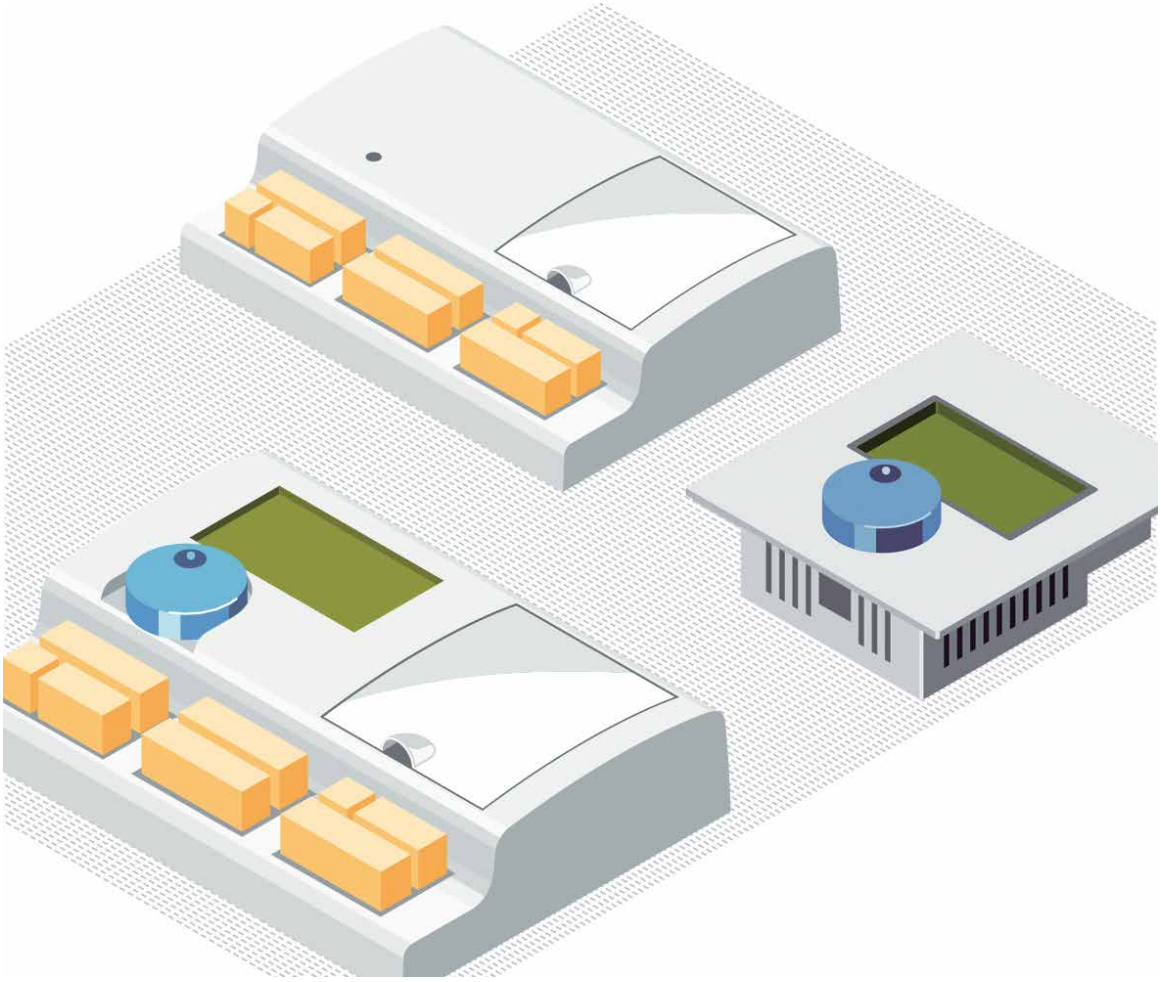
SAIA BURGESS CONTROLS



PCS1 Series

Document 26/781; Edition EN07 | 2014-08-05

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0 Content

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0.1 Document History

Date	Version	Changes	Remarks
EN01	2007-10-25	-	Document translated from German
EN01	2007-12-18	4.9	Name of the modems corrected
EN01	2008-01-24	div.	Some small corrections
EN02	2008-07-07	4.8.4	Precised the naming of the S-Bus PGU Port
EN03	2008-09-25	2 5.5.1	Some pages taken from the TI 26/345 C4xx and C6xx just 2 W2-A/D-converter
EN04	2008-10-30	5 5.5.2	Count and number of I/Os Connection diagrams (Nr. 15 → 16)
EN04	2009-04-06	4.5.1 4.6.2	Pin assignment # 3 reversed Rx & Tx swapped
EN04	2009-11-11	3.13.2	New phrasing for connecting external displays PCD7.D320
EN05	2010-11-12	2.4	Resolution analog outputs 0…255
EN06	2013-11-22	-	aktualisiert
EN07	2014-08-05	4.6.4	Connection example for PCD7.F180

0.2 Brands and trademarks

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

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

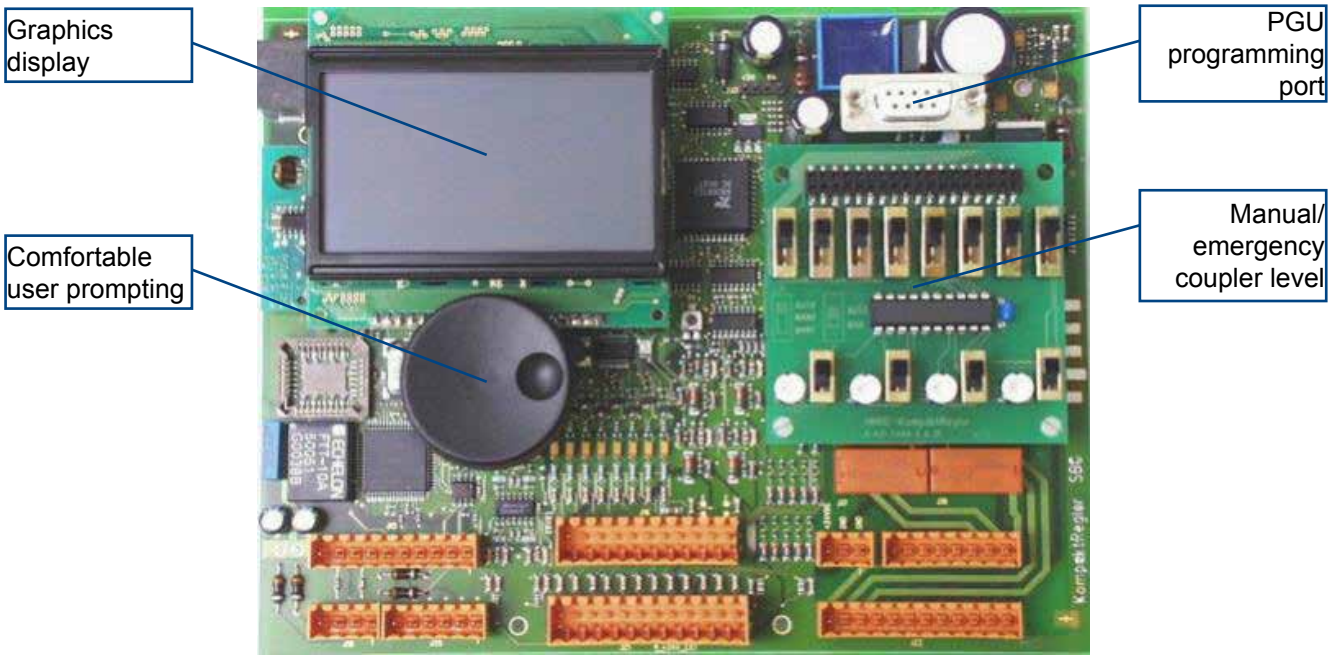
Published in Switzerland

1 Graphical index

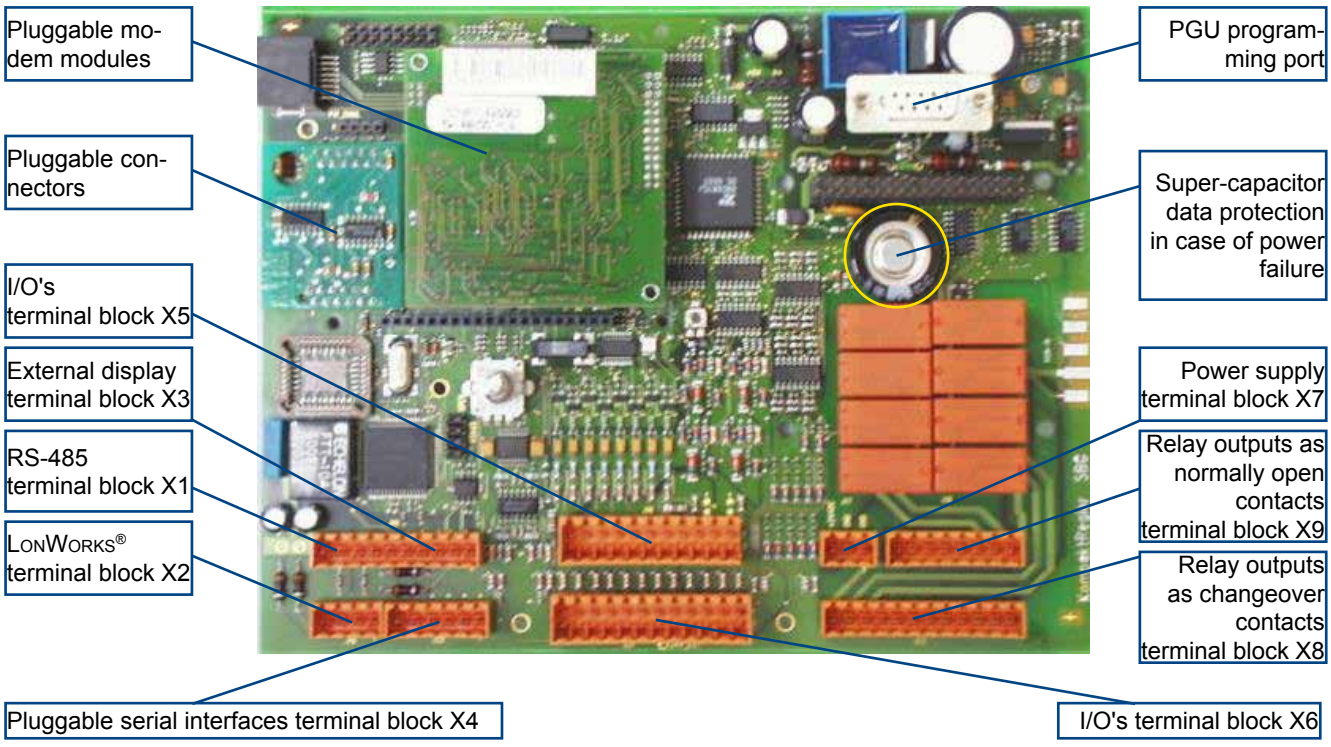
The graphical index singles out some highlights from the Hardware manual for the PCD1/PCD2 Series, and allows you to click on a component/connector to jump straight to the corresponding section. The facility to jump to any section from the table of contents is still to be completed.

1.1 PCS1.Cxx0

Front view:



Front view without display and without manual control unit:



2 Guidance

This manual covers the technical aspects of the PCS1 components. The following terms are used frequently:

- CPU Central processing unit: the heart of the PCS1
- Modules Input/output elements, mounted in a housing, matched to the PCS1 system

The aim of the Overview section is to present the essentials of planning and installing control systems with PCS1 components. It covers the following topics:

- Introduction
- Family overview PCS1
- Performance overview of the PCS1 family
- Digital and analogue data points
- Panorama des terminal block assignment
- Pin Configuration
- Connection of communications interfaces
- Cabling

Details of hardware, software, configuration, maintenance and troubleshooting are described in separate sections.

2.1 Introduction

This compact, freely programmable automation system excels precisely where other compact controllers find their limits. It has a mix of data points designed for the HeaVAC market and outstanding communications capabilities, allowing an almost limitless spectrum of uses.

Extensive functionality in the minimum space

- Integral or remote graphics display with jog dial control.
- Integral manual/emergency and coupler level.
- Compact size: 195 × 150 × 60 mm (W × H × D).
- Plug-in spring terminals with cover.
- Large main memory for history data.
- 19, 30 or 44 data points in the base unit, expandable via networks.

Custom solution for all areas of application.

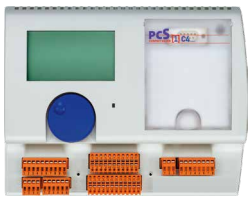
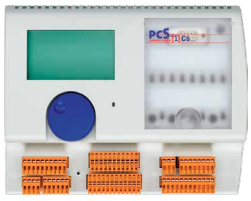
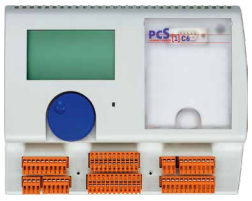
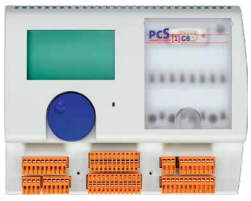
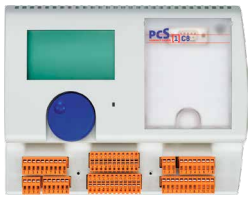
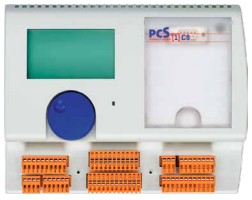
Through its distinctive data point structure, the DDC-Compact is ideally suited for use in:

- Ventilation installations,
- Heating installations,
- Compact air-conditioning equipment,
- District heating transfer stations...

Interfaces make it a great communicator.

- SBC S-Bus (Saia PCD/room control systems or remote data points).
- LonWorks.
- EIB (European Installation Bus) / Konnex.
- MP-BUS (BELIMO MFT drives).
- M-Bus (remote counter reading).
- Modbus (RTU and ASCII).
- Telecommunication via analogue, ISDN or GSM modem. Functions include telemaintenance, remote diagnosis, SMS error messaging and remote programming

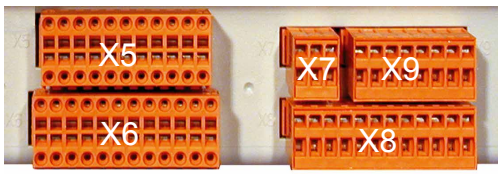
2.2 Family overview PCS1

Base unit with 19 data points				
	PCS1.C420	PCS1.C421	PCS1.C422	PCS1.C423
				
Base unit with 30 data points				
	PCS1.C620	PCS1.C621	PCS1.C622	PCS1.C623
				
Base unit with 44 data points				
	PCS1.C820	PCS1.C821	PCS1.C822	PCS1.C823
				
Base unit with 44 data points and LonWorks				
	PCS1.C880	PCS1.C881	PCS1.C882	PCS1.C883
				

2.3 Performance overview of the PCS1 family

Technical data	PCS1.C42x				PCS1.C62x				PCS1.C82x				PCS1.C88x			
	PCS1.C420	PCS1.C421	PCS1.C422	PCS1.C423	PCS1.C620	PCS1.C621	PCS1.C622	PCS1.C623	PCS1.C820	PCS1.C821	PCS1.C822	PCS1.C823	PCS1.C880	PCS1.C881	PCS1.C882	PCS1.C883
Internal graphics display	■	■	–	–	■	■	–	–	■	■	–	–	■	■	–	–
Manual / emergency control	■	–	■	–	■	–	■	–	■	–	■	–	■	–	■	–
Data points																
Digital inputs 0,2 ms	0				2				3				3			
Digital inputs 8 ms	4				4				9				9			
Digital inputs / outputs	2				4				4				4			
Relay outputs as 'make' contact	4				4				4				4			
Relay outputs as changeover switch	0				4				4				4			
Universal inputs (0…10 V; 24 V on / off)	2				2				4				4			
Analogue inputs (Pt / Ni 1000, 0.6 °C)	0				0				4				4			
Analogue inputs (Pt / Ni 1000, 0.15 °C)	4				6				8				8			
Analogue outputs (0…10 V)	3				4				4				4			
Total	19				30				44				44			
Data ports																
PGU RS-232	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
S-Bus RS-485 M / S	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
RS-232 for EIB / DALI / M-Bus etc.	Optional via modules PCD7.F1xx															
RS-422 remote control terminal																
RS-485 S-Bus, EnOcean etc.																
MP-Bus, Belimo																
LonWorks	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■
General data																
Supply voltage	24 VDC -20 / +25 %															
User memory	1 MByte Flash and 896 KByte RAM															
Real-time clock	yes															
Data protection Flash	> 10 years															
RAM	5…15 days															

2.4 Digital and analogue data points



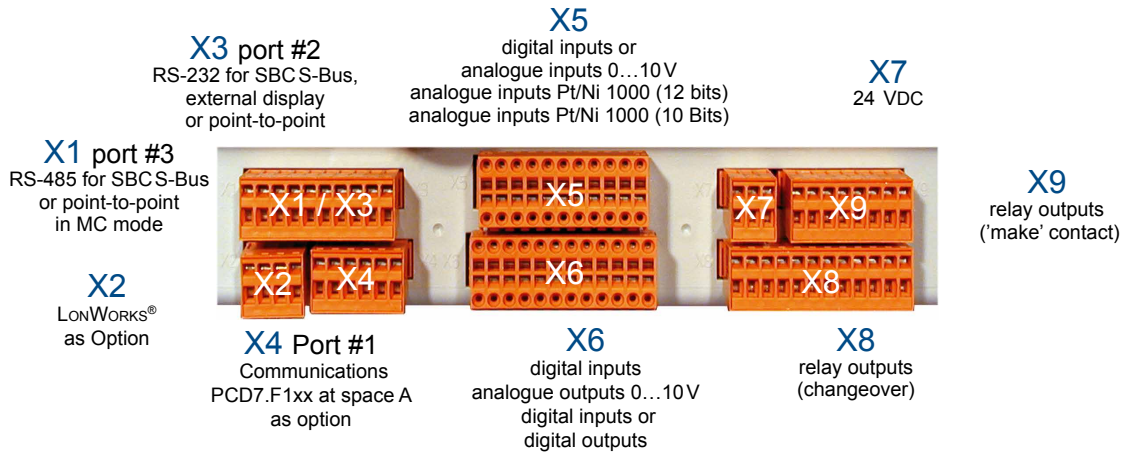
Please follow installation instructions.
N. B. : All data points except relay outputs are electrically connected.

	C4xx	C6xx	C8xx
Digital inputs 24 VDC, terminal block X6			
Number of inputs			
with input delay typ. 8 ms (pulsed voltage possible) like PCD2.E110	4	4	9
with input delay typ. 0.2 ms (smoothed voltage required) like PCD2.E111	0	2	3
General data			
Input voltage	24 VDC		
Input signal	Low –30…+5 V High 15…30 V		
Input current	6 mA per input at 24 VDC		
Digital inputs 24 VDC or outputs, terminal block X6			
Number of combined inputs/outputs (like PCD2.B100)	2	4	4
Digital inputs selectable by wiring			
Input voltage	24 VDC		
Input signal	Low –0.5…+5 V High 15…32 V		
Input current	7 mA per input at 24 VDC		
Input delay	typically 8 ms (pulsed voltage possible)		
Digital outputs selectable by wiring			
Output current Ia	5…500 mA		
Total current	3 A for continuous duty		
Voltage range Ua	5…32 VDC smoothed		
Voltage drop	max. 0.7 V at 0.5 A		
Output delay	typically 50 µs or max.100 µs (off)		
Relay outputs as changeover/normally open contacts, terminal block X8 and X9			
Digital inputs			
Relay output ‚make' like PCD2.A200	4	4	4
Relay output changeover like PCD3.A251	0	4	4
General data			
Breaking capacity	2 changeover 2 A, 250 VAC/50 VDC 2 changeover 4 A, 250 VAC/50 VDC 2 ‚make' 2 A, 250 VAC/50 VDC 2 ‚make' 4 A, 250 VAC/50 VDC		
Output delay	typ. 5 ms at 24 VDC		
Supply voltage	24 VDC, smoothed or pulsed		
Current consumption	9 mA per relay		
Manual/emergency	these outputs can be accessesd control manually		

Important: By switching of Inductive or capacitive loads, it is needed to protect the output by an external RC element!

	C4xx	C6xx	C8xx
Digital inputs 24 VDC or analogue inputs 0…10 V and Pt/Ni 1000 (2-wire), terminal block X5			
Number of analogue inputs (like PCD2.W200)	2	2	4
In service as digital inputs (selectable by FBox)			
Input voltage: 24 VDC			
Input signal: Low –0.5…+5 V, High 15…32 V			
Input current: 7 mA per input at 24 VDC			
Input delay: typ. 8 ms (pulsed voltage possible)			
In service as analogue inputs 0...10 V (selectable by FBox)	2	2	4
Resolution: 10 Bits (0…1023)			
Input filter: 5 ms			
Accuracy: ±0.4 %			
Analogue inputs Pt/Ni 1000 (like PCD2.W220)			
Number of inputs Pt/Ni 1000, 2-wire (selectable by FBox)	0	0	4
Resolution: 10 Bit (0…1023) bzw. 0.6 °C			
Input filter: 10 ms			
Accuracy: ±0.4 %			
Signal ranges: Pt 1000 –50…+400 °C; Ni 1000 –50…+200 °C; Ni 1000 L&S –30…+120 °C			
Analogue inputs Pt/Ni 1000 (2-wire), terminal block X5			
Analogue inputs Pt/Ni 1000, 2-wire (like PCD2.W340)			
Number of inputs (selectable by FBox)	4	6	8
Resolution: 12 Bit (0…4095) or max. 0.15 °C (Pt 1000) or max. 0.08 °C (Ni 1000) typically. 16.9 ms			
Accuracy: ±0.3 %			
Signal ranges: Pt 1000 –50…+400 °C; Ni 1000 –50…+200 °C; Ni 1000 L&S –30…+120 °C			
Analogue outputs 0…10 V, terminal block X6			
Number of outputs 0…10 V (like PCD2.W400)			
Number of inputs, short-circuit proof	3	4	4
Resolution: 8 Bit (0…255)			
Accuracy: ±0.5 %			
Signal ranges: 0…10 V			
Load impedance: ≥ 3 kΩ Manual/emergency these outputs can be accessesd control manually via potentiometers			

2.5 Panorama des terminal block assignment



Block	Pin	C4xx Name	C4xx I/O address	C6xx Name	C6xx I/O address	C8xx Name	C8xx I/O address	Notes
X1	1	Data_Sbus		Data_Sbus		Data_Sbus		Port#3, RS-485, SBC S-Bus Standard port on all PCS1
	2	/Data_Sbus		/Data_Sbus		/Data_Sbus		
	3	GND		GND		GND		
X3	4	+5V		+5V		+5V		
	5	n.c.		n.c.		n.c.		Port#2, RS-232, external display. Standard port on all PCS1.Cx22 and PCS1.Cx23
	6	GND		GND		GND		
	7	CTS2_ext		CTS2_ext		CTS2_ext		
	8	RxD2_ext		RxD2_ext		RxD2_ext		
	9	RTS2_ext		RTS2_ext		RTS2_ext		
	10	TxD2_ext		TxD2_ext		TxD2_ext		
X2	1							Reserved for LonWorks
	2	LON A Data		LON A Data		LON A Data		
	3	LON B Data		LON B Data		LON B Data		
	4	GND		GND		GND		
X4	1	GND		GND		GND		Port#1 Optional port RS-485/RS-422/ RS-232
	2	I1A		I1A		I1A		
	3	I1B		I1B		I1B		
	4	I1C		I1C		I1C		
	5	I1D		I1D		I1D		
	6	I1G		I1G		I1G		
X5	1	COM		COM		COM		Base address = 48 see also FBox PCS1.W2
	3	E48	I 48 ch 0	E48	I 48 ch 0	E48	I 48 ch 0	
	5	E49	I 48 ch 1	E49	I 48 ch 1	E49	I 48 ch 1	
	7	GND		GND		E50	I 48 ch 2	GND for Pt/Ni 1000 [1]
	9	GND		GND		E51	I 48 ch 3	Inputs 0…10 V or digital inputs 24 VDC
	11	GND		GND		GND		
	13	GND		GND		GND		Analogue inputs Pt/Ni 1000
	15	COM		COM		E52	I 48 ch 4	
	17	COM		COM		E53	I 48 ch 5	
	19	COM		COM		E54	I 48 ch 6	
	21	COM		COM		E55	I 48 ch 7	
	2	COM		COM		COM		Basisadresse = 64 see also FBox PCS1.W3
	4	E64	I 64 ch 0	E64	I 64 ch 0	E64	I 64 ch 0	
	6	E65	I 64 ch 1	E65	I 64 ch 1	E65	I 64 ch 1	
	8	E66	I 64 ch 2	E66	I 64 ch 2	E66	I 64 ch 2	
	10	E67	I 64 ch 3	E67	I 64 ch 3	E67	I 64 ch 3	
	12	GND		GND		GND		GND for Pt/Ni 1000 [1]
	14	GND		GND		GND		
	16	GND		E68	I 64 ch 4	E68	I 64 ch 4	Pt/Ni 1000
	18	GND		E69	I 64 ch 5	E69	I 64 ch 5	
	20	GND		GND		E70	I 64 ch 6	
	22	GND		GND		E71	I 64 ch 7	

Block	Pin	C4xx Name	C4xx I/O address	C6xx Name	C6xx I/O address	C8xx Name	C8xx I/O address	Notes
X6	1	E0	I 0	E0	I 0	E0	I0	
	3	E1	I 1	E1	I 1	E1	I1	
	5	E2	I 2	E2	I 2	E2	I2	
	7	E3	I 3	E3	I 3	E3	I3	Digital inputs 8 ms E110 like PCD2.E110
	9	GND		E4	I 4	E4	I4	
	11	GND		E5	I 5	E5	I5	
	13	GND		GND		E6	I6	
	15	GND		GND		E7	I7	
	17	GND		GND		E8	I8	
	19	GND		GND		E9	I 9	Digital inputs 0.2 ms like PCD2.E111
	21	GND		GND		E10	I 10	
	23	GND		GND		E11	I 11	
X6	2	GND		GND		GND		Base address = 80 see also FBox PCS1.W4
	4	A80	O 80 ch 0	A80	O 80 ch 0	A80	O 80 ch 0	
	6	A81	O 80 ch 1	A81	O 80 ch 1	A81	O 80 ch 1	
	8	A82	O 80 ch 2	A82	O 80 ch 2	A82	O 80 ch 2	
	10	A83		A83	O 80 ch 3	A83	O 80 ch 3	Outputs 0…10 V [1]
	12	GND		GND		GND		
	14	+24V_XT		+24V_EXT		+24V_EXT		
	16	E/A12	I/O 12	E/A12	I/O 12	E/A12	I/O 12	Selectable as digital inputs (I 12 ... I 15) or digital outputs (O 12 ... O 15)
	18	E/A13	I/O 13	E/A13	I/O 13	E/A13	I/O 13	
	20	E/A14		E/A14	I/O 14	E/A14	I/O 14	
	22	E/A15		E/A15	I/O 15	E/A15	I/O 15	
	24	GND		GND		GND		
X7	1	Uin +24VDC		Uin +24VDC		Uin +24VDC		Power supply (inc. 24 VDC) for relays
	2	GND		GND		GND		
	3	GND		GND		GND		
X8	1			NO20	O 20	NO20	O 20	1. relay [2] /open
	2			COM20		COM20		common
	3			NC20	O 20	NC20	O 20	closed
	4			NO21	O 21	NO21	O 21	2. relay [2] /open
	5			COM21		COM21		common
	6			NC21	O 21	NC21	O 21	closed
	7			NO22	O 22	NO22	O 22	3. relay [2] /open
	8			COM22		COM22		common
	9			NC22	O 22	NC22	O 22	closed
	10			NO23	O 23	NO23	O 23	4. relay [2] /open
	11			COM23		COM23		common
	12			NC23	O 23	NC23	O 23	closed
X9	1	COM16		COM16		COM16		5. relay [2] /common
	2	NO16	O 16	NO16	O 16	NO16	O 16	open
	3	COM17		COM17		COM17		6. relay [2] /common
	4	NO17	O 17	NO17	O 17	NO17	O 17	open
	5	COM18		COM18		COM18		7. relay [2] /common
	6	NO18	O 18	NO18	O 18	NO18	O 18	open
	7	COM19		COM19		COM19		8. relay [2] /common
	8	NO19	O 19	NO19	O 19	NO19	O 19	open
	Intern	A_M16	I 24	A_M16	I 24	A_M16	I 24	Switch pos.1
	Intern	A_M17	I 25	A_M17	I 25	A_M17	I 25	
	Intern	A_M18	I 26	A_M18	I 26	A_M18	I 26	
	Intern	A_M19	I 27	A_M19	I 27	A_M19	I 27	
				A_M20	I 28	A_M20	I 28	Acknowledgement of manual/ emergency control level (Auto/Man = 1/0) [3] Switch pos.1
				A_M21	I 29	A_M21	I 29	
				A_M22	I 30	A_M22	I 30	
				A_M23	I 31	A_M23	I 31	
	Intern	A_M80_0	I 32	A_M80_0	I 32	A_M80_0	I 32	
	Intern	A_M80_1	I 33	A_M80_1	I 33	A_M80_1	I 33	
	Intern	A_M80_2	I 34	A_M80_2	I 34	A_M80_2	I 34	
				A_M80_3	I 35	A_M80_3	I 35	

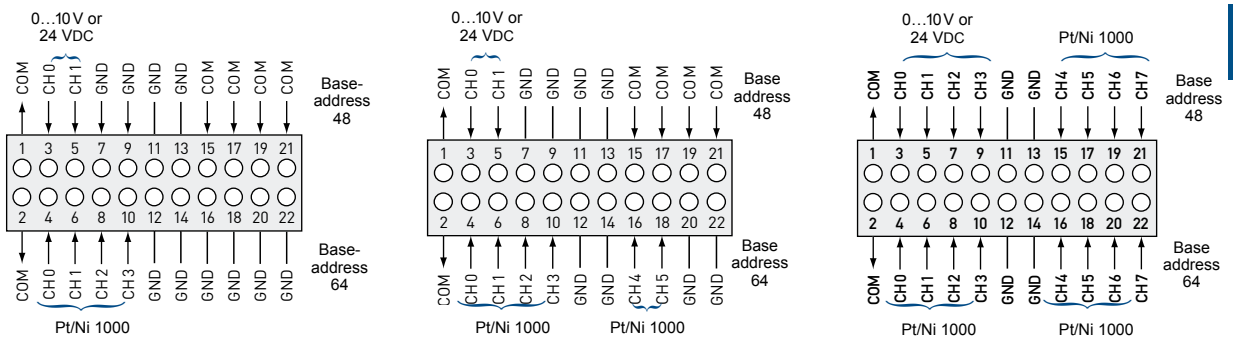
[1] extra filtered

[2] With manual/emergency control level as option

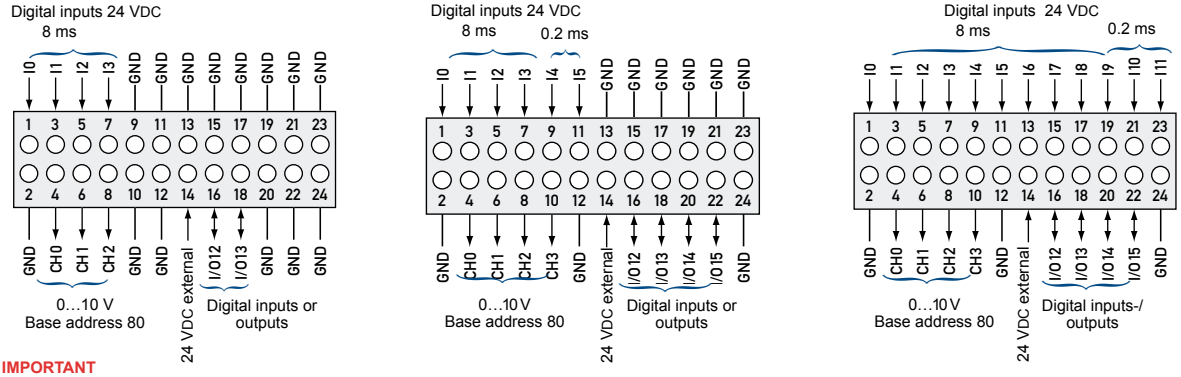
[3] Caution: If the manual/emergency control level is not equipped, the status of inputs I24 to I35 is always logical “1”.

2.6 Pin Configuration

Pin Configuration terminal block X5

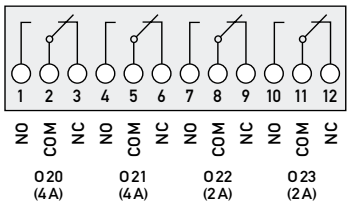


Pin Configuration terminal block X6



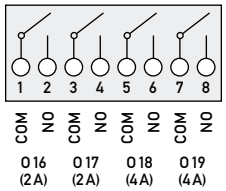
IMPORTANT
If combined I/Os 12…15 are used as outputs, an external supply is required (24 VDC external).
In such cases only source operation will be possible at the inputs.

Pin configuration on terminal block X8



PCS1.C6xx
PCS1.C8xx

Pin configuration on terminal block X9

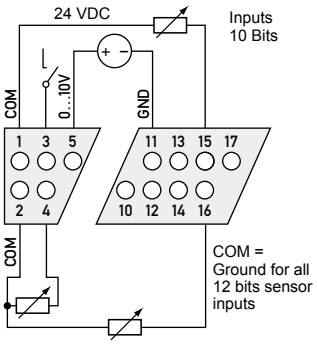


PCS1.C4xx
PCS1.C6xx
PCS1.C8xx

Wiring details

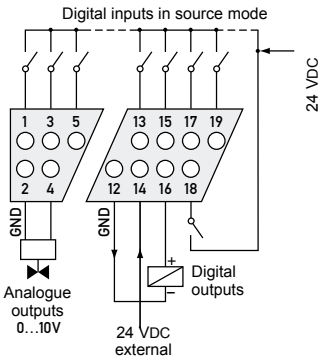
PCS1.C8xx (terminal block X5)

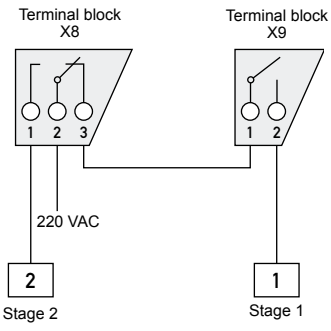
Wiring details



PCS1.C8xx (terminal block X6)

Wiring details





Wiring details

Example of a 2-stage fan controller with mutual latching

2.7 Connection of communications interfaces

X1 port #3
RS-485 for SBC S-Bus or point-to-point in MC mode

X2
LonWorks® interface as option

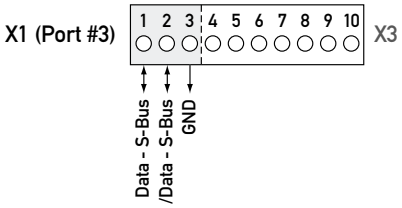
X3 port #2
RS-232 for SBC S-Bus, external display or point-to-point

X4 Port #1
Communications module PCD7.F1x0 at space A as option

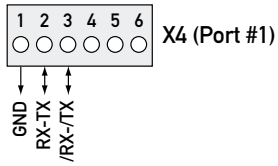
Pins on terminal block X4 for PCD7.F1x0 communications modules at space A

Pin	PCD7.F110 RS-485	PCD7.F110 RS-422	PCD7.F120 RS-232	PCD7.F150 RS-485 *g.i.	PCD7.F180 MP-Bus	*g.i. = galvanically isolated
1 (gnd)	GND	GND	GND	—	GND	MP-Bus GND
2 (I1A)	RX-TX	TX	TX	RX-TX	A-COM	MP-Bus signal line
3 (I1B)	/RX-/TX	/TX	RX	/RX-/TX	MST	BELIMO programming unit
4 (I1C)	—	RX	RTS	—	IN	BELIMO programming unit detection
5 (I1D)	—	/RX	CTS	—	GND	BELIMO programming unit GND
6 (I1G)	—	—	—	SGND	—	

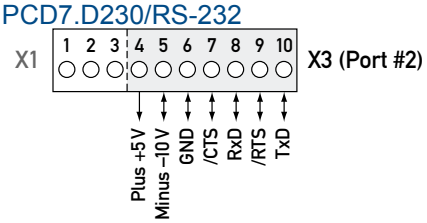
Connection for SBC S-Bus/RS-485



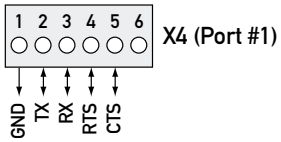
Connection PCD7.F110 for SBC S-Bus/RS-485



Connection external display PCD7.D230/RS-232

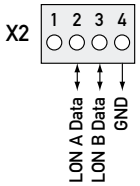


PCD7.F120 connection with RS-232



The PCS1 does not support all the handshake signals necessary for modem control with the PCD7.F120 communications module.

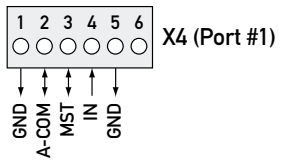
LonWorks connection as option



The option with LonWorks connection is a fixed installation. For details, see ordering information on page 20.

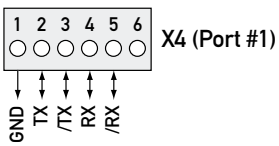
The service pin is located on the left-hand side of the housing, next to the RJ 45 connector, and can be actuated through an opening.

PCD7.F180 connection for BELIMO MP-Bus

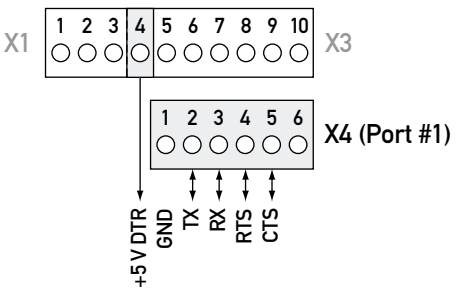


Up to 8 MFT/MFT2 drives from BELIMO® can be connected to the PCD7.F180 connection module for the MP-Bus. For details see Technical Information P+P26/342.

PCD7.F110 connection with RS-422



PCD7.F120 connection for EIB/RS-232



2.8 Cabling

2.8.1 Cable routing

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

Surge protection for long distances or external lines

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

3 PCS1 hardware

3.1 PCS1 summary specifications

Technical data

	PCS1.C420	PCS1.C421	PCS1.C422	PCS1.C423	PCS1.C620	PCS1.C621	PCS1.C622	PCS1.C623	PCS1.C820	PCS1.C821	PCS1.C822	PCS1.C823	PCS1.C880	PCS1.C881	PCS1.C882	PCS1.C883
Internal graphic display	■	■	–	–	■	■	–	–	■	■	–	–	■	■	–	–
Manual/emergency operation	■	–	■	–	■	–	■	–	■	–	■	–	■	–	■	–
Data points																
Digital input 0.2 ms	0				2				3				3			
Digital input 8 ms	4				4				9				9			
Digital input/output	2				4				4				4			
Relay output - make	4				4				4				4			
Relay output - change-over	0				4				4				4			
Universal input (0…10 V; 24 V on/off)	2				2				4				4			
Analogue input (Pt/Ni 1000, 0.6 °C)	0				0				4				4			
Analogue input (Pt/Ni 1000, 0.15 °C)	4				6				8				8			
Analogue output (0…10 V)	3				4				4				4			
Total	19				30				44				44			
Data ports																
PGU RS-232	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
S-Bus RS-485 M/S	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
RS-232 for EIB/DALI/M-Bus etc..	Optional via PCD7.F1xx module															
RS-422 remote control terminal																
RS-485 S-Bus, EnOcean etc.																
MP-Bus, Belimo																
LonWorks	–	–	–	–	–	–	–	–	–	–	–	–	–	■	■	■	■
General details																
Supply voltage	24 VDC -20/+25 %															
User memory	1 MB flash and 896 kB RAM															
Date/time	yes															
Data backup Flash	> 10 years															
RAM	5…15 days															

3.2 System overview and general technical details

Supply (external and internal)	
Supply voltage (acc. to EN/IEC61131-2)	24 VDC -20/+25% incl. 5% ripple
Power consumption[1)]	max. 10 W
Transient power outages (acc. to EN/IEC 61131-2)	≤ 10 ms at intervals ≥ 1 s

1) The loads handled by the outputs and other consumers are generally more important for sizing the supply than the internal power leakage of the control

Atmospheric conditions	
Ambient temperature	0…+55 °C when mounted on vertical surface with vertically aligned terminals In all other mounting positions: 0…+40 °C
Storage temperature	-25…+70 °C
Relative humidity	10…95% with no condensation

Vibration resistance	
Vibration	according to EN/IEC61131-2 5…13.2 Hz constant amplitude 1.42 mm 13.2…150 Hz, constant acceleration (simple gravitational acceleration)

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

Electromagnetic compatibility	
Noise emission	according to EN61000-6-3: (residential)
Noise immunity	according to EN61000-6-4: (industry)

Mechanism and mounting	
Housing material	Base: zinc-plated steel Cover: plastic Fibre optics: PC, crystal-clear
Mounting rail	Top-hat rail 35 mm according to DIN EN60715TH35 (former EN50022-35)

Connections	
Plug-in cage clamp terminals	The terminal block may be plugged onto up to 20 times. It must then be replaced, to guarantee a reliable contact
Plug-in screw terminals	The terminal block may be plugged onto up to 20 times. It must then be replaced, to guarantee a reliable contact
Screw terminals	Unless specified otherwise: for wires of 1.5 mm^2 (AWG 16) or 2×0.5 mm^2 (2×AWG 20)

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

3.3 System resources

3.3.1 Program blocks: BLOCTEC structure

Type	Quantity	Addresses	Remarks
Cyclic organization blocks (COB)	16	0…15	Main program elements
Exception/system-dependent organization blocks (XOB)	31	0…30	called from the system
Program blocks (PB)	300	0…299	Sub-programs
Function blocks (FB)	1000	0…999	Sub-programs with parameters

3.3.2 Program blocks: GRAFTEC structure

Type	Quantity	Addresses	Remarks
Sequential blocks (SB)	32	0…31	for Graftec programming of sequential processes
Steps (ST)	2000	0…1099	
Transitions (TR)	2000	0…1999	
Parallel branches	32	0…31	

3.3.3 Computation ranges for count types

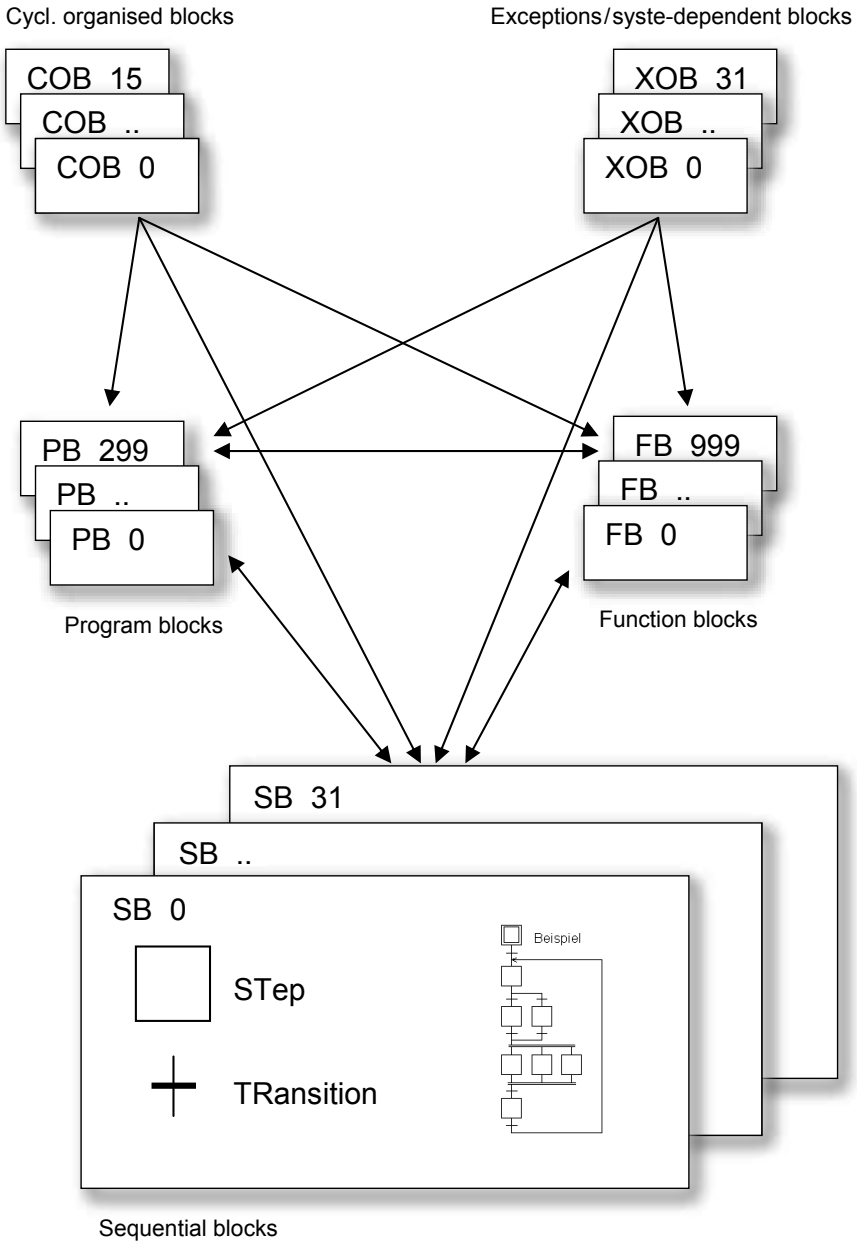
Type		Remarks
Integers	– 2,147,483,648 to + 2,147,483,647	Format: decimal, binary, BCD or hexadecimal
Floating point numbers	-9.22337×10^{18} to -5.42101×10^{-20} $+9.22337 \times 10^{18}$ to $+5.42101 \times 10^{-20}$	Instructions are provided to convert values held in SBC format (Motorola Fast Floating Point, FFP) to IEEE 754 format and vice versa.

3.3.4 Media

Type	Quantity	Addresses	Remarks
Flags (1 bit)	8192	F 0…8191	By default, flags are not volatile, but a volatile range can be configured, beginning with address 0
Registers (32 bit)	4096	R 0…4095	For integer or floating point values
EEPROM registers (32 bit) Hardware versions < E Hardware versions ≥ E	 5 50		Allow values to be stored that are retained even when the battery or the buffer capacitor is empty. These values can be read and written with SYSRD/SYSWR instructions. The mechanism is intended for configuration data that does not change often; the number of write cycles is limited to 100,000
Text/data blocks with/without extended user memory	6000	X or DB	Text/data blocks 0…3999 are saved to flash and hence always ROM text/data blocks (=> cannot be changed) Text/data blocks 4000…5999 are saved to SRAM and so can be used as RAM text/data blocks (=> can be changed)
Timers/counters (31 bit)	1600[1)]	T/C 0…1599	The breakdown of timers and counters is configurable. Timers are periodically decremented by the operating system; the basic time unit can be set between 10 ms and 10 seconds
Constants with media code K	any		Values 0…16383; may be used in instructions instead of registers
Constants with no media code	any		Values - 2,147,483,648 to +2,147,483,647. Can only be loaded into a register with an LD command, and cannot be used in instructions instead of registers.

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

3.3.5 Program structure of the PCS series



More information on this subject can be found in the TIs 26/362 (Saia PG5) and 26/354 (Operating system)

3.4 CPU overview

Differences between base units (general)	PCS1.C42x	PCS1.C62x	PCS1.C82x	PCS1.C88x
Number of I/O data points	19	30	44	44
Processor	68340 @ 16 MHz			
Processing time Bit instruction Word instruction	e.g. ANH F 0 5 µs[2)] e.g. ADD R 0 20 µs[2)] R 1 R 2			
Firmware	Downloadable to flash EPROM			
Minimum PG5 version	1.0, for TCP/IP 1.1			
User memory hardware version < E RAM basic specification Flash EPROM FEEPROM	 128 Kb 240 Kb 5 bytes			
User memory hardware version ≥ E RAM basic specification Flash EPROM FEEPROM	 896 Kb 1 MB 50 bytes			
Clock (RTC)	Deviation < 60 sec./month			
Data backup	5…15 days with super capacitor[5)]			
Interrupt inputs Maximum input frequency	no -			

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

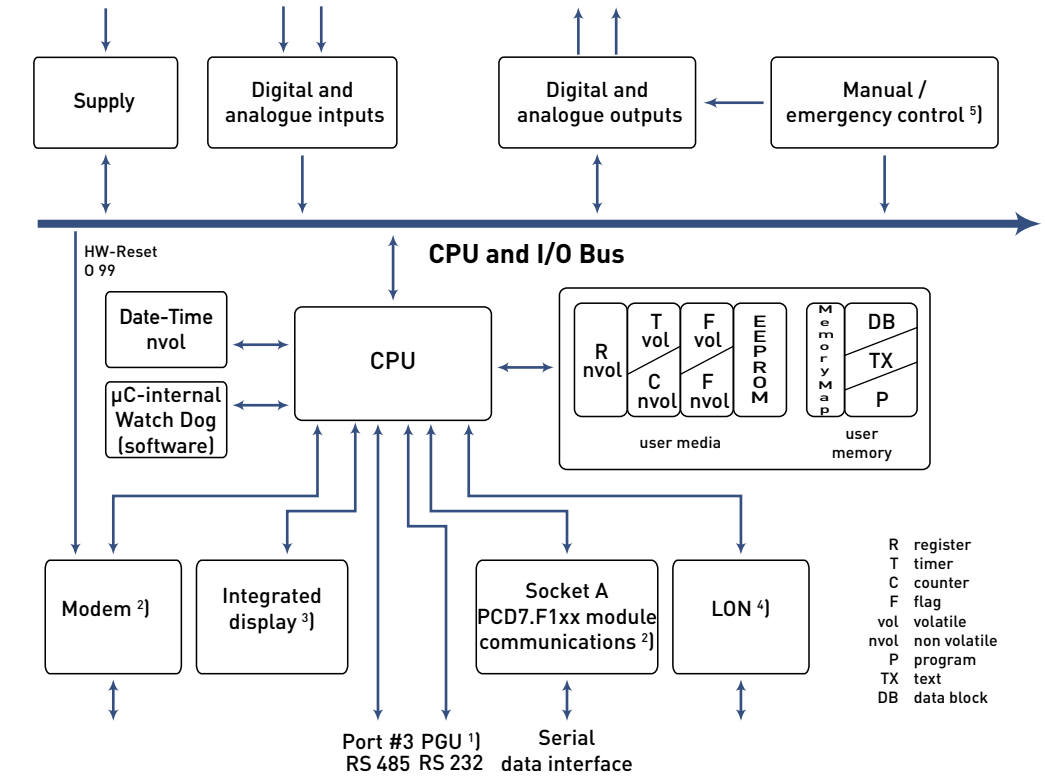
5) The period given is a buffer time; it is dependent on the ambient temperature (a higher temperature means a shorter buffer time)

Differences between base units (interfaces)	PCS1.C42x	PCS1.C62x	PCS1.C82x	PCS1.C88x
Programming interface	PGU port D-Sub socket, 9-pole[1)] (for programming cable PCD8.K111)			
Serial data port Slot A	1 RS-232, RS-422/485, MP-Bus or 20mA TTY current loop usable (PCD7.F1xx modules)			
Field bus connections				LonWorks
Modem	Analogue, ISDN or GSM			

1) Can also be used as a serial data port, e.g. to connect a terminal, but this complicates troubleshooting with the debugger

3

3.4.1 Block diagram for PCS1



1) PGU: Connection for programming unit
2) Ready fabricated according to the order key
3) Only with PCS1.Cxx0 and PCS1.Cxx1
4) Only with PCS1.Cx8x
5) Only with PCS1.Cxx0 and PCS1.Cxx2

Removing the cover exposes components that are sensitive to electrostatic discharges.

Recommendations: Immediately before touching the electronic circuits, briefly touch the metal housing of the PGU connection. It is safer to use an anti-static wrist band, connected to the Minus of the system.

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

3.4.2 Hardware and firmware versions for PCS1

The firmware versions for the PCS1 are generally backwards-compatible in terms of hardware, so old CPUs can be fitted with new firmware, in order to take advantage of new functions. This feature is highly valued, and we will try to retain it for as long as possible; however, we cannot guarantee this.

Firmware update

256 kByte flash as memory

The firmware can be updated locally at any time using PG5 via the PGU interface. This is done with the «Saia PCD FW Downloader» function on the «Tools» menu in PG5.

If the connection is lost during the download, or the power fails, the Saia PCD will start up in a special «boot» mode, in which the procedure via PGU can be repeated at any time.

'Boot' mode is displayed by way of a regularly alternating status LED (green/red):
- Slow PGU not connected
- Fast PGU connected.

In this case, the online debugger can be called, which will show the booter version.

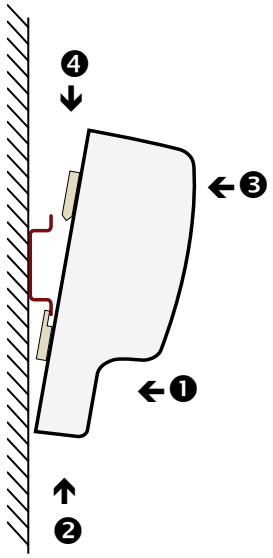
In this «boot» mode, only the firmware can be loaded. Other instructions (apart from firmware download) are not supported in this mode.

For further information, see Section 7.1.

3.5 Mounting

The PCS1 can be snapped onto a top-hat rail according Top-hat rail according to DIN EN60715TH35 (formerly DIN EN50022) (1 × 35 mm) . The PCS1 can also be screwed to any other flat surface with 2 M4 screws; the grooves provided for this purpose can be accessed by lifting off the snap-on cover.

Mounting on DIN rail



Mounting the PCS1 on the top-hat rails

❶ Press bottom of housing onto the mounting surface

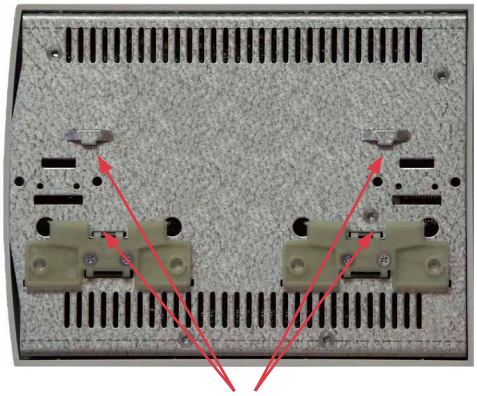
❷ Press upwards against the top-hat rail

❸ Press top of housing against the mounting surface and snap into place

❹ Push the housing down onto the top-hat rail to ensure that it is secure

Removal

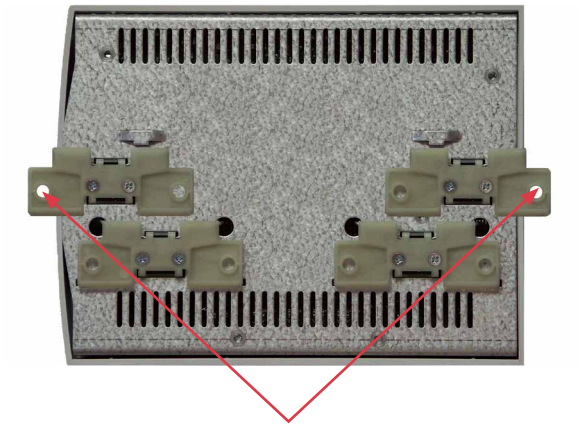
To remove the housing, push upwards and pull out.



Standard mounting on 35 mm top-hat rail

Wall mounting

Apart from the typical mounting on the 35 mm top hat rail inside a switching cabinet, the DDC Compact can also be used for field installation.



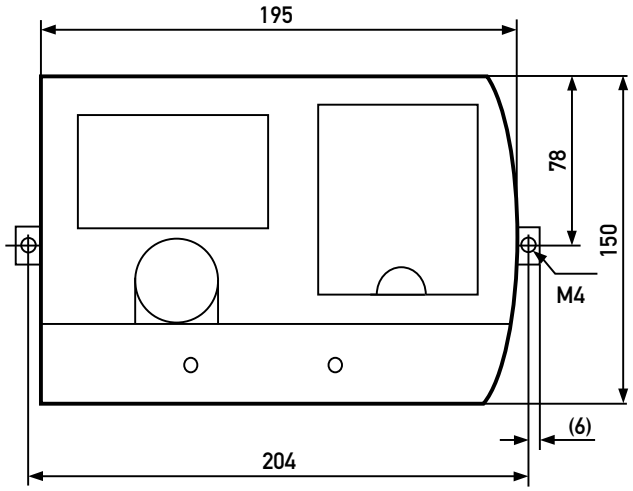
Waall mounting as an option

3.5.1 Mounting position and ambient temperature

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

3.6 Dimensions

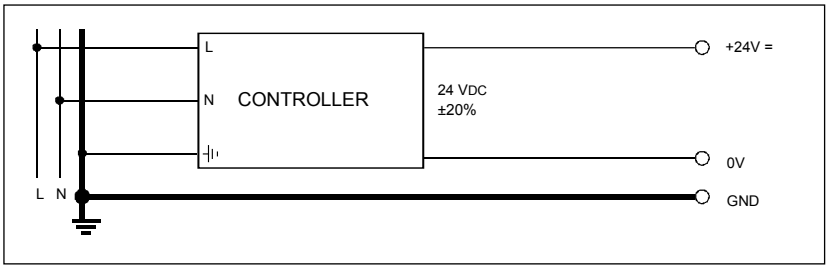
PCS1.Cxxx



3.7 Power supply and connection plan

3.7.1 External power supply

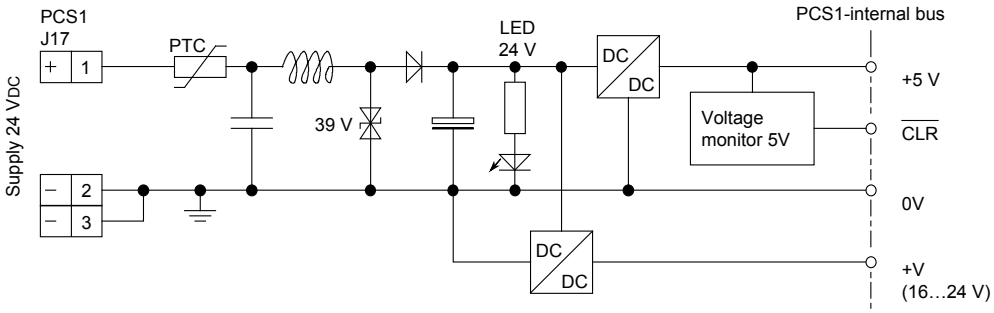
Small to medium installations (recommended)



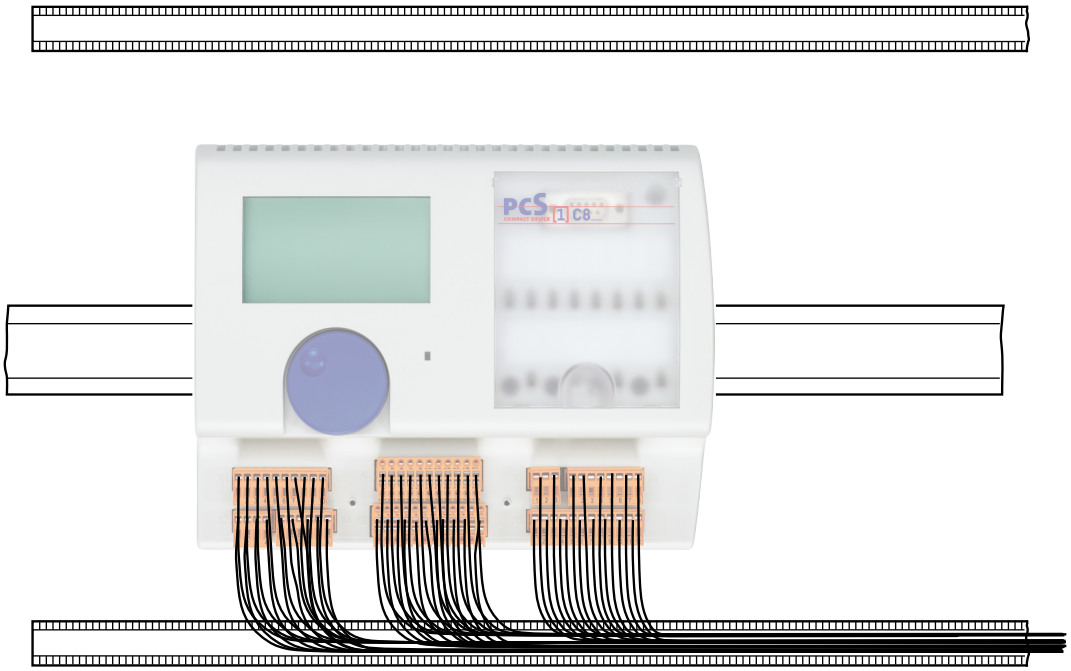
Controller: usual primary switched network component

- Sensors: Electro-mechanical and proximity switches, photoelectric barriers
- Actuators: Relays, lamps, displays, small valves with < 0.5 A switching current

3.7.2 Internal power supply



3.8 Cable layout



On the PCS1 the terminals are accessible without removing the cover.

The wiring should be on one side, in cable channels. If this rule is followed, the display and the LEDs will be visible and access to the manual and emergency operation and connection level will be clear.

3

3.8.1 Earthing and connection plan

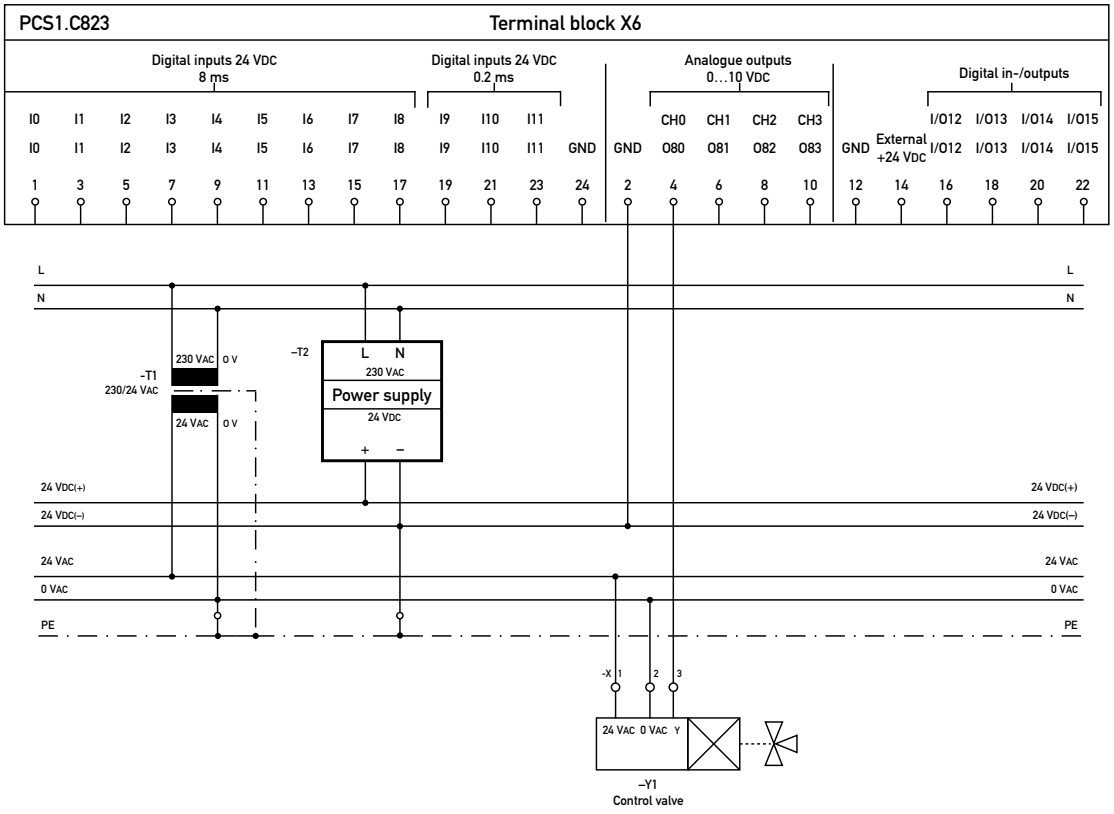
Ground wire plan with earthing bar

In the bottom part of the PCS1 housing there is a shielding and earthing plate. This constitutes the common, large-area ground for all I/O modules and for the external power supply.

The zero-potential (Minus pole) of the 24 V supply is connected to the Minus terminal of the PCS1 supply. This should be connected to the earthing bar with the shortest possible wire (< 25 cm) of 1.5 mm^2. Similarly for the minus pole of the PCD7.F1xx communication modules.

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

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



The ground should be laid as close as possible to the transformer.

Star-shaped ground wire plan (alternative to earthing bar)

The star-shaped ground wire plan should only be used where there is no earthing bar.

Examples of ground wire terminals for 35 mm mounting rails[1)]

Manufac-turer	Connection type	Type	End plate	End bracket/ end clamp
Weidmüller	Screw connection	WPE4 101 010 0000		
Weidmüller	Screwless spring clip	ZPE4 163 208 0000	ZAP/TB4 163 209 0000	ZEW 954 000 0000
Wago	Screwless cage clamp	default: 281-107	grey: 281-301 orange: 281-302	6 mm: 249-117 10 mm: 249-116
Wieland	Screw connection	WKI4SL/35	AP2.5-4 grey	9708/2 S 35
Wieland	Spring clip	WKI4SL/35	APF2.5-4 GN	WEF 1/35

[1)] DIN46277, NFC, CENELEC

3.9 PCS1 memory ranges

The PCS1 units have 1 MB of flash EPROM as user memory.

This can be freely partitioned by the user with the PG5 programming tool into program memory (default 1008 kB) and memory for text/data blocks (default 896 kB).

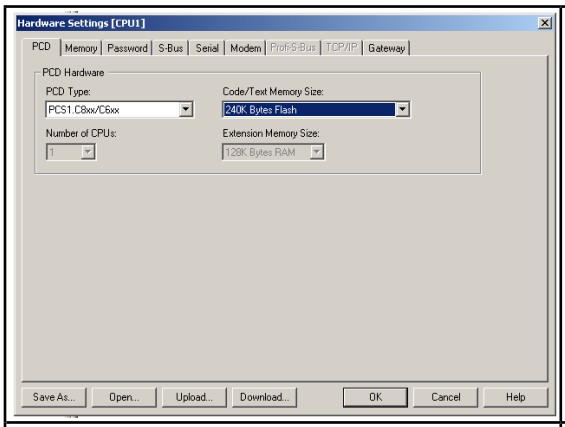
896 kB RAM as memory for historical data

The user can then edit and archive large volumes of historical data (text/data blocks 4000 ... 5999). As the data can be read over network or telecommunications lines, parent systems are also able to archive, analyse and display data graphically, and run energy management processes.

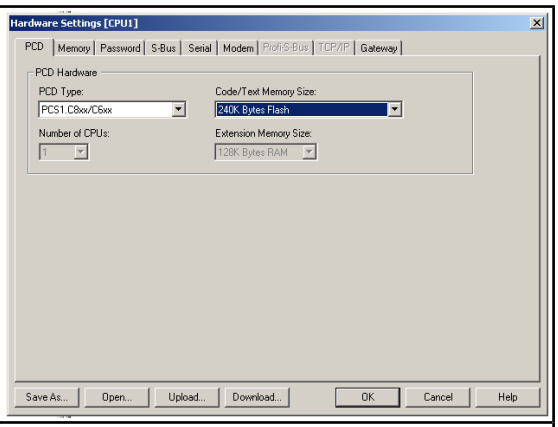
3.9.1 Example of a memory configuration

The screenshots below show an example hardware configuration and matching software settings in PG5 for a PCS1 with 240 kB flash (hardware version <= 2004) and a PCS1 with 1008 kB flash (hardware version > 2004).
Extension memory is configured automatically and is used to store RAM text and data blocks.

Step 1: Hardware configuration



Hardware versions to 2004



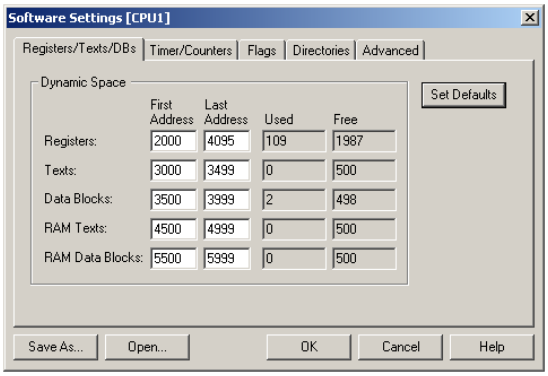
Hardware versions from 2004

There are only 128 kB of flash EPROM available for code/text memory. One block of memory is lost to configuration data (header), because flash EPROM can only be accessed in block mode.

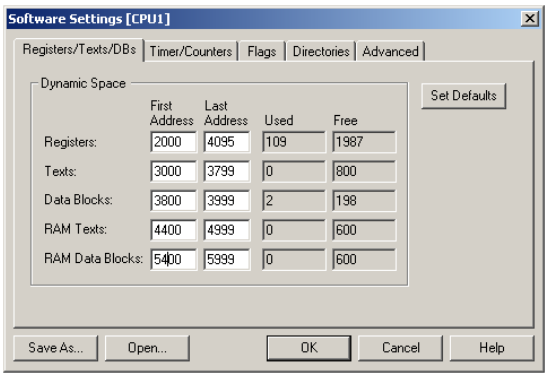
Step 2: Download the hardware configuration

Step 3: Modify software settings

Software settings before modification:



After modification ("Set defaults" pressed):



The addresses of the RAM text strings and DBs have been changed.

The “Set Defaults” button is useful in many cases, as the addresses are automatically set according to the hardware configuration. However, the previous settings are lost.

The new software settings are picked up at the next build.

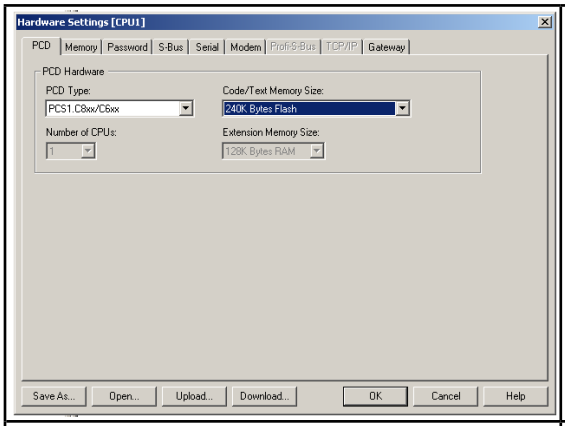
3.9.2 Partitioning options for user memory

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

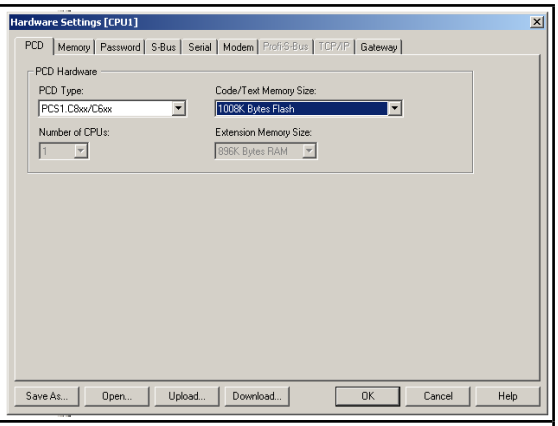
In the case of a large program with few texts/DBs or a very small program with many texts/DBs, the user can partition the memory manually. In order to choose an appropriate breakdown, the following should be noted:

- the partitioning is into "kB lines of code" and "kB text/DBs", where the "kB lines of code" can only be changed in 4 kB steps, as every line of code occupies 4 bytes
- the result of the formula (4 × "kB program cells") + "kB texts/DBs" must equal the effectively available user memory,
  e.g. 4 × 24 kB + 32 kB = 128 kB
- each character of a text occupies 1 byte
- each 32-bit element of a DB occupies eight bytes in the address range 0..3999, and the header of the DB takes up a further three bytes

Example of manual partitioning of a PCS1:



Hardware versions to 2004



Hardware versions from 2004

3.10 Data storage in case of power failure

The resources (registers, flags, timers, counters etc), and possibly the user program and the text strings/DBs, are stored in RAM. To ensure that these are not lost in the event of a power failure and that the hardware clock continues to run, the PCS1s are fitted with a buffer capacitor (SuperCap). The RAM data is always buffered with the SuperCap, but the buffering of the hardware clock can be disabled, increasing the buffer time for the RAM.

CPU type	Buffer	Buffer time
PCS1	Super Cap (soldered)	5...15 days[1)]

[1)] Depending on the ambient temperature; the higher the temperature, the shorter the buffer time.
If the hardware clock is disabled, the buffer time increases by approx. 5 days

To retain the data in RAM at least 2 volts are needed. This voltage is reached after approx. 6 minutes, but this level is sufficient only for very short-term data storage. The complete loading cycle for the SuperCap requires at least 45 minutes (5 tau).

3.11 Hardware clock (real-time clock)

CPU type	Where is the hardware clock?
PCS1	On the motherboard

Deactivating the real-time clock may be useful e.g. in configured systems to allow sufficient time after delivery for installation. After commissioning the controller, the real-time clock should be reactivated and set. This function is only available on the PCS1. It must be part of every Fupla application.

3.11.1 Enabling/disabling buffering of the hardware clock (RTC)

Enabling/disabling buffering of the hardware clock (RTC) by system commands:

System command 9001 can be used to enable/disable the hardware clock:

Instruction:			
	SYSWR	**K 9001** **0**	; only RAM buffered
		K 9001 **1**	; RAM + hardware clock (RTC) buffered

Enabling/disabling buffering of the hardware clock (RTC) using an FBox:

In the standard library in sub-directory "Special functions" is the "Clock/SCap" FBox.

Input	**Colour**	
En	Enable	; While the input is "high" (1), the hardware clock (RTC) is fed from the SuperCap

Description of the function

The feed to the real-time clock is enabled via input "En" to the FBox. The voltage is provided by the SuperCap. This means that the data stored in RAM can be retained approx. 3 times as long when the real-time clock is inactive.

RAM approx. 15 days

RAM and real-time clock approx. 5 days

Disabling the hardware clock is very useful when a PCS1 with user program loaded into RAM needs to be transported or stored.

When the system is placed into operation again, the buffering of the hardware clock should be reactivated. The hardware clock then needs to be adjusted again.

The function should only be used with the following versions of the FBox library:

≥ $2.3.142 for PG5 1.2
≥ $2.4.121 for PG5 1.3
or PG5 V1.4

Interim solution (workaround only):

Where no more recent version of the library is available (and no Internet access to www.sbc-support.com), the following IL sequences should be integrated into the project:

; Enable

```
$XOBSEG 16
     SYSWR      K9001 ;  Enable buffering of RTC
                K 1
$ENDXOBSEG
```

; Disable

```
$XOBSEG 16

     SYSWR      K9001 ;  Disable buffering of RTC
                K 0
$ENDXOBSEG
```

3.12 Monitoring the CPU (watchdog)

The watchdog monitoring unit can be used to monitor the correct processing of the user program with a high level of reliability. In the event of errors, effective safety measures can be triggered, e.g. to switch off parts of the installation.

3.12.1 Software watchdog for PCS1

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

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

Instruction:

SYSWR	**K 1000**	; Software watchdog instruction
	R/K x	; Parameters as per table below: ; K constant or value in register
x = 0	The software watchdog is deactivated	
x = 1	The software watchdog is activated; if the instruction is not repeated within 200 ms, there will be a cold start	
x = 2	The software watchdog is activated; if the instruction is not repeated within 200 ms, XOB 0 will be called and then there will be a cold start XOB 0 calls are entered in the PCS1 history as follows:	
	"XOB 0 WDOG START"	where XOB 0 has been invoked by the software watchdog
	"XOB 0 START EXEC"	where XOB 0 has been invoked because of a supply fault

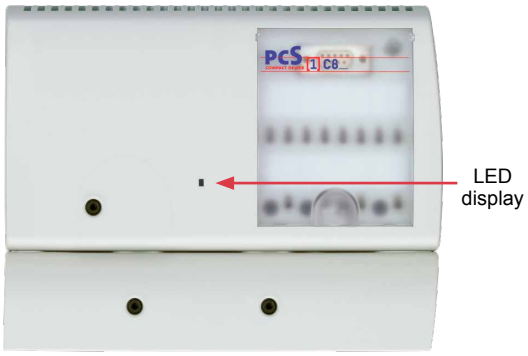
3.13 Internal LED and graphic display

The PCS1 has a programmable three-colour LED (CPU LED).

Outputs / communication interfaces can be used to connect external displays and terminals to all PCS1s. On the PCS1.Cxx0 and PCS1.Cxx1 types, there is a graphic display.

3.13.1 CPU LED

With the three-colour LED (red/green/yellow) built into the cover of the casing, the system integrator can show the user the current status of the controller at a glance. The control of the LED is freely programmable, so can be adapted to the needs of the operator.



Default status of LED

System in Boot mode	red LED flashing (no firmware in PCS1)
Downloading firmware	LED flashes green/red/off
System in RUN mode	yellow LED on
System in Stop/Halt mode	LED off
Hardware error in system	red LED flashing every 500 ms

The red, green and yellow colours and the "LED off" setting can be overridden by the user (program) using system command 9000:

Instruction:	**SYSWR**	**K 9000 0**	; LED switches to "yellow"
		K 9000 1	; LED switches to "red"
		K 9000 2	; LED switches to "green"
		K 9000 3	; LED switches to "dark", LED off

In the pilot series (80 units delivered before end 2001) the colours are coded in reverse order: 0 = off, 1 = green, 2 = red and 3 = yellow.

Controlling the CPU LED with an FBox

In the standard library in sub-directory "Special functions" is the "CPU LED" FBox.

Input	**Colour**	
Ylw	**Yellow**	; Command to set the colour yellow
Red	**Red**	; Command to set the colour red
Grn	**Green**	; Command to set the colour green
Off	**Off**	; Command to set the colour off/dark

Functional description of FBox:

A positive edge at the input sets the CPU LED to the corresponding colour.

Remember that the LED will be controlled by the firmware again when the operating mode (RUN/STOP) of the PCS1 changes.

3.13.2 User navigation with external or integrated graphic display

Integrated graphic display | PCD7.D230 | PCD7.D231 | PCD7.D232

The PCS1.Cxx0 and PCS1.Cxx1 types have an integrated graphic display. This is equivalent to the PCD7.D230 (graphic display with single-knob control). An external graphic display of type PCD7.D230 can be connected on the port #2 of the units PCS1.Cxx2 and PCS1.Cxx3.

The graphic display with one-knob control enables simple and clear user navigation. The graphic display has a resolution of 128 × 64 pixels and so can be used for complex displays in plain text or graphic mode. The back-lighting makes it easy to use even in poor light.

The sub-menu structure and various process parameters are selected by "turning" and "pressing" the control knob. This allows setpoints or timer programs to be entered.

Turn = Menu navigation, parameter selection, value changes

Press	=	short	for Edit mode, to confirm input
		long	to page back in the menu
		hold	to return to main menu

All system functions configured by the user can be parameterised via the integrated or external terminal. The different input levels can be password-protected.

The integrated graphic displays are connected to Port #2

The integrated graphic displays are connected to Port #2.
In the HMI Editor, under "Settings", "Serial Line" should be set to "Channel 2".

3.14 Storing data in EEPROM

On the PCS1, an EEPROM is used to store configuration data. Part of this is available to the user to store 32-bit values (EEPROM register). These values are not lost even in the case of battery failure or an empty buffer capacitor.

On PCS1s with hardware version < E, there are **five** EEPROM registers (addresses 2000 to 2004).

On PCS1s with hardware version ≥ E, there are **fifty** (addresses 2000 to 2049). The EEPROM registers are independent of the "normal" registers with the same addresses.

The values are read with a SYSRD instruction and written with a SYSWR instruction:

Read:

SYSRD	**Kx or R x** **R y**	; Kx is the address of the EEPROM ; register in range K 2000 to ; K 2004 for PCS1 CPUs, ; or K 2000 to K 2049 for PCS1 CPUs ; Alternatively, the address of a ; register can be passed across, ; containing the address of the ; EEPROM (same ranges as for ; K constants)
		; R y is the target register

Write:

SYSWR	**Kx or R x** **R y**	; Kx is the address of the EEPROM ; register in range K 2000 to ; K 2004 for PCS1 CPUs, ; or K 2000 to K 2049 for PCS1 CPUs ; Alternatively, the address of a ; register can be passed across, ; containing the address of the ; EEPROM (same ranges as for ; K constants)
		; R y is the source register

When using the instruction SYSWR K 20xx, note the following:

- The EEPROM can be written to a maximum of 100,000 times, so it is not permissible to invoke the instruction in a cyclical manner or at short intervals.
- The processing time for the instruction is approx. 20 ms. For this reason, the instruction must not be invoked in XOB 0 (XOB for a power failure) or during time-critical processes.

3.15 Manual/emergency operation

The provision of a manual/emergency operation level allows the user to intervene in the process at any time in case of emergency or service.

The PCS1 has an integrated connection level with a total of 8 relay outputs. Four of these are set up as make contacts and four as change-over switches, so the user can interlock the outputs in the case of a two-stage fan control (see connection diagram, section 5.4.2). The switches have auto/off/on functions. Four more switches and potentiometers are used for manual/emergency operation of the analogue outputs. This allows e.g. fans or baffles to be overridden. The switches have auto/man functions, and the potentiometers can be set from 0 to 100%. The plates provided can be used to label system-specific manual/emergency settings.

The inputs/outputs are described in more detail in Chapter 5.

3.16 Use of Port #0 (PGU) as RS-232 interface

A new function was introduced with fimware version 0A1. This allows PGU Port #0 (Sub-D, 9-pole) to be used as a free port (e.g. Serial S-Bus, MC etc.). This allows the user to use the PCS1 as a gateway (Port #0 as 'slave' port).

Port #0 on the PCS1 is used for modem access and by the PGU connection.

The Port can be switched using the following system commands:

Instruction:

SYSWR	**K 9002**	; PGU Switch instruction
	K x	; Parameter according to table below, K ; constants
x = 0	Default setting: Port #0 used for the internal modem	
x = 1	Port #0 attached to the Sub-D connector, the internal modem can no longer be used	

The user program can issue the instructions to switch from modem to Sub-D connector at any time. If the instruction is issued during communication, this will be interrupted.

The value is saved in the buffered area of RAM, i.e. it will be retained even when the system is rebooted.

The port can also be switched directly from the Online Debugger. For this, the PCS first has to be stopped, then the following instruction has to be input:

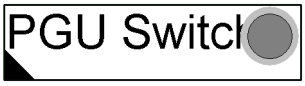
```
I SYSWR K9002, K 0 <enter>
```
switches Port #0 to the internal modem

```
I SYSWR K9002, K 1 <enter>
```
switches Port #0 to the Sub-D connector

The DSR signal (Pin 6) from the D-Sub connector is used to detect the PGU cable (i.e. to recognise that the cable is connected). When the signal DSR detects a logical 1 ("high"), Port #0 will be run as a PGU port and earlier configurations will be deactivated.

"PGU Switch" FBox/PCS1

In the standard library in sub-directory "Special functions" is the "PGU Switch" FBox.



This FBox in the FUPLA program allows Port#0 (PGU connector) to be used as an RS-232 interface also.

4 PCS1 Communication interfaces

4.1 Serial data ports

The PCS1 controllers support the protocols to connect various peripheral devices such as printers, user terminals, light and shade and access control systems. The connection is made via standard interfaces such as RS-232/RS-422/RS-485 at up to 38.4 kBit/s.

The PCS1 supports the following modes:

- MC mode = character mode to connect external systems with ASCII protocols (e.g. EIB, M-Bus, Modbus etc.)
- S-Bus mode = for exchanging data with SBC systems in a network in half-duplex operation

IMPORTANT:

- **Port #0:** on the PCS1 is used for modem access and by the PGU connection. The modem channel is active in normal operation. When the connection to the programming device is established with the PGU cable, the DSR signal switches the port to the PGU connection (PGU has priority and works by default at 38.4 kBit/s). When the PGU cable is removed, modem access is re-initialised. With SYSWR K9002 (K1), Port 0 can also be switched to the PGU D-Sub connector, and so can be used as a normal interface (e.g. SBC S-Bus)

- **Port #1:** The PCS1 does not support all handshake signals from the PCD7.F120 communication module that are required for modem operation (see above).

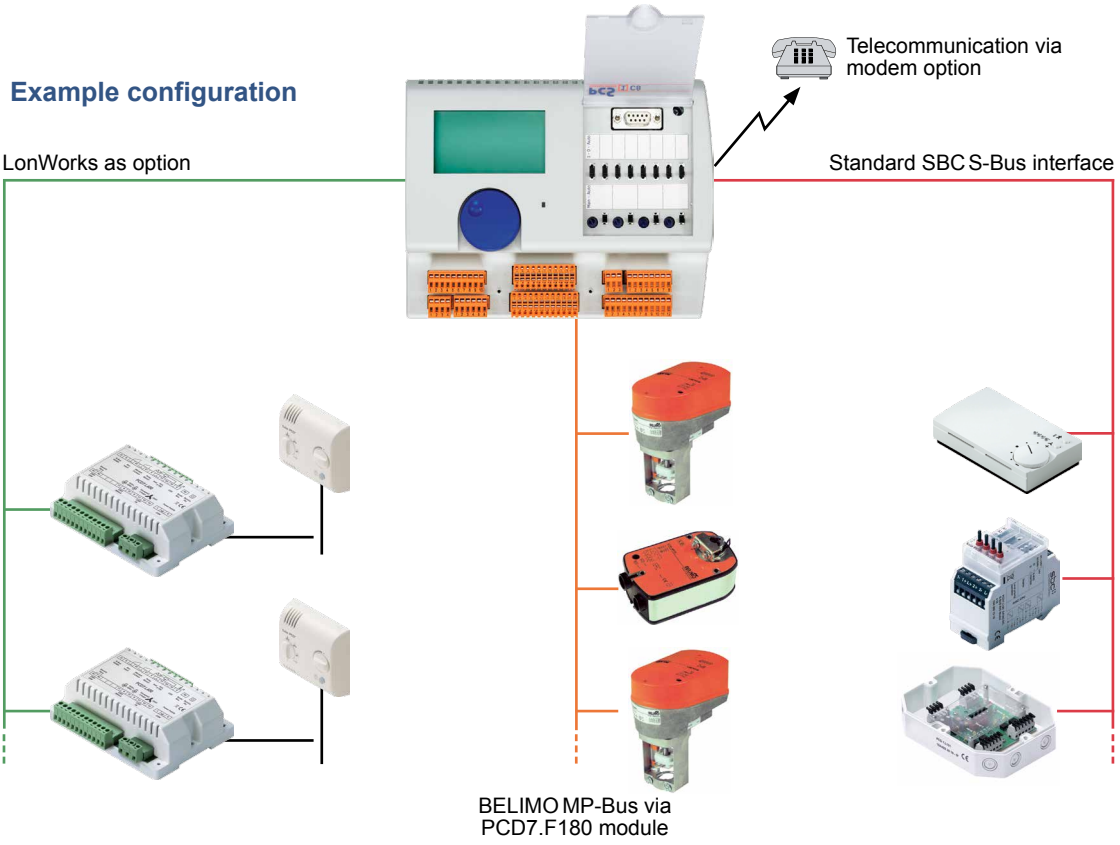
- **Port #2:** External RS-232 connection, on PCS1.Cx22/Cx23 without internal display only

Port #0 and Port #1 are handled by a UART.

A UART cannot support 2 ports running at 38.4 kBit/s at the same time.
2 × 38.4 kBit/s not possible
1 × 38.4 kBit/s and 1 × 19.2 kBit/s not possible either
1 × 38.4 kBit/s and 1 × 9.6 kBit/s works
2 × 19.2 kBit/s works

4.2 Network connection/field bus control

Even for more complex or large-scale automation tasks, the excellent network capability of the PCS1 allows it to be extended almost without any limit. Whether the local data points are implemented with standardised network connections such as LonWorks, EIB, Modbus or M-Bus, or with an economical SBC S-Bus or BELIMO MP-Bus, the extensibility of the controller offers almost limitless possibilities.



4.2.1 LonWorks interface

The LonWorks technology is a universal automation concept, which is becoming more and more important in the field of building and industrial automation. Its many advantages such as decentralised intelligence, modular structure and adaptability to existing infrastructures make the LonWorks technology increasing interesting for data transfer in the field. The individual network users, the so-called nodes, can exchange data among themselves on an event-driven basis. LonWorks is the platform for manufacturer-independent communication between different aspects of building automation.

The DDC Compact meets these various requirements by virtue of its modular interface design and great flexibility. The LonWorks host interface in the controller allows the user to define more than 1000 variables for data interchange with other systems. Its programmability also allows the system integrator to adapt the system to the technical requirements of the building systems.

FTT-10A transceiver technology

For the network connection, SBC uses the industry-standard FTT-10A transceiver technology patented by Echelon, with the following characteristics:

- Cable type: 2 × 2 wires twisted
- Transmission rate: 78 kBit/s
- Network structure / cable length: free topology max. 500 m, Bus topology max. 2700 m
- Number of LonWorks nodes: max. 64 per segment, over 32,000 in a domain Standard network variables SNVT a

The implementation of a MIP (microprocessor interface program) allows over 1000 SNVTs (standard network variable types) to be defined in a DDC sub-station and linked to other Saia PCDs of external systems. All SNVTs current specified in LonMark are supported by the Saia PCD systems. To connect to LonWorks nodes with proprietary information, "explicit messages" can also be sent.

After binding (linking the variables), this information must be backed up using the "Upload DBx" function in Saia PG5. Without a backup, this binding information may be lost after program changes and subsequent downloads.

4.2.2 MP-Bus interface for BELIMO drives

The fields bus was developed by BELIMO specifically for MFT and MFT2 drives (MFT = multi-function technology). Saia Burgess Controls has developed two switching modules for 8 and 16 drives for integration into the whole DDC-Plus range.

An MP-Bus network (MP = multi-point) comprises a three-pole cable connection between the switch in the automation system or control unit and the drives. Up to 8 drives can be connected to a communication channel. Further process data can also be sent to the attached drives directly via a drive or add-on modules on the MP-Bus. Passive sensors, active sensors and 2-point on/off signals are supported.

The direct connection of standard sensors for humidity, temperature etc. to an MFT/MFT2 drive makes analogue sensors Bus-compatible.
For details, see Technical Information sheet P+P26/342.

4.2.3 EIB interface

At some point, EIB users reach the performance limits of the EIB components obtainable on the market today. Efficient management of building installations requires powerful functions uniting all aspects. The PCS1 controllers with associated EIB driver offer an optimum solution for complex EIB tasks.

The principle

PCS1 controllers can access the EIB network via the serial RS-232 port on the EIB interface module. Depending on its user program, the PCS1 issues instructions over the EIB network and receives constant information from it on the EIB peripherals. This allows logical links, timer and counter functions, mathematical operations or sequential processes to be implemented within the EIB network.

4.2.4 M-Bus and Modbus interface

The M-Bus (EN 1434-3) is an international standard for remote reading of counters. The M-Bus connection is made via a standard RS-232 interface and an M-Bus converter. This enables amounts of water, heat or energy to be recorded in a DDC sub-station. The measurements are then processed via a component library in SBC FUPLA.

The interface to the Modbus is provided by an RS-485 port on the PCS1. The Saia PG5 component library allows the user to read and work with process data and transfer control values to the Modbus network. This very popular network standard is often used by compact climate control manufacturers to connect to higher-level systems.

Detailed information on the M-Bus and Modbus interfaces can be found at:

www.engiby.ch and www.ludwig-systemelektronik.de

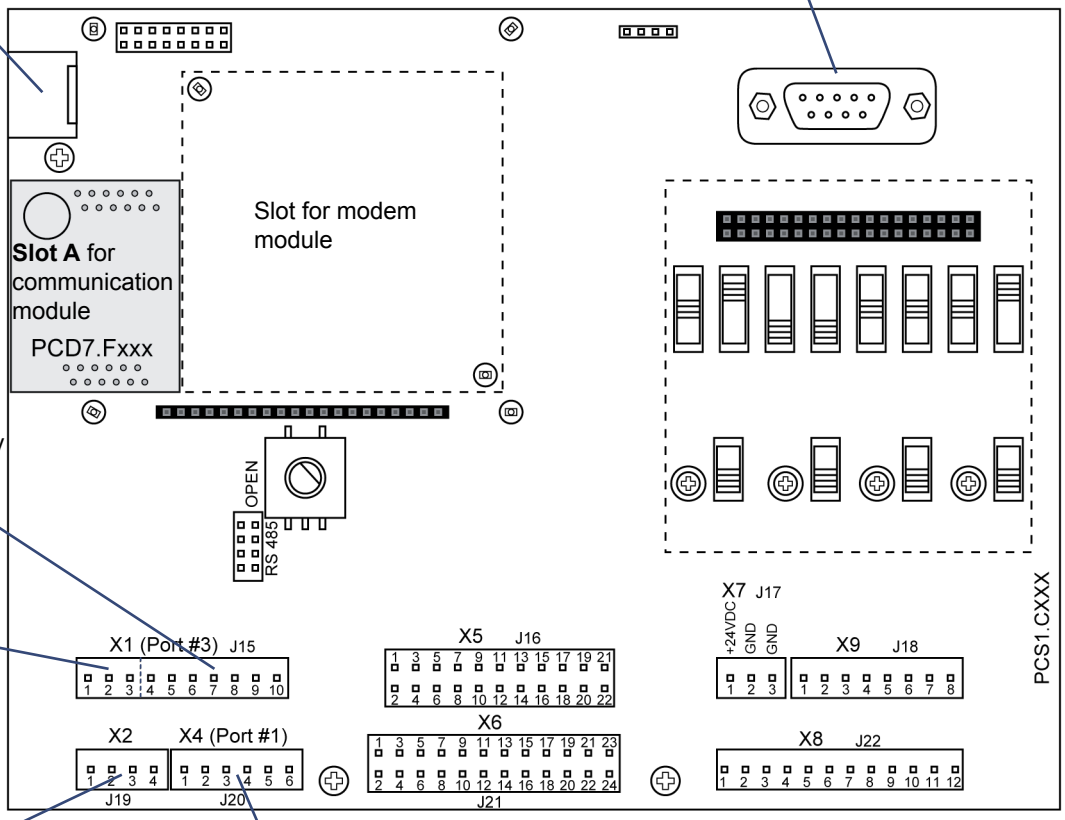
4.2.5 Other connections

You country office will be happy to provide information on other external system connections such as Siemens 3964R, Cerberus, GENIbus for Grundfos pumps, STX-Bus for NeoVac, TwiLine or JCI-N2-Bus.

4.3 Overview of PCS1.C4xx/PCS1.C6xx/PCS1.C8xx interfaces

PORT #0
Modem or
programming interface (PGU)

PORT #0
Programming interface (PGU)



X3 PORT #2
Connection for
external display
PCD7.D230/
RS-232

X1 PORT #3
Connection for
SBC S-Bus/
RS-485

X2
Connection for
LonWorks

X4 PORT #1
Connection for Slot A
communication modules
PCD7.F1x0

4.3.1 Overview of PCS1.C4xx/PCS1.C6xx/PCS1.C8xx onboard interfaces

Base unit with onboard interfaces	Summary without plug-in communication modules				
	Port #	PGU | RS-232	External display	LonWorks	SBC S-Bus RS-485
PCS1.C420 and PCS1.C421	0	■	-	-	-
	2	-	-	-	-
	3	-	-	-	■
PCS1.C422 and PCS1.C423	0	■	-	-	-
	2	-	■	-	-
	3	-	-	-	■
PCS1.C620 and PCS1.C621	0	■	-	-	-
	2	-	-	-	-
	3	-	-	-	■
PCS1.C622 and PCS1.C623	0	■	-	-	-
	2	-	■	-	-
	3	-	-	-	■
PCS1.C820 and PCS1.C821	0	■	-	-	-
	2	-	-	-	-
	3		-	-	■
PCS1.C822 and PCS1.C823	0	■	-	-	-
	2	-	■	-	-
	3		-	-	■
PCS1.C880 and PCS1.C881	0	■	-	-	-
	2	-	-	■	-
	3		-	-	■
PCS1.C882 and PCS1.C883	0	■	-	-	-
	2	-	■	■	-
	3		-		■

4.3.2 Overview of PCS1.C4xx/.C6xx/.C8xx plug-in interface modules

Base unit with sockets for plug-in communication modules	Summary of plug-in communication modules							
		X4 connector Port #1				X2 connector		
	Slot	PCD7.F110	PCD7.F120[1)]	PCD7.F150	PCD7.F180	analogue	ISDN	GSM
PCS1.C420 and PCS1.C421	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■
PCS1.C422 and PCS1.C423	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■
PCS1.C620 and PCS1.C621	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■
PCS1.C622 and PCS1.C623	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■
PCS1.C820 and PCS1.C821	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■
PCS1.C822 and PCS1.C823	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■
PCS1.C880 and PCS1.C881	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■
PCS1.C882 and PCS1.C883	A	■	■	■	■	-	-	-
	Modem module	-	-	-	-	■	■	■

[1)] The PCS1 does not support all handshake signals from the PCD7.F120 communication module that are required for modem operation.

4.4 Detailed description of onboard interfaces

4.4.1 PGU connector (PORT#0) (RS-232) for connecting programming devices

The PGU interface (Port#0) is connected to a 9-pole D-Sub connector (female). The interface is used to connect the programming device when the unit is commissioned.

The interface is of type RS-232c.

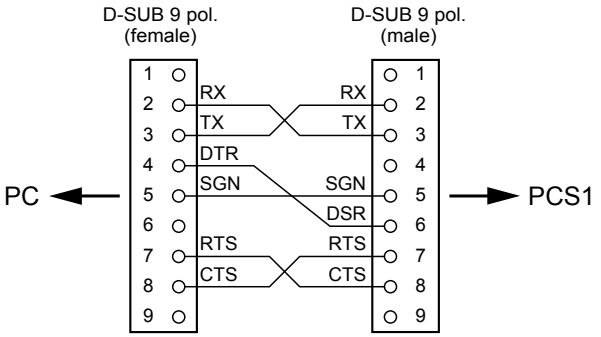
The pin configuration and associated signals are:

Pin	Designation	Meaning	
1	PGND	Protective ground	[Schutzerde]
2	RXD	Receive data	[Empfangsdaten]
3	TXD	Transmit data	[Sendedaten]
4	n.c.	Not connected	[Nicht verwendet]
5	SGN	Signal ground	[Signalerde]
6	DSR	PGU connected	[Erkennung PGU]
7	RTS	Request to send	[Sender einschalten]
8	CTS	Clear to send	[Sendebereitschaft]
9	+5 V	P100 supply	[Speisung P100]

The PGU protocol is provided for operation with a programming device. The use of the PCD8.P800 service unit is supported from firmware version $301 for all PCS1 controllers.

PCD8.K111 connecting cable

(P8 and S-Bus protocol, suitable for all PCS1 units)



The PGU interface (Port#0) is also used by the PCS1 for modem access. In normal operation, the modem channel is active. When the connection to the programming device is established with the PGU cable, the DSR signal switches the port to the PGU connection (PGU has priority and works by default at 38.4 kBit/s). When the PGU cable is removed, modem access is re-initialised. With SYSWR K9002, (K1), Port 0 can also be switched to the PGU D-Sub connector, and so can be used as a normal interface (e.g. SBC S-Bus)

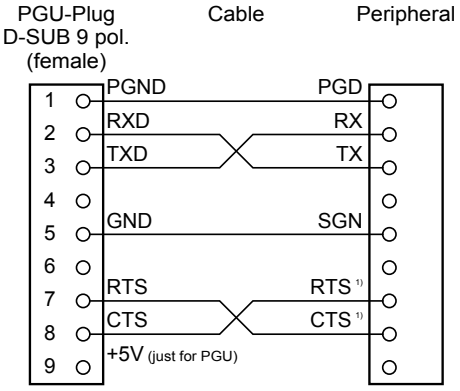
4.4.2 PGU connector (PORT#0) (RS-232) as communication interface

When commissioning/programming are complete, the port can be used for other purposes.

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

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

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



1) When communicating with terminals, check whether some connections are provided with bridges or need to be set to "H" or "L" with the "SOCL" instruction. It is generally recommended to use a handshake (RTS/CTS).

4.5 SBC S-Bus

The SBC S-Bus, with its simple and secure protocol is part of the basic set up of all Saia PCD PCS systems, for use as master or slave. The protocol is used for optimum exchange of data between Saia PCD PCS systems or decentralised peripherals such as RIOs or room control systems. Access from the Saia PG5 programming tool for programming, debugging and commissioning is supported, as is connection to the ViSi.Plus building control technology from Saia Burgess Controls. The SBC S-Bus enables economical master/slave networks or point-to-point connections to be set up with a simple two-wire cable, based on an RS-485 interface. The maximum distance per segment, or between devices/repeaters, is 1200 m.

IMPORTANT: To guarantee reliable connections between network users within an RS-485 network, SBC S-Bus components have to be used The Bus connection is made via the PCD7.T160 termination box. For details, see Technical Information sheet P+P26/370.

Technical data with RS-485 interface: Master with up to 38.4 kBit/s Saia PCD PCS system connection (high net data rate because of low protocol overhead), up to 4 masters via gateway function; Slave with up to 38.4 kBit/s and up to 254 Saia PCD® PCS slaves in segments of 32 stations each, up to 100 Slaves with PCD7.Lxx modules (for details, see TI 26/339).

4.5.1 X1 (PORT #3) RS-485 as S-Bus or communication interface

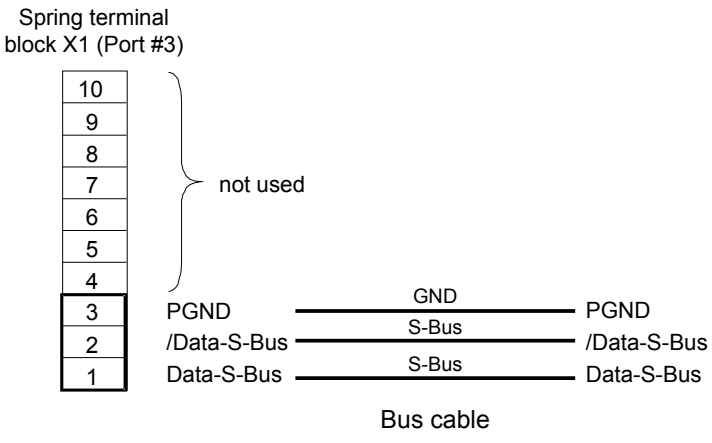
The X1 interface (Port #3) is supported in two modes:

- MC mode = character mode to connect external systems with ASCII protocols (e.g. EIB, M-Bus, Modbus etc.)
- S-Bus mode = for exchanging data with SBC systems in a network in half-duplex operation

The pin configuration and associated signals are:

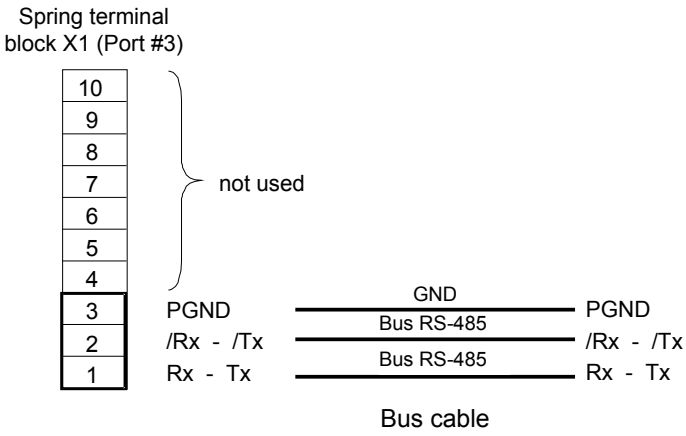
X1 pin	Designation	Meaning	
3	GND	Ground	[Schutzerde]
2	/Data-SBus	/Rx-/Tx	Data line
1	Data-SBus	Rx-Tx	Data line

Connecting SBC S-Bus with RS-485 to X1:

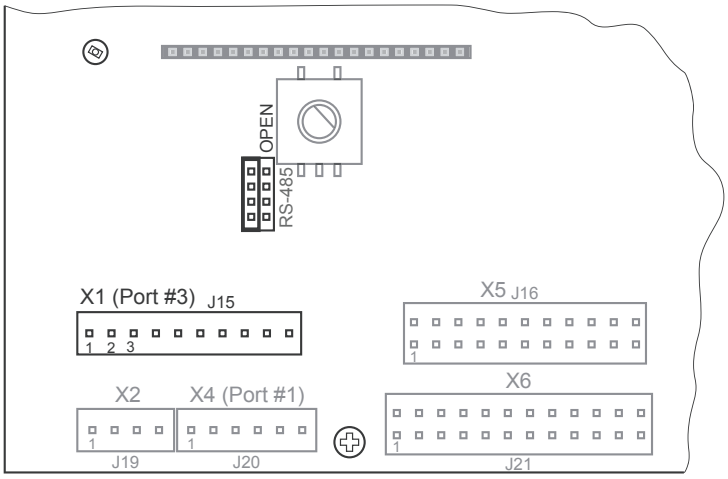


4

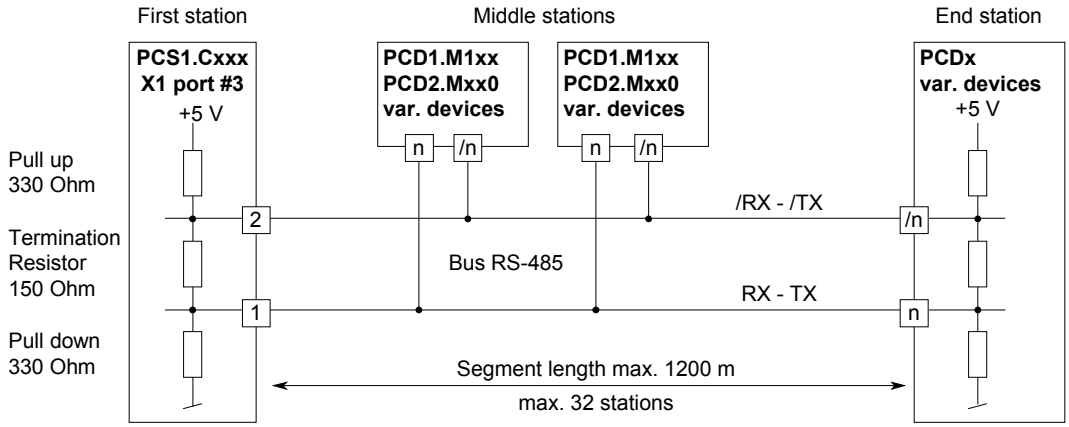
Connecting communication interfaces with RS-485 to X1:



Activating the terminal resistors



Choice of termination resistors

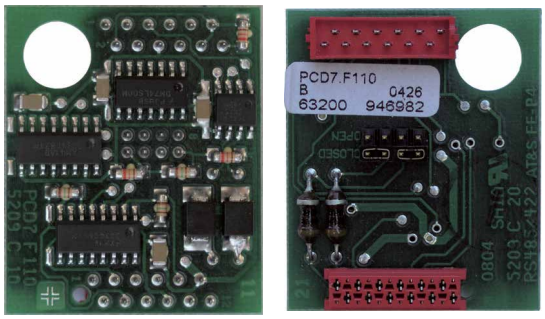


At the first and last stations, the "RS-485" jumper must be set to the "CLOSED“ position.

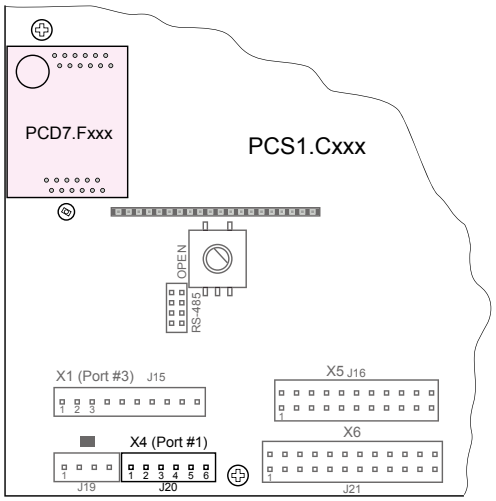
At all other stations, the "RS-485" jumper must be set to "OPEN" (factory setting).

4.6 Plug-in interface modules on Slot A

4.6.1 RS-485/422 with PCD7.F110, Port #1

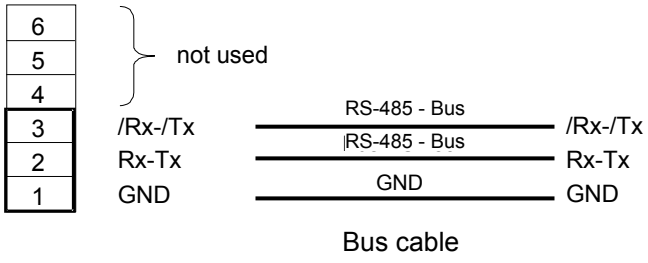


PCD7.F110:
RS-422 with RTS/CTS or RS-485 electrically connected, with line termination resistors capable of activation, for Slot A

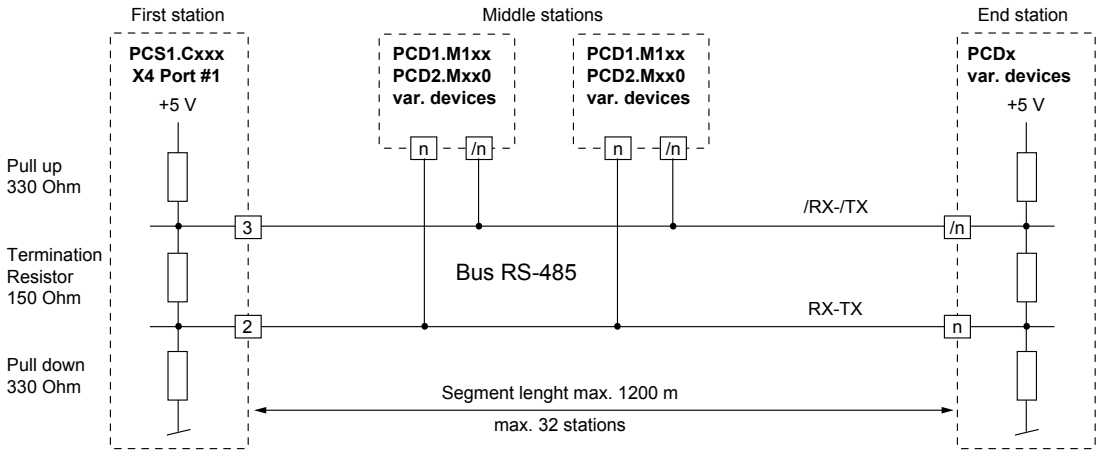


Connection for RS-485

Spring terminal block X4 (Port #1)



Choice of termination resistors



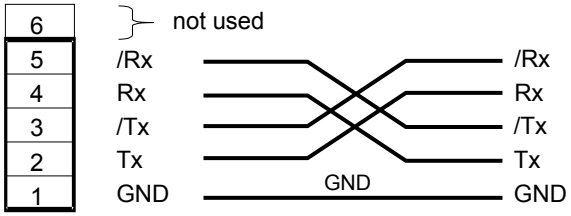
Not all manufacturers use the same connection configuration, so the data lines may need to be crossed

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

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

Connection for RS-422

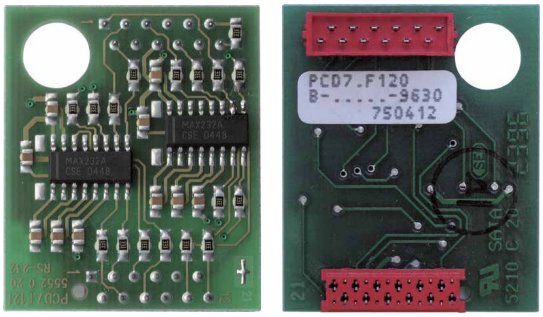
Spring terminal
block X4 (Port #1)



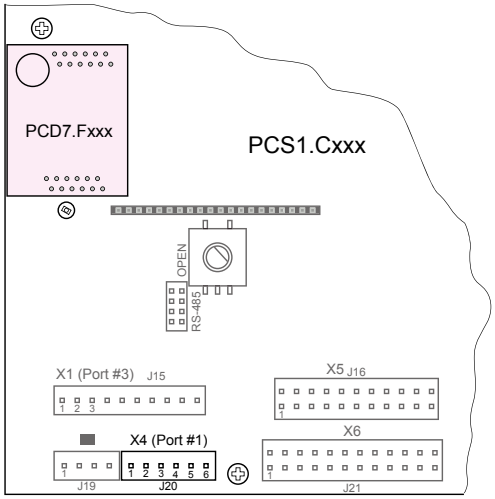
Bus cable

For RS-422, each pair of receive lines is terminated with a 150 Ω line termination resistor. Jumper J1 must be left in the “OPEN” position (factory setting). The jumper is on the connection side of the module. The RTS and CTS control lines cannot be used.

4.6.2 RS-232 with PCD7.F120 (suitable for modem), Port #1

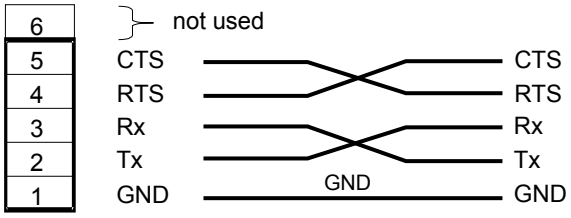


PCD7.F120:
RS-232 with RTS/CTS, DTR/DSR, DCD, suitable for modem connection, for Slot A



Connection for RS-232

Spring terminal block X4 (Port #1)

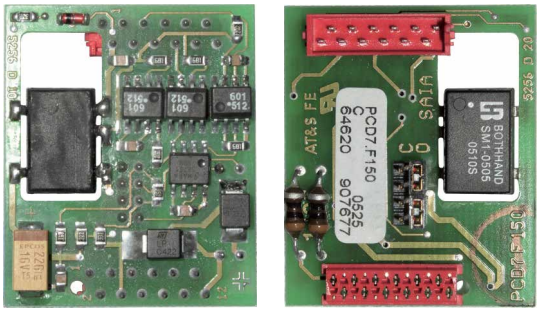


Bus cable

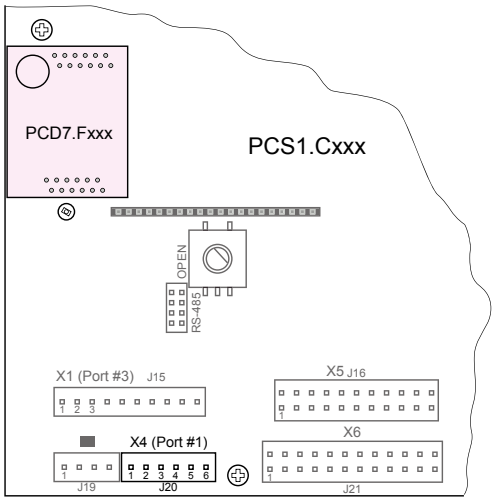
RS-232 interface, Port #1 for external modem (DCE)

The PCS1 does not support all handshake signals from the PCD7.F120 communication module that are required for modem operation (see above).

4.6.3 RS-485 with PCD7.F150, Port #1



PCD7.F150:
RS-485 electrically isolated, with line termination resistors capable of activation, for Slot A



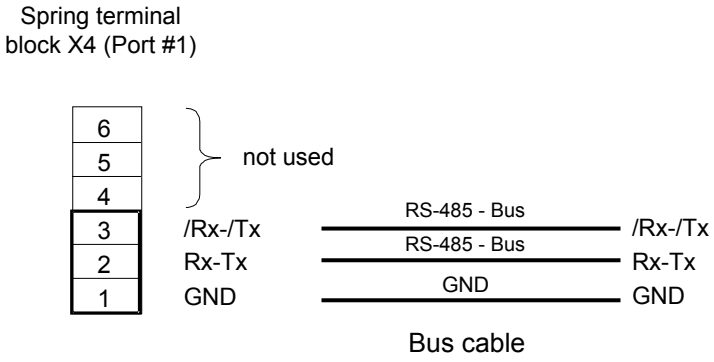
Block diagram:

Spring terminal block X4 (Port #1)

6	-	GND
5	GND	Earth connection, MST programming unit
4	‚IN'	MST programming unit detection (input 10 kΩ, Z5V1)
3	‚MST'	MST programming unit (MP-Bus internal)
2	A COM	MP-Bus signal line (18 V in/out)
1	-	GND (Branch A–)

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

Connection for RS-485

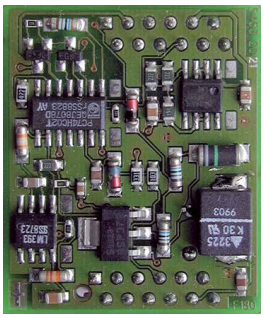


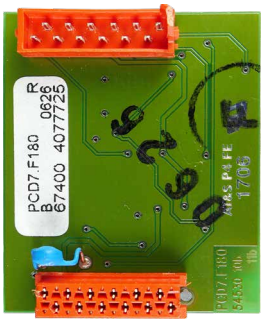
Not all manufacturers use the same connection configuration, so the data lines may need to be crossed

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

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

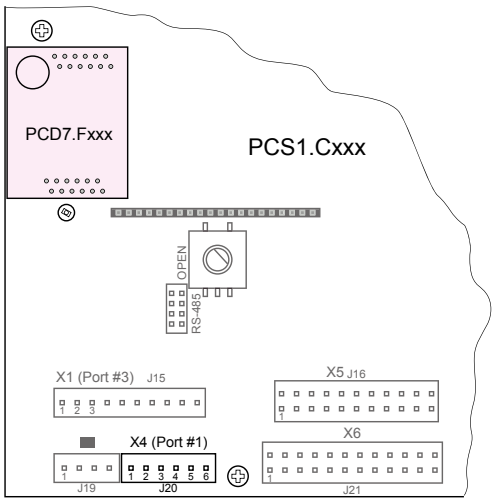
4.6.4 MP-Bus with PCD7.F180





PCD7.F180:
Connecting module for MP-Bus, for Slot A

The user can connect an MP-Bus line with 8 drives and sensors.



MP-Bus connections

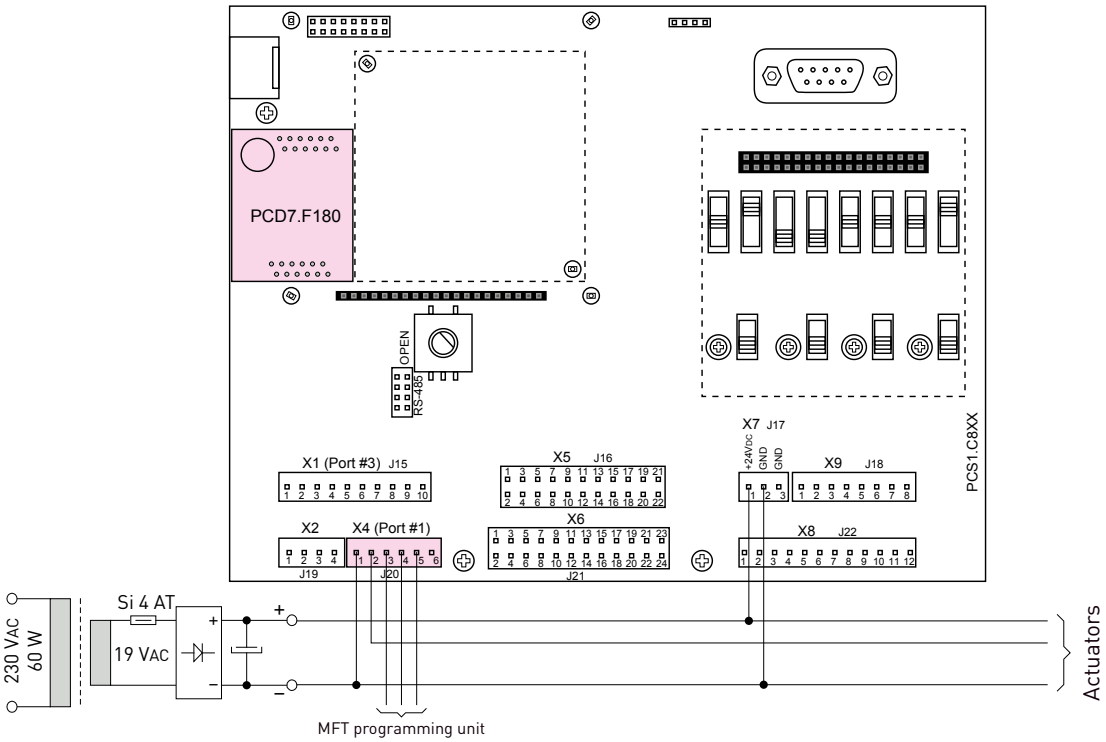
Spring terminal block X4 (Port #1)

6	-	GND
5	GND	Earth connection, MFT programming unit
4	‚IN'	MFT programming unit detection (input 10 kΩ, Z5V1)
3	‚MFT'	MFT programming unit (MP-Bus internal)
2	A COM	MP-Bus signal line (18 V in/out)
1	-	GND (Branch A–)

4

Supply option

Common supply for control and drive

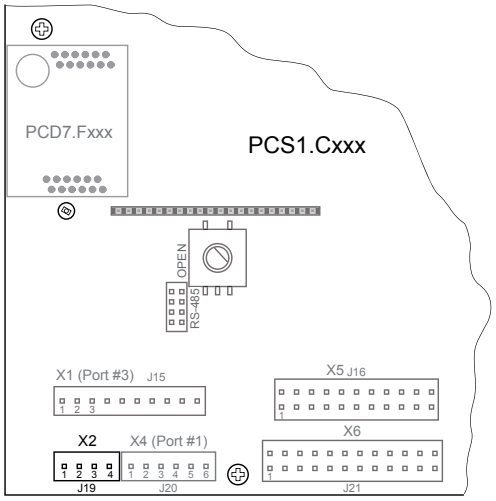


When using the PCD7.F180 connection module, the supply voltage to the PC control unit must be at least 24 VDC, **±5 %** (not the default tolerance of ±20 %).

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

For details see Technical Information sheet P+P26/342
"MP-Bus interface for BELIMO drives"

4.7 LonWorks on PCS1.C88x

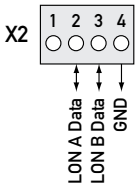


The option with a LonWorks connection is installed as standard.

The service pin is located on the left-hand side of the casing next to the RJ45 connector, and can be operated through an aperture in the casing.

4

Connection for LonWorks

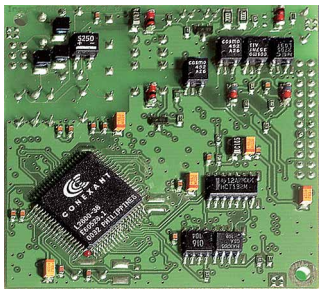


4.8 Plug-in interface modules on Slot for modem module

Every PCS1 can be ordered with an option of an analogue, ISDN or GSM modem. Only the telephone cable or GSM aerial is plugged into the controller. This provides all the major telecommunications services such as remote maintenance and diagnostics, transmission of error messages via SMS and remote programming. With state-of-the-art telecommunications combined with the DDC.Plus systems, customers can not only save costs in commissioning and maintenance, but also increase the security, availability and profitability of a system.

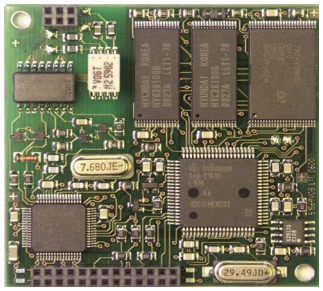
- Event or time-driven information and requests to operations and support staff
- Fault clearance with remote diagnostics
- Process optimisation with software updates and/or updates to process parameters
- Efficient preventive maintenance by qualified specialists, giving lower repair costs
- Transmission of alarm messages via SMS or pager

4.8.1 Analogue modem type PCS1.814 (successor to PCS1.T813)



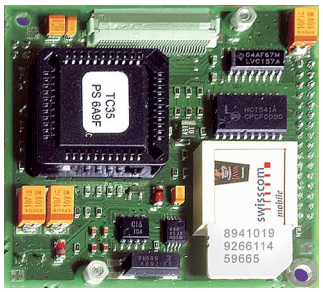
■ Data transfer	V.34+, V.34, V.32bis, V.32, V.22, V.21, V.23, BELL norm 102, 212
■ Data compression	MNP 2-4, V.42, LAPM, MNP 10, MNP 10 EC
■ Functions	Extended AT instruction set, automatic call pick-up, watchdog and reset

4.8.2 ISDN modem type PCS1.T851 (successor to PCS1.T850)



- Data transfer
- Channel B — V.110, V.120, x.75, PPP, X.25/X.31, ML-PPP, HDLC (transparent)
- Channel D — 1TR6, DSS1, National 1.5ESS, JATE (INS64), VN4, TPH1962, X.31
- ISDN interface — S0/I.430
- Functions — Extended AT instruction set

4.8.3 GSM modem type PCS1.T830



- GSM dual-band 900/1800 MHz
- FME antenna connector

4.8.4 General details of modems

- Power supply — 5 VDC internal (max. 350 mA)
- Connection modem/telephone network — Standard RJ45 telephone plug
- Approvals — In the whole of Europe according to CTR21; complies with current CE guidelines
- Ambient temperature — operation: 0…+55 °C

The later modem types PCS1.T814 and PCS1.T851 only work with PCS1 from modification > 4. Older PCS1s have to be retrofitted at the factory.

The S-Bus serial PGU port must be assigned to a different port (e.g. Port #1 RS-232), or the FBox **Modem xx** will report "NO Modem" and it will not be possible to send SMS messages etc.

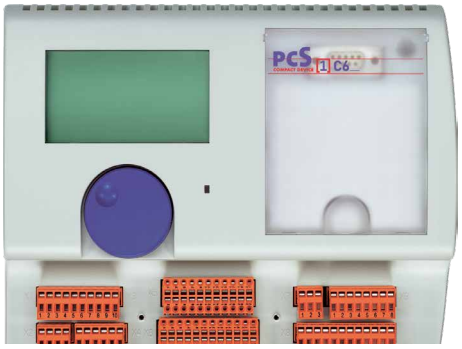
To send SMS messages, the country prefix must be entered with the number:

e.g. for Switzerland, not		079 4999 000
but	+41	079 4999 000

4.8.5 Hardware reset of modems

Output **O 99** on the PCS1.T813, PCS1.T814, PCS1.T850 and PCS1.T851 modems can be used to trigger a hardware reset.

The hardware reset can also be triggered via the **Modem 18** FBox (successor to **Modem 14** and **Modem 15**):



By sending a digital signal to the input **HwR**, the modem can be reset.

4.8.6 Modem accessories

GSM antenna

The internal GSM Modem and the external GSM modem Q.G736-AS2 also need an antenna. This is not supplied as standard, as a different type of antenna is needed for different applications.

We recommend sizing the antenna together with an antenna specialist.
(For Switzerland, we recommend: www.celphone.ch)

For test and pilot systems, we recommend the PCD7.K830 antenna from our own product range. This has a metal foot and has the following technical data:

Frequency range	824…960 MHz, 1.8 GHz/1.9 GHz
Gain	5 dB
Cable type	RG 58
Cable length	3.5 m
Connector type	FME-f
Impedance	50 Ohms
Dimensions Diameter of foot Height (total)	 Ø 7.7 cm 36 cm
Weight	350 g

5 Inputs and outputs (I/Os)

The following summary shows the available digital and analogue inputs and outputs for the PCS1.C4xx, PCS1.C6xx and PCS1.C8xx:

Qty	Designation	Description	Input/ output signal range	Equivalent PCD1|PCD2 I/O type	Terminal block
PCS1.C4xx digital inputs/outputs					
2	I 48…I 49	Inputs, 8 ms or analogue inputs, selected via FBox	24 VDC	PCD2.E110	X5
4	I 0…I 3	Inputs 8 ms	24 VDC	PCD2.E110	X6
2	I/O12…I/O13	Inputs or outputs, dependent on wiring	24 VDC	PCD2.B100	X6
4	O16…O19	Relay outputs, make contacts	250 VAC	PCD2.A200	X9
PCS1.C4xx analogue inputs/outputs					
2	I 48…I 49	Analogue inputs 10 bit or digital inputs, selected via FBox	0…10 VDC	PCD2.W200	X5
4	I 64…I 67	Analogue inputs 12 bit	Pt/Ni 1000	PCD2.W340	X5
3	O80…O82	Analogue outputs 10 bit	0…10 VDC	PCD2.W400	X6
PCS1.C6xx digital inputs/outputs					
2	I 48…I 49	Inputs, 8 ms or analogue inputs, selected via FBox	24 VDC	PCD2.E110	X5
4	I 0…I 3	Inputs 8 ms	24 VDC	PCD2.E110	X6
2	I 4…I 5	Inputs 0.2 ms	24 VDC	PCD2.E111	X6
4	I/O12…I/O15	Inputs or outputs, dependent on wiring	24 VDC	PCD2.B100	X6
4	O20…O23	Relay outputs, change-over switches	250 VAC	PCD2.A251	X8
4	O16…O19	Relay outputs, make contacts	250 VAC	PCD2.A200	X9
PCS1.C6xx analogue inputs/outputs					
2	I 48…I 49	Analogue inputs 10 bit or digital inputs, selected via FBox	0…10 VDC	PCD2.W200	X5
6	I 64…I 69	Analogue inputs 12 bit	Pt/Ni 1000	PCD2.W340	X5
4	O80…O83	Analogue outputs 10 bit	0…10 VDC	PCD2.W400	X6

Qty	Designation	Description	Input/ output signal range	Equivalent PCD1|PCD2 I/O type	Terminal block
PCS1.C8xx digital inputs/outputs					
4	I 48…I 51	Inputs, 8 ms or analogue inputs, selected via FBox	24 VDC	PCD2.E110	X5
9	I 0…I 8	Inputs 8 ms	24 VDC	PCD2.E110	X6
3	I 9…I 11	Inputs 0.2 ms	24 VDC	PCD2.E111	X6
4	I/O12…I/O15	Inputs or outputs, dependent on wiring	24 VDC	PCD2.B100	X6
4	O20…O23	Relay outputs, change-over switches	250 VAC	PCD2.A251	X8
4	O16…O19	Relay outputs, make contacts	250 VAC	PCD2.A200	X9
PCS1.C8xx analogue inputs/outputs					
4	I 48…I 51	Analogue inputs 10 bit or digital inputs, selected via FBox	0…10 VDC	PCD2.W220	X5
4	I 52…I 55	Analogue inputs 10 bit	Pt/Ni 1000	PCD2.W210	X5
8	I 64…I 71	Analogue inputs 12 bit	Pt/Ni 1000	PCD2.W340	X5
4	O80…O83	Analogue outputs 10 bit	0…10 VDC	PCD2.W400	X6

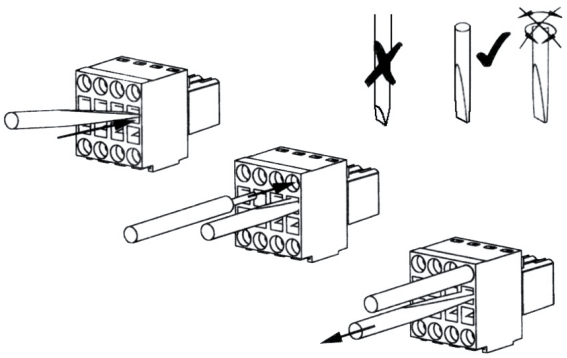
5

5.1 General details

5.1.1 Connector types

Type	Quantity	Description	Connector type
4 405 4931 0	1	Plug-in I/O cage clamp terminal block, ?-pole. to connector X7	
4 405 4932 0	1	Plug-in I/O cage clamp terminal block, 4-pole. to connector X2	
4 405 4933 0	1	Plug-in I/O cage clamp terminal block, 6-pole up to 2.5 mm², labelled 1 to 6, for Web Panel with embedded micro-browser or for PCS1 (connector X4)	
4 405 4934 0	1	Plug-in I/O cage clamp terminal block, 8-pole up to 1.5 mm², labelled 1 to 8, for PCD3.W800 manual control modules, connector or for PCS1 (connector X9)	J
4 405 4935 0	1	Plug-in I/O cage clamp terminal block, 10-pole, to connectors X1 & X3	
4 405 4936 0	1	Plug-in I/O cage clamp terminal block, 12-pole up to 1.5 mm², labelled 1 to 12, for PCD3.A810 manual control modules, connector type "F" or for PCS1 (connector X8)	
4 405 4937 0	1	Plug-in I/O cage clamp terminal block, 22-pole, to connector X5	
4 405 4938 0	1	Plug-in I/O cage clamp terminal block, 24-pole, to connector X6	
4 405 4941 0	1	Plug-in I/O cage clamp terminal block, Complete 8-part set	

Plug-in cage clamp terminals



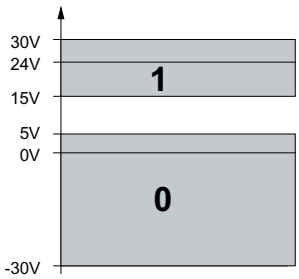
The plug-in cage clamp terminals simplify the installation significantly. The cage clamp terminals support cable diameters from 1.0 mm² through 1.5 mm² up to 2.5 mm².

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

5.2 Digital inputs

Definition of input signals

(PCD2.E110/E111)



The I/O terminal blocks may only be plugged in and removed when the PCS1 is disconnected from the power supply.

5.2.1 Digital inputs, 24 VDC, terminal block X6

Application

Suitable for most electronic and electromechanical switching elements at 24 VDC.
Electrically connected

Technical data (inputs as for PCD2.E110)

Characteristic	Source operation, electrically connected
Inputs on PCS1.C4xx	4 (I 0, I 1, I 2, I 3)
Inputs on PCS1.C6xx	4 (I 0, I 1, I 2, I 3)
Inputs on PCS1.C8xx	9 (I 0, I 1, I 2, I 3, I 4, I 5, I 6, I 7, I 8)
Input voltage: Voltage range "low": Voltage range "high":	24 VDC smoothed or pulsed -30 … +5 VDC 15 … 30 VDC
Input current:	6 mA at 24 VDC
Input delay:	typically 8 ms
External current consumption:	6 mA per input at 24 VDC

Technical data (inputs as for PCD2.E111)

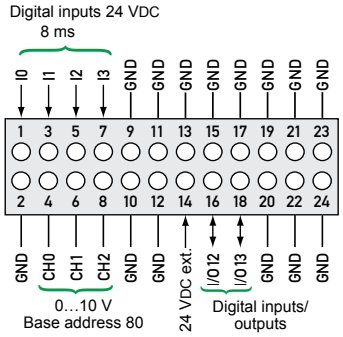
Characteristic	Source operation, electrically connected
Inputs on PCS1.C4xx	-
Inputs on PCS1.C6xx	2 (I 4, I 5)
Inputs on PCS1.C8xx	3 (I 9, I 10, I 11)
Input voltage:	24 VDC smoothed, max. 10% ripple
Input current:	6 mA at 24 VDC
Input delay:	typically 0.2 ms
External current consumption:	6 mA per input at 24 VDC

General technical data on inputs and outputs

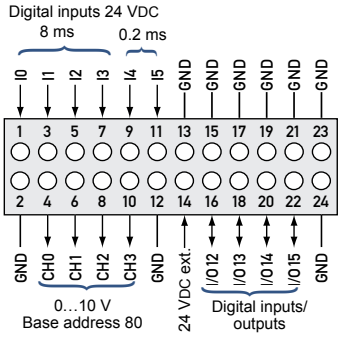
Resistance to interference: acc. to IEC 801-4	2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…24 mA typically 12 mA
Internal current consumption: (from V+ bus)	0 mA
External current consumption:	max. 48 mA (all inputs=1) at 24 VDC
Terminals:	Plug-in I/O cage clamp terminal block 4 405 4938 0 2×12-pole for Ø up to 1.5 mm²

Pin allocation on terminal block X6

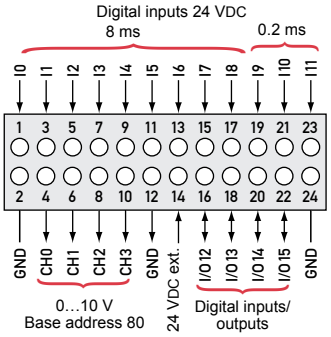
PCS1.C4xx



PCS1.C6xx



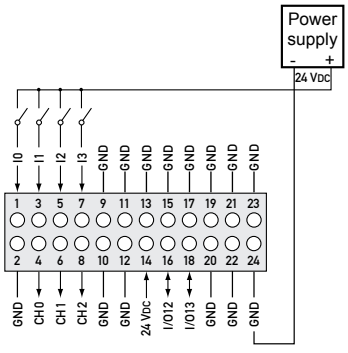
PCS1.C8xx



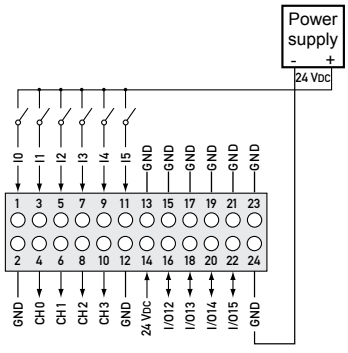
Wiring details

Source operation:

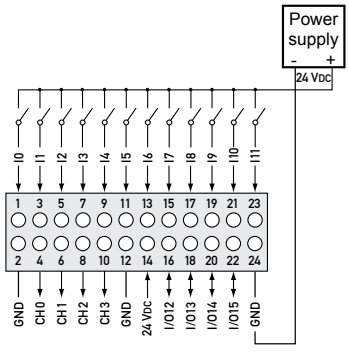
PCS1.C4xx



PCS1.C6xx



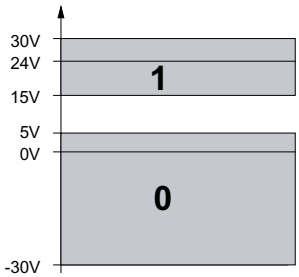
PCS1.C8xx



5.3 Digital combined inputs/outputs

Definition of input signals

(PCD2.B100)



The I/O terminal blocks may only be plugged in and removed when the PCS1 is disconnected from the power supply.

5.3.1 Digital combined inputs/outputs, 24 VDC, terminal block X6

Application

Suitable for most electronic and electromechanical switching elements at 24 VDC. The outputs are electrically connected. Depending on the wiring, the I/Os work as inputs or outputs.

Technical data (inputs as for PCD2.B100)

Characteristic	Source operation, electrically connected
Inputs on PCS1.C4xx	2 (I/O12, I/O13)
Inputs on PCS1.C6xx	4 (I/O12, I/O13, I/O14, I/O15)
Inputs on PCS1.C8xx	4 (I/O12, I/O13, I/O14, I/O15)
Input voltage:	24 VDC smoothed or pulsed
low range: high range: Switching threshold 0-1: Switching threshold 1-0: Hysteresis: Input current (at 24 VDC): Switching delay 0-1 (at 24 VDC): Switching delay 1-0 (at 24 VDC):	-0.5…+5 V *) +15…+32 V typically 6 V typically 7 V typically 7 mA typically 8 ms typically 8 ms
*) Negative voltage is restricted by the protective diode (I_{max} = 0.5 A)	

Technical data (outputs as for PCD2.B100)

Characteristic	Source operation, not short circuit protected, electrically connected
Outputs on PCS1.C4xx	2 (I/O12, I/O13)
Outputs on PCS1.C6xx	4 (I/O12, I/O13, I/O14, I/O15)
Outputs on PCS1.C8xx	4 (I/O12, I/O13, I/O14, I/O15)
Current:	5…500 mA steady load
Voltage range:	5…32 VDC *)
Voltage drop:	< 0.7 V at 500 mA
Total current for all X6 outputs:	3 A steady load
Switch-on delay:	typically 10 µs
Switch-off delay:	typically 50 µs (100 µs max.), (ohmic load 5…500 mA), longer under inductive load

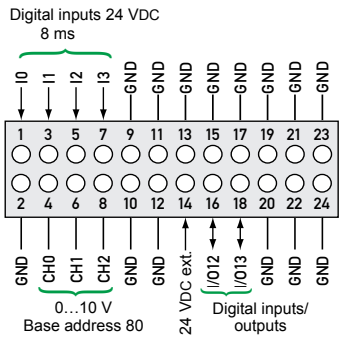
5

General technical data on inputs and outputs

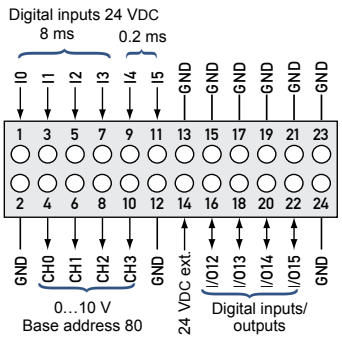
Insulation voltage	1000 VAC, 1 min.
Resistance to interference: acc. to IEC 801-4	4 kV under direct coupling 2 kV under capacitive coupling (whole trunk group)
Internal current consumption: (from +5 V bus)	1…25 mA typically 15 mA
Internal current consumption: (from V+ Bus)	0 mA
External current consumption:	Load current
Terminals:	Plug-in I/O cage clamp terminal block 4 405 4938 0 2×12-pole for Ø up to 1.5 mm²

Pin allocation on terminal block X6

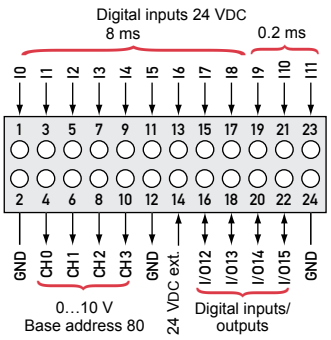
PCS1.C4xx



PCS1.C6xx



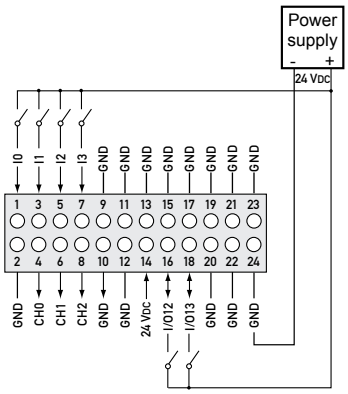
PCS1.C8xx



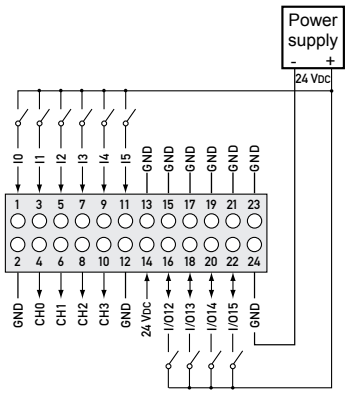
Wiring details

Source operation:

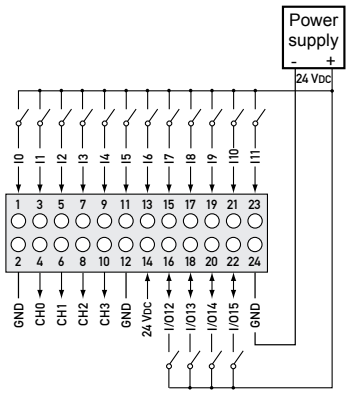
PCS1.C4xx



PCS1.C6xx

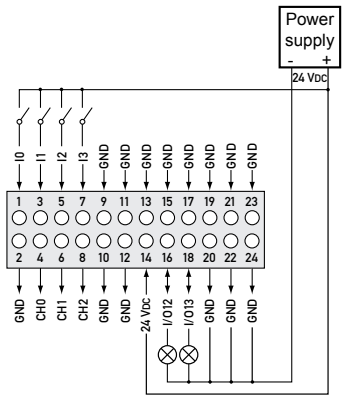


PCS1.C8xx

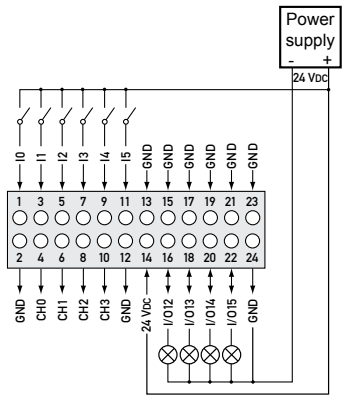


Outputs only:

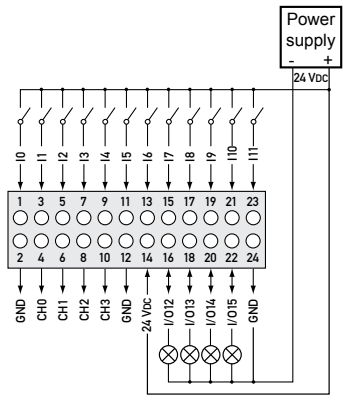
PCS1.C4xx



PCS1.C6xx

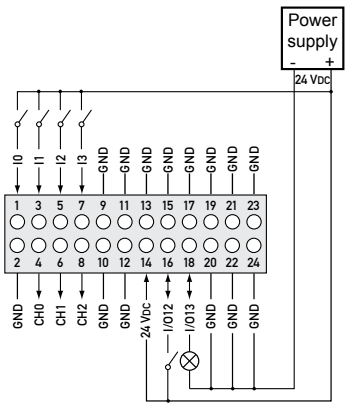


PCS1.C8xx

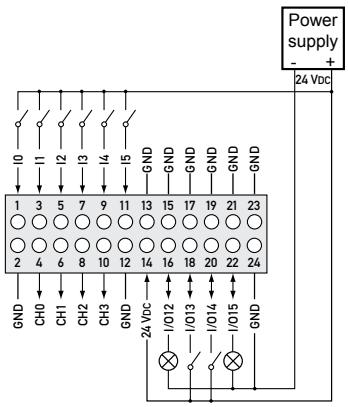


Mixed operation (inputs/outputs)
(Digital inputs always in source operation)

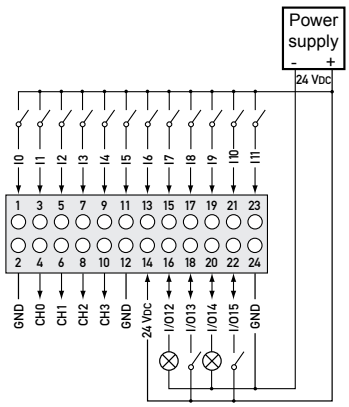
PCS1.C4xx

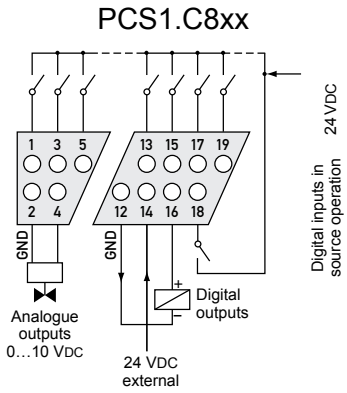


PCS1.C6xx



PCS1.C8xx





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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 "0" status of an open input can be overwritten as "1" 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.

5.4 Digital outputs

Installation instructions

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

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

Using low voltage (50...250 V), all connections to the relay contacts must be connected on the same circuit, i.e. only one phase per module is permitted across one common fuse. Each load circuit may also be fused individually.

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

The Appendix, Section A.4 "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.

5.4.1 Digital relay outputs with make contacts, terminal block X9

Application

4 relays with make contacts for direct and alternating current up to 2 A, 250 VAC. These outputs are especially suited wherever perfectly isolated AC switching circuits with infrequent switching have to be controlled.

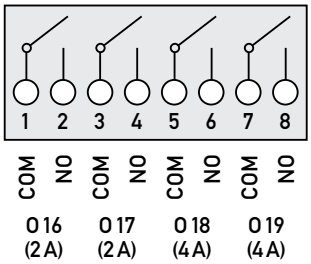
Technical data (as for PCD2.A200)

Number of outputs:	4, electrically isolated make contacts
Outputs on PCS1.C4xx	4 (A16, A17, A18, A19)
Outputs on PCS1.C6xx	4 (A16, A17, A18, A19)
Outputs on PCS1.C8xx	4 (A16, A17, A18, A19)
Type of relay (typical):	RE 030024, SCHRACK
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 $0{,}7 \times 10^6$ operations 1 A, 250 VAC AC11 $1{,}0 \times 10^6$ operations 2 A, 50 VDC DC1 $0{,}3 \times 10^6$ operations [3)] 1 A, 24 VDC DC11 $0{,}1 \times 10^6$ 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)

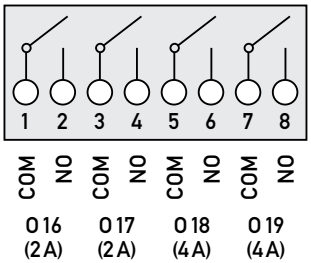
Terminals:	Plug-in I/O cage clamp terminal block 4 405 4934 0 1×8-pole for Ø up to 1.5 mm²
[1] With external protective diode [2] With reverse voltage protection [3] These ratings are not UL-listed	

Pin allocation on terminal block X9

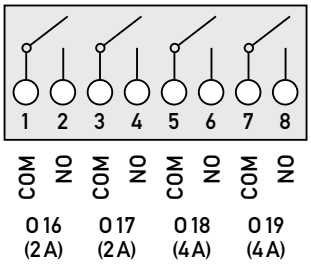
PCS1.C4xx



PCS1.C6xx



PCS1.C8xx



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5.4.2 Digital relay outputs with change-over contacts, terminal block X8

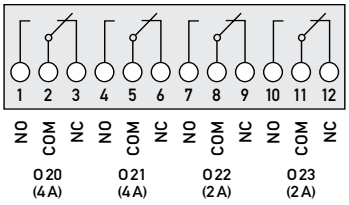
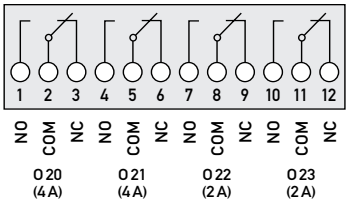
Application

Relays for direct and alternating current up to 2 A, 250 VAC. These outputs are especially suited wherever AC switching circuits with infrequent switching have to be controlled. For space reasons, there is no integrated contact protection.

Technical data (as for PCD3.A251, but designed for 250 VAC)

Number of outputs:	4 change-over contacts
Outputs on PCS1.C4xx	-
Outputs on PCS1.C6xx	4 (O20, O21, O22, O23)
Outputs on PCS1.C8xx	4 (O20, O21, O22, O23)
Relay type:	RE 014024, SCHRACK
Operating mode:	> 12 V, > 100 mA
Switching capacity: (contact lifetime)	2 A, 250 VAC AC1 $0{,}7 \times 10^6$ operations 1 A, 250 VAC AC11 $1{,}0 \times 10^6$ operations 2 A, 50 VDC DC1 $0{,}3 \times 10^6$ operations [3] 1 A, 24 VDC DC11 $0{,}1 \times 10^6$ 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)
Terminals:	Plug-in 12-pole spring terminal block (4 405 4936 0) for wires up to 1 mm²
[1] With external protective diode [2] With reverse voltage protection [3] These ratings are not UL-listed	

Output circuits and terminal designation

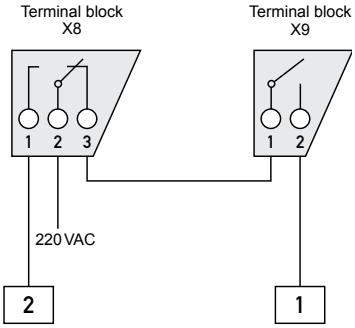
PCS1.C4xx	PCS1.C6xx	PCS1.C8xx
		

Example of a 2-stage fan control with interlocking

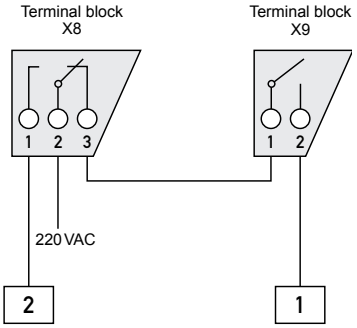
PCS1.C4xx

Not possible with PCS1.C4xx (the PCS1.C4xx controller has no change-over contacts)

PCS1.C6xx



PCS1.C8xx



5

5.5 Analogue inputs

5.5.1 Analogue inputs, 8 channels, 10 bit resolution, terminal block X5

Application

With their short conversion time of < 50 µs, these inputs are universally suitable for picking up analogue signals. The only limitations are with weak signals, as with Pt 100 resistive temperature sensors, or with thermocouples.

Technical data (inputs as for PCD2.W200) in operation as digital inputs

Inputs on PCS1.C4xx	2 (I 48, I 49)
Inputs on PCS1.C6xx	2 (I 48, I 49)
Inputs on PCS1.C8xx	4 (I 48, I 49, I 50, I 51)
Input voltage: Voltage range "low": Voltage range "high":	24 VDC smoothed or pulsed -30 … +5 VDC 15 … 30 VDC
Time constant of input filter:	typically 8 ms
External current consumption:	7 mA

Technical data (inputs as for PCD2.W200) in operation as analogue inputs

Inputs on PCS1.C4xx	2 (I 48, I 49)
Inputs on PCS1.C6xx	2 (I 48, I 49)
Inputs on PCS1.C8xx	4 (I 48, I 49, I 50, I 51)
Signal ranges:	0…10 V
Resolution (digital representation):	10 bit (0…1023)
Temperature error:	± 0,4 % (over a temperature range from 0°…+55 °C)
Input resistance:	200 kΩ / 0.15 % at 0…10 V
Time constant of input filter:	typically 5 ms
External current consumption:	0 mA

Technical data (inputs as for PCD2.W220)

Inputs on PCS1.C4xx	-
Inputs on PCS1.C6xx	-
Inputs on PCS1.C8xx	4 (I 52, I 53, I 54, I 55)
Signal ranges: Pt 1000 Ni 1000 NI 1000 L&S	Pt/Ni 1000 resistance thermometer -50…+400 °C -50…+200 °C -30…+120 °C
Resolution (digital representation):	10 bit (0…1023) or 0.6 °C
Temperature error:	± 0,4 % (over a temperature range from 0°…+55 °C)
Maximum measurement current for resistance measurement	1.5 mA
Time constant of input filter:	typically 10 ms

General technical details

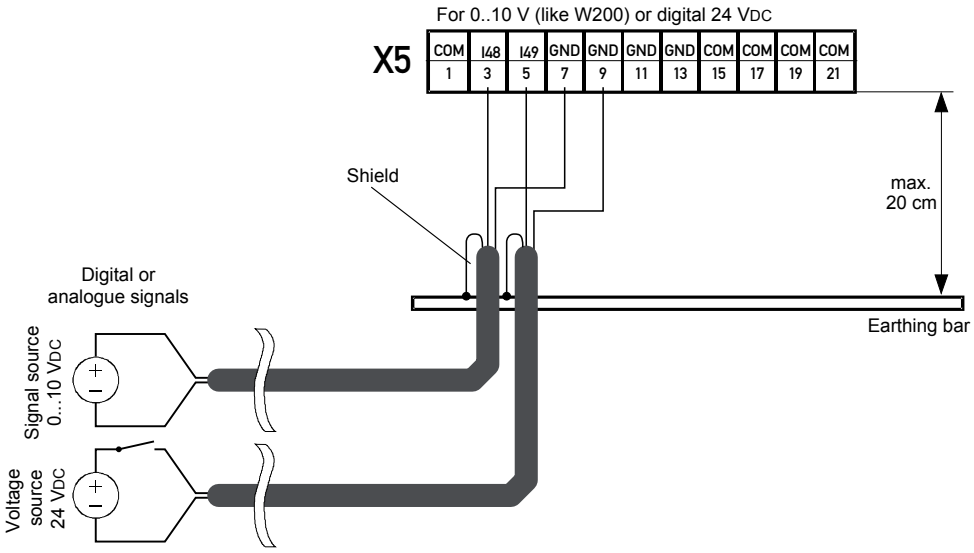
Galvanic separation:	no
Overvoltage protection:	± 50 VDC
Measuring principle:	non-differential, single-ended
Burst protection: acc. to IEC1000-4-4	± 1 kV, with unshielded cables ± 2 kV, with shielded cables
Terminals:	Plug-in 2×11-pole cage clamp terminal block 4 405 4937 0 for wires up to 1.5 mm²

If an input receives a signal with incorrect polarity, the measurement results for the other channels will be significantly distorted.

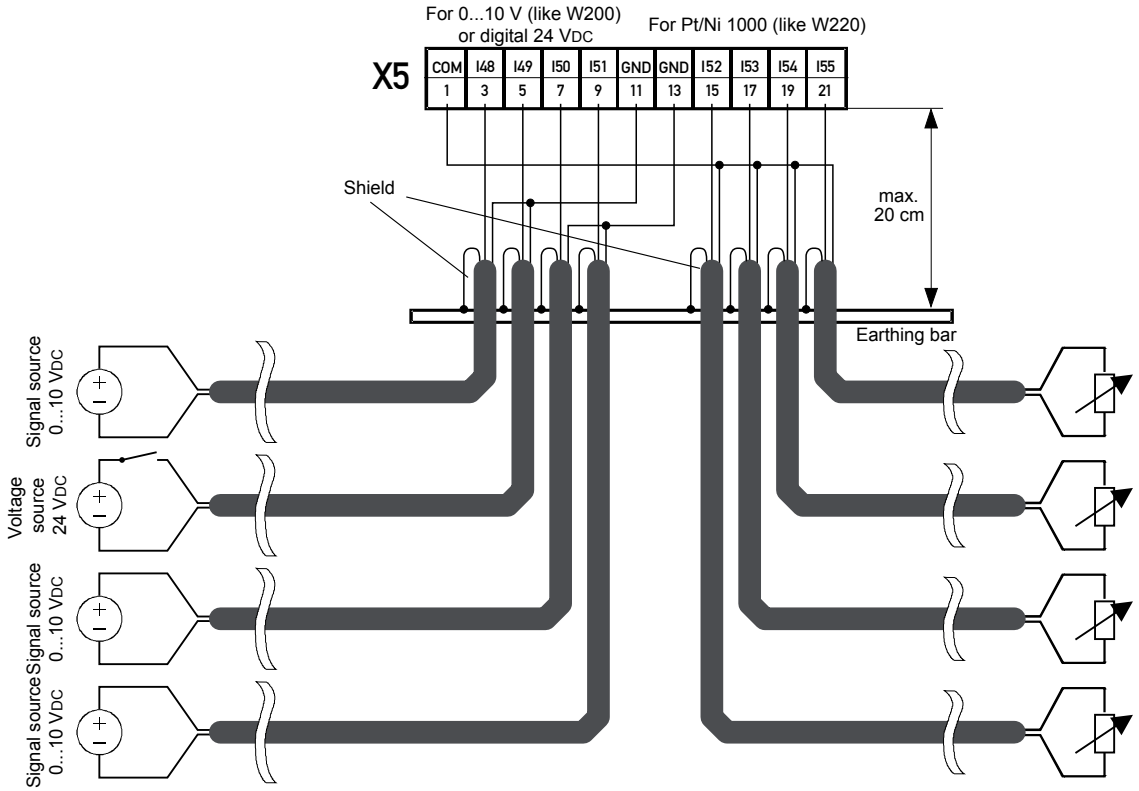
Digital/analogue values

Input signals and type		Digital values
PCD2.W200	**PCD2.W220**	**Binary [bit]**
+ 10.0 V	Calculate the appropriate values with the formulae at the end of this section	1023
+ 5.0 V		512
		205
0 V		0
– 10.0 V		0

Connection diagram for PCS1.C4xx and PCS1.C6xx



Connection diagram for PCS1.C8xx



- 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.

Temperature measurement with Pt 1000

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

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

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

Example 1: Digital value DV = 562
Temperature T in °C ?

$$T[^\circ C] = \frac{562}{2.08 - (0.509 \cdot 10^{-3} \cdot 562)} - 261.8 = \underline{51.5\,^\circ C}$$

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

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

Example 2: Temperature reading 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

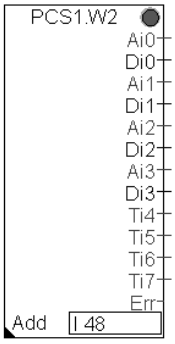
Special temperature sensors or any other resistances up to 2.5 kΩ can be connected to the PCD2.W220. The digital value can be calculated as follows:

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

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

Saia PG5® FBox PCS1.W2 for analogue inputs, 10 bit

(X5 terminal block, top row)



Ai0…Ai3	Analogue input signal 0…10 V on input channels 0 to 3
Di0…Di3	Digital input signal 24 VDC on input channels 0 to 3
Ti4…Ti7	Temperature input signal Pt/Ni 1000 on channels 4 to 7
Add	Base address of input channels 0 to 7 (on PCS1, always I48)
LED	Red when input value invalid

The FBox converts the signals into the input channels for the PCS1. The first 4 inputs can be used as analogue 0…10 VDC or digital 24 VDC inputs. The last 4 inputs are interpreted as Pt/Ni 1000 for temperature values. The sensor type is selected in the FBox. The error output displays which input is showing an error caused by invalid values (bit 0 for input 0, bit 1 for input 1 etc.). This allows e.g. a sensor fault to be detected. Resolution of analogue signals: 10 bit (0.6 °C).

The FBox must be used in a COB or a cyclically processed PB. One input is processed in each CPU cycle.

Settings window	
Error/Acknowledge	Switch to delete faults already resolved. The LED then switches from red to green
Output when in error	To define the output value when a sensor is defective
Ch 0…3/Mode	Selection of input signal (0…10 V or 24 VDC) for each input channel
Ch 4…7/Sensor type	Selection of sensor type for each input channel

Sensor types for Saia PG5 FBoxes	
1 : 1	No conversion of input signals, range of settings 0…1023 (10 bit resolution) [1])
Pt 1000	Pt 1000 temperature sensor, range of settings –500…4000 for –50.0 °C to 400.0 °C
Ni 1000	Ni 1000 temperature sensor, range of settings –500…2000 for –50.0 °C to 200.0 °C
Ni 1000 L&S	Landis & Staefa Ni 1000 temperature sensor, range of settings -300…1200 for -30.0 °C to 120.0 °C

[1]) The HeaVAC FBoxes always use the range 0…4095, i.e. the range 0…1023 undergoes linear conversion in the FBox to 0…4095; however, the resolution is not improved by this.

The effective Min and Max values and the range may differ slightly from the values given above.

The I/O terminal blocks may only be plugged in and removed when the PCS1 is disconnected from the power supply.

5.5.2 Analogue inputs, 8 channels, 12 bit resolution, terminal block X5

Application

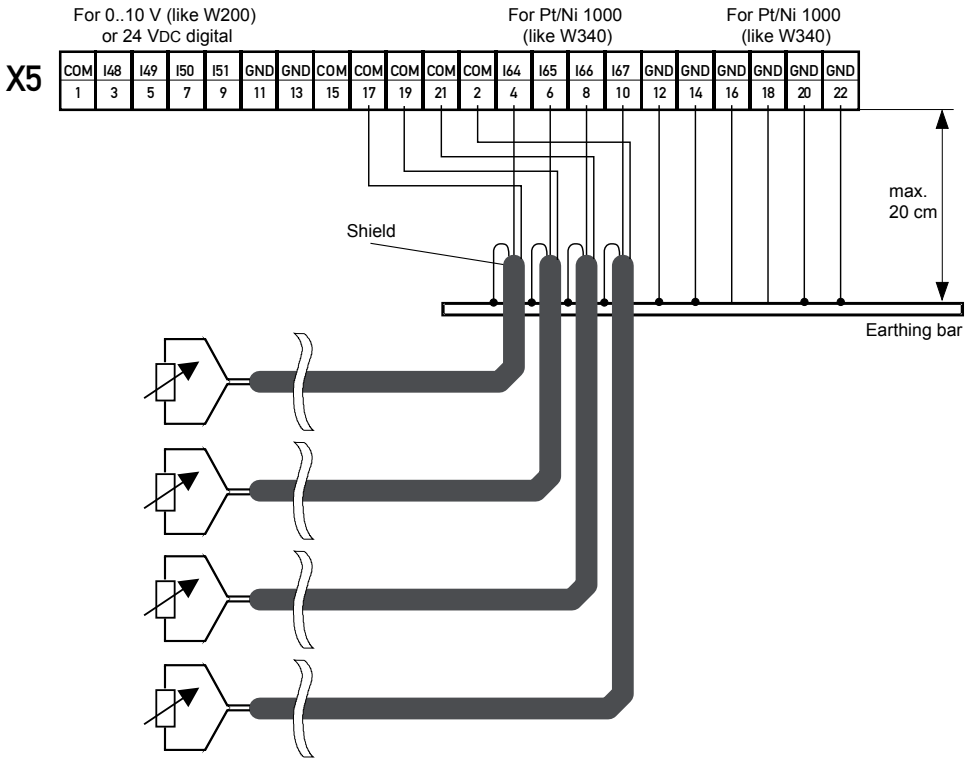
Rapid analogue inputs with 12 bit resolution. Various temperature probes can be connected.

Technical data (inputs as for PCD2.W340)

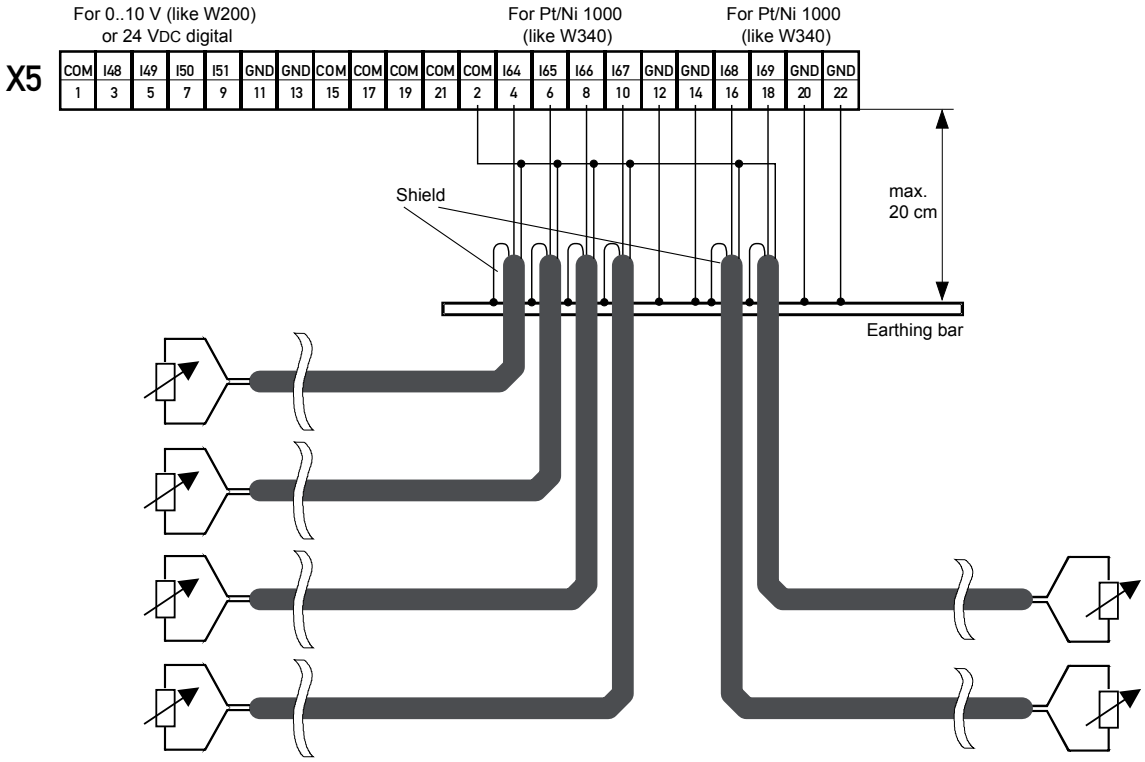
Inputs on PCS1.C4xx	4 (I 64, I 65, I 66, I 67)	
Inputs on PCS1.C6xx	6 (I 64, I 65, I 66, I 67, I 68, I 69)	
Inputs on PCS1.C8xx	8 (I 64, I 65, I 66, I 67, I 68, I 69, I 70, I 71)	
Inputs	**Measurement range**	**Resolution *)**
Pt 1000:	-50…+400 °C	0.14…0.24 °C
Ni 1000:	-50…+200 °C	0.09…0.12 °C
Measuring principle:	non-differential, single-ended	
Galvanic separation:	no	
Resolution (digital representation):	12 bit (0…4095)	
Accuracy at 25 °C	± 0.3 %	
Repeating accuracy:	± 0.05 %	
Temperature error (0…+55 °C):	± 0.2 %	
Conversion time A/D:	< 10 µs	
Maximum measurement current for temperature probes:	2.0 mA	
Input resistance:	U: 200 kΩ	
Overvoltage protection:	± 50 VDC (permanent)	
Overcurrent protection:	± 40 mA (permanent)	
EMC protection:	yes	
Time constant of input filter:	V: typically 7.8 ms	
External current consumption:	0 mA	
Terminals:	Plug-in 2 × 11-pole cage clamp terminal block 4 405 4937 0 for wires up to 1.5 mm²	

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

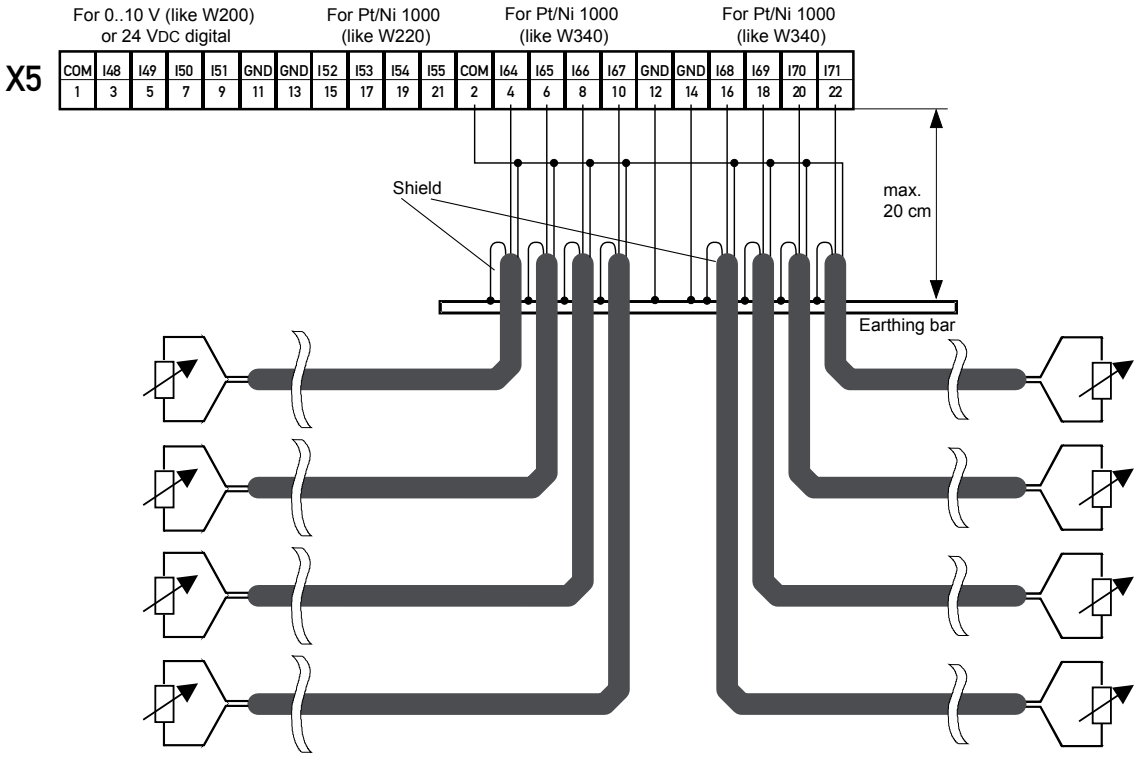
Connection diagram for PCS1.C4xx



Connection diagram for PCS1.C6xx



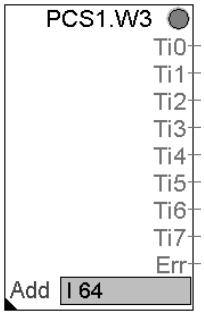
Connection diagram for PCS1.C8xx



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

Saia PG5® FBox PCS1.W3 for analogue inputs, 12 bit

X5 terminal block, bottom row 2-22, see page 11)



Ti0…Ti7	Temperature input signal Pt/Ni 1000 on channels 0 to 7
Add	Base address of input channels 0 to 7 (on PCS1, always I64)
LED	Red when input value invalid

The FBox converts the signals to the input channels on the PCS1 with a resolution of 12 bits (max. 0.15 °C for Pt 1000, max. 0.08 °C for Ni 1000). All inputs are interpreted as Pt/Ni 1000. The sensor type can be selected in the FBox. The error output displays which input is showing an error caused by invalid values (bit 0 for input 0, bit 1 for input 1 etc.). This allows e.g. a sensor fault to be detected.

The FBox must be used in a COB or a cyclically processed PB. One input is processed in each CPU cycle.

Settings window	
Error/Acknowledge	Switch to delete faults already resolved. The LED then switches from red to green
Output when in error	To define the output value when a sensor is defective
Ch 0…7/Sensor type	Selection of sensor type for each input channel

Sensor types for Saia PG5® FBoxes	
1 : 1	No conversion of input signals, Range of settings 0…1023 or 0…4095
Pt 1000	Pt 1000 temperature sensor, range of settings -500…4000 for -50.0 °C to 400.0 °C
Ni 1000	Ni 1000 temperature sensor, range of settings -500…2000 for -50.0 °C to 200.0 °C
Ni 1000 L&S	Landis & Staefa Ni 1000 temperature sensor, range of settings -300…1200 for -30.0 °C to 120.0 °C

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

Special temperature sensors or any other resistances up to 2.5 kΩ can be connected to the PCD2.W3xx. 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.

The effective Min and Max values and the range may differ slightly from the values given above.

The I/O terminal blocks may only be plugged in and removed when the PCS1 is disconnected from the power supply.

5.6 Analogue outputs

5.6.1 Analogue outputs, 4 channels, 10 bit resolution, terminal block X6

Application

Rapid outputs with a resolution of 10 bits. Suitable for processes in which actuators have to be controlled, such as in the chemical industry and building automation.

Technical data (outputs as for PCD2.W400)

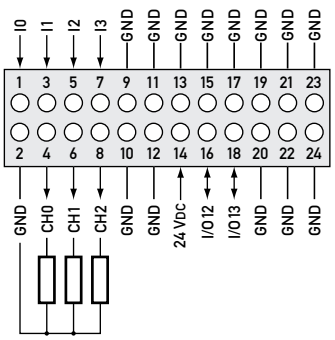
Outputs on PCS1.C4xx	3 (O80, O81, O82)
Outputs on PCS1.C6xx	4 (O80, O81, O82, O83)
Outputs on PCS1.C8xx	4 (O80, O81, O82, O83)
Short circuit protection:	yes
Signal ranges:	0…10 V
Resolution (digital representation):	8 bit (0…1023)
Conversion time D/A:	< 5 µs
Load impedance:	for 0…10 V: ≥ 3 kΩ
Accuracy (relative to output value):	for 0…10 V: 1 % ± 50 mV
Residual ripple:	for 0…10 V: < 15 mVpp
Temperature error:	typically 0.2 %, (over temperature range 0…+55 °C)
Burst protection: acc. to IEC 801-4	± 1 kV, with unshielded cables ± 2 kV, with shielded cables
External current consumption:	0 mA
Terminals:	Plug-in 2 × 12-pole cage clamp terminal block 4 405 4938 0 for wires up to 1.5 mm²

Analogue/digital values

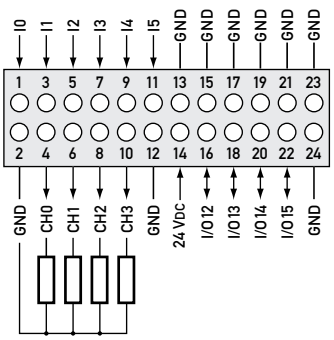
Digital value	Output voltage
1023	10.0 V
512	5.0 V
206	2.5 V
0	0 V

Connection concept

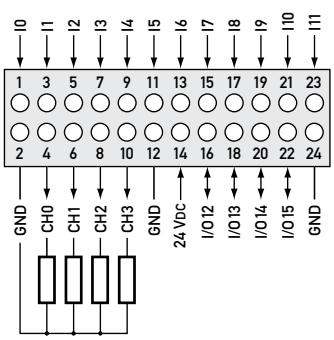
PCS1.C4xx



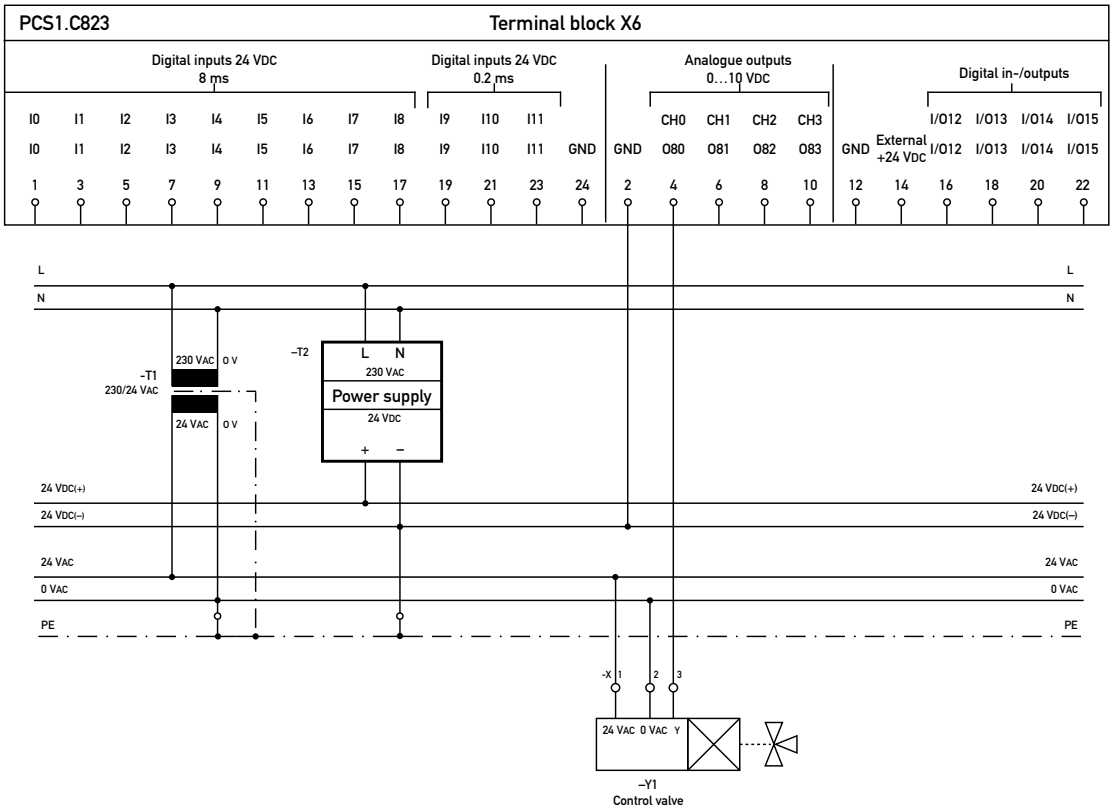
PCS1.C6xx



PCS1.C8xx

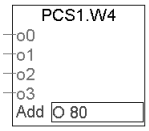


Connection example: fan drive with analogue output



Saia PG5® FBox PCS1.W4 for analogue outputs, 10 bit

(X6 terminal block, bottom row 2-10)



o0…o3	Digital value of analogue output channels 0 to 3
Add	Base address of of analogue output channels 0 to 3 (on PCS1, always O 80)

The FBox transfers the stored analogue signals to the output channels of the PCS1 with a resolution of 10 bits. The FBox must be used in a COB or a cyclically processed PB. One output is processed in each CPU cycle.

The output channels can be overridden via the manual/emergency control level. The override can be monitored via addresses I 32 to I 35.

The I/O terminal blocks may only be plugged in and removed when the PCS1 is disconnected from the power supply.

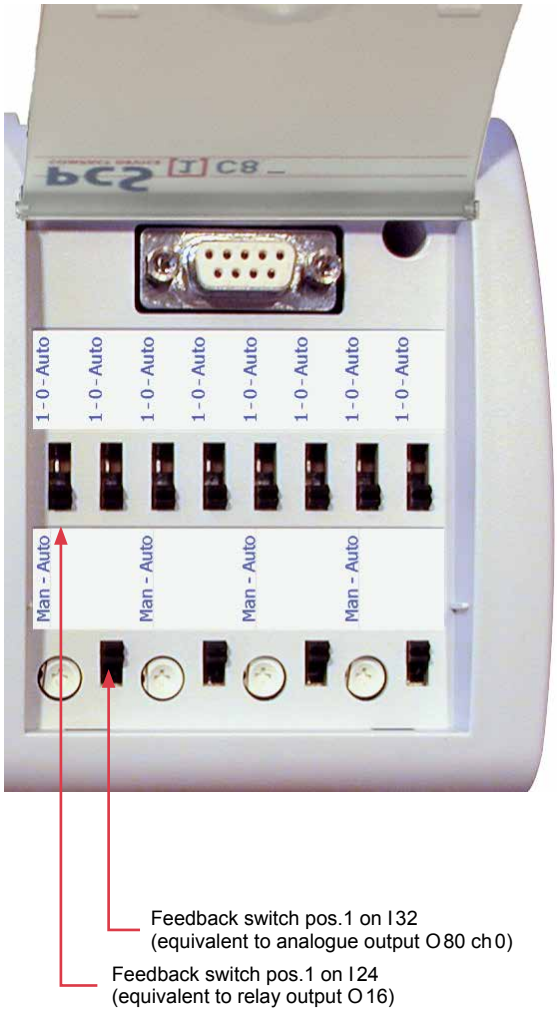
5.7 Manual operation

Manual/emergency operation of the PCS1.Cxx0 and PCS1.Cxx2 devices

The provision of a manual/emergency operation level allows the user to intervene in the process at any time in case of emergency or service.

The Compact Easy has an integrated connection level with a total of 8 relay outputs. Four of these are set up as make contacts and four as change-over switches, so the user can interlock the outputs in the case of a two-stage fan control (see connection diagram, page 9). The switches have auto/off/on functions.

Four more switches and potentiometers are used for manual/emergency operation of the analogue outputs. This allows e.g. fans or baffles to be overridden. The switches have auto/man functions, and the potentiometers can be set from 0 to 100%. The plates provided can be used to label system-specific manual/emergency settings.



Blank marking strips can be ordered with the number 4 310 8681 0

PCS1.C620/C622, PCS1,C820/C822 and PCS1.C880/C882

Block	Name	I/O address:	Remarks
Internal	A_M16	I 24	Switch pos.1 (see page 8)
Internal	A_M17	I 25	Feedback from
Internal	A_M18	I 26	manual/emergency operation
Internal	A_M19	I 27	(Auto/Man = 1/0) [1]
Internal	A_M20	I 28	
Internal	A_M21	I 29	
Internal	A_M22	I 30	
Internal	A_M23	I 31	
Internal	A_M80_0	I 32	Switch pos.1 (see page 8)
Internal	A_M80_1	I 33	
Internal	A_M80_2	I 34	
Internal	A_M80_3	I 35	

[1] Note: If the manual/emergency operation level has not been fitted, the state of inputs I24 to I35 is always logical "1"

PCS1.C420 and PCS1.C422

Block	Name	I/O address:	Remarks
Internal	A_M16	I 24	Switch pos.1 (see page 8)
Internal	A_M17	I 25	Feedback from
Internal	A_M18	I 26	manual/emergency operation
Internal	A_M19	I 27	(Auto/Man = 1/0) [1]
Internal	A_M80_0	I 32	Switch pos.1 (see page 8)
Internal	A_M80_1	I 33	
Internal	A_M80_2	I 34	

[1] Note: If the manual/emergency operation level has not been fitted, the state of inputs I24 to I35 is always logical "1"

5.8 Special inputs/outputs

5.8.1 Hardware reset for the integrated modem

Output O 99 on the PCS1.T813, PCS1.T814, PCS1.T850 and PCS1.T851 modems can be used to trigger a hardware reset.

The GSM modem PCS1.T830 has no hardware reset.

For details, see Section 4.8

6 Maintenance

SBC PCS1 components are maintenance-free.

6.1 Firmware updates

The firmware for the PCS1 is stored in an integrated (soldered-on) flash EPROM.

The firmware can be updated locally at any time using Saia PG5 via the PGU interface. This is done with the 'PCD FW Downloader' function on the 'Tools' menu in Saia PG5.

The procedure is as follows:

- Go to www.sbc-support.com and download the latest firmware version. The firmware file must have the extension 'blk' (e.g. PCS1Cxxx_0C0.blk)
- Establish a PGU connection between Saia PG5 and the CPU. Use the Saia PG5 cable connected to the COM 0 port to select "PGU" from "Online Settings" in Saia PG5
- From the Tools menu, select "Update Firmware", then use the Browse function to select a path to the file for the new firmware version. Ensure that only one file is selected for download
- Start the download. First, there will be a message that the flash will be erased. After erasing the flash, reprogramming starts. This is indicated by a red/green/off signal.
- When the Saia PG5 message "Download succeeded" appears, wait until the PCS1 has restarted. Programming is complete when the PCS1 has restarted. This will be the case when the LED is no longer flashing.
- If the process is cancelled before the flash is erased, the old firmware will still be present and fully usable. You can restart the download at any time. You can verifiy the version currently loaded with the Online Debugger or Online Configurator.
- If the process is interrupted during programming, the PCS1 will be restarted in the special 'Boot' mode. You can also repeat the download at any time in this mode, to ensure that the PCS1 works fully again.

  In older versions, the LED signals for the firmware download may differ slightly from those described here.

Older firmware versions:

You should generally use the latest firmware versions where possible.

Firmware version **< 0A1** was supplied without a working "Update Firmware" function.
Contact your Saia Burgess Controls agent for guidance on what to do next.

Firmware version **0B0** was supplied with a memory access error and should not be used.

In this version, when the unit is turned off and on, the register ranges > 3770 may be overwritten with random data. As FUPLA uses, or can use, this register range as dynamic storage, unforeseen effects may arise.

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 Definitions of serial interfaces

A.2.1 RS-232

Designation of signal lines:

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

Signals to RS-232

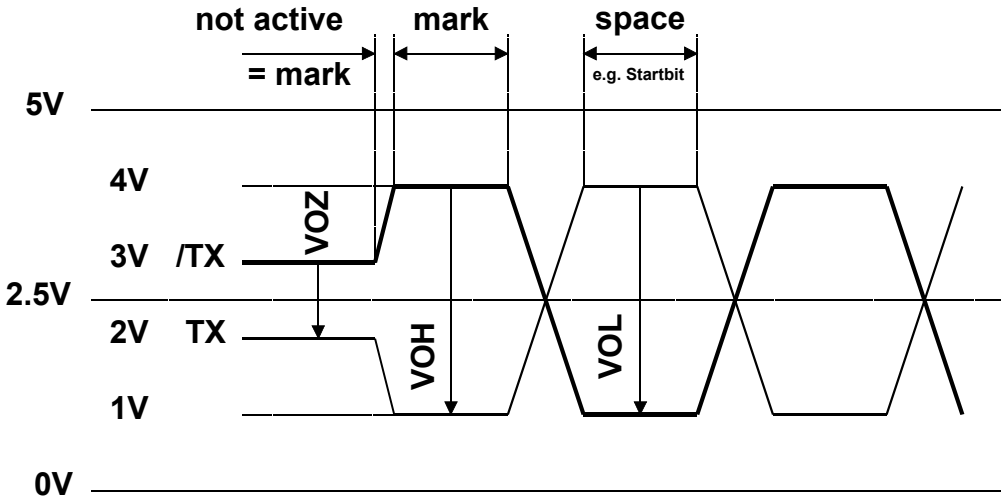
Signal type	Logical state	Set-point	Nominal value
Data signal	0 (space) 1(mark)	+3 V to +15 V -15 V to -3 V	+7 V -7 V
Control/ message signal	0 (off) 1 (on)	-15 V to -3 V +3 V to +15 V	-7 V +7 V

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

A

A.2.2 RS-485/422

Signals to RS-485 (RS-422)



VOZ = 0.9 V min … 1.7 V
VOH = 2 V min (with load) … 5 V max (no load)
VOL = -2 V … -5 V

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

RS-422:

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

RS-485:

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

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

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

A.2.3 TTY/current loop

Signals to TTY/current loop

Terminal 11	TS	Transmitter Source	Sender
Terminal 13	TA	Transmitter Anode	
Terminal 16	TC	Transmitter Cathode	
Terminal 18	TG	Transmitter Ground	
Terminal 12	RS	Receiver Source	Recipient
Terminal 14	RA	Receiver Anode	
Terminal 17	RC	Receiver Cathode	
Terminal 19	RG	Receiver Ground	

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

The idle state of the data signals = "mark"
By wiring to the cable connector, the user selects either an "active" or "passive" circuit.

A

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

A.3 Protocols on serial ports

A.3.1 Protocols supported by the firmware

Protocol	Purpose	PCS1.Cxxx
PGU with **pin 6** (DSR) of the PGU connector **set to logical "1"** (Parity mode, full protocol)	Programming, debugging	✓1)
S-Bus PGU on the PGU port, **with** pin 6 **(DSR) of the PGU connector** set to logical "0"	Programming, debugging, visualization. Also allows access via gateway to stations within a different S-Bus network	✓2)
Serial S-Bus on any serial port (Data, Parity or Break mode)	Exchange of data with other controllers or with RIOs; previously called just S-Bus	✓3)
Character mode (MC1 to MC5)	Transmission of characters or text over serial ports; basis for creating own protocols in the user program	✓4)

1) Requires the use of programming cable PCD8.K111

2) Requires a corresponding setting via SYSWR K9002 or via FBox (see Section 4.5)

3) Requires an assignment of the port in the user program (SASI). For new applications, Data mode should always be selected. Exceptions: on PCD7.D7xx terminals, Parity mode is used

4) MC5 mode (RS-485 with immediate release of data line after transmission of last character) requires minimum firmware versions: V090

A

A.3.2 Protocols implemented in the user program

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

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

Some protocols (e.g. MP-Bus) can conveniently be controlled using FBoxes.

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

A.4 Installation instructions and relay contacts

A.4.1 Installation instructions for switching extra-low voltage

For safety reasons, voltages up to max. 50 V can be connected to this module.

The safety standard covering the air and leakage current distances between neighbouring channels is not satisfied by this module for low voltages (50…250 V).

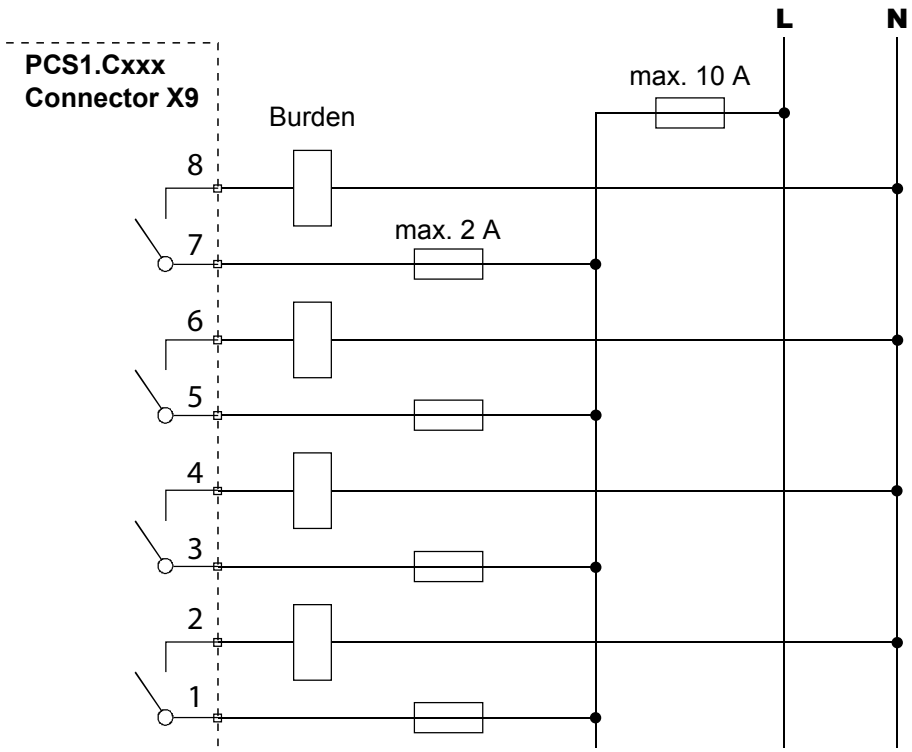
Note that all connections to the relay contacts on the module ..A250 must be connected to the same circuit, i.e. only one phase per module is permitted. Each load circuit may however be fused individually.

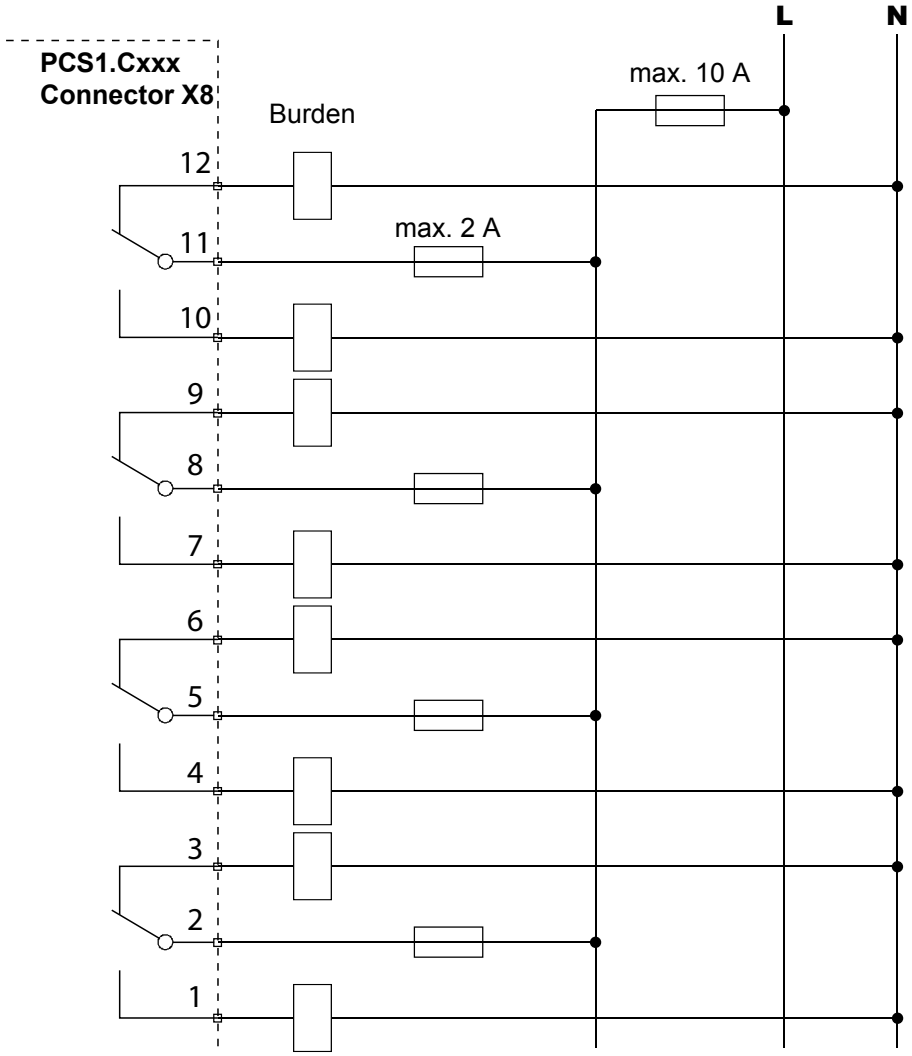
A.4.2 Installation instructions for switching low voltage

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

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

Using low voltage (50...250 V), all connections to the relay contacts on the ..A200 module must be connected in the same circuit, i.e. only one phase per module is permitted across one common fuse. Each load circuit may however be fused individually.





A.4.3 Carrying inductive loads

Because of the physical properties of inductance, it cannot be cut off without interference. This interference must be minimised as far as possible. Although the Saia PCD is immune to this interference, there are other devices that could be affected.

Please note that, as a result of harmonisation of norms within the EU, the EMC standards have been in effect since 1996 (EMC Directive 89/336/EC). Two principles can therefore be set out:

- INTERFERENCE SUPPRESSION IS ESSENTIAL FOR INDUCTIVE LOADS
- INTERFERENCE SHOULD BE ELIMINATED AT SOURCE WHERE POSSIBLE

The relay contacts on this module are switched. However, it is still recommended to connect a suppressor element to the load.

(Often obtainable as a standard component of certified gates and valves).

When carrying direct current, it is recommended to install a protective diode across the load, even where an ohmic load is theoretically present. In practice, there will

always be an inductive portion (connecting cable, resistor winding etc.). Note that the switch-off time will be extended.

(Tau approx. L/RL * √ (RL * IL/0.7).

For direct current, the transistor output modules are recommended.

A.4.4 Details of relay manufacturers for sizing of RC elements

Contact protection circuits:

The purpose of contact protection circuits is to suppress arcing and hence to increase the service life of the contact elements. Any protective circuit may have disadvantages as well as advantages. For how to suppress arcing with an RC element, see figure opposite.

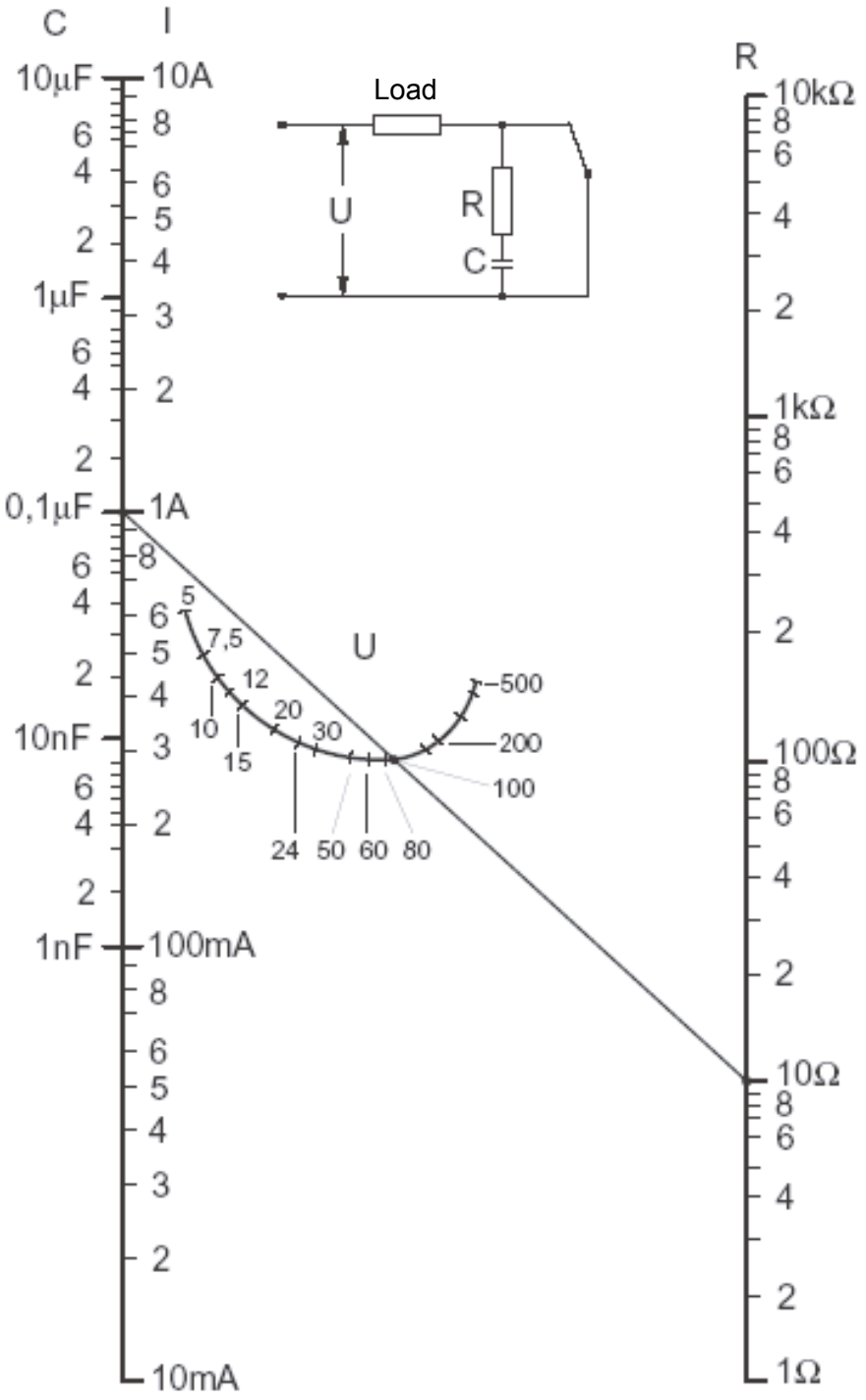
When switching off load circuits with inductive components (e.g. relay coils and magnet windings), the break in current to the contacts causes an overvoltage (self-inductance voltage), which may be many times the operating voltage and compromise the isolation of the load circuit. The resulting sparks will cause the relay contacts to wear out quickly. For this reason, the contact protection circuit is particularly important with inductive load circuits. The values for the RC combination can also be determined from the diagram, but for voltage U the overvoltage arising when the current is interrupted (measured e.g. with an oscillograph) should be used. The current can be calculated from this voltage and the known resistance against which it was measured.

In suppression elements, suppression condensers conforming to VDE 0565 T1 Class X2 must be used. These condensers are switch-tolerant and designed for particularly high overvoltages. Direct operation at mains voltage is still possible.

The resistors used must be able to withstand high voltages (impulse resistance). Particularly at low resistances, there may be flashovers in the coil caused by the production process. This is why fixed carbon resistors are most often used for suppression elements. However, vitreous enamelled wire-wound resistors and cement resistors with large pitch windings are also suitable.

Sizing aid:

The value C is derived directly from the current to be carried. The value of resistance R is found by drawing a straight line between the relevant points on the I and R curves and reading the resistance at the intersection with the R curve.



Example:
U = 100 V I = 1 A
C is calculated directly as 0.1 µF
R = 10 Ω (intersection with R scale)

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A.5 Order codes

Order details for programmable PCS1s

The devices are supplied ready-assembled under the following order codes:

Base unit	Data points	PCD7.F1xx	Modem	Software	Mechanical options
PCS1.C42x	19	0 = none	0 = none	0 = PG5	0 = no terminal cover
PCS1.C62x	30	A = ..F110	1 = analogue		1 = with terminal cover
PCS1.C8xx	44	B = ..F120	2 = ISDN		2 = no terminal cover, wall mounting
		D = ..F150	3 = GSM		3 = with terminal cover, wall mounting
		E = ..F180			

Example: PCS1.C820A200
Base unit with graphic display and manual/emergency operation, with RS-422/RS-485 interface, ISDN modem, programmable with Saia PG5, no terminal cover.

Orders must quote the full details

Type	Description	Weight
	Base units with 19 data points	
PCS1.C420	with graphic display and manual/emergency operation	1,210 g
PCS1.C421	with graphic display	1,115 g
PCS1.C422	with manual/emergency operation	1,135 g
PCS1.C423	no display, no manual/emergency operation	1,080 g
	Base units with 30 data points	
PCS1.C620	with graphic display and manual/emergency operation	1,210 g
PCS1.C621	with graphic display	1,115 g
PCS1.C622	with manual/emergency operation	1,135 g
PCS1.C623	no display, no manual/emergency operation	1,080 g
	Base units with 44 data points	
PCS1.C820	with graphic display and manual/emergency operation	1,210 g
PCS1.C821	with graphic display	1,115 g
PCS1.C822	with manual/emergency operation	1,135 g
PCS1.C823	no display, no manual/emergency operation	1,080 g
	LON base units with 44 data points	
PCS1.C880	with graphic display and manual/emergency operation	1,210 g
PCS1.C881	with graphic display	1,115 g
PCS1.C882	with manual/emergency operation	1,135 g
PCS1.C883	no display, no manual/emergency operation	1,080 g
	Accessories (spare parts)	
4'405'4941'0	Complete 8-part cage clamp terminal set	100 g
4'111'4927'0	Terminal cover with 2 screws	
4'109'4849'0	Set for wall mounting	
4'310'8681'0	Blank marking strips	
PCD7.D230	External graphic terminal	400 g
PCD7.K423	Shielded interface connection cable, length 2.5 m: Between terminal (D-Sub, 9-pole) and RS-232 interface with RTS/CTS on the PCS1 or Saia PCD (free wire ends)	150 g

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PCD8.K111	Connection cable for configuration/programming tool	200 g
PCD7.L400	Local extension module with 4 analogue outputs 0…10 VDC	95 g
	PCD7.F1x0 communication modules (for swap-out)	
PCD7.F110	RS-422/RS-485 interface, electrically connected	8 g
PCD7.F120	RS-232 interface (RTS/CTS only supported)	8 g
PCD7.F150	RS-485 interface, electrically isolated	8 g
PCD7.F180	MP-Bus switching module for BELIMO	8 g
	Modem modules (for swap-out)	
PCS1.T814	Analogue	
PCS1.T851	ISDN-TA	
PCS1.T830	GSM	

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A.6 Contact

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