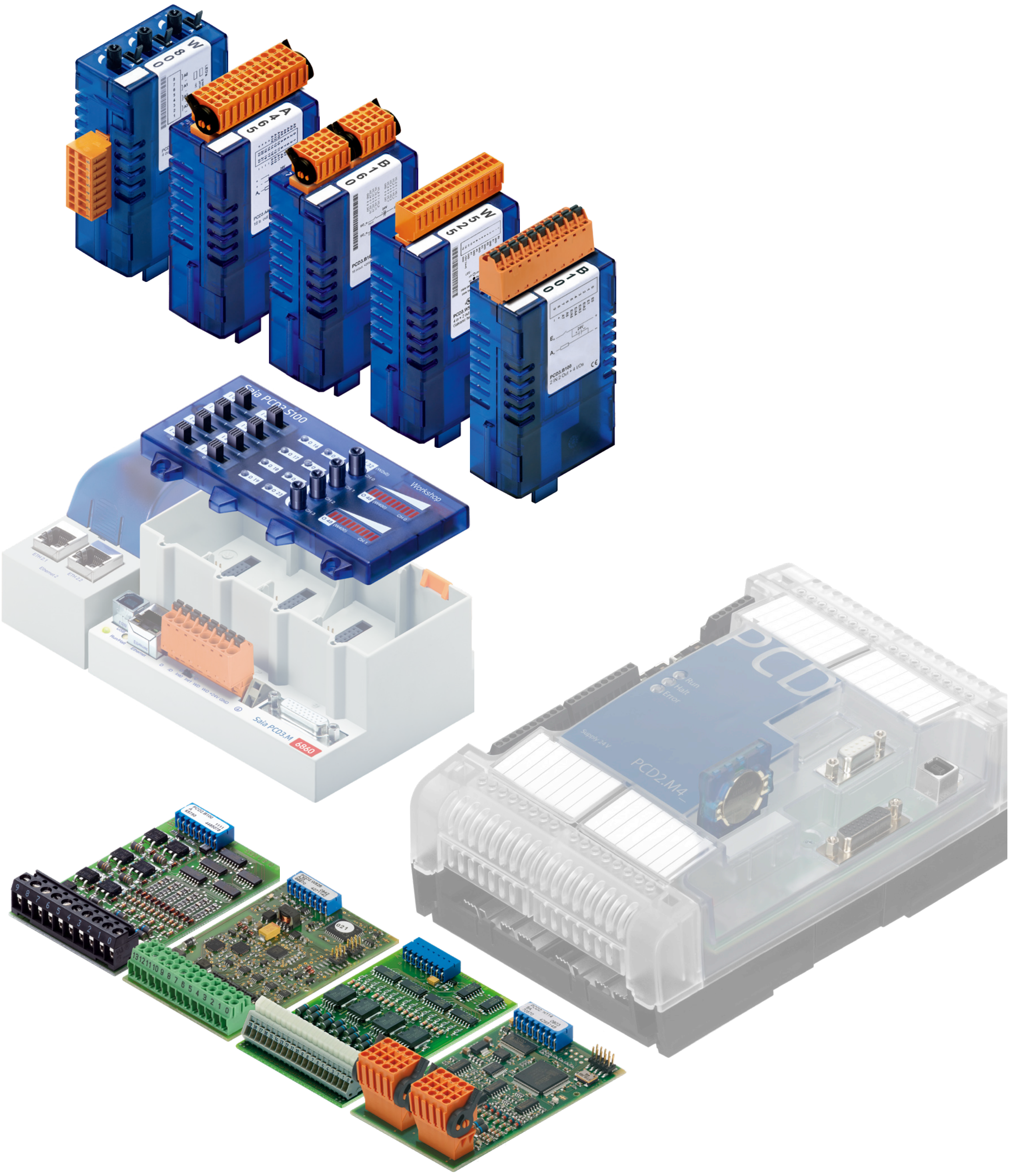
Manual

SAIA BURGESS CONTROLS



I/O-Modules

for PCD1 / PCD2 and PCD3

Document 27-600 | Release ENG11 | 2023-03

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0.1 Document versions

Version	Changes	Published	Remarks
EN01	2014-07-28	2014-07-30	New document content from manual 26/737 PCD1|PCD2
EN02	2014-08-06	2014-08-06	Content from 26/789 PCD3 added
EN03	2014-09-19	2014-09-19	Better names for the chapters
ENG04	2015-06-11	2015-06-11	New phone numbers PCD3.W800 has no galvanic separation
ENG05	2015–10-13 2016-04-27	2015–10-13 2016-04-27	- Wrong text the for PCD2.A460 - new chapter A4 HW-Watchdog
ENG06	2017-03-07	2017-03-07	PCD2.W6x5 ➔ outputs and not inputs
ENG07	2018-06-01 2018-06-18 2018-06-22	2018-06-25 2018-06-25 2018-06-25	- PCDx.B160 added - PCDx.W380 added - PCD2.G200 added
ENG08	2018-07-11	2018-07-11	PCDx.W2x0 ➔ Temperature range +400°C
ENG09	2019-05-01	2019-05-01	■ Status of products in a separate chapter ■ Wiring examples relays: in the appendix
ENG10	2021-07-29	2019-07-29	■ Higher power consumption with PCD3.A810 & PCD3.W800
ENG11	2023-03	2023-03	■ Added a new section “7.2.10. Precau-tions”

0.3 Brands and trademarks

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

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

Published in Switzerland

3 Product status of the I/O-moduls

Article PCD2.	Article PCD3.	Active	Outphased (no longer produced)	Repair phase until:	Follow-up product:
PCD2.A200	PCD3.A200	×			
PCD2.A210	PCD3.A210	×			
PCD2.A220	PCD3.A220	×			
PCD2.A250		×			
	PCD3.A251	×			
PCD2.A300			×	2026-12-30	PCD2.Axxx or PCD3.A300
	PCD3.A300	×			
PCD2.A400	PCD3.A400	×			
PCD2.A410	PCD3.A410	×			
PCD2.A460	PCD3.A460	×			
PCD2.A465	PCD3.A465	×			
PCD2.B100	PCD3.B100	×			
PCD2.B160	PCD3.B160	×			
PCD2.E110	PCD3.E110	×			
PCD2.E111	PCD3.E111	×			
PCD2.E112	PCD3.E112		×	2021-12-31	no
PCD2.E116	PCD3.E116		×	2021-12-31	no
PCD2.E160	PCD3.E160	×			
PCD2.E161	PCD3.E161	×			
PCD2.E165	PCD3.E165	×			
PCD2.E166	PCD3.E166	×			
PCD2.E500	PCD3.E500	×			
PCD2.E610	PCD3.E610	×			
PCD2.E611	PCD3.E611	×			
PCD2.E613	PCD3.E613	×			
PCD2.E616	PCD3.E616		×	2021-12-31	no
PCD2.G200		×			
PCD2.G400			×	2018-12-31	no
PCD2.G410			×	2018-12-31	no
PCD2.H100	PCD3.H100		×	expired	no
PCD2.H110	PCD3.H110		×	2018-12-31	no
PCD2.H112	PCD3.H112	×			
PCD2.H114	PCD3.H114	×			
PCD2.H150	PCD3.H150	×			
PCD2.H210	PCD3.H210		×	2018-12-31	no
PCD2.H222			×	2026-12-30	PCD3.H222
	PCD3.H222	×			
PCD2.H310	PCD3.H310		×	2027-12-30	no
PCD2.H311	PCD3.H311		×	2027-12-30	no
PCD2.H320			×	2018-12-31	no
PCD2.H322			×	2018-12-31	no
PCD2.H325			×	2018-12-31	no
PCD2.H327			×	2018-12-31	no

* not recommended for new projects

Article PCD2.	Article PCD3.	Active	Outphased (no longer produced)	Repair phase until:	Follow-up product:
PCD2.W100	PCD3.W100		×	expired	PCD2.W380
PCD2.W105	PCD3.W105		×	expired	PCD2.W380
PCD2.W110	PCD3.W110		×	expired	PCD2.W350
PCD2.W111	PCD3.W111		×	expired	PCD2.W350
PCD2.W112	PCD3.W112		×	expired	PCD2.W340
PCD2.W113	PCD3.W113		×	expired	PCD2.W340
PCD2.W114	PCD3.W114		×	expired	PCD2.W350
PCD2.W200	PCD3.W200	×			
PCD2.W210	PCD3.W210	×			
PCD2.W220	PCD3.W220	×			
PCD2.W220Z02	PCD3.W220Z02		Candidate*		
PCD2.W220Z12	PCD3.W220Z12		Candidate*		
PCD2.W300	PCD3.W300	×			
PCD2.W305			×	2026-12-30	PCD3.W305
	PCD3.W305	×			
PCD2.W310	PCD3.W310	×			
PCD2.W315	PCD3.W315	×			
PCD2.W325			×	2026-12-30	PCD3.W325
	PCD3.W325	×			
PCD2.W340	PCD3.W340	×			
PCD2.W350	PCD3.W350	×			
PCD2.W360	PCD3.W360	×			
PCD2.W380	PCD3.W380	×			
PCD2.W525	PCD3.W525	×			
PCD2.W400	PCD3.W400	×			
PCD2.W410	PCD3.W410	×			
PCD2.W500	PCD3.W500		×	expired	PCD2.W525
PCD2.W510	PCD3.W510		×	expired	PCD2.W525
PCD2.W600	PCD3.W600	×			
PCD2.W610	PCD3.W610	×			
PCD2.W605	PCD3.W605	×			
PCD2.W615	PCD3.W615	×			
PCD2.W625			×	2026-12-30	PCD3.W625
	PCD3.W625	×			
PCD2.W710	PCD3.W710		×	expired	PCD2.W720
PCD2.W720	PCD3.W720		×	2026-12-30	PCD3.H222
PCD2.W745	PCD3.W745	×			

* not recommended for new projects

5 Input/output (I/O) modules for PCD1 and PCD2

5.1 General informations

5.1.1 Overview

The summary below shows the available digital and analogue I/O modules, counters etc. for the PCD2 series:

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page

PCD2 digital input modules

PCD2.E110	8 I	8	8 inputs 8 ms	24 VDC	5-10
PCD2.E111	8 I	8	8 inputs 0.2 ms	24 VDC	5-10
PCD2.E112	8 I	8	8 inputs 9 ms	12 VDC	5-10
PCD2.E116	8 I	8	8 inputs 0.2 ms	5 VDC	5-10
PCD2.E160	16 I	16	16 inputs 8 ms, connection via 34-pole ribbon connector	24 VDC	5-13
PCD2.E161	16 I	16	16 inputs 0.2 ms, connection via 34-pole ribbon connector	24 VDC	5-13
PCD2.E165	16 I	16	16 inputs 8 ms, spring terminal connection	24 VDC	5-16
PCD2.E166	16 I	16	16 inputs 0.2 ms, spring terminal connection	24 VDC	5-16

PCD2 digital input modules, electrically isolated 1)

PCD2.E500	6 I	6	6 inputs	100…240 VAC	5-19
PCD2.E610	8 I	8	8 inputs 10 ms, electrically isolated	24 VDC	5-21
PCD2.E611	8 I	8	8 inputs 0.2 ms, electrically isolated	24 VDC	5-21
PCD2.E613	8 I	8	8 inputs 9 ms, electrically isolated	48 VDC	5-21
PCD2.E616	8 I	8	8 inputs 0.2 ms, electrically isolated	5 VDC	5-21

PCD2 digital output modules

PCD2.A300	6 O	6	6 outputs 2 A	10…32 VDC	5-24
PCD2.A400	8 O	8	8 outputs 0.5 A	5…32 VDC	5-26
PCD2.A460	8 O	8	16 outputs 0.5 A, connection via 34-pole ribbon connector	10…32 VDC	5-28
PCD2.A465	16 O	16	16 outputs 0.5 A, spring terminal connection	10…32 VDC	5-31

1) galvanic separation of outputs to Saia PCD®, the channels themselves are not separated against each other

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page

PCD2 digital output modules, electrically isolated

PCD2.A200	4 O	4	4 make contacts 2 A	250 VAC 50 VDC	5-34
PCD2.A210	4 O	4	4 break contacts 2 A	250 VAC 50 VDC	5-36
PCD2.A220	6 O	6	6 make contacts 2 A	250 VAC 50 VDC	5-38
PCD2.A250	8 O	8	8 make contacts 2 A	48 VAC 50 VDC	5-40
PCD2.A410	8 O	8	8 outputs 0.5 A, electrically isolated [1])	5…32 VDC	5-42

PCD2 digital, combined I/O modules

PCD2.B100	2 I + 2 O + 4 I/O	8	2 inputs, 2 outputs, 4 selectable as inputs or outputs	24 VDC 5…32 VDC 24 VDC	5-45
PCD2.B160	16 I/O	16	In blocks of 4 configurable	18…30 VDC	7

PCD2 multi-functional I/O modules

PCD2.G200	In Out In In In Out	4 4 2 2 4 8	Digital: 15…30 VDC Digital: 0.5 A/10…32 VDC Analogue: 0…10 V Analogue: Pt1000 or Ni1000 Analogue: Universal (selectable) Analogue: 0…10 V	see left side	9
PCD2.G400	In In In Out Out	10 2 6 8 6	Digital inputs Analogue inputs 10 bit Analogue inputs 10 bit Digital outputs Analogue outputs 8 bit	24 VDC 0…10 V Pt/Ni 1000 24 VDC 0…10 VDC	5-49
PCD2.G410	In In Out Out	16 4 4 4	Digital inputs Analogue inputs 10 bit Relay outputs Analogue outputs 8 bit	24 VDC I/U/T 250 VAC U/I	5-50

1) galvanic separation of outputs to Saia PCD®, the channels themselves are not separated against each other

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page

PCD2 analogue input modules

PCD2.W100	4 I	4	Analogue inputs 12 bit	0…10 V, –10…+10 V	5-53
PCD2.W105	4 I	4	Analogue inputs 12 bit	0…+20 mA -20…0 mA -20…+20 mA	5-53
PCD2.W110	4 I	4	Analogue inputs 12 bit	Pt 100	5-56
PCD2.W111	4 I	4	Analogue inputs 12 bit	Ni 100	5-56
PCD2.W112	4 I	4	Analogue inputs 12 bit	Pt 1000	5-56
PCD2.W113	4 I	4	Analogue inputs 12 bit	Ni 1000	5-56
PCD2.W114	4 I	4	Analogue inputs 12 bit	Pt 100	5-56
PCD2.W200	8 I	8	8 analogue inputs 10 bit	0…10 V	5-61
PCD2.W210	8 I	8	8 analogue inputs 10 bit	0…20 mA	5-61
PCD2.W220	8 I	8	8 analogue inputs 10 bit	Pt/Ni 1000	5-61
PCD2.W220Z02	8 I	8	8 analogue inputs 10 bit	NTC 10	5-61
PCD2.W220Z12	8 I	8	8 analogue inputs 10 bit	4×0…10 V 4×Pt/Ni 1000	5-61
PCD2.W300	8 I	8	8 analogue inputs 12 bit	0…10 V	5-67
PCD2.W310	8 I	8	8 analogue inputs 12 bit	0…20 mA	5-67
PCD2.W340	8 I	8	8 analogue inputs 12 bit, jumper selectable	0…10 V, 0…2,5 V 0…20 mA, Pt/Ni 1000	5-67
PCD2.W350	8 I	8	8 analogue inputs 12 bit	Pt/Ni 100	5-67
PCD2.W360	8 I	8	8 analogue inputs 12 bit, resolution ‹ 0.1 °C	Pt 1000	5-67
PCD2.W380	8 I	8	8 analogue inputs 13 bit, configuration via software	diverse	8

PCD2 analogue input modules, electrically isolated [1])

PCD2.W305	7 I	7	7 analogue inputs 12 bit	0…10 V	5-74
PCD2.W315	7 I	7	7 analogue inputs 12 bit	0…20 mA	5-74
PCD2.W325	7 I	7	7 analogue inputs 12 bit	–10…+10 V	5-74

1) galvanic separation of outputs to Saia PCD®, the channels themselves are not separated against each other

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page

PCD2 analogue output modules

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page
PCD2.W400	4 O	4	4 analogue outputs 8 bit	0…10 V	5-79
PCD2.W410	4 O	4	4 analogue outputs 8 bit, jumper selectable	0…10 V, 0…20 mA, 4…20 mA	5-79
PCD2.W600	4 O	4	4 analogue outputs 12 bit	0…10 V	5-83
PCD2.W610	4 O	4	4 analogue outputs 12 bit, jumper selectable	0…10 V, –10 V..+10 V 0…20 mA, 4…20 mA	5-83

PCD2 analogue output modules, electrically isolated [1])

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page
PCD2.W605	6 O	6	6 analogue outputs 10 bit	0…10 V	5-88
PCD2.W615	4 O	4	4 analogue outputs 10 bit	0…20 mA	5-88
PCD2.W625	6 O	6	6 analogue outputs 10 bit	–10…+10 V	5-88

PCD2 analogue combined input/output modules

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page
PCD2.W500	2I + 2O	4	2 analogue inputs 12 bit + 2 analogue outputs 12 bit	0…10 V, –10…+10 V	5-92
PCD2.W510	2I + 2O	4	2 analogue inputs 12 bit + 2 analogue outputs 12 bit	0…+20 mA -20…+20 mA	5-92

PCD2 analogue combined input/output modules, electrically isolated [1])

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page
PCD2.W525	4 E	4	4 analogue inputs 14 bit	0…10 V, 0(4)…20 mA Pt 500/1000, Ni 1000	5-98
	+ 2 A		+ 2 analogue outputs 12 bit	0…10 V, 0(4)…20 mA	

5

Type	Desig-nation	No. I/Os or mod	Description	Input/output signal range	Page

PCD2 weighing modules

PCD2.W710	1 I	1	1-channel weighing module for 4/6-wire weighing cells		5–106
PCD2.W720	2 I	2	2-channel weighing module for 4/6-wire weighing cells		5–106

5

PCD2 thermocouple modules

PCD2.W745	4 I	4	Thermocouple module for J, K… thermocouples 2)		5–107

1) Galvanic separation of outputs to Saia PCD®, channels themselves not separated
2) Non-pluggable cage clamp terminals

Type	Description	Page

PCCD2 fast counting I/O modules

PCD2.H100	Counting module up to 20 kHz	5–109
PCD2.H110	General purpose module up to 100 kHz	5–114

PCD2 SSI encoder modules

PCD2.H150	SSI interface module	5-117

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PCD2 Positioning modules for stepping motors

PCD2.H210	Motion control module for stepper motors	5-121

Positioning modules for servo-drives

PCD2.H310	Motion control module for servo-motors 1-axis encoder 24 V_{DC}	5-125
PCD2.H311	Same as H310, but 1-axis encoder 5 V_{DC}	5-125
PCD2.H320	Motion control module for servo-drives 2-axis with encoder 24 V_{DC}	5-129
PCD2.H322	Same as H320, but 1-axis (slave operation)	5-129
PCD2.H325	Motion control module for servo-drives, 2-axis with 5 V and SSI absolute value encoder	5-129
PCD2.H327	Same as H325, but 1-axis (slave operation)	5-129

5.1.2 Power consumption of PCD2 input/output modules

Type PCD2.…	Maximal internal current consumption I from +5 V [mA]	Maximal internal current consumption I from +V [mA]	Maximal external current consumption at 24 V, I [mA]
E11x	24	---	8 inputs, 6 mA/input
E16x	72	---	16 inputs, 4 mA/input
E500	1	---	6 inputs, 10…12 mA/input
E61x	24	---	8 inputs, 5 mA/input
A200	15	---	32 mA[1)]
A220	20	---	48 mA[1)]
A251	25	---	64 mA[1)]
A300	20	---	Load current
A400	25	---	Load current
A410	24	---	Load current
A46x	74	---	Load current
B100	25	---	Load current
B160	120	---	Load current
G200	12	35	Load current
W200/210	8	5	---
W220	8	16	---
W300/310	8	5	---
W3x5	60	0	---
W340/360	8	20	---
W350	8	30	---
W380	25	25	---
W4x0	1	30	W410 100 mA[2)]
W5x0	200	---	---
W525	40	---	Load current
W600	4	20	---
W605/625	110	---	---
W610	110	---	100 mA[2)]
W615	55	---	90 mA
W720	60	100	---
W745	200	---	---
H100/H110	90	---	CCO output: load current
H150	25	---	Load current
H210	85	---	Load current
H310/H311	140	---	max. 15 mA
H320/H322	230	20	Load current
H325/H327	250	20	Load current

1) Coil resistance of the relay 3 kOhm

2) Basic consumption 20 mA, plus 0..20 mA per output

5.1.3 Maximal current consumption from base units

Base unit	internal 5 V-Bus	internal +V-Bus
PCD1	750 mA	100 mA
PCD2.M110/M120 (before hardware version H)	1100 mA	200 mA
PCD2.M110/M120	1600 mA	200 mA
PCD2.M150/M170	1600 mA	200 mA
PCD2.C200	1500 mA	630 mA
PCD2.M2210-C15	500 mA	200 mA
PCD2.M480	2000 mA	200 mA
PCD2.M4x60	800 mA	250 mA
PCD2.M5xx0	1400 mA	800 mA
PCD2.C1000	1400 mA	800 mA
PCD2.C2000	1400 mA	800 mA

5.2 Digital input modules

PCD2.E110	**8 inputs, 24 VDC, 8 ms**
PCD2.E111	**8 inputs, 24 VDC, 0.2 ms**
PCD2.E112	**8 inputs, 12 VDC, 9 ms**
PCD2.E116	**8 inputs, 5 VDC, 0.2 ms**
PCD2.E160	**16 inputs, 24 VDC, 8 ms, connection via 34-pole ribbon connector**
PCD2.E161	**16 inputs, 24 VDC, 0.2 ms, connection via 34-pole ribbon connector**
PCD2.E165	**16 inputs, 24 VDC, 8 ms, spring terminal connection**
PCD2.E166	**16 inputs, 24 VDC, 0.2 ms, spring terminal connection**

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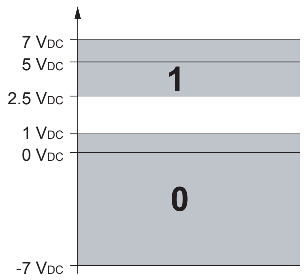
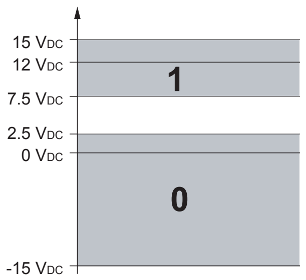
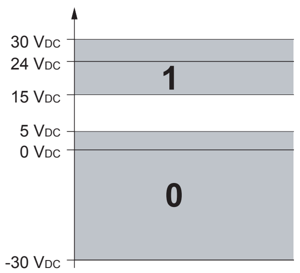
Definition of input signals

for 5 VDC	for 12 VDC	for 24 VDC
PCD2.E116	PCD2.E112	PCD2.E110, PCD2.E111, PCD2.E160…E166







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

5.2.1 PCD2.E11x, 8 digital inputs

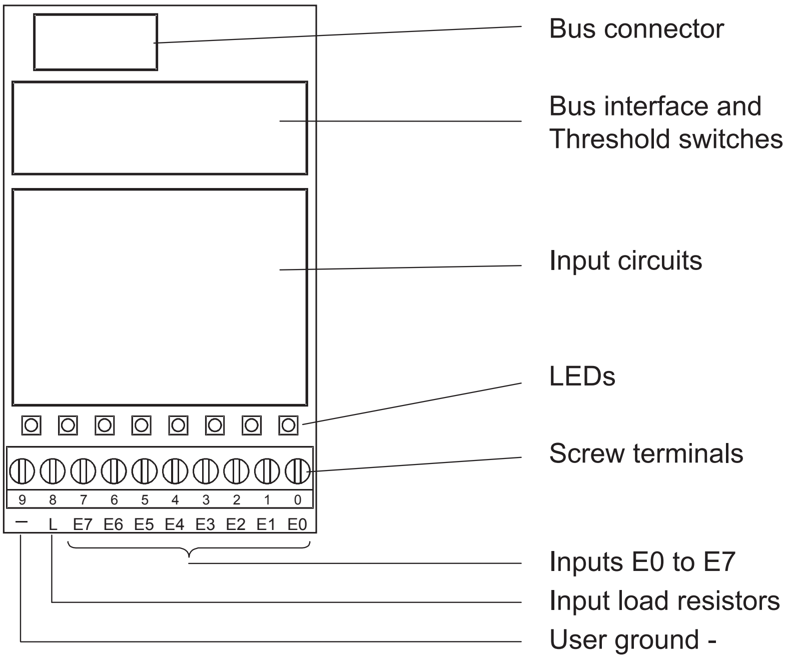
Application

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 PCD2.E111 differs from the PCD2.E110 in its shorter input delay, typically 0.2 ms.

Technical data

Number of inputs:	8 electrically connected, source or sink operation
Input voltage E110 : E111 : E112 : E116 : Special :	24 VDC (15…30 VDC) smoothed or pulsed 24 VDC (15…30 VDC) smoothed, max. 10 % residual ripple 12 VDC (7.5…15 VDC) smoothed, max. 10 % residual ripple 5 VDC (1…7 VDC) smoothed, max. 10 % residual ripple other values on request
Input current:	6 mA at 24 VDC
Input delay E110 : E111 : E112 : E116:	typically 8 ms typically 0.2 ms typically 9 ms typically 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; typically 12 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 48 mA (all inputs=1) at 24 VDC
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

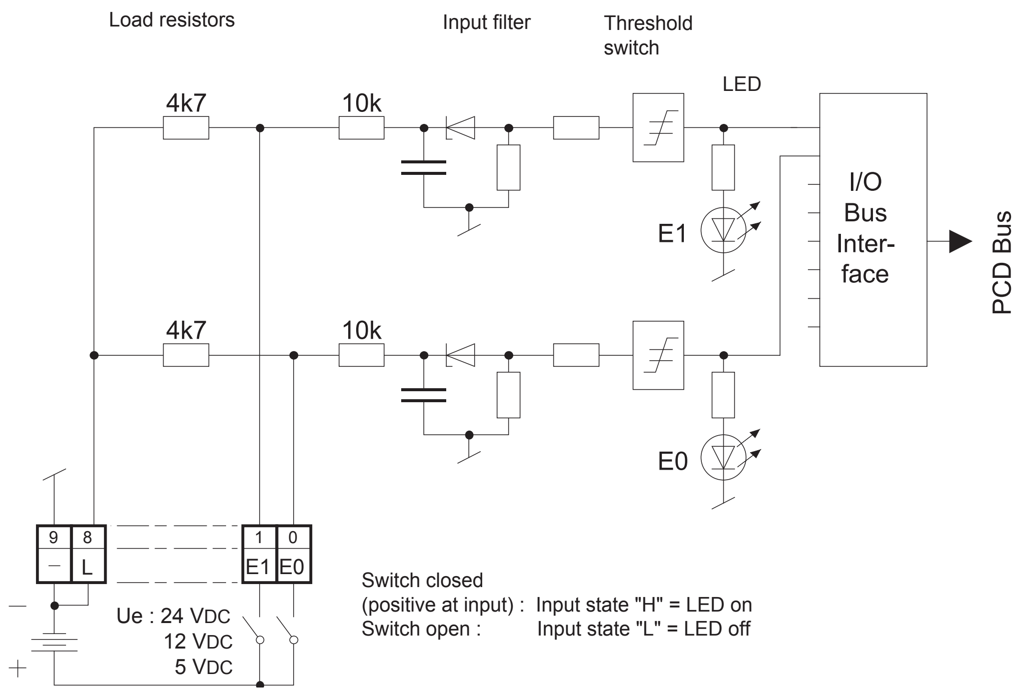
LEDs and connection terminals



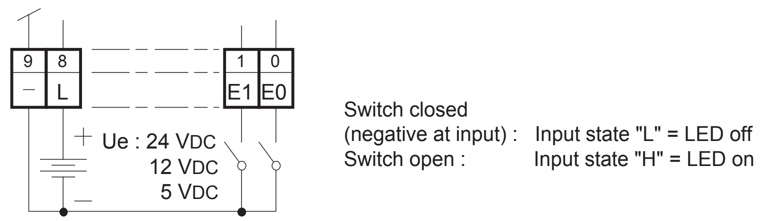
Input circuits and terminal designation

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.2.2 PCD2.E160/161, 16 digital inputs, ribbon cable connector

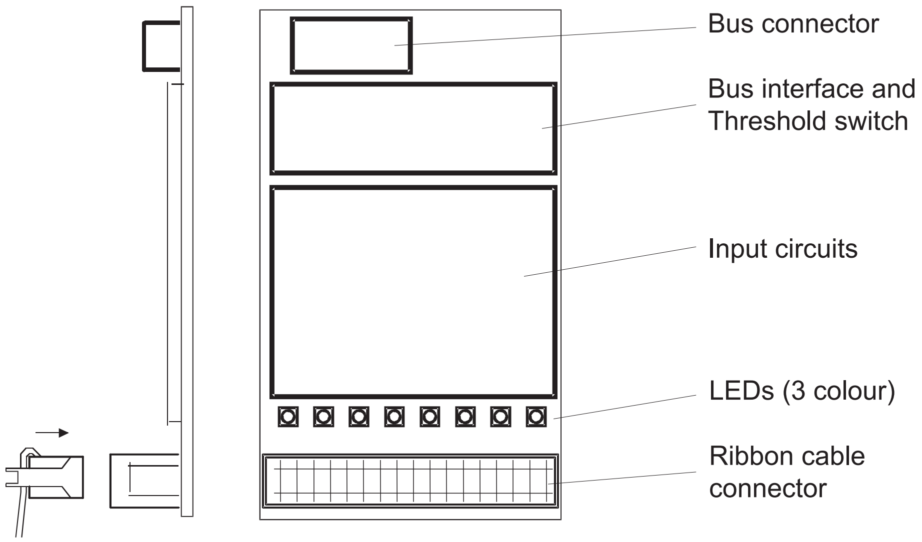
Application

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 PCD2.E161 differs from the PCD2.E160 in its shorter input delay, 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 % residual 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 IEC 1000-4-4	2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…72 mA; typically 36 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 connector

LEDs and connection terminals



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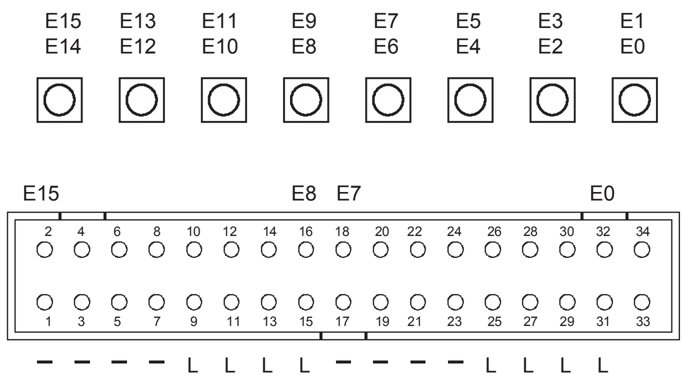


For every 2 inputs, a 3-colour LED is fitted:

LED	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
green	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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 PCD2.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

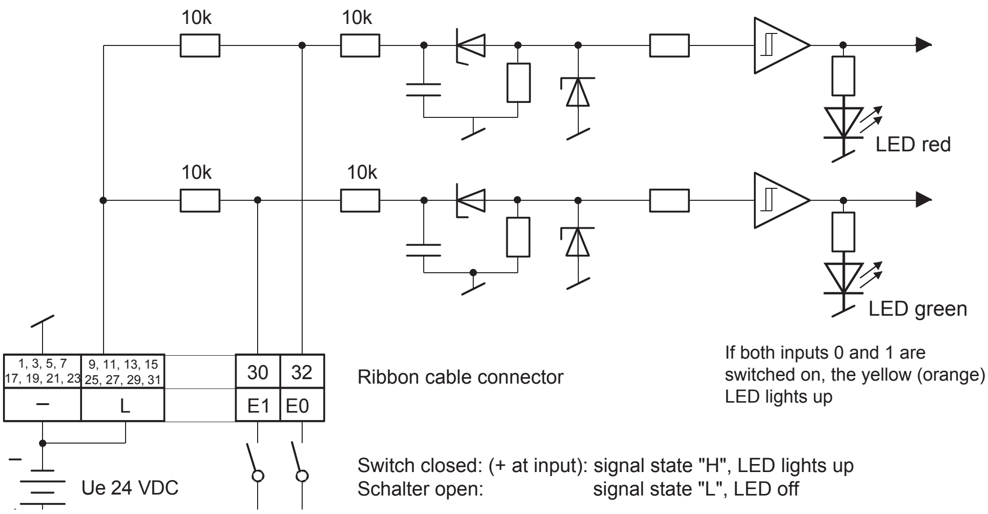
Matching cables can be ordered in reels from ‘3M’:
- Ribbon cable 34-pole, grey with pin 1 identification — Type 3770/34 or 3801/34
- Round cable 34-pole, grey with pin 1 identification — Type 3759/34

*) optional

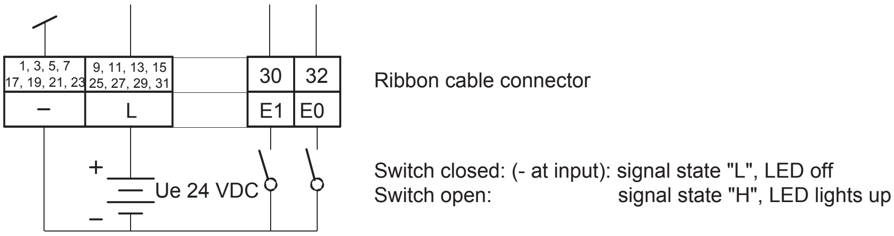
Input circuits and terminal designation

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

Source operation (positive logic):



Sink operation (negative logic):



Watchdog: This module can interact with the watchdog; if it is used on base address 240 (or 496 for the PCD2.M17x), the last input with address 255 (or 511 for the PCD2.M17x) cannot be used.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.2.3 PCD2.E165/166, 16 digital inputs, spring terminal connectors

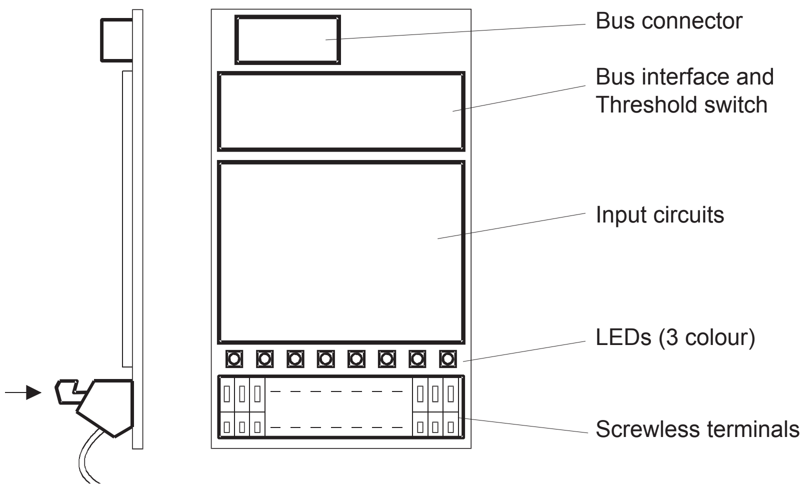
Application

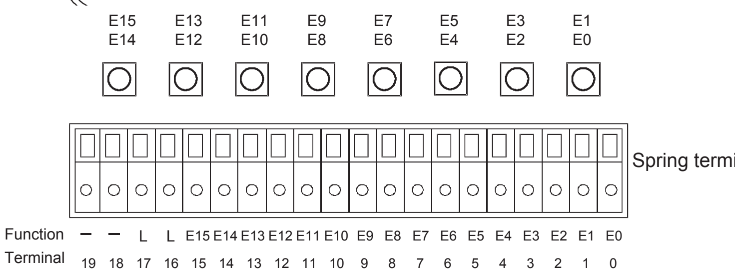
Low-cost input module for source or sink operation with 16 inputs, electrically connected. Suitable for most electronic and electromechanical switching elements at 24 VDC. The PCD2.E166 differs from the PCD2.E165 in its shorter input delay, typically 0.2 ms.

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 % residual 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 IEC 1000-4-4	2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…72 mA; typically 36 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption	max. 64 mA (all inputs=1) at 24 VDC
Terminals:	Spring terminal connection (not pluggable), for wires up to max. 0.5 mm² (1 × AWG 20)

LEDs and connection terminals





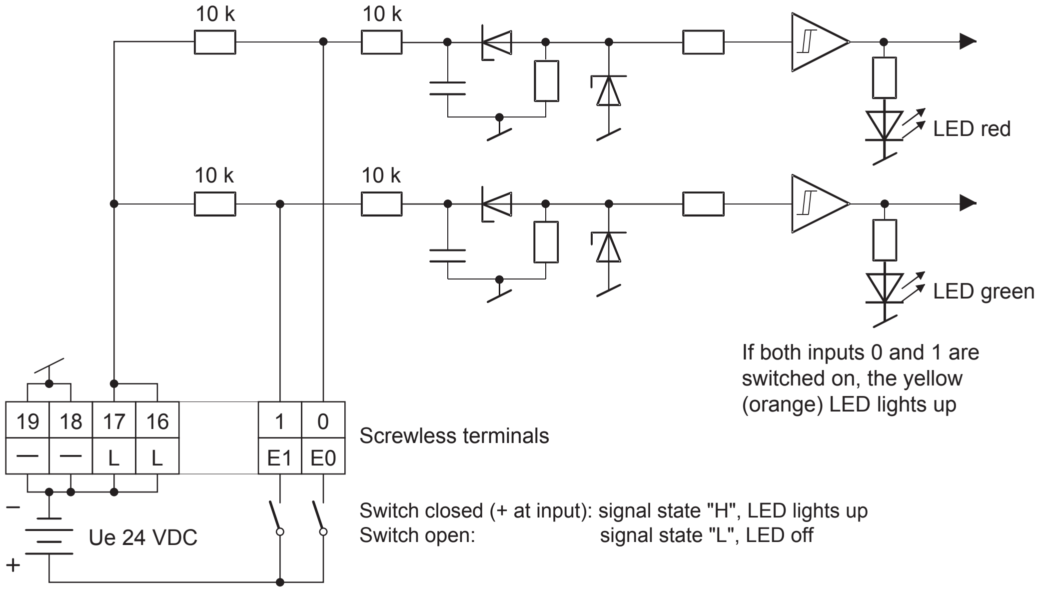
For every 2 inputs, a 3-colour LED is fitted:

LED is	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
green	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

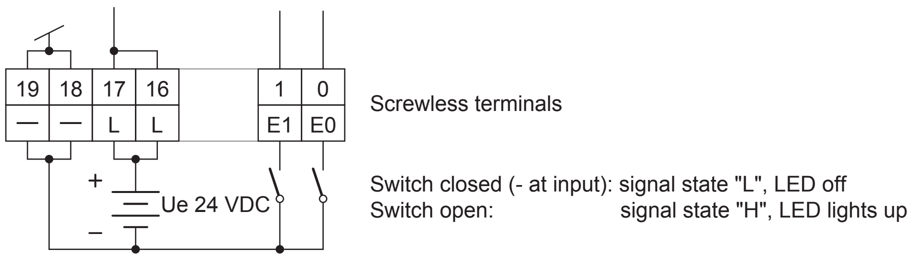
Input circuits and terminal designation

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 interact with the watchdog; if it is used on base address 240 (or 496 for the PCD2.M17x), the last input with address 255 (or 511 for the PCD2.M17x) cannot be used.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

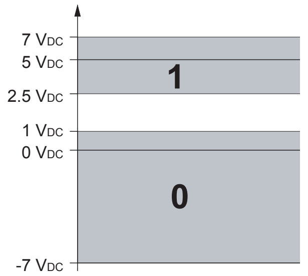
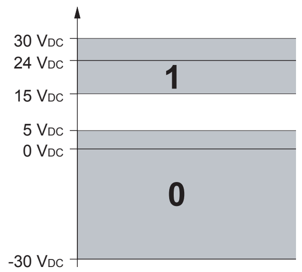
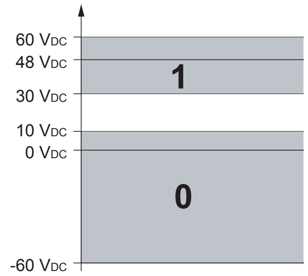
5.3 Digital input modules, electrically isolated

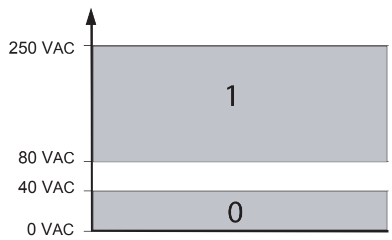
PCD2.E500	**6 inputs for 115 - 230 VAC**
PCD2.E610	**8 inputs 24 VDC, 10 ms**
PCD2.E611	**8 inputs 24 VDC, 0.2 ms**
PCD2.E613	**8 inputs 48 VDC, 9 ms**
PCD2.E616	**8 inputs 5 VDC, 0.2 ms,**

Electrical isolation of outputs to the Saia PCD®.
The channels are not isolated from each other.

5

Definition of input signals

for 5 VDC	for 24 VDC	for 48 VDC
PCD2.E616	PCD2.E610, PCD2E611	PCD2.E613
		

for 115 – 230 VAC
PCD2.E500


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 Saia 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 also be protected individually.

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

5.3.1 PCD2.E500, 6 digital inputs for 115 - 230 VAC

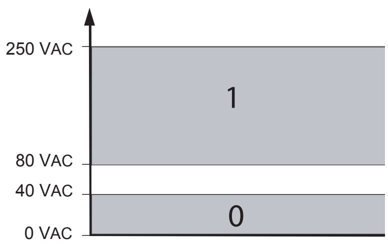
Application

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.

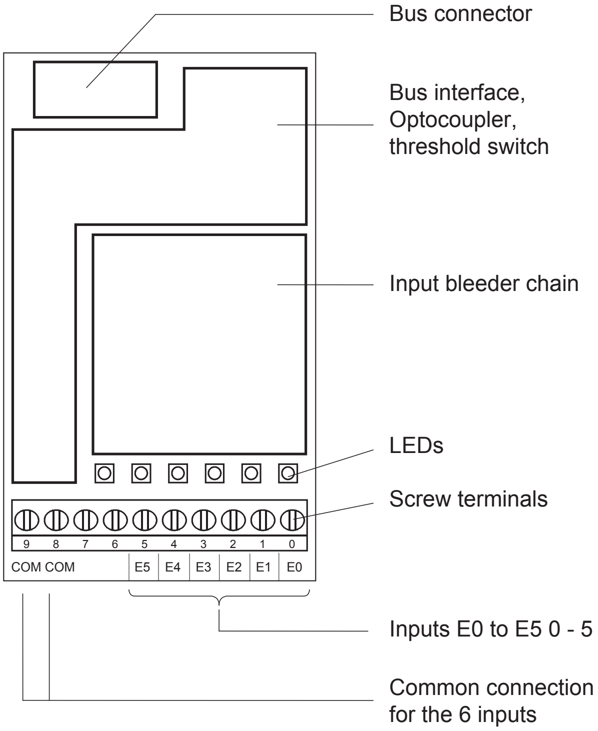
Technical data

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:	 typically 10 ms; max. 20 ms typically 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 MOhm / 500 VDC
Optocoupler isolation voltage	2.5 kV Galvanic separation of outputs to Saia PCD®. The channels themselves not are separated.
Internal current consumption: (from +5 V bus)	< 1 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

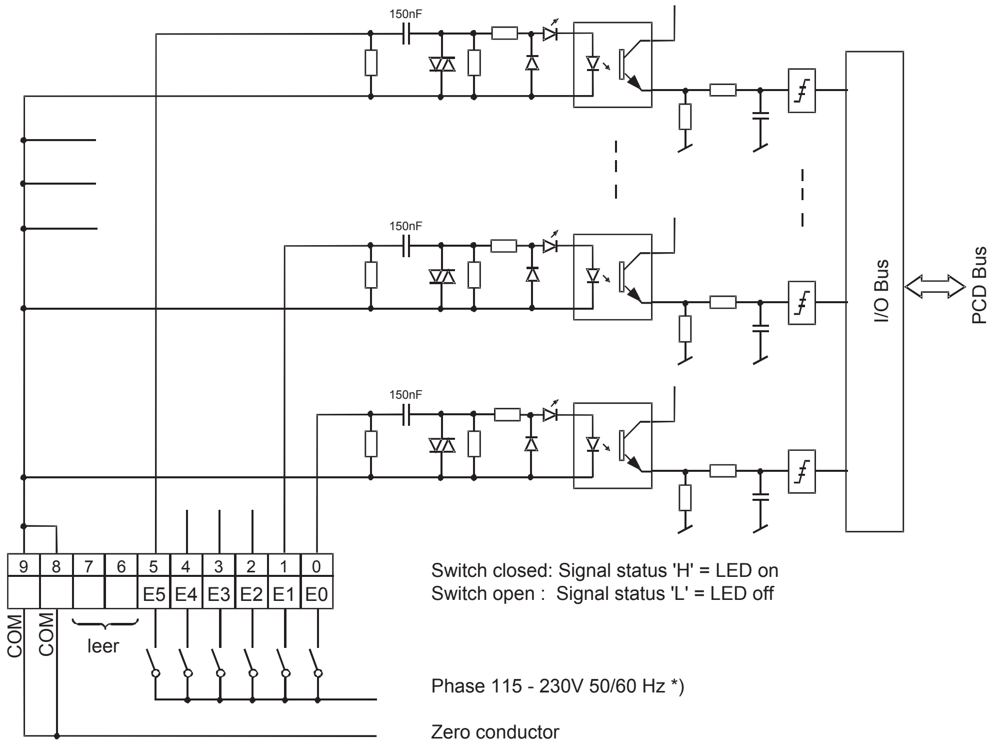
Switch on/off level:



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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

5.3.2 PCD2.E610/611/613/616, 8 digital inputs, electrically isolated

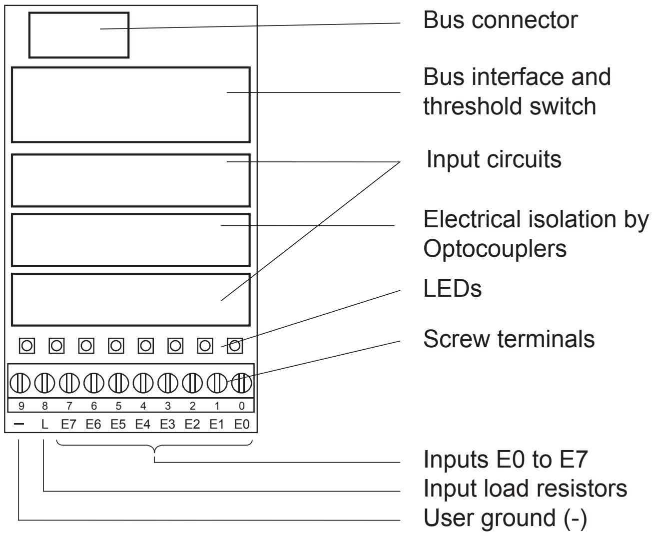
Application

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. The PCD2.E611 differs from the PCD2.E610 in its shorter input delay, typically 0.2 ms.

Technical data

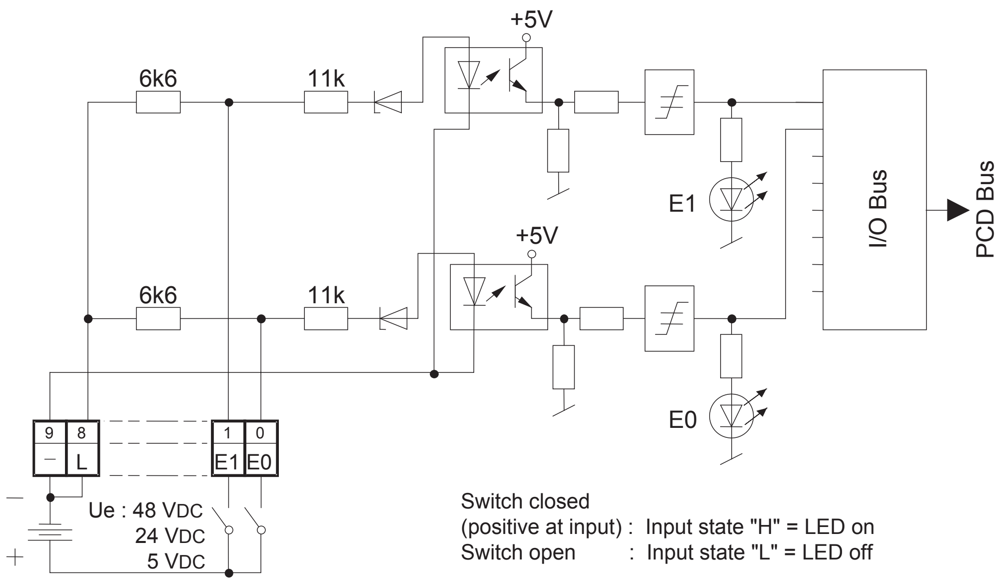
Number of inputs:	8 electrically isolated by optocoupler, source or sink operation, all inputs to the module in the same phase
Input voltage E610: E611: E613: E616:	24 VDC (15…30 VDC) smoothed or pulsed 24 VDC (15…30 VDC) smoothed max. 10 % residual ripple 48 VDC (30…60 VDC) smoothed max. 10 % residual ripple 5 VDC (7.5…15 VDC) smoothed max. 10 % residual ripple
Supply voltage: for source operation: for sink operation:	E610: E611: E613: E616: min. 15 V 15 V 30 V 3 V min. 18 V 18 V 36 V 3.6 V
Input current: (at input voltage) for source operation: for sink operation:	E610: E611: E613: E616: (24 VDC) (24 VDC) (48 VDC) (5 VDC) 5 mA 5 mA 2 mA 8.4 mA 3.7 mA 3.7 mA 1.5 mA 6.2mA
Input delay (0-1/1-0):	E610: E611: E613: E616: on. 10 ms 0.2 ms 9 ms 0.2 ms off. 10 ms 1.0 ms 9 ms 1.0 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 Galvanic separation of outputs to Saia PCD®. The channels themselves not are separated.
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:	Pluggable 10-pole spring terminal block (4 405 4847 0), for wires up to 1.5 mm²

LEDs and connection terminals



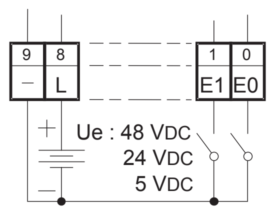
Input circuits and terminal designation

Depending on external wiring, this module may be used for source or sink operation.**Source operation (positive logic):**



Switch closed
(positive at input) : Input state "H" = LED on
Switch open : Input state "L" = LED off

Sink operation (negative logic):



Switch closed
(negative at input) : Input state "H" = LED off
Switch open : Input state "L" = LED on

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

5.4 Digital output modules

PCD2.A300	**6 outputs 2 A, 10…32 VDC**
PCD2.A400	**8 outputs 0.5 A, 10…32 VDC**
PCD2.A460	**16 outputs 0.5 A, 10…32 VDC**
PCD2.A465	**16 outputs 0.5 A, 10..32 VDC**

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

5.4.1 PCD2.A300, 6 digital outputs for 2 A each

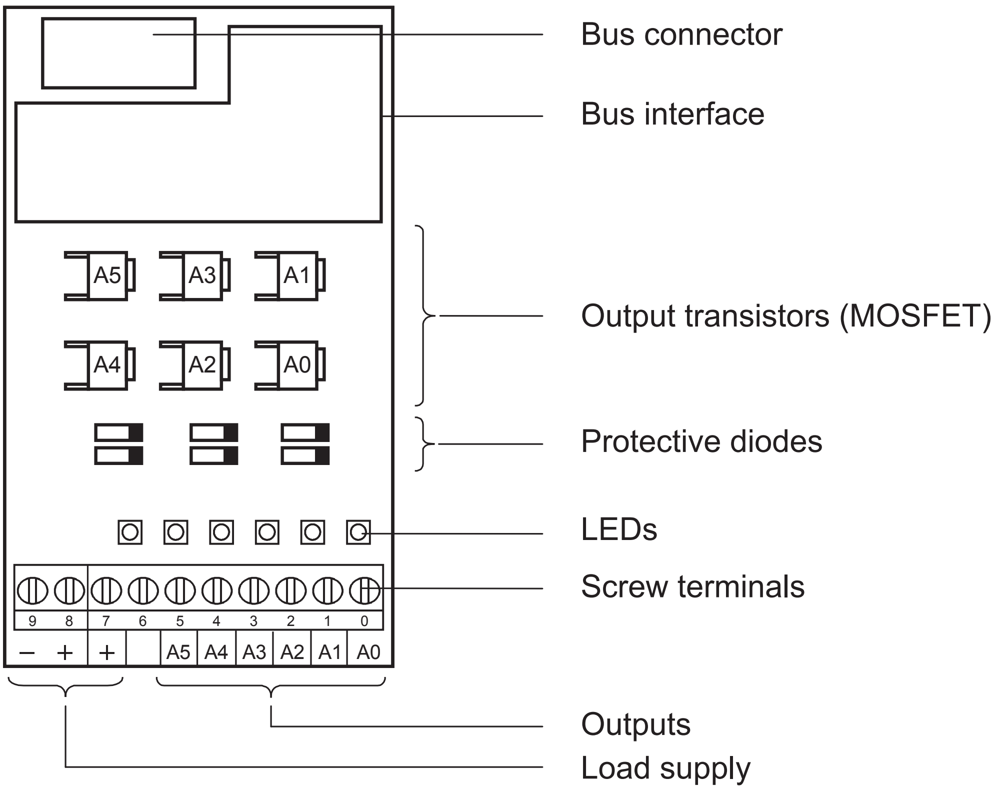
Application

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.

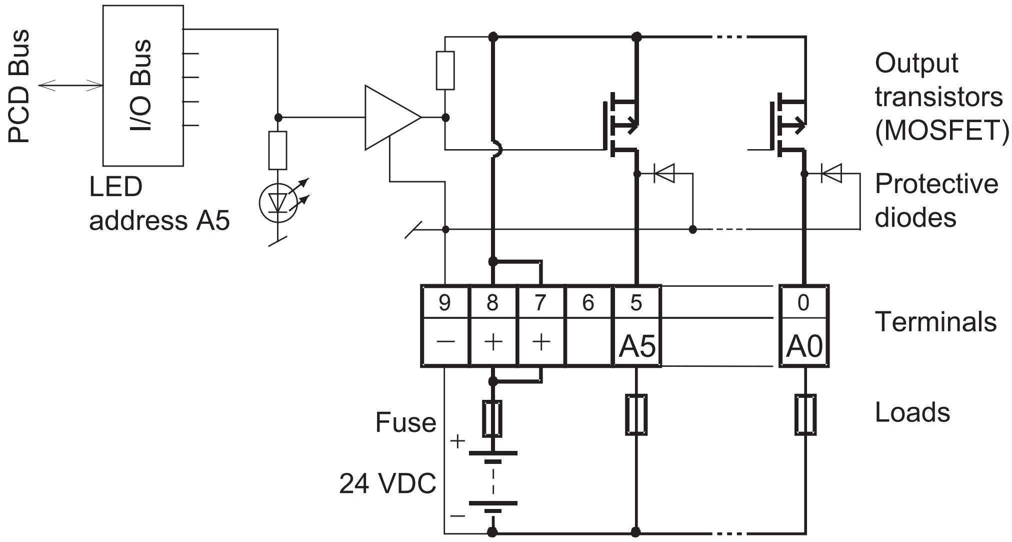
Technical data

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:	0.2 V 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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.4.2 PCD2.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 (for version “B”)*

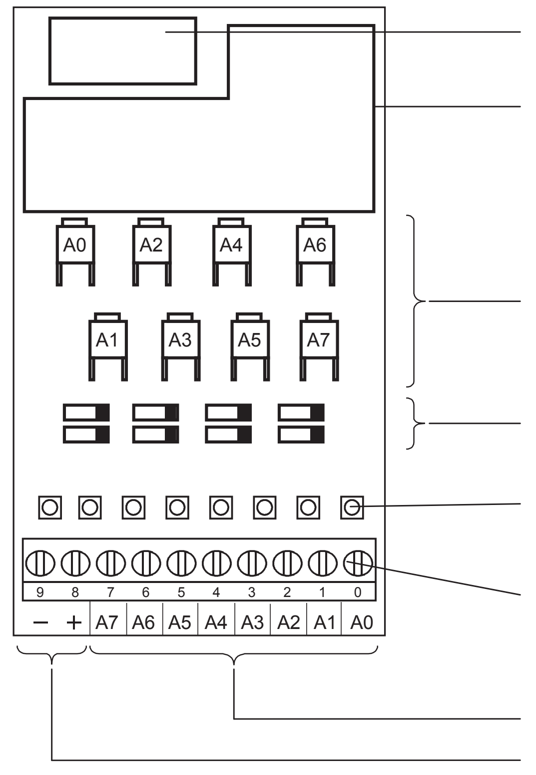
Number of outputs:	8, electrically connected
Output current:	5…500 mA (leakage current max. 0,1 mA) Within the voltage range 5…24 VDC, the load resistance should be at least 48 Ω
Total current per module:	4 A on 100 % duty cycle
Operating mode:	Source operation (positive switching)
Voltage range:	5…32 VDC, smoothed 10…25 VDC, pulsed
Voltage drop:	≤ 0.4 V at 0.5 A
Output delay:	Switch-on delay typically 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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

* Version “B” available since February 1995

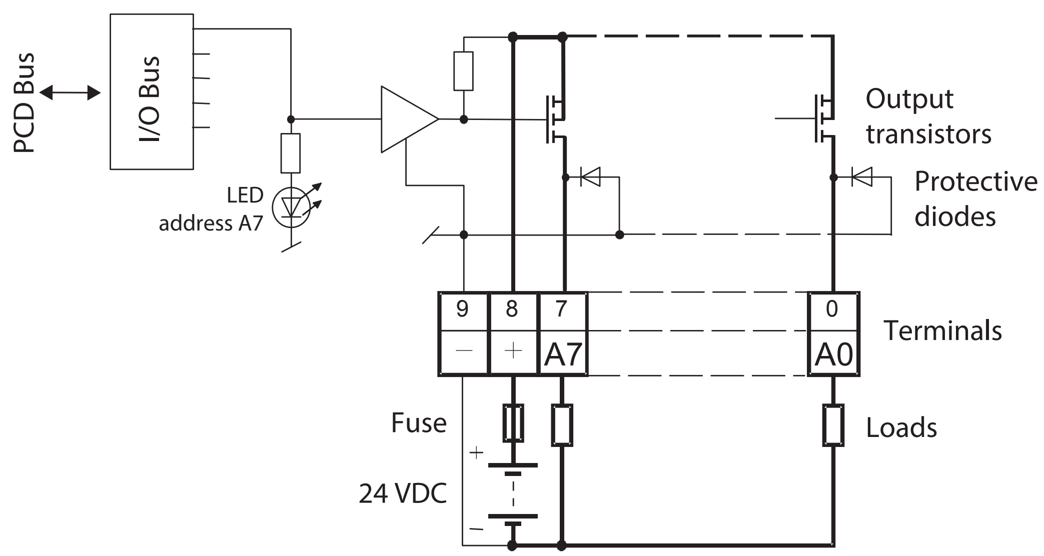
(Version “A” was fitted with bipolar transistors. These had a shorter recovery time, but also a higher residual voltage, resulting in a restriction on 100 % loading)

5

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

5.4.3 PCD2.A460, 16 digital outputs for 0.5 A each, with ribbon connector

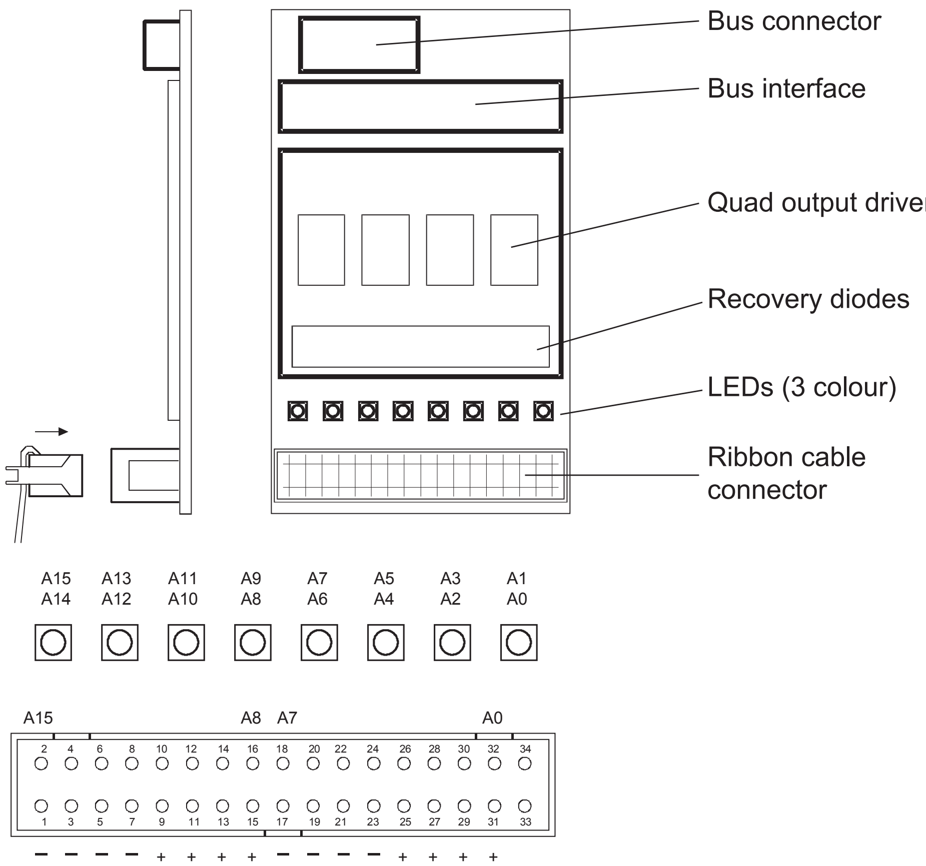
Application

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 % residual ripple
Voltage drop:	max. 0.3 V at 0.5 A
Output delay:	typically 50 µs, max. 100 µs for resistive 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 74 mA (all outputs = “1”) typically 40 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	34-pole ribbon cable connector

LEDs and connection terminals



For every 2 outputs, a 3-colour LED is fitted:

LED is	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
green	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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

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These connection cables can be plugged at one end into the PCD2.A460 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.

i

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

i

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

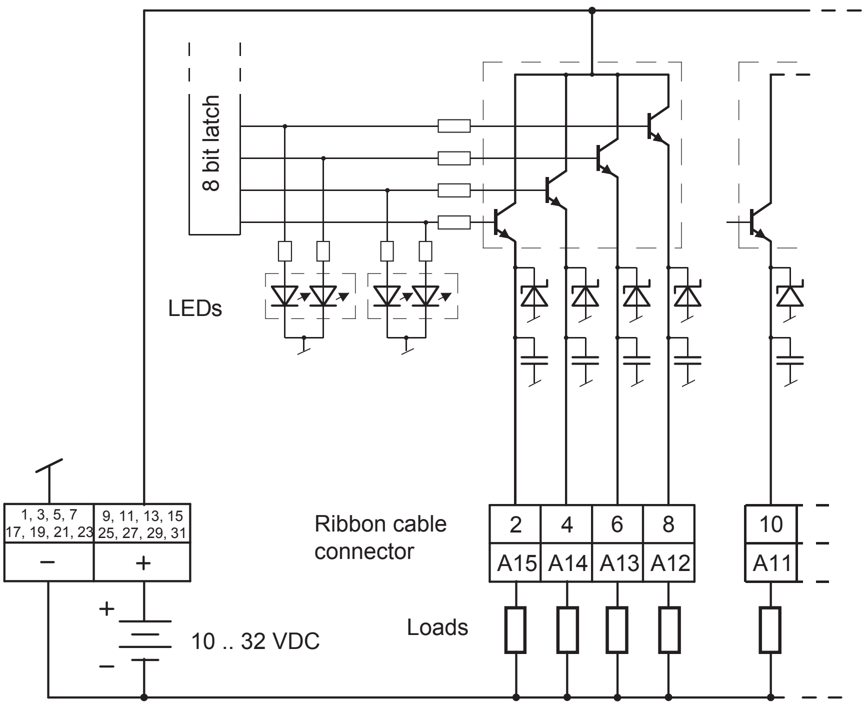
- Socket connector 34-pole — Type 3414-6600
- (Metal strain relief) *) — Type 3448-2034
- (Handle for socket connector 34-pole) *) — Type 3490-3

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 (or 496 for the PCD2.M17x), the last input with address 255 (or 511 for the PCD2.M17x) cannot be used.
For details, please refer to the section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

5.4.4 PCD2.A465, 16 digital outputs, for each 0.5 A

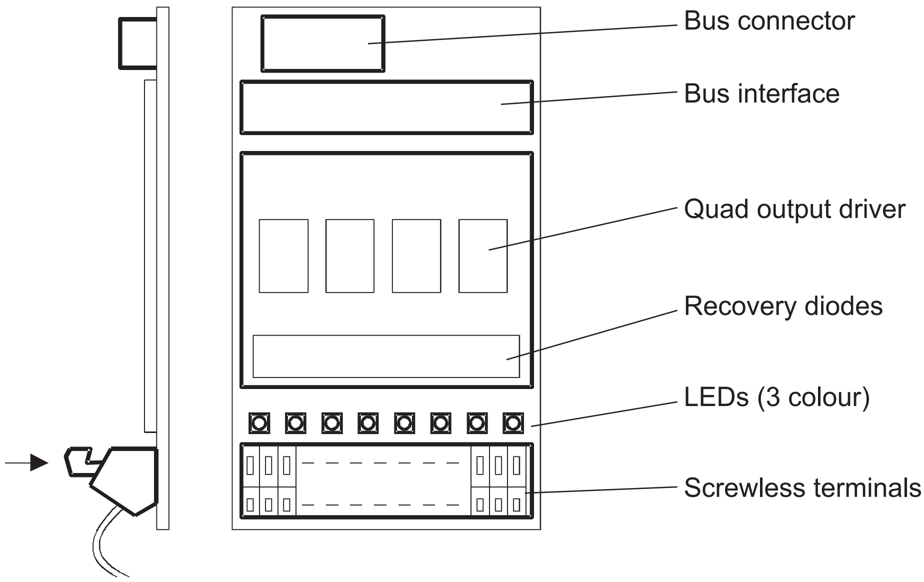
Application

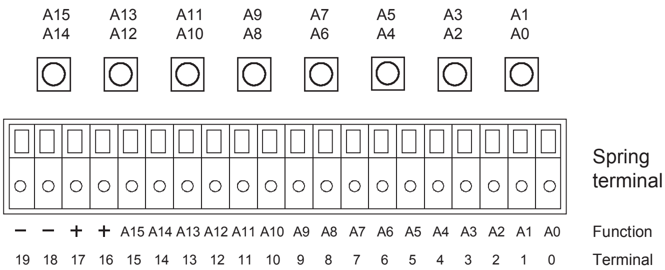
Low cost output module with 16 transistor outputs 5…500 mA, with short-circuit protection. The individual circuits are electrically connected; the voltage range is 10…32 VDC.

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 % residual ripple
Voltage drop:	max. 0.3 V at 0.5 A
Output delay:	typically 50 µs, max. 100 µs for resistive 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 74 mA (all outputs = “1”) typically 40 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	Load current
Terminals:	Spring terminal connection (not pluggable), for wires up to max. 0.5 mm² (1 × AWG 20)

LEDs and connection terminals

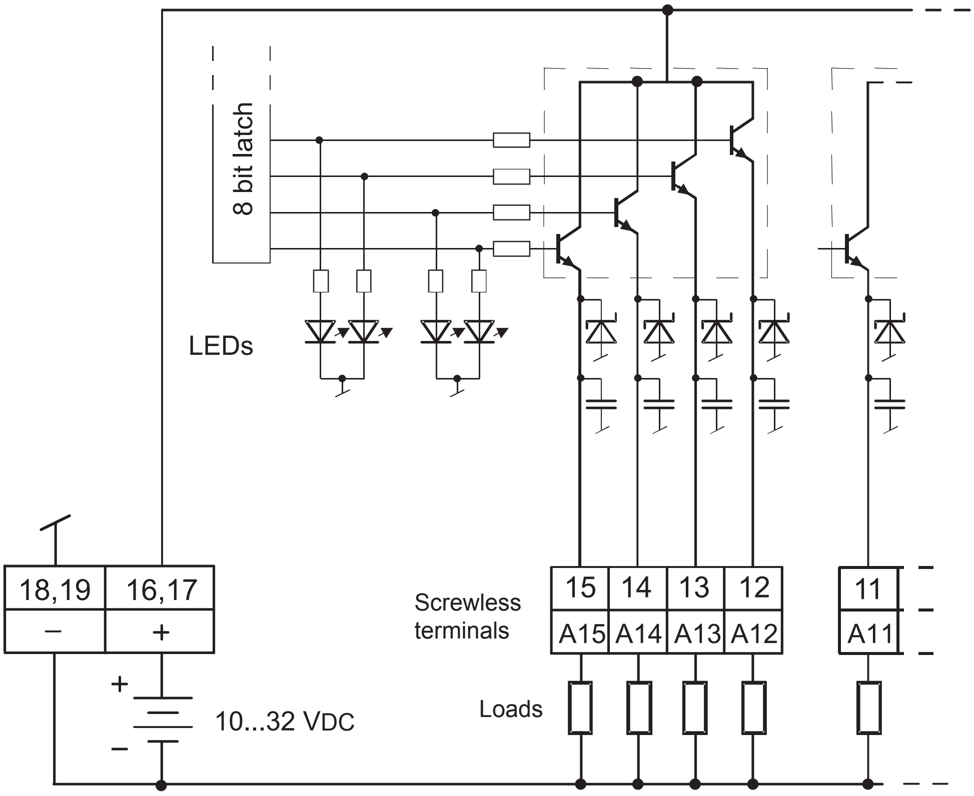




For every 2 outputs, a 3-colour LED is fitted:

LED is	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	E15
off	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
red	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
green	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Output circuits and terminal designation



Watchdog: This module can interact with the watchdog; if it is used on base address 240 (or 496 for the PCD2.M17x), the last input with address 255 (or 511 for the PCD2.M17x) cannot be used.
For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.5 Digital output modules, electrically isolated

PCD2.A200	**4 make contacts 2 A, 250 VAC | 50 VDC**
PCD2.A210	**4 break contacts 2 A, 250 VAC | 50 VDC**
PCD2.A220	**6 make contacts 2 A, 250 VAC | 50 VDC**
PCD2.A250	**8 make contacts 2 A, 48 VAC | 50 VDC** **pluggable 14-pole screw terminal block**
PCD2.A410	**8 digital outputs 0.5 A each, 5…32 VDC,** **electrically isolated against PCD2 bus**

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 Saia 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 also be protected individually.

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

In the appendix, Chapter A.4 relay contacts, are calculation data and wiring suggestions for the relay contacts. These data should be absolutely considered for safe switching and a long life span of the relays.

5.5.1 PCD2.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.

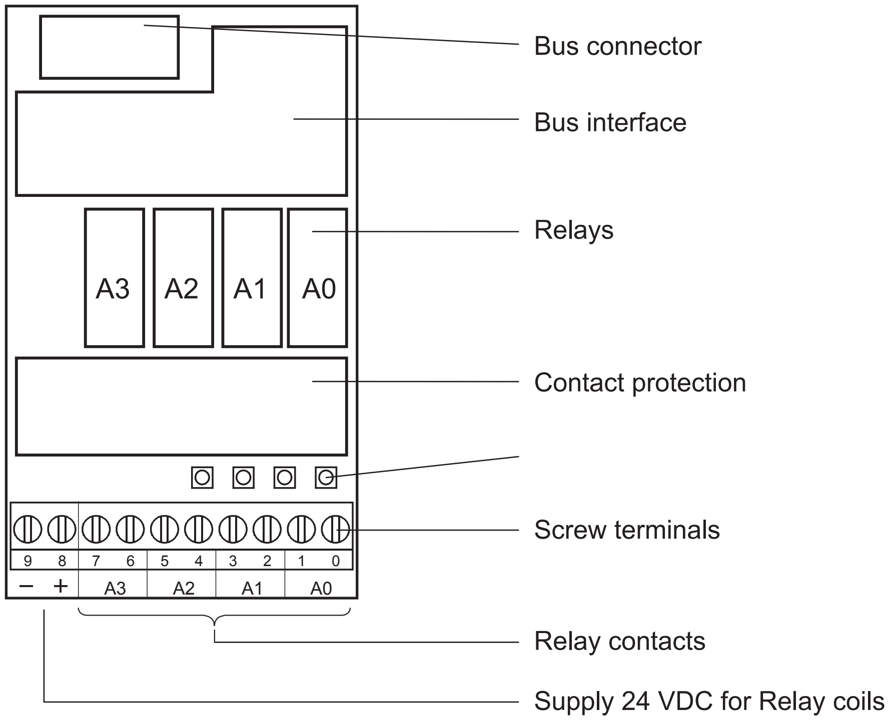
Technical data

Number of outputs:	4, electrically isolated make contacts
Type of relay (typical):	RE 030024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 0.7 × 10^6 operations 1 A, 250 VAC AC11 1.0 × 10^6 operations 2 A, 50 VDC DC1 0.3 × 10^6 operations [3] 1 A, 24 VDC DC11 0.1 × 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 bei 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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

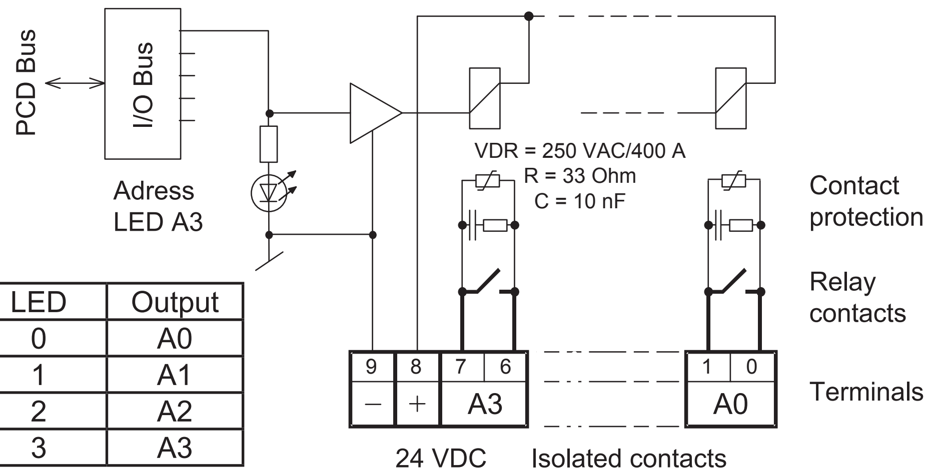
[1)] With external protective diode
[2)] With reverse voltage protection
[3)] These ratings are not UL-listed

In the appendix, Chapter A.4 relay contacts, are calculation data and wiring suggestions for the relay contacts. These data should be absolutely considered for safe switching and a long life span of the relays.

LEDs and connection terminals



Output circuits and terminal designation



LED	Output
0	A0
1	A1
2	A2
3	A3

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 PCD2.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. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.5.2 PCD2.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.

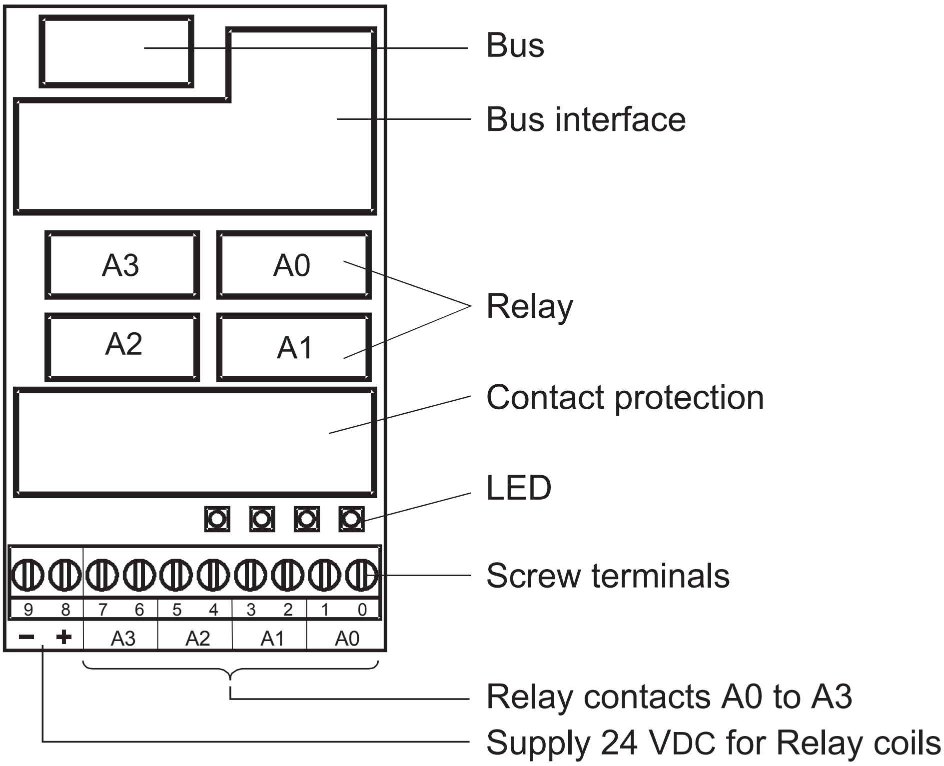
Technical data

Number of outputs:	4, electrically isolated break contacts
Type of relay (typical):	RE 014024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 0.7×10^6 operations 1 A, 250 VAC AC11 1.0×10^6 operations 2 A, 50 VDC DC11 0.3×10^6 operations [3] 1 A, 24 VDC DC11 0.1×10^6 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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

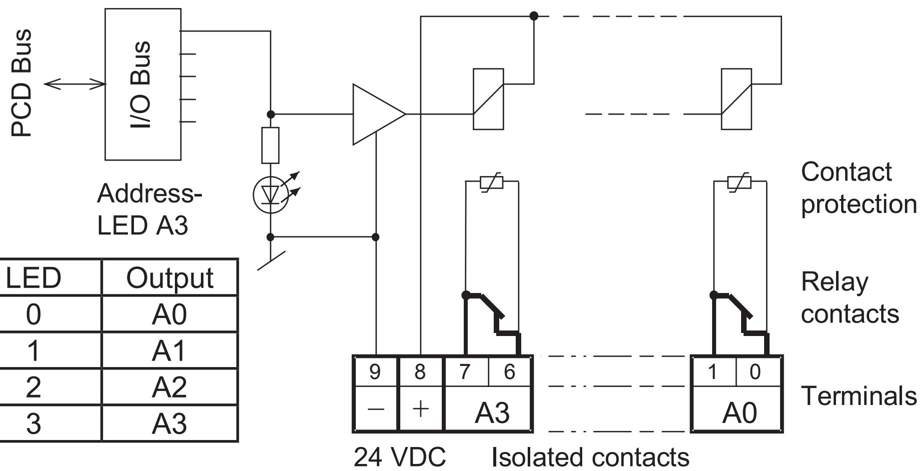
[1] With external protective diode
[2] With reverse voltage protection
[3] These ratings are not UL-listed

! In the appendix, Chapter A.4 relay contacts, are calculation data and wiring suggestions for the relay contacts. These data should be absolutely considered for safe switching and a long life span of the relays.

LEDs and connection terminals



Output circuits and terminal designation



LED	Output
0	A0
1	A1
2	A2
3	A3

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. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.5.3 PCD2.A220, 6 relays with make contacts, without contact protection

Application

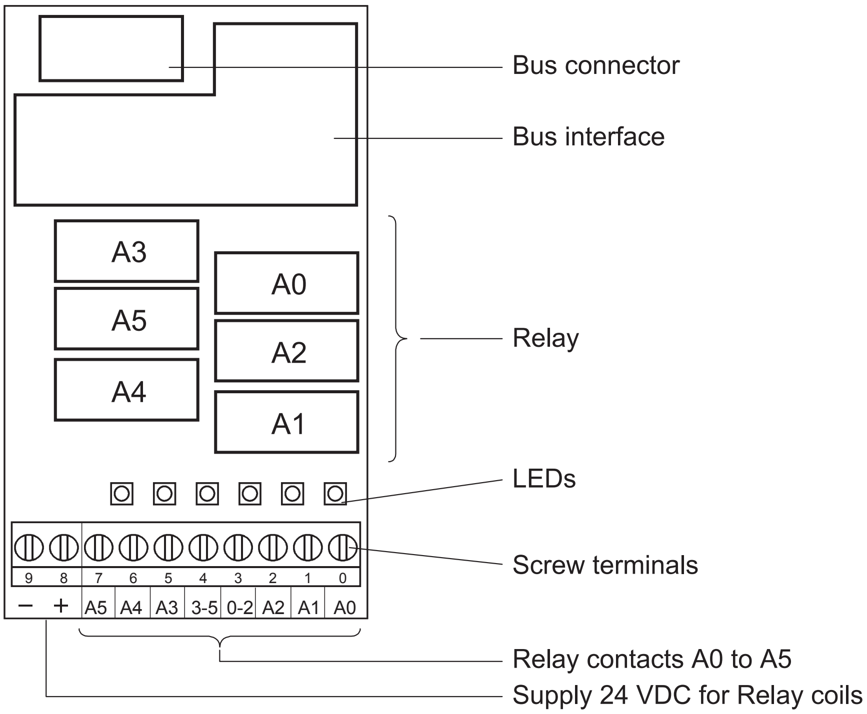
The module contains 6 relays with normally-open contacts for direct or alternating current up to 2 A, 250 VAC. The module is especially suited wherever AC switching circuits with infrequent switching have to be controlled. For space reasons, there is no integrated contact protection. Each group of 3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

Technical data

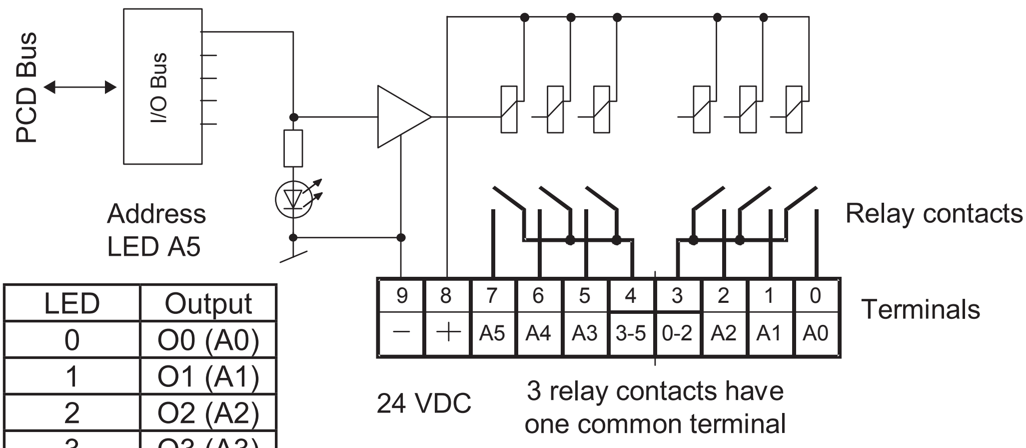
Number of outputs:	3 + 3 make contacts with common terminal
Type of relay (typical):	RE 030024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 — 0.7×10^6 operations 1 A, 250 VAC AC11 — 1.0×10^6 operations 2 A, 50 VDC DC11 — 0.3×10^6 operations [3] 1 A, 24 VDC DC11 — 0.1×10^6 operations [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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²
[1] With external protective diode [2] With reverse voltage protection [3] These ratings are not UL-listed	

In the appendix, Chapter A.4 relay contacts, are calculation data and wiring suggestions for the relay contacts. These data should be absolutely considered for safe switching and a long life span of the relays.

LEDs and connection terminals



Output circuits and terminal designation



LED	Output
0	O0 (A0)
1	O1 (A1)
2	O2 (A2)
3	O3 (A3)
4	O4 (A4)
5	O6 (A5)

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. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.5.4 PCD2.A250, 8 relays with make contacts, without contact protection

Application

The module contains 8 relays with normally-open contacts for direct or alternating current up to 2 A, 48 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.

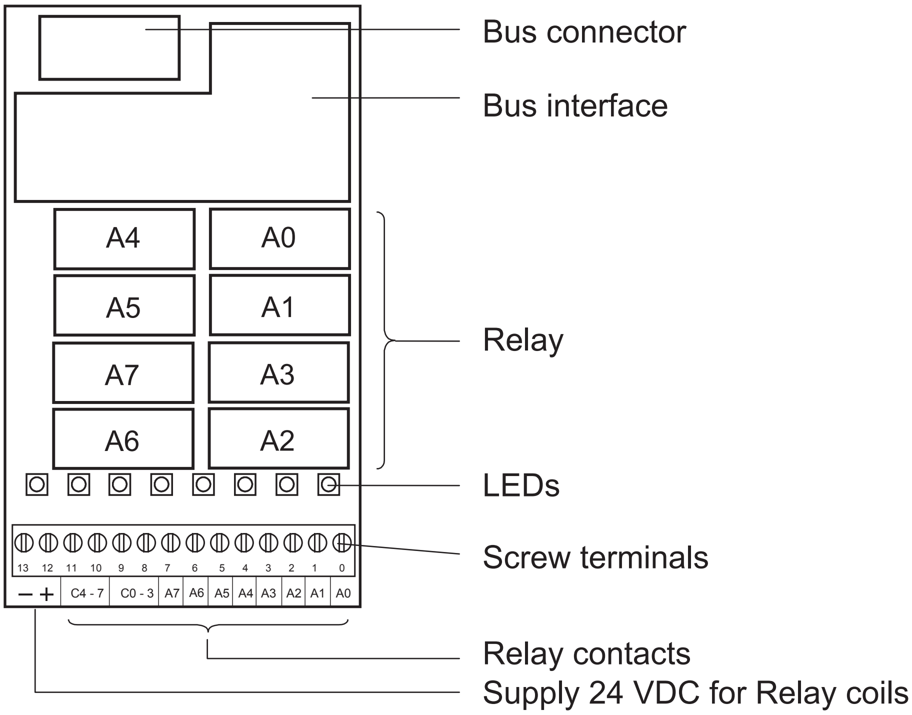
Technical data

Number of outputs:	4 + 4 make contacts with common terminal
Type of relay (typical):	RE 030024, SCHRACK
Operating mode:	> 12 V, > 100 mA
Switching capacity: *) (contact lifetime)	2 A, 48 VAC AC1 0.7×10^6 operations 1 A, 48 VAC AC11 1.0×10^6 operations 2 A, 50 VDC DC11 0.3×10^6 operations [3] 1 A, 24 VDC DC11 0.1×10^6 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 14-pole screw terminal block (4 405 4869 0), for wires up to 0.6 mm²
1) With external protective diode 2) With reverse voltage protection 3) These ratings are not UL-listed	

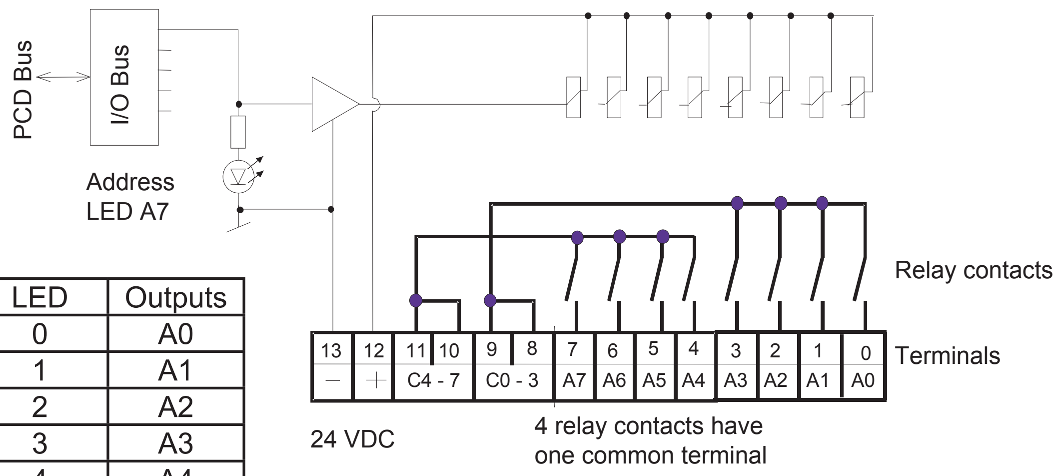
***)** Higher voltages are not allowed for this module because safety standards for clearance and creepage distances do not apply.

In the appendix, Chapter A.4 relay contacts, are calculation data and wiring suggestions for the relay contacts. These data should be absolutely considered for safe switching and a long life span of the relays.

LEDs and connection terminals



Output circuits and terminal designation



LED	Outputs
0	A0
1	A1
2	A2
3	A3
4	A4
5	A5
6	A6
7	A7

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. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.5.5 PCD2.A410, 8 digital outputs for 0.5 A each, electrically isolated

Application

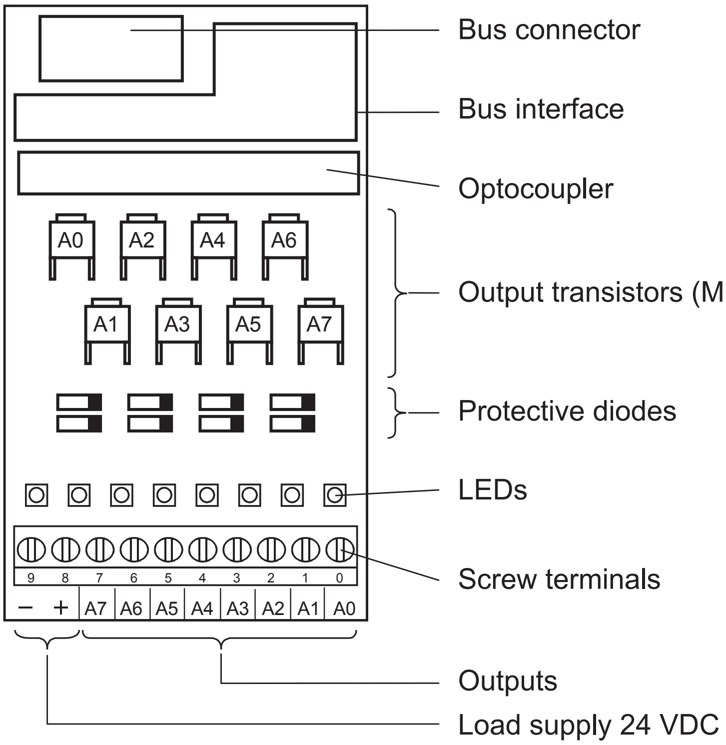
Output module, electrically isolated from the CPU, with 8 MOSFET transistor outputs, without short-circuit protection. Voltage range 5…32 VDC.

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

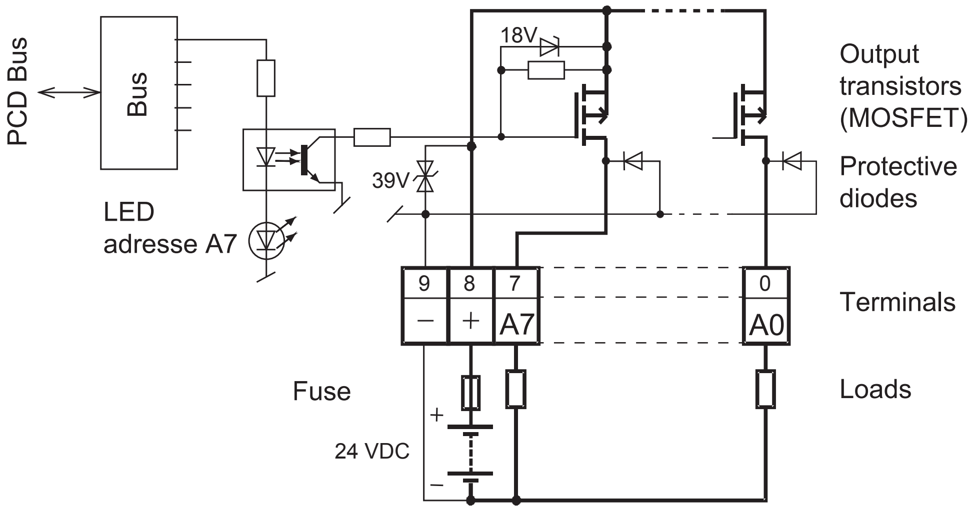
Technical data

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 typically 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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

LEDs and connection terminals



Output circuits and terminal designation



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

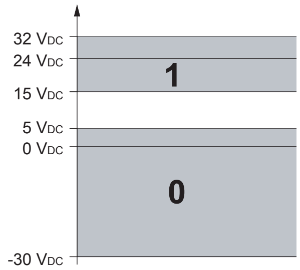
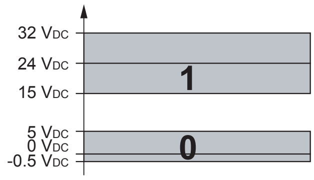
Fuse: It is recommended that each module should be separately protected with a fast-blow (S) 4 A fuse

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

5.6 Digital combined input and output modules

PCD2.B100	**2 inputs, 2 outputs, 4 selectable as inputs or outputs**

Definition of input signals

for 24 VDC	for 24 VDC
PCD2.B100; E0 and E1	PCD2.B100; E2 to E5
	

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

5.6.1 PCD2.B100, 2 inputs + 2 outputs + 4 digital inputs/outputs (selectable)

Application

Economical combined input/output module with:

- 2 inputs 24 VDC/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 VDC/8 ms or 0.5 A/5…32 VDC on common I/O terminals.

5

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)	

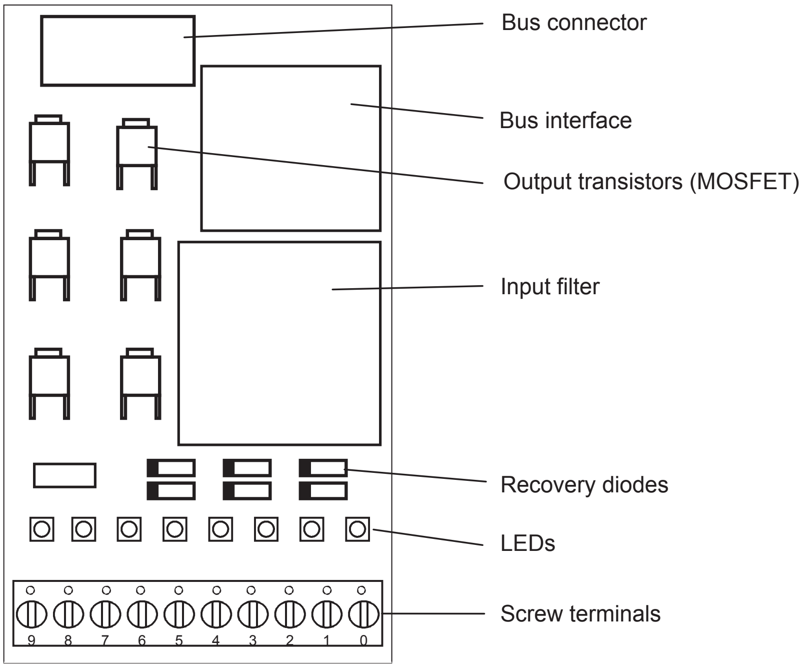
Technical data on outputs

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 A6 and A7 < 0.7 V at 500 mA for E/A2…E/A5
Total current per module:	3 A steady load
Switch-on delay:	10 µs typically
Switch-off delay:	50 µs typically (100 µs max.), (ohmic load 5…500 mA), longer for inductive load because of protective diode.
*) If it is intended to read the status of a combined output, the external voltage must be at least 17 VDC, as both the status and the LED are displayed via the input.	

General technical data on inputs and outputs

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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 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.

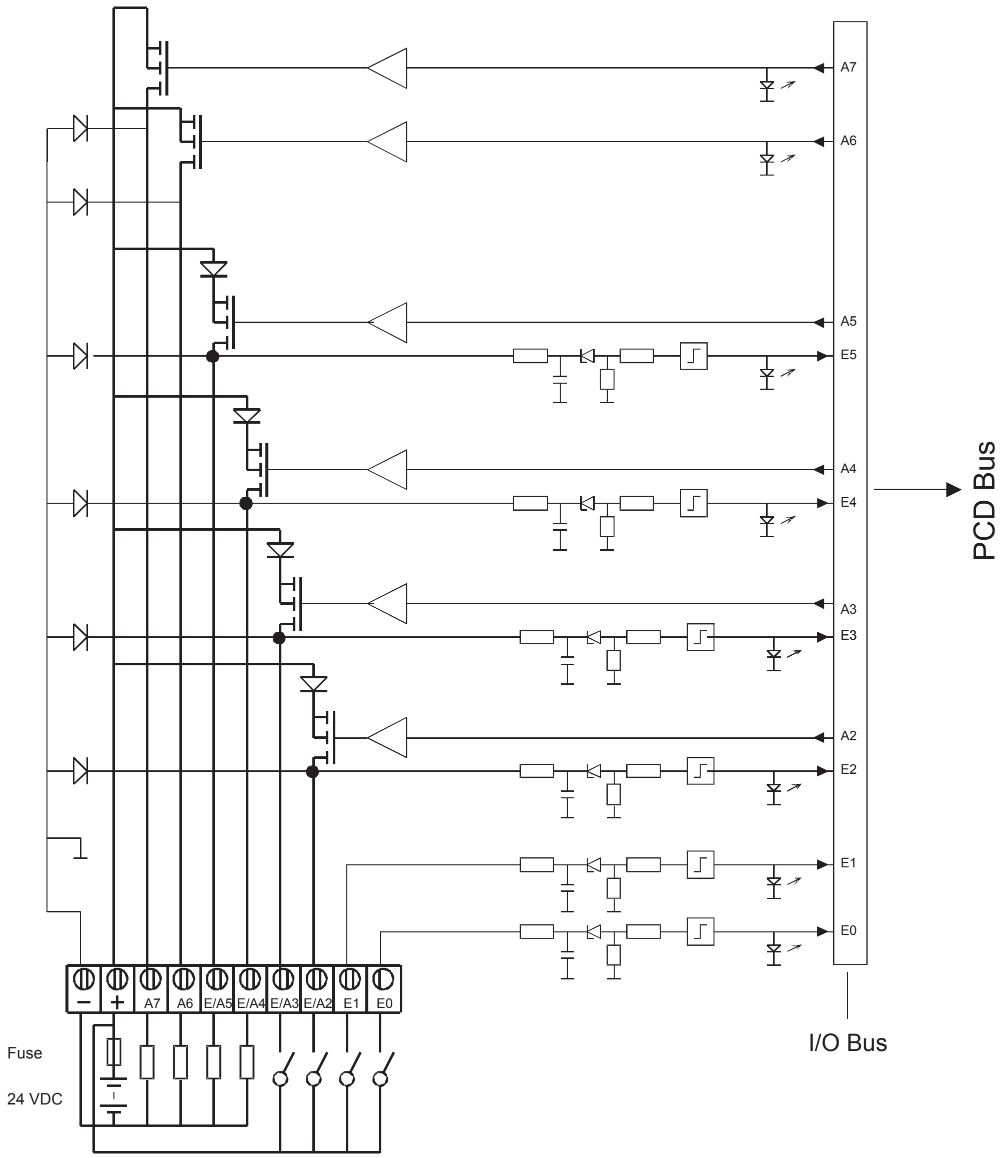
If the combined I/Os are used as outputs, the following should be noted:
The LEDs of combined outputs E/A2…E/A5 only light up when the output is high and a supply voltage of 24 V is connected.

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.

5

Input/output circuits and terminal designation



The example shows E/A2 and E/A3 used as inputs and
E/A4 and E/A5 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

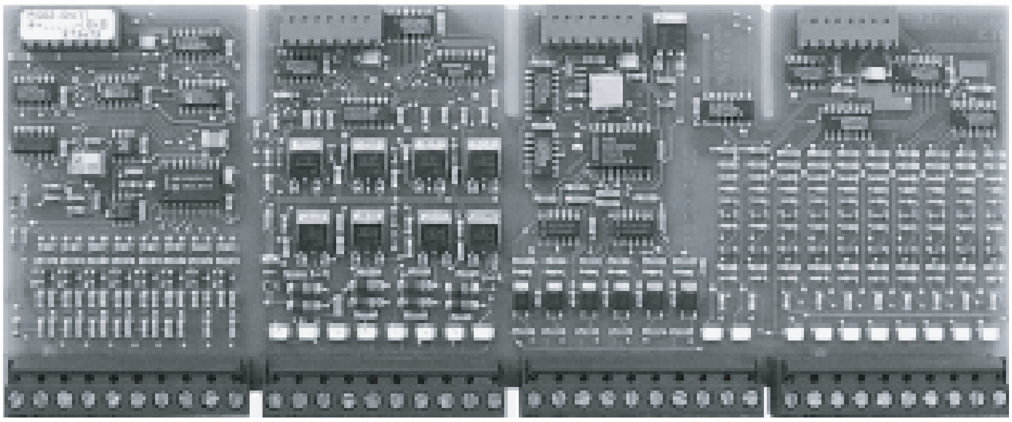
Fuse: It is recommended that each module should be separately protected with a fast-blow 3.15 A fuse.

Watchdog: This module can be used on all base addresses; there is no interaction with the watchdog on the CPUs. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.7 Multi-functional input/output modules

PCD2.G400	**Multi-functional input/output module**
PCD2.G410	**Multi-functional input/output module**

The two modules PCD2.G400 and PCD2.G410 are examples of the development and production of customer-specific versions.



The wide range of digital and analogue I/O modules provides optimum adaptability.

- Economic: The modular structure means that it is only necessary to include (and pay for) those functions that are actually required for a specific application.
- Flexible: All modules at the I/O level can be plugged onto any preferred point on the bus and are easy to exchange.
- Functional security: Guaranteed by their robust design and excellent reliability (average field failure rate FFR > 106 hours).
- Time saved in electrical wiring: Due to plug-in screw terminals, spring terminals or ready-made cables and ribbon cable adapters.

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

5.7.1 PCD2.G400, multi-functional input/output module

Application

Combined module with digital and analogue inputs and outputs. This module is designed to extend the range of uses for the Saia PCD®. The functions and the technical specification are based on the existing PCD2 modules.

This module cannot be installed in the PCD1.

The technical details should be taken from the descriptions of these modules.

Number and type of inputs/outputs

10 digital inputs, E0 … E9 (*addresses 0 … 9)

Technical data as for PCD2.E110, but without the option of sink operation, i.e. no “L” connection.

6 analogue outputs, A16 … A21 (*base address 16, channels 0 … 5)

0 … 10 VDC / 8 bit; remaining tech. data as for PCD2.W400.

8 digital outputs, A32 … A39 (*addresses 32 … 39)

24 VDC / 0.5 A; remaining tech. data as for PCD2.A400.

2 analogue inputs, E48 and E49 (*base address 48, channels 0 … 1)

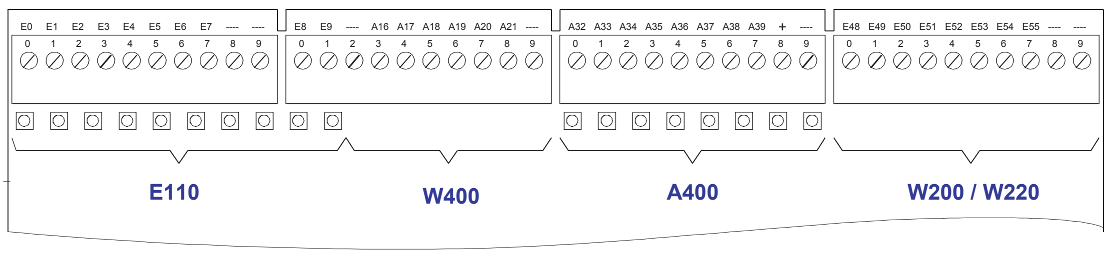
0 … 10 VDC / 10 bit; remaining tech. data as for PCD2.W200.

6 analogue inputs, E50 … E55 (*base address 48, channels 2 … 7)

Pt/Ni 1000 / 10 bit with data as for PCD2.W220.

Internal current consumption from	+5 V bus:	10 … 65 mA
	V+ bus:	35 mA

LEDs and connection terminals



*The module can be installed on sockets 1 … 4 (top) on the PCD2.

5.7.2 PCD2.G410, multi-functional I/O module with elect. isolated digital I/O

Application

Combined module with digital and analogue inputs and outputs. This module is designed to extend the range of uses for the Saia PCD®. The functions and the technical specification are based on the existing PCD2 modules.

This module cannot be installed in the PCD1.

The technical details should be taken from the descriptions of these modules.

Number and type of inputs/outputs

16 digital inputs, electrically isolated, E0…E15, (addresses 0…15).

Tech. data as for PCD2.E610,
Source or sink operation selectable via “Q/S” jumper.

4 relay outputs, A16…A19 (addresses 16…19),
Each with a changeover contact protected with 2 varistors.
Tech. data as for PCD2.A200.
The 24 V supply to the relay coils is via the screwless terminals “U_{ext}”, located next to the 4 relays.

4 analogue outputs, with 8 bit resolution, A32…A35
(base address 32 *, channels 0…3)
Each channel selectable with “U/I” jumper for voltage 0…10 V
or current 0…20 mA.
Tech. data as for PCD2.W410.

4 analogue inputs, with 10 bit resolution, E48…E51
(base address 48 *, channels 0…3)

Each channel can be configured separately with the jumper combinations shown for voltage 0…10 V (“U”), current 0…20 mA (“I”) or for resistive temperature sensors Pt/Ni 1000 (“T”) for a temperature range from -20…+100 °C.
Tech. data as for PCD2.W2xx.

Internal current consumption from	+5 V bus	10…50 mA
	V+ bus	10…40 mA

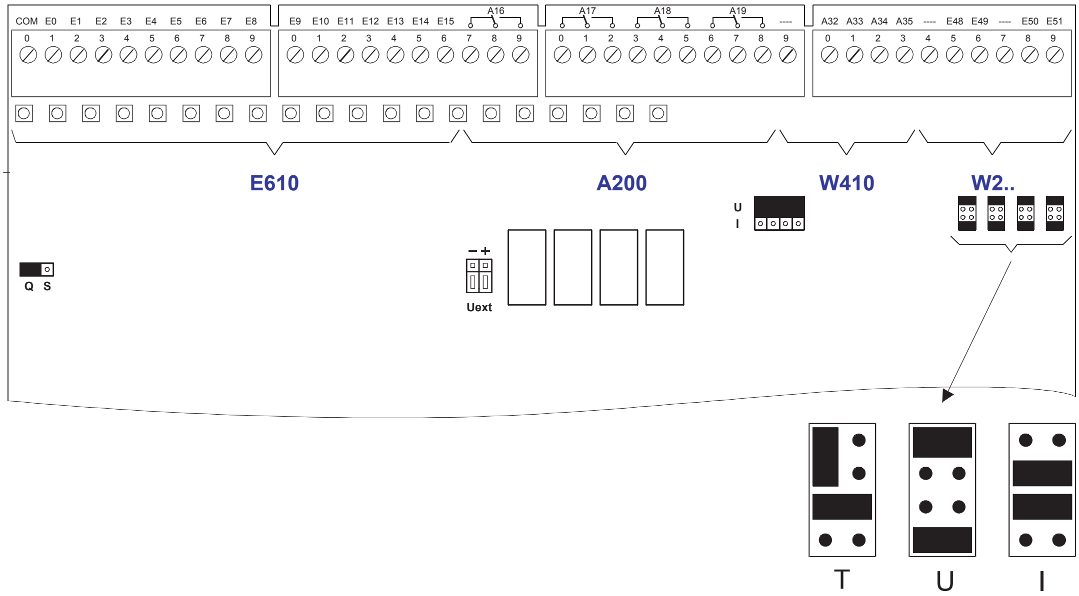
24 V connection (U_{ext}):
This is located next to the 4 relays as screwless terminal “U_{ext}”.
The 24 V supply is common to the relay coils and the external supply to the analogue outputs.

Current consumption:	9 mA per relay
	20 mA per analogue output

* (when the module is installed on sockets 1…4 on the PCD2).

LEDs and connection terminals

The terminal numbering refers to the use of the module on sockets 1…4 (top) on the PCD2. If the module is installed on sockets 5…8 (bottom), the value 64 must be added to the addresses given. When using the module in the PCD2.C100 expansion housing, the same logic applies, with the value 128 to be added to the 'top' and 192 to the 'bottom'.



Jumper Config.

Factory settings:	E0…E15	Source operation:	Q
	A32…A35	Voltage:	0…10 V "U"
	E48…E51	Voltage:	0…10 V "U"

5.8 Analogue input modules

PCD2.W100**	**4 analogue inputs 12 Bit, 0…10 V, –10 V…+10 V *)**
PCD2.W105**	**4 analogue inputs 12 Bit, 0…+20 mA, -20…0 mA, -20 mA…+20 mA *)**
PCD2.W110**	**4 analogue inputs 12 bit, Pt 100**
PCD2.W111**	**4 analogue inputs 12 bit, Ni 100**
PCD2.W112**	**4 analogue inputs 12 bit, Pt 1000**
PCD2.W113**	**4 analogue inputs 12 bit, Ni 1000**
PCD2.W114**	**4 analogue inputs 12 Bit, Pt 100, 0 °C…+350 °C**
PCD2.W200	**8 analogue inputs 10 bit, 0…10 V**
PCD2.W210	**8 analogue inputs 10 bit, 0..20 mA**
PCD2.W220	**8 analogue inputs 10 bit, Pt/Ni 1000**
PCD2.W220Z02	**8 analogue inputs 10 bit, NTC 10**
PCD2.W220Z12	**8 analogue inputs 10 bit, 4 × 0…10 V, 4 × Pt/Ni 1000**
PCD2.W300	**8 analogue inputs 12 bit, 0…10 V**
PCD2.W310	**8 analogue inputs 12 bit, 0…20 mA**
PCD2.W340	**8 analogue inputs 12 bit, 0…10 V, 0…20 mA, Pt/Ni 1000 *)**
PCD2.W350	**8 analogue inputs 12 bit, Pt/Ni 100**
PCD2.W360	**8 analogue inputs 12 bit, resolution ‹ 0.1 °C, Pt 1000**

*) jumper selectable

**) no longer available

***) not recommended for new projects

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

5.8.1 PCD2.W10x, analogue inputs, 4 channels, 12 bit resolution

High-speed module for general use for recording analogue signals with a conversion time of ≤ 30 µs and a resolution of 12 bits.

Module overview

PCD2.W100 4 channels for signals 0…10 V
Unipolar*): 0 V…+10 V or –10 V…0 V
Bipolar*): –10 V…+10 V
Input resistance: >10 MΩ

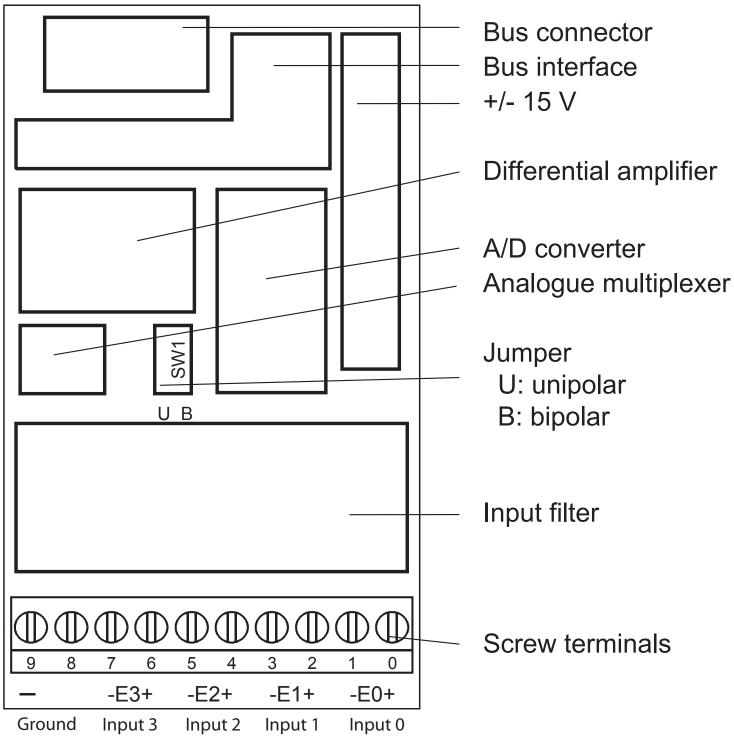
PCD2.W105 4 channels for signals 0…20 mA
Unipolar*): 0…+20 mA or -20…0 mA
Bipolar *): -20 mA…+20 mA
Circuit resistance (Rshunt): 100 Ω/0.1 %

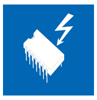
*) Unipolar - bipolar, switchable with jumper

Technical data

Signal ranges	see module overview
Galvanic separation	no
Resolution (digital representation)	12 bits (0…4095)
Measuring principle	differential
Conversion time	≤ 30 µs
Input resistance	W100: >10 MΩ W105: 100 Ω/0.1 %
Accuracy at 25 °C (of measured value)	W100: ± 0.1 % + ± 1 LSB bipolar W100: ± 0.05 % + ± 1 LSB unipolar W105: ± 0.2 % + ± 1 LSB unip/bip.
Repeating accuracy	± 1 LSB
Common mode range (CMR)	W100: ± 11 V W105: ± 8 V
Common mode rejection (CMRR)	> 70 dB
Temperature error (0…+55 °C)	W100: ± 0.2 % + ± 2 LSB W105: ± 0.3 % + ± 2 LSB
Overvoltage protection (W100)	± 60 VDC (permanent)
Overcurrent protection (W105)	± 50 mA (permanent)
Burst protection capacitive coupling (IEC 801-4)	± 1 kV, with unshielded cables ± 2 kV, with shielded cables
Time constant of input filter	3 ms
Internal current consumption: (from +5 V bus)	45 mA typ. 20 mA
Internal current consumption: (from V+ bus)	15 mA
External current consumption:	0 mA
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

Terminals





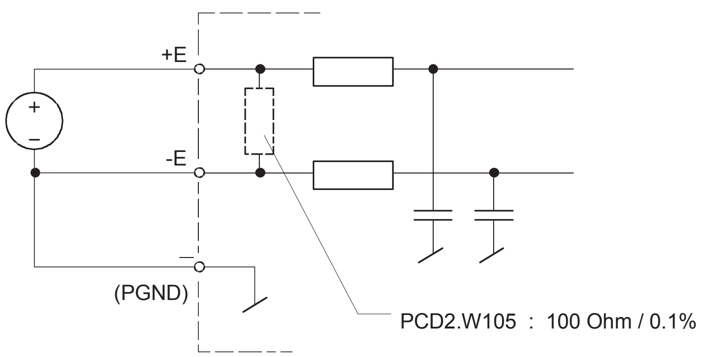
Moving the jumpers

On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, “Icons”.

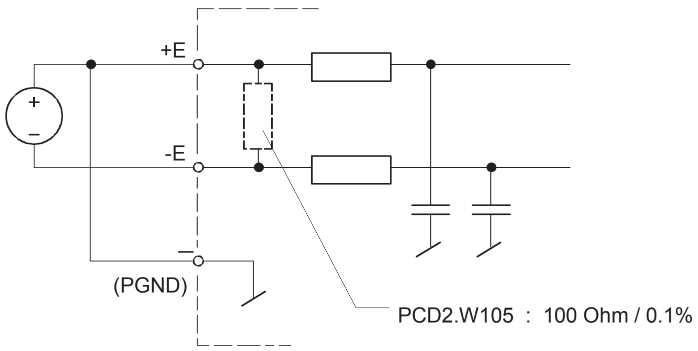
Analogue/digital values

PCD2.W100 (voltage range 0…10 V)		
Unipolar positive	**Unipolar negative**	**Bipolar**
0 V → 0 +5 V → 2047 +10 V → 4095	0 V→ 0 -5 V → 2047 –10 V → 4095	–10 V→ 0 0 V → 2047 +10 V → 4095
PCD2.W105 (current range 0…20 mA)		
Unipolar positive	**Unipolar negative**	**Bipolar**
0 mA→ 0 +10 mA → 2047 +20 mA → 4095	0 mA→ 0 –10 mA → 2047 -20 mA → 4095	-20 mA→ 0 0 mA → 2047 +20 mA → 4095

Wiring for positive unipolar or bipolar analogue inputs

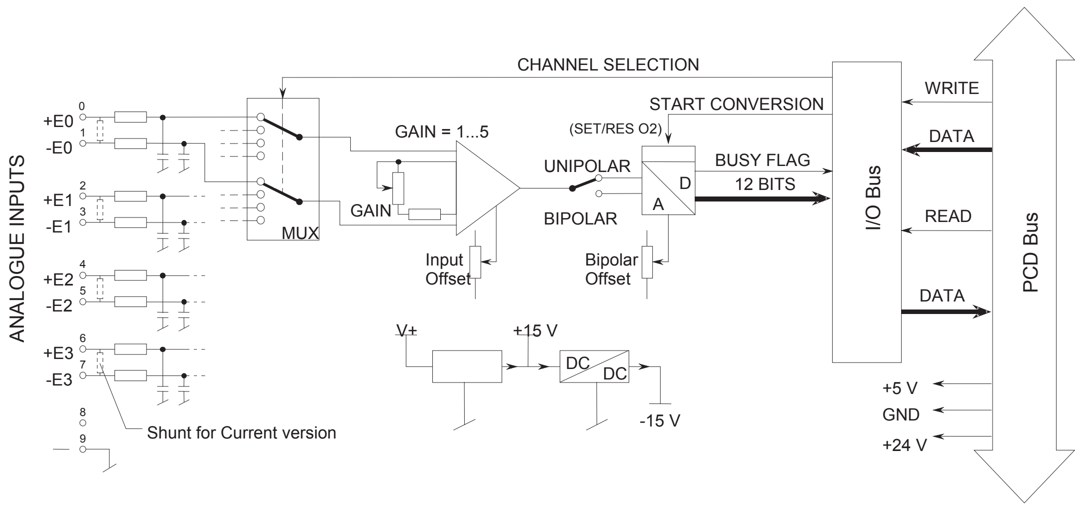


Wiring for negative unipolar analogue inputs



All unused inputs must be earthed.

Output circuits and terminal designation



Programming

Classic: Programming examples for the PCD2.W10x can be found in a separate manual and on the TCS Support site (www.sbc-support.com + getting started).
xx7: the firmware reads in the values according to the configuration (I/O Builder)

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.8.2 PCD2.W11x, analogue inputs, 4 channels, 12 bit resolution

for resistive temperature sensors Pt/Ni 100, 1000

High-speed, convenient module for recording absolute temperatures in the range –50…+150 °C or +350 °C (W114) using a resistive temperature sensor. (2-wire connection with zero adjustment) The temperature curves are linearized in the module itself. The resolution is 12 bits.

Module overview

PCD2.W110	4 analogue inputs for temperature measurement with Pt 100 probes (IEC 751)
PCD2.W111	4 analogue inputs for temperature measurement with Ni 100 probes (DIN 43 760)
PCD2.W112	4 analogue inputs for temperature measurement with Pt 1000 probes (IEC 751)
PCD2.W113	4 analogue inputs for temperature measurement with Ni 1000 probes (DIN 43 760)
PCD2.W114	4 analogue inputs for temperature measurement with Pt 100 probes (IEC 751)

Technical data

Number of channels	4
Galvanic separation	no
Resolution (digital representation)	12 bits (0…4095)
Measuring principle	differential
Conversion time	< 30 µs
Time between 2 measurements	≥ 1 ms
Temperature error:	+10…+30 °C max. ± 0.4 °C 0…+55 °C max. ± 1 °C
Repeating accuracy (multiple measurements with the same module under the same conditions)	± 2 LSB
Probe type	2-wire
Linearization	integrated
Current sources	1 per channel
Offset setting (allows zero value to be adjusted according to length of cable)	separate for each channel
Sensitivity	20.475 LSB/° C (4095…200) or 0.0488 °C/LSB (200…4095)
Internal current consumption: (from +5 V bus)	45 mA typ. 20 mA
Internal current consumption: (from V+ bus)	30 mA (W110/W111) 20 mA (W112/W113/W114)
External current consumption:	0 mA
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

Technical data for add-on modules (variant modules)

PCD2.W110	4 inputs for Pt 100 probes
Current sources	2 mA
Measuring range	–50 °C … +150 °C
Accuracy of measurement	better than 0.2 °C

PCD2.W111	4 inputs for Ni 100 probes
Current sources	2 mA
Measuring range	–50 °C … +150 °C
Accuracy of measurement	better than 0.4 °C

PCD2.W112	4 inputs for Pt 1000 probes
Current sources	0.2 mA
Measuring range	–50 °C … +150 °C
Accuracy of measurement	better than 0.2 °C

PCD2.W113	4 inputs for Ni 1000 probes
Current sources	0.2 mA
Measuring range -	–50 °C … +150 °C
Accuracy of measurement	better than 0.4 °C

PCD2.W114	4 inputs for Pt 100 probes
Current sources	0.2 mA
Measuring range	0 °C … +350 °C
Accuracy of measurement	better than 0.4 °C

Accuracy of measurements

The curves below show the maximum measurement error (measurement and repeating accuracy).

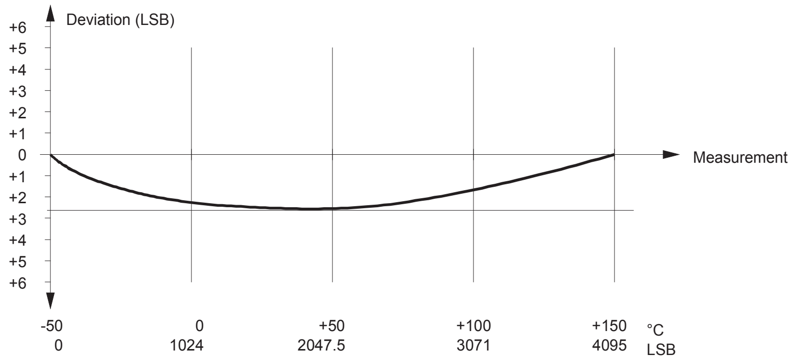
Total error = linearization error + repeating error

Each channel is calibrated to the minimum and maximum values:

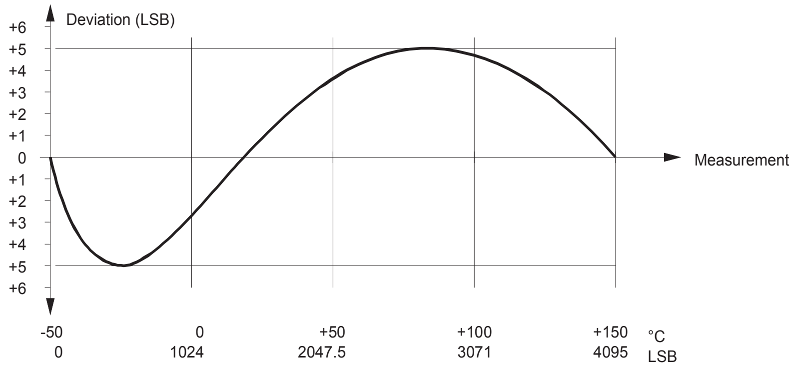
-50 °C	→	0	+ 2 LSB
+150 °C	→	4095	- 2 LSB

For these two values, the measurement error = 0.

Typical linearity error for W110/112/114 (Pt 100/Pt 1000)



Typical linearity error for W111/113 (Ni 100/Ni 1000)



On cable break → Measurement 4095
On short circuit → Measurement 0

Base and variant modules

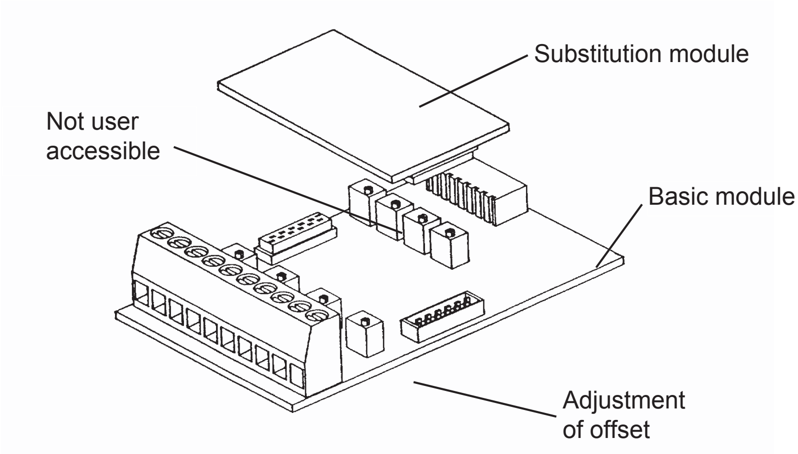
Each module comprises 2 individual modules.

- Base module with input filters, A/D converter, I/O port. Same module with same fittings for all 4 variants.
- Plug-on variant modules with switching circuit to generate –15 V, power sources and linearization. Each of the four variants has a module of its own, i.e. a module with different equipment.

The user has access to the 4 potentiometers to set the offset for each individual channel. This can be useful for adjusting the zero value (at –50 °C) for long measurement cables.

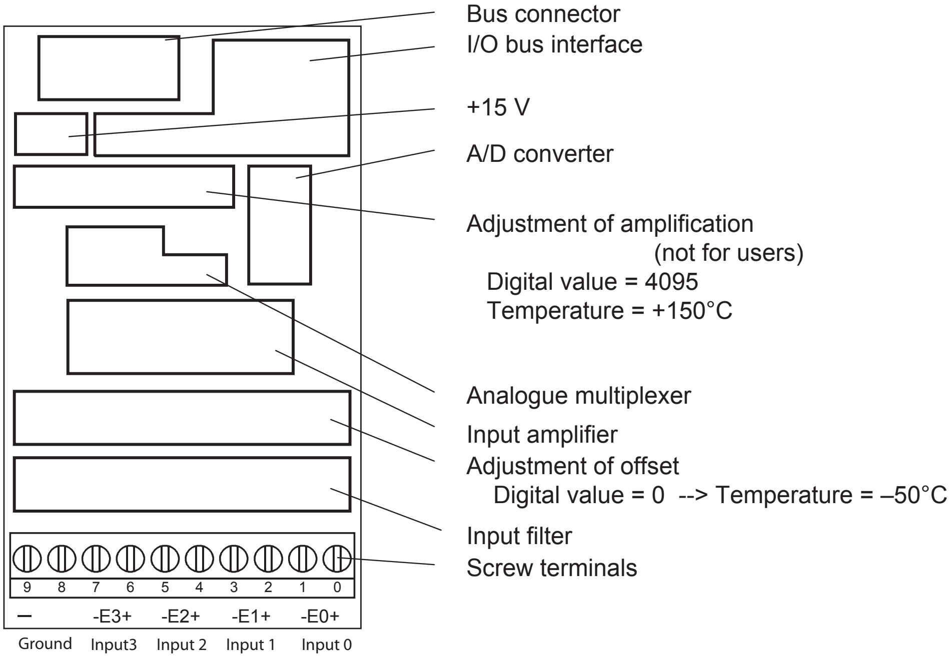
All modules are set up in pairs (base and variant module) at the factory. The variant modules must **not** be exchanged.

The 4 built-in potentiometers for setting the amplification are not accessible to the user and must **not** be adjusted.

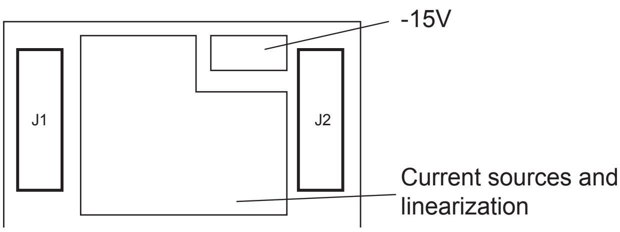


Terminals

Basic module



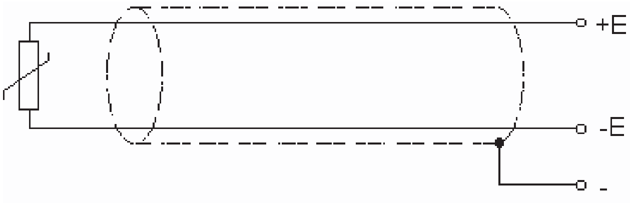
Substitution module



The negative terminals for each input are connected to the ground.

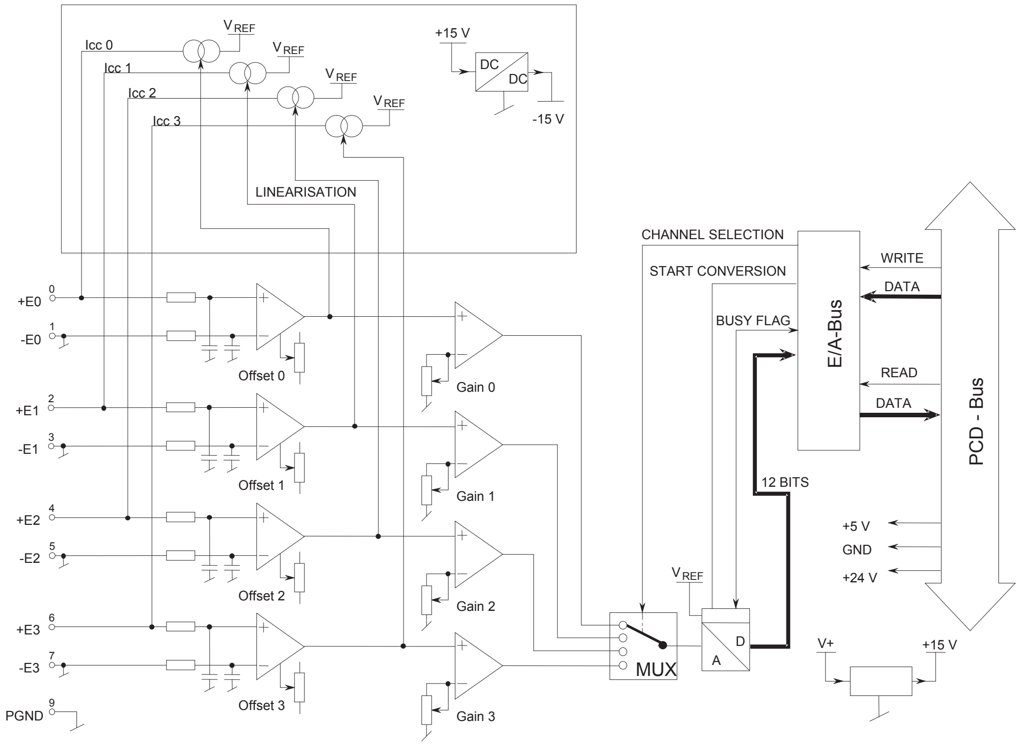
On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, “Icons”.

Wiring



All unused inputs must be short-circuited: +I to -I in each case

Output circuits and terminal designation



Programming

Classic: Programming examples for the PCD2.W11x can be found in a separate manual and on the TCS Support site (www.sbc-support.com + getting started).
xx7: the firmware reads in the values according to the configuration (I/O Builder)

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.8.3 PCD2.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 Pt 100 resistive temperature sensors, or with thermocouples.

Module overview

PCD2.W200	8 channels for signals 0 … 10 V
PCD2.W210	8 channels for signals 0 … 20 mA
PCD2.W220	8 channels for resistive temperature sensors Pt/Ni 1000
PCD2.W220Z02	8 channels for NTC10 temperature sensors
PCD2.W220Z12	4 channels for signals 0 … 10 V 4 channels for resistive temperature sensors Pt/Ni 1000

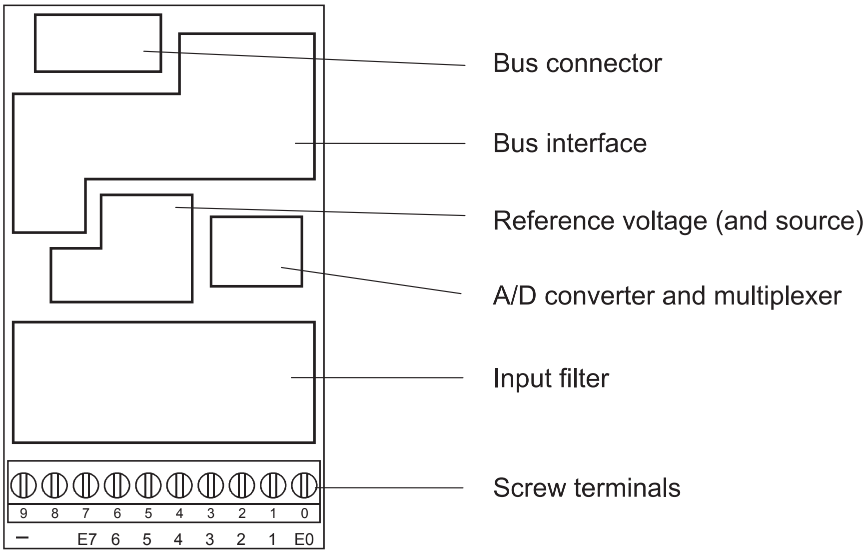
Technical data

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: 80 kΩ / 0.15 % 0 … 20 mA: 125 Ω / 0,1 % Pt/Ni 1000: 7,5 kΩ / 0,1 % NTC 10: 10 kΩ / 0,1 %
Maximum signal current for the 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: (IEC 1000-4-4)	± 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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

! A signal with wrong polarity at an input, may cause that the measuring results at the other channels are significantly falsified.

5

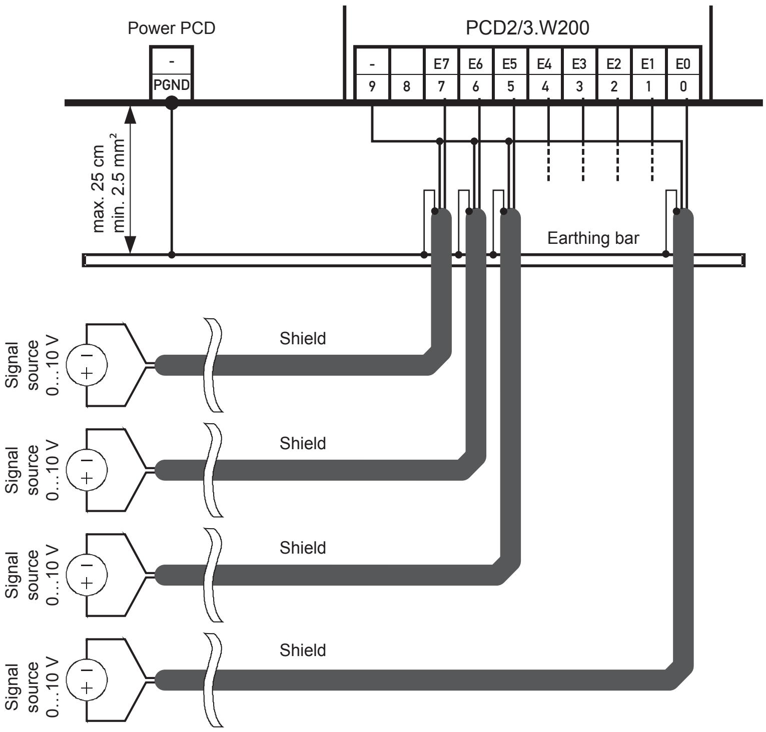
Terminals



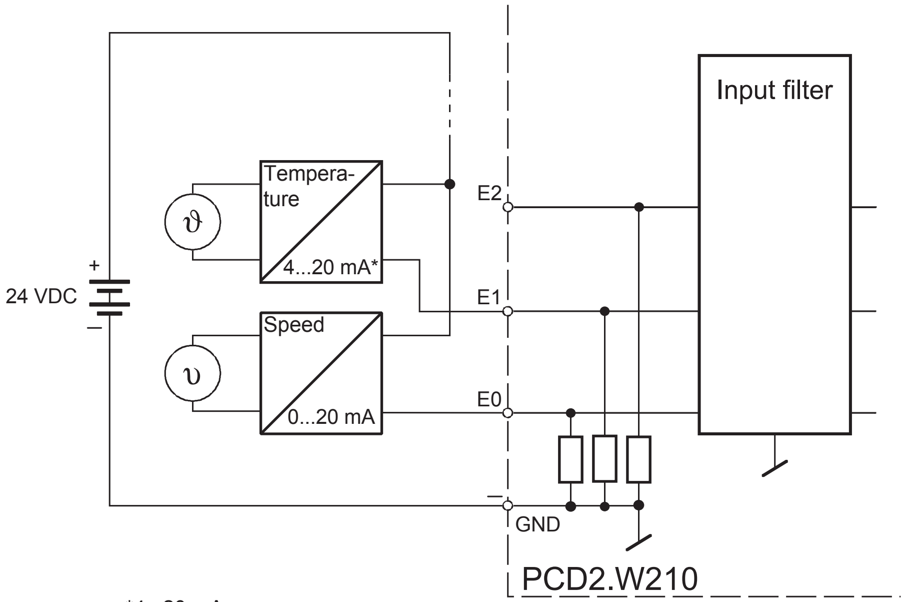
Digital/analogue values

Input signals and type			Digital values		
PCD2.W200	**PCD2.W210**	**PCD2.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	13824
	+ 4 mA		205	205	5530
0 V	0 mA		0	0	0
– 10.0 V	– 20 mA		0	0	0

Connection concept PCD2.W200



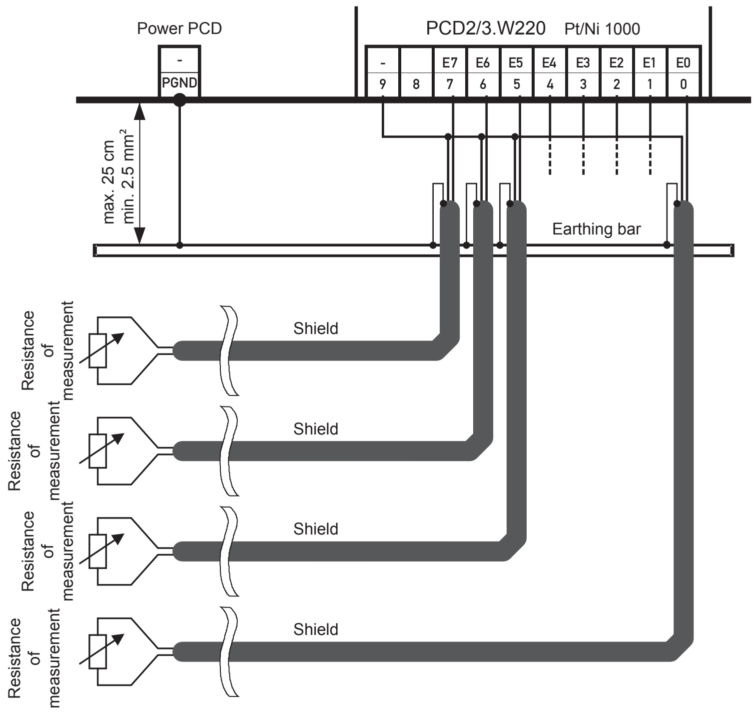
Connection concept PCD2.W210 for two-wire transducers



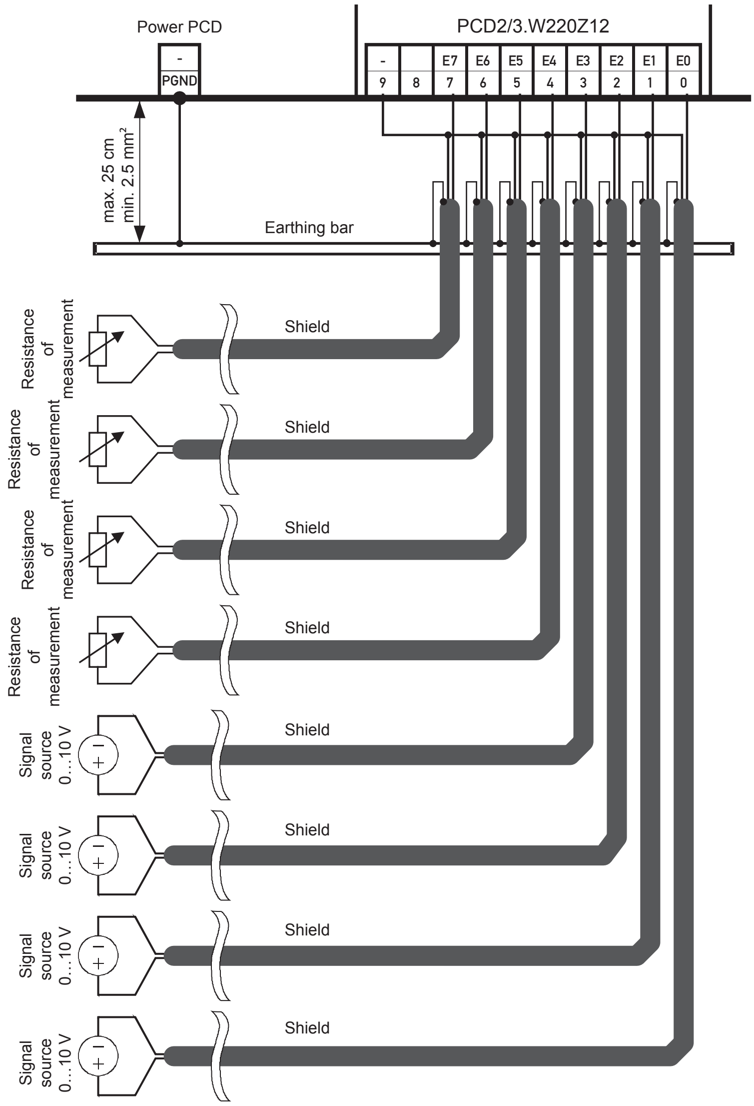
*4...20 mA over user program

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

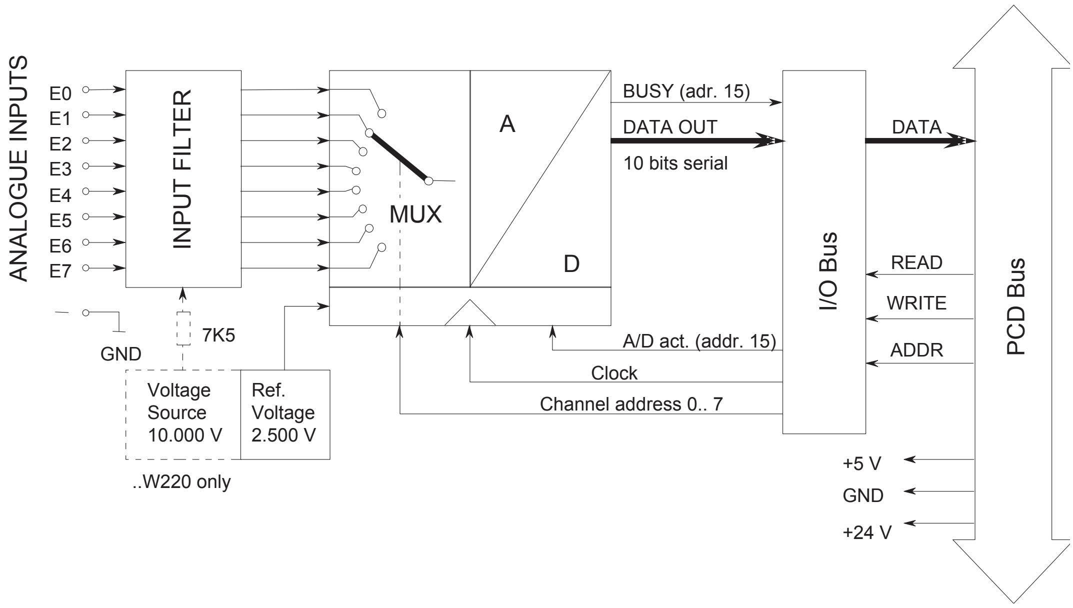
Connection concept PCD3.W220 Pt1000 / Ni1000
Connection concept PCD3.W220Z02 NTC10



Connection concept PCD2.W220Z12
4 × 0…10 V and 4 × Pt1000 / Ni1000



Block diagram



Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M170), because it would interact with the watchdog, and would cause a malfunction.

Classic

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

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

5

Temperature measurement with Pt1000

In the temperature range – 50 °C to + 400 °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 PCD2.W220. The digital value can be calculated as follows:

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

where $0 \le DV \le 1023$ and R=the resistance to be measured in Ω.

5.8.4 PCD2.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…10 V, current 0…20 mA and the use of different resistance thermometers are available.

Module overview **resolution *)**

PCD2.W300:	Voltage 0…10 V		2.442 mV
PCD2.W310:	Current 0…20 mA		4.884 µA
PCD2.W340:	General purpose module		
	0…10 V		2.442 mV
	0…20 mA		4.884 µA
	Pt/Ni 1000 (default)		
	Pt 1000:	–50…+400 °C	0.14…0.24 °C
	Ni 1000:	–50…+200 °C	0.09…0.12 °C
PCD2.W350:	Temperature sensor		
	Pt/Ni 100		
	Pt 100:	–50…+600 °C	0.14…0.20 °C
	Ni 100:	–50…+250 °C	0.06…0.12 °C
PCD2.W360:	Temperature sensor		
	Pt 1000	–50…+150 °C	0.07…0.09 °C (resolution < 0.1 °C)
Method of linearization for temperature inputs: by software			

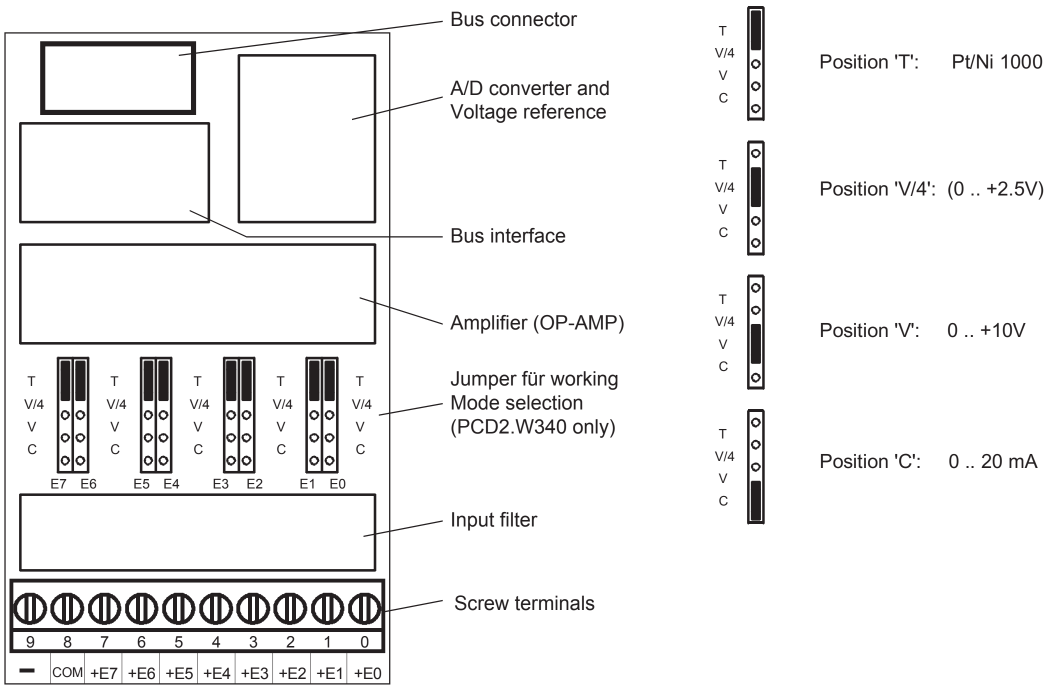
*) Resolution = value of least significant bit (LSB)

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: 125 Ω W350: not relevant W360: not relevant
Maximum signal current for the resistance thermometers:	2.0 mA
Accuracy at 25 °C	W300, 310: ± 0.5 % W340, 350, 360: ± 0.3 %
Repeating 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		
Internalcurrent consumption: (from V+ bus)	W300, 310		< 5 mA
	W340, 360		< 20 mA
	W350		< 30 mA
External current consumption:	0 mA		
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²		
*) No negative input voltage should be applied on these modules.			

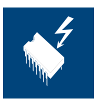
Terminals



Jumper positions for selecting working mode

PCD2.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 A1, “Icons”.

5

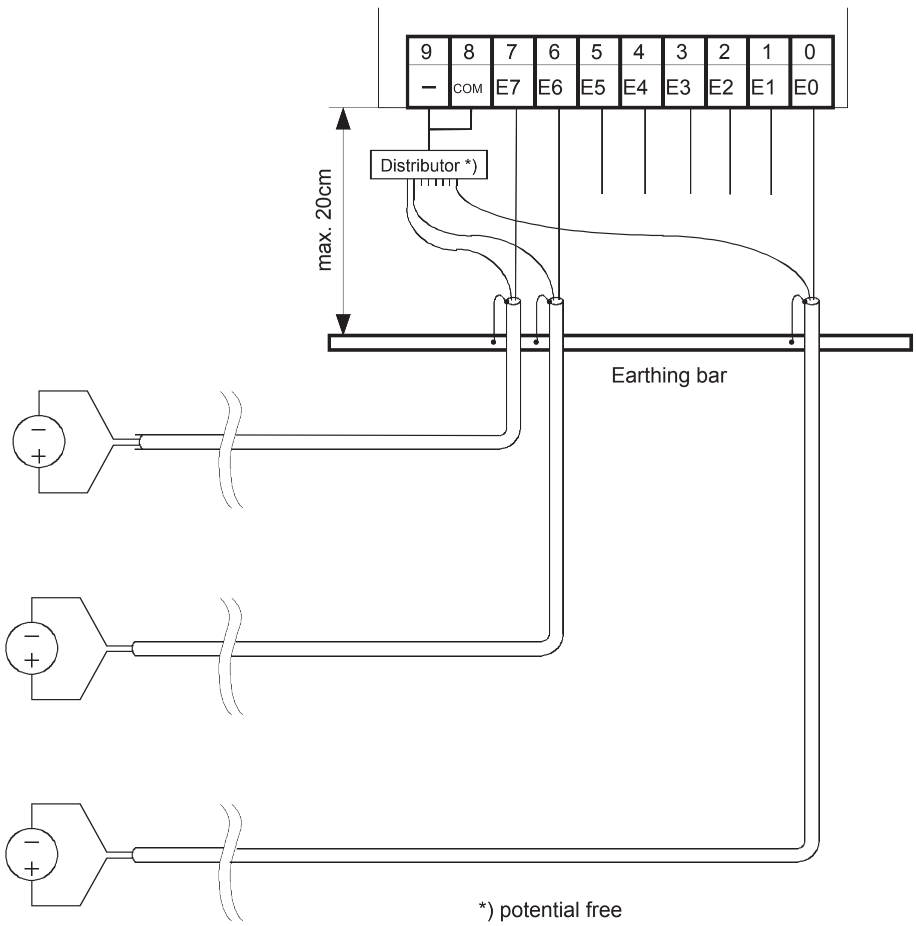
Digital/analogue values

Input signals and type			Digital values		
PCD2.W300/W340	**PCD2.W310/W340**	**PCD2.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	13824
0 V	0 mA		0	0	0

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 PCD2.W300 and …W340 Modules or
- current inputs with the PCD2.W310 and …W340 Modules

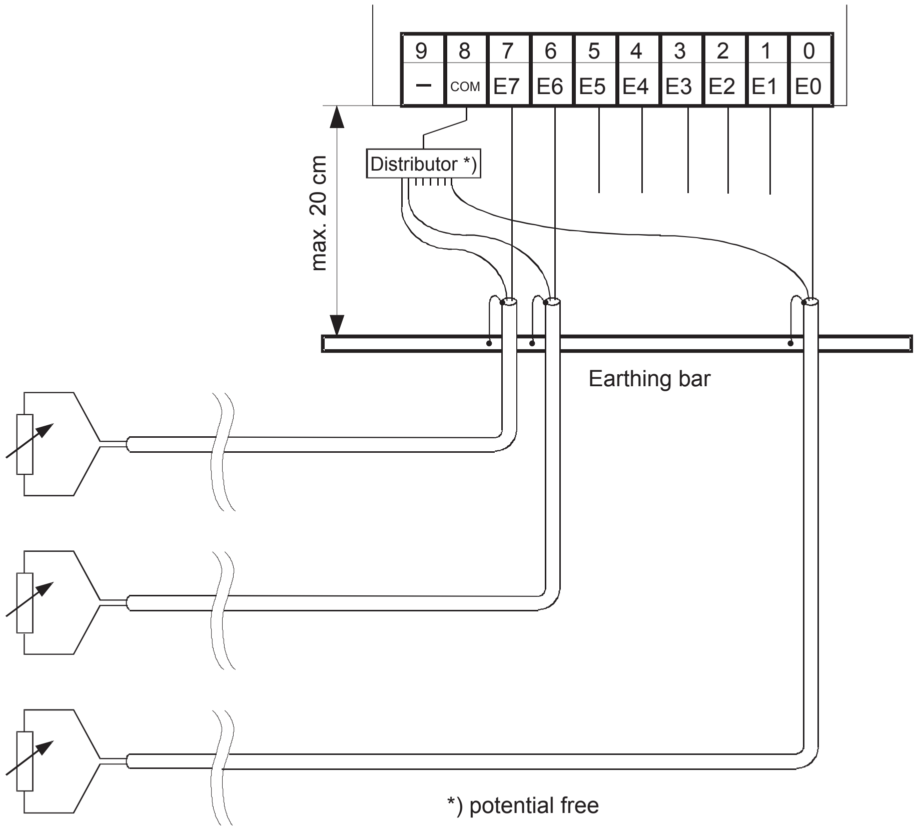


- The reference potentials of signal sources should be wired to a common GND connection ("–" and "COM" terminals). To obtain optimum measurement results, any connection to an earthing bar should be avoided
- If shielded cables are used, the shield should be continued to an external earthing bar.

Connection concept for temperature sensors

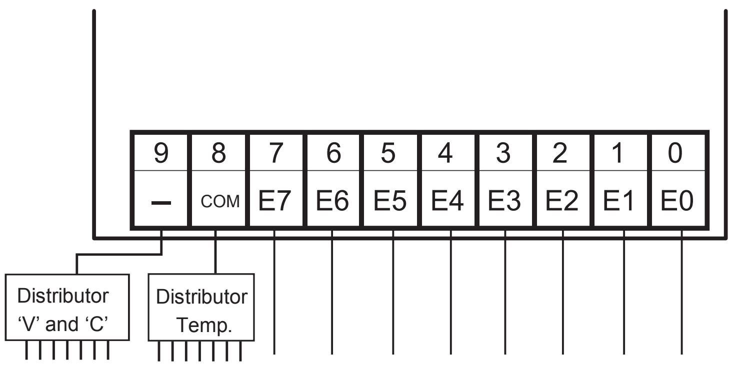
The input signals for the temperature sensors are connected directly to the 10-pole terminal block (E0…E7).

The following connection diagram shows a typical layout for temperature sensors with the PCD2.W340, …W350 and …W360 Modules.

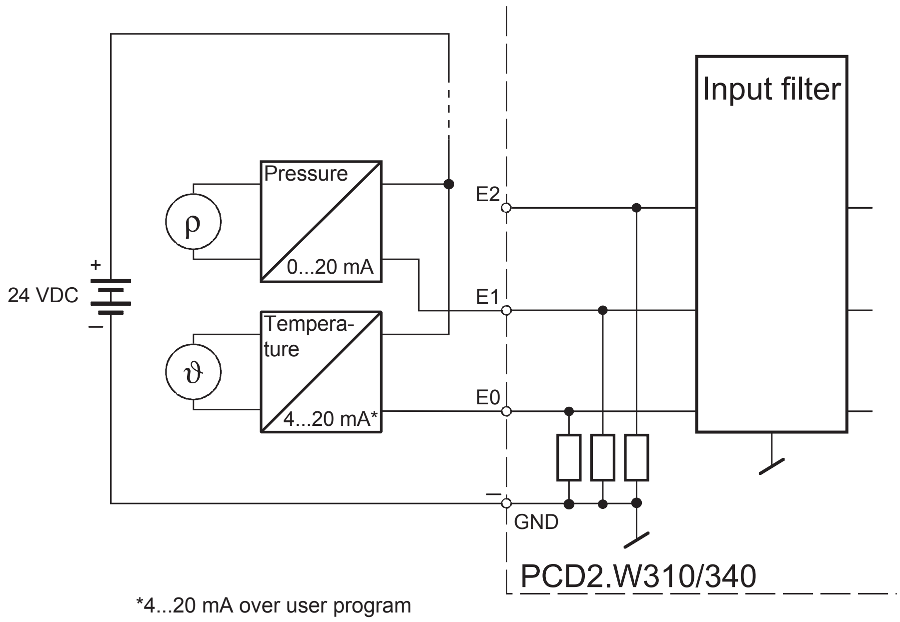


- The reference potential for temperature measurements is the “COM” terminal, which should not have any external earth or GND connection.
- If screened cables are used, screening should be continued to an external earthing bar.
- Unused temperature inputs are to be connected to the logical ground.

Mixed operation



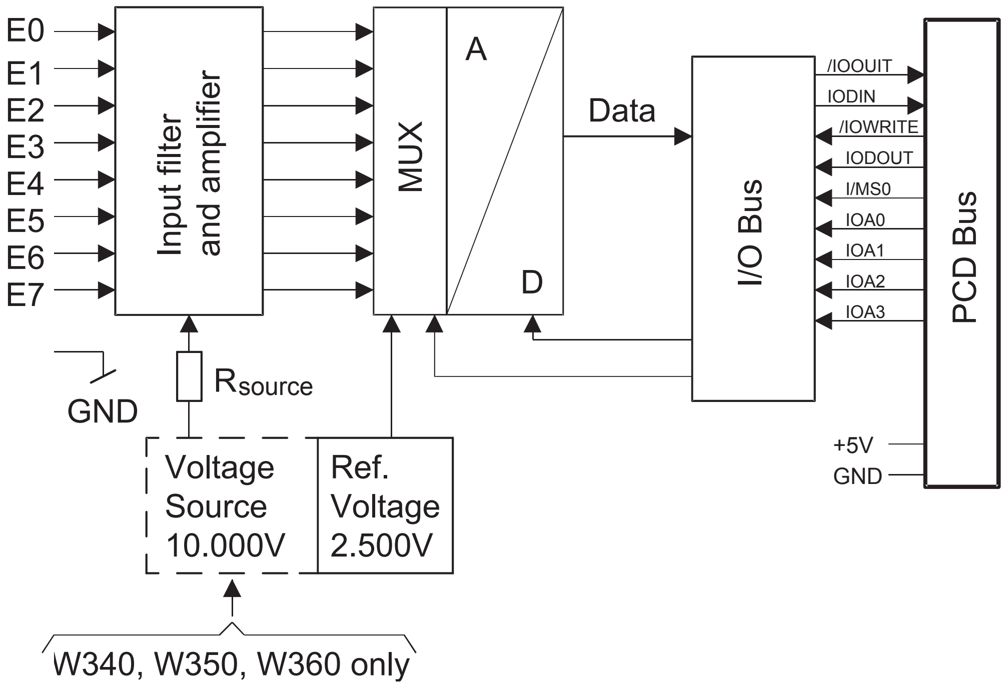
Connection concept for two-wire transducers



*4...20 mA over user program

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

Block diagram



Programming

Classic: Programming examples for the PCD2.W3x0 can be found in a separate manual and on the TCS Support site (www.sbc-support.com + getting started).

xx7: the firmware reads in the values according to the configuration (I/O Builder)

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

Formulae for temperature measurement

For Ni 1000 (PCD2.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 Pt 1000 (PCD2.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 (PCD2.W340)

Special temperature sensors or any other resistances up to 2.5 kΩ can be connected to the PCD2.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 (PCD2.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 Pt 100 (PCD2.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 Pt 1000 (PCD2.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

5.9 Analogue input modules with electricaly isolation

PCD2.W305	**7 analogue inputs 12 bit resolution, 0…10 V**
PCD2.W315	**7 analogue inputs 12 bit resolution, 0…20 mA**
PCD2.W325	**7 analogue inputs 12 bit resolution, –10 V…+10 V**

Galvanic separation of outputs to Saia PCD®, channels themselves not separated

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

5.9.1 PCD2.W3x5, analogue inputs, 7 channels, 12 bit resolution, electrical isolated

Application

High-speed input module with galvanic separation of inputs to Saia PCD® bus, 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.

Module overview **resolution *)**

PCD2.W305:	Voltage 0…10 V	2.5 mV
PCD2.W315:	Current 0…20 mA	5 µA
PCD2.W325:	Voltage –10…+10 V	5 mV

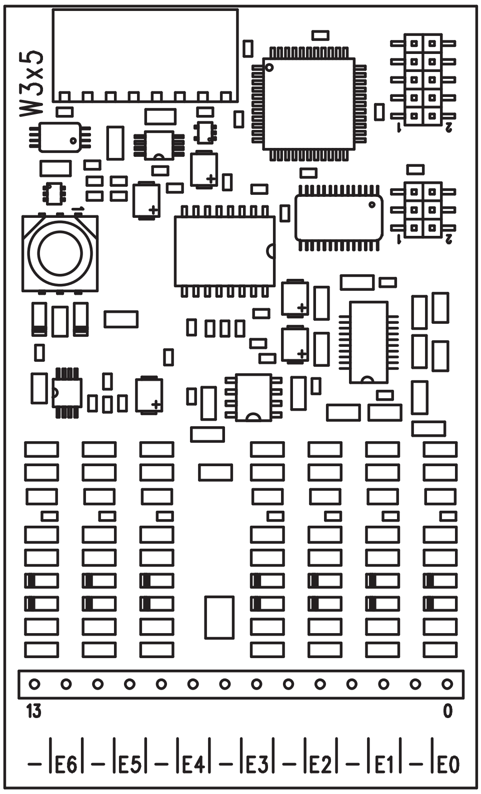
*) Resolution = value of least significant bit (LSB)

5

Technical data

Input ranges:	see module overview
Galvanic separation:	500 V, galvanic separation of inputs to Saia 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 %
Repeating 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 cage spring terminal block (4 405 5002 0), for wires up to 1.5 mm²

Terminals



Digital/analogue values

Input signals and type			Digital values		
PCD2.W305	**PCD2.W315**	**PCD2.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

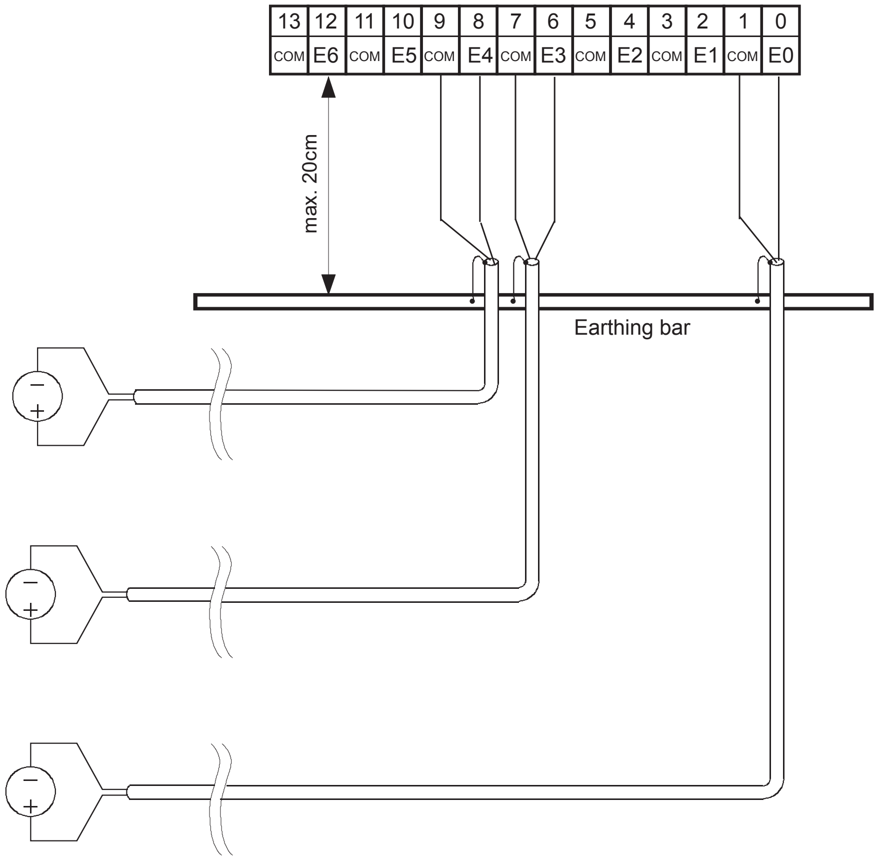
Connection concept for voltage and current inputs

The voltage and current input signals are connected directly to the 14-pole terminal block (E0…E6 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.

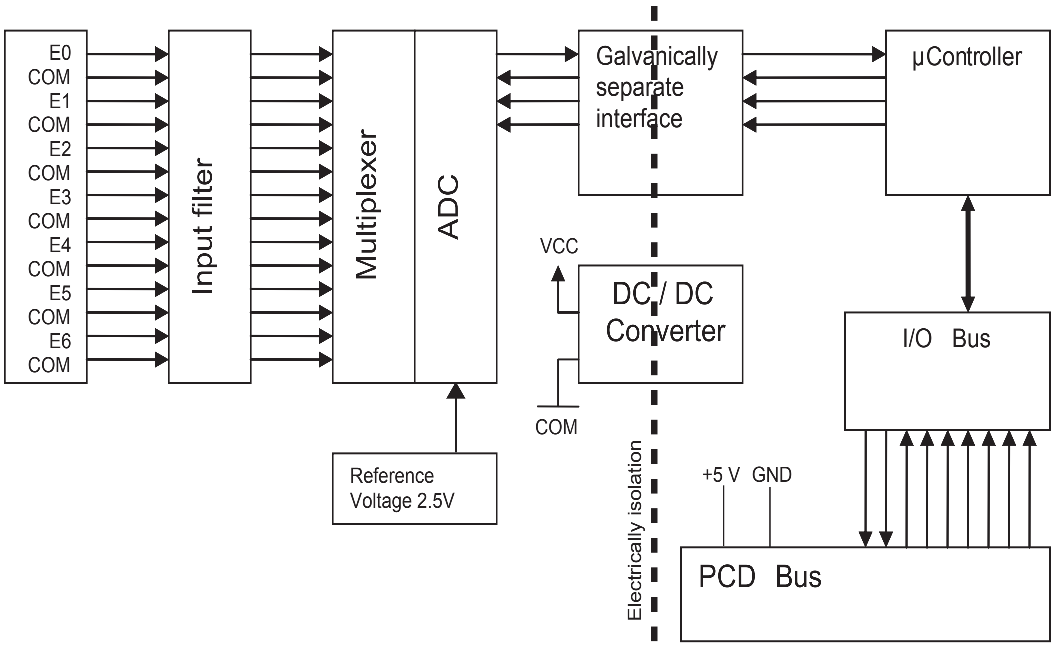
5

The following connection diagram shows a typical wiring layout for:

- Voltage inputs with the PCD2.W305 and .W325 modules or
- Current inputs for the PCD2.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, an FBox is available.
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. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.10 Analogue output modules

PCD2.W400	**4 analogue outputs 8 bit, 0…10 V**
PCD2.W410	**4 analogue outputs 8 bit, 0…10 V, 0…20 mA, 4…20 mA *)**
PCD2.W600	**4 analogue outputs 12 bit, 0…10 V**
PCD2.W610	**4 analogue outputs 12 bit, 0…10 V, 0…20 mA, 4…20 mA *)**

*) jumper selectable

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

5.10.1 PCD2.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

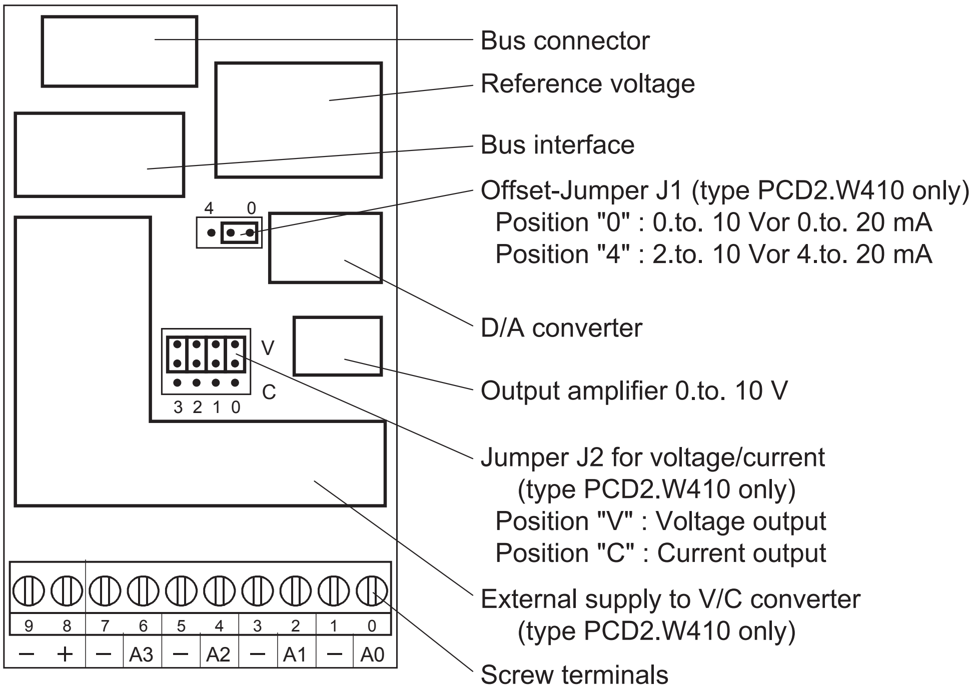
PCD2.W400: Simple module with 4 output channels of 8 bits each. 0…10 V

PCD2.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 with jumpers 0…20 mA 4…20 mA *) Factory setting
Resolution (digital representation):	8 bits (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 mVpp for 0…20 mA: < 50 µApp for 4…20 mA: < 50 µApp
Temperature error:	typically 0.2 %, (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 PCD2.W410 only, for current outputs)
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

Terminals



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**	**13824**	5.0 V*)	10 mA*)	12 mA*)
0	**0**	**0**	0	0	4 mA

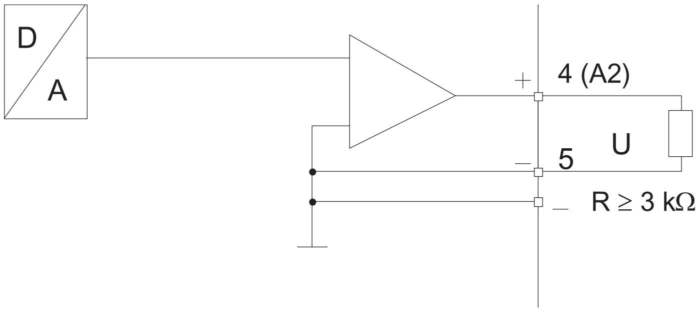
*) The exact values are 1/255 higher

Changing the jumpers

On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, “Icons”.

Connection concept

Connection for 0…10 V



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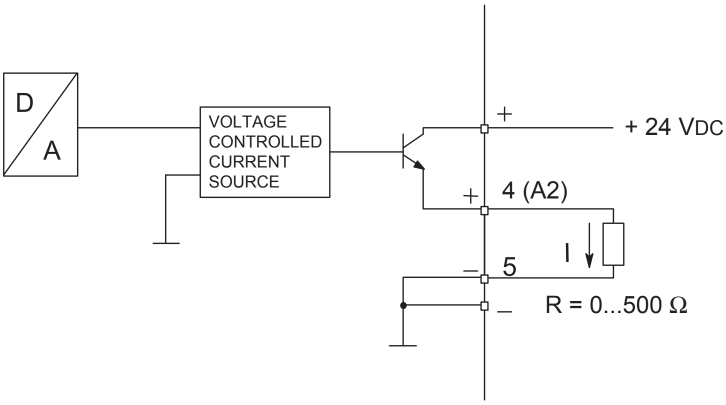
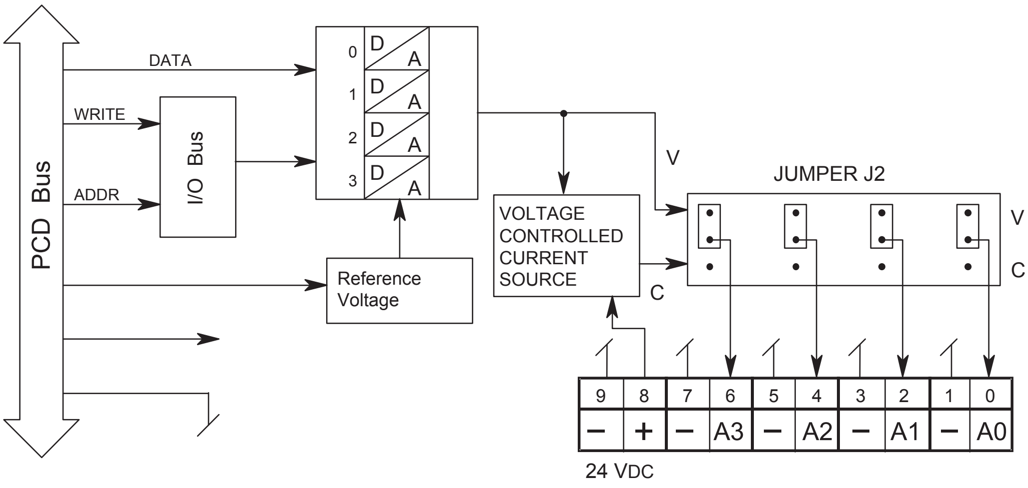
Connection for 0…20 mA or 4…20 mA
(selectable with jumpers on type PCD2.W410)



An external 24 VDC supply is required for current outputs

Block diagram



Programming

Classic: Programming examples for the PCD2.W4x0 can be found in a separate manual and on the TCS Support site (www.sbc-support.com + getting started).

xx7: the firmware writes the values according to the configuration (I/O Builder)

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.10.2 PCD2.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…10 V, –10…+10 V and current 0…20 mA are available.

Module overview

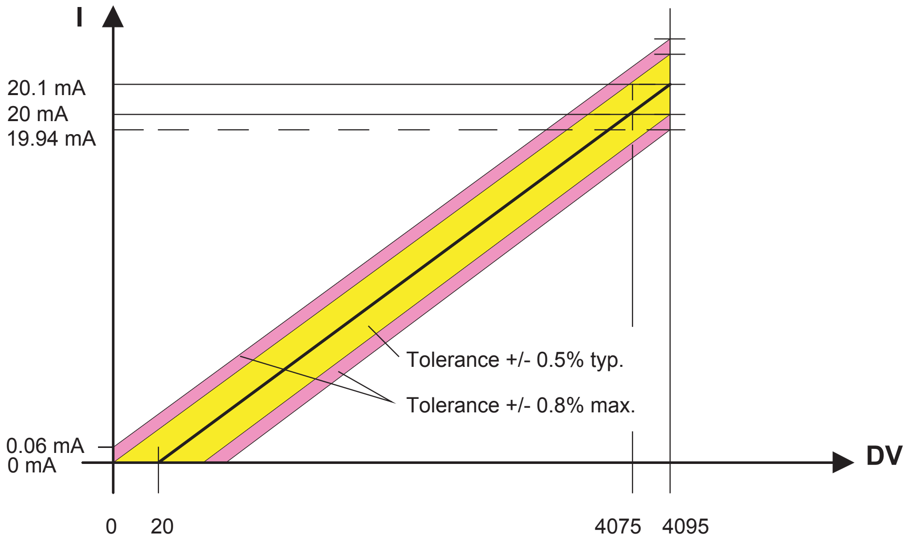
PCD2.W600:	Unipolar voltage outputs	0…10 V
PCD2.W610:	Bipolar voltage outputs to unipolar voltage	–10 V…+10 V, switchable 0…10 V / current 0…20 mA

Technical data resolution

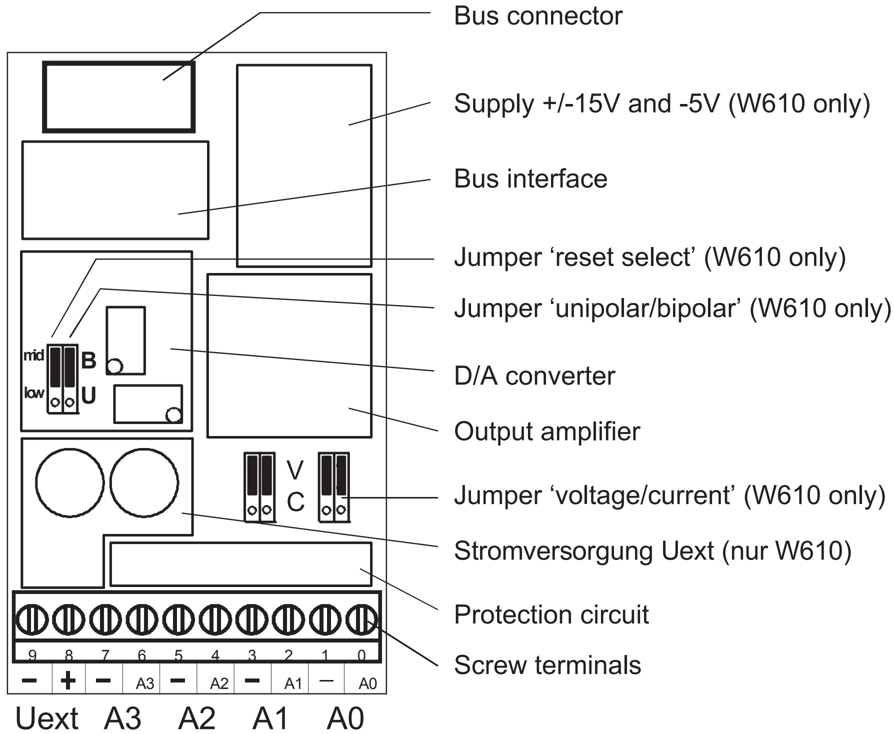
Number of output channels:	4, short circuit protected
Signal range:	W600: 0…+10 V 2.442 mV W610: –10 V…+10 V 4.884 mV 0…+10 V 2.442 mV 0…20 mA 4.884 µA (W610 ranges) selectable with jumper
Galvanic separation:	no
Resolution (digital representation):	12 bits (0…4095)
Conversion time D/A:	typ. 10 µs
Load 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 % (across temperature Current: ± 0.2 % range 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 PCD2.W610 only, for current outputs)
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 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 the start, a voltage of 5 V will be at all outputs of the module PCD2.W600. The starting phase lasts 40 ms, afterwards 0 V will be put to the outputs.



Terminals



Digital/analogue values

Digital values			Output signals
Classic	**xx7**	**Simatic**	
4095	4095	27648	+20.1 mA
4075	4075	27513	+20 mA
2048	2048	13824	+10 mA
20	20	135	0 mA
0	0	0	0 mA

Changing the jumpers
There are components on this circuit board, that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, “Icons”.

Range selection (PCD2.W610)

Jumpers, factory settings:	A0…A3:	“V”	(voltage)
	U/B:	“B”	(bipolar)
	Reset select:	“mid“	(reset to mid-scale, i.e. 0 V in bipolar mode)

Ranges depending on application:

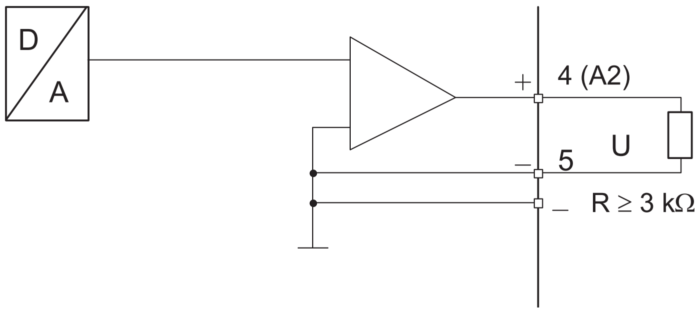
Per module:	U/B:	**U**nipolar or **B**ipolar operation
	Reset select:	Reset to **low-** or **mid-**scale
	Rec. setting:	Unipolar →low-scale Bipolar → mid-scale

Per channel:	“V”	Voltage output:	0…+10 V or –10 V…+10 V
	“C”:	Current output:	0…20 mA

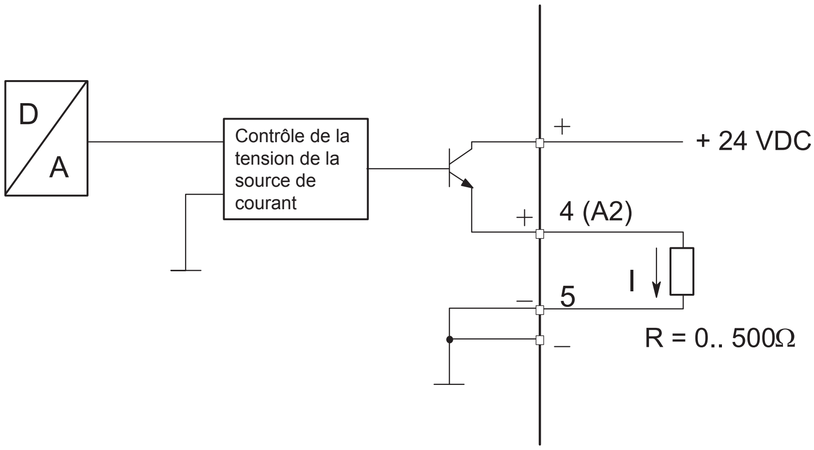
Current outputs have been laid out for unipolar mode. Bipolar mode is possible, but for the negative half of this operation the output is 0 mA.

Connection concept

Connection for 0…10 V or –10 V…+10 V: (selectable on the PCD2.W610)

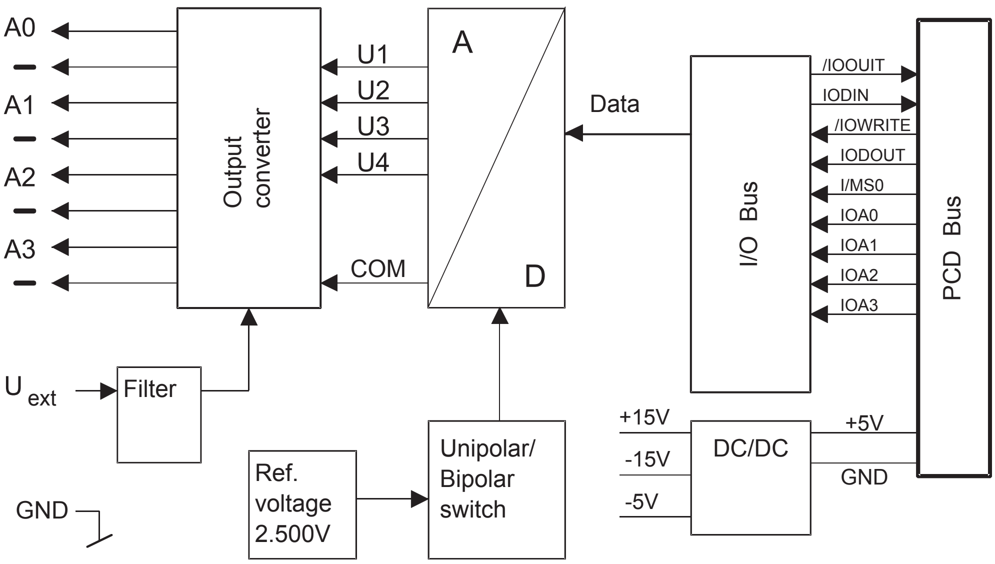


Connection for 0…20 mA: (PCD2.W610 only)



An external 24 VDC supply is required for current outputs.

Block diagram



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Programming

Classic: Programming examples for the PCD2.W6x0 can be found in a separate manual and on the TCS Support site (www.sbc-support.com + getting started).
xx7: the firmware writes the values according to the configuration (I/O Builder)

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.11 Analogue output modules with electrically isolation

PCD2.W605	**6 analogue outputs 10 bit resolution, 0…10 V**
PCD2.W615	**4 analogue outputs 10 bit resolution, 0…20 mA**
PCD2.W625	**6 analogue outputs 10 bit resolution, –10 V…+10 V**

Galvanic separation of outputs to Saia PCD®, channels themselves not separated

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

5.11.1 PCD2.W6x5, analogue outputs, 6 (4) channels, 10 bit resolution, electrical isolated

Application

High-speed output module with galvanic separation of outputs to Saia PCD® bus, for general use with 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
PCD2.W605:	Voltage 0…10 V	6 (A0…A5)	10 mV
PCD2.W615:	Current 0…20 mA	4 (A0…A3)	20 µA
PCD2.W625:	Voltage –10…+10 V	6 (A0…A5)	20 mV

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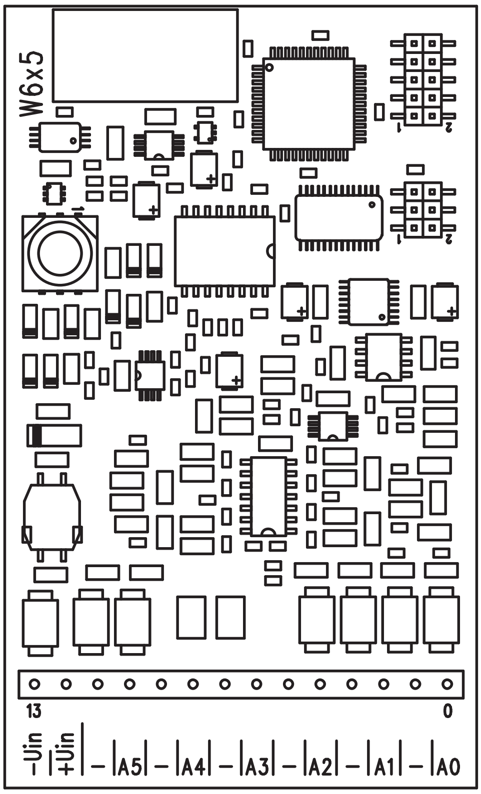
Technical data

Output ranges:	see module overview
Galvanic separation:	500 V, galvanic separation of outputs to Saia PCD®, channels themselves not separated
Resolution (digital representation):	10 bits (0…1023)
Loadresistance:	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 circuitprotection:	yes (permanent)
EMC protection:	acc. to standards ENV 50141, EN 55022, EN 61000-4-2, EN 61000-4-4, EN 61000-4-5
Time constant of output filter:	W605: typically 1 ms W615: typically 0.3 ms W625: typically 1 ms
Internal current consumption: (from +5 V bus)	W605: 110 mA (typ. 80 mA) W615: 55 mA (typically 45 mA) W625: 110 mA (typically 80 mA)
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 90 mA, smoothed 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 wires up to 1.5 mm²

Terminals



Digital/analogue values

Output signals and type			Digital values		
PCD2.W605	**PCD2.W615**	**PCD2.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):
PCD2.W605: –0.26 V…+ 10.36 V (instead of 0…+ 10 V)
PCD2.W615: 0 mA …21.4 mA (instead of 0…20 mA)
PCD2.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:
PCD2.W605: 1 LSB = 10.38 µV
PCD2.W615: 1 LSB = 21.7 µA
PCD2.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.

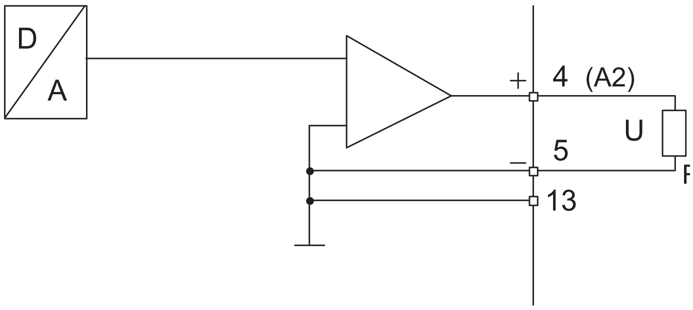
Connection concept for voltage and current outputs

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:

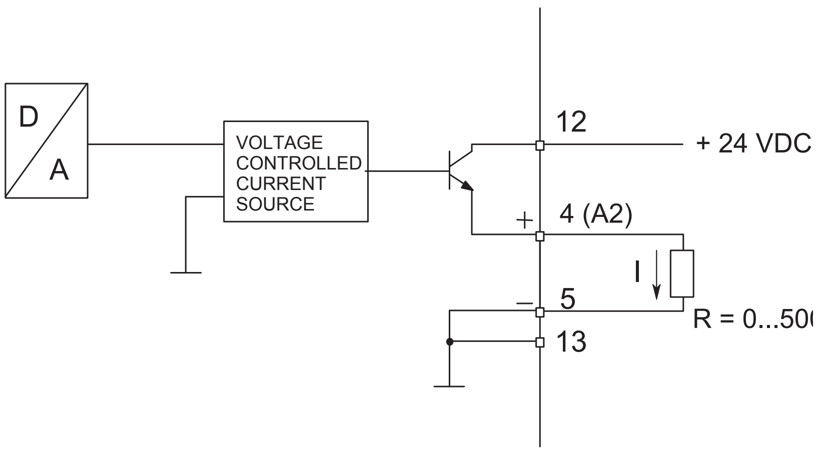
- voltage outputs with the PCD2.W605 and .W625 modules or
- current outputs for the PCD2.W615 module

Connection for 0…10 V (W605) or –10 V…+10 V (W625):



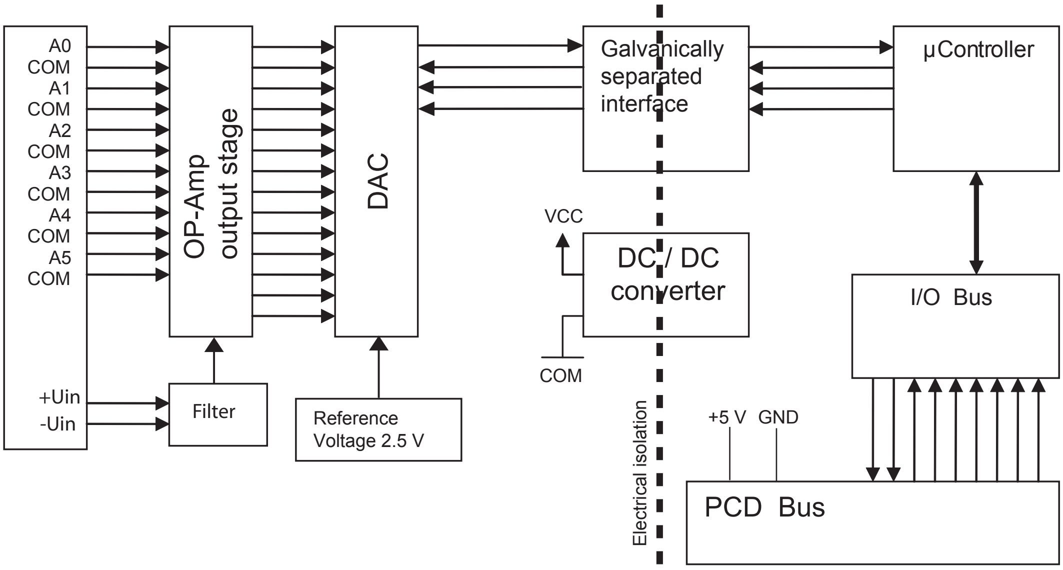
For voltage outputs no external supply is needed.

Connection for 0…20 mA (W615)



An external 24 VDC supply is required for current outputs.

Block diagram



Programming

Classic: For programming the modules, an FBox is available.
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. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.12 Analogue input and output modules

PCD2.W500	**2 analogue inputs 12 bit + 2 analogue outputs 12 bit, 0…10 V, –10 V…+10 V *)**
PCD2.W510	**2 analogue inputs 12 bit + 2 analogue outputs 12 bit, 0…+20 mA, -20…+20 mA *)**

*) jumper selectable

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

5.12.1 PCD2.W5x0, 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

PCD2.W500: 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 (standard module).

PCD2.W510: Module with 2 current inputs and 2 voltage outputs (special version)

5

Technical data

Inputs	
Number of input channels:	2
Signal ranges W500: W510:	0…+10 V, –10…+10 V } jumper selectable together 0…+20 mA, -20…+20 mA } jumper selectable together
Galvanic separation:	no
Measuring principle:	differential
Conversion timeA/D:	< 30 µs
Resolution (digital representation):	12 bits (0…4095)
Input resistance:	0…+10 V :1 MΩ 0…+20 mA: 100 Ω
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:	± 40 VCC (permanent)
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

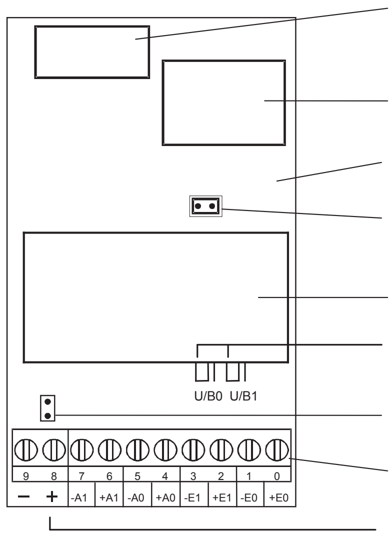
Technical data common to the whole module

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:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 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.

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

PCD2.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.

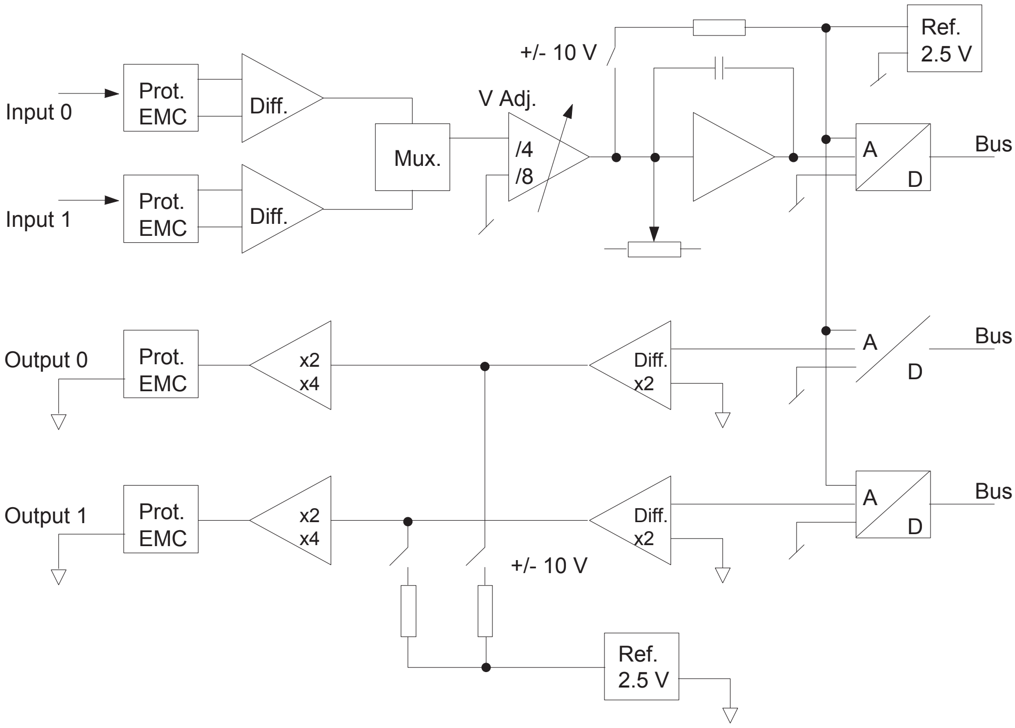
The plug-on module contains the two analogue outputs with the two 3-pole jumpers for the individual unipolar or bipolar operation of each output.

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 A1, “Icons”.

Block diagram



Programming

Reset

When the module or CPU powers up, both analogue outputs of the PCD2.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 PCD2.W500 are then set to the maximum value of +10 V, despite the reset routine.

Classic: Programming examples for the PCD2.W500 can be found in a separate manual and on the TCS Support site (www.sbc-support.com + getting started).
xx7: the firmware reads and writes the values according to the configuration (I/O Builder)

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components

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5.13 Combined analogue input/output modules with galvanic isolation

PCD2.W525	**4 inputs,** **14 bits, 0…10 V, 0(4)…20 mA, Pt 1000, Pt 500 or Ni 1000 (selectable by DIP switch)** **and** **2 outputs, 12 bits, 0…10 V or 0(4)…20 mA (selectable by software (FBox, FB)**

Galvanic separation of outputs to Saia PCD®, channels themselves not separated

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

5.13.1 PCD2.W525 Combined analogue input/output modules with galvanic isolation

General Information

PCD2.W525 is an analogue multipurpose module with four inputs and two outputs. Each input and each output can be individually configured as one of the standard industrial interface type like 0…10 V, 0…20 mA and 4…20 mA. In addition, the inputs can be configured to support Pt/Ni1000 or Pt500 temperature sensors. Furthermore, the module offers high flexibility in selecting filter types and scaling ranges.

Inputs-14 Bit

- 4 Inputs. Every channel has four modes of operation (configurable by 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 50 Hz / 60 Hz filter

Outputs-12 Bit

- 2 Outputs. Every channel has three modes of operation (configurable by 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 galvanically isolated to the Saia PCD® and external power supply. (But all channels are galvanically connected to each other.)
- Every channel has two connection terminals.

Configuration

Module connections/LED

The connections of the module terminal are the following:

Supply		*Outputs*				*Inputs*							
13 -	12 +	11 -	10 +	9 -	8 +	7 -	6 +	5 -	4 +	3 -	2 +	1 -	0 +
Uext		A1		A0		E3		E2		E1		E0	

Description of the LED:

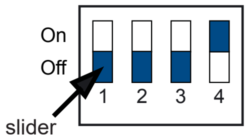
- Off: Module is not powered. U_{ext} (24 V) is missing.
- On: Module is running without errors
- Blinking slow: Channel error (Over range/under range/short circuit/open load)
- Blinking fast: U_{ext} is lower than specified (< 19 V)

How to configure the inputs

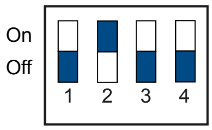
Each input channel is configured by a DIP-Switch with four switches. The function of each switch is the following:

Switch nr.	*Off*	*On*
1	Differential Mode	Single Ended Mode
2		Current Shunt On
3		Supply for external Resistors On
4	Gain=1	Gain=0.25

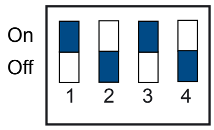
According to this table, the configuration for the different modes of operation is as follows:



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

How to configure the outputs

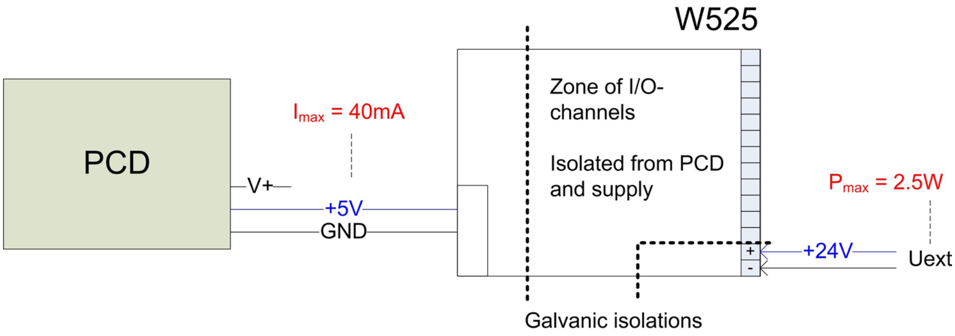
Since the outputs are configured by software (with the corresponding FBox or FB), there is no need to configure the mode of operation of the outputs with any kind of jumpers or DIP-Switches.

5

Function

Power Supply

PCD2.W525 has to be supplied externally! This power supply is galvanically isolated to both, the Saia PCD® and the I/Os of W525. Furthermore, the design allows using the same power supply for the Saia PCD® and for W525 without loosing the galvanic isolation. These schematics show the different zones of isolation:



Timing

- **Inputs**
  - Internally, W525 finishes acquiring every 2 ms a new value for every input channel
  - This value is always ready to be read by the Saia PCD®.
  - Dependent on the Saia PCD® speed, the transmission time of a single 16-Bit scaled value (of a single input channel) takes typically 100 μs (on a PCD2.M480) or 600μs (on a PCD2.M170)
- **Outputs**
  - Internally, W525 outputs the last received output value from Saia PCD® with a maximum delay of 2 ms.
  - Dependent on the Saia PCD® speed, the transmission time of a single 16-Bit scaled output value takes typically 100 μs (on a PCD2.M480) or 600 μs (on a PCD2.M170).

Filter

- **Inputs**

  There are two factors, which have filtering effects to the acquired values:
  - The base hardware filter with a time constant of 2 ms. This filter attenuates the input signal by 6 dB/decade at a cut-off frequency of 80 Hz.
  - The second influence is caused by software and results in a delay of the acquired value for 2 ms with a notch filter characteristics at 500 Hz if no software based 50 Hz / 60 Hz filter is selected.

In case of use of a 50 Hz (60 Hz) filter, the notch filter frequency is 50 Hz (60 Hz); the delay remains the mentioned 2ms.

- **Outputs**

  There is only the hardware based filter with a time constant of 1 ms, which is active

Technical Data

Inputs	
General:	
Resolution:	14 Bit
Kind of Measurement:	differential
Number of channels:	4
Galvanic isolated to Saia PCD®:	yes, 500 V
Galvanic isolated to external supply:	yes, 500 V
Galvanic isolated between other channels:	no
Kind of connections:	two wires per channel
How to configure mode of operation:	by DIP-Switches
Accuracy at 25 °C:	± 0.2% max.
Accuracy repetitive:	± 0.05% max.
Temperature drift (0...55 °C) max.:	± 70 ppm/°C
Over voltage protection:	± 50 V min.
Over current protection:	± 35 mA min.
Common mode voltage max:	± 50 V min.
Common mode rejection ratio:	70 dB min.
Filter:	
Time constant of 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:	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
Power dissipation in temp. sensor / resistor:	2.5 mW max
Outputs	
General:	
Resolution:	12 Bit
Number of channels:	2
Galvanic isolated to Saia PCD®:	yes
Galvanic isolated to external supply:	yes
Galvanic isolated between other channels:	no

Kind of connections:		two wires per channel
How to configure mode of operation:		by software (FBOX, FB)
Accuracy at 25 °C:		± 0.5% max.
Accuracy repetitive:		± 0.1% max.
Temperature drift (0...55 °C) max.:		± 70 ppm/°C.
Over current protection:		short circuit protected
Time constant of filter:		1 ms
Voltage mode:		
Max. load to guarantee specified accuracy:		> 700 Ω
Resolution range 0…10 V:		12 Bit; 2.44 mV per LSB
Current mode:		
Working 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 Data		
Power consumption at I/O-Bus +5V:		max. 40 mA
Power consumption at I/O-Bus V+:		unloaded
Temperature range:		0...55 °C
External power supply		
(It is possible and allowed to use the same power supply as the Saia PCD® itself is supplied with – without losing the galvanic isolation of the I/Os!)		
Operation voltage:		24 V ±4 V smoothed
Power consumption:		max. 2.5 W (depends on output load)
Terminal:	PCD2	Pluggable 14-pole screw terminal (PCD2.W525; O no. 4 405 5002 0, will be delivered with the module), both for wires up to 1,5 mm²

Signification of the I/O words of a PCD2/3.W525 module?

When configuring a W525 module using the Device Configurator or the Profi-S-I/O (or Profibus DP) Network Configurator, the PCD2/3.W525 does need two registers for the analogue outputs and 8 registers for the analogue inputs.

The significations of the registers are the following:

Output registers:

Register	Bit 31…16	Bit 15…0
n		Value CH0 Output
n+1		Value CH1 Output

Description of the output registers:

Value CH0..1 (Register n, n+1)
This registers (Bit 0 to 15) does contain the analogue output value of the corresponding analogue output. It's a 12 Bit value.

Input registers:

Register	Bit 31…16	Bit 15…0
n		Value CH0 Input
n+1		Value CH1 Input
n+2		Value CH2 Input
n+3		Value CH3 Input
n+4		Load Current/Voltage
n+5		Status Module
n+6		Status Input
n+7		Status Output

Description of the input registers:

Value CH0…CH3 (Register n…n+3)
This registers (Bit 0 to 15) does contain the analogue input value of the corresponding analogue input. It's a 14 Bit value.

Load_Current / Load_Voltage (Register n+4)
On this register (Bit 0 to 15) the actual current or voltage value is displayed.

- current in [µA] (0…20'000)
- voltage in [mV] (0…10'000)

Status Module (Register n+5)
This register (Bit 0 to 15) does contain the actual status of the module

Table module status:

Bit	Description
15:14	Reserved
13	Error on the output channel CH1
12	Error on the output channel CH0
11	Error on the input channel CH3
10	Error on the input channel CH2
9	Error on the input channel CH1
8	Error on the input channel CH0
7:5	Reserved
4	Communication: Illegal Command. Is set to 1 if the module receive a not know instruction.
3	Communication: packet too long. Is set to 1 if during the communication a data byte (CMD/Data = 0) is received although a commando byte should be received (CMD/Data = 1)
2	UExt too low. The voltage of the external power supply is to low!
1	UExt Fail.
0	No Response.

Status Input (Register n+6)
This register (Bit 0 to 15) does contains the status of the input channels CH0..CH3. The status of each input channel is displayed on 4 bits.

Status Input:

Bit	Description
Bit 0…3	CH0 Status
Bit 4…7	CH1 Status
Bit 8…11	CH2 Status
Bit 12…15	CH3 Status

Table input status:

Bit	Description
3	Over Temperature
2	Not Calibrated
1	Over Range
0	Under Range

Status Output (Register n+7)

This register (Bit 0 to 15) does contain the status of the two output channels CH0 and CH1.
The status of each output channel is displayed on 6 bits.

Status Output:

Bit	Description
Bit 0…5	CH0 Status (LOW BYTE)
Bit 8…13	CH1 Status (HIGH BYTE)

Table output status:

Bit		Description
CH0	CH1	
5	13	Load Resistance too high. Only for outputs in current mode. Occurs typically if the output circuit is open
4	12	Load Resistance too low. Only for outputs in voltage mode. Occurs typically in case of short circuit
3	11	Over Temperature
2	10	Not Calibrated
1	9	Over Range
0	8	Under Range

5.14 Analogue weighing modules

PCD2.W710	**1-channel weighing module for 4/6-wire elements**
PCD2.W720	**2-channel weighing module for 4/6-wire elements**

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

The module PCD2.W7x0 is described in the manual 26-833.

5.15 Analogue thermocouple modules

PCD2.W745	4-channel thermocouple modules for J, K… thermoelemets

Supported temperature sensors are:

- Thermocouples – TC type J, K
- Resistive temperature detectors – RTD's type Pt 100, Pt 1000, Ni 100, Ni 1000

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

The module PCD2.W745 is described in the manual 26-796.

5.16 Fast counting modules

PCD2.H100	**Counting module up to 20 kHz**
PCD2.H110	**General purpose counting and measuring module up to 100 kHz**

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

5.16.1 PCD2.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).

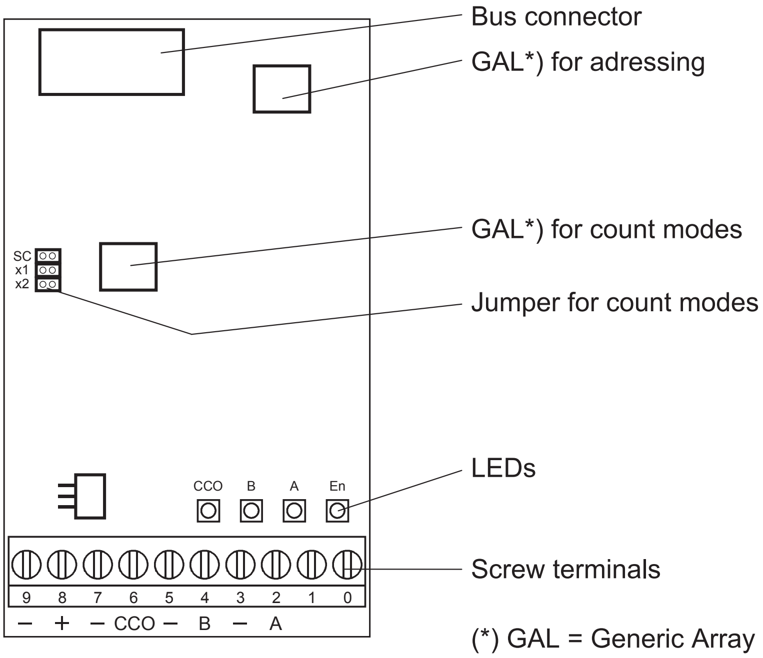
Typical areas of application:
- Counting revolutions or distances (impulses)
- Presetting a count value and switching off output CCO when Counter = 0
- Measurement by counting: measuring signals counted only when particular conditions are met, e.g. photoelectric barrier covered
- Counting with recognition of count direction for incremental shaft encoders providing simple motion control

5

Technical data

Number of systems:	1
Counting range:	0…65,535 (16 bit, can be ext. with CPU counters)
Counting frequency:	max. 20 kHz (at pulse/pause ratio 50 %)
Data protection:	All data in this module are volatile (non-volatile Saia 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, residual ripple max. 10 %
Circuit type:	Electrically coupled, not short circuit protected, positive switching
Voltage drop:	typically 2V at 500 mA
Output delay:	< 10 µs (longer for inductive load due to 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 61000-6-3 / EN 61000-6-2
Programming:	Based on Saia PCD® user program and pre-programmed function blocks (FB).
Count modes:	Selectable with jumper
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

LEDs and connection terminals



(*) GAL = Generic Array Logic)

“A”	Input “A”	1
“B”	Input “B”	2
“En” (Enable)	Counter active	0
“CCO”	Output “CCO”	3

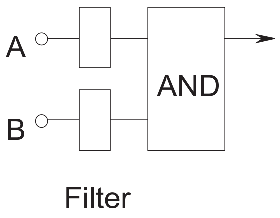
5

Changing the jumpers

On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, “Icons”.

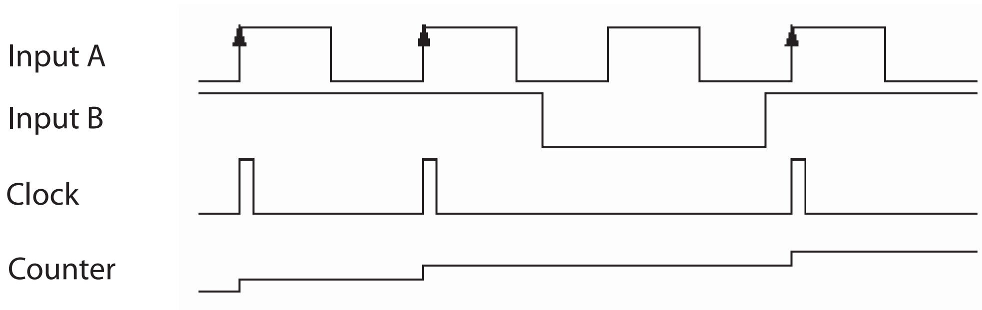
Count modes

SC (Single Count):



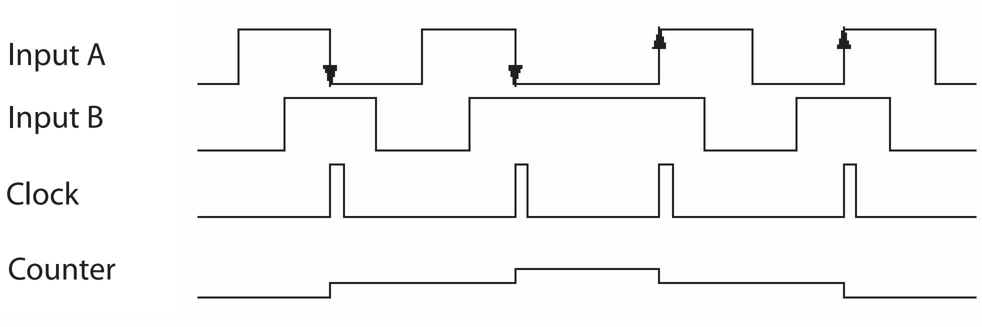
Counting signals at input A.
Up and down counting selectable by user program.

To enable signals at input A to be counted, input B must be connected to 24 V (AND gate).

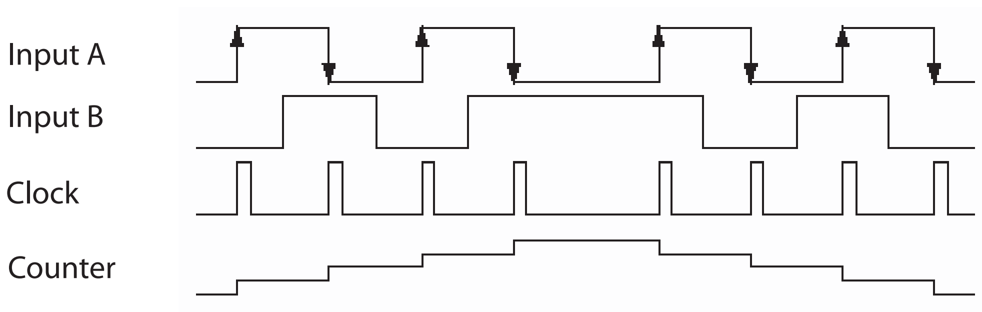


Modes x1, x2: Up/down counting mode for 2-phase incremental shaft encoder at inputs A and B.

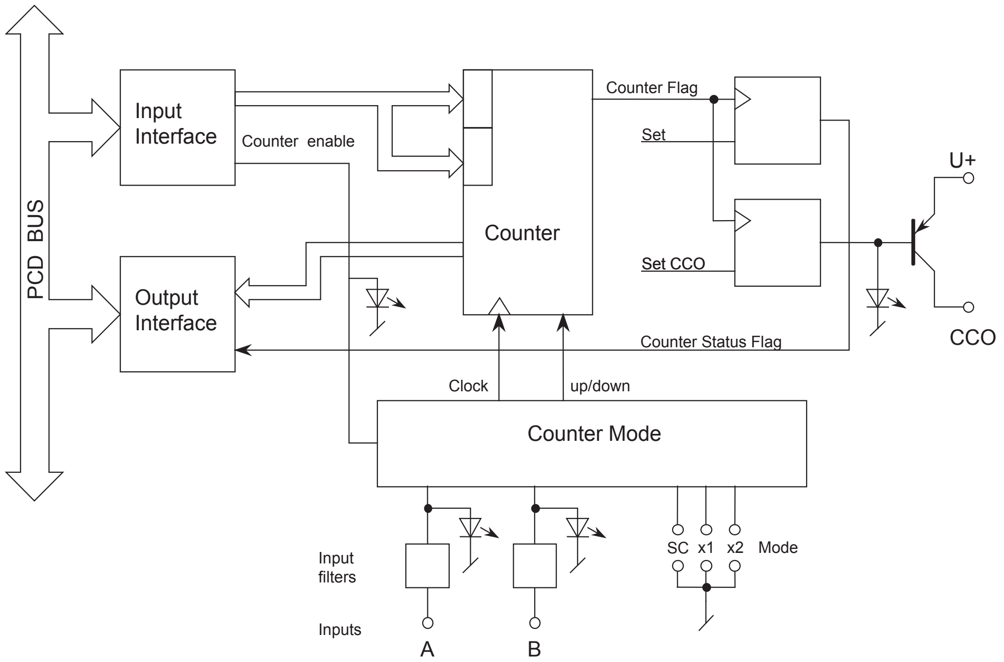
x1



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:

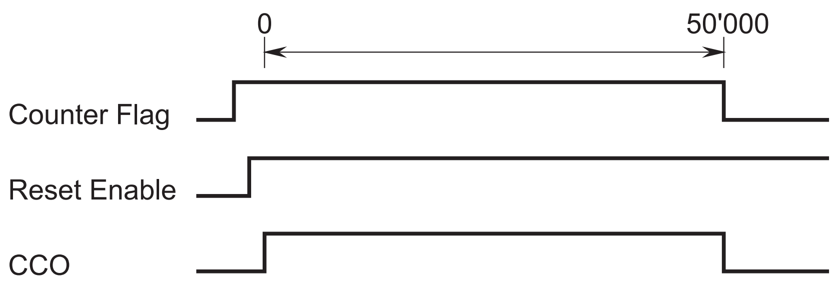
The output of the internal counter is identified as “Counter Flag”. The user has no hardware access to it. This counter flag is set to “1” whenever the counter is loaded or by means of a separate instruction.

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

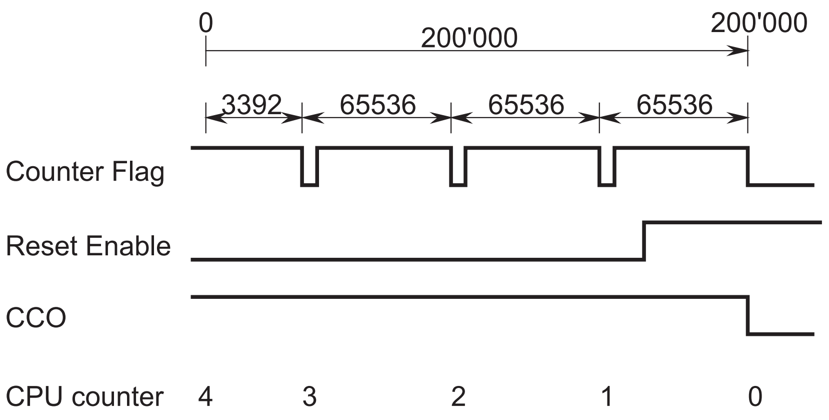
Case a): Resetting the counter flag results in a simultaneous reset of the CCO output.



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 PCD2.H100 can be found in a separate manual and on the TCS Support site (www.sbc-support.com + getting started).
xx7: the firmware reads in the values according to the configuration (I/O Builder)

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.16.2 PCD2.H110, general purpose counting / measuring module up to 100 kHz

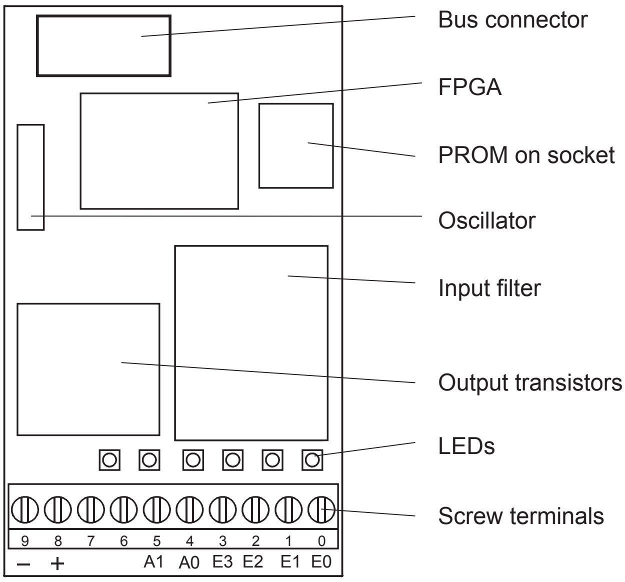
Application

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

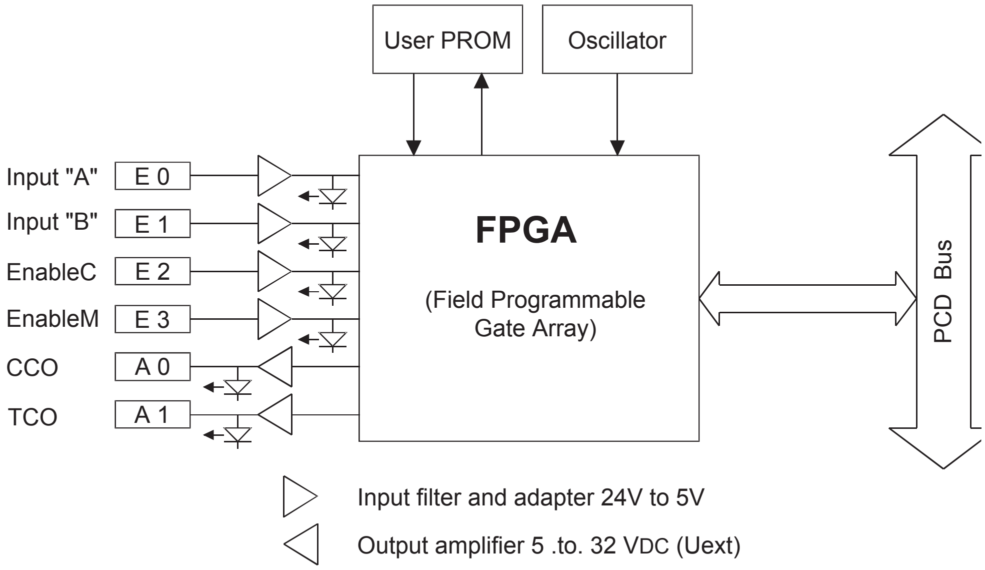
Number of systems:	1
Counting range:	0…16,777,215 (24 bit)
Counting frequency:	up to 100 kHz
Data protection:	All data in this module are volatile (non-volatile Saia PCD® registers are available).
Digital inputs	
Number of inputs: Terminal 0 = E0 Terminal 1 = E1 Terminal 2 = E2 Terminal 3 = E3	4 Input “A”: for counting and measuring Input “B”: for counting only Input “Enable C”: for use as counting module Input “Enable 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 of outputs: Terminal 4 A0: Terminal 5 A1:	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…24 V).
Frequency:	≤ 100 kHz
Voltage range:	5…32 V smoothed, residual ripple max. 10 %
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 due to 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 61000-6-3 and EN 61000-6-2
Programming:	Based on Saia PCD® user program and pre-programmed function blocks (FB).
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

LEDs and connection terminals



LED 0 State of input “A”
LED 1 State of input “B”
LED 2 State of input “EnableC”
LED 3 State of input “EnableM”
LED 4 State of output “CCO”

Block diagram



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For further details, please refer to manual 26-755 "PCD2.H110 - Universal counting and measuring module".

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction. For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.17 SSI interface modules

PCD2.H150	**SSI interface module**

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

5.17.1 PCD2.H150, SSI interface module for absolute encoder

Application

The PCD2.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 RS-422 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 PCD2.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 an incorrect FB parameter is sent) 'fRing_err' (if compare error in 'double read')
SSI interface	
1 input for SSI data	RS-422, electrically isolated
1 output for SSI clock	RS-422, electrically connected, as the encoder input is normally isolated
Digital outputs	
Number of outputs: Terminal 4 = A12: Terminal 5 = A13: Terminal 6 = A14: Terminal 7 = A15:	4 Speed high Speed low Dir + positive direction Dir - negative direction
Switching capacity:	0.5 A 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:	typically 50 µs, max. 100 µs, 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, 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 61 000-6-3 and EN 61 000-6-2
Programming:	Based on Saia PCD® user program and pre-programmed function blocks (FB).
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

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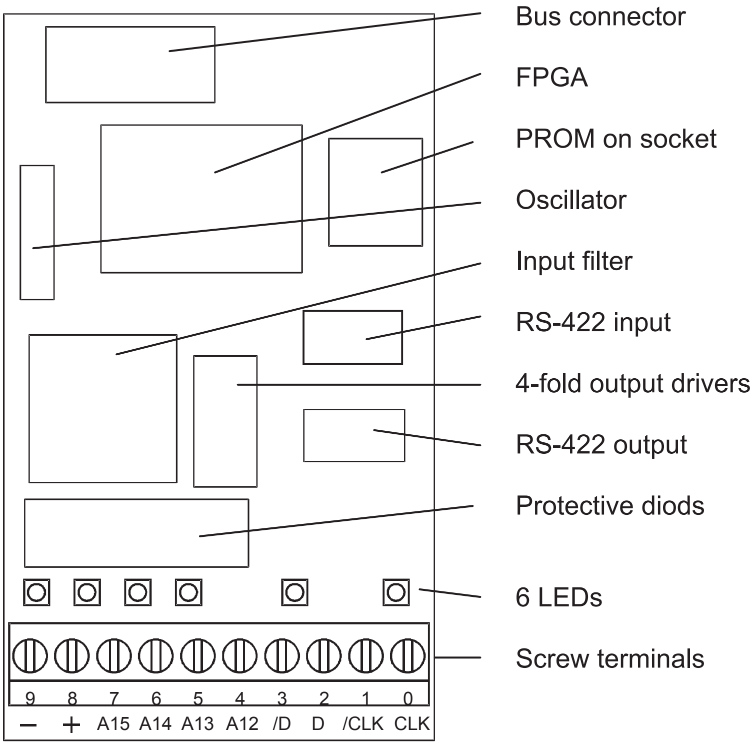
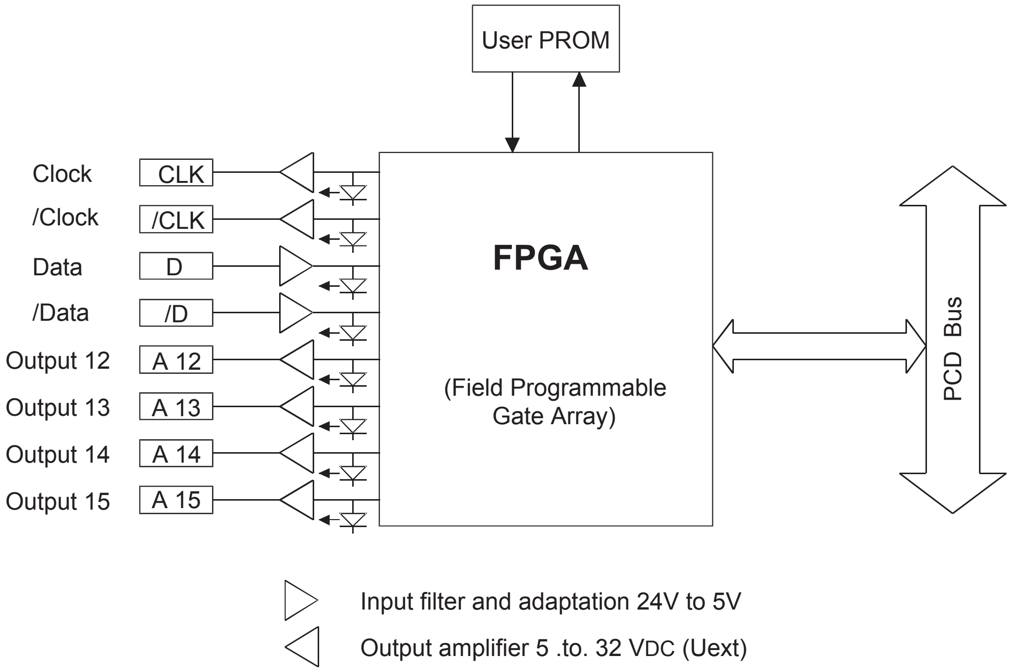
LEDs and connection terminals



LED 0: SSI output ‘Clock’
LED 2: SSI input ‘Data’
LED 4: State of output 12
LED 5: State of output 13
LED 6: State of output 14
LED 7: State of output 15

Block diagram



For further details, please refer to manual 26-761 “PCD2.H150 - SSI interface for absolute encoder”.

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.18 Motion control modules for stepper motors

PCD2.H210	Motion control module for stepper motors

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

5.18.1 PCD2.H210, Motion control module for stepper motors

Application

The PCD2.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.

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 depending on the selected frequency range
Profile generator:	with symmetrical acceleration and braking ramps
Data protection:	All data in this module are volatile (non-volatile Saia PCD® registers are available).
Digital inputs	
Number of inputs: Terminal 0 = E0 Terminal 1 = E1 Terminal 2 = E2 Terminal 3 = E3	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:	< 1ms
Circuit type:	electrically connected
Digital outputs	
Number of outputs: Terminal 4 A0: Terminal 5 A1: Terminal 6 A2: Terminal 7 A3:	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 due to 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 61 000-6-3 and EN 61 000-6-2
Programming:	Based on Saia PCD® user program and pre-programmed function blocks (FB).
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

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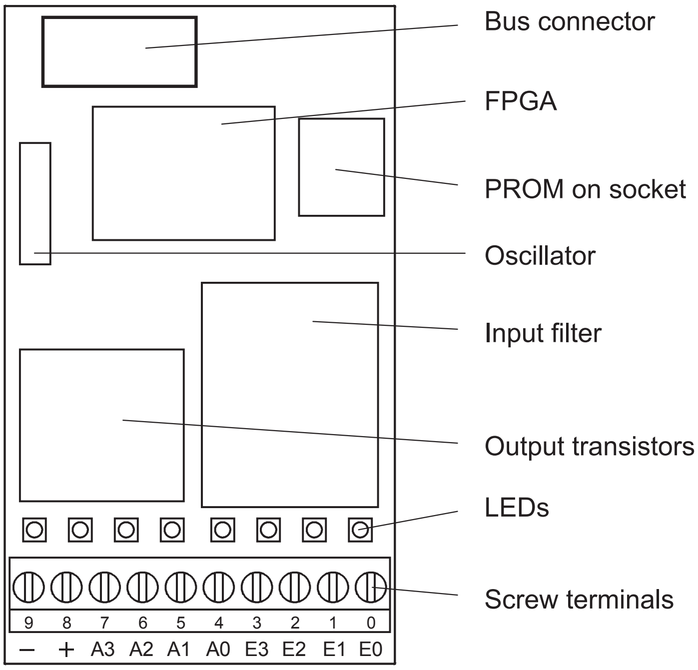
***)** For further information, please refer to manual 26-760, "PCD2.H210 - motion control modules for stepper motors".

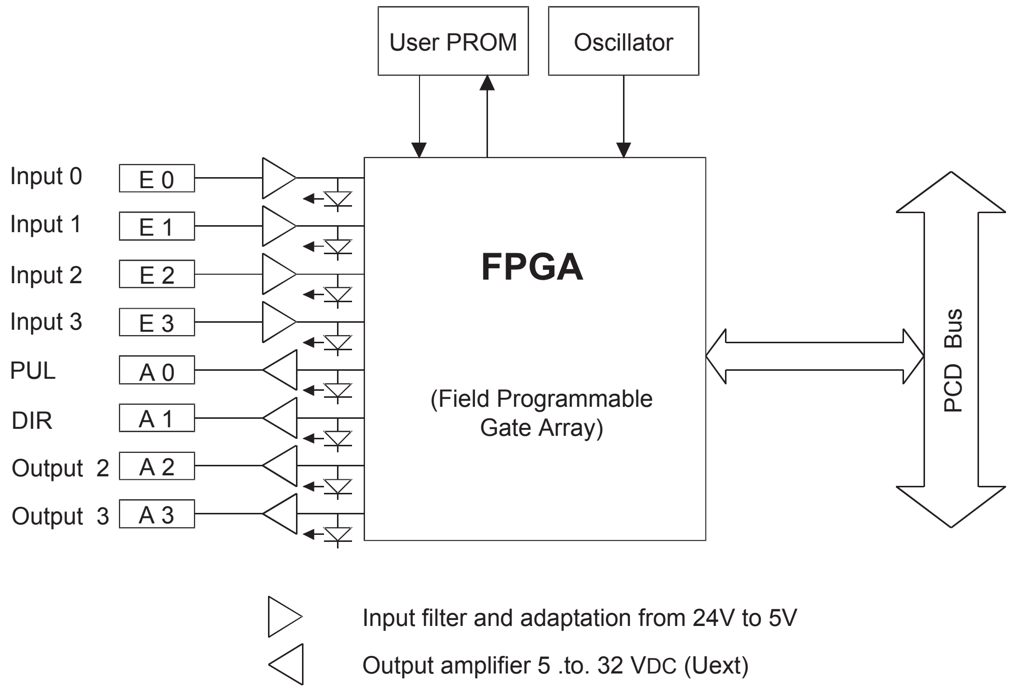
LEDs and connection terminals



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

Block diagram



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For further information, please refer to manual 26-760, “PCD2.H210 - motion control modules for stepper motors”

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.19 Motion control modules for servo-motors

PCD2.H310	**Motion control module for servo-motors, 1-axis encoder, 24 V**
PCD2.H311	**Motion control module for servo-motors, 1-axis encoder, 5 V**
PCD2.H320	**Motion control module for servo-drives, 2-axis with 24 V encoder**
PCD2.H322	**Motion control module for servo-drives, 1-axis with 24 V encoder (slave operation)**
PCD2.H325	**Motion control module for servo-drives, 2-axis with 5 V and SSI absolute value encoder**
PCD2.H327	**Motion control module for servo-drives, 1-axis with 5 V encoder and SSI absolute value encoder (slave operation)**

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!

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

5.19.1 PCD2.H31x, motion control module for servo-motors, 1-axis encoder

Application

The PCD2.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.

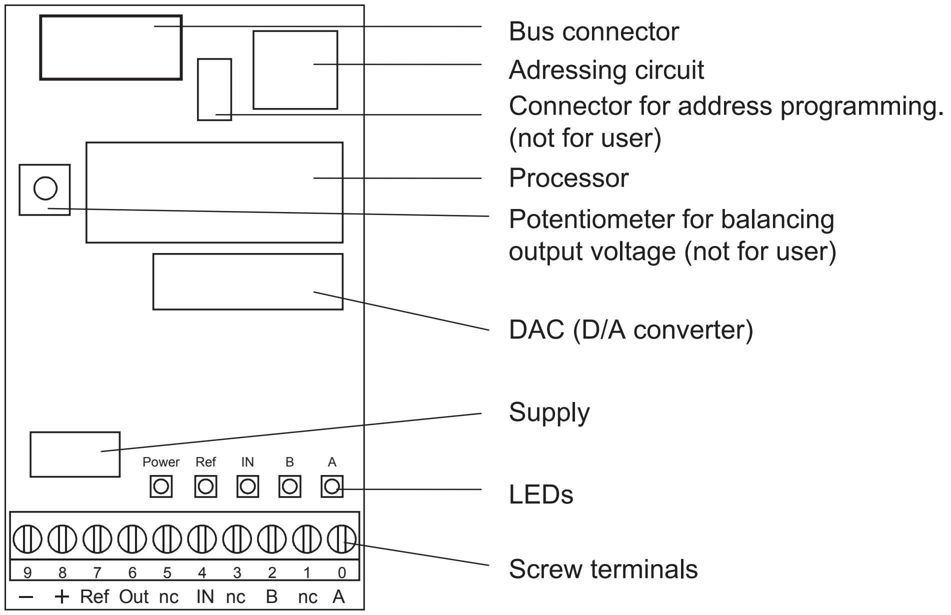
Technical data

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 PCD2.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 PCD2.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 RS-422
Hysteresis:	max. 200 mV
Line termination resistance:	150 Ω
Encoder frequency:	max. 100 kHz
Analogue outputs for PCD2.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

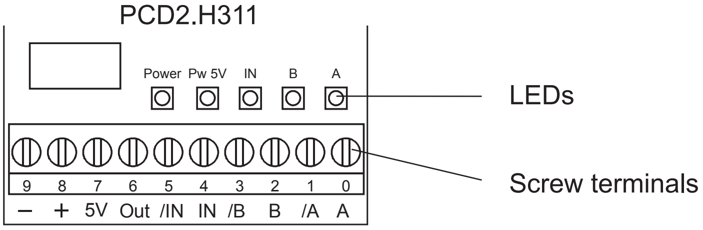
Minimum load impedance:	3 kΩ
*) Balancing output voltage is carried out in the factory. The user is strongly advised not to adjust the tuning potentiometer.	
5 V supply for 5 V encoder for PCD2.H311	
5 V output:	5 V supply of encoder
Short circuit protection:	yes
Electrical isolation:	no
Output voltage:	5 V
Max. load current:	300 mA
Short circuit current:	400 mA (this current also loads the PCD's +5 V bus)
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 61 000-6-3 and EN 61 000-6-2
Programming:	Based on Saia PCD® user program and pre-programmed function blocks (FB).
Terminals:	Pluggable 10-pole screw terminal block (4 405 4847 0), for wires up to 1.5 mm²

LEDs and connection terminals

PCD2.H310



PCD2.H311



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 5 V”	Supply (5 V) to encoder (H311)
LED “Power”	Supply ± 15 V

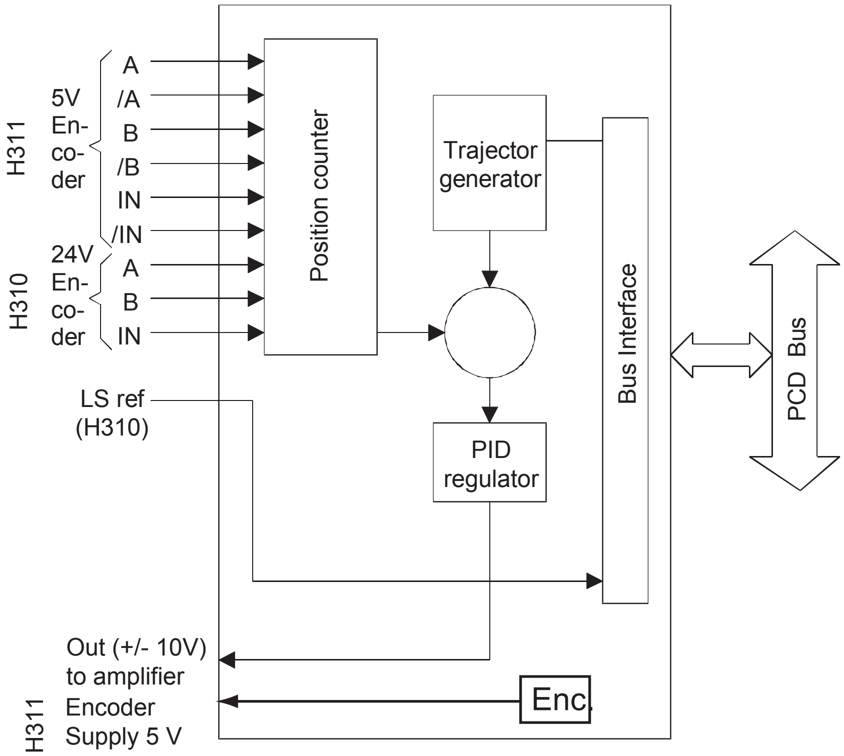
Terminals - PCD2.H310

– 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 - PCD2.H311

– and +	=	external supply terminals
5 V	=	output for 5 V 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 cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

5.19.2 PCD2.H32x, motion control modules for servo-drives

There are four module types available:

PCD2.H320: 2 axes with 24 V encoder
PCD2.H325: 2 axes with 5 V and SSI absolute value encoder
PCD2.H322: 1 axis (slave operation) with 24 V encoder
PCD2.H327: 1 axis (slave operation) with 5 V and SSI absolute value encoder

The PCD2.H32x motion control modules are intelligent I/O modules in the PCD2 series. They are used to position two independent axes, with one variable speed AC or DC drive (servo-motor) each, or two axes as an electronic transmission. This requires the drive unit to have a power stage and incremental shaft encoder for capturing position or speed. Displacement control may also be achieved with an SSI absolute value encoder.
Each module contains a DSP processor that independently controls every movement according to parameters supplied by the user program: velocity, acceleration and destination position ("PID control"). This enables each axis to execute independent movements, perform S-curve and trapezoidal motion profiles, change velocity and acceleration, perform interrupt functions and record the current axis position during motion.

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In a PCD2 with expansion housing, up to 7 PCD2.H32x modules can be operated in parallel.

Technical data

Function-specific data		
Number of systems:	2	for H320/5
	1	for H322/7 + 1 H100 counter input 4 DI + 1 DO

Motion parameters	
31-bit registers are used for destination position, velocity and acceleration, numerical range ± 2^{30})	
Position	Units and resolution selectable (depending on mechanical factor)
Velocity	Units and resolution selectable (depending on mechanical factor)
Acceleration	Units and resolution selectable (depending on mechanical factor)
PID controller	Sample time 100 µs / axis, programmable proportional, integral and differential factors. Sample time for differential part can be programmed separately. Additional velocity and acceleration feed-forward (all 16 bit values)
Analogue controller output	Velocity set point ± 10 V (resolution 12 bit)
Counting frequency	max. 125 kHz for H320/5 max. 250 kHz for H322/7

Digital inputs for all PCD2.H32x modules per axis	
Number of inputs	1 reference input “REF” 1) 2 limit switch inputs “LS1 / LS2” 1) 1 synchronization input “SI” 2)
Input voltage	24 VDC (6 to 32 VDC) smoothed, max. residual ripple 10 %
“Low” range	–30…+5 V
“High” range	+15…+32 V
Input current at 24 VDC	7 mA (typically)
Circuit type	electrically connected
Reaction time	300 µs

1) For safety reasons, normally-closed (NC) or PNP sensors should be used for the reference and limit switches. For this reason, these inputs work in sink mode (negative logic, i.e. LED = on when 0 V at input).
2) The synchronization input works in source mode (positive logic)

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Digital outputs for all PCD2.H32x modules		
	Axis 1	**Axis 2**
Outputs	SO	SO
Supply	Uext	Uext
U_{ext} (typically 24 VDC)	6…32 VDC	6…32 VDC
I out	5…500 mA	5…500 mA
Voltage drop at 500 mA	< 0.3 V	< 0.3 V
Short circuit protection	Yes 1)	Yes 1)
Electrical isolation	No	No

1) The short circuit current is restricted to max. 1.6 A

Analogue outputs for modules PCD2.H320 and PCD2.H325		
	Axis 1	**Axis 2**
Outputs	OUT	OUT
Resolution (incl. sign bit)	12 bit	12 bit
Short circuit protection	Yes	Yes
Electrical isolation	No	No
Output voltage fluctuation 1)	± 10 V	± 10 V
Minimum load impedance	3 kΩ	3 kΩ

1) Setting accuracy ± 5 mV. Balancing output voltage is carried out in the factory, and the value is stored in a digitally programmable potentiometer

Analogue outputs for modules PCD2.H322 and PCD2.H327		
	Axis 1	**Axis 2**
Outputs	OUT	NC
Resolution (incl. sign bit)	12 bit	-
Short circuit protection	Yes	-
Electrical isolation	No	-
Output voltage fluctuation 1)	± 10 V	-
Minimum load impedance	3 kΩ	-

1) Setting accuracy ± 5 mV. Balancing output voltage is carried out in the factory, and the value is stored in a digitally programmable potentiometer

Encoder inputs for modules PCD2.H320 and PCD2.H322		
	Axis 1	**Axis 2**
Inputs	A B IN	A B IN
Number of inputs	3	3
Input voltage (typical)	24 V	24 V
Signal state L (Low)	–30…+5 V	–30…+5 V
Signal state H (High)	+15…+32 V	+15…+32 V
Input current (typical) H320 H322	7 mA 7 mA	7mA 2mA
Source operation (positive logic)	×	×
F_{max}	125 kHz [1]	125 kHz [1]
[1] Internal counting frequency 500 kHz		

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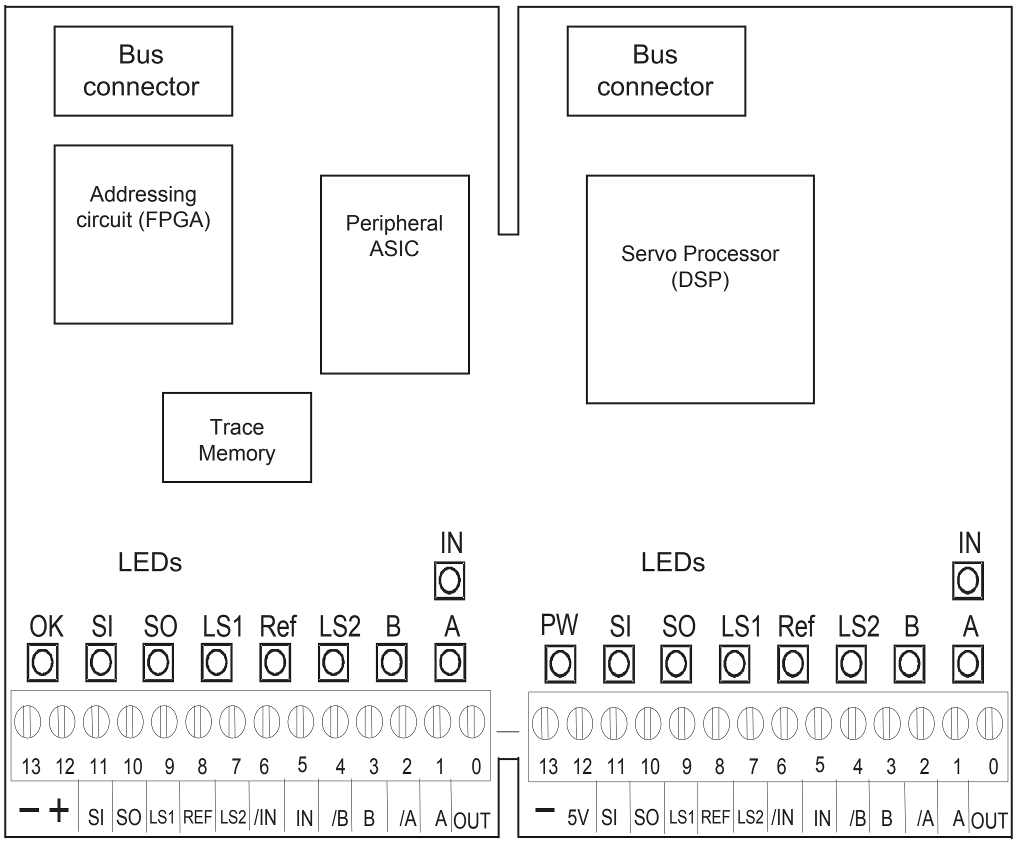
Encoder inputs for modules PCD2.H325 and PCD2.H327		
	Axis 1	**Axis 2**
Inputs	A,/A B,/B IN,/IN	A,/A B,/B IN,/IN
Number of inputs	6	6
Input voltage (typical)	RS-422	RS-422
Input impedance (typical) H325 H327	150 Ω 150 Ω	150 Ω 1500 Ω
F_{max}	250 kHz [1]	250 kHz [1]
[1] Internal counting frequency 1 MHz		

5 V supply for 5 V encoder modules PCD2.H325 and PCD2.H327	
Short circuit protection	Yes
Electrical isolation	No
Output voltage	5 V
Max. load current	300 mA
Short circuit current	400 mA
Overvoltage protection	TVS diode 39 V ± 10 %
Reverse voltage protection	No

Power supply to all modules	
Internal current consumption: from +5 V bus (without encoder)	typically 210 mA, max. 230 mA (250 mA in SSI operation)
Internal current consumption: from V+ bus (without encoder)	15…20 mA
External current consumption:	0…2 mA (without load current) 1 A for outputs
! Total current consumption for all I/O modules including encoders must not exceed 1.6 A. PCD2.H32x modules should be plugged onto the base unit wherever possible (not the expansion housing).	
Operational conditions	
Ambient temperature	operation: 0…+55 °C without forced ventilation, storage: –20…+85 °C
Noise immunity:	EC mark according to EN 61000-6-3 and EN 61000-6-2
Programming:	Based on Saia PCD® user program and pre-programmed function blocks (FB).
Terminals:	Pluggable 10-pole spring terminal block (4 405 4847 0), for wires up to 1.5 mm²

LEDs and connection terminals



Screw terminal block J4, Axis 2 Screw terminal block J5, Axis 1

2× LED “IN”	State of index input
2× LED “A”	State of encoder input “A”
2× LED “B”	State of encoder input “B”
2× LED “LS2”	State of limit switch 2
2× LED “Ref”	State of reference switch
2× LED “LS1”	State of limit switch 1
2× LED “SO”	State of synchronization output
2× LED “SI”	State of synchronization input
1× LED “PWR”	State of internal voltage (± 15 V)
1× LED “OK”	State of controller

On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, “Icons”.

Inputs per axis				
Module type	**PCD2.H320**	**PCD2.H322**	**PCD2.H325**	**PCD2.H327**
Terminal 1 = “A”	Encoder signal “A”			
Terminal 2 = “/A”	Not used		Encoder signal “/A”	
Terminal 3 = “B”	Encoder signal “B”			
Terminal 4 = “/B”	Not used		Encoder signal “/B”	
Terminal 5 = IN”	Encoder signal “IN”			
Terminal 6 = /IN”	Not used		Encoder signal “/IN”	
Terminal 7 = “LS2”	Limit switch 2			
Terminal 8 = REF”	Reference switch			
Terminal 9 = “LS1”	Limit switch 1			
Terminal 11 = SI”	Synchronization input			
Screw terminal block J5, axis 1				
Terminal 12 = “5 V”	Not used		Supply output +5 VDC for encoder	
Terminal 13 = “-”	Ground (PGND)			
Screw terminal block J4, axis 2				
Terminal 12 =“+”	External supply + 24 VDC smoothed, for SO			
Terminal 13 = “-”	Ground (PGND)			
Outputs per axis				
Module type	**PCD2.H320**	**PCD2.H322**	**PCD2.H325**	**PCD2.H327**
Terminal 0 = “OUT”	Analogue control output. (Slave) axis 1 only			
Terminal 10 = “SO”	Synchronization output			

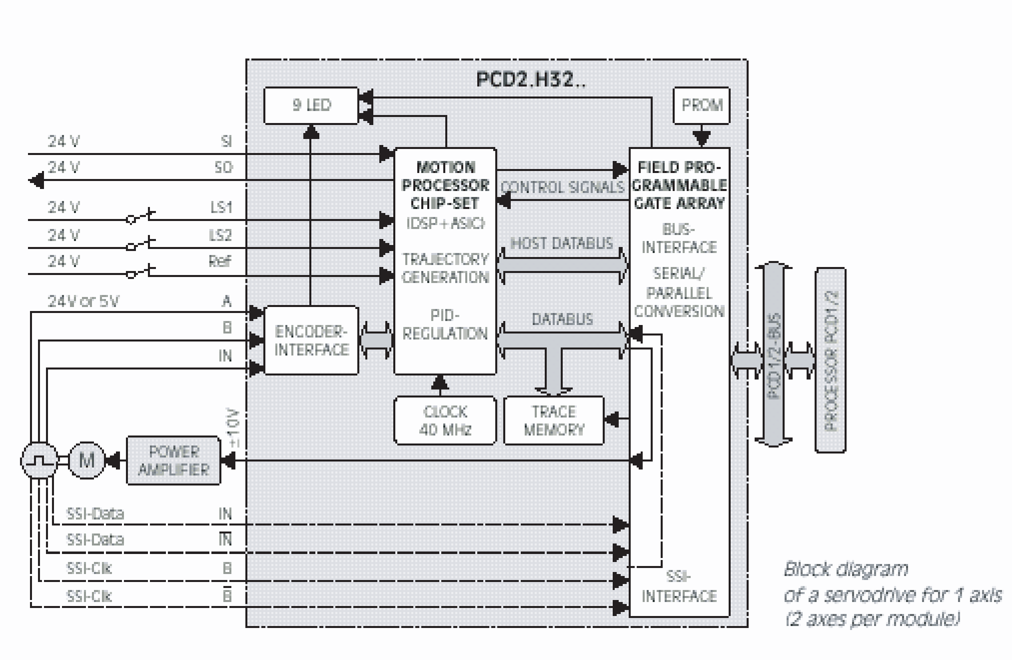
Software queries

The elements listed in the table below can be queried by the user (examples for module 1). The module type and the FPGA version can be obtained with the ‘FB Exec’ function and the ‘RdIdent’ instruction.

Inputs	Description
REF_1s2	REFerence switch
LS1_1s2	Limit switch 1
LS2_1s2	Limit switch 2
AxisSelect_1_2 (output)	RES = axis 1, SET = axis 2
AxisIn_1s2	State of axis synchronization input
AxisOut_1s2	State of axis synchronization output
AxisEvent_1_2	Axis event interrupt
PowerError_1_2	Internal supply error
PowerEncError_1_2	Encoder supply error
CableBreak_1s2	Cable break
SSI_timeout_1s2	SSI timeout
OK_LED_1_2	State of controller (OK LED)
HostIOError_1_2	Host I/O error

(_1s2 selection of axis via “Axis Select” output)
(_1_2 affects whole module)

Block diagram



Block diagram of a servodrive for 1 axis (2 axes per module)

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For further information, please refer to manual 26-772, “PCD2.H32x - motion control modules for servo-drives”

Watchdog: This module cannot be used on the base address 240 (or 496 for the PCD2.M17x), because it would interact with the watchdog, and would cause a malfunction.

For details, please refer to the section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

6 Input/output (I/O) modules for PCD3

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 Saia 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

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Digital input modules

PCD3.E110	8 I	8 inputs 8 ms	24 VDC	A / B	6-12
PCD3.E111	8 I	8 inputs 0.2 ms	24 VDC	A / B	6-12
PCD3.E112	8 I	8 inputs 9 ms	12 VDC	A / B	6-12
PCD3.E116	8 I	8 inputs 0.2 ms	5 VDC	A / B	6-12
PCD3.E160	16 I	16 inputs 8 ms, connection via 34-pole ribbon connector	24 VDC	D [7])	6-14
PCD3.E161	16 I	16 inputs 0.2 ms, connection via 34-pole ribbon connector	24 VDC	D [7])	6-14
PCD3.E165	16 I	16 inputs 8 ms, connection via 24-pole cage clamp terminal block	24 VDC	C	6-16
PCD3.E166	16 I	16 inputs 0.2 ms, connection via 24-pole cage clamp terminal block	24 VDC	C	6-16

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	6-19
PCD3.E610	8 I	8 inputs 10 ms, electrically isolated	24 VDC	A / B	6-21
PCD3.E613	8 I	8 inputs 9 ms, electrically isolated	48 VDC	A / B	6-21

Digital output modules

PCD3.A300	6 O	6 outputs 2 A	24 VDC	A / B	6-24
PCD3.A400	8 O	8 outputs 0.5 A	24 VDC	A / B	6-26
PCD3.A460	16 O	16 outputs 0.5 A, connection via 34-pole ribbon connector	24 VDC	D [7])	6-28
PCD3.A465	16 O	16 outputs 0.5 A, connection via 24-pole spring terminal block	24 VDC	C	6-30

Type	I/Os	Description	Input/ output signal range	I/O connector type [3]	Page

Digital output modules, electrically isolated from the I/O Bus

PCD3.A200	4 O	4 make contacts 2 A	250 VAC 50 VDC	A / B	6-33
PCD3.A210	4 O	4 break contacts 2 A	250 VAC 50 VDC	A / B	6-35
PCD3.A220	6 O	6 make contacts 2 A	250 VAC 50 VDC	A / B	6-37
PCD3.A251	8 O	6 changeover + 2 make contacts 2 A, connection via 24-pole spring terminal block	48 VAC 50 VDC	C	6-39
PCD3.A410	8 O	8 outputs 0.5 A, electrically isolated	24 VDC	A / B	6-41

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	6-44
PCD3.A860	2I+2O	Light and shade module, 2 outputs 12 A/250 VAC, 2 inputs 24 VDC	250 VAC 24 VDC	G H	6-48

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	6-55
PCD2.B160	16 I/O	In blocks of 4 configurable	18…30 VDC	2× K	7

Analogue input modules

PCD3.W200	8 I	8 inputs 10 bit	0…10 V	A / B	6-59
PCD3.W210	8 I	8 inputs 10 bit	0…20 mA	A / B	6-59
PCD3.W220	8 I	8 inputs 10 bit	Pt/Ni1000	A / B	6-59
PCD3.W300	8 I	8 inputs 12 bit	0…10 V	A / B	6-65
PCD3.W310	8 I	8 inputs 12 bit	0…20 mA	A / B	6-65
PCD3.W340	8 I	8 inputs 12 bit, jumper selectable	0…10 V, 0…2.5 V 0…20mA, Pt/Ni1000	A / B	6-65
PCD3.W350	8 I	8 inputs 12 bit	Pt/Ni 100	A / B	6-65
PCD3.W360	8 I	8 inputs 12 bit, resolution ‹ 0.1 °C	Pt1000	A / B	6-65
PCD3.W380	8 I	8 analogue inputs 13 bit, configuration via software	Diverse	2× K	8

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

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

PCD3.W305	7 I	7 inputs 12 bit, electrically isolated	0…10 V	E	6-74
PCD3.W315	7 I	7 inputs 12 bit, electrically isolated	0…20 mA	E	6-74
PCD3.W325	7 I	7 inputs 12 bit, electrically isolated	–10 V…+10 V	E	6-74

Analogue output modules

PCD3.W400	4 O	4 outputs 8 bit	0…10 V	A / B	6-79
PCD3.W410	4 O	4 outputs 8 bit, jumper selectable	0…10 V, 0…20 mA, 4…20 mA	A / B	6-79
PCD3.W600	4 O	4 outputs 12 bit	0…10 V	A / B	6-83
PCD3.W610	4 O	4 outputs 12 bit, jumper selectable	0…10 V, –10 V…+10 V 0…20 mA, 4…20 mA	A / B	6-83

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

PCD3.W605	6 O	6 outputs 10 bit, electrically isolated	0…10 V	E	6-89
PCD3.W615	4 O	4 outputs 10 bit, electrically isolated	0…20 mA	E	6-89
PCD3.W625	6 O	6 outputs 10 bit, electrically isolated	–10 V…+10 V	E	6-89

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	6-94

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	6-99

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	6-105

6

Weighing modules

PCD3.W710	1 I	1 weighing systems, up to 6 weighing cells 18 bit ²)	E	6-109
PCD3.W720	2 I	2 weighing systems, up to 6 weighing cells 18 bit ²)	E	6-109

Universal temperature measurement module

PCD3.W745	4 I	Thermocouple module for J, K…thermocouples	⁸)	6-110

Counting and motion control modules

PCD3.H100		Counter module up to 20 kHz	A / B	6-112
PCD3.H110		Counter module up to 100 kHz	A / B	6-117
PCD3.H150		SSI interface module	A / B	6-119
PCD3.H210		Motion control module for stepper motors ²)	A / B	6-122
PCD3.H310		Motion control module for servo-motors 1-axis encoder 24 VDC ²)	A / B	6-125
PCD3.H311		same as H310, with 1-axis encoder 5 VDC ²), ⁹)	A / B	6-125

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 Saia 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	Connec-tor type
4 405 4952 0	1	Pluggable cage clamp terminals for LIO PCD3.C200, 2-pole (up to 2.5 mm²)	
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
4 405 4995 0	1	Pluggable cage clamp terminals for supply PCD3, 8-pole (up to 2.5 mm²)	
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

Supply plugs PCD3 CPUs and LIO PCD3.C200


4 405 4995 0


4 405 4952 0

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)

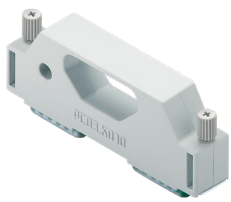

4 405 4936 0 (Typ F)


4 405 5027 0 (Typ G)


4 405 5028 0 (Typ H)


4 405 4934 0 (Typ J)

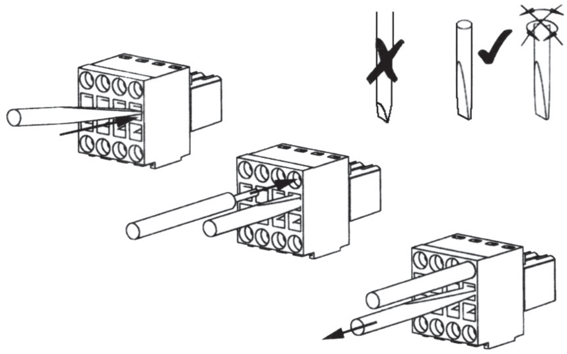
Compounds between module holders


PCD3.K010


PCD3.K106/K116

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 mm^2 through 1,5 mm^2 to 2.5 mm^2.
Screwdrivers of type SDI 0.4 × 2.5 × 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	55	--	--
A860	18	--	--
B100	1…25	--	Load current
B100	120	--	Load current
W200/210	8	5	--
W220	8	16	--
W300/310	8	5	--
W340/360	8	20	--
W350	8	30	--
W380	25	25	--
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	--
W7x0			
W745	200	--	
W800	55	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

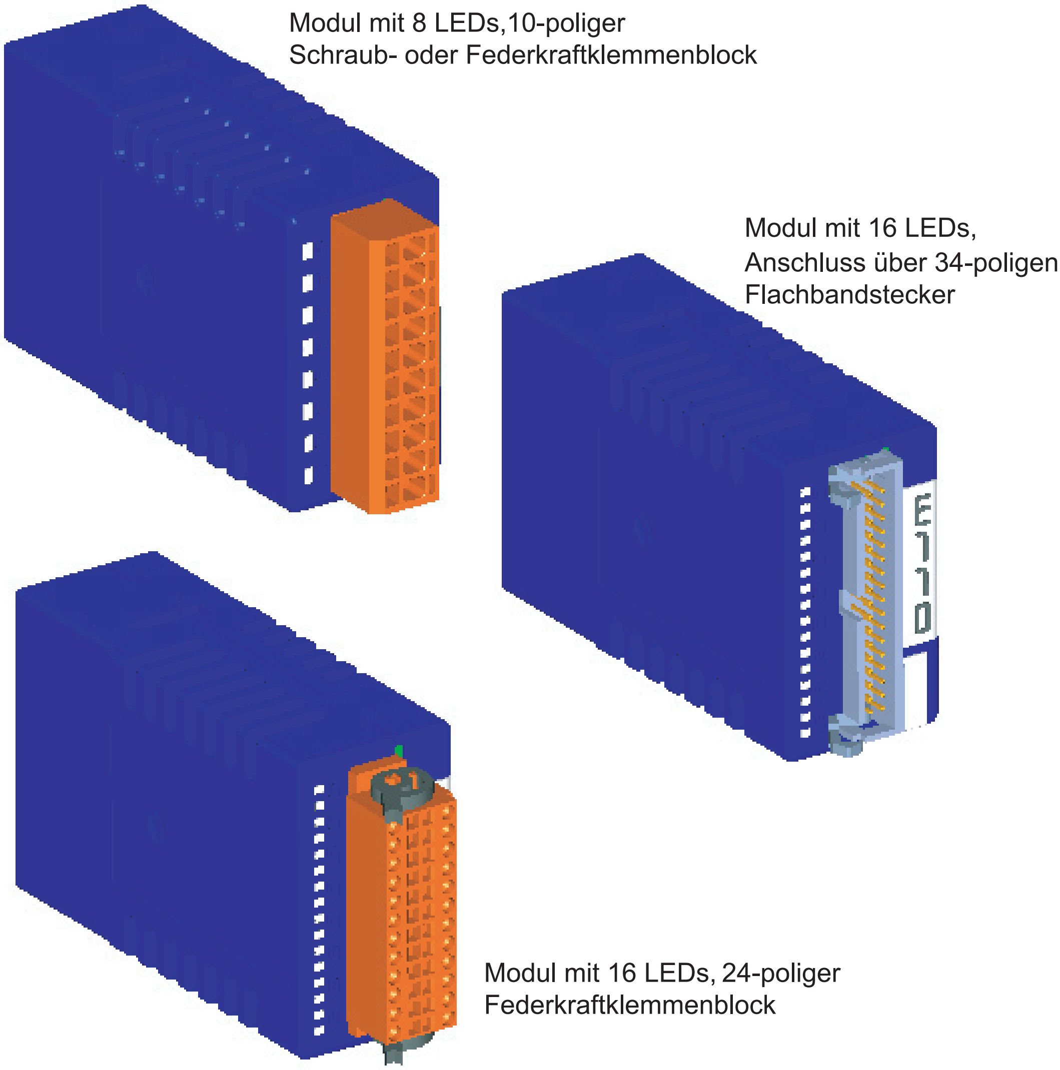
[1]) These I/O modules cannot currently be used with the PCD3 RIO head station
[2]) for H311: up to max. 300 mA for the encoder, this current also loads the +5V bus on the module

6.1.3 External input voltage

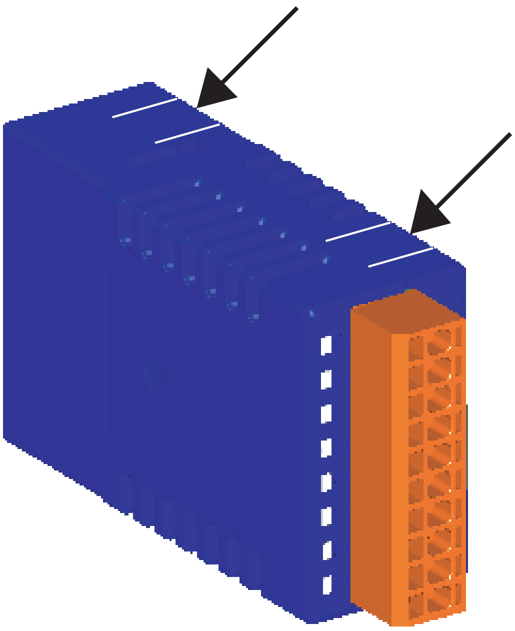
Type	Description	External input voltage or voltage range
Digital input modules		
PCD3.E110	8 inputs 8 ms	24 VDC smoothed or pulsed
PCD3.E111	8 inputs 0.2 ms	24 VDC smoothed, max.ripple 10%
PCD3.E112	8 inputs 9 ms	12 VDC smoothed, max.ripple 10%
PCD3.E116	8 inputs 0.2 ms	5 VDC smoothed, max.ripple 10%
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 9 ms	48 VDC smoothed or pulsed
Digital output modules		
PCD3.A200	4 make cont. 2 A	250 VAC, 50 VDC
PCD3.A210	4 break contacts 2 A	250 VAC, 50 VDC
PCD3.A220	6 make cont. 2 A	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
PCD3.B160	16 I/O configurable	18…30 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.W380	8 inputs 13 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.W7x0	Weighing modules	
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

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.

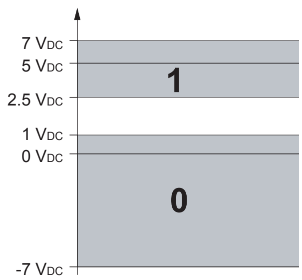
Close
To close the housing, lay the bottom part on a flat surface (table etc.). Ensure that the circuit board is precisely located in this part of the housing. Press top part onto bottom until you hear the snap-in clips engage. Ensure that all four clips are correctly engaged.

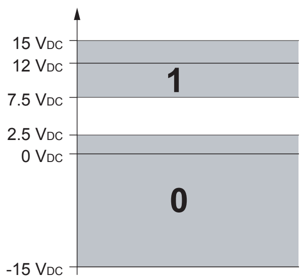
6.2 Digital input modules

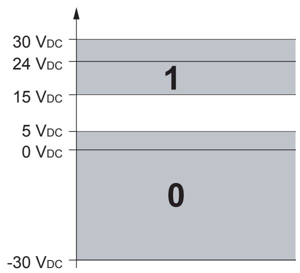
PCD3.E110	**8 inputs 8 ms, 24 VDC**
PCD3.E111	**8 inputs 0.2 ms, 24 VDC**
PCD3.E112	**8 inputs 9 ms, 12 VDC**
PCD3.E116	**8 inputs 0.2 ms, 5 VDC**
PCD3.E160	**16 inputs 8 ms, connection via 34-pole ribbon connector**
PCD3.E161	**16 inputs 0.2 ms, connection via 34-pole ribbon connector**
PCD3.E165	**16 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 Saia PCD® and the external +24V are disconnected from the power supply.

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

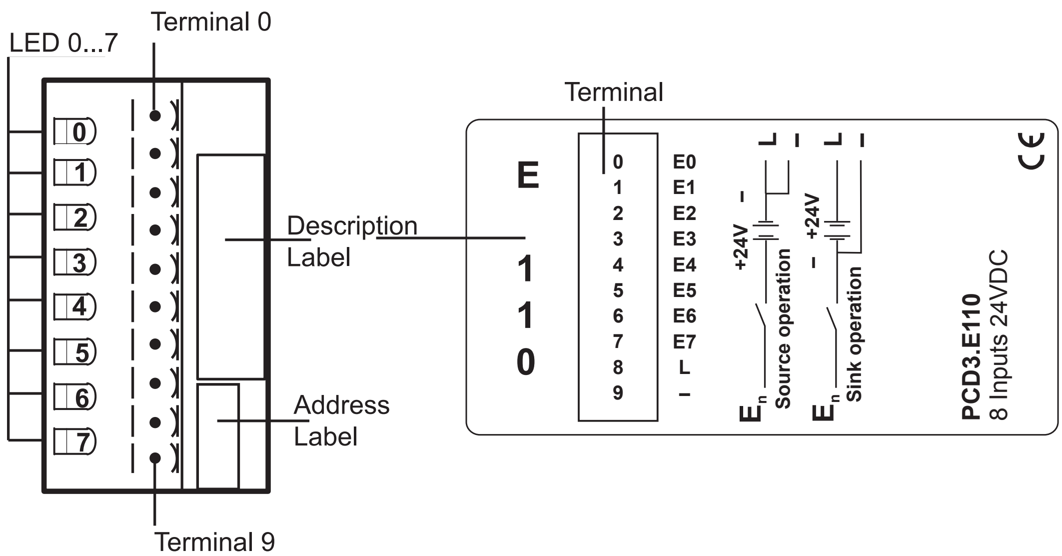
Application

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: E111: E112: E116: Special:	24 VDC (15…30 VDC) smoothed or pulsed 24 VDC (15…30 VDC) smoothed, max. 10 % ripple 12 VDC (7.5…15 VDC) smoothed, max. 10 % ripple 5 VDC (1…7 VDC) smoothed, max. 10 % ripple Further values on request
Input current:	6 mA at 24 VDC
Input delay E110: E111: E112: E116:	typ. 8 ms typ. 0.2 ms typ. 9 ms 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

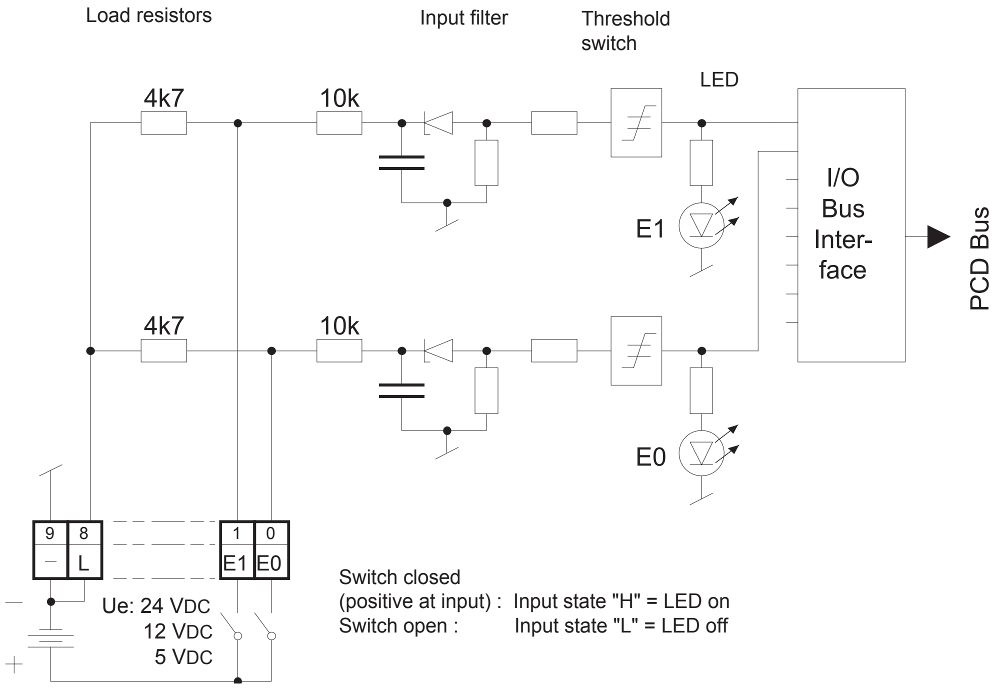
LEDs and connection terminals



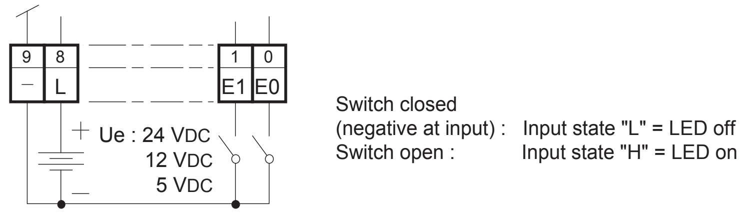
Input circuits and terminal designation

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

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

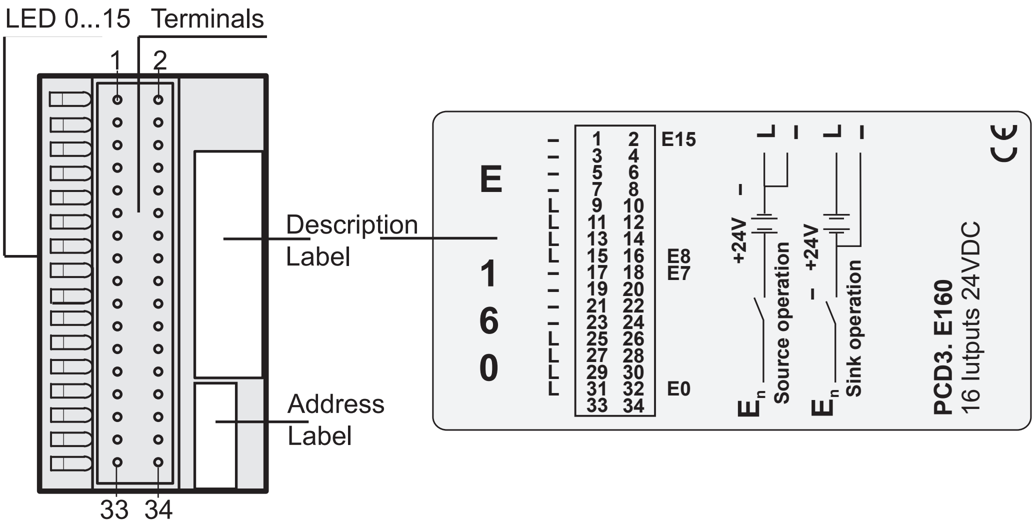
Application

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

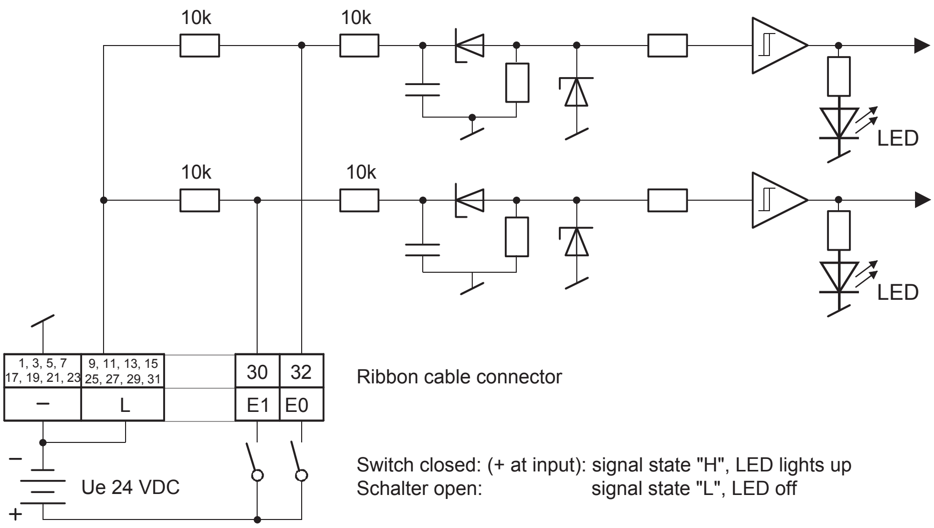
*) optional

Input circuits and terminal designation

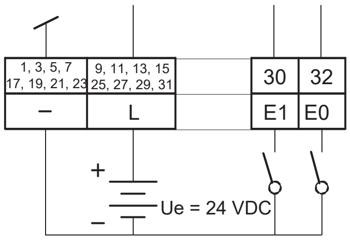
Depending on external wiring, this module may be used for source or sink operation.

6

Source operation (positive logic):



Sink operation (negative logic):



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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

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

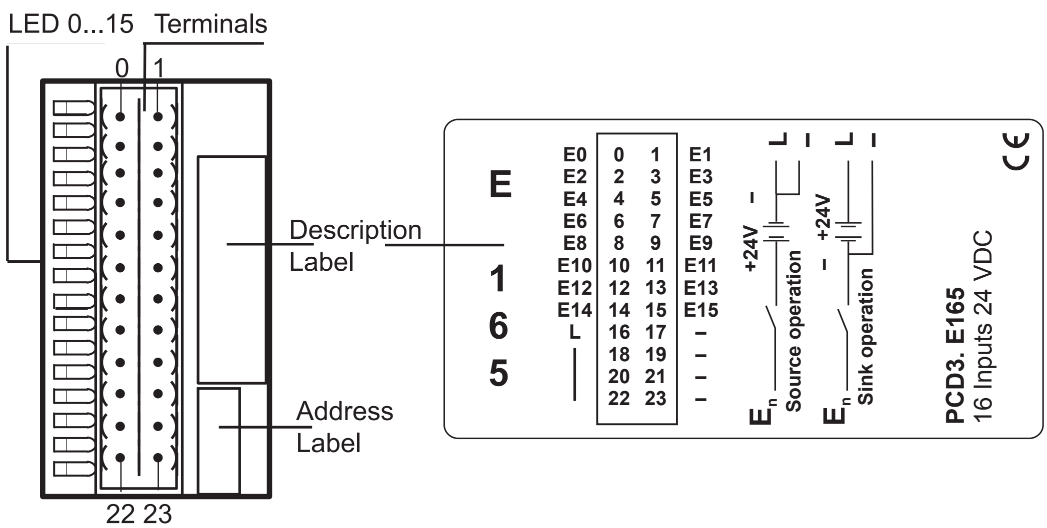
Application

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,

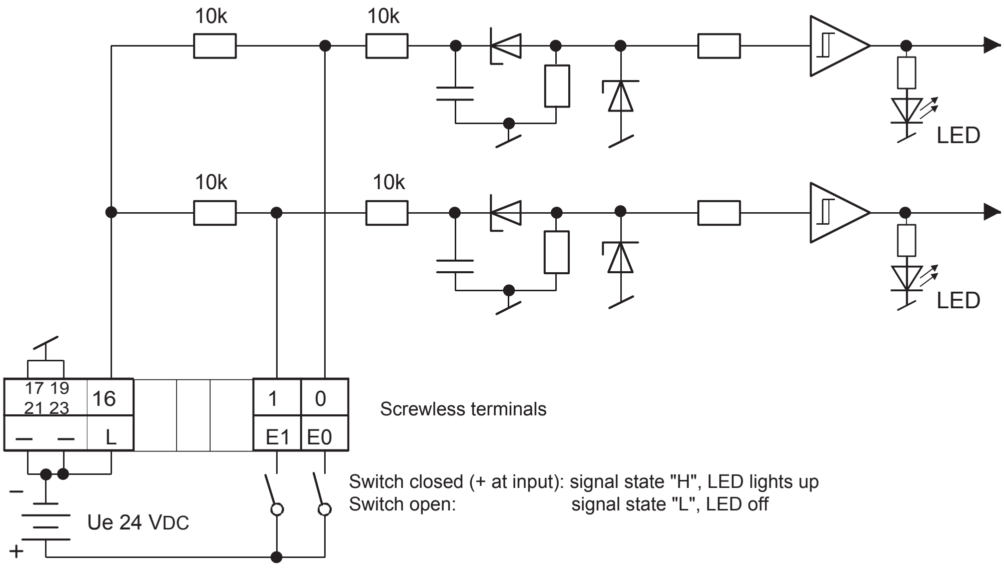
LEDs and connection terminals



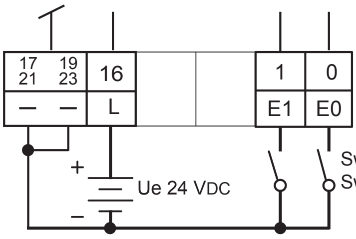
Input circuits and terminal designation

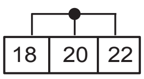
Depending on external wiring, this module may be used for source or sink operation.

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.

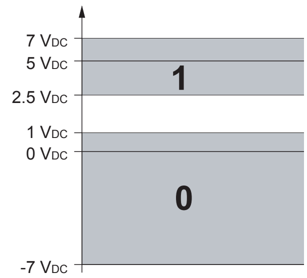
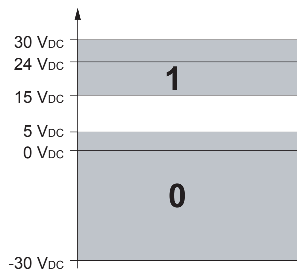
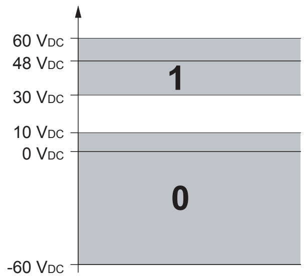
For details, please refer to the section “A4Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

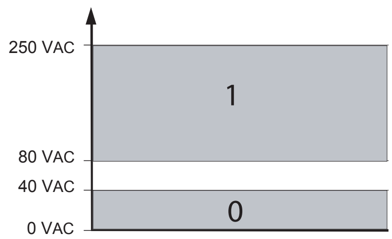
6.3 Digital input modules, electrically isolated from the I/O Bus

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 Saia 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 Saia 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 Saia PCD® and the external +24V are disconnected from the power supply.

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

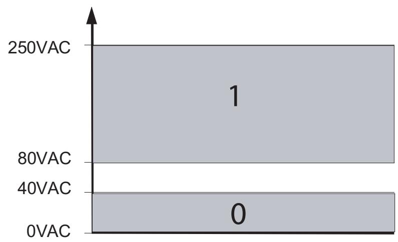
Application

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.

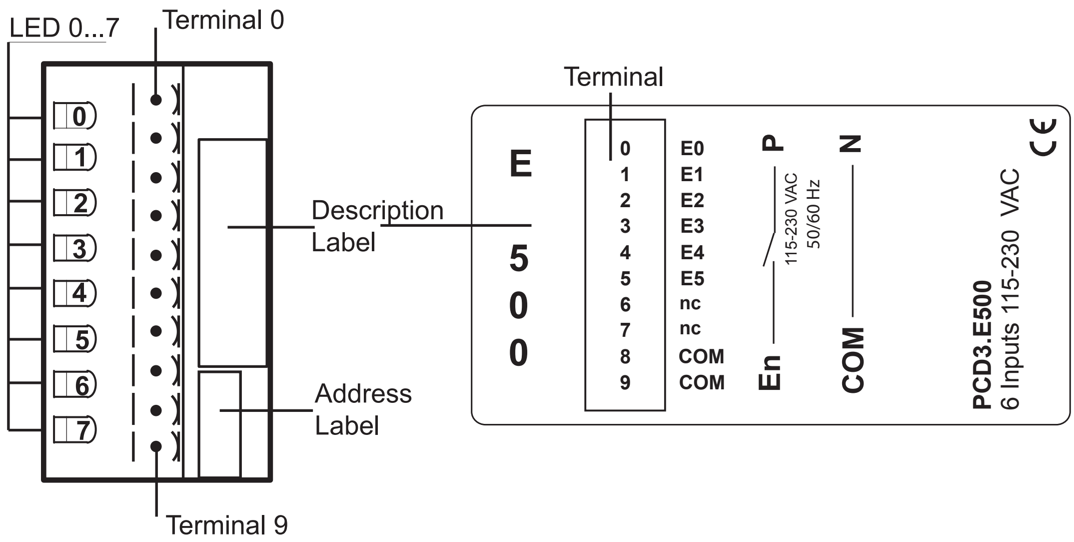
Technical data

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

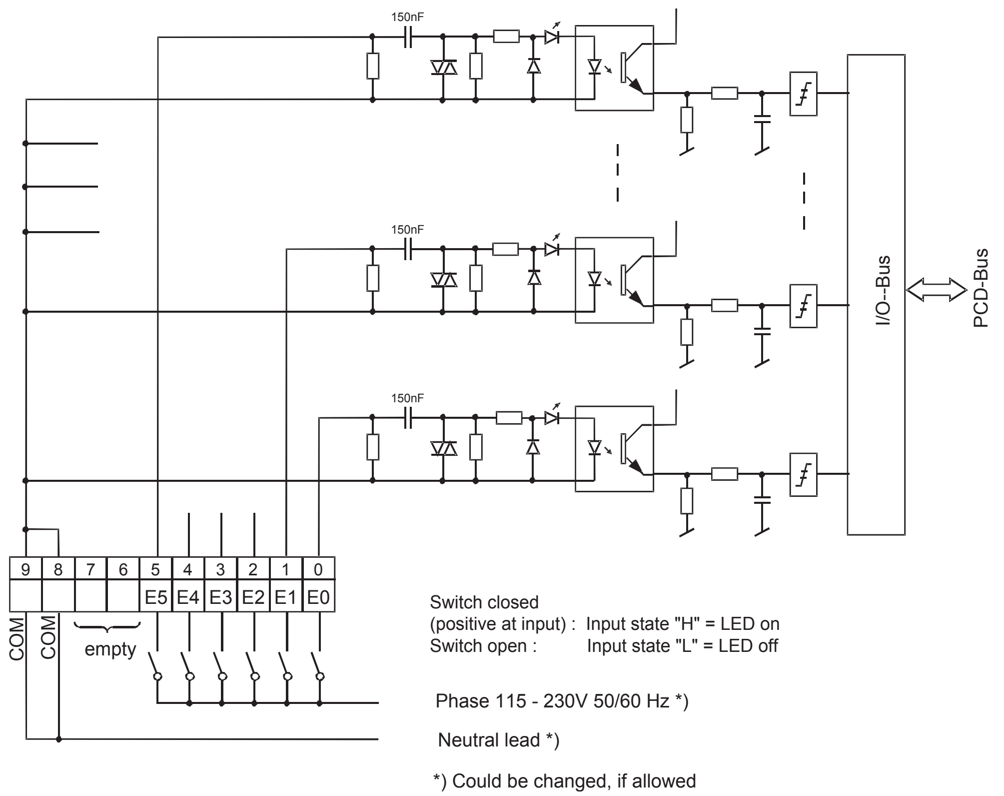
Switch on/off level:



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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD components.

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

Application

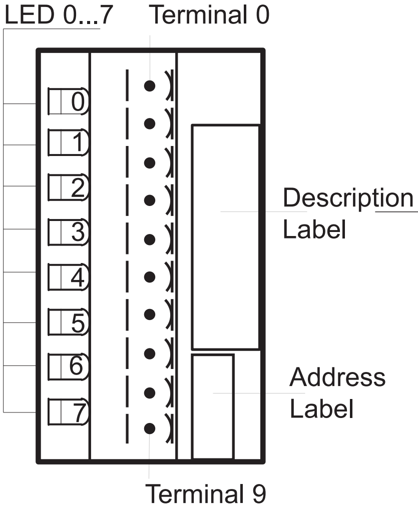
Input module for source or sink operation with 8 inputs, electrically isolated by optocoupler. Suitable for most electronic and electromechanical switching elements at 24 VDC.

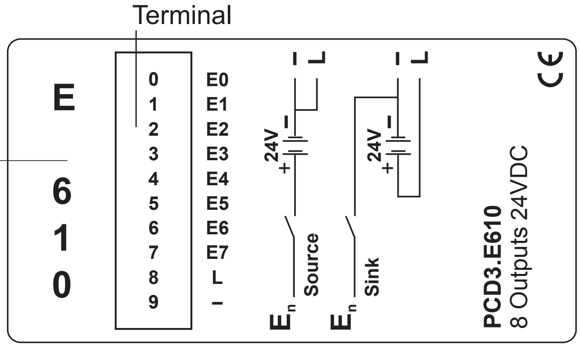
Technical data

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 Saia 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

6

LEDs and connection terminals

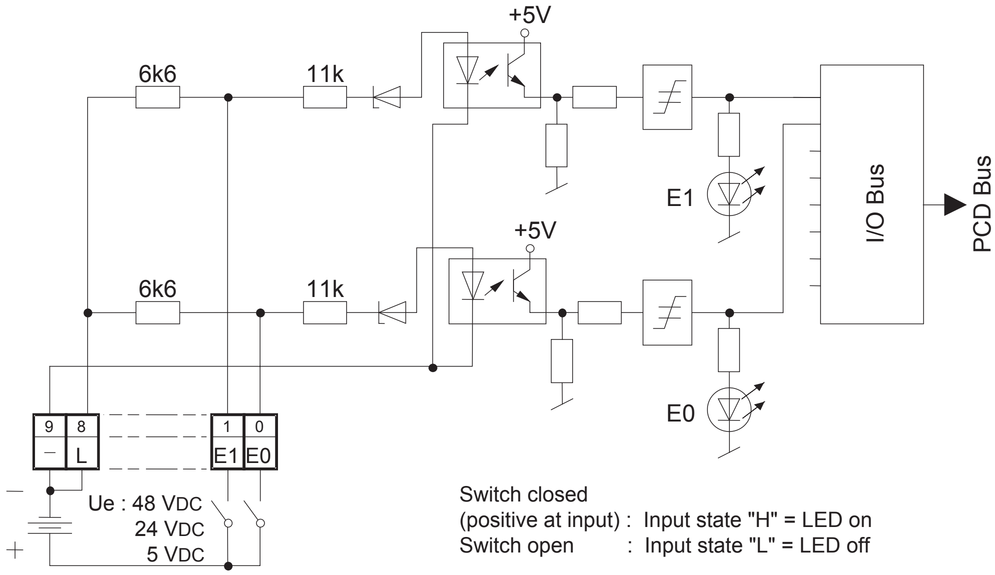




Input circuits and terminal designation

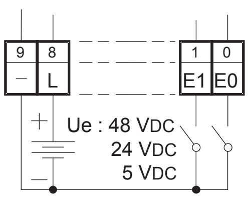
Depending on external wiring, this module may be used for source or sink operation.

Source operation (positive logic):



Switch closed
(positive at input) : Input state "H" = LED on
Switch open : Input state "L" = LED off

Sink operation (negative logic):



Switch closed
(negative at input) : Input state "H" = LED off
Switch open : Input state "L" = LED on

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD 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 Saia PCD® and the external +24V are disconnected from the power supply.

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

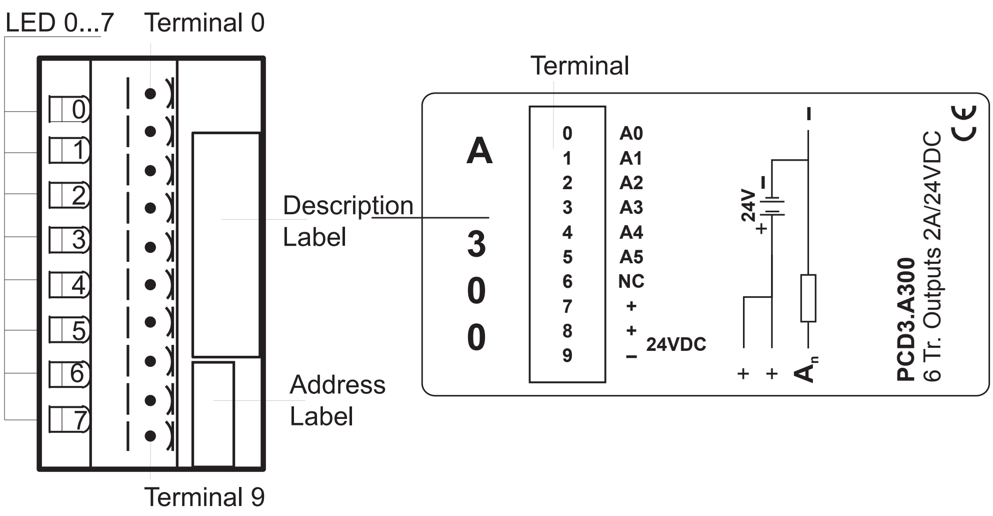
Application

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.

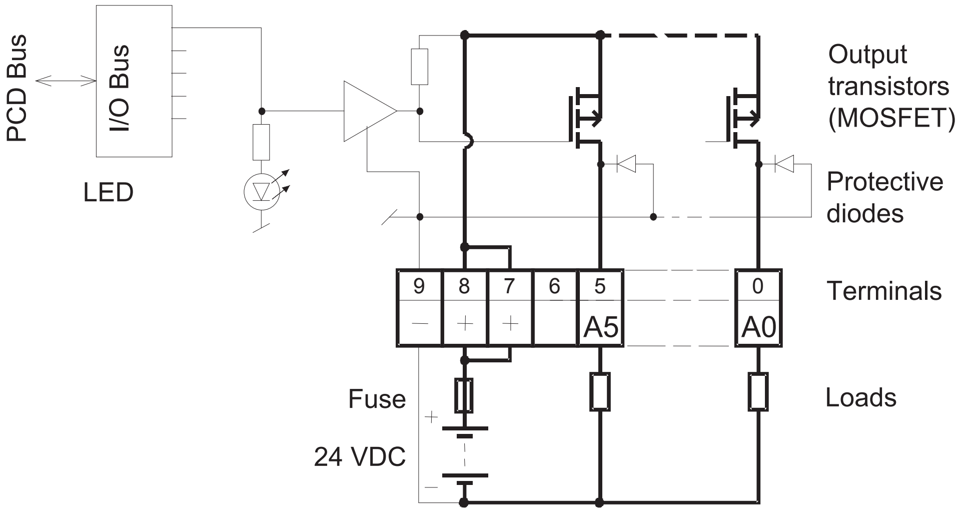
Technical data

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD3 components.

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

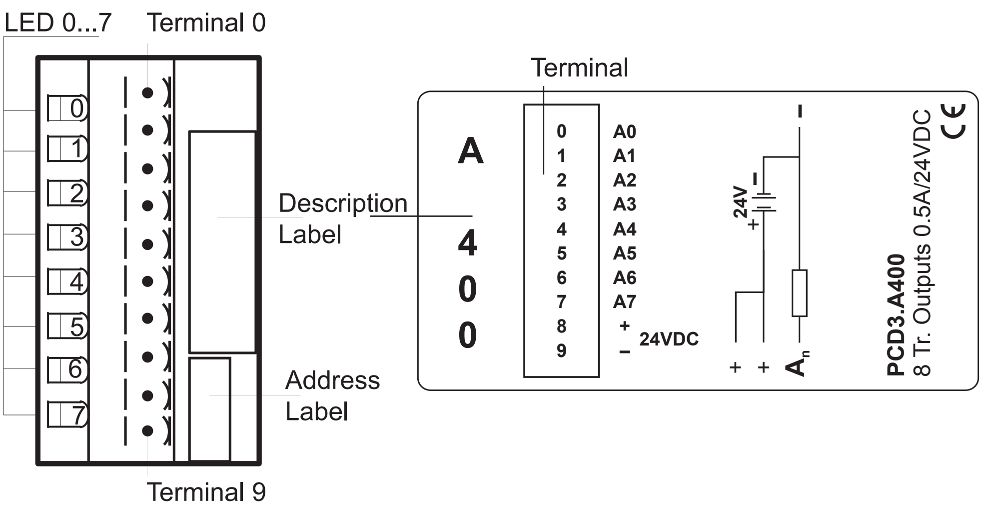
Application

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.

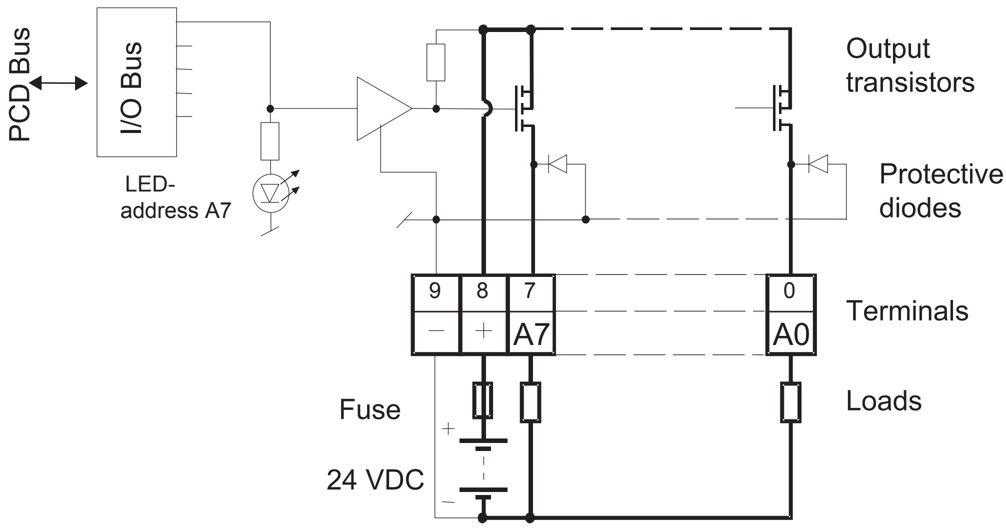
Technical data

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

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

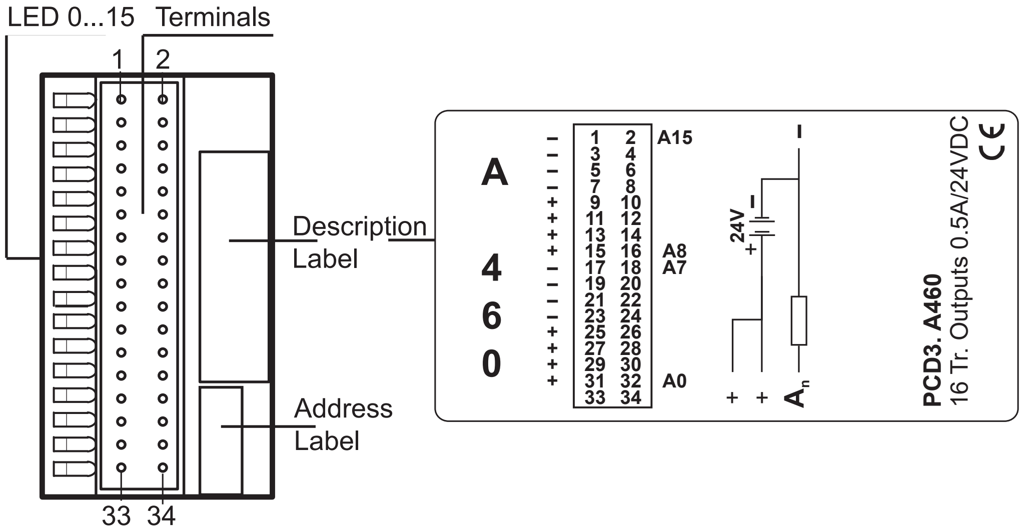
Application

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’:

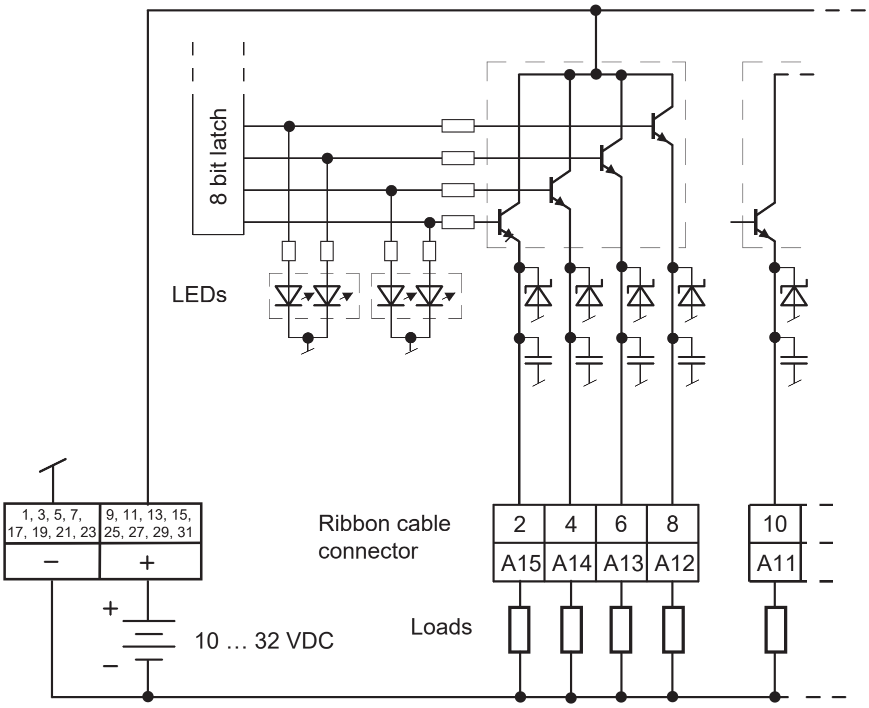
- Socket connector 34-pole — Type 3414-6600
- (Metal strain relief) *) — Type 3448-2034
- (Handle for socket connector 34-pole) *) — Type 3490-3

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

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

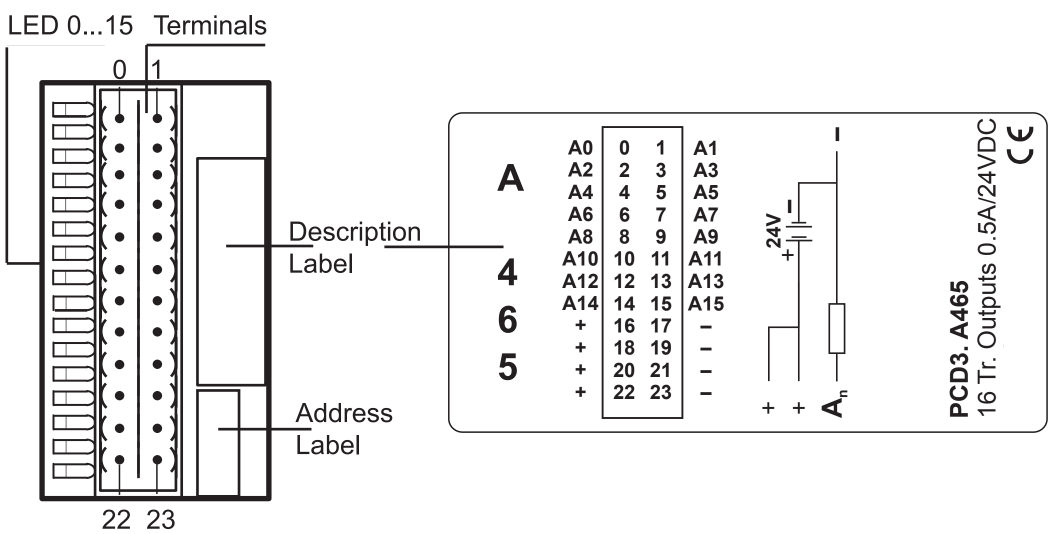
Application

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.

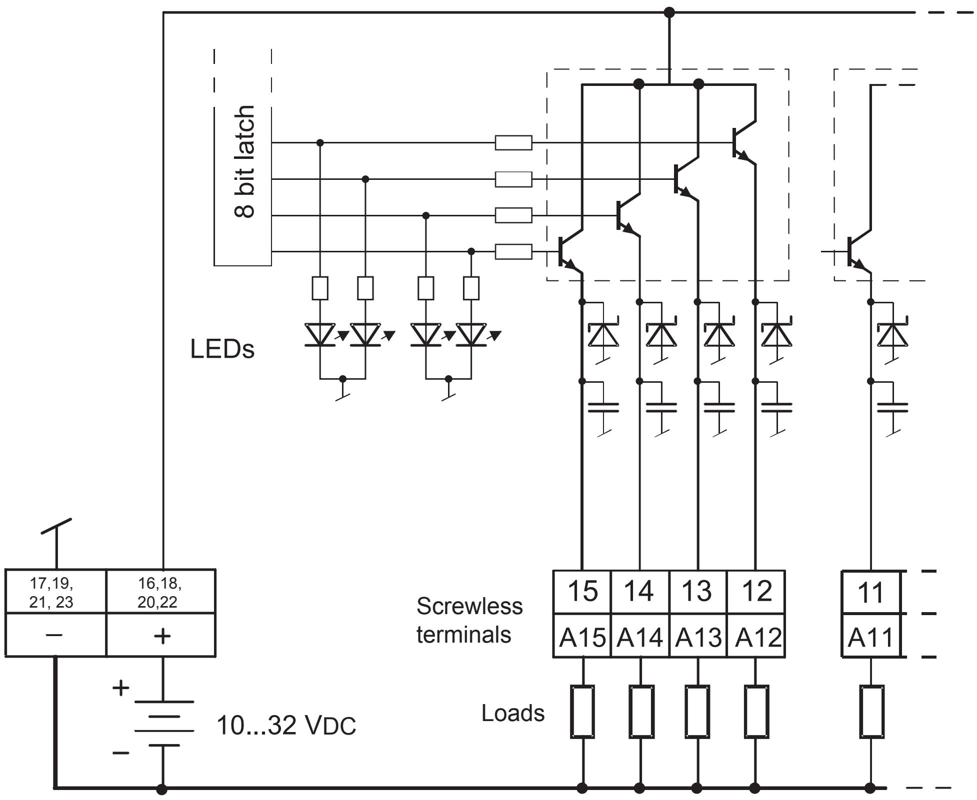
Technical data

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



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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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD 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 Saia 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 Saia PCD® and the external +24V are 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.

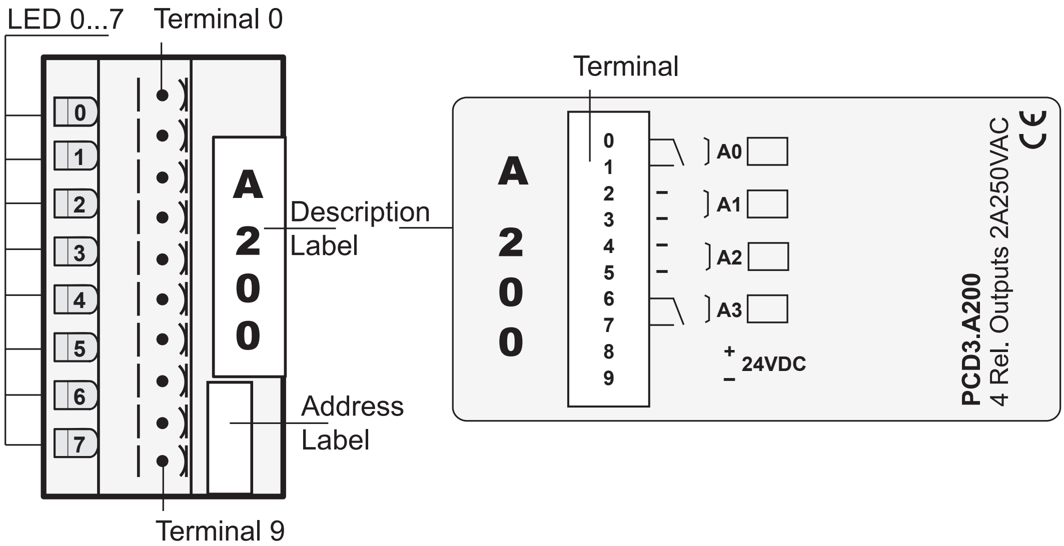
Technical data

Number of outputs:	4, electrically isolated make contacts
Type of relay (typical):	RE 03 0024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 — 0.7 × 10^6 operations 1 A, 250 VAC AC11 — 1.0 × 10^6 operations 2 A, 50 VDC DC11 — 0.3 × 10^6 operations [3] 1 A, 24 VDC DC11 — 0.1 × 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 3) These ratings are not UL-listed	2) With reverse voltage protection

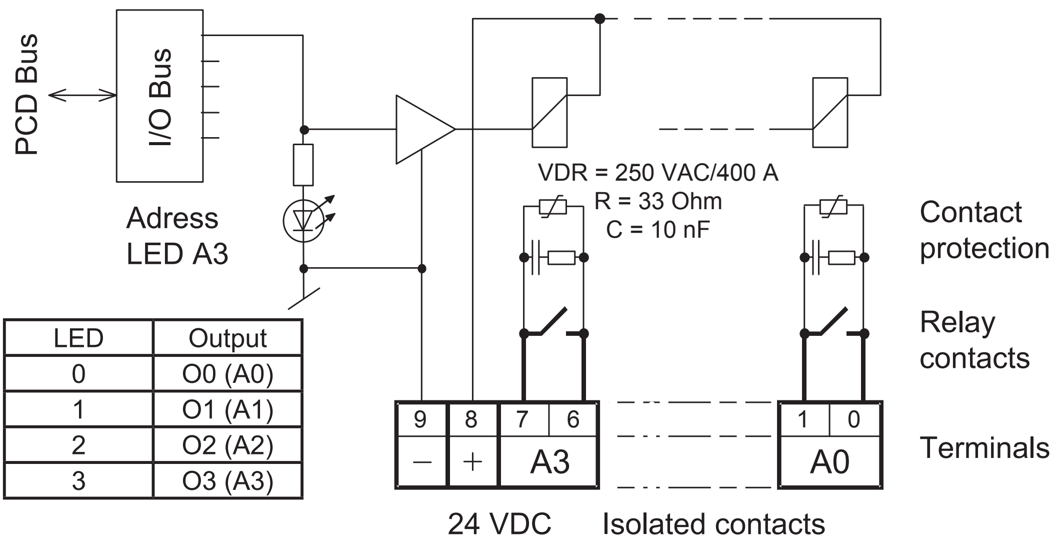
!

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 (A0)
1	O1 (A1)
2	O2 (A2)
3	O3 (A3)

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

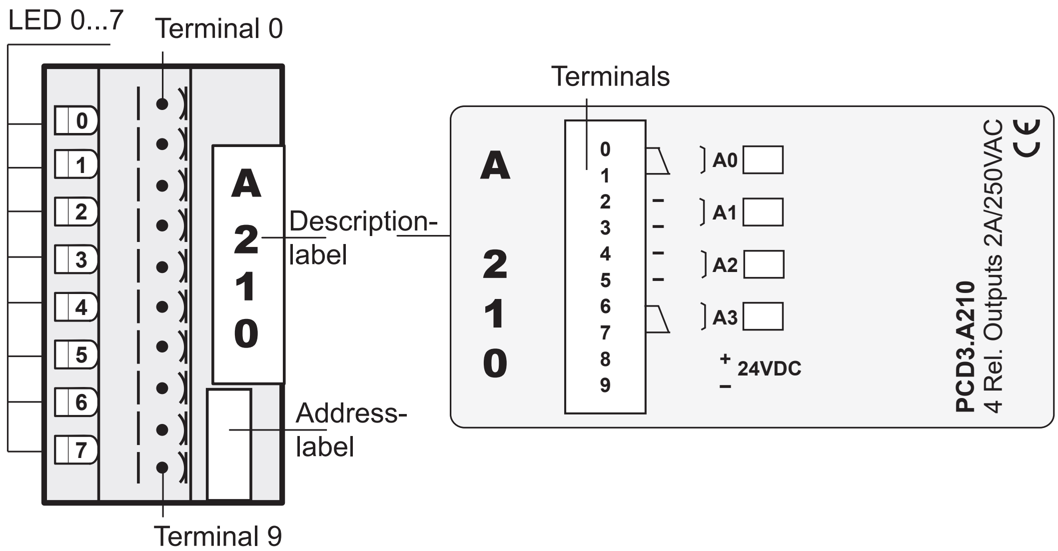
The module contains 4 relays with normally-closed contacts for direct or alternating current up to 2 A, 250 VAC. The contacts are protected by a varistor. The module is especially suited wherever perfectly isolated AC switching circuits with infrequent switching have to be controlled.

Technical data

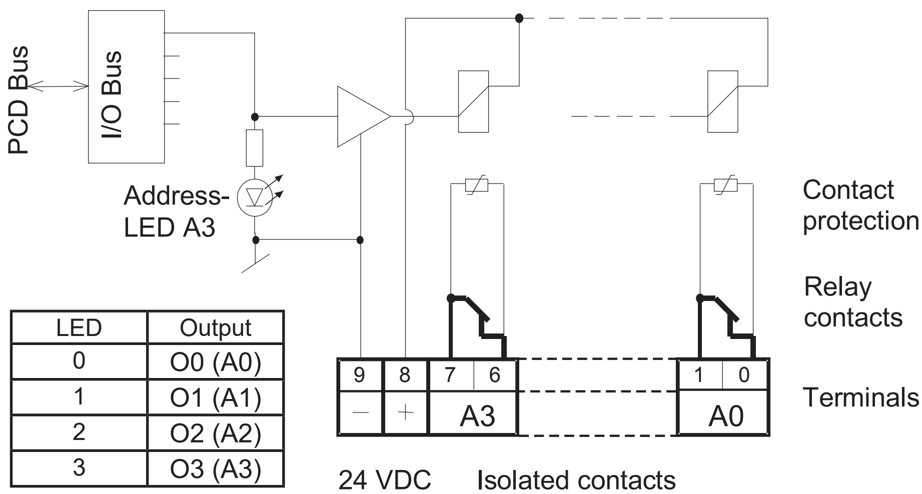
Number of outputs:	4, electrically isolated break contacts
Type of relay (typical):	RE 01 4024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 — 0.7×10^6 operations 1 A, 250 VAC AC11 — 1.0×10^6 operations 2 A, 50 VDC DC11 — 0.3×10^6 operations [3)] 1 A, 24 VDC DC11 — 0.1×10^6 operations [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 [3)] These ratings are not UL-listed	[2)] With reverse voltage protection

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 (A0)
1	O1 (A1)
2	O2 (A2)
3	O3 (A3)

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

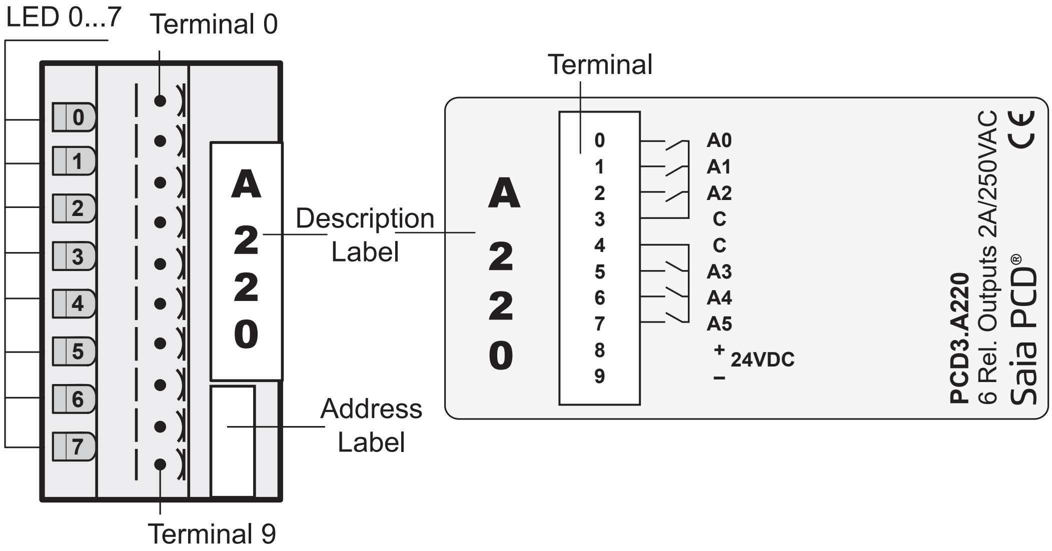
The module contains 6 relays with normally-open contacts for direct or alternating current up to 2 A, 250 VAC. The module is especially suited wherever AC switching circuits with infrequent switching have to be controlled. For space reasons, there is no integrated contact protection. Each group of 3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

Technical data

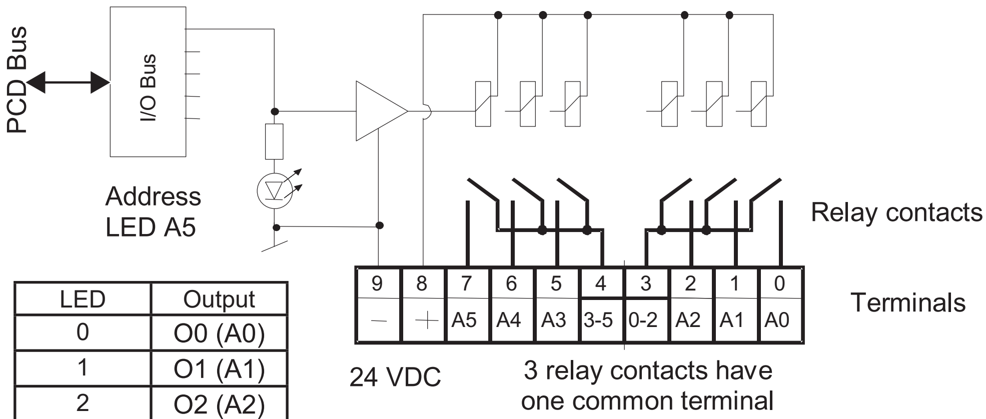
Number of outputs:	3 + 3 make contacts with common terminal
Type of relay (typical):	RE 03 0024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 — 0.7×10^6 operations 1 A, 250 VAC AC11 — 1.0×10^6 operations 2 A, 50 VDC DC11 — 0.3×10^6 operations [3)] 1 A, 24 VDC DC11 — 0.1×10^6 operations [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 [3)] These ratings are not UL-listed	[2)] With reverse voltage protection

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 (A0)
1	O1 (A1)
2	O2 (A2)
3	O3 (A3)
4	O4 (A4)
5	O5 (A6)

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.

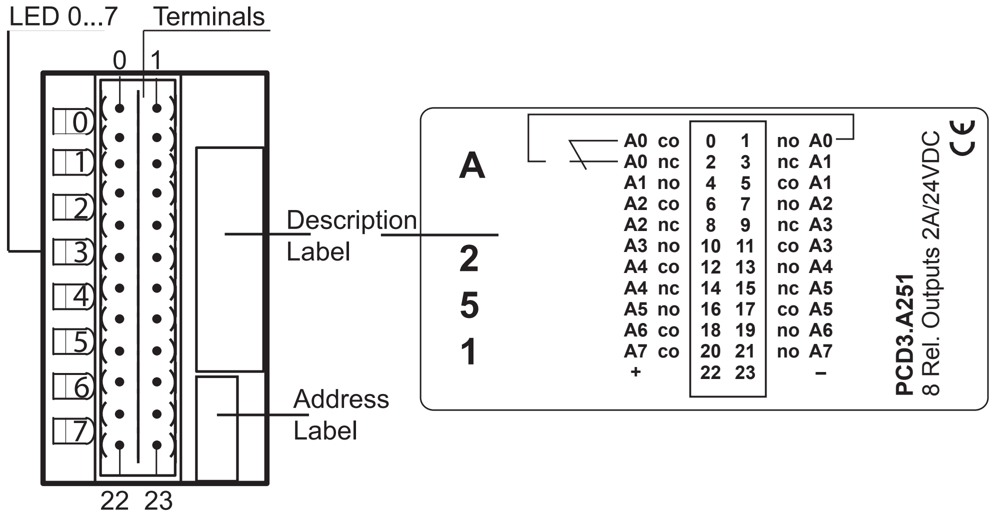
Technical data

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 [3] These ratings are not UL-listed	[2] With reverse voltage protection

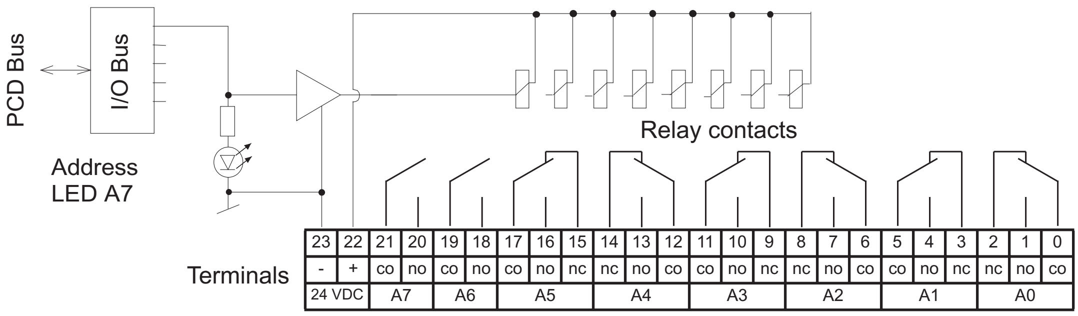
***)** Higher voltages are not allowed for this module because clearances between circuit paths too small.

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

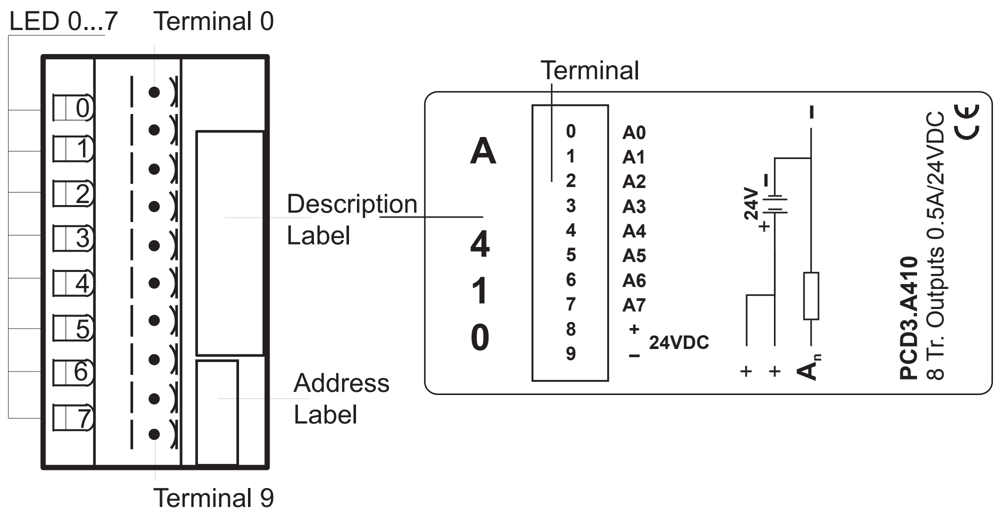
Output module, electrically isolated from the CPU, with 8 MOSFET transistor outputs, without short-circuit protection. Voltage range 5…32 VDC.

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

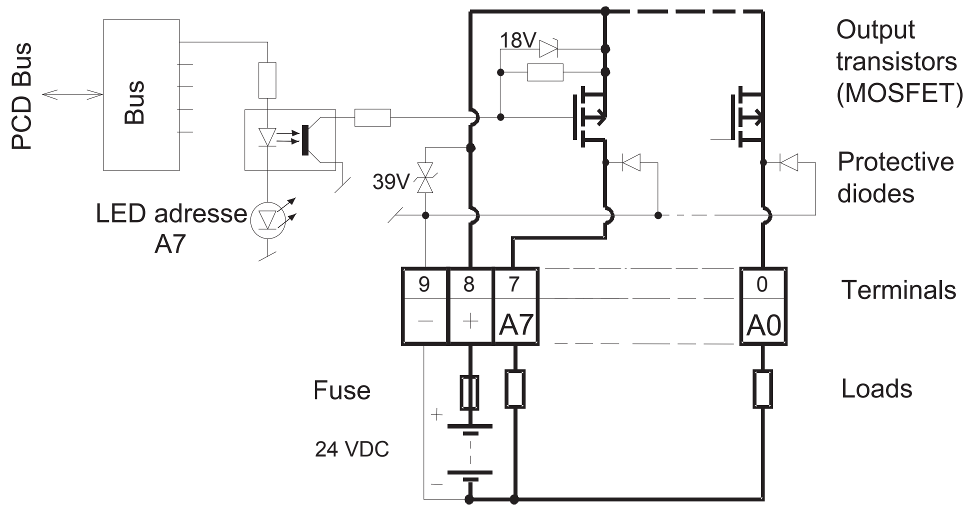
Technical data

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

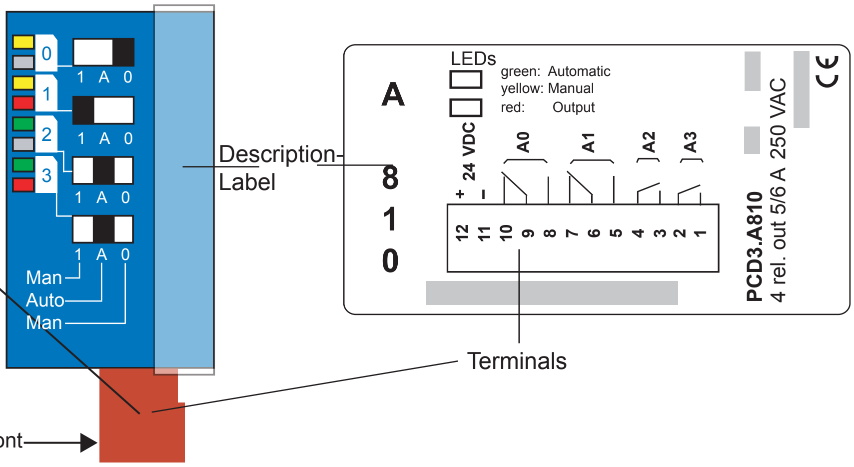
The module has 4 relay outputs: 2 changeover and 2 make contacts. Each channel has a switch with the settings MAN 1, AUTO, MAN 0. On MAN 0, the relay is always switched off; on MAN 1 it is always switched on; on AUTO the switch state is defined by the application program. This is not an emergency module that will work even when the Saia 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 3.20).

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 2 A, 250 VAC AC15 cosφ=0.3	1.5×10^5 operations 1.2×10^5 operations
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 2 A, 250 VAC AC11	1×10^5 operations 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) Up to and with HW version: B From HW version: C	 max. 45 mA max. 55 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 Saia PCD® side. General technical specifications as per CL-EPC-015 Rev. 02		

LEDs and connection terminals

12	24V
11	GND
10	A0 nc
9	A0 co
8	A0 no
7	A1 nc
6	A1 co
5	A1 no
4	A2 co
3	A2 no
2	A3 co
1	A3 no



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.

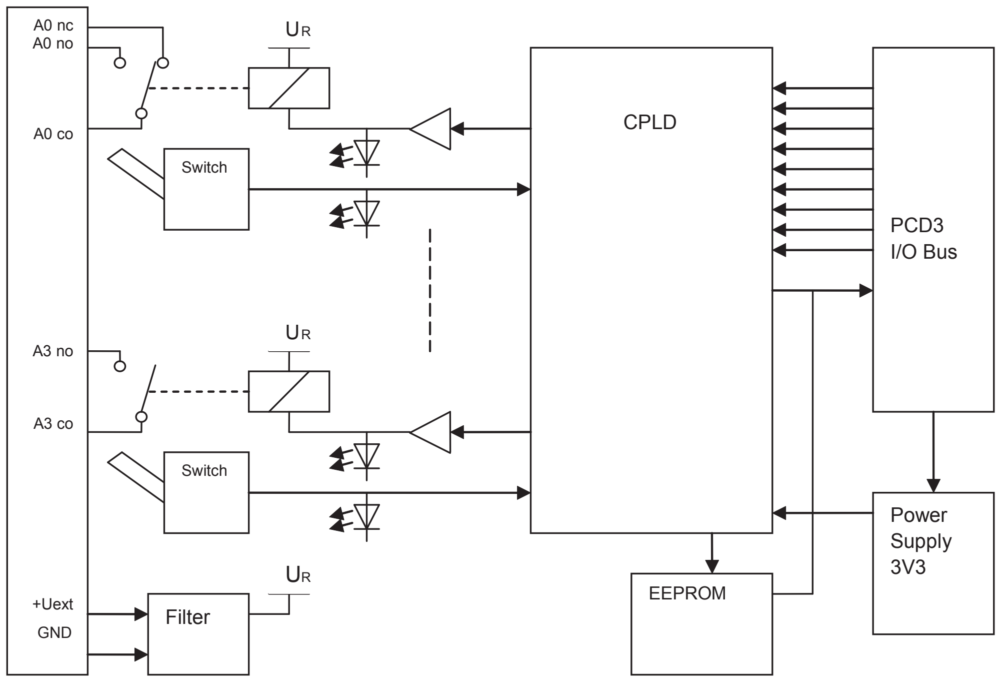
Example (above):

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 Saia PCD® where the electrical supply is not present.

6

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 RJ-45 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 RS-232 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

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

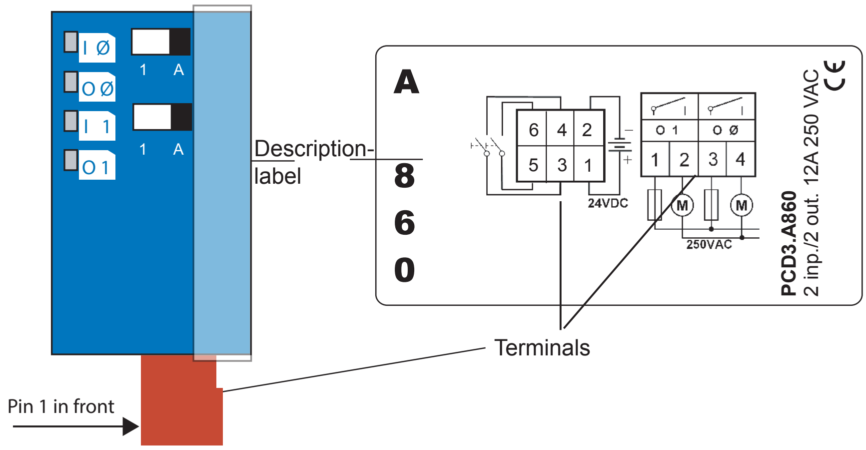
Application

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



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***:

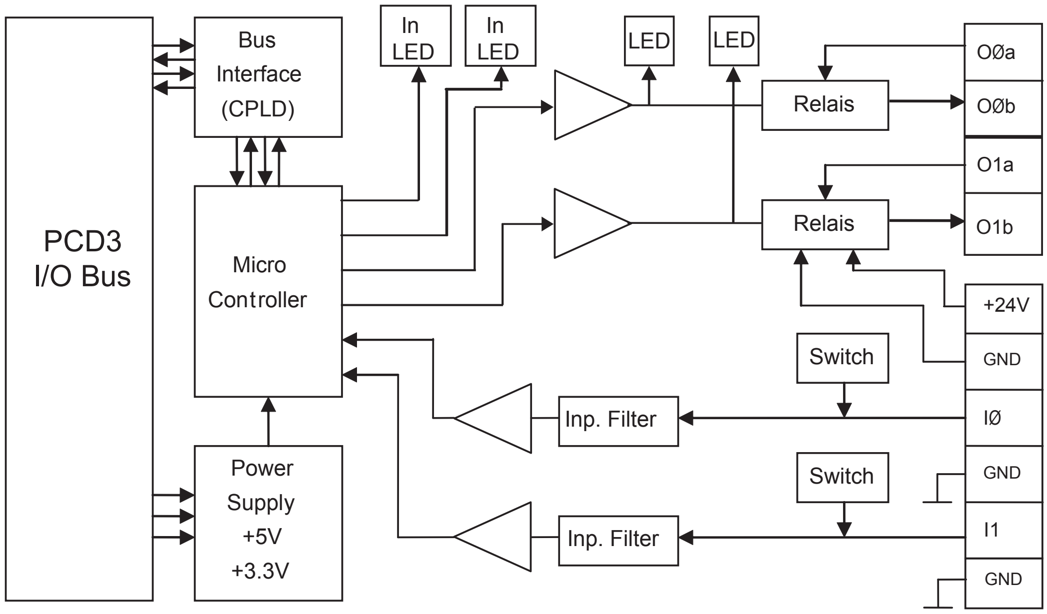
O Ø	Skylight 0 / blind motor up
O 1	Skylight 1 / blind motor down

- ***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



6

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.

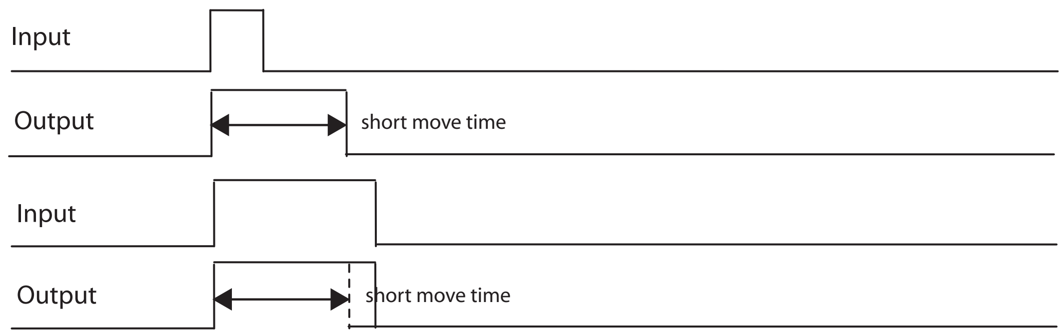
The two outputs are interlocked, so both outputs cannot be activated together. For the correct operation of shade control, the only input information should be from sensors.

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 Saia 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.

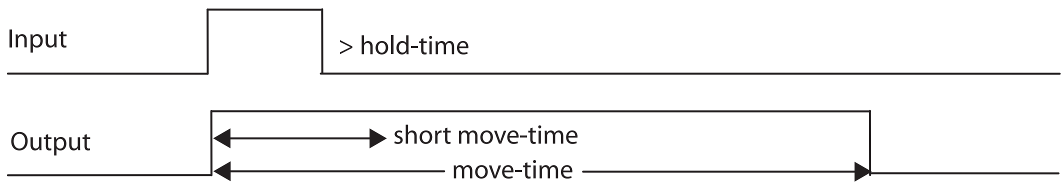
During a short move, the relay cannot be interrupted by any further input or key activation on the module.



Shade function, hold function

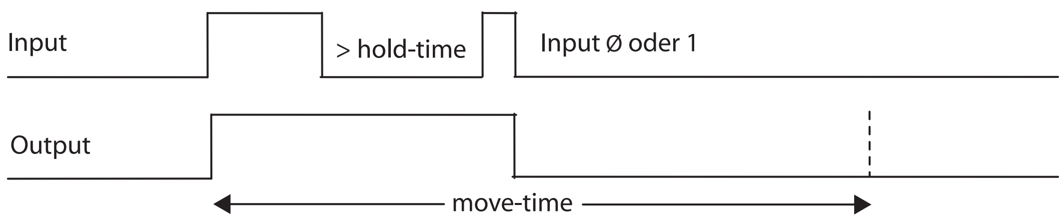
If a key (or Input 0 / Input 1) is activated for longer than the defined "hold time", the module will switch to hold operation. The smallest value that can be set for the hold time is 1 (1/10 second), i.e. the module will switch directly into hold mode.

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 Saia 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 RS-232 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.

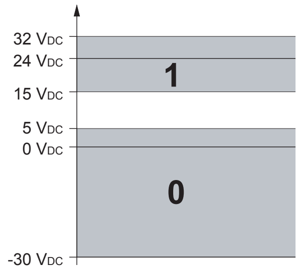
PCD3.K106/116 cable, hardware version B, with 90° angled connector

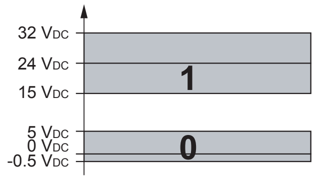
6.7 Digital combined input/output modules

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 Saia PCD® and the external +24V are 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)	

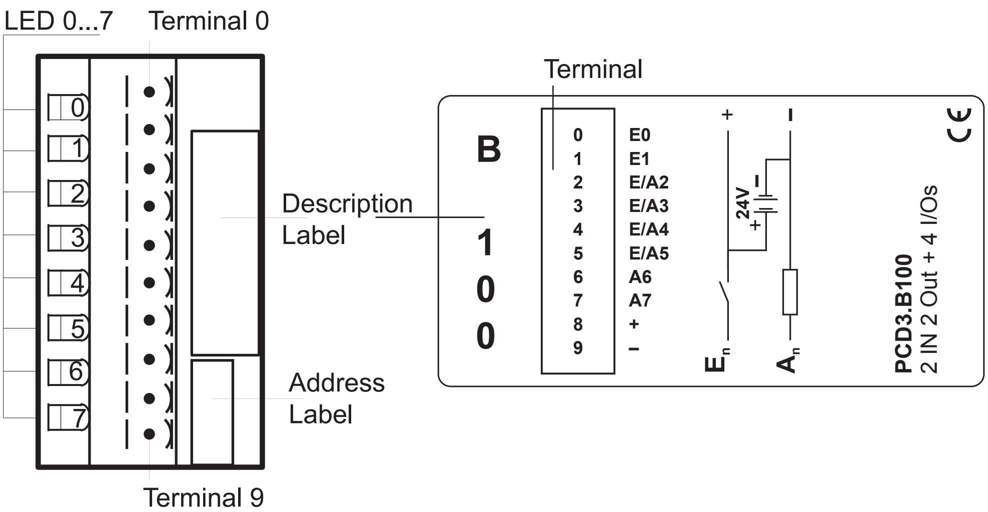
Technical data on outputs

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

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:

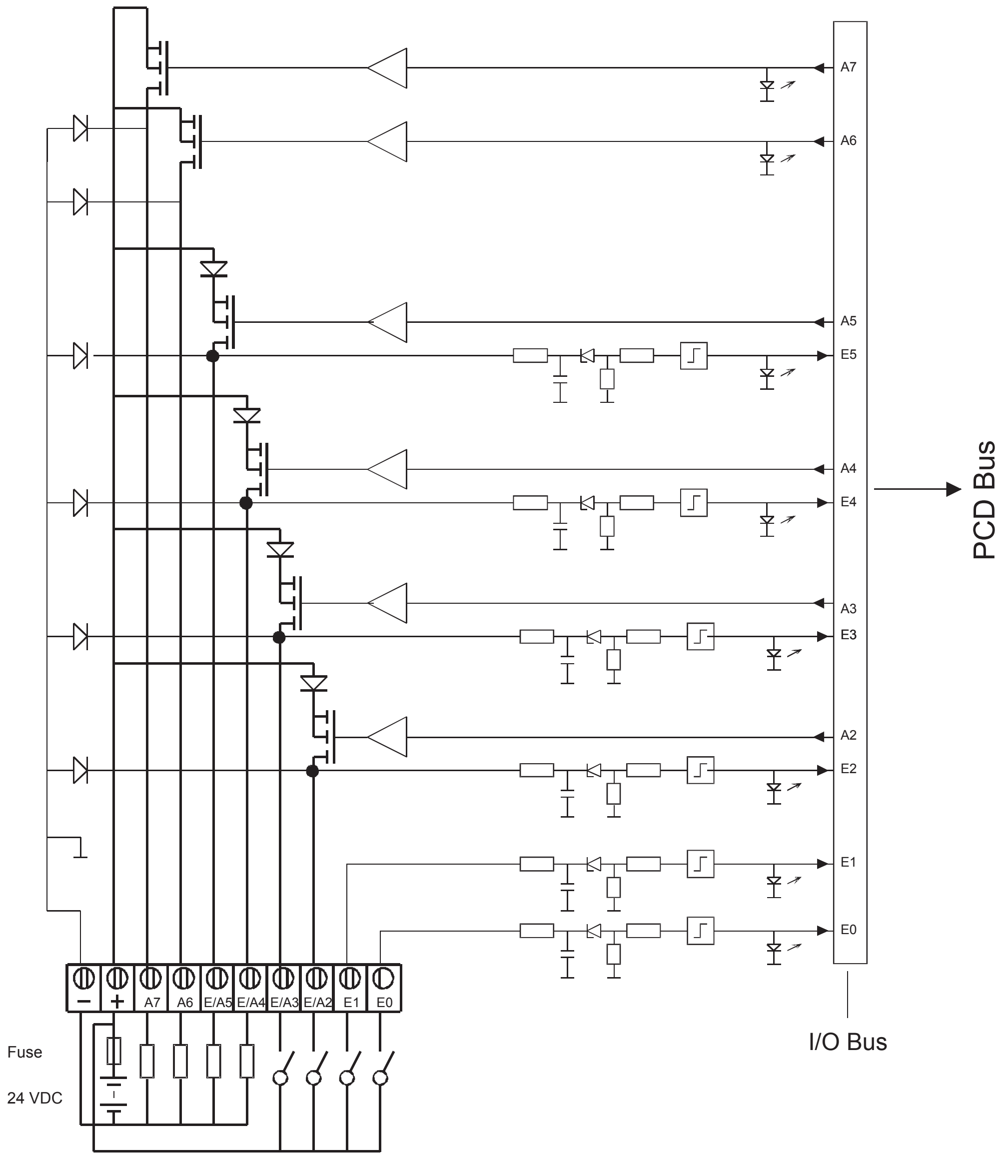
- 2 LEDs are directly triggered by the pure inputs.
- 2 LEDs are directly triggered by the pure outputs.
- 4 LEDs are triggered by the inputs of the combined inputs/outputs and therefore always indicate voltage status at the I/O terminal.

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…10 V**
PCD3.W210	**8 analogue inputs 10 bit, 0…20 mA**
PCD3.W220	**8 analogue inputs 10 bit, Pt/Ni1000**
PCD3.W300	**8 analogue inputs 12 bit, 0…10 V**
PCD3.W310	**8 analogue inputs 12 bit, 0…20 mA**
PCD3.W340	**8 analogue inputs 12 bit, 0…10 V, 0…20 mA, 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 Saia PCD® and the external +24V are 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

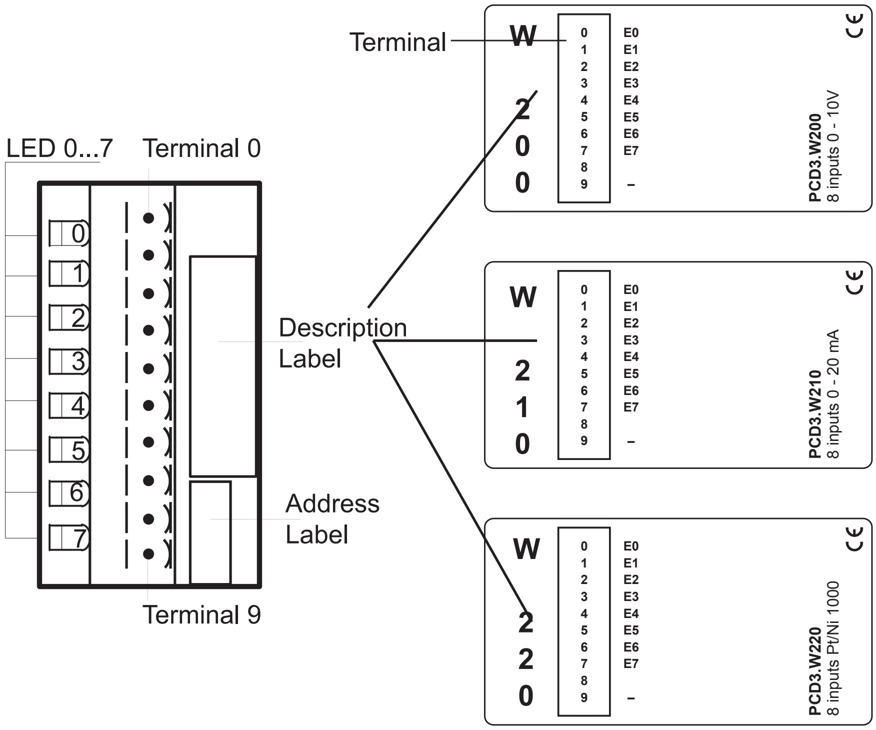
PCD3.W200	8 channels for signals 0…0.10 V
PCD3.W210	8 channels for signals 0…20 mA
PCD3.W220	8 channels for resistive temperature sensors Pt/Ni1000
PCD3.W220Z03	8 channels for NTC10 temperature sensors
PCD3.W220Z12	4 channels for signals 0…10 V 4 channels for resistive temperature sensors Pt/Ni1000

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.

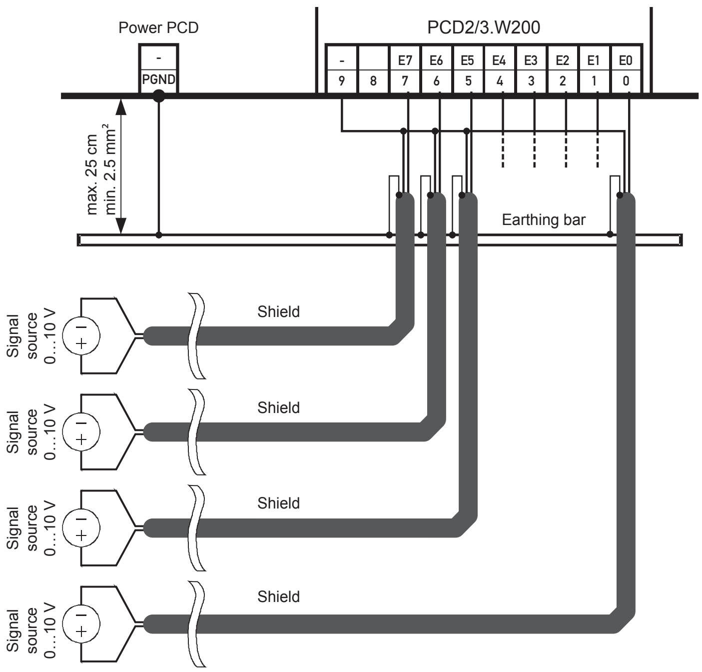
LEDs and connection terminals



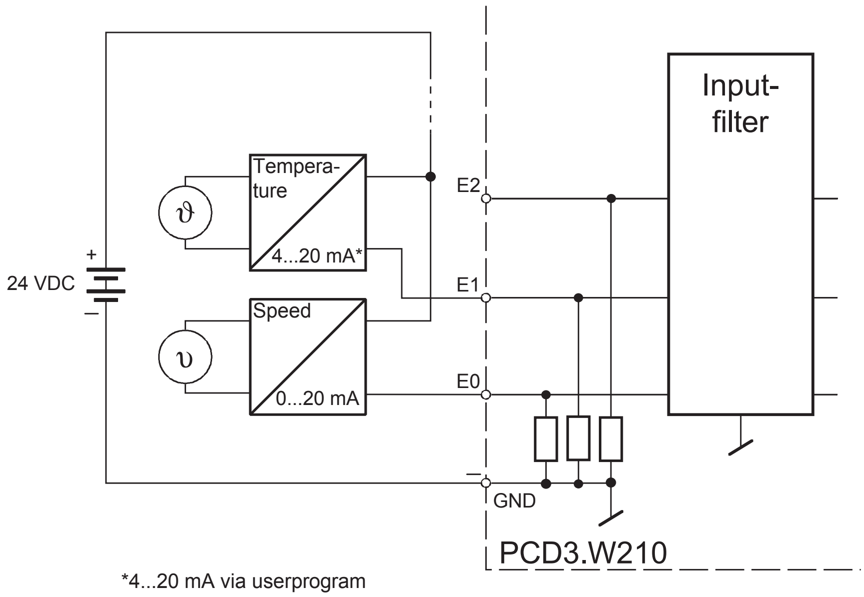
Digital/analogue values

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

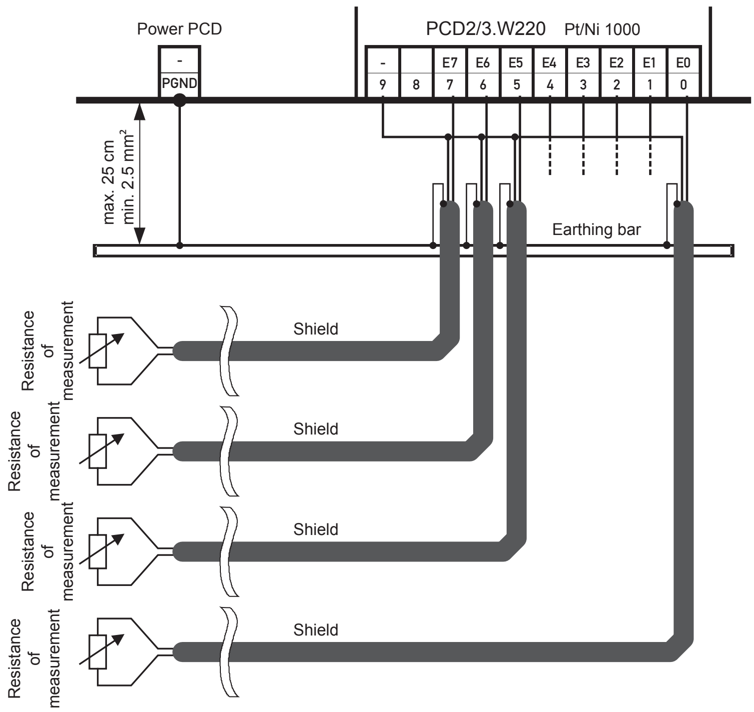


Connection concept for two-wire transducers

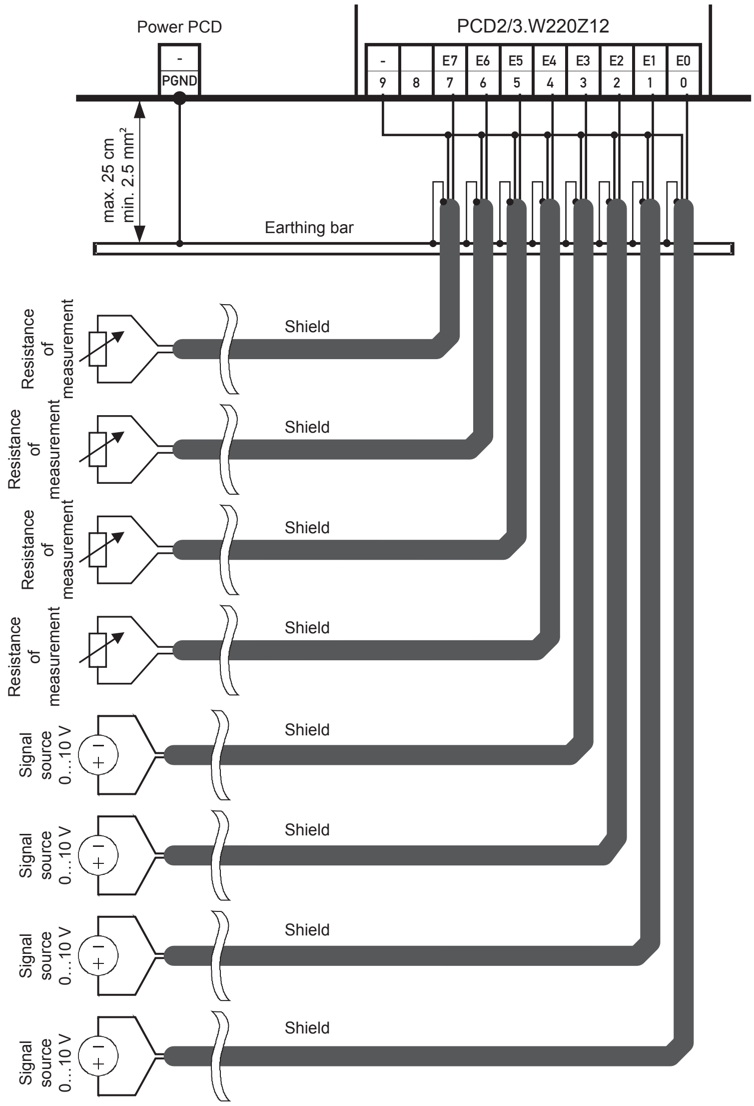


Two-wire transducers (0…20 mA and 4…20 mA transmitters) need a 24 VDC supply in the measuring trunk.

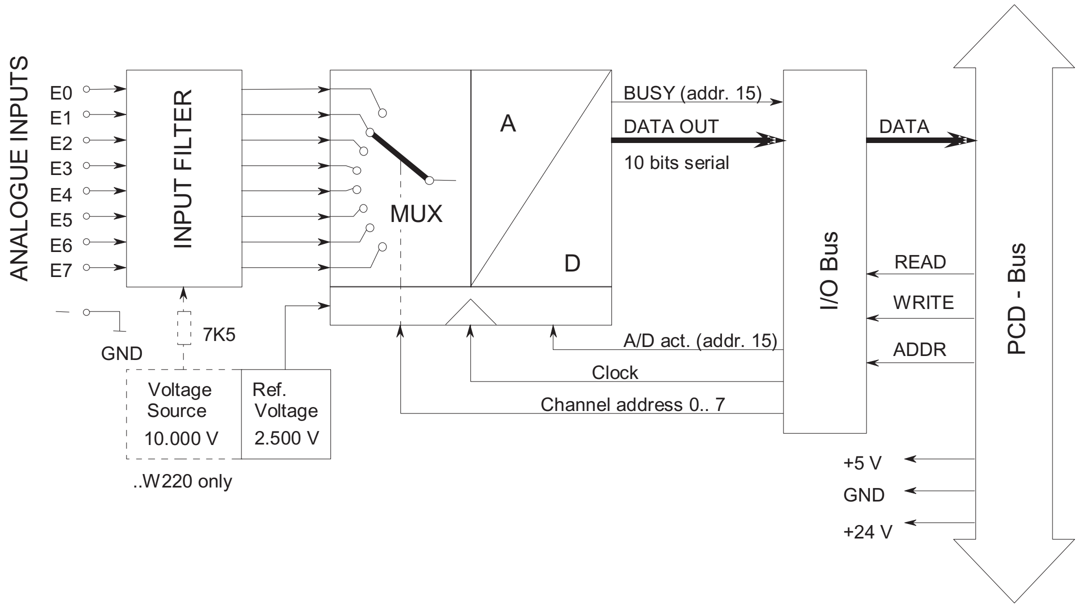
Connection concept PCD3.W220 Pt1000 / Ni1000
Connection concept PCD3.W220Z02 NTC10



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.com.

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

Temperature measurement with Pt1000

In the temperature range –50° to + 400°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)

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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 $0 \leq DV \leq 1023$ 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…10 V, current 0…20 mA and the use of different resistance thermometers are available.

Module overview **resolution *)**

PCD3.W300:	Voltage 0…10 V	2,442 mV
PCD3.W310:	Current 0…0.20 mA	4,884 µA
PCD3.W340:	General purpose module	
	0…10 V	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 .	0.09…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		

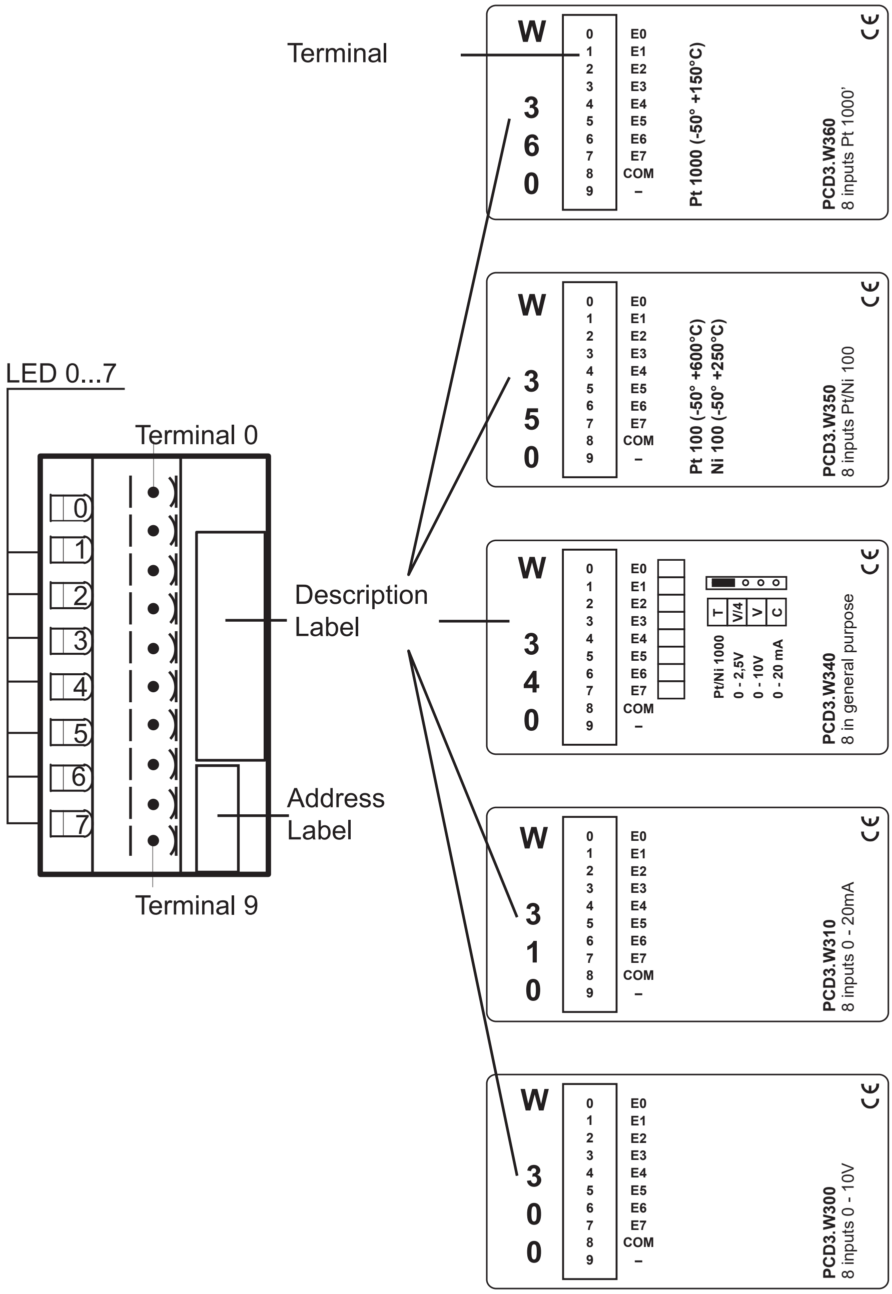
*) Resolution = value of least significant bit(LSB)

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, W310: ± 0.5% W340, W350, W360: ± 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, W310 < 5 mA W340, W360 < 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.	

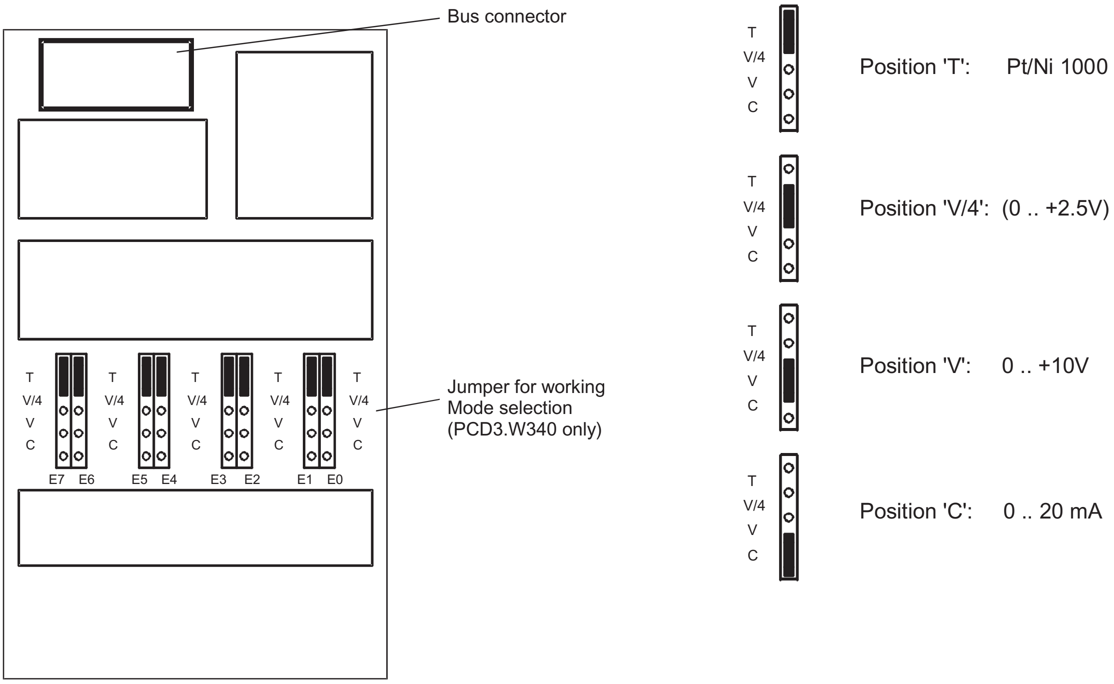
LEDs and connection terminals



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)



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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'.

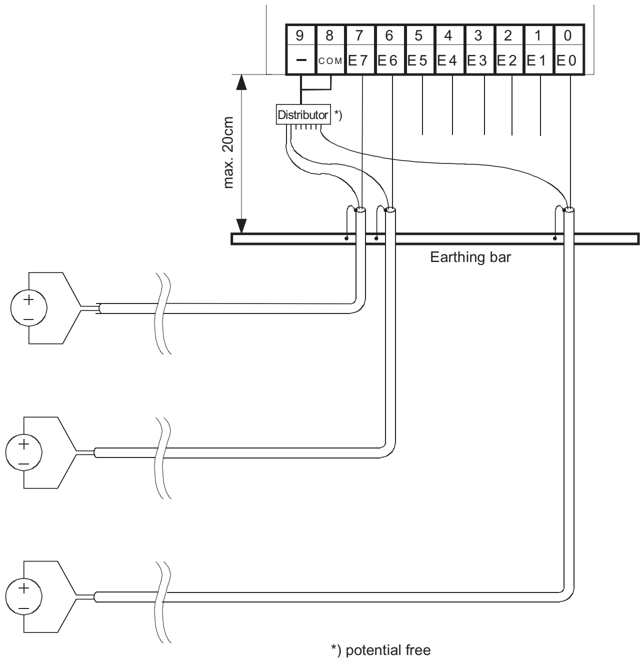
Changing the jumpers

On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, "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

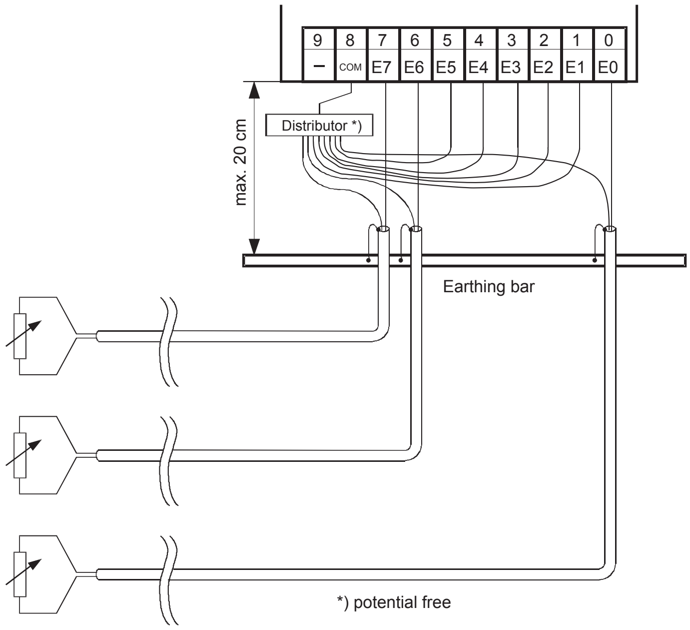


- The reference potentials of signal sources should be wired to a common GND connection (“–” and “COM” terminals). To obtain optimum measurement results, any connection to an earthing bar should be avoided.
- If screened cables are used, screening should be continued to an external earthing bar.

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.



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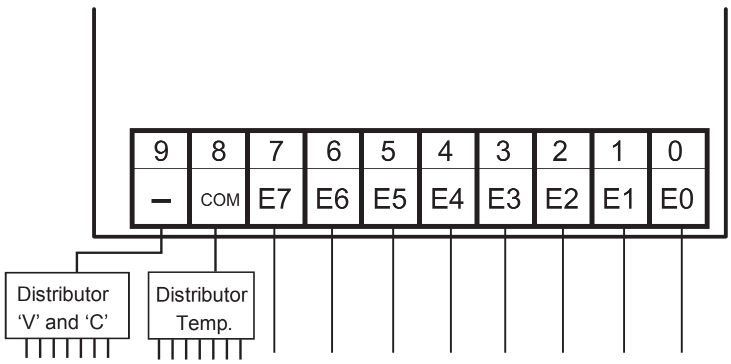
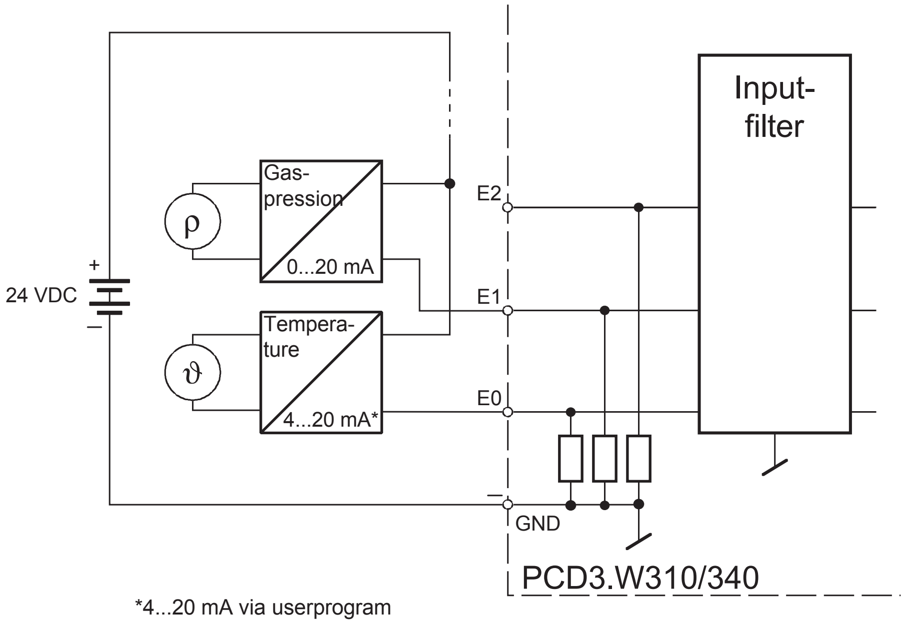
- The reference potential for temperature measurements is the “COM” terminal, which should not have any external earth or GND connection
- If screened cables are used, screening should be continued to an external earthing bar
- Unused temperature inputs are to be connected to the "COM"

Mixed operation

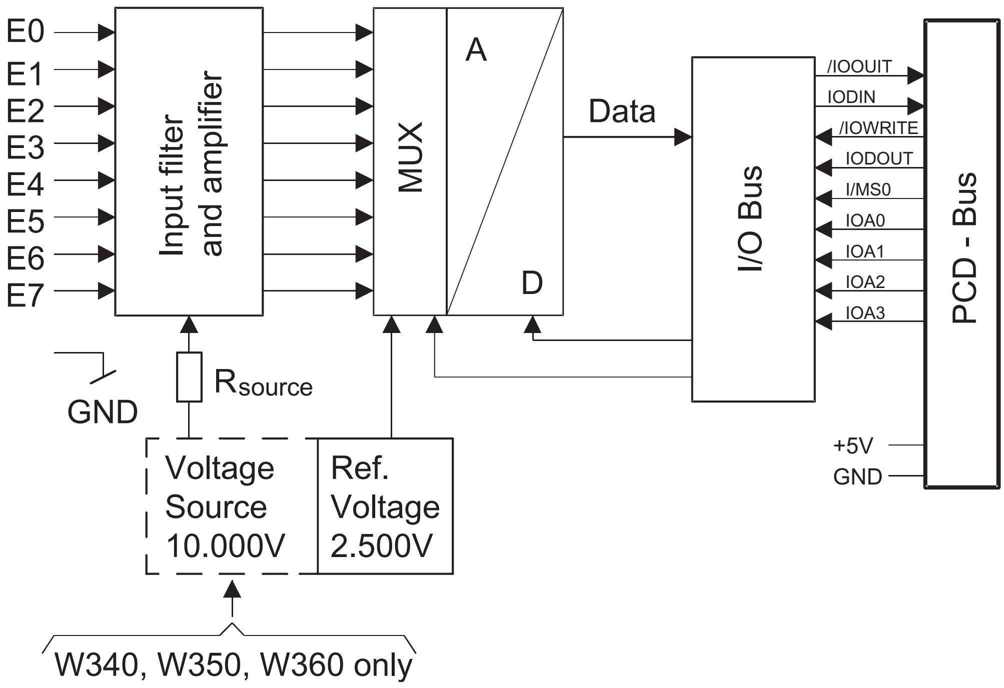


Connection concept for two-wire transducers



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

Block diagram



Programming

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

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

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

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

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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 Saia PCD®, channels themselves not separated

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

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

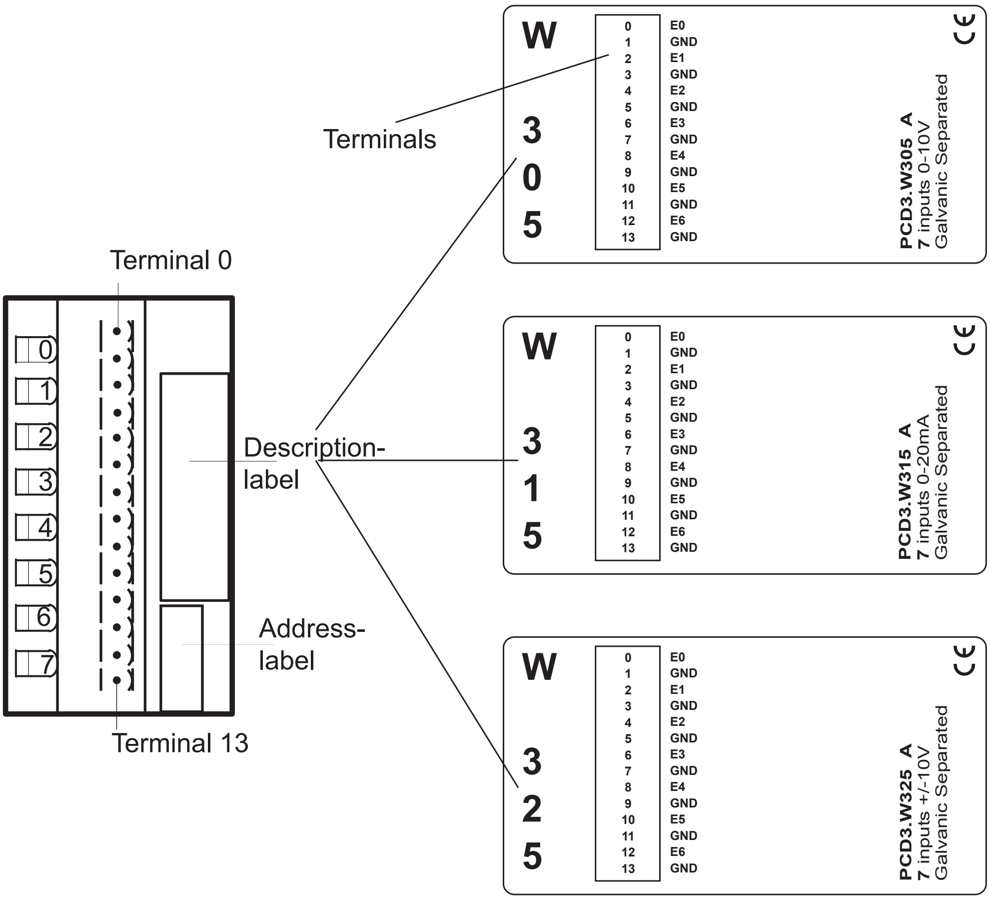
*) Resolution = value of least significant bit(LSB)

6

Technical data

Input ranges:	see module overview
Galvanic separation:	500 V, electrical isolation of outputs to Saia 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



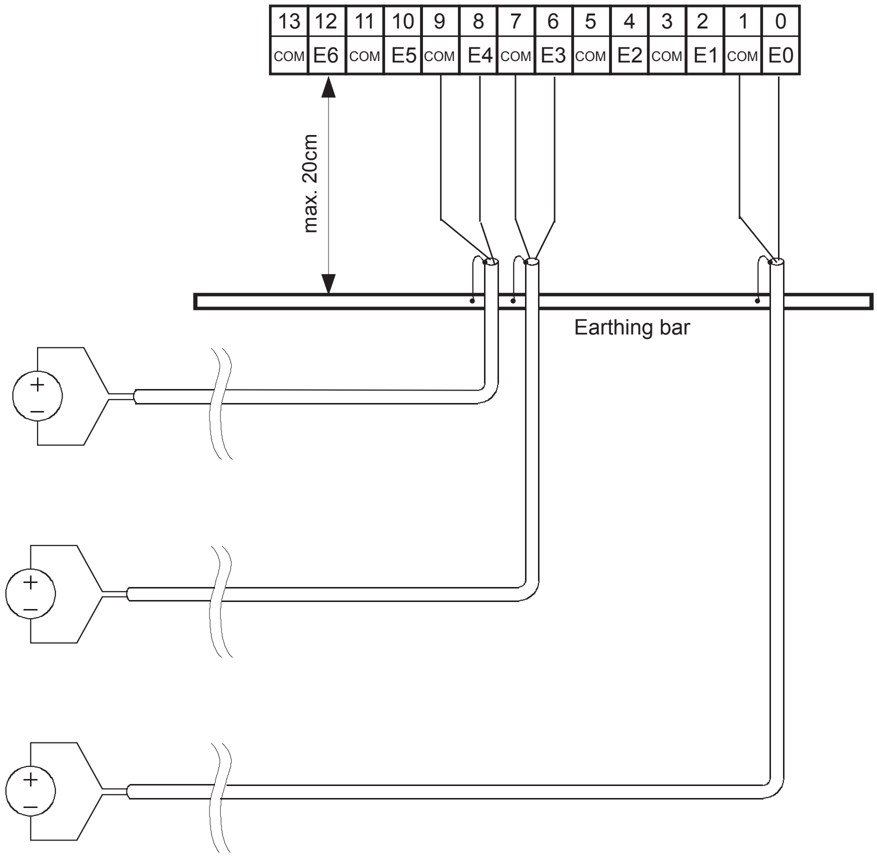
Digital/analogue values

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

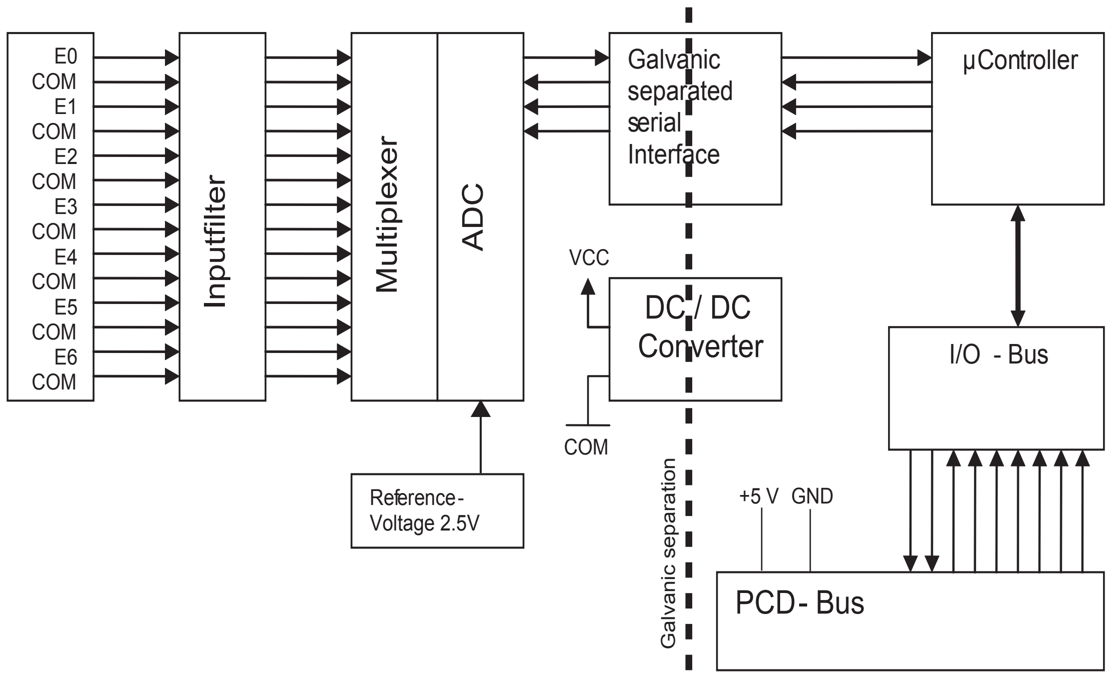
Connection concept for voltage and current inputs

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

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

xx7 and RIOs: the firmware reads in the values according to the configuration (I/O Builder 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 *)**

*) jumper selectable

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

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

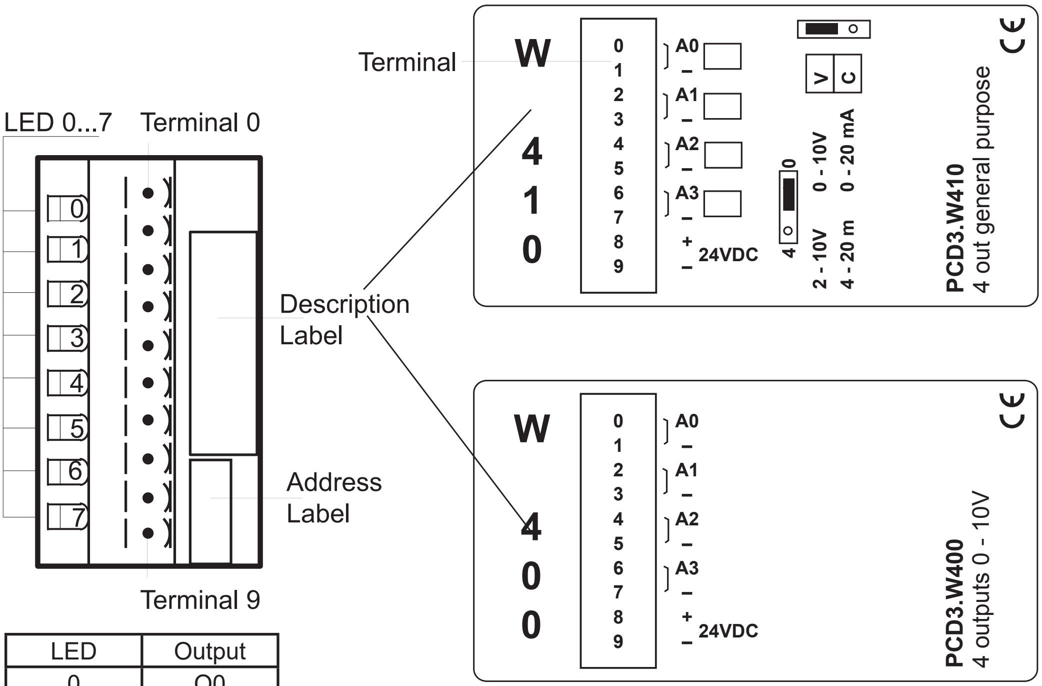
PCD3.W410: General purpose module with 4 output channels of 8 bits each. Signals can be selected from 0…10 V, 0…20 mA or 4…20 mA.

6

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
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. 0.2% (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
*) Factory setting	

LEDs and connection terminals



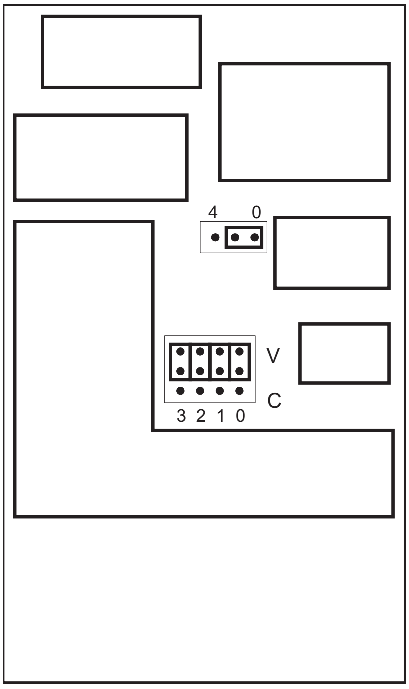
LED	Output
0	O0
1	O1
2	O2
3	O3

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			
255 128 0	255 128 0	27648 13842 0	10.0 V 5.0 V*) 0	20 mA 10 mA*) 0	20 mA 12 mA*) 4 mA

*) The exact values are 1/255 higher

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



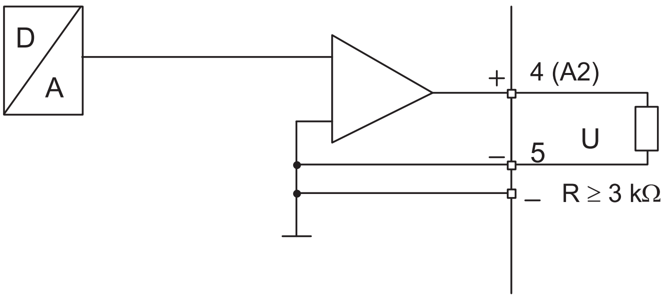
Offset jumper J1 (PCD3.W410 only)
Position “0”: 0… 10 V or 0… 20 mA
Position “4”: 2… 10 V or 4… 20 mA

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

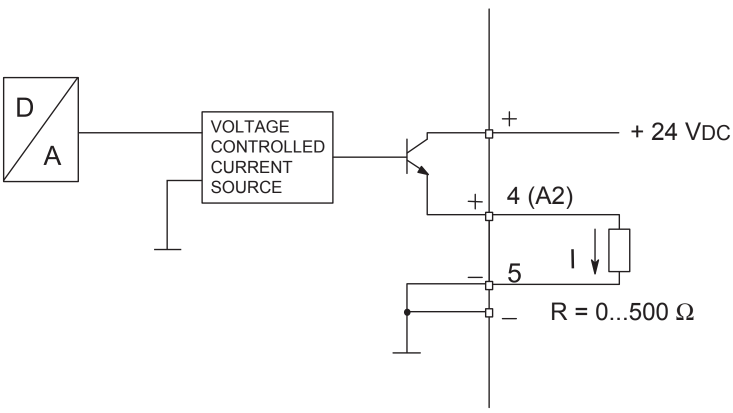
Factory settings (PCD3.W410):
- Position “V”: Voltage output
- Position “0”: range 0…10 V:

Changing the jumpers
On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, "Icons"

Connection for 0…10 V

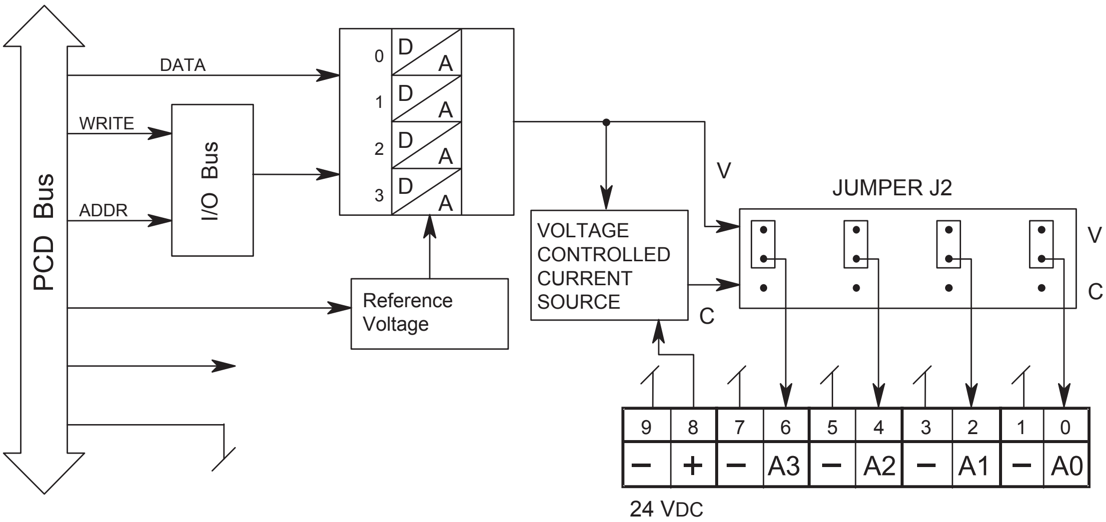


Connection for 0…20 mA or 4…20 mA
(selectable with jumpers on type PCD3.W410)



An external 24 VDC supply is required for current outputs.

Block diagram



6

Programming

Classic

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

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

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

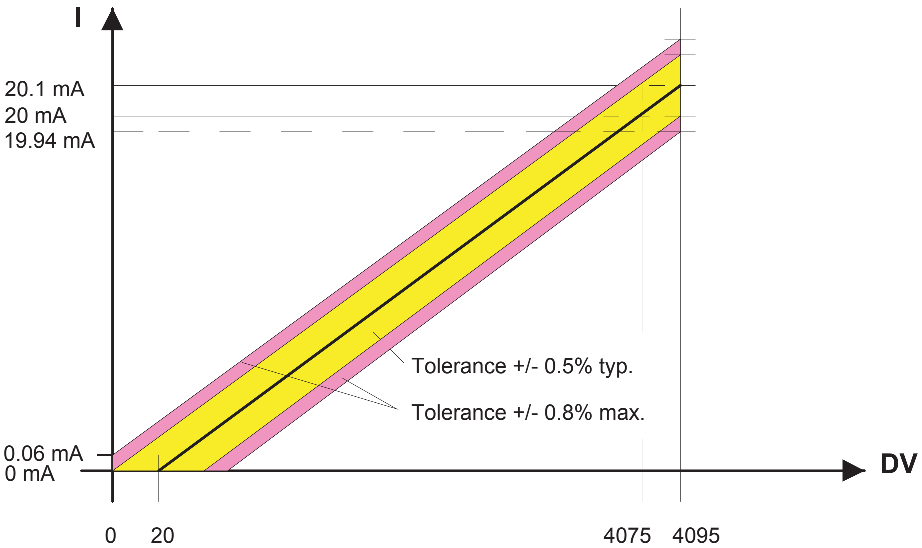
6

Technical data Resolution

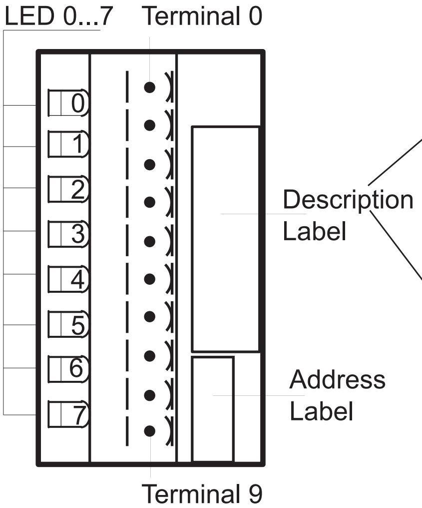
Number of output channels:	4, short circuit protected			
Signal range:	W600:	0…+10 V	2.442 mV	
	W610:	–10 V…+10 V	4.884 mV	selectable with jumper
		0…+10 V	2.442.mV	
		0…20 mA	4.884 µA	
Galvanic separation:	no			
Resolution (digital representation):	12 bits (0…4095)			
Conversion time D/A:	typ. 10 µs			
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			

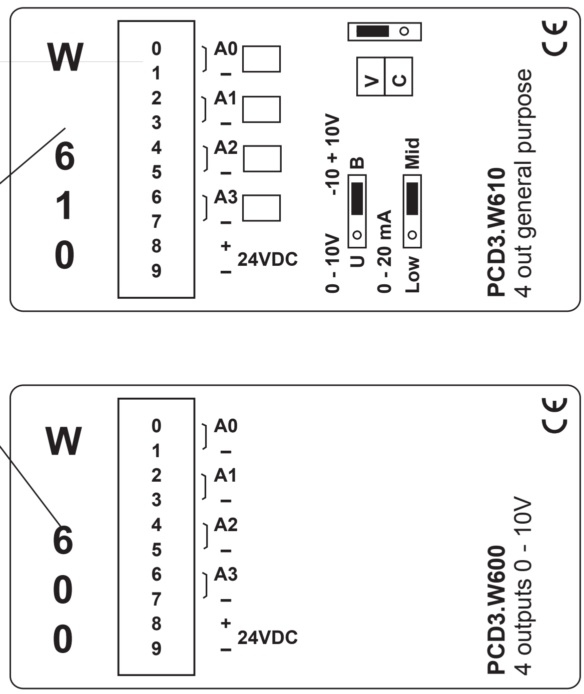
*) Note on current outputs:
Since for some applications it is important to be able to reach the outside limit values of the range (0 mA, 20 mA), current outputs have been laid out according to the following characteristic line:

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.



LEDs and connection terminals



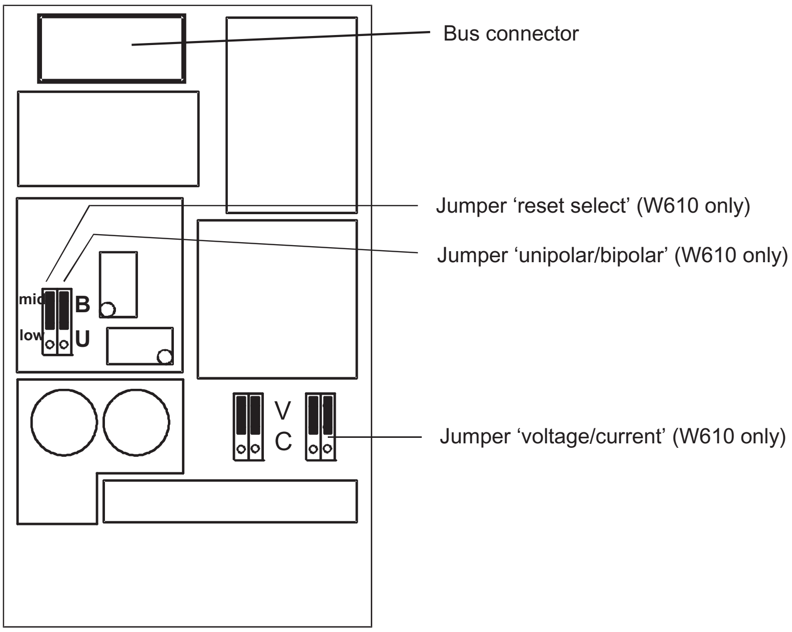


LED	Output
0	O0
1	O1
2	O2
3	O3

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 A1, "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:

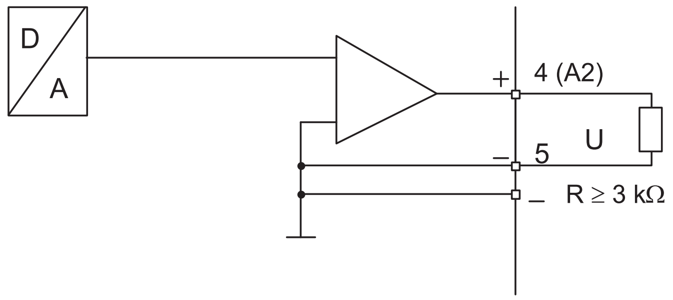
U/B:	**U**nipolar or **B**ipolar operation
Reset select:	Reset to **low-** or **mid-**scale
Rec. setting:	Unipolar →low-scale
	Bipolar → mid-scale

Per channel:	“V”	Voltage output: 0…+10 V or –10 V…+10 V
	“C”:	Current output: 0…20 mA

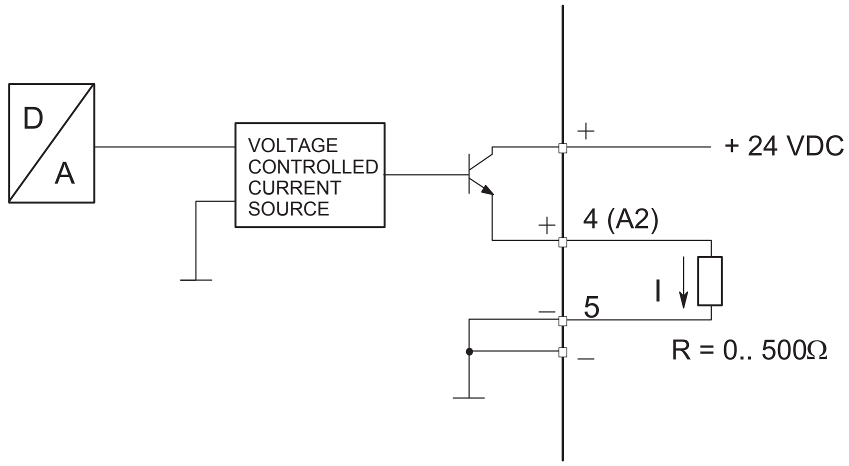
Current outputs have been laid out for unipolar mode. Bipolar mode is possible, but for the negative half of this operation the output is 0 mA.

Connection concept

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

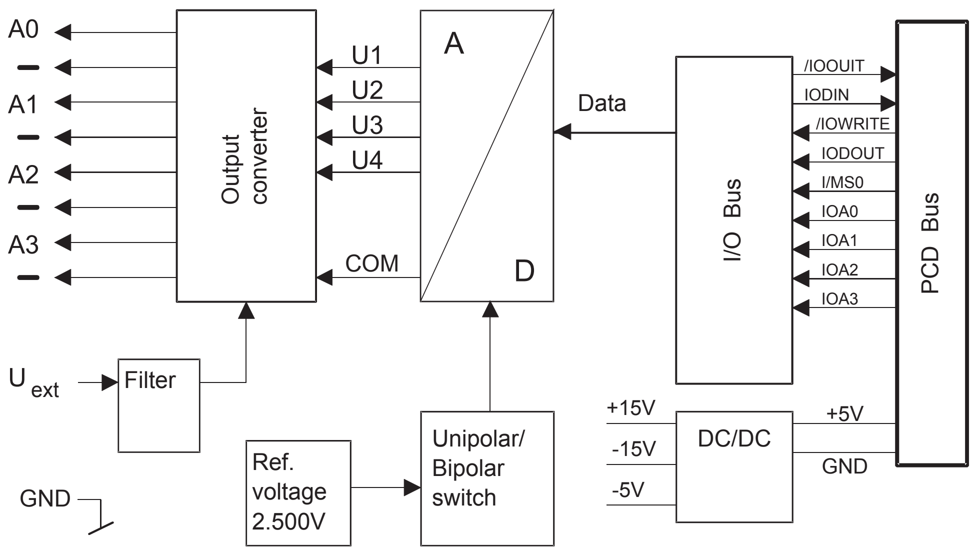


Connection for 0…20 mA: (PCD3.W610 only)



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.com.

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD 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 Saia PCD®, channels themselves not separated

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

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.

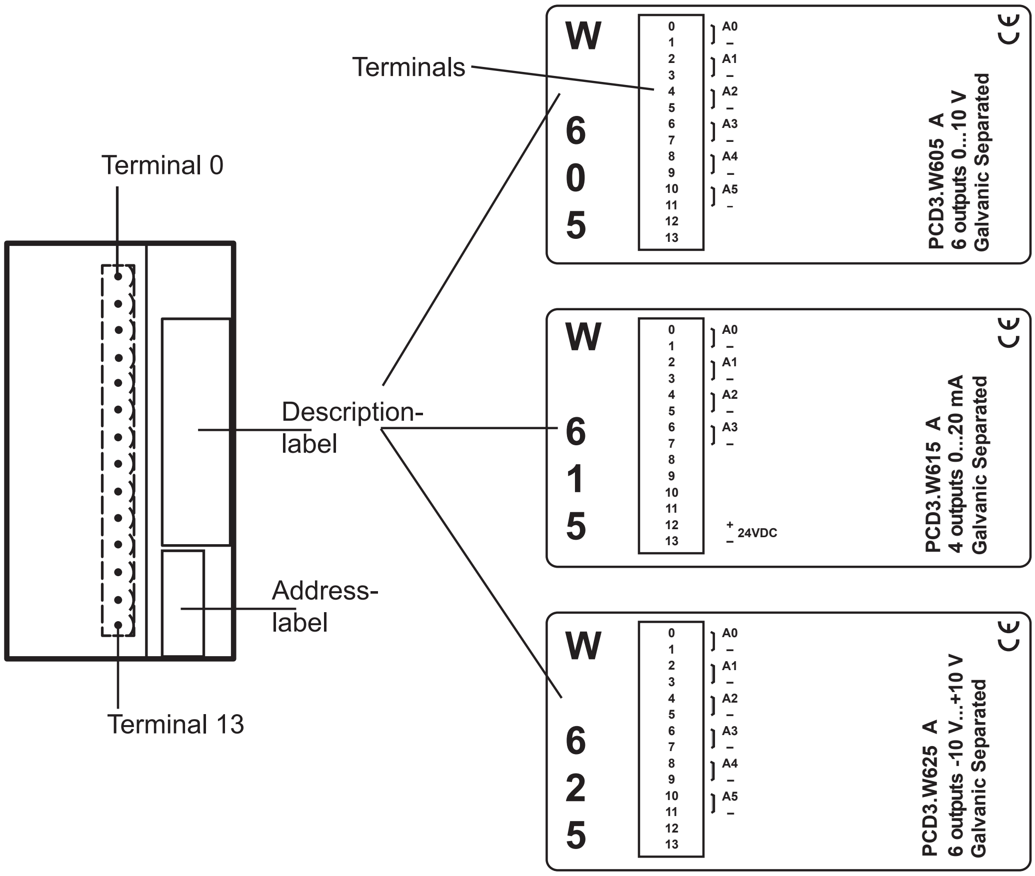
Module overview		Channels	Resolution
PCD3.W605:	Voltage 0…10 V	6 (A0…A5)	10 mV
PCD3.W615:	Current 0….20 mA	4 (A0…A3)	20 µA
PCD3.W625:	Voltage –10…+10 V	6 (A0…A5)	20 mV

6

Technical data

Output ranges:	see module overview
Galvanic separation:	500 V, electrical isolation of outputs to Saia 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



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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 PCD3.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):
PCD3.W605: –0.26 V…+ 10.36 V (instead of 0…+ 10 V)
PCD3.W615: 0 mA …21.4 mA (instead of 0…20 mA)
PCD3.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:
PCD3.W605: 1 LSB = 10.38 µV
PCD3.W615: 1 LSB = 21.7 µA
PCD3.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).

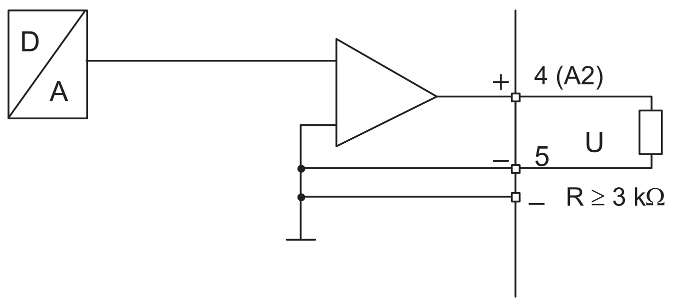
This extended range does depend on the tolerances of the components, and cannot be guaranteed.

Connection concept for voltage and current inputs

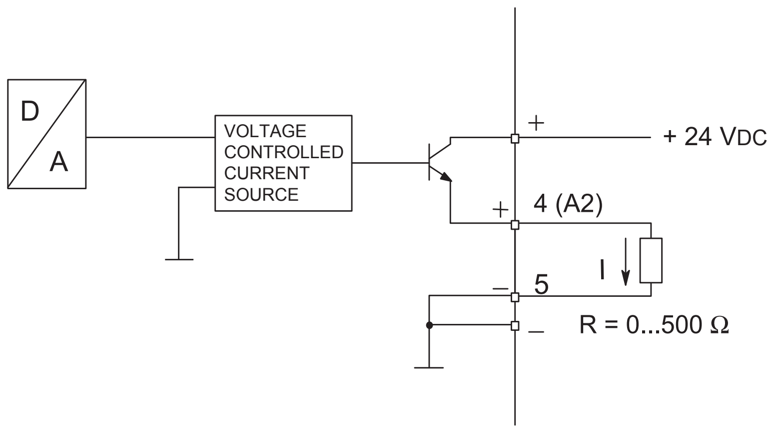
The voltage and current output signals are connected directly to the 14-pole terminal block (A0 … A5 / A3 and -).

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 (PCD3.W605) or –10 V…+10 V (PCD3.W625):

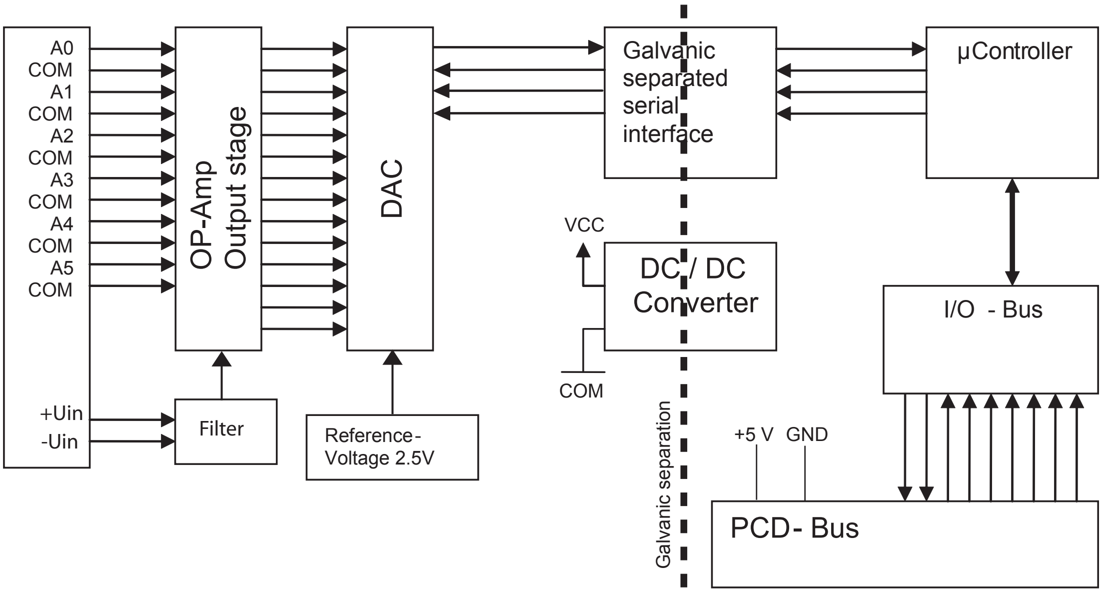


Connection for 0…20 mA (PCD3.W615)



An external 24 VDC supply is required for current outputs.

Block diagram



6

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.

6.12 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 Saia PCD® and the external +24?V are 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

6

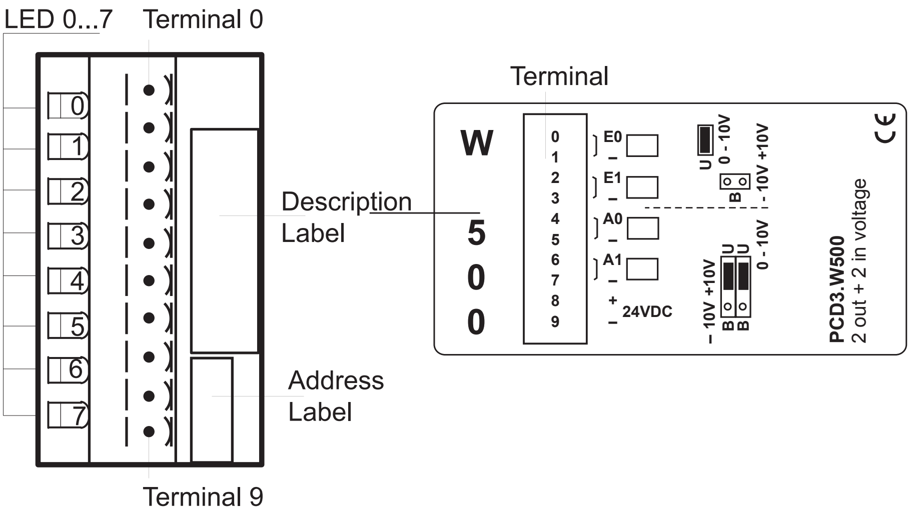
Inputs	
Number of input channels:	2
Signal ranges:	W500: 0…+10 V / –10…+10 V } jumper selectable commonly
Galvanic separation:	no
Measuring principle:	differential
Conversion time A/D:	< 30 µs
Resolution (digital representation):	12 bits (0…4095)
Input resistance:	W500: 0…+10 V: 1 MΩ
Accuracy (of measured 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

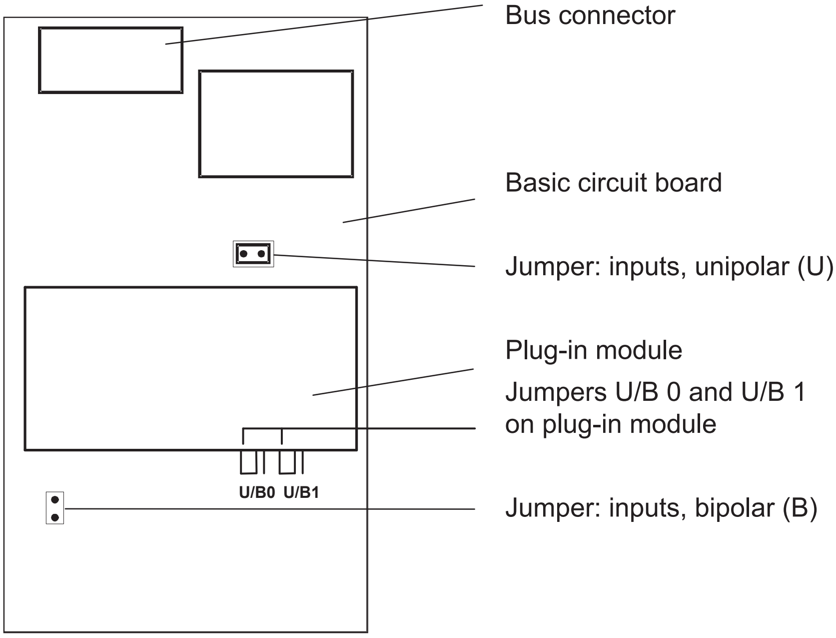
Inputs

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)



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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.

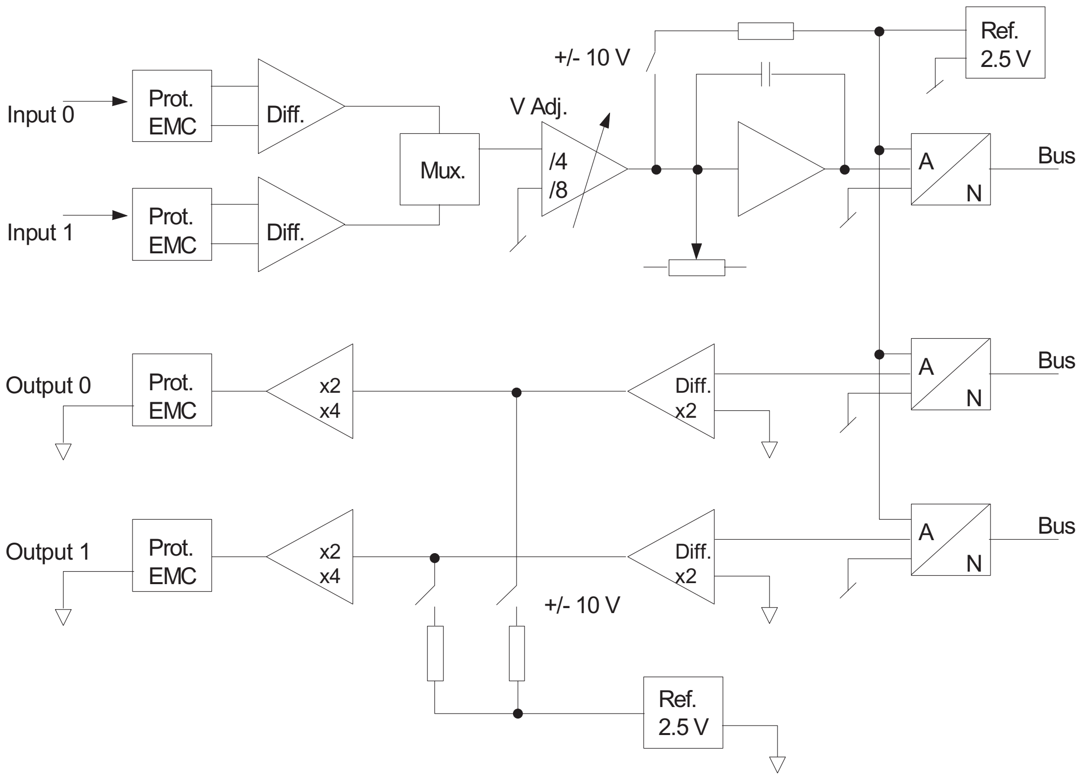
The plug-on module contains the two analogue outputs with the two 3-pole jumpers for the individual unipolar or bipolar operation of each output.

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 A1, "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.com.

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD 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 Saia PCD®, channels themselves not separated

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

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 Saia 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:

Supply		Outputs				Inputs							
13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	+	-	+	-	+	-	+	-	+	-	+	-	+
Uext		A1		A0		E3		E2		E1		E0	

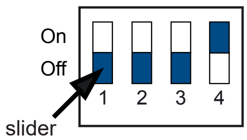
Description of LED:
- Off: No power supply to module. U_{ext} (24 V) absent.
- On: Module working correctly.
- Flashing slowly: Channel error (overload/underload/short circuit/ open load)
- Flashing quickly: U_{ext} lower than specified (< 19 V).

Configuration of inputs

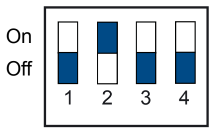
Each input channel is configured via a DIP switch with four pins. The function of each pin is as follows:

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

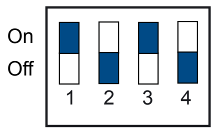
According to this table, the configuration of the various operating modes is as follows:



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

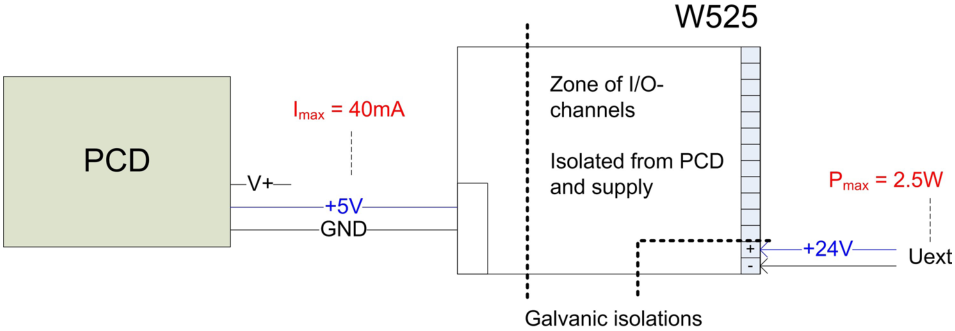
Configuration of outputs

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 Saia 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 Saia PCD® at any time.
  - Depending on the speed of the Saia 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 Saia PCD® with a maximum delay of 2 ms.
  - Depending on the speed of the Saia 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 Saia PCD®:	yes, 500 V
Galvanic separation of external supply:	yes, 500 V
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 Saia 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 Saia 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

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

6

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

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.

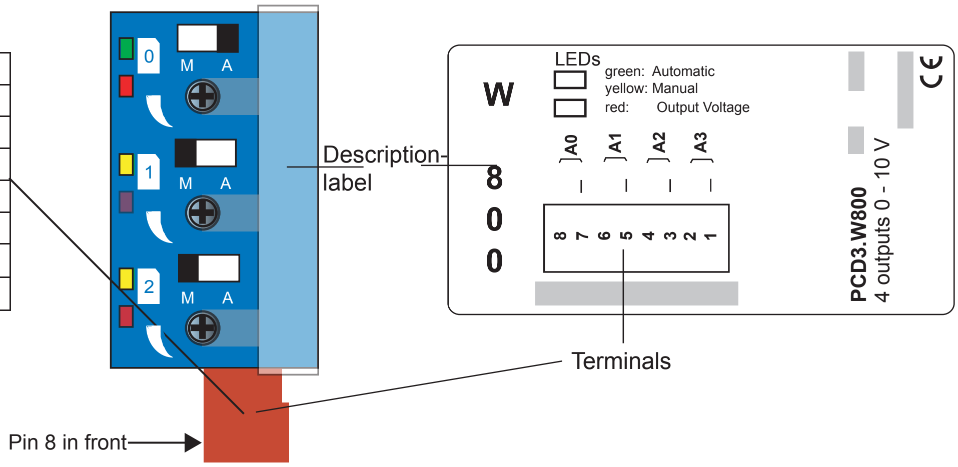
Three of the analogue output channels have manual control functionality. In this mode, the output voltage is preset via the potentiometer on the front panel. (for emergency and manual operation, see also section 3.20).

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) Up to and including HW version: D From HW version: E	 typ. 35 mA / max. 45 mA max. 55 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

8	A0
7	GND
6	A1
5	GND
4	A2
3	GND
2	A3
1	GND



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):

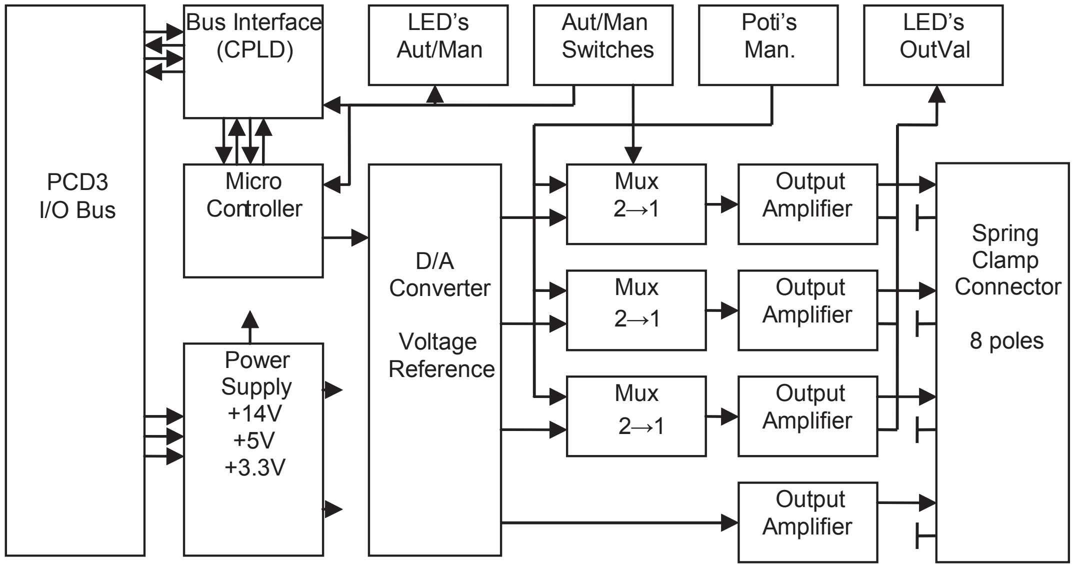
Output 0:	Automatic	LED 1 = green
	Value (100 %)	LED 2 = red (max.)
Output 1:	Manual	LED 1 = amber
	Value (15 %)	LED 2 = red (weak)
Output 2:	Manual	LED 1 = amber
	Value (85%)	LED 2 = red (strong)

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

For programming the modules PCD3.W800, an FBox is available.

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 RJ-45 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 RS-232 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.W710	1-channel weighing module for 4/6-wire weighing cells
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 Saia PCD® and the external +24?V are disconnected from the power supply.

6.15.1 PCD3.W7x0

The PCD3.W7x0 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 Saia PCD® and the external +24?V are 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

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

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

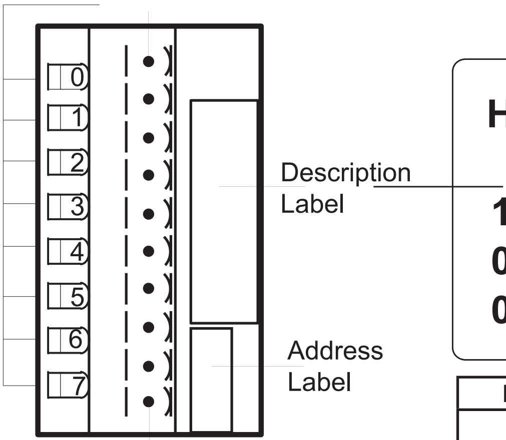
6

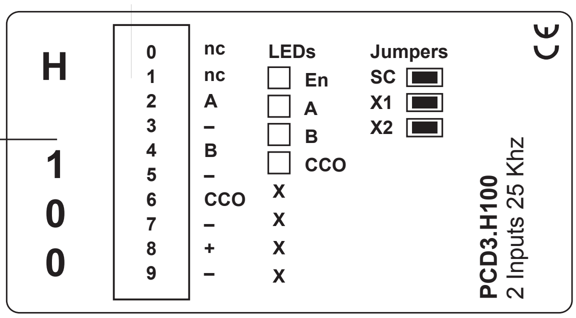
Technical data

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 Saia 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: -25…+85°C
Noise immunity:	EC mark according to EN 50081-1 and EN 50082-2
Programming:	Based on Saia 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

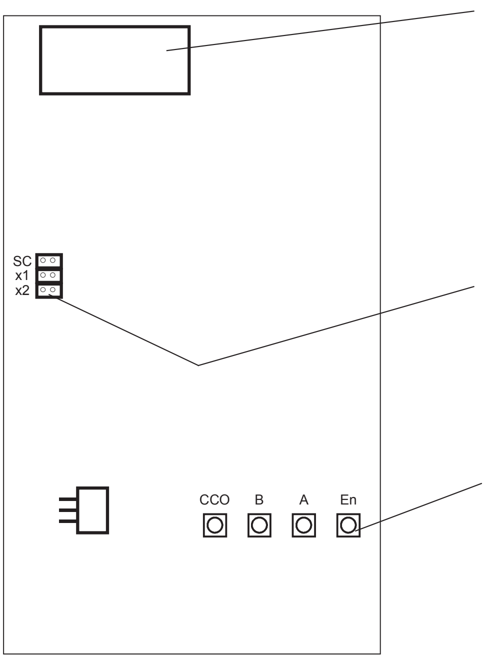
LEDs and connection terminals





LED	In- / Outputs
0	En
1	A
2	B
3	CCO

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

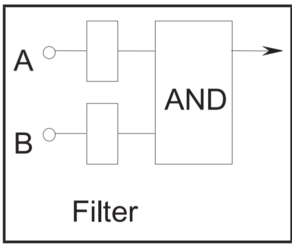


“A”	Input “A”	1
“B”	Input “B”	2
“En” (Enable)	Counter active	0
“CCO”	Output “CCO”	3

Changing the jumpers
On this circuit board there are components that are sensitive to electrostatic discharges. For further information, refer to Appendix A1, "Icons"

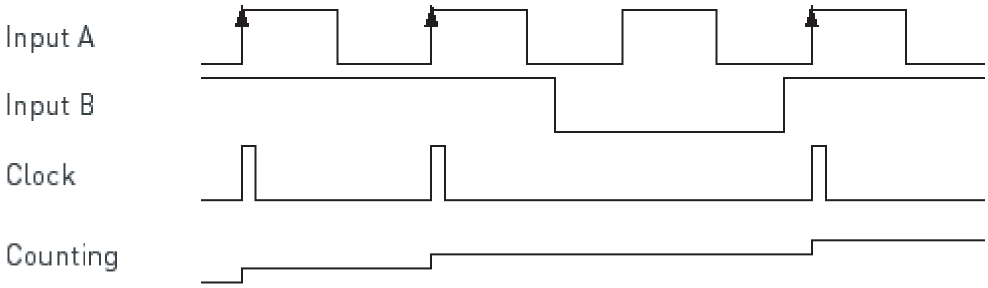
Count modes

SC (Single Count):



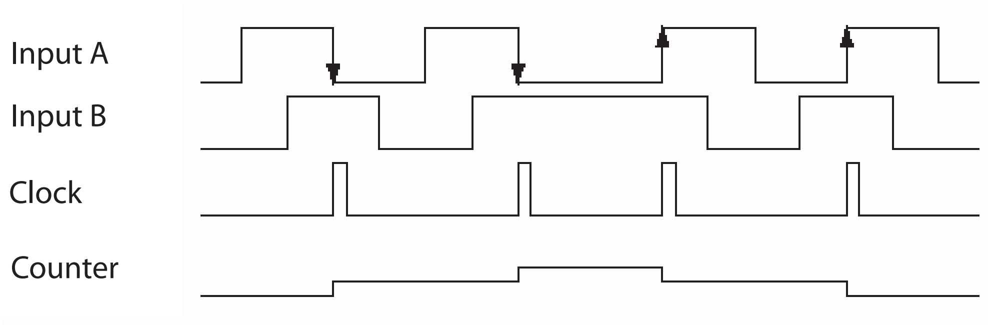
Counting signals at input A.
Up and down counting selectable by user program.

To enable signals at input A to be counted, input B must be connected to 24 V (AND gate).

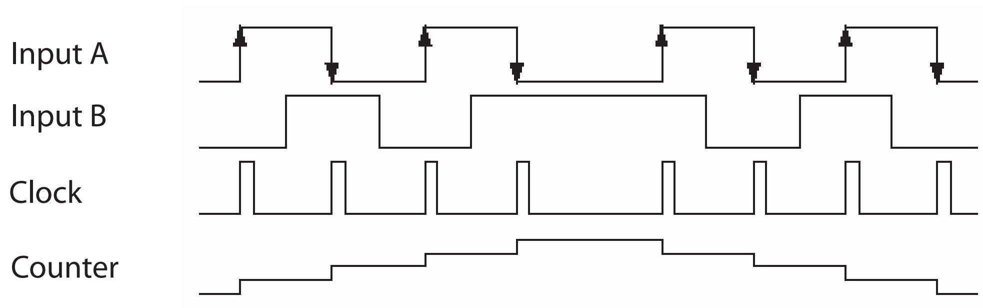


Modes x1, x2: Up/down counting mode for 2-phase incremental shaft encoder at inputs A and B.

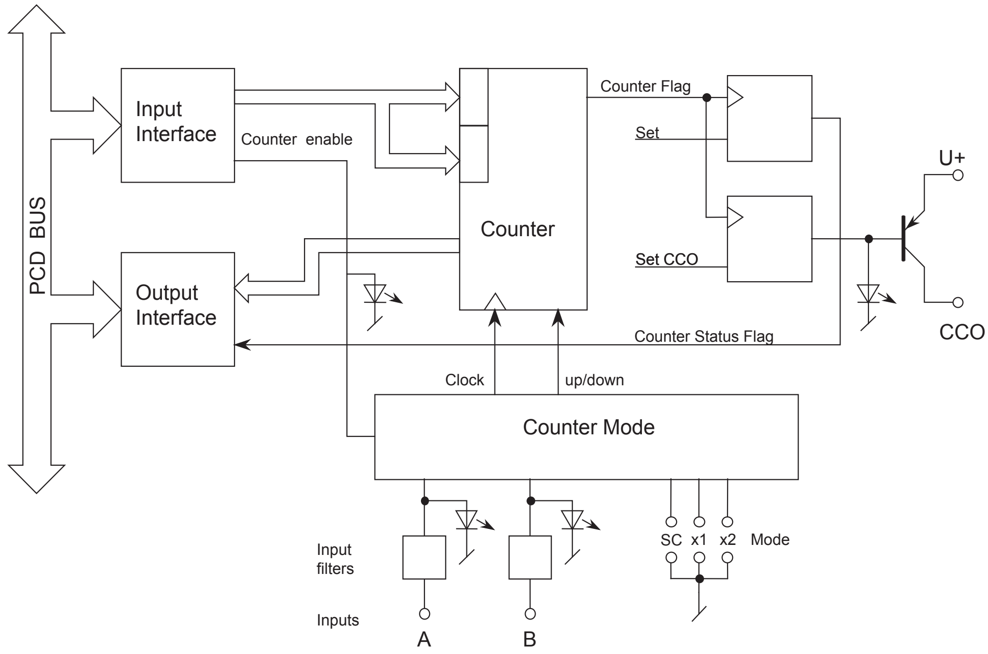
x1



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:

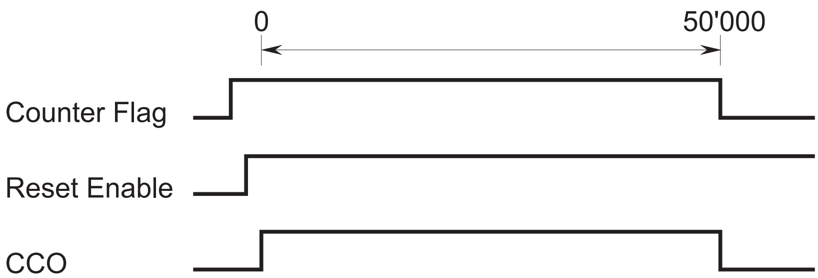
The output of the internal counter is identified as “Counter Flag”. The user has no hardware access to it. This counter flag is set to “1” whenever the counter is loaded or by means of a separate instruction.

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

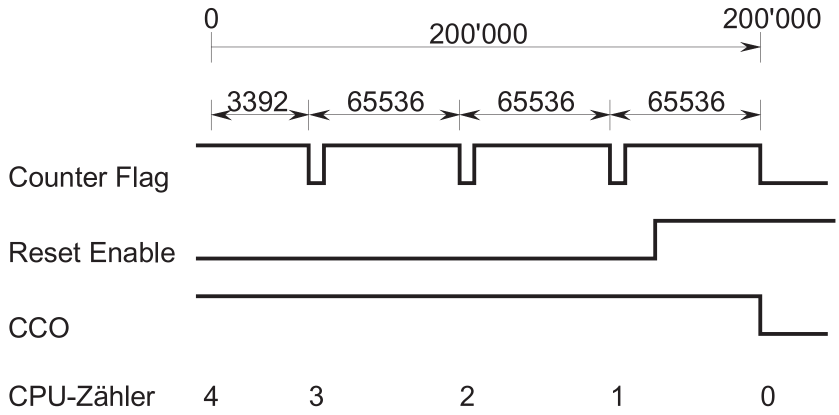
Case a): Resetting the counter flag results in a simultaneous reset of the CCO output.



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

Programming examples for the PCD3.H100 can be found on the TCS Support site www.sbc-support.com.

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD 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 Saia 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: –25…+85°C
Noise immunity:	EC mark according to EN 50081-1 and EN 50082-2
Programming:	Based on Saia PCD® user program and pre-programmed function blocks (FB). There are other FBs for use in the RIO head station.

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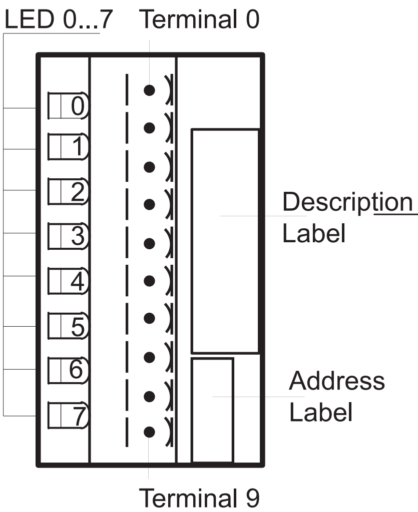
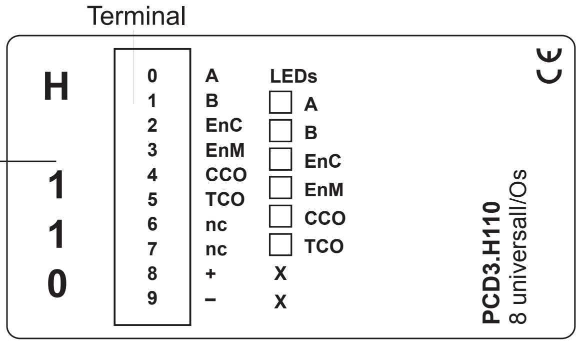
Terminals:	Plug-in 10-pole spring terminal block (4 405 4954 0) or pluggable 10-pole screw terminal block (4 405 4955 0), both for wires up to 2.5 mm²

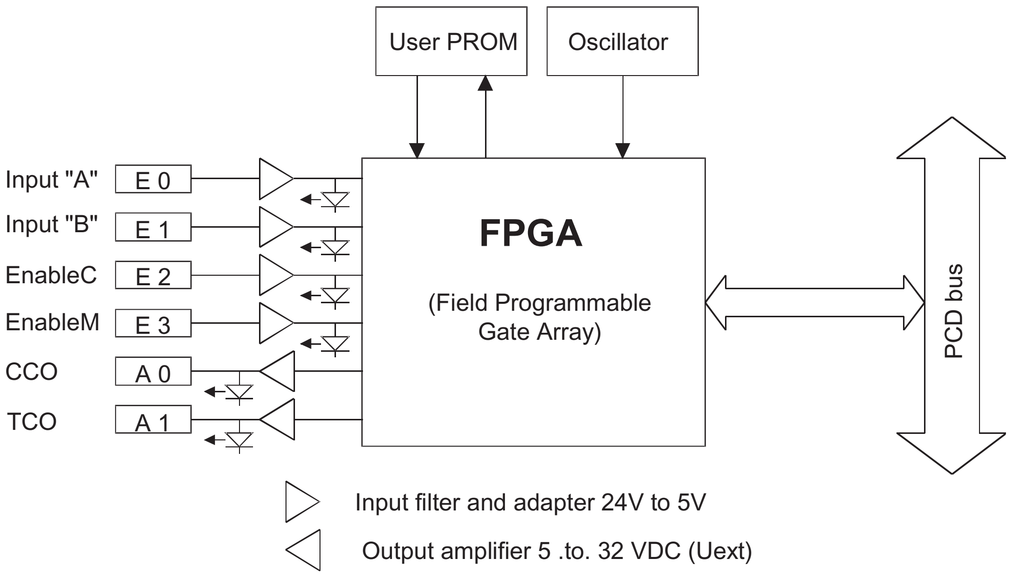
LEDs and connection terminals





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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD 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”.

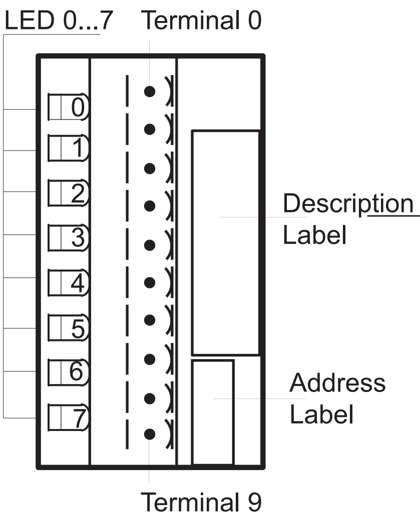
The hardware consists of an RS-422 port for the SSI interface and 4 general-purpose digital outputs. Functionality is provided by an FPGA (field programmable gate array).

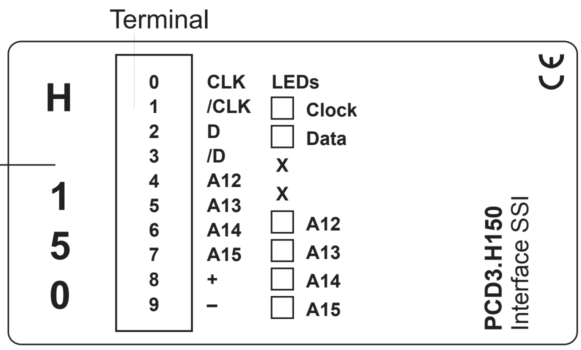
Technical data

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	RS-422, electrically isolated
1 output for SSI clock	RS-422, electrically connected, as the encoder input is normally isolated
Digital outputs	
Number of outputs: Terminal 4 = 012: 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: -25…+85°C
Noise immunity:	EC mark according to EN 50081-1 and EN 50082-2
Programming:	Based on Saia 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

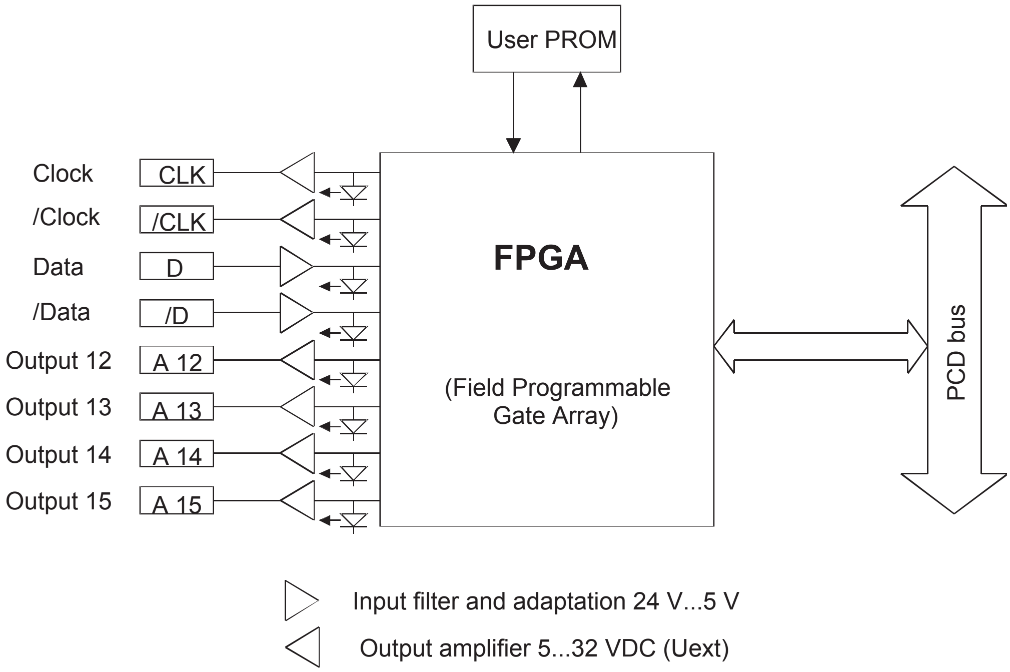
LEDs and connection terminals





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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD 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 Saia 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: –25…+85°C
Noise immunity:	EC mark according to EN 50081-1 and EN 50082-2
Programming:	Based on Saia 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

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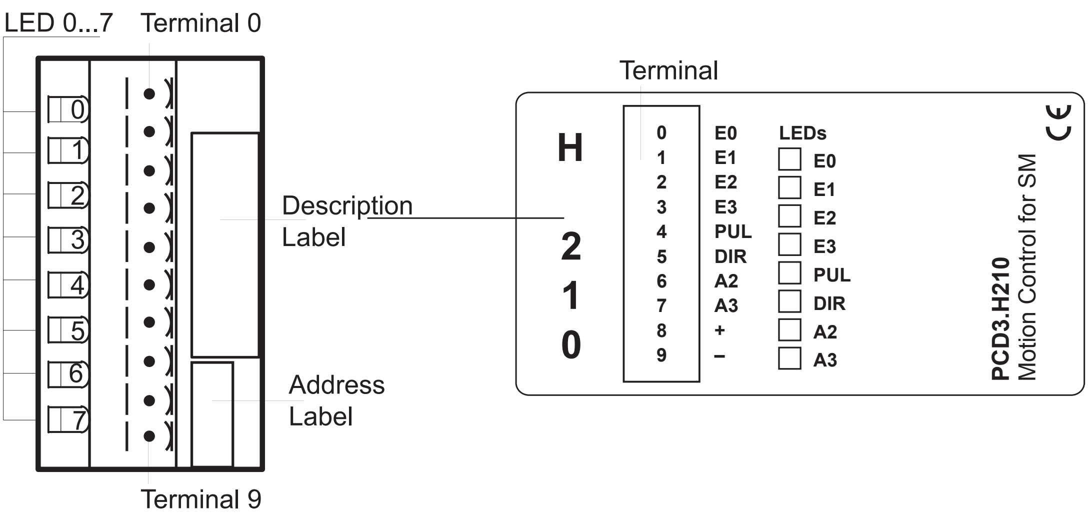
*) For further information, please refer to manual 26-760, "PCD2.H210 - motion control modules for stepper motors".

LEDs and connection terminals

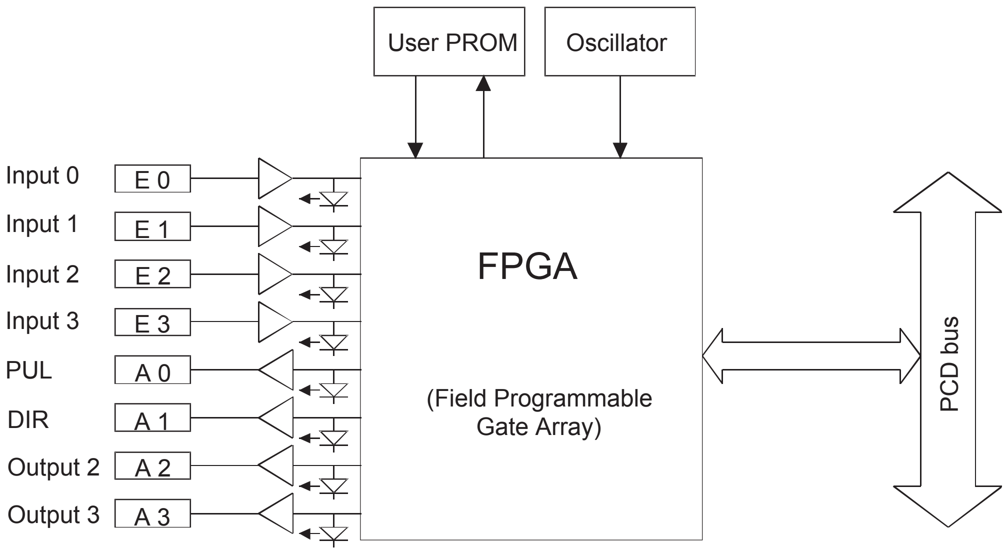


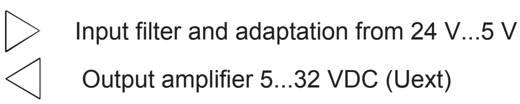
LED	In- / Outputs
0	I0
1	I1
2	I2
3	I3
4	O0/PUL
5	O1/DIR
6	O2
7	O2

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

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 section A4 "Hardware Watchdog", which describes the correct use of the watchdog in conjunction with PCD 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.

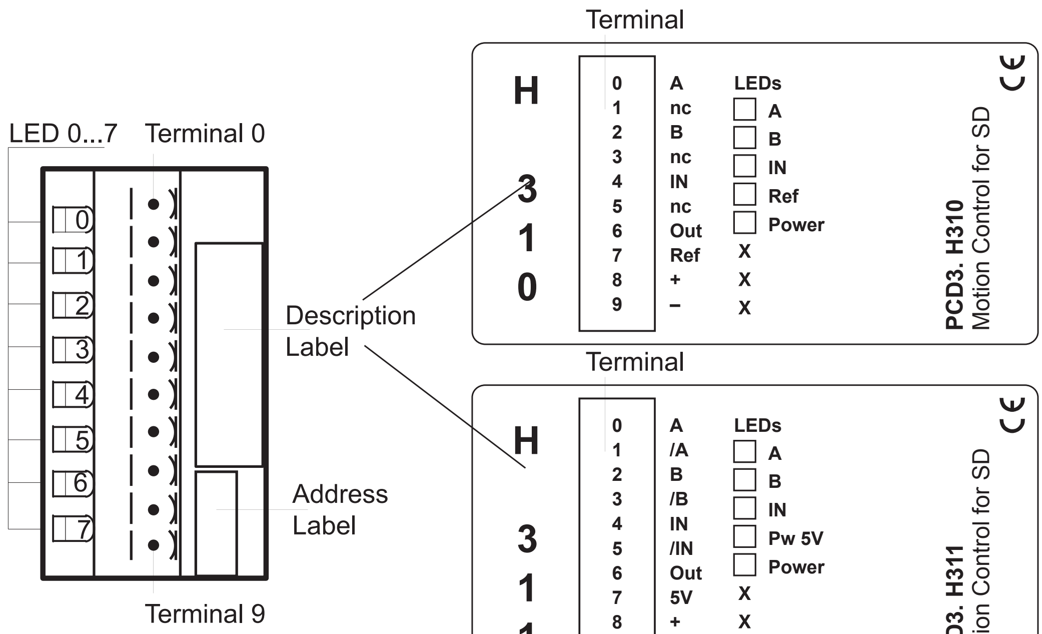
! This I/O module cannot currently be used with the PCD3 RIO head station

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 RS-422
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: –25…+85°C
Noise immunity:	EC mark according to EN 50081-1 and EN 50082-2
Programming:	Based on Saia 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

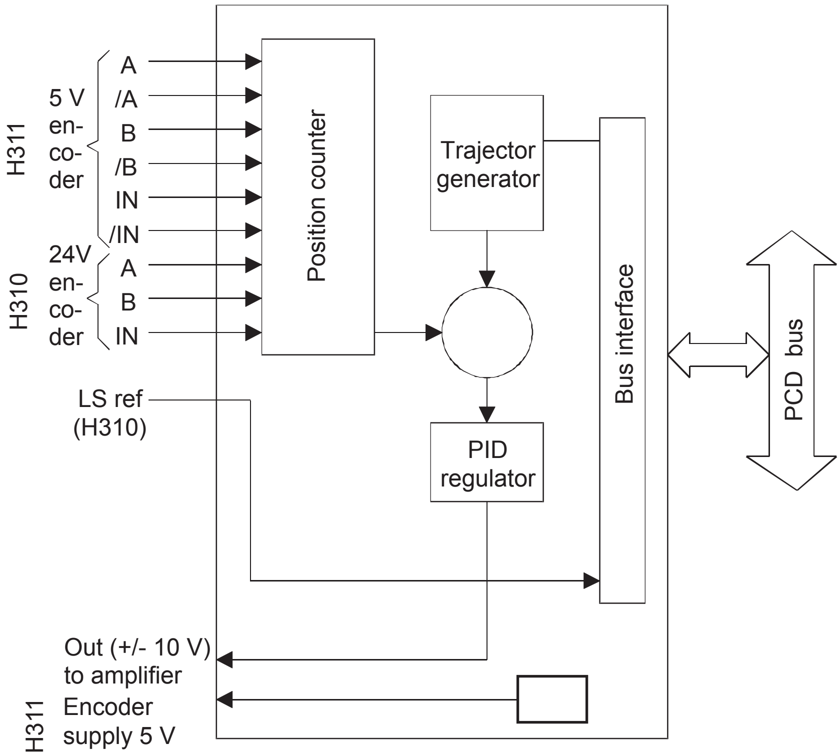
Terminals - PCD3.H310

– 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



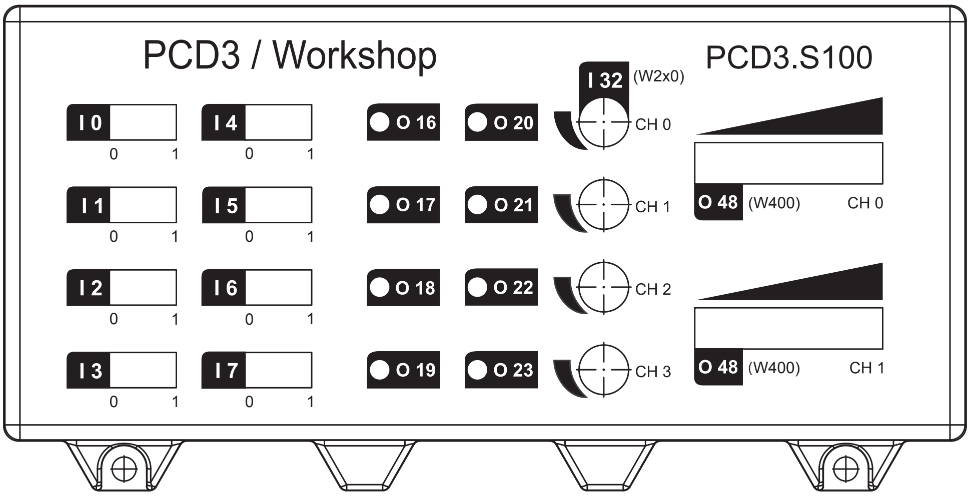
For further information, please refer to manual 26-762, "PCD2.H31x - motion control module for stepper motors"

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 section A4 “Hardware Watchdog”, which describes the correct use of the watchdog in conjunction with PCD components.

6.18 Miscellaneous modules

PCD3.S100	Workshop simulator unit

6.18.1 PCD3.S100 Workshop simulator unit



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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.

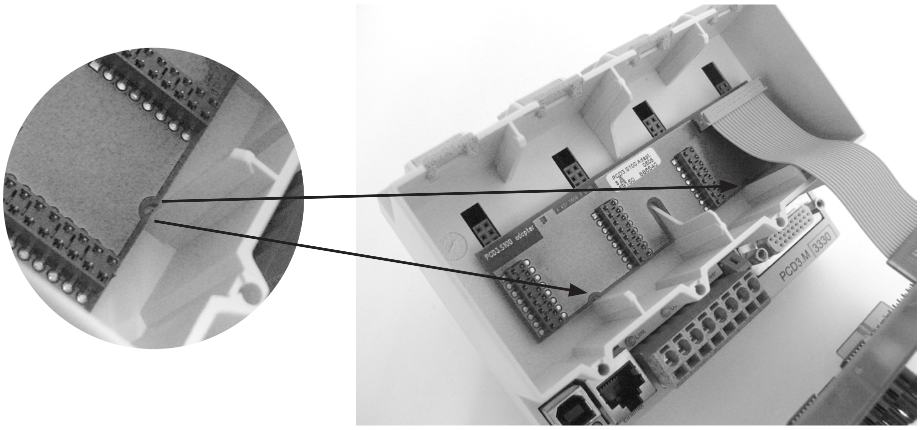
Technical data

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	1× PCD3.E110, 1× PCD3.A400, 1× PCD3.W200, 1× 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 Saia PCD®.

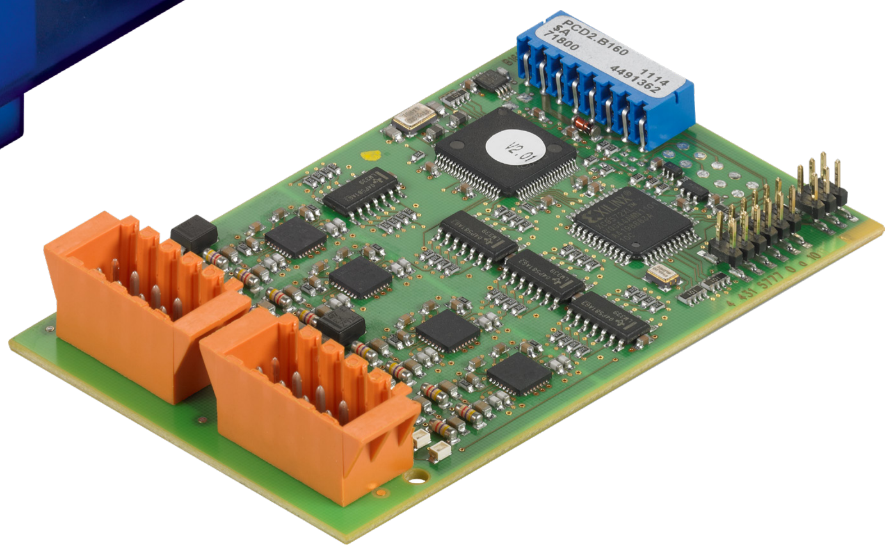
2) Connect the bus plate to the I/O bus. Ensure that the bus plate is firmly positioned in the I/O bus sockets, and that the grooves line up with the guides; see arrows.



3) First insert the bus plate,

then locate the front plate on the module holder.

4) Fix with the two screws provided.



PCD2.B160 & PCD3.B160
Digital Input&Output-module with 16 I/O

7 PCD2.B160 & PCD3.B160

7.1 Module Overview

The configurable digital in- and output module offers on smallest space the possibility to configure 16 I/Os in groups of four either as in- or as output.

In terms of expandability and maximum space usage this modules leaves no wishes

- Module current consumption: 120 mA from the +5V Bus
- Input: typ. 24 VDC
- Input filter: 0.2/8 ms configurable
- Galvanic isolation: none
- Outputs: 0.25 A / 18 …30 VDC
- Protection against short circuit
- I/O connector type K
- Configuration with PG5 Device Configurator (Service Pack 2)

Compatibility:

- FW 1.16.52 or higher
- PG5 2.0 official release PG5 V2.0.210 or higher
- Supported platforms PCD3, PCD2.M5_ and PCD1.M2_

7.2 Hardware

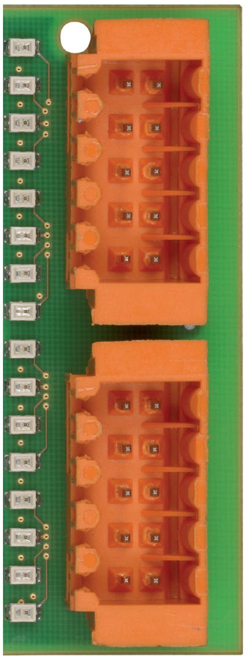
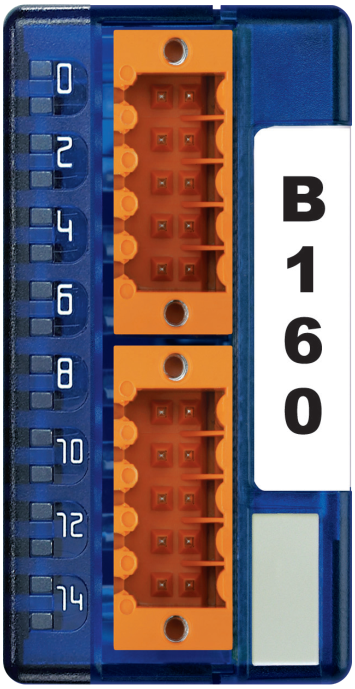
The configuration of the I/O is done in groups of four.

Following combinations are possible:

16O/0I, 12O/4I, 8O/8I, 4O/12I, 0O/16I

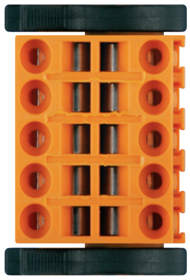
The I/O module can be placed on any slot of a PCD1.M2_, PCD2.M5_, PCD3.M and their corresponding IO-Extension modules (except slot 15 because of the watch dog - I/O address 255).

7.2.1 I/O connection

PCD2	PCD3
X0 IO 0…7	X0 IO 0…7
	
X1 IO 8…15	X1 IO 8…15

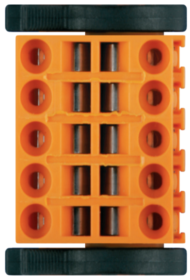
Description

Connector X0 Type K



I/O_0	0	1	I/O_1
I/O_2	2	3	I/O_3
I/O_4	4	5	I/O_5
I/O_6	6	7	I/O_7
GND	8	9	24 V

Connector X1 Type K



I/O_8	0	1	I/O_9
I/O_10	2	3	I/O_11
I/O_12	4	5	I/O_13
I/O_14	6	7	I/O_15
GND	8	9	24 V

X0		X1		Description:
0	IO_0	0	IO_8	Mixed In-/Output
1	IO_1	1	IO_9	Mixed In-/Output
2	IO_2	2	IO_10	Mixed In-/Output
3	IO_3	3	IO_11	Mixed In-/Output
4	IO_4	4	IO_12	Mixed In-/Output
5	IO_5	5	IO_13	Mixed In-/Output
6	IO_6	6	IO_14	Mixed In-/Output
7	IO_7	7	IO_15	Mixed In-/Output
8	GND	8	GND	GND extern
9	24V	9	24V	+24 V extern

7.2.2 LED signalization

The module has 16 LEDs. Each channel has its own LED.

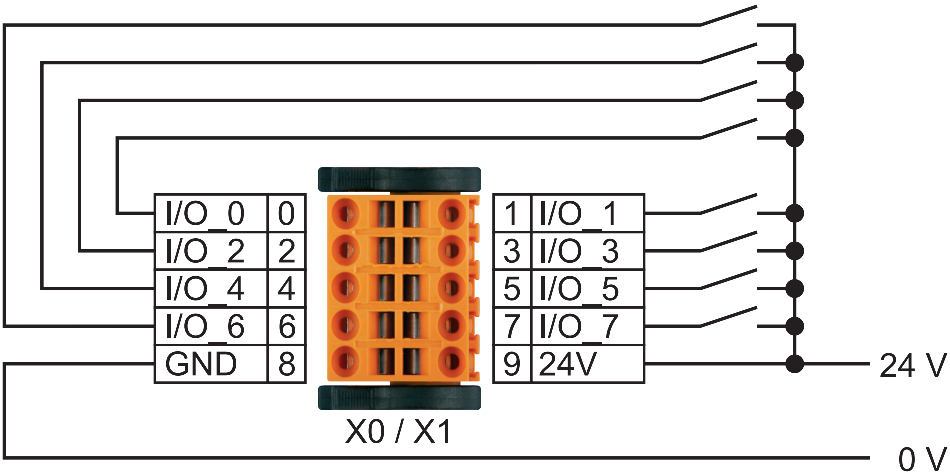
7.2.3 General technical data on inputs and outputs

Internal current consumption:(from +5 V bus)	120 mA
Internal current consumption:(from V+ bus)	4 mA
External current consumption:	22 mA (for driver) at 24 V (without load current)
Terminal	Type K (Part No. 4 405 5048 0)

7.2.4 Technical data on inputs

Number of inputs	16, source operation, not isolated (in groups of 4)
Input voltage	typ. 24 VDC
Input current	typ. 3 mA at 24 VDC
Input delay	8 ms (default) or 0.2 ms (configurable)
Overvoltage protection	Transient Suppressor Diode 39 V

7.2.5 Input wiring

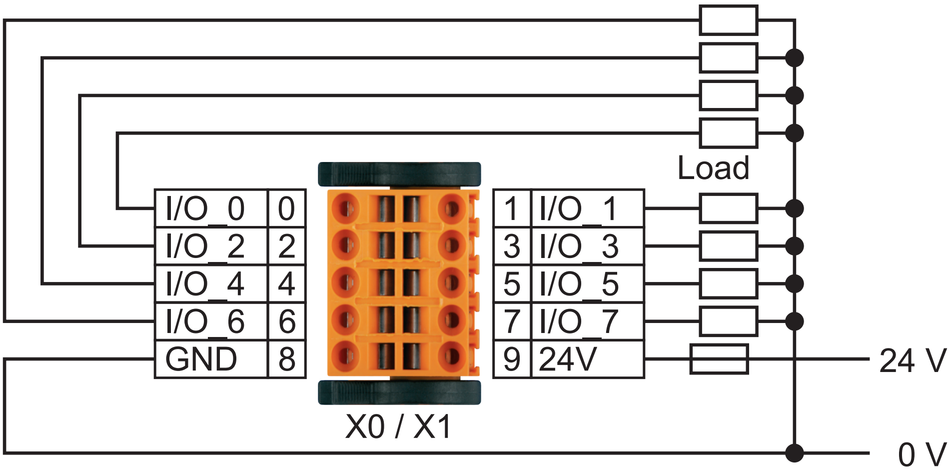


The supply pins of each connector must be powered.
Be careful of the power polarity.

7.2.6 Technical data on outputs

Number of outputs:	16, source operation, not isolated (in groups of 4)
Voltage range:	18…30 VDC
Output current:	250 mA per channel
Total module current:	2 A
Output delay (on/off):	typ. 2 μs
Inductive loads:	Transient Suppressor Diode 39 V
Short circuit proof:	Yes

7.2.7 Output wiring



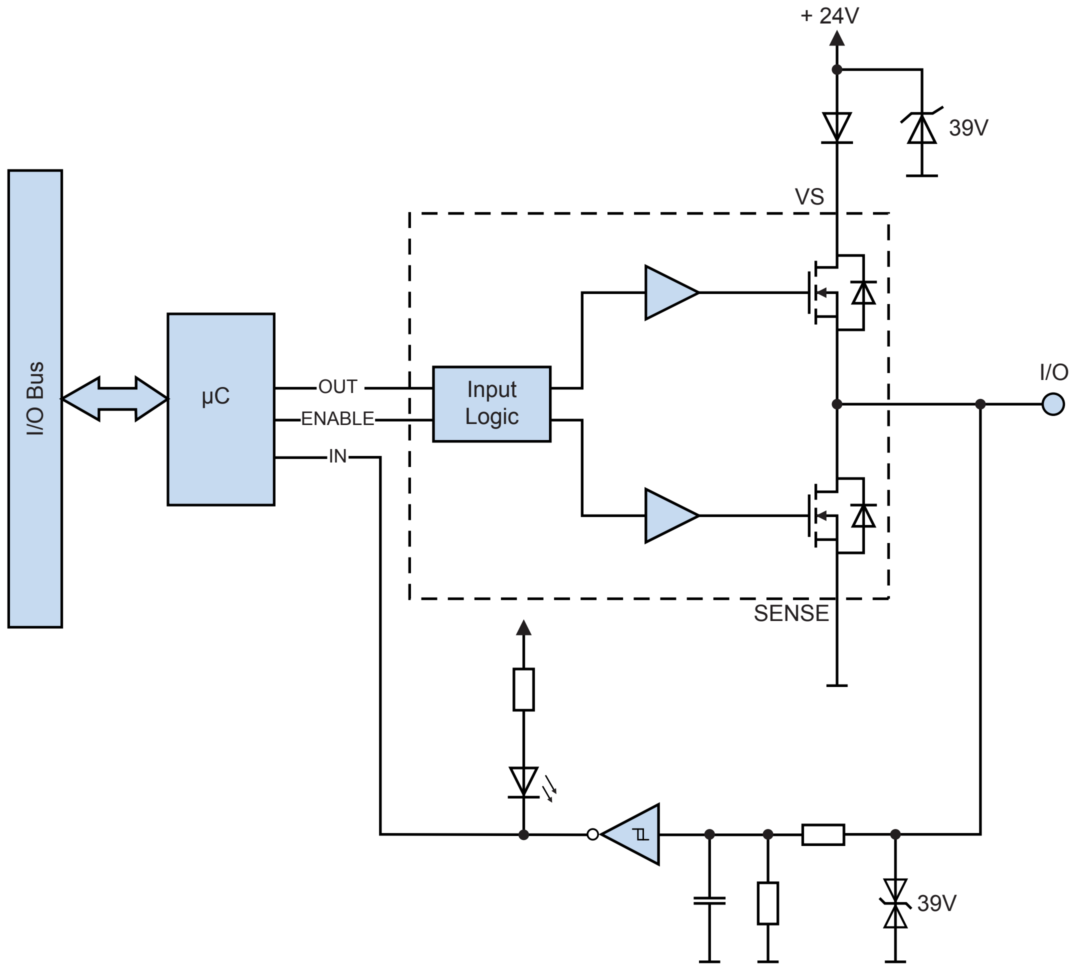
The supply pins of each connector must be powered.
Be careful of the power polarity.

Fuse:	It is recommended that each supply connection should be separately protected with a fast-blow (S) fuse. The value depends on the application.

7.2.8 Label Editor

for PCD2.B160	for PCD3.B160
B160	B160
I/O 0	I/O 0
I/O 1	I/O 1
I/O 2	I/O 2
I/O 3	I/O 3
I/O 4	I/O 4
I/O 5	I/O 5
I/O 6	I/O 6
I/O 7	I/O 7
I/O 8	I/O 8
I/O 9	I/O 9
I/O 10	I/O 10
I/O 11	I/O 11
I/O 12	I/O 12
I/O 13	I/O 13
I/O 14	I/O 14
I/O 15	I/O 15
Slot# 1	Slot# 1

7.2.9 Bloc Diagram



7.2.10 Precautions

The 16 channels of the module are divided into 4 groups of four channels each. It's possible to define for each of the 4 groups if the 4 channels of the group are configured as input or as output.

The I/O definition of the 4 groups is saved permanently into flash memory on the PCDx.B160.

At power-up, the I/O definition is loaded from flash memory, and the channels are configured accordingly as input or outputs.

When downloading the PG5 application program, the input/output configuration of the PCDx.B160 defined in the PG5 device configurator is saved permanently on the flash memory of the PCDx.B160.

All channels of the PCDx.B160 are defined as factory delivery setup as inputs.

ATTENTION

The PCDx.B160 modules can be damaged if the I/O configuration of the PCDx.B160 is changed and the PCDx.B160 is wired and if 24VDC is applied to the I/O.

If the I/O's of the PCDx.B160 are configured as outputs, and the configuration for this group of 4 channels is changed to inputs, 24 VDC is applied to one I/O of that group. Following the loading of the application program, all four channels in the group will be damaged, leaving the four channels unusable.

To avoid the damage:

1. Power off the 24VDC of the PCD and the PCDx.B160
2. Remove the 2 I/O terminals from the PCDx.B160
3. Power on the 24VDC of the PCD
4. Load the modified PG5 device configuration and the PG5 application program.
5. Match the wiring of the PCDx.B160 I/O terminals to the loaded I/O configuration.
6. Plug-in the 2 I/O terminals to the PCDx.B160

If the configuration of the PCDx.B160 device is not changed, then it's possible to download modified user programs without removing the IO plugs each time.

7.3 Configuration in PG5 device Configurator

Media Mapping For Inputs, Outputs: Yes	To use values of this module in Fupla programming the media mappig must be active.

Channels Direction Direction Channels 0 To 3: **Output** Direction Channels 4 To 7: Input Direction Channels 8 To 11: Input Direction Channels 12 To 15: Input	The channel direction defines whether the four data points are used as input or output.
Filter Input Filter Enabled: Yes	Filter for the inputs: yes = 8 ms (default) no = 0.2 ms
Media Mapping Read Error Output Detection Media Type: Flag Number Of Media: 16	Output error flag These flags indicate an error on the outputs. The flags are always set by two. When a corresponding flag is set, the output is in high-impedance. example: if the Output Error Detection flags equal: 0000000000000011 That indicates an error on I/O 0 or I/O 1 like an over-current or short circuit. These outputs are in high-impedance.

Per default all channels of the modules act as input. They are configured during the power-up sequence of the PCD CPU.

After a first use, the module configuration is saved into flash memory and is loaded at power-up.

To use the PCDx.B160 module no F-Boxes are needed.

In order to optimize the memory used on a PCD it is possible to delete the unused symbols in the media mapping window. After compilation no flag or register will be assigned to the unused symbols:

Example: I/O 0…3 => Inputs & I/O 4…7 => Output with Output Error detection

<table>
<tr>
<td>Inputs 0…3

Delete the symbols that are not assigned to inputs.</td>
<td>
<table>
<tr><td>S.IO.Slot0.RdDigitalIO</td><td>F [16]</td><td>0</td><td></td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdDigitalIO0</td><td>F</td><td>S.IO.Slot0.RdDigitalIO + 0</td><td>Read digital I/O 0 (usa...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdDigitalIO1</td><td>F</td><td>S.IO.Slot0.RdDigitalIO + 1</td><td>Read digital I/O 1 (usa...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdDigitalIO2</td><td>F</td><td>S.IO.Slot0.RdDigitalIO + 2</td><td>Read digital I/O 2 (usa...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdDigitalIO3</td><td>F</td><td>S.IO.Slot0.RdDigitalIO + 3</td><td>Read digital I/O 3 (usa...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Read digital I/O 4 (usa...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Read digital I/O 5 (usa...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Read digital I/O 6 (usa...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Read digital I/O 7 (usa...</td><td>Public</td><td>S_IO</td></tr>
</table>
</td>
</tr>
<tr>
<td>Output Error 4…7

Delete the media & address that are not assigned to the outputs .</td>
<td>
<table>
<tr><td>S.IO.Slot0.RdOutputError</td><td>F [16]</td><td>16</td><td></td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdOutputError4</td><td>F</td><td>S.IO.Slot0.RdOutputError + 4</td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdOutputError5</td><td>F</td><td>S.IO.Slot0.RdOutputError + 5</td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdOutputError6</td><td>F</td><td>S.IO.Slot0.RdOutputError + 6</td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.RdOutputError7</td><td>F</td><td>S.IO.Slot0.RdOutputError + 7</td><td>Error detection on outp...</td><td>Public</td><td>S_IO</td></tr>
</table>
</td>
</tr>
<tr>
<td>Outputs 4..7

Delete the media & address that are not assigned to the outputs .</td>
<td>
<table>
<tr><td>S.IO.Slot0.WrDigitalOutput</td><td>F [16]</td><td>32</td><td></td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Write digital output 0 (...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Write digital output 1 (...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Write digital output 2 (...</td><td>Public</td><td>S_IO</td></tr>
<tr><td></td><td>F</td><td></td><td>Write digital output 3 (...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.WrDigitalOutput4</td><td>F</td><td>S.IO.Slot0.WrDigitalOutput +...</td><td>Write digital output 4 (...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.WrDigitalOutput5</td><td>F</td><td>S.IO.Slot0.WrDigitalOutput +...</td><td>Write digital output 5 (...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.WrDigitalOutput6</td><td>F</td><td>S.IO.Slot0.WrDigitalOutput +...</td><td>Write digital output 6 (...</td><td>Public</td><td>S_IO</td></tr>
<tr><td>IO.Slot0.WrDigitalOutput7</td><td>F</td><td>S.IO.Slot0.WrDigitalOutput +...</td><td>Write digital output 7 (...</td><td>Public</td><td>S_IO</td></tr>
</table>
</td>
</tr>
</table>

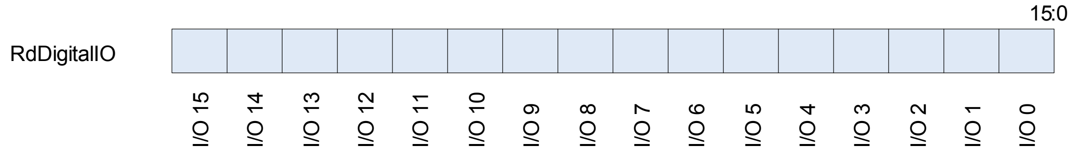
7

7.4 Media Mapping

7.4.1 Symbol name & description

7.4.1.1 RdDigitalIO

This array of 16 flags returns the states of each I/O whatever their configuration. We can read each flag separately with the symbol RdDigitalIO"y" where "y" = the number of the flag. Each flag corresponds to one I/O.

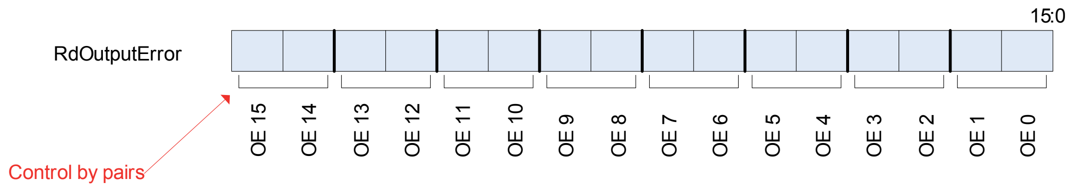


7.4.1.2 RdOutputError

This array of 16 flags returns the status of the outputs. They indicate if an output is not functioning correctly and is set in high impedance. The module puts the outputs in high impedance if there is a short circuit, an overcurrent or the supply pins of the connectors are not powered when using output.

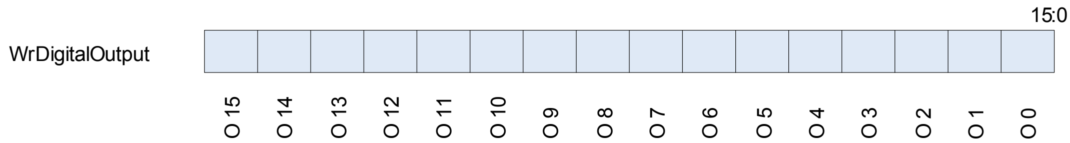
The module controls the outputs by pairs.

For example: if there is a short circuit on output 0 then the outputs 0 & 1 will be in high impedance and their respective status flags are set. The flags will be: RdOutputError = 00000000 00000011.



7.4.1.3 WrDigitalOutput

This array of 16 flags contains the value you want writing on the outputs. Each flag corresponds to one output. If you write a flag whose I/O is not configured in output, nothing happens.



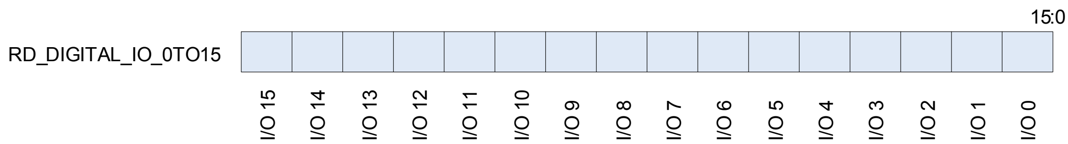
7.5 Direct input or output access in IL

With IL commands it is possible to do accesses to the module independent of the media mapping.

7.5.1 Symbol name & description

7.5.1.1 RD_DIGITAL_IO_0TO15

This symbol returns the states of each I/O whatever their configuration.

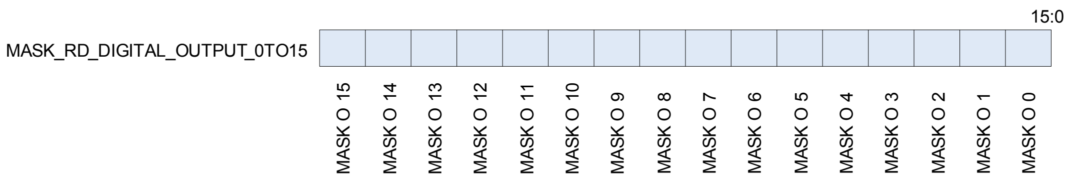


IL example:

```
RDPW  IO.Slot0.IOAccess.RD_DIGITAL_IO_0TO15
      IO_0_15
```

7.5.1.2 MASK_RD_DIGITALOUTPUT_0TO15

This symbol gives us which I/O are configured in outputs. In case you want have only the outputs value from the symbol RD_DIGITAL_IO_0TO15, you can do a mask.



IL example:

```
RDPW IO.Slot0.IOAccess.RD_DIGITAL_IO_0TO15
     IO_0_15

LD   MASK
     O.Slot0.IOAccess.MASK_RD_DIGITAL_OUTPUT_0TO15

AND  IO_0_15
     MASK
     OUT_0_15
```

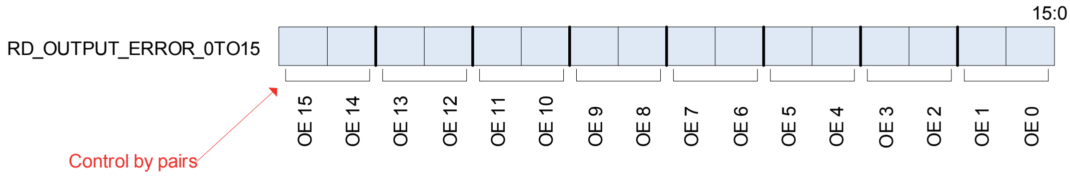
7.5.1.3 RD_OUTPUT_ERROR_0TO15

This symbol returns the status of the outputs. They indicate if an output is not functioning correctly and is set in high impedance. The module puts the outputs in high impedance if there is a short circuit, an overcurrent or the supply pins of the connectors are not powered when using output.

The module controls the outputs by pairs.

For example: if there is a short circuit on output 0 then the outputs 0 & 1 will be in high impedance and their respective status flags are set.

The flags will be: RD_OUTPUT_ERROR_0TO15 = 00000000 00000011.

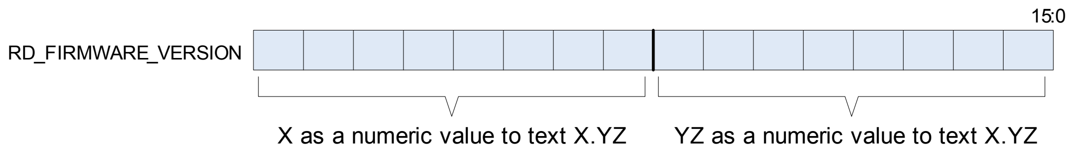


IL example:

```
RDPW  IO.Slot0.IOAccess.RD_OUTPUT_ERROR_0TO15
      OE_0_15
```

7.5.1.4 RD_FIRMWARE_VERSION

This symbol returns the firmware version of the module in ASCII.



Example: if the RD_FIRMWARE_VERSION = 00000010 00000011 then the firmware version is 2.03.

IL example:

```
RDPW  IO.Slot0.IOAccess.RD_FIRMWARE_VERSION
      FW_VERSION
```

7

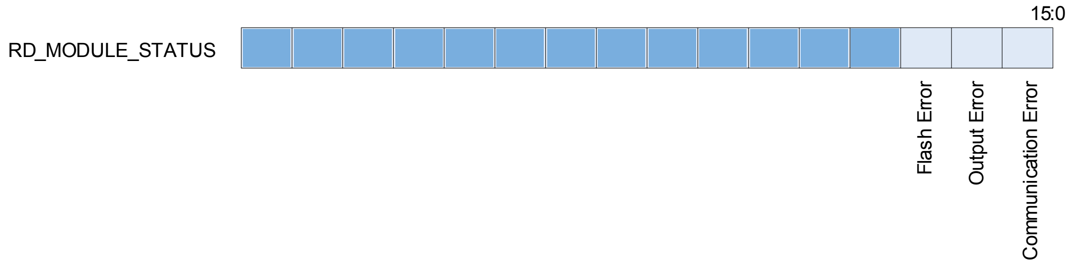
7.5.1.5 RD_MODULE_STATUS

This symbol returns the status of the module. When there is no error all the bits are low. Symbol clears automatically after reading.

Communication Error: Sets when an error occurs during the communication between the PCD & the module.

Output Error: Sets when outputs are in high impedance because of short circuit, overcurrent or no power on connector.

Flash Error: Sets when module failed to save configuration into flash.

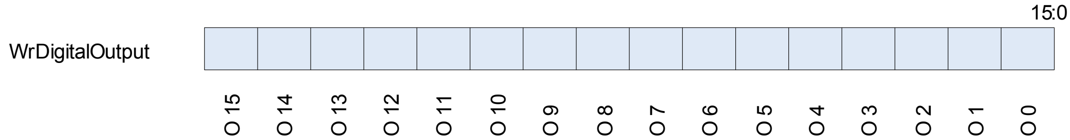


IL example:

```
RDPW IO.Slot0.IOAccess.RD_MODULE_STATUS
     Status
```

7.5.1.6 WR_DIGITAL_OUTPUT_0TO15

This symbol is used to write the outputs. Each bit corresponds to one output. If you write a bit whose I/O is not configured in output, nothing happens.



IL example:

```
LD   Data_Out
     0FFFFH
WRPW IO.Slot0.IOAccess.WR_DIGITAL_OUTPUT_0TO15
     Data_Out
```

7.5.2. Error PCD XOB 13

An XOB 13 is called in following cases:

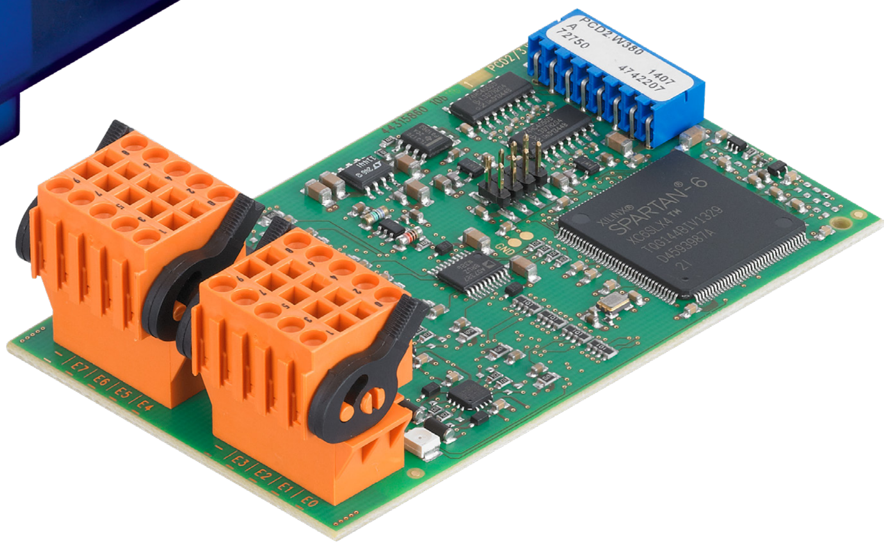
- If module is not present into the PCD slot and Program tries to access it with 'Direct Access Instructions'
- During an internal reset of the module

If XOB13 is not programmed then Error Flags is set.

7.6 Error PCD XOB 13

The XOB 13 error happens if the PCD wants communicate with the module but it is not in the slot.

In case of reset of the module (Watchdog UC), XOB13 happens if PCD try access to the module during restart.



8

PCD2.W380 & PCD3.W380
8 analogue configurable inputs

8 PCD2.W380 & PCD3.W380

8.1 PCD2/3.W380, 8 analog configurable inputs

This new module is a universal analog input module with improved embedded features. This is an intelligent module with a very comfortable utilization. It is able to measure voltages, currents, resistances and temperatures with the common sensors available in the market and with a precision of 0.3% or better (based on the full range). The inputs can be easily configured directly with PG5 and the Device Configurator. Every channel can be configured individually.

This module can be used in applications where the data acquisition speed is important. Each channel value is updated in internal buffer each 680 us that means each input value is refreshed at 1.5 kHz.

8.1.1 Module overview

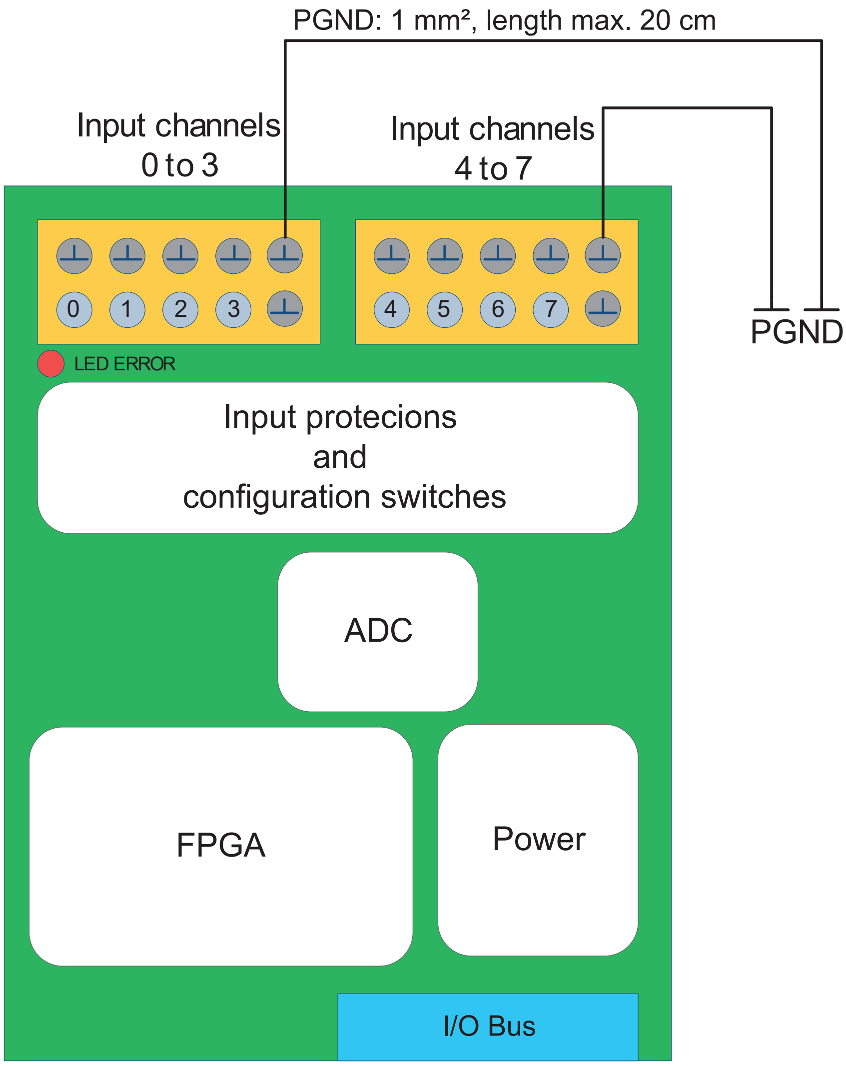


Figure 1: Module overview

8.1.2 Inputs connection

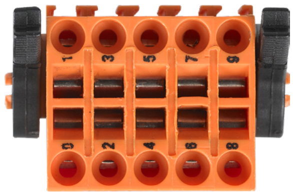
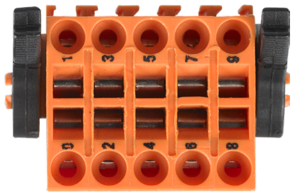
X0	1: GND	3: GND	5: GND	7: GND	9: GND
					
	0: CH0	2: CH1	4: CH2	6: CH3	8: GND
X1	1: GND	3: GND	5: GND	7: GND	9: GND
					
	0: CH4	2: CH5	4: CH6	6: CH7	8: GND

Figure 2: Inputs connections

- 2 connections per channel (signal and ground). All the ground pins are internally connected together.
- 4 channels per connector.
- In supplement, 2 ground connections per connector (pins 8 and 9). One of this pin should be used for a protective ground connection.
- Wires up to 1 mm².

8.1.3 Specifications

8.1.3.1 General data

Technical data				
COMPATIBILITY	PCD1, PCD2, PCD3			
POWER				
Module power supply voltage	+5V and V+ IOBUS			
Current consumption	25 mA on +5 V and 25 mA on V+			
Galvanic separation	No			
INPUTS				
Number of inputs	8			
Input ranges of each mode	Voltage	–10 V	…	+10 V
	Current	–20 mA	…	+20 mA
	Resistance	0 Ω 0 Ω	… …	2’500 Ω 300 kΩ
	Diode	0 V	…	5 V
	Pt1000	–50 °C	…	+400 °C
	Ni1000	–50 °C	…	+200 °C
	Ni1000L&S	–30 °C	…	+130 °C
	NTC10k	used in range 0	…	300 kΩ
	NTC20k	used in range 0	…	300 kΩ
Absolute maximum input voltage	±20 V (independent of the inputs configuration)			
Temperature error (0°C … +55°C)	± 0.2%			
Inputs configuration	Each input can be configured individually in 5 modes (ranges above)			
Configuration method	Software (PG5, Device Configurator)			
User connector	Per channel: 1 pin for input and 1 pin for ground. 2 pins for protective ground and 2 pins for ground in supplement.			
Inputs wiring	Up to 1 mm²			
TIMING				
Refresh of each channel	680 µs (all channels are updated during this time)			
Hardware input filter time constant	Voltage			τ = 2,5 ms
	Current			τ = 2,5 ms
	Resistance	(< 2’500 Ω) * (typ. for R < 300 kΩ) **		τ < 4,4 ms τ ≈ 8 ms
	Diode	(typ. for U < 5 V)		τ ≈ 4,4 ms
Digital input filter available	No Filter	One value per cycle		τ = 680 us
	Filter 1:	Mean of 4 cycles		τ = 2,72 ms
	Filter 2:	Mean of 8 cycles		τ = 5,44 ms
	Filter 3*** :	Mean of 16 cycles		τ = 10,88 ms
Min. number of I/O Bus accesses to read one channel				28 (~28 us)

* Temperature sensors Pt1000, Ni1000 and Ni1000L&S.
** Temperature sensors NTC10k and NTC20k.
*** Recommended filter, configured by default in Device Configurator.

Table 1: Technical data of the module

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8.1.3.2 Technical data of inputs

Each input can be configured to be used in the following modes:

Mode	Reso-lution [Bit]	Resolution [measure]	Accuracy (@ $T_{Ambient}$ = 25°C)	Display
Voltage –10 V … +10 V	12 + Sign	2,44 mV (linear) R_{IN} = 330 kΩ	0,2 % of measured value ± 10 mV	–10'000 … +10'000
Current –20 mA … +20 mA	12 + Sign	5,39 µA (linear) R_{SHUNT} = 225Ω	0,2 % of measured value ± 20 mV	–20'000 … +20'000
Resistance 0...2'500 Ω	12 bit	0,50…0,80 Ω Measuring current: 1,0…1,3 mA	0,2 % of measured value ± 3 Ω	0 … 25'000
Resistance	13 bit	0…10 kΩ: 1…10 Ω 10 k…40 kΩ: 10…40 Ω 40 k…70 kΩ: 40…100 Ω 70 k…100 kΩ: 100…200 Ω 100 k…300 kΩ: 0,2…1,5 kΩ Measuring current: 30 µA…1,3 mA	0,2 % of measured value ± 40 Ω 0,2 % of measured value ± 160 Ω 0,5 % of measured value ± 400 Ω 1,0 % of measured value ± 800 Ω 2,5 % of measured value ± 5,0 Ω	0 … 300'000
Pt 1000	12 bit	–50…+400 °C: 0,15…0,25 °C Measuring current: 1,0…1,3 mA	0,2 % of measured value ± 0,5 Ω	–500 … 4000
Ni 1000	12 bit	–50…+200 °C: 0,09…0,11 °C Measuring current: 1,0…1,3 mA	0,2 % of measured value ± 0,5 °C	–500 … 2000
Ni 1000 L&S	12 bit	–30…+130 °C: 0,12…0,15 °C Measuring current: 1,0…1,3 mA	0,2 % of measured value ± 0,5 °C	–300 … 1300
Diode 0...5'000 mV	12 bit	1,22 mV (linear) Measuring current: 0,7…1,3 mA	0,2 % of measured value ± 10 mV	0 … 5'000

Table 2: Inputs specifications for each mode

The measuring current was chosen to be the best compromise between the resolution and the sensors self-heating effect, which is negligible for most of the sensors and applications. Even in bad measuring conditions with Pt/Ni1000 sensors with a low thermal coupling as 4 mW/K, the maximal error produced by the sensors self-heating is lower than 0.3°C.

The module offers the possibility to use NTC temperature sensors. The corresponding input must be configured in mode "Resistance 0…300 kΩ".

Mode „Resistance 0…300 kΩ"	**Resolution [Bit]**	**Resolution [measure]**		**Accuracy (@ $T_{Ambient}$ = 25 °C)**	**Display**
NTC10k[1)]	13 Bit	–40…+120 °C:	0,05…0,1 °C	–20…+60 °C: ± 0,6 °C –30…+80 °C: ± 1,0 °C –40…+120 °C: ± 2,8 °C	–400…1200[2)]
NTC20k[3)]	13 Bit	–10…+80 °C: –20…+150 °C:	0,02…0,05 °C < 0,15 °C	–15…+75 °C: ± 0,6 °C –20…+95 °C: ± 1,0 °C +95…+120 °C: ± 2,5 °C +120…+150 °C: ± 5,8 °C	–200…1500[4)]

¹ The temperature curves for the NTC10k are not standardized and may be different for each manufacturer. For this reason, the curves can be loaded by the user program using the linearization FBox. The curve of the NTC10k from Produal is available in a CSV file and can be downloaded from the Support Website.
² This is the output value of the FBox for linearization. The module gives a resistance 0 … 300'000 Ω.
³ For the same reason of NTC10k, the curve of the NTC20k from Honeywell can be downloaded from the Support Website.
⁴ This is the output value of the FBox for linearization. The module gives a resistance 0 … 300'000 Ω.

Table 3: Inputs specifications for NTC10k and NTC20k

For an example of the utilization of a NTC sensor, please see the chapter 4 "Example of linearization".

With an input configured in "Diode 0…5000 mV", it is possible to use integrated circuit temperature sensors operating as a 2-terminal zener. A typical sensor for this measurement is the LM235 for example.

Mode „Resistance 0...300 kΩ"	**Resolution [Bit]**	**Resolution [measure]**		**Accuracy (@ $T_{Ambient}$ = 25 °C)**	**Display**
LM235	12 Bit	–40…+125 °C:	0,12 °C	0,2 % of measured value ±1,0 °C	–400…1250 [1]

1 This is the output value of the FBox for linearization. The module gives a voltage 5'000mV.0 … 5'000 mV.

Table 4: Inputs specifications for LM235

For an example of the utilization of a LM235 sensor, please see the chapter 4 "Example of linearization".

8.1.4 Input wiring

The module is connected with the PCD by the I/O Bus connector. It can be plugged with all the PCD versions PCD1, PCD2, PCD3. The module is completely powered from the PCD bus, no external power supply is needed.

The inputs are connected with the module by two 10-pins connectors for cables up to 1 mm². These connectors are very reliable and providing 2 pins per channel, one for the input and the other connected to the ground. In each connector, 2 pins are connected to the ground and can be used by user. In each connector, one of these pins should be used as protective ground connection to avoid immunity problems against external perturbations. A wire with a section of 1 mm² and a maximum length of 20 cm is recommended for a good PGND connection.

Every measurement mode has an equivalent input stage.

For resistance measurements (temperature sensors), 10 V are provided through a 7.5 kΩ resistor to the input.

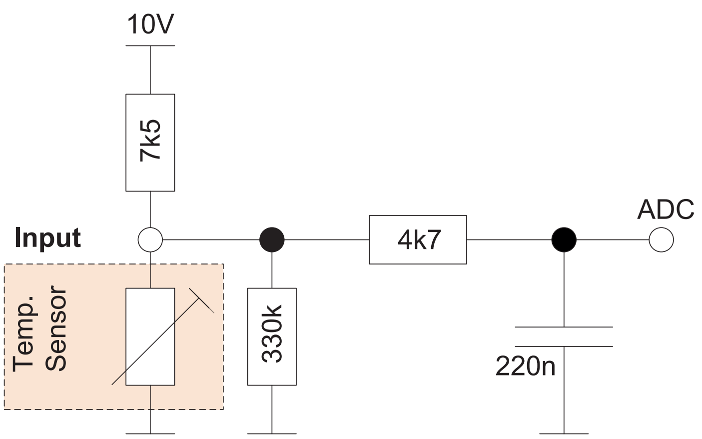


Figure 3: Equivalent schematic of input in temperature and resistance mode

For current measurements, a shunt of 225 Ω is connected to the ground.

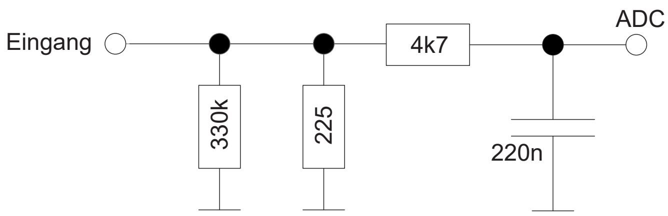


Figure 4: Equivalent schematic of input in "current" mode

In voltage measurements, the input is “directly” connected to the ADC.

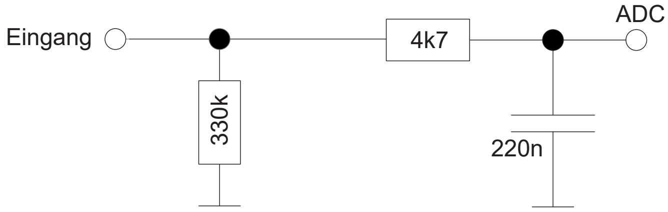


Figure 5: Equivalent schematic of input in "voltage" mode

In “Diode” mode, the module measures voltages in an “active” way. The schematic is the same as the mode for resistance measurements. The output values are given in [mV]. This mode is useful for temperature sensors as LM235.

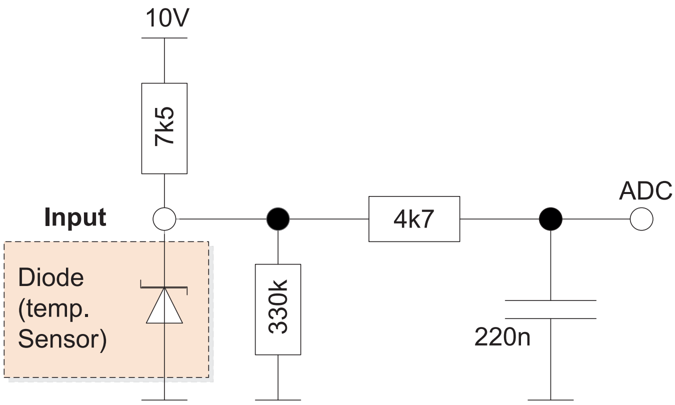
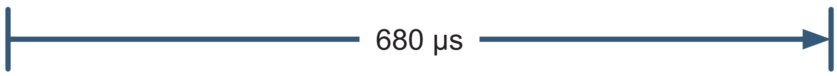


Figure 6: Equivalent schematic of input in "diode" mode

8.1.5 Input values acquisition

The module is able to acquire and convert the each channel one by one, with a total cycle time of 680µs:

CH0 → CH1 → CH2 → CH3 → CH4 → CH5 → CH6 → CH7 → CH0 → ...



8.1.6 Configurable digital filters

Each channel can be configured with a digital filter. Four possibilities are available:

- Disabled: Each channel value is updated in buffer every 680 µs (f = 1.47 kHz)
- 3 ms: Mean of 4 cycles, value updated every 2.72 ms (f = 367 Hz)
- 6 ms: Mean of 8 cycles, value updated every 5.44 ms (f = 184 Hz)
- 12 ms: Mean of 16 cycles, value updated every 10.88 ms (f = 92 Hz)

8.1.7 Out of range indication

The module has an out of range indication. This information can be read in the registers “OutOfRange”.
The table below shows the values setting the bits “Out Of Range.

N/A means not available.

Mode		"Out of range" bit set…	
		Limit min	Limit max
Voltage	–10 V … +10 V	N/A	N/A
Current	–20 mA … +20 mA	–20’002 uA	+20’002 uA
Resistance	0 … 2'500 Ω	N/A	2518.7 Ω
Resistance	0 … 300 kΩ	N/A	302’010 Ω
Pt 1000		–50.0 °C	+408.7 °C
Ni 1000		–50.0 °C	+210.3 °C
Ni 1000 L&S		–30.0 °C	+130 °C
Diode	0 … 5’000 mV	k. A.	4’999 mV

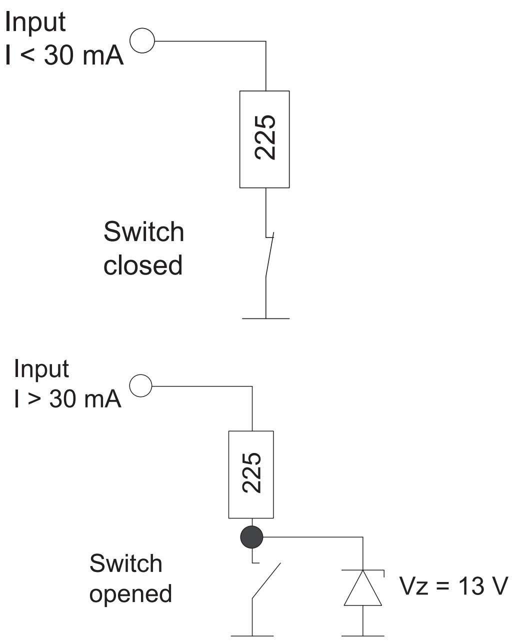
Table 5: Limits for Out Of Range

8.1.8 Input protections

The design supports an input voltage between –20 V to +20 V in all the modes of measurement. It can be considered a passive protection. Higher values can damage the module. For voltages higher than ±13 V a current passes through the circuit. It can be calculated approximately: $I_{overvoltage}$ = (Vin – 13 V) / 225 Ω.
In this situation, the values measured on the other channels can be falsified.

Active protections are implemented for current measurements, but in all conditions the input voltage must be lower than ±20 V. The bit corresponding to the channel is set to ‘1’ in the register “ModuleErrors” when the protection is enabled.

8.1.8.1 Current measuring range



¹ HW version ‘A’ and ‘A1’ : Limit = ±24 mA

If current mode is chosen the measuring shunt is connected to ground through the switch as shown in the picture on the left.

In case the current is higher than 30 mA[1] the switch opens to protect the measuring shunt. For voltage lower than ±13 V on the opened input the current will be kept lower than 1 mA. If the voltage on the opened input rises above +/-13 V the current can be approximately calculated using the formula:

$I_{overvoltage}$ = (Vin – 13 V) / 225 Ω

Care should be taken to keep input voltage below ±20 V.

8.1.9 Protection mode

The input stage configuration (switch) is automatically modified when the module enters in protection mode. The input values of the others channels could be out of the specified tolerances when a channel is in protection mode.

The modules from version ‘A2’ have an automatic reconfiguration mechanism after the active protection has become active. Once triggered, the input will remain for 10 seconds in protection mode. After 10 seconds, the input will switch back to normal operating configuration. If the input is still in overload condition, protection will again be activated. This feature is available only with firmware version greater than 1.24.10.

For Modules with version ‘A’ or ‘A1’ the protection will also be activated when an overload occurs, but to switch back to normal operation mode the PCD has to be restarted.

8.1.10 LED signalization

One red LED is placed near the channel 0. The LED is enabled when an error occurs on the module. This is a general indication and the details of the error must be read in the specific register of the module.

The signaled errors are:

- Configuration error: The desired inputs configuration is not applied correctly.
- ADC-Fehler: A/D converter doesn’t respond.
- Calibration error: Module not calibrated.
- Protection mode: An input channel has been automatically put in protection mode, because the module detects a situation which can cause important damages to hardware.

8.1.11 Block diagram

The PLC communicates with the module through the I/O Bus.

The data acquisition is independent of the rest. The input values are continuously updated into the internal buffer. One value is stored per channel. The values are sent to the PLC when the user program sends a defined request to the module.

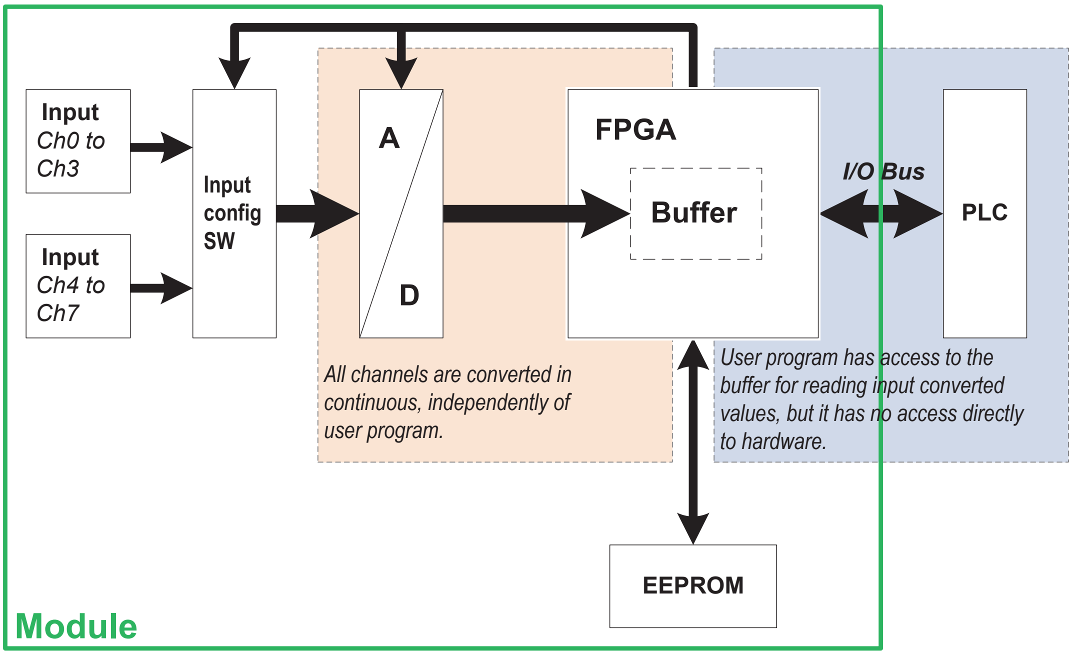


Figure 7: Global diagram of module structure conception

The configuration of the module is done in PG5 Device Configurator. The user program can read the input values or input configurations by specific registers.

8.2 Preparing the PLC system

The PCD used for the module PCDx.W380 must be updated with a firmware version 1.22.28 or higher. Please, download the last firmware version from the support website and load it in the PCD with the PG5 Firmware Downloader Tool.

8.3 Module in PG5 environment

8.3.1 Preparing PG5

This module can only be used with the software version PG5 2.1.300 or higher. Please, verify if your system is up-to-date. You find the last PG5 version on the support Website www.sbc-support.com.

8.3.2 Choosing the module

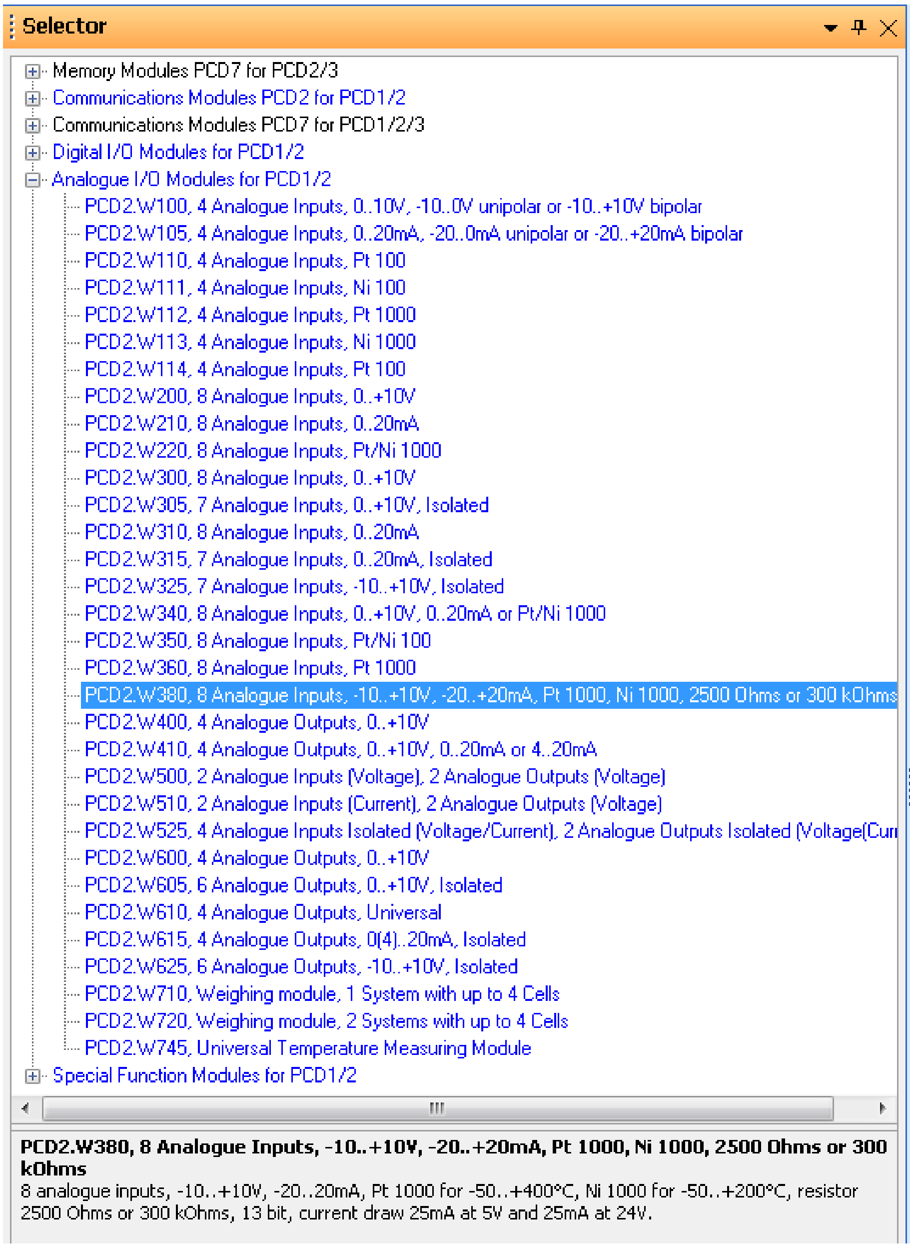


Figure 8: List of modules in PG5

8.3.3 Inputs configuration

Slot 0 : PCD2.W380, 8 Analogue Inputs, -10..+10V, -20..+20mA, Pt 1000, Ni 1000, 2500 Ohms or 300 kOhms	
General	
Base Address	0
Power Consumption	
Power Consumption 5V [mA]	25
Power Consumption V+ [mA]	25
Media Mapping	
Media Mapping Enabled	**Yes**
Media Type	Register
Number Of Media	8
Media Mapping Status/Diagnostic	
Media Type For Status/Diagnostic	**Flag**
Number Of Media For Status/Diagnostic	24
Analogue Input 0	
Digital Filter Input 0	**Disabled**
Input 0 Range	-10..10V in mV resolution
Minimum Value Input 0	-10000
Maximum Value Input 0	10000
Analogue Input 1	
Digital Filter Input 1	**Disabled**
Input 1 Range	**-20..20mA in uA resolution**
Minimum Value Input 1	-20000
Maximum Value Input 1	20000
Analogue Input 2	
Digital Filter Input 2	**Disabled**
Input 2 Range	**User defined range for current input -20..20mA**
Minimum Value Input 2	**-1000**
Maximum Value Input 2	**1000**
Analogue Input 3	
Digital Filter Input 3	**3 ms**
Input 3 Range	**0..2500Ohms**
Minimum Value Input 3	0
Maximum Value Input 3	25000
Analogue Input 4	
Digital Filter Input 4	**6 ms**
Input 4 Range	**Pt 1000 (-50..400°C)**
Minimum Value Input 4	-500
Maximum Value Input 4	4000
Analogue Input 5	
Digital Filter Input 5	12 ms
Input 5 Range	**0..300kOhms**
Minimum Value Input 5	0
Maximum Value Input 5	300000
Analogue Input 6	
Digital Filter Input 6	**Disabled**

Figure 9: PG5, inputs configuration (1)

The module can be used by two ways:

- With media mapping
- With direct access

The two possibilities are described in the next chapter.

Analogue Input 0	
Digital Filter Input 0	12 ms (Disabled / 3 ms / 6 ms / 12 ms)
Input 0 Range	
Minimum Value Input 0	
Maximum Value Input 0	
Analogue Input 1	

Figure 10: PG5, inputs configuration (2)

-10..10V in mV resolution
User defined range for voltage input -10..10V
-20..20mA in uA resolution
User defined range for current input -20..20mA
Pt 1000 (-50..400°C)
Ni 1000 (-60..200°C)
Ni 1000 L&S (-30..+130°C)
0..2500Ohms
0..300kOhms
0..5000mV Diode

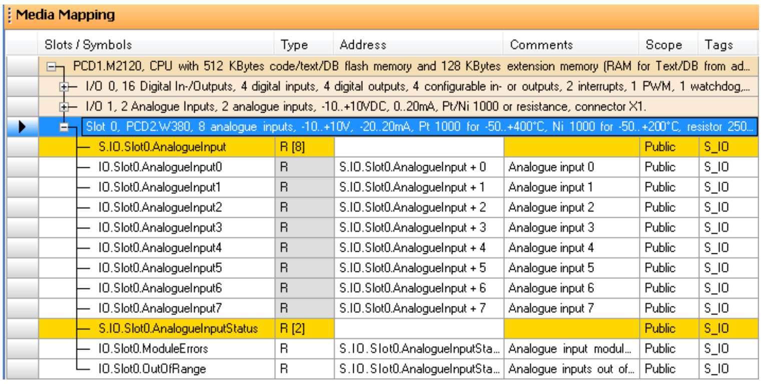
Figure 11: PG5, inputs configuration (3)

8.3.4 Data acquisition

The format of the values is directly linked with the corresponding input configuration. For example, the value is a temperature if the input is configured for a Ni1000 sensor.

8.3.4.1 With media mapping

With the media mapping enabled, each module has these following registers:



Media Mapping

Slots / Symbols	Type	Address	Comments	Scope	Tags
PCD1.M2120, CPU with 512 KBytes code/text/DB flash memory and 128 KBytes extension memory (RAM for Text/DB from ad...					
I/O 0, 16 Digital In-/Outputs, 4 digital inputs, 4 digital outputs, 4 configurable in- or outputs, 2 interrupts, 1 PWM, 1 watchdog,...					
I/O 1, 2 Analogue Inputs, 2 analogue inputs, -10..+10VDC, 0..20mA, Pt/Ni 1000 or resistance, connector X1.					
Slot 0, PCD2.W380, 8 analogue inputs, -10..+10V, -20..20mA, Pt 1000 for -50..+400°C, Ni 1000 for -50..+200°C, resistor 250...					
S.IO.Slot0.AnalogueInput	R [8]			Public	S_IO
IO.Slot0.AnalogueInput0	R	S.IO.Slot0.AnalogueInput + 0	Analogue input 0	Public	S_IO
IO.Slot0.AnalogueInput1	R	S.IO.Slot0.AnalogueInput + 1	Analogue input 1	Public	S_IO
IO.Slot0.AnalogueInput2	R	S.IO.Slot0.AnalogueInput + 2	Analogue input 2	Public	S_IO
IO.Slot0.AnalogueInput3	R	S.IO.Slot0.AnalogueInput + 3	Analogue input 3	Public	S_IO
IO.Slot0.AnalogueInput4	R	S.IO.Slot0.AnalogueInput + 4	Analogue input 4	Public	S_IO
IO.Slot0.AnalogueInput5	R	S.IO.Slot0.AnalogueInput + 5	Analogue input 5	Public	S_IO
IO.Slot0.AnalogueInput6	R	S.IO.Slot0.AnalogueInput + 6	Analogue input 6	Public	S_IO
IO.Slot0.AnalogueInput7	R	S.IO.Slot0.AnalogueInput + 7	Analogue input 7	Public	S_IO
S.IO.Slot0.AnalogueInputStatus	R [2]			Public	S_IO
IO.Slot0.ModuleErrors	R	S.IO.Slot0.AnalogueInputSta...	Analogue input modul...	Public	S_IO
IO.Slot0.OutOfRange	R	S.IO.Slot0.AnalogueInputSta...	Analogue inputs out of...	Public	S_IO

Figure 12: PG5, media mapping

8.3.4.1.1 Inputs values

In a Fupla or IL program, the input values are saved in registers and can be read with the names:

- **IO.Slot0.AnalogueInput0** for channel 0
- **IO.Slot0.AnalogueInput1** for channel 1
- **IO.Slot0.AnalogueInput2** for channel 2
- **IO.Slot0.AnalogueInput3** for channel 3
- **IO.Slot0.AnalogueInput4** for channel 4
- **IO.Slot0.AnalogueInput5** for channel 5
- **IO.Slot0.AnalogueInput6** for channel 6
- **IO.Slot0.AnalogueInput7** for channel 7

8.3.4.1.2 Status and errors

Two registers are implemented for the status of the module:

- IO.Slot0.ModuleErrors
- IO.Slot0.OutOfRange

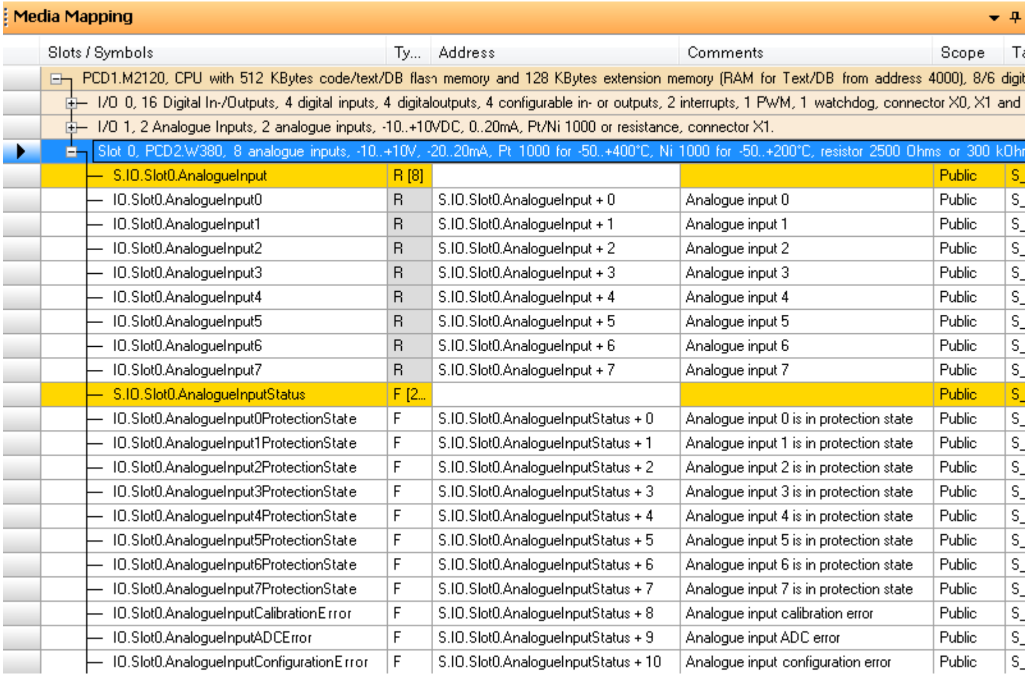
This information can be read as registers or flags. It can be configured in the device configurator:

Figure 13: Media type for diagnostic

The behavior of the diagnostic bits is the same for the two types.

8.3.4.1.2.1 Module Errors

With flag type configuration, one flag per channel is created for the protection state and three flags for Calibration, ADC and Configuration errors.



Media Mapping

Slots / Symbols	Ty...	Address	Comments	Scope	T
PCD1.M2120, CPU with 512 KBytes code/text/DB flash memory and 128 KBytes extension memory (RAM for Text/DB from address 4000), 8/6 digit					
I/O 0, 16 Digital In-/Outputs, 4 digital inputs, 4 digitaloutputs, 4 configurable in- or outputs, 2 interrupts, 1 PWM, 1 watchdog, connector X0, X1 and					
I/O 1, 2 Analogue Inputs, 2 analogue inputs, -10..+10VDC, 0..20mA, Pt/Ni 1000 or resistance, connector X1.					
Slot 0, PCD2.W380, 8 analogue inputs, -10..+10V, -20..20mA, Pt 1000 for -50..+400°C, Ni 1000 for -50..+200°C, resistor 2500 Ohms or 300 kOhm					
S.IO.Slot0.AnalogueInput	R [8]			Public	S_
IO.Slot0.AnalogueInput0	R	S.IO.Slot0.AnalogueInput + 0	Analogue input 0	Public	S_
IO.Slot0.AnalogueInput1	R	S.IO.Slot0.AnalogueInput + 1	Analogue input 1	Public	S_
IO.Slot0.AnalogueInput2	R	S.IO.Slot0.AnalogueInput + 2	Analogue input 2	Public	S_
IO.Slot0.AnalogueInput3	R	S.IO.Slot0.AnalogueInput + 3	Analogue input 3	Public	S_
IO.Slot0.AnalogueInput4	R	S.IO.Slot0.AnalogueInput + 4	Analogue input 4	Public	S_
IO.Slot0.AnalogueInput5	R	S.IO.Slot0.AnalogueInput + 5	Analogue input 5	Public	S_
IO.Slot0.AnalogueInput6	R	S.IO.Slot0.AnalogueInput + 6	Analogue input 6	Public	S_
IO.Slot0.AnalogueInput7	R	S.IO.Slot0.AnalogueInput + 7	Analogue input 7	Public	S_
S.IO.Slot0.AnalogueInputStatus	F [2...			Public	S_
IO.Slot0.AnalogueInput0ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 0	Analogue input 0 is in protection state	Public	S_
IO.Slot0.AnalogueInput1ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 1	Analogue input 1 is in protection state	Public	S_
IO.Slot0.AnalogueInput2ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 2	Analogue input 2 is in protection state	Public	S_
IO.Slot0.AnalogueInput3ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 3	Analogue input 3 is in protection state	Public	S_
IO.Slot0.AnalogueInput4ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 4	Analogue input 4 is in protection state	Public	S_
IO.Slot0.AnalogueInput5ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 5	Analogue input 5 is in protection state	Public	S_
IO.Slot0.AnalogueInput6ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 6	Analogue input 6 is in protection state	Public	S_
IO.Slot0.AnalogueInput7ProtectionState	F	S.IO.Slot0.AnalogueInputStatus + 7	Analogue input 7 is in protection state	Public	S_
IO.Slot0.AnalogueInputCalibrationError	F	S.IO.Slot0.AnalogueInputStatus + 8	Analogue input calibration error	Public	S_
IO.Slot0.AnalogueInputADCError	F	S.IO.Slot0.AnalogueInputStatus + 9	Analogue input ADC error	Public	S_
IO.Slot0.AnalogueInputConfigurationError	F	S.IO.Slot0.AnalogueInputStatus + 10	Analogue input configuration error	Public	S_

Figure 14: Flags for module errors

In register type, the following register is created:

Bit	Description
11 .. 15	*Reserved*
10	Configuration error
9	ADC error
8	Calibration error
7	CH7 protection
6	CH6 protection
5	CH5 protection
4	CH4 protection
3	CH3 protection
2	CH2 protection
1	CH1 protection
0	CH0 protection

Table 6: Description of ModuleErrors register

- Configuration error: The desired inputs configuration is not applied correctly.
- ADC error: A/D converter doesn't respond.
- Calibration error: Module not calibrated.
- Protection mode: An input channel has been automatically put in protection mode, because the module detects a situation which can cause important damages to hardware.

8

8.3.4.1.2.2 Out Of Range

One flag per channel is created to signalize when the input values are out of range:

IO.Slot0.AnalogueInput0OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 16	Analogue input 0 out of range	Public	S_
IO.Slot0.AnalogueInput1OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 17	Analogue input 1 out of range	Public	S_
IO.Slot0.AnalogueInput2OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 18	Analogue input 2 out of range	Public	S_
IO.Slot0.AnalogueInput3OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 19	Analogue input 3 out of range	Public	S_
IO.Slot0.AnalogueInput4OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 20	Analogue input 4 out of range	Public	S_
IO.Slot0.AnalogueInput5OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 21	Analogue input 5 out of range	Public	S_
IO.Slot0.AnalogueInput6OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 22	Analogue input 6 out of range	Public	S_
IO.Slot0.AnalogueInput7OutOfRange	F	S.IO.Slot0.AnalogueInputStatus + 23	Analogue input 7 out of range	Public	S_

If the configuration is done in “register type”, an 8-bit register is created:

Bit	Description
7	CH7 out of range
6	CH6 out of range
5	CH5 out of range
4	CH4 out of range
3	CH3 out of range
2	CH2 out of range
1	CH1 out of range
0	CH0 out of range

Table 7: Description of OutOfRange register

The “out of range” status bit means that the converted value is out of the specified range. The input value stay at the minimum or other maximum value allowed.

The mode “VOLTAGE” hasn’t out of range detection.

8.3.4.2 With direct access

The module allows direct access with RDP commands.

Symbol Name	Type	Address/Value	Comment	Tags	Scope
All Publics	**ROOT**				
IO	GROUP				
IOAccess	GROUP				
Slot0	GROUP				
IOAccess	GROUP				
ANALOGUE_INPUT_0	CONST	8	Address of analogue input 0 in memory input range - used for direct access		Public
ANALOGUE_INPUT_1	CONST	12	Address of analogue input 1 in memory input range - used for direct access		Public
ANALOGUE_INPUT_2	CONST	16	Address of analogue input 2 in memory input range - used for direct access		Public
ANALOGUE_INPUT_3	CONST	20	Address of analogue input 3 in memory input range - used for direct access		Public
ANALOGUE_INPUT_4	CONST	24	Address of analogue input 4 in memory input range - used for direct access		Public
ANALOGUE_INPUT_5	CONST	28	Address of analogue input 5 in memory input range - used for direct access		Public
ANALOGUE_INPUT_6	CONST	32	Address of analogue input 6 in memory input range - used for direct access		Public
ANALOGUE_INPUT_7	CONST	36	Address of analogue input 7 in memory input range - used for direct access		Public
MODULE_ERRORS	CONST	40	Address of module errors in memory input range - used for direct access		Public
OUT_OF_RANGE	CONST	42	Address of out of range status in memory input range - used for direct access		Public

Here an IL program example to read the input values, the module errors and the out of range status:

Declaration of a mask:

```
; Mask declaration (top of the file)
Mask1Byte     EQU     R
; Load the vlaue 255 in the mask to keep only
; the least significant byte (in XOB16 or in COB)
              LD      MASK1Byte
                      255
```

Commands for reading module data:

```
; 4 bytes (dword) : RDP command for ANALOGUE_INPUT_x
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_0
              R 0
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_1
              R 1
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_2
              R 2
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_3
              R 3
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_4
              R 4
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_5
              R 5
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_6
              R 6
RDP           IO.Slos0.IOAccess.ANALOGUE_INPUT_7
              R 7
; 2 bytes (dword) : RDPW command for MODULE_ERRORS
RDPW          IO.Slos0.IOAccess.MODULE_ERRORS
              R 8

; 1 byte : RDPW command with mask for OUT_OF_RANGE
RDPB          IO.Slos0.IOAccess.OUT_OF_RANGE
              R 9
AND           R 9
              MASK1Byte
              R 9
```

The type of read data for each “register” is the same than using media mapping.

The mask after the command RDPB is only for the comfort. The RDPB command has an integrated 2-complement conversion. If the channel 7 is out of range, the bits 8 to 31 of the register R 9 are setting to ‘1’. To avoid this phenomenon, a mask can be placed to keep only the desired data on R 9 and the bits 8 to 31 stay ‘0’.

The register MODULE_ERRORS must be read cyclically even if they are not used in the user program.

8.4 Example of linearization

The choice of NTC sensors is not available in the Device Configurator because these sensors are not standardized. To use a NTC with the module PCD2/3.W380, please configure the desired channel in mode “0…300 kΩ” and use the linearization FBox available in PG5 environment.

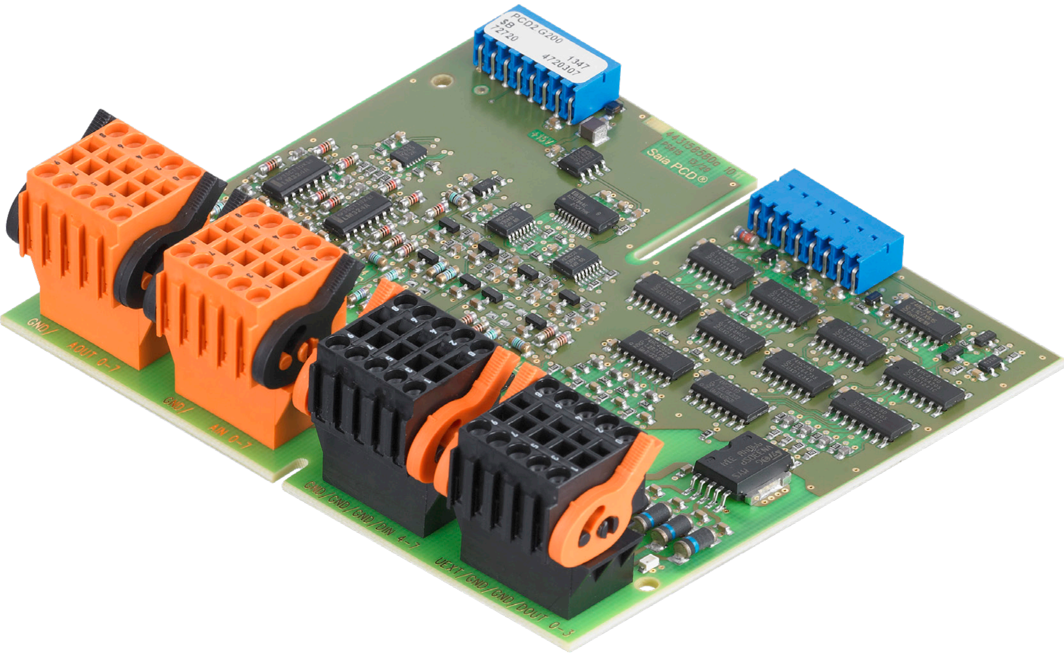
This FBox can be used to enter the own tables for the conversion of a resistance value in a temperature value.

A project example can be downloaded from the SBC Support Website at this location:

http://www.sbc-support.com/

This project example can be used for temperature measurements with integrated circuits operating as a 2-terminal zener too. This FBox can be used to enter the own tables for the conversion of a voltage value in a temperature value.

The desired channel must be configured in mode “Diode 0…5000 mV”.



PCD2.G200
Multifunction module (2 sockets side-by-side)

9 PCD2.G200

9.1 Overview PCD2.G200

The PCD2.G200 is a double I/O-module that uses two I/O-slots and includes the following functions:

- 4 digital outputs 24 VDC
- 4 digital inputs 24 VDC
- 8 analogue inputs 12 bit
  (2 × 0…10 V, 4 × selectable 0…10 V, Pt/Ni1000 or 0…20 mA, 2 × Pt/Ni1000
- 8 analogue outputs 0...10 V (10 Bit)

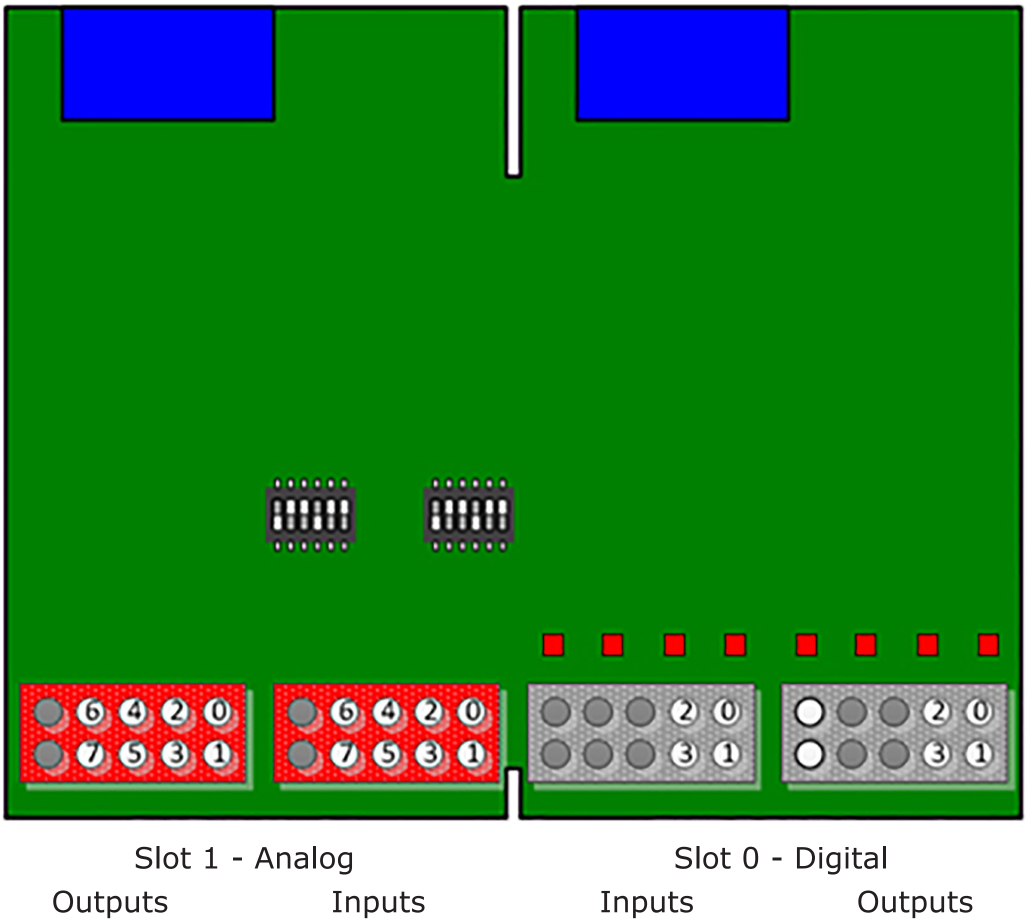


Figure 1: Module overview

9.2 Specifications

Technical data	
COMPATIBILITY	PCD1, PCD2
Storage temperature	–25…+70 °C
Ambient temperature operating	0…+55 °C
Relative air humidity	10…95% r.h. non condensing
POWER	
Module power supply voltage	+5V and V+ (from I/O-BUS) And 24V ext. for digital outputs
Current consumption	12 mA on +5V and max. 35 mA on V+
Galvanic separation	No
DIGITAL OUTPUTS	
Number of outputs	4, electrically connected, source operation
Addressing	O 0…3 (+BA)
Voltage range	10…32 VDC, smoothed, max. 10% residual ripple
Output current	5…500 mA (leakage current max. 0,1 mA) min. load resistance: 48 Ω
Short circuit protection	yes
Voltage drop	max. 0.3 V at 0.5 A
Output delay	Typically 50 µs, max. 100 µs for resistive load
Overvoltage protection	TVS Diode 39 V
LEDs	yes
Terminals	1 plug-in spring-load terminal block, 10-pole, 3.5mm for wiring up to 1 mm², black
DIGITAL INPUTS	
Number of inputs	4, electrically connected, source operation
Addressing	I 4…7 (+BA)
Input voltage	Typ. 24 VDC smoothed or pulsed H level: 15…30 V L level: –30…+5 V
Input current	typ. 7 mA at 24 VDC (IEC 61131-2, Typ 1)
Input delay	typ. 8 ms
Overvoltage protection	no (Umax = ±34 V)
LEDs	yes
Terminals	1 plug-in spring-load terminal block, 10-pole, 3.5 mm for wiring up to 1 mm², black

Table 1: Technical Data

Technical data		
ANALOGUE INPUTS		
Number of inputs	8	
Configuration	AI0 / AI1: AI2 / AI3 / AI4 / AI5: AI6 / AI7:	0…10 V Dip Switch selectable PT/NI1000
Galvanic separation	no	
Signal ranges	0…10 V Resolution*) 2.44 mV 0…20 mA, Resolution*) 4.88 µA *) Resolution = value of least significant bit (LSB)	
Resolution (digital representation)	12 bits (0…4095) rsp. directly in 1/10 °C or in 0.1 Ω	
Connection technique for sensors	2-wires (passiv input)	
Measuring principle	Single ended	
Input resistance	10 V range: 20 mA range: PT/NI1000:	20 kΩ 125 Ω 7.5 kΩ
Input filter	typ. typ.	10 ms (0…10 V) 20 ms (0…20 mA; PT/NI1000)
Input ranges for temperature sensors	PT1000: NI1000: NI1000L&S: Resistance: Resistance:	–50…+400°C –60…+200°C –60…+200°C 0 … 2500 Ω 0 … 300 kΩ
Accuracy at 25°C	± 0.5% (±0.4% ±4 LSB)	
Temperature error (0…+55°C)	± 0.25%	
Overrange protection	10 V range: + 35 V (39 V TVS Diode) 20 mA range: no protection (40 mA max.)	
Terminals	1 plug-in spring-load terminal block, 10-pole, 3.5 mm for wiring up to 1 mm², orange	
ANALOGUE OUPUTS		
Number of outputs	8	
Galvanic separation	no	
Signal ranges	0…10 V Resolution 10 mV, LSB (least significant bit)	
Resolution (digital representation)	10 bits (0…1023)	
Accuracy at 25°C	± 0.5% ± 50 mV	
Temperature error (0…+55°C)	± 0.25%	
Load resistance	min. 3 kΩ	
Short-circuit protection	yes, permanent	
Terminals	1 plug-in spring-load terminal block, 10-pole, 3.5 mm for wiring up to 1 mm², orange	

Table 2: Technical data of the module

9

9.2.1 Resolution of the analogue inputs

Mode	Resolution [analogue]		Resolution [digital]	Read Values (default)
Voltage 0…+10 V	2.44 mV (linear)		1 mV	0…+10‘000
Current 0…+20 mA	5.14 uA (linear)		1 uA	0…+20‘000
Resistance 0…2'500 Ω	0.50…0.80 Ω		0.1 Ω	0...25’000
Resistance 0…300 kΩ	0…10 kΩ: 10 k…20 kΩ: 20 k…40 kΩ: 40 k…70 kΩ: 70 k…100 kΩ: 100 k…300 kΩ:	2…14 Ω 14…40 Ω 40…130 Ω 130…350 Ω 350…700 Ω 0.7…4.5 kΩ	1 Ω	0..300’000
Pt 1000	–50…+400°C:	0.15…0.25°C	0.1°C	–500…4000
Ni 1000	–60…+200°C:	0.09…0.11°C	0.1°C	–600…2000
Ni 1000 L&S	–60…+200°C:	0.12…0.15°C	0.1°C	–600…2000

Table 3: Resolution of the module

9.2.2 Dip Switch position

The input circuit for the analogue inputs AI2 … AI5 can be selected by mini Dip switches:

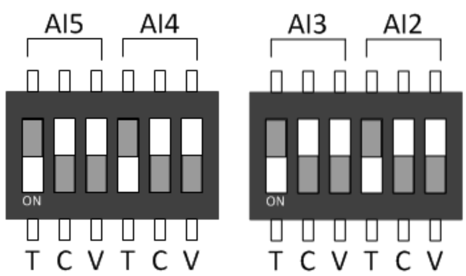


Figure 3: DIP Switches

The modes T (NI/PT1000), C (0…20 mA) or V (0…10 V) are selected by putting the switch in the down position. Only one switch per channel has to be on, except in the 0…300 kΩ range where the T and the V switch must be on.

The above picture shows the default setting (all on T) where all inputs are configured in the temperature measurement mode.

9.2.3 I/O connection

4 plug-in spring-load terminal blocks, 10-pole, 3.5 mm for wiring up to 1 mm² Weidmüller Type K. Orange: Part No. 4 405 5048 0, black Part No. 4 405 5054 0

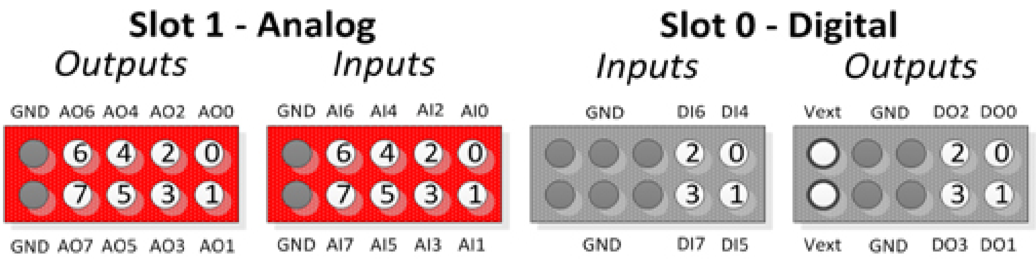


Figure 4: Inputs connections

9.3 Preparing the PLC system

9.3.1 CPU FW

The analog inputs/outputs can be mapped in the device configurator.

Therefore the PCD firmware must be version PCD1.M2xx0_1.22.28, rsp. PCD2.M5xx0_1.22.28 or newer.

Older PCD's can be updated by downloading a new FW with the PG5 firmware download tool:

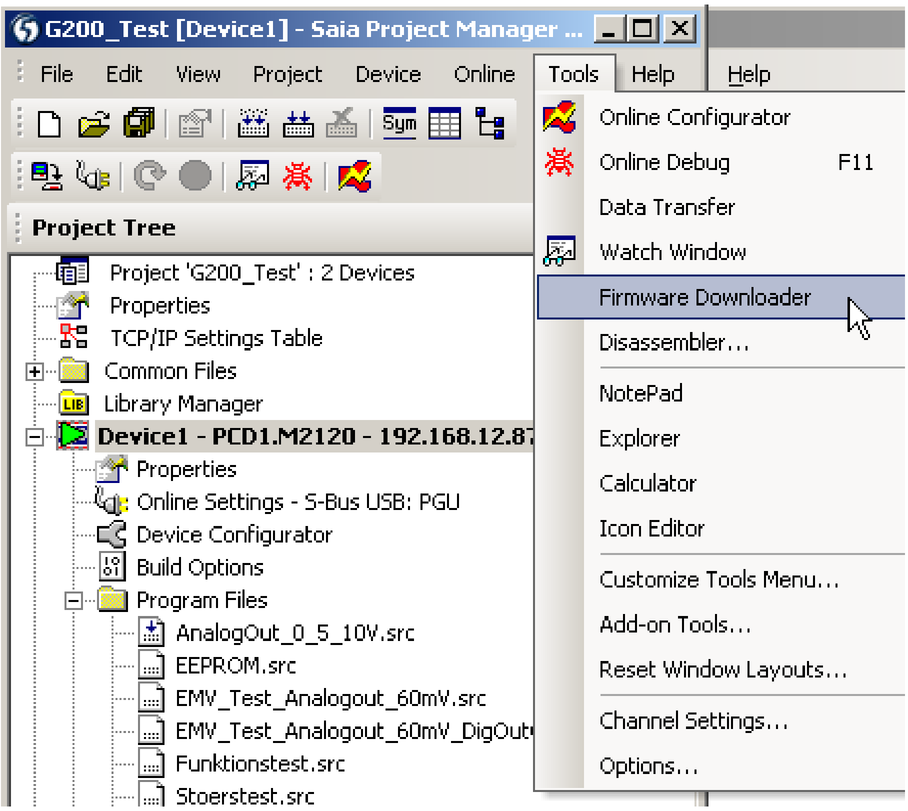


Figure 5: Firmware Downloader Tool

Actual FW can be find on the support website www.sbc-support.com.

9.3.2 Preparing PG5

The PCD2.G200 module can only be used with the software version PG5 2.1.200 or newer. Please, verify if your system is up-to-date.

You find the last PG5 version on the support Website www.sbc-support.com.

From PG5 version V2.1.300 on the PCD2.G200 is fully supported.
For older versions the following templates:

- pcd2multifunction.saiaxml PCD2.G200 configuration
- pcd1mxxx0.saiaxml PCD1 modul selection
- pcd2mxx0.saiaxml PCD2 modul selection

Have to be copied in the template directory.
Example: C:/Program Files (x86)/Saia-Burgess/PG5 V2.1.200/DeviceTemplates

9.3.2.1 Device configurator

9.3.2.1.1 Choosing the module

The PCD2.G200 can be selected from the Multi-Function Modules and placed on Slot0 for PCD1:

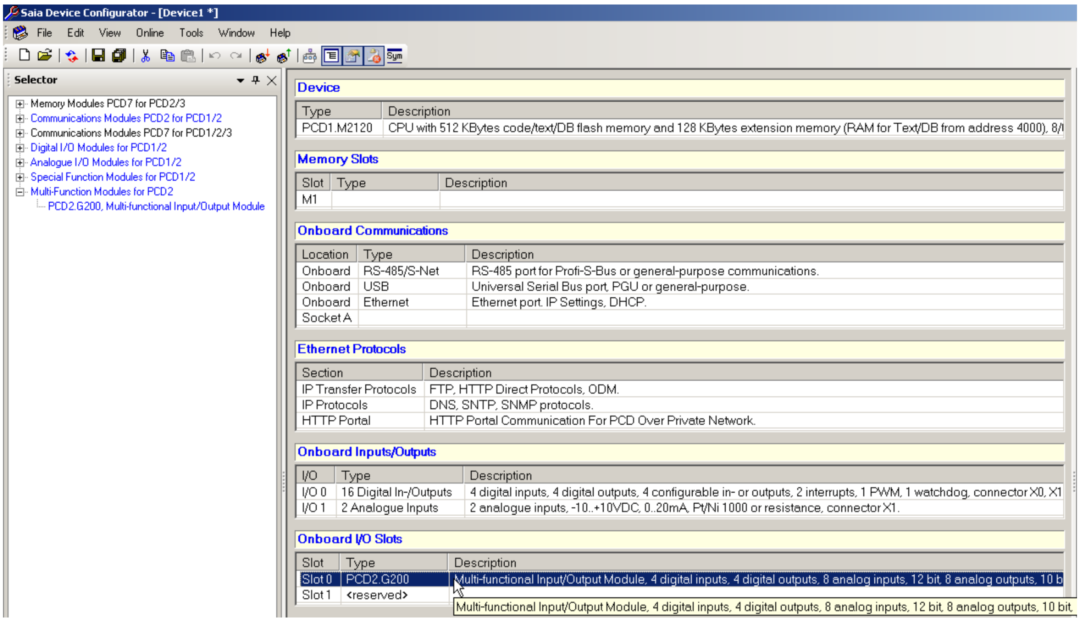


Figure 6: Device Configurator

For PCD1 systems only the Slot0 is allowed. For PCD2 systems only the even slots (0,2,4,6) are allowed.

9.3.2.1.2 Configuring Analog Inputs

The Media Mapping for analog inputs and outputs has to be set to Yes:

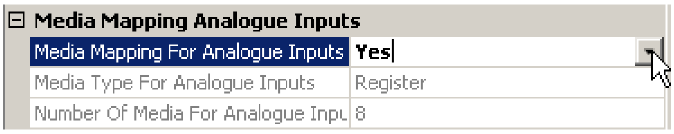


Figure 7: Mapping Analogues Inputs

For each analog input there are several resolution options to select :

Analog inputs 0 and 1 can be set to 0…10000 mV or user defined range or to non converted 12 bit values 0…4095:

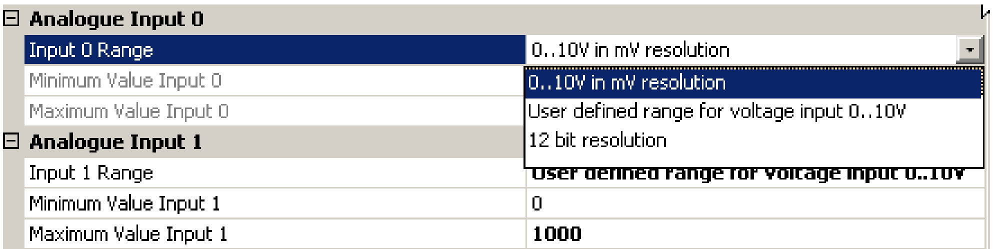


Figure 8: Range selection AI0 / AI1

The default user range is 0…1000

The Analog Inputs 2 to 5 (with the DIP switches) havethe following possibilities:

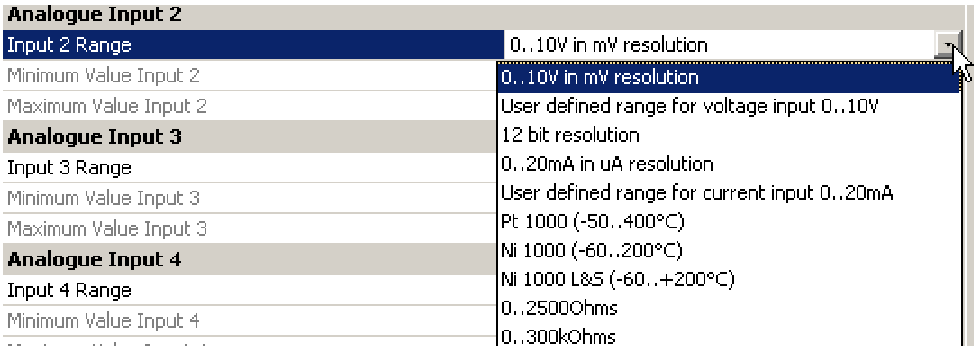


Figure 9: Range selection AI2…AI5

There is no automatic recognition when uploading the configuration from the CPU since the DIP switch position can not be read by the CPU.

For the Analog Inputs 6 and 7 there are the following options:

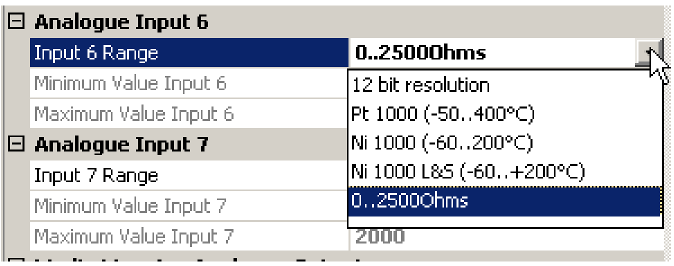


Figure 10: Range selection AI6 / AI7

9

9.3.2.1.3 Configuring Analog Outputs

Each analog output can be configured to 0…10000 mV or 10 bit values 0…1923 or to any other user defined range:

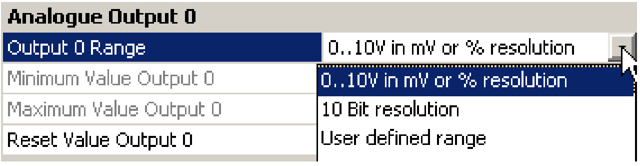


Figure 11: Range selection Analogues Outputs

Additionally a reset value can be specified:

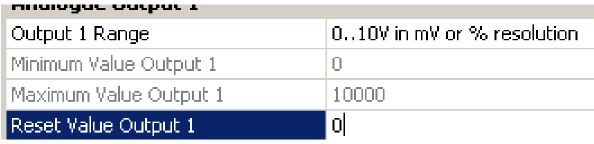


Figure 12: Reset value Analogues Outputs

9.3.2.1.4 Configuring Digital Inputs / Outputs

The digital Outputs can be addressed directly on O0…O3 (+BaseAddress of the slot).

The digital Inputs can be addressed directly on I4…I7 (+BaseAddress of the slot).

They can also be mapped like any standard digital module.

9.3.2.2 Media mapping

With media mapping, each PCD2.G200 module uses the following registers:

Slot 0, PCD2.G200, Multi-functional Input/Output Module, 4 digital inputs, 4 digital outputs, 8 analog inputs, 12 bit, 8

S.IO.Slot0.DigitalInput	F [8]			Public
IO.Slot0.RdDigitalOutput0	F	S.IO.Slot0.DigitalInput + 0	Read digital output 0	Public
IO.Slot0.RdDigitalOutput1	F	S.IO.Slot0.DigitalInput + 1	Read digital output 1	Public
IO.Slot0.RdDigitalOutput2	F	S.IO.Slot0.DigitalInput + 2	Read digital output 2	Public
IO.Slot0.RdDigitalOutput3	F	S.IO.Slot0.DigitalInput + 3	Read digital output 3	Public
IO.Slot0.DigitalInput4	F	S.IO.Slot0.DigitalInput + 4	Digital input 4	Public
IO.Slot0.DigitalInput5	F	S.IO.Slot0.DigitalInput + 5	Digital input 5	Public
IO.Slot0.DigitalInput6	F	S.IO.Slot0.DigitalInput + 6	Digital input 6	Public
IO.Slot0.DigitalInput7	F	S.IO.Slot0.DigitalInput + 7	Digital input 7	Public
S.IO.Slot0.DigitalOutput	F [4]			Public
IO.Slot0.WrDigitalOutput0	F	S.IO.Slot0.DigitalOutput + 0	Write digital output 0	Public
IO.Slot0.WrDigitalOutput1	F	S.IO.Slot0.DigitalOutput + 1	Write digital output 1	Public
IO.Slot0.WrDigitalOutput2	F	S.IO.Slot0.DigitalOutput + 2	Write digital output 2	Public
IO.Slot0.WrDigitalOutput3	F	S.IO.Slot0.DigitalOutput + 3	Write digital output 3	Public
S.IO.Slot0.AnalogueInput	R [8]			Public
IO.Slot0.AnalogueInput0	R	S.IO.Slot0.AnalogueInput + 0	Analogue input 0	Public
IO.Slot0.AnalogueInput1	R	S.IO.Slot0.AnalogueInput + 1	Analogue input 1	Public
IO.Slot0.AnalogueInput2	R	S.IO.Slot0.AnalogueInput + 2	Analogue input 2	Public
IO.Slot0.AnalogueInput3	R	S.IO.Slot0.AnalogueInput + 3	Analogue input 3	Public
IO.Slot0.AnalogueInput4	R	S.IO.Slot0.AnalogueInput + 4	Analogue input 4	Public
IO.Slot0.AnalogueInput5	R	S.IO.Slot0.AnalogueInput + 5	Analogue input 5	Public
IO.Slot0.AnalogueInput6	R	S.IO.Slot0.AnalogueInput + 6	Analogue input 6	Public
IO.Slot0.AnalogueInput7	R	S.IO.Slot0.AnalogueInput + 7	Analogue input 7	Public
S.IO.Slot0.AnalogueOutput	R [8]			Public
IO.Slot0.AnalogueOutput0	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 0	Public
IO.Slot0.AnalogueOutput1	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 1	Public
IO.Slot0.AnalogueOutput2	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 2	Public
IO.Slot0.AnalogueOutput3	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 3	Public
IO.Slot0.AnalogueOutput4	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 4	Public
IO.Slot0.AnalogueOutput5	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 5	Public
IO.Slot0.AnalogueOutput6	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 6	Public
IO.Slot0.AnalogueOutput7	R	S.IO.Slot0.AnalogueOutput +...	Analogue output 7	Public

Figure 13: PG5, media mapping

In the user program the analogue I/O's are accessed with the symbols:

Example: set Analog Output2 to 5V :

```
LD      IO.Slot0.AnalogueOutput2
5000                              ; range selected= 10000mV
```

The CPU reads the inputs at before executing the COB and updates the outputs after executing the COB.

For „mixed“ I/O Modules as the PCD2.G200 the digital outputs have also a input symbol IO.Slot0.RdDigitalOutput0…3 , but these are not used in this case.

To write the outputs only the symbols IO.Slot0.WrDigitalOutput0…3 are used.

The effective addresses can be seen in the Data List View:

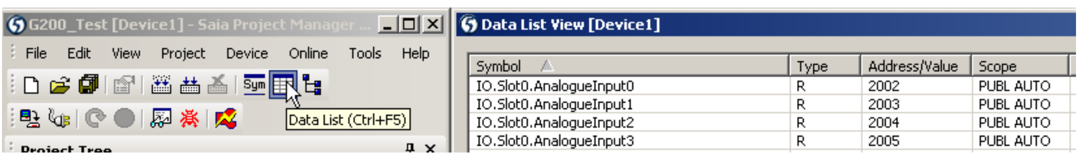


Figure 14: effective addresses

9.4 Example of linearization

NTC sensors are not inplemented in the Device Configurator because these sensors are not standardized. To use a NTC with the module PCD2.G200, please configure the desired channel in mode “0…300 kΩ” and use the linearization FBox available in PG5 environment.

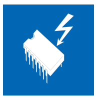
In the FBox the resistance values of the sensor have to be entered that the conversion to a temperature is executed.

A project example can be downloaded from the SBC Support Website:

http://www.sbc-support.com/en/services/getting-started/programm-examples/pg5-21/general.html

A Appendix

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 PCD® Classic series.
	Explanations beside this sign are valid only for the Saia PCD® xx7 series.

A.2 Terms

A.3 Abbreviations

Ni	Element: nickel (temperature probes made of nickel) Temperature coefficient $\alpha = 6.0 \cdot 10^{-3}$ [K^{-1}]
NTC	High-temperature conductor: Temperature measuring probes with negative temperature coefficient
Pt	Element: platinum (temperature measuring probes made of platinum) Temperature coefficient $\alpha = 3.92 \cdot 10^{-3}$ [K^{-1}]
PTC	PTC thermistor: temperature measuring probes with a positive temperature coefficient

A.4 Hardware watchdog

Saia PCD® 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.

> **!** 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
all **(except: see below)**	- No analogue, counter and motion control modules on the socket with base address 240 - **Output 255 cannot be used for digital I/O modules**
PCD2.M170	- No analogue, counter and motion control modules on the socket with base address 496 - **Output 511 cannot be used for digital I/O modules**
PCD2.M480	- No analogue, counter and motion control modules on the socket with base addresses 752 and 1008 - **The outputs 767 and 1023 cannot be used for digital I/O modules**

A.5 Saftey Instructions

ATTENTION

These devices must only be installed by a professional electrician, otherwise there is the risk of fire or the risk of an electric shock.

WARNING

Product is not intended to be used in safety critical applications, using it in safety critical applications is unsafe.

WARNING - Safety

The unit is not suitable for the explosion-proof areas and the areas of use excluded in EN 61010 Part 1.

WARNING - Safety

Check compliance with nominal voltage before commissioning the device (see type label). Check that connection cables are free from damage and that, when wiring up the device, they are not connected to voltage.

NOTE

In order to avoid moisture in the device due to condensate build-up, acclimatise the device at room temperature for about half an hour before connecting.

CLEANING

The device can be cleaned in dead state with a dry cloth or cloth soaked in soap solution. Do not use caustic or solvent-containing substances for cleaning.

MAINTENANCE

These devices are maintenance-free. If damaged during transportation or storage, no repairs should be undertaken by the user.

GUARANTEE

Opening the module invalidates the guarantee.

WEEE Directive 2012/19/EC Waste Electrical and Electronic Equipment directive
The product should not be disposed of with other household waste. Check for the nearest authorized collection centers or authorized recyclers. The correct disposal of end-of-life equipment will help prevent potential negative consequences for the environment and human health.

A.6 Installation direction and relays contact protection

NOTE

Extra low voltages (ELV) or secure low voltages (SELV) are voltages up to 50 Volts.

NOTE

Low voltages are voltages between 50 … 250 Volts.

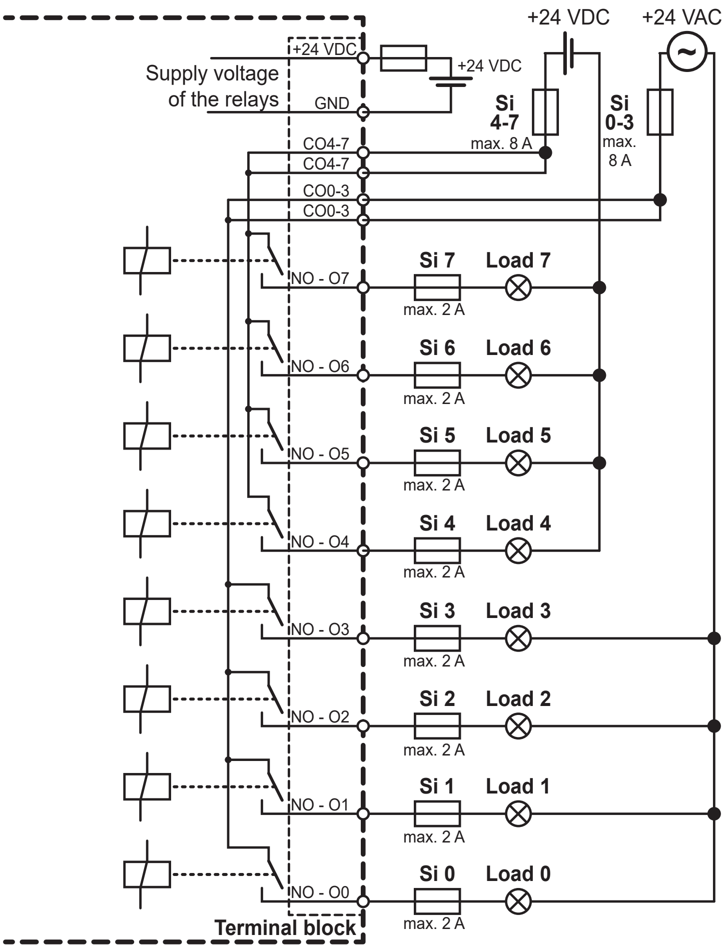
A.6.1 Installation direction for switching extra low voltages

Scope: PCD2.A250 and PCD3.A251

For safety reasons, voltages of up to 50 V may be applied to this module.

The safety standard, concerning the air and leakage current distances between adjacent channels, is not given with this module for higher voltages (50…250 V).

Connection example PCD2.A250 and PCD3.A251:



All connections to the relay contacts, which are connected to the same circuit, must be protected by a common fuse.

The individual load circuits, on the other hand, may be protected individually by a fuse.

A

A.6.2 Installation direction for switching low voltages

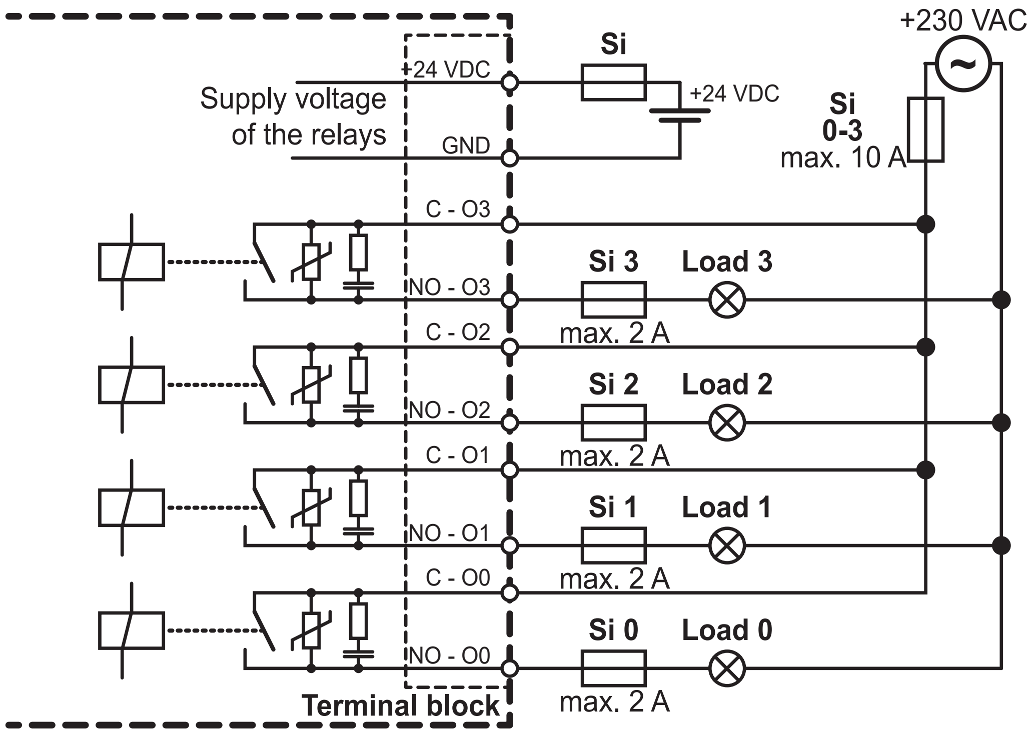
Scope: **PCD2.A200 and PCD3.A200**
PCD2.A210 and PCD3.A210
PCD2.A220 and PCD3.A220

- For safety reasons, extra low voltage (up to 50 V) and low voltage (50…250 V) must not be connected to the same module.
- Neither different phases may be connected to the same module.

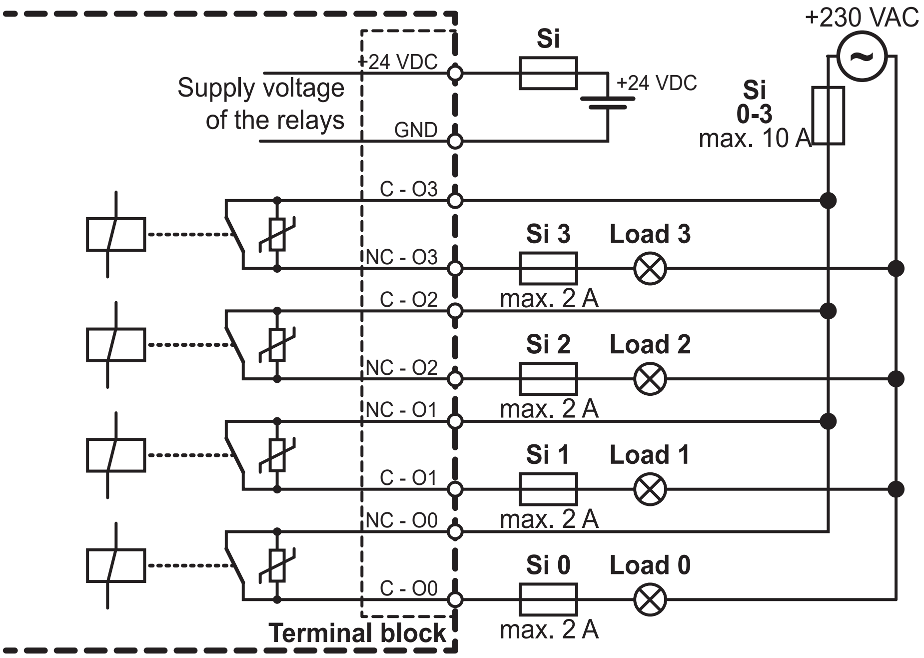
If a Saia PCD® system module is connected to a higher voltage (50…250 V) approved components for this voltage have to be used for all elements which are galvanically connected to the system.

Using higher voltage (50…250 V), all connections to the relay contacts are to be connected on the same circuit. That means at one point in such a way that they are all protected against one AC-phase by only one fuse. Each load circuit may be protected individually by a fuse of max. 2 A.

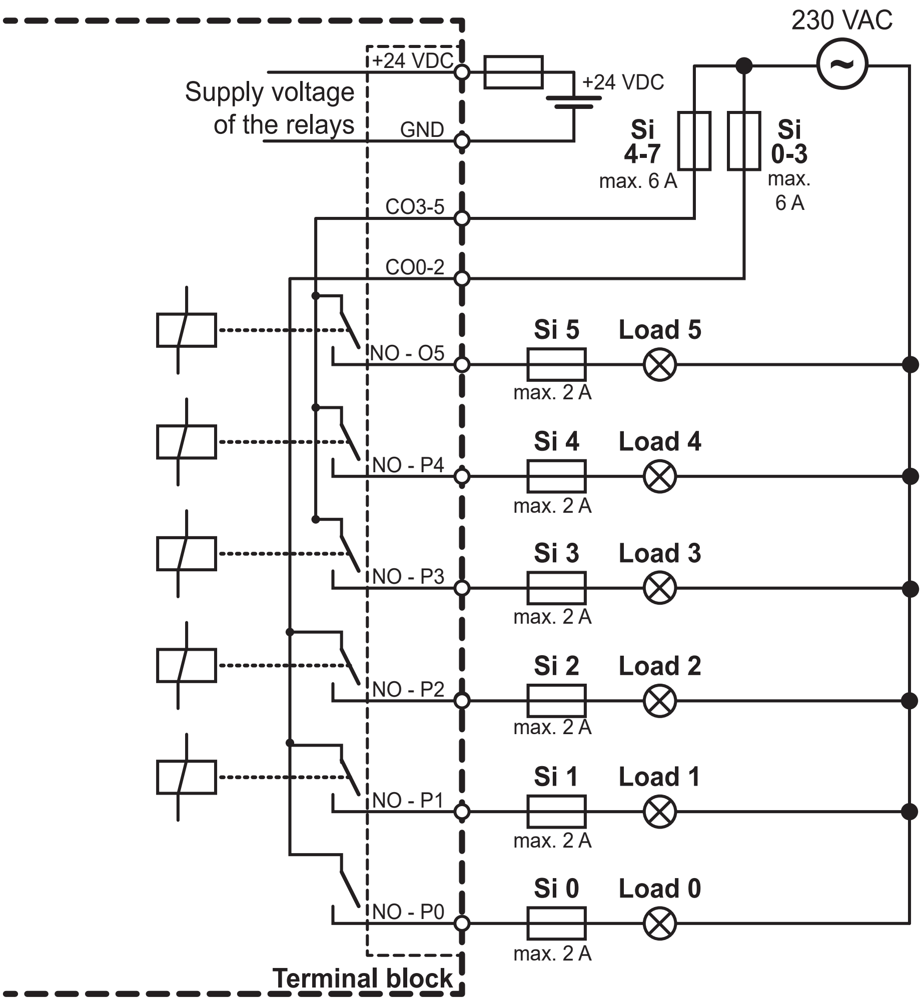
Connection example PCD2.A200 and PCD3.A200:



Connection example PCD2.A210 and PCD3.A210:



Connection example PCD2.A220 and PCD3.A220 with low voltage:



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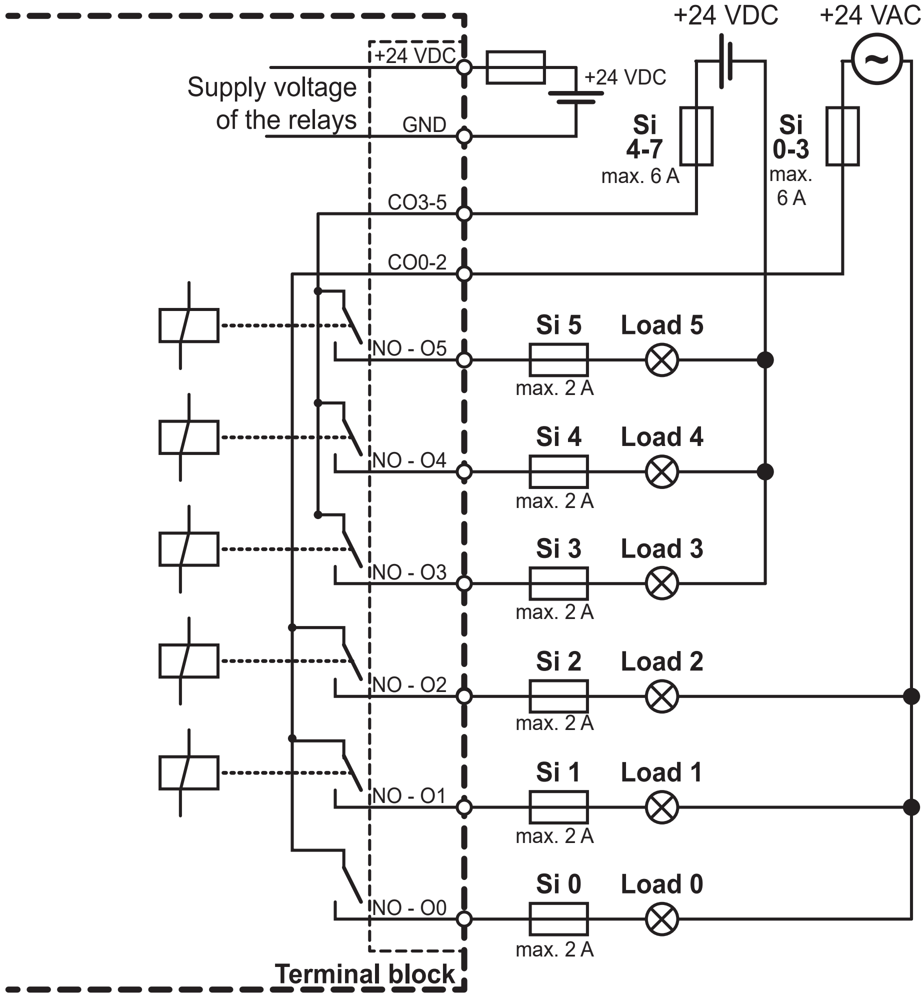
Connection example PCD2.A220 and PCD3.A220 with extra low voltages:



A.6.3 Switching inductive loads

Because of the physical properties of inductive loads, it is not possible to disconnect inductance without interference. This interference must be minimized as far as possible. Although the Saia PCD® is immune to this interference, there are other devices which may be susceptible.

It should be noted here that, as part of the harmonization of standards throughout the EU, EMC standards have applied since 1996 (EMC Directive 89/336/EG). Two firm principles can therefore be stated:

- PROTECTION AGAINST INTERFERENCE FROM INDUCTIVE LOADS IS MANDATORY
- INTERFERENCE SHOULD BE ELIMINATED AS CLOSE AS POSSIBLE TO ITS SOURCE

Relay contacts on the present module have been wired. However, it is still recommended that a protection circuit should be fitted at the load.

(Often available as normal components on standardized contactors and valves).

When switching direct voltage it is urgently recommended that a recovery diode is fitted above the load. This should even take place when, theoretically, an Ohmic load is switched. In practice, there will always be a proportion which is inductive (connection cable, resistance coil, etc.). In this case it should be noted that the switch-off time will be longer.

(Approximate Ta . L/RL * √ (RL * IL/0,7).

For direct voltage, transistor output modules are recommended.

A

A.6.4 Relay manufacturer's information on RC unit dimensioning

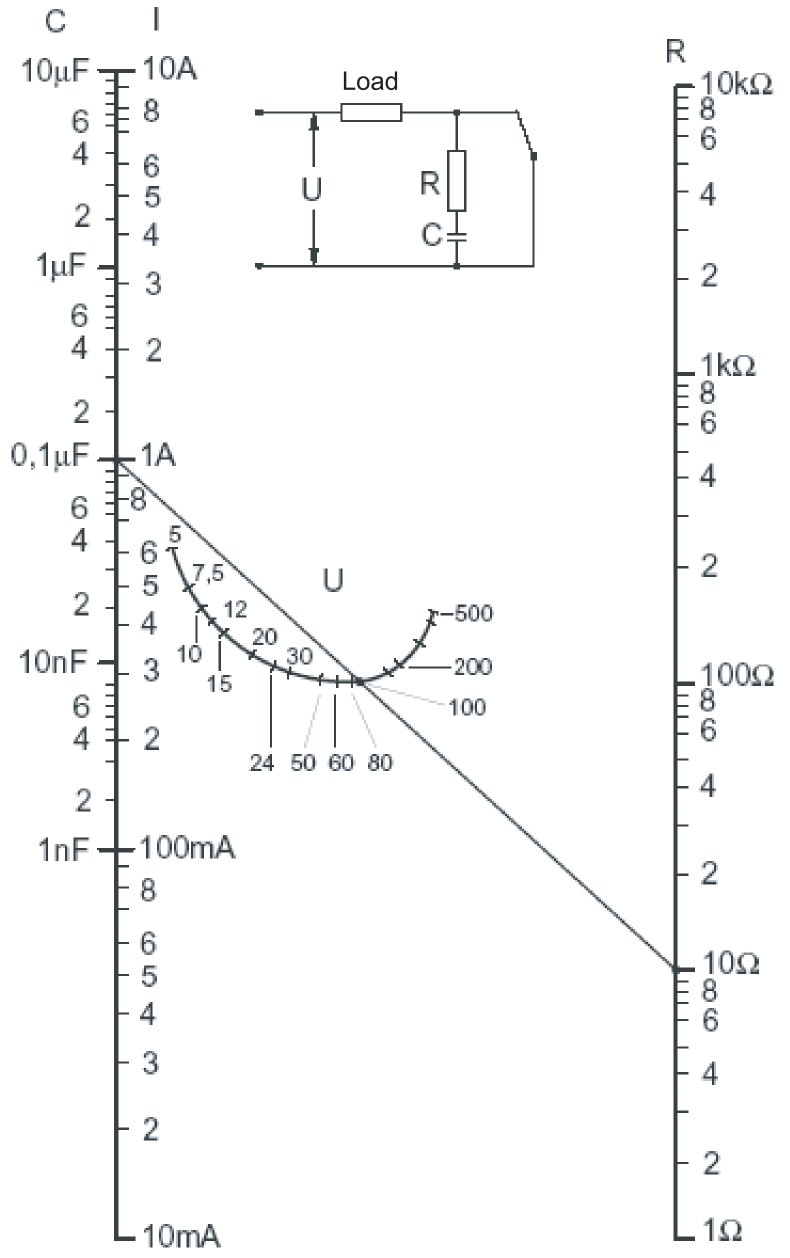
Wiring contact protection:

The purpose of contact protection wiring is to suppress switch arcing ("sparks") and thereby prolong the lifetime of the contacts. All protection wiring has disadvantages as well as advantages. For the cancellation of arcing by means of an RC unit, see adjacent diagram.

When switching off load circuits with inductive components (e.g. relay coils and magnet coils) the interruption of current results in overvoltage (standard inductance) at the switching contacts. This may amount to many times the operating voltage and so threaten the insulation of the load circuit. The resultant breaking spark leads to rapid wear of the relay contacts. For this reason contact protection wiring is particularly important with inductive load circuits. Values for the RC combination can also be determined from the adjacent diagram. However, for voltage U it is necessary to use the overvoltage arising from the interruption of current (e.g. measurable with an oscillograph). Current must be calculated from this voltage and the known resistance, against which the voltage was measured.

Screening units should only use anti-interference capacitors that comply with VDE 0565 T1 class X2. These capacitors are switchproof and designed for particularly high switching surges. They can also run directly on mains voltage.

The resistors used must withstand high voltages (pulse stability). With low resistance values in particular, voltage flashovers can occur at the ground helical section produced in the manufacturing process. For this reason, composite carbon resistors are often used in screening units. However, enamelled wire resistors or cement resistors with a large helical pitch are suitable.

Dimensioning guide:
The value for C is the direct result of the switching current. The resistance value R can be established by drawing a straight line through the corresponding points on the I and U curves and reading off the resistance at the intersection with the R curve.

Example: U = 100 V   I = 1 A C is direct result with 0,1 µF R = 10 Ω (point of intersection with R scale)

A

A.6 Contact

Saia-Burgess Controls AG
Route Jo-Siffert 4
1762 Givisiez
Switzerland

Email support: .... support@saia-pcd.com
Supportsite: .... www.sbc-support.com
SBC site: .... www.saia-pcd.com
International Represetatives &
SBC Sales Companies: .... www.saia-pcd.com/contact

Postal address for returns from customers of the Swiss Sales office

Saia-Burgess Controls AG
Route Jo-Siffert 4
1762 Givisiez
Switzerland

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