range 5…24 VDC, the load resistance should be at least 48 Ω.
Total current per module:	4 A on 100% duty cycle
Operating mode:	Source operation (positive switching)
Voltage range:	5…32 VDC, smoothed 10…25 VDC, pulsed
Voltage drop:	≤ 0.4V at 0.5 A
Output delay:	Switch-on delay typ. 10 µs Switch-off delay typically 50 µs (ohmic load 5…500 mA), longer with inductive load, because of the protective diode.
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…25 mA typically 15 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



Output circuits and terminal designation



Output conducting (set): LED on
Output disconnected (reset): LED off

Fuse: It is recommended that each module should be separately protected with a fast-blow (S) 4 A fuse.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD2 components.

6.4.3 PCD3.A460, 16 digital outputs for 0.5 A each, with ribbon cable connector

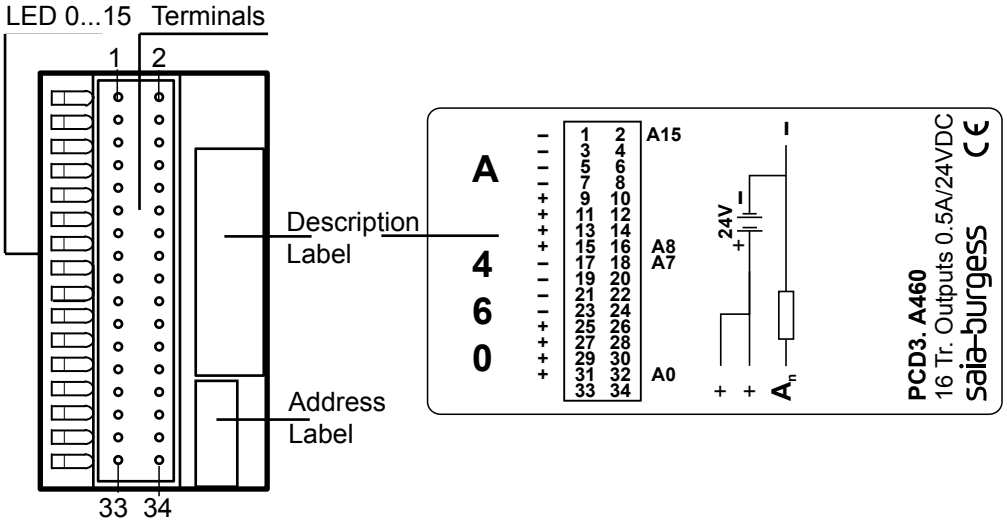
Application

Low cost output module with 16 transistor outputs 5…500 mA, with short-circuit protection. The individual circuits are electrically connected; the voltage range is 10…32 VDC.

Technical data

Number of outputs:	16, electrically connected
Output current:	5…500 mA (leakage current max. 0,1 mA) Within the voltage range 5…24 VDC, the load resistance should be at least 48 Ω.
Short circuit protection	yes
Total current per module:	8 A on 100% duty cycle
Operating mode:	Source operation (positive switching)
Voltage range:	10…32 VDC, smoothed, max. 10% ripple
Voltage drop:	max. 0.3 V at 0.5 A
Output delay:	typ.50 µs, max. 100 µs under ohmic load
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	max 10 mA (all outputs = "1") typically 8 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	34-pole ribbon cable connector

LEDs and connection terminals



Saia-Burgess Controls provides a wide range of pre-configured cables with a 34-pole ribbon connector at one or both ends.

These connection cables can be plugged at one end into the PCD3.E160 I/O module and at the other end into an I/O terminal adapter.
The following adapters are obtainable from Saia-Burgess Controls: terminal adapters for connecting 3-wire sensors to individual terminals for Signal, Plus and Minus; terminal adapters for connecting 16 I/Os with and without LED and relay interface; and terminal adapters with changeover contacts for signal conversion for digital output modules.

Further information can be found in the Manual on *"System cables and connection system"* 26/792.

The following materials can be ordered from '3M':

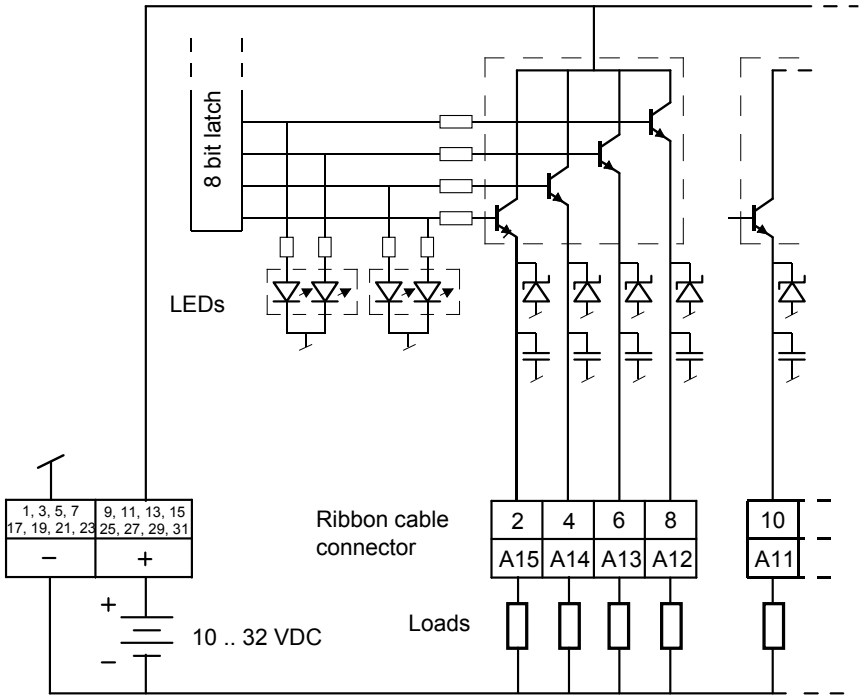
- Socket connector 34-pole — Type 3414-6600
- (Metal strain relief) *) — Type 3448-2034
- (Handle for socket connector 34-pole) *) — Type 3490-3

Matching cables can be ordered in reels from '3M':

- Ribbon cable 34-pole, grey with pin 1 identification — Type 3770/34 or 3801/34
- Round cable 34-pole, grey with pin 1 identification — Type 3759/34

*) optional

Output circuits and terminal designation



Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.

For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.4.4 PCD3.A465, 16 digital outputs for 0.5 A each

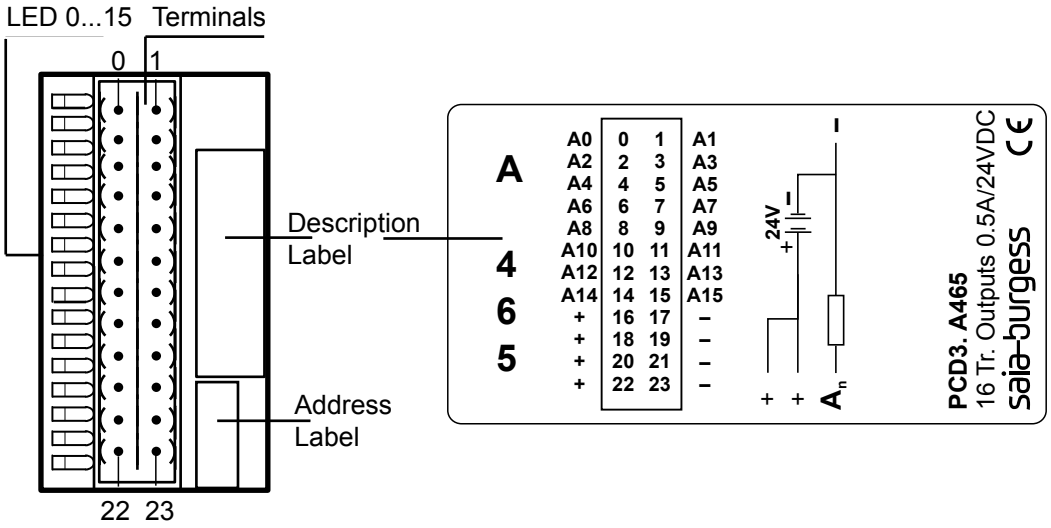
Application

Low cost output module with 16 transistor outputs 5…500 mA, with short-circuit protection. The individual circuits are electrically connected; the voltage range is 10…32 VDC.

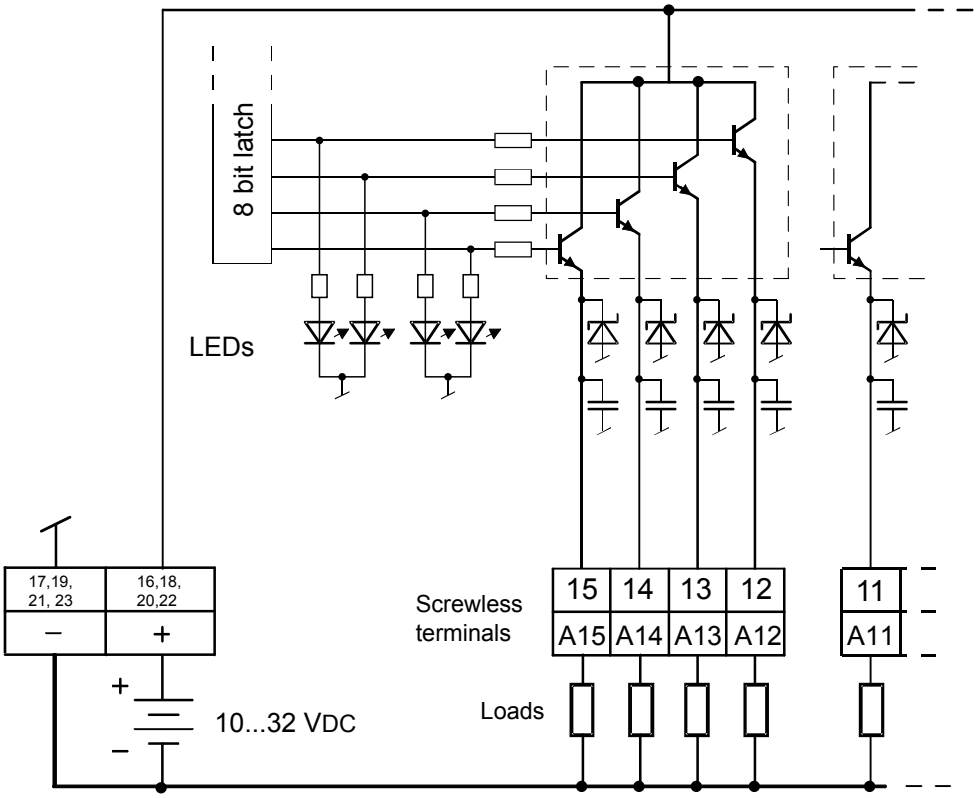
Technical data

Number of outputs:	16, electrically connected
Output current:	5…500 mA (leakage current max. 0,1 mA) Within the voltage range 10…24 VDC, the load resistance should be at least 48 Ω.
Short circuit protection	yes
Total current per module:	8 A on 100% duty cycle
Operating mode:	Source operation (positive switching)
Voltage range:	10…32 VDC, smoothed, max. 10% ripple
Voltage drop:	max. 0.3 V at 0.5 A
Output delay:	typ.50 µs, max. 100 µs under ohmic load
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	max 10 mA (all outputs = "1") typically 8 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	Pluggable 24-pole spring terminal block (4 405 4956 0), for Ø up to 1 mm²,

LEDs and connection terminals



Output circuits and terminal designation



Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.

For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.5 Digital output modules, electrically isolated

PCD3.A200	**4 make contacts 2 A**
PCD3.A210	**4 break contacts 2 A**
PCD3.A220	**6 make contacts 2 A**
PCD3.A251	**6 changeover contacts + 2 make contacts 2 A, 24-pole cage clamp terminal block**
PCD3.A410	**8 outputs 0.5 A**

Installation instructions

For reasons of safety it is not permissible to connect low voltages (up to 50 V) and higher voltages (50…250 V) to the same module.

If a PCD module is connected to a higher voltage (50…250 V), approved components for this voltage must be used for all elements that are electrically connected to the system.

Using higher voltage (50…250 V), all connections to the relay contacts must be connected on the same circuit, i.e. in such a way that they are all protected against one AC phase by one common fuse. Each load circuit may however be fused individually.

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

The Annex, Section A.3 "Relay contacts" contains measurement details and suggested wiring for the relay contacts. For safe switching and a long service life, these figures must be observed.

6.5.1 PCD3.A200, 4 relays with make contacts, with contact protection

Application

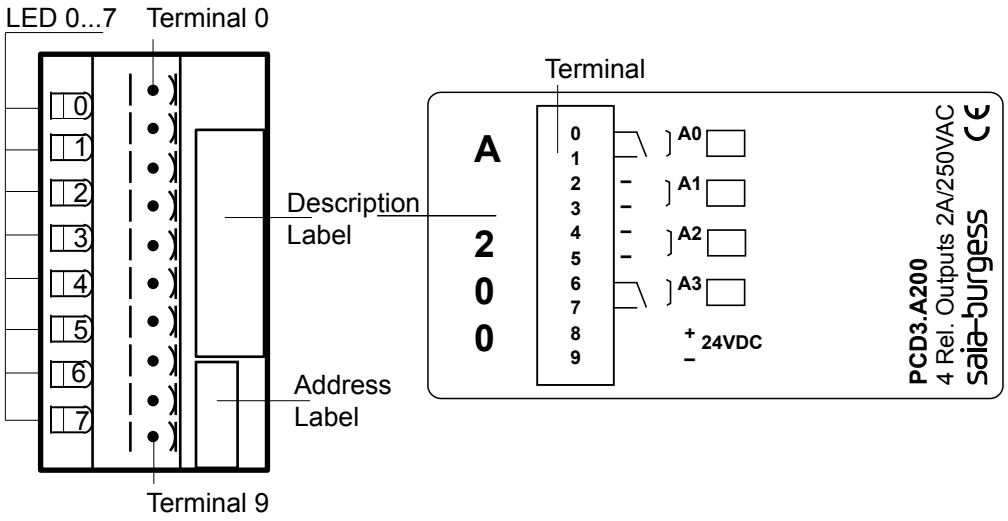
The module contains 4 relays with normally-open contacts for direct or alternating current up to 2 A, 250 VAC. The contacts are protected by a varistor and an RC element. The module is especially suited wherever perfectly isolated AC switching circuits with infrequent switching have to be controlled.

Technical data

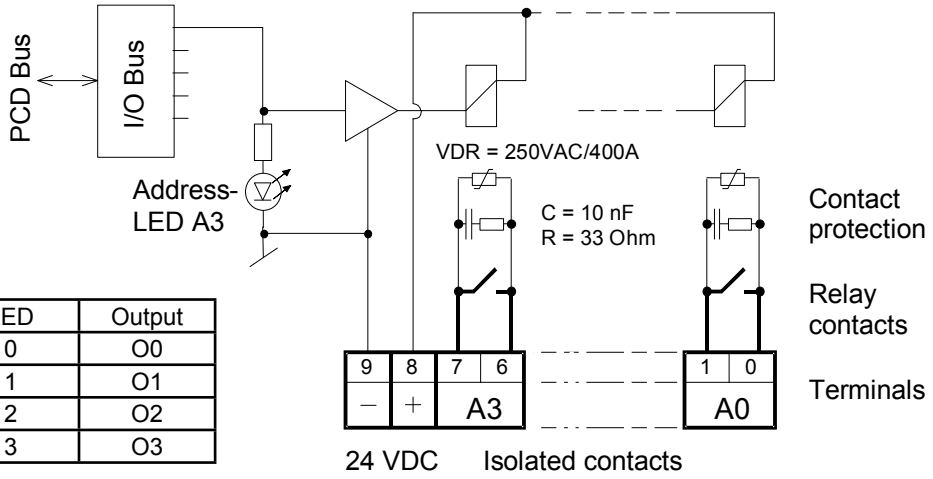
Number of outputs:	4, electrically isolated make contacts
Type of relay (typical):	RE 03 0024, SCHRACK
Switching capacity: (contact lifetime)	2A, 250 VAC AC1 0.7 x 10^6 operations 1 A, 250 VAC AC11 1.0 x 10^6 operations 2 A, 50 VDC DC11 0.3 x 10^6 operations [3] 1 A, 24 VDC DC11 0.1 x 10^6 operations [1)3)]
Relay coil supply: [2]	nominal 24 VDC smoothed or pulsed, 8 mA per relay coil
Voltage tolerance, dependent on ambient temperature:	20°C: 17.0…35 VDC 30°C: 19.5…35 VDC 40°C: 20.5…32 VDC 50°C: 21.5…30 VDC
Output delay:	typically 5 ms at 24 VDC
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…15 mA typically 10 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 32 mA
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²
[1)] With external protective diode [2)] With reverse voltage protection [3)] These ratings are not UL-listed	

The Annex, Section A.3 "Relay contacts" contains measurement details and suggested wiring for the relay contacts. For safe switching and a long service life, these figures must be observed.

LEDs and connection terminals



Output circuits and terminal designation



LED	Output
0	O0
1	O1
2	O2
3	O3

Relay energized (contact closed): LED on
Relay reset (contact open): LED off
24 VDC must be connected to the +/- terminals.

With an open relay contact, the current leakage through the contact protection is **0.7 mA** (at 230 V / 50 Hz). This should be taken into account for smaller AC loads. If this is too high, it is recommended to use a PCD3.A220 module (without contact protection).

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

6.5.2 PCD3.A210, 4 relays with break contacts, with contact protection

Application

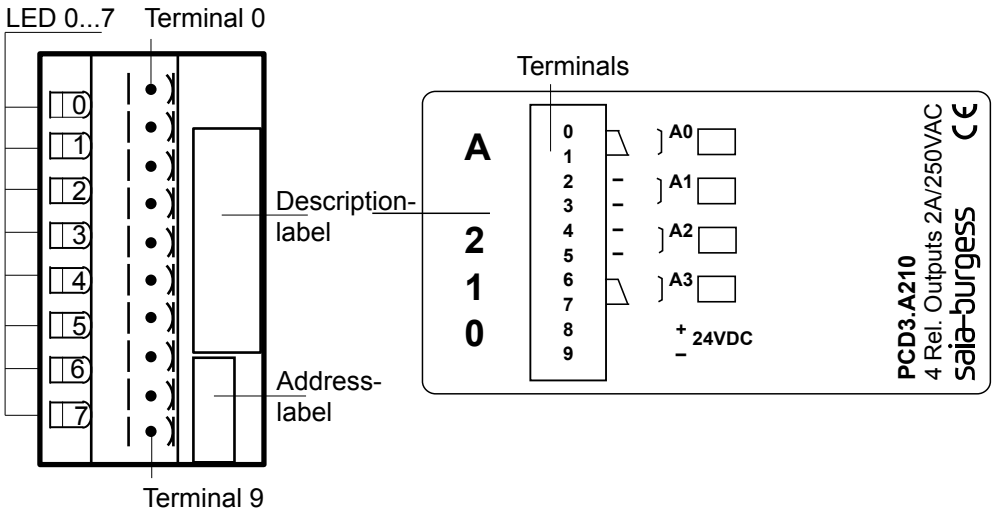
The module contains 4 relays with normally-closed contacts for direct or alternating current up to 2 A, 250 VAC. The contacts are protected by a varistor. The module is especially suited wherever perfectly isolated AC switching circuits with infrequent switching have to be controlled.

Technical data

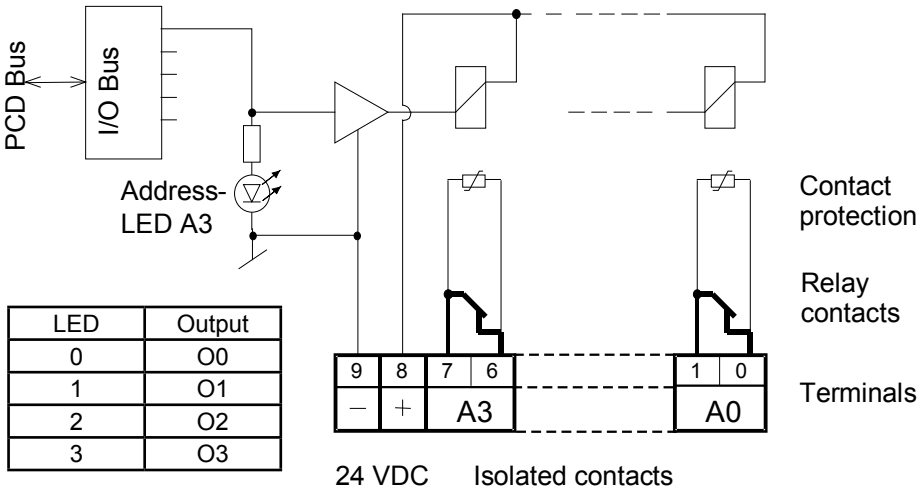
Number of outputs:	4, electrically isolated break contacts
Type of relay (typical):	RE 01 4024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 0.7 x 10^6 operations 1 A, 250 VAC AC11 1.0 x 10^6 operations 2 A, 50 VDC DC11 0.3 x 10^6 operations [3] 1 A, 24 VDC DC11 0.1 x 10^6 operations [1)3)]
Relay coil supply: [2]	nominal 24 VDC smoothed or pulsed, 9 mA per relay coil
Voltage tolerance, dependent on ambient temperature:	20°C: 17.0…35 VDC 30°C: 19.5…35 VDC 40°C: 20.5…32 VDC 50°C: 21.5…30 VDC
Output delay:	typically 5 ms at 24 VDC
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…15 mA typically 10 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 32 mA
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²
[1] With external protective diode [2] With reverse voltage protection [3] These ratings are not UL-listed	

The Annex, Section A.3 "Relay contacts" contains measurement details and suggested wiring for the relay contacts. For safe switching and a long service life, these figures must be observed.

LEDs and connection terminals



Output circuits and terminal designation



LED	Output
0	O0
1	O1
2	O2
3	O3

Relay energized (contact open): LED on
Relay reset (contact closed): LED off
24 VDC must be connected to the +/- terminals.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

6.5.3 PCD3.A220, 6 relays with make contacts, without contact protection

Application

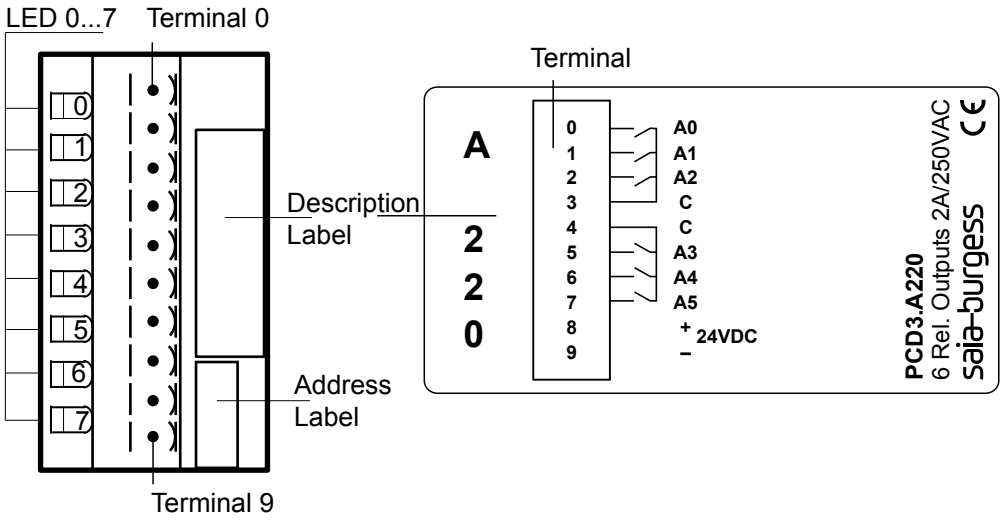
The module contains 6 relays with normally-open contacts for direct or alternating current up to 2 A, 250 VAC. The module is especially suited wherever AC switching circuits with infrequent switching have to be controlled. For space reasons, there is no integrated contact protection. Each group of 3 relays has a common connection.

Technical data

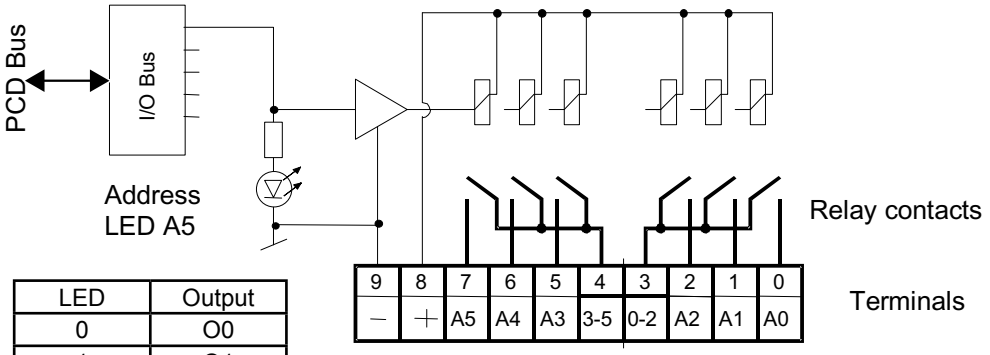
Number of outputs:	3+3 make contacts with common terminal
Type of relay (typical):	RE 03 0024, SCHRACK
Switching capacity: (contact lifetime)	2A, 250 VAC AC1 0.7 x 10^6 operations 1 A, 250 VAC AC11 1.0 x 10^6 operations 2 A, 50 VDC DC11 0.3 x 10^6 operations [3)] 1 A, 24 VDC DC11 0.1 x 10^6 operations [1)3)]
Relay coil supply: [2)]	nominal 24 VDC smoothed or pulsed, 8 mA per relay coil
Voltage tolerance, dependent on ambient temperature:	20°C: 17.0…35 VDC 30°C: 19.5…35 VDC 40°C: 20.5…32 VDC 50°C: 21.5…30 VDC
Output delay:	typically 5 ms at 24 VDC
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…20 mA typically 10 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 48 mA
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²
[1)] With external protective diode [2)] With reverse voltage protection [3)] These ratings are not UL-listed	

The Annex, Section A.3 "Relay contacts" contains measurement details and suggested wiring for the relay contacts.
For safe switching and a long service life, these figures must be observed.

LEDs and connection terminals



Output circuits and terminal designation



LED	Output
0	O0
1	O1
2	O2
3	O3
4	O4
5	O5

Relay energized (contact closed): LED on
Relay reset (contact open): LED off
24 VDC must be connected to the +/- terminals.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

6.5.4 PCD3.A251, 8 relays, 6 with changeover contacts, 2 with make contacts

Application

The module contains 8 relays for direct or alternating current up to 2 A, 48 VAC. 6 of them have changeover contacts and 2 of them make contacts. The module is especially suited wherever AC switching circuits with infrequent switching have to be controlled. For space reasons, there is no integrated contact protection.

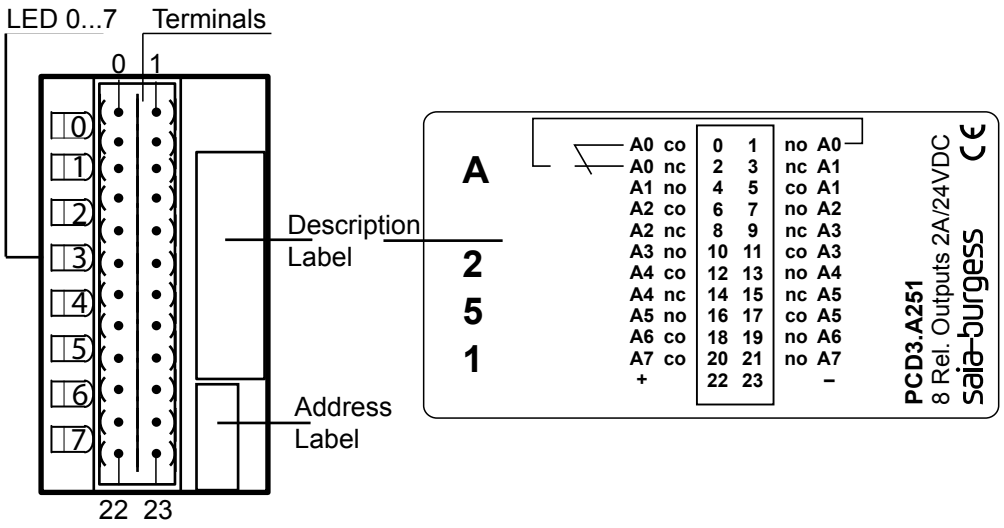
Technical data

Number of outputs:	6 changeover contacts and 2 make contacts.
Relay type:	RE 014024, SCHRACK
Operating mode:	> 12 V, > 100 mA
Switching capacity: *) (contact lifetime)	2A, 48 VAC AC1 0.7 x 10^6 operations 1 A, 48 VAC AC11 1.0 x 10^6 operations 2 A, 50 VDC DC1 0.3 x 10^6 operations [3] 1 A, 24 VDC DC11 0.1 x 10^6 operations [1][3]
Relay coil supply: [2]	nominal 24 VDC smoothed or pulsed, 8 mA per relay coil
Voltage tolerance, dependent on ambient temperature:	20°C: 17.0…35 VDC 30°C: 19.5…35 VDC 40°C: 20.5…32 VDC 50°C: 21.5…30 VDC
Output delay:	typically 5 ms at 24 VDC
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…25 mA typically 15 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 64 mA
Terminals:	Pluggable 24-pole spring terminal block (4 405 4956 0), for Ø up to 1 mm²,
[1] With external protective diode [2] With reverse voltage protection [3] These ratings are not UL-listed	

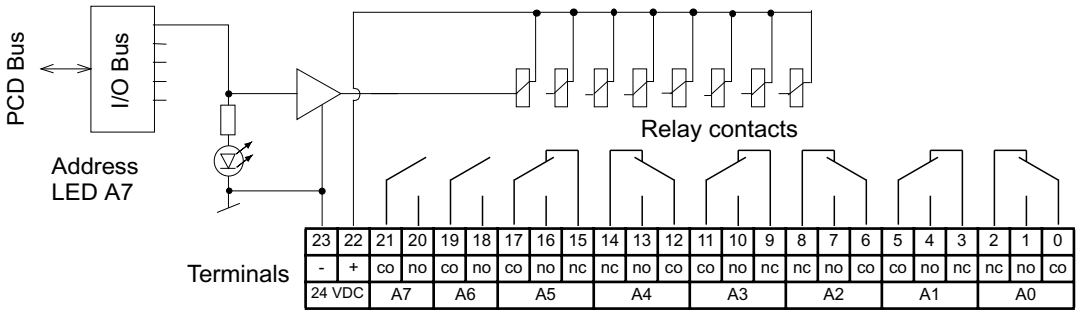
***)** Higher voltages are not allowed for this module because clearances between circuit paths too small.

The Annex, Section A.3 "Relay contacts" contains measurement details and suggested wiring for the relay contacts. For safe switching and a long service life, these figures must be observed.

LEDs and connection terminals



Output circuits and terminal designation



LED	Outputs
0	O0
1	O1
2	O2
3	O3
4	O4
5	O5
6	O6
7	O7

Relay energized (contact closed): LED on
Relay reset (contact open): LED off
24 VDC must be connected to the +/- terminals.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

6.5.5 PCD3.A410, 8 digital outputs for 0.5 A each, electrically isolated

Application

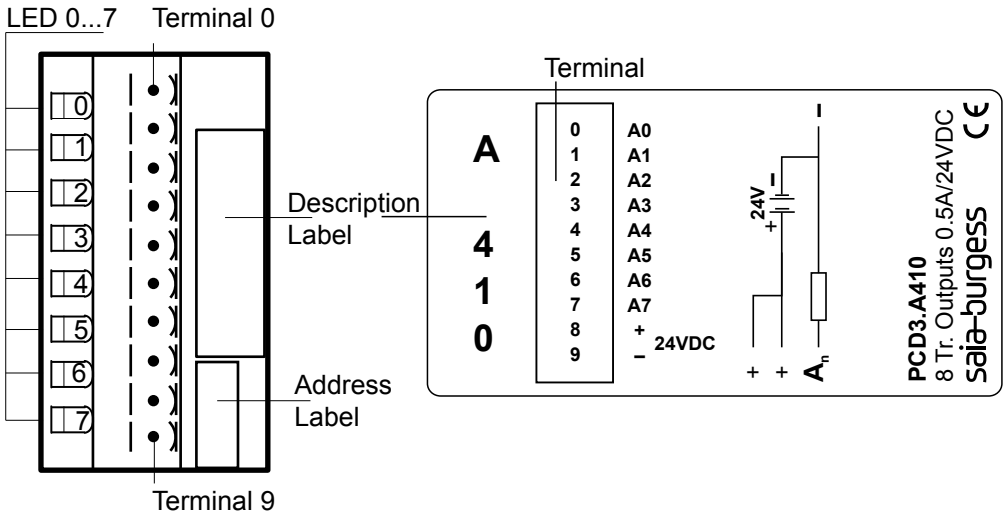
Output module, electrically isolated from the CPU, with 8 MOSFET transistor outputs, without short-circuit protection. Voltage range 5…32 VDC.

This module is not suitable for triggering the PCA2.D12/D14 display modules.

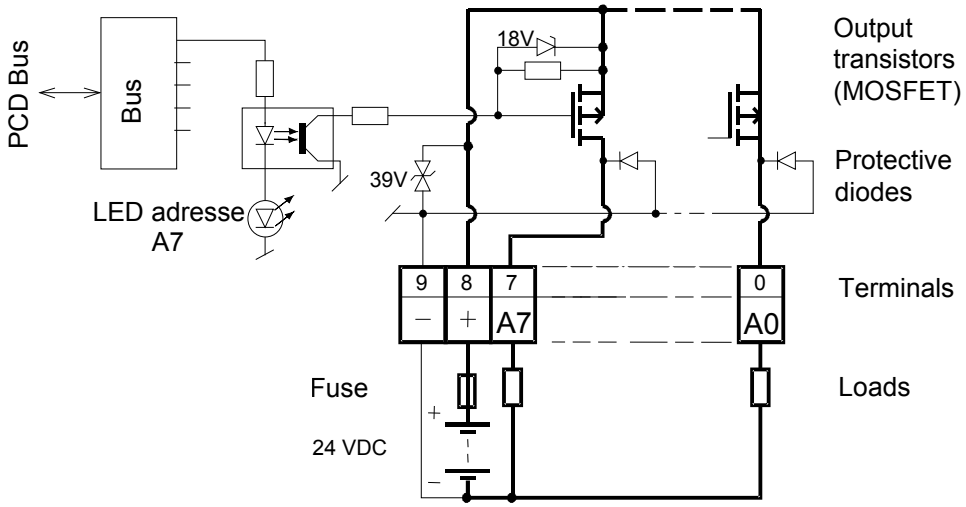
Technical data

Number of outputs:	8, electrically isolated
Output current:	1…500 mA (leakage current max. 0,1 mA) Within the voltage range 5…24 VDC, the load resistance should be at least 48 Ω.
Total current per module:	4 A on 100% duty cycle
Operating mode:	Source operation (positive switching)
Voltage range:	5…32 VDC, smoothed 10…25 VDC, pulsed
Voltage drop:	≤ 0.4 V at 0.5 A
Output delay:	Switch-on delay typ. 10 µs Switch-off delay typically 50 µs (ohmic load 5…500 mA), longer with inductive load, because of the protective diode.
Isolation voltage:	1000 VAC, 1 min
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…24 mA typically 15 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



Output circuits and terminal designation



Output conducting (set): LED on
Output disconnected (reset): LED off

Fuse: It is recommended that each module should be separately protected with a fast-blow (S) 4 A fuse.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

6.6 Digital output modules for manual operation, electrically isolated

PCD3.A810	**Manual control module, with 2 changeover and 2 make contacts**
PCD3.A860	**Light and shade module, with 2 make contacts**

The Annex, Section A.3 "Relay contacts" contains measurement details and suggested wiring for the relay contacts.
For safe switching and a long service life, these figures must be observed.

6.6.1 PCD3.A810, Digital manual control module with 4 relays, 2 with changeover, 2 with make contacts

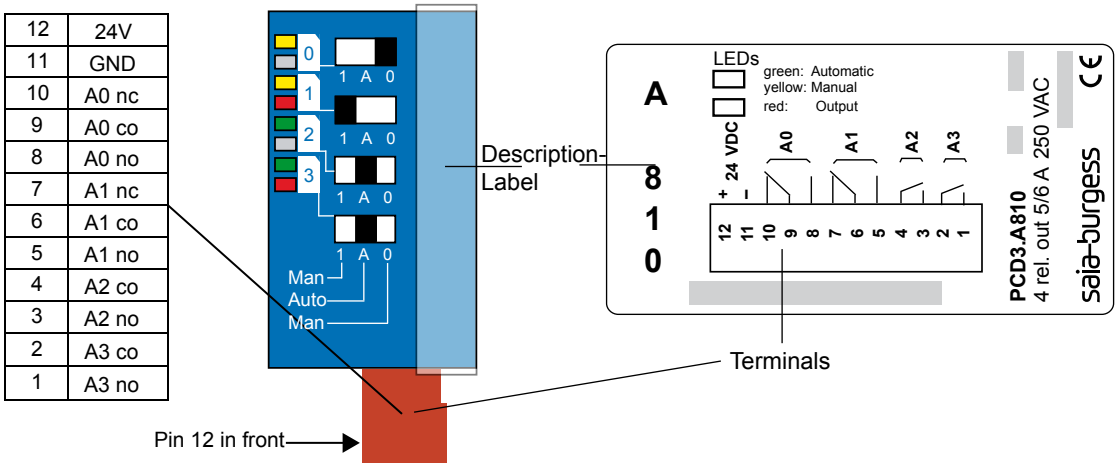
Application

The module has 4 relay outputs: 2 changeover and 2 make contacts. Each channel has a switch with the settings MAN 1, AUTO, MAN 0. On MAN 0, the relay is always switched off; on MAN 1 it is always switched on; on AUTO the switch state is defined by the application program. This is not an emergency module that will work even when the PCD is switched off (or defective). The external 24 V supply feeds only the relays, and not the logic. For space reasons, there is no integrated contact protection (for emergency and manual operation, see also section 3.19).

Technical data

Number of outputs:	4, 2 changeover (O 0, 1) and 2 make contacts (O 2, 3)
Switching capacity	
Relay type changeover (O 0, 1):	RE 01 4024, SCHRACK
Operating mode:	> 12 V, > 100 mA
Max. switching current:	5 A, 250 VAC AC1
Contact lifetime *):	5 A, 250 VAC AC1 1.5 × 10^5 operations 2 A, 250 VAC AC15 1.2 × 10^5 operations cosφ=0.3
Relay type make (O 2, 3):	RE 03 0024, SCHRACK
Operating mode:	> 12 V, > 100 mA
Max. switching current:	6 A 250 VAC AC1
Contact lifetime *):	6 A, 250 VAC AC1 1 × 10^5 operations 2 A, 250 VAC AC11 4 × 10^5 operations
*) there are no suppressors fitted to the module; these must be provided externally .	
Switching delay:	typically 5 ms at 24 VDC
Internal current consumption: (from +5 V bus)	max. 45 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 45 mA
Relay coil supply:	nom. 24 VDC smoothed or pulsed, reverse voltage protected
Voltage tolerance, dependent on ambient temperature:	20°C: 21.5…32 VDC 30°C: 21.9…32 VDC 40°C: 22.3…32 VDC 50°C: 22.8…32 VDC
Isolation	
Withstand voltage - coil contacts Withstand voltage - open contact circuit	4 kV (relay details) 1 kV (relay details)
Terminals:	Plug-in 12-pole spring terminal block (4 405 4936 0), for Ø up to 1.5 mm², or as above with 12 grouped strands, numbered, 2.5 m long (PCD3.K810)
The supply to the relay coils is not electrically isolated from the PCD side. General technical specifications as per CL-EPC-015 Rev. 02	

LEDs and connection terminals



Control elements

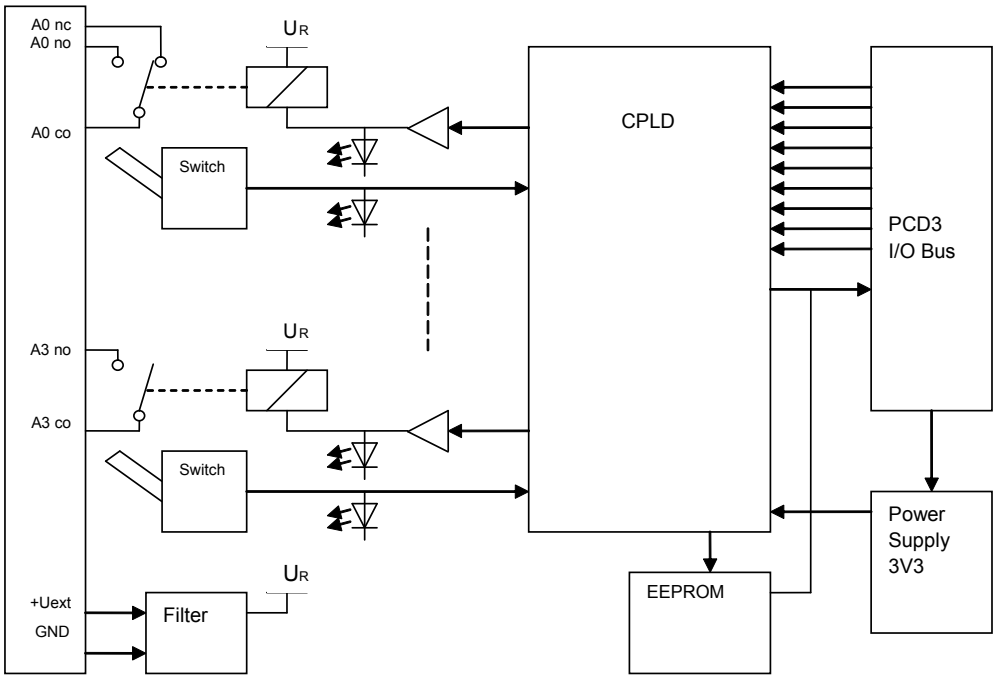
Each channel has a toggle switch with three settings
Manual on, Auto, Manual off.
There are 2 LEDs fitted per channel:
The upper LED is two-colour and displays the operating mode for the channel:
amber = Manual; green = Automatic
The lower LED displays the switch state of the relay:
Red = relay activated.

Example (above):

Output 0:	Manual off	LED 1 = amber
	Relay off	LED 2 = off
Output 1:	Manual on	LED 1 = amber
	Relay on	LED 2 = red
Output 2:	Automatic	LED 1 = green
	Relay off	LED 2 = off
Output 3:	Automatic	LED 1 = green
	Relay on	LED 2 = red

If there is no external supply to the relay coils, the LED does not light up and the relays are not activated.
There is no error message to the PCD where the electrical supply is not present.

Block diagram



Addressing

The PCD3.A810 occupies 16 addresses, of which 8 are used:

Address + BA	**Data read** (inputs)	**Data write** (outputs)
0	Switch state: Output 0	Output 0
1	Switch state: Output 1	Output 1
2	Switch state: Output 2	Output 2
3	Switch state: Output 3	Output 3
4		
5		
6		
7		
8	Switch: Output 0 (0=auto;1=man)	
9	Switch: Output 1 (0=auto;1=man)	
10	Switch: Output 2 (0=auto;1=man)	
11	Switch: Output 3 (0=auto;1=man)	
12		
13		
14		
15		

No FBs or FBoxes are required; the module can be addressed in the same way as a normal relay module. At addresses 0…3, the relay outputs are written to and the effective switch state of the outputs is read back.
The effective switch state is displayed at these addresses in manual operation also. However, the display of the switch state does not indicate whether the external relay supply is present - just as with normal output modules.
The operating mode (Auto or Manual) for each channel can be read at input addresses 8…11; "0" = Auto; “1” = Man.

Restrictions (not applicable with cables, hardware version B)

For the I/O connectors set out below, the following restrictions must be observed:

…on the PCD3.Mxxxx CPUs:

If a PCD3.K106/116 cable is used to connect to the next module holder, do ***not*** plug module into Slot 3 (far right).

The Ethernet cable can be plugged in, but (depending on the RJ45 cable) may touch the I/O connection to the module if in Slot 0.

…on the PCD3.Cxxx module holders:

No restriction, where the PCD3.K010 connector is used to connect to other module holders (the supply connector can also be plugged in to the C200 with no problems).

If a PCD3.K106/116 cable is used to connect from the preceding module holder or to the next module holder, do ***not*** plug the module into Slot 0 (far left) and do ***not*** plug into Slot 3 (far right).

…on PCD3.T76x head stations:

All angled Profibus connectors with max. height 40 mm can be used, e.g.

- ERNI, angled (light grey)
- Siemens “PROFIBUSCONNECTOR“ 6ES7, angled (dark grey) with optional termination resistors
- VIPA 972-0DP10, angled (metallic)

To plug in or remove the Profibus connector, remove the module. A second Profibus cable to extend the network cannot be plugged directly into the first Profibus connector. There are no problems with the RS232 cable and the supply connector, which can be plugged in with the module in place.

If a Profibus connector with height > 40 mm is used, the module ***cannot*** be plugged in to Slot 0 , e.g. with:

- WAGO 750-970 (height=42mm, contacts the I/O connector)

If a PCD3.K106/116 cable is used to connect to the next module holder, do ***not*** plug module into Slot 3 (far right).

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

PCD3.K106/116 cable, hardware version B, with 90° angled connector

6.6.2 PCD3.A860, digital light and shade module, with 2 make contacts

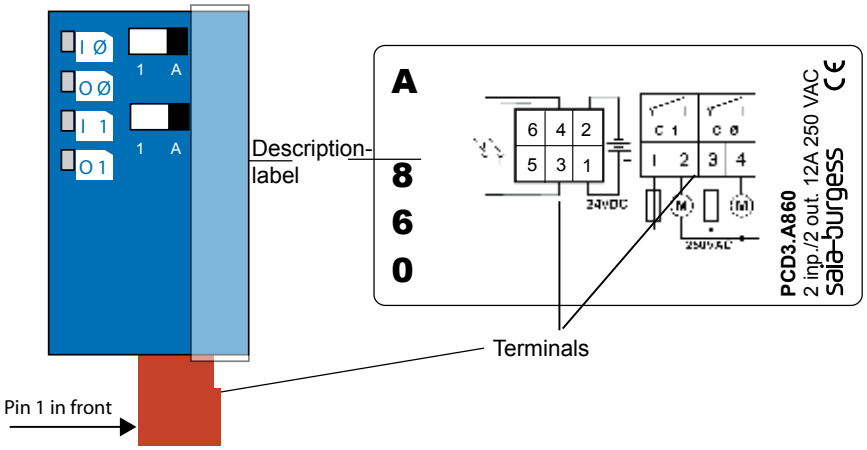
Application

The module is a light and shade module with a manual control option. The desired functionality can be selected in the user program. There are two efficient make contacts (without suppressors) and 2 digital inputs. It is also possible to operate this module in "transparent mode". In this mode, the module is a pure I/O module with two inputs/outputs.

Technical data

Digital inputs:		2
Digital outputs:		2
Contact type		2 make contact
Nominal voltage:		12 A / 250 VAC each
Peak start-up current (20 ms):		80 A (AC)
Reverse voltage protection (U_{ext}):		yes
Time constant of input filter:		typically 6 ms
Internal current consumption: (from +5 V bus)		max. 40 mA (both input LEDs on)
Internal current consumption: (from V+ bus)		0 mA
External current consumption:		max. 40 mA (both relay coils live, both output LEDs on)
Terminals,	Relay outputs:	1 x pluggable 4-pole cage clamp terminal block (4 405 5027 0), for wires up to 2.5 mm², or as above with 4 grouped strands, numbered, 2.5 m long (PCD3.K860)
	Sensor inputs:	1 x pluggable 6-pole cage clamp terminal block (4 405 5028 0), for wires up to 1.0 mm², or as above with 6 grouped strands, numbered, 2.5 m long (PCD3.K861)

LEDs and connection terminals



6

Control elements

- ***Impulse switch:***

  The switches can be used to activate the two inputs manually.
  The keys have the same effect as the external inputs.

  A = Rest position; the module works via the inputs and via the FBox for the relevant function.
  1 = Switch on manually (impulse only)

- ***LEDs:***

  The LEDs (red) display the state of the inputs/outputs.
  I Ø + I 1 are also used to display the U_{ext} error. If U_{ext} is not connected, the two input LEDs flash together.

  I (Ø+1): Inputs 0 + 1 + U_{ext} error
  O (Ø+1): Outputs 0 + 1

- ***Four-pole connector***:

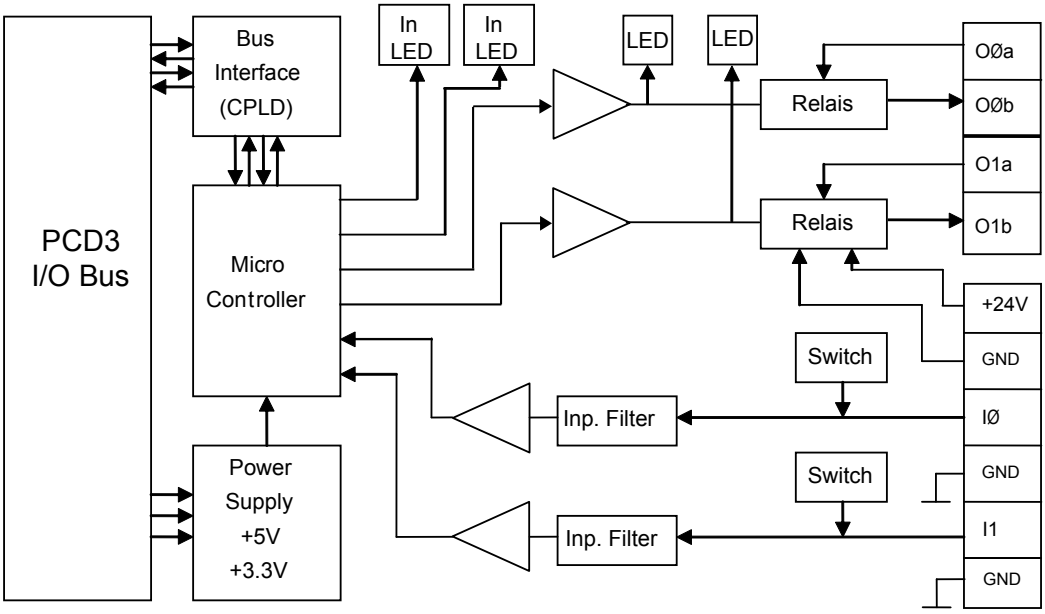
  O Ø Skylight 0 / blind motor up
  O 1 Skylight 1 / blind motor down

- ***Six-pole connector:***

  I Ø (pin 5) – GND (pin 6) external switch for Input 0 (skylight 0 / blind motor up)
  I 1 (pin3) – GND (pin4) external switch for Input 1 (skylight 1 / blind motor down)
  Uext (pin 1) – GND (pin 2) external supply + 24 VDC

  The GND connections are fitted to the circuit board.

Block diagram



Summary of functions

Function	Keys / inputs:	FBox
Shade module	Fully up/down	Fully up/down
	Slat movement up/down	Slat movement up/down (variable)
	-----	Stop all movements
	-----	Reset module and reinitialise
	-----	Block keys and inputs
Light module	On/off per channel (2x)	On/off per channel (2x)
	-----	Reset module and reinitialise
	-----	Block keys and inputs
Transparent module	2 digital inputs (24 VDC sink operation)	2 relay outputs

Description of functions

Shade function, general

With the shade function, the blind drive is connected in such a way that
Relay 0 (OØ) controls upward movement and
Relay 1 (O1) downward movement.

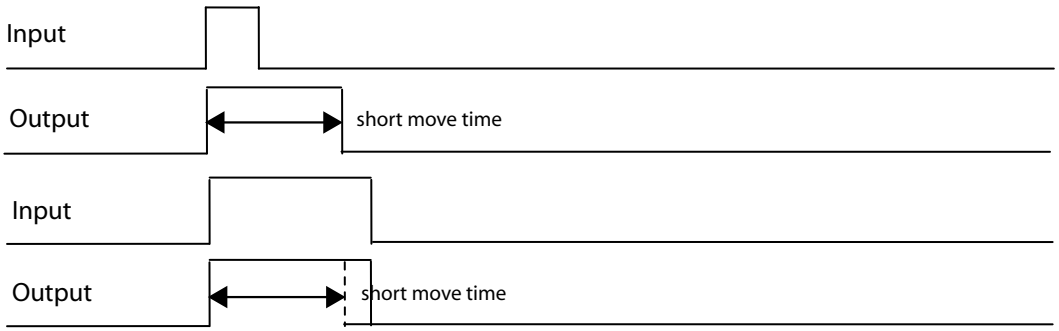
The two outputs are interlocked, so both outputs cannot be activated together. For the correct operation of shade control, the only input information should be from sensors.

The module is set up to use blind systems with integrated limit switches. Suppressors should be fitted externally. The module can be operated by the PCD via an FBox or via the inputs (blind/light switches) on the module. The choice of function and initialisation with the various times is handled exclusively by the F-Box, and must be carried out after activation.

Shade function, short move function

If a key (or ext. Input 0 / Input 1) is activated briefly, the corresponding relay switches on for the "short move time". If the key/input is activated for longer than the "short move time", the output will stay on for as long as the key is pressed.

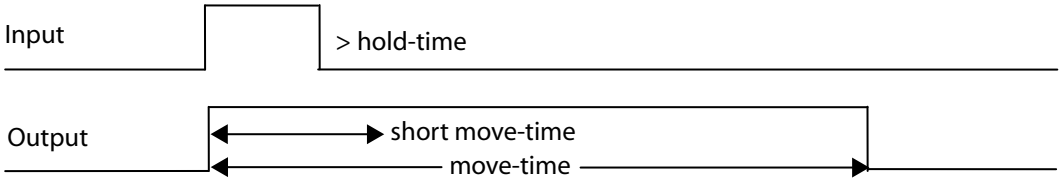
During a short move, the relay cannot be interrupted by any further input or key activation on the module.



Shade function, hold function

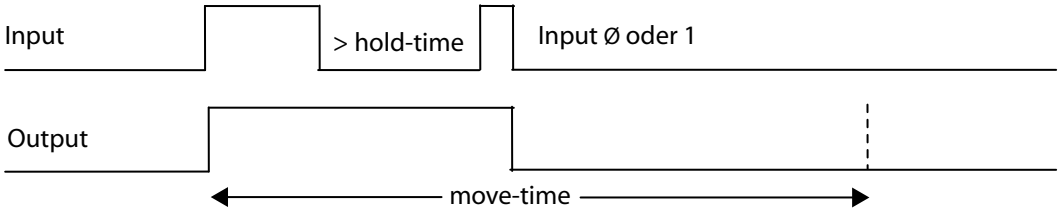
If a key (or Input 0 / Input 1) is activated for longer than the defined "hold time", the module will switch to hold operation. The smallest value that can be set for the hold time is 1 (1/10 second), i.e. the module will switch directly into hold mode.

In hold mode, the output (blinds up/down) stays on for the defined "move time". The module resets the output at the end of this time. The movement can be stopped by activating an input. The processing of these times may be affected by accesses by the PCD. The hold function can also be activated via the FBox.



Stopping the movement

If an output is switched to hold mode, this will stop as soon as a new input pulse is detected, regardless of which key (direction) is pressed.



Special case:
If both keys are pressed together and held down, Relay 0 will switch on and the long ("hold") movement will be executed. When the time has expired, Relay 1 will switch on immediately, and a long movement in the reverse direction will occur.

Light function

With the light function, a skylight is connected to each of Outputs O Ø and O 1. Activating an input / key switches the relevant output on or off. Each pulse at the input switches the output over (toggling).

Where multiple keys are provided for a skylight, they can be wired in parallel to the same output.

Transparent function

In transparent mode, the inputs/outputs are not interlocked. The card is used like a digital I/O card, except that it is controlled via an FBox.

RIO operation

The switches/keys cannot be read via “Monitorio”.

Operation in an xx7 control

To use the module in an xx7 control requires FBs, which can be provided later on request. They do not have to be implemented in the "IO Builder".

Restrictions (not applicable with cables, hardware version B)

For the I/O connectors set out below, the following restrictions must be observed:

…on the PCD3.Mxxxx CPUs:

If a PCD3.K106/116 cable is used to connect to the next module holder, do ***not*** plug module into Slot 3 (far right).

The USB cable can be plugged in, but may touch the I/O connection to the module if in Slot 0.

…on the PCD3.Cxxx module holders:

No restriction, where the PCD3.K010 connector is used to connect to other module holders (the supply connector can also be plugged in to the C200 with no problems).

If a PCD3.K106/116 cable is used to connect from the preceding module holder or to the next module holder, do ***not*** plug the module into Slot 0 (far left) and do ***not*** plug into Slot 3 (far right).

…on PCD3.T76x head stations:

All angled Profibus connectors with max. height 40 mm can be used, e.g.

- ERNI, angled (light grey)
- Siemens “PROFIBUSCONNECTOR“ 6ES7, angled (dark grey) with optional termination resistors
- VIPA 972-0DP10, angled (metallic)

To plug in or remove the Profibus connector, remove the module. A second Profibus cable to extend the network cannot be plugged directly into the first Profibus connector. There are no problems with the RS232 cable and the supply connector, which can be plugged in with the module in place.

If a Profibus connector with height > 40 mm is used, the module ***cannot*** be plugged in to Slot 0 , e.g. with:

- WAGO 750-970 (height=42mm, contacts the I/O connector)

If a PCD3.K106/116 cable is used to connect to the next module holder, do ***not*** plug module into Slot 3 (far right).

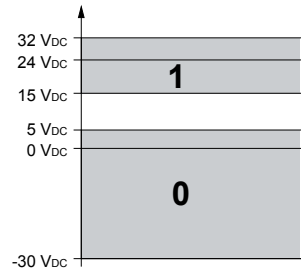
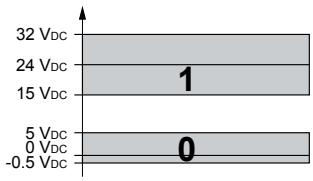
Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

PCD3.K106/116 cable, hardware version B, with 90° angled connector

6.7 Digital combined input/output modules

PCD3.B100	**2 inputs, 2 outputs, 4 selectable as inputs or outputs**

Definition of input signals

for 24 VDC	for 24 VDC
PCD3.B100; I0 and I1	PCD3.B100; I2 to I5
	

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.7.1 PCD3.B100, combined with 2 inputs + 4 digital I/Os

Application

Economical combined input/output module with:

- 2 inputs 24 V / 8 ms for source operation, electrically connected
- 2 transistor outputs 0.5 A / 5…32 VDC, electrically connected, not short circuit protected, and
- 4 combined inputs/outputs 24 V/8 ms or 0.5 A / 5…32 VDC on common I/O terminals.

Technical data on inputs

Number of inputs:	6 (2 + 4), electrically connected, source operation
Input voltage:	24 VDC smoothed or pulsed
2 inputs E0 and E1 low-range: high range:	 -30…+5 V +15…+32 V
4 inputs E/A2…E/A5 low-range: high range:	 -0.5…+5 V *) +15…+32 V
All 6 inputs: low-high switching threshold: high-low switching threshold: Hysteresis: input current (24 VDC): switching delay 0-1 (24 VDC): switching delay 1-0 (24 VDC):	 13 V typically 6 V typically 7 V typically 7 mA typically 8 ms typically 8 ms typically
*) Negative voltage is restricted by the protective diode (I_{max} = 0.5 A)	

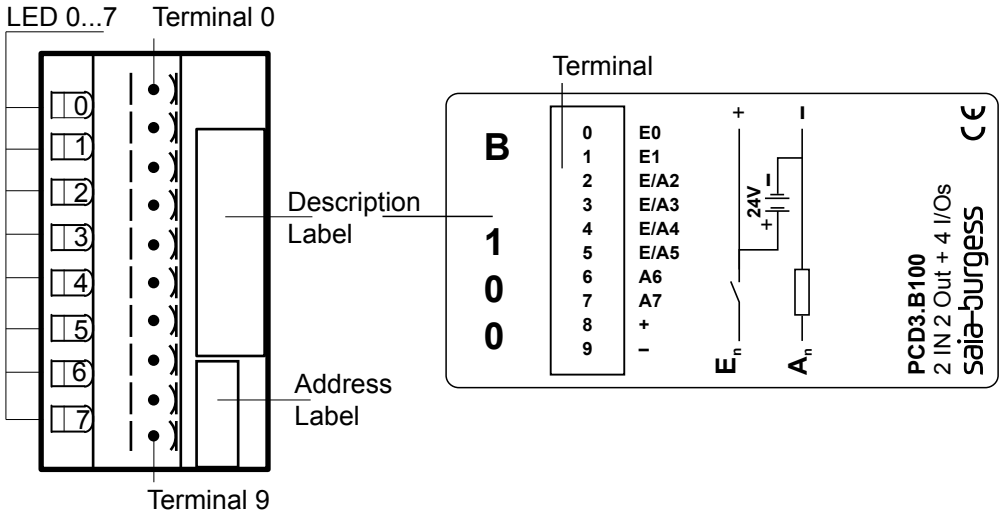
Technical data on outputs

Number of outputs:	6 (2 + 4) electrically connected Source operation, not short circuit protected,
Current:	5…500 mA steady load
Voltage range:	5…32 VDC *)
Voltage drop:	< 0.3 V at 500 mA for I6 und I7 < 0.7 V at 500 mA for I/O2…I/O5
Total current per module:	3 A steady load
Switch-on delay:	10 µs typ.
Switch-off delay:	50 µs typ. (100 µs max.), (ohmic load 5…500 mA), longer for inductive load because of protective diode.
*) If the state of a combined output is to be read off, voltage U_{ext} must be at least 17 VDC, as the state and the LED are displayed via the input.	

General technical data on inputs and outputs

Insulation voltage	1000 VAC, 1 min
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…25 mA typically 15 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



The module contains 8 LEDs:

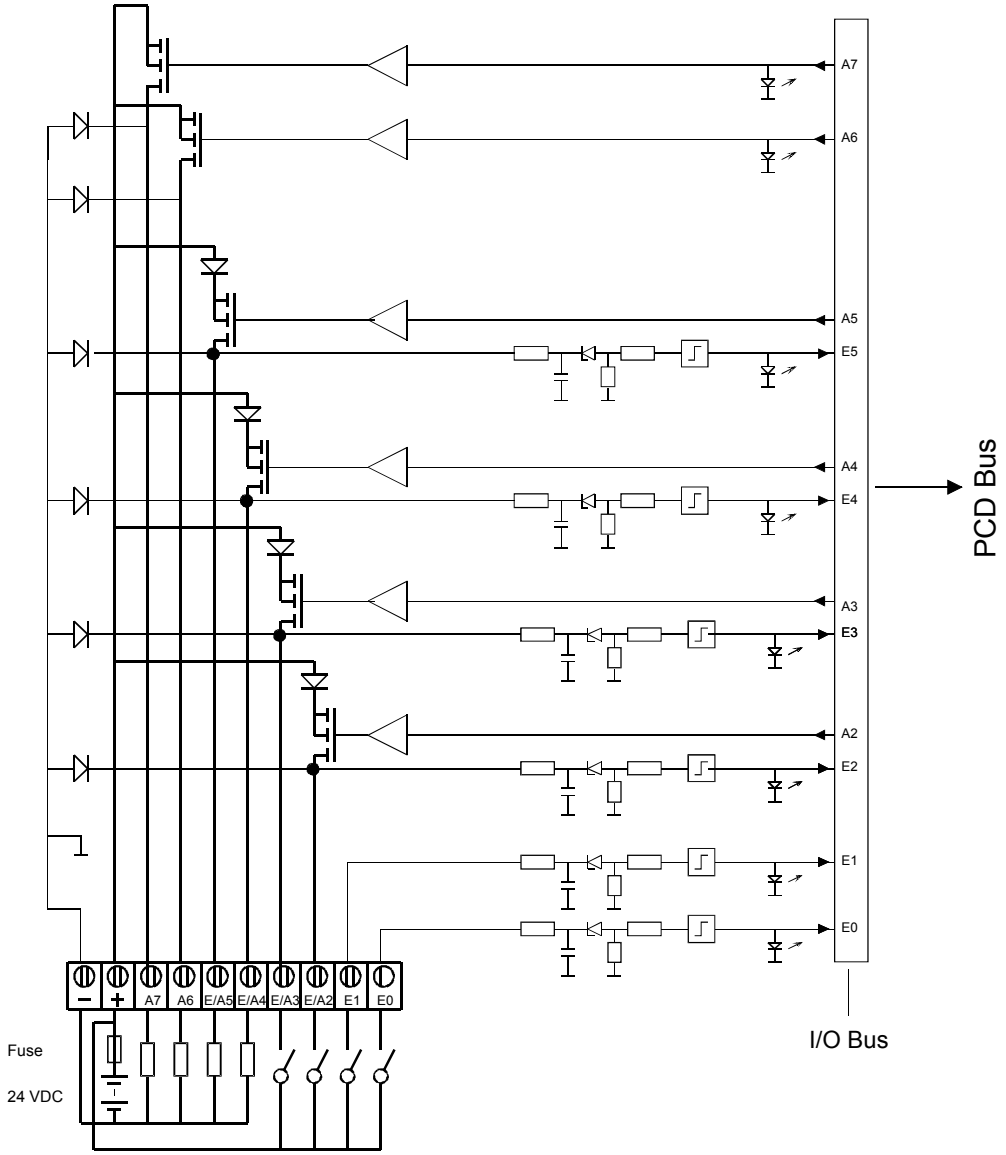
- 2 LEDs are directly triggered by the pure inputs.
- 2 LEDs are directly triggered by the pure outputs.
- 4 LEDs are triggered by the inputs of the combined inputs/outputs and therefore always indicate voltage status at the I/O terminal.

If the combined I/Os are used as outputs, the following should be noted:
The LEDs of combined outputs E/A2…E/A5 only light up when the output is high and a supply voltage of 24 V is connected to U_{ext}.

Mixing the combined inputs/outputs

If combined I/Os are used as inputs in source operation, i.e. with sending devices which either apply +24 V to the input or are open, the low status of an open input can be overwritten as high if the corresponding output at the same address is set in error. However, if the input is shifted to 0 V with a changeover contact and the corresponding output is set in error, the MOS-FET can be destroyed, as it is not short circuit protected. For this reason, only positive-switching contacts should be used.

Input/output circuits and terminal designation



The example shows I/O2 and I/O3 used as inputs and
I/O4 and I/O5 used as outputs

The following applies for the inputs:

Switch closed (input positive): Signal state = “1” = LED on
Switch open: Signal state = “0” = LED off

Fuse: It is recommended that each module should be separately protected with a fast-blow 3.15 A fuse.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

6.8 Analogue input modules

PCD3.W200	**8 analogue inputs 10 bit, 0…10V**
PCD3.W210	**8 analogue inputs 10 bit, 0…20mA**
PCD3.W220	**8 analogue inputs 10 bit, Pt/Ni1000**
PCD3.W300	**8 analogue inputs 12 bit, 0…10V**
PCD3.W310	**8 analogue inputs 12 bit, 0…20mA**
PCD3.W340	**8 analogue inputs 12 bit, 0…10V, 0…20mA, Pt/Ni1000 *)**
PCD3.W350	**8 analogue inputs 12 bit, Pt/Ni 100**
PCD3.W360	**8 analogue inputs 12 bit, resolution ‹ 0.1 °C, Pt1000**

*) jumper selectable

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.8.1 PCD3.W2x0, analogue inputs, 8 channels, 10 bit resolution

Application

With its short conversion time of <50 µs, this module is universally suitable for recording analogue signals. The only limitations are with weak signals, as with Pt100 resistive temperature sensors, or with thermocouples.

Module overview

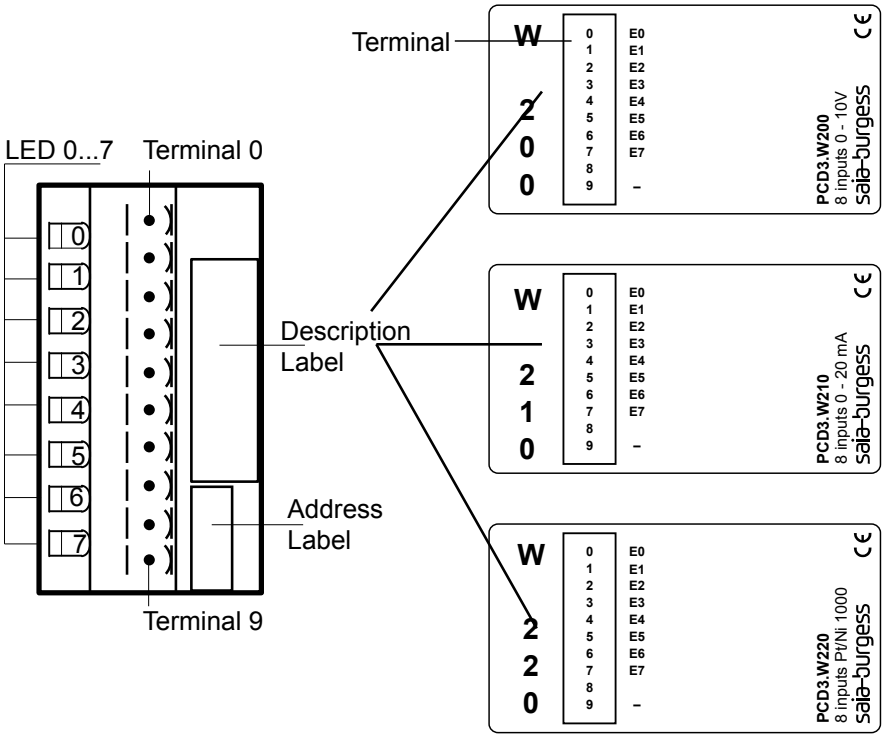
PCD3.W200	8 channels for signals 0…0.10 V
PCD3.W210	8 channels for signals 0…20 mA
PCD3.W220	8 channels for resistive temperature sensors Pt/Ni1000
PCD3.W220Z03	8 channels for NTC10 temperature sensors
PCD3.W220Z12	4 channels for signals 0…10 V 4 channels for resistive temperature sensors Pt/Ni1000

Technical data

Signal ranges:	see module overview
Galvanic separation:	no
Resolution (digital representation):	10 bits (0…1023)
Measuring principle:	non-differential, single-ended
Input resistance:	0…10 V: 200 kΩ / 0.15 % 0…20 mA: 125 Ω / 0,1 % Pt/Ni1000: 7.5 kΩ / 0.1 % NTC 10: 10 kΩ / 0,1 %
Maximum measurement current for resistance measurement with W220:	1.5 mA
Accuracy (of measured value):	± 3 LSB
Repeating accuracy (under same conditions):	within 1 LSB
Temperature error:	± 0.3% (± 3 LSB), (over temperature range from 0°…+55°C)
Conversion time A/D:	<50 µs
Overvoltage protection:	W200/220: ± 50 VDC
Overcurrent protection:	W210: ± 40 mA
Burst protection: (IEC1000-4-4)	± 1 kV, with unshielded cables ± 2 kV, with shielded cables
Time constant of input filter:	W200: typically 5 ms W210: typically 1 ms W220 : typically 10 ms
Internal current consumption: (from +5 V bus)	8 mA (W200/210/220)
Internal current consumption: (from V+ bus)	5 mA (W200/210) 16 mA (W220)
External current consumption:	0 mA
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

Input signals with incorrect polarity significantly distort the measurements on the other channels.

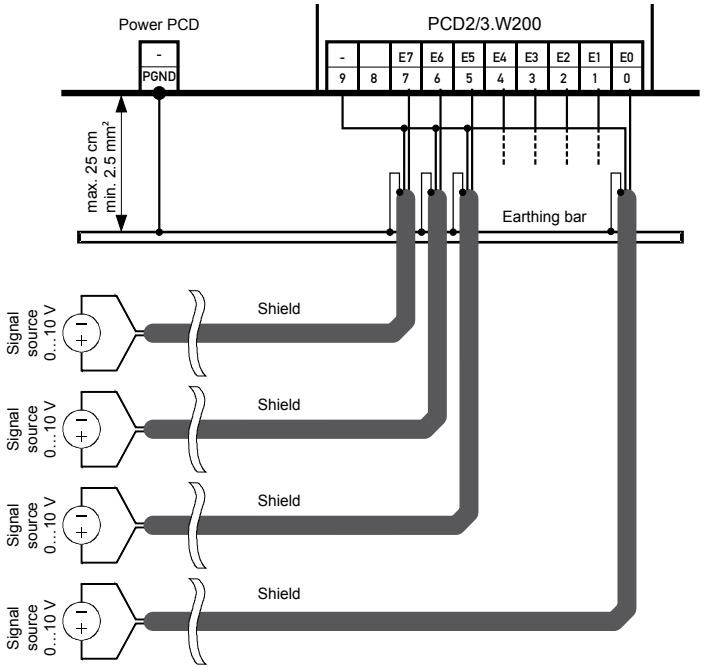
LEDs and connection terminals



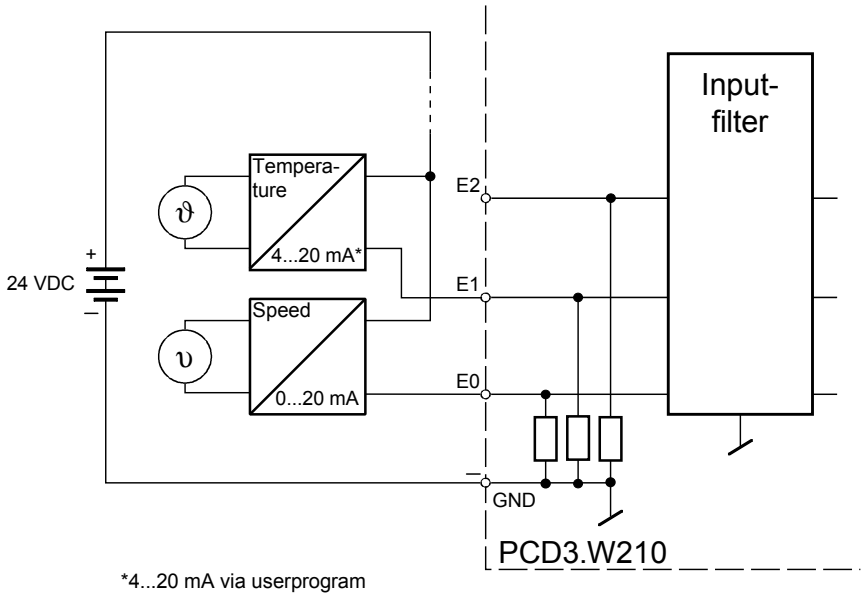
Digital/analogue values

Input signals and type			Digital values		
PCD3.W200	**PCD3.W210**	**PCD3.W220**	**Classic**	**xx7**	**Simatic**
+ 10.0 V	+ 20 mA	Calculate the appropriate values with the formulae at the end of this section	1023	1023	27648
+ 5.0 V	+ 10 mA		512	512	13842
	+ 4 mA		205	205	5530
0 V	0 mA		0	0	0
– 10.0 V	– 20 mA		0	0	0

Connection concept PCD3.W200



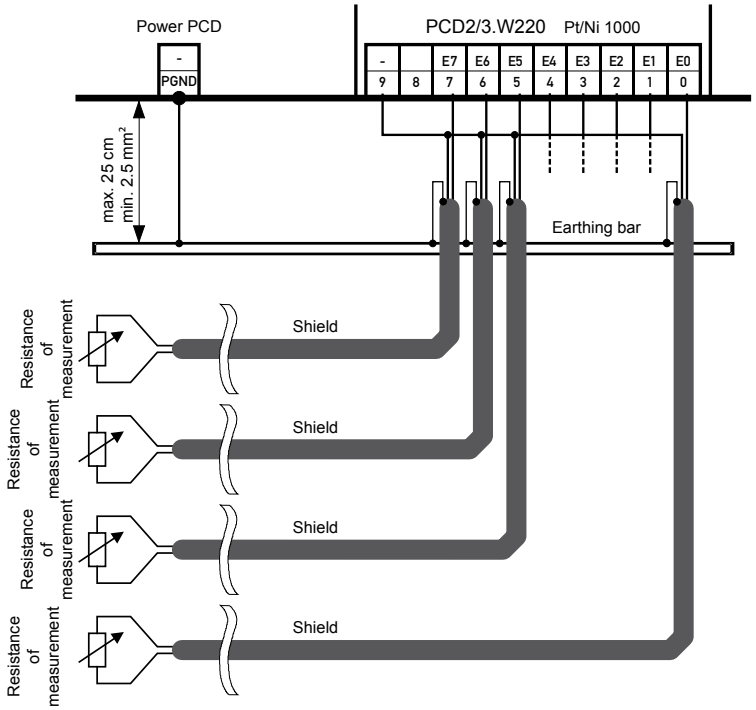
Connection concept for two-wire transducers



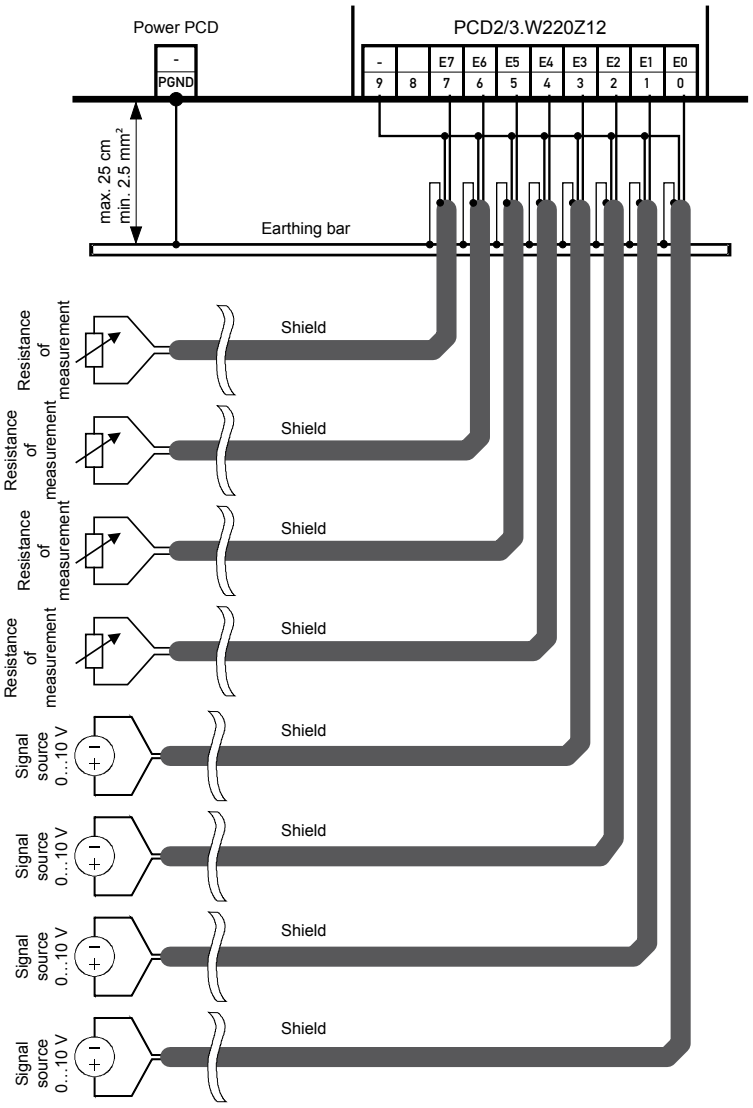
*4...20 mA via userprogram

Two-wire transducers (0…20 mA and 4…20 mA transmitters) need a 24 VDC supply in the measuring trunk.

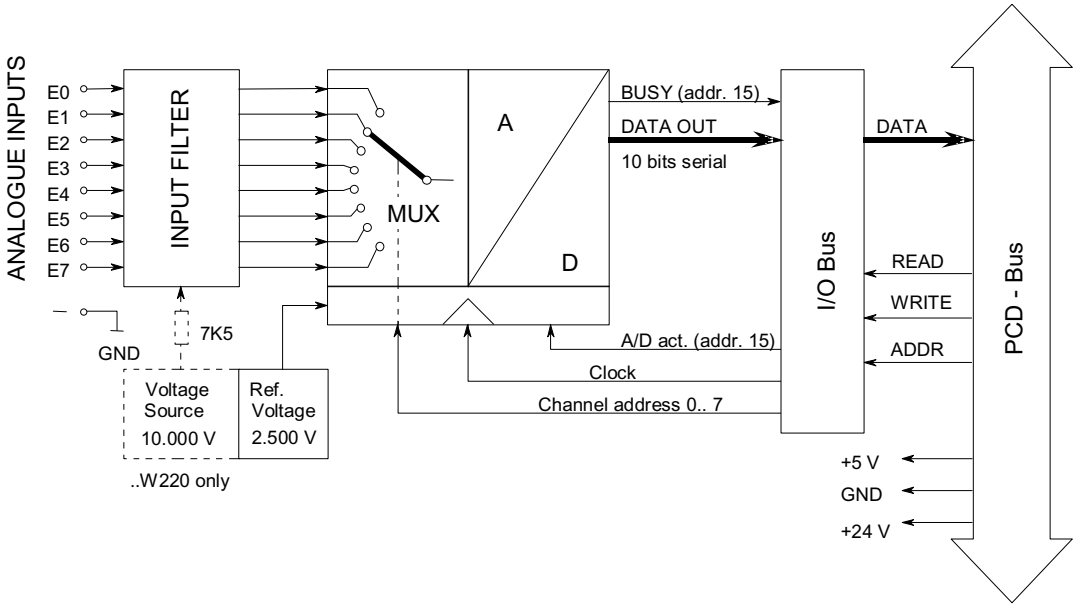
Connection concept PCD3.W220 Pt1000 / Ni1000
Connection concept PCD3.W220Z02 NTC10



Connection concept PCD3.W220Z12
4 × 0…10 V and 4 × Pt1000 / Ni1000



Block diagram



Programming

Classic

Programming examples for the PCD3.W2x0 can be found in a separate manual and on the TCS Support site www.sbc-support.ch.

xx7

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder or network configurator).

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6

Temperature measurement with Pt1000

In the temperature range – 50° to + 200°C, the following formulae can be used for working to an accuracy of ± 1 % (± 1.5°C).
Repeating accuracy is significantly higher.

$$T[°C] = \frac{DV}{2.08 - (0.509 \cdot 10^{-3} \cdot DV)} - 261.8$$

T=temperature in °C DV=digital value (0…1023)

Example 1: digital value DV=562
temperature T in °C ?

$$T[°C] = \frac{562}{2.08 - (0.509 \cdot 10^{-3} \cdot 562)} - 261{,}8 = \underline{51.5}\,°C$$

$$DV = \frac{2.08 \cdot (261.8 + T)}{1 + (0.509 \cdot 10^{-3} \cdot (261.8 + T))}$$

DV=digital value (0…1023) T=temperature in °C

Example 2: preset temperature T= –10°C
corresponding digital value DV ?

$$DV = \frac{2.08 \cdot (261.8 - 10)}{1 + (0.509 \cdot 10^{-3} \cdot (261.8 - 10))} = \underline{464}$$

Resistance measurement up to 2.5 kΩ

Special temperature sensors or any other resistances up to 2.5 kΩ can be connected to the PCD3.W220. The digital value can be calculated as follows:

$$DV = \frac{4092 \cdot R}{(7500 + R)}$$

where 0 ≤ DV ≤ 1023 and R = the resistance to be measured in Ω.

6.8.2 PCD3.W3x0, analogue inputs, 8 channels, 12 bit resolution

Application

High-speed input module for general use with 8 channels, each with 12 bit resolution. Different variants for voltage 0…10V, current 0…20 mA and the use of different resistance thermometers are available.

Module overview

		resolution *)
PCD3.W300:	Voltage 0..0.10V	2,442 mV
PCD3.W310:	Current 0…0.20 mA	4,884 µA
PCD3.W340:	General purpose module	
	0…10V	2,442 mV
	0…20 mA	4,884 µA
	Pt/Ni1000 (default)	
	Pt1000: -50…+400°C	0.14…0.24°C
	Ni1000: -50…+200°C .	09…0.12°C
PCD3.W350:	Temperature sensor	
	Pt/Ni 100	
	Pt100: -50…+600°C	0.14…0.20°C
	Ni100: -50…+250°C	0.06…0.12°C
PCD3.W360:	Temperature sensor	
	Pt1000 -50…+150°C	0.07…0.09°C (resolution <0.1°C)
Method of linearization for temperature inputs: by software		

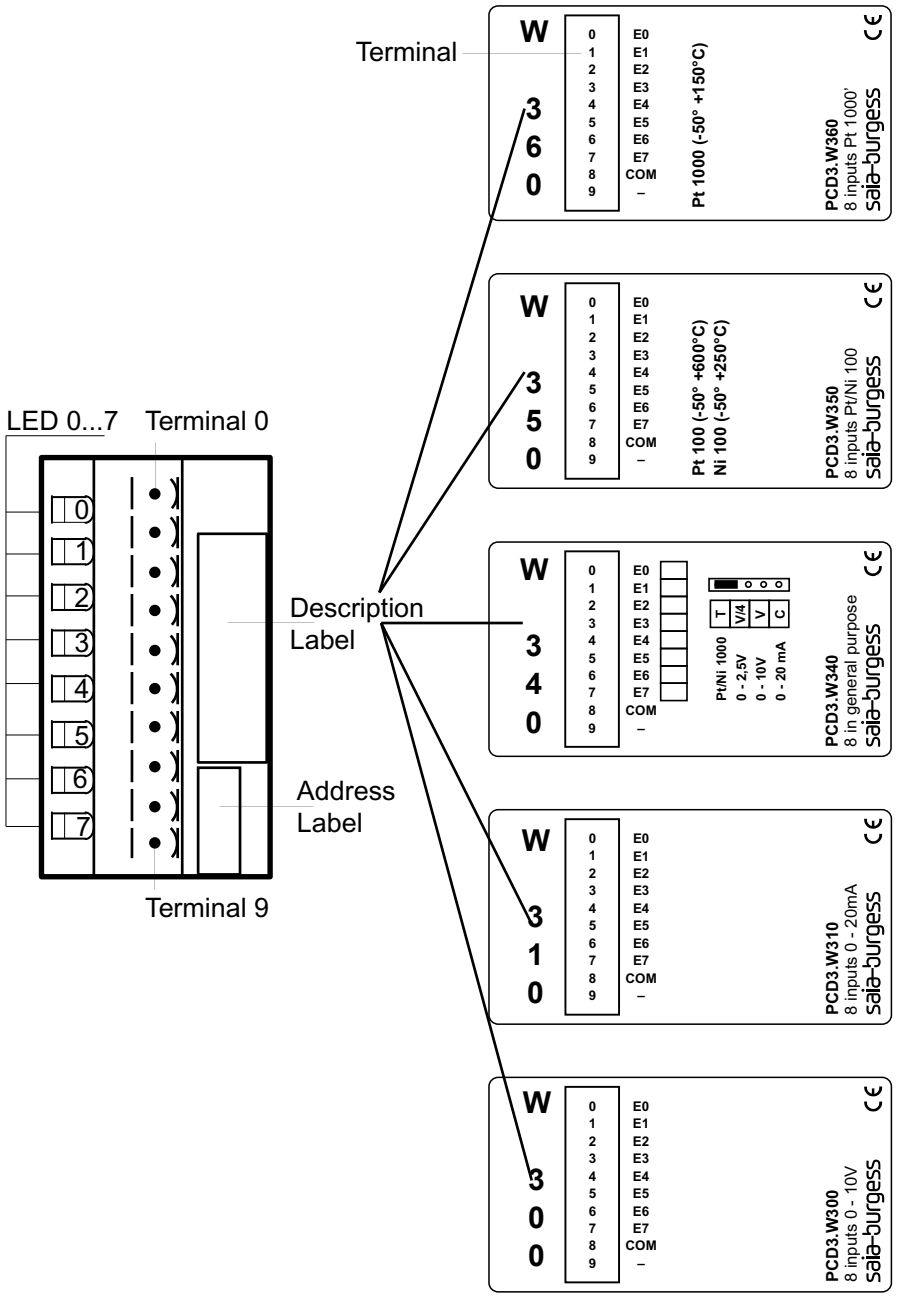
*) Resolution = value of least significant bit(LSB)

Technical data

Input ranges:	see module overview
Galvanic separation:	no
Resolution (digital representation):	12 bits (0…4095)
Measuring principle:	non-differential, single-ended
Input resistance:	W300: 20 kΩ / 0.15% W310: 125 Ω / 0.1% W340: U: 200 kΩ / I: 125Ω W350: not relevant W360: not relevant
Maximum measurement current for temperature probes:	1.5 mA
Accuracy at 25°C	W300, 310: ± 0.5% W340, 350, 360: ± 0.3%
Repeat accuracy:	± 0.05%
Temperature error (0…+55°C)	± 0.2%
Conversion time A/D:	< 10 µs
Overvoltage protection:	W340: ± 50 VDC (permanent) W300 *): + 50 VDC (permanent)
Overcurrent protection:	W340: ± 40 mA (permanent) W310 *): + 40 mA (permanent)
EMC protection:	yes
Time constant of input filter:	W300: typically 10.5 ms W310: typically 12.4 ms W340 V: typically 7.8 ms C: typically 24.2 ms T: typically 24.2 ms W350: typically 16.9 ms W360: typically 16.9 ms

Internal current consumption: (from +5 V bus)	< 8 mA for all module types
Internal current consumption: (from V+ bus)	W300, 310 < 5 mA W340, 360 < 20 mA W350 < 30 mA
External current consumption:	0 mA
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²
*) No negative input voltage should be applied on these modules.	

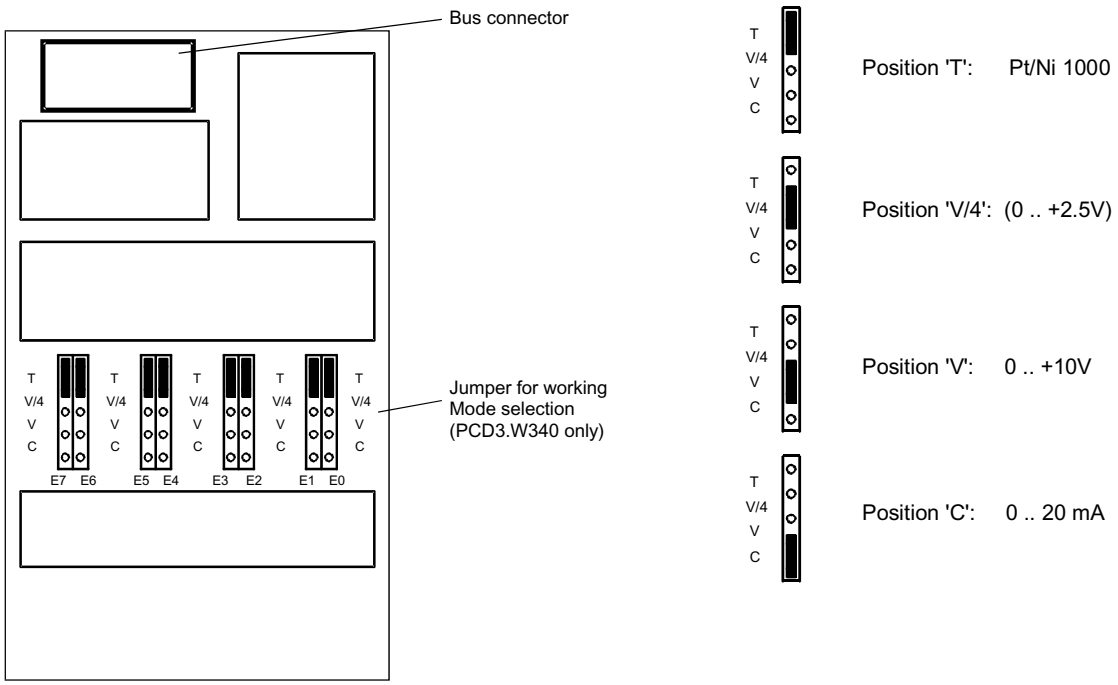
LEDs and connection terminals



Digital/analogue values

Input signals and type			Digital values		
PCD3.W300/W340	**PCD3.W310/W340**	**PCD3.W340/50/60**	**Classic**	**xx7**	**Simatic**
+ 10.0 V	+ 20 mA	Calculate the appropriate values with the formulae at the end of this section	4095	4095	27684
+ 5.0 V	+ 10 mA		2047	2047	13842
0 V	0 mA		0	0	0

Layout (housing open, for instructions, see section 6.1.5)



6

Jumper positions for selecting working mode

PCD3.W340 only; on the other module types the working modes are fixed

All inputs set for temperature (position T) must be wired. All unused inputs (with the W340) must be adjusted to current range ‘C’ or voltage range ‘V’.

Changing the jumpers

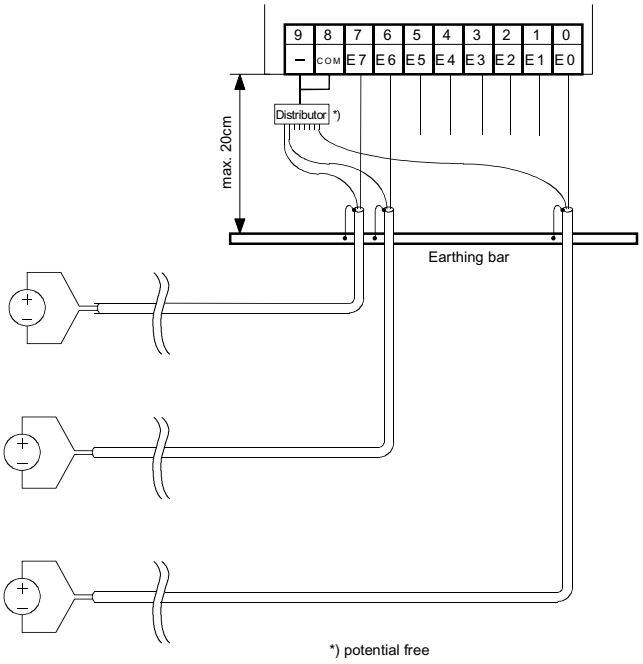
On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix B, "Icons"

Connection concept for voltage and current inputs

The voltage and current input signals are connected directly to the 10-pole terminal block (E0…E7). To minimize the amount of interference coupled into the module via the transmission lines, connection should be made according to the principle explained below.

The following connection diagram shows a typical wiring layout for:

- voltage inputs with the PCD3.W300 and …W340 modules or
- current inputs with the PCD3.W310 and …W340 modules

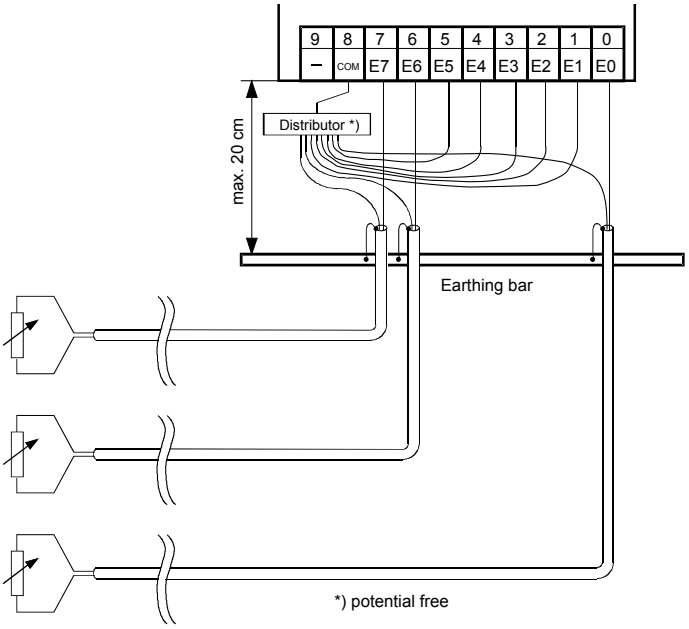


- The reference potentials of signal sources should be wired to a common GND connection (“–” and “COM” terminals). To obtain optimum measurement results, any connection to an earthing bar should be avoided.
- If screened cables are used, screening should be continued to an external earthing bar.

Connection concept for temperature sensors

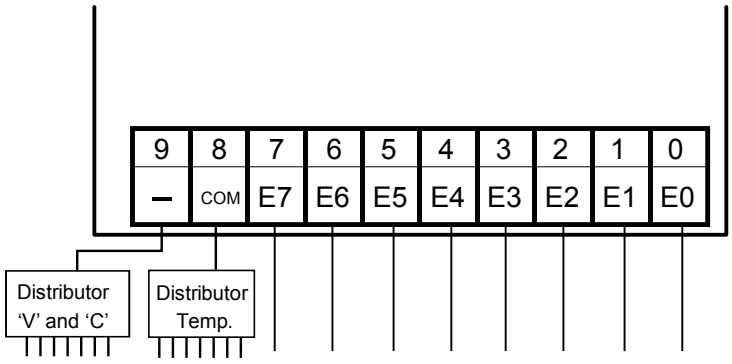
The input signals for the temperature sensors are connected directly to the 10-pole terminal block (I0 … I7).

The following connection diagram shows a typical layout for temperature sensors with the PCD3.W340, …W350 and …W360 modules.

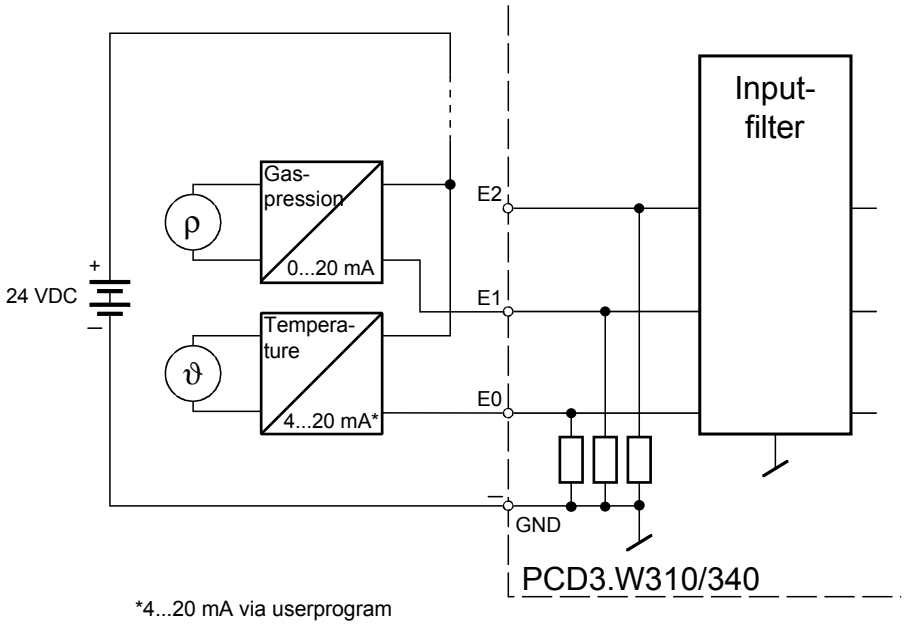


- The reference potential for temperature measurements is the “COM” terminal, which should not have any external earth or GND connection
- If screened cables are used, screening should be continued to an external earthing bar
- Unused temperature inputs are to be connected to the "COM"

Mixed operation

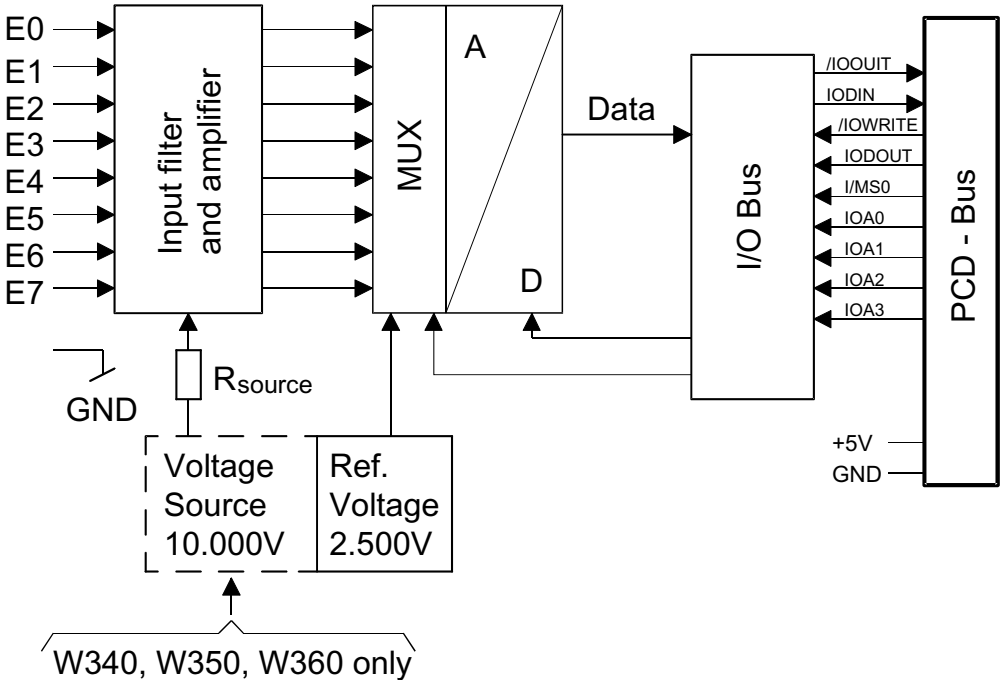


Connection concept for two-wire transducers



Two-wire transducers need a 24 VDC-supply in the measuring trunk.

Block diagram



Programming

Classic

Programming examples for the PCD3.W3x0 can be found in a separate manual and on the TCS Support site www.sbc-support.ch.

xx7

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder or network configurator).

Watchdog: this module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6

Formulae for temperature measurement

For Ni1000 (PCD3.W340)

Validity: Temperature range - 50…+ 210°C

Computational error: ± 0.5°C

$$T = -188.5 + \frac{260 \cdot DV}{2616} - 4.676 \cdot 10^{-6} \cdot (DV - 2784)^2$$

For Pt1000 (PCD3.W340)

Validity: Temperature range - 50…+ 400°C

Computational error: ± 1.5°C

$$T = -366.5 + \frac{450 \cdot DV}{2474} + 18.291 \cdot 10^{-6} \cdot (DV - 2821)^2$$

Resistance measurement up to 2.5 kΩ (PCD3.W340)

Special temperature sensors or any other resistances up to 2.5 kΩ can be connected to the PCD3.W340. The digital value can be calculated as follows:

$$DV = \frac{16\,380 \cdot R}{(7\,500 + R)}$$

where 0 ≤ DV ≤ 4095 and R = the resistance to be measured in Ω.

For Ni 100 (PCD3.W350)

Validity: Temperature range - 50…+ 250°C

Computational error: ± 1.65°C

$$T = -28.7 + \frac{300 \cdot DV}{3628} - 7.294 \cdot 10^{-6} \cdot (DV - 1850)^2$$

For Pt100 (PCD3.W350)

Validity: Temperature range - 50…+ 600°C

Computational error: ± 1°C

$$T = -99.9 + \frac{650 \cdot DV}{3910} + 6.625 \cdot 10^{-6} \cdot (DV - 2114)^2$$

For Pt1000 (PCD3.W360)

Validity: Temperature range - 50…+ 150°C

Computational error: ± 0.25°C

$$T = -178.1 + \frac{200 \cdot DV}{2509} + 3.873 \cdot 10^{-6} \cdot (DV - 2786)^2$$

T = temperature

DV = digital value

6.9 Analogue input modules, electrically isolated from the I/O Bus

PCD3.W305	**7 electrically isolated analogue inputs 12 bit, 0…10 V**
PCD3.W315	**7 electrically isolated analogue inputs 12 bit, 0…20 mA**
PCD3.W325	**7 electrically isolated analogue inputs 12 bit, -10 V…+10 V**

Galvanic separation of inputs to PCD, channels themselves not separated

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.9.1 PCD3.W3x5, analogue inputs electrically isolated from the I/O Bus, 7 channels, 12 Bit resolution

Application

High-speed input modules for general use with 7 channels, each with 12 bit resolution. Different variants for voltage 0..10 V, -10 V…+10 V and current 0..20 mA are available. Electrically isolated from the CPU.

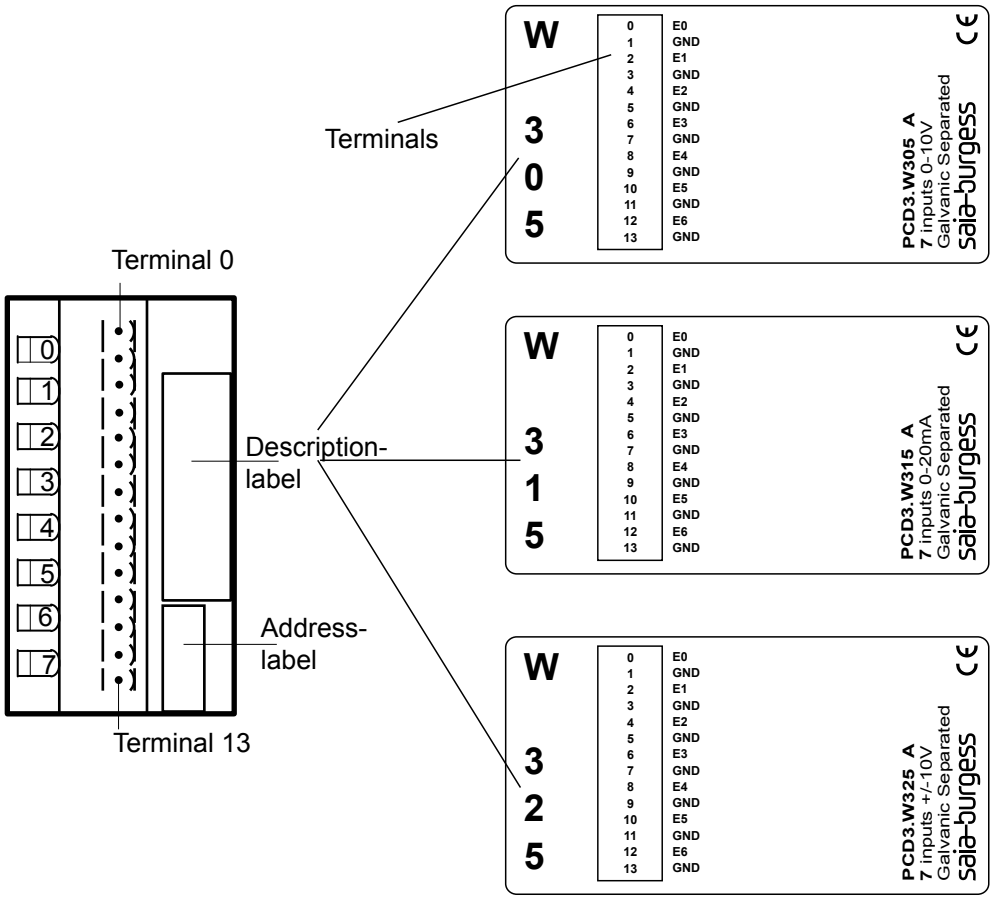
Module overview		resolution *)
PCD3.W305:	Voltage 0…10 V	2.5 mV
PCD3.W315:	Current 0…20 mA	5 µA
PCD3.W325:	Voltage -10…+10 V	5 mV

*) Resolution = value of least significant bit(LSB)

Technical data

Input ranges:	see module overview
Galvanic separation:	500 V, electrical isolation of outputs to PCD, channels themselves not separated
Resolution (digital representation):	12 bits (0…4095)
Measuring principle:	non-differential, single-ended
Input resistance:	W305: 13.5 kΩ / 0.1% W315: 120 Ω / 0.1% W325: 13.7 kΩ / 0.1%
Accuracy at 25°C	± 0.15%
Repeat accuracy:	± 0.05%
Temperature error (0…+55°C)	± 0.25%
Conversion time A/D:	≤ 2 ms
Overvoltage protection:	W305: ± 40 VDC (permanent) W325: ± 40 VDC (permanent)
Overcurrent protection:	W315: ± 35 mA (permanent)
EMC protection:	yes
Time constant of input filter:	typically 2.4 ms
Internal current consumption: (from +5 V bus)	< 60 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	0 mA
Terminals:	Pluggable 14-pole spring terminal block (4 405 4998 0), for Ø up to 1.5 mm²,

Connections



Digital/analogue values

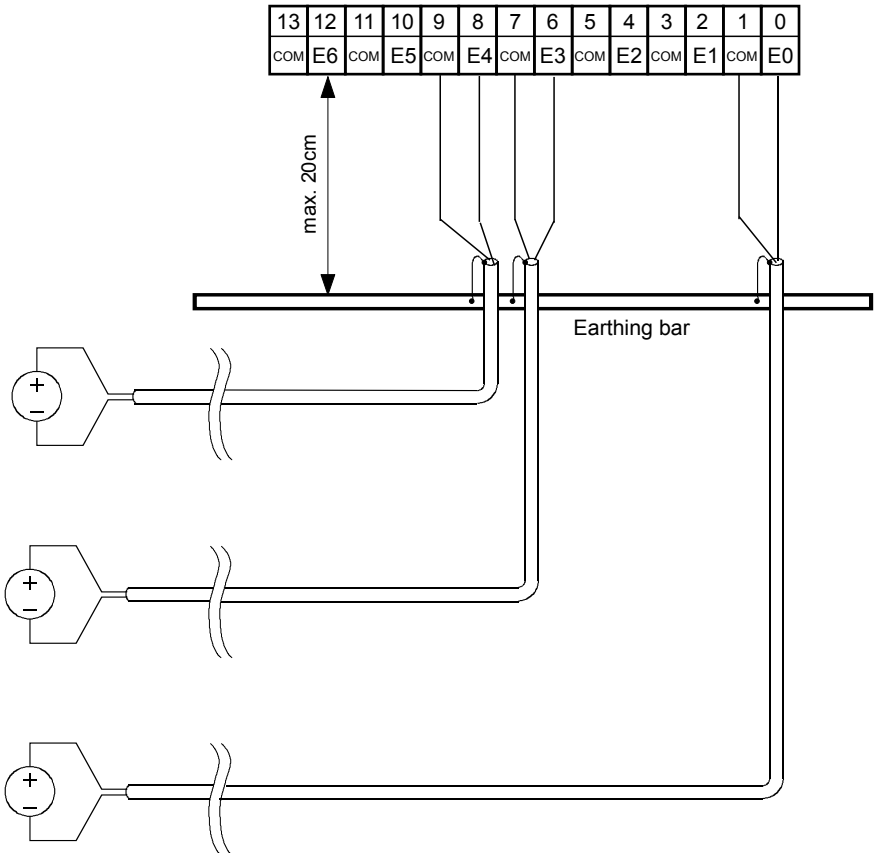
Input signals and type			Digital values		
PCD3.W305	**PCD3.W315**	**PCD3.W325**	**Classic**	**xx7**	**Simatic**
+ 10.0 V	+ 20 mA	+10 V	4095	4095	27684
+ 5.0 V	+ 10 mA	0 V	2047	2047	13842
0 V	0 mA	-10 V	0	0	0

Connection concept for voltage and current inputs

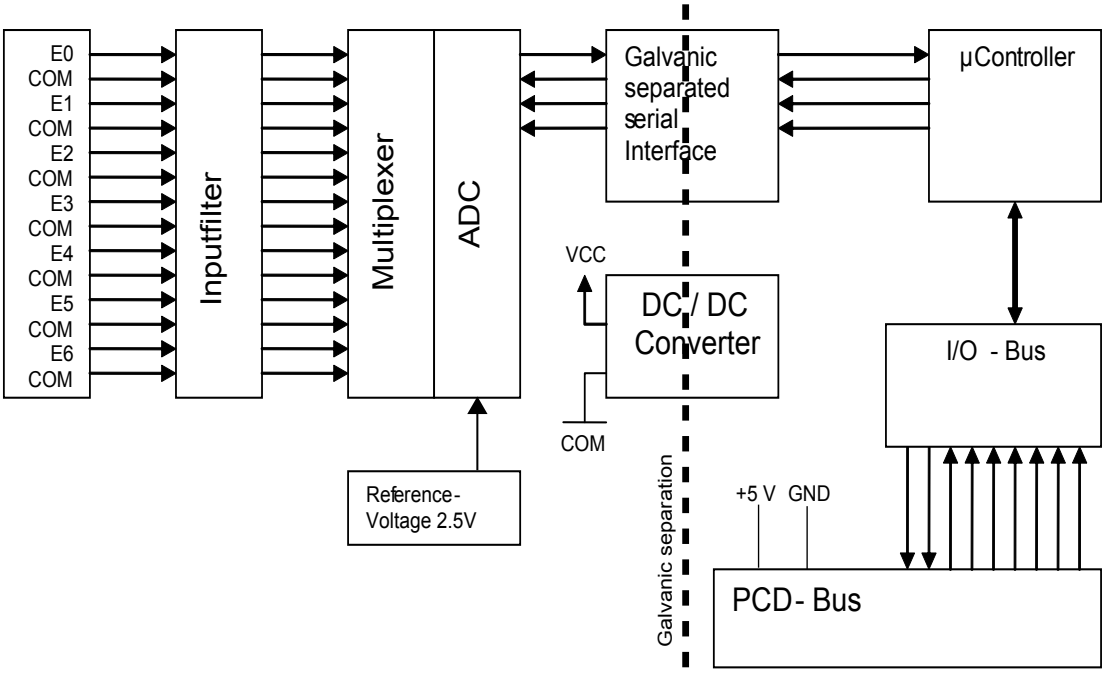
The voltage and current input signals are connected directly to the 14-pole terminal block (I0…I6 and COM). To minimize the amount of interference coupled into the module via the transmission lines, connection should be made according to the principle explained below.

The diagram shows a typical wiring layout for:

- Voltage inputs for the PCD3.W305 and PCD3.W325 modules, or current inputs for the PCD3.W315 module
- If shielded cables are used, the shield should be continued to an external earthing bar.



Block diagram



Programming

Classic

For programming the modules PCD3.W3x5, an FBox is available.

xx7

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder or network configurator).

Watchdog: This module can be used on all base addresses;
there is no interaction with the watchdog on the CPUs.

6.10 Analogue output modules

PCD3.W400	**4 analogue outputs 8 bit, 0…10 V**
PCD3.W410	**4 analogue outputs 8 bit, 0…10 V, 0…20 mA, 4…20 mA *)**
PCD3.W600	**4 analogue outputs 12 bit, 0…10 V**
PCD3.W610	**4 analogue outputs 12 bit, 0…10 V, 0…20 mA, 4…20 mA, Pt/Ni1000 *)**

*) jumper selectable

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.10.1 PCD3.W4x0, analogue outputs, 4 channels, 8 bit resolution

Application

High-speed output module with 4 output channels of 8 bits each. Different output signals can be chosen with the aid of jumpers. Suitable for processes in which a large number of actuators have to be controlled, such as in the chemical industry and building automation.

Module overview

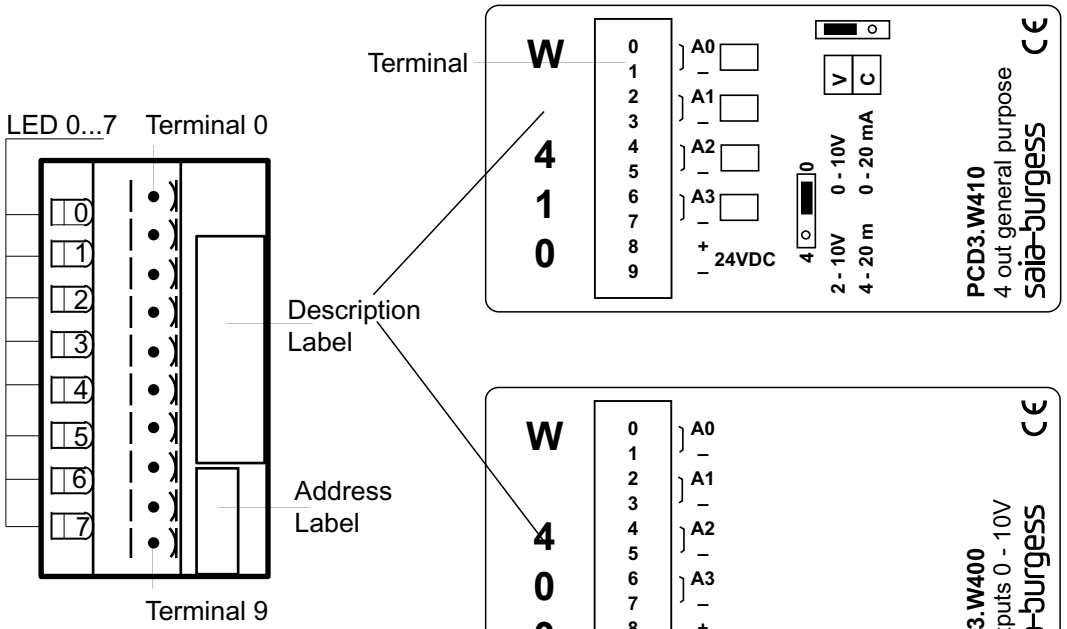
PCD3.W400: Single signal module with 4 output channels of 8 bits each. 0…10 V

PCD3.W410: General purpose module with 4 output channels of 8 bits each. Signals can be selected from 0…10 V, 0…20 mA or 4…20 mA.

Technical data

Number of output channels:	4, short circuit protected
Signal ranges:	W400 0…10 V W410 0…10 V*) } selectable 0…20 mA } with 4…20 mA } jumpers *) Factory setting
Resolution (digital representation):	8 bits (0..0.255)
Conversion time D/A:	< 5 µs
Load impedance:	for 0…10 V: ≥ 3 kΩ for 0…20 mA: 0…500 Ω for 4…20 mA: 0…500 Ω
Accuracy (of output value):	for 0…10 V: 1% ± 50 mV for 0…20 mA: 1% ± 0.2 mA for 4…20 mA: 1% ± 0.2 mA
Residual ripple:	for 0…10 V: < 15 mV pp for 0…20 mA: < 50 µA pp for 4…20 mA: < 50 µA pp
Temperature error:	typ. -.2% (across temperature range 0…+55 °C)
Burst protection: (IEC 801-4)	± 1 kV, with unshielded cables ± 2 kV, with shielded cables
Internal current consumption: (from +5 V bus)	1 mA
Internal current consumption: (from V+ bus)	30 mA
External current consumption:	max. 0.1 A (type PCD3.W410 only, for current outputs)
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



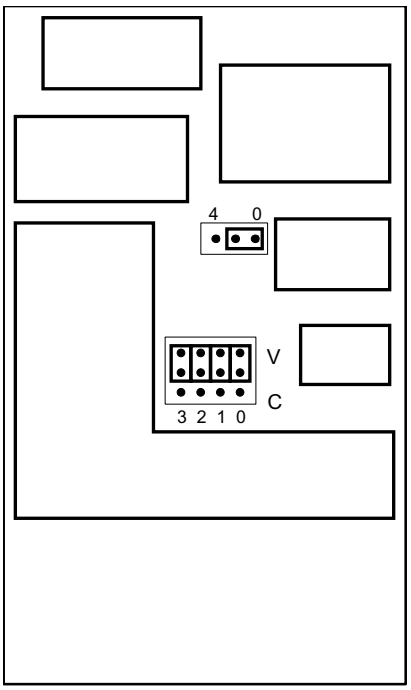
LED	Output
0	O0
1	O1
2	O2
3	O3

Analogue/digital values and jumper positions

Jumper "V/C"			V	C	C
Jumper "0/4"			0	0	4
Signal range			0…10 V	0…20 mA	4…20 mA
Digital values					
Classic	**xx7**	**Simatic**			
255	255	27648	10.0 V	20 mA	20 mA
128	128	13842	5.0 V*)	10 mA*)	12 mA*)
0	0	0	0	0	4 mA

*) The exact values are 1/255 higher

Layout (housing open, for instructions, see section 6.1.5)



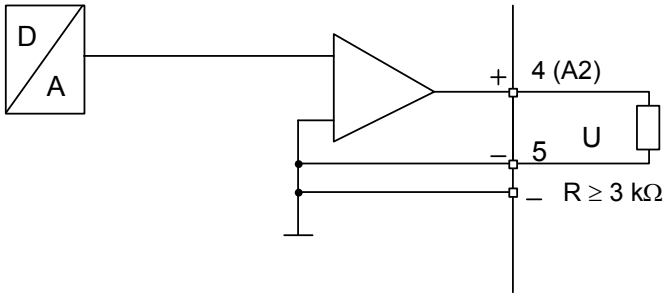
Offset jumper J1 (PCD3.W410 only)
Position “0”: 0… 10 V or 0… 20 mA
Position “4”: 2… 10 V or 4… 20 mA

Jumper J2 for current/voltage
(PCD3.W410 only)
Position “V”: Voltage output
Position “C”: Current output

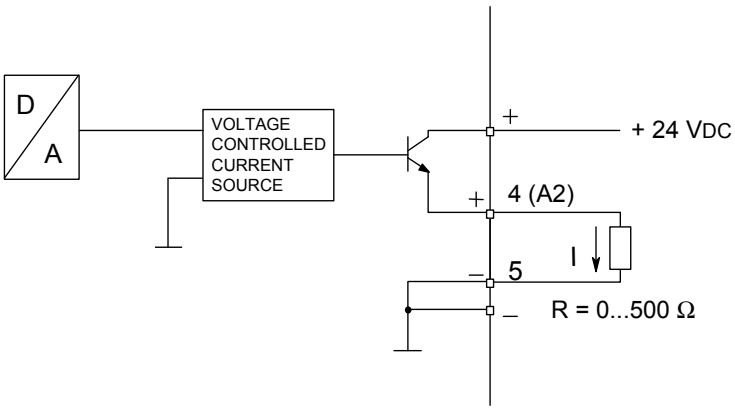
Factory settings (PCD3.W410):
- Position “V”: Voltage output
- Position “0”: range 0…10 V:

Changing the jumpers
On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix B, "Icons"

Connection for 0…10 V

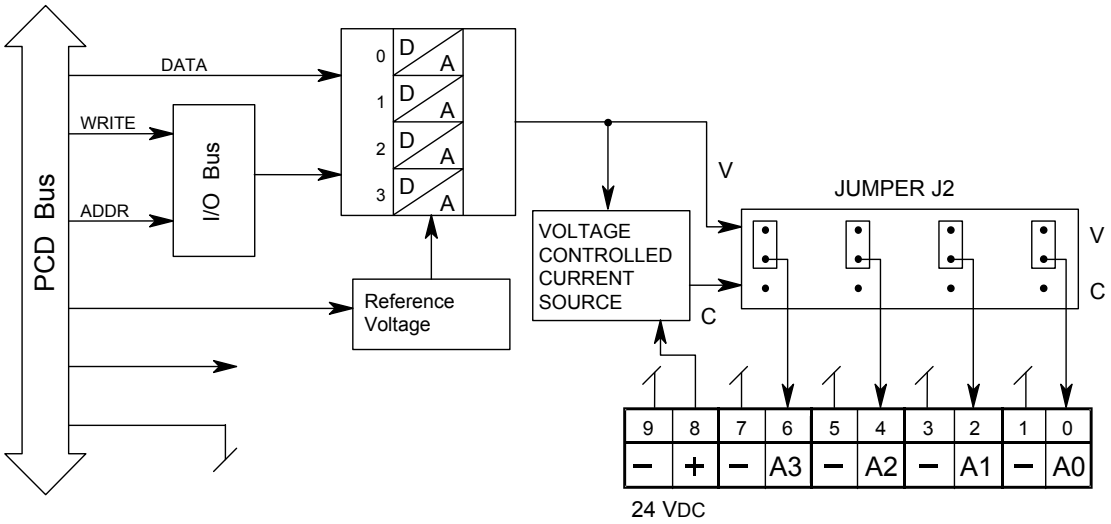


Connection for 0…20 mA or 4…20 mA
(selectable with jumpers on type PCD3.W410)



An external 24 VDC supply is required for current outputs.

Block diagram



Programming

Classic

Programming examples for the PCD3.W4x0 can be found in a separate manual and on the TCS Support site www.sbc-support.ch.

xx7

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder or network configurator).

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6

6.10.2 PCD3.W6x0, analogue outputs, 4 channels, 12 bit resolution

Application

High-speed output module for general use with 4 channels, each with 12 bit resolution. Different variants for voltage 0…10V, -10…+10V and current 0…20 mA are available.

Module overview

PCD3.W600: Unipolar voltage outputs 0…10 V
PCD3.W610: Bipolar voltage outputs -10 V…+10 V,
switchable to unipolar voltage 0…10 V / current 0…20 mA

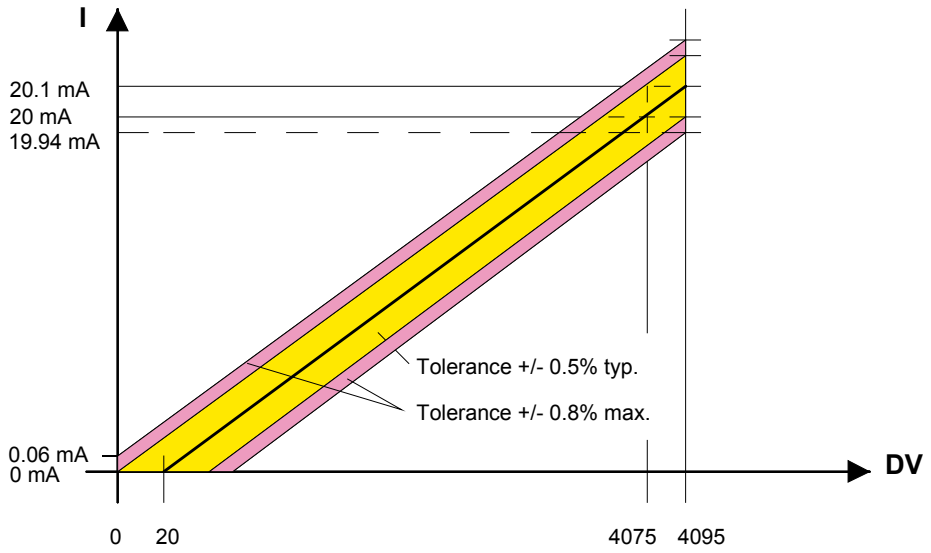
Technical data

Resolution

Number of output channels:	4, short circuit protected		
Signal range:	W600:	0…+10 V	2.442 mV
	W610:	-10 V…+10 V	4.884 mV
		0…+10 V	2.442.mV
		0…20 mA	4.884 µA
	selectable with jumper		
Galvanic separation:	no		
Resolution (digital representation):	12 bits (0…4095)		
Conversion time D/A:	typ. 10 µs		
Load impedance	Voltage:	> 3 kΩ	
	Current:	< 500 Ω	
Accuracy at 25°C (of output value)	Voltage:	± 0.5 %	
	Current:	± 0.8 % *)	
Temperature error:	Voltage:	± 0.1 % (over temperature range	
	Current:	± 0.2 % 0…+55 °C)	
Internal current consumption: (from +5 V bus)	W600:	max. 4 mA	
	W610:	max. 110 mA	
Internal current consumption: (from V+ bus)	W600:	max. 20 mA	
	W610:	0 mA	
External current consumption:	max. 100 mA	(type PCD3.W610 only, for current outputs)	
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²		

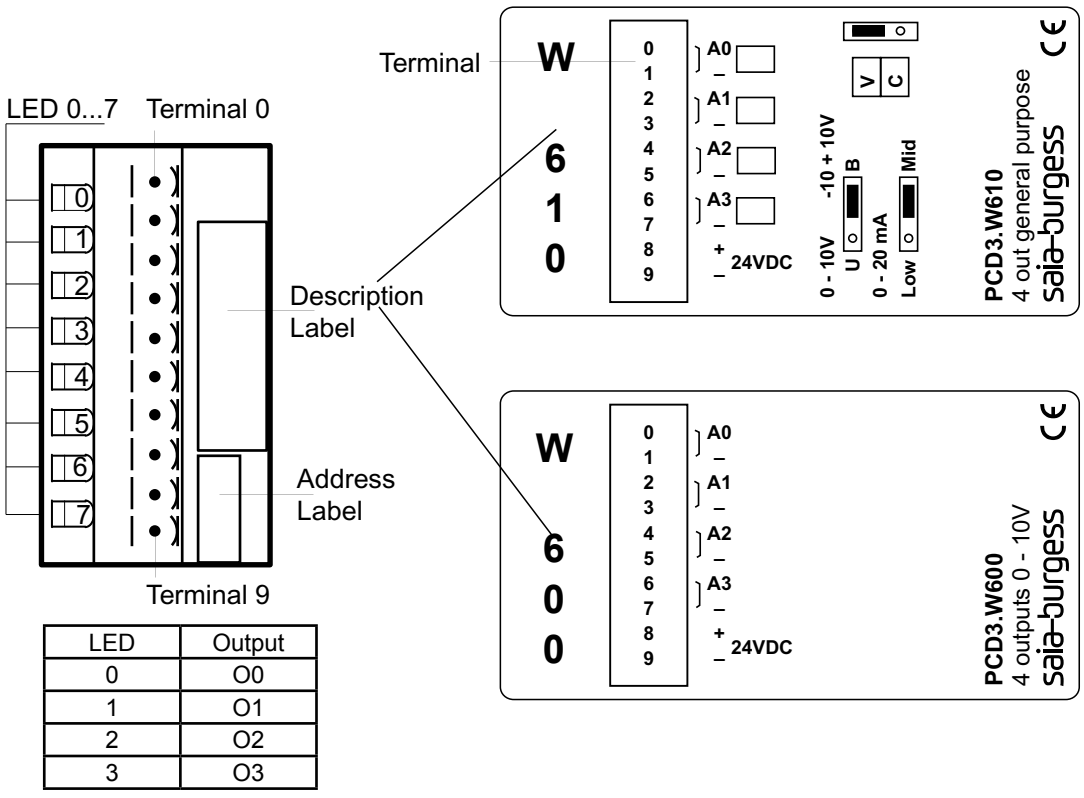
*) Note on current outputs:
Since for some applications it is important to be able to reach the outside limit values of the range (0 mA, 20 mA), current outputs have been laid out according to the following characteristic line:

During start-up, a voltage of 5 V is sent to all outputs of the W600 module. The start-up phase lasts 40 ms, then 0 V is sent to the outputs.



6

LEDs and connection terminals

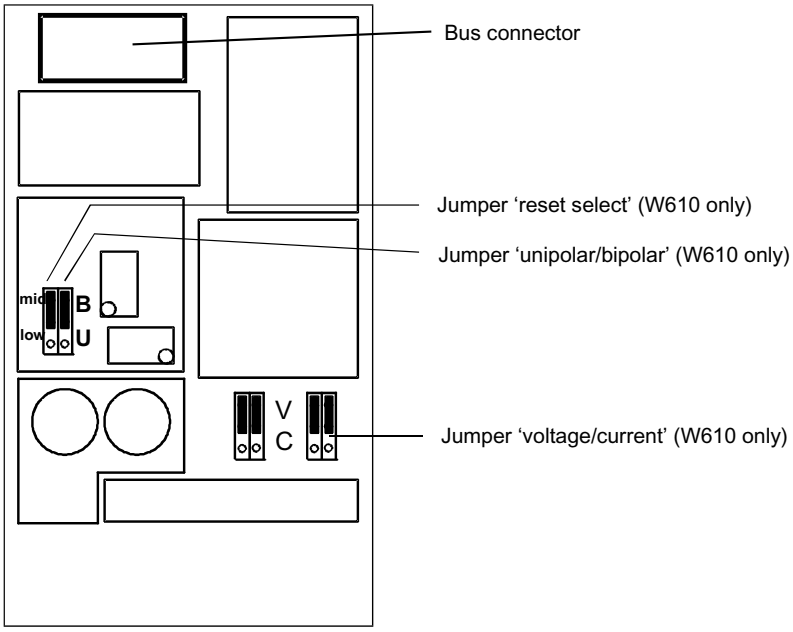


LED	Output
0	O0
1	O1
2	O2
3	O3

Digital/analogue values

Digital values			Output signals
Classic	**xx7**	**Simatic**	
4095	4095	27648	+20.1 mA
4075	4075	27513	+20 mA
2048	2048	13842	+10 mA
20	20	135	0 mA
0	0	0	0 mA

Layout (housing open, for instructions, see section 6.1.5)



Changing the jumpers
On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix B, "Icons"

Range selection(PCD3.W610)

Jumpers, factory settings:	O0…O3:	“V”	(voltage)
	U/B:	“B”	(bipolar)
	Reset select:	“mid“	(reset to mid-scale, i.e. 0V in bipolar mode)

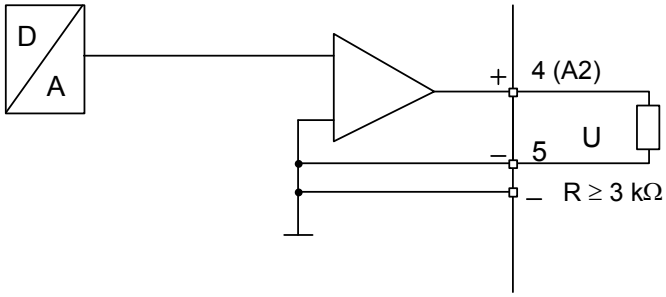
Ranges depending on application:

Per module: U/B:		**U**nipolar or **B**ipolar operation	
	Reset select:		Reset to **low-** or **mid-**scale
	Rec. setting:		Unipolar →low-scale Bipolar → mid-scale
Per channel:		“V”	Voltage output: 0…+10 V or -10 V…+10 V
		“C”:	Current output: 0…20 mA

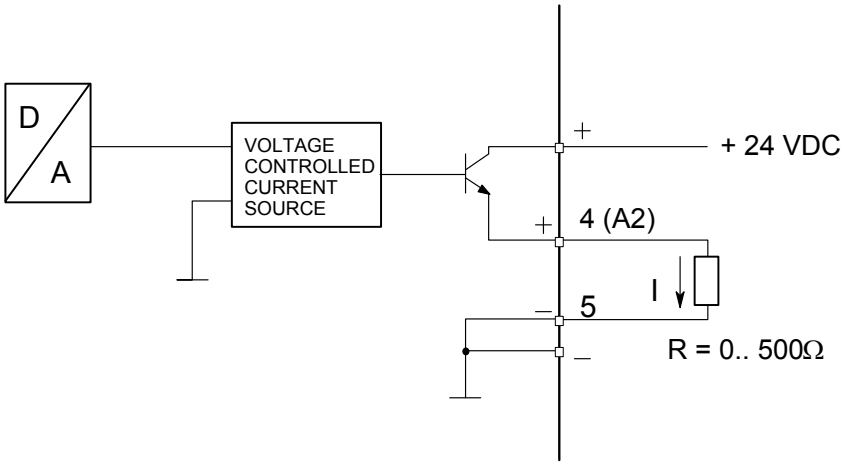
Current outputs have been laid out for unipolar mode. Bipolar mode is possible, but for the negative half of this operation the output is 0 mA.

Connection concept

Connection for 0..0.10 V or -10 V…+10 V: (selectable on the PCD3.W610)

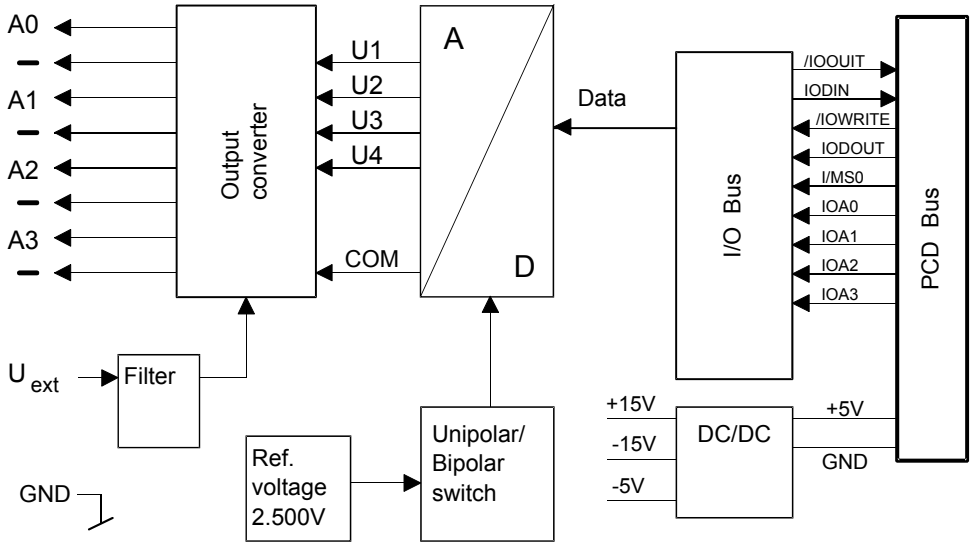


Connection for 0…20 mA: (PCD3.W610 only)



An external 24 VDC supply is required for current outputs.

Block diagram



Programming

Classic

Programming examples for the PCD3.W6x0 can be found on the TCS Support site www.sbc-support.ch.

xx7

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder or network configurator).

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.11 Analogue output modules, electrically isolated from the I/O Bus

PCD3.W605	**6 electrically isolated analogue outputs 10 bit, 0…10 V**
PCD3.W615	**4 electrically isolated analogue outputs 10 bit, 0…20 mA**
PCD3.W625	**6 electrically isolated analogue outputs 10 bit, -10 V…+10 V**

Galvanic separation of outputs to PCD, channels themselves not separated

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.11.1 PCD3.W6x5, analogue outputs electrically isolated from the I/O Bus, 6(4) channels, 10 Bit resolution

Application

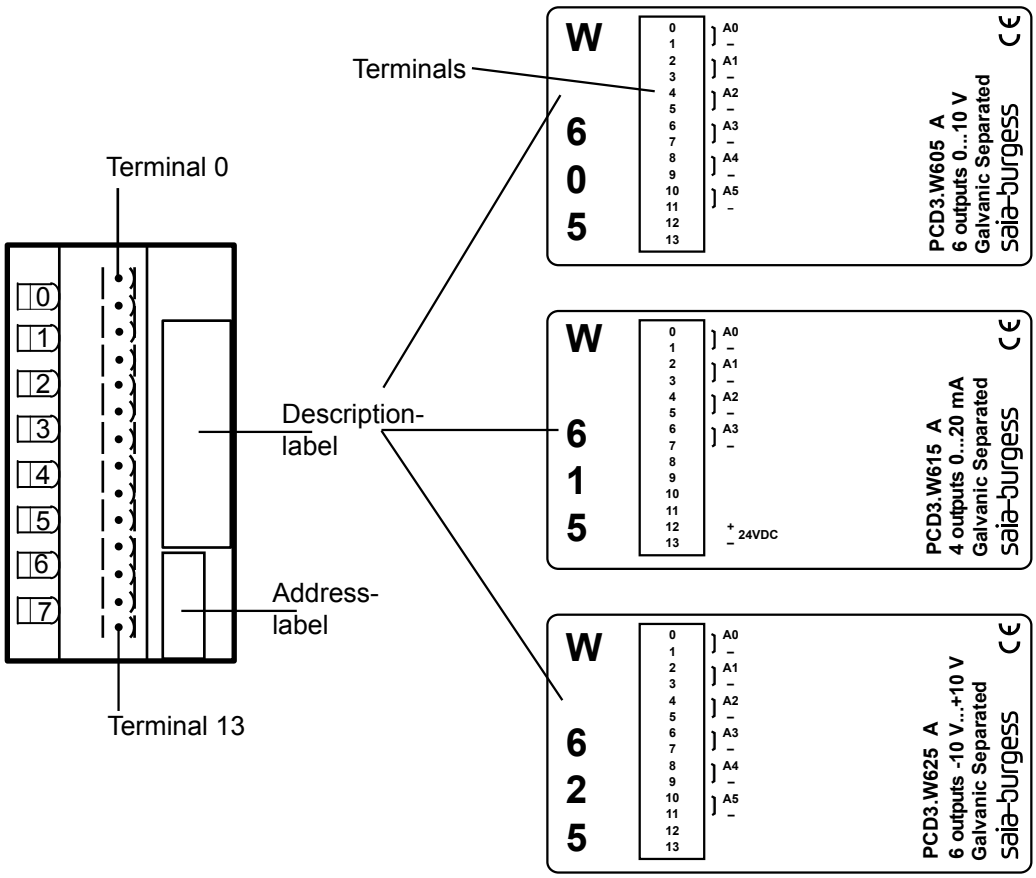
High-speed output module for general use, electrically isolated, 6 (4) channels, each with 10 bit resolution. Different variants for voltage 0..10 V, -10 V…+10 V and current 0..20 mA are available.

Module overview		**Channels**	**Resolution**
PCD3.W605:	Voltage 0…10 V	6 (A0…A5)	10 mV
PCD3.W615:	Current 0….20 mA	4 (A0…A3)	20 µA
PCD3.W625:	Voltage -10…+10 V	6 (A0…A5)	20 mV

Technical data

Output ranges:	see module overview
Galvanic separation:	500 V, electrical isolation of outputs to PCD, channels themselves not separated
Resolution (digital representation):	10 bits (0…1023)
Load resistance:	W605: >3 kΩ W615: <500 Ω* W625: >3 kΩ
Accuracy at 25°C	W605: ± 0.4% W615: ± 0.7% W625: ± 0.4%
Temperature error (0…+55°C)	± 0.25%, 100 ppm/K or 0.01%/K
Short circuit protection:	yes (permanent)
EMC protection:	acc. to standards ENV 50 141, EN 55 022, EN 61000-4-2, EN 61000-4-4, EN 61000-4-5
Time constant of output filter:	W605: typ. 1 ms W615: typ. 0.3 ms W615: typ. 1 ms
Internal current consumption: (from +5 V bus)	W605: 110 mA (typ. 80 mA) W615: 55 mA (typ. 45 mA) W625: 110 mA (typ. 80 mA)
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 90 mA, smoothed (W615 only) Voltage range: RL•20 mA + 10…20 V *e.g. RL=500 Ω → Ue = 20…30 V RL=0 Ω → Ue=10…20 V
Terminals:	Pluggable 14-pole spring terminal block (4 405 4998 0), for Ø up to 1.5 mm²,

Connections



Digital/analogue values

Output signals and type			Digital values		
PCD3.W605	**PCD3.W615**	**PCD3.W625**	**Classic**	**xx7**	**Simatic**
+ 10.0 V	+ 20 mA	+10 V	1023	1023	27684
+ 5.0 V	+ 10 mA	0 V	512	512	13842
	+ 4 mA		205	205	5530
0 V	0 mA	-10 V	0	0	0

Notes on the output range

Balancing the offset and the amplification is done for the PCD2.W6x5 digitally by the µC. As there is no potentiometer, the output range has been slightly enlarged to cover maximum values even in the worst case.

Typical output range (without component tolerances):
W605: - 0.26 V…+ 10.36 V (instead of 0…+ 10 V)
W615: 0 mA …21.4 mA (instead of 0…20 mA)
W625: - 10.62 V … 10.36 V (instead of - 10…+10 V)

This range is broken down on a 10 bit scale (1024 steps), as before. The result is the following LSB resolution:
W605: 1 LSB = 10.38 µV
W615: 1 LSB = 21.7 µA
W625: 1 LSB = 20.75 µV

With this balance the nominal range (0…10 V) is now scaled 0…1023, making it possible for the output value not to change on an increase of 1 LSB.

In the FBs the output values are not limited to 0…1023, so the whole range of the module can be used.

For voltages > 10 V or currents > 20 mA, values >1023 may be output, and for voltages < 0 V or

< -10 V, negative values may be output. (With the W615 it is not possible to output negative currents).

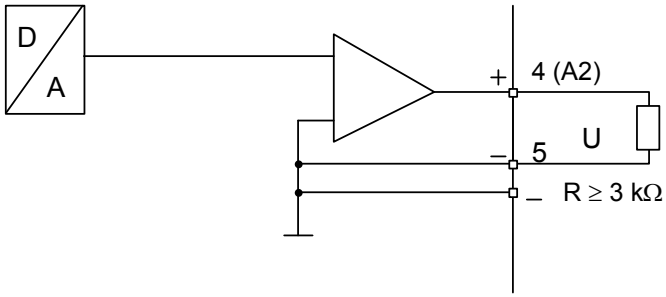
This extended range does depend on the tolerances of the components, and cannot be guaranteed.

Connection concept for voltage and current inputs

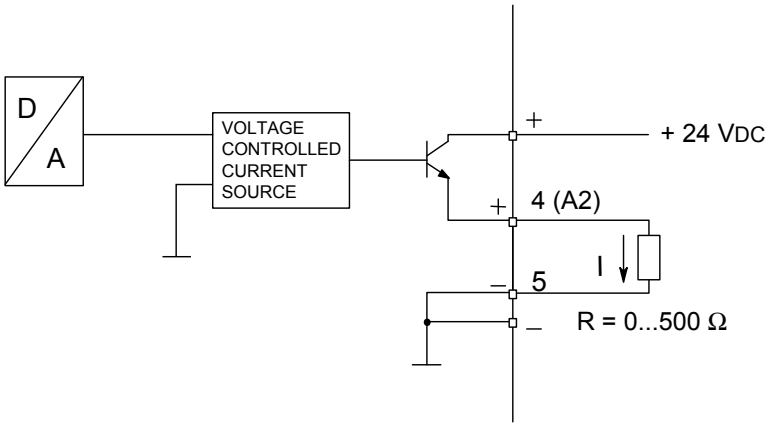
The voltage and current output signals are connected directly to the 14-pole terminal block (A0 … A5 / A3 and -).

The following connection diagram shows a typical wiring layout for:
- voltage outputs with the PCD3.W605 and .W625 modules or
- current outputs for the PCD3.W615 module

Connection for 0…10 V (W605) or -10 V…+10 V (W625):

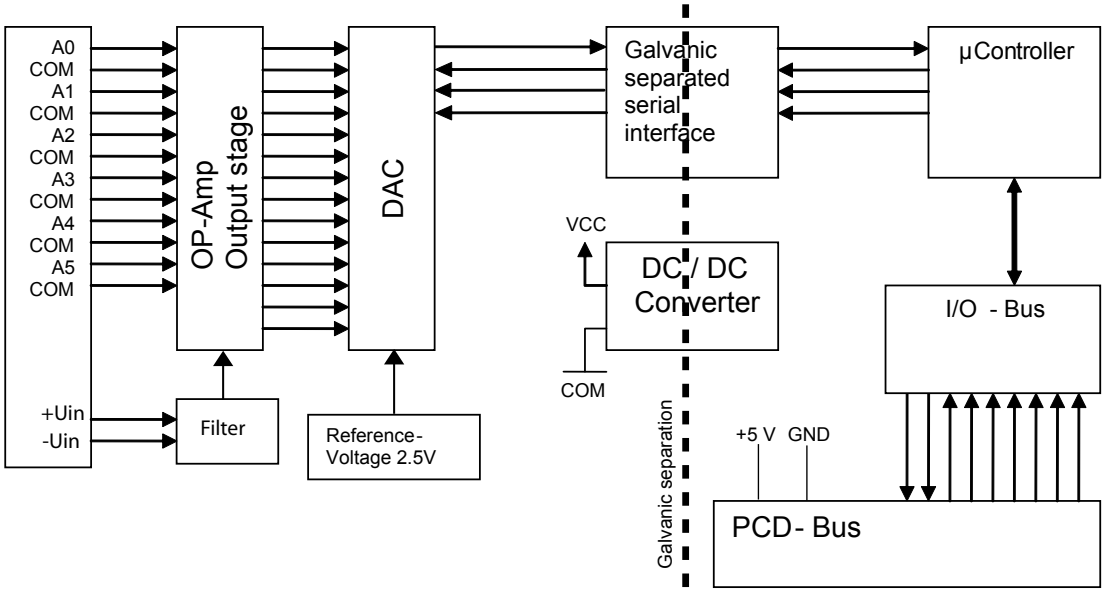


Connection for 0…20 mA (W615)



An external 24 VDC supply is required for current outputs.

Block diagram



Programming

Classic

For programming the modules PCD3.W6x5, an FBox is available.

xx7

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder or network configurator).

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

6

6.12 Analogue combined input/output modules

PCD3.W500	**2 analogue inputs 12 bit + 2 analogue outputs 12 bit, 0…10 V, -10 V…+10 V *)**

*) jumper selectable

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.12.1 PCD3.W500, analogue inputs/outputs, 2 + 2 channels, 12 bit resolution

Application

Combined high speed analogue input/output module with 2 voltage inputs and 2 voltage outputs 0…+10 V (unipolar) or -10…+10 V (bipolar), jumper selectable, All with 12 bit resolution. The module is suitable for precise, high-speed applications.

Module overview

PCD3.W500: Module with 2 voltage inputs and 2 voltage outputs

Technical data

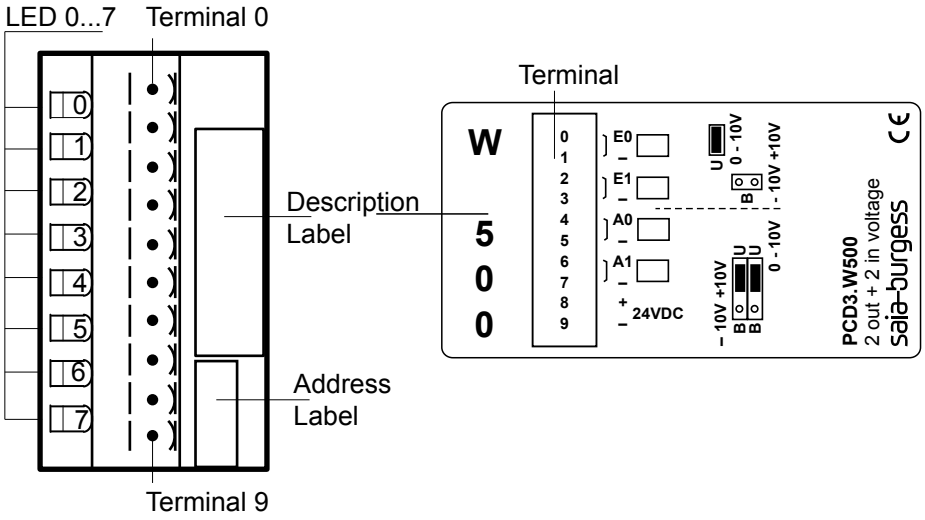
Inputs	
Number of input channels:	2
Signal ranges:	W500: 0…+10 V, -10…+10 V } jumper selectable commonly
Galvanic separation:	no
Measuring principle:	differential
Conversion time A/D:	< 30 µs
Resolution (digital representation):	12 bits (0…4095)
Input resistance:	W500: 0…+10 V: 1 MΩ
Accuracy (of measured value):	unipolar: ± 2 LSB bipolar: ± 10 LSB
Repeating accuracy (under same conditions):	± 2 LSB
Common mode range:	CMR ±10 V
Common mode rejection:	CMRR ≥ 75 dB
Overvoltage protection W500:	± 40 VCC (permanent)
Overvoltage protection W510:	45 mA
Time constant of input filter:	3 ms
Outputs	
Number of output channels:	2, short circuit protected
Signal ranges:	0…+10 V, -10…+10 V } jumper selectable individually
Galvanic separation:	no
Conversion time D/A:	< 20 µs
Resolution (digital representation):	12 bits (0…4095)
Load impedance:	≥3 kΩ
Accuracy (of output value):	0.3% ± 20 mV

Technical data common to the whole module

Burst protection: (IEC 801-4)	± 1 kV, with unshielded cables ± 2 kV, with shielded cables
Temperature error	0.3% (across temperature range 0…+55 °C)
Internal current consumption: (from +5 V bus)	max. 200 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	0 mA
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

As the current consumption of this module is considerable, when using a number of them in the same system, the total load for all modules must be taken into consideration..

LEDs and connection terminals



The negative terminals "–" of outputs are connected internally to the ground, each via a 100 Ω resistor.

Analogue/digital values

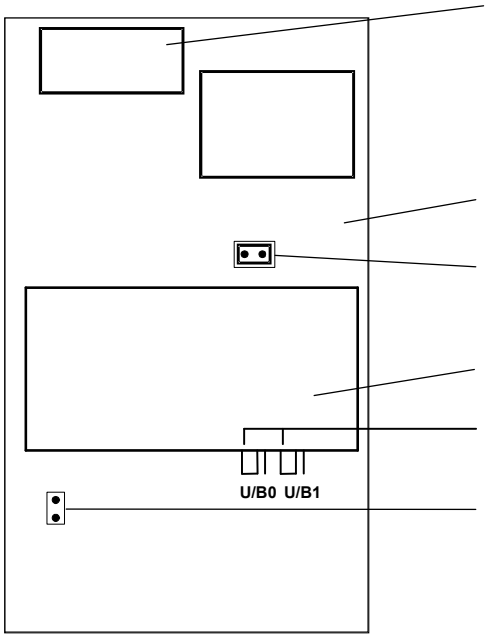
Inputs

Input signals	Digital values					
	Classic		xx7		Simatic	
	unipolar	bipolar	unipolar	bipolar	unipolar	bipolar
+10 V	4095	4095	4095	4095	27648	27648
+5 V	2047	3071	2047	3071	13824	13824
0 V	0	2047	0	2047	0	0
-5 V	0	1023	0	1023	0	-13824
-10 V	0	0	0	0	0	-27648

Outputs

Digital values			Output signals	
Classic	xx7	Simatic	unipolar	bipolar
4095	4095	27648	+10.0 V	+10.0 V
3071	3071	20736	+7.5 V	+5.0 V
2047	2047	13824	+5.0 V	0 V
1023	1023	6912	+2.5 V	-5.0 V
0	0	0	0 V	-10.0 V

Layout (housing open, for instructions, see section 6.1.5)



Bus connector

Basic circuit board

Jumper: inputs, unipolar (U)

Plug-in module

Jumpers U/B 0 and U/B 1
on plug-in module

Jumper: inputs, bipolar (B)

PCD3.W500 module, fully equipped
(with additional module plugged on)

Apart from the bus connector, DC-DC converter and terminals, the base module carries the two input channels with the 2-pole jumper for unipolar or bipolar operation and a number of preset potentiometers, which cannot be adjusted by the user.

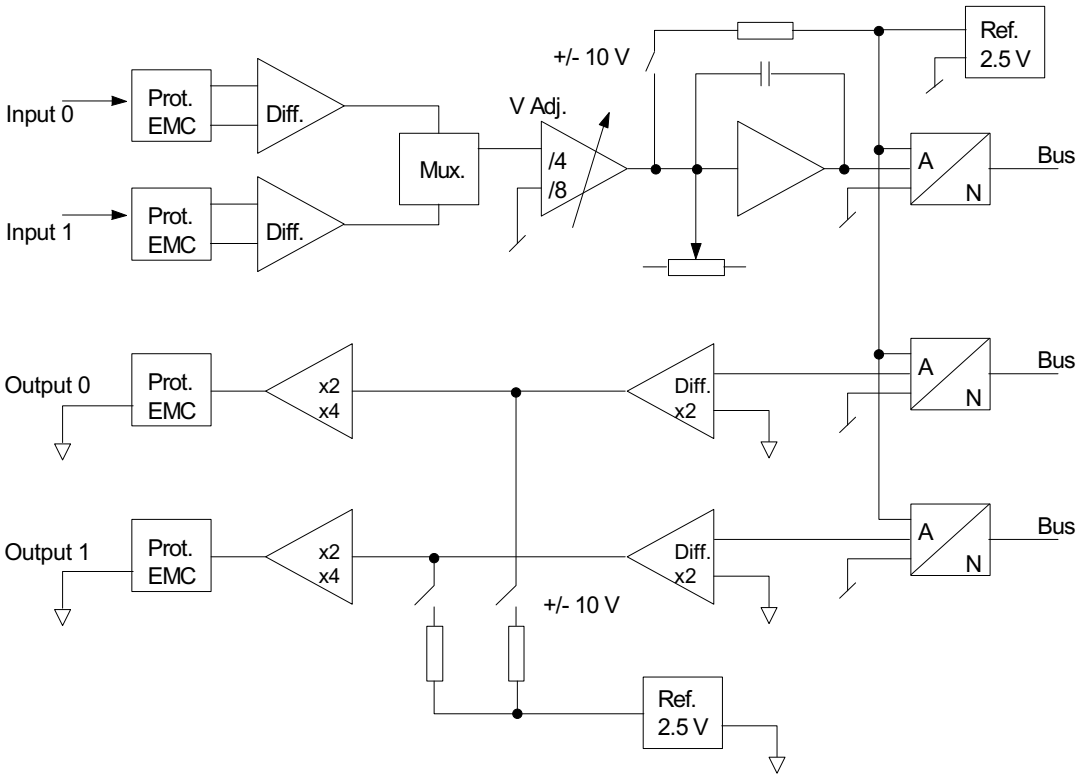
The plug-on module contains the two analogue outputs with the two 3-pole jumpers for the individual unipolar or bipolar operation of each output.

The module also works without the plug-on module.

Changing the jumpers

On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix B, "Icons"

Block diagram



Programming

Reset

When the module or CPU powers up, both analogue outputs of the PCD3.W500 module are set at the maximum value of +10 V (or a random value between 0 and +10 V). If this should cause problems, XOB 16 (the cold-start routine) should be used to initialize both these outputs to zero or any desired cold-start value.

If the debugger is connected or the P100 handheld service device is plugged in, there is no cold-start when the CPU supply switches on. Both analogue outputs of the PCD3.W500 are then set to the maximum value of +10 V, despite the reset routine.

Classic

Programming examples for the PCD3.W500 can be found on the TCS Support site. www.sbc-support.ch.

xx7

xx7 and RIOs: the firmware reads and writes the values according to the configuration (I/O Builder or network configurator)

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.13 Analogue combined input/output modules, electrically isolated

PCD3.W525	**4 inputs,** **14 Bit, 0…10 V, 0(4)…20 mA, Pt1000, Pt500 or Ni1000** **(selectable via DIP switch)** **and** **2 outputs,** **12 Bit, 0…10 V or 0(4)…20 mA** **(selectable via software (FBox, FB)**

Galvanic separation of outputs to PCD, channels themselves not separated

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.13.1 PCD3.W525 analogue combined input/output module with electrical isolation

General information

The PCD3.W525 is an analogue multi-purpose module with four inputs and four outputs. Each input and output can be configured individually as an industry-standard interface of type 0…10 V, 0…20 mA und 4…20 mA. The inputs can also be configured in such a way that they can support Pt/Ni1000 or Pt500 temperature sensors. Various filter types and scaling ranges can also be used for the module.

Inputs, 14 Bit

- 4 inputs. Each channel has four operating modes (configurable with DIP switches)
  - ***Differential voltage inputs***
    0…10 V, resolution: 0.61 mV per LSB (14 Bit)
  - ***Differential current inputs*** - measured in differential mode
    0…20 mA, resolution: 1.2 µA per LSB (14 Bit)
    4…20 mA, resolution: 1.2 µA per LSB (13.7 Bit)
  - ***Temperature***
    Pt1000, -50…400 °C, resolution: 0.1 °C
    Pt500, -50…400 °C, resolution: 0.2 °C
    Ni1000, -60…200 °C, resolution 0.1 °C
  - ***Resistance***
    0…2500 Ω, resolution 0.2 Ω
- Each channel can be configured to have a software-based filter with 50 Hz/ 60 Hz

Outputs, 12 Bit

- 2 outputs. Each channel has three operating modes (configurable via software)
  - ***Voltage***
    0…10 V, resolution: 2.44 mV per LSB (12 Bit)
  - ***Current***
    0…20 mA, resolution: 4.88 µA per LSB (12 Bit)
    4…20 mA, resolution: 4.88 µA per LSB (11.7 Bit)
- ***High impedance:***

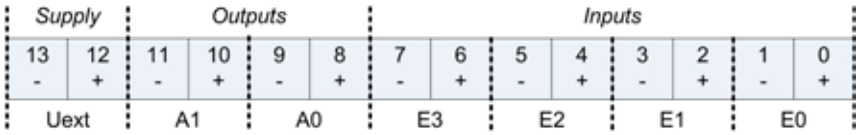
Miscellaneous

- All I/O channels are electrically isolated from the PCD and the external power supply. (but all channels are electrically connected to each other).
- Each channel has two connections.

Configuration

Module connections/LEDs

The module connections are as follows:



Description of LED:

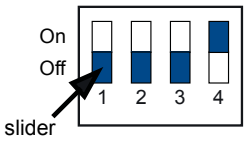
- Off: No power supply to module. U_{ext} (24 V) absent.
- On: Module working correctly.
- Flashing slowly: Channel error (overload/underload/short circuit/ open load)
- Flashing quickly: U_{ext} lower than specified (< 19 V).

Configuration of inputs

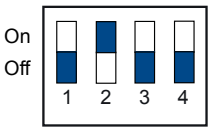
Each input channel is configured via a DIP switch with four pins. The function of each pin is as follows:

Pin no.	*Off*	*On*
1	Differential mode	Single-ended mode
2		Current shunt resistance on
3		Supply to external resistors on
4	Gain=1	Gain=0,25

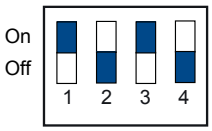
According to this table, the configuration of the various operating modes is as follows:



Voltage mode
0...10 V



Current mode
0...20 mA
4...20 mA



Temperature mode
Pt1000 (-50...400 ˚C)
Pt500 (-50...400 ˚C)
Ni1000 (-60...200 ˚C)
Resistor mode
0...2500 Ω

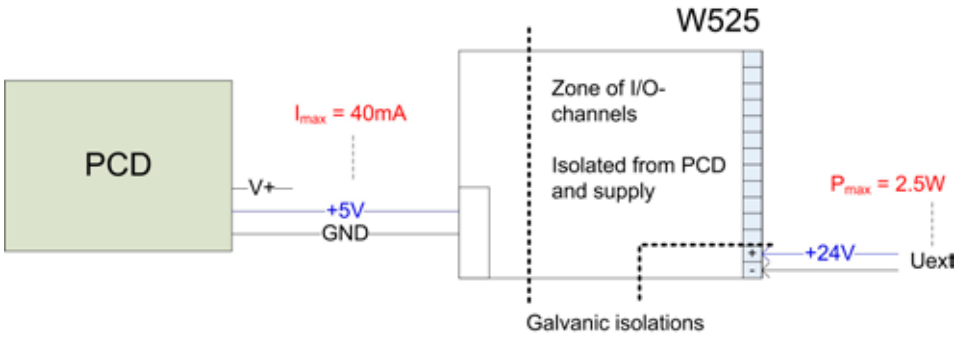
Configuration of outputs

As the outputs are configured using software (with the relevant FBox or FB), it is not necessary to configure the operating mode of the outputs using jumpers or DIP switches.

Function

Power supply

PCD3.W525s must have an external power supply. This power supply is electrically isolated from both the PCD and the inputs/outputs of the W525. The design also allows the use of the same power supply for the PCD and the W525 without losing the galvanic separation. The diagram below shows the various areas of separation:



Timing

- **Inputs**
  - Internally, the W525 captures a new value for each input channel every 2 ms
  - This value can be read by the PCD at any time.
  - Depending on the speed of the PCD, the transmission time for each individual value scaled to 16 bit (14 bit → 16 bit) (for a single input channel) is normally 100 µs.
- **Outputs**
  - Internally, the W525 outputs the last output value received from the PCD with a maximum delay of 2 ms.
  - Depending on the speed of the PCD, the transmission time for each individual output value scaled to 16 bit (12 bit → 16 bit) is normally 100 µs.

Filters

- **Inputs**

  There are two factors used to filter the captured values:

  - The basic hardware filter with a time constant of 2 ms. This filter attenuates the input signal by 6 dB per order of magnitude at a switching frequency of 80 Hz.
  - The software also has an effect. This results in a delay to the captured value of 2 ms with a notch filter property at 500 Hz, where no software-based filter with 50 Hz/60 Hz has been selected.

  Where a 50 Hz (60 Hz) filter is used, the frequency of the notch filter is 50 Hz (60 Hz); in this case, the delay is also 2 ms.

- **Outputs**

  Only the hardware-based filer with a time constant of 1 ms is active.

Technical data

Inputs	
General:	
Resolution:	14 bit
Measurement type:	differential
Number of channels:	4
Galvanic separation of the PCD:	yes
Galvanic separation of external supply:	yes
Galvanic separation between channels:	no
Type of connections:	two cables per channel
Configuration of operating mode:	using DIP switches
Accuracy at 25°C:	± 0.2% max.
Repeat accuracy:	± 0.05% max.
Temperature drift (0…55°C) max.:	± 70 ppm/°C
Overvoltage protection:	± 50 V min.
Overcurrent protection:	± 35 mA min.
Common mode max. voltage:	± 50 V min.
Common mode rejection:	70 dB min.
Filter:	
Time constant for hardware filter:	2 ms
Attenuation of software-based 50 Hz filter:	40 dB min. between 49.5 and 50.5 Hz
Attenuation of software-based 60 Hz filter:	40 dB min. between 59.5 and 60.5 Hz
Voltage mode:	
Resolution range 0…10 V mode:	14 Bit; 0.61 mV per LSB
Current mode:	
Current shunt resistance:	125 Ω
Resolution range 0…20 mA:	14 Bit; 1.22 µA per LSB
Resolution range 4…20 mA:	13.7 Bit; 1.22 µA per LSB
Temperature / resistance mode:	
Resolution for Pt1000; range -50…400°C	0.1 °C
Resolution for Pt500; range -50…400°C	0.2 °C
Resolution for Ni1000; range -60…200 °C	0.1 °C
Resolution for resistor; range 0…2500 Ω	0,2 Ω
Shunt capacity for temp sensor / resistor:	2.5 mW max.

Outputs	
General:	
Resolution:	12 bit
Number of channels:	2
Galvanic separation of the PCD:	yes
Galvanic separation of external supply:	yes
Galvanic separation between channels:	no
Type of connections:	two cables per channel
Configuration of operating mode:	using software (FBOX, FB)
Accuracy at 25°C:	± 0.5% max.
Repeat accuracy:	± 0.1% max.
Temperature drift (0…55°C) max.:	± 70 ppm/°C
Overcurrent protection:	short circuit protected
Time constant for filter:	1 ms
Voltage mode:	
Max. load to maintain specified accuracy:	> 700 Ω
Resolution range 0…10 V:	12 Bit; 2.44 mV per LSB
Current mode:	
Operating resistance:	< 600 Ω
Resolution range 0…20 mA:	12 Bit; 4.88 µA per LSB
Resolution range 4…20 mA:	11.7 Bit; 4.88 µA per LSB
General details	
Current consumption at I/O bus +5V:	max. 40 mA
Current consumption at I/O bus V+:	no load
Temperature range:	0…55 °C
External power supply	
(The same power supply can be used as for the PCD without losing the galvanic separation of the inputs/outputs.)	
Operating voltage:	24 V ±4 V smoothed
Current consumption:	max. 2.5 W (depending on output load)
Terminals:	Plug-in 14-pole screw clamps (PCD3.W525; item no: 4 405 4998 0) for cables up to 1.5 mm²

6.14 Analogue manual control modules

PCD3.W800	**Analogue output module with 4 output channels, 0...+10 V, 10 Bit resolution** **3 outputs with manual operation,** **1 output without**

Galvanic separation of outputs to PCD, channels themselves not separated

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.14.1 PCD3.W800, Analogue manual control module with 4 output channels, 0...+10 V, 10 bit resolution

Application

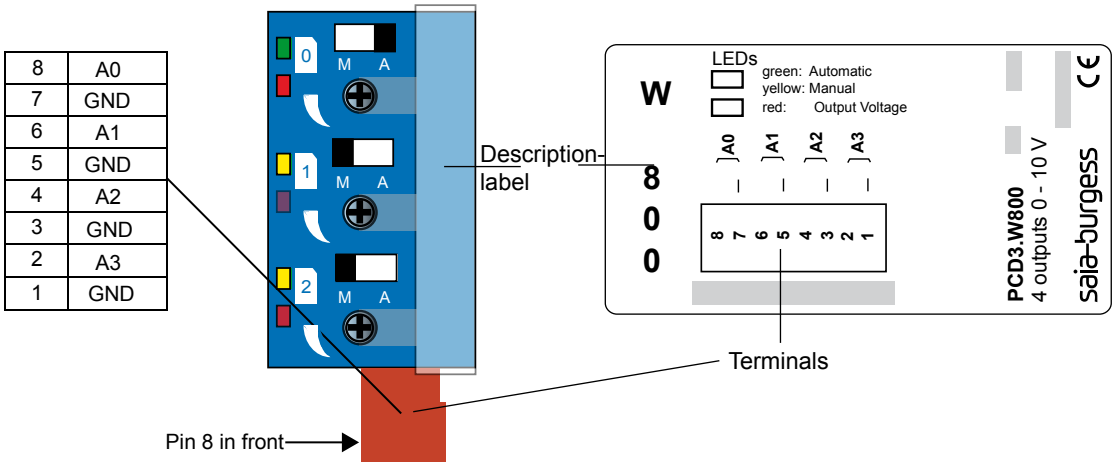
The PCD3.W800 module is a rapid analogue output module with a manual control option. In Automatic mode, there are 4 analogue 0…+10 V output channels available, each with 10 bit resolution.

Three of the analogue output channels have manual control functionality. In this mode, the output voltage is preset via the potentiometer on the front panel. (for emergency and manual operation, see also section 3.19).

Technical data

Automatic mode	
Output ranges:	Voltage 0..+10 V
Channels:	4 analogue outputs O0…O3 (3 with manual operation O0…O2)
Resolution:	10 mV
Digital representation:	10 bits (0..1023)
Load resistance:	> 3 kΩ
Accuracy at 25°C:*	±0.4 %
Temperature error (0…+55°C):	± 0.25 %, 100 ppm/K or 0.01 %/K
Short circuit protection:	Yes (permanent)
Time constant of output filter:	typically 1 ms
* Tolerance value for output signals > 100 mV	
Manual operation mode	
Output ranges	Voltage 0…10 V
Range of settings for potentiometer	0°…280° ±5°
Output voltage at 0°	typically 0 V
Output voltage at 140°	typically 5 V
Output voltage at 280°	typically 10 V
Accuracy at end stop	±5 %
Linearity error of potentiometer	±20 %
moment of potentiometer	< 0.01 Nm
Lifetime of potentiometer	> 5000 cycles
Internal current consumption: (from +5 V bus)	typ. 35 mA / max. 45 mA
Internal current consumption: (from V+ bus)	typ. 20 mA / max. 35 mA
External current consumption:	
Connections	Pluggable 8-pole cage clamp terminal block (4 405 4934 0), for wires up to 1.5 mm², or as above with 8 grouped strands, numbered, 2.5 m long (PCD3.K800)

LEDs and connection terminals



Control elements

Channels A0…A2 each have a toggle switch with the two positions Manual and Automatic.
There are 2 LEDs fitted per channel:
The upper LED is two-colour and displays the operating mode for the channel: amber = Manual; green = Automatic
The brightness (red) of the lower LED displays the output voltage of the channel (Manual and Automatic)

Example (above):

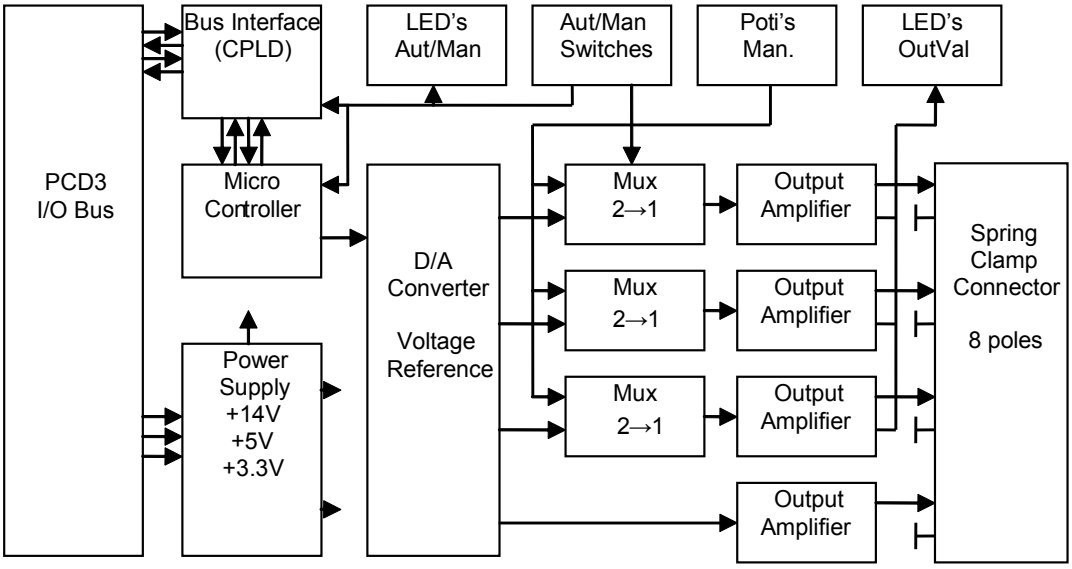
Output 0:	Automatic	LED 1 = green
	Value (100 %)	LED 2 = red (max.)
Output 1:	Manual	LED 1 = amber
	Value (15 %)	LED 2 = red (weak)
Output 2:	Manual	LED 1 = amber
	Value (85%)	LED 2 = red (strong)

Digital/analogue values

Output signals	Digital values		
	Classic	**xx7**	**Simatic**
+ 10.0 V	1023	1023	27684
+ 5.0 V	511	511	13824
0 V	0	0	0

The user is able to set application-specific parameters. It is possible for example to work directly in %. For this purpose, the appropriate parameters should be set to 0…1,000 in the FBox, corresponding to 0…100% in the HeaVAC library.

Block diagram



Programming

Classic

For programming the modules PCD3.W800, an FBox is available.

xx7

xx7 and RIOs: the firmware reads and writes the values according to the configuration (I/O Builder or network configurator)

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs.

Restrictions (not applicable with cables, hardware version B)

For the I/O connectors set out below, the following restrictions must be observed:

…on the PCD3.Mxxxx CPUs:

If a PCD3.K106/116 cable is used to connect to the next module holder, do ***not*** plug module into Slot 3 (far right).

The Ethernet cable can be plugged in, but (depending on the RJ45 cable) may touch the I/O connection to the module if in Slot 0.

…on the PCD3.Cxxx module holders:

No restriction, where the PCD3.K010 connector is used to connect to other module holders (the supply connector can also be plugged in to the C200 with no problems).

If a PCD3.K106/116 cable is used to connect from the preceding module holder or to the next module holder, do ***not*** plug the module into Slot 0 (far left) and do ***not*** plug into Slot 3 (far right).

…on PCD3.T76x head stations:

All angled Profbus connectors with max. height 40 mm can be used, e.g.

- ERNI, angled (light grey)
- Siemens “PROFIBUSCONNECTOR“ 6ES7, angled (dark grey) with optional termination resistors
- VIPA 972-0DP10, angled (metallic)

To plug in or remove the Profibus connector, remove the module. A second Profibus cable to extend the network cannot be plugged directly into the first Profibus connector. There are no problems with the RS232 cable and the supply connector, which can be plugged in with the module in place.

If a Profibus connector with height > 40 mm is used, the module ***cannot*** be plugged in to Slot 0 , e.g. with:

- WAGO 750-970 (height=42mm, contacts the I/O connector)

If a PCD3.K106/116 cable is used to connect to the next module holder, do ***not*** plug module into Slot 3 (far right).

PCD3.K106/116 cable, hardware version B, with 90° angled connector.

6.15 Weighing modules

PCD3.W720	**2-channel weighing module for 4/6-wire weighing cells**

[1]) These I/O modules cannot currently be used with the PCD3 RIO head station

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.15.1 PCD3.W720

The PCD3.W720 module is described in Manual 26/833.

6.16 General-purpose temperature modules

PCD3.W745	Thermocouple modules, 4-channel

Supported temperature sensors are:

- Thermocouples – TC type J,K
- Resistance thermometer (RTD) – RTD type Pt 100, Pt 1000, Ni 100, Ni1000

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.16.1 PCD3.W745

The PCD3.W745 module is described in Manual 26/796.

6.17 Counting and motion control I/O modules

PCD3.H100	**Counter module up to 20 kHz**
PCD3.H110	**General purpose counting and measuring module up to 100 kHz**
PCD3.H150	**SSI interface module**
PCD3.H210	**Motion control module for stepper motors [1])**
PCD3.H310	**Motion control module for servo-motors, 1-axis encoder, 24 V [1])**
PCD3.H311	**Motion control module for servo-motors, 1-axis encoder, 5 V [1])**

[1]) These I/O modules cannot currently be used with the PCD3 RIO head station

I/O modules and I/O terminal blocks may only be plugged in and removed when the PCD is disconnected from the power supply.

6.17.1 PCD3.H100, counting module up to 20 kHz

Application

Simple counting module, comprising two inputs "A" and "B" plus one direct control output marked “CCO”; allows counting of the number of revolutions or the calculation of distances (pulses) and the measurement by counting of pulses within a logical AND gate
(second input)

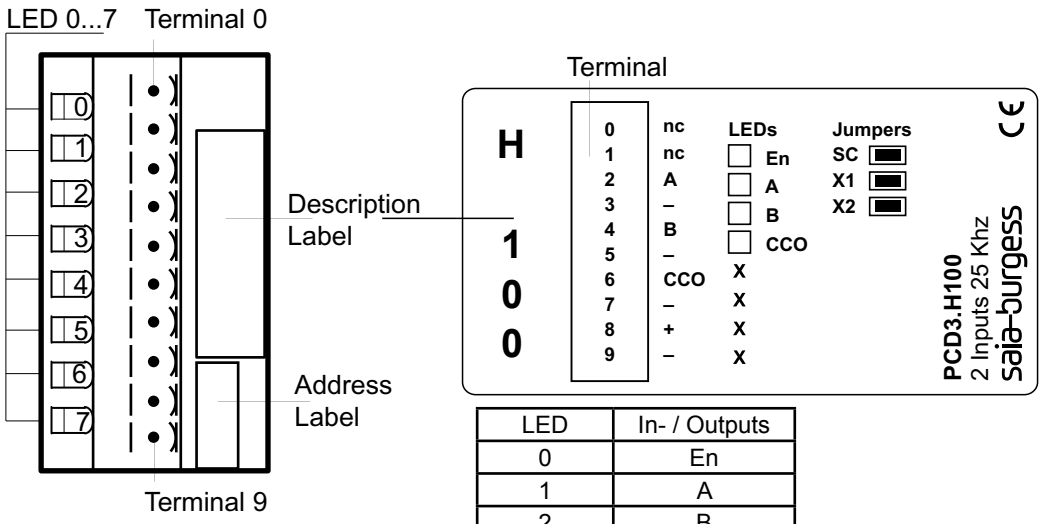
Typical areas of application:
- Counting revolutions or distances (impulses)
- Presetting a count value and switching off output CCO when Counter = 0
- Measurement by counting: measuring signals counted only when particular conditions are met, e.g. photoelectric barrier covered
- Counting with recognition of count direction for incremental shaft encoders providing simple motion control

Technical data

Number of systems:	1
Counting range:	0…65,535 (16 bit) (can be extended with CPU counters)
Counting frequency:	max. 20 kHz (at pulse/pause ratio 50%)
Data protection:	All data in this module are volatile (non-volatile PCD registers are available).
Digital inputs	
“IN-A” and “IN-B” signal voltages:	Nominal voltage: 24 VDC “low” range: -30…+5 V “high” range: +15…30 V for source operation
Input current:	typically 7.5 mA
Input filer:	25 kHz
Process output	
Counter controlled output CCO:	counter output (switches when count is 0 or 65,535)
Current range:	5…500 mA (max. current leakage 1 mA) (min. load resistance 48 Ω in voltage range 5…24 V).
Voltage range:	5…32 V smoothed, max. 10% ripple
Circuit type:	Electrically coupled, not short circuit protected, positive switching
Voltage drop:	typically 2 V at 500 mA
Output delay:	< 10 µs, (longer for inductive load because of protective diode).
Power supply	
External supply	5…32 VDC, (for supply of CCO output only)
Internal current consumption: (from +5 V bus)	max. 90 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	CCO output load current
Operational conditions	
Ambient temperature	Operation: 0…+55°C without forced ventilation Storage: -20…+85°C
Noise immunity:	EC mark according to EN 50 081-1 and EN 50 082-2
Programming:	Based on PCD user program and pre-programmed function blocks (FB). There are other FBs for use in the RIO head station.

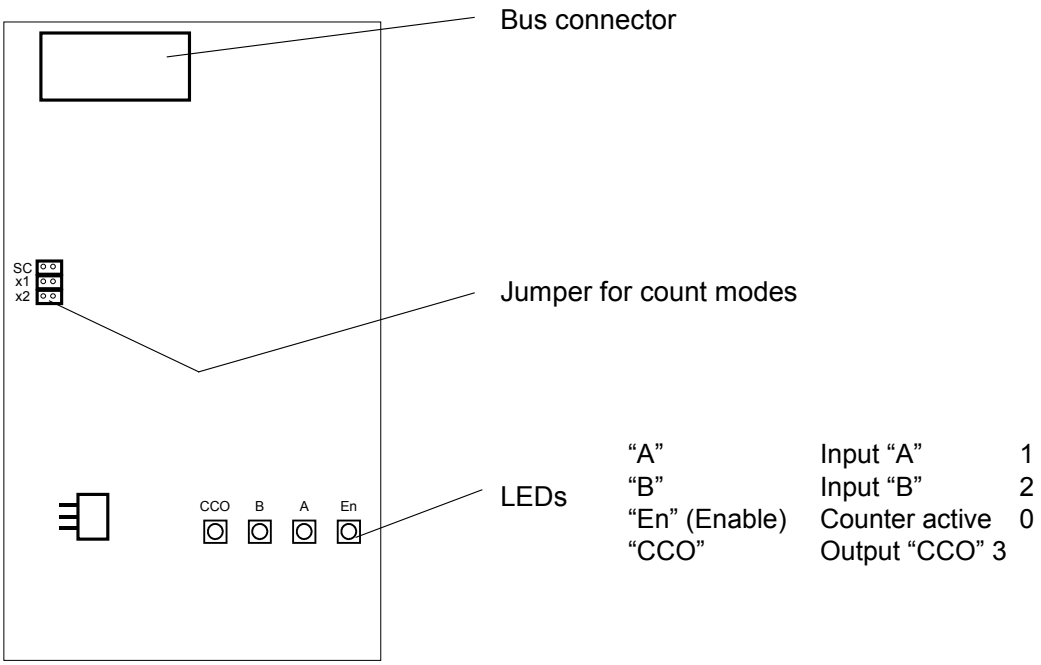
Count modes:	Selectable with jumper
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



LED	In- / Outputs
0	En
1	A
2	B
3	CCO

Layout (housing open, for instructions, see section 6.1.5)

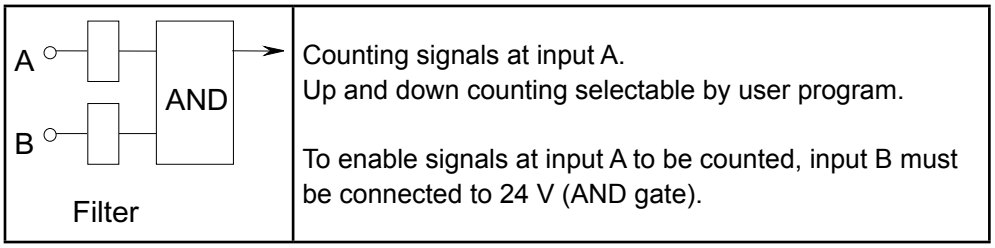


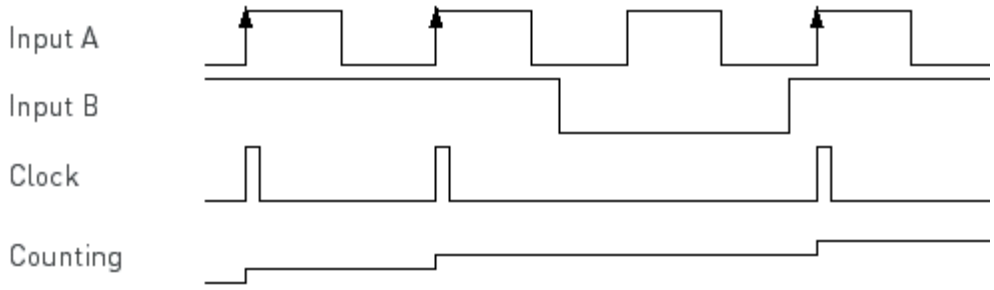
Changing the jumpers

On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix B, "Icons"

Count modes

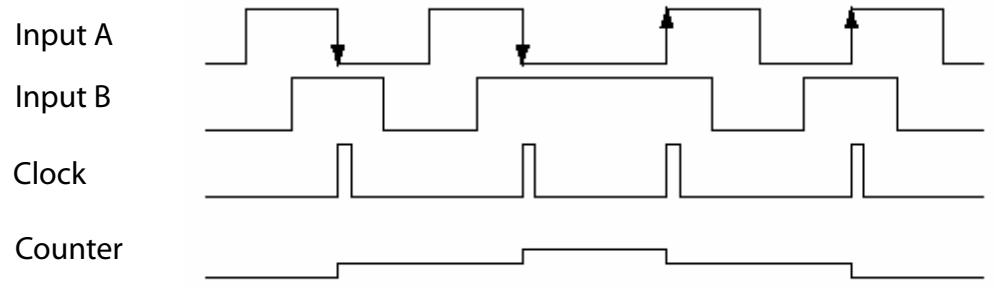
SC (Single Count):



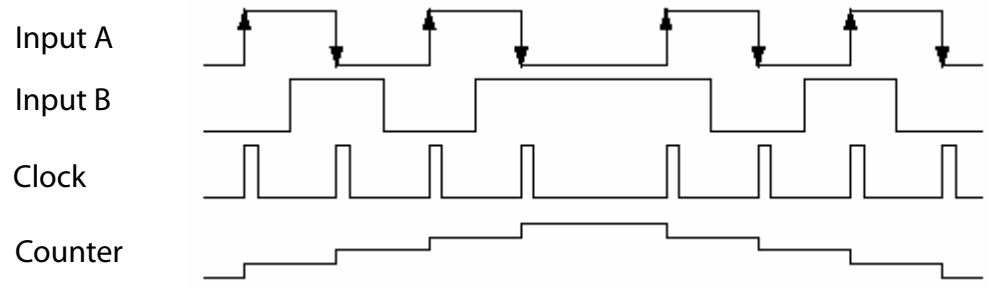


Modes x1, x2: Up/down counting mode for 2-phase incremental shaft encoder at inputs A and B.

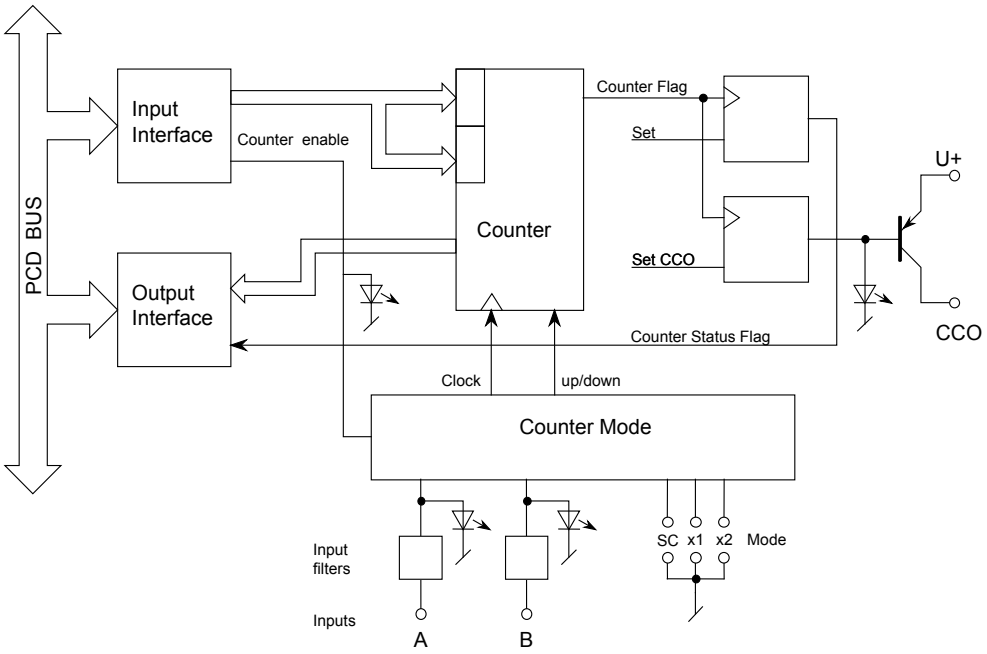
x1



x2



Block diagram



Operating principle

This can be largely derived from the block diagram. It is only necessary to add some explanation about the counter output circuit:

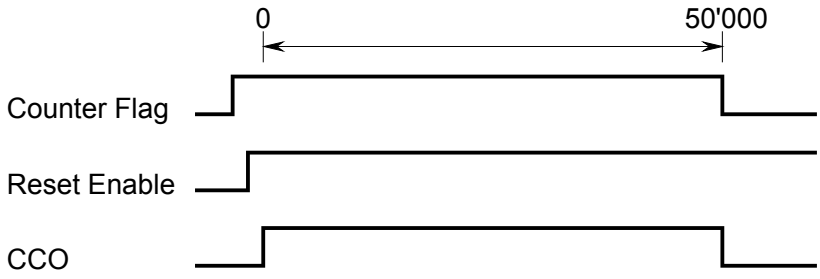
The output of the internal counter is identified as “Counter Flag”. The user has no hardware access to it. This counter flag is set to “1” whenever the counter is loaded or by means of a separate instruction.

The flag is set to “0” in up-counting mode: when counter value 65,535 is reached
in down-counting mode: when counter value 0 is reached

To reset a CCO hardware output which had previously been set high by the user program, it is necessary to differentiate between two cases:

a) count range between 0…65,535 (normal case)
b) count range exceeding 65,535

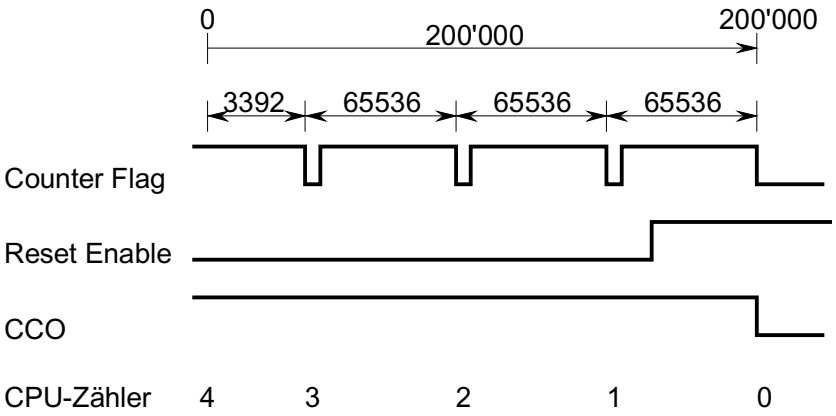
Case a): Resetting the counter flag results in a simultaneous reset of the CCO output.



The “Reset-Enable” should be activated **before** the counter reaches zero.

Case b): If the count range has to extend beyond the value 65,535, “Reset Enable” can be activated later, i.e. between the penultimate and the last time the counter reaches zero. This means that the CCO output is only reset after several passes of the counter. The number of passes is counted by a CPU counter.

For example, output CCO should be switched off after 200,000 count signals.



Programming

Classic

Programming examples for the PCD3.H100 can be found on the TCS Support site www.sbc-support.ch.

xx7

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder or network configurator).

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.17.2 PCD3.H110, counting module up to 100 kHz

Application

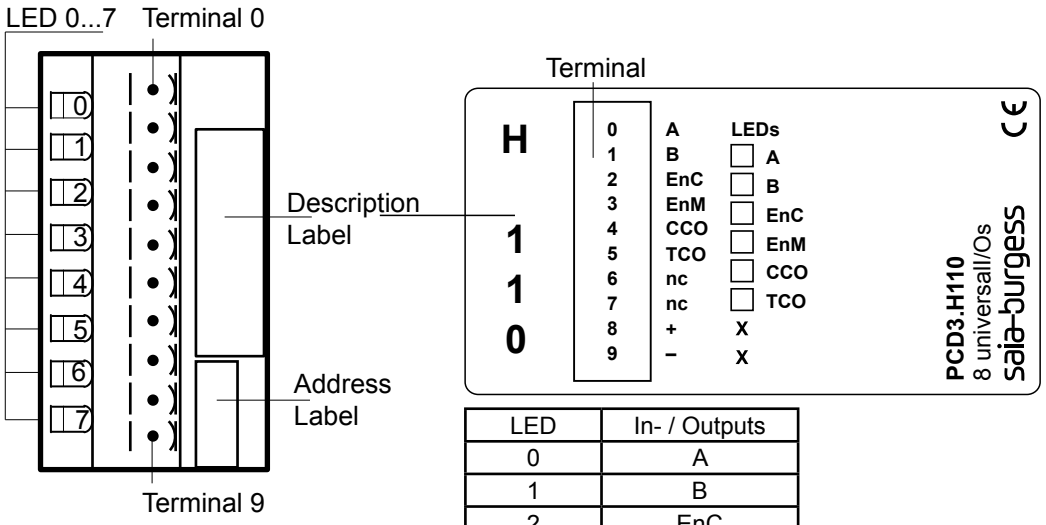
Measuring and fast counting module for general counting and simple motion control tasks; also for specific applications such as frequency measurement, period and pulse length measurement, etc. The module is equipped with an FPGA (Field Programmable Gate Array) and can be programmed for special high volume applications by using a plug-in PROM.

Technical data

Number of systems:	1
Counting range:	0…16,777,215 (24 bit)
Counting frequency:	up to 100 kHz
Data protection:	All data in this module are volatile (non-volatile PCD registers are available).
Digital inputs	
Number of inputs: Terminal 0 = I0 Terminal 1 = I1 Terminal 2 = I2 Terminal 3 = I3	4 Input “A”: for counting and measuring Input “B”: for counting only Input En"C”: for use as counting module Input En"M”: for use as measuring module
Nominal voltage:	24 VDC “low” range: -30…+5 V “high” range: +15…30 V for source operation
Input current:	typically 6.5 mA
Input filer:	150 kHz
Circuit type:	electrically connected
Digital outputs	
Number: Terminal 4 O0: Terminal 5 O1:	2 Output “CCO” (for counter) Output “TCO” (for measuring functions)
Current range:	5…500 mA (max. current leakage 1 mA) (min. load resistance 48 Ω in voltage range 5…24V).
Frequency:	≤ 100 kHz
Voltage range:	5…32 V smoothed, max. 10% ripple
Circuit type:	Electrically coupled, not short circuit protected, positive switching
Voltage drop:	typically < 0.5 V at 500 mA
Output delay:	< 1 µs, (longer for inductive load because of protective diode).
Power supply	
External supply	5…32 VDC, (for supply of CCO output only)
Internal current consumption: (from +5 V bus)	max. 90 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 2 A (all outputs)
Operational conditions	
Ambient temperature	Operation: 0…+55°C without forced ventilation Storage: -20…+85°C
Noise immunity:	EC mark according to EN 50 081-1 and EN 50 082-2
Programming:	Based on PCD user program and pre-programmed function blocks (FB). There are other FBs for use in the RIO head station.

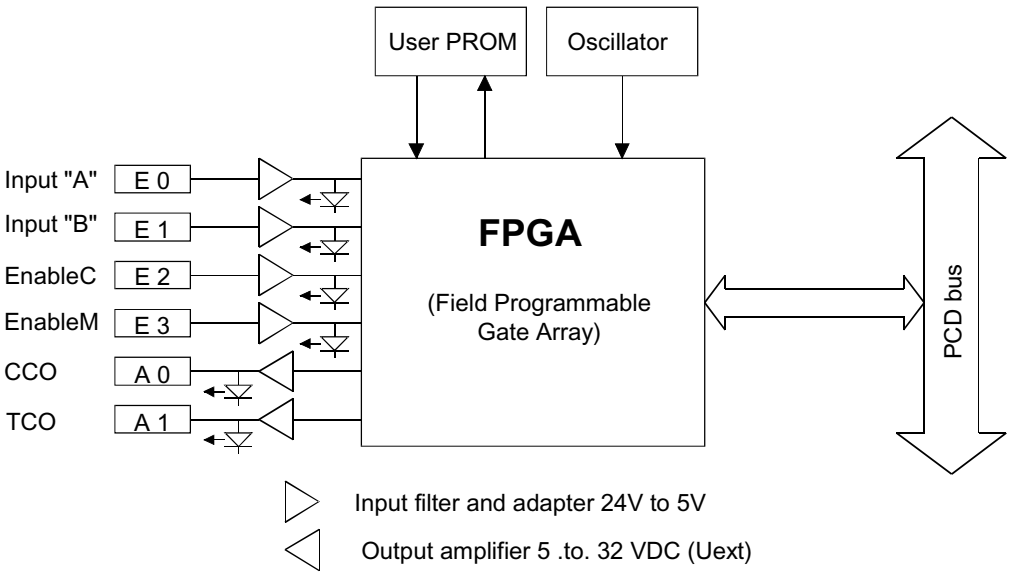
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



LED	In- / Outputs
0	A
1	B
2	EnC
3	EnM
4	CCO
5	TCO

Block diagram



For further details, please refer to manual 26/755 "PCD2.H110 - Universal counting and measuring module".

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.17.3 PCD3.H150, SSI interface module for absolute encoder

Application

The PCD3.H150 module is an interface module for the SSI standard. (SSI = Synchronous Serial Interface). The SSI standard is used with most absolute encoders. Details of SSI specifications can be obtained from the STEGMANN company's brochure: "SSI-Technical Information".

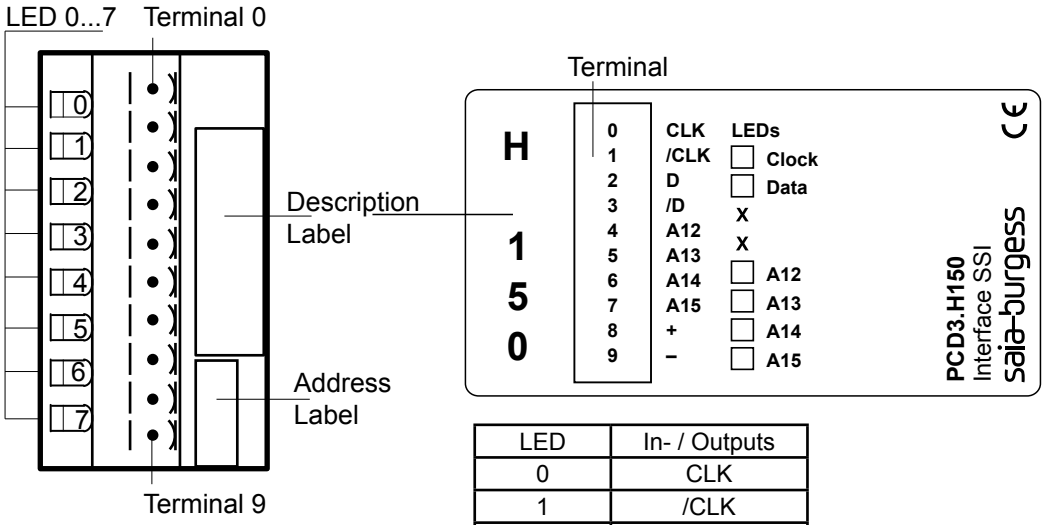
The hardware consists of an RS422 port for the SSI interface and 4 general-purpose digital outputs. Functionality is provided by an FPGA (field programmable gate array).

Technical data

Resolution:	configurable for 8…29 data bits and 0…2 control bits
Clock frequency:	configurable for 100 kHz, 200 kHz, 300 kHz and 500 kHz (input filter designed for 500 kHz)
Frequency has to be selected depending on cable length:	Cable length Frequency < 50 m max. 500 kHz < 100 m max. 300 kHz < 200 m max. 200 kHz < 400 m max. 100 kHz
Data code:	configurable - Gray or binary
Read mode:	Normal (single read). Ring mode: 'double read and compare' (not all encoders support this function)
Offset position:	An offset can be defined when initializing the PCD3.H150. The defined offset is always subtracted in the FBs. The 'Set Zero' command also uses this offset register.
Execution time:	typically 1.5 ms for reading the SSI value
Cable break detection:	detected with the FB 'timeout' (10 ms)
Flags	'fTimeout', (for cable break, encoder fault or incorrect addressing) 'fPar_Err', (if a wrong FB parameter is sent) 'fRing_err' (if compare error in 'double read')
SSI interface	
1 input for SSI data	RS422, electrically isolated
1 output for SSI clock	RS422, electrically connected, as the encoder input is normally isolated
Digital outputs	
Number of outputs: Terminal 4 = O12: Terminal 5 = O13: Terminal 6 = O14: Terminal 7 = O15:	4 Speed high Speed low Dir + positive direction Dir - negative
Switching capacity:	0.5A each in the range 10…32 VDC, residual ripple max. 10%
Short circuit protection:	yes, I_{max}=1.5 A
Electrical isolation:	no
Voltage drop:	max. 0.3 V at 0.5 A
Circuit type:	positive switching
Output delay:	typ.50 µs, max. 100 µs under ohmic load
Power supply	
Internal current consumption: (from +5 V bus)	25 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	For all outputs max. 2 A, ripple max. 10 %
Operational conditions	

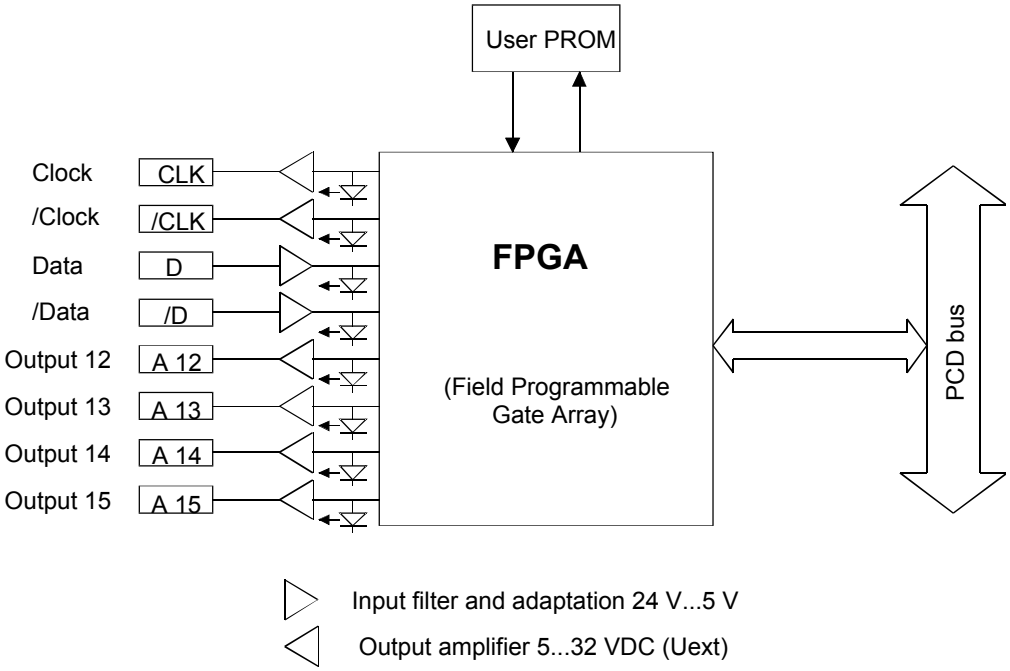
Ambient temperature	Operation: 0…+55°C without forced ventilation Storage: -20…+85°C
Noise immunity:	EC mark according to EN 50 081-1 and EN 50 082-2
Programming:	Based on PCD user program and pre-programmed function blocks (FB). There are other FBs for use in the RIO head station.
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



LED	In- / Outputs
0	CLK
1	/CLK
2	D
3	/D
4	O12
5	O13
6	O14
7	O15

Block diagram



For further details, please refer to manual 26/761 "PCD2.H150 - SSI interface for absolute encoder".

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.17.4 PCD3.H210, Motion control module for stepper motors

Application

The PCD3.H210 module provides fully autonomous control and monitoring of stepper motor travel, with run-up and braking ramps. The commands for stepper motor motion cycles are transmitted to the module by function blocks in the user program.

During motion, the SM processor monitors the frequency profile and the acceleration and braking ramps to move the axis to the destination position without loss of steps. Each module controls an independent axis. The module supplies a monophase pulse string which is conveyed to a suitable electronic drive. The module has 4 inputs and 4 outputs.

This I/O module cannot currently be used with the PCD3 RIO head station

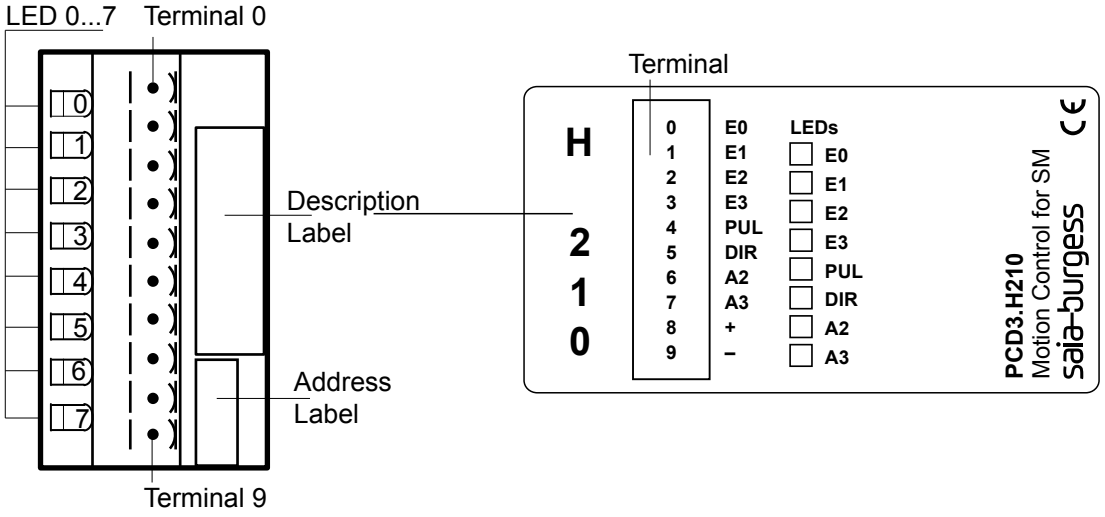
Technical data

Number of axes:	1
Positioning distance (counting range):	0…16,777,215 (24 bit)
Frequency ranges (selectable) *):	9.5…2,431 Hz 19…4,864 Hz 38…9,727 Hz 76…19,454 Hz
Acceleration *):	0.6…1224 kHz/s, non-linear range division, dependent on selected frequency range
Profile generator:	with symmetrical acceleration and braking ramps
Data protection:	All data in this module are volatile (non-volatile PCD registers are available).
Digital inputs	
Number of inputs: Terminal 0 = I0 Terminal 1 = I1 Terminal 2 = I2 Terminal 3 = I3	4 configurable as emergency stop or for general use configurable as limit switch LS1 or for general use configurable as reference switch or for general use configurable as limit switch LS2 or for general use
Nominal voltage:	24 VDC “low” range: -30…+5 V “high” range: +15…30 V for source operation only, for safety reasons, normally-closed contacts (negative logic) should be used
Input current:	typically 6.5 mA
Input filer:	< 1 ms
Circuit type:	electrically connected
Digital outputs	
Number: Terminal 4 O0: Terminal 5 O1: Terminal 6 O2: Terminal 7 O3:	4 Output “PUL” (pulses for motor) Output “DIR” (direction of motor rotation) programmable as required programmable as required
Switching capacity:	0.5 A each in the range 5…32 V, residual ripple max. 10%
Short circuit protection:	no
Electrical isolation:	no
Voltage drop:	max. 0.3 V at 500 mA

Output delay:	< 1 µs, (longer for inductive load because of protective diode).
Power supply	
Internal current consumption: (from +5 V bus)	85 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 2 A (all outputs), residual ripple max. 10%
Operational conditions	
Ambient temperature	Operation: 0…+55°C without forced ventilation Storage: -20…+85°C
Noise immunity:	EC mark according to EN 50 081-1 and EN 50 082-2
Programming:	Based on PCD user program and pre-programmed function blocks (FB).
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

***)** For further information, please refer to manual 26/760, "PCD2.H210 - motion control modules for stepper motors".

LEDs and connection terminals

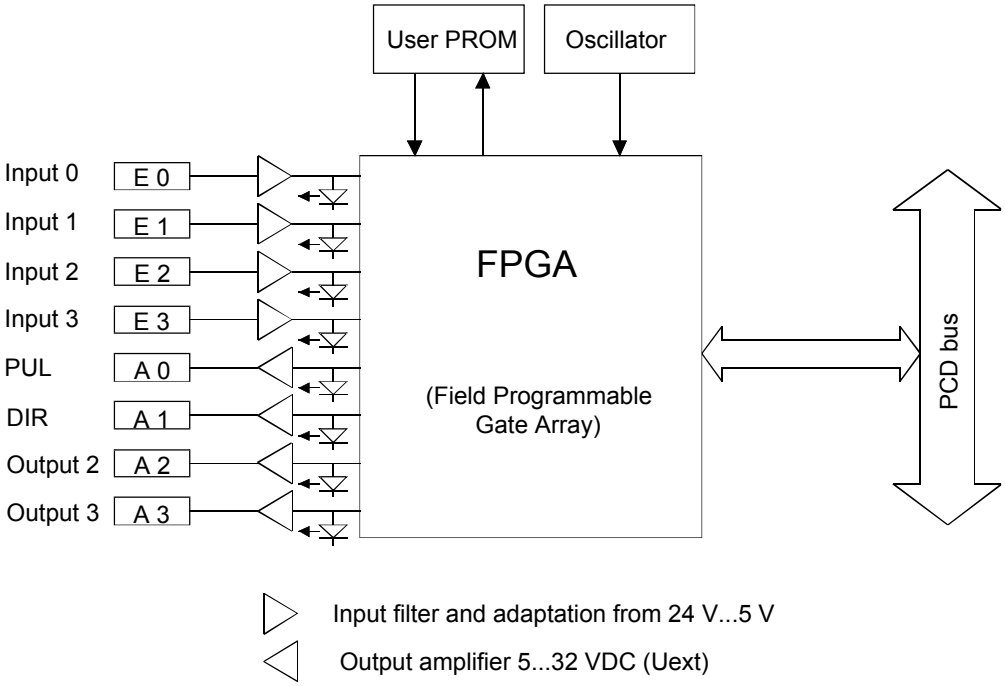


LED 0: *) Voltage at input 0: (Emergency stop)
LED 1: *) Voltage at input 1: (LS1)
LED 2: *) Voltage at input 2: (REF)
LED 3: *) Voltage at input 3: (LS2)
LED 4: Voltage at output 0: PUL
LED 5: Voltage at output 1: DIR
LED 6: Voltage at output 2
LED 7: Voltage at output 3

*) status inverted when used as a limit switch

LED	In- / Outputs
0	I0
1	I1
2	I2
3	I3
4	O0/PUL
5	O1/DIR
6	O2
7	O2

Block diagram



For further information, please refer to manual 26/760, "PCD2.H210 - motion control module for stepper motors"

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.17.5 PCD3.H31x, motion control module for servo-motors, 1-axis encoder

Application

The PCD3.H31x motion control module is an intelligent I/O module. The module is used to position a single axis with variable speed control DC or AC servomotors. This requires the drive unit to have a power stage and incremental shaft encoder for capturing position or speed.

Each module contains a single-chip processor that independently controls every movement according to parameters supplied by the user program (velocity, acceleration and destination position). The axes are controlled independently of each other, which means that no interpolation is possible to trace curved paths. On the other hand, linking of multiple axes (point-point) in quasi-synchronous operation cane be programmed.

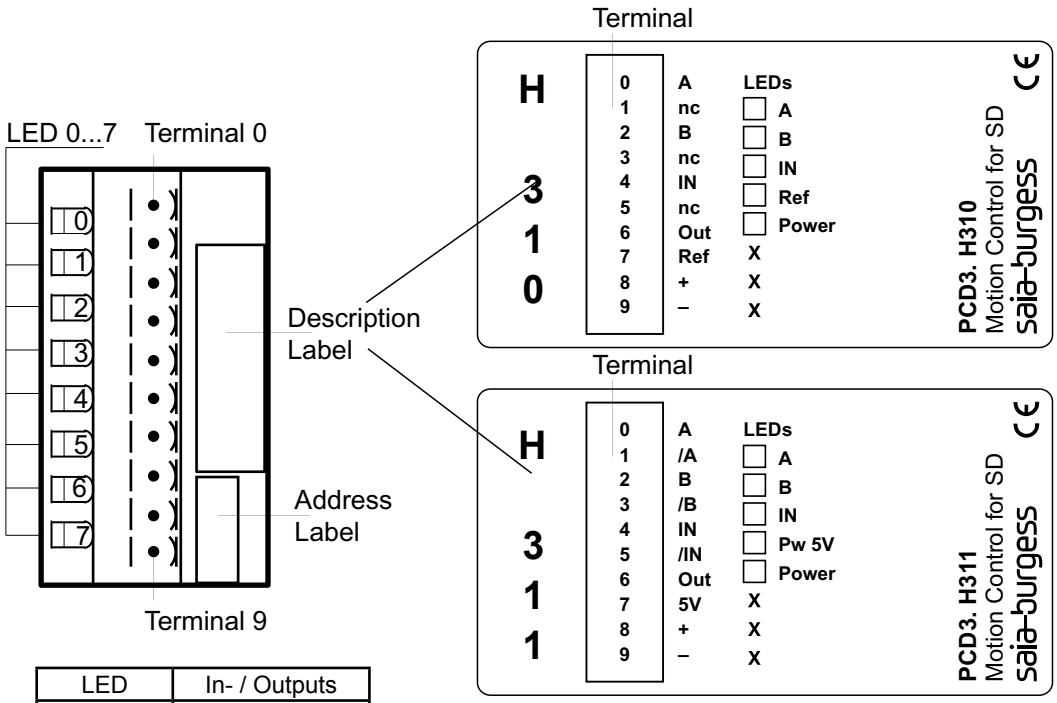
This I/O module cannot currently be used with the PCD3 RIO head station

Technical data

Number of axes:	1
Motion parameters	
31-bit registers are used for destination position, velocity and acceleration, numerical range ± 2^{30}	
Position:	Resolution selectable (depending on mechanical factor)
Velocity:	Resolution selectable (depending on mechanical factor)
Acceleration:	Resolution selectable (depending on mechanical factor)
PID controller:	Sample time 341 µs, programmable proportional, integral and differential factors. Sample time for differential part can be programmed separately.
Analogue controller output:	Velocity set point ±10 V (resolution 12 bit)
Counting frequency:	max. 50 kHz
Digital inputs to PCD3.H310	
Number of inputs:	1 encoder A, B, IN, 1 reference input
Nominal voltage:	24 V typically “low” range: 0…+4 V “high” range: +15…30 V for source operation only,
Input current:	typically 6 mA
Circuit type:	electrically connected
Reaction time:	30 µs
Encoder frequency:	max. 100 kHz
Digital inputs to PCD3.H311	
Number of inputs:	1 encoder A, /A, B, /B, IN, /IN, (no reference input)
Input voltage:	5 V typically
Signal level:	antivalent inputs according to RS422
Hysteresis:	max. 200 mV
Line termination resistance:	150 Ω
Encoder frequency:	max. 100 kHz
Analogue outputs for PCD3.H310/311	
Analogue controller output:	resolution 12 bit (with sign bit)
Short circuit protection:	yes
Electrical isolation:	no
Output voltage *):	±10 V, accuracy of adjustment ±5 mV

Circuit type:	positive switching
Minimum load impedance:	3 kΩ
*) Balancing output voltage is carried out in the factory. The user is strongly advised not to adjust the tuning potentiometer.	
5 V supply for 5 V encoder for PCD3.H311	
5 V output:	5 V supply of encoder
Short circuit protection:	yes
Electrical isolation:	no
Output voltage:	5 V
Max. load current: Short circuit current:	300 mA 400 mA (this current also loads the +5 V Bus on the module)
Power supply	
Internal current consumption: (from +5 V bus)	max. 140 mA typically 125 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 15 mA, typically 10 mA, residual ripple max. 10 %
Operational conditions	
Ambient temperature	Operation: 0…+55°C without forced ventilation Storage: -20…+85°C
Noise immunity:	EC mark according to EN 50 081-1 and EN 50 082-2
Programming:	Based on PCD user program and pre-programmed function blocks (FB).
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or plug-gable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

LEDs and connection terminals



LED	In- / Outputs
0	A
1	B
2	IN
3	Ref/Pw 5V
4	Power

LED “A” State of encoder input “A”
LED "B" State of encoder input “B”
LED "IN" State of index input
LED “Ref” State of reference switch (H310)
LED “Pw 5V” Supply (5V) to encoder (H311)
LED “Power” Supply ± 15V

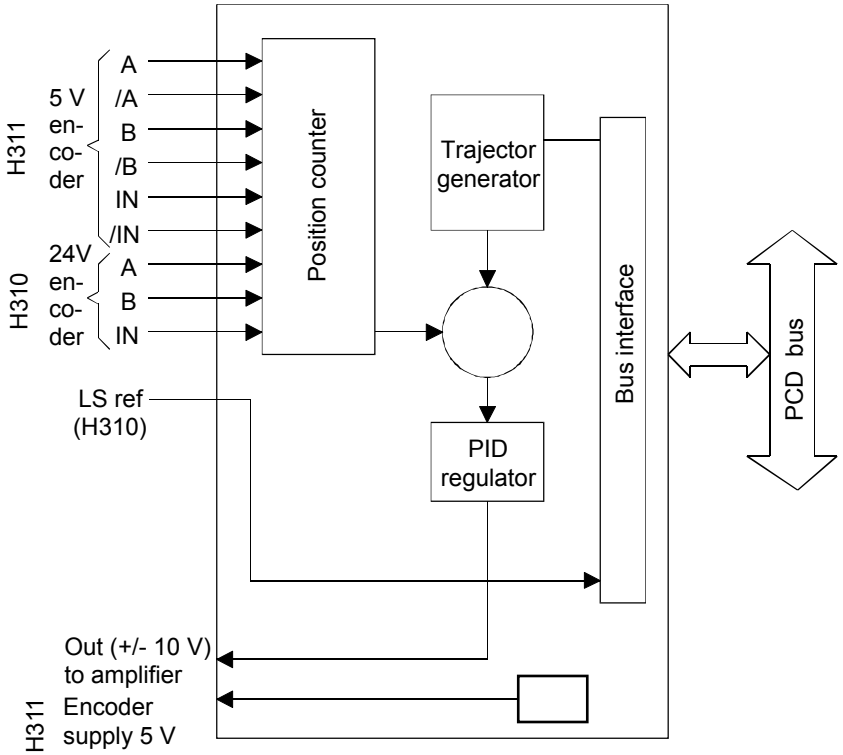
Terminals - PCD3.H310

− and **+** = external supply terminals
Ref = digital input for the reference switch
Out = analogue controller output
A, B, IN = encoder signals
nc = terminals not used

Terminals - PCD3.H311

− and **+** = external supply terminals
5V = output for 5V supply to encoder (300 mA max.)
Out = analogue controller output
A, B, IN = non-inverted encoder signals
/A, /B, /IN = inverted encoder signals

Block diagram



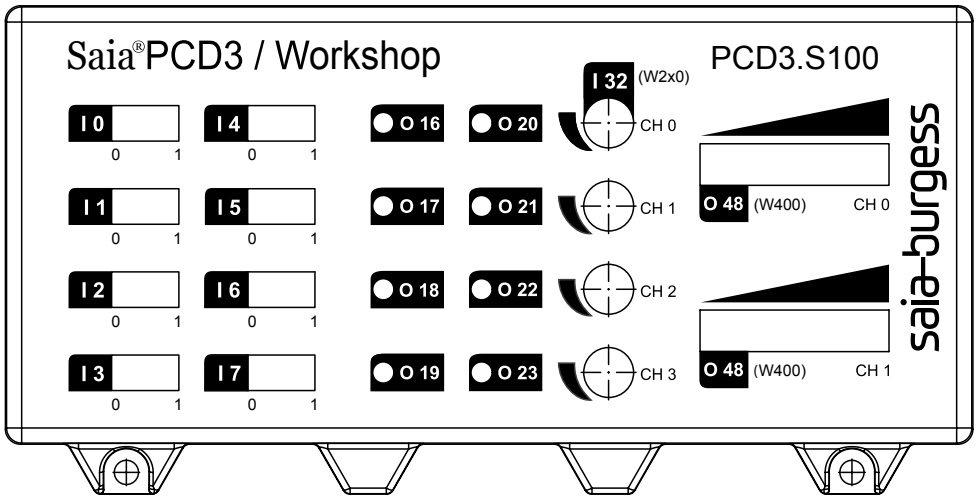
For further information, please refer to manual 26/762, "PCD2.H31x - motion control module for stepper motors"

Watchdog: This module can interact with the watchdog, if it is used on base address 240. In this case, the last input with address 255 cannot be used.
For details, please refer to the "Watchdog" section, which describes the correct use of the watchdog in conjunction with PCD3 components.

6.18 Miscellaneous modules

PCD3.S100	**Workshop simulator unit**

6.18.1 PCD3.S100 Workshop simulator unit



The PCD3.S100 workshop simulator unit **is only designed for use in workshops and training courses.**

It does not meet the requirements of general applications: it is not approved or calibrated, there are no thorough tests of the mechanical and electrical properties, and no guarantees regarding availability or repair.

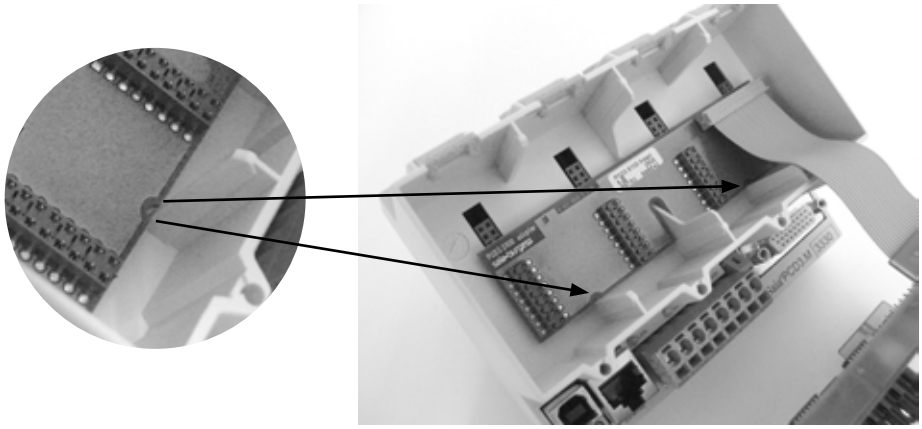
Technical data

Digital inputs:	8 switches to simulate digital inputs, base address +0
Digital outputs:	8 LEDs to display the status of digital outputs, base address +16
Analogue inputs:	4 potentiometers (~270° rotation) to simulate analogue inputs, 10 bit resolution, base address +32 With PCD3.Mxxxx or Cxxx, use the PCD2/PCD3.W2x0 FBoxes from the standard or HeaVAC libraries
Analogue outputs:	2 LED histograms with 10 segments, to simulate analogue outputs, base address +48 With PCD3.Mxxxx or Cxxx, use the PCD2/PCD3.W400 FBoxes from the standard or HeaVAC libraries
Configuration when used with PCD3.T760 RIOs	1x PCD3.E110, 1x PCD3.A400, 1x PCD3.W200, 1x PCD3.W400
Internal current consumption: (from +5 V bus)	max. 70 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	--
Compatibility:	Use for workshops / training courses, mounted in **PCD3.Mxxxx**, PCD3.C100, PCD3.C200 and PCD3.T76x units
Terminals:	No connections for external wiring

Assembly instructions

1) Remove or disable power supply to the PCD.

2) Connect the bus plate to the I/O bus. Ensure that the bus plate is firmly positioned in the I/O bus sockets, and that the grooves line up with the guides; see arrows.



3) First insert the bus plate,

then locate the front plate on the module holder.

4) Fix with the two screws provided.

7 Configuration

7.1 CPUs

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

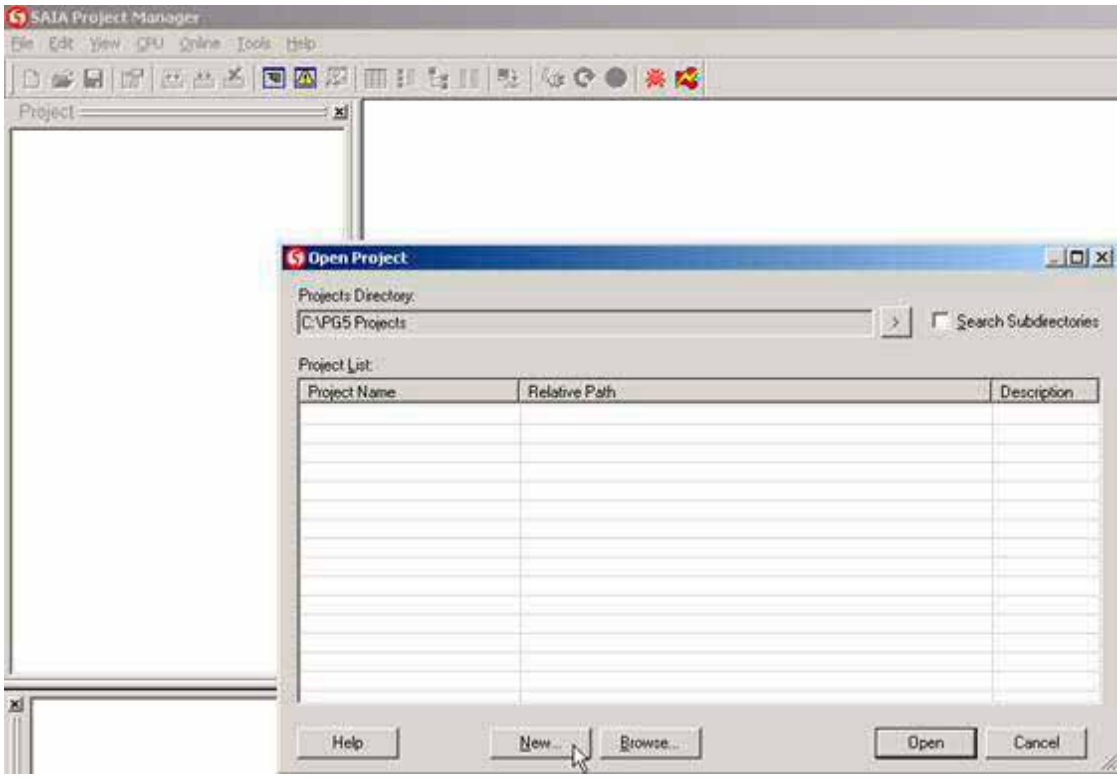
7.1.1 Configuring the PCD with PG5

Connecting the PCD to the configuration with PG5:

❶ Start up PG5 1.3

❷ Create new project:

- Click on “New…”



- The “New Project” dialogue is displayed

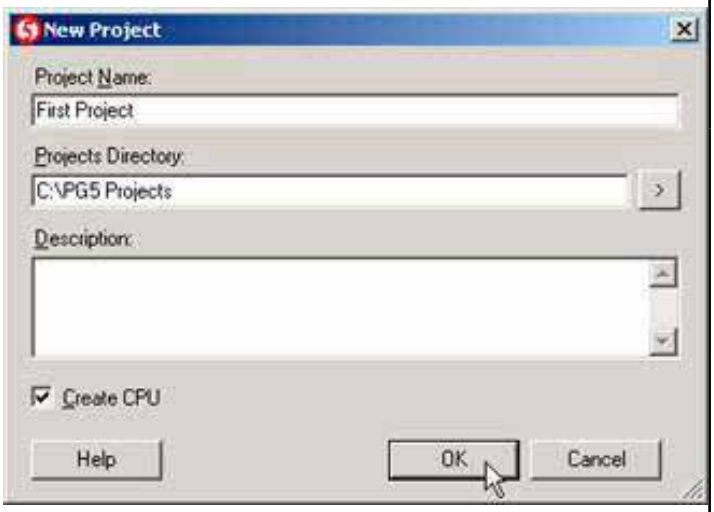
Creating and opening a new project.
The dialogue box is brought up via “File/New Project”. The size of the dialogue box can be changed by dragging the bottom right corner or by dragging the frame.

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

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

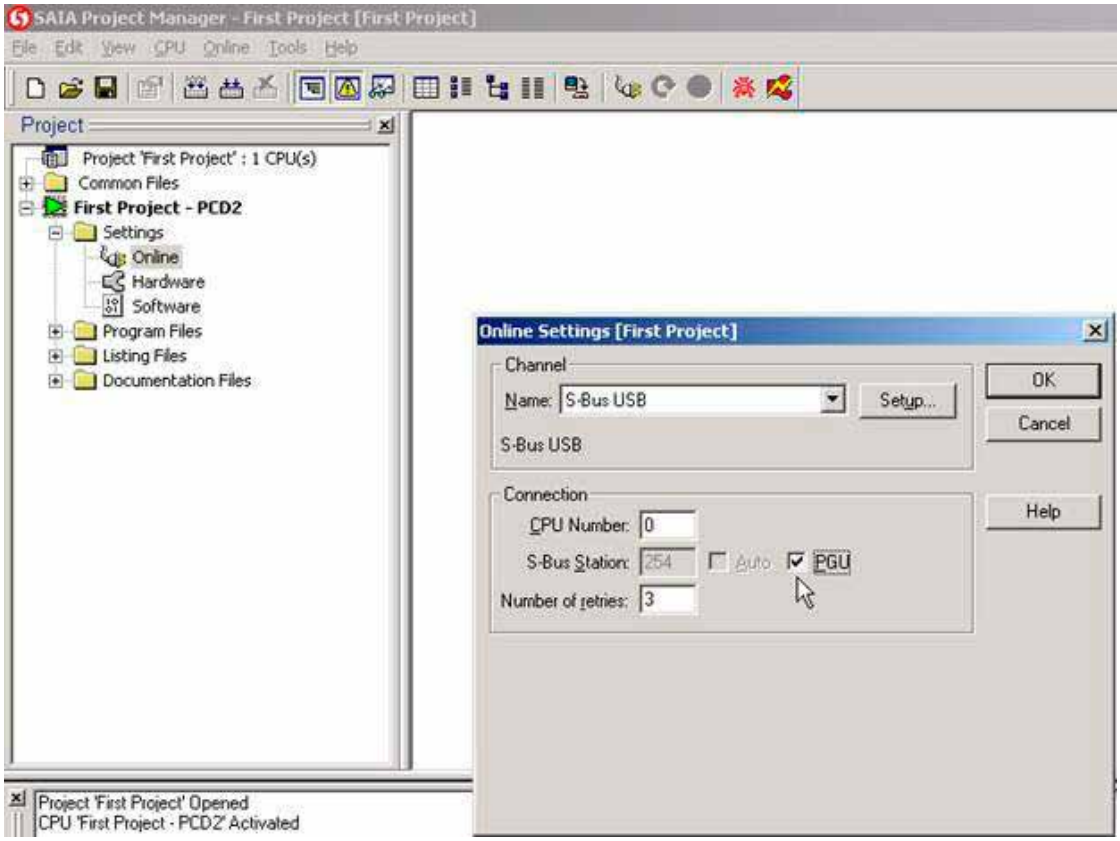
Description
May contain up to 2000 characters of free text. The first line of text is displayed in the "Description" window in the "Open Project" dialogue box.

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



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

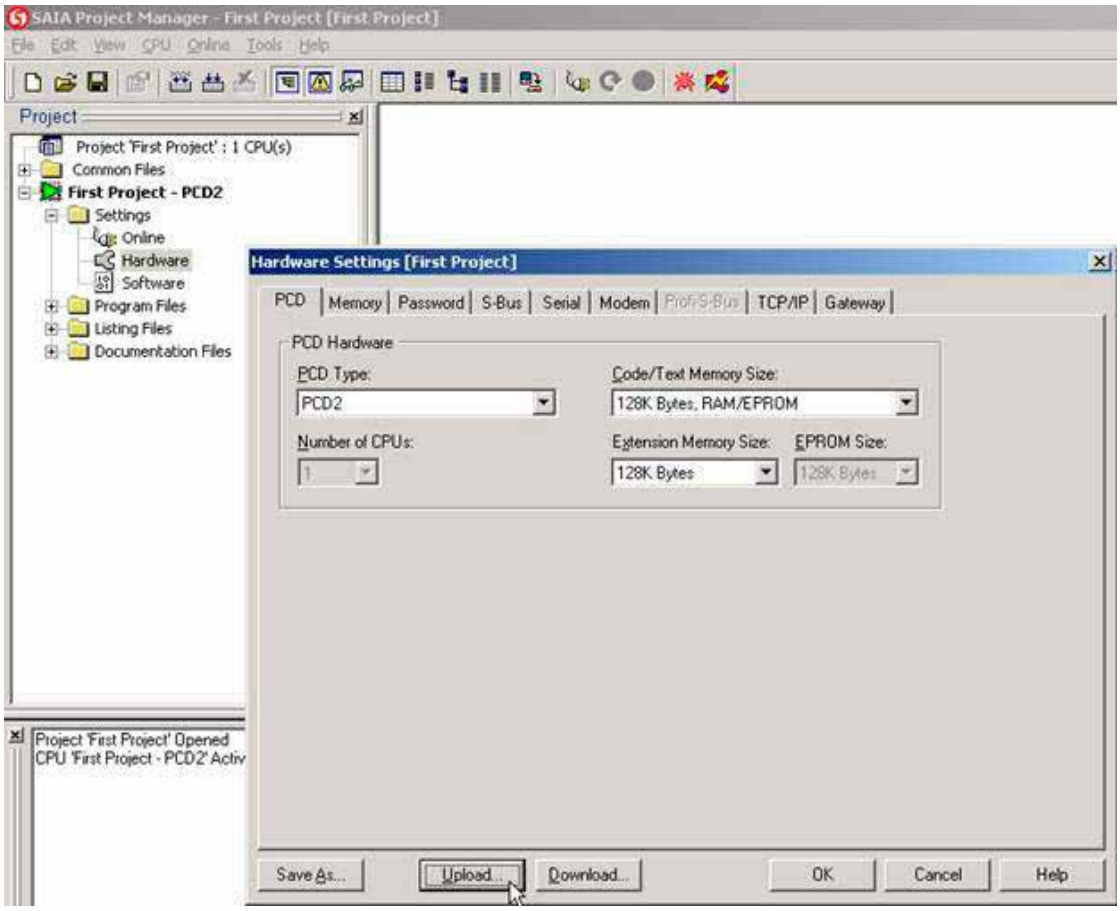
❸ Go to "Online Settings" and select the following options:
- Channel name: S-Bus USB
- Tick PGU option
- Click “OK”



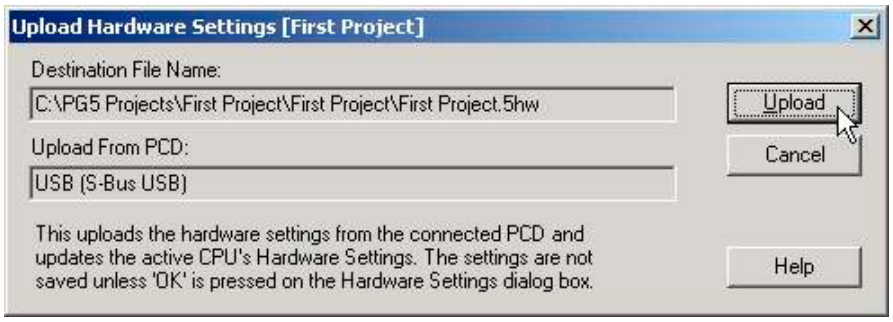
❹ Now connect the PCD to the PC via the USB cable. Ensure that the PCD is connected to the 24 VDC supply.

❺ Go to “Hardware Settings”:

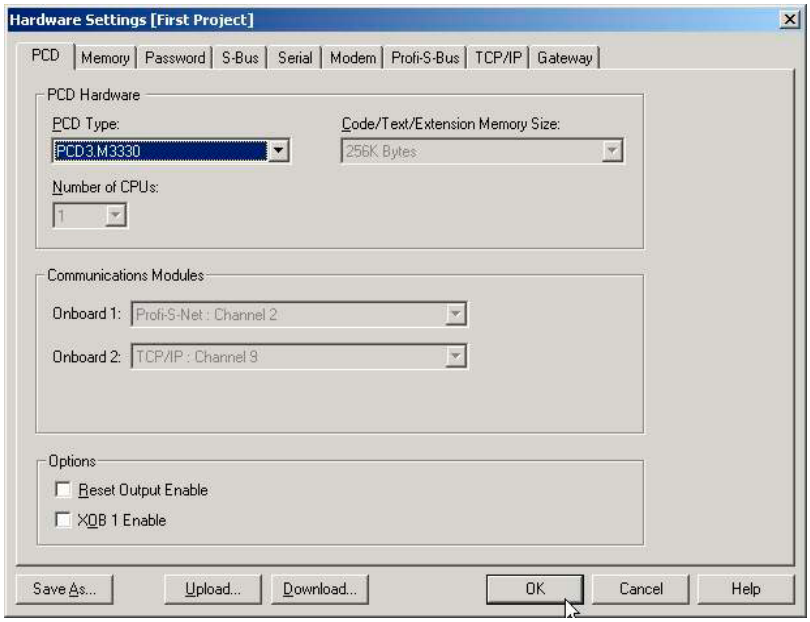
- Click on “Upload…”, to copy the settings from the CPU.



- Click on “Upload…”



- Click “OK”



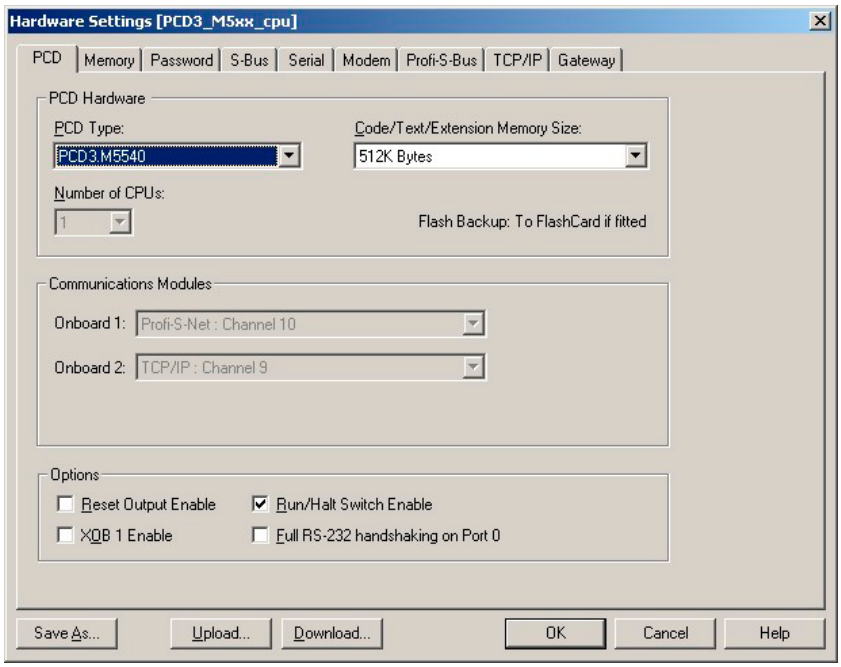
The connection of the PCD to the configuration with PG5 via the PC is complete. The hardware settings can now be changed and programming the application can begin.

7.1.2 "Hardware settings" option

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

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

Example: PCD3.M5540 settings



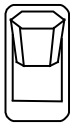
Reset Output Enable

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

XOB 1 Enable

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

Run/Halt Switch Enable



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

Full RS-232 handshaking on Port 0

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

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

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

7.2 RIOs

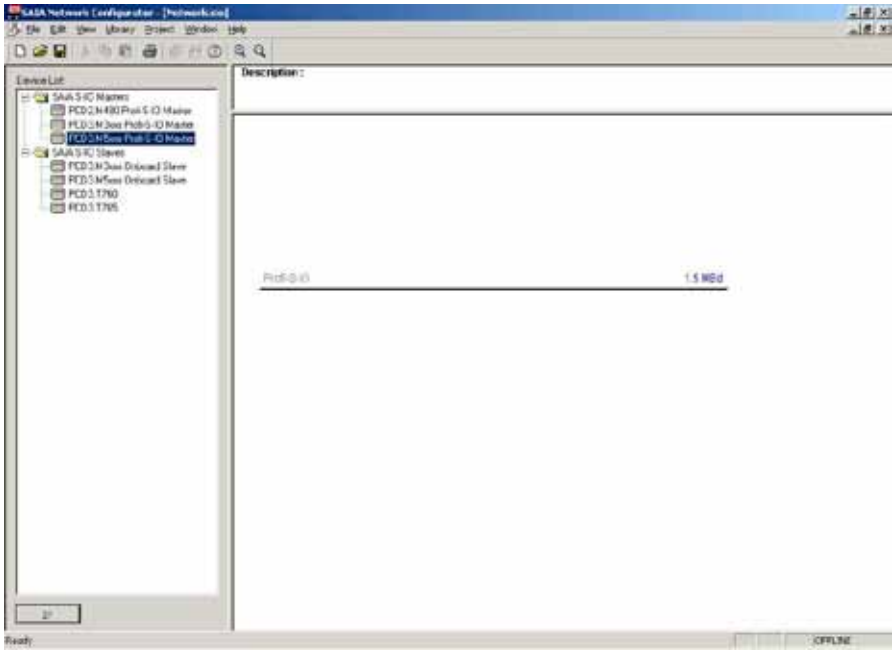
The following description assumes that the user is familiar with the PG5 software. If not, you are advised to read manual 26/733 "PG5".

7.2.1 Example project with PG5 and Profibus-S-IO

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

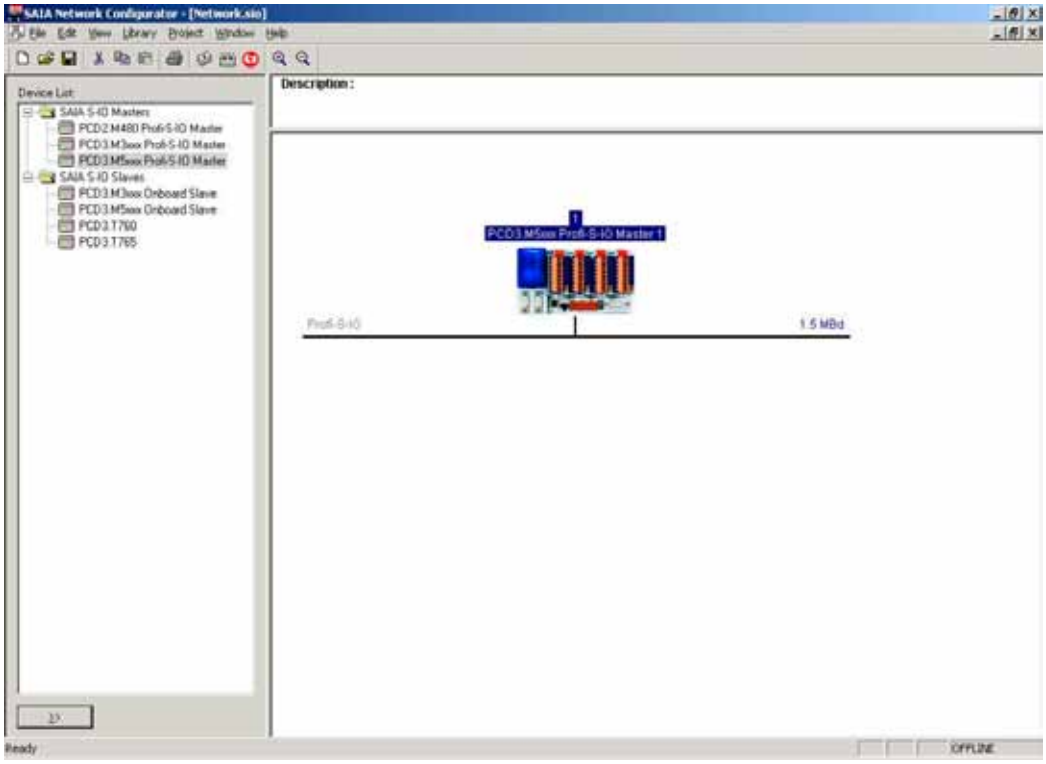
Definition of the "Master" PCD

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



Here, a PCD3 has already been selected as "Master". By pressing or the “Enter” key, move the PCD into the right half of the screen.

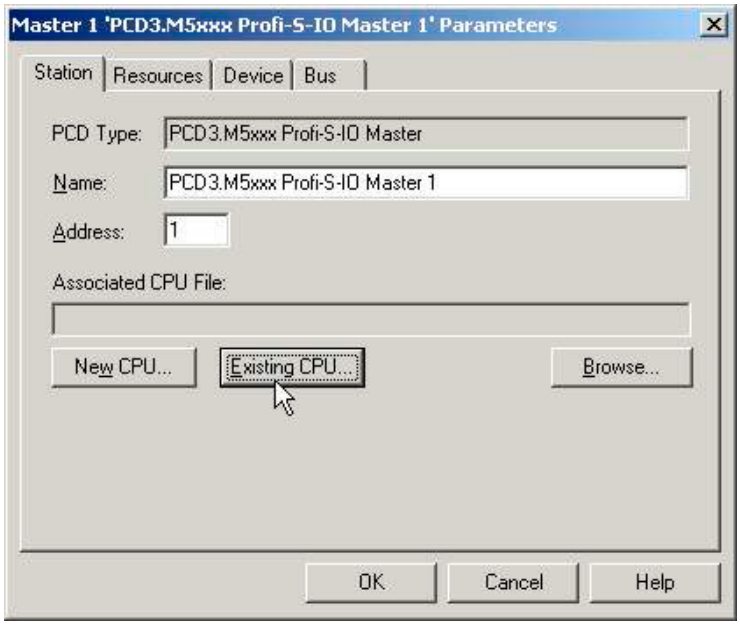
Set parameters



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

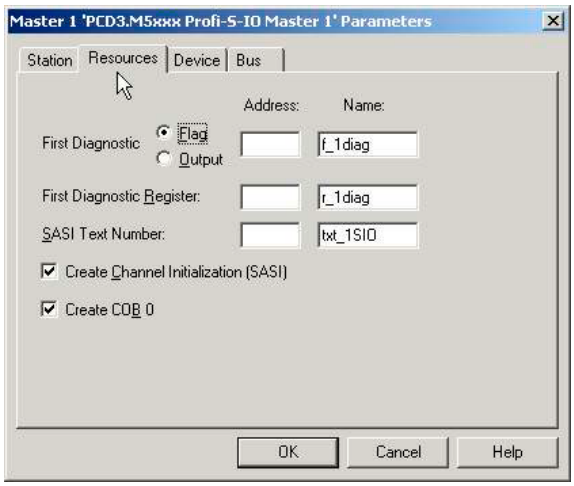
“Station” tab

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



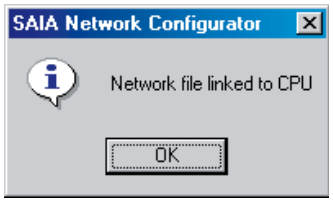
“Resources” tab

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



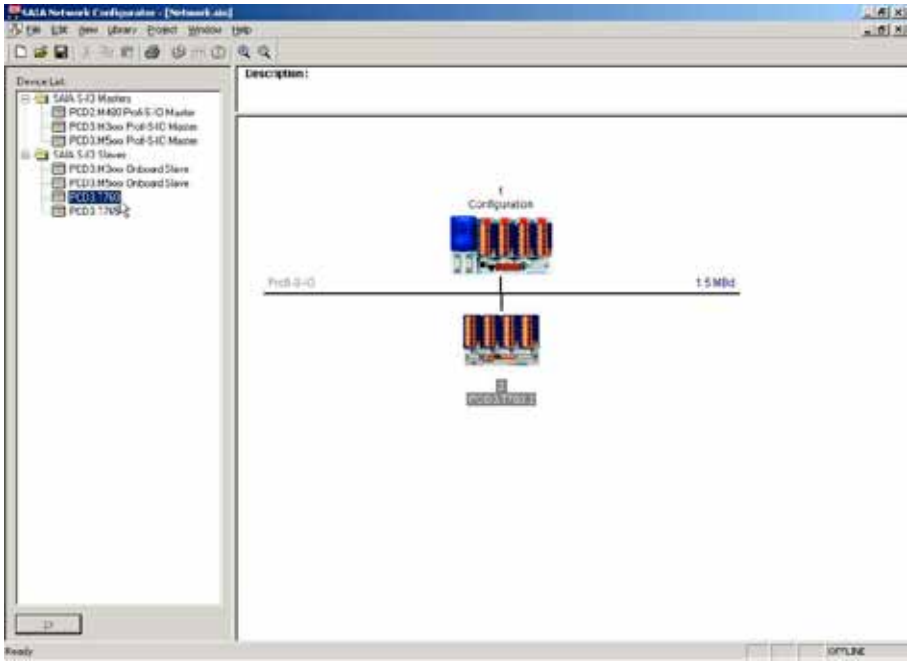
These are the entries for this CPU; click "OK" to finish.

Confirmation:



Definition of PCD3.RIO

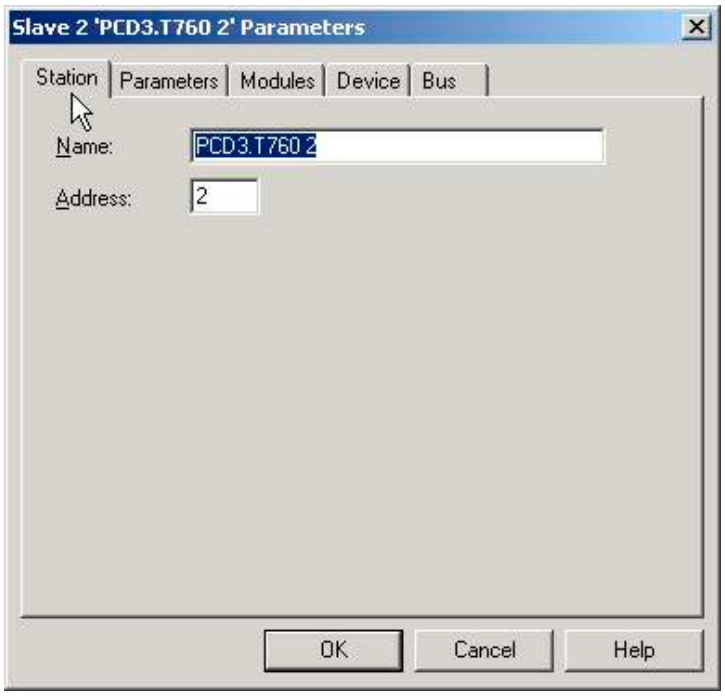
One PCD3.RIO has already been positioned in this window.



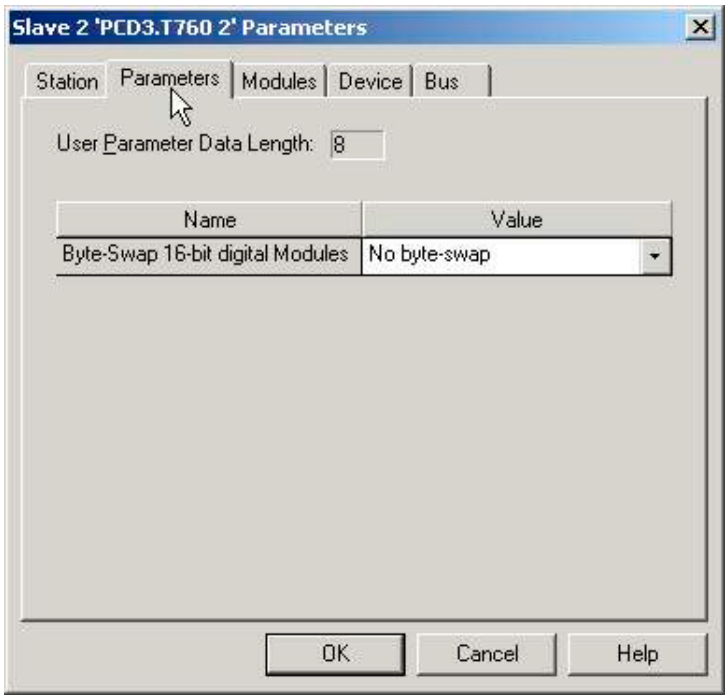
Double-click on the “PCD3.RIO DP Slave” icon.

“Station” tab

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



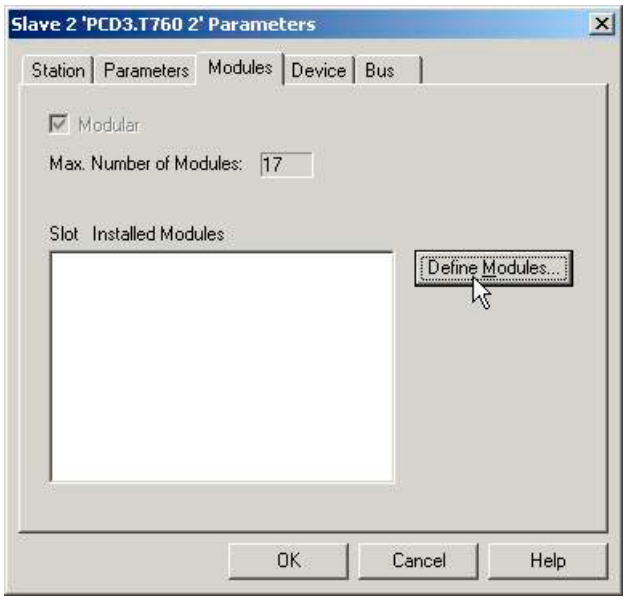
“Parameters” tab



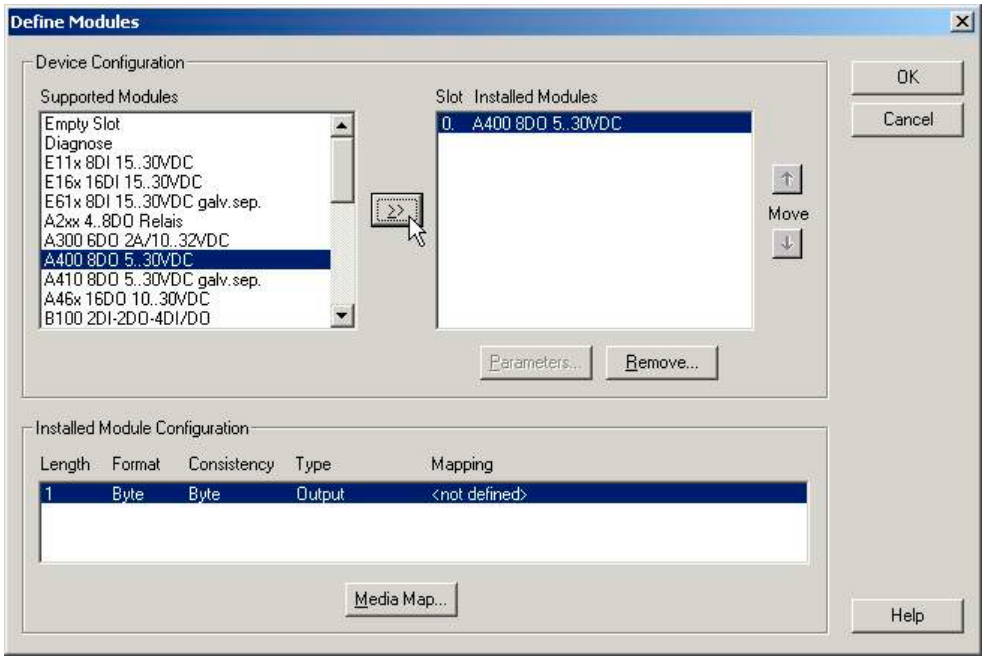
Option to swap the “Low” byte with the “High” byte for a 16-channel I/O module.

“Modules” tab

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



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



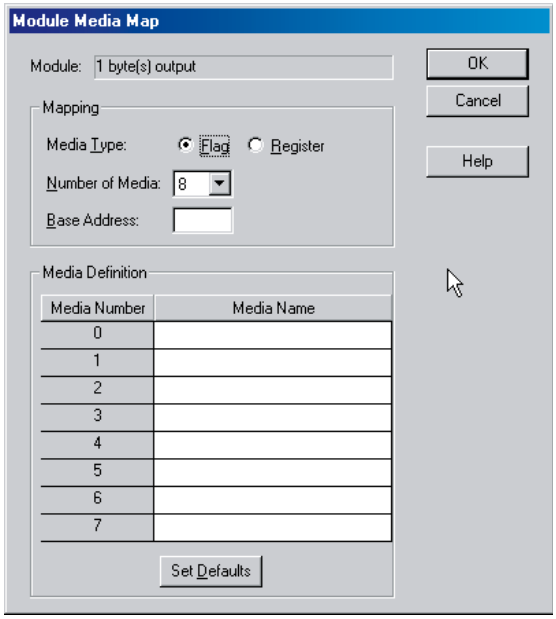
The bottom part of the window shows information on the copied modules under “Installed Module Configuration”.

Select next module.

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

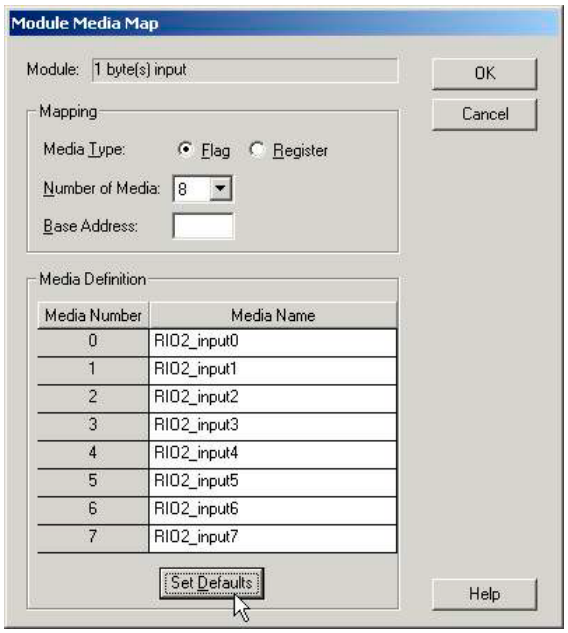
The "diagnostic module" can be used to exchange diagnostic information between Master and RIO. The use of a Diagnostic module is not mandatory. This "diagnostic module" must be configured after the last I/O module: detailed description in section 3.19.6.

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



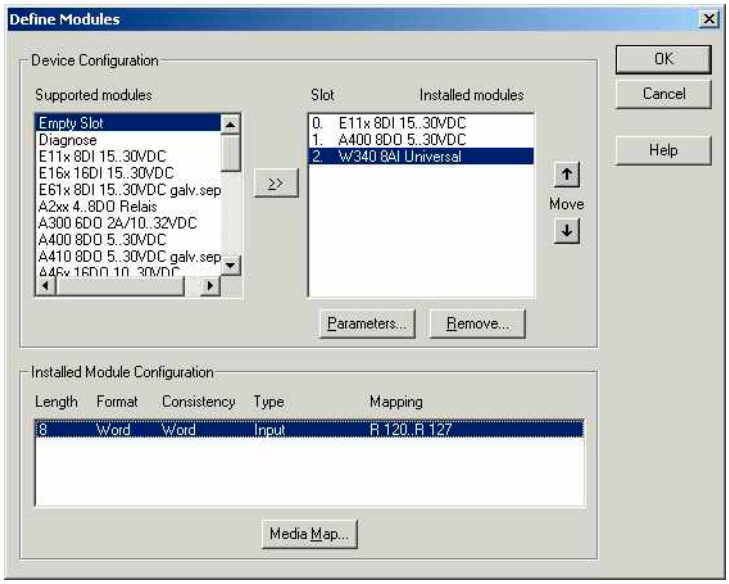
The user either enters the “Base Address” for the number of elements defined in the “Number of Media” field, or enters the symbol names in the fields under “Media Name” (PG5 then takes the dynamic resources from the “Software Settings”).

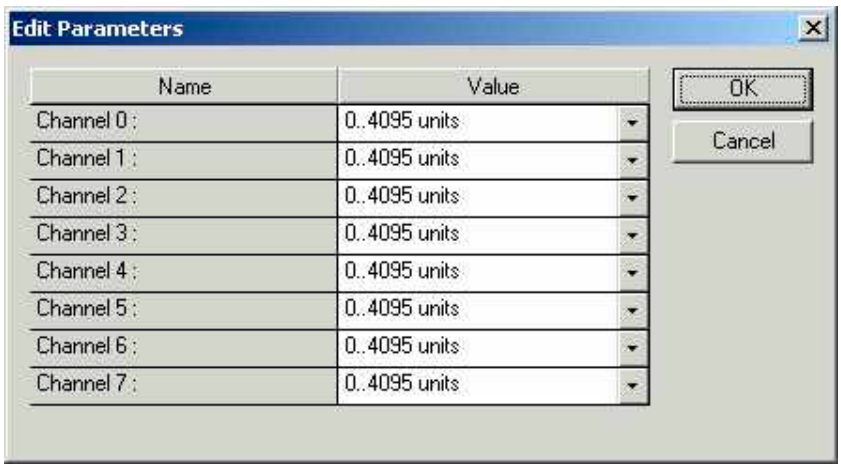
More convenient: first define the symbol name for “Media Number 0”, and then press the “Set Defaults” button; the elements will be automatically numbered from 0 to 7.



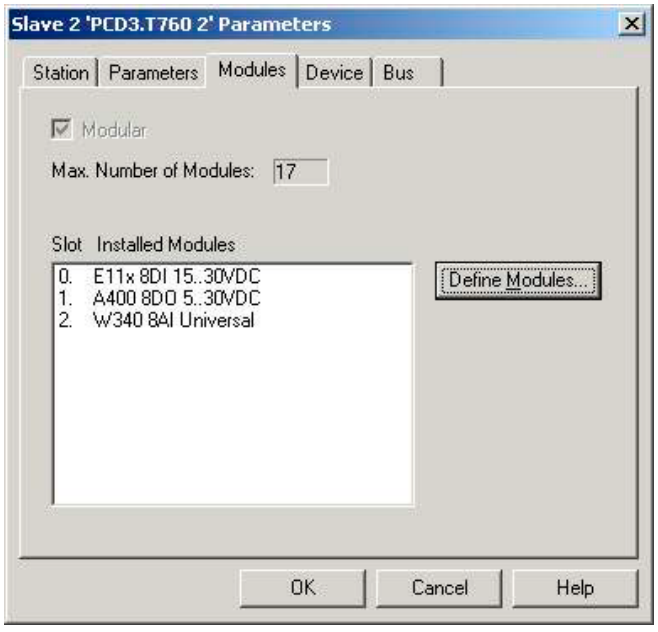
Further RIO I/O modules can be configured in the same way.

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



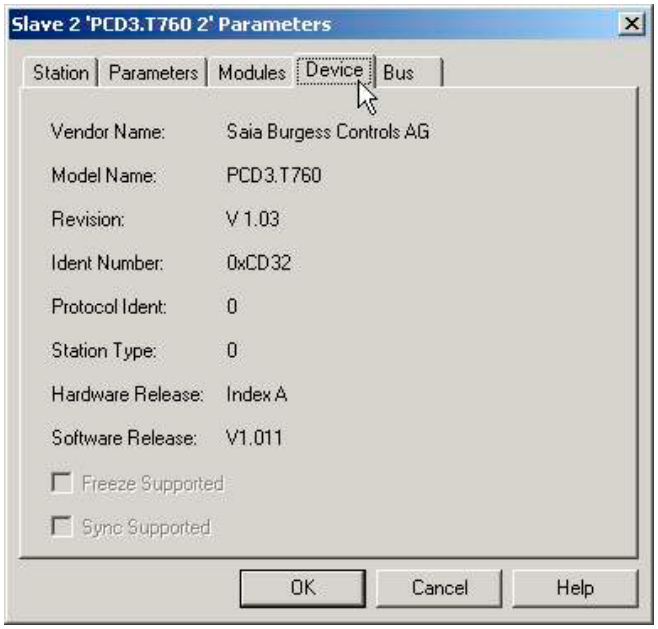


The result is a list of all the modules required in this example.



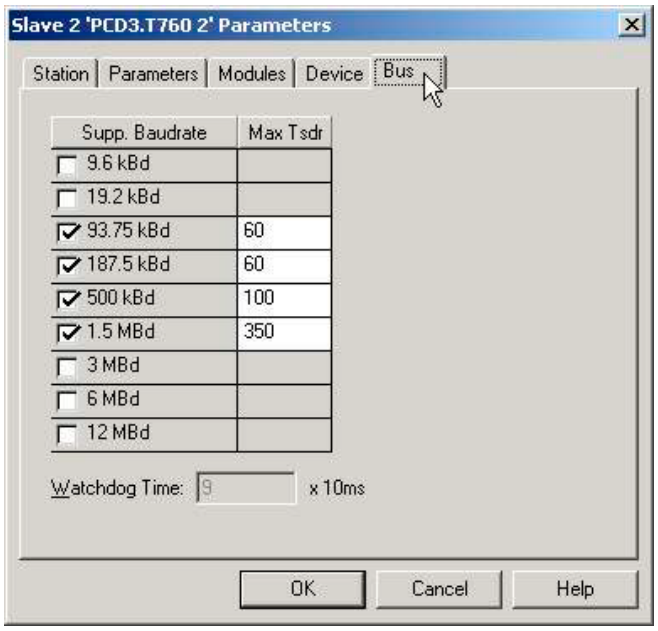
“Device” tab

Information on current RIO nodes



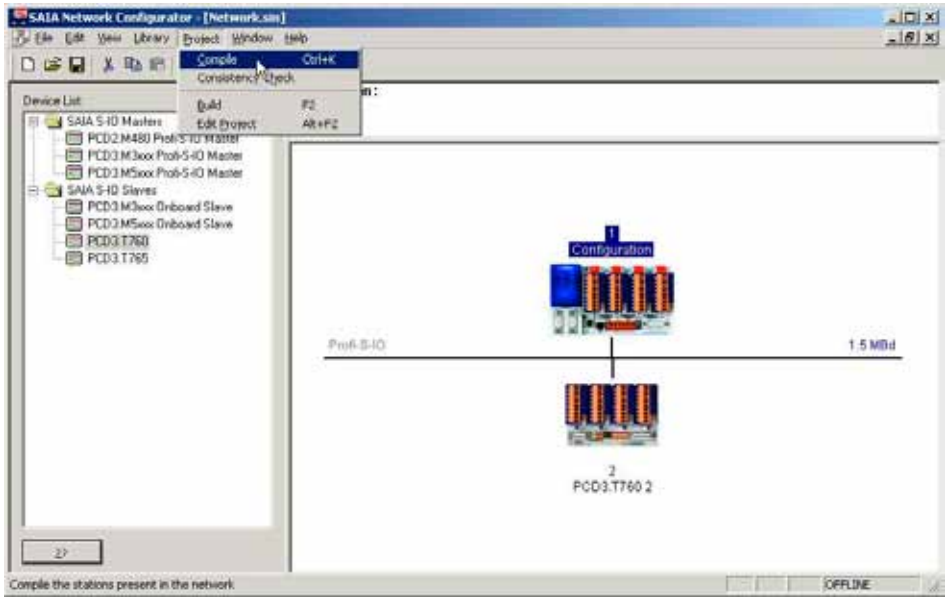
“Bus” tab

Information on possible transmission rates



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

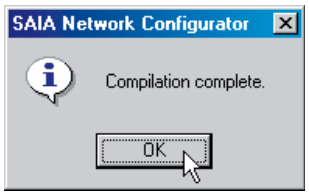
The next step is to compile the configuration with the DP Configurator.



Acknowledge the message below with "Yes".

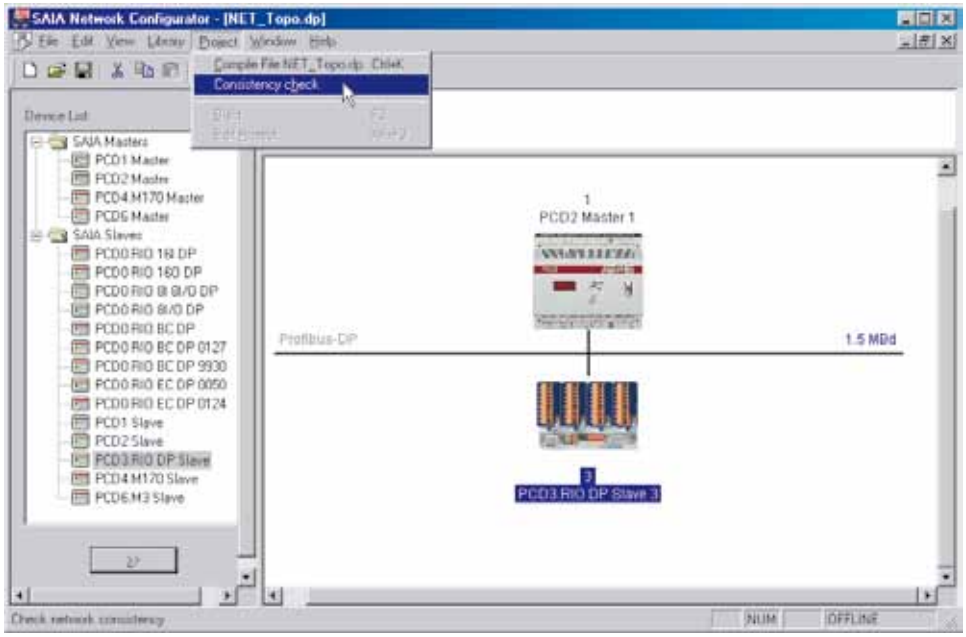
If an error message is returned during the compilation, all details entered for this example should be checked from the beginning.

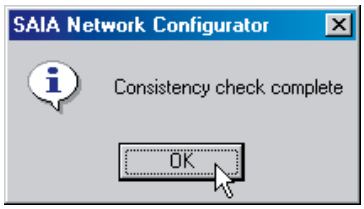
If everything is OK:



7

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





7.2.2 Web server

The PCD3.T76x has an integrated web server. This can be accessed via any standard web browser such as Internet Explorer or Netscape Navigator, and used for commissioning and diagnostics. The connection between web server and web browser is via RS232 (connecting cable PC ↔ PCD3.T76x: PCD3.K225).

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

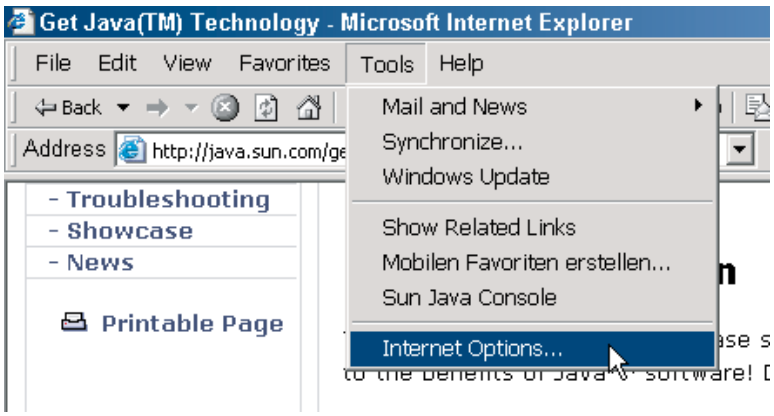
Special requirements for the web server on the PCD3.T76x

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

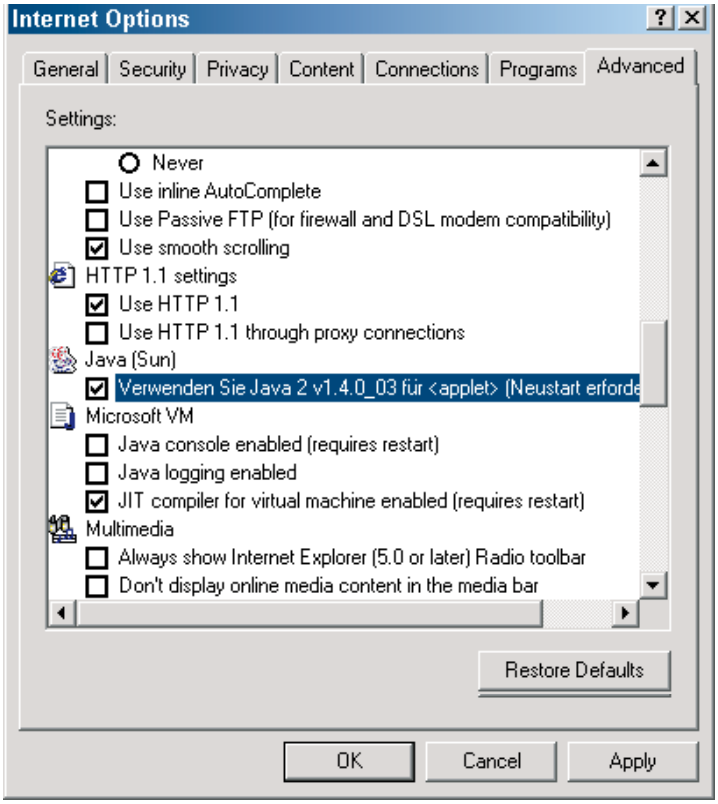
Java Machine

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

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



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



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

7.2.3 Device-specific web pages

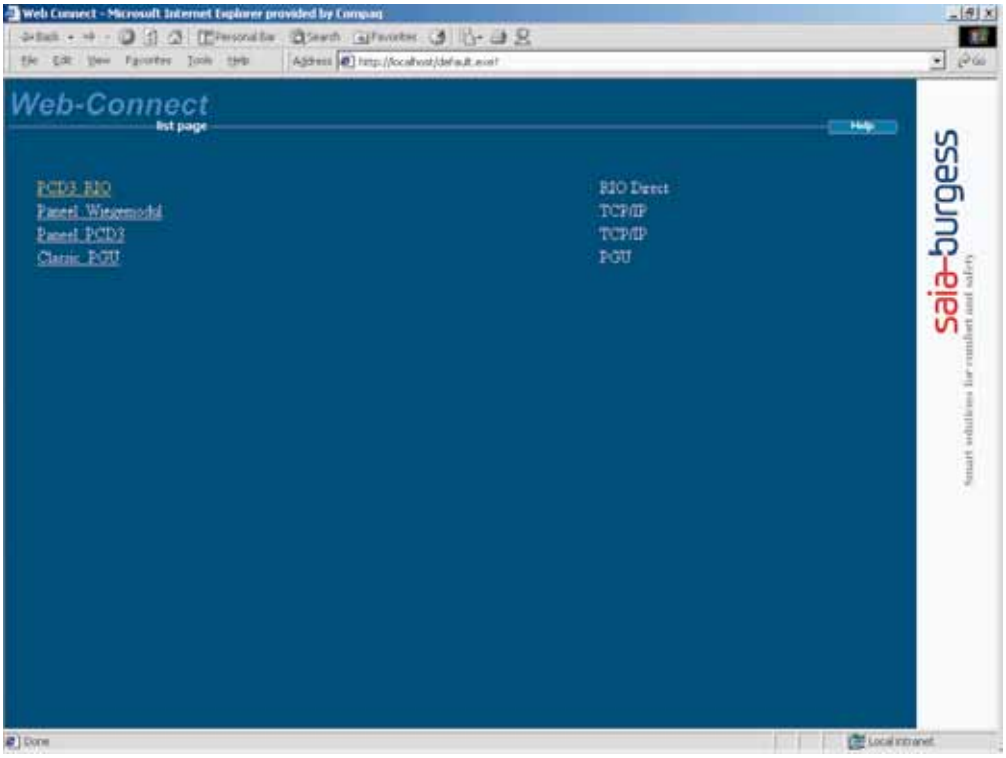
Launch device-specific web pages

Connect the RS232 interface on the PCD3.T76x to the PC with cable PCD3.K225. To access the web server on the PCD3.T76x, first launch the Web Connect software. For more detailed information, refer to the "Web Connect" section in manual 26/790 "Web server".

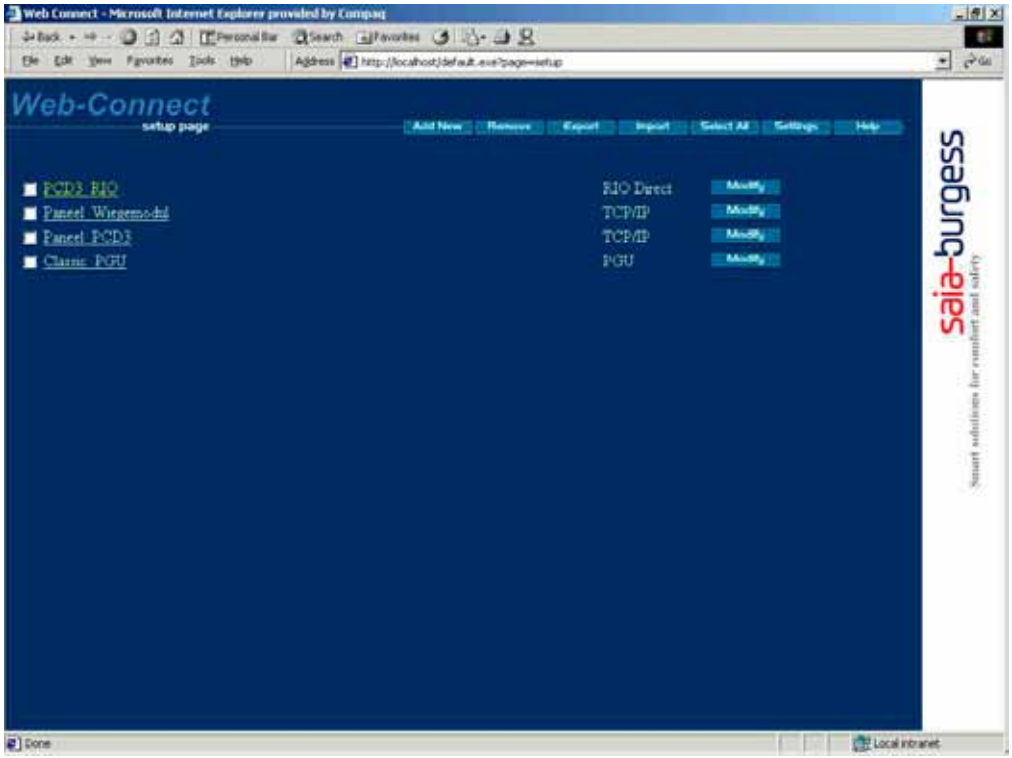
Once Web Connect is running, the device-specific web pages for the PCD3.T76x can be retrieved by starting up the web browser. Enter the correct URL in the address field within the web browser: http://localhost/

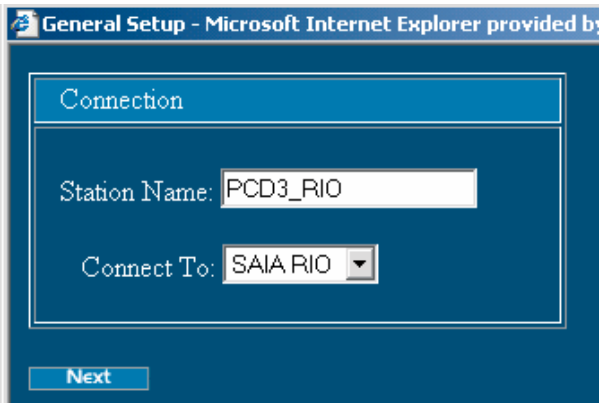
The screen will display a standard web page, similar to the page shown overleaf.

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

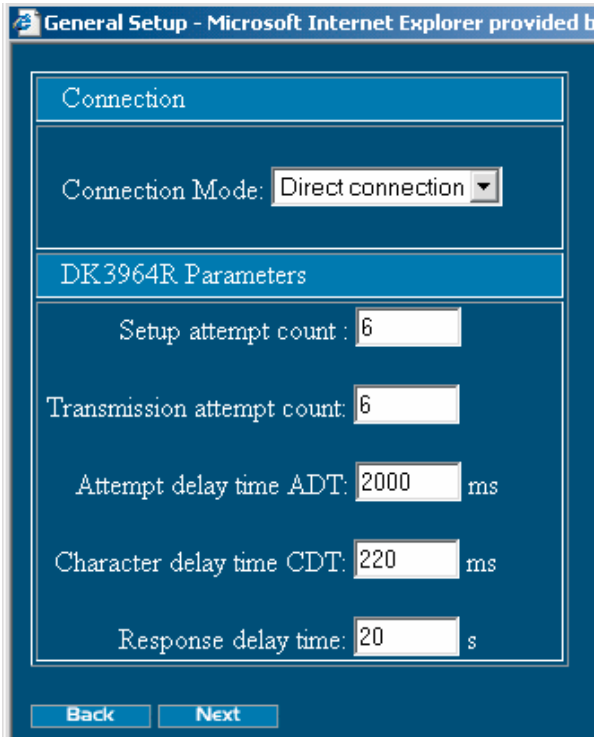


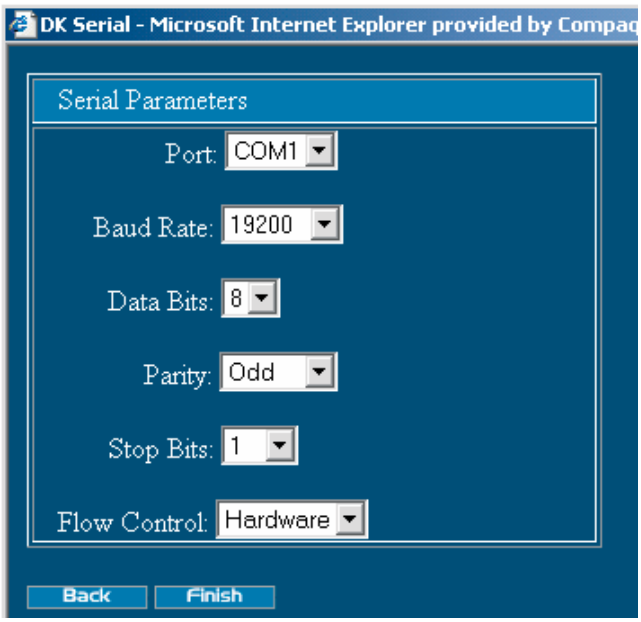
If no connection to the PD3.T76x has been defined, this can be rectified now, using the Setup page: http://localhost/setup





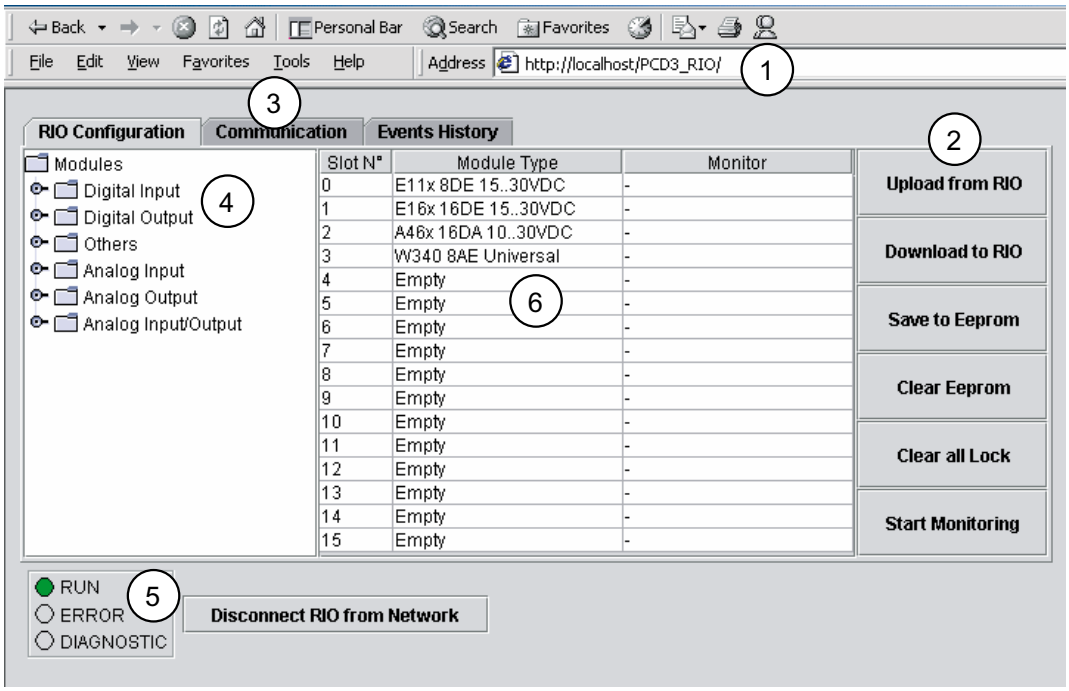
Add new stations with the following parameters:





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

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



① URL to launch the device-specific web pages for the PCD3.T76x
②Command buttons
③ Tab selection
④ Directory tree
⑤Control field
⑥ List of configured modules

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

② Command button field, with buttons for configuration upload and download, Start/Stop monitoring and EEPROM functionality.

③ Tab selection for communication or configuration.

④ Directory tree with all possible modules that can be plugged into the PCD3.T76x

⑤ Control field with status LEDs for the PCD3.T76x.

⑥ List of possible and already configured module positions on the PCD3.T76x (0-15)

Command buttons

① Loads the current configuration of the PCD3.T76x

② Loads the configuration displayed into the device-specific web pages for the PCD3.T76x

③ Saves the current configuration of the PCD3.T76x to the PCD3.T76x EEPROM

④ Clears the PCD3.T76x EEPROM

⑤ Clears all "locks" configured in the PCD3.T76x

⑥ Starts or stops Monitoring mode

7

① Upload function

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

② Download function

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

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

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

③ Saving to EEPROM

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

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

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

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

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

④ Clear EEPROM

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

⑤ Clear all "locks”

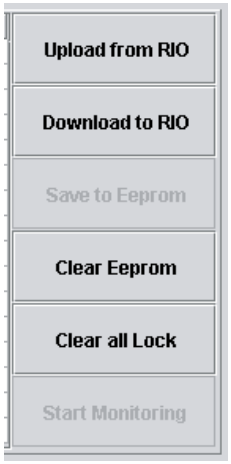
This function is not available in Monitoring mode. This function clears all "locks” in the PCD3.T76x RAM; the "lock” in EEPROM is retained.

⑥ Start/Stop monitoring

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

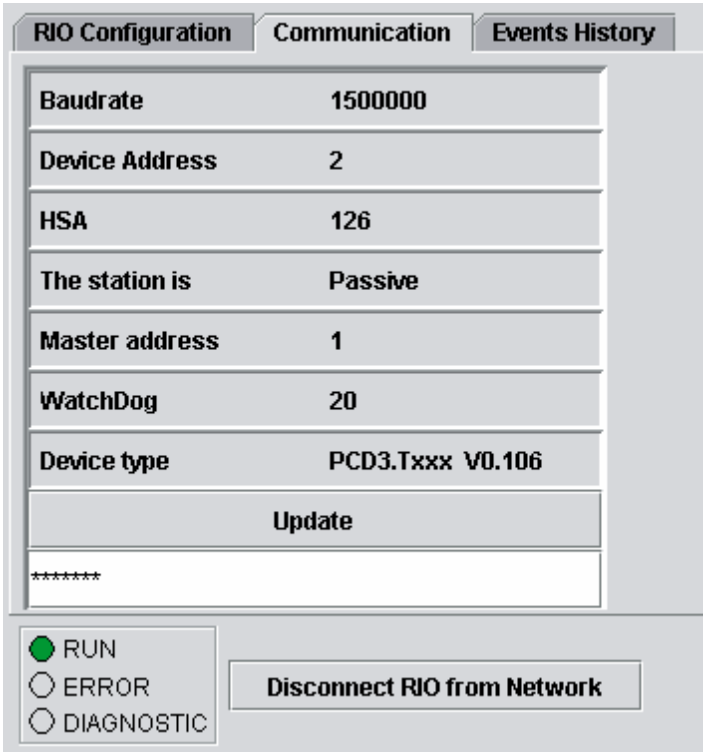
Synchronizing the configuration

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



Tab selection (Configuration/Communication/Events History)

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

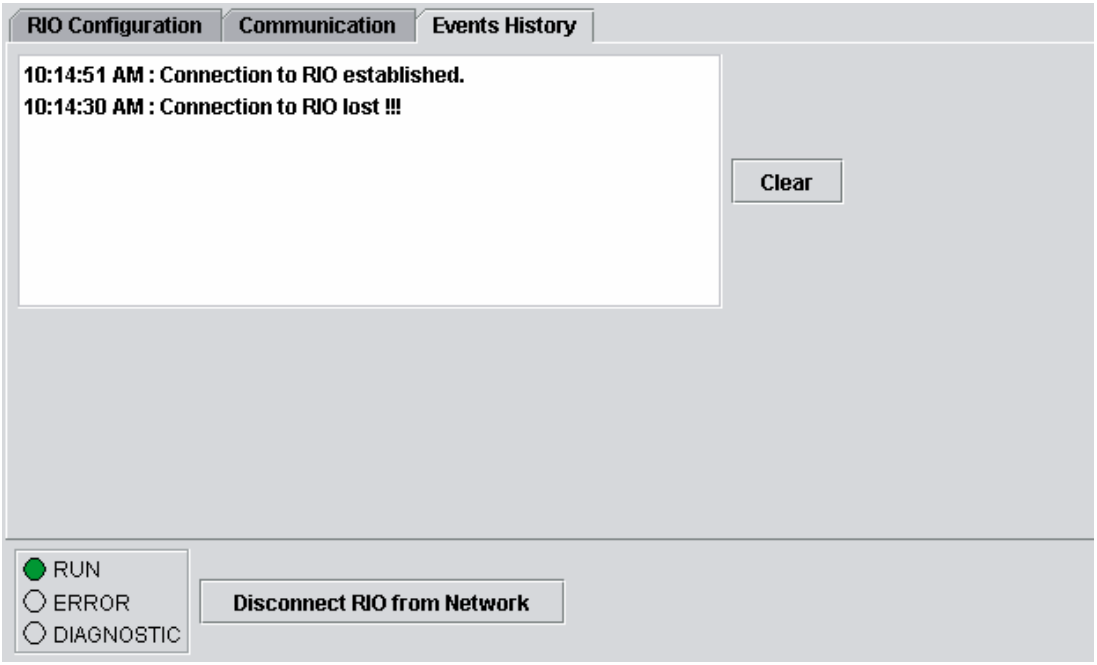


This tab displays information on the communication status of the PCD3.T76x. Most of the information relates to Profibus-DP/Profi-S-Net communication. “Device type” shows the PCD3.T76x and its firmware version. The “Update” button is used to update this information.

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

Events History tab

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



Control field

LEDs

The control field is mainly used to display the PCD3.T76x status LEDs. These show the current status of the PCD3.T76x; see also section 3.19.6 "Diagnostic information on RIOs".

Master connect/disconnect

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

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

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

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

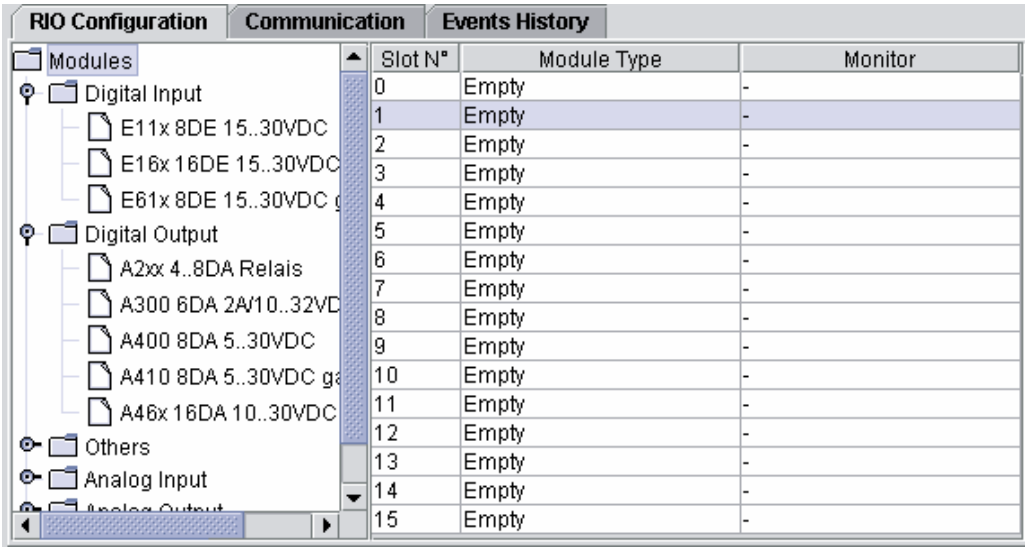
- “Reconnect Master” button
- Switching the supply to the PCD3.T76x off and on again. On POWER ON, the PCD3.T76x is reconnected to the Master (default setting).

Configuring the PCD3.T76x with the web server

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

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

This configuration is not possible in Monitoring mode.



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

Add module

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

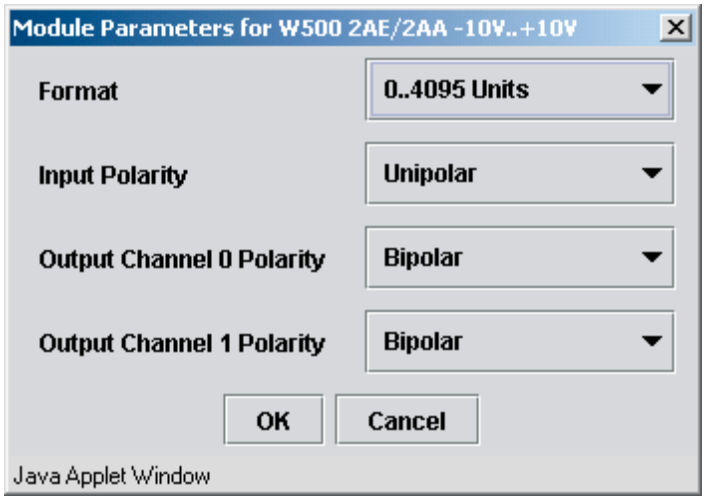
Remove module

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

Set parameters for a module

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

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



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

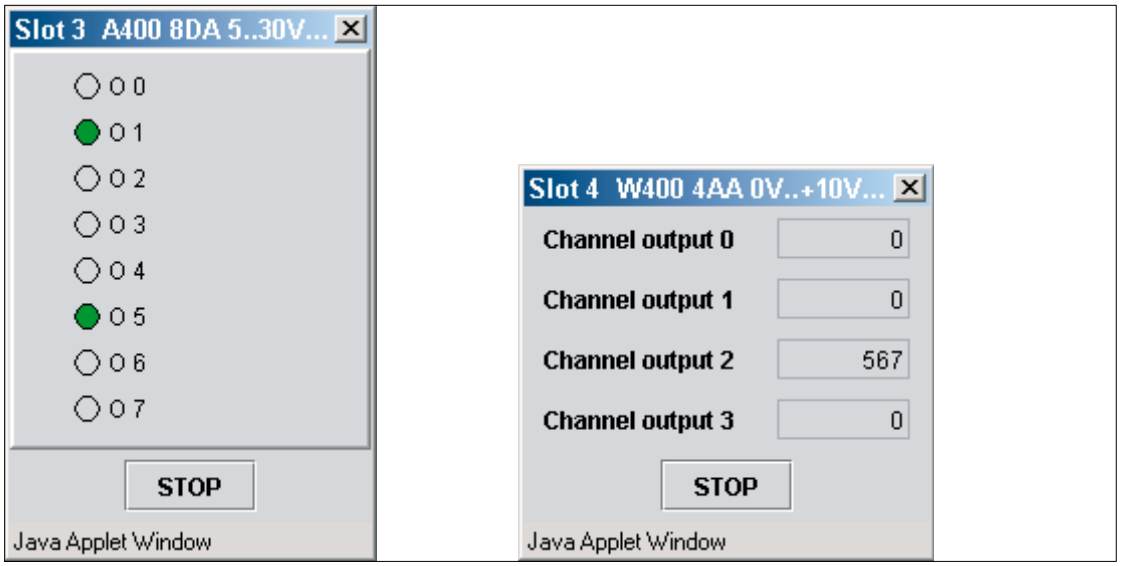
7

Monitoring mode

In order to enter Monitoring mode, a configuration must first be synchronized, to activate the “Start Monitoring” button; if it is not, synchronize the configuration via “Download” or “Upload”.
In Monitoring mode, all configuration functionality is blocked: directory tree, parameterization, upload and download of the configuration.

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

Examples of digital and analogue output modules:



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

Write values to outputs

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

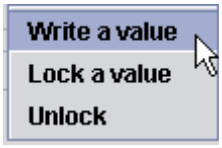
Write value:

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

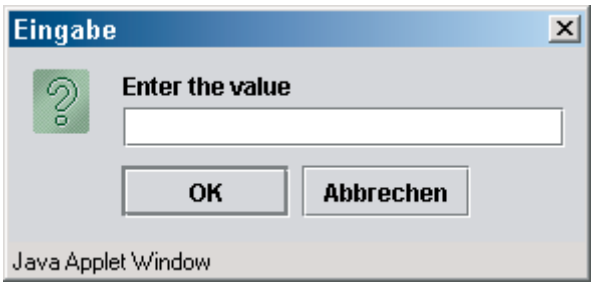
When the function and value have been selected, the operation is executed immediately and the value written to the output. The image is updated. There is no record of these commands.

Analogue module:

Context menu: select “Write a value”.

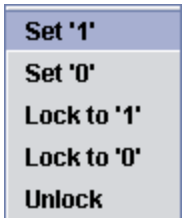


A new window opens, to enter the desired value.



Digital module:

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



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

"Locking" inputs and outputs

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

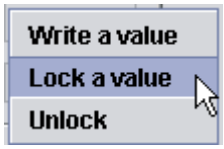
Lock inputs or outputs:

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

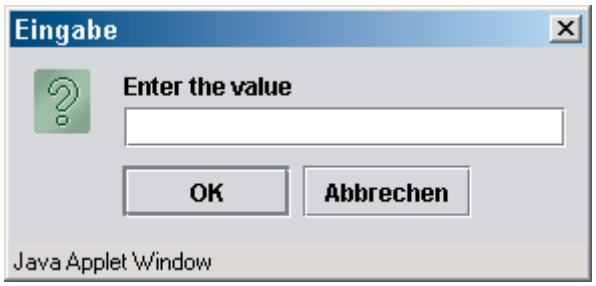
When the function and value have been selected, the operation is executed immediately and the value written to the input or output, regardless of what is transmitted from the Master. The locks are held in a list within the PCD3.T76x.

Analogue module:

Context menu: select “Lock a value”.

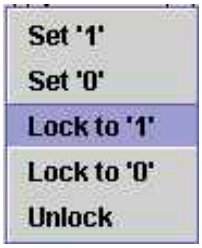


A new window opens, to enter the desired value to lock the input/output.



Digital module:

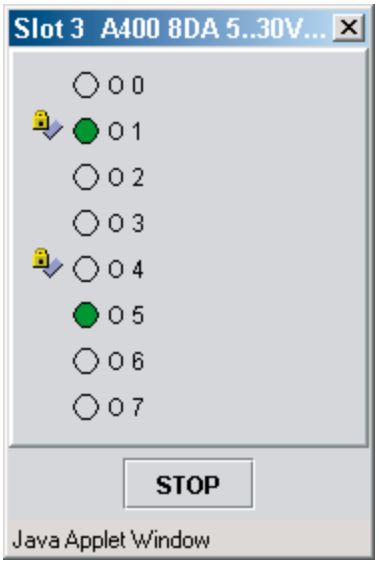
The context menu can be used to lock the input or output directly.



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

Output 1 locked “ON”,
Output 4 locked “OFF”,

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



Unlock:

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

7.2.4 Application-specific web pages

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

8 Maintenance

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

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

8.1 Changing the battery on the PCD3.M5xx0/M6xx0

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

CPU type	Buffer	Buffer time
PCD3.M3xx0	Super Cap (soldered, maintenance-free)	8 hours[1)]
PCD3.M5xx0/M6xx0	Renata CR 2032 lithium battery + Super Cap (soldered)	1-3 years[2)]

1) The total charging time is approx. 6 minutes
2) Depending on the ambient temperature; the higher the temperature, the shorter the buffer time

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

- Insert CR 2032 coin cells in such a way that the Plus pole is visible

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

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

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

8.2 Other PCD3 components (in preparation)

9 Troubleshooting

9.1 CPUs (in preparation)

9.2 RIOs

For troubleshooting, please refer to manual 26/765 "PROFIBUS-DP”.

Diagnose

The RIO itself provides a whole range of diagnostic facilities. These are described in section 4.4.

A Annex

A.1 Icons

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

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A.2 Definitions of serial interfaces

A.2.1 RS232

Designation of signal lines:

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

Signals to RS232

Signal type	Logical state	Set-point	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"
of the control and message signals = “off”

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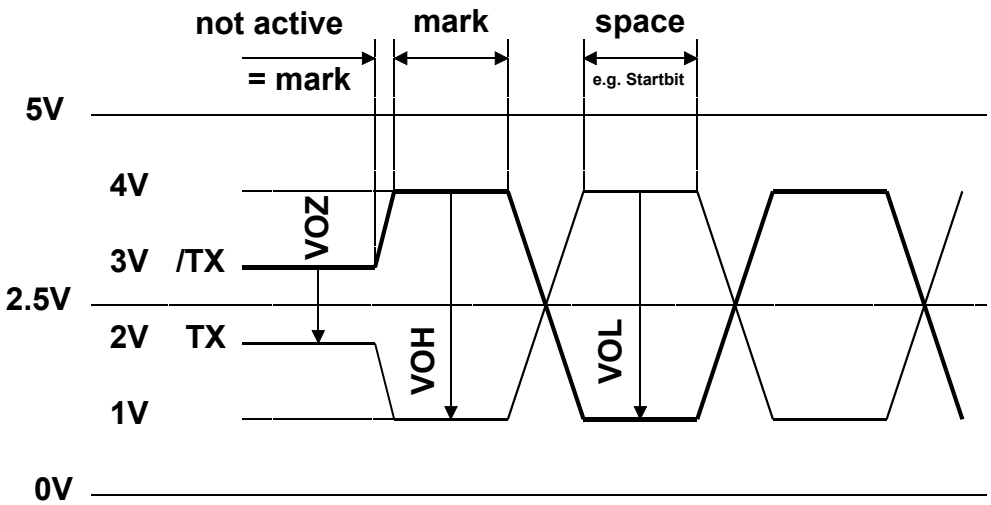
A.2.2 RS485/422

Signals to RS485 (RS422)



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

In the idle state, RS422 is in the “mark” position

RS422:

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

RS485:

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

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

To guarantee error-free operation of an RS485 network, the network should be terminated at both ends. Cable and line termination resistors should be selected in accordance with manual 26/740 "Installation components for RS485 networks".

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

A.2.3 TTY/current loop

Signals to TTY/current loop

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

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

The idle state of the data signals = "mark"
By wiring to the cable connector, the user selects either an "active" or "passive" circuit.

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

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A.3 Installation instructions and relay contacts

A.3.1 Installation instructions for carrying extra-low voltage

On modules designed for low voltage (e.g. PCD3.A251), only voltages up to max. 50 V may be connected for safety reasons.

The safety standard covering the air and leakage current distances between neighbouring channels is not satisfied by this module for higher voltages (50…250 V).

Note that all connections to the relay contacts on a module must be connected to the same circuit, i.e. only one phase per module is permitted. Each load circuit may however be fused individually.

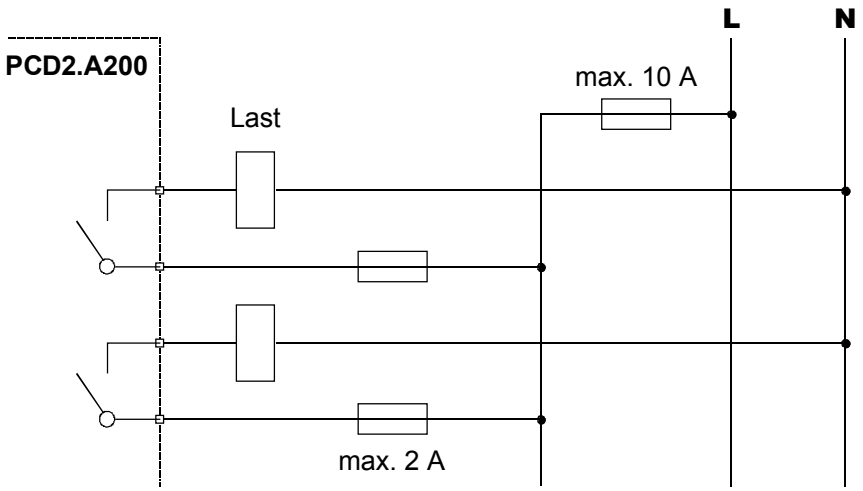
A.3.2 Installation instructions for carrying low voltage

For reasons of safety it is not permissible to connect extra-low voltages (up to 50V) and low voltages (50…250 V) to the same module.

If a PCD module is connected to a higher voltage (50…250 V), approved components for this voltage must be used for all elements that are electrically connected to the system.

Using higher voltage (50…250V), all connections to the relay contacts must be connected on the same circuit, i.e. in such a way that they are all protected against one AC phase by one common fuse. Each load circuit may however be fused individually.

Examples:



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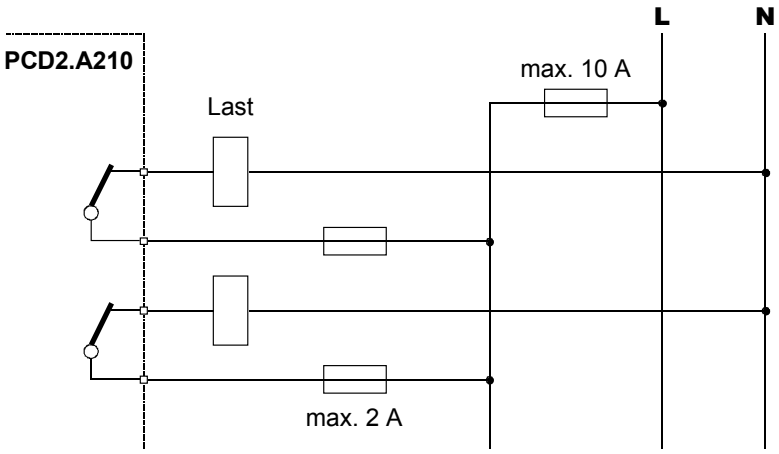
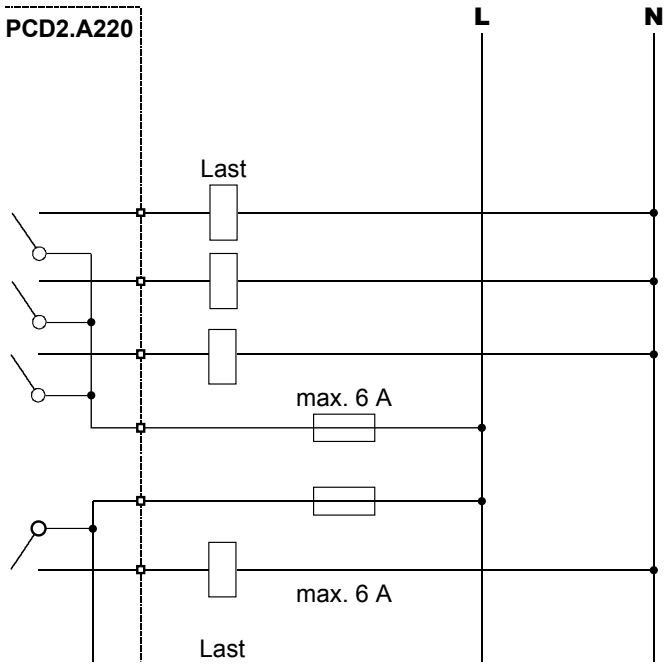
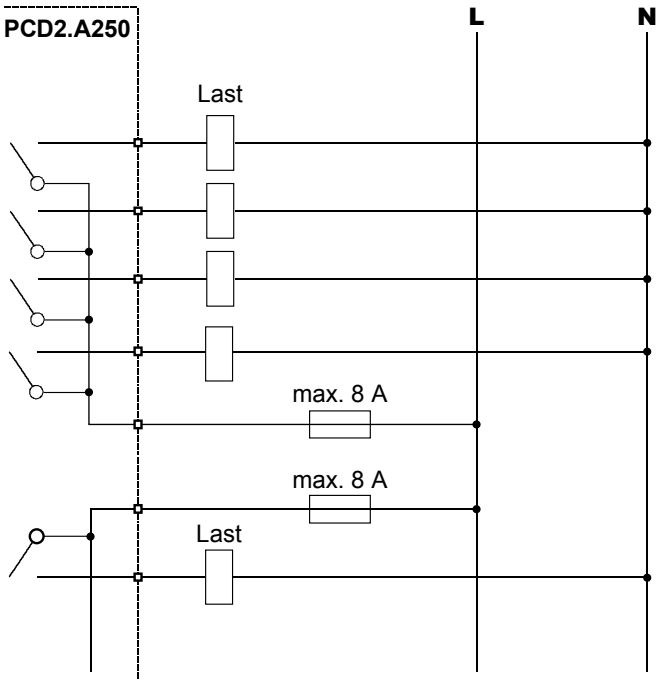

PCD2.A210
L
N
max. 10 A
Last
max. 2 A


PCD2.A220
L
N
Last
max. 6 A
max. 6 A
Last


PCD2.A250
L
N
Last
max. 8 A
max. 8 A
Last

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A.3.3 Carrying inductive loads

Because of the physical properties of inductance, it cannot be cut off without interference. This interference must be minimised as far as possible. Although the PCD is immune to this interference, there are other devices that could be affected.

Please note that, as a result of harmonisation of norms within the EU, the EMC standards have been in effect since 1996 (EMC Directive 89/336/EC). Two principles can therefore be set out:

- INTERFERENCE SUPPRESSION IS ESSENTIAL FOR INDUCTIVE LOADS
- INTERFERENCE SHOULD BE ELIMINATED AT SOURCE WHERE POSSIBLE

The relay contacts on this module are switched. However, it is still recommended to connect a suppressor element to the load.

(Often obtainable as a standard component of certified gates and valves).

When carrying direct current, it is recommended to install a protective diode across the load, even where an ohmic load is theoretically present. In practice, there will always be an inductive portion (connecting cable, resistor winding etc.). Note that the switch-off time will be extended.

(Tau approx. L/RL * √ (RL * IL/0.7).

For direct current, the transistor output modules are recommended.

A.3.4 Details of relay manufacturers for sizing of RC elements

Contact protection circuits:

The purpose of contact protection circuits is to suppress arcing and hence to increase the service life of the contact elements. Any protective circuit may have disadvantages as well as advantages. For how to suppress arcing with an RC element, see figure opposite.

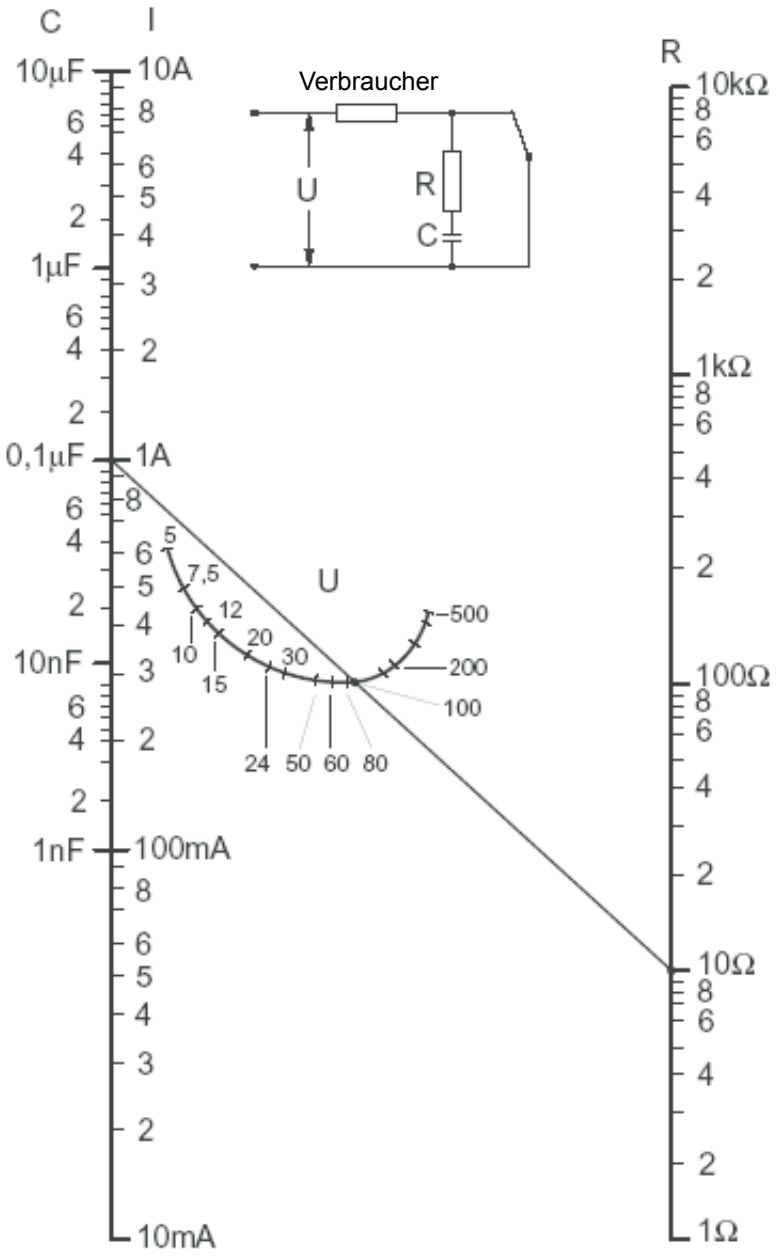
When switching off load circuits with inductive components (e.g. relay coils and magnet windings), the break in current to the contacts causes an overvoltage (self-inductance voltage), which may be many times the operating voltage and compromise the isolation of the load circuit. The resulting sparks will cause the relay contacts to wear out quickly. For this reason, the contact protection circuit is particularly important with inductive load circuits. The values for the RC combination can also be determined from the diagram, but for voltage U the overvoltage arising when the current is interrupted (measured e.g. with an oscillograph) should be used. The current can be calculated from this voltage and the known resistance against which it was measured.

In suppression elements, suppression condensers conforming to VDE 0565 T1 Class X2 must be used. These condensers are switch-tolerant and designed for particularly high overvoltages. Direct operation at mains voltage is still possible.

The resistors used must be able to withstand high voltages (impulse resistance). Particularly at low resistances, there may be flashovers in the coil caused by the production process. This is why fixed carbon resistors are most often used for suppression elements. However, vitreous enamelled wire-wound resistors and cement resistors with large pitch windings are also suitable.

Sizing aid:

The value C is derived directly from the current to be carried. The value of resistance R is found by drawing a straight line between the relevant points on the I and R curves and reading the resistance at the intersection with the R curve.



Example:

U = 100 V I = 1 A

C is calculated directly as 0.1 µF

R = 10 Ω (intersection with R scale)

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A.4 Order details

Type	Description	Weight
	Base units for 4 I/O modules	
PCD3.M3020	CPU with 128 KByte user program memory Backup with internal flash memory, USB port for PG5 max. 64 digital I/Os (not expandable), 2 interrupts, web server RS485 for Profi-S-Net or S-Bus	400 g
PCD3.M3120	asPCD3.M3020 plus Ethernet TCP/IP	400 g
PCD3.M3230	CPU with 256 KBytes user program memory Backup with internal flash memory, USB port for PG5 max. 1,023 digital I/Os, 2 interrupts, web server RS485 for Profi-S-Net or S-Bus	400 g
PCD3.M3330	asPCD3.M3020 plus Ethernet TCP/IP	400 g
PCD3.M5340	CPU with 1 MByte user program memory, 1 MByte onboard Flash memory for backup, up to 1,023 digital I/Os (with PCD3.Cxxx), 2 interrupts, web server USB port for PG5, RS232, RS485 for Profi-S-Net and RS485 for S-Bus, Ethernet TCP/IP, Run/Stop switch, 2 sockets for PCD7.Rxxx, data backup 1…3 years with lithium battery	560 g
PCD3.M5440	CPU with 512 KBytes user program memory, with Run/Stop switch Backup option with PCD7.R500 flash card, USB port for PG5 max. 1,023 digital I/Os, 2 interrupts, web server RS232, RS485 for Profi-S-Net and RS485 for S-Bus Data backup 1…3 years with lithium battery	560 g
PCD3.M5540	asPCD3.M5440 plus Ethernet TCP/IP	560 g
PCD3.M6240	CPU with 1 MByte user program memory, 1 MByte onboard Flash memory for backup, up to 1,023 digital I/Os (with PCD3.Cxxx), 2 interrupts, web server, USB port for PG5, RS232, RS485 for Profi-S-Net/MPI/S-Bus, CAN interface, Run/Stop switch, 2 sockets for PCD7.Rxxx, data backup 1…3 years with lithium battery	560 g
PCD3.M6340	asPCD3.M6240 plus Ethernet TCP/IP	560 g
PCD3.M6440	CPU with 1 MByte user program memory, 1 MByte onboard Flash memory for backup, up to 1,023 digital I/Os (with PCD3.Cxxx), 2 interrupts, web server, USB port for PG5, RS232, RS485 for Profi-S-Net/MPI/S-Bus, Profibus DP Master, Run/Stop switch, 2 sockets for PCD7.Rxxx, data backup 1…3 years with lithium battery	560 g
PCD3.M6540	asPCD3.M6440 plus Ethernet TCP/IP	560 g
	Additional memory	
PCD3.R500	Flash module holder, 1 MByte program backup for PCD3.Mxxx0, I/O Slot 0,	
PCD7.R500	Flash module, 1 MByte program backup for PCD3.M5xx0/.M6xx0, Slot M1,	
PCD3.R550M04	Flash module holder, 4 MByte with file system for PCD3.M3xx0, I/O Slots 0…3	
PCD7.R550M04	Flash module, 4 MByte with file system for PCD3.M5xx0/.M6xx0, Slot M1 or M2	
PCD3.R551M04	Flash module holder, 1 MByte program backup + 3 MByte file system for PCD3.Mxx0, I/O Slots 0…3,	
PCD7.R551M04	Flash module, 1 MByte program backup + 3 MByte file system for PCD3.M5xx0/.M6xx0,, Slot M1/M2	
PCD3.R560	Bacnet Flash module holder, for PCD3.Mxxx0, I/O Slots 0…3	
PCD7.R560	Bacnet Flash module for PCD3.M5xx0/.M6xx0, Slot M1/M2	
PCD3.R561	Flash module holder, 1 MByte program backup + 1 MByte file system for PCD3.M3xx0, I/O Slots 0…3	
PCD7.R561	Bacnet Flash module, 1 MB program backup + 1 MB file system for PCD3.M5xx0/.M6xx0, Slot M1/M2	
PCD7.R600	PCD3 module holder to take SD Flash memory cards, plugs into I/O Slots 0…3,	
PCD7.R-SD256	Saia®SD Flash card, 256 MByte with file system	
PCD7.R-SD512	Saia®SD Flash card, 512 MByte with file system	
	Spares	
4 104 7502 0	I/O slot cover	6 g
4 104 7493 0	PCD3.M5xxx covering cap	12 g
4 405 4995 0	1 for CPUs: Pluggable cage clamp terminal, 8-pole (up to 2.5 mm²)	12 g
PCD3.R010	Battery module for PCD3.M3xxx	30 g
4 639 4898 0	Battery module for PCD3.M5xxx/M6xxx	12 g
4 507 4817 0	Lithium battery	3 g

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Type	Description	Weight
	Communication modules on I/O module Slot#0	
PCD3.F110	with RS 422/RS485 interface (electrically connected)	80 g
PCD3.F121	with RS232 interface (suitable for modem)	80 g
PCD3.F130	with interface for 20 mA current loop	80 g
PCD3.F150	with RS485 interface (electrically isolated)	80 g
PCD3.F180	Belimo MP-Bus (based on RS232))	80 g
	Communication modules on I/O module Slot#0…3 (optional with PCD3.F1xx module)	
PCD3.F221	serial interface module, RS232	80 g
PCD3.F210	serial interface module, RS422/RS485	80 g
	Module holders for expansion units	
PCD3.C100	Module holder for for 4 I/O modules	350 g
PCD3.C110	Module holder for for 2 I/O modules	180 g
PCD3.C200	Module holder for 4 I/O modules, with 24V supply	350 g
	PCD3 RIO head station	
PCD3.T760	Profibus RIO head station with 4 I/O module sockets Profibus DP/Profi-S-Net connection	370 g
PCD3.T765 (on request)	Profibus RIO head station with 4 I/O module sockets Profibus DP/Profi-S-Net connection + facility to implement user-specific software modules (plug-Ins)	370 g
	Input/output modules	
	Digital input modules	
	with 8 inputs 24 VDC	
PCD3.E110	Input delay typically 8 ms (pulsed voltage possible)	60 g
PCD3.E111	Input delay typically 0.2 ms (smoothed voltage required)	60 g
PCD3.E112	Input delay typically 9 ms, 12 VDC (smoothed voltage required)	60 g
PCD3.E116	Input delay typically 0.2 ms, 5 VDC (smoothed voltage required)	60 g
	with 16 inputs 24 VDC	
PCD3.E160	Input delay typically 8 ms (pulsed voltage possible, connection via 34-pole system cable)	65 g
PCD3.E161	Input delay typically 0.2 ms (smoothed voltage required, connection via 34-pole system cable)	65 g
PCD3.E165	Input delay typically 8 ms (pulsed voltage possible, connection via 24-pole spring terminal block)	65 g
PCD3.E166	Input delay typically 0.2 ms (smoothed voltage required, connection via 24-pole spring terminal block)	65 g
	with 6 inputs 250 VAC, electrically isolated	
PCD3.E500	Input delay typically 20 ms (pulsed voltage possible)	65 g
	with 8 inputs 24 VDC, electrically isolated	
PCD3.E610	Input delay typically 10 ms (pulsed voltage possible)	65 g
PCD3.E613	Input delay typically 10 ms, 48 VDC (pulsed voltage possible)	65 g
	relay output modules	
PCD3.A200	with 4 make contacts 2 A/250 VAC or 2 A/50 VDC	85 g
PCD3.A210	with 4 break contacts 2 A/250 VAC or 2 A/50 VDC	90 g
PCD3.A220	with 6 make contacts 2 A/250 VAC or 2 A/50 VDC	90 g
PCD3.A251	with 6 changeover contacts and 2 make contacts 2 A/48 VAC or 2 A/50 VDC	90 g
PCD3.A300	with 6 outputs, 24 VDC/2 A	70 g
	withTransistor outputs, 0.5 A/24 VDC	
PCD3.A400	8 outputs, 24 VDC/0.5 A	65 g
PCD3.A410	8 outputs 24 VDC/0.5 A, electrically isolated	65 g
PCD3.A460	16 outputs, connection via 34-pole system cable	65 g
PCD3.A465	16 outputs, connection via 24-pole spring terminal block	70 g
	Manual control modules	
PCD3.A810	Manual control module, 2 changeover contacts + 2 make contacts, 2 A, 5(6) A	75 g
PCD3.A860	Light and shade module, 2 outputs 12 A/250 VAC, 2 inputs 24 VDC	75 g

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Type	Description	Weight
	Combined digital input and output module	
PCD3.B100	with 2 inputs and 2 transistor outputs, plus 4 selectable as inputs or outputs	70 g
	Analogue input modules	
	with 8 input channels, 10 bit resolution	
PCD3.W200	8 input channels 0..0.10 V	60 g
PCD3.W210	8 input channels 0…20 mA	60 g
PCD3.W220	8 input channels for resistive temperature sensors Pt/Ni 1000 (2-wire), –50…+400 °C or +200 °C	65 g
	with 8 input channels, 12 bit resolution	
PCD3.W300	8 input channels 0..0.10 V	65 g
PCD3.W310	8 input channels 0…20 mA	65 g
PCD3.W340	8 input channels, jumper selectable: 0…10 V, 0…20 mA or for resistive temperature sensor Pt/Ni 1000 (2-wire)	65 g
PCD3.W350	8 input channels for 2-wire resistive temperature sensor Pt 100 for –50…+600 °C or Ni 100 for –50…+250 °C	65 g
PCD3.W360	8 input channels for 2-wire resistive temperature sensor Pt 1000 for –50…+150 °C, resolution < 0.1 °C	65 g
	with 7 input channels, 12 bit resolution	
PCD3.W305	7 input channels 0..0.10 V	80 g
PCD3.W315	7 input channels 0…20 mA	80 g
PCD3.W325	7 input channels -10 V…+10 V	80 g
	Analogue output modules	
	with 4 output channels, 8 bit resolution	
PCD3.W400	Single modules: 4 channels 0…10 V (≥ 3 kΩ)	60 g
PCD3.W410	General purpose modules: 4 channels 0…10 V (≥ 3 kΩ) 0…20 mA (≤ 500 kΩ) oder 4…20 mA (≤ 500 kΩ)	45 g
	with 6 (4) output channels, 10 bit resolution	
PCD3.W605	Single modules: 6 channels 0…10 V (≥ 3 kΩ)	80 g
PCD3.W615	Single modules: 4 channels 0…20 V (≥ 500 kΩ)	80 g
PCD3.W625	Single modules: 6 channels -10…+10 V (≥ 3 kΩ)	80 g
	with 4 output channels, 12 bit resolution	
PCD3.W600	Single modules: 4 channels 0…10 V (≥ 3 kΩ)	45 g
PCD3.W610	General purpose modules: 4 channels, jumper selectable, 0…10 V and –10…+10 V (≥ 3 kΩ) 0…20 mA (≤ 500 Ω)	45 g
	Combinedanalogue input and output module	
PCD3.W500	2 input and 2 output channels for voltage signals	80 g
PCD3.W510	2 input and 2 output channels for current/voltage signals	80 g
PCD3.W525	4 analogue inputs, 14 Bit + 2 analogue outputs, 12 Bit	80 g
	Weighing and thermocouple modules	
PCD3.W720	2-channel weighing module for 4/6-wire weighing cells	80 g
PCD3.W745	4-channel thermocouple module for J, K… thermocouples	80 g
	Manual control module	
PCD3.W800	3 outputs 0…10 V with manual control, 1 output 0…10 V without	75 g
	Counting, measuring and motion control modules	
PCD3.H100	Counter module up to 20 kHz	80 g
PCD3.H110	General purpose counting and measuring module up to 100 kHz	80 g
PCD3.H150	SSI interface module	80 g
PCD3.H210	Motion control module for one stepper motor axis	80 g
PCD3.H310	Motion control module up to 100 kHz for servo-drives, 1 axis for 24 VDC encoder	80 g
PCD3.H311	Motion control module up to 100 kHz for servo-drives, 1 axis for 422 VDC encoder	80 g

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Type	Description	Weight
	Accessories	
PCD3.E009	Empty cassette	35 g
PCD3.K010	Connector PCD3 ↔ PCD3	40 g
PCD3.K106	Connecting cable 0.7 m PCD3 ↔ PCD3	70 g
PCD3.K116	Connecting cable 1.2 m PCD3 ↔ PCD3	70 g
PCD2.K106	Connecting cable 0.7 m PCD2 ↔ PCD3 (supplied with numeric labelling)	70 g
4 405 4954 0	1: Pluggable I/O spring terminal block, 10-pole (Type A)	12 g
4 405 4955 0	1: Pluggable I/O spring terminal block, 10-pole (Type B)	12 g
PCD2.K2xx PCD2.K3xx	For connecting "ribbon cable to screw terminal" adapters with PCD2.K23x or PCD2.K22x cables (type D)	
4 405 4956 0	1: Pluggable I/O spring terminal block, 24-pole (Type C)	12 g
4 405 4998 0	1: Pluggable I/O spring terminal block, 14-pole (Type E)	12 g
4 405 4936 0	1 for A810: Pluggable spring terminals, 12-pole (up to 1.5 mm²), (Type F)	12 g
PCD3.K810	1 for A810: Pluggable spring terminals, 12-pole (as 4 405 4936 0, Type F with 12 grouped strands, numbered, 2.5 m long	25 g
4 405 5027 0	1 for A860: Pluggable spring terminals, 4-pole (up to 2.5 mm²), (Type G)	6 g
PCD3.K860	1 for A860: Pluggable spring terminals, 4-pole (as 4 405 5027 0, Type G), with 4 grouped strands, numbered, 2.5 m long	15 g
4 405 5028 0	1 for A860: Pluggable spring terminals, 6-pole (up to 1.0 mm²), (Type H)	10 g
PCD3.K861	1 for A860: Pluggable spring terminals, 6-pole (as 4 405 5028 0, Type H), with 6 grouped strands, numbered, 2.5 m long	20 g
4 405 4934 0	1 for A800: Pluggable spring terminals, 8-pole (up to 1.5 mm²), (Type J)	12 g
PCD3.K800	1 for A800: Pluggable spring terminals, 8-pole (as 4 405 4934 0, Type J), with 8 grouped strands, numbered, 2.5 m long	25 g
4 329 4819 0	Label plates, set of 10	2 g
4 310 8686 0	Preprinted tapes	2 g
PCD3.K225	Connecting cable 2.5 m PCD3 web server↔PC	70 g

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A.5 Address of Saia-Burgess Controls Ltd.

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CH-3280 Murten / Switzerland

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Saia-Burgess Controls Ltd.

Service Après-Vente
Bahnhofstrasse 18
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