Controls

saia-burgess

Smart solutions for comfort and safety

PCD4 PLC based controllers

The process control device for tasks with a broad requirement profile

Manual

Powerful functions – already integrated in base unit

- **Up to 510/2048 inputs/outputs:** Modular structure with up to 32 sockets for digital, analogue, counting, measuring and/or motion control modules
  - up to 510 central inputs/outputs
  - up to 2048 local inputs/outputs (e.g. PROFIBUS DP)
- **Up to 1 MByte user memory:** For programs, text and data blocks. 1 MByte flash memory as option for ease of down/uploading program modifications and backups.
- **Up to 6 serial data ports:** Can be fitted with a choice of RS232, RS422, RS485 or TTY/current loop 20 mA.
- **Field bus connections:** Can be fitted with a choice of PROFIBUS FMS, PROFIBUS DP as master or slave and Ethernet-TCP/IP.
- **Standard inputs:** Fast counters and interrupt inputs directly on CPU of controller (only PCD4.M170).

High performance operating system and efficient programming tools

- **Efficient programming with PG5** due to its many programming languages, such as IL, FUPLA, GRAFTEC etc. and its diagnostic and other add-on tools. An efficient instruction set, comprehensive FBox libraries and a structure that complies with IEC 1131-3 simplify the editing of transparent programs.
- **Portability of user programs** due to harmonized system resources and the integral SAIA®S-Bus, user programs are transferable across the entire PCD family (PCD1 up to PCD6) and capable of running.
- **Short reaction times** due to direct accessing of I/O signals, without the passing through a process map (image).
- **Flexible network integration** due to through communications and programming via Ethernet-TCP/IP to the connected field bus stations PROFIBUS DP or FMS.

Edition 26/734 E9, July 2003

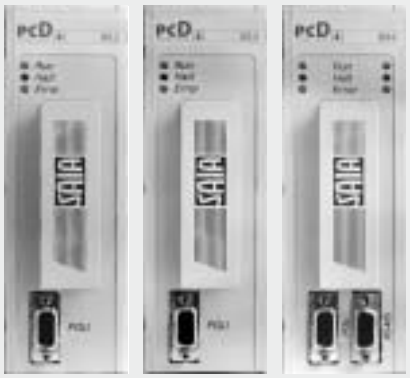
The adaptive controller platform

The PCD4 series is an extremely flexible system. From the minimum system with the simplest processor, one serial interface, a low-cost power supply module and 2 I/O modules, through to the fully equipped system with up to 32 I/O and function modules, processor module ..M170, up to 6 independent serial interfaces or SAIA®S-Bus, PROFIBUS FMS/DP or Ethernet-TCP/IP network connections. The system can be assembled in one go, or expanded in stages.

All modules are in the form of equal sized cassettes. Cassette modules are plugged into the appropriate bus modules. The bus modules are in turn snapped onto mounting rails and connected together to form the system bus. Connections to the external process are wired to the bus modules, which means that cassette modules can be inserted or removed without affecting the wiring.

Power supply modules Page 10

Processor and public memory modules Page 6



SAIA®S-Bus (RS 485)

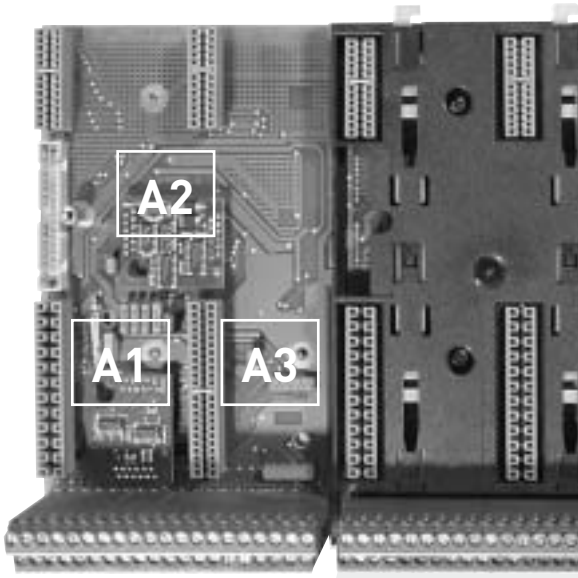
The efficient protocol for this master-slave network is supported by every PCD both as master and as slave. Economical design across a serial RS 485 data port.

Pages 8/9

Combined bus module PCD4.C340

with sockets for processor module, power supply module, 4 I/O modules and 3 sockets for serial data ports.

Page 7

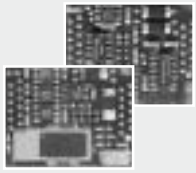


Serial data ports

sockets A1, A2, A3 on PCD4.C340

up to 3 serial data ports as RS 422/RS 485, RS 485 electrically isolated, RS 232 for modem or TTY/ current loop 20 mA.

Pages 8/9

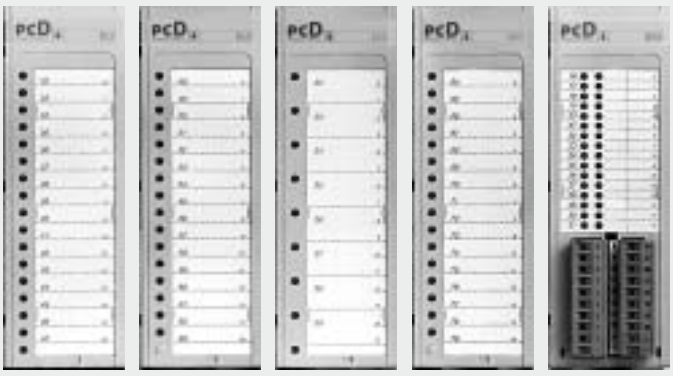


Flexible and modular I/O level using bus modules

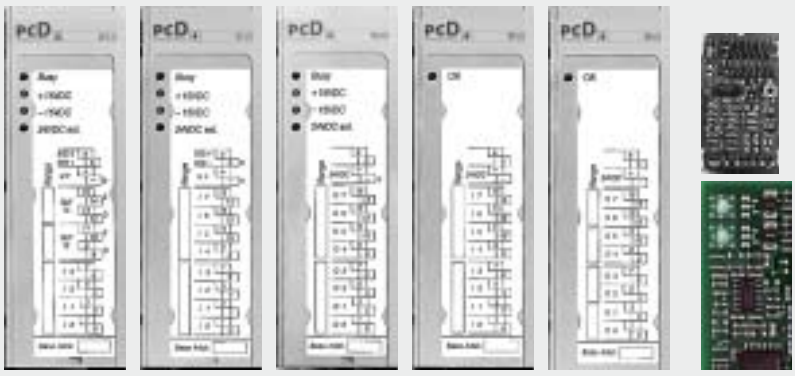
The I/O bus modules with 2 or 6 module sockets allow expansion up to 510 inputs/outputs or 32 I/O modules.

Page 7

Digital input/output modules Pages 11–13

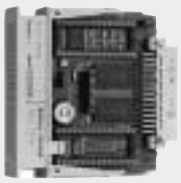


Analogue input/output modules Pages 14–16

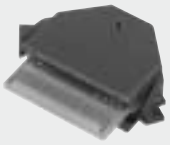


up to 428 KBytes user memory as RAM or EPROM

Page 5



Processor module PCD4.M170 Page 6



User memory

1 MByte RAM and plug-on flash card for saving user memory.

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Field bus connections

sockets B1 and/or B2

PROFIBUS FMS / DP: For both networks various modules are available as master or slave, also with additional RS485 serial data port.

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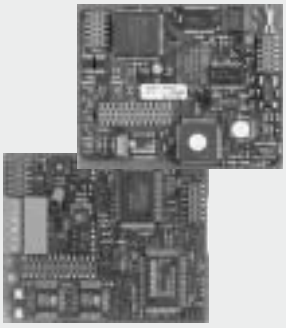

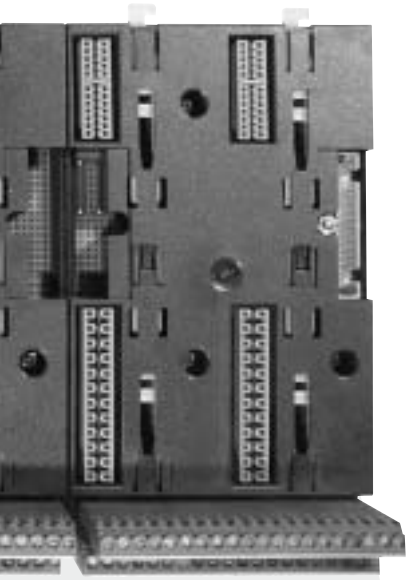

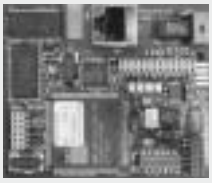

Ethernet-TCP/IP socket B2

Intelligent co-processor module with fast dual-port RAM interface to the CPU, Ethernet 10 Base-T/100 Base-TX. SAIA®S-Bus with UDP/IP for PG5⇔PCD communication and PCD⇔PCD multimaster communication. Transmission and receipt of TCP and UDP data packages for communication with any choice of system.

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Serial data ports

socket B2

2 × RS232 or RS232 for modem, RS232 and RS422/RS485

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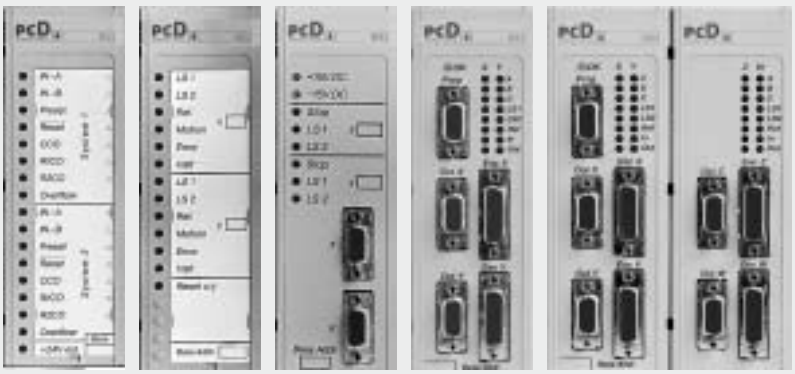
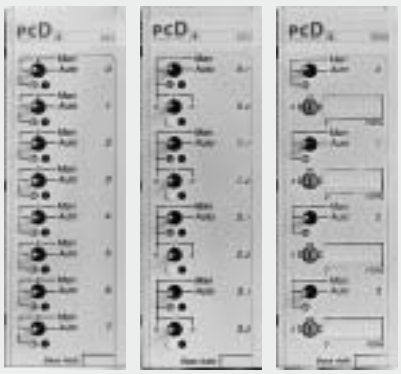
Counting, measuring and motion control modules Pages 18–20

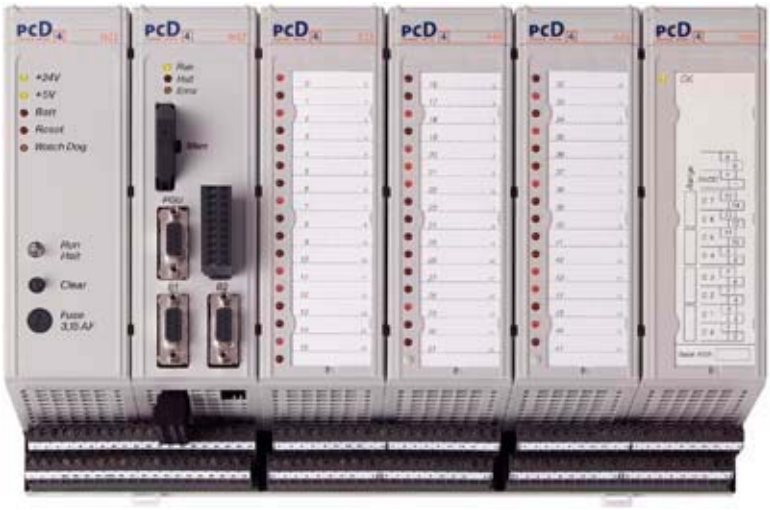


Manual operation modules Page 17



Manual PCD4

SAIA®Programmable Control Devices



HB-PCD4 26/734 E9, Chapter 5.1 07.2003

Subject to technical changes

Updates

Chronology

Date	Chapter	Page	Description
20.06.03	5	5.1-1 to -44	PCD4.M170 with 1 MByte flash card
20.06.03	5	5.1-30, 39	Reference to termination box PCD7.T160

Reliability and safety of electronic controllers

Anlagen- bzw. Maschinenbauer

Saia-Burgess Controls Ltd. is a company which devotes the greatest care to the design, development and manufacture of its products:

- state-of-the-art technology
- compliance with standards
- ISO 9001 certification
- international approvals: e.g. Germanischer Lloyd, United Laboratories (UL), Det Norske Veritas, CE mark ...
- choice of high-quality componentry
- quality control checks at various stages of production
- in-circuit tests
- run-in (burn-in at 85°C for 48h)

Despite every care, the excellent quality which results from this does have its limits. It is therefore necessary, for example, to reckon with the natural failure of components. For this reason Saia-Burgess Controls Ltd. provides a guarantee according to the "General terms and conditions of supply".

The plant engineer must in turn also contribute his share to the reliable operation of an installation. He is therefore responsible for ensuring that controller use conforms to the technical data and that no excessive stresses are placed on it, e.g. with regard to temperature ranges, overvoltages and noise fields or mechanical stresses.

In addition, the plant engineer is also responsible for ensuring that a faulty product in no case leads to personal injury or even death, nor to the damage or destruction of property. The relevant safety regulations should always be observed. Dangerous faults must be recognized by additional measures and any consequences prevented. For example, outputs which are important for safety should lead back to inputs and be monitored from software. Consistent use should be made of the diagnostic elements of the PCD, such as the watchdog, exception organization blocks (XOB) and test or diagnostic instructions.

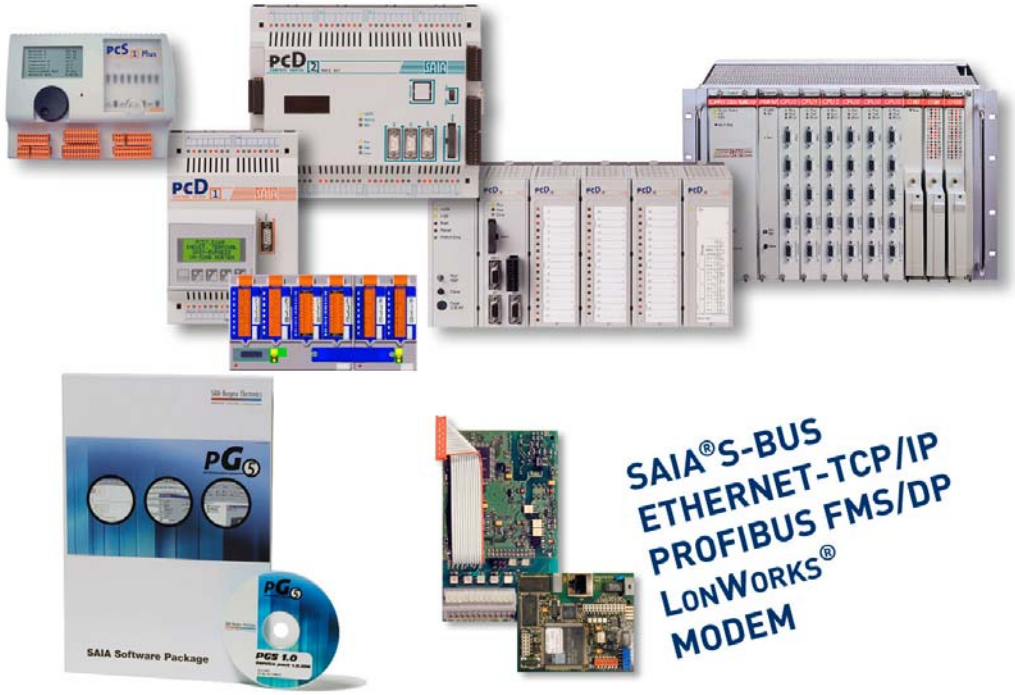
If all these points are taken into consideration, the SAIA PCD will provide you with a modern, safe programmable controller to control, regulate and monitor your installation with reliability for many years.

1 Read me

1.1 About ourselves

Saia-Burgess Controls Ltd (SBC) is a medium-sized European controls technology company. SBC is committed to the values, standards and culture of PLC engineering.

All hardware, operating systems, software tools, CPUs, interfaces, etc. have been developed by SBC itself and are marketed as embedded controls.



With full technical knowledge of all system elements and with quality-oriented business processes, SBC is equipped to provide unique, custom solutions regarding range of use, functionality, openness, flexibility, reliability and price.
These core competencies, combined with innovative strength, a broad product range and a readiness to implement special customer requests rapidly, have made SBC the attractive, competitive partner of choice for a large number of international customers.

1.2 Product and documentation concept

The SAIA® PCD product range is rigorously modular in structure. It demonstrates a clear hierarchy of systems, sub-systems, functions and diverse accessories. Fully developed software tools allow the efficient creation of user programs.
All SAIA® PCD systems (up to PCD6) work with the same operating system. The PCD systems communicate easily with each other and PCD user programs run on all systems.
PCDn xx7 series controllers have a special operating system. This enables them to be programmed with Siemens® STEP®7 and to communicate readily with the corresponding systems of other manufacturers.

SAIA® PCD customer documentation comprises pre-sales and after-sales documents that complement each other. As a rule, they are published in three language versions (German, English, French).

Technical information

Manuals

References

Technical Information (TI) documents offer overviews of a system (e.g. the SAIA® PCD operating system OS), sub-system (e.g. PCD2) or product family with common features (e.g. digital I/O modules, etc.).
TIs have been designed as pre-sales documents. They describe the system or product features and contain all the selection criteria necessary for a preliminary project. They offer the prospective customer more information than a normal brochure.
TIs are available free-of-charge as brochures or in electronic form (on CD for a token fee or free of charge via Internet **http://www.sbc-support.ch**).

Manuals are after-sales documents. They contain all the detailed information and application examples necessary for the efficient realization of a project. Manuals are available to the SAIA® PCD customer in electronic form on CD (for a token fee) and free of charge via Internet **http://www.sbc-support.ch**.

References describe projects that have been successfully realized with SAIA® PCDs (after-sales). The solutions outlined in them will provide many ideas for the use of SAIA® PCDs in similar projects (pre-sales, closing the loop with the TI). References are available free-of-charge as brochures or in electronic form (on CD or via Internet **http://www.sbc-support.ch**). Please read also our Controls News published on internet side: **http://www.controls-news.ch.**

P documentation (P = preliminary) describes new or extensively redeveloped products. After extensive internal testing of function and integration, these products are supplied to external commercial partners for field trials under more difficult conditions. P documentation is provided for these field trials. Improvements suggested by these external partners influence the definitive documentation. P documents can be requested as PDF files and some are available free-of-charge via Internet **http://www.sbc-support.ch**.

1.3 Technical support

Any questions that you cannot answer by referring to the documentation will be dealt with promptly and reliably for you by the SAIA® PCD Support Team. The team is based in Switzerland and can be reached by telephoning **++41 26 672 72 72** or by E-Mail **pcdsupport@saia-burgess.com**.
The addresses of Saia-Burgess sales companies and agents for other sales areas can be found under **http://www.saia-burgess.com**.

1.4 Workshops, training literature

Interesting, informative SAIA®PCD workshops offer technically qualified people the opportunity to make valuable contacts and extend their technical knowledge of the PCD, taking home with them both the training literature and the solutions produced collaboratively during the workshop.
Workshops are your route to joining the large group of enthusiastic SAIA®PCD users.

Current workshop programs are among a wealth of other useful information to be found under **http://www.sbc-support.ch/**

1.5 Navigation in electronic-based PDF documents

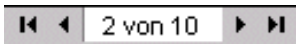
To navigate in PDF documents, press the "hand tool (H)" button. 

1.5.1 Structure of PCD manuals

PCD manuals comprise a "General section" and the chapter sections or sub-sections. These in turn comprise a number of document modules. The latter are uniquely identified with their own number, version details and issue date. This is necessary because many document modules are used in more than one manual.
Blue web links, e.g. **http://www.sbc-support.ch/** serve to establish an Internet connection.

1.5.2 Navigation

Navigation is via bookmarks. Clicking the mouse on “+” will display ancillary bookmarks.
The pictograms offer further navigation possibilities (after clicking the mouse on the appropriate index card), as do the "Contents lists” of individual chapters.

(Scrolling with the arrow keys takes a little longer. They are 

or  practical for going to the title page or to the back page, which has the ordering information and addresses with blue web links.)

A mouse click on the desired chapter heading will take you to the beginning of that chapter. From there, it is best to use the arrow keys for scrolling, or the links identified by blue key words.

Right-clicking once on the mouse will open a menu with various options (e.g. "Go to previous view"). Normally, bookmarks will be a faster way of arriving at the starting point or any new destination (e.g. another chapter).

1.5.3 Summary of navigational aids

- Bookmarks (on left margin of screen, outside the document)
- Any pictograms (after clicking mouse on index card)
- Contents lists with links to topics required
- Blue web links, for establishing Internet connections quickly
- Key words marked blue, for accessing more detailed information (within any one chapter section or subsection)

1.6 Icons

In manuals, this symbol refers the reader to further information in other manuals or technical information documents (e.g. “For details see TI 26/365”).
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: at least touch the Minus of the system (cabinet of PGU connector) before coming in contact with the electronic parts. Better is to use a grounding wrist strap with its cable attached to the Minus of the system.

The caution sign accompanies instructions that must always be followed.

Contents

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1. The modular system structure of the PCD4 series

The modular design of PCD4 series offers great flexibility. Within addressing limits, a range of processor and memory modules, power supplies, digital I/O modules, analogue I/O modules, fast counter modules and DC and stepper motor controllers can be combined to satisfy almost any application.

The system can be built up in stages : from the minimal system, with one processor, one serial interface and a power supply, to the full system with two processors, four serial interfaces, 32 add-on modules and a S-Bus or a PROFIBUS connection.

All modules are produced in the form of cartridges with the same dimensions. Each cartridge is plugged into a bus module. The bus modules are snapped onto mounting rails, and connect electrically to form the PCD4 bus.

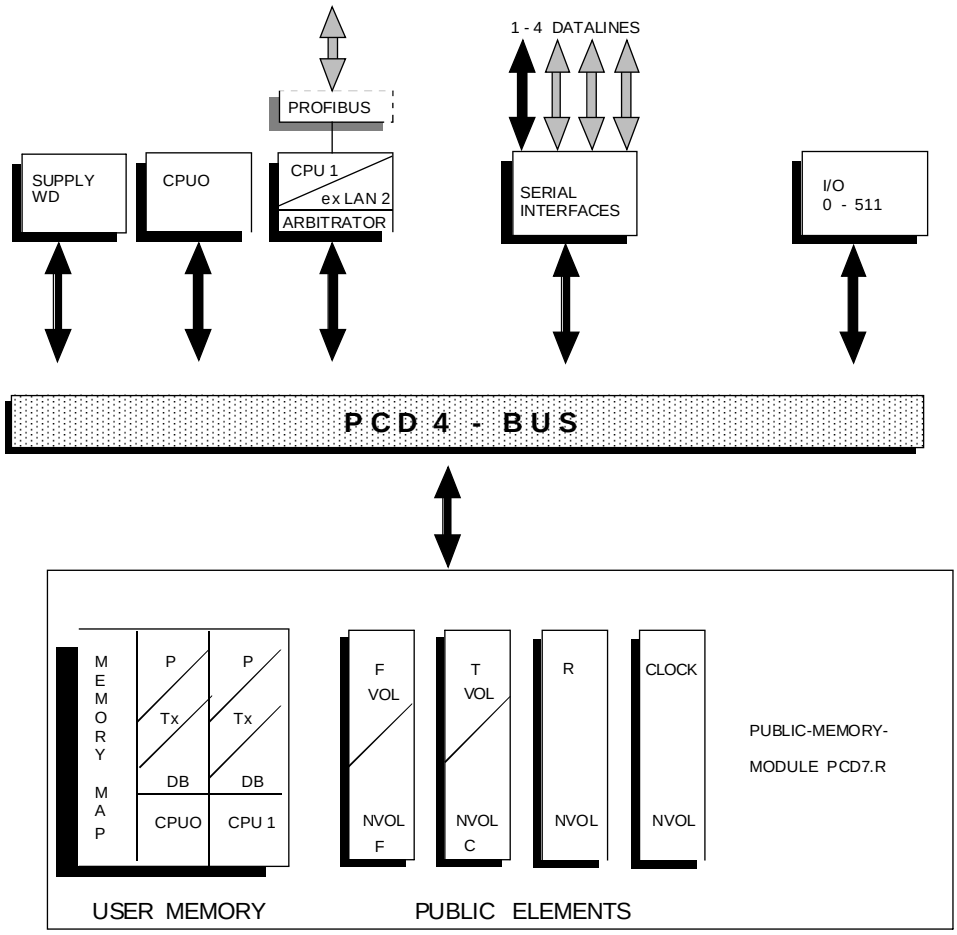
Apart from mechanical design, the PCD4 differs from the PCD1- PCD2 and PCD6 series in only four areas :

	PCD1	PCD2	PCD4	PCD6
Max. Inputs/Outputs	64	256	512	5120
Number of CPU's	1	1	1 or 2	1 to 6
Nb. of serial interfaces	1 to 2	1 to 4	1 to 4	5 to 30
User memory	17 to 140 KBytes	32 to 640 KBytes	64 to 428 KBytes	256 KB to 1 MBytes

The PCD4 has the same number of flags (8192), timers/counters (1600), registers (4096), program blocks, texts and data blocks as the PCD6 series. The instruction sets are identical, and the same programming tools are used for all series.

1.1 Block diagram

The following block diagram shows the internal structure of the PCD4 system :



P	Program	F	Flags	CLOCK	Date-time
TX	Text	T	Timers	VOL	Volatile
DB	Data blocks	C	Counters	NVOL	Non-volatile
		R	Registers		

The **power supply module** supplies the voltages for the internal electronics. The supervisory "Watch dog" timer (WD) is also located in this module.

The **memory module**, which is plugged into the **processor module**, contains the memory for user programs, texts and data blocks in the form of RAM or EPROM, with the necessary memory map. It also holds all shared resources : flags, timers, counters, data registers and the real-time clock.

As the diagram shows, the 8192 flags (F) can be defined as volatile (VOL) or non-volatile (NVOL) flags, as desired. The user can also select which of the 1600 x 32-bit timer/counters will be timers (T) and which will be counters (C) in accordance with his requirements. The timers are always volatile, the counters are always non-volatile. The 4096 x 32 bit data registers (R) are always non-volatile. Flags, timers, counters and registers can be accessed by both processors, if present.

The user memory for programs, texts and data blocks (P / TX / DB) on the memory module is battery-backed in the RAM version. The "Configure" programming utility carries out the allocation of memory for user program and text for one or two processors, according to the application.

The PCD4 bus, formed by the bus modules, extends through the whole system as the block diagram shows. This bus provides the data path between all system components and is used by the processors and all add-on I/O modules. The internal power is also supplied via this bus.

The positions to the right of the processor module can be fitted with **I/O modules** for digital and analogue signals, or with special modules such as the fast counters or stepper motor controllers.

1.2 System information

Processor module	With 1 or 2 processors for 1 bit or word processing and communication. Or with1 processor and a co-processor for connection to the PROFIBUS-FMS network.
Processing time	Approx. 4 µs per bit instruction (read directly, without a process copy).
User memory	Either battery-backed RAM, or EPROM memory. Total 64K x 32 bits. This allows 64K of user program lines or 256K of text characters, or a mixture of both, and additional 172 KByte RAM for TX and DB.
Number of I/Os	Max. 512 in up to 32 modules (each module has 8 or 16 I/Os)
Serial interfaces	1 to 4 independent serial channels
Serial interface types	RS 232, RS 422 or RS 485 as well as 20mA current loop. Serial interface 0 is always RS232, since it is used for connection to the programming unit.
Flags	8192 x 1 bit (divided between volatile and non-volatile)
Timers/counters	1600 x 31 bits, programmable division. (timers are always volatile, counters are non-volatile.
Timebase for timers	Programmable from 10ms to 10 seconds
Data registers	4096 x 32 bits (non-volatile), can be loaded by the user program, or via the programming unit from/to diskette. Additional max. 32K registers in data blocks if the user memory (RAM or EPROM) is used.
Data formats	Decimal, hexadecimal, BCD, binary or floating point (exponential representation)
Index register	17 x 13 bits per processor (1 for each COB and 1 for all XOBs)

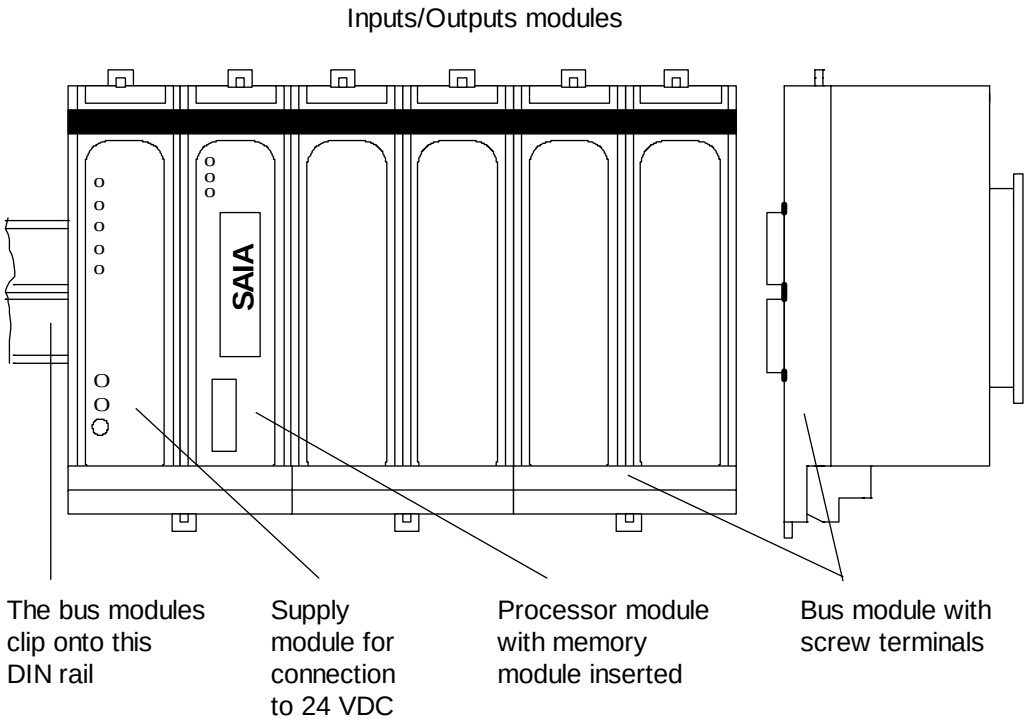
Cyclic Organization Blocks (COB)	16 per processor
Exception Organization Blocks (XOB)	Up to 32 per processor
Program Blocks (PB)	300 per processor
Function Blocks (FB)	1000 per processor, with run-time parameters
Sequential Blocks (SB)	32 per processor (for GRAFTEC programming with 2000 steps and 2000 transitions with up to 32 active parallel branches)
Texts (TX) and data blocks (DB)	8000 per processor, with up to 3 levels of sub-texts
Special texts	For output of date, time, logic states, contents of registers and counters in various formats (also with decimal point), addressed directly or indirectly.
Date/time (hardware clock)	Week, day of week, year, month, date, hour, minute, second. Precision : Better than 60s/month Battery power reserve : 2 months
Operating temperature	0...55°C (below modules)
Resistance to interference of digital I/Os and power supply	In accordance with IEC 801-4 Class III (4000 V)
Supply voltages (nominal)	For supply module : 24 VDC For I/Os 24 VDC

Notes :

2. The mechanical structure of the PCD4 series

As the following diagrams show, the clip-on bus modules are connected together to form the backbone and bus of the PCD4.

The cartridge-style power supply, processor and I/O modules are plugged into these bus modules.

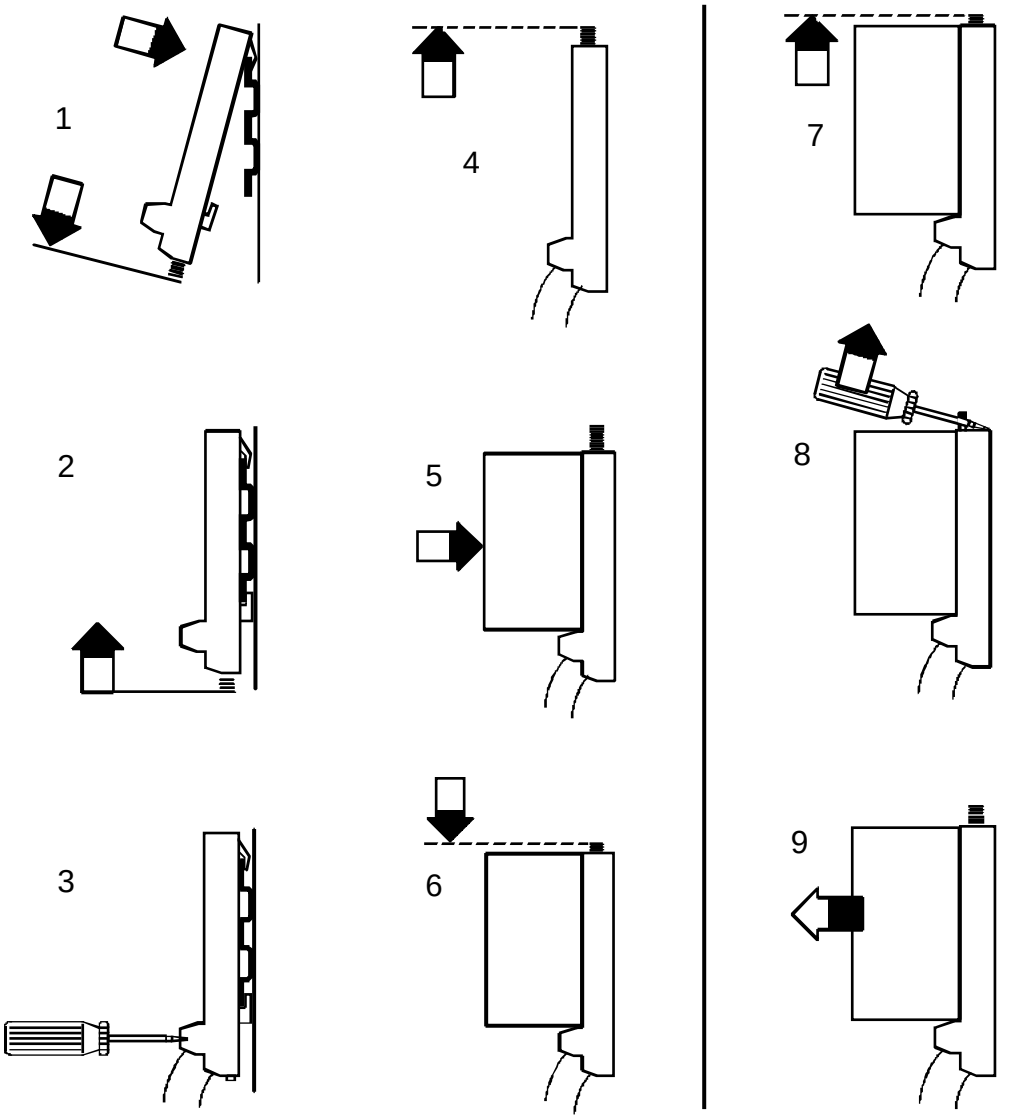


A double mounting rail (35 mm, DIN/EN 50022) is used to support the bus modules. The required number of bus modules are snapped onto this rail and connected together electrically and mechanically (see drawing on next page). External connections should be wired next, using the screw terminals.

After completion of assembly and wiring, insert and fasten the supply module, the processor module and up to 32 add-on I/O or special modules.

The sequence of assembly is shown in these diagrams :

Assembly PCD4 **Disassembly PCD4**



1. Pull the retaining clip down and slot the bus module onto the DIN rail
2. Push the retaining clip upwards
3. Connect the wires with a no. 1 screwdriver
4. Pull up the module retaining clip
5. Insert the module
6. Push the module retaining clip downwards

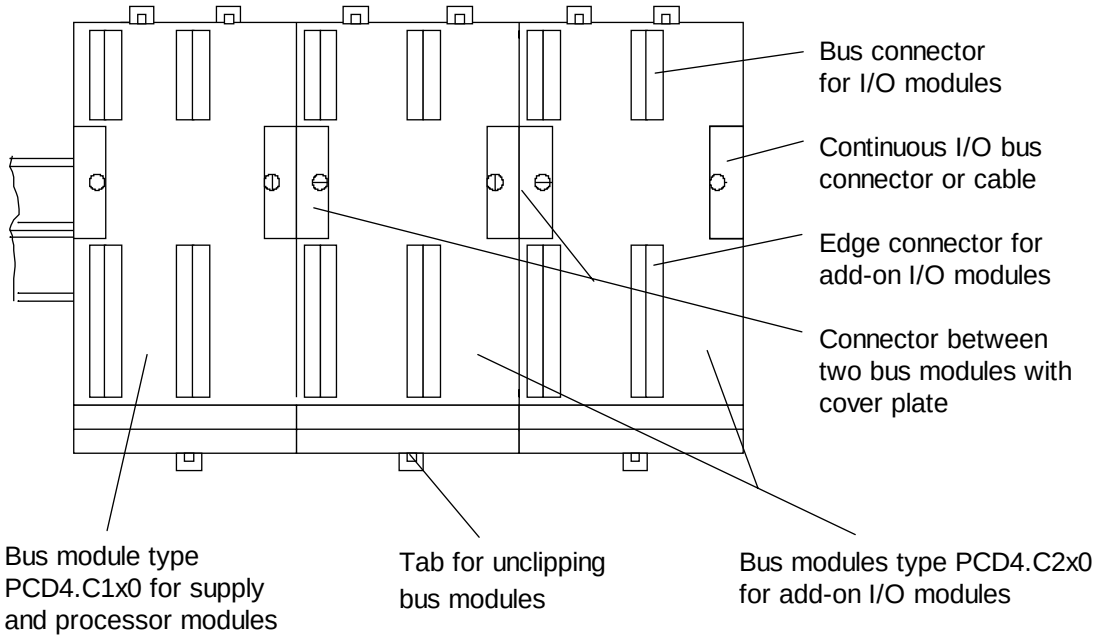
7/8. Pull up the module retaining clip using a no. 1 screwdriver

9. Unplug the module

Important note : (risk of damage)

Modules must never be inserted onto or removed from the bus module when the supply voltage is present !

2.1 Arrangement of the bus modules

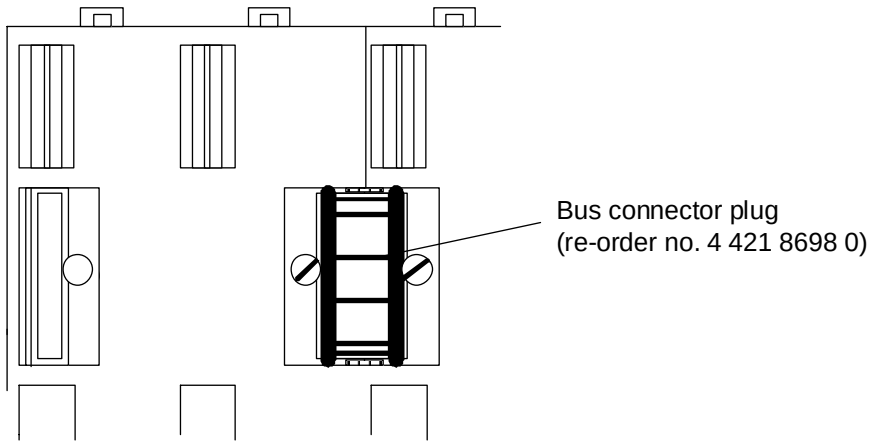


The bus modules for the supply and processor modules must each be installed on the left side of every assembled PCD4 (PCD4.C1x0 or ..C340). The I/O bus modules (PCD4.C2x0) are placed on the right.

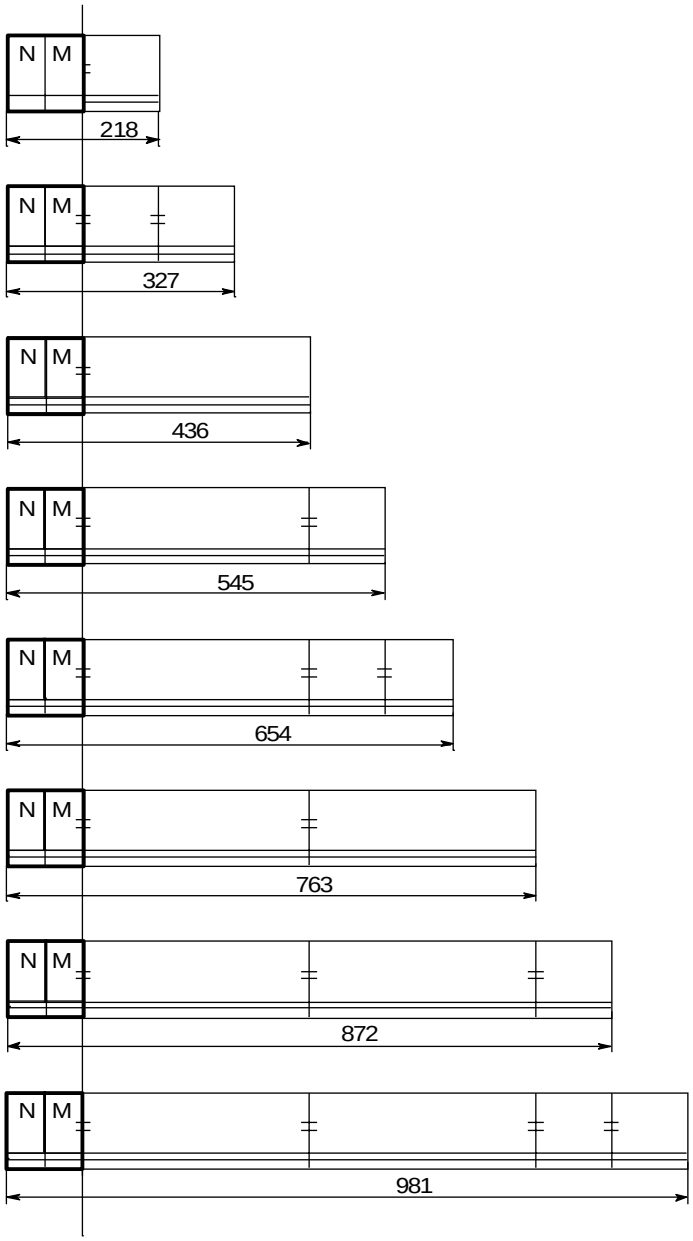
To unclip and remove a bus module, the lower tab must be pulled downwards.

Connection between bus modules is via connector plugs and the accessories which accompany every bus module
(re-order with no. 4 421 8698 0).

After insertion of the bus connector, the cover plate (supplied as an accessory) should be screwed down with two screws. This metal cover protects the bus and ensures good mass distribution throughout the system.



2.2 PCD4 assembly in one row for a maximum of 256 I/O *)



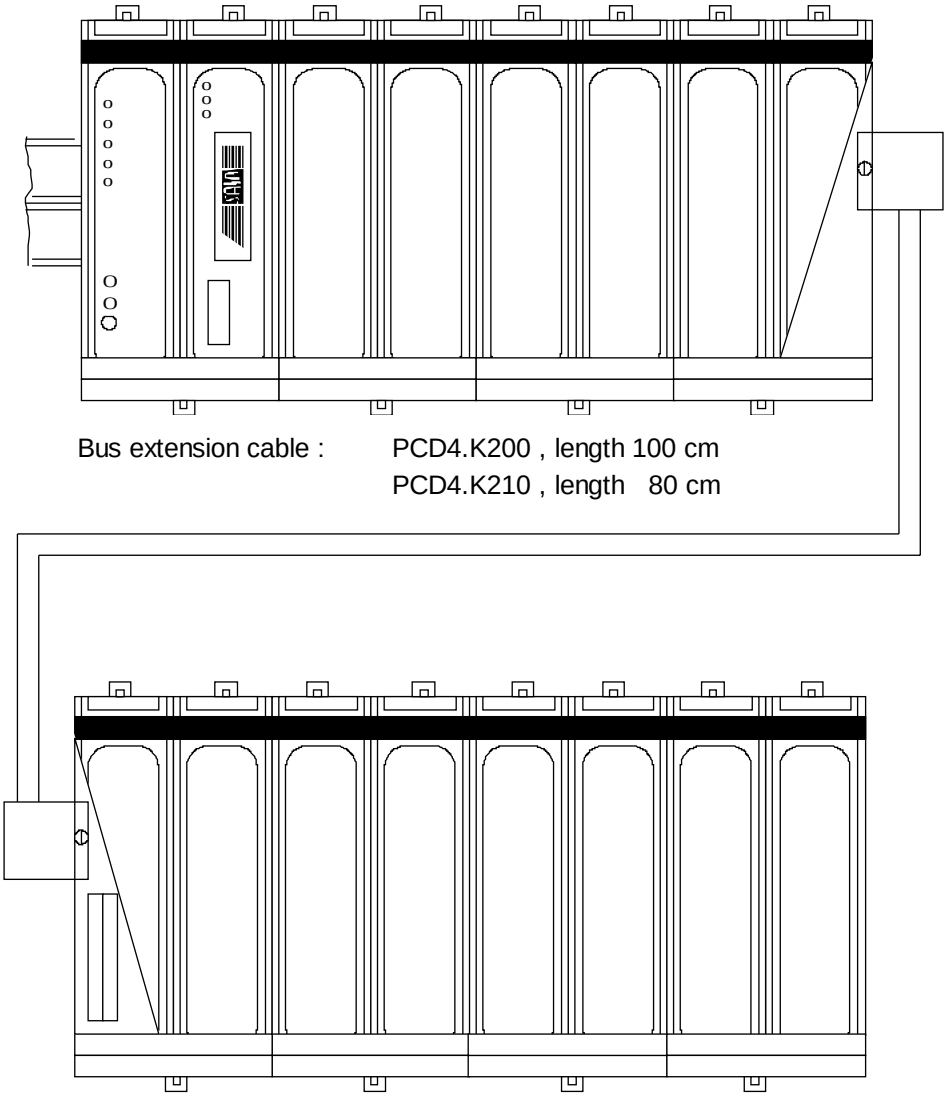
Number of I/O modules	Address range
2	0 to 31
4	0 to 63
6	0 to 95
8	0 to 127
10	0 to 159
12	0 to 191
14	0 to 223
16	0 to 254

The PCD4 series allows from 2 to 16 add-on I/O modules to be arranged in one row. For this purpose, bus modules with sites for either 2 add-on modules (PCD4.C220) or 6 add-on modules (PCD4.C260) are available. If possible, the above combinations should be used.

Note that the fewest possible bus connectors should be used. **The upper limit is around 5 connectors**. This includes the connecting cable in case of assembly in two rows, see next page.

*) This number can be doubled by use of the digital ..B900 modules (16 inputs + 16 outputs).

2.3 PCD4 assembly in two rows for a maximum of 256 I/O *)



If there is insufficient space for all I/O modules in one row, they can be arranged in a second row above or below the row which contains the processor module.

The bus extension cable PCD4.K200 or ..K210 is required for extending the bus. This is fitted into the bus connector and secured with a screw.

Since it is well screened, the bus extension cable can be layed in the cable channel of the installation wiring. The length of the bus extension cable must not be changed.

Addressing the I/O modules continues via the bus extension cable in the same way, as if they were assembled in one row.

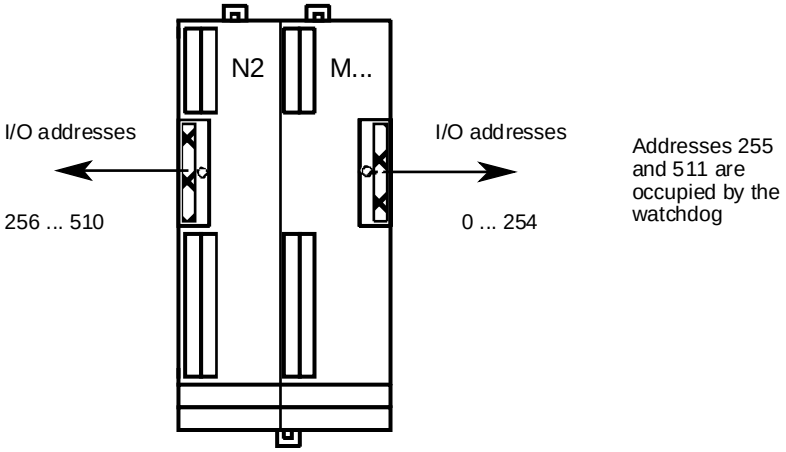
*) This number can be doubled by use of the digital ..B900 modules (16 inputs + 16 outputs).

2.4 PCD4 assembly for a maximum of 512 I/O *)

While paying attention to the internal power requirements placed on the power supply module, it is possible to add a maximum of 32 I/O modules, providing 512 I/Os (or more with ..B900 modules).

Addressing from the basic package (consisting of N2.. and M.. to ..C1x0 or ..C340 modules) is done on two sides :

- right bus connector addresses 0 to 254
- left bus connector addresses 256 to 510

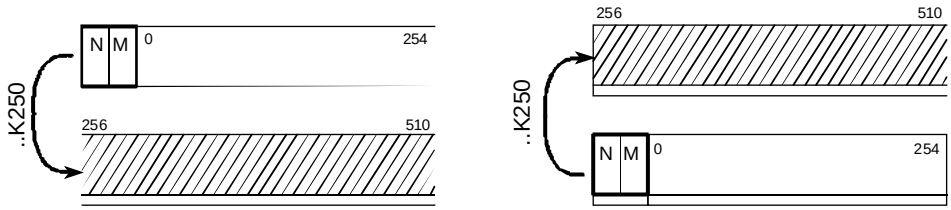


PCD4.C1..

With the help of two additional bus cables, the following assemblies can be constructed in two to four rows :

- In 2 rows :

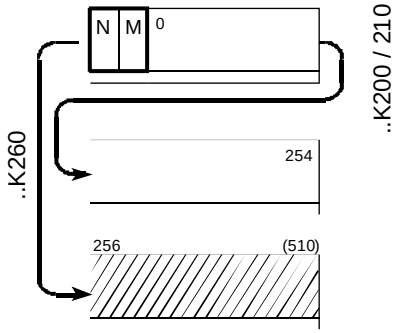
2a) **2b)**



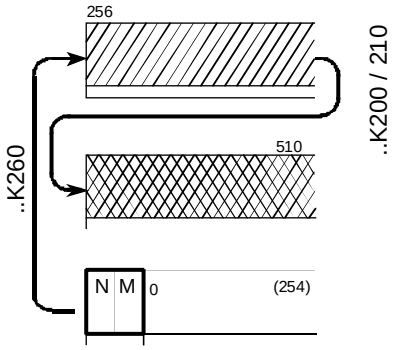
*) The maximum number of I/O modules is limited by internal power requirements. The table in chapter 7 "Power Supply Modules" must be consulted.

- In 3 rows :

3a)

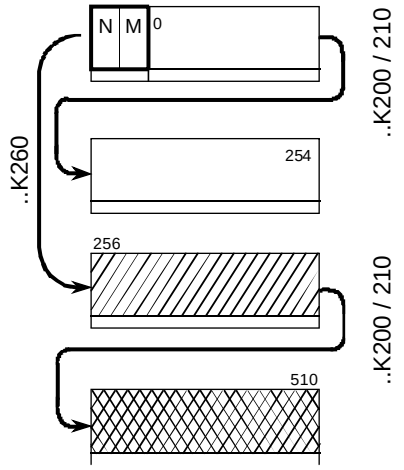


3b)

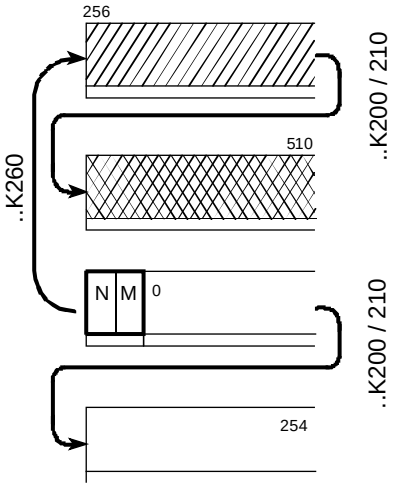


- In 4 rows :

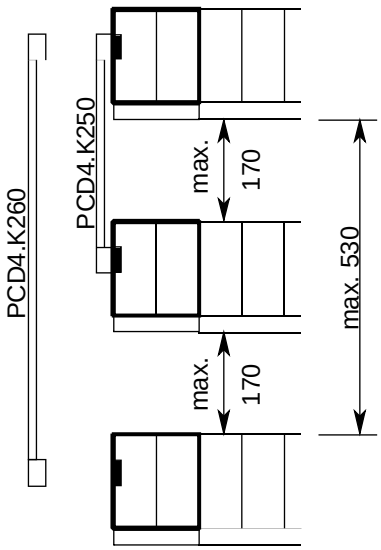
4a)



4b)



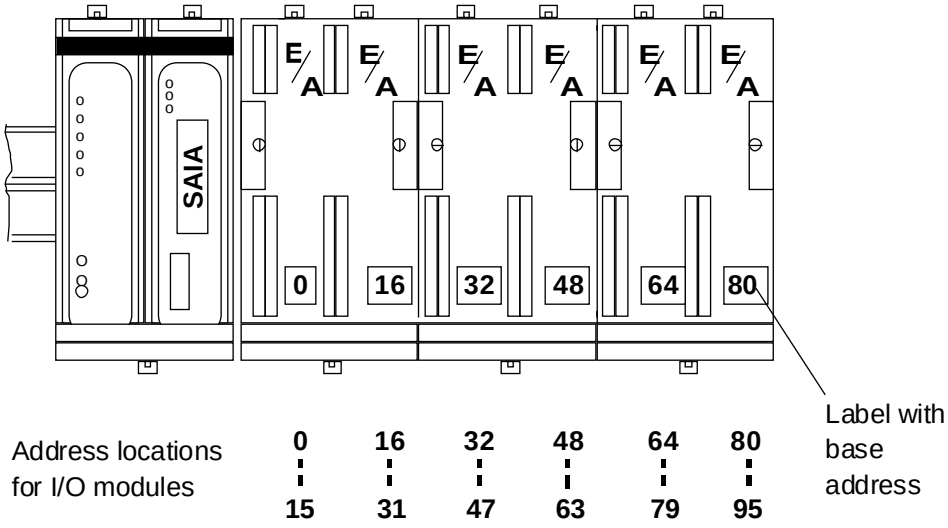
The following spacing should be observed between rows of modules :



Remarks :

- Maximum length of 2.5 m between the CPU and the last I/O module.
- Maximum 5 interconnections

2.5 Addressing input and output modules



Each add-on I/O module reserves 16 addresses. Starting with the base address 0 (zero) at the first module position to the right of the processor module, the addresses increase towards the right in steps of 16. The same also applies for modules which occupy only 8 addresses. If modules with 8 addresses are used, 8 addresses are lost for each module.

If the bus extension cable is used to form a second row of modules, addressing continues similarly in the second row.

It is recommended that the sticky labels with base address 0, 16, 32, etc. are applied to the bus modules for each module position, so that each I/O module can be easily labelled.

As shown in the preceding section, cables ..K250 and ..K260 can be used to expand addressing from 256 to 510.

Caution : Since the Watch Dog (see chapter 7.2) uses addresses 255 and 511, only digital I/O modules may be inserted in these fields.

Analogue modules (types ..W) and counting or positioning modules (types ..H) cannot be run in the addresses ranges 240 to 255 and 496 to 511.

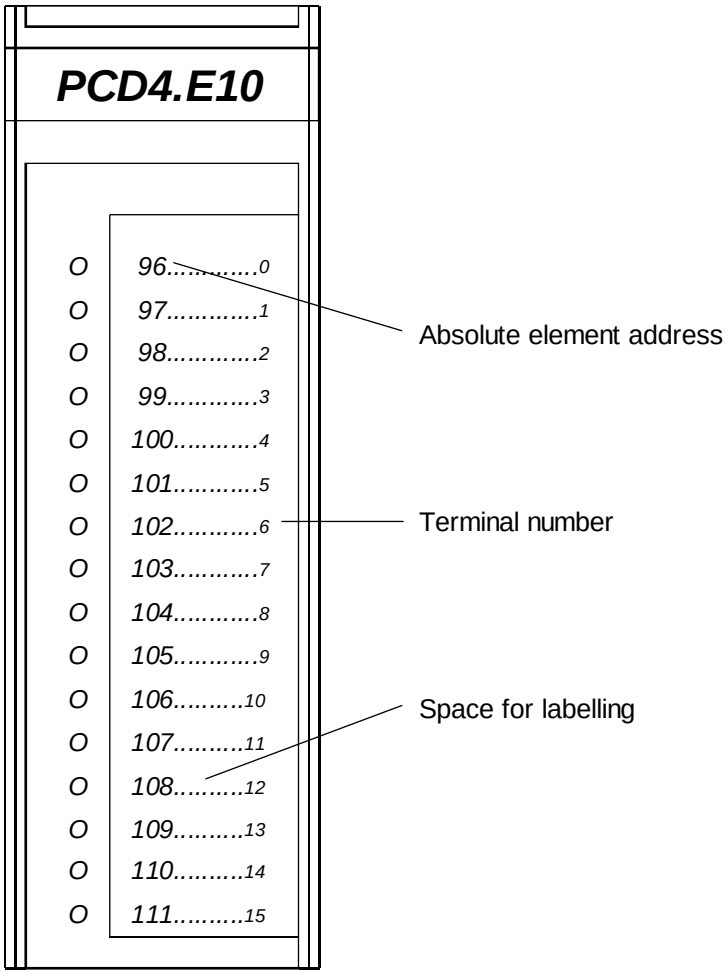
The numbered labels, which accompany the modules, serve to identify the I/O modules by address location. These labels slide onto the front of each module. On the left is the absolute address (belonging to the LED); on the right is the terminal number. (The terminal numbers are the same for every I/O module).

After each address, a blank space is provided for writing the associated I/O name or reference. Analogue and other special modules have different labels.

Sticky labels for the base addresses on the bus modules and front plates for the digital I/O modules for addresses 0...127 are supplied as accessories with every PCD4.C1x0 or PCD4.C340 bus module.

Other sets are available :

4'310'8567'0	for addresses	0 ... 127
4'310'8568'0	for addresses	128 ... 255
4'310'8569'0	for addresses	256 ... 511
4'310'8570'0	for ..W and ..H modules	



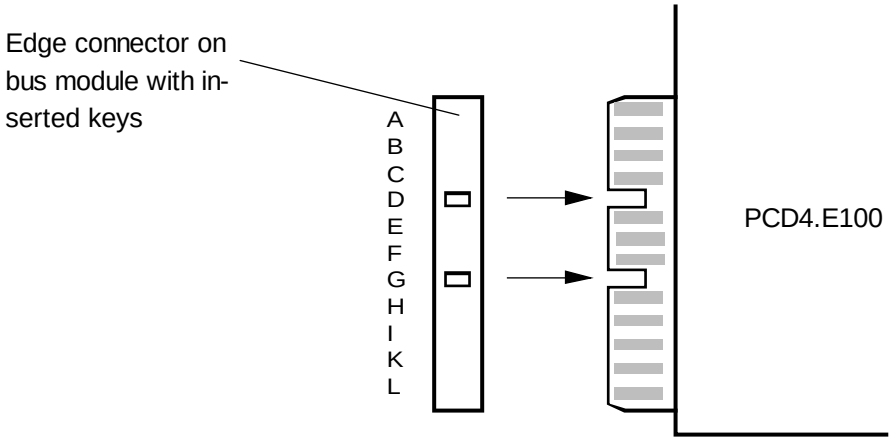
2.6 Coding the module edge connectors

To prevent the insertion of the wrong plug-in module, the edge connectors on the bus modules can be specially keyed. Each module type has an identification key in the form of slots cut into the edge connector, according to the following table :

	C1x0 / C340		C2x0 / C340																		
			Inputs				Outputs						Function modules								
	N2x0	Mxxx	E10x	E11x	E60x	B90x	A200	A250	A350	A4x0	A810	A820	W100	W300	W400	W500	W600	W800	H120	H2xx	H3xx	H4x0
A											x								x	x		x
B												x									x	
C													x	x	x	x	x	x	x			
D			x	x	x	x																
E							x	x	x	x	x	x	x									
F		(x)														x						x
G			x			x			x									x		x	x	
H	(x)							x									x					
I				x			x							x								
K					x					x					x							
L																						

Keys are already inserted for the power supply and processor modules on the bus module PCD4.C1x0 or ..C340.

For the I/O modules, the keys should be located according to the above table.



Connecting terminals to I/O addresses

Terminals	Addresses for the modules PCD4.E110 / E600 / A400 / B900							
0	0	16	32	48	64	80	96	112
1	1	17	33	49	65	81	97	113
2	2	18	34	50	66	82	98	114
3	3	19	35	51	67	83	99	115
4	4	20	36	52	68	84	100	116
5	5	21	37	53	69	85	101	117
6	6	22	38	54	70	86	102	118
7	7	23	39	55	71	87	103	119
8	8	24	40	56	72	88	104	120
9	9	25	41	57	73	89	105	121
10	10	26	42	58	74	90	106	122
11	11	27	43	59	75	91	107	123
12	12	28	44	60	76	92	108	124
13	13	29	45	61	77	93	109	125
14	14	30	46	62	78	94	110	126
15	15	31	47	63	79	95	111	127

Terminals	Addresses for the modules PCD4.E110 / E600 / A400 / B900							
0	128	144	160	176	192	208	224	240
1	129	145	161	177	193	209	225	241
2	130	146	162	178	194	210	226	242
3	131	147	163	179	195	211	227	243
4	132	148	164	180	196	212	228	244
5	133	149	165	181	197	213	229	245
6	134	150	166	182	198	214	230	246
7	135	151	167	183	199	215	231	247
8	136	152	168	184	200	216	232	248
9	137	153	169	185	201	217	233	249
10	138	154	170	186	202	218	234	250
11	239	155	171	187	203	219	235	251
12	140	156	172	188	204	220	236	252
13	141	157	173	189	205	221	237	253
14	142	158	174	190	206	222	238	254
15	143	159	175	191	207	223	239	255

Connecting terminals to I/O addresses

Terminals	Addresses for the modules PCD4.A200 / A350							
0	0	16	32	48	64	80	96	112
1	0 +	16 +	32 +	48 +	64 +	80 +	96 +	112 +
2	1	17	33	49	65	81	97	113
3	1 +	17 +	33 +	49 +	65 +	81 +	97 +	113 +
4	2	18	34	50	66	82	98	114
5	2 +	18 +	34 +	50 +	66 +	82 +	98 +	114 +
6	3	19	35	51	67	83	99	115
7	3 +	19 +	35 +	51 +	67 +	83 +	99 +	115 +
8	4	20	36	52	68	84	100	116
9	4 +	20 +	36 +	52 +	68 +	84 +	100 +	116 +
10	5	21	37	53	69	85	101	117
11	5 +	21 +	37 +	53 +	69 +	85 +	101 +	117 +
12	6	22	38	54	70	86	102	118
13	6 +	22 +	38 +	54 +	70 +	86 +	102 +	118 +
14	7	23	39	55	71	87	103	119
15	7 +	23 +	39 +	55 +	71 +	87 +	103 +	119 +

Terminals	Addresses for the modules PCD4.A200 / A350							
0	128	144	160	176	192	208	224	240
1	128 +	144 +	160 +	176 +	192 +	208 +	224 +	240 +
2	129	145	161	177	193	209	225	241
3	129 +	145 +	161 +	177 +	193 +	209 +	225 +	241 +
4	130	146	162	178	194	210	226	242
5	130 +	146 +	162 +	178 +	194 +	210 +	226 +	242 +
6	131	147	163	179	195	211	227	243
7	131 +	147 +	163 +	179 +	195 +	211 +	227 +	243 +
8	132	148	164	180	196	212	228	244
9	132 +	148 +	164 +	180 +	196 +	212 +	228 +	244 +
10	133	149	165	181	197	213	229	245
11	133 +	149 +	165 +	181 +	197 +	213 +	229 +	245 +
12	134	150	166	182	198	214	230	246
13	134 +	150 +	166 +	182 +	198 +	214 +	230 +	246 +
14	135	151	167	183	199	215	231	247
15	135 +	151 +	167 +	183 +	199 +	215 +	231 +	247 +

3. The bus modules of the PCD4 series

As previously stated, the bus modules and connections to the plug-in modules form the basic mechanical structure, electrical data paths and the power connection for all system components (PCD4 bus).

The I/O bus modules (PCD4.C2x0) are relatively simply organized : each has connectors for addressing and I/O data exchange, plus the screw terminals for individual inputs/outputs and the power supply for output elements (transistors, relays).

The bus modules for the power supply and the processors (PCD4.C1x0 and PCD4.C340) are slightly different, because in addition to the connections to the bus and the screw terminals for the main supply, they also carry the drivers and terminals for the serial interfaces nos. 1, 2 and 3.

Notes :

3.1 Bus modules PCD4.C1x0 for supply and processor

These are always the width of two module units. The various types differ in the number and types of serial interface.

For serial interfaces no. 1, 2 and 3 the electronics (UART) are in the processor module. But the drivers for these interfaces are contained in the bus module. A series of various bus modules is offered, according to the interface type (RS 232, RS 422 / RS 485, 20 mA current loop) and number of interfaces.

Note : The RS 232 serial interface is a 9-pin D-type connector (female) on the front panel of each processor module. The electronics (UART) of this interface is contained on the CPU card 0. This interface is not connected to the bus modules. During commissioning the PGU connector is used with the programming unit. Upon completion of the commissioning phase then the PGU connector can be used for a general purpose interface (channel 0).

PCD4.C100 Simplest bus module of the C1x0 series,
without serial interfaces no. 1, 2 or 3 (unequipped).

PCD4.C110 Bus module with 1 serial interface

no. 1 :	20 mA current loop - on screw terminals 10 ... 17
no. 2 and 3 :	unequipped

PCD4.C120 Bus module with 3 serial interfaces

no. 1 :	RS 232 - on screw terminals 10 ... 17
no. 2 :	20 mA current loop - on screw terminals 20 ... 27
no. 3 :	20 mA current loop - on screw terminals 30 ... 37

PCD4.C130 Bus module with 3 serial interfaces

no. 1 :	RS 422 / RS 485 - on screw terminals 10 ... 17
no. 2 :	RS 422 - on screw terminals 20 ... 27
no. 3 :	RS 232 - on screw terminals 30, 31 and 34, 35

PCD4.C340 Bus module for supply, processor and 4 I/O modules. The interfaces can be fitted as desired with the pluggable interface modules :

- PCD7.F110 → RS 422 / RS 485
- PCD7.F120 → RS 232
- PCD7.F130 → 20 mA current loop
- PCD7.F150 → RS 485 electrically isolated

See description of the module in the chapter 3.4

Terminals (for all bus modules)

All screw terminals of the bus modules are provided for the following wire sections :

	1st HW version	from Q4 / 1994
- Rigid wires	1 x 2.5 mm^2 2 x 0.75 mm^2	1 x 0.5 ... 4 mm^2
- Flexible wires with ferrules	1 x 1.5 mm^2 2 x 0.5 mm^2	1 x 0.5 ... 2.5 mm^2
- Tightening torque	0.5 Nm	0.5 Nm

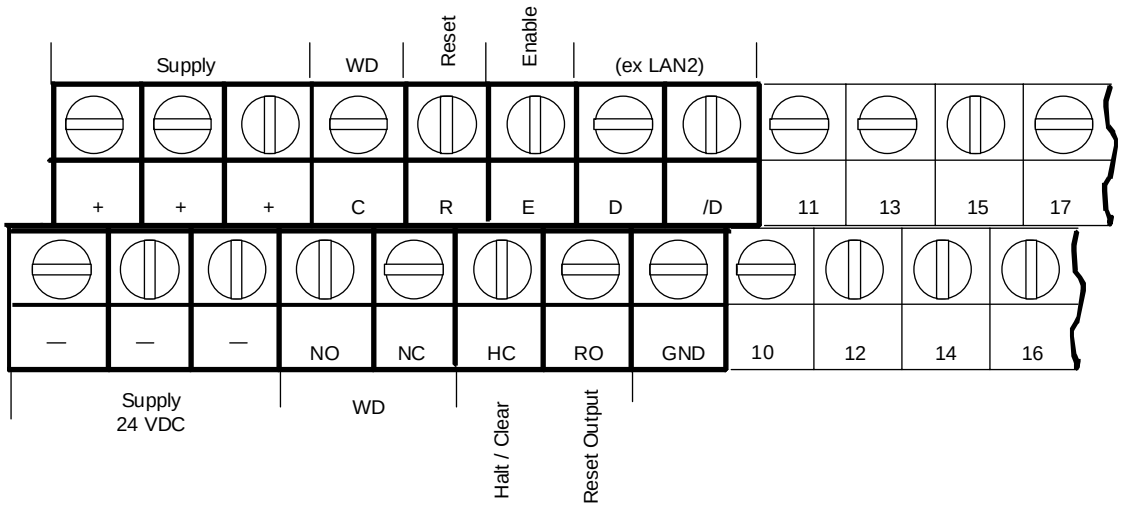
The terminals and the PCB connectors generally have a rated current of 2 A. For the PCD4.A400 and ..B900 modules, the exceptions to this are noted.

UL and C-UL requirements

Wire data	Temperature :	60/75°C
	Copper wire only	
	Tightening torque :	0.5 Nm

3.2 Screw terminal assignments of the PCD4.C1x0 bus modules for supply and processor

Supply, Watch Dog, Reset



Supply

+	+ 24 V	Supply voltage for the PCD4 system
–	0 V, GND	(for details see PCD4.N2..)

Watch Dog (WD)

C	Common	Switch contact of the WD relay
NC	Normally closed	(for details see PCD4.N2..)
NO	Normally open	

External Reset

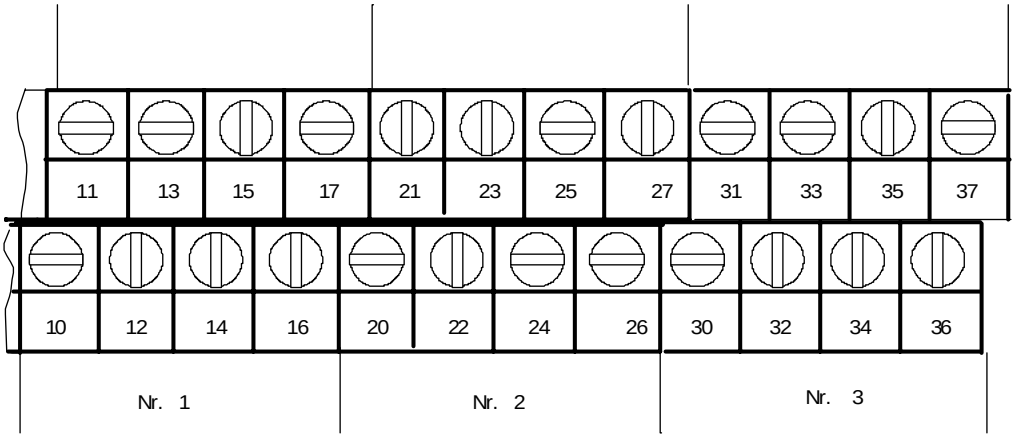
R	External Reset	(for details see 4.1.6)

CPU (Processor)

E	Enable	Define the behaviour of
RO	Reset Output	the system when reset
HC	Halt/Clear	(for details see 4.1.4 and 4.1.5)

3.3 Screw terminal assignments of the PCD4.C1x0 bus modules for communication interfaces

Communication interfaces



Connection of serial interfaces

Each serial interface uses 8 terminals :

- Interface no. 1 : Terminals 10 ... 17 (x = 1)
- Interface no. 2 : Terminals 20 ... 27 (x = 2)
- Interface no. 3 : Terminals 30 ... 37 (x = 3)

3.3.1 Interface RS 232

	Terminal x0 :	TX	Transmit Data
	Terminal x1 :	RX	Receive Data
*)	Terminal x2 :	DTR	Data Terminal Ready
*)	Terminal x3 :	DSR	Data Set Ready
	Terminal x4 :	RTS	Request To Send
	Terminal x5 :	CTS	Clear To Send
*)	Terminal x6 :	RSV	Reserve
*)	Terminal x7 :	DCD	Data Carrier Detect

*) These terminals are wired only on serial interface no. 1.

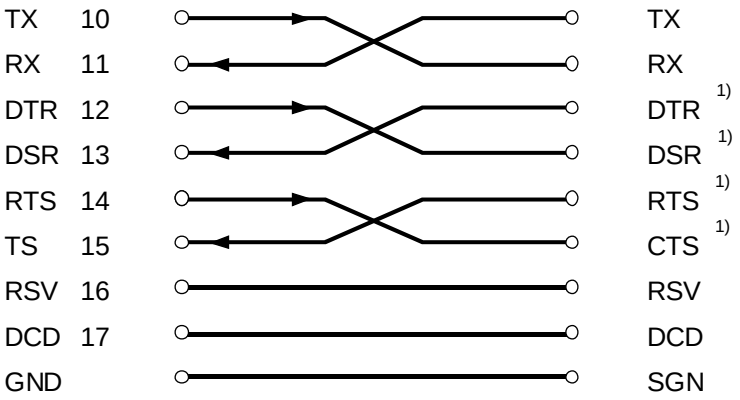
Signal type	Logical state	Required Value	Nominal Value
Data signal	0 (space)	+3 V ... +15 V	+7 V
	1 (mark)	–15 V ... –3 V	–7 V
Control/	0 (off)	–15 V ... –3 V	–7 V
Message signal	1 (on)	+3 V ... +15 V	+7 V

The idle state for data signals is "mark", the idle state for control/message signals is "off".

Connection examples for RS 232

- **For serial interface no. 1 :**

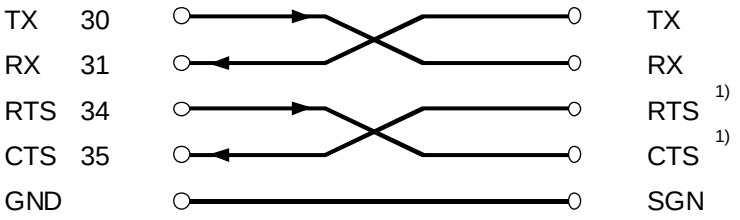
PCD4 terminals Cable Peripheral



Adapt connector type and connections according to the peripheral.

- **For serial interface no. 3 :**

PCD4 terminals Cable Peripheral



Adapt connector type and connections according to the peripheral.

1) For communication with serial terminals (VDUs), check which connections should be made. Set/clear the control signals using the SOCL instruction

- **For serial interface no. 0 :**

The PGU interface is located on the front panel of the processor module. This is primarily used for connection of the programming unit. However, the PGU interface can also be used as general purpose serial interface 0 for connection to another peripheral device, providing the following points are noted :

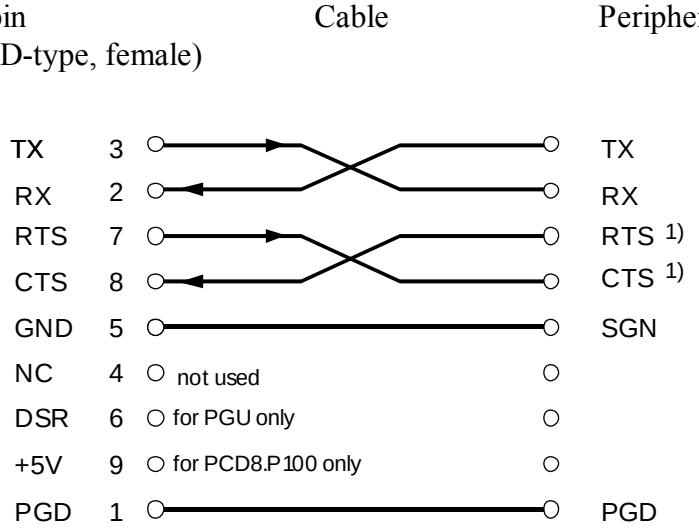
- During power-up, the firmware automatically configures the PGU interface to 9600 Baud for connection to the programming unit.

- If another peripheral device is to be connected, then serial interface 0 should be assigned accordingly using the SASI instruction.

- If the programming unit is subsequently connected in place of the peripheral during operation, the interface automatically switches back to PGU mode (connection pin 6 to pin 8).

- To use the interface once again for connection to the peripheral device, interface 0 must again be reassigned using the SASI instruction.

- See section 4.1.8 for PGU connection details.



Adapt connector type and connections according to the peripheral.

1) For communication with serial terminals (VDUs), check which connections should be made. Set/clear the control signals using the SOCL instruction.

3.3.2 Interface 20 mA current loop *)

Terminal	x0 :	TS	Transmitter Source	Transmitter
Terminal	x2 :	TA	Transmitter Anode	
Terminal	x4 :	TC	Transmitter Cathode	
Terminal	x6 :	TG	Transmitter Ground	
Terminal	x1 :	RS	Receiver Source	Receiver
Terminal	x3 :	RA	Receiver Anode	
Terminal	x5 :	RC	Receiver Cathode	
Terminal	x7 :	RG	Receiver Ground	

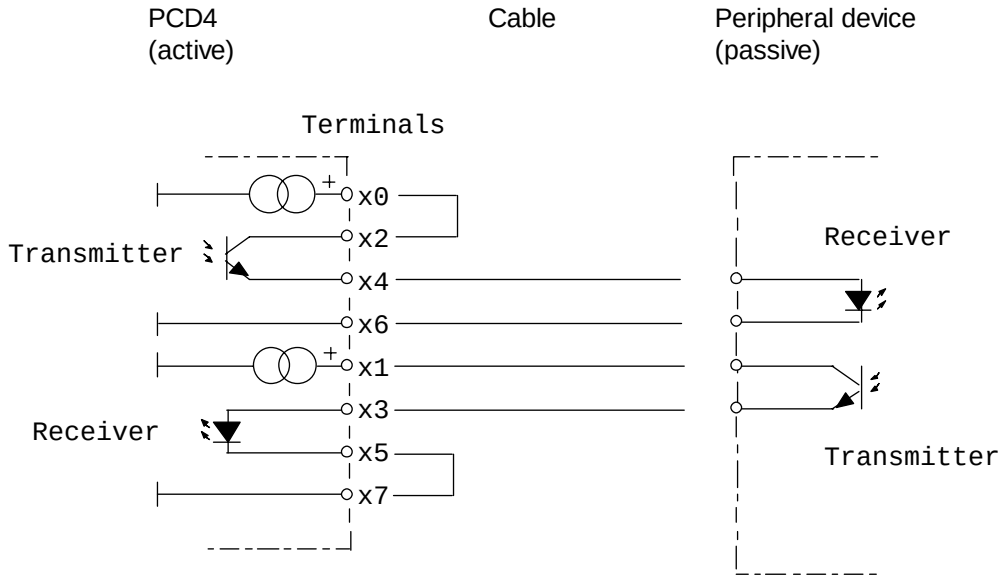
Signal type	Required value	Nominal value
Power for logic L (space)	–20 mA ... + 2 mA	0 mA
Power for logic H (mark)	+12 mA ... +24 mA	+20 mA
Neutral Voltage on TS, RS	+11.1 V ... +14.9 V	+13 V
Short circuit power on TS, RS	+18 mA ...+29.6 mA	+23.2 mA

The idle state for data signals is "mark".

The user selects "active" or "passive" switching by means of wire jumpers on the screw terminals.

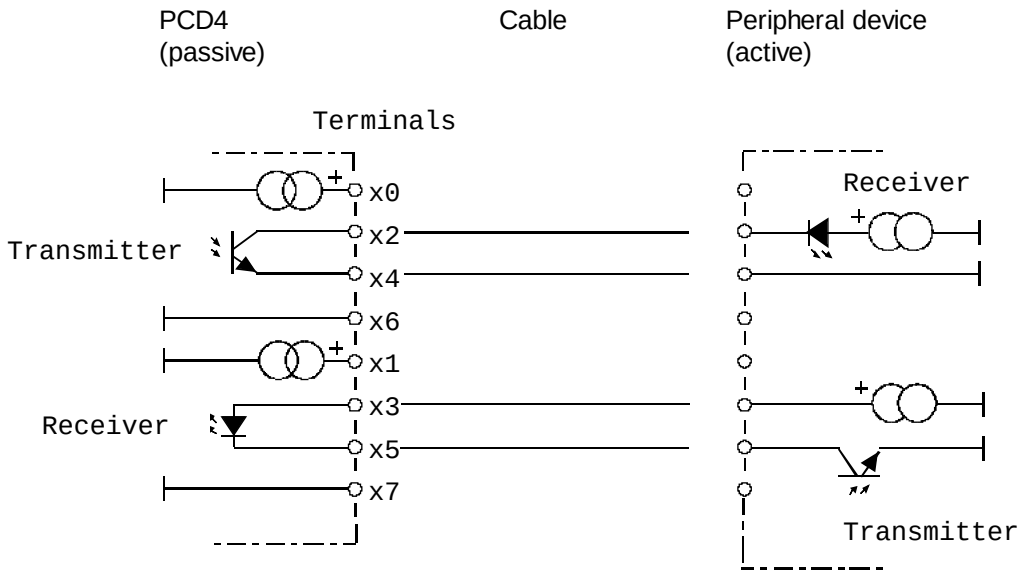
Connection examples for 20 mA current loop

a) PCD4 Active

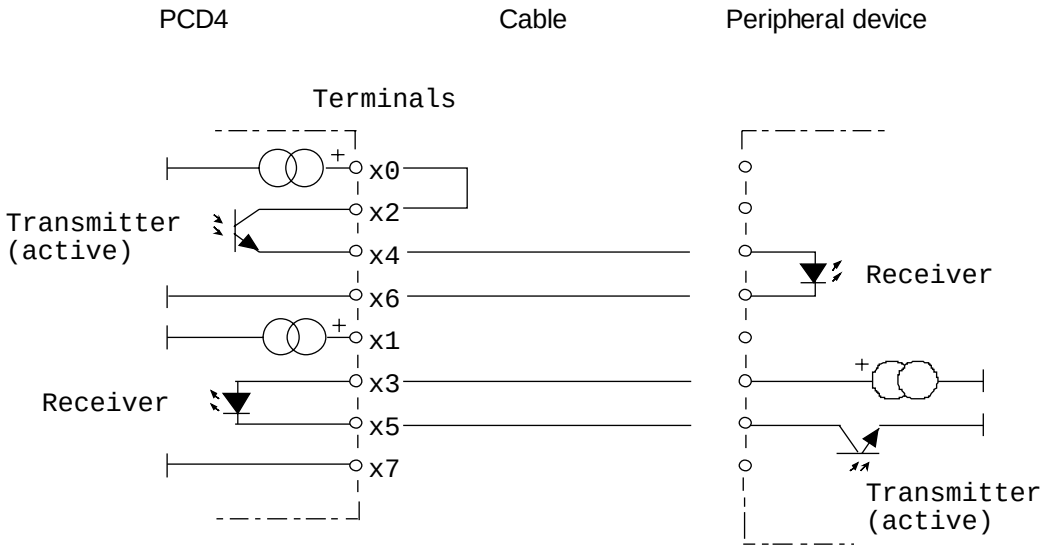


*) max. baud rate for 20 mA current loop limited to 9600 Baud

b) PCD4 Passive



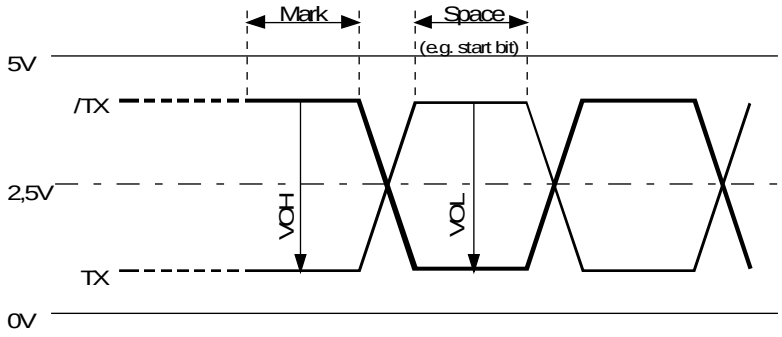
c) PCD4 transmitter and peripheral transmitter active



3.3.3 Interface RS 422

Terminal	x0 :	TX	Transmit Data
Terminal	x2 :	/TX	Transmit Data
Terminal	x1 :	RX [1)]	Receive Data
Terminal	x3 :	/RX	Receive Data
Terminal	x4 :	RTS	Request To Send
Terminal	x6 :	/RTS	Request To Send
Terminal	x5 :	CTS [1)]	Clear To Send
Terminal	x7 :	/CTS	Clear To Send

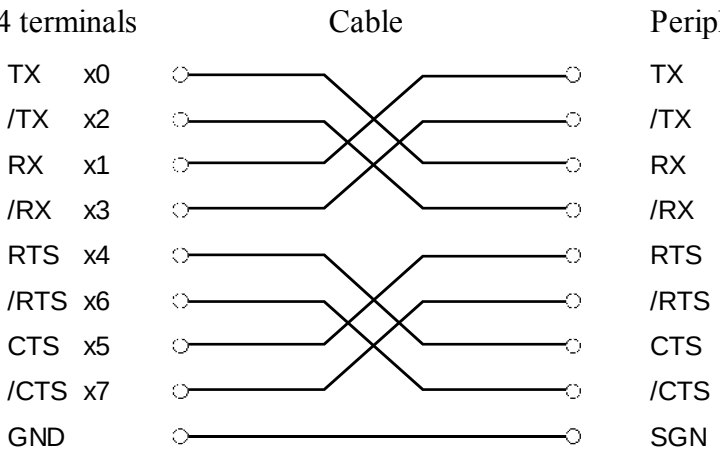
Signal type	Logical state	Polarity
Data signal	0 (space) 1 (mark)	TX positive to /TX /TX positive to TX
Control/Message signal	0 (off) 1 (on)	/RTS positive to RTS RTS positive to /RTS



VOH = 2 V min (with load) to 5 V max (without load)
VOL = –2 V ... –5 V

1) Between RX - /RX and between CTS - /CTS there is in each case a termination resistance of 150 Ω.

Terminal example for RS 422



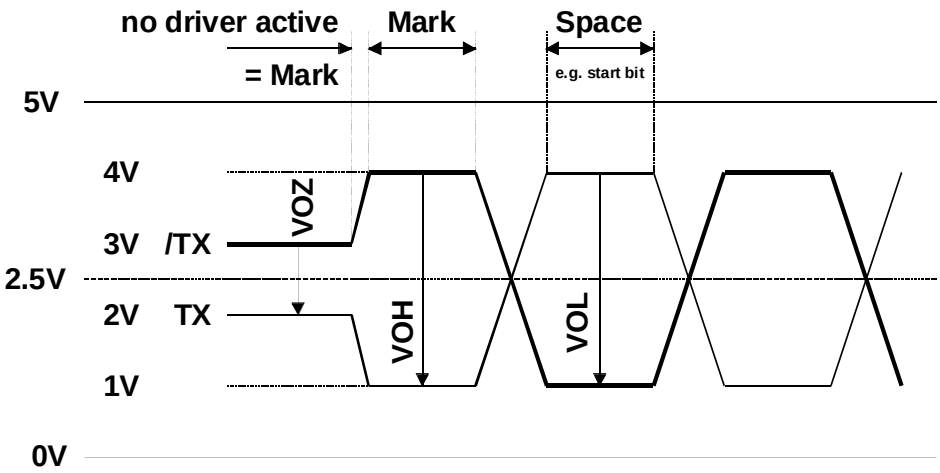
Adapt connector type and connections according to the peripheral.

3.3.4 Interface RS 485 *)

Interface no. 1 of bus module ..C130

Terminal 10 :	RX - TX	Data
Terminal 12 :	/RX - /TX	/Data
Terminal 11 :	not used	
Terminal 13 :		
Terminal 14 :		
Terminal 16 :		
Terminal 15 :		
Terminal 17 :		
Terminal 32 :	Terminals for termination and pull up and pull down resistors	
Terminal 33 :		
Terminal 36 :		
Terminal 37 :		

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



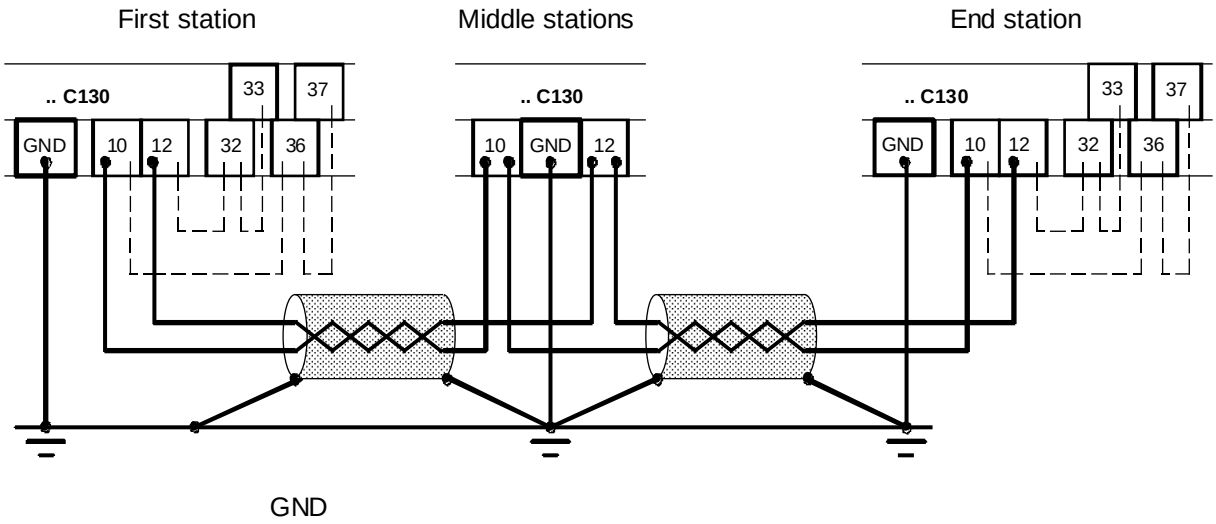
VOZ = 0.9 V min ... 1.7 V max (no driver active)
VOH = 2 V min (with load) to 5 V max (without load)
VOL = –2 V ... –5 V

*) Serial interface no. 1 works as RS 422 by assignation in the SASI modes MC0 to MC3 or MD0/SD0. Using the assignation in the SASI modes MC4 or SM1/SS1 the interface no. 1 works as RS 485.

Connection example for RS 485 and S-Bus

RS 485 is a multi-point standard, which usually connects more than two stations. Screened twisted pair cable of at least 2 x 0.5 mm^2 should be used, wired in accordance with the diagram below. Note that terminal 10 is always connected to terminal 10, and terminal 12 to 12.

The cable's screening must always be connected at both ends, to produce a continuous, solid earth line, and so reduces potential differences to a minimum.

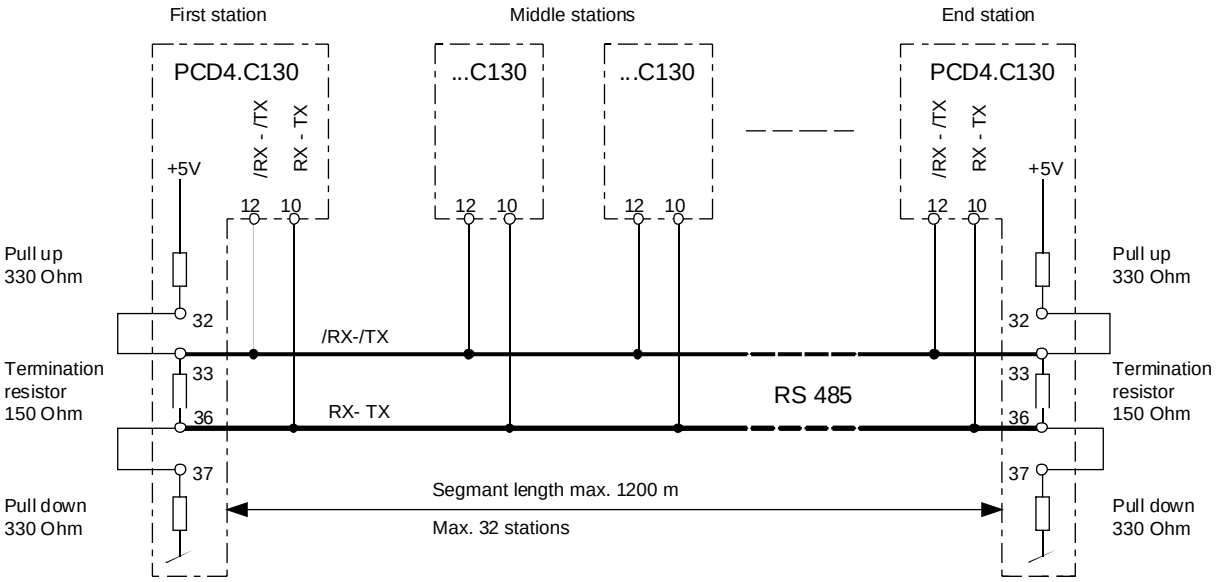


It is recommended that the RS 485 cable is not laid in direct proximity to motor cables which may produce interference, unless these cables are also well screened.

See also the manual "Installation components for RS 485 networks", order code 26/740 E.

Line termination resistors for RS 485 and S-Bus

To suppress noise and avoid reflections, every PCD4.C130 bus module incorporates damping resistors, which should be connected according to the following diagram. Spur cables must not exceed 0.5 m.



Important : If a network is expanded or an end station is replaced, care should always be taken to ensure that the ends correspond to the above diagram.

See also the manual "Installation components for RS 485 networks", order code 26/740 E.

3.4 Bus module PCD4.C340 for supply, processor, 4 I/O modules and 3 serial interfaces

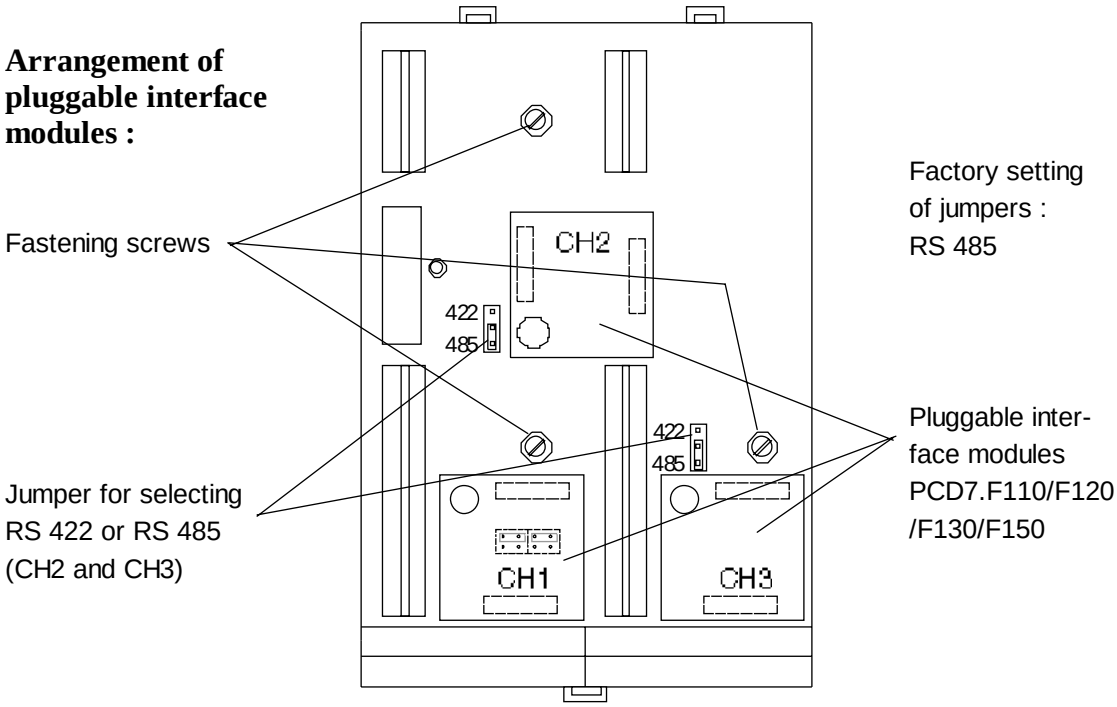
The PCD4.C340 bus module has 6 sockets :

Socket no. 1	for power supply module PCD4.N2..
Socket no. 2	for processor module PCD4.M..
Socket no. 3 to 6	for I/O modules, ..W and ..H modules

The 3 interfaces can be fitted with the required pluggable interface modules PCD7.F1x0

- ..F110 (RS 422 / RS 485)
- ..F120 (RS 232)
- ..F130 (20 mA current loop)
- ..F150 (RS 485 electrically isolated)

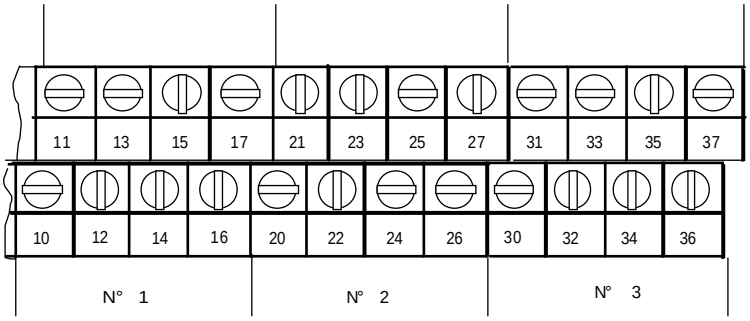
Arrangement of pluggable interface modules :



The interface modules can be reached by removing the plastic cover of sockets 1 and 2 (far left cover), which is fastened with 3 screws. The interface modules are now accessible and can be manipulated. After completion of assembly, the cover should be screwed down again.

Connection of the supply, watch dog and reset ("External Reset") is the same as for the PCD4.C1x0 bus modules and can referred to in section 3.2. Connection of the I/O modules is as described in section 3.5.

Connections for the serial interfaces, terminals 10 to 37 :



Each interface occupies 8 terminals :

Interface no. 1 : Terminals 10 … 17 (x = 1)
Interface no. 2 : Terminals 20 … 27 (x = 2)
Interface no. 3 : Terminals 30 … 37 (x = 3)

Caution ! The pin configurations of the PCD4.C340 are not the same as the pin configurations of PCD4.C1x0 bus modules !

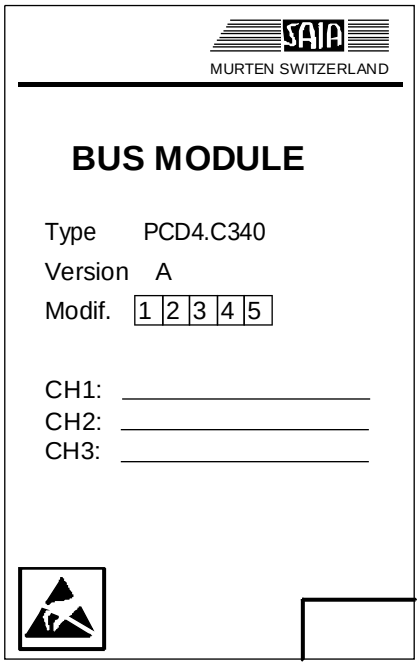
Terminal	Pluggable interface modules				
	PCD7.F110 RS 422	PCD7.F110 RS 485	PCD7.F120 RS 232	PCD7.F130 20 mA CL	PCD7.F150 RS 485
x0	TX >	D	TX >	TS >	D
x1	/ TX >	/ D	RX <	RS >	/ D
x2	RX <		RTS >	TA <	
x3	/ RX <		CTS <	RA <	
x4	RTS >		DTR > *)	TC >	
x5	/ RTS >		DSR < *)	RC >	
x6	CTS <		RSV > *)	TG >	SGND
x7	/ CTS <		DCD < *)	RG >	
GND		GND			

*) These signals can only be used if the interface module PCD7.F120 is plugged onto communications interface no. 1 (CH1).

Important : The PCD7.F110 interface module can only be configured at interface no. 1 with application software as RS 422 or RS 485.

For interfaces no. 2 and 3 the function must be defined with the jumper "RS 422/RS 485" on the PCD4.C340 bus module when the interface module is installed.

Nameplate :



The actual configuration should be entered on the nameplate of the module.

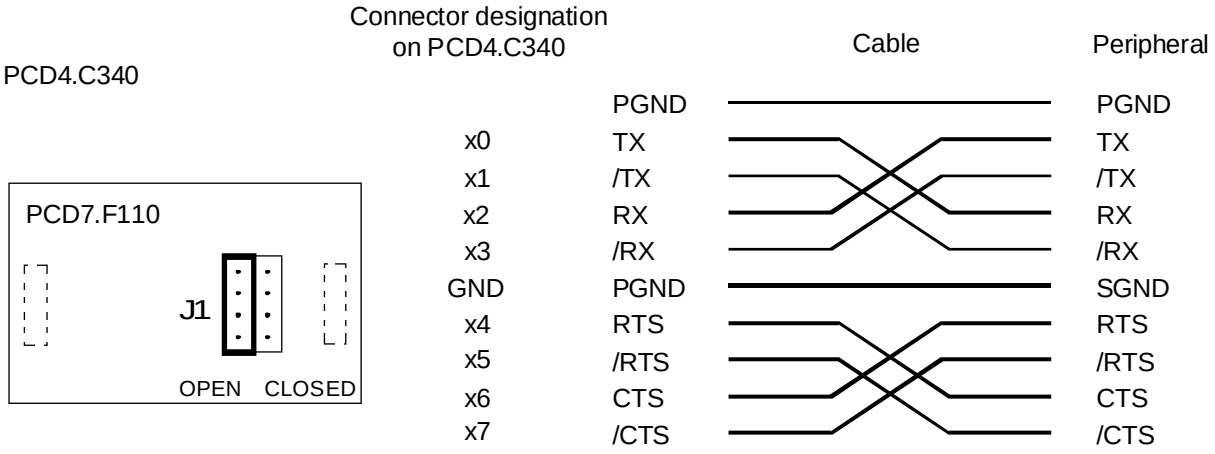
Connection examples :

As connection examples, refer to the specific serial interfaces in the following pages.

3.4.1 Interface RS 422 / RS 485 with module PCD7.F110

- **Connection for RS 422**

Point-to-point communications in all modes with the exception of MC4 and SS../SM.. (S-Bus) modes.



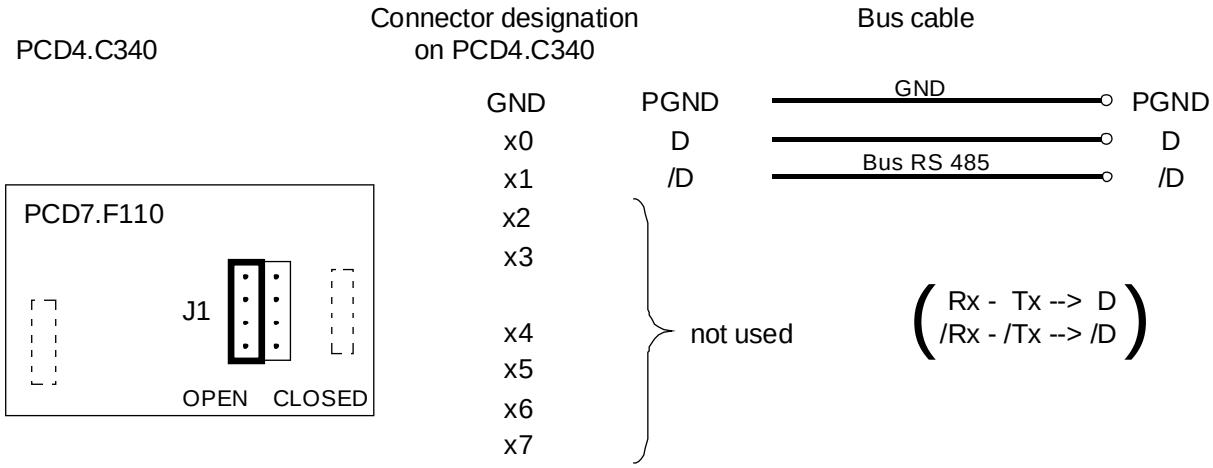
Note :

- For RS 422 each pair of receiver lines is terminated on the ..F110 module with a 150 Ω line termination resistor.
- For this, jumper J1 must be left in the "OPEN" position (factory setting). The jumper J1 is located on the rear side of the F1-board.

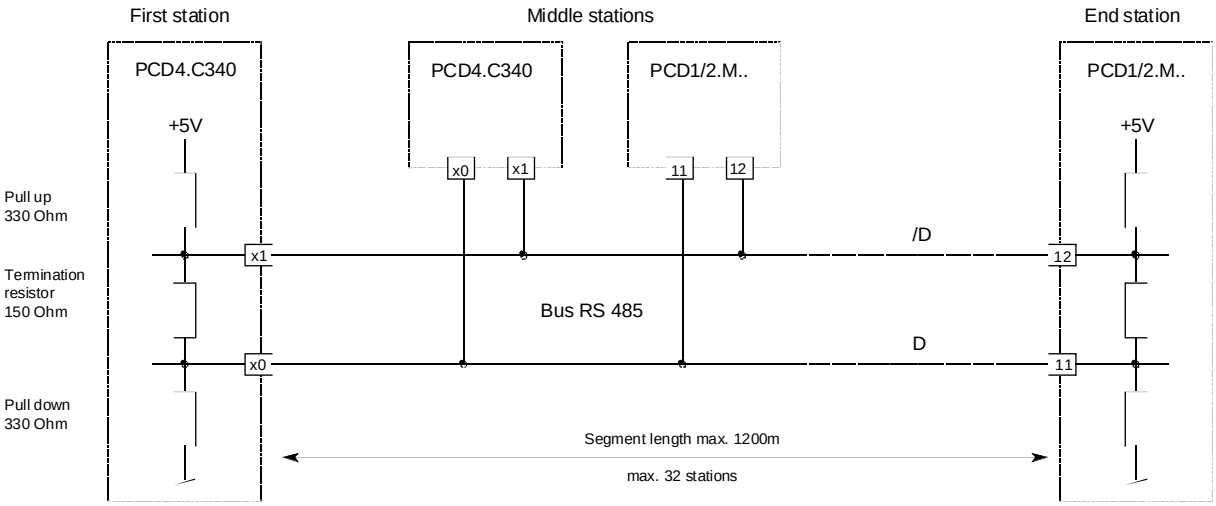
- **Connection for RS 485 and S-Bus**

In order to define the interface according to RS 485, the SASI instruction must be used to select one of the following modes :

- MC4 : RS 485 in C mode
- SS../SM.. : RS 485 in S-Bus mode



Selection of line termination resistors



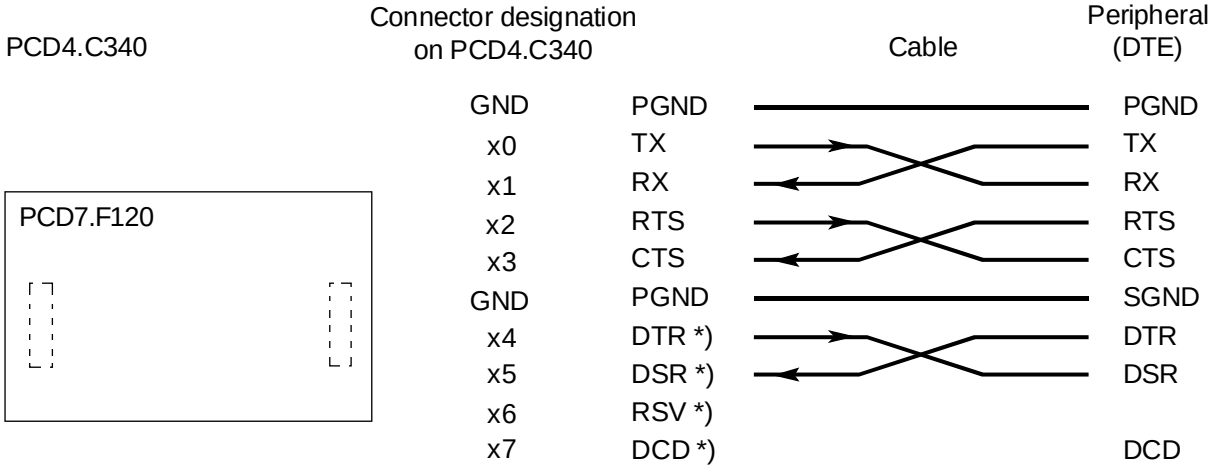
Note :

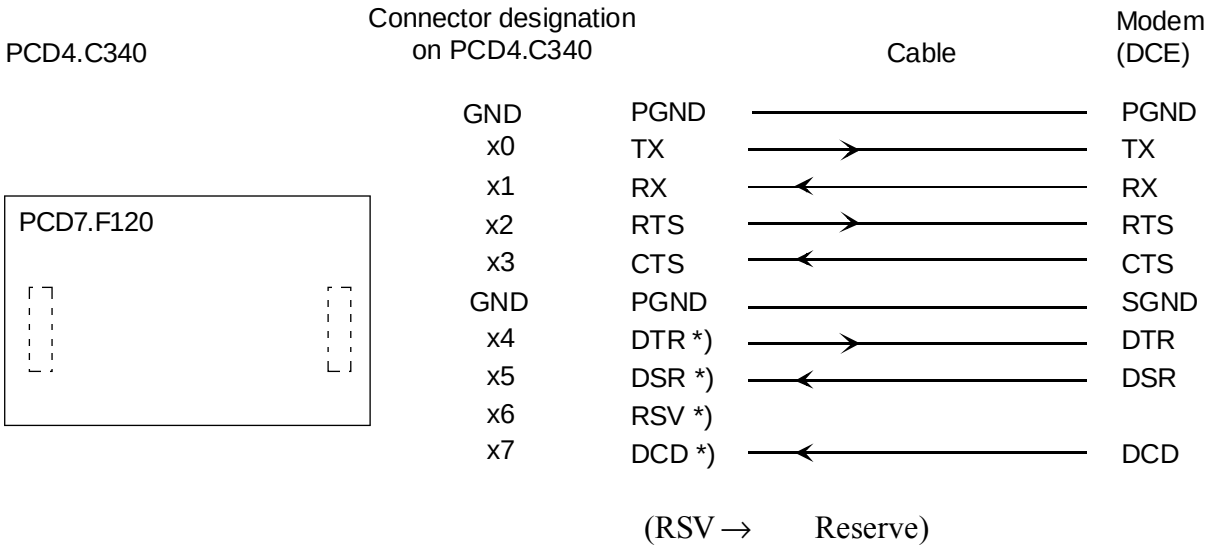
- At the first and last stations jumper J1 must be set to the "CLOSED" position.
- For all other stations, jumper J1 must be left in the "OPEN" position (factory setting).
  The jumper J1 is located on the rear side of the F1-board.

See also manual "Installation Components for RS 485 Networks", order code 26/740 E.

3.4.2 Interface RS 232 with module PCD7.F120

This interface allows a connection to a modem





*) These signals can only be used, if the interface module PCD7.F120 is plugged in on place (CH1).

DTE : **D**ata **T**erminal **E**quipment

DCE : **D**ata **C**ommunication **E**quipment

3.4.3 Interface 20 mA current loop with module PCD7.F130 *)

Terminal	x0 :	TS	Transmitter Source	Transmitter
Terminal	x2 :	TA	Transmitter Anode	
Terminal	x4 :	TC	Transmitter Cathode	
Terminal	x6 :	TG	Transmitter Ground	
Terminal	x1 :	RS	Receiver Source	Receiver
Terminal	x3 :	RA	Receiver Anode	
Terminal	x5 :	RC	Receiver Cathode	
Terminal	x7 :	RG	Receiver Ground	

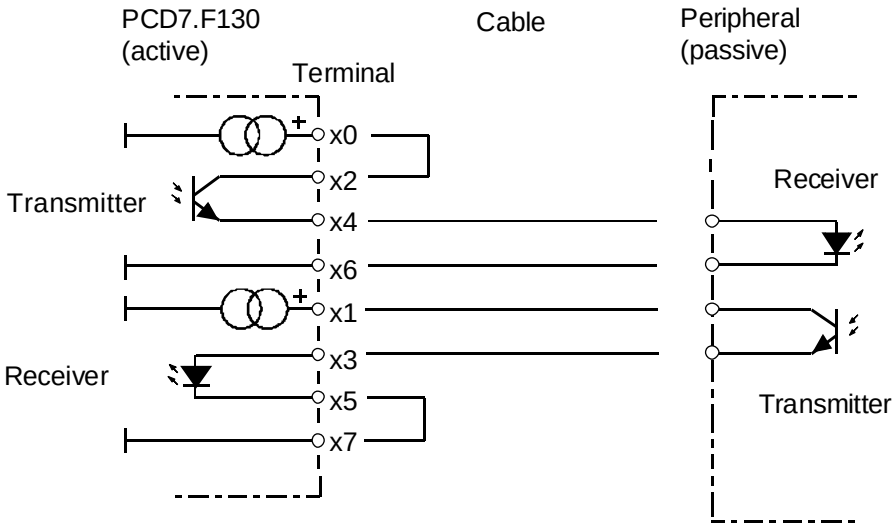
Signal type	Required value	Nominal value
Power for logic L (space)	–20 mA ... + 2 mA	0 mA
Power for logic H (mark)	+12 mA ... +24 mA	+20 mA
Neutral Voltage on TS, RS	+16.0 V ... +24.0 V	+24.0 V
Short circuit power on TS, RS	+18 mA ...+29.6 mA	+23.2 mA

The idle state for data signals is "mark".

The user selects "active" or "passive" switching by means of wire jumpers on the screw terminals.

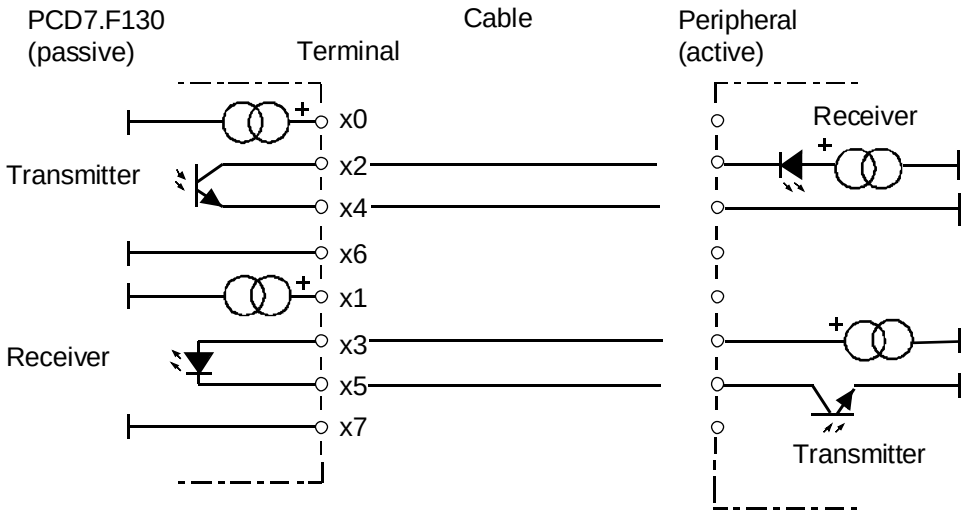
Connection examples for 20 mA current loop

a) PCD4 Active

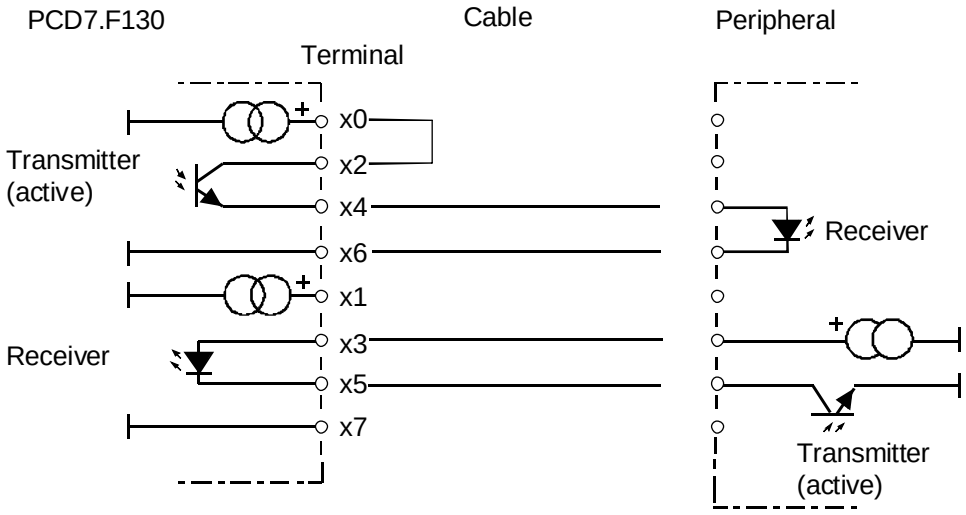


*) max. baud rate for 20 mA current loop limited to 9600 Baud

b) PCD4 Passive



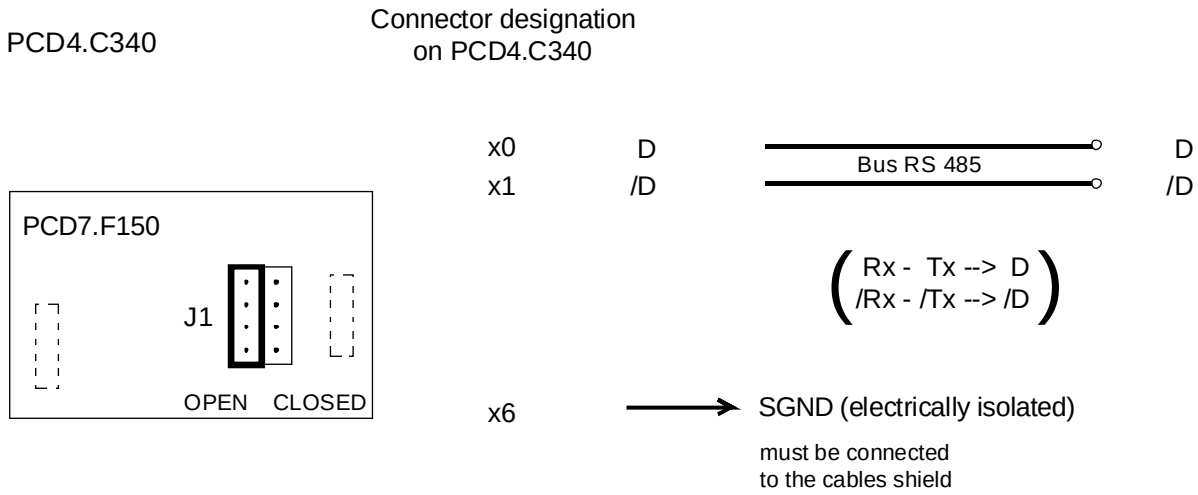
c) PCD4 transmitter and peripheral transmitter active



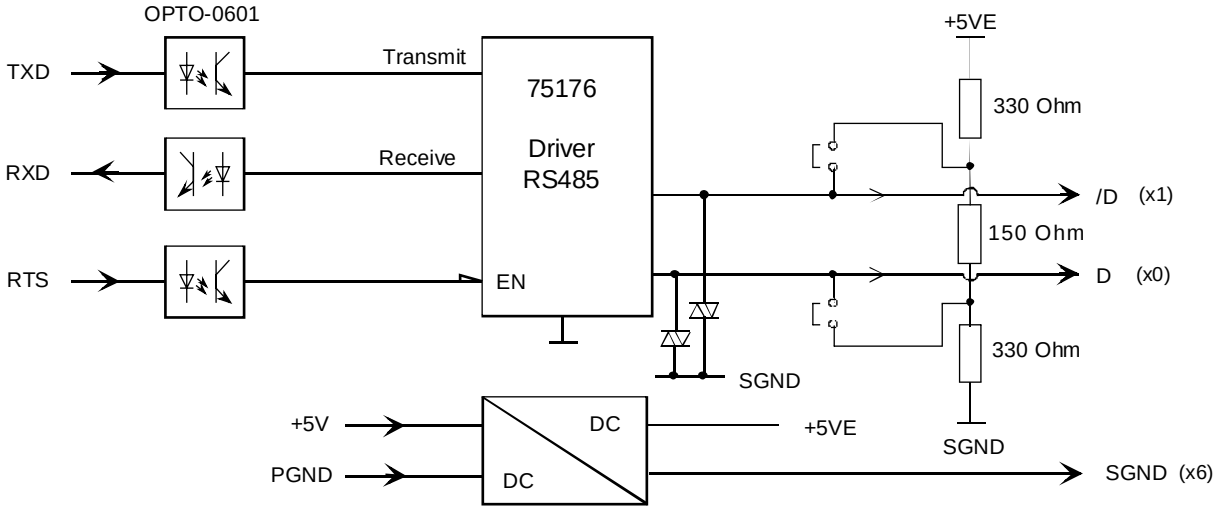
3.4.4 Interface RS 485, electrically isolated, with PCD7.F150

Electrical isolation is achieved with 3 optocouplers and a DC/DC converter. Data signals D and /D are each protected against overvoltages by a suppressor diode (10 V). The line termination resistors can be connected or disconnected with the jumper J1.

Connection



Block diagram



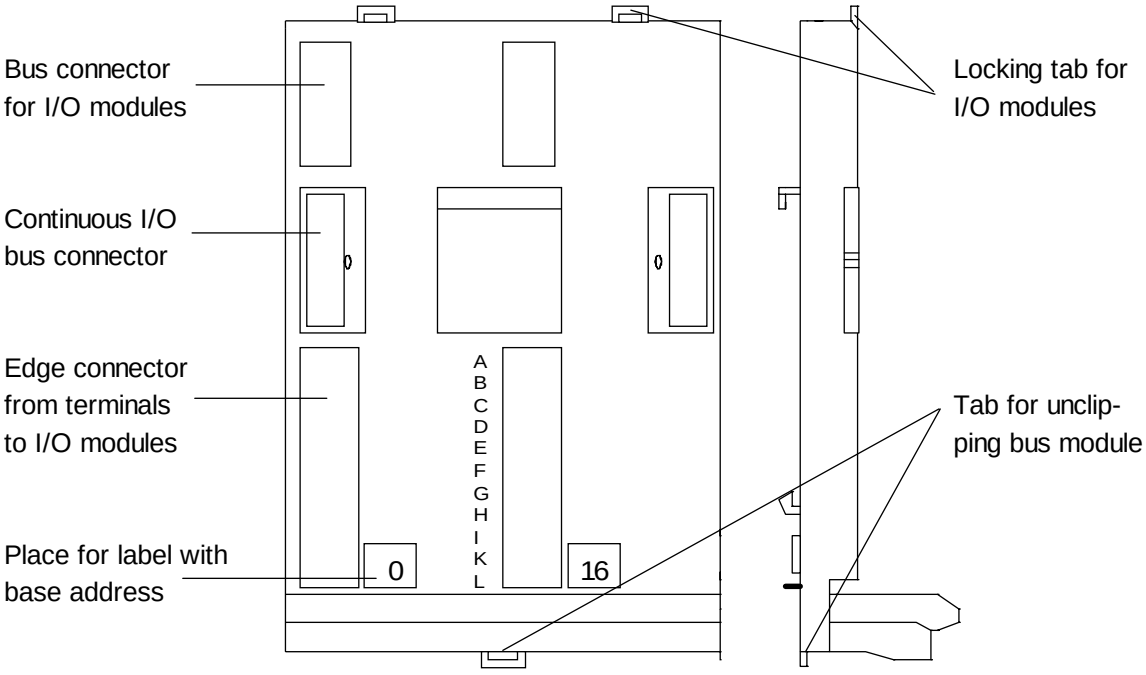
Note : Common mode voltage :
50 V, limited by capacitors between the data lines and SGND (on the base module)

For the installation, see the manual "Installation components for RS 485 networks", order code 26/740 E.

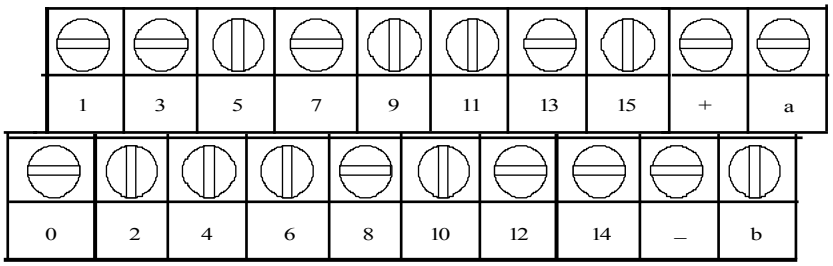
3.5 Bus modules PCD4.C2x0 for input/output modules

There is a choice of three types :

- PCD4.C220 : for attaching 2 add-on I/O modules
- PCD4.C260 : for attaching 6 add-on I/O modules
- PCD4.C225 : for coupling the PCD4 I/O modules in expansion to a **PCD2.M…**
  (see description in the chapter 3.6)



Screw terminal assignment of PCD4.C2x0 bus modules



The designations of screw terminals are the same for all PCD4.C2x0 bus modules.

The terminals for other I/O and special modules have different assignments. Consult the data sheets for the module.

See chapter 3.1 for the information regarding the wire sections and rated current of the terminals and PCB connectors.

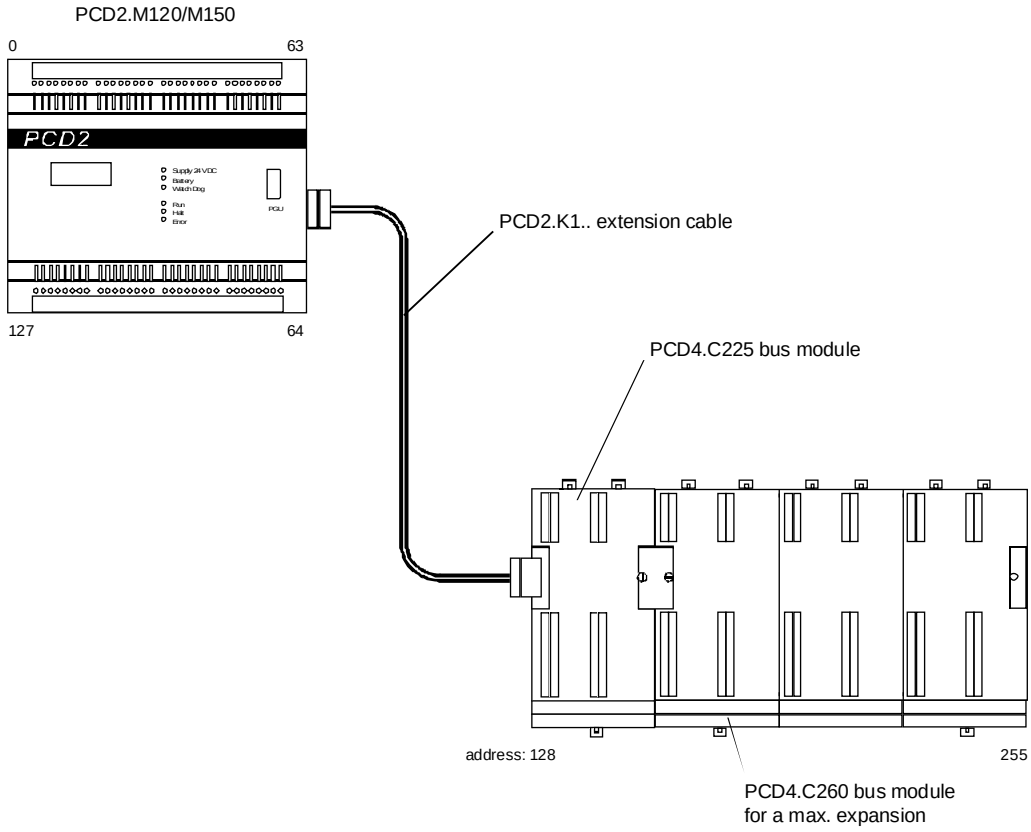
3.6 Bus module PCD4.C225 for coupling the PCD4 I/O modules in expansion to a PCD2.M…

The PCD4.C225 bus module version 'A', enables the manual control modules PCD4.A810, PCD4.A820 and PCD4.W800 (which are mainly used in building automation) to be coupled to the PCD2 series.

From version 'B' on, all PCD4 I/O modules with exception of ..H3/..H4 and ..W1/..W3/..W4 (±15 V not wired) can be used (see table next page).

The PCD4.C225 has 2 module sockets. On the left of the module it is connected by the PCD2.K1x0 extension cable to the PCD2.M... .
On the right of the module it is possible, as with every PCD4.C1x0 or ..C340 bus module, to connect an additional PCD4.C2x0 bus module via the PCD4 bus extension connector. Expansion can take place up to a maximum of 8 modules (3 x PCD4.C220 or 1 x PCD4.C260).

The PCD2 expansion cable PCD2.K1x0 is available in different lengths. The cable with the maximum length of 2 m, order reference PCD2.K120, is provided for local assembly of the PCD4.C225 with the PCD2.M… .
It is, of course, also possible to use the shorter cable (..K100/..K110).



As with a PCD2.C100 expansion unit, addressing of the PCD4.C225 starts at 128 and extends, if fully equipped with a maximum of 8 modules, to 255. If an attempt is made to fit a 9th module, addressing starts at zero and then runs parallel to the address range of the PCD2.M… base module (addresses 0 - 15).

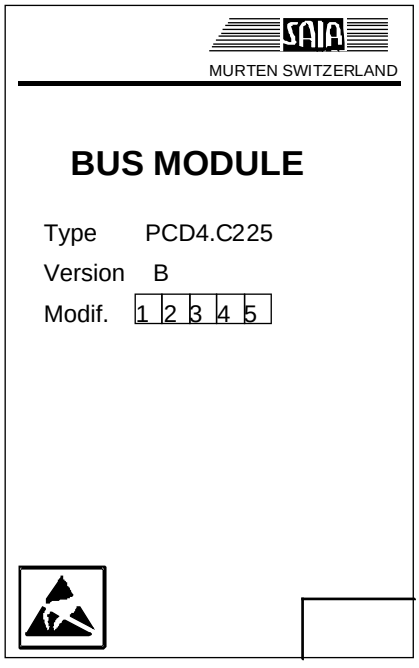
Caution :  It should be noted that, due to addressing conflicts with the watch dog, some restrictions for the 8th socket (addresses 240 - 255) or for address 255 only have to be respected (see table below).

Restrictions regarding the use of the PCD4 I/O modules :

Modules not allowed on the 8th socket	Modules not allowed to work address 255	Modules not possible to use on PCD4.C225
PCD4.A810	PCD4.A250	PCD4.H3xx
PCD4.H120	PCD4.A400	PCD4.H4x0
PCD4.H2x0	PCD4.A410	PCD4.W100
PCD4.W500	PCD4.B900/B901	PCD4.W300
PCD4.W600	PCD4.E110/E11x	PCD4.W400
	PCD4.E600/E601	

Current is supplied exclusively via the PCD2's +5 V supply.

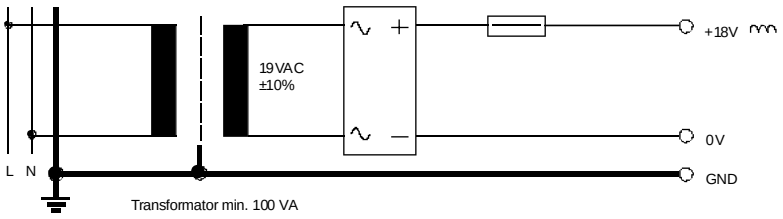
Nameplate :



3.7 Power supply and connection plan

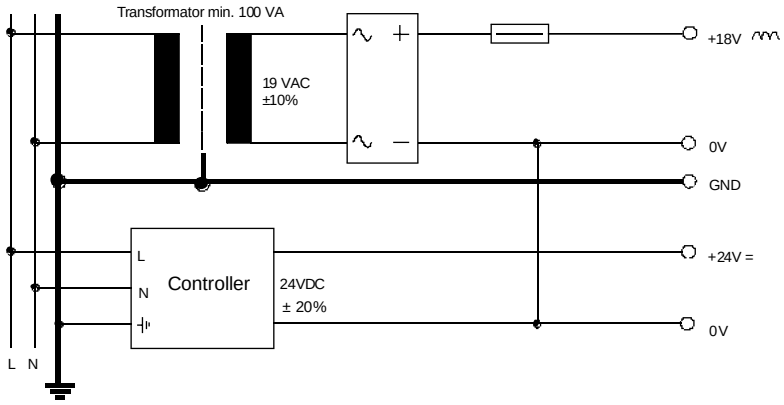
3.7.1 External power supply

- **Application : simple and small installations**



- Sensors	Electromechanical switches
- Actuators	Relays, lamps and small valves with < 0.5 A switching current
- For modules	PCD4.N2.., PCD4.M1.., PCD4.M4.. PCD4.E1.., E6.., A2.., A4.., A8.., B9.. PCD4.W1.., W3.., W4.., W8..

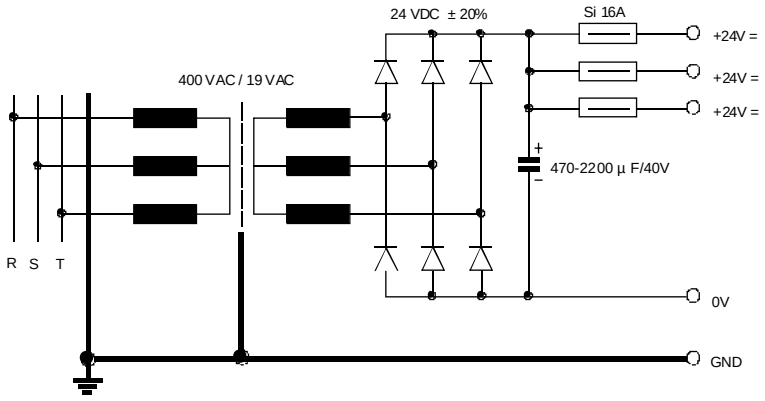
- **Application : small to medium installations**



- Sensors	Electromechanical switches, proximity switches and photoelectric barriers
- Actuators	Relays, lamps, displays and small valves with < 0.5 A switching current
- For modules	PCD4.N2.., PCD4.M1.., PCD4.M4.. PCD4.E1.., E6.., A2.., A4.., A8.., B9.. PCD4.W1.., W3.., W4.., W5.., W6.., W8.. PCD4.H1.. *), H2.. *), H3.. *), H4.. *) PCD7.D1.. *), D2.. *), PCA2.D12 *), D14 *)

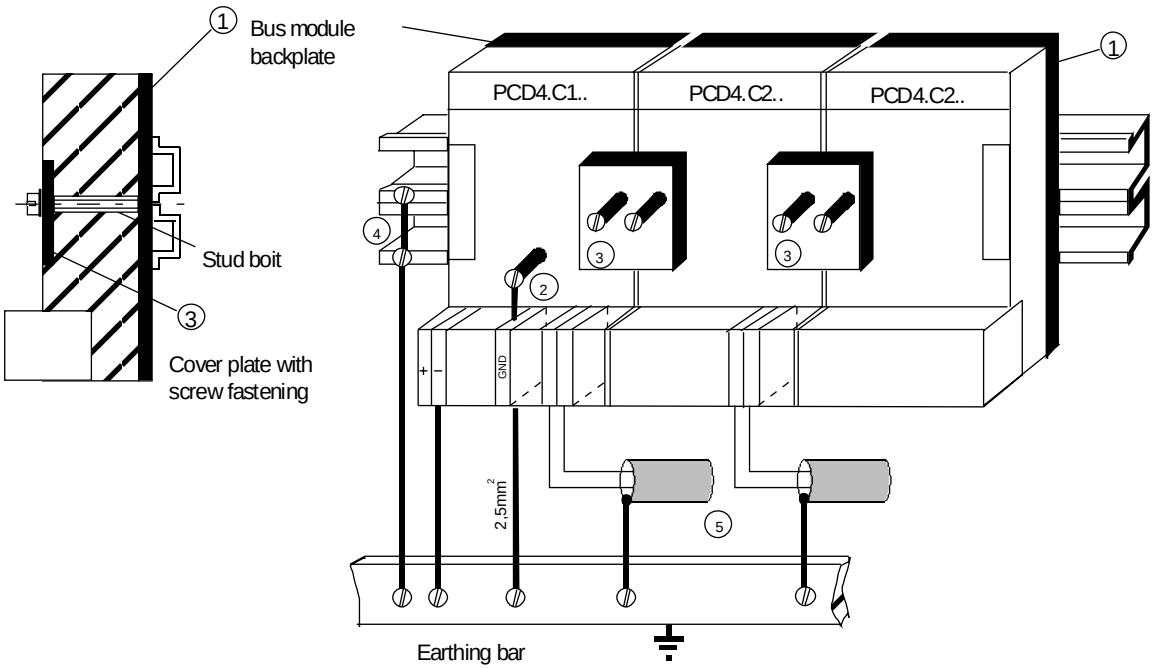
*) These modules must be connected to 24 VDC smoothed.

- **Application : medium to large installations**



- Sensors	Electromechanical switches, proximity switches and photoelectric barriers
- Actuators	Relays, lamps, large valves and large contactors with consumption up to 2 A
- For modules	PCD4.N2.., PCD4.M1.., PCD4.M4.. PCD4.E1.., E6.., A2.., A3.., A4.., A8.., B9.. PCD4.W1.., W3.., W4.., W5.., W6.., W8.. PCD4.H1.., H2.., H3.., H4.. PCD7.D1.., D2... PCA2.D12, D14

3.7.2 Grounding plan



1) The bus module backplate forms the continuous protective ground (PGND) of the PCD4 system.

2) The stud bolt connects the protective ground to the bus module, which should be well connected to the earthing bar using the shortest possible length of 2.5 mm^2 wire.

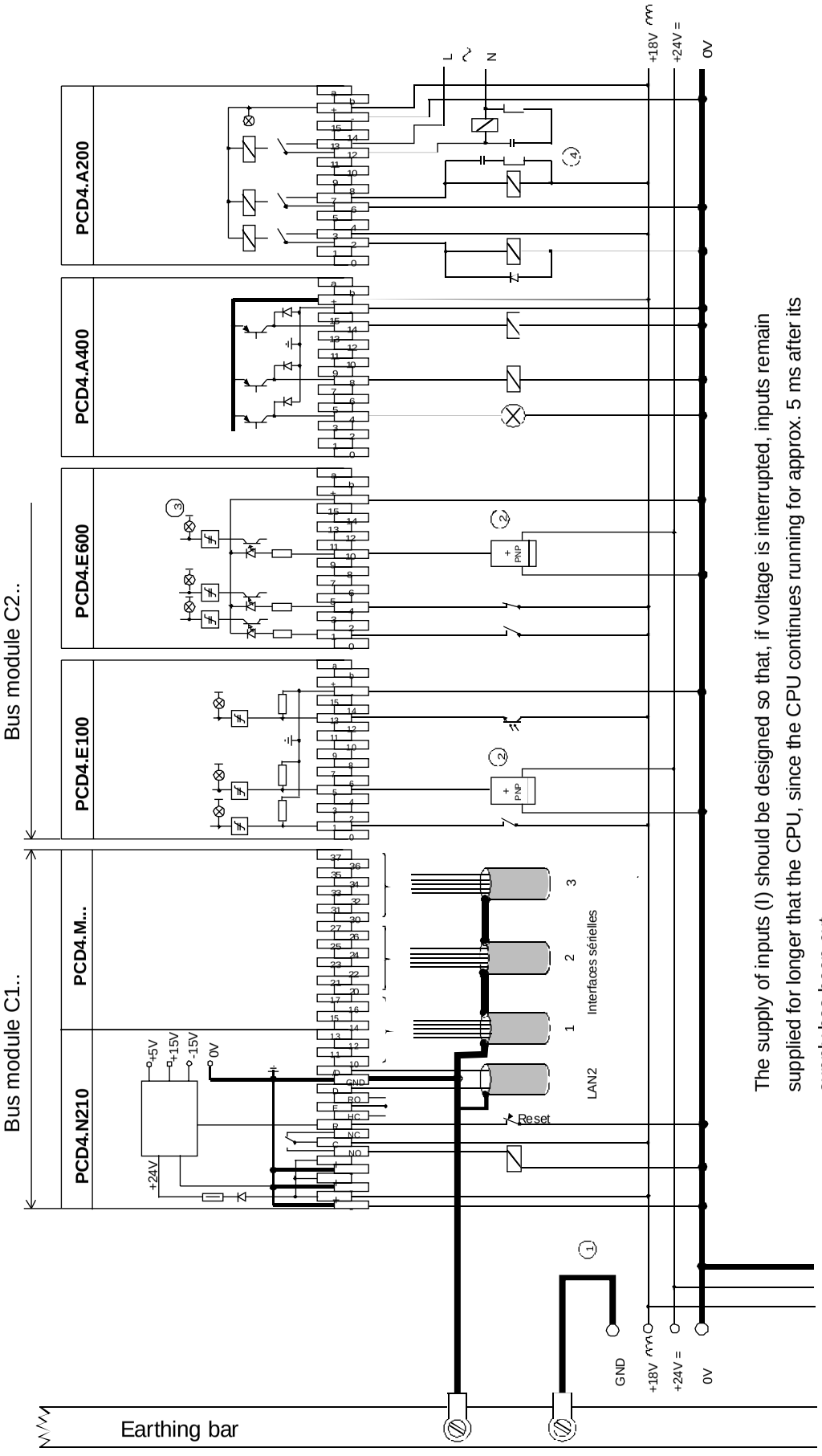
3) The cover plates provide the earth connection between each bus module. It is important that the fastening screws are properly tightened: the lock washers ensure good contact.

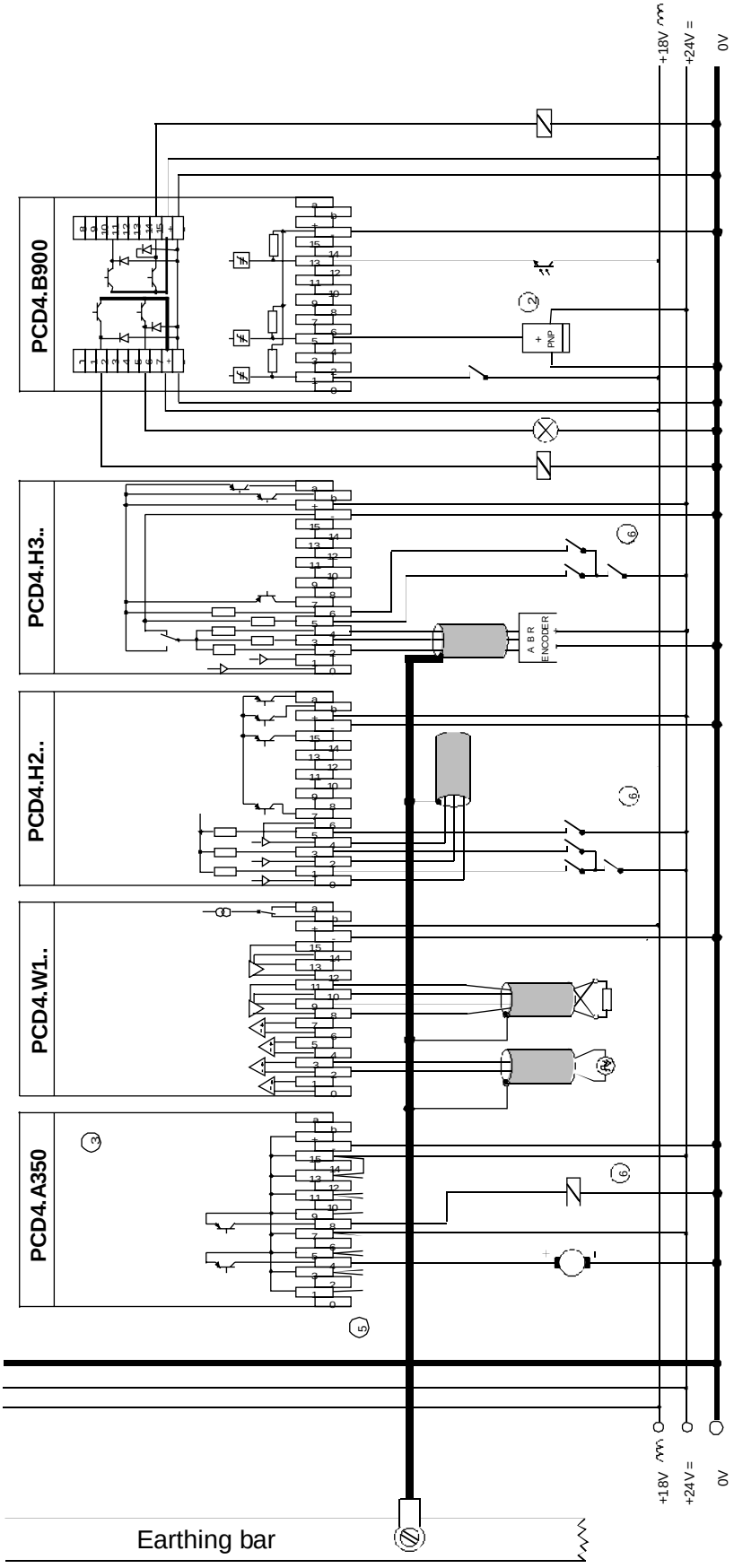
4) It is also advisable to connect the mounting rails to the earthing bar. The negative terminal (–) should also be earthed.

5) Cable screening (RS 485 cables or those for ..H and ..W modules) should also be connected to the earthing bar.

	**Importante note :** To function perfectly, every PCD4 system must absolutely be connected in accordance with the above grounding plan.

3.7.3 Connection plan





1) Use a power supply with 3-phase transformer and bridge rectifier allows all inputs and outputs to be supplied from the same source. In this case, the two lines "+18V rectified" and "+24V= smoothed" can be viewed as a single shared line.

2) Regulated voltage is only necessary if required by the transmitting device. For example proximity switches demand narrower voltage tolerances and cannot generally cope with more than 10% ripple.

3) The galvanically isolated modules A350 and E600 can be supplied by separate circuits, as long as the potential difference to system ground does not excess 50V.

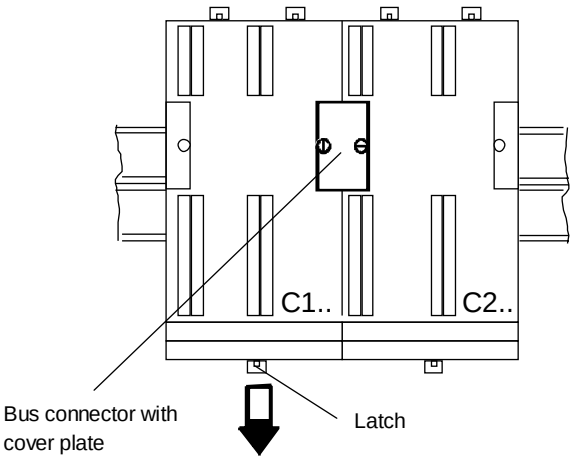
4) If relay modules are used, an external RC spark protection is recommanded, particulary when switching inductive loads. Apart from avoiding undesired noise, this has the adventage of incrasing the lifespan of the contacts. It is only permissible to connect either extralow voltages or low voltages to the same relay module (see instructions for installation in the detailed description of the A200 module).

5) The positive terminals on the A350 module should be connected together (despite the internal connection). This prevents the current on an individual PCB contact from exceeding 2A.

6) The entire 24 VDC supply can (especialy for small systems) be provided by rectified direct current. However, smoothed direct curent is required for electronically protected outputs (A350) as well as for input modules with a typical input delay of less than 6 ms (e.g.. E101, B901, H120, H2.., H3.., PCA2.D12 and D14).

3.8 Quick guide to handling the PCD4

3.8.1 Bus module assembly

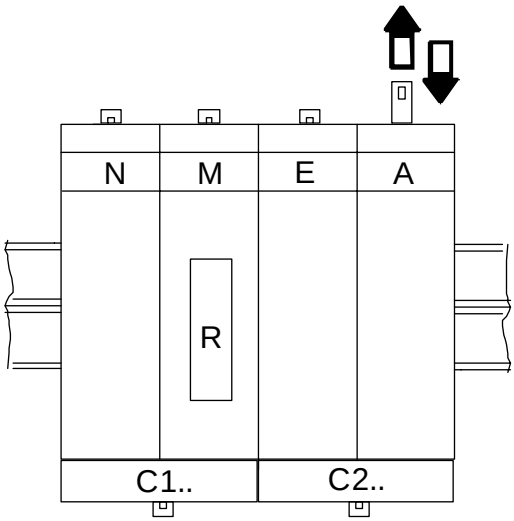


1) Snap the bus module PCD4.C1x0 or ..C340 onto the DIN double mounting rail (by pulling the lower latch down).

2) Then snap a PCD4.C220 or ..C260 bus module to the right of it.

3) Supplied with the ..C2x0 you will find :
   - the bus connector
   - the bus connector cover plate
   Insert the bus connector and push home at each end, and firmly tighten both screws on the cover plate (ground connection)

- **Inserting plug-in modules**



4) To plug in the modules :
   - pull the top latch upwards as far as it will go
   - push then module in all the way
   - push the latch down again

   The following modules can be used :

- position N : (supply)	PCD4. N200 PCD4. N210
- position M : (processor)	PCD4. M110 PCD4. M125/M145 PCD4. M445

with on

- position R : (memory)	PCD7. R210/R220 PCD7. R310
(Caution :	take care that the jumper is **not** in position WR)

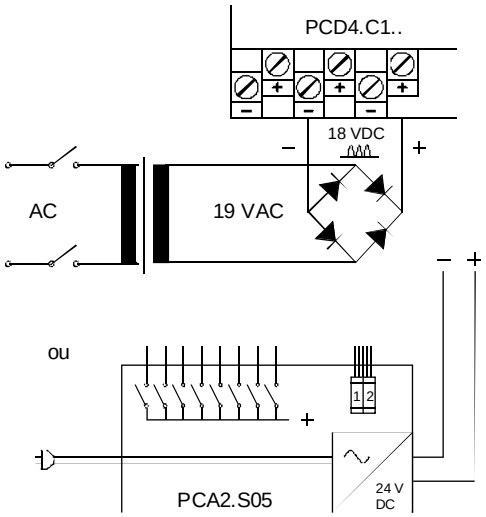
or

- position M :	PCD4.Mx70

with on

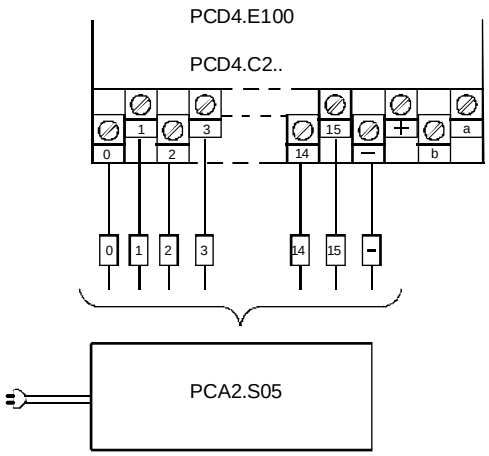
- position R :	PCD7.R400
- position E : (inputs)	PCD4. E110/E11x PCD4. E600/E601 PCD4. B900/B901
- position A : (outputs)	PCD4. A200/A250 PCD4. A350 PCD4. A400

- **Connection of power supply**



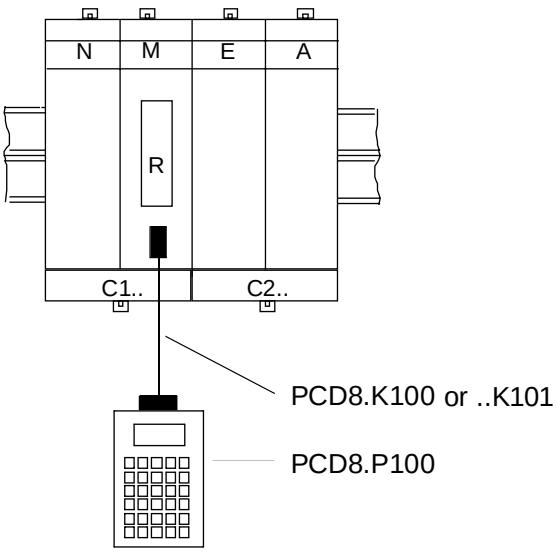
5) Connect 24 VDC smoothed or 18 VDC full wave rectified to terminals + and –. For small-scale requirements, 24 VDC at 0.5 A is adequate. An easy way to do this is to use the PCA2.SO5 input simulator (no longer available), which not only provides 16 input switches but also offers 24 VDC.

- **Connection of inputs**



6) The PCA2.SO5 applies +24 VDC to inputs 0 to 15 via the switches.
This can also be obtained from an external power source.

- **Connection of PCD8.P100 programming unit**



7) Use cable PCD8.K101 to connect the PCD8.P100 programming unit to the PGU interface.
(or the former ..K100 cable).

3.8.2 Entering a lamp flasher program

8) Switch on 24 VDC. After completion of the power up tests, the P100 indicates status "STOP". All processor LEDs are off.

- C P ENTER ALT Y

9) As a precaution, user memory should be cleared before entering the program. This is done with the "Clear Program and texts" command, by pressing the keys shown.

- W P 0 ENTER

```
(0) COB                          SP  0  ENTER
                                 SP  0  ENTER
    STH   SP  SP  I              SP  3  ENTER
    ANL   SP  SP  T              SP  9  ENTER
    LD    SP  SP  T              SP  9  ENTER
                                 SP  5  ENTER
    COM   SP  SP  O              SP  16 ENTER
    ECOB                             ENTER
```

10) Type : "Write", "Programm", <address> 0, "ENTER".

11) The program can now be entered starting from address 0.
Incorrect entries can be deleted by pressing "ALT" and "DEL" simultaneously ("ALT+DEL").

Note : The P100 always indicates both Timers "T" and Counters "C" with a "C"..

- **Cold start and RUN**

HOME ALT
E C ENTER Y
R ENTER

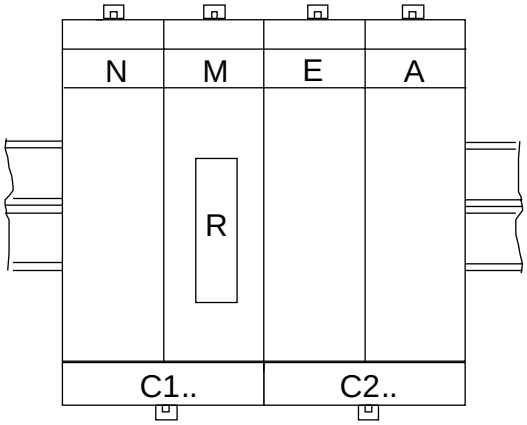
12) Next, a cold start must be done, then the PLC can be put into "RUN".

- **Program**

```
COB  0    ; Start of Cyclic
     0    ;  Organization Block 0
---------------------------------
STH  I 3  ; If input 3 high
ANL  T 9  ; and timer 9 timed out
LD   T 9  ; then timer 9 starts
       5  ;  again with 0.5 sec
COM  O 16 ; and toggles output 16
---------------------------------
ECOB      ; End of Cyclic
          ;  Organization Block
```

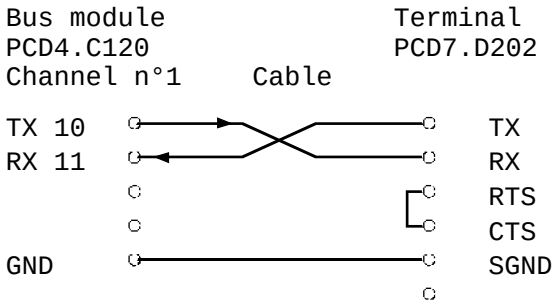
13) The "RUN" LED on the processor module goes on : the program is now running. If input 3 is switched on, output 16 will flash at the rate 0.5 sec on and 0.5 sec off.

3.8.3 Outputting texts to the PCD7.202 terminal via the RS 232 serial interface

- 

14) The following modules must be present for channel 1 to be used as an RS 232 interface :

- bus module PCD4.C120 or ..C340 with interface PCD7.F120
- processor module PCD4.M125/ M145/M445 or PCD4.Mx70 series
- output module PCD4.A400

- 

15) Make up the cable for connecting the PCD4 and the terminal in MC0 mode (no control lines needed).

Do not forget the RTS-CTS jumper on the PCD7.D202

or use the cable PCD7.K422

- 16) Provide a 24 VDC supply to the terminal.

- [S] [ENTER]

17) To enter the additional program, put the CPU into "STOP". The "RUN" LED on the processor module should go out.

- [W] [P] [0] [ENTER]
  [ALT] [ALT] [ALT] [ALT] [ALT]
  [INS] [INS] [INS] [INS] [INS]

18) Entering the text output program on the P100.

By simultaneously depressing the "ALT" and "INS" keys ("ALT+INS") we first insert five blank lines before the COB, in which we enter the code shown to initialize the interface (channel 1 is initialized from the definition in TEXT 100).

```
XOB    16
SASI   1   ; assign channel 1
       100 ;  from text 100
EXOB
```

- [▼] ,,, 14 ECOB

```
STH  O  16  ; if O 16 High
DYN  F  0
ANK  O  30  ; and XBSY Low
CFB  H  2   ; output text
ECOB        ; from PB 2

PB      2   ; Program Block 2
STXT    1   ; output to channel 1
        1   ; the text number 1
EPB
```

19) Use the down arrow key to step down to line 14, and overwrite line 14 and subsequent lines with the program shown.

Note : After instructions such as STH or ANL, the P100 always shows "I" (Input), even if an Output "O" is being referenced.

Text number 1, containing the date and time, should be output to the D100's display every second (synchronized with the flashing lamp).

- [HOME]
  [W] [X] [100] [ENTER]

UART:9600,8,E,1;MODE
:MC0;DIAG:O24.R100

```
24 ●
   ○
   ○
   ○
   ○
   ○
30 ●  XBSY
31 ○
```

20) Now enter the serial interface definition text using : "Write" "teXt" "100"

U → To enter the underlined characters (red alphabetic keys) the "ALT" key must be pressed simultaneously.

Note : If O24 is entered after "DIAG:", 8 diagnostic flags (in this case, outputs) are actually used.
In our example, only O30 is referenced as the "text bus flag" XBSY.

[ALT]
[ENTER]

Save TEXT 100 by pressing "ALT+ENTER" simultaneously.

- [1] [ENTER]

21) The original "Write teXt 100" command is re-displayed.

Now write TEXT 1 by pressing "1" then "ENTER".

- <12> HAVE A NICE DAY
  <13><10> WITH YOUR
  PCD4<13><19> $D<10>
  $H<26>

22) Enter TEXT 1 to produce this display :

HAVE A NICE DAY
WITH YOUR PCD4
91-07-26 (TIME)
(Date) 17:30:42

- ALT + ENTER

23) Save TEXT 1 with "ALT+ENTER".

- HOME, E, C, ENTER, ALT, Y

24) After entering program and text, another cold start must be done to reset the PLC.

- HOME, R, ENTER

25) Select "RUN" from main menu.

- I3 → O 16 blinks and text is output

26) Closing switch I3 not only makes output LED O16 flash, but also outputs the text every second (it may be necessary to correct the time with the "Write clocK" command).
Output O30 is turned on briefly every second, while the text is output (this is the "text busy flag" XBSY).

Notes :

4. The earlier processor modules of the PCD4 series

A range of different processor modules are available for the PCD4, so that the optimal solution for performance and price can be offered for every application.

The processors can be divided into 4 groups which are briefly described below :

The M110 series has 1 processor (10 MHz) and, apart from serial interface 0 for the programming unit (always present) has no other serial interface.

The M1x5 series has 1 processor (16 MHz) and, apart from serial interface 0 for the programming unit (always present) has 1 or 3 additional serial interfaces.

The M445 series has 2 independent processors (multi-processor system, 16 MHz) and an additional PROFIBUS-FMS coprocessor. This series has, apart from the serial programming interface always provided, 3 additional independent serial interfaces. The PROFIBUS-FMS connection takes place via an additional connector on the front panel of the module.

A new Mx70 series based on the technology of the PCD2.M170 (25 MHz) is treated in the chapter 5 of this manual.

Remarks about CPU's from the preceding generation (10 MHz) :

The M1.. series including the processor modules PCD4.M120 and M140 has been replaced by the M1x5 series.

The M2.. series including the processor module PCD4.M240 has been replaced by the M445 series.

The M3.. series including the processor module PCD4.M340 (coprocessor for SAIA® LAN2) has not been replaced (phased out module).

The M4.. series including the processor module PCD4.M440 has been replaced by the M445 series.

4.1 Points common to all processor modules

4.1.1 General

The entire instruction set of the PCD range is available to all processor types. Therefore, every processor allows bit and word processing, integer and floating point calculation and PID control in BLOCTEC, GRAFTEC or as a flow chart. If serial interfaces are present, all communications possibilities can also be used.

All PROFIBUS-FMS functions can be handled with the M445 processor.

Other features are the programmable diagnostics using up to 32 system interrupts (XOBs), and test instructions which can be incorporated into all user programs.

A summary of the combinations of bus and processor modules is found in section 4.4 at the end of this chapter.

4.1.2 Shared characteristics

Microprocessor	M110/M1x5	32-bit µP	68000	10, resp. 16 MHz
	M445	32-bit µP	68340	16 MHz

Number of instructions: More than 100, with four different addressing modes.

Processing time PCD4.M110:

Bit processing :
e. g. : ANH F 0 = 6…10 µs *)

Word processing :
e. g. : ADD R 0, R 1, R 2 = 35…60 µs *)

Processing time PCD4.M1x5/M445:

Bit processing :
e. g. : ANH F 0 = 3.6…6 µs *)

Word processing :
e. g. : ADD R 0, R 1, R 2 = 20…40 µs *)

*) Processing time is affected by the number of active serial interfaces and the speed of data exchange.

per system	Number of I/Os	512
per CPU	Cyclic Organization Blocks (COB)	16
	Index registers	17 x 13 bit (1 for each COB and 1 for all XOB's)
	Exception Organization Blocks (XOB)	Up to 32
	Program Blocks (PB) 1)	300
	Function Blocks (FB) 1)	1000, with run-time parameters
	Sequential Blocks (SB)	32, for GRAFTEC programming with 2000 Steps and 2000 Transitions with up to 32 active parallel branches
	Texts (TX) and Data Blocks (DB)	8000; with up to 3 levels of sub-texts

All user memory (programs, texts, data blocks, flags, registers, counters, timers, etc...) and the hardware clock are located in the memory module PCD7.R1../R3.. .

1) PB and FB calls can be nested up to 7 levels, in any combination.

4.1.3 Operating states of the processor module

Every processor module can have the following operating states :

START, RUN, CONDITIONAL RUN, STOP, HALT and RESET.

Every processor has three LEDs on the front panel :

- RUN Yellow LED
- HALT Red LED
- ERROR Yellow LED

State	LED	Meaning
START	RUN on HALT on ERROR on	Self-check for approx. 1 sec when switched on, or after a "Restart". (Lamp check)
RUN	RUN on HALT off ERROR off	Normal processing of the user program after START, if no PG connected.
COND. RUN	RUN flashing HALT off ERROR off	Conditional RUN. A breakpoint has been set by the debugger (Run Until..) which is not yet satisfied.
STOP	RUN off HALT off ERROR off	If the PCD is on and the PG connected and running the debugger, then the CPU has not yet been put into RUN, or was stopped by the PG. Or a break-point has been satisfied.
HALT	RUN off HALT on ERROR off	Serious error in user program, hardware error or HALT instruction processed, or no program loaded.
RESET	RUN on HALT on ERROR on	The supply voltage is too low or there is an EXTERNAL RESET.
RUN or COND. RUN despite ERROR	RUN on or flashing HALT off ERROR on	A self-check interrupted during the processing of a program and the corresponding XOB is not programmed.

The jumpers "Enable", "Reset Output" and "Halt/Clear" on the PCD4.C1x0 or PCD4.C340 bus module, together with the two switches "Halt, Clear" on the front panel of the supply module PCD4.N2.., can influence the operating state of the processor, or else react to these operating states (e.g. in case of power loss all outputs are set low). The following chapters contain further information on this.

4.1.4 "RESET OUTPUT" - "ENABLE" jumper

If a wire jumper joins the screw terminals RESET OUTPUT (RO) and ENABLE (E) on the supply bus module and the processors (PCD4.C1x0 or PCD4.C340), all outputs of the whole system are set low in case of a HALT or STOP of CPU 0.

This HALT or STOP can be triggered off by the RUN/HALT switch on the supply module PCD4.N210, by the debugger, by the HALT instruction, or as a result of a serious error in a user program.

Note : If this jumper is fitted and the processor is being run in "Trace" or "Run Until" mode at start-up, all outputs are set low after every program stop, which can be very misleading.

Important : If analogue modules of the PCD4.W3.. and W4.. series are being used, **operation in "Trace" mode with this jumper fitted is NOT allowed**, this can lead to incorrect output !

If no jumper is fitted between these terminals, the outputs retain their present state after a HALT or a STOP.

If a processor module with 2 CPUs is being used and CPU 0 goes into HALT, then CPU 1 also goes into HALT. However, if CPU 1 goes into HALT, CPU 0 is not affected and the outputs are not set low, even if the jumper is fitted.

4.1.5 "HALT/CLEAR" - "ENABLE" jumper

If a supply module of the type PCD4.N210 is fitted (this one has one RUN/HALT switch and a CLEAR button on the front panel), both these switches can be made active by inserting a wire jumper between the HALT/CLEAR (HC) and ENABLE (E) screw terminals of the supply and processor bus module (PCD4.C1x0 or PCD4.C340).

If **the RUN/HALT switch** is in the HALT position, both processor modules immediately go into the **HALT state**. This switch has higher priority than the PG commands Run, Trace and Restart. The red "HALT" LED on the processor module is illuminated in the HALT state.

If **the RUN/HALT switch** is switched from HALT to RUN, both processors execute **a cold start**, i.e. the self-check is executed, all volatile elements are set low and the cold start user routine (XOB 16) is executed.

If **the CLEAR button** is pressed while the switch is being switched from the HALT to the RUN position, **all elements, with the exception of the registers, are set low or to zero** (also all non-volatile flags and counters). At all other times the CLEAR button has no effect.

4.1.6 The "EXTERNAL RESET" function

If an 0 volt signal (Ground) is connected to screw terminal "R" (External Reset) of the supply and processor bus module, the processor immediately goes into RESET and all outputs are set low within a maximum of 2 ms, independently of the "Reset Output - Enable" jumper. Removal of the 0 volt signal gives a cold start.

To prevent the processor starting itself up again, this should be done in user software. (e.g. wait at the beginning of XOB 16 until an input is switched on).

This "Hardware Reset" has effects on the voltage monitoring of the power supply module, and works in the same way as the "Reset", if the supply voltage is too low.

4.1.7 The firmware

The firmware (system program) is located on 2 EPROMs numbered "1" and "2" and carry indications of the firmware version number V... .

	Processor module	EPROM type	EPROM access time	Firmware version EPROM "1"	Firmware version EPROM "2"
	PCD4.M110	27C512	≤ 120 ns	V005/1	V005/2
CPU 0	PCD4.M1x5	27C1001	≤ 100 ns	V0E0/1	V0E0/2
CPU 1 *)	PCD4.M445	27C1001	≤ 100 ns	V0E0/1	V0E0/2

*) **Caution !** Do not mixed the firmware CPU 0 and CPU 1, it is not the same.

Firmware is subject to upward compatible firmware changes.

4.1.8 The PGU serial interface

This interface is a 9-pole D-type connector (female). The connector is located on the front panel of every processor module. During commissioning the PGU connector is used with the programming unit. Upon completion of the commissioning phase then the PGU connector can also be used for a general purpose interface as channel 0. (See chapter 3.3.1)

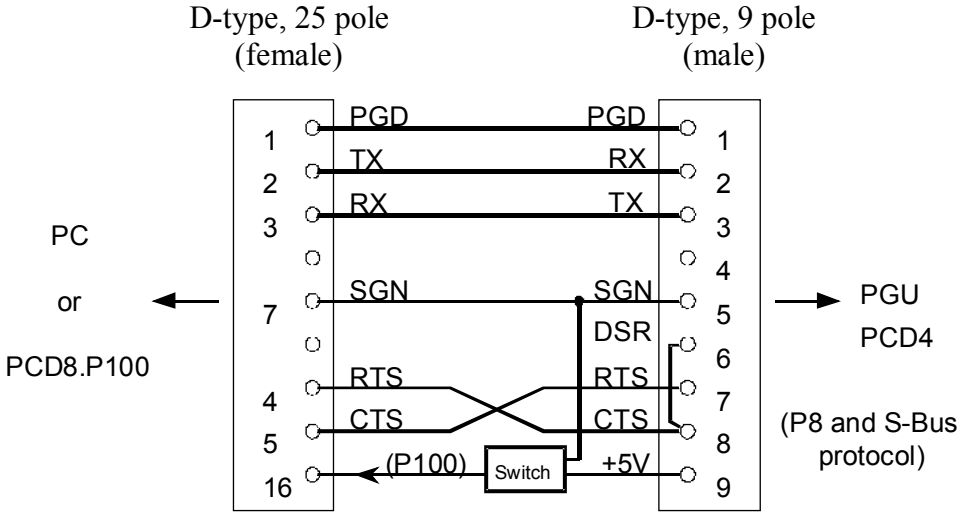
This interface is of the type RS 232.
Pin assignment and data are as follows :

Pin no.	Signal	Meaning
3	TX	Transmit Data
2	RX	Receive Data
7	RTS	Request To Send
8	CTS	Clear To Send
5	SGN	Signal Ground
4	NC	Not Connected
6	DSR	PGU Connected
9	+5V	Supply P100
1	PGD	Protective Ground

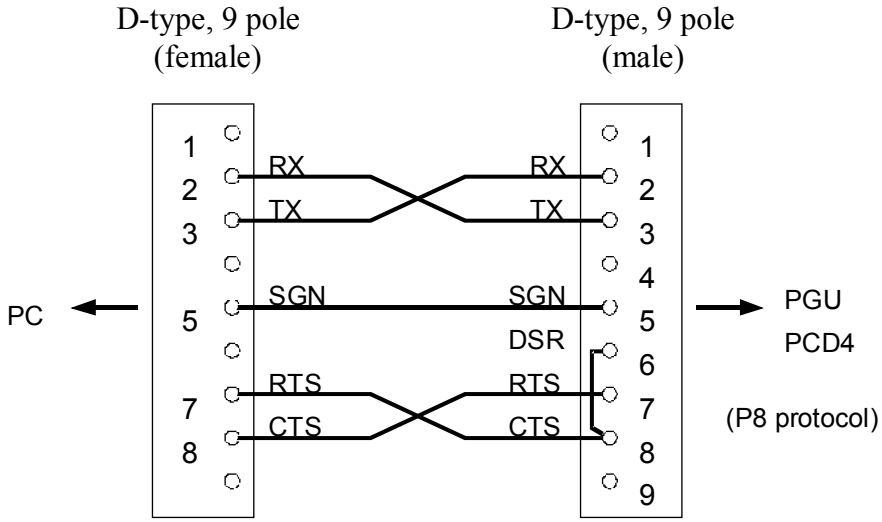
Signal type	Logical state	Required Value	Nominal Value
Data signal	0 (space)	+3 V ... +15 V	+7 V
	1 (mark)	–15 V ... –3 V	–7 V
Control/	0 (off)	–15 V ... –3 V	–7 V
Message signal	1 (on)	+3 V ... +15 V	+7 V

The idle state for data signals is "mark", the idle state for control/message signals is "off".

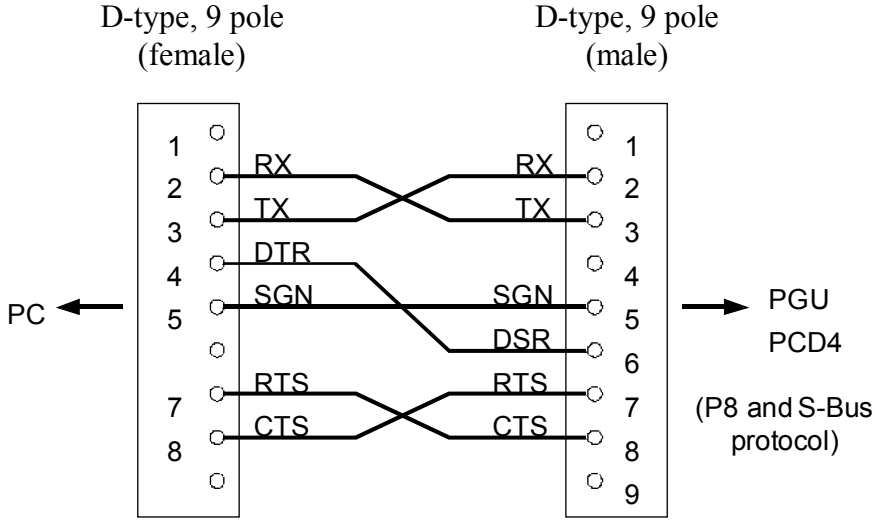
PCD8.K101 connecting cable (for P8 and S-Bus protocol)
(as replacement for ..K100 which cannot be used for PCD1)



PCD8.K110 connecting cable (for P8 protocol)



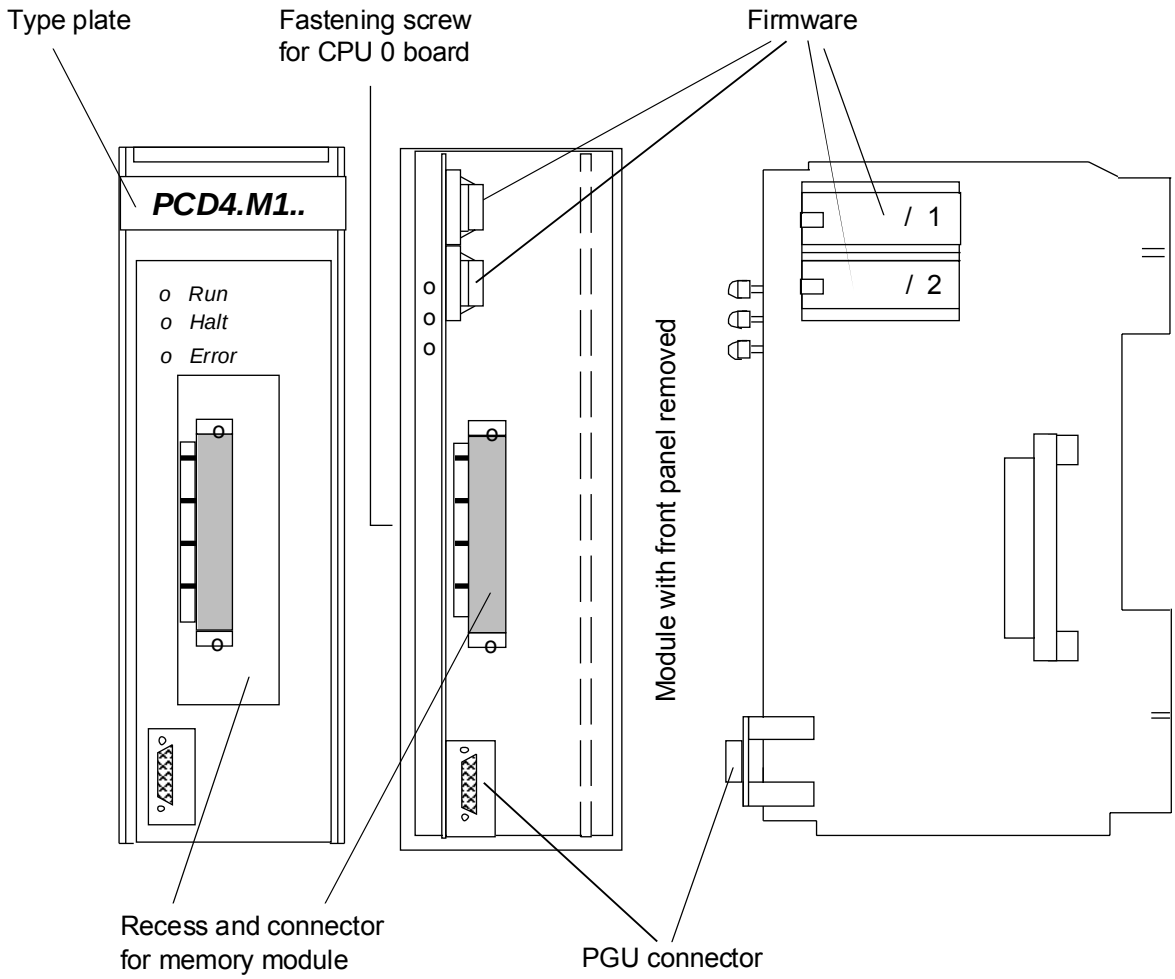
PCD8.K111 connecting cable (for P8 and S-Bus protocol)



4.2 The processor modules PCD4.M110 and PCD4.M1x5 with 1 processor

The M1.. series (PCD4.M110 and PCD4.M1x5) has 1 processor and, apart from the serial programming interface (always present), has either no additional serial interfaces, or 1 or 3 serial interfaces.

4.2.1 Front panel and board layout



To update the firmware, remove the processor module (cartridge) from the bus module, then remove the front panel from the processor module and unscrew and take out the board. Now both EPROMs can be easily changed. Re-assembly is done in the reverse order.

4.2.2 Processor module PCD4.M110

This is the simplest processor module. Apart from the PGU interface, it has no other serial interfaces.

Recommended bus module : PCD4.C100

Internal power consumption (5 V bus) 600 mA

4.2.3 Interfaces of processor module PCD4.M125

Apart from PGU interface no. 0, this processor module has one other interface (no. 1).

Recommended bus module :

- PCD4.C110 With this combination, interface no. 1 is of type 20 mA current loop (CL).

  For other protocols, bus module PCD4.C120 can be used for RS 232, or PCD4.C130 for RS 422/RS 425. It should be noted that in both these combinations two interfaces of each bus module remain unused.

- PCD4.C340 The interface no. 1 can be fitted with the required pluggable interfaces modules :

  - PCD7.F110 → RS 422 / RS 485
  - PCD7.F120 → RS 232 (modem possible)
  - PCD7.F130 → 20 mA current loop
  - PCD7.F150 → RS 485 electrically isolated

Internal power consumption (5 V bus) 740 mA

4.2.4 Interfaces of processor module PCD4.M145

Apart from PGU interface no. 0, this processor module has three other interfaces, nos. 1, 2 and 3.

Recommended bus module : The types of serial interface are dependent on the bus module chosen.

- PCD4.C120 Bus module with 3 interfaces :
  - no. 1 → RS 232 (modem possible)
  - no. 2 → 20 mA current loop *)
  - no. 3 → 20 mA current loop *)

- PCD4.C130 Bus module with 3 interfaces :
  - no. 1 → RS 422 / RS 485 **)
  - no. 2 → RS 422
  - no. 3 → RS 232

- PCD4.C340 The interfaces nos. 1, 2 and 3 can be fitted with the required pluggable interface modules :
  - PCD7.F110 → RS 422 / RS 485
  - PCD7.F120 → RS 232 (modem possible)
  - PCD7.F130 → 20 mA current loop
  - PCD7.F150 → RS 485 electrically isolated

Bus module PCD4.C120 or PCD4.C340 (equipped with the communication module PCD7.F120 plugged in on place CH1 only) should be chosen **for connecting the PCD4 to a modem**, as only interface no. 1 of type RS 232 has all the control lines necessary for the control of a modem.

Bus modules PCD4.C100 and PCD4.C110 can also be used with a PCD4.M145, but the processor module interfaces cannot be employed, or else only partially.

Internal power consumption (5 V bus) 740 mA

*) max. baud rate limited to 9600 bps

**) in SASI modes MC4, and SM1, SS1 or SM0, SS0

Notes :

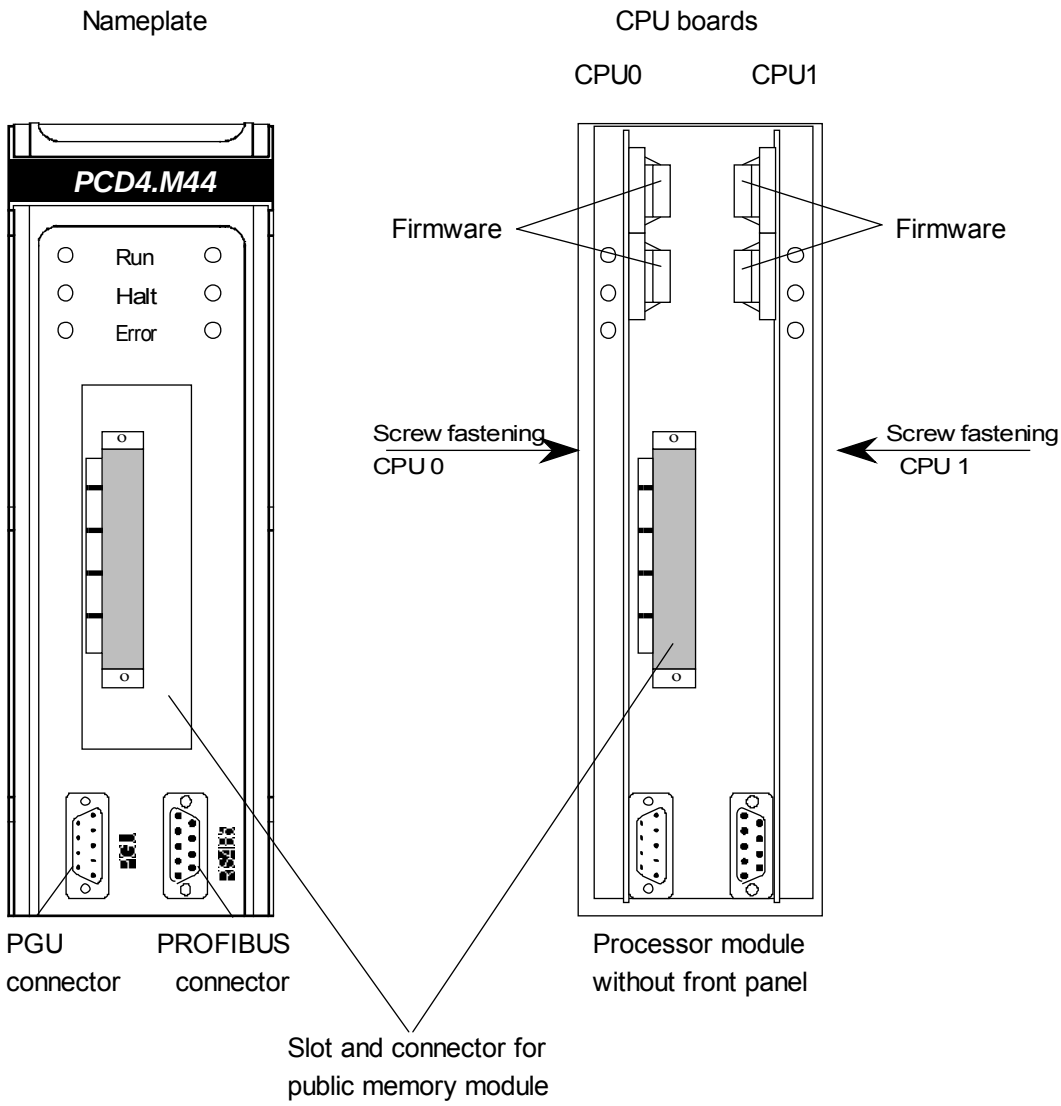
4.3 The processor module PCD4.M445 with 2 processors and an additional PROFIBUS-FMS co-processor

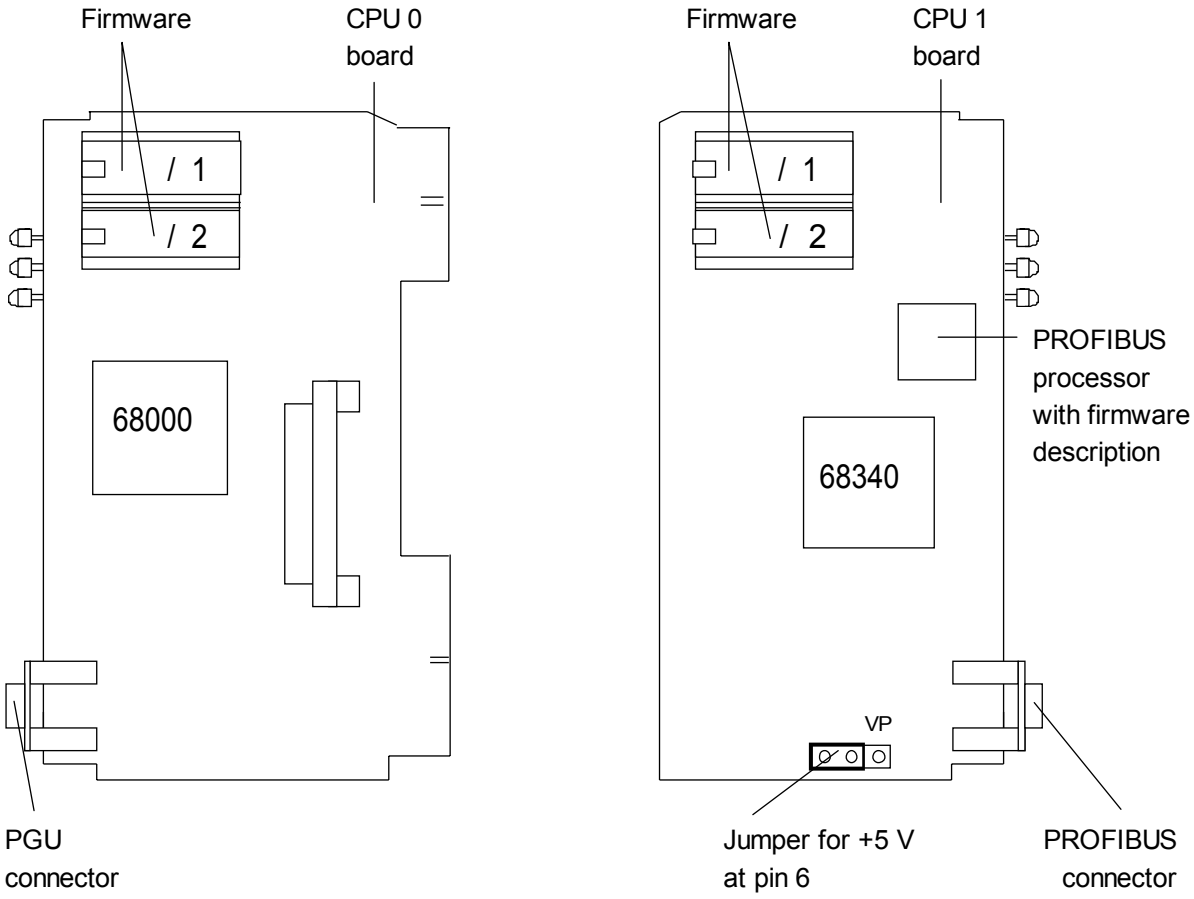
This processor module has 2 independent processors (genuine multiprocessor system).

In addition to the programming interface which is always there, it also has 3 additional serial interfaces which are also independent of each other.

The module has a further PROFIBUS-FMS co-processor, connected via a 9-pole D-type connector on the front panel.

4.3.1 Front panel and board layout

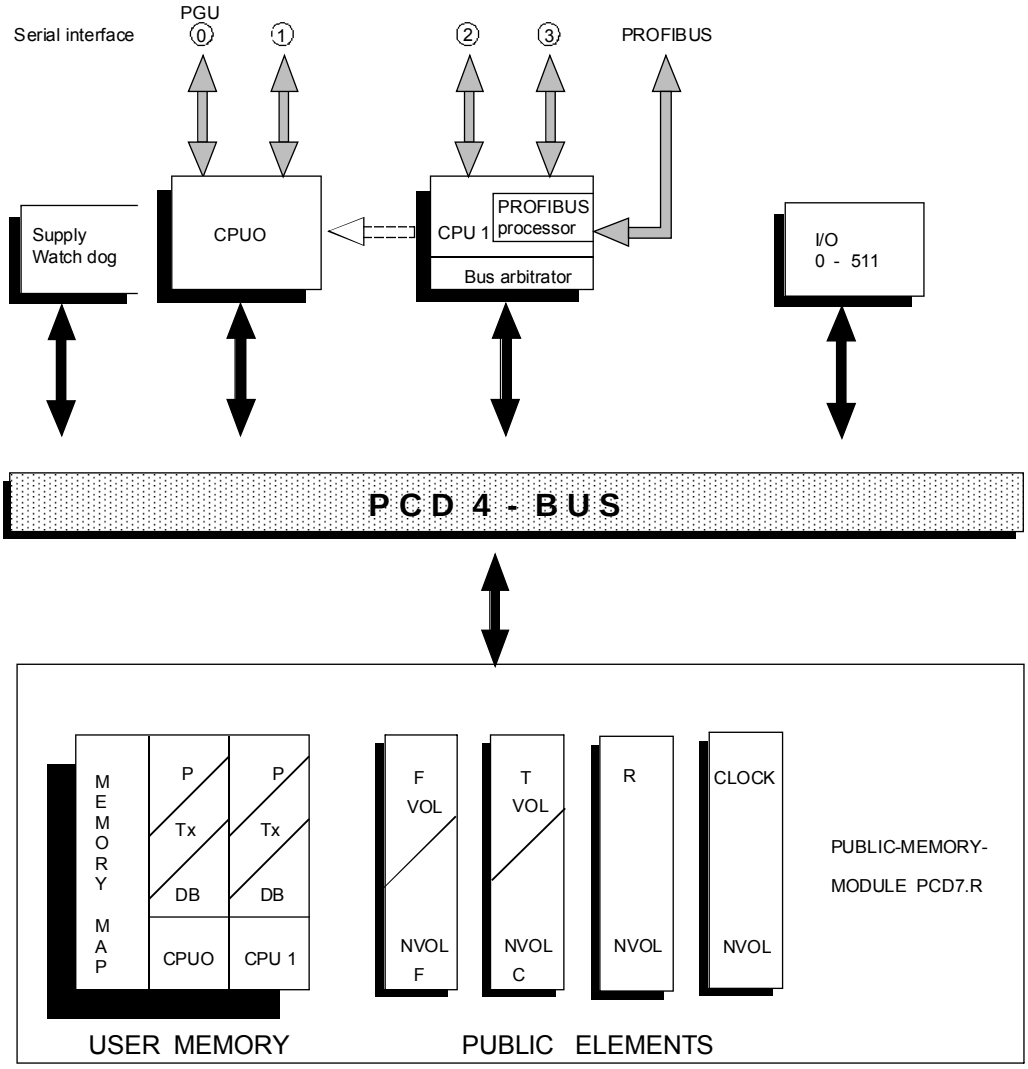




The three types of firmware for the CPU 0, CPU 1 and for the PROFIBUS-FMS co-processor must co-ordinate with each other. Therefore any firmware updates should only be carried out in the factory.

Internal power consumption (5 V bus) 1440 mA

4.3.2 Block diagram



Access to the serial interfaces :

- CPU 0 : no. 0 PGU and no. 1
- CPU 1 : no. 0 PGU and nos. 1, 2, 3

Important : The above-mentioned limitation regarding the access to the serial communication interfaces should be taken into account. In certain cases, user programs must be adapted.

The PROFIBUS-FMS co-processor is situated on the printed circuit board of CPU 1. Its interface is accessible at an additional 9-pole, D-type connector (female) on the front panel (like the PGU connector).

4.3.3 Serial interfaces of the PCD4.M445 processor module

This processor module has, apart from the PGU interface no. 0, three more interfaces numbered 1, 2 and 3. (The PROFIBUS-FMS interface is dealt with separately in the following section).

Recommended bus module : The types of serial interface are dependent on the bus module chosen.

- PCD4.C120 Bus module with 3 interfaces :
  - no. 1 → RS 232 (modem possible)
  - no. 2 → 20 mA current loop *)
  - no. 3 → 20 mA current loop *)

- PCD4.C130 Bus module with 3 interfaces :
  - no. 1 → RS 422 / RS 485 **)
  - no. 2 → RS 422
  - no. 3 → RS 232

- PCD4.C340 The interfaces nos. 1, 2 and 3 can be fitted with the required pluggable interface modules :
  - PCD7.F110 → RS 422 / RS 485
  - PCD7.F120 → RS 232 (modem possible)
  - PCD7.F130 → 20 mA current loop
  - PCD7.F150 → RS 485 electrically isolated

Bus module PCD4.C120 or PCD4.C340 (equipped with the communication module PCD7.F120 plugged in on place CH1 only) should be chosen **for connecting the PCD4 to a modem**, as only interface no. 1 of type RS 232 has all the control lines necessary for the control of a modem.

Bus modules PCD4.C100 and PCD4.C110 can also be used with a PCD4.M445, but the processor module interfaces cannot be employed, or else only partially.

Internal power consumption (5 V bus) 1440 mA

*) max. baud rate limited to 9600 bps

**) in SASI modes MC4, and SM1, SS1 or SM0, SS0

4.3.4 The PROFIBUS-FMS interface

Technical data in brief :

- FMS protocol according to DIN 19245 parts 1 and 2
- Status : PROFIBUS-FMS master or slave
- Controller class 2 (extended)
- Transmission speeds : 9.6, 19.2, 38.4, 93.75, 187.5 or 500 kBit/sec
- Up to 127 addressable stations (divided by PCD7.T100 repeater into segments of 32 stations each)
- Up to 90 connections established simultaneously (channels 10 to 99) for synchronous or asynchronous communications

4.3.5 PROFIBUS-FMS utilities and data types

• Initiate	Establish a connection
• Abort	Terminate a connection
• Reject	Rejection of a telegram
• Identify (as server)	Identification of "Virtual Field Device" (manufacturer, type and version)
• Status	Advise functional status of station
• GET-OV (as server)	Advise object directory
• Read ¦	Read/write contents of an object
• Write ¦	with the following data types : - Boolean - Integer 8 / 16 / 32 Bit - Unsigned 8 / 16 / 32 Bit - Octet string - Bit string - Floating point

4.3.6 SAIA® PCD PROFIBUS configurator

The creation of a user program, i.e. the configuration of PROFIBUS in the PCD (SASI text), takes place with the SAIA® PCD PROFIBUS configurator (PCD8.C20E). This configuration tool runs under MSWINDOWS (see PROFIBUS-FMS manual order code 26/742 E).

The SAIA® PCD PROFIBUS configurator provides user-prompting for entry of all parameters required by PROFIBUS, also enabling them to be loaded into the processor and documented.

4.3.7 PROFIBUS-FMS connection

The PROFIBUS-FMS is connected to the 9-pole, D-type connector (female), located on the front panel of the PCD4.M445 module.

The pin assignment is as follows :

Pin number	PROFIBUS standard	SAIA	Signification
3	RxD/TxD-P	/D	Receive/Transmit-Data-Positive
8	RxD/TxD-N	D	Receive/Transmit-Data-Negative
5	DGND	SGND	Data reference potential (Signal Ground)
1	SHIELD	PGND	Shield, Protective Ground
6 *)	VP	+5 V	Supply voltage +5 V (+5 V output, max. 100 mA)

The other pins are not connected.

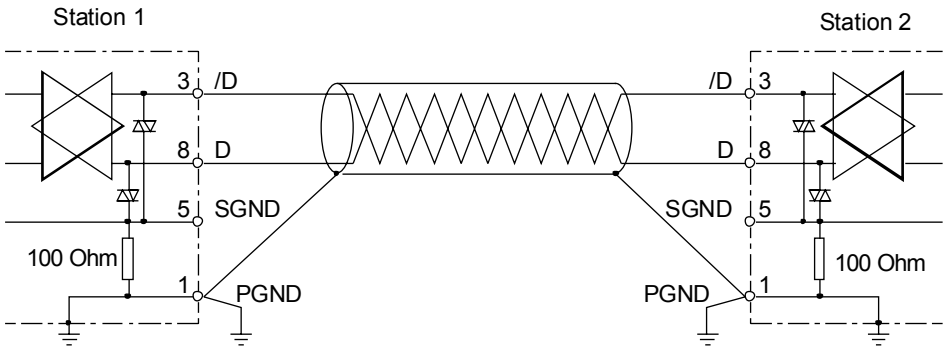
*) Connectable with jumper. Factory setting : disconnected

The shielding must be connected to the metal case of the plug. The sleeve must be secured with an electrically conductive screw connection.

All connections of the PROFIBUS-FMS interface, with the exception of pin 1 (PGND), are electrically isolated from the rest of the module, whereby a 100 Ω resistor between SGND and PGND draws the electrically isolated circuit towards PGND (frame ground).

D and /D are protected against overvoltage peaks by built-in 10 V transient suppressor diodes.

Connection, bus line routing and earthing plan



Important : The two signal lines "D" and "/D" must not be confused !

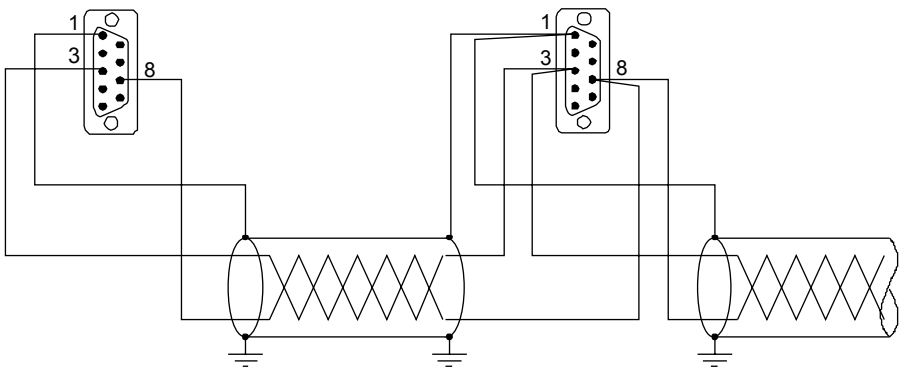
For the wiring diagram shown above, the potential difference between the data reference potentials SGND of all stations should not exceed ±7 V.

Bus cable

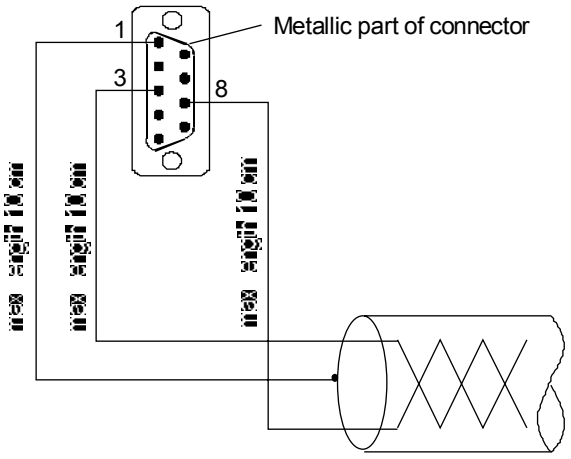
For the bus cable, screened, twisted, 2-core cable should be used. The wave resistance should be in the range 100 to 130 Ω at f > 100 kHz, the cable capacity should be < 100 pF/m and the core section should be at least 0.22 mm^2 (AWG 24). Maximum signal loss allowed is 6 dB.

Recommended, proven types of bus cable :

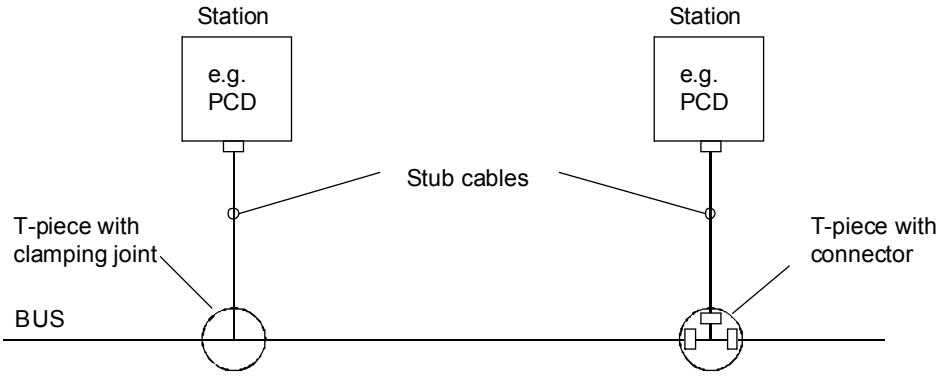
Manufacturer :	Cable type :
• Volland AG	UNITRONIC-BUS
• CABLOSWISS	1 x 2 x AWG24
• Kromberg & Schubert	371'502



Care should be taken to ensure that the bus line still remains continuously connected when one or more plugs are removed.



The unshielded part of the cable at any connector, and from the shield alone to pin 1, should not exceed 10 cm.



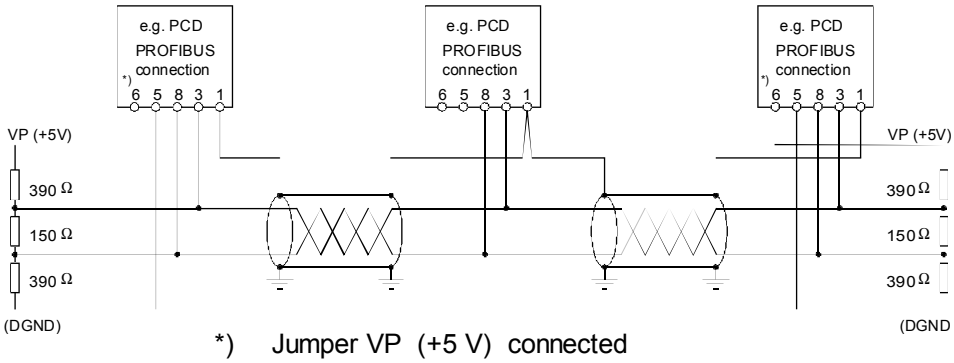
In the case of a wiring plan using stub cables, care should be taken to ensure that the shielded stub cables are no longer than 100 cm for a transmission speed up to 19.2 kBit/s, and no longer than 30 cm for 500 kBit/s.

Line termination

To suppress interference and avoid reflections, the bus must be correctly terminated at both ends.

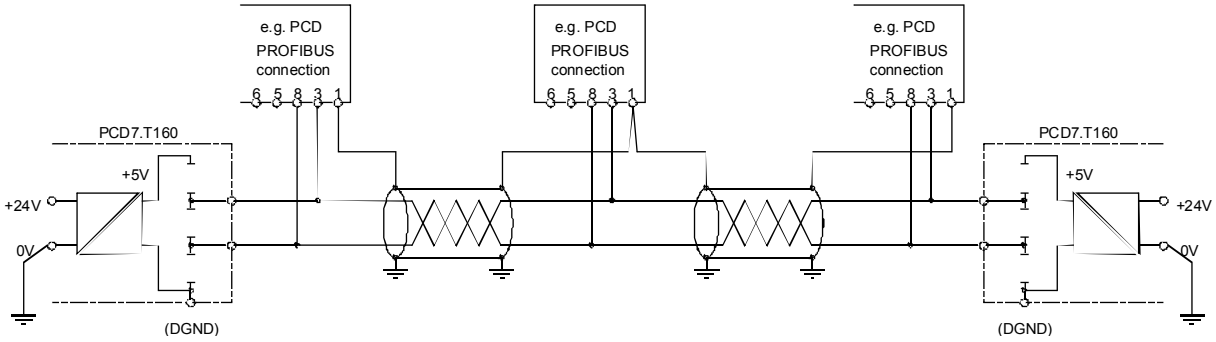
Important : The termination networks must be applied to each bus, even if initial trials show that they would also work without them.

General solution with external resistors :



*) Jumper VP (+5 V) connected

The PCD7.T160 termination boxes should be used to terminate the bus cleanly :



Further information on the correct installation of PROFIBUS can be obtained from the manual "Installation components for RS-485 networks", order number 26/740 E.

For more detailed information, please consult the manual :

"PROFIBUS-FMS with SAIA® PCD"

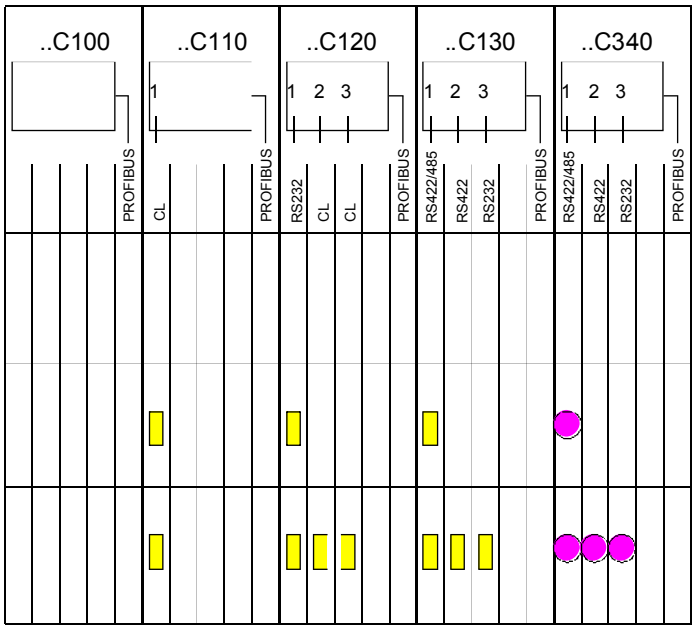
Order reference : PUBLI-26/742 E.

4.4 Summary of bus and processor module combinations

The following table shows diagrams of the various processor modules and their valid combinations with bus modules.

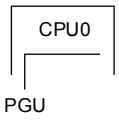
PCD4.M.. processor modules.
Each has one RS232 connector for the programming unit (PGU) or for another peripheral

Bus modules PCD4.C1.. with their serial interfaces



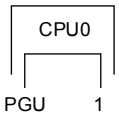
Processor modules with 1 CPU

1 CPU without DL*), PGU only



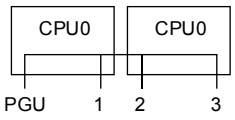
..M110

1 CPU with 1 DL*) and PGU



..M125

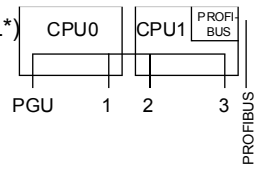
1 CPU with 3 DL*) and PGU



..M145

Processor module with 2 CPUs and 1 PROFIBUS-FMS coprocessor

2 CPUs with 3 DL*) and PGU + PROFIBUS coprocessor



..M445

Notes on the serial interfaces:

- ▮ = serial interfaces (data lines) which can be used.
- ● = Each space can be filled with a plug-in interface module PCD7.F110, F120, F130 or F150 in any required combination.
- The PGU connector is located on the front of each processing module as a 9-pin D-type connector (female).
- The PROFIBUS-FMS connection is also on the front of the module.
- The remaining serial interfaces connections are via the bus module screw terminals.
- All serial interfaces can be individually assigned as desired by the user program.

*) DL = Data Line

5 CPU options

Differentiation of base units

	 PCD4.M110	 PCD4.M125	 PCD4.M145	 PCD4.M445	 PCD4.M170
Number of inputs/outputs or I/O module sockets	510 [1] 32	510 [1] 32	510 [1] 32	510 [1] 32	510 [1] 32
Number of CPUs	1	1	1	2	1
Processing time bit command word command	6 µs 35 µs	4 µs 20 µs	4 µs 20 µs	4 µs 20 µs	2 µs 10 µs
Serial data ports PGU, sockets on bus or processor modules	1 (PGU) RS 232	1 + 1 RS 232, RS 422, RS 485, TTY/ current loop 20 mA	1 + 3 RS 232, RS 422, RS 485, TTY/ current loop 20 mA	1 + 3 RS 232, RS 422, RS 485, TTY/ current loop 20 mA	1 + 3 + 2 RS 232, RS 422, RS 485, TTY/ current loop 20 mA
Field bus connections	SAIA®S-Bus	SAIA®S-Bus	SAIA®S-Bus	SAIA®S-Bus PROFIBUS FMS	SAIA®S-Bus PROFIBUS FMS PROFIBUS DP
Network connections	no	no	no	no	Ethernet-TCP/IP
User memory RAM standard equipment Expansion with RAM or EPROM	0...172 KBytes [2] up to 428 KBytes [2]	0...172 KBytes [2] up to 428 KBytes [2]	0...172 KBytes [2] up to 428 KBytes [2]	0...172 KBytes [2] up to 428 KBytes [2]	1024 KBytes 1024 KBytes (..R400)
Date-time	yes	yes	yes	yes	yes
Data protection and power reserve for real-time clock	>2 month (battery)	>2 month (battery)	>2 month (battery)	>2 month (battery)	1–3 years with lithium battery
Interrupt inputs or fast counter inputs	no –	no –	no –	no –	2 1 kHz

[1] With 32 × PCD4.B900 modules an I/O capacity of 512 I plus 512 O is achieved.
[2] Via central memory module with memory modules plugged on.

1) With 32xPCD4.B900 modules an I/O capacity of 512 inputs plus 512 outputs is achieved.
2) Via central memory module with memory modules plugged on..
.

Contents

5.1 PCD4.M170 controller

5.1.1 Performance characteristics

Power supply module **PCD4.N210**	CPU-module **PCD4.M170** with PCD7.R400 1024 KByte flash card	Bus modules with terminals The PCD4 bus, formed by the bus modules, extends through the whole system. This bus provides the data path between all system components and is used by the processors and all add-on I/O modules. The internal power is also supplied via this bus.

The PCD4 series is an extremely flexible system. From the minimum system with the simplest processor, one serial interface, a power supply module and 2 I/O modules, through to the fully equipped system with up to 32 I/O and function modules, processor module ..M170, up to 6 independent serial interfaces or SAIA®S-Bus, PROFIBUS FMS/DP or Ethernet-TCP/IP network connections. The system can be assembled in one go, or expanded in stages.

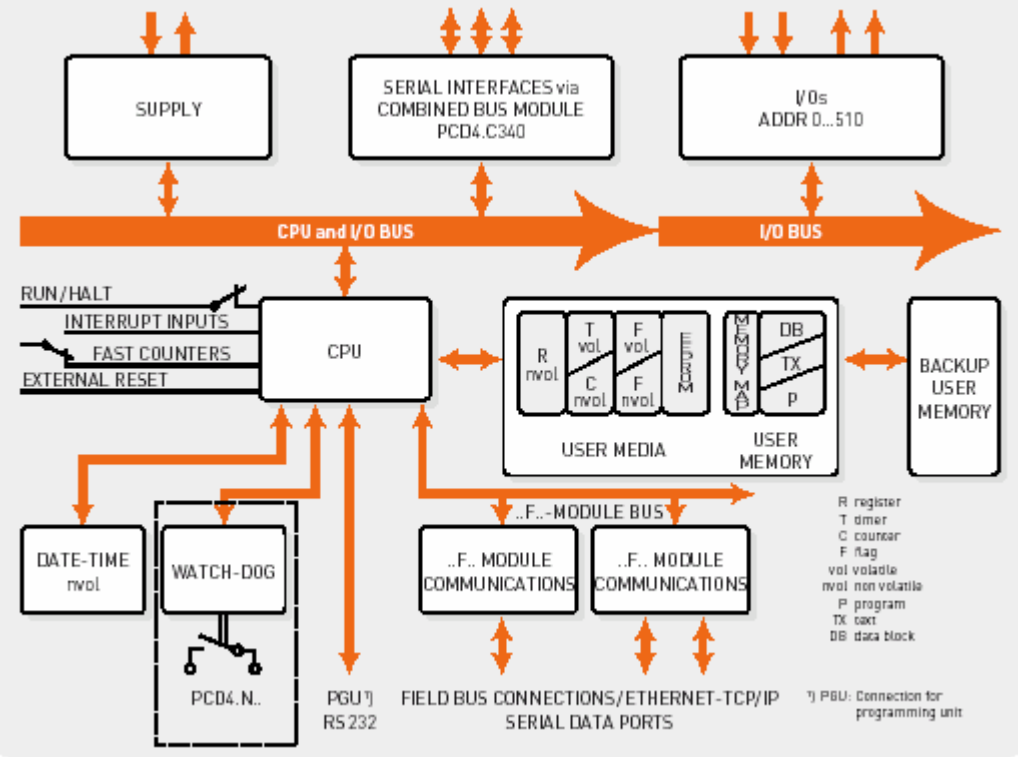
All modules are in the form of equal sized cassettes. Cassette modules are plugged into the appropriate bus modules. The bus modules are in turn snapped onto 35mm mounting rails according to DIN/EN 50022 and connected together to form the system bus. Connections to the external process are wired to the bus modules, which means that cassette modules can be inserted or removed without affecting the wiring.

Functions

Function	PCD4.M170
Firmware	on SMD - flash
I/O modules	All PCD4 I/O modules can be used
Bus modules	All PCD4.C... can be used
PGU / serial port # 0	RS232c
Serial Port # 1, 2, 3	Can be configured for bus module
Serial Port # 4 & 5	Socket B2
Network modules	Sockets B1 / B2
Processor	68340 @ 25 MHz
Processing times [1]:	Performance:
- Bit processing	
STH F 0	1.87 µs
SET O 0	3.00 µs
NOP	4.70 µs (artificially lengthened)
- Word processing	
CMP R 0, R 1	7.62 µs
MUL R 0, R 1, R 2	11.58 µs
FMUL R 0, R 1, R 2	14.71 µs
User memory:	
- RAM standard equipment	1024 KByte user memory
- Extended memory	PCD7.R400 (1024 KByte flash card memory)
Programming tools:	P100 from version $3.01 PG5 from version 1.0
FB and Fbox compatibility	yes

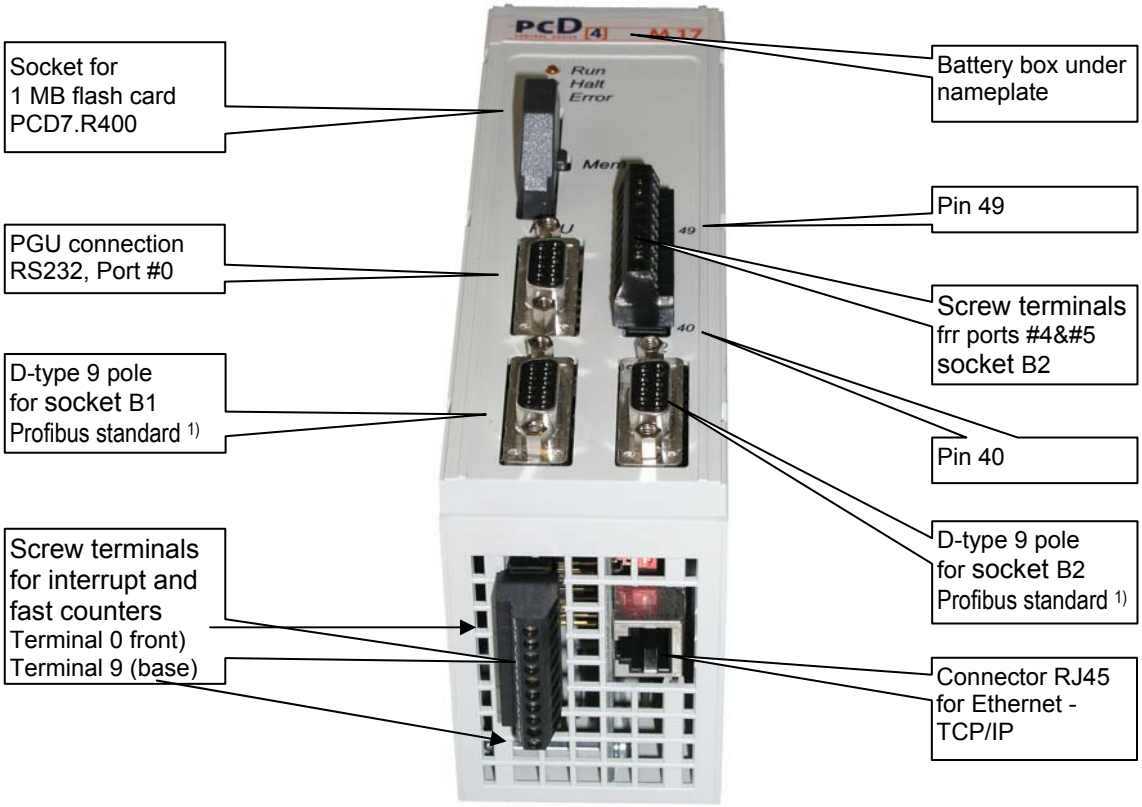
1) From internal RAM, without S-Bus

5.1.2 PCD4.M170 block diagram



P =	program	R =	registers	date-time (clock)
TX =	text	T =	timers	
DB =	data blocks	C =	counters	vol = volatile
		F =	flags	nvol = non volatile

5.1.3 Pin configuration



1) The pin configuration of these two D-Sub connectors (9 pole female) complies with the PROFIBUS standard. The two D-type connectors should preferably be used for PROFIBUS networks. Further serial ports should, if possible, be connected to the 10-pole plug in screw terminals.

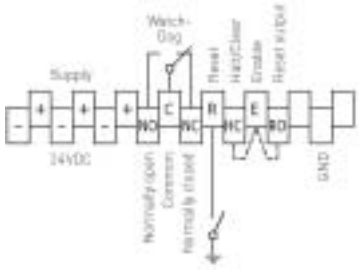
Caution: Removal of the cover exposes components to contact that are sensitive to electrostatic discharges.

When the supply is connected, no manipulations should be carried out (such as changing jumper positions or inserting/removing I/O modules, etc.).

Batteries can be changed while the supply is connected, without loss of data and in all operating modes. The battery box is located beneath the nameplate (see also PCD4.M170, Changing batteries).

Pin configuration ports #0 t0 Port #5

Supply and watch-dog
Terminals on bus module
PCD4.C100 and PCD4.C340

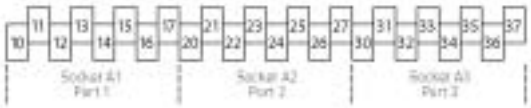


Serial data ports via sockets A1...3 on bus module PCD4.C340 Port #1...3

Terminal	RS422 PCD7.F110	RS485 PCD7.F110	RS232 PCD7.F120	TTY/20 mA PCD7.F130	RS485 (galv.) PCD7.F150
x0	Tx	D	Tx	TS	D
x1	/Tx	/D	Rx	RS	/D
x2	Rx		RTS	TA	
x3	/Rx		CTS	RA	
x4	RTS		DTR[1]	TC	
x5	/RTS		DSR[1]	RC	
x6	CTS		RSV[1]	TG	SGND
x7	/CTS		DCD[1]	RG	
GND		GND			

[1] These signals can only be used if the interface module PCD7.F123 is plugged into socket no. 1

Terminals for the sockets A1...3 on bus module PCD4.C340



PGU/RS 232 Port #0

PGU RS 232	
1	PGND
2	RXD
3	TXD
4	-
5	GND
6	DSR
7	RTS
8	CTS
9	+5V

Serial data ports, socket B2: screw terminal blocks on PCD4.M170 Port #4 and Port #5

Port #	Terminal 40...49	RS485/RS232 PCD2.F520	RS485 PCD7.F772	RS422 and RS232 PCD2.F520	2x RS232 PCD2.F522	RS232 full PCD2.F522
4	40	PGND	PGND	PGND	PGND	PGND
	41	TXD	RX – TX	TXD	TXD	TXD
	42	RXD	/RX – /TX	RXD	RXD	RXD
	43	RTS	-	RTS	RTS	RTS
	44	CTS	-	CTS	CTS	CTS
5	45	PGND	-	PGND	PGND	PGND
	46	RX – TX	-	TX	TXD	DTR
	47	/RX – /TX	-	/TX	RXD	DSR
	48	-	-	RX	RTS	-
	49	-	-	/RX	CTS	DCD

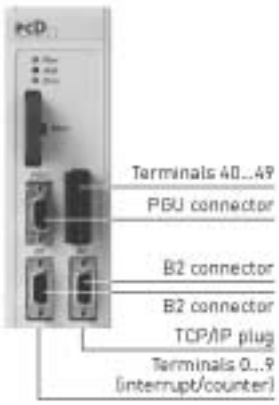
Serial data ports, sockets B1 and B2: 9-pole, D-type connector, on PCD4.M170, Port #4 and Port #5

D-Sub B1 and B2	RS422 PCD2.F520[1]	RS485 PCD2.F520[1]	RS232 PCD2.F522[1]	PROFIBUS Port #8/#9
1	PGND	PGND	PGND	PGND
2	-	-	-	-
3	/TX	/RX – /TX	RxD	RxD/TxD-P
4	-	-	-	CNTR-P/RTS
5	RX	-	RTS	GND
6	/RX	-	CTS	+5V
7	-	-	-	-
8	TX	RX – TX	TxD	RxD/TxD-N
9	-	-	-	-

[1] Only on socket B2 and Port #5

Interrupt and/or counter

Terminal 0...9	
0	IN A1
1	IN B1
2	IN A2
3	IN B2
4	OUT 1
5	OUT 2
6	+
7	L
8	PGND
9	PGND



PROFIBUS DP/FMS on PCD4.M170
Connection of socket B2 can be achieved either vie screw terminal block or viea the 9-pole, D-type connector. Details see relevant documentation.
Ethernet-TCP/IP om PCD4.M170
Connection via RJ45 plug, category 5

5.1.4 Power supply, Watch Dog, Reset....

Power supply and plan connection, see chapter 3.7

Power supply modules, see chapter 7

Watch Dog, see chapter 7.2

Reset...., see chapter 4.1.n

5.1.5 Battery

The PCD is equipped with a standard, non-rechargeable 3.0 V lithium battery

- Type: CR 2032 (IEC)

A battery is enclosed with each new PCD and must be inserted before commissioning. SAIA only recommends the use of types with a capacity of min. 200 mAh, e.g.:

- RENATA order reference 4'507'4817'0

The battery supports the following functions during a power failure:

- RAM memory for F / C / R / history data
- RAM memory for P / TX / DB
- Real-time clock

How long the battery can safeguard stored data depends largely on the power needs of RAM memory. If the calculation is based on extreme values, total buffer duration (when the PCD is isolated from the supply) is 1 to 3 years. The batteries spontaneously discharge at an annual rate of approx. 5%.
These values relate to an ambient temperature of 25°C.
The above figures are reduced at ambient temperatures higher than 25°C.

The Battery LED comes on and XOB 2 is called whenever battery power is lower than 2.3V or higher than 3.5 V

- the battery is flat
- the battery has an interruption
- the battery is missing

Battery replacement

In any operating mode the battery can be changed without difficulty and without loss of data, as long as power remains connected to the PCD.

Battery replacement

In any operating mode the battery can be changed without difficulty and without loss of data, as long as power remains connected to the PCD.

Since the CPU is additionally equipped with a SuperCAP, the PCD4.M170 can also be briefly disconnected from the supply (for up to 1 h) while the battery is changed.

1. Remove cover.
2. Take out the old battery with the help of an isolated tool (pair of tweezers).
3. Push the new lithium battery with its positive pole (+) downward into the battery box
4. Mount the cover

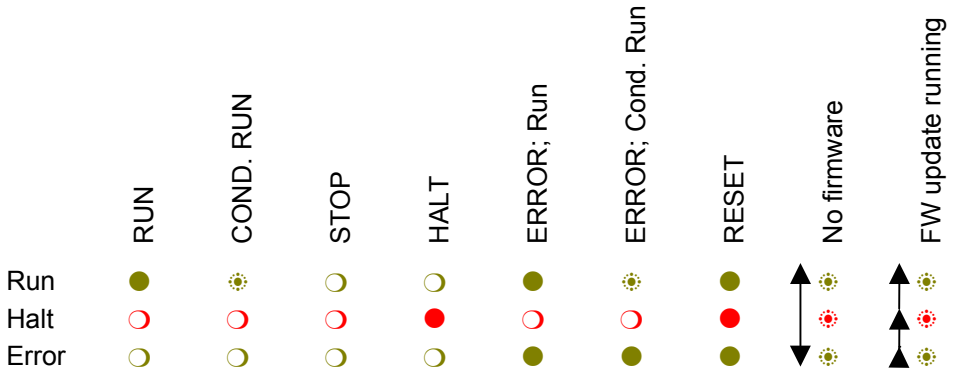
5.1.6 Processor module operating states

Possible operating states

The processor can have the following operating states:

RUN, COND. RUN, STOP, HALT, RESET and ERROR.

3 LEDs indicate these states:	RUN	yellow LED
	HALT	red LED
	ERROR	yellow LED



● LED on
☼: LED flashing
❍: LED off

RUN Normal processing of the user program.

COND. RUN Conditional RUN mode. The condition of a breakpoint set with the PG has not yet been satisfied.

STOP The following circumstances will set the operating state to STOP:

- PG connected and in debug mode when CPU is switched on
- PCD stopped by the PG
- a COND. RUN breakpoint has been satisfied

HALT The following circumstances will set the operating state to HALT:

- RUN/HALT switch active and in HALT position
- HALT instruction processed
- Unrecoverable error in the user program
- Hardware error

ERROR Internal diagnostics have detected an error during processing of the program (RUN or COND. RUN). However, the corresponding error handling XOB has not been programmed.

RESET The following are causes of a RESET state:

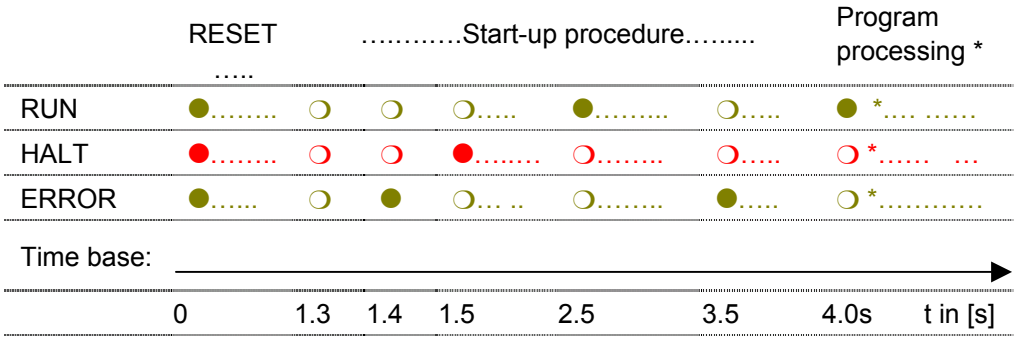
- Self-diagnosis during power-up (for approx. 1s)
- Supply voltage is too low.

No firmware The system has no runnable firmware available. New firmware must be loaded with the PG5 tool: FW Update (LEDs flash in up/down sequence)

FW update running: Firmware is being loaded. The controller must not be switched off while new firmware is being loaded. (LEDs flash from bottom to top)

PCDn.M170 start-up procedure

When the CPU powers up, the M170 self-starts. During this process, operating state LEDs will show the following sequence:



●: LED on
❍: LED off

*) In RUN the user program is being processed correctly.
Other possible operating states after start-up are:

RUN	●	The user program is being correctly processed.
HALT	❍	
ERROR	❍ / ●	

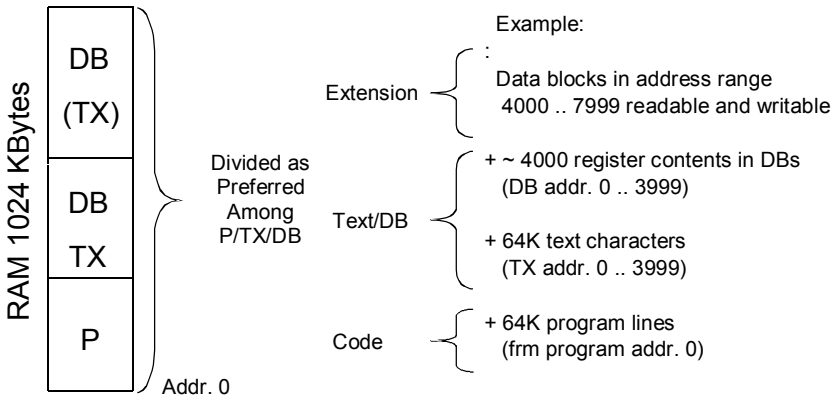
RUN	❍	1. The CPU has stopped (while PG connected). 2. The CPLD is being reprogrammed (after a firmware update). **Caution:** During this procedure, the controller must not be switched off (duration: approx. 30s).
HALT	❍	
ERROR	❍ / ●	

RUN	❍	The M170 is in the HALT operating state
HALT	●	
ERROR	❍ / ●	

Note:
The ERROR LED is switched on if an error is detected and the corresponding error handling XOB has not been programmed.

5.1.7 User memory for program, text and data blocks

The PCD2.M170 base unit contains 1024 kBytes of RAM.



All 3 resources can exist together in the same memory, as long as they do not exceed 1024 KBytes in total. Please note, therefore:

- 1 program line takes uo 4 Bytes (max. 256K program lines)
- 1 text character takes up 1 Byte (max. 1024K text characters)
- 1 register content in DB form takes up 8 Bytes plus 3 Bytes per DB.

Useful information about DBs:

- In the address range 4000.. 7999 one register (32 Bit) needs 4 Bytes of space in memory. For its part, every DB needs 8 bytes (for address and length).
- Data blocks can also be accommodated in the address range 0 .. 3999. They then have the same address range as text. However, a register content requires 8 Bytes, plus 3 Bytes per DB. In addition, the time to access these data blocks is longer than in address range 4000.. 7999.

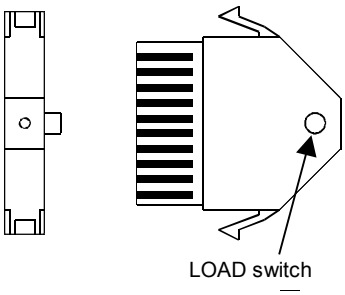
5.1.8 PCD7.R400 flash card, 1 MByte

Validity

This description is valid for the following CPUs:

- PCD2.M170
- PCD4.M170

User program transfer



With the PCD7.R400 flash memory card it is easy to copy any program that is stored on the card to the user memory of the relevant PCD.

Procedure:

1. Plug in PCD7.R400 flash memory card
2. Switch on supply
3. Hold LOAD switch down for 3 s with the tip of a ballpoint pen
4. The program is copied to the PCD's user memory

In addition, a number of special instructions and functions are available with the PG5:

- User program backup (copy, RAM → flash card)
- User program update (copy, flash card → RAM)
- Saving text / DBs to the flash card
- Restoring text / DBs to RAM (source: PCD7.R400)

RAM memory is transferred to the flash card by a function of the PG5 programming tool.

Caution:
The flash card should not be inserted or removed while the power is connected. The PCD's supply must be switched off before the card is plugged in or withdrawn.

Copy user program ↔ flash card

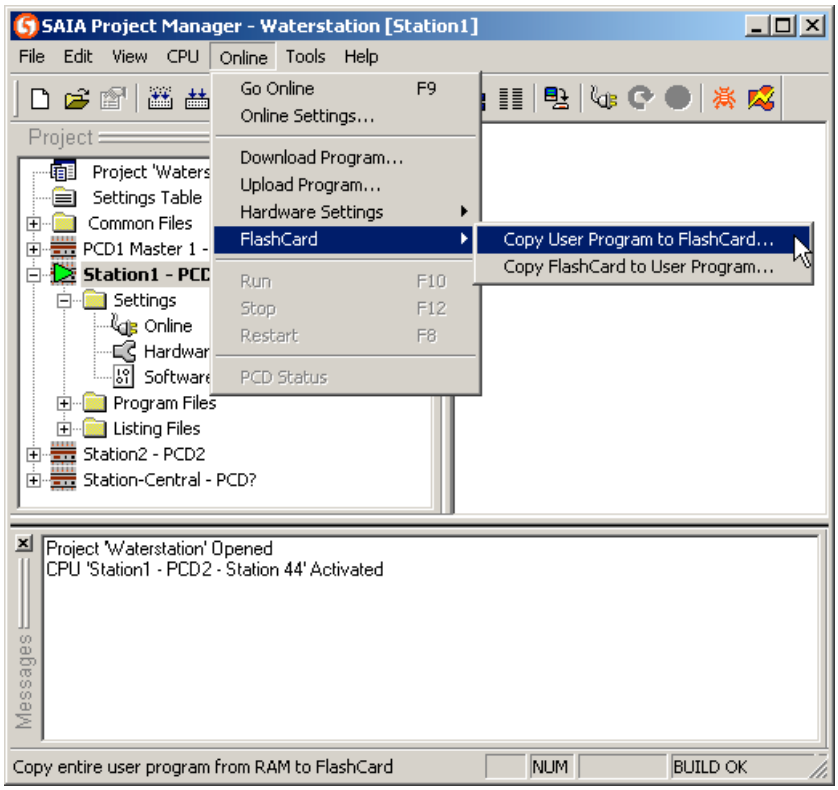
The user program is always copied in full (code, text and extensions). The range for backing up DBs/text is deleted from the flash card when the user program is transferred. With SYSWR, DBs/text stored on the flash card will therefore be lost.

Methods of copying:

a) with PG5 SPM: copy from PCD to flash card
copy from flash card to PCD

b) LOAD switch: copy from flash card to PCD
(hold switch down for 3 seconds at least)

c) If there is no user program in the PCD on start-up, or if no correct header can be identified, copying from the flash card to the PCD takes place automatically.



N.B.:
While copying is underway, the PCD is always in stop. A subsequent manual start is required.

SYSWR/SYSRD for save/restore text/DBs

This function is used to save/restore DBs and text to the flash card.

Features:

- 64 KByte memory for backup
- DBs/text from extension memory (4000..7999)

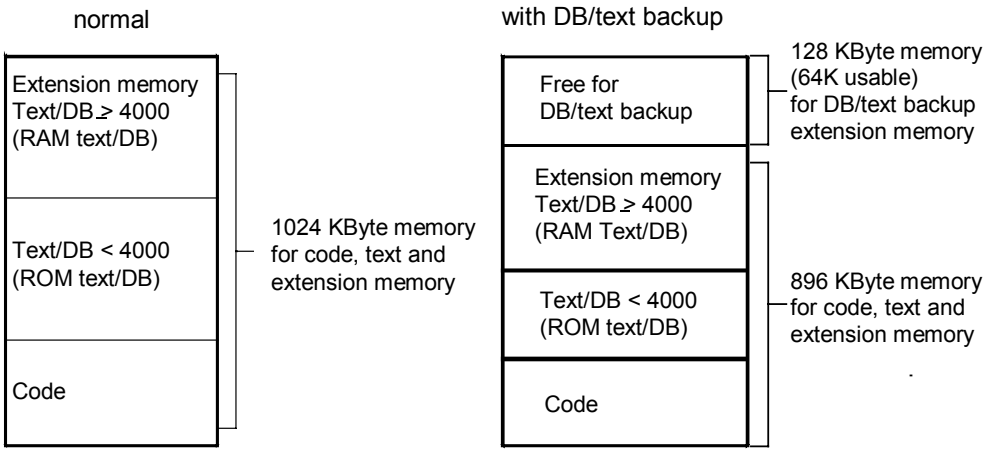
SYSWR function:

- SYSWR 9000 backup DBs/text to flash card
- SYSWR 9001 restore DBs/text from flash card
- SYSWR 9002 delete memory

The save/restore function must be enabled during memory configuration. It is then possible to allocate memory in 2 flash sectors (128 KByte) to DBs/text. Half of this memory (64 KByte) can now be used for saving DBs/text >4000 (RAM DB/text).
The firmware automatically deletes a previous version of DBs/text if the same sequence is saved again. In some cases, the firmware will create free space in memory, since certain DBs/text have been saved several times. A sector of flash memory is deleted for that purpose. ACCU = H indicates via SYSWR that the memory mechanism is busy. Before any save/restore of the DBs/text can take place, a SYSRD 9000 instruction must be executed to ensure that background functions have finished.
If there is no free space in memory for storing DBs/text, this is indicated by diagnostics.

Memory configuration for saving DBs/text

During memory configuration, the option "Reserve 128KByte for Text/DB backup" must be activated.



Flash card SYSWR

SYSWR	**Kx or Rx** **Ky or Ry**

Where: **Kx** or **Rx** is the constant or register with the function code.
Ky or **Ry** is the or register with the text/DBs.

There are two SYSWR commands for copying text/DBs:

Function code:
- 9000 for copying text/DBs from RAM to flash card
- 9001 for copying text/DBs from flash card to RAM
- 9002 for deleting memory (all DBs/text stored on the flash card are deleted)

Allowed values for**:**

Ry or **Ky**: 4000..7999

Flags:
- Accu = L: Flash card ready → SYSWR executable
- Accu = H: Flash card not ready → wait

The error flag is set if an error is detected. → Read diagnostic register with SYSRD 9000

Please note:
The flash card can be overwritten a maximum of 1 million times. Therefore, the SYSWR 900x command must never be included in program loops.
When writing, please note that, due to the lengthy processing times of these instructions, they should not be used in XOB 0.

Flash card SYSRD

SYSRD	**Kx or Rx** **Ry**

Where: **Kx** or **Rx** is the constant or register with the function code.
Ry is the diagnostic register

Function code:	9000	Flash card test
Allowed values for **Ry**:	0 .. 4095	Diagnostic register
Flags:	ACCU = L: ACCU = H:	flash card ready → SYSWR executable flash card not ready → wait

The error flag is set if an error is detected → Read diagnostic register

Description of the diagnostic register

Bit	Description	Cause
0	No flash card	No flash card in PCD
1	Header not configured	No header/user program on the flash card
2	SYSWR not enabled	DB/text memory mode not active (memory configuration)
3	DB/Text not present	Incorrect DB/text numbers (addresses)
4	DB/Text format invalid	DB/text format has been changed (length)
5	Restored	DB/text on flash card has been restored because an error occurred.
6	Memory full	Too many DBs/text. No more space free in memory
7	Already processing	The previous SYSWR 900x instruction had not been processed in full before the next one was started.
8 ..31	Reserve	

5.1.9 EEPROM configuration memory

The PCD has a small memory for permanent storage of settings for the S-Bus, the modem connection (max. 250 characters or. 232 with S-Bus gateway) and some production data. To a limited extent, the user also has the possibility of using this memory for writing to registers (K2000… K2049) and for writing the S-Bus station number (K6000).

The contents of 50 registers (50x32 bits) can be read with the SYSRD command, or written with SYSWR.

SYSRD	**Kx** or **Rx** (source) **Ry** (destination)

Kx = constant 2000... 2049, i.e. EEPROM register 0... 49.
Rx = address of register containing the above constant.
Ry = address of register in which the value read will be stored.

SYSWR	**Kx** or **Rx** (destination) **Ry** (source)

Kx = constant 2000... 2049, i.e. EEPROM register 0... 49.
Rx = address of register containing the above constant.
Ry = address of register from which the value written will be taken.

Caution:
The EEPROM register can be overwritten a maximum of 100 000 times. Therefore, instructions SYSWR K 20xx and K 6000 should never be included in program loops. Several EEPROM registers can be read consecutively within a short time.
When writing, it should be noted that the instructions SYSWR K 20xx and K 6000 last approx. **20 ms**, during which time no other user instructions will be processed. These instructions should not, therefore, be used in XOB 0 either.

5.1.10 PGU connector for attaching programming units

The PGU interface (no. 0) runs to a 9-pole D-type connector (female). During commissioning, the programming unit will be connected via this interface.
The interface type is RS 232c.
Its pin configuration is as follows (with relevant signals):

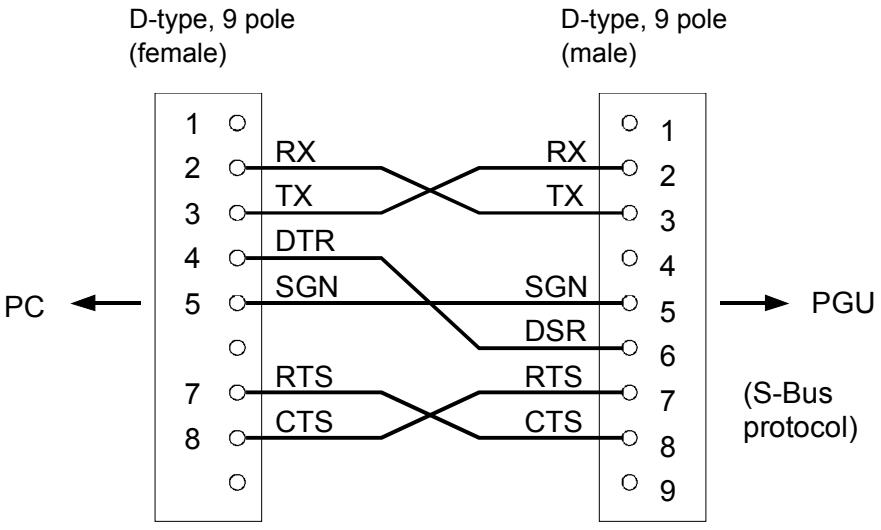
Pin no.		Signal
3	TXD	Transmit Data
2	RXD	Receive Data
7	RTS	Request To Send
8	CTS	Clear To Send
5	SGN	Signal Ground
4	-	Not Connected
6	DSR	PGU Connected
9	+5 V	Supply P100
1	PGND	Protective Ground

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

The neutral position for data signals is "mark" and for control and message signals "off".

For operation with a programming unit, the S-Bus protocol has been provided. Use of the PCD8.P800 service unit is possible from firmware version $301.

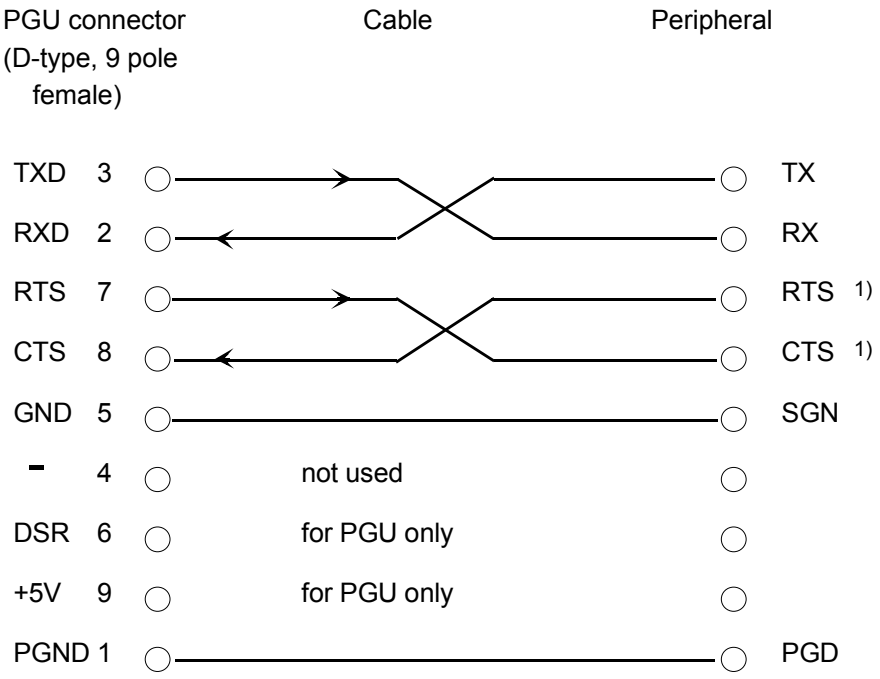
PCD8.K111 connecting cable (for S-Bus protocol)



5.1.11 PGU connector as RS232 communications port

When commissioning/programming is complete, this interface can be used as a data line.

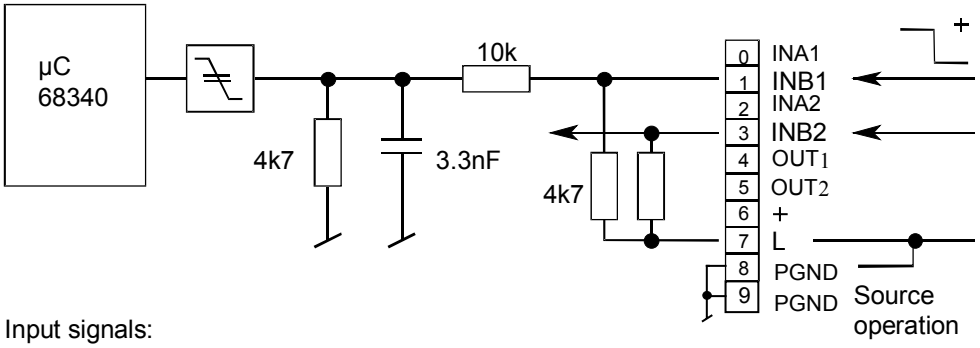
- When the PCD is powered up, firmware automatically sets the PGU interface to 9600 Baud, ready to work with the programming unit.
- If any other peripheral device is to be connected, a SASI instruction must be used to configure interface 0 accordingly.
- If during operation a programming unit is again connected in place of the peripheral device, the switch back to PGU mode takes place automatically (bridge pin 6 to pin 8).
- Before the port can be used again as a data line for the peripheral device, a SASI instruction is once more needed to configure interface 0 accordingly



1) When communicating with terminals it is necessary to check whether certain pins should be provided with bridges, or whether they should be set H or L with the SOCL instruction.

5.1.12 Interrupt inputs

Both interrupt inputs are located on the main board and can be connected via the 10-pole (0 – 9) plug-in terminal block.



Input signals:

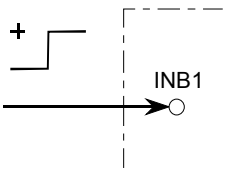
H = 15.. 30V
L = -30.. +5V

(for sink operation L at +24V)

Functional method

Immediately after the last user instruction has been processed, a positive edge at INB1 calls **XOB 20**. A positive edge at INB2 calls **XOB 25**. The reaction time before XOB 20 or XOB 25 will be called is **max. 1 ms**. The user is free to choose which alarm or counting functions should be executed within the interrupt XOB.

Alarm function
When a positive edge is received at INB1, output 32 must be reset within max. 1 ms, independently of the user program..




```
XOB          20
RES    0     32
EXOB
```

Counting function up to 1kHz

The interrupt inputs can also be used for counting functions up to approx 1 kHz.

Example:

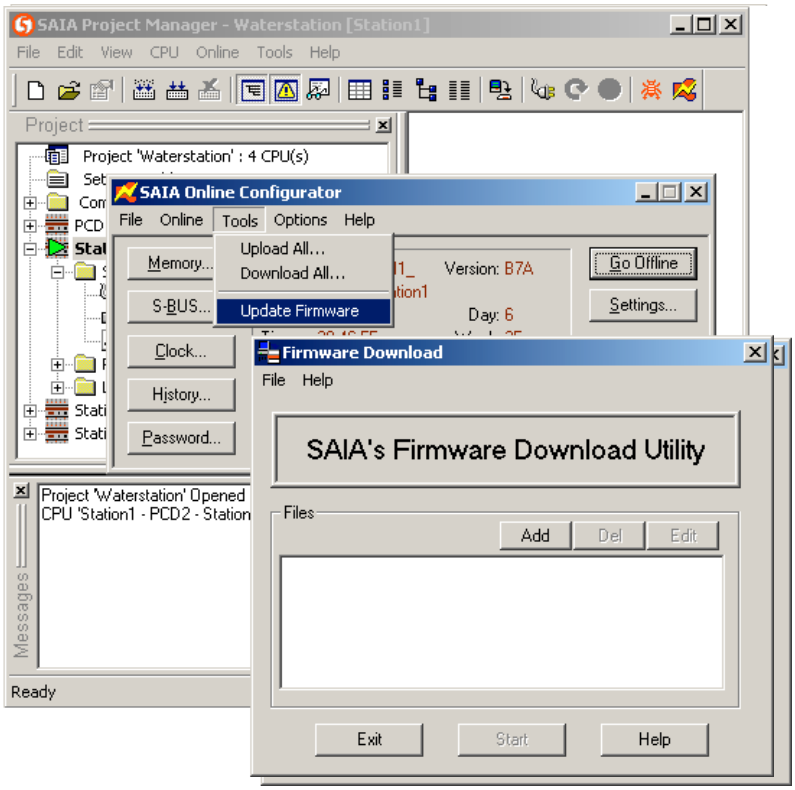
```
COB         0
            0
 :
 :
STH  I      5      ;      If signal at I5 is H,
DYN  F      5
LD   C      10     ;        counter 10 will be loaded
            200    ;        with value 200 and
SET  O      33     ;        output 33 will be set.
 :
 :
ECOB


XOB         20     ;      If pos. Edge is at INB1,
DEC  C      10     ;        the counter will decrement
STL  C      10     ;        and, when it reaches zero,
RES  O      33     ;        output 33 will be reset.
EXOB
```

5.1.13 Firmware update

Firmware Download

A firmware update can be executed with the PG5's 'FWDownload' function (FWDnld.exe). The following steps should be executed:

1. Start online configurator
2. Select serial connection under Settings:
   - PGU or
   - S-Bus (Modem, Ethernet TCP/IP
3. Click "Go Online"
4. Select menu: "Tools" => "Update Firmware".
5. Select firmware files (*.blk) with "ADD"
   The FW file contains a binary Motorola format (.blk).
6. Start download. (with "START")
7. Wait until the controller restarts.



When this message is displayed, the new firmware has been stored in the controller's RAM. The firmware will subsequently be programmed into flash memory (see LED states).
Depending on the new firmware, the "CPLD" may also then be programmed (all LEDs off). The PCD should not under any circumstances be switched off during this time (about 10 to 30 seconds).

LED states during FW update

FW update running	RUN HALT ERROR	↕	FW is being loaded. While the new FW is being loaded, the controller must not be switched off. LEDs flash from bottom to top
No FW	RUN HALT ERROR	↕	No runnable firmware is available on the system. New FW must be loaded with the additional PG5 program "FW Update". LEDs flash in sequence up and down

Please note:
The user program in PCD RAM will be lost when the new firmware is loaded. It can be loaded again from the flash card (if present) next time the PCD restarts.

5.2 Communications possibilities with PCD4.M170

5.2.1 General

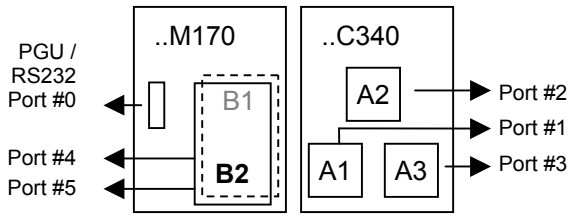
SAIA®S-Bus (PGU), Port #0

SAIA®S-Bus with its safe and easy protocol, is already available in the base equipment (without additional modules) of all PCDs as master or slave.

Technical data	
Master connection	38.4 kBit/s (high net data rates due to low protocol overhead), up to 4 masters via gateway function
Slave connection	Up to 254 slaves in segments of 32 stations each

Manuals:
Saia S-Bus → 26/739, RS485 → 26/740
Technical information → 26/370 and 26/339

5.2.2 Sockets for communications cassette modules



Steckplatz	PCD4.C340				PCD4.M170						
	PCD7.F110	PCD7.F120 [1]	PCD7.F130	PCD7.F150	PCD2.F520	PCD2.F522 [1]	PCD7.F700	PCD7.F750	PCD7.F770	PCD7.F772	PCD7.F651
A1	■	■	■	■	–	–	–	–	–	–	–
A2	■	■	■	■	–	–	–	–	–	–	–
A3	■	■	■	■	–	–	–	–	–	–	–
B1	–	–	–	–	–	–	■	■	■ [3]	—	–
B2	–	–	–	–	■	■	–	■	■ [3]	■	■

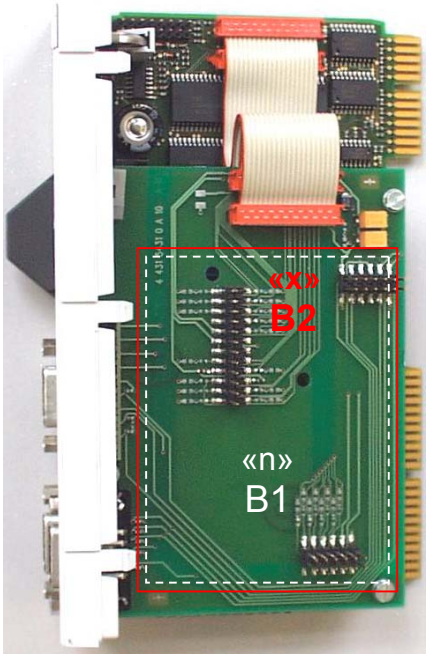
1) Suitable for modem connection due to provision of 6 control lines. (PCD7.F120 always on socket1).
3) 2 × PROFIBUS DP Slave are not possible

Serial data ports #1 to #3

The serial interface modules PCD7.F1nn for ports #1 to #3 (sockets A1 to A3) are described in chapter 3.4.n.

Sockets B1 and B2 for PCD2.F5__ or PCD7.F___, ports #4 and #5

The PCD4.M170 has two module sockets - one on the rear side (white) and one on the front side (red) for communication modules PCD2.F5__ or PCD7.F___.



Order numbers for configured processor modules

The processor modules PCD4.M170 Fnx are delivered pre-configured:

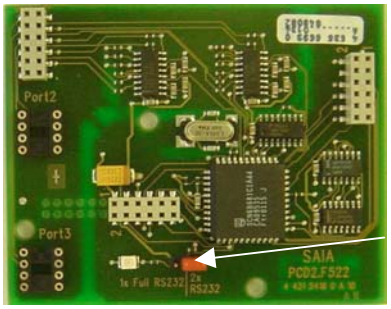
- «n» defins the ..Fnnn-module on socket B1 (rear side)
- «x» defins the ..Fnnn-module on socket B2 (front side)

n (socket B1, rear side)	**x (socket B2, front side)**
0 = empty	0 = empty
1= PCD7.F700 (PROFIBUS FMS)	---
2 = PCD7.F750 (PROFIBUS DP Master)	2 = PCD7.F750 (PROFIBUS DP Master)
3 = PCD7.F770 (PROFIBUS DP Slave)	3 = PCD7.F770 (PROFIBUS DP Slave)
---	4 = PCD7.F772 (PROFIBUS DP Slave, RS485)
---	7 = PCD2.F520 (RS 232/422, RS 485)
---	8 = PCD2.F522 (RS 232)
---	9 = PCD7.F65x (Ethernet-TCP/IP)

5.2.3 Serial interfaces RS 232, RS 422 und RS 485

Modules for serial data ports on socket B2, ports #4 and #5

PCD2.F520
RS 232 with RTS/CTS and
RS 422 without RTS/CTS or
RS 485 electrically connected with line termination resistors capable of activation,
suitable for S-Bus or other communications modes.



PCD2.F522
Choice possible between
2× RS232 with RTS/CTS or
1× RS232 full with RTS/CTS, DTR/DSR, DCD,

suitable for modem connection

Jumper for selection of
2 x RS232 (default)
or
1 x RS232 full
(The module PCD4.M170 must be opened to change the jumper position.)

5.2.4 Field bus connections

PROFIBUS FMS and PROFIBUS DP

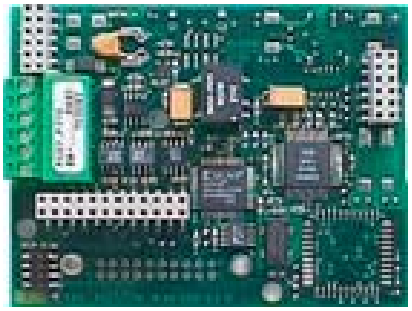
For the field level in industrial automation, PROFIBUS DP and FMS are provided as standardized, open network protocols for data transfer.

Technical data PROFIBUS FMS	
Connection	Up to 500 kBit/s, Up to 126 parties in segments of 32 stations each

Technical data PROFIBUS DP	
Master connection	12 MBit/s,
Slave connection	Up to 124 slaves in segments of 32 stations each

PROFIBUS connection modules at socket B1 or B2

PCD7.F770



PCD7.F700
For connection of PROFIBUS FMS
PCD7.F750
For connection of PROFIBUS DP as Master
PCD7.F770
For connection of PROFIBUS DP as Slave
PCD7.F772
For connection of PROFIBUS DP as Slave and with electrically isolated RS 485 port

Note: It is recommended that the line termination resistors should be included in the cable connector. There are no termination resistors on the module itself. With PCD7.F700 (PROFIBUS FMS) the termination box PCD7.T160 should be used.

Manuals:
Installation components → 26/740, Profibus FMS → 26/742, Profibus DP → 26/765, PCD RIO for Profibus DP → 26/766, RIO Fieldbus modules 26/764

5.2.5 Network connections

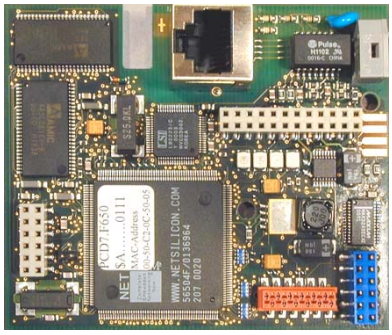
Ethernet-TCP/IP

The intelligent co-processor module provides the PCD with access to the Ethernet

Technical data	
Connection	10 Base-T/100 Base TX (RJ 45)
Speed	10/100 MBit/s (autosensing)
Protocols and services	SAIA®S-Bus with UDP/IP for PG5 ⇔ PCD communication, PCD ⇔ PCD multimaster communication and SCADA ⇔ PCD communication

Ethernet-TCP/IP connection module at socket B2

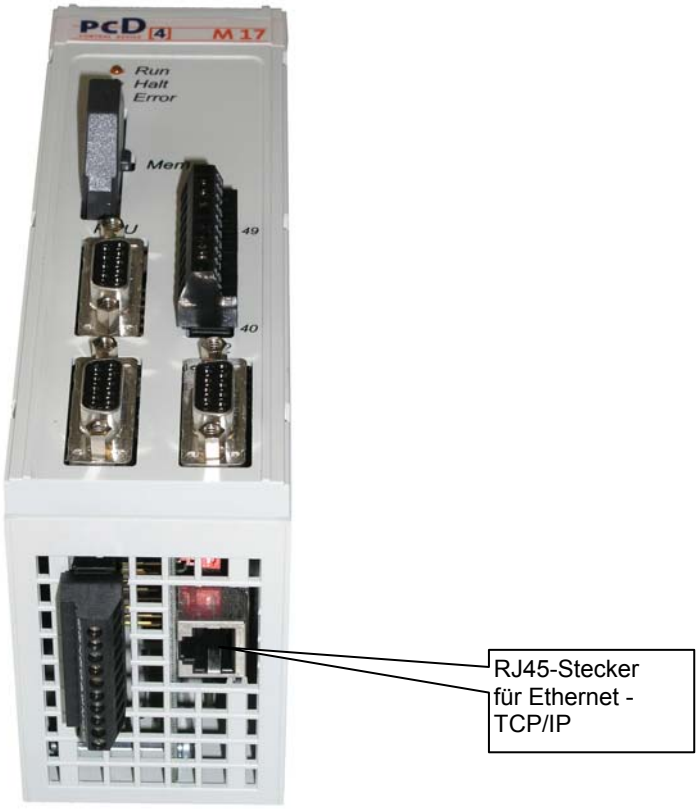
PCD7.F65x



PCD7.F65x
Intelligent interface module for connection to Ethernet-TCP/IP

Manual:
TCP/IP → 26/776
Technical information → 26/356

Ethernet-TCP/IP connector



5.2.6 Connection diagrams for RS 232-, RS 422- and RS 485-modules

RS 232/422/485 serial interface with module PCD2.F520, ports #4 and #5, socket B2

RS 232 interface, connection for peripheral unit, port #4, socket B2

PCD4.M170	PCD2.F520, RS232

		Cable	Peripheral unit
49	**Screw terminal**		
48	**block**		
47			
46			
45			
44	CTS		CTS
43	RTS		RTS
42	RXD		RXD
41	TXD		TXD
40	PGND		SGND

Note:
These ports do not have any control lines. If control lines are required, insert a PCD7.F110 module at socket A, or a PCD2.F522 module at socket B2.

RS 422 interface, connection of peripheral unit, port #5, socket B2

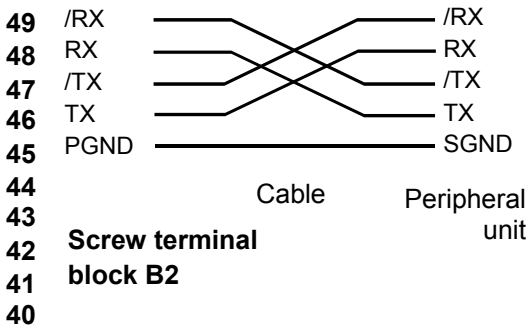
As assignated in the user program the modules with two serial interfaces RS422 and RS485 will work with the assignated protocol, i.e. RS422 or RS485

Communikations mode	Type
MC0...MC3, MD0/S0	RS422
MC4, S-Bus	RS485

With SOCL instruction (immediatly after SASI instruction) the protocol used may be changed.

PCD4.M170

PCD2.F520, RS422



D-type female B2	Pin	PCD2.F520, RS422
Port #5 RS422	1	PGND
	2	-
	3	/TX
	4	-
	5	/RX
	6	RX
	7	-
	8	TX
	9	-

Notes:

For RS 422 each pair of receiver lines is terminated with a 150Ω line termination resistor. For this, jumper J1 must be left in the "OPEN" position (factory setting).

These ports do not have any control lines. If control lines are required, insert a PCD7.F110 module at socket A1 (port #1) of ..C340 or PCD2.F522 module at socket B2.

RS 485 interface, port #5, socket B2

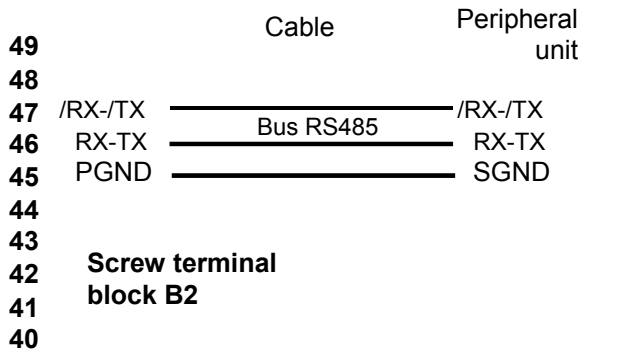
As assignated in the user program the modules with two serial interfaces RS422 and RS485 will work with the assignated protocol, i.e. RS422 or RS485

Communikations mode	Type
MC0...MC3, MD0/S0	RS422
MC4, S-Bus	RS485

With SOCL instruction (immediatly after SASI instruction) the protocol used may be changed.

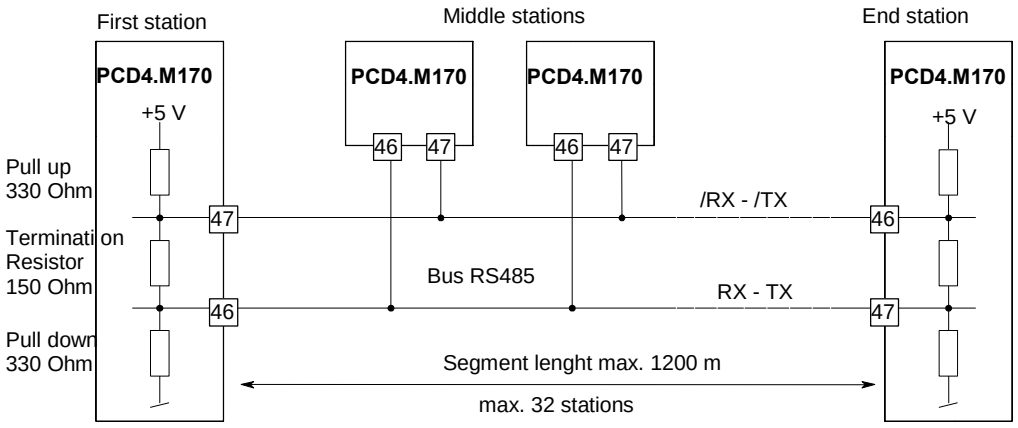
PCD4.M170

PCD2.F520, RS485



D-type female B2	Pin	PCD2.F520, RS485
Port #5 RS485	1	PGND
	2	-
	3	/RX - /TX
	4	-
	5	-
	6	-
	7	-
	8	RX – TX
	9	-

Selection and connection of line termination resistors



Note:
At the first and last stations, jumper J1 must be set to the "CLOSED" position.
For all other stations, jumper J1 must be left in the "OPEN" position (factory setting).

See manual RS485 → 26/740

2 x RS 232 - module PCD2.F522, serial data ports #4 and #5, Socket B2

2 x RS 232, connection of 2 peripheral units

PCD4.M170 **2 x RS 232**

	Screw terminal block B2	Cable	Peripheral unit
49	CTS		CTS
48	RTS		RTS
47	RXD		RXD
46	TXD		TXD
45	PGND		SGND
44	CTS		CTS
43	RTS		RTS
42	RXD		RXD
41	TXD		TXD
40	PGND		SGND

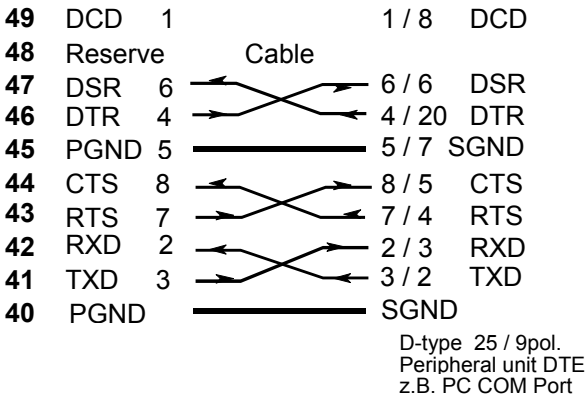
1 x RS 232, port #3, socket B2

PCD4.M170	D-type female B2	Pin	RS232
		**1**	PGND
		2	-
	Port #5	**3**	RXD
		4	-
		5	RTS
	RS232	**6**	CTS
		7	-
		8	TXD
		9	-

1 x RS 232 full, connection of peripheral unit (DTE), port #4, socket B2

PCD4.M170 **1 x RS 232 full**

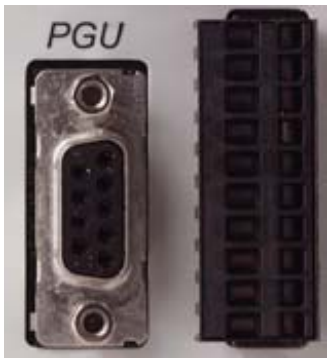
Screw terminal block B2

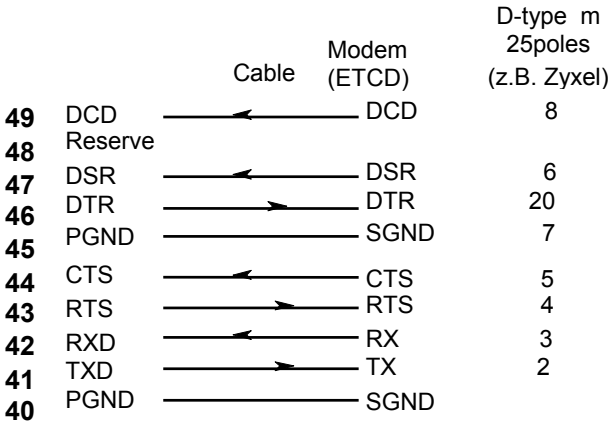


1 x RS 232 full, connection of external modem (DCE), port #4, Socket B2

PCD4.M170 **1 x RS 232 full**

Screw terminal block B2





5.2.7 Connection diagrams for field bus modules

PROFIBUS FMS, module PCD7.F700, socket B1, (ports #9 / #8)

D-type female, 9 poles B1	
Pin	**PROFIBUS-FMS**
1	PGND
2	**–**
3	RxD/TxD-P
4	CNTR-P/RTS
5	GND
6	+5V-
7	**–**
8	RxD/TxD-N
9	**–**

PCD4.M170

Note: There are no termination resistors on th module itself. The necessary 5V-power supply is also missing. Correct termination can be achieved only with the termination box PCD7.T160.
See manuals: Installation Components → 26/740 and/or
Profibus FMS → 26/742).

PROFIBUS DP Master, module PCD7.F750, socket B1 and/or B2 ports #9/ #8

D-type female, 9 poles

B1 and / or B2

Pin	PROFIBUS DP Master
1	PGND
2	–
3	RxD/TxD-P
4	CNTR-P/RTS
5	GND
6	+5V-
7	–
8	RxD/TxD-N
9	–

Note: It is recommended that the line termination resistors should be included in the cable connector. There are no termination resistors on the module itself.

PROFIBUS DP Slave, module PCD7.F770, Socket B1 or B2, ports #9 / #8

D-type female, 9 poles

B1 or B2

Pin	PROFIBUS DP Slave
1	PGND
2	–
3	RxD/TxD-P
4	CNTR-P/RTS
5	GND
6	+5V-
7	–
8	RxD/TxD-N
9	–

Note:

Possible is only 1 module PCD7.F770 on socket B1 or B2.

It is recommended that the line termination resistors should be included in the cable connector. There are no termination resistors on the module itself.

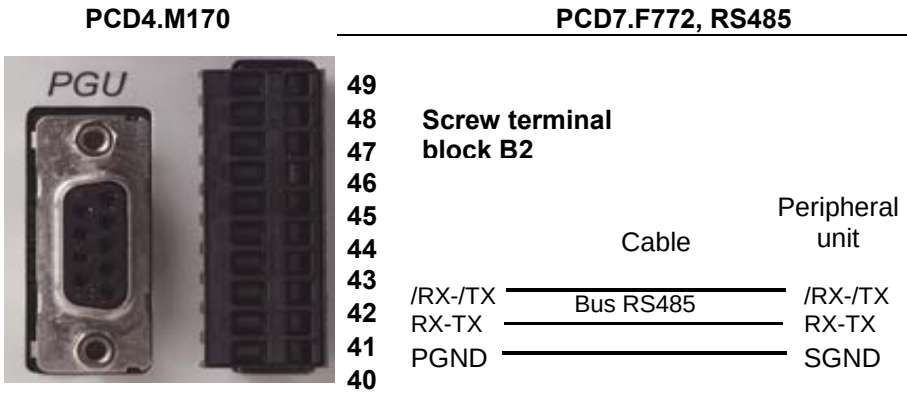
PROFIBUS DP Slave, module PCD7.F772, Socket B2, ports #9 / #8

D-type female, 9 poles B2	
Pin	**PROFIBUS DP Slave**
1	PGND
2	–
3	RxD/TxD-P
4	CNTR-P/RTS
5	GND
6	+5V-
7	–
8	RxD/TxD-N
9	–

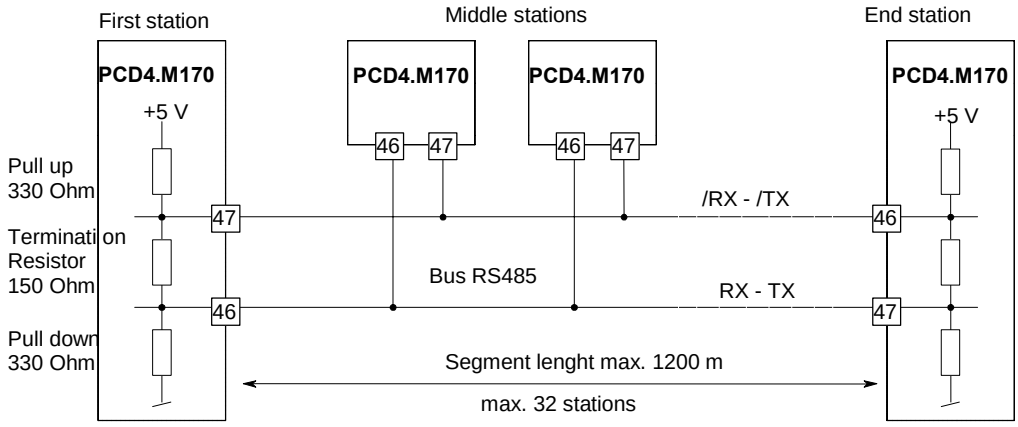
Note: It is recommended that the line termination resistors should be included in the cable connector. There are no termination resistors on the module itself.

The bus can also be connected directly at the 6 pole terminal of the PCD7.F7nn module. In this case the cassette PCD4.M170 must be opened.

RS485 electrically isolated, module PCD7.F772, socket B2, port #4



Selection and connection of line termination resistors

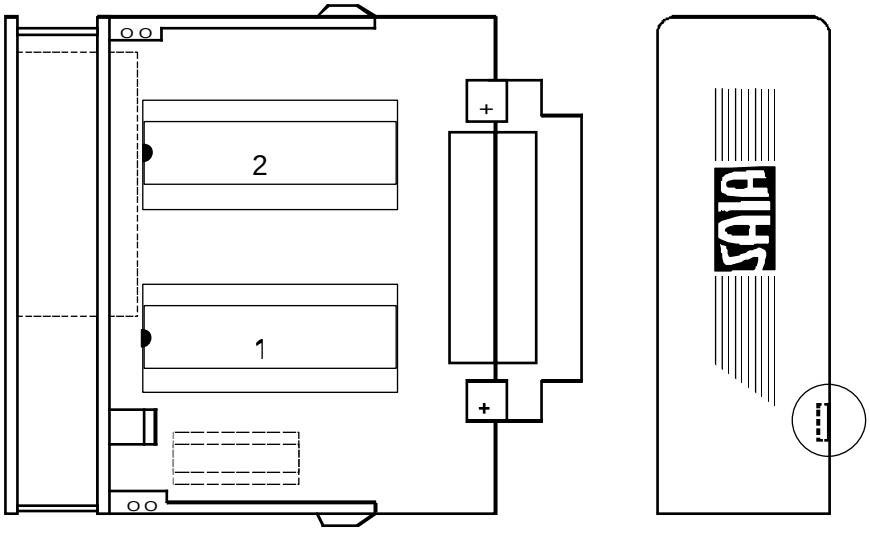


Note: It is recommended that the line termination resistors should be included in the cable connector. There are no termination resistors on the module itself.

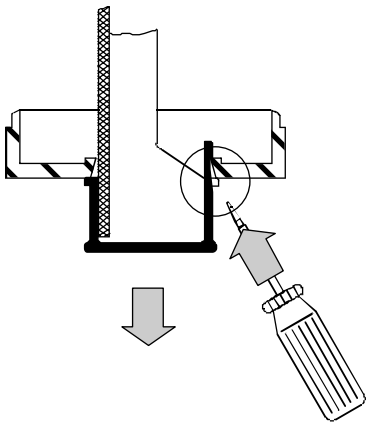
6. The public memory modules PCD7.R…

The public memory module (PCD7.R1.. or PCD7.R3..) has a central function within the system. It contains the user programs and texts of both processors, with their memory map, all flags, registers, timers, counters and the hardware clock (when present). The memory module is inserted in the recess provided in the front panel processor module.

It should be repeated here that, when power is connected, the removal or insertion of modules is not permitted. In particular, this applies to the public memory modules described in this section.



The memory module is provided with a security clip to prevent it from falling out during transportation and heavy vibrations. To remove the module screwdriver no. 1 or 2 is needed. The screwdriver must be inserted and the memory module simultaneously removed.



Remarks : The PCD7.R... modules differ from the superseded PCD4.R... models in their increased memory capacity for program, texts and data blocks.

Important : The processor modules of the **PCD4.Mx70 series** are equipped with a new public memory module **PCD7.R400** (see details in chapter 5).

6.1 Common specifications

User memory	for program, texts and data blocks PCD7.R1../R2.. : max. 256 KBytes PCD7.R310 : max. 428 KBytes *(PCD4.R1../R2..)* : max. 64 KBytes
Flags	8192 x 1 bit flags The division of non-volatile and volatile flags is done be the DEFVM instruction.
Registers	4096 x 32 bit registers All registers are always non-volatile
Data formats	The standard format is decimal. Range : –2 147 483 648 … +2 147 483 647 -2^{31} … $+2^{31}-1$ These alternative formats are supported : Binary : 31 bits with +/- sign Hexadecimal : 0 ... FFFFFFFF BCD : 0 ... 1999999999 Floating Point : $+9.223\ 37 \times 10^{18}$ … $+5.42\ 101 \times 10^{-20}$ $-9.223\ 37 \times 10^{18}$ … $-5.42\ 101 \times 10^{-20}$
Timers/Counters	1600 x 31 bits The division between timers and counters is done by the DEFTC instruction. All counters are non-volatile. All timers are volatile.
Data formats	As for registers, but positive values only and without floating point
Timebase for timers	10 ms ... 10 s (the same for both processor modules). The timebase is defined with the DEFTB instruction.
Hardware clock	Week, day of week, year, month, date, hour, minute, second
Precision	Better than 15 s/month at Ta = 15 ... 30°C
Battery power reserve	2 months (see section 6.2)
Power consumption (5 V bus)	all memory modules 140 mA each

6.2 The battery

The rechargeable NiCd battery prevents loss of data when the controller is switched off (user program and text on RAM, registers, counters and non-volatile flags, history log) and also powers the hardware clock.

The "Batt" LED on the front panel of the supply module PCD4.N2.. shows the battery state (PCD4 powered on) :

LED Batt	=	off	:	Battery ok.
LED Batt	=	on (red)	:	Battery low (XOB2 is called)

The battery is located on the memory module. The battery change due date is written on a label on the memory module's handle.

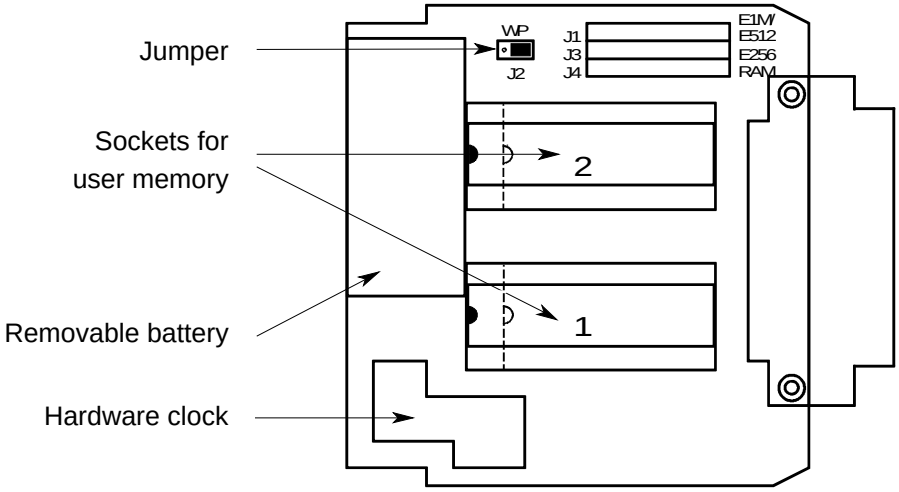
In the case of the older PCD7.R1../R2.. (and PCD4.R1../R2..) modules, the battery is changed by removing the module from the PCD, removing the two screws and lifting off the handle. Before replacing the battery, the data in memory (registers, counters, flags etc.) can be saved using the programming tools, then restored after the new battery has been inserted and has been in use for a short time.

With the PCD7.R310, it is possible to change the battery while the PCD is running (live) (see section 6.4).

Data :	- Fully charged battery power reserve in unpowered memory module	2 months
	- Battery charge-up time	15 hours
	- Life expectancy	5 years
	- Nominal voltage	2.4 V
Order number (for replacement)		4 507 1360 0

6.3 PCD7.R110 with user memory up to 256 KBytes

Presentation



Type summary

Three different modules are available :

- PCD7.R110 for EPROM with hardware clock
- PCD7.R210 [3] fitted with 64 KBytes RAM [2] with hardware clock
- PCD7.R220 [3] fitted with 256 KBytes [1] RAM [2] with hardware clock

The following can be used as EPROM :

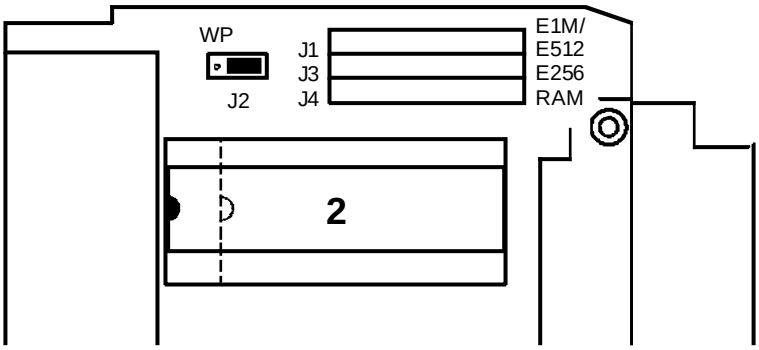
- Type 27C256-10 , Item number 1 chip piece 4'502'5327'0
  .
  fitted with 2 EPROMs resulting in 64 KBytes user memory
  (insert EPROMs aligned to the right)
- Type 27C512-10 , Item number 1 chip piece 4'502'3958'0
  fitted with 2 EPROMs resulting in 128 KBytes user memory
  (insert EPROMs aligned to the right)
- Type 27C1001-10 , Item number 1 chip piece 4'502'7126'0
  fitted with 2 EPROMs resulting in 256 KBytes [1] user memory

Note : - 1 text character requires memory capacity of 1 byte
- 1 program line requires memory capacity of 4 bytes
- 1 register in DB requires memory capacity of 8 bytes

Any combination in the same RAM or EPROM user memory is possible.

1) From version "E" upwards of processor modules PCD4.Mxx0
2) Using non original RAM components (equipped by SAIA) there is a danger of loss of data
3) Phased out modules

Setting the jumpers



Insertion of jumpers allows the following memory chips to be fitted :

Memory	Jumpers position (large jumper block)	Results in PCD4 memory
EPROM	J3 : 2 x 27C256-10 EPROM's	64 KBytes 2)
	J1 : 2 x 27C512-10 EPROM's	128 KBytes
	J1 : 2 x 27C1001-10 EPROM's	256 KBytes 1)
RAM (factory fitted)	J4 : 2 x 256 KBit RAM	64 KBytes
	J4 : 2 x 1 MBit RAM	256 KBytes 1)

1) From version "E" upwards of processor modules PCD4.Mxx0

2) In the models for EPROM (type ..R110) the factory setting for the jumper is position J3.

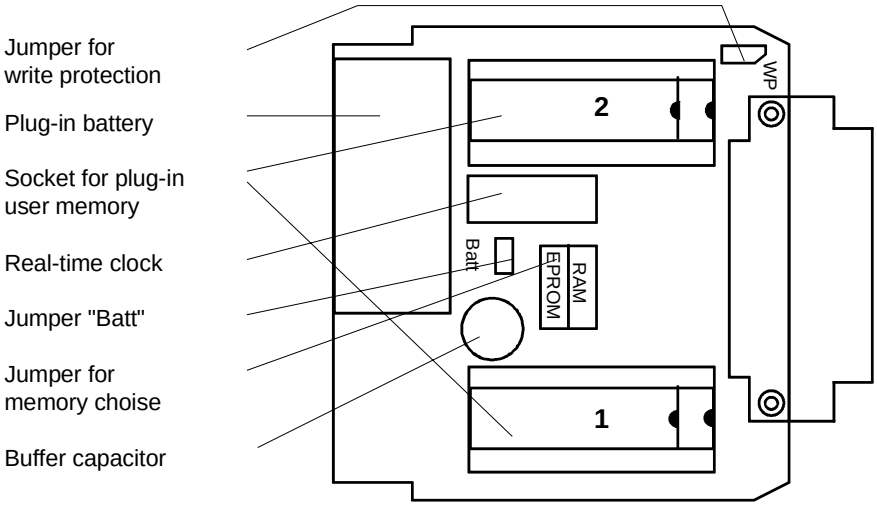
The **single jumper J2** is for write protection when RAM memory is used.

Position WP : Write Protected

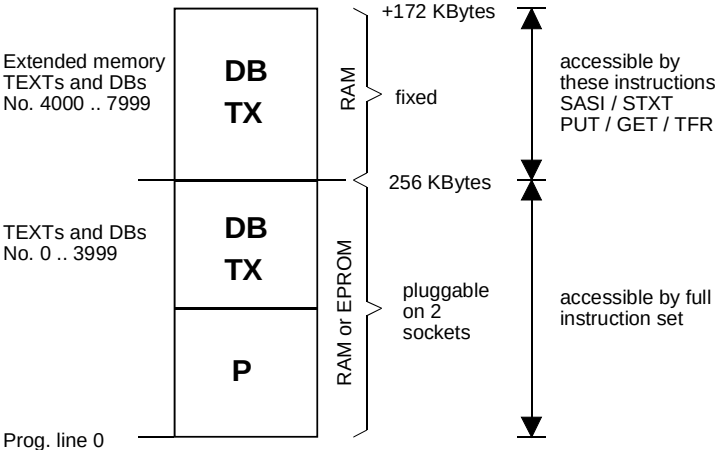
The factory setting is "not write protected".

6.4 PCD7.R310 with user memory up to 428 KBytes

Presentation



Division of memory



Equipment and jumper positions :

Memory	Type	Order number for 1 piece	Jumpers	Results in PCD4 memory *)
EPROM	27C512-10	4'502'3958'0	EPROM : 2 x 512 KBit	128 KBytes
	27C1001-10 **)	4'502'7126'0	2 x 1 MBit	256 KBytes
RAM	62'256ALP-70	4'502'5414'0	RAM : 2 x 256 KBit	64 KBytes
	TC55'1001BPL-70L	4'502'7013'0	2 x 1 MBit	256 KBytes

*) additional 172 KBytes RAM for TX and DB

**) AMD AM27C010-90DC
Fairchild NM27C010Q-90
SGS-Thomson M27C1001-10F1

By the enlargement if fixed RAM memory, the capacity of the ..R310 module can be increased to 428 KBytes. For example, it is possible to insert 2 EPROMs in the 2 sockets producing a total of 256 KBytes for fixed programs, texts and data blocks.

Read/write data blocks and texts are stored in the additional 172 KBytes of RAM. In this way, the 172 KBytes can be used to store approx. 40 K of 32-bit registers, transferable as required to CPU registers R0 ... 4095 with the PUT, GET and TFR instructions.

Note :

1 element of 1 data block in address range 0 ... 3999 uses 8 bytes
1 element of 1 data block in address range 4000 ... 7999 uses 4 bytes

The **small jumper "+5V/BATT"** can be used to disconnect the real-time clock from the battery. This results in longer data protection. However, in this operating mode the clock will only run when the PCD is powered up.

Jumper at "BATT" setting :	clock runs from battery (running always) *)
Jumper at "+5V" setting :	clock disconnected from battery

*) Factory setting of jumper

With RAM, **the small "WP" jumper** can be used to protect memory from being overwritten :

Jumper "WP" in position "WP" : write protected

Standard factory setting: not write protected. If the memory is fitted with EPROMs, the "WP" jumper is not significant.

Changing the battery

There are 2 different ways of replacing the battery without loss of data, depending on circumstances :

a) Changing the battery while the PCD4 is running (live) :

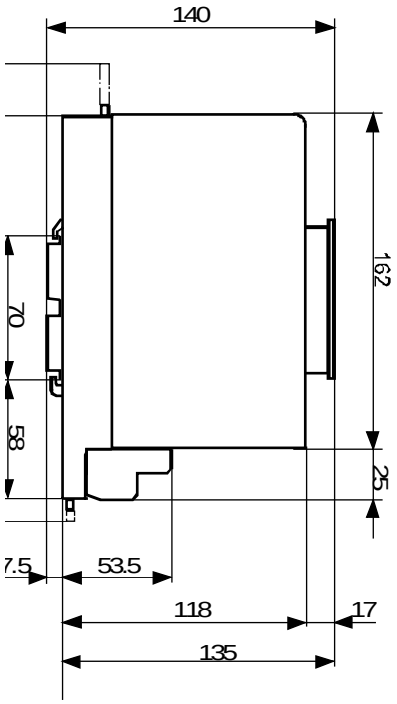
To lift off the plastic handle only (not the board), a screw is removed from the side. Lift off the handle and take out battery from the side of the socket. Insert new battery and screw down handle.

b) Changing the battery when memory module has been taken out :

Remove plastic handle in the same way and change the battery.
A buffer capacitor protects data for at least 30 sec. when the battery is exchanged.

Mechanics

The PCD7.R310 memory module is 3 mm longer than the previous models, which may have to be taken into account for installation in an enclosure.



Compatibility

The PCD7.R310 modules' expanded memory capacity can be utilized by all firmware and Programming Utilities versions starting from the following :

- PCD4.M110 *)	Version "G"	(firmware V003)
- PCD4.M125 - PCD4.M145 - PCD4.M445 (CPU 0)	Version "A"	(firmware V00B)
- PCD4.M445 (CPU 1)	Version "A"	(firmware V00B)
- PCD6.M540	Version "C"	(firmware V002)

- PCD Programming Utilities :	PG3	V1.7
	PG4	V1.21

The new PCD7.R310 memory modules can also be used with older CPUs. However, memory expansion above 256 KBytes cannot be utilized in this case.

Almost all older user programs will run with the PCD7.R310.

*) also for the old CPUs ..M120, ..M140, ..M240 and ..M340

7. The power supply modules PCD4.N2..

7.1 General

Type PCD4.N200 (≥ version "B")	Basic type for digital I/O modules only (E.. and A.. types), without "Halt" and "Clear" switches.
Type PCD4.N210 (≥ version "B")	For all I/O modules (E.., A.., W.., and H.. types), with "Halt" and "Clear" switches.

Technical Information

Supply voltage	24 VDC ±20 % smoothed 19 VAC ±15 % from transformer of min. 100 VA full-wave rectified results in pulsating 18 VDC (see section 3.7)
Galvanically isolated	No, negative connected to chassis
Current	Max. 2.5 A at 24 VDC (version A : 2 A)
Input fuse	3.15 AF fast (version A : 4 AT)
Reverse voltage protection	Yes

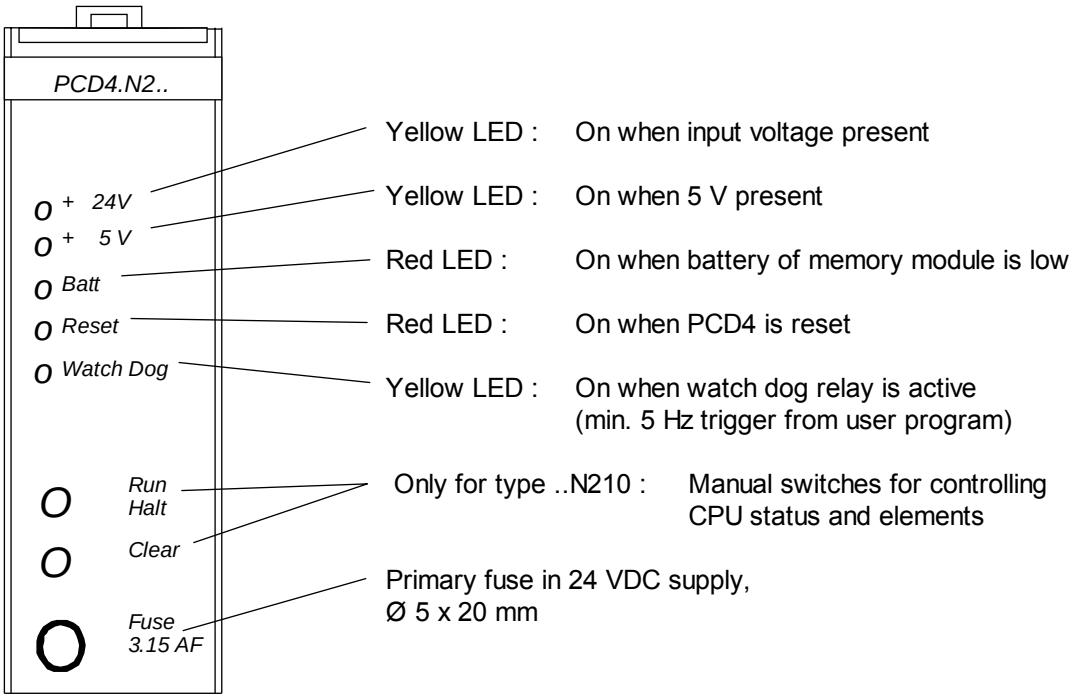
Output voltages and currents to PCD4 bus

	N200	N210	
+5 V	4 A	4 A	
+15 V	0.1 A	0.5 A	(vers. A : 0.3 A)
–15 V	0.05 A	0.45 A	(vers. A : 0.2 A)

Short circuit protection on all outputs.

Voltage monitoring	24 VDC input voltage and +5 V, +15 V, –15 V output
Watch dog frequency	≥ 5 Hz on addresses 255 or 511
Watch dog contact	48 VAC or VDC, max. 0.5 A
External reset	Fast reset input of 2 ms (R to chassis = Reset) for Instruction Pointer, Outputs, Timers and volatile Flags. (Details see section 4.1.6)
Output power held after power failure	min. 10 ms (at max. load, i.e. 4 A at 5 V) (without calling XOB 0) (version A : min. 5 ms)

Front panel



Description

The PCD4.N2.. power supply module provides the internal power for the entire PCD4 system via the PCD4 bus. The modules are plugged into the left-hand connector of the PCD4.C1x0 or ..C340 bus module (next to the processor module).

If PCD4.W.. or H.. type I/O modules are present, the PCD4.N210 power supply module should be used, which provides them with a stabilized voltage of –15 VDC.

The PCD4.N2.. power supply modules are adequate to provide power for up to 16 digital I/O modules (up to 256 I/Os) in any desired combination. For more than 16 modules or use of W... and H... types see section 7.3.

As the diagram shows, every N2.. module has :

- LEDs showing operating states
- Voltage monitoring
- Watch dog circuit
- ..N210 : Manual switches for controlling CPU status and elements

- **Voltage monitoring** provides control when the PCD4 is powered off and on, and ensures it is "Reset" if the voltage is low. This prevents the PCD4 from continuing to run if errors may occur.

- **The "Halt/Clear"** switches on the front are only present on the ..N210 model. "Halt" allows the controller to be set into the "Halt" state manually (without using the programming unit). "Clear" allows all the elements to be cleared (excluding the Registers and the real-time clock). For details, see the chapter describing processor modules.

  To avoid unintentional use of these switches, both switches are only active if the following jumpers on the ..C1x0 or ..C340 module are present :

  - Jumper E-HC : Activates the "Halt" and "Clear" switches

  - Jumper E-RO : Forces all outputs low in the "Halt" and "Stop" states (see bus module ..C1x0 or ..C340)

- **External reset.** In any operating state, the PCD4 can be reset within 2 ms, if the "R" connector on the bus module is grounded (GND). On reset, the following elements are affected :

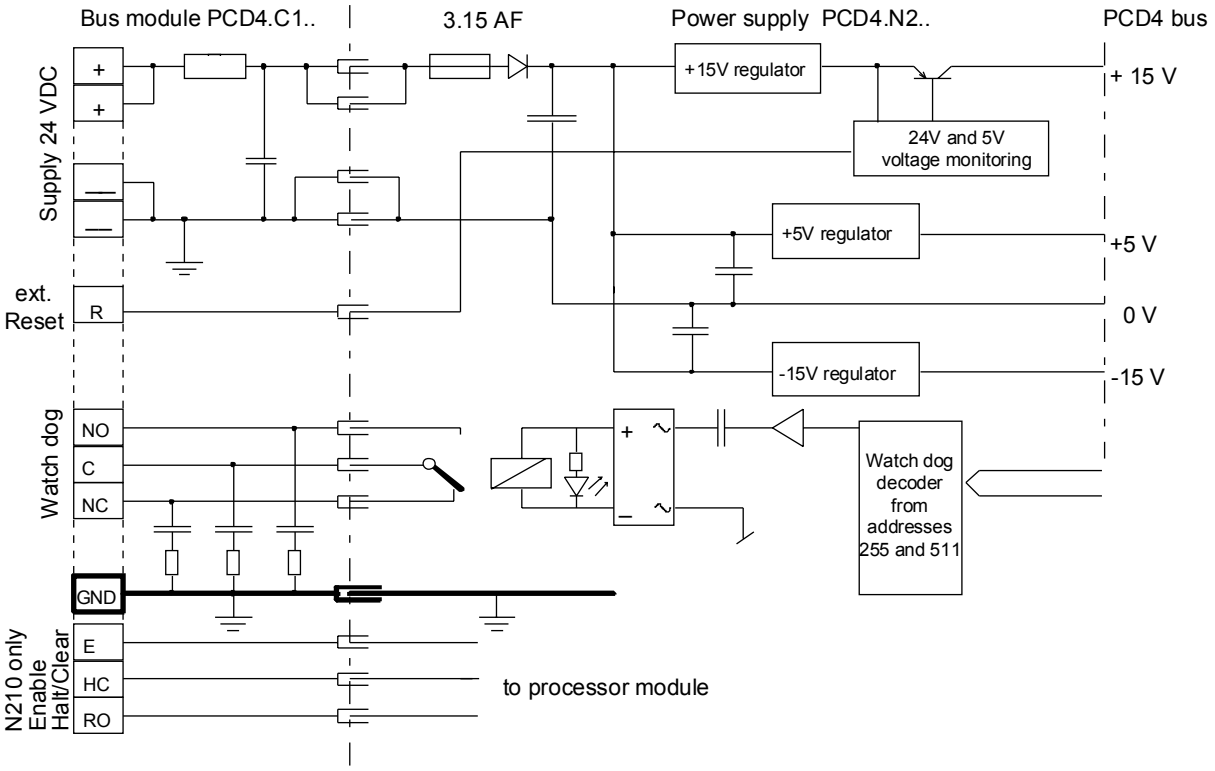
  - All digital Outputs are reset (independent of jumper E-RO)

  - All Timers and volatile Flags are reset

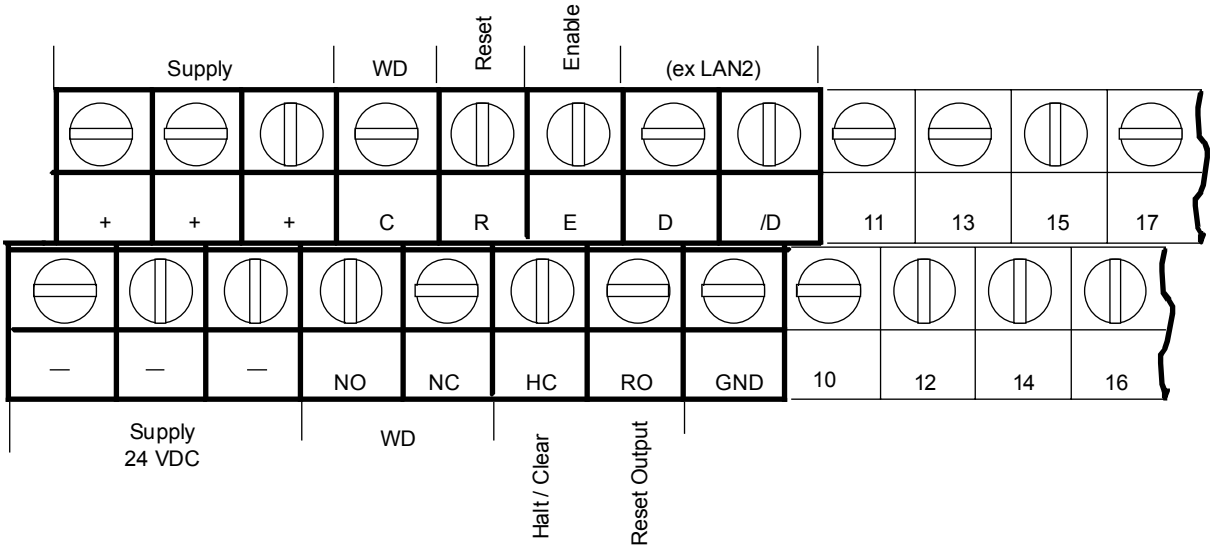
  - Instruction Pointer is set at zero (coldstart)

The Reset state is indicated by the corresponding LED on the front panel.

Block diagram



Screw terminal connections of PCD4.C1x0 or ..C340 bus module



7.2 Use of the "Watch Dog"

The watch dog circuit enables the correct processing of the user program to be monitored reliably. In case of error, effective safety measures can be taken.

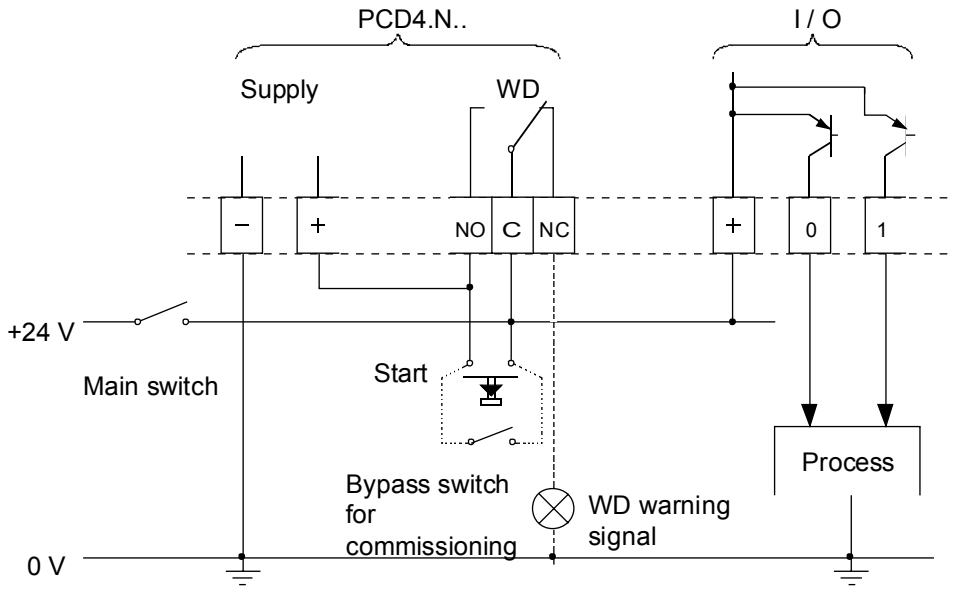
The WD relay remains active (contact C-NO closed) as long as I/O addresses 255 or 511 receive an alternating signal ≥ 5 Hz.
This signal is easily produced by inserting the instruction "COM O 255" or "COM O 511" in any COB which is being cyclically executed.

```
    COB       0      ; or COB 1 ... 15
              0

  ( ACC       H      )
    COM       O 255  ; or O 511
     :          :
     :          :
    ECOB
```

If a fault should arise in the user program or the CPU, or if any other operating mode than "RUN" is chosen, the watch dog will time-out, the C-NO relay contact opens and the yellow watch dog LED is extinguished. Necessary safety measures can now be carried out using this watch dog relay contact.

Note : Watch dog addresses 255 and 511 should NOT be used as element addresses for digital inputs and outputs. In general, special modules such as analogue, motion control or fast counting modules, must not be used at addresses 240 ... 255 and 496 ... 511.

Connection diagram



7.3 Power requirements of the PCD4 modules

The PCD4 power supply modules provide the **internal** power for all PCD4 modules at +5 V, +15 V and –15 V.

If the system is extended to contain up to 32 I/O modules (512 I/O addresses), it is necessary to check internal power requirements when there are a large number of modules.

Capacity of the PCD4.N2.. power supply module

Type PCD4	I at +5 V (mA)	I at +15 V (mA)	I at –15 V (mA)
..N200	4000	100 [2)]	50 [2)]
..N210 (≥ vers. B)	4000	500	450
..N210 (vers. A)	4000	300	200

Power requirements of PCD4 modules

Type PCD4	I at +5 V (mA)		I at +15 V (mA)		I at –15 V (mA)	
	max.	mean [1)]	max.	mean [1)]	max.	mean [1)]
..C100	25	18	--	--	--	--
..C110	60	50	40	20	--	--
..C120	85	50	80	40	20	10
..C130	320	220	--	--	--	--
..C220	5	5	--	--	--	--
..C225	5	5	--	--	--	--
..C260	5	5	--	--	--	--
..C340	5	5	--	--	--	--
..M110	600	600	5	3	16	8
..M125	740	740	5	3	16	8
..M145	740	740	5	3	16	8
..M445	1440	1440	5	3	16	8
PCD7.R110	140	140	--	--	--	--
.R310	140	140	--	--	--	--
PCD7.F110	50	50	--	--	--	--
.F120	10	10	--	--	--	--
.F130	10	10	40	40	--	--
.F150	130	130	--	--	--	--
PCD8.P100	120	120	--	--	--	--

1) 2) See next page

Type PCD4	I at +5 V (mA) max.	I at +5 V (mA) mean 1)	I at +15 V (mA) max.	I at +15 V (mA) mean 1)	I at –15 V (mA) max.	I at –15 V (mA) mean 1)
..E100	(5) 45	(5) 25	--	--	--	--
..E11x	45	25	--	--	--	--
..E60x	45	25	--	--	--	--
..A200	(65) 25	(35) 15	3	3	--	--
..A250	45	25	3	3	--	--
..A350	(50) 25	(30) 15	3	3	--	--
..A400	(125) 45	(65) 25	6	6	--	--
..A410	45	25	3	3	--	--
..A810	45	45	3	3	--	--
..A820	45	45	3	3	--	--
..B90x	(130) 95	(70) 50	7	7	--	--
..W100	50	50	35	35	35	35
..W300	30	30	16	16	9	9
..W400	10	10	50	30	25	15
..W500	150	150	3	3	--	--
..W600	200	200	3	3	--	--
..W800	30	30	10	10	--	--
..H120	120	65	9	9	--	--
..H210	85	65	3	3	--	--
..H215	85	70	3	3	--	--
..H220	150	100	3	3	--	--
..H225	95	95	3	3	--	--
..H31x	150	100	9	9	3	3
..H32x	220	180	11	11	6	6
..H4x0	650 + 100 per axis	550 + 100 per axis	8	6	25	20

1) 50 % of all I/Os active and remaining modules at statistical mean load.

2) This voltage is not regulated. Therefore modules of the types W… and H... require the ..N210 power supply (power supply for RS 232).

These modules require the ..N210 power supply.

( ) superseded versions

new versions	E100 :	B	from 1993
	A200 :	A1	from 1993
	A350 :	C	from Q4 / 1994
	A400 :	B	from Q4 / 1994
	B900 :	B	from 1991

Example 1 : 16 I/O modules (address range 0 … 255)

Type PCD4	I at +5 V (mA)		I at +15 V (mA)		I at –15 V (mA)	
	max.	mean	max.	mean	max.	mean
1 x C120	85	50	80	40	20	10
1 x M125	740	740	5	3	16	8
1 x R110	140	140	--	--	--	--
6 x E110	270	150	--	--	--	--
2 x A350	50	30	6	6	--	--
4 x A400	180	100	24	24	--	--
3 x W100	150	150	105	105	105	105
1 x H320	220	180	11	11	6	6
2 x C220	10	10	--	--	--	--
2 x C260	10	10	--	--	--	--
(1 x P100)	(120)	(120)	--	--	--	--
Total	1855 (+ 120)	1560 (+ 120)	231	189	147	129
Test	< 4000	< 4000	< 500	< 500	< 450	< 450

This PCD4 system with digital and analogue modules and a controller for 2 axes can easily be supplied by the PCD4.N210 module (version "A" or ≥ "B")..

The occasional use of the PCD8.P100 hand-held programming unit will not cause any power supply problems.

Example 2 : 24 I/O modules (address range 0 ... 383)

Type PCD4	I at +5 V (mA)		I at +15 V (mA)		I at –15 V (mA)	
	max.	mean	max.	mean	max.	mean
1 x C340	5	5	--	--	--	--
2 x F110	100	100	--	--	--	--
1 x F120	10	10	--	--	--	--
1 x M445	1440	1440	5	3	16	8
1 x R310	140	140	--	--	--	--
4 x E110	180	100	--	--	--	--
4 x A200	100	60	12	12	--	--
10 x B900	950	500	70	70	--	--
1 x W300	30	30	16	16	9	9
1 x W400	10	10	50	30	25	15
1 x W500	150	150	3	3	--	--
1 x W600	200	200	3	3	--	--
2 x H225	190	190	6	6	--	--
1 x C220	5	5	--	--	--	--
3 x C260	15	15	--	--	--	--
(1 x P100)	(120)	(120)	--	--	--	--
Total	3525 (+ 120)	2955 (+ 120)	165	143	50	32
Test	< 4000	< 4000	< 500	< 500	< 450	< 450

This complex PCD4 system with two CPUs is easily supplied by the PCD4.N210 module (version "A" or ≥ "B"); it consists of 416 digital I/O, 32 analogue I/O and 4 controlled stepper motor axes).

In the above example, if the maximum address range of 511 (32 modules) were fully utilized, e.g. with a further 8 x ..B900 modules and 2 bus modules, this maximum system would require :

at 5 V : max. 4295 mA (+ 120 mA for P100)
mean 3365 mA (+ 120 mA for P100)

at +15 V : max. 221 mA
mean 199 mA

Result : The above configuration (672 digital I/O, 32 analogue I/O, 4 controlled stepper motor axes) **CANNOT** be extended to 32 modules.

Example 3 : 32 digital I/O modules (address range 0 ... 511)

Type PCD4	I at +5 V (mA)		I at +15 V (mA)		I at –15 V (mA)	
	max.	mean	max.	mean	max.	mean
1 x C340	5	5	--	--	--	--
1 x F120	10	10	--	--	--	--
2 x F130	20	20	80	80	--	--
1 x M145	740	740	5	3	16	8
1 x R310	140	140	--	--	--	--
10 x E110	450	250	--	--	--	--
6 x A350	150	90	18	18	--	--
16 x B900	1520	800	112	112	--	--
6 x C260	30	30	--	--	--	--
(1 x P100)	(120)	(120)	--	--	--	--
Total	3065 (+ 120)	2085 (+ 120)	215	213	16	8
Test	< 4000	< 4000	< 500	< 500	< 450	< 450

This purely digital configuration of 32 I/O modules with a total of 720 digital I/Os is permitted for the PCD4.N210 (version "A" or ≥ "B").

8. Digital input/output modules

To guarantee maximum protection against interference, all digital I/O modules pass a stringent 4 kV interference test, in accordance with IEC 801-4. The modules can be plugged anywhere on the PCD4 bus, providing the I/O bus module's edge connector has not been keyed to prevent insertion of that module type.

The module type number is marked on the front panel of each module. The addresses and names of each signal can be written on the label.

Caution : Digital I/O modules should only be changed when the PCD4 is disconnected from the power source.

Digital input modules PCD4.E...

Types / / Characteristics	..E110	..E111		..E600	..E601
Number of inputs	16	16		16	16
Nominal input voltage	24 VDC	24 VDC		24 VDC	24 VDC
Electrically isolated	No	No		Yes	Yes
Operating mode	Source or sink	Source or sink		Source only	Source only
Input current	8 mA	8 mA		7 mA	7 mA
Input delay (ms.)	8.0	0.1		8.0 / 8.0	0.1 / 0.3
See chapter	8.1	8.1		8.2	8.2

Digital output modules PCD4.A...

Types / / Characteristics	..A200	..A250	..A350	..A400	..A410
Number of outputs	8	16	8	16	16
Control element	Relay 1)	Relay 2)	MOSFET	MOSFET	MOSFET
Electrically isolated	Yes	Yes	Yes	No	Yes
Operating mode	("Make" contact)	("Make" contact)	Positive switching	Positive switching	Positive switching
Breaking capacity	2A, 250VAC 2A, 50VDC	2A, 250VAC 2A, 50VDC	2A, 24VDC	0.5A, 24VDC	0.5A, 24VDC
Short-circuit protection	No	No	Yes	No	No
See chapter	8.3	8.4	8.5	8.6	8.7

1) Relay with integrated contact protection

2) Relay without contact protection

The combined input/output modules PCD4.B90x are intended to double the input/output capacity of the PCD4 in the same space.

Theirs functions and technical specifications are based on the existing PCD2 digital I/O modules (for details, see section 8.8).

8.1 PCD4.E110/E111 Module with 16 digital inputs

Application

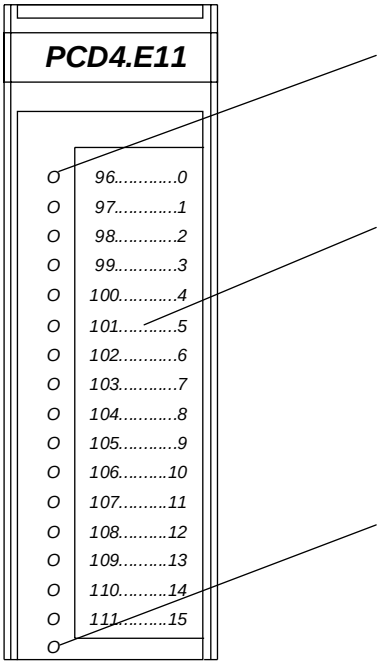
Low price input module for source or sink operation with 16 non-isolated inputs. Suitable for most electronic and electro-mechanical switching elements at 24 VDC, special voltages are possible.

Technical data

Number of inputs per module	16, electrically connected
Operating mode	Source or sink operation
Input voltage Ue (nominal)	E110 : 24 VDC, smoothed or pulsed E111 : 24 VDC, smoothed with ripple of max. 10 % Special: 5, 12 or 48 VDC on request
Input current	8 mA at 24 VDC (12 or 48 VDC) 4 mA at 5 VDC
Typical input delay	E110 : 8 ms, smoothed or pulsed voltage E111 : 0.1 ms, smoothed voltage (ripple of max. 10 %)
Ambient temperature	Operating : –20 ... +55°C Storage : –20 ... +85°C
Conforms to standards	IEC 1131-2 VDI 2880 NF C63-850
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (3 kV impulse 1.2 / 50 µs IEC 255-4)
Internal current consumption (from 5 V bus)	5 ... 45 mA

Important : If an universal PCD4.E110/E111 input module replaces a former PCD4.E100/E101 input module, the negative terminal ("–") must always be wired.

Presentation



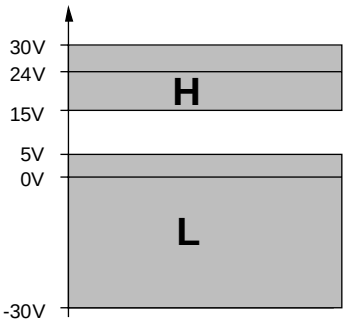
LED display indicating the signal states of the inputs.

Slot-in label address with input addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

17th LED (sink/source)
- Source operation : LED is out
- Sink operation : LED lights up

Input signal definition for standard version 24 VDC

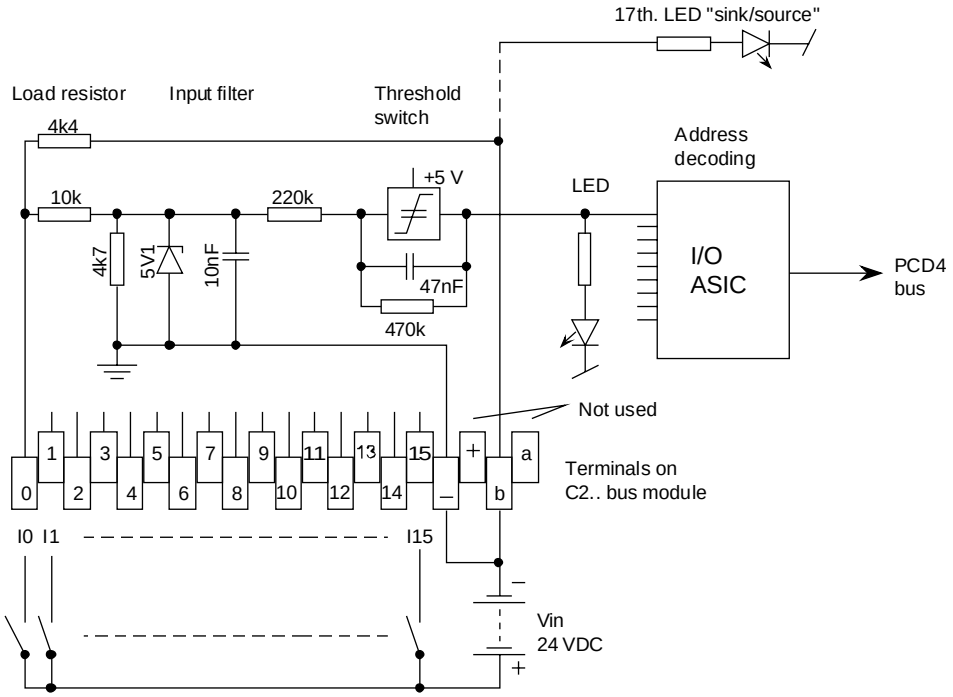


Due to the input delay of typically 8 ms in the standard version (..E110), full-wave rectified DC voltage is adequate for the external supply.

For the ..E111 model, smoothed DC voltage is required.

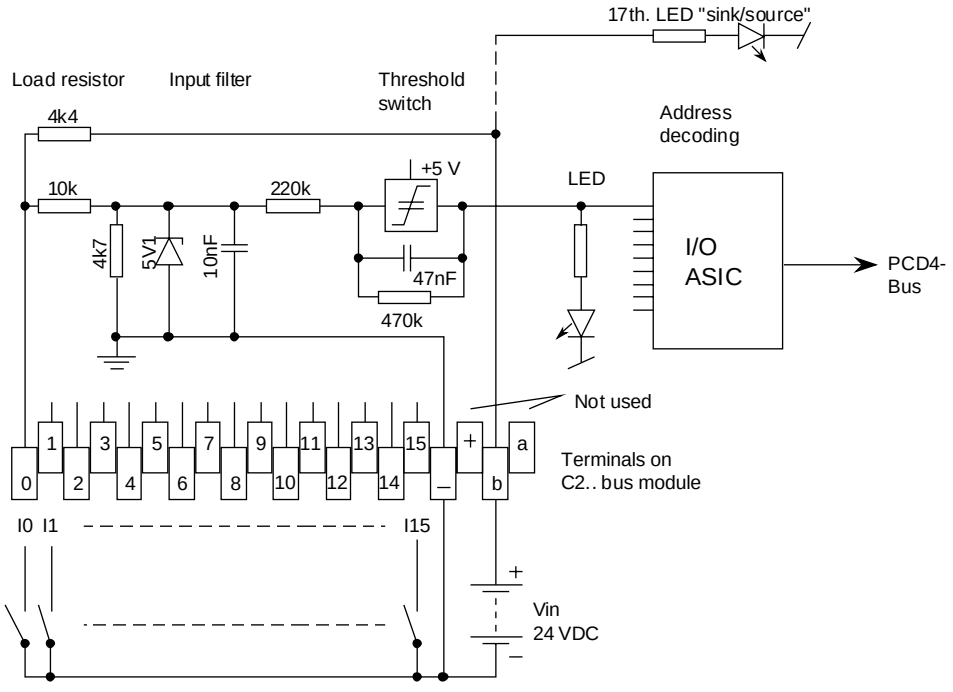
Input circuits and terminal assignments

- **Source operation or positive logic :** (for standard version 24 VDC)



Switch closed
(Positive at input) : Signal status "H" = LED lights up
Switch open : Signal status "L" = LED is out

- **Sink operation or negative logic :** (for standard version 24 VDC)



Switch closed
(negative at input) : Signal status "L" = LED is out
Switch open : Signal status "H" = LED lights up

Notes :

8.2 PCD4.E600/E601 Module with 16 digital inputs, with electrical isolation

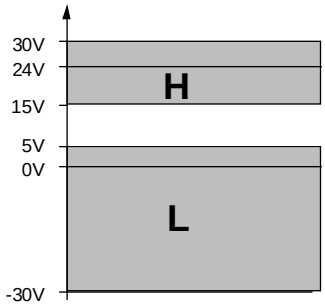
Application

Input module with electrical isolation for source operation only with 16 inputs. Suitable for most electronic and electro-mechanical switching elements at 24 VDC

The model type PCD4.E601 differs from type PCD4.E600 because of its shorter input rise-time. The ..E601 model needs a smoothed DC voltage.

Technical data

Number of inputs per module	16, electrically isolated by opto-couplers, source operation only
Input voltage Ue (nominal)	E600 : 24 VDC, smoothed or pulsed E601 : 24 VDC, smoothed with ripple of max. 10 % Special: 5 or 48 VDC on request



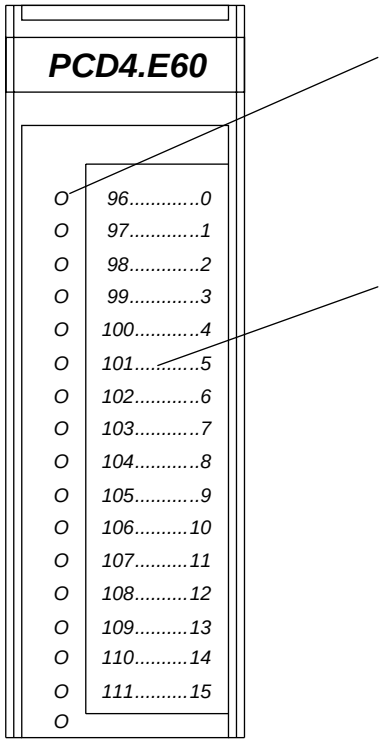
Due to the input delay of typically 8 ms in the standard version (..E600), full-wave rectified DC voltage is adequate for the external supply.

For the ..E601 model, smoothed DC voltage is required.

Input current	7 mA at 24 VDC
Typical input delay (low-high / high-low)	E600 : 8 ms / 8 ms E601 : 0.1 ms / 0.3 ms
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (whole brunch of pairs)
Electrical isolation voltage	1000 VAC, 1 min. [1)]
Optocoupler isolation voltage	2.5 kV
Internal current consumption (from 5 V bus)	1 ... 45 mA

1) **Caution !** This information only applies for the module itself, i.e. without bus module. On each bus module there is an anti-interference capacitor of 47 nF / 250 V between the negative (–) terminal and PGND, and between the positive (+) terminal and PGND.

Presentation

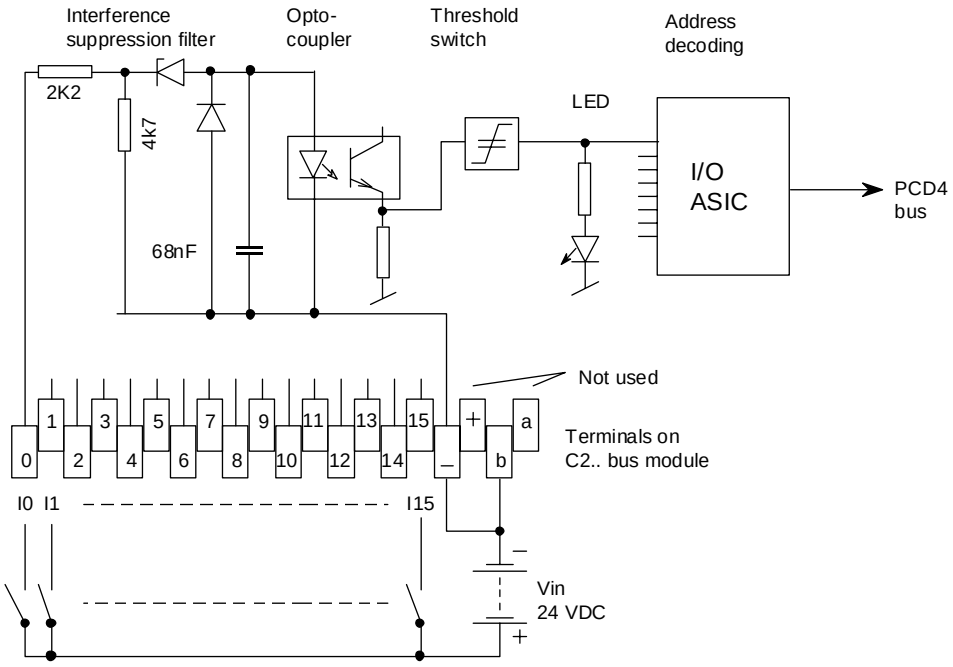


LED display indicating the signal states of the inputs.

Slot-in label address with input addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

Input circuit (source operation) and terminal assignments



Switch closed
(Positive at input) : Signal status "H" = LED lights up
Switch open : Signal status "L" = LED is out

8.3 PCD4.A200 Digital output module with 8 relay contacts, type "normally open" (with contact protection)

Application

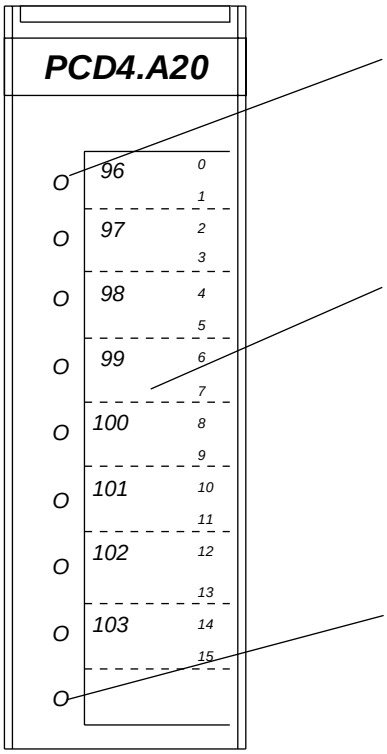
The module contains 8 relays with normally-open contacts for direct or alternating current up to 2 A, 250 VAC. It is especially suited wherever perfectly isolated AC switching circuits must be controlled with infrequent switching (see "installation notes").

Technical data

Number of outputs per module	8, isolated normally, open contacts (NO)
Type of relay (typical)	REO 30024, SCHRACK [1]
Switch rating (Contact lifetime)	2 A, 250 VAC AC1 (0.7×10^6 operations) 1 A, 250 VAC AC11 (1.0×10^6 operations) 2 A, 50 VDC DC1 (0.3×10^6 operations) [4] 1 A, 24 VDC DC11 (0.1×10^6 operations) [2] [4]
Relay coil supply [3]	Nominal 24 VDC, smoothed or pulsed, 8 mA per relay
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
Typical output delay	5 ms at 24 VDC
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (whole brunch of pairs)
Internal current consumption (from the bus)	+5 V : 5 ... 25 mA +15 V : 3 mA

1) from version B (Q4 / 1994)
2) only with external recovery diode
3) this terminal is reverse voltage protected
4) these ratings are not UL-listed !

Presentation



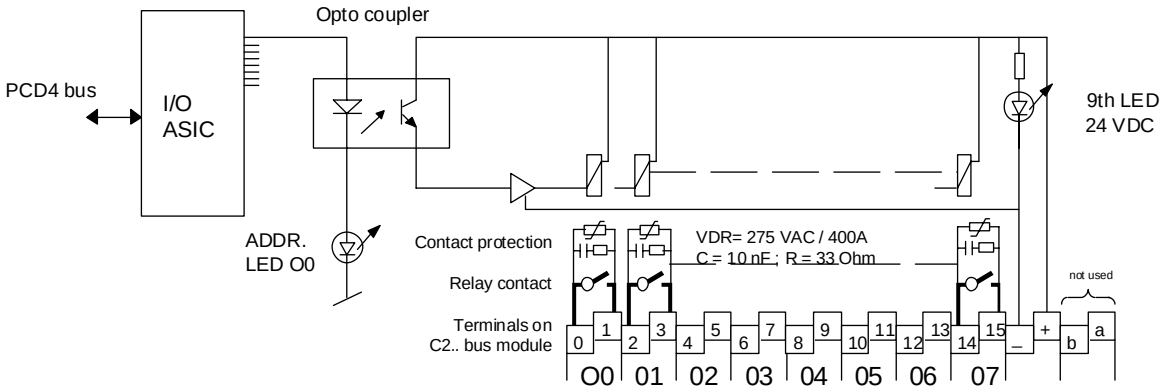
LED display indicating the signal states of the outputs (independent of external module supply).

Slot-in label address with output addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

LED display for the modules's external 24 VDC supply.

Output circuit and terminal assignments



Outputs usable as desired

Relay energized (contact closed): LED lights up
Relay reset (contact open) : LED is out
24 VDC must be connected to terminals +/– and 9. LED must lights up

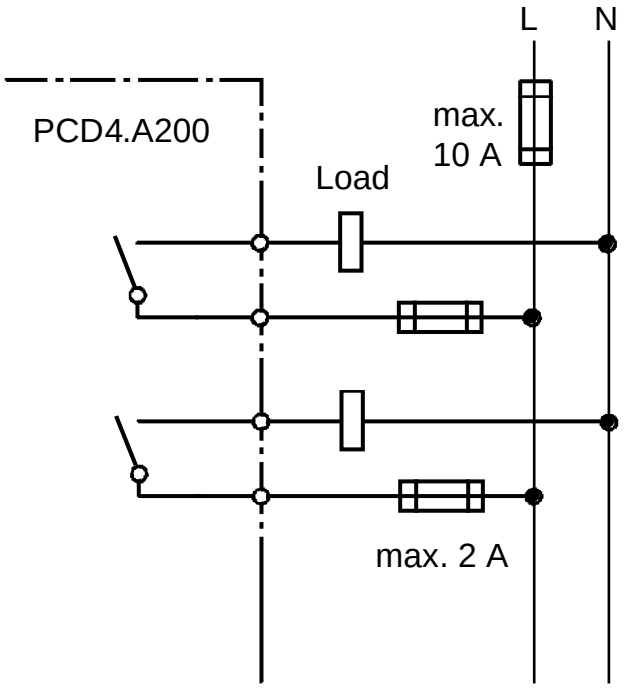
If the relay contact is open, the current leakage through the contact protector is **0.7 mA** (at 230 V / 50 Hz). This should be taken into account for the smaller AC loads.

Installation notes

For reasons of safety it is **not allowed** that low voltages (up to 50 V) and higher voltages (50 ... 250 V) are connected to the same module.

If a PCD4 system module is connected to a higher voltage (50 ... 250V), higher voltage approved components have to be used for all elements which are galvanically connected to the system.

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



Switching inductive loads

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

Is should be noted here that, as part of the harmonization of standards throughout the EU, the EMC standards are valid from 1996 (EMC Directive 89/336/EG). Two principles should therefore be emphasized :

1) THE PROTECTION AGAINST INTERFERENCES FROM INDUCTIVE LOADS IS IMPERATIVE.

2) INTERFERENCE SHOULD BE ELIMINATED AS CLOSE AS POSSIBLE TO ITS SOURCE.

It is therefore recommended that a protection circuit should be fitted at the load (often available as normal components on standardized contactors and valves).

When switching direct voltage it is urgently recommended that a recovery diode is fitted above the load. This should even take place when, theoretically, an Ohmic load is switched.

In practice, there will always be a proportion which is inductive (connection cable, resistance coil, etc.). In this case it should be noted that the switch-off time will be longer :

$$\text{Ta approx. } L/RL * \sqrt{(RL * IL/0.7)}$$

For direct voltage the transistor output modules are recommended.

Relay manufacturer's information on RC unit dimensioning.

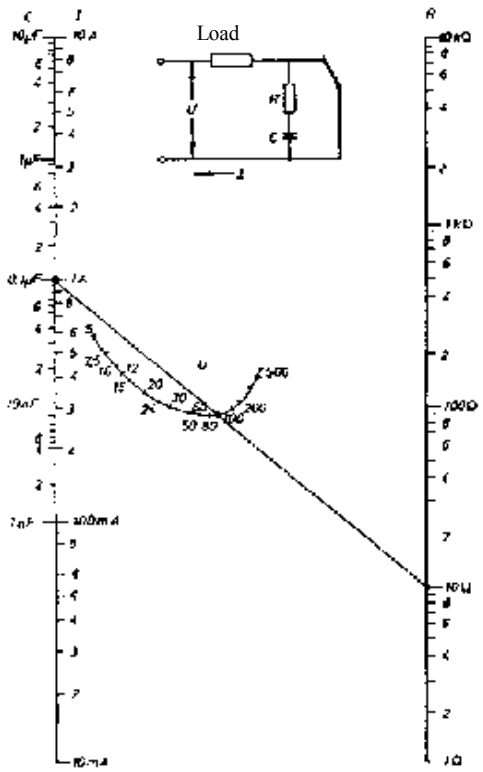
Wiring contact protection :

The purpose of contact protection wiring is to suppress switch arcing ("sparks") and thereby prolong the lifetime of the contacts. All protection wiring has disadvantages as well as advantages. The diagram opposite should simplify the search for a favourable solution in each case. For the cancellation of arcing by means of an RC unit, see example.

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

When switching off load circuits with inductive components (e.g. relay coils and magnet coils) the interruption of current results in overvoltage (standard inductance) at the switching contacts. This may amount to many times the operating voltage and so threatens the insulation of the load circuit. The resultant breaking spark leads to rapid wear of the relay contacts. For this reason contact protection wiring is particularly important with inductive load circuits.

Dimensioning guide for
RC combinations



Example :

U = 100V; I = 1A
C is found directly as 0.1 µF
R = 10 Ω (from line trough
R scale)

Notes :

8.4 PCD4.A250 Digital output module with 16 relay contacts, type "normally open" (without contact protection)

Application

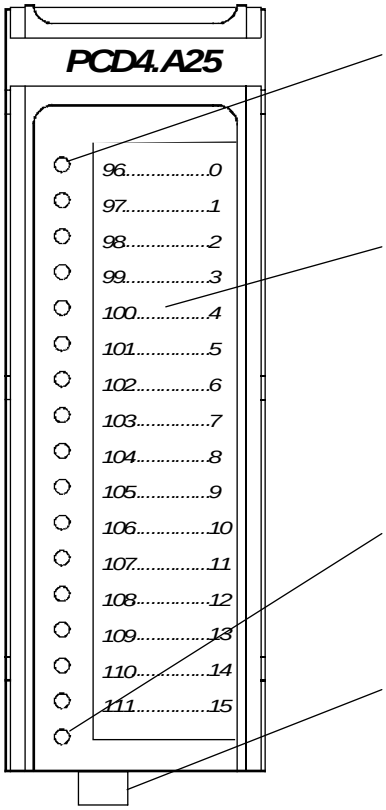
The module contains 16 relays with normally-open contacts for direct and alternating current up to 2 A, 250 VAC. The module is particularly suited to situations where AC switching circuits with infrequent switch actuation are controlled (see "installation notes"). The relay contacts have no integral contact protection. For each group of 4 relay contacts there is a common connection to a separate 4-pole terminal.

Technical data

Number of outputs per module	4 x 4, common terminal for each group of 4, open contacts (NO)
Type of relay (typical)	REO 30024, SCHRACK [1]
Application range	>12 V, >100 mA
Switch rating (Contact lifetime)	2 A, 250 VAC AC1 (0.7×10^6 operations) 1 A, 250 VAC AC11 (1.0×10^6 operations) 2 A, 50 VDC DC1 (0.3×10^6 operations) [4] 1 A, 24 VDC DC11 (0.1×10^6 operations) [2] [4]
Relay coil supply [3]	Nominal 24 VDC, smoothed or pulsed, 8 mA per relay
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
Typical output delay	5 ms at 24 VDC
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (whole brunch of pairs)
Internal current consumption (from the bus)	+5 V : 5 ... 45 mA +15 V : 3 mA

1) from version B (Q4 / 1994)
2) only with external recovery diode
3) this terminal is reverse voltage protected
4) these ratings are not UL-listed !

Presentation



LED display indicating the signal states of the outputs (independent of external module supply).

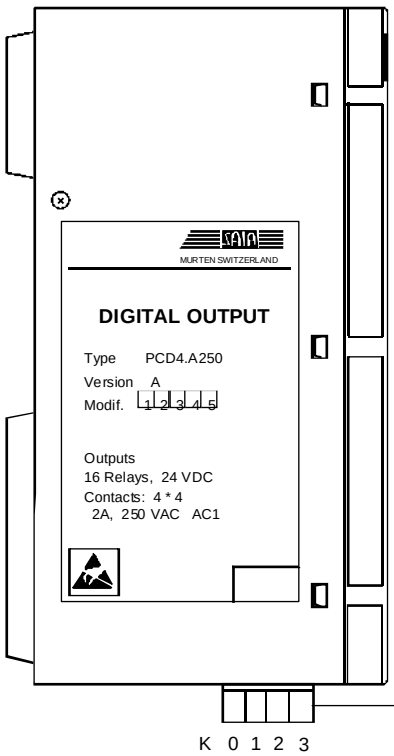
Slot-in label address with output addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

LED display for the modules's external 24 VDC supply.

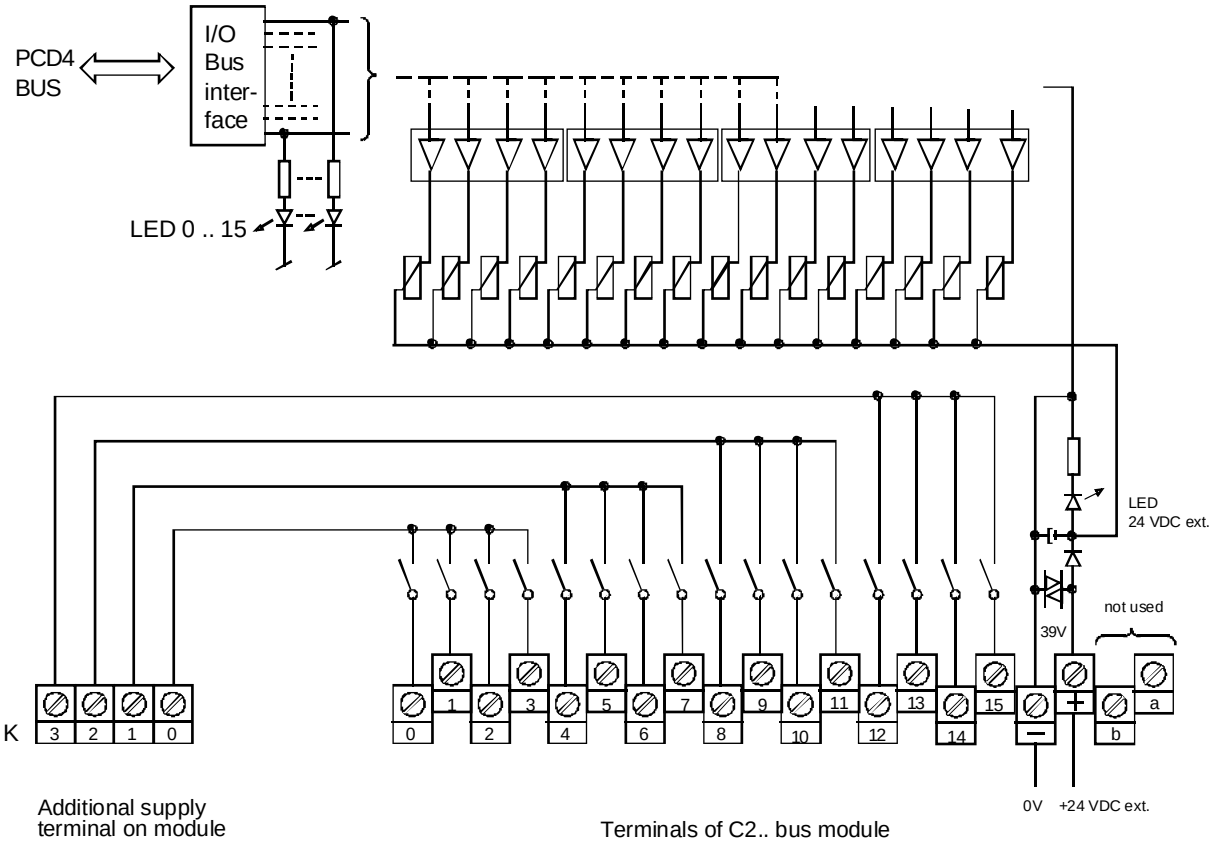
4-pole additional terminal (plug-in) for supplying the 4 groups of relay output contacts.

Additional supply terminals and name plate



4-pole terminal (plug-in) K0 … K3

Output circuit and terminal assignments



K0 ... K3	:	Terminal plug
0 ... 15	:	Relay contact, corresponds to output address
+, –	:	External supply of relay coils, the " – " is connected with internal Ground of PCD4

Relay energized	(contact closed) [1]	:	LED lights up
Relay reset	(contact open)	:	LED is out

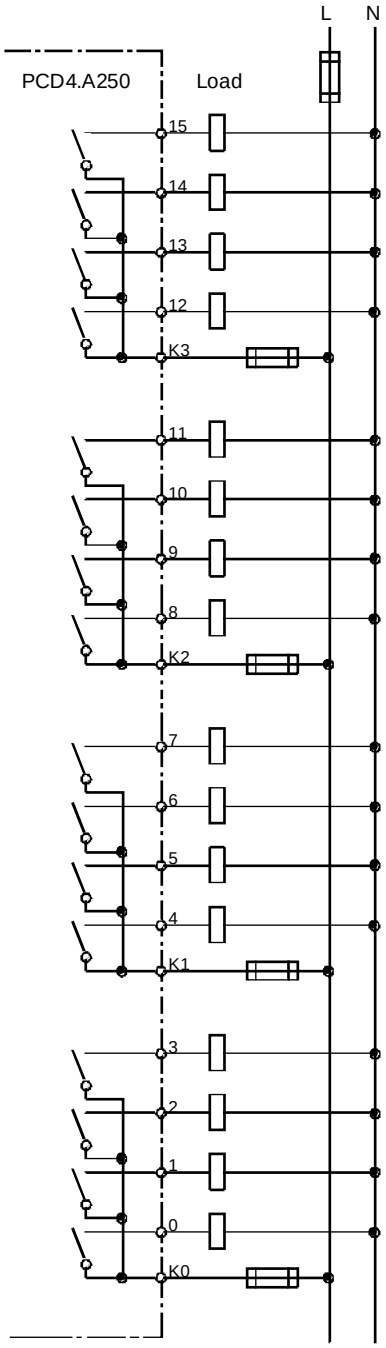
1) When the PCD4 supply and the module's +24 Vext. are switched on.

Installation notes

For reasons of safety it is **not allowed** that low voltage (up to 50 V) and higher voltage (50 … 250 V) are connected to the same module

If a PCD4 system module is connected to a higher voltage (50 … 250 V), higher voltage approved components have to be used for all elements which are galvanically connected to the system.

Using higher voltage (50 … 250 V), all connections to the relay contacts are to be connected on the same circuit. That means at one point in such a way that they are all protected against one AC phase by only one fuse. The individual load circuits, however, can again be individually fuse protected.



Switching inductive loads

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

Is should be noted here that, as part of the harmonization of standards throughout the EU, the EMC standards are valid from 1996 (EMC Directive 89/336/EG). Two principles should therefore be emphasized :

1) THE PROTECTION AGAINST INTERFERENCES FROM INDUCTIVE LOADS IS IMPERATIVE.

2) INTERFERENCE SHOULD BE ELIMINATED AS CLOSE AS POSSIBLE TO ITS SOURCE.

It is therefore recommended that a protection circuit should be fitted at the load (often available as normal components on standardized contactors and valves).

When switching direct voltage it is urgently recommended that a recovery diode is fitted above the load. This should even take place when, theoretically, an Ohmic load is switched.

In practice, there will always be a proportion which is inductive (connection cable, resistance coil, etc.). In this case it should be noted that the switch-off time will be longer :

$$\text{Ta approx. } L/RL * \sqrt{(RL * IL/0.7)}$$

For direct voltage the transistor output modules are recommended.

Relay manufacturer's information on RC unit dimensioning.

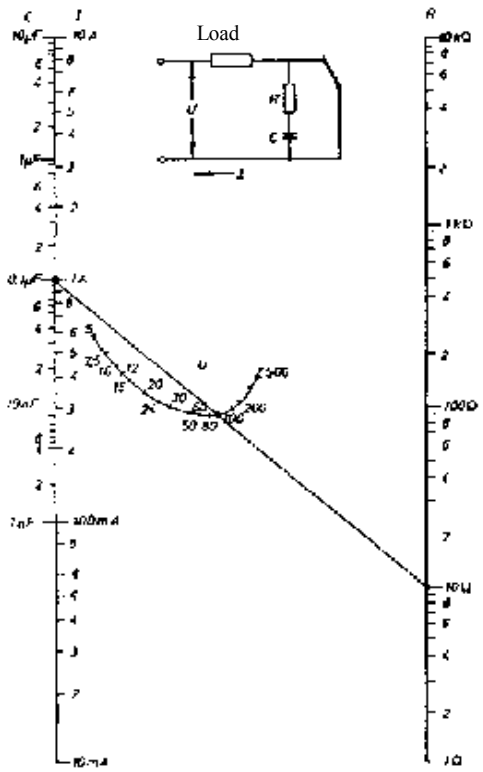
Wiring contact protection :

The purpose of contact protection wiring is to suppress switch arcing ("sparks") and thereby prolong the lifetime of the contacts. All protection wiring has disadvantages as well as advantages. The diagram opposite should simplify the search for a favourable solution in each case. For the cancellation of arcing by means of an RC unit, see example.

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

When switching off load circuits with inductive components (e.g. relay coils and magnet coils) the interruption of current results in overvoltage (standard inductance) at the switching contacts. This may amount to many times the operating voltage and so threatens the insulation of the load circuit. The resultant breaking spark leads to rapid wear of the relay contacts. For this reason contact protection wiring is particularly important with inductive load circuits.

Dimensioning guide for RC combinations



Example :

U = 100V; I = 1A
C is found directly as 0.1 µF
R = 10 Ω (from line trough R scale)

8.5 PCD4.A350 Module with 8 digital outputs, 24 VDC / 2 A, with electrical isolation

Application

Efficient output module with 8 transistor outputs of 5 mA up to 2 A, isolated, short-circuit protected, voltage range 8 ... 32 VDC.

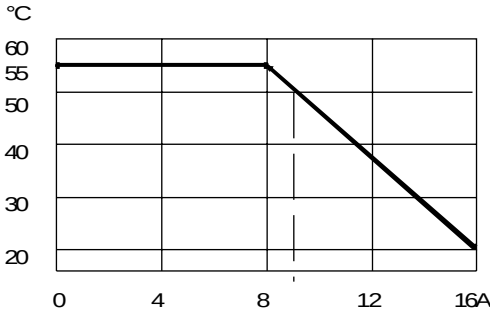
Technical data

Number of outputs per module	8, electrically isolated by optocouplers
Output current (Ia)	5 mA ... 2 A (leakage current max. : 1 mA) within the voltage range 8 ... 24 VDC, the load resistance should be at least 12 Ω. max. inductivity : - 150 mH at 1.5 A - 80 mH at 2 A
Behaviour under short-circuit	If the load circuit shorts out, the output current is limited to 3.5 A. Sustained over-load causes the output to switch off after a few seconds. From this time, attempts are periodically made to switch on. If the overload has ceased, the output switches on again automatically.
Operating mode	Source operation (positive switching)
Total current per module	See diagram (next page)
Voltage range (Ua)	8 ... 32 VDC, smoothed
Residual ripple of Ua	max. 10 %
Voltage drop	max. 2 V at I = 2 A
Typical output delay	10 µs - switch on delay 100 µs - switch off delay (resistive load 5 mA … 2 A)
Ambient temperature	Operating : –20 ... +55°C Storage : –20 ... +85°C

Conforms to standards	IEC 1131-2 DIN 19230 and 19232 VDI 2880 NF C63-850
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (whole brunch of pairs)
Internal current consumption (from 5 V bus)	max. 25 mA

Current load/ambient temperature diagram

Ambient temperature below the modules (with vertical openings)



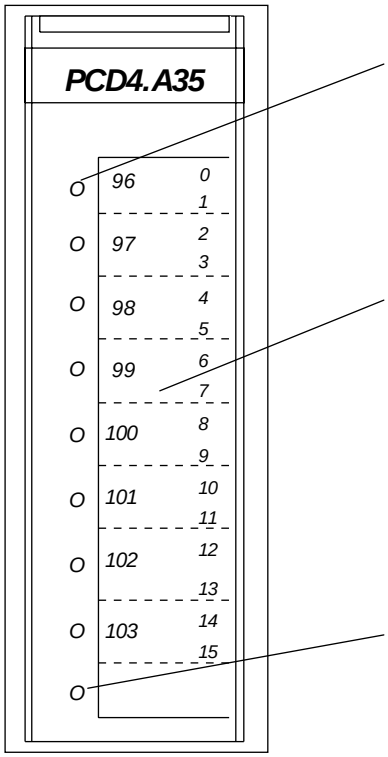
Mean sustained overall current for all outputs in the same module (module in vertical position)

Example :
(Ua = 24 VDC)

4 x 48 W valves	(50% duty cycle *)	4A
2 x 48 W valves	(75% duty cycle *)	3A
2 x 24 W contactors	(95% duty cycle *)	2A
Mean overall current		9A
Permissible ambient temperature		50°C

*) thermical time constant of the module : 5 min.

Presentation



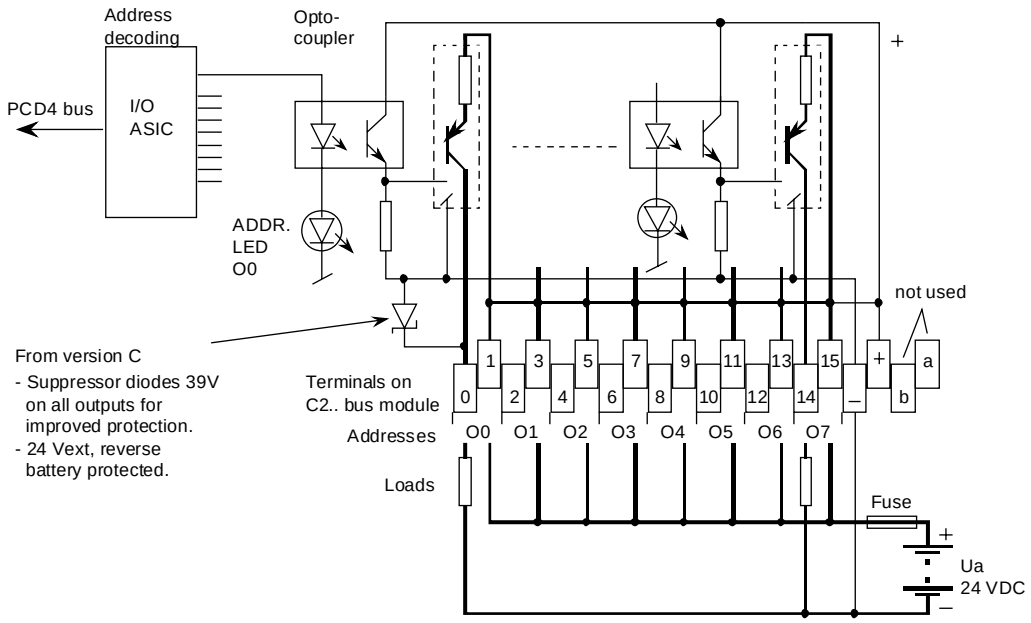
LED display indicating the signal states of the outputs (independent of external module supply).

Slot-in label address with output addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

LED display showing if there is an output overload.

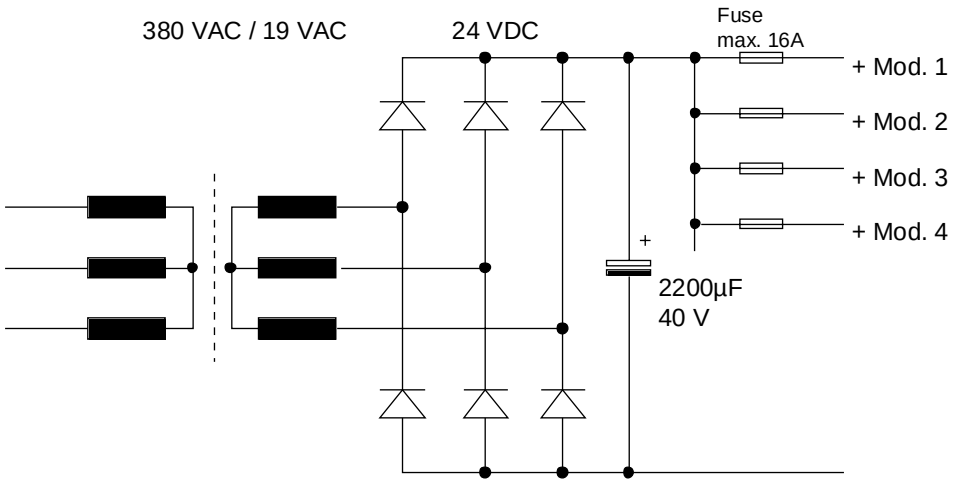
Output circuit and terminal assignments



Output conducting (set) : LED lights up
Output disconnected (reset) : LED is out

User external supply

The following user supply is recommended for minimal ripple. To bypass turn-on peaks (e.g. caused by a lamp load), a capacitor on the DC voltage side is imperative.



Capacity of three-phase transformer
$P(VA) = I_{max\ 24\ VDC}\ (A) * 27\ V$

Note : All information refers to version "B" (or "C").
The earlier version "A" has the outputs in 2 groups :
Group 1 = outputs 0 - 3 ; Group 2 = outputs 4 - 7

Notes :

8.6 PCD4.A400 Module with 16 digital outputs, 0.5 A, electrically connected

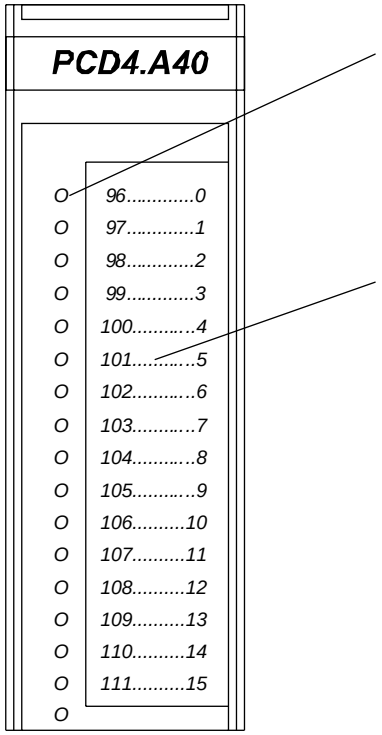
Application

Low cost output module with 16 transistor outputs 5 ... 500 mA, without short-circuit protection. Non-isolated current circuits in the voltage range 5 ... 32 VDC.

Technical data

Number of outputs per module	16, electrically connected
Output current (Ia)	5 ... 500 mA (leakage current max. : 0.1 mA)
Operating mode	Source operation (positive switching)
Total current per module	16 x 0.5 A = 8 A (on 100% duty cycle) (from version "B")
Voltage range (Ua)	5 ... 32 VDC, smoothed 10 ... 27 VDC, pulsed
Voltage drop	max. 0.3 V at 0.5 A (version "A" : 1.0 V)
Typical output delay	10 µs - switch on delay 50 µs - switch off delay (version "A" : 10 µs) (resistive load 5 ... 500 mA) with inductive loads, the delay is longer due to the protective diode.
Ambient temperature	Operating : –20 ... +55°C Storage : –20 ... +85°C
Conforms to standards	IEC 1131-2 VDI 2880 NF C63-850
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (whole brunch of pairs)
Internal current consumption (from 5 V bus)	5 ... 45 mA (version "A" : 5 ... 125 mA)

Presentation

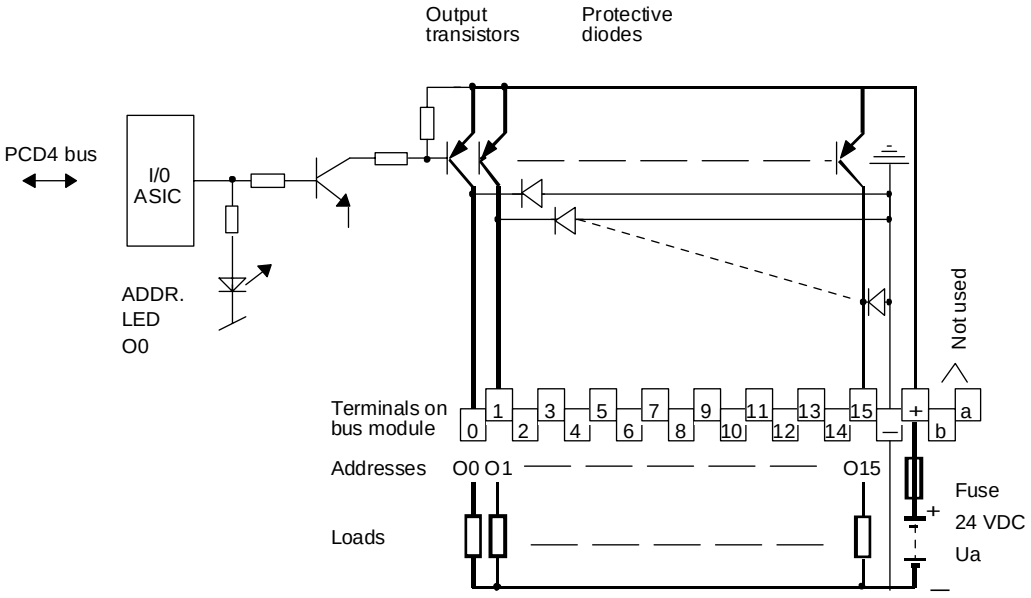


LED display indicating the signal states of the outputs (independent of Ua).

Slot-in label address with output addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

Output circuit and terminal assignments



Output conducting (set) : LED lights up
Output disconnected (reset) : LED is out

Fuse : It is recommended that each PCD4.A400 module is protected against short-circuit with a quick-break fuse of max. 10 A.

Terminal current : The terminals 0 ... 15 can carry the nominal output current (500 mA), the "+" terminal can carry a total current of 8 A.

8.7 PCD4.A410 Module with 16 digital outputs, 0.5 A, with electrical isolation

Application

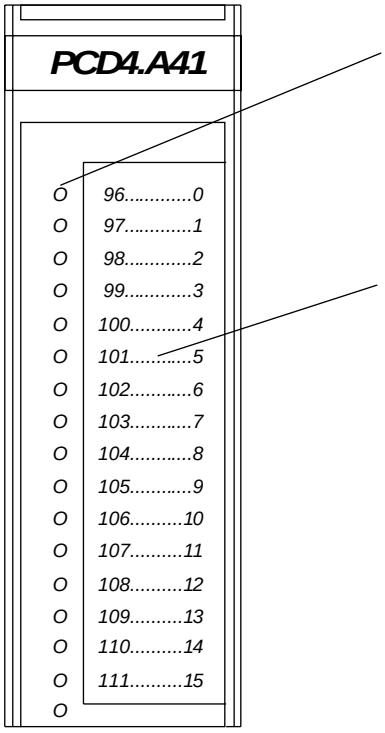
Output module, electrically isolated from the CPU, with 16 MOSFET transistor outputs 1 … 500 mA, without short-circuit protection. Electrically isolated current circuits in the voltage range 5 … 32 VDC.

Caution : This module **is not** suitable for driving the PCA2.D12/D14 display modules !

Technical data

Number of outputs per module	16, electrically isolated
Output current (Ia)	1 ... 500 mA (leakage current max. : 0.1 mA)
Operating mode	Source operation (positive switching)
Total current per module	8 A (on 100% duty cycle)
Voltage range (Ua)	5 ... 32 VDC, smoothed 10 ... 27 VDC, pulsed
Voltage drop	max. 0.3 V at 0.5 A
Typical output delay	5 µs - switch on delay 500 µs - switch off delay (resistive load 5 ... 500 mA) with inductive loads, the delay is longer due to the protective diode.
Electrical isolation voltage All terminal connections against CPU part	1500 VAC, 1 minute
Common voltage mode	200 V
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (whole brunch of pairs)
Internal current consumption (from the bus)	+5 V : 5 ... 45 mA +15 V : 3 mA (for reset)

Presentation

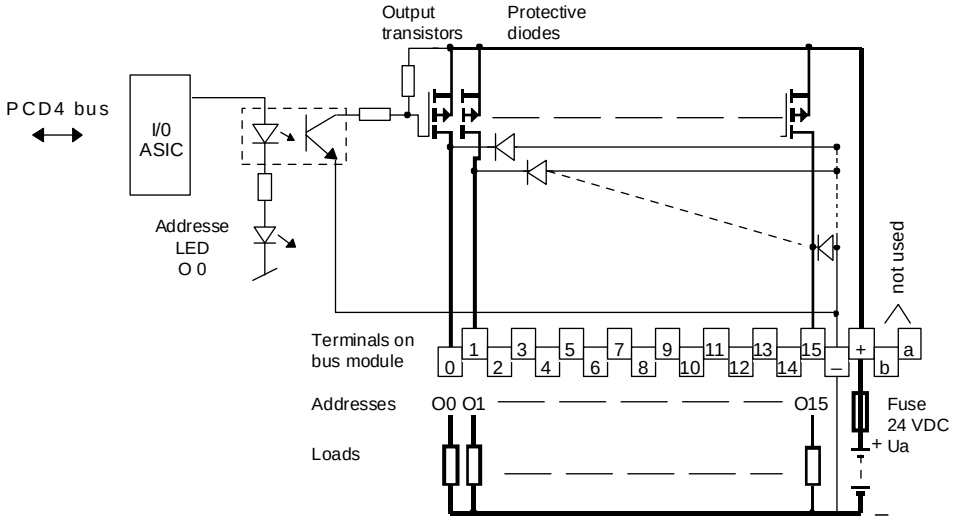


LED display indicating the signal states of the outputs (independent of Ua).

Slot-in label address with output addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

Output circuit and terminal assignments



Output conducting (set) : LED lights up
Output disconnected (reset) : LED is out

The minus terminal (–) is NOT connected to the internal ground. Due to interference decoupling capacitors on the bus module from – and + terminal to PGND, the common mode voltage is limited to 200 V AC or DC.

Fuse : It is recommended that each PCD4.A410 module is protected against short-circuit with a quick-break fuse of max. 10 A.

Terminal current : The terminals 0 ... 15 can carry the nominal output current (500 mA), the "+" terminal can carry a total current of 8 A.

8.8 PCD4.B900/B901 Digital input/output module, with 16 inputs and 16 outputs

Application

The ..B900 module doubles the I/O capacity in the same space in an inexpensive way. Inputs and outputs are electrically connected and function in accordance with the source operation principle.

Inputs and outputs use the same addresses. For this reason, the setting commands such as OUT, SET, RES or even BITO(R) and DIGO(R) are the only ones that may be used for outputs. All interrogation commands refer to the corresponding inputs.

Type ..B901 has a short input delay of typically 0.4 ms

Technical data on inputs

Number of inputs per module	16, electrically connected, source operation only
Connections	Screw connections on bus module
Input voltage Ue (nominal)	B900 : 24 VDC, smoothed or pulsed B901 : 24 VDC, smoothed with ripple of max. 10 %
Input current	8 mA at 24 VDC
Typical input delay	B900 : 9 ms B901 : 0.4 ms

Technical data on outputs

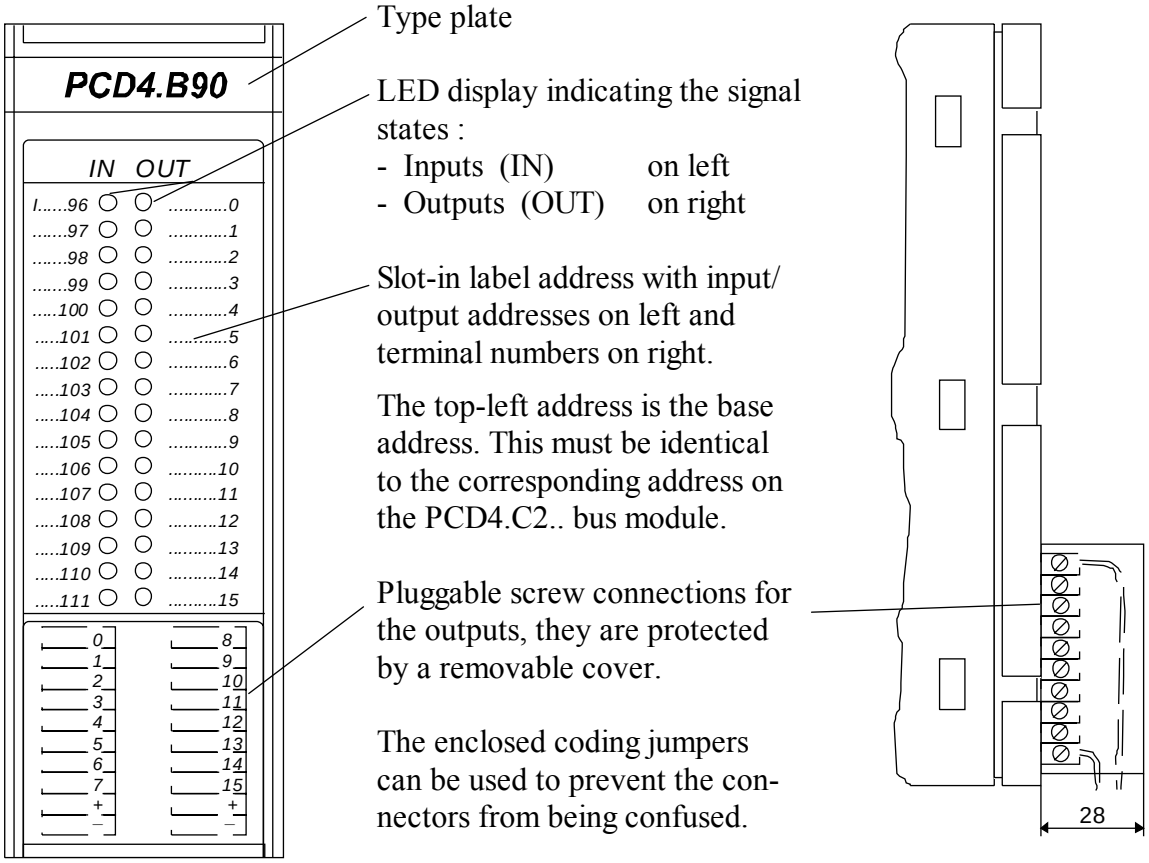
Number of outputs per module	16, electrically connected
Connections	Pluggable screw connectors at module front
Output current (Ia)	5 ... 500 mA (leakage current max. : 0.1 mA) within the voltage range 5 ... 24 VDC, the load resistance should be at least 48 Ω.
Operating mode	Source operation (positive switching)
Total current per module	6 A (UL rating max. 4.5 A)

Voltage range (Ua)	5 ... 32 VDC, smoothed 10 ... 27 VDC, pulsed
Voltage drop	1 V at 0.5 A
Typical output delay	10 µs, with inductive loads, the delay is longer due to the protective diode.

Common technical data on inputs/outputs

Ambient temperature	Operating : –20 ... +55°C Storage : –20 ... +85°C
Conforms to standards	IEC 1131-2 VDI 2880 NF C63-850
Resistance to interference according to IEC 801-4	4 kV under direct coupling 2 kV under capacitance coupling (whole brunch of pairs)
Internal current consumption (from the bus)	+5 V : 5 ... 95 mA +15 V : 7 mA

Presentation



Type plate

LED display indicating the signal states :
- Inputs (IN) on left
- Outputs (OUT) on right

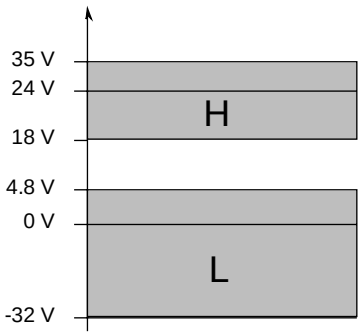
Slot-in label address with input/ output addresses on left and terminal numbers on right.

The top-left address is the base address. This must be identical to the corresponding address on the PCD4.C2.. bus module.

Pluggable screw connections for the outputs, they are protected by a removable cover.

The enclosed coding jumpers can be used to prevent the connectors from being confused.

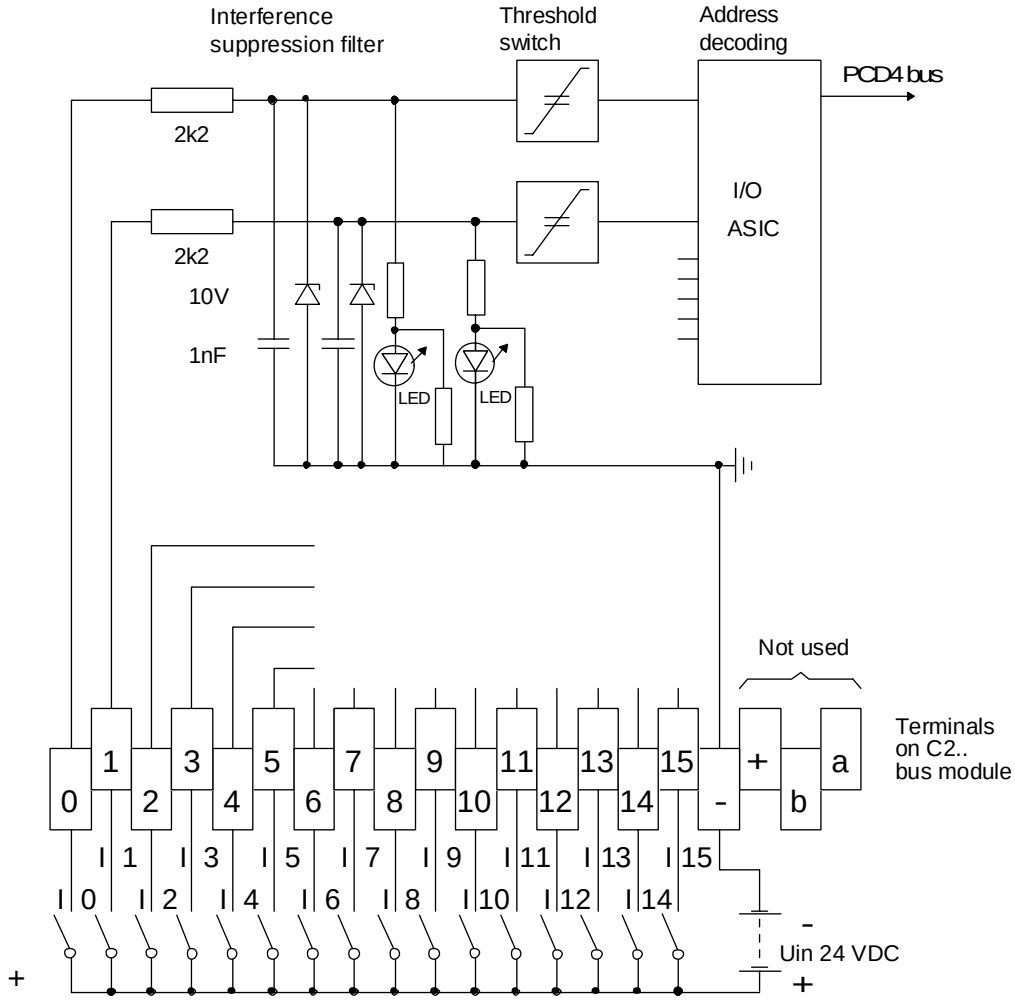
Input signal definition



Due to the input delay of typically 9 ms in the standard version (..B900), full-way rectified DC voltage is adequate for the external supply.

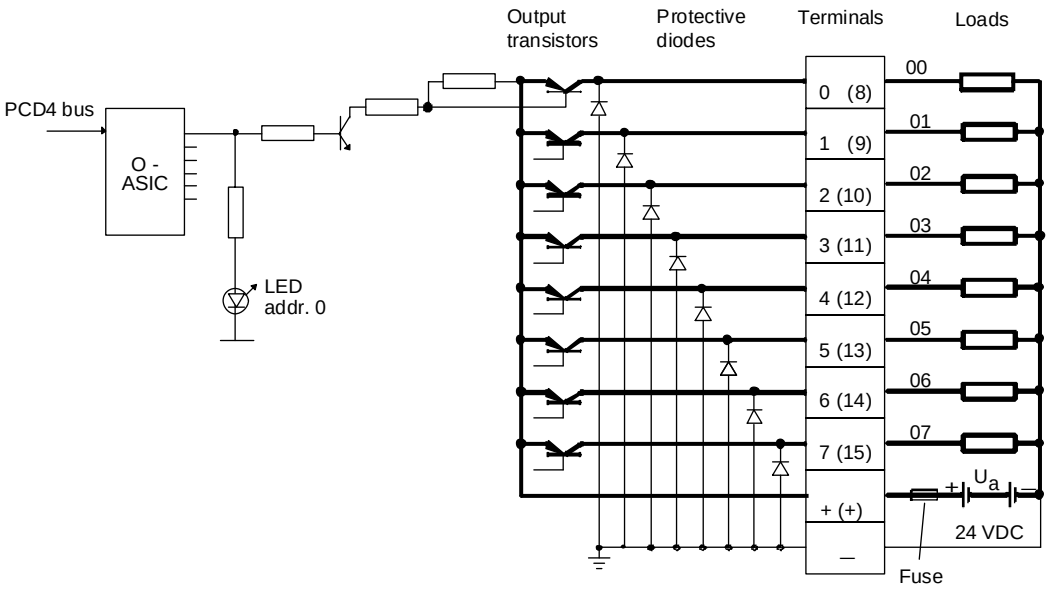
For the ..B901 model, smoothed DC voltage is required

Input circuit (source operation) and terminal assignments



Switch closed
(Positive at input) : Signal status "H" = LED lights up } left row
Switch open : Signal status "L" = LED is out } (IN)

Output circuit

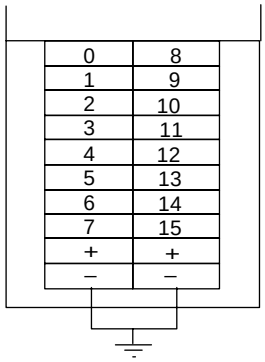


Output conducting (set) : LED lights up } right row
Output disconnected (reset) : LED is out } (OUT)

Fuse : It is recommended that each PCD4.B90x module is protected against short-circuit with a quick-break fuse of max. 10 A.

Terminal current : The terminals 0 ... 15 may be loaded with the nominal output current (500 mA), the "+" terminals with the total current of 4 A each.

Output terminal assignments



The terminals are always numbered from 0 ... 15. The absolute output address is determined by adding the basic address of the module to the terminal number.

The screw terminals are pluggable, which allows separating 8 output circuits from the control at all times.
Cabling guide's, see "Presentation".

Note concerning the voltage source for inputs and outputs

The input and output circuits may be operated with different voltages within the specified range. The two voltage sources share the negative pole and they are connected to ground. This also holds true for the two output groups 0 ... 7 and 8 ... 15 (different positive pole, common negative pole).

9. Analogue input/output modules

Analogue modules have a flexible design. A choice of "Range Modules", which govern the I/O voltage range, are available for each base module. There are up to 8 analogue channels available per module.

Analogue input modules PCD4.W…

Types	Range module PCD7.W..	Number of channels	Measuring range	Resolu-tion	Accuracy	See chap.
..W100 4 I (+ 2 O)	..W101	4	0 … +10 V –10 … +10 V –5 … +5 V	12 bits	unip. : ± 0.5 % bip. : ± 0.6 %	9.1
		2	Pt/Ni 1000			
	..W105	4	*) 0 …+20 mA –20 …+20 mA –10 …+10 mA			
..W300 8 I	..W100	4	–10 … +10 V	12 bits + sign bit	± 0.35 %	9.2
	..W101	4	–1 … +1 V			
	..W102	4	–100 … +100 mV			
	..W103	4	*) –20 …+20 mA			
	..W104	4	+4 … +20 mA two-wire current converter			
	..W110	4	Pt 1000 : –50 … +150°C			
	..W111	4	Ni 1000 : –50 … +150°C			
	..W120	4	Constant current 2 mA ..W100 : Pt/Ni 1000 ..W101 : Pt/Ni 100	---		
..W500 8 I	..W100	4	0 … +10 V –10 … +10 V	12/15 bits	± 0.3 %	9.4
	..W101	4	0 … +1 V –1 … +1 V			
	..W103	4	*) 0 …+20 mA			
	..W104	4	+4 … +20 mA two-wire current converter			
	..W110	4	Pt 1000 : –50 … +150°C			
	..W111	4	Ni 1000 : –50 … +150°C			
	..W120	4	Constant current 0 … 10 mA ..W101 : Pt/Ni 100/1000	---		

*) +4 … +20 mA by user program

Analogue output modules PCD4.W…

Types	Range module PCD7.W..	Number of channels	Output range	Resolu-tion	Accuracy	See chap.
..W100	..W200	1	0 … +10 V	12 bits	± 1.0 %	9.1
2 O	..W201	1	0 … +1 V		± 1.5 %	
(+ 4 I)	..W202	1	–10 … +10 V		± 1.0 %	
	..W203	1	–1 … +1 V		± 1.5 %	
	..W204	1	0 … +20 mA		± 1.65 %	
	..W205	1	+4 … +20 mA		± 1.65 %	
	..W206	1	–10 … 0 V		± 1.0 %	
..W400	none	8	0 … +10 V 0 … +20 mA +4 … +20 mA	8 bits	voltage : ± 1.5 % current : ± 2.0 %	9.3
8 O						
..W600	..W300	2	0 … +10 V	12 bits	voltage : ± 0.3 %	9.5
8 O	..W302	2	–10 … +10 V			
	..W304	2	0 … +20 mA		current : ± 0.3 %	
	..W305	2	+4 … +20 mA			

Caution : Analogue I/O modules should only be changed when the PCD4 is disconnected from power source.

9.1 PCD4.W100 Analogue input/output module, 6 channels (4I + 2O), 12 bit resolution

Application

The ..W100 analogue module for fast processes consists of a base module and up to three add-on range modules which select the input and output voltage or current ranges.

This enables the 4 input channels and 2 output channels to be configured independently; it is also possible to directly connect two resitive temperature sensors.

Module overview

Base module :

PCD4.W100 : Contains the input multiplexer with the A/D converter for 4 input channels via the range module, and connections for 2 output channels.

Range modules :

- **Inputs**

PCD7.W101 : 4 channels, measurement range 0 ... 10 V, ±10 V or ±5 V, input resistance 10 MΩ

PCD7.W105 : 4 channels, measurement area 0 ... 20 mA, ±20 mA or ±10 mA, input resistance 499 Ω / 0.1 %

Time constant on input filter : 1 ms

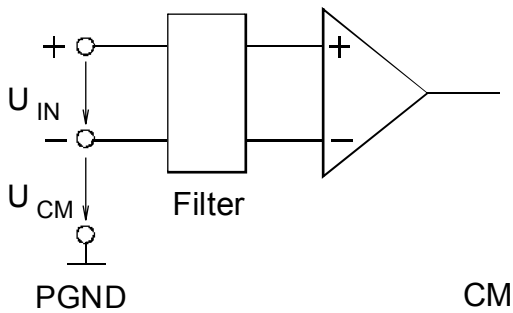
- **Outputs**

PCD7.W200 :	1 channel,	range 0 ... 10 V,	min. load resist. ≥ 3 kΩ
PCD7.W201 :	1 channel,	range 0 ... 1 V,	min. load resist. ≥ 300 Ω
PCD7.W202 :	1 channel,	range ±10 V,	min. load resist. ≥ 3 kΩ
PCD7.W203 :	1 channel,	range ±1 V,	min. load resist. ≥ 300 Ω
PCD7.W204 :	1 channel,	range 0 ... 20 mA,	max. circuit resist. 500 Ω
PCD7.W205 :	1 channel,	range 4 ... 20 mA,	max. circuit resist. 500 Ω
PCD7.W206 :	1 channel,	range –10 ... 0 V,	min. load resist. ≥ 3 kΩ

Technical data of the base module

- **Inputs**

Number of input channels	4 voltage or current inputs, or 2 inputs for resistive temperature sensors (Pt/Ni 1000)
Potential separation	No
Measuring principle	Differential
Input ranges	See section "range modules"
Resolution (digital representation)	12 bits (0 ... 4095) Unipolar or bipolar, selectable by jumper on the base module.
A/D conversion time	≤ 30 µs
Accuracy (referred to measured value)	0.45 % ± 2 LSB unipolar 0.45 % ± 6 LSB bipolar
Repeating accuracy	Within 3 LSB
Temperature error (typical)	0.2 % across temp. range 0 ... 50°C
Max. overvoltage at analogue inputs	60 VDC
Resistance to interference according to IEC 801-4	1 kV under capacitance coupling, with cables not shielded 2 kV under capacitance coupling, with cables shielded
Common-mode behaviour	$U_{IN} + U_{CM} \leq \pm 12$ V CMR = 74 dB CMMR = 200 µV/V

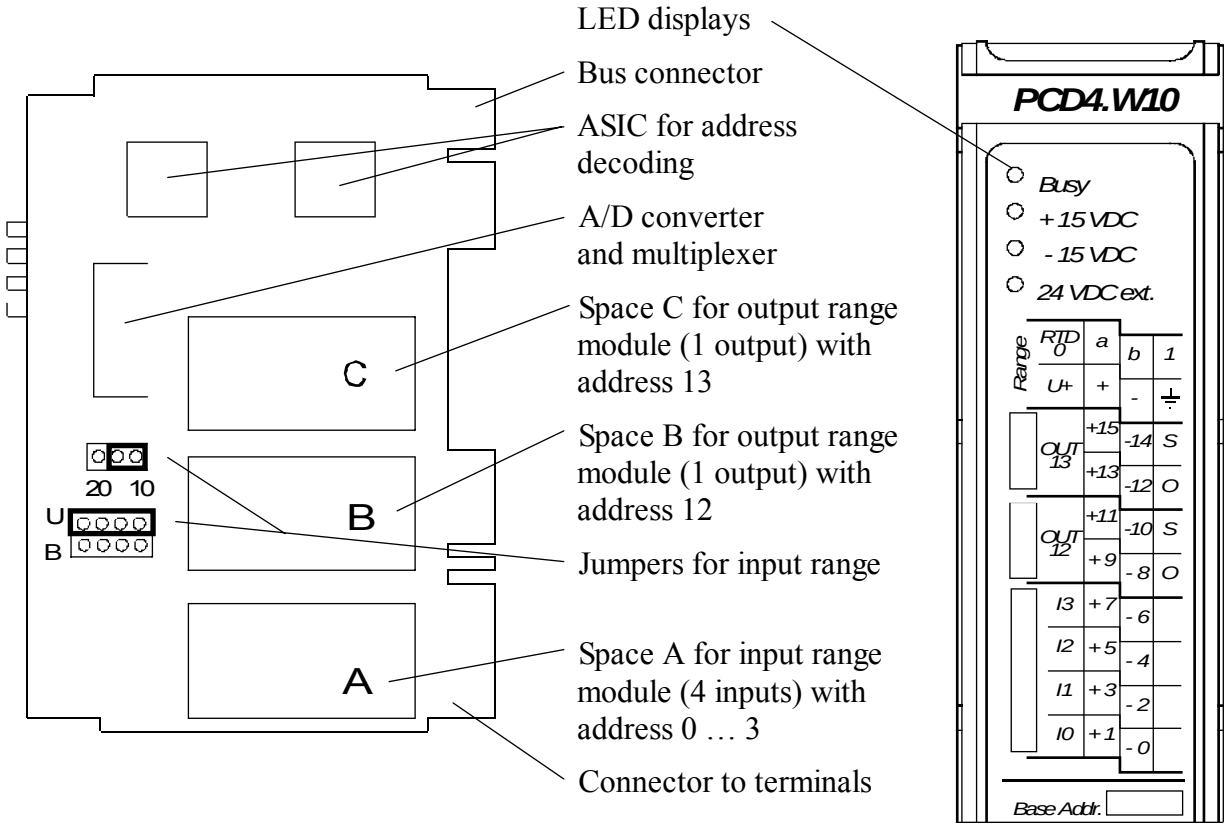


CM : Common mode

- **Outputs**

Number of output channels	Max. 2, voltage or current, short-circuit protected
Potential separation	No
Output ranges	See section "range modules"
Resolution (digital representation)	12 bits (0 ... 4095) Unipolar or bipolar, depending on choice of the range module.
D/A conversion time	≤ 20 µs
SENSE inputs	2 each per output : for precise voltage control
Resistance of OUT signal cables	Max. 200 Ω (total for both cables)
Accuracy (referred to output value)	Voltage : 1 % ± 5 mV Current : 1.4 % ± 50 µA Constant current : 2 mA ± 1 %
Temperature error (typical)	0.2 % across temp. range 0 ... 50°C
External supply 24VDC	Only required for current outputs, same quality as for supply module N2.. (max. 50 mA)
Internal current consumption (from the bus)	+5 V : 50 mA +15 V : 35 mA –15 V : 35 mA

Presentation



The following functional blocks can been seen :

- The base printed circuit board (PCB) with bus interface, address decoding, A/D converter with multiplexer (MUX) and three spaces for insertion of range modules.

- Spaces A, B and C for I/O range modules :

  A : 4 inputs with the same signal ranges

  B + C : Each output with an individual signal range

- Factory setting of jumpers : 10 / U

Insertion of the range modules

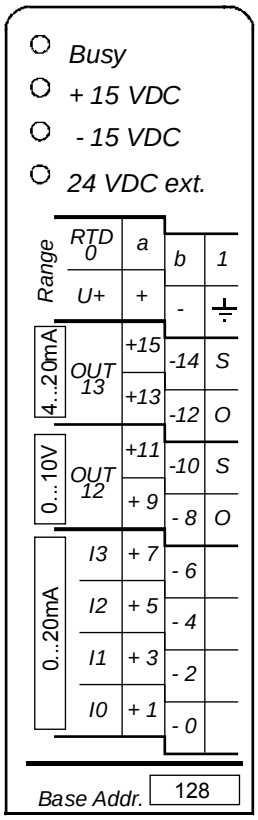
The base printed circuit board must first be removed from the module housing in order to install a range module. This is done by pressing in the snap fastenings on either side of the front panel. Then the PCB fastening screw on the upper left hand side of the module is unscrewed, so that the PCB can be removed from the casing.

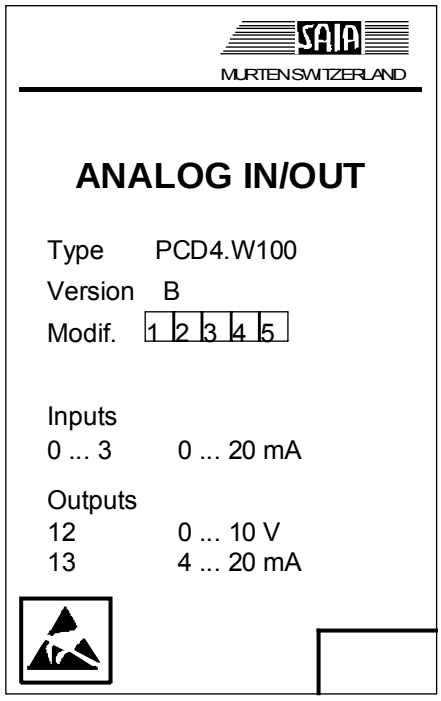
At the lowest space A, one range module for 4 input channels with addresses 0 ... 3 (+ base address) can be fitted. The upper spaces B and C are each reserved for 1 output channel with addresses 12 and 13 (+ base address).

After installing the range modules, close the housing and tighten up the PCB fastening screw again.

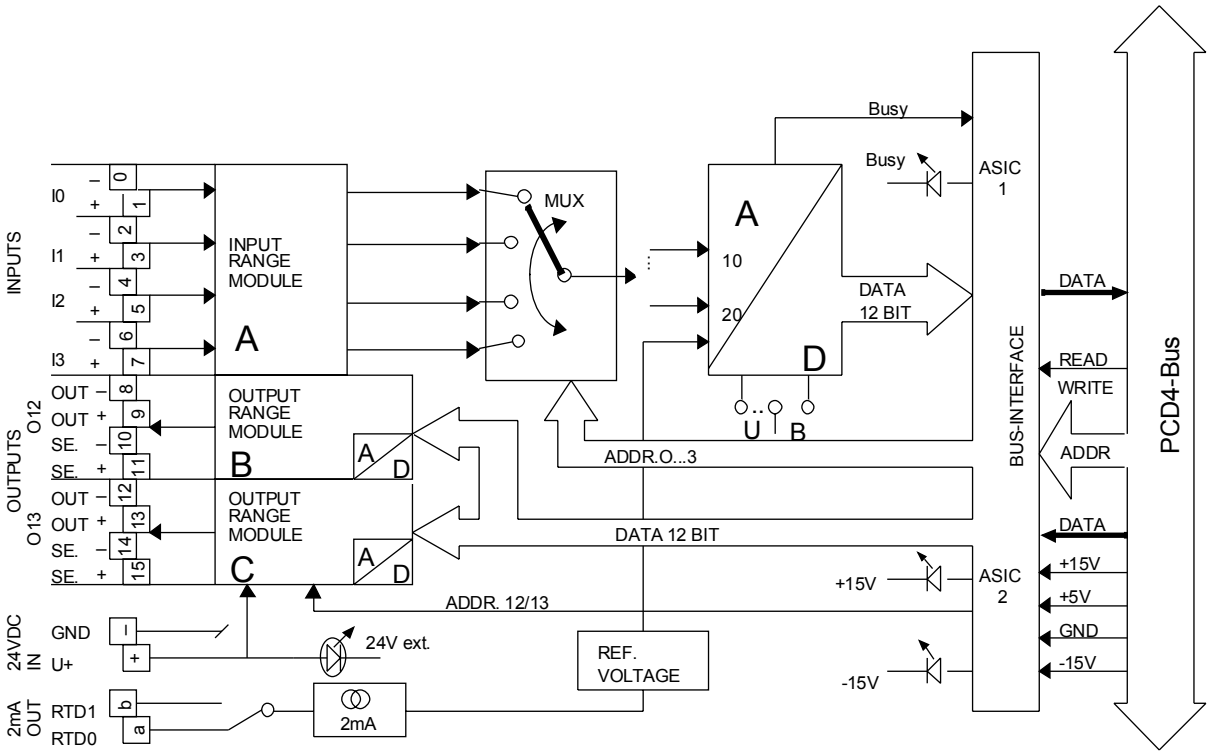
Caution : The base PCB and the range modules incorporate components which are sensitive to electrostatic discharges.

Various types of range modules can be attached to the output spaces B and C. In order to keep the internal equipment obvious to outside inspection, remember to write the I/O type on the labels provided on the front and side panel (see example below).

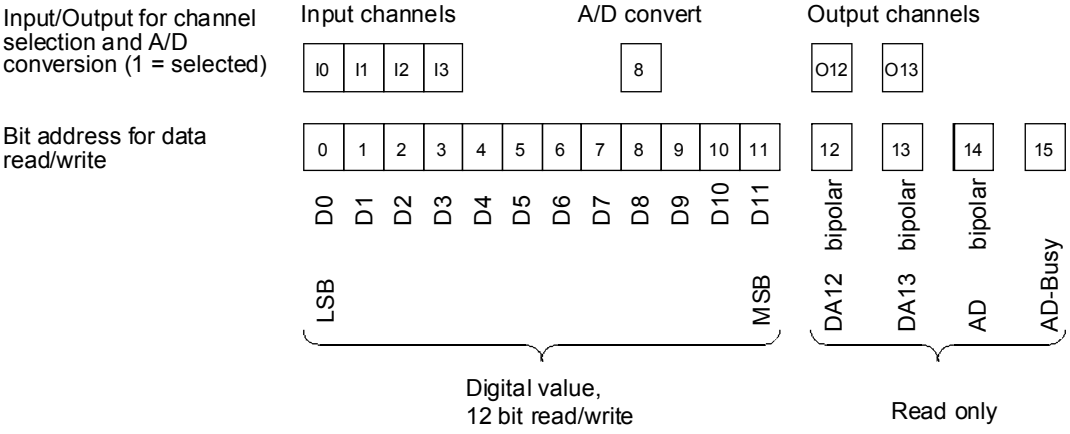




Block diagram



Meaning of the 16 addresses



If bit 12 "DA 12 bipolar" = 1 : then a bipolar output range module is fitted at space B (address 12)

If bit 13 "DA 13 bipolar" = 1 : then a bipolar output range module is fitted at space C (address 13)

If bit 14 "AD bipolar" = 1 : then jumper U/B is in the bipolar position for input range module at space A

If bit 15 "AD Busy" = 1 : then A/D conversion is in progress

User program for reading an analogue value

To read an analogue value from channel I2 into Register R102.

```
(ACC   H )          (accu must be 1)
SET    O 2    *)    ; select input channel I2
RES **) O 8    *)    ;
SET    O 8    *)    ; } start A/D conversion
RES    O 8    *)    ;
STH    I 15   *)    ; high = conversion in progress 30 µs
JR     H -1         ;  (wait or branch until is complete)
------------------
BITI     12         ; read A/D value, 12 bits
       I 0    *)    ; from address 0 (LSB)
       R 102        ; into Register R102
------------------
```

*) The base address of the module must be added to these operands.

**) If Pt/Ni 1000 are used wait 10 ms (before instruction RES) due to conversion RTD0 to RTD1 (2 mA).

User program to output an analogue value

Outputs an analogue value from Register R113 to output channel O13.

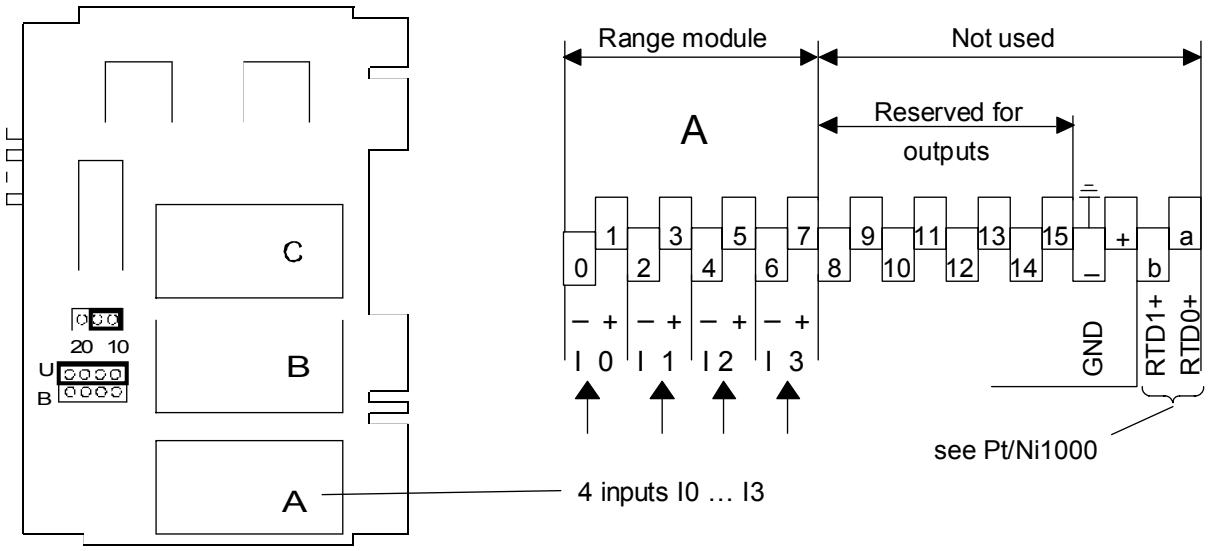
```
BITO     12         ; output 12 bits
       R 113        ; from Register R113
       O 0    *)    ; to address 0 (LSB)
------------------
(ACC   H )          (accu must be 1)
SET    O 13   *)    ; select output channel O13
RES    O 13   *)    ; and start D/A conversion
```

*) The base address of the module must be added to these operands.

Module connection of analogue inputs

Practically any combination of I/O channel range modules is possible. The 4 inputs have the same range of measurement, while the outputs can be individually configured.

- **Voltage inputs for ranges : 0 ... 10 V, ±10 V or ±5 V**



Installing at space A

Range module

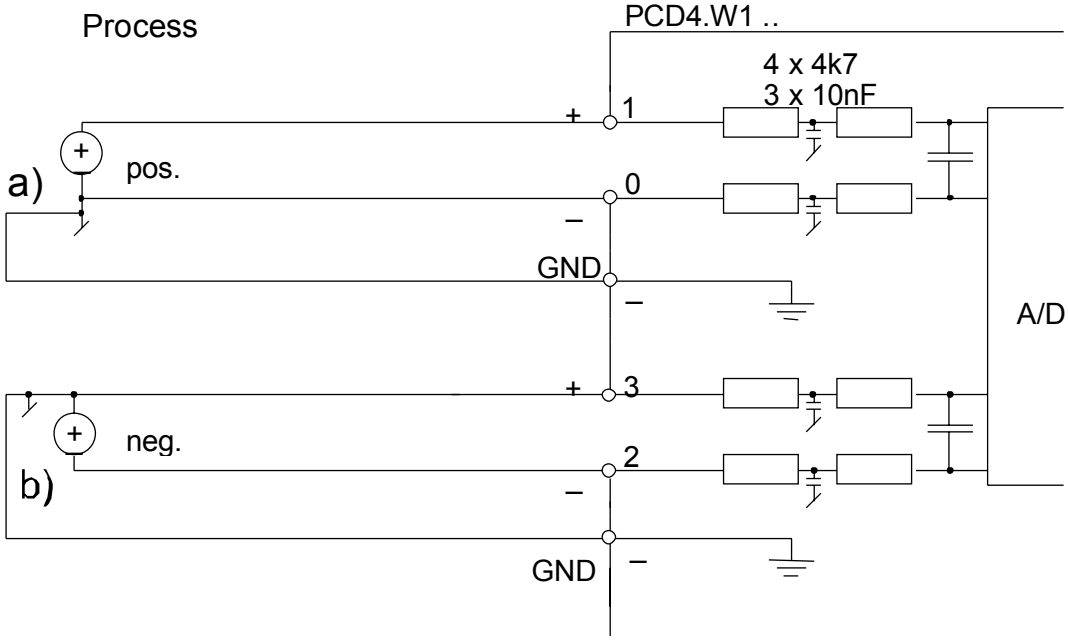
PCD7.W101 : measuring range 0 ... 10 V, ±10 V or ±5 V

There are two jumpers on the base module for voltage range selection :

U	=	unipolar voltage
B	=	bipolar voltage
10	=	entire voltage range of 10 V
20	=	entire voltage range of 20 V (e.g. ±10 V)

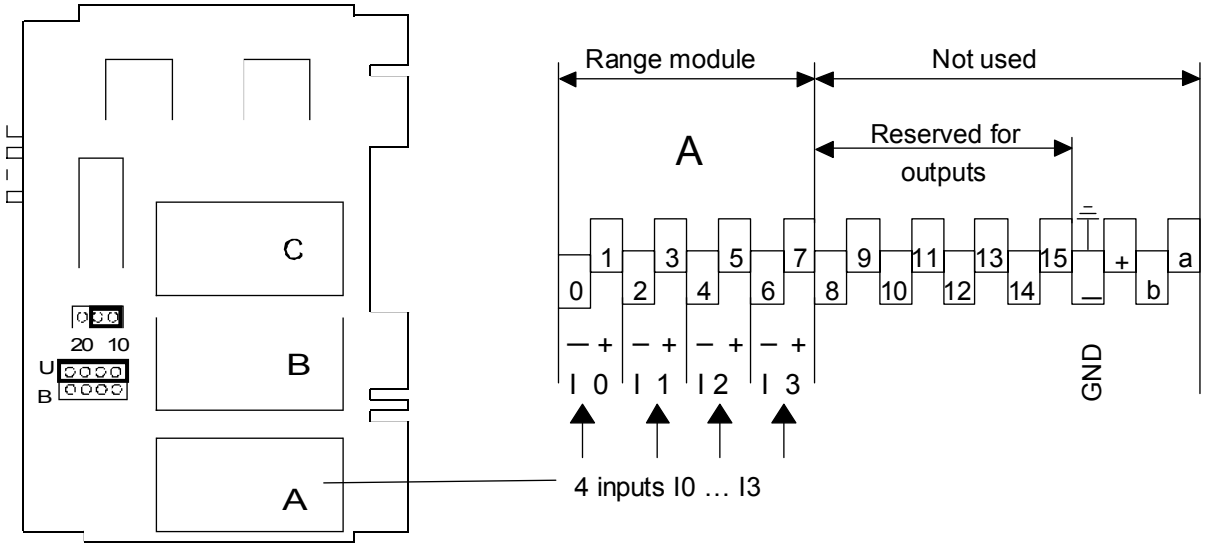
Digital input values are as follows :

	Range module PCD7.W101		
Jumper U / B	U	B	B
Jumper 10 / 20	10	20	10
Signal	0 … 10 V	±10 V	±5 V
Digital values			
4095	+10 V	+10 V	+5 V
2048	+5 V	0 V	0 V
0	0 V	–10 V	–5 V



Note : The process ground, or that of an input amplifier, must be connected to the ground of the analogue module (at terminal " – "). In unipolar operation, the more positive potential is connected to the " + " terminal. In this way, negative voltages (b) can also be measured.

- **Current inputs for ranges : 0 ... 20 mA, 4 ... 20 mA, ±20 mA or ±10 mA**



Installing at space A

Range module

PCD7.W105 : measuring range 0 ... 20 mA, 4 … 20 mA, ±20 mA or ±10 mA

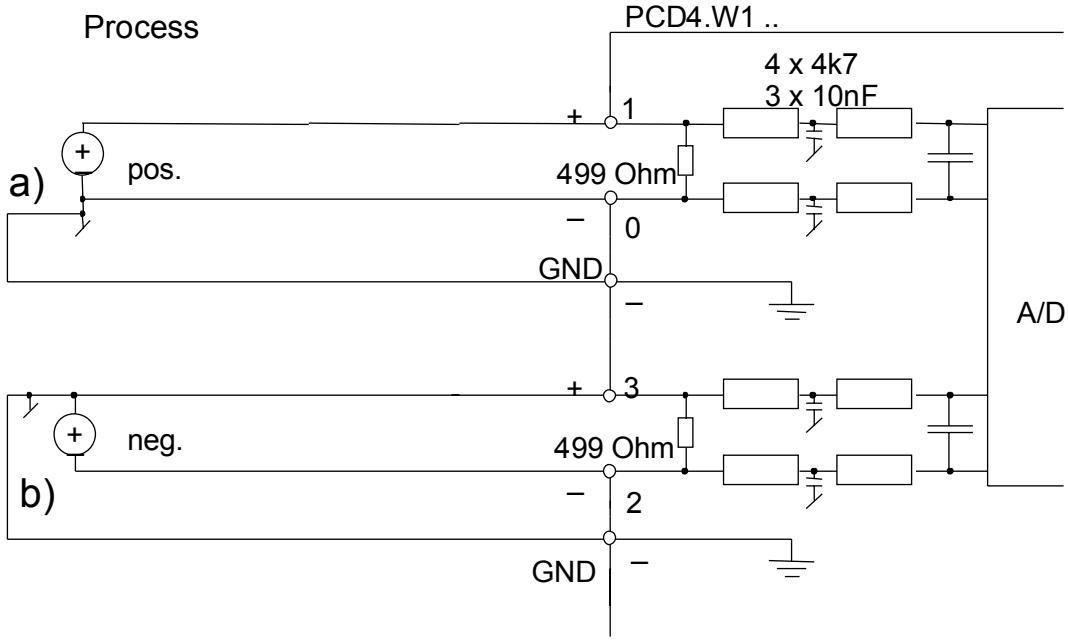
There are two jumpers on the base module for current range selection :

U	=	unipolar input
B	=	bipolar input
10	=	entire current range of 20 mA
20	=	entire current range of 40 mA (e.g. ±20 mA)

Digital input values are as follows :

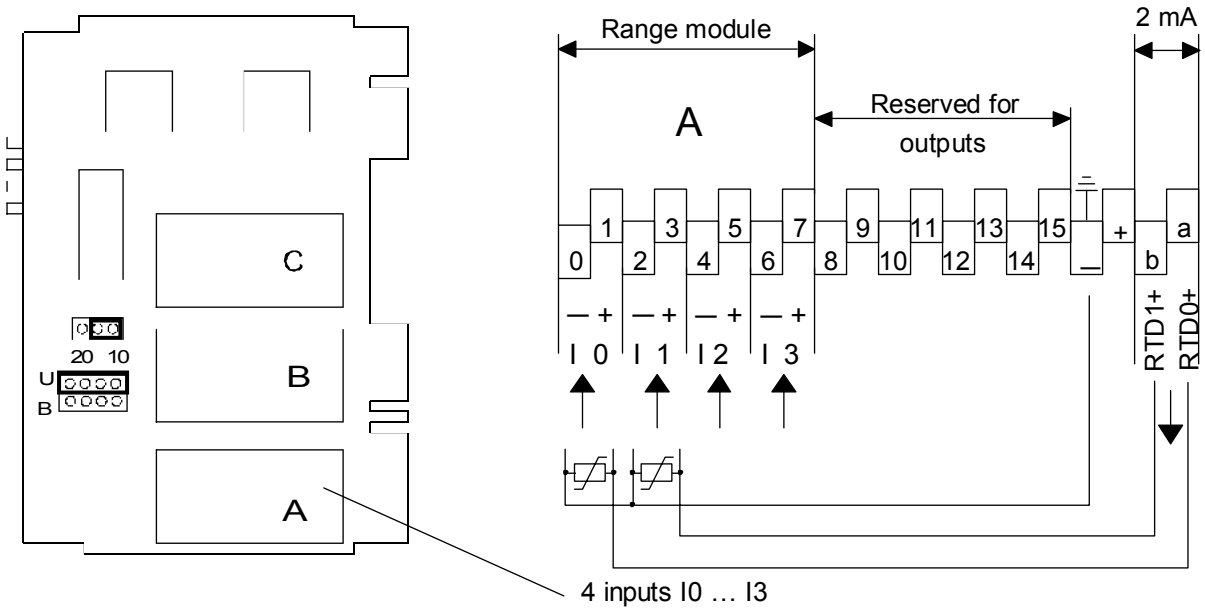
	Range module PCD7.W105		
Jumper U / B	U	B	B
Jumper 10 / 20	10	20	10
Signal	0 … 20 mA	±20 mA	±10 mA
Digital values			
4095	+20 mA	+20 mA	+10 mA
2048	+10 mA	0 mA	0 mA
819 *)	+4 mA *)		
0	0 mA	–20 mA	–10 mA

*) The same range module is fitted for current range 4 ... 20 mA.
The 4 mA current limit is controlled with the user program.



Note : The process ground, or that of an input amplifier, must be connected to the ground of the analogue module (at terminal " – "). In unipolar operation, the more positive potential is connected to the " + " terminal. In this way, negative voltages (b) can also be measured.

- **Connection of 2 resistive temperature sensors Pt/Ni 1000**



Installing at space A

Range module

PCD7.W101 : (0 … 10 V) for Pt 1000 or Ni 1000

The 2 mA constant current is supplied from the base module to the terminals " a " (RTD0) and " b " (RTD1).

RTD0 must connect to input channel I0 and RTD1 to I1.

RTD0 can be read by reading channel I0, RTD1 is read by reading channel I1.

Inputs I2 and I3 are available for other inputs 0 ... 10 V.

Recommended jumper positions on the base module are : U and 10.

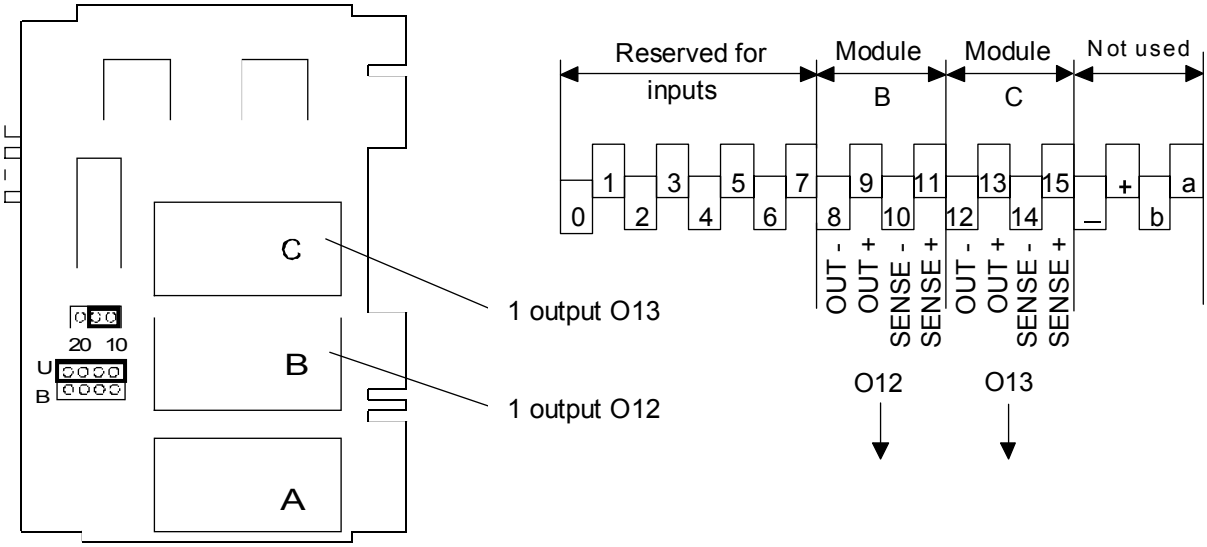
For calculation of temperature and digital value, see description of analogue module PCD4.W300.

Note : Due to conversion RTD0 to RTD1 (2 mA) the wait time must be increased to 10 ms (see "Programming and I/O addressing"). When only one terminal is used (RTD0 or RTD1), the unused terminal must be connected to the negative terminal " – ".

Module connection of analogue outputs

On the PCD4.W100 base module, the 2 output channels can be individually configured from a selection of output range modules. The spaces B and C are provided for this. The following description shows both outputs with the same range module.

- **Voltage outputs**



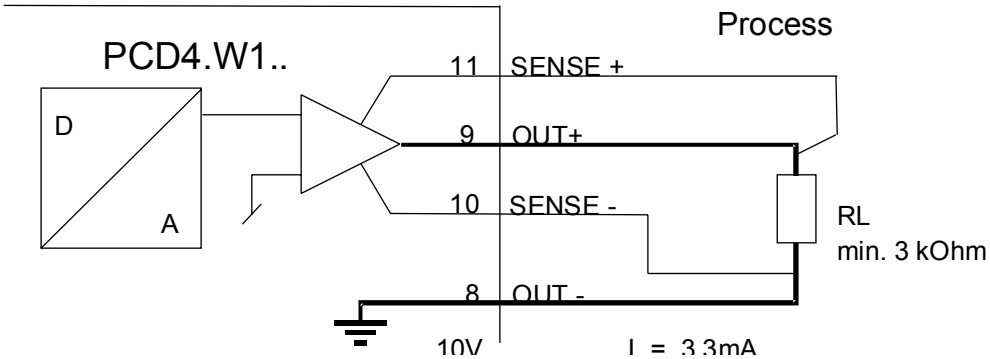
Installing at space B and/or C

Range module

PCD7.W200 : 1 output channel for range 0 ... 10 V
PCD7.W201 : 1 output channel for range 0 ... 1 V
PCD7.W202 : 1 output channel for range ±10 V
PCD7.W203 : 1 output channel for range ± 1 V
PCD7.W206 : 1 output channel for range –10 ... 0 V

Digital output values are as follows :

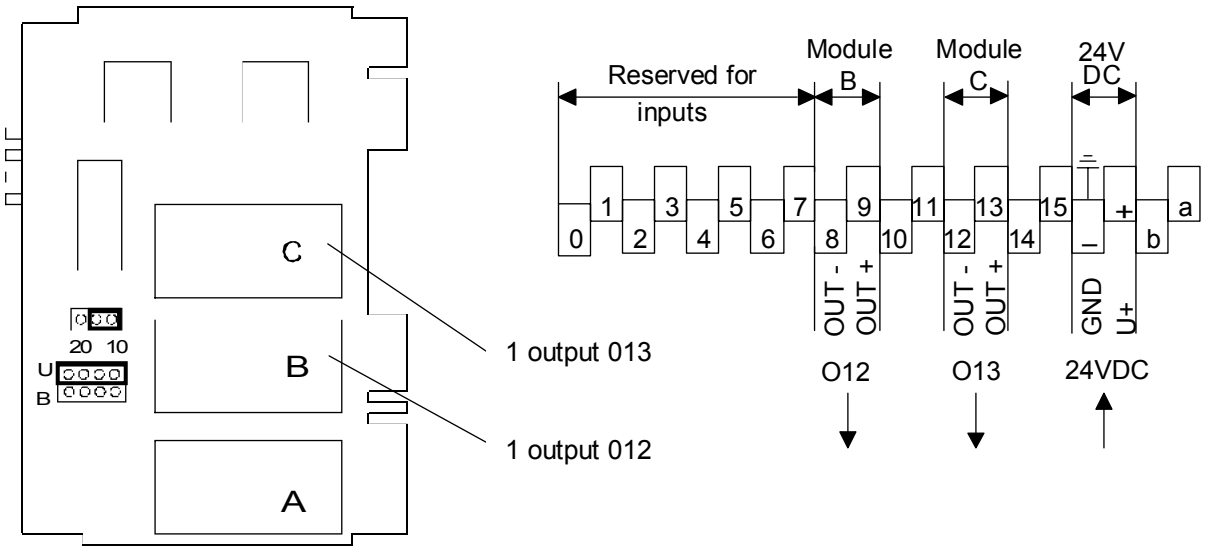
	Range module PCD7.W2..				
Digital values	..W200 (0 …10 V)	..W201 (0 … 1 V)	..W202 (±10 V)	..W203 (±1 V)	..W206 (–10 … 0 V)
4095	+10 V	+1 V	+10 V	+1 V	0 V
2048	+5 V	+0.5 V	0 V	0 V	–5 V
0	0 V	0 V	–10 V	–1 V	–10 V



Note : Two "SENSE" measurement cables are provided to increase voltage precision at the load resistance RL.

These must be high impedance cables ($I \leq 0.2$ mA), by which the effective voltage RL is measured, and if necessary corrected. If the SENSE detectors are not required, then terminals 8-10 and 9-11 must be connected together.

- **Current outputs**



Installing at space B and/or C

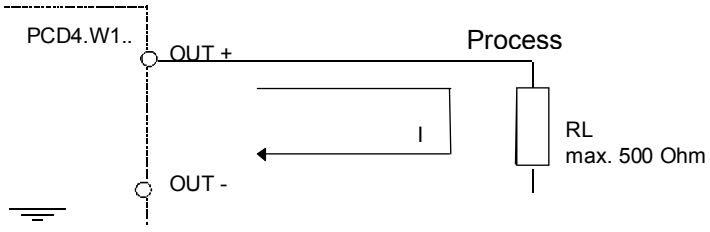
Range module

PCD7.W204 : 1 output channel for range 0 ... 20 mA

PCD7.W205 : 1 output channel for range 4 ... 20 mA

Digital outputs values are as follows:

Digital values	Range module PCD7.W2.. ..W204 (0 … 20 mA)	..W205 (4 … 20 mA)
4095	+20 mA	+20 mA
2048	+10 mA	+12 mA
0	0 mA	+4 mA



For supplying current outputs, the " + " terminal must be connected to +24 VDC. This supply can be that same as that of the power supply module PCD4.N2.. with a maximum current requirement of 60 mA.

The spaces B and C can be independently fitted with different output modules (e.g.: B = current output and C = voltage output.)

Notes :

9.2 PCD4.W300 Analogue input module, 8 channels, 12 bit resolution and sign bit

Application

The ..W300 analogue module for slow processes consists of a base module with 1 or 2 add-on input range modules.

Voltage ranges of ±100 mV to 10 V, or current ranges 0 ... 20 mA and 4 ... 20 mA can be measured, and stored in digital form in a Register. Resistive temperature sensors or thermocouples can also be connected.

Various input range modules can be used to configure the module for specific requirements.

Module overview

Base module :

PCD4.W300 : For use in a 50 Hz environment with anti-phase noise suppression. Input multiplexer for up to 8 input channels. Special 2 mA constant current output.

Range modules :

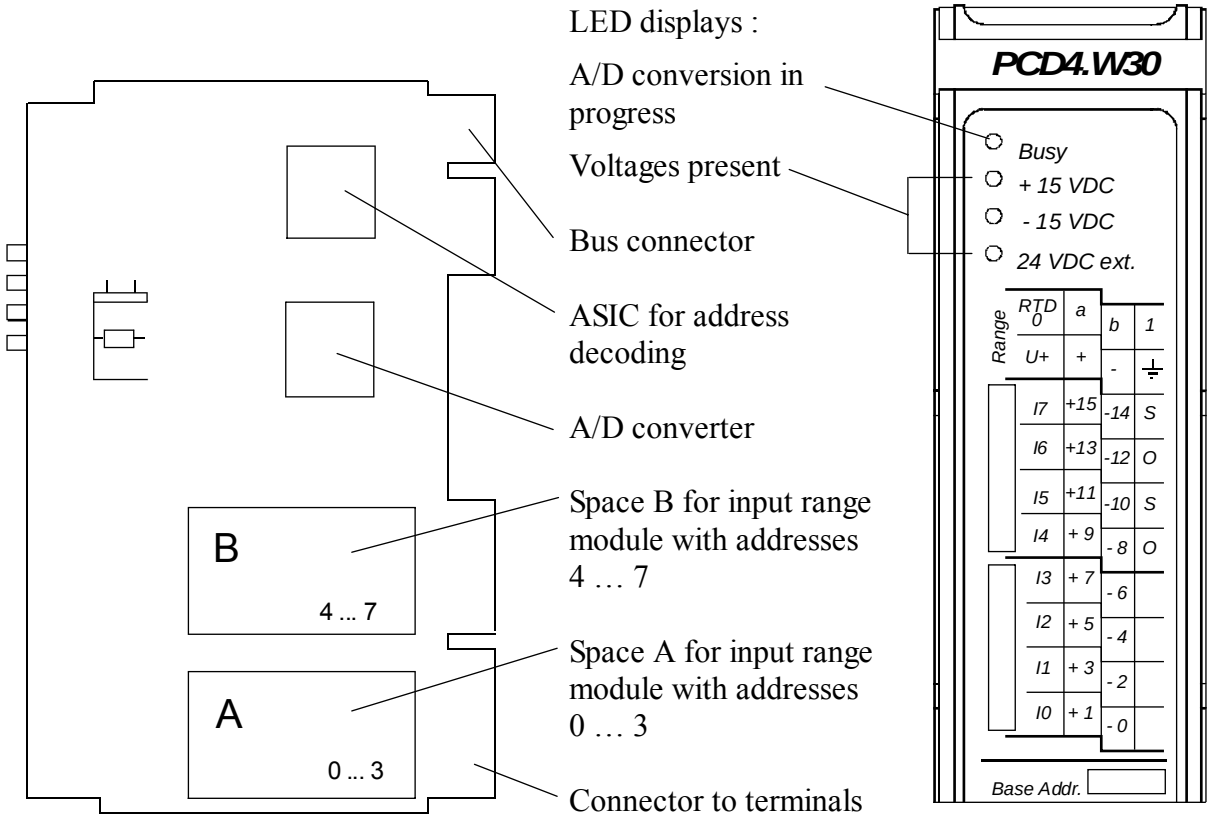
PCD7.W100 :	4 channels,	voltage range ±10 V, input resistance 200 kΩ / 0.2 %
PCD7.W101 :	4 channels,	voltage range ±1 V, input resistance ≥10 MΩ
PCD7.W102 :	4 channels,	voltage range ±100 mV, input resistance ≥10 MΩ
PCD7.W103 :	4 channels,	current range ±20 mA (4 ... 20 mA), input resistance 49.9 Ω / 0.1 %
PCD7.W104 :	4 channels,	current range 4 ... 20 mA for two-wire converter, resistance 49.9 Ω / 0.1 %,
PCD7.W110 :	4 channels,	for Pt 1000, temperature range –50 … +150°C, resolution approx. 1/10°C
PCD7.W111 :	4 channels,	for Ni 1000, temperature range –50 ... +150°C, resolution ≤ 1/10°C
PCD7.W120 :	4 x 2mA constant current outputs,	for 4 x Pt/Ni 100 or Pt/Ni 1000 resistive temperature sensors

Time constant on input filter : 1 ms

Technical data of the base module

Number of input channels	8 voltage or current inputs, or 4 inputs for resistive temperature sensors with four-wires (Pt/Ni 100 or Pt/Ni 1000), or 8 inputs for resistive temperature sensors with two-wires (Pt/Ni 1000)
Potential separation	No (differences of the minus potential max. 1.5 V)
Measuring principle	Differential
Input ranges	See section "range modules"
Resolution (digital representation)	12 bits + sign bit (± 4095)
Conversion principle	Integration
Integration time	20 ms (at 60 Hz : 16 $^2/_3$ ms)
A/D conversion time	≤ 120 ms (at 60 Hz : ≤ 100 ms)
Error message	When range exceeded by > ± 4095
Accuracy (referred to measured value)	0.3 % ± 2 LSB
Repeating accuracy	Within 3 LSB
Temperature error (typical)	0.8 % across temp. range 0 ... 50°C
Max. overvoltage at analogue inputs	60 VDC
Resistance to interference according to IEC 801-4	1 kV under capacitance coupling, with cables not shielded 2 kV under capacitance coupling, with cables shielded
Output	1 x 2 mA ±1 % constant current output for temperature compensation of the sensors (Pt/Ni 100) when thermocouples are connected
External supply 24 VDC	Only required for current inputs from two-wire current converters, supply of same quality as for supply module N2..
Internal current consumption (from the bus)	+5 V : 30 mA +15 V : 16 mA –15 V : 9 mA

Presentation

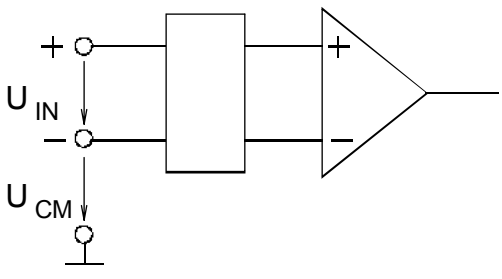


The following functional blocks can be seen :

- The base printed circuit board (PCB) with bus interface, address decoding, A/D converter with multiplexer (MUX) and two spaces for insertion of range modules.

- Spaces A and B to receive the range modules

Common-mode behaviour



CM : Common mode

$U_{IN} + U_{CM} \leq 2.5$ V

CMR = 86 dB
CMMR = 50 µV/V @ U_{CM} ± 1.5 V

Insertion of the range modules

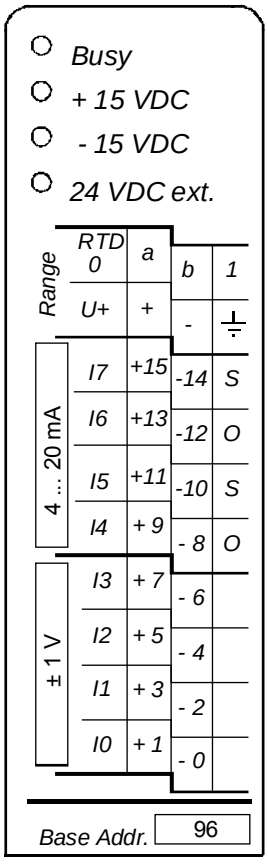
The base printed circuit board must first be removed from the module housing in order to install a range module. This is done by pressing in the snap fastenings on either side of the front panel. Then the PCB fastening screw on the upper left hand side of the module is unscrewed, so that the PCB can be removed from the casing.

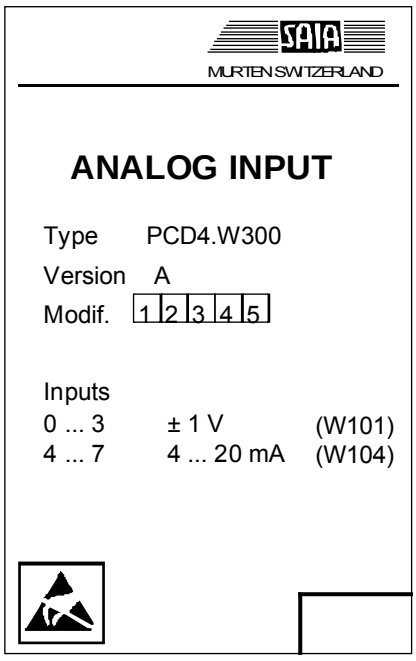
At the lowest space A, one range module for 4 input channels with addresses 0 ... 3 (+ base address) can be fitted. The upper space B is either for the 4 channels with addresses 4 ... 7 (+ base address) or for the special PCD7.W120 module for the resistive temperature sensors.

After installing the range modules, close the housing and tighten up the PCB fastening screw again.

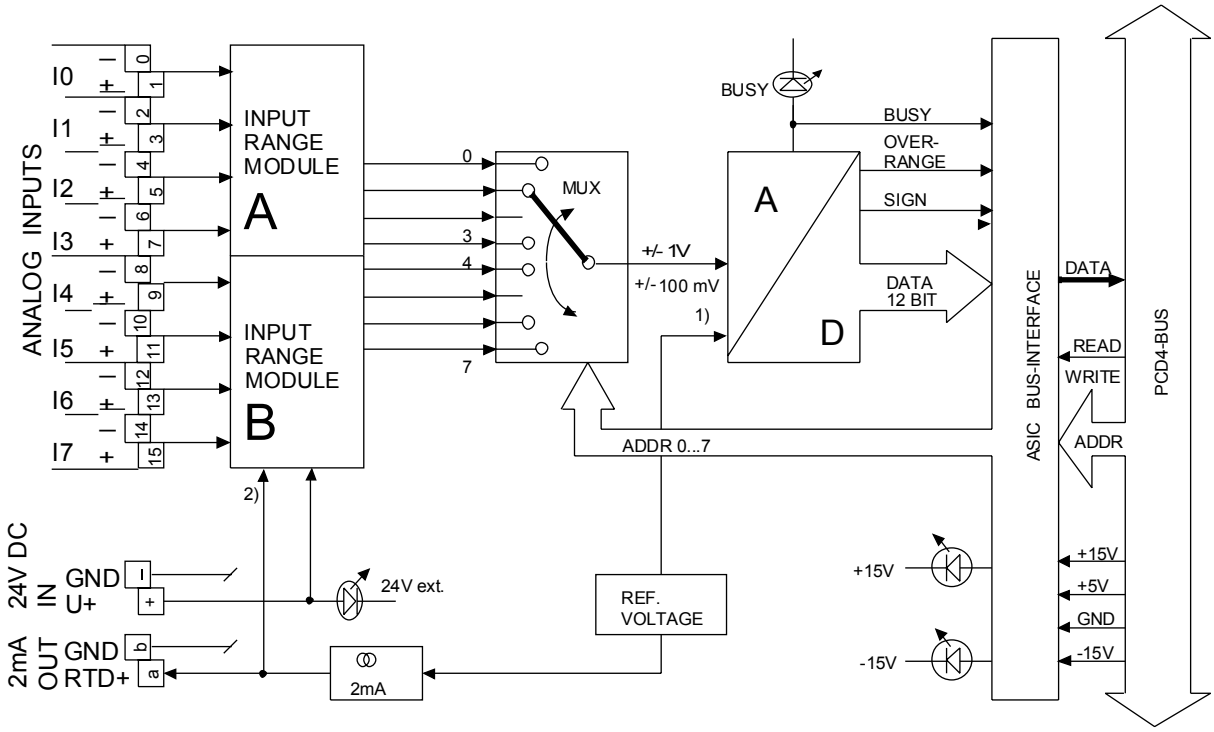
Caution : The base PCB and the range modules incorporate components which are sensitive to electrostatic discharges.

Various types of range modules can be attached to the output spaces A and B. In order to keep the internal equipment obvious to outside inspection, remember to write the I/O type on the labels provided on the front and side panel (see example below).





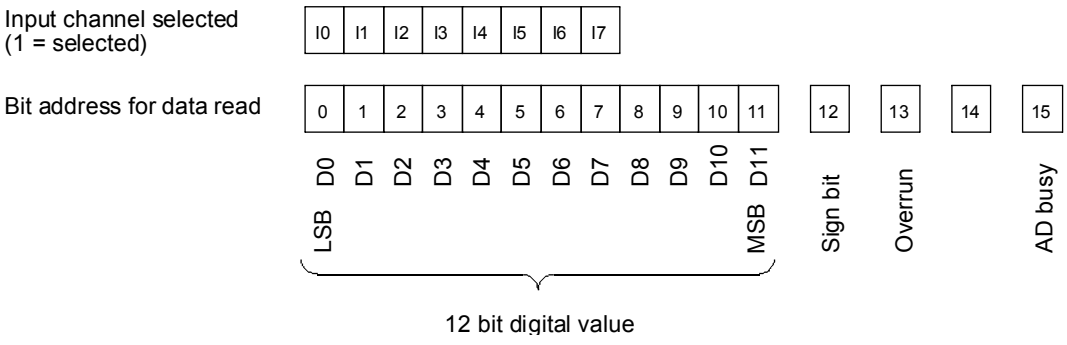
Block diagram



1) By installing range module ..W102 (±100 mV) the A/D converter for the corresponding addresses is set for ±100 mV.

2) By installing range module ..W120 in space B, the 2 mA source is connected to output terminals 8 ... 15.

Meaning of the 16 addresses



Bit 12 "sign bit" = 1 : Negative value

Bit 13 "overrun" = 1 : Absolute value > 4095

Bit 15 "AD busy" = 1 : A/D conversion in progress.

User program

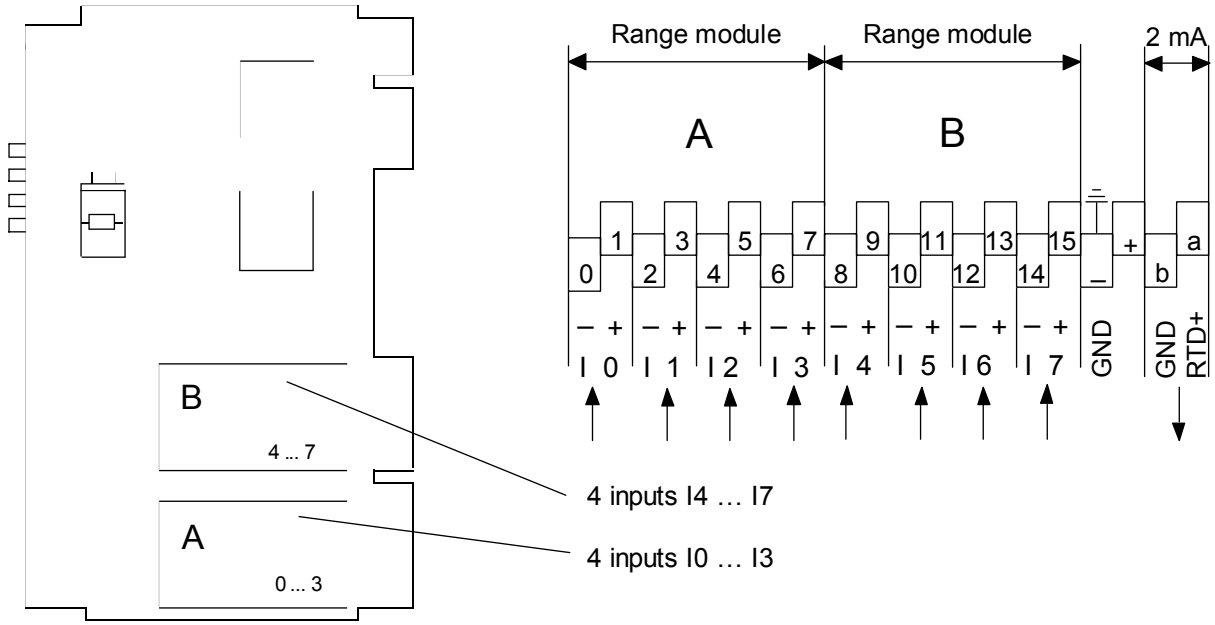
To read an analogue value from channel I 3 into Register R103.

```
(ACC   H )          (accu must be 1)
SET    O 3   *)   ; select input channel I3 and
                  ;  start A/D conversion
STH    I 15  *)   ; high=conversion in progress ≤120 ms
JR     H -1       ;  (wait or branch until is complete)
------------------
BITI     12       ; read A/D value, 12 bits
       I 0   *)   ; from address 0 (LSB)
       R 103      ; into Register R103
------------------
STH    I 12  *)   ; check sign bit
CFB    H

STH    I 13  *)   ; check overrun (amount > 4095)
CFB    H          ;  value out of range
```

*) The base address of the module must be added to these operands.

Module connection of analogue inputs

- **Voltage inputs for ranges : ±100 mV, ±1 V or ±10 V**



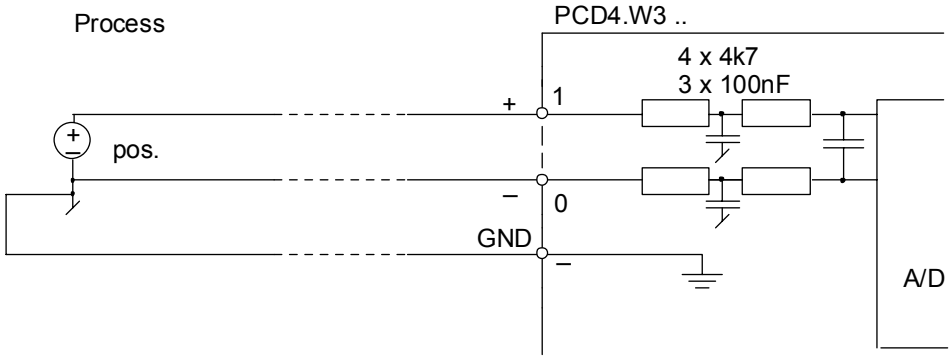
Installing at space A and/or B

Range module

PCD7.W100 :	measuring range	±10 V	=	± 4095
PCD7.W101 :	measuring range	±1 V	=	± 4095
PCD7.W102 :	measuring range	±100 mV	=	± 4095

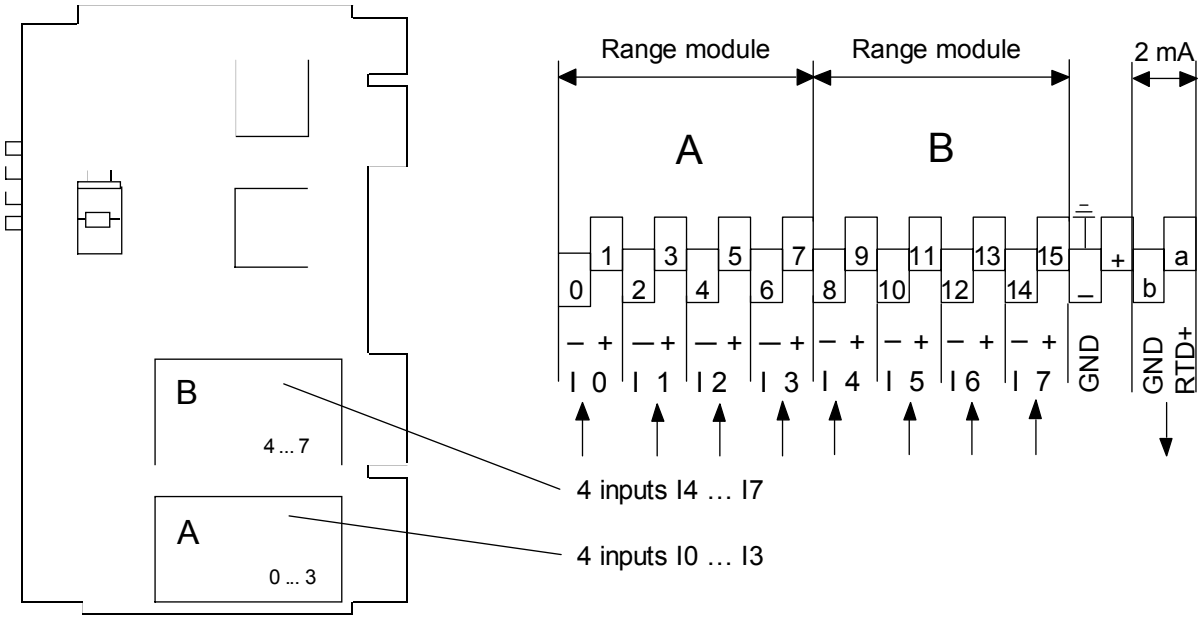
The spaces A and B can be fitted with different range modules.

The 2 mA constant current output RTD+ is always available, independent of the range modules fitted.



Note : The process ground, or that of an input amplifier, must be connected to the ground of the analogue module (at terminal " – "). Instead of a separate ground line the shield of the cable can be used.

- **Current inputs for ranges : ± 20 mA or 4 ... 20 mA**



Installing at space A and/or B

Range module

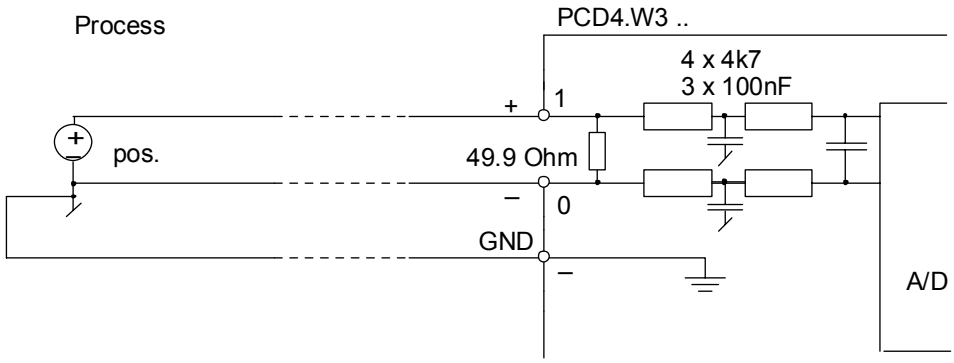
PCD7.W103 : measuring range ±20 mA = ± 4095

The same range module is fitted for the range 4 ... 20 mA.
The current limits are controlled by the user program :

4 mA	=	+ 819	digital value
20 mA	=	+ 4095	digital value

The spaces A and B can be fitted with different range modules (eg. A = ±20 mA and B = ±10 V).

The 2 mA constant current output RTD+ is always available, independent of the range modules fitted.



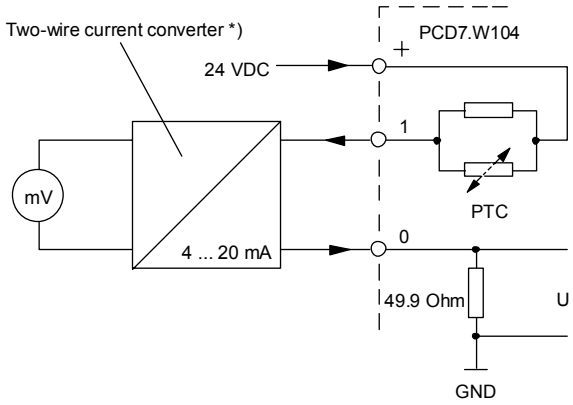
Note : The process ground, or that of an input amplifier, must be connected to the ground of the analogue module (at terminal " – "). Instead of a separate ground line the shield of the cable can be used.

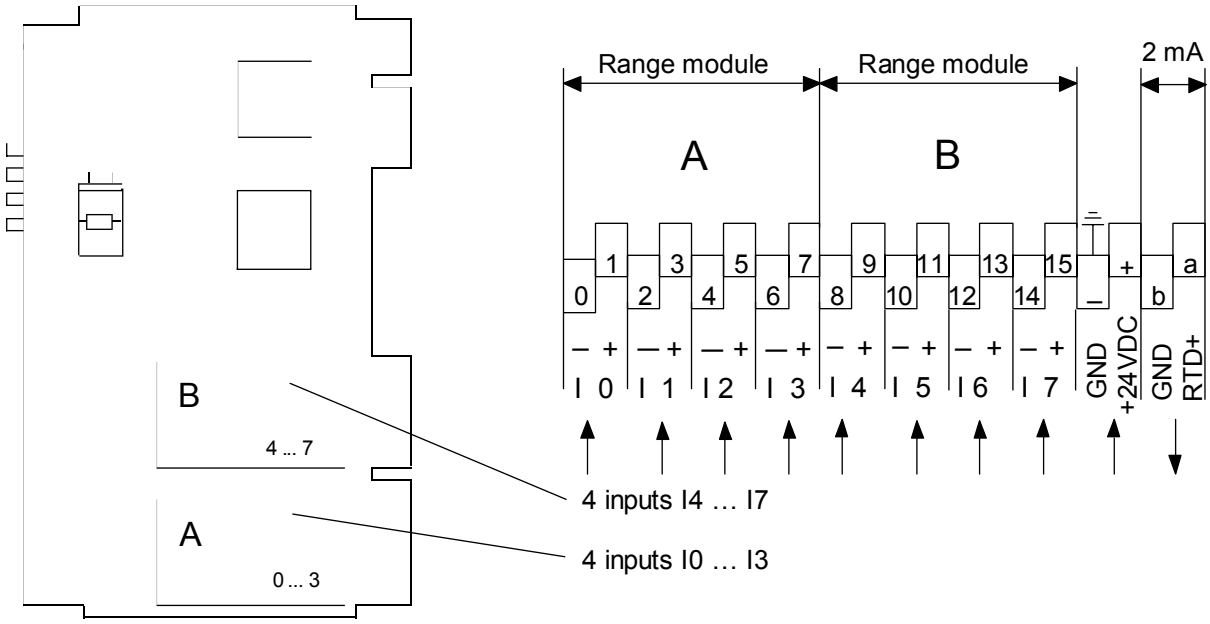
- **Current inputs for 4 ... 20mA from two-wire current converter**

Two-wire current converters require a 24 VDC supply, as shown in the diagram below :

*) The range module ..W104 can also be used without the two-wire current converters for normal 20 mA inputs.

To implement this, the inputs must be connected to the even terminals (0, 2, 4 etc.) and the common ground terminal " – ".





Installing at space A and/or B

Range module

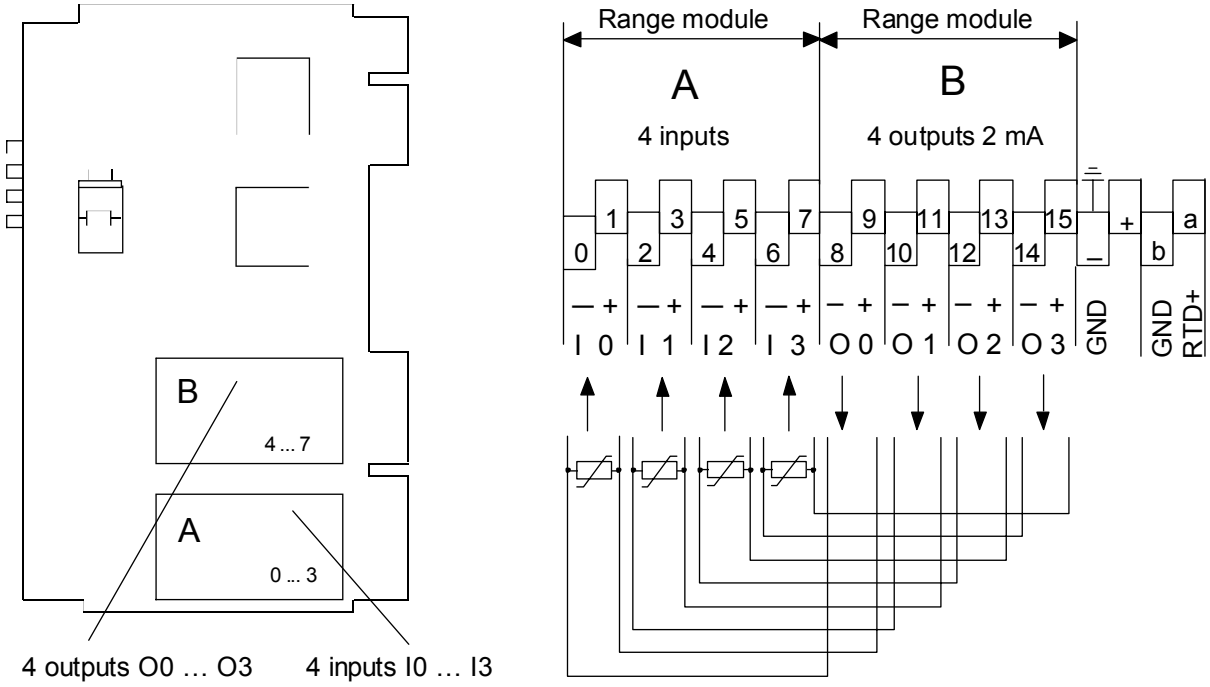
PCD7.W104:	measuring range	4 ... 20 mA	4 mA	=	+ 819
	(digital value)		20 mA	=	+ 4095

The " + " terminal must be connected to +24 VDC to supply the current converter. This supply can be the same as that of the power supply module PCD4.N2.. . Maximum current required is 0.2 A with 8 converters connected.

The spaces A and B can be fitted with different range modules (eg. A = 4 ... 20 mA and B = ±10 V).

The 2mA constant current output RDT+ is always available, independent of the range modules fitted.

- **Connection of 4 resistive temperature sensors Pt/Ni 100 or Pt/Ni 1000**



Installing at space A

Range module

PCD7.W101 : (±1 V) for 4 sensors Pt100 or Ni100
PCD7.W100 : (±10 V) for 4 sensors Pt1000 or Ni1000

Installing at space B

Special range module

PCD7.W120 : for 4 constant current outputs at 2 mA

The module in space B provides a constant current of 2 mA up to a circuit resistance of 2000 Ω. The voltage drop across the resistive temperature sensor is connected to the range module in space A.

Note : Not used 2mA outputs must be short-circuited

Software

If the range modules are correctly installed on the base module (voltage inputs in space A, constant current outputs in space B), this is recognized as an arrangement for resistive temperature devices. The user therefore needs only to be concerned with the treatment of voltage inputs on the software side, as described in the chapters entitled "User program".

Temperature measurement with Pt 100 and range module for ±1 V

At 0°C, the temperature dependent Pt 100 resistance shows a resistance of **R0 = 100 Ω**. Within the temperature range of –20°C to +200°C, the change in resistance can be described with an accuracy of ±1 % using the following formula :

$R_T = R0 \ (1 + 3.83 * 10^{-3} * T)$ T in °C

At the range module, sensitivity S amounts to "±1 V" under 2 mA :

$S = 3.83 * 10^{-3}/°C * 4096 \text{ LSB}/1V * 0.002A * 100\Omega = 3.14 \text{ LSB}/°C$

The 2 mA constant current gives a voltage of 0.2 V at 100 Ω.
On the "±1 V" range modules, this corresponds to a digital value of :

$4096 * 0.2 = 819$; i.e. 100 Ω = **0°C = 819 LSB = Offset**

These two values allow the temperature in °C to be determined at any time from the digital measurement.

$$T\ (°C) = \frac{\text{digital measurement} - 819}{3.14}$$

or

$$\text{digital measurement} = 3.14 * T + 819$$ T en °C

Example 1 : digital measurement 1300 LSB

$$T = \frac{1300 - 819}{3.14} = + 153.2°C$$

Example 2 : digital measurement 770 LSB

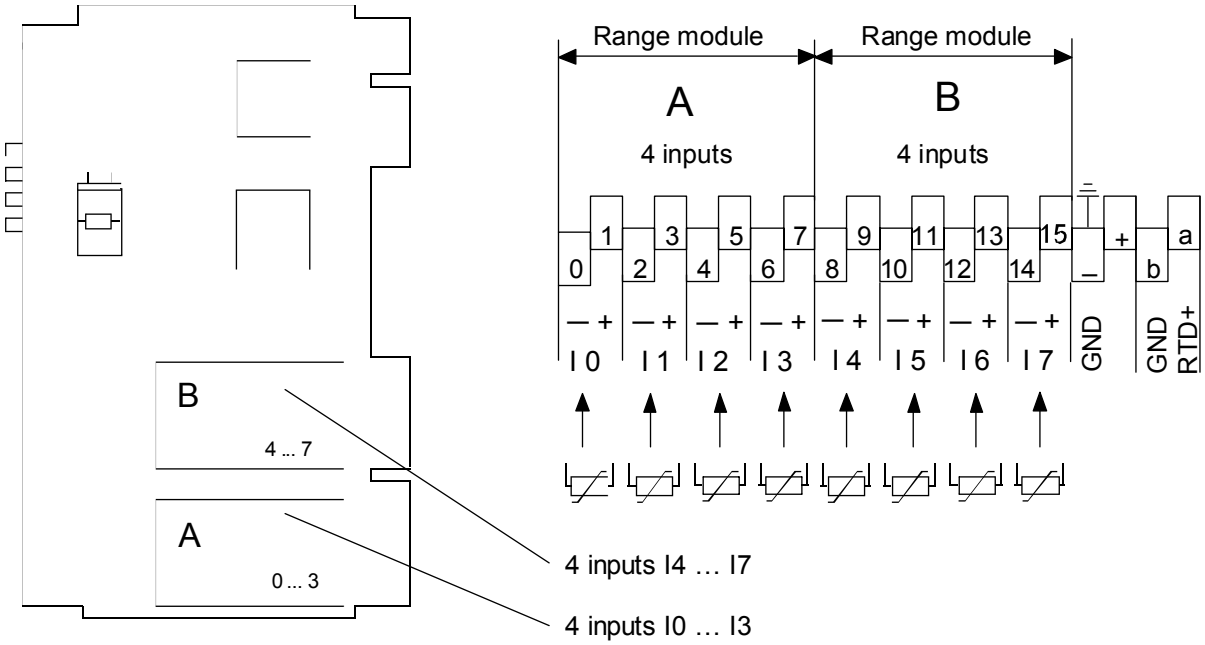
$$T = \frac{770 - 819}{3.14} = - 15.6°C$$

Example 3 : 100°C corresponds to which digital measurement ?
Digital measurement = 3.14 * 100 + 819 = 1133

Temperature measurement with Pt 1000 and range module ±10 V

The same formula apply as for Pt100.

- **Connection of 8 resistive temperature sensors Pt 1000 or Ni 1000**



Installing at space A

Range module

PCD7.W110 for 4 sensors Pt 1000
PCD7.W111 for 4 sensors Ni 1000

Installing at space B

Range module

PCD7.W110 for 4 sensors Pt 1000
PCD7.W111 for 4 sensors Ni 1000

Each of these modules will accept connection of 4 x Pt/Ni 1000 resistive temperature sensors. An internal stabilized power supply provides the voltage for the resistive temperature sensors. The modules are adjusted in the factory and are independent of the PCD4.W300 base module; i.e. the modules are interchangeable.

Adjustment to compensate for cable length is possible using each channel's potentiometer on the module itself. However, to guarantee interchangeability, it is preferable for this compensation to take place in the user program.

The " Rt " temperature sensor resistance values and the corresponding " Dv " digital value, which after conversion is located in a PCD register, can be taken from the following tables in steps of 10°C for Pt1000 or Ni1000. The interpolation factor is also given in Digit/°C or °C/Digit for each 10° range.

For these modules, the conversion formulae from " Rt " to " Dv " and vice versa are as follows :

Pt 1000	Ni 1000
$Dv = \frac{40950 * Rt}{Rt + 14165}$	$Dv = \frac{40950 * Rt}{Rt + 17900}$
$Rt = \frac{14165 * Dv}{40950 - Dv}$	$Rt = \frac{17900 * Dv}{40950 - Dv}$

Current load of the resistive temperature sensor	< 1 mA
Drift in measured value	≤ 0.05°C/°C (3 Bit/10 °C)

Temp. °C	Rt Ω	Dv Digits	dDv Digits/°C
–50	803.15	2197	
–40	842.75	2300	10.2
–30	882.24	2401	10.1
–20	921.61	2502	10.1
–10	960.86	2601	10.0
0	1000.00	2700	9.9
10	1039.02	2798	9.8
20	1077.93	2896	9.7
30	1116.72	2992	9.7
40	1155.39	3088	9.6
50	1193.95	3183	9.5
60	1232.39	3278	9.4
70	1270.72	3371	9.4
80	1308.93	3464	9.3
90	1347.02	3556	9.2
100	1385.00	3647	9.1
110	1422.86	3738	9.1
120	1460.61	3828	9.0
130	1498.24	3917	8.9
140	1535.75	4005	8.8
150	1573.15	4093	8.8

Examples for fine adjustment by interpolation.

- **PT 1000**

Example 1 (Pt 1000) :

To find : Temperature for digital value of 2930

2896 → 20°C

2930 – 2896 = 34

$$\frac{34}{Dv\ (20°C)} = \frac{34}{9.7} = 3.5°C$$

2930 → 20°C + 3.5°C = 23.5°C

=======

Temp. °C	Rt Ω	Dv Digits	dDv Digits/°C
–50	742.55	1631	
–40	791.31	1734	10.3
–30	841.46	1839	10.5
–20	892.96	1946	10.7
–10	945.82	2055	10.9
0	1000.00	2167	11.2
10	1055.52	2280	11.4
20	1112.36	2396	11.6
30	1170.56	2514	11.8
40	1230.11	2633	12.0
50	1291.05	2755	12.2
60	1353.40	2879	12.4
70	1417.21	3004	12.6
80	1482.50	3132	12.8
90	1549.34	3262	13.0
100	1617.79	3394	13.2
110	1687.89	3529	13.4
120	1759.72	3665	13.7
130	1833.35	3805	13.9
140	1908.87	3946	14.2
150	1986.35	4090	14.4

- **Ni 1000**

Example 2 (Ni 1000) :

To find : Digital value for temperature of 48°C

50°C → 2755 Digits

48°C – 50°C = – 2°C

2°C → 2 * 12.2 = 24.4 Digits

48°C → 2755 – 24.4 = 2730.6

=======

- **Connection of thermocouples**

When thermocouples are used, particular attention must be paid to two points :

- Thermocouples produce only very small voltages. Therefore the ±100 mV range modules must be used.

- The voltage of thermocouples is a function of the difference in temperature between the measuring point and the thermocouple connector.

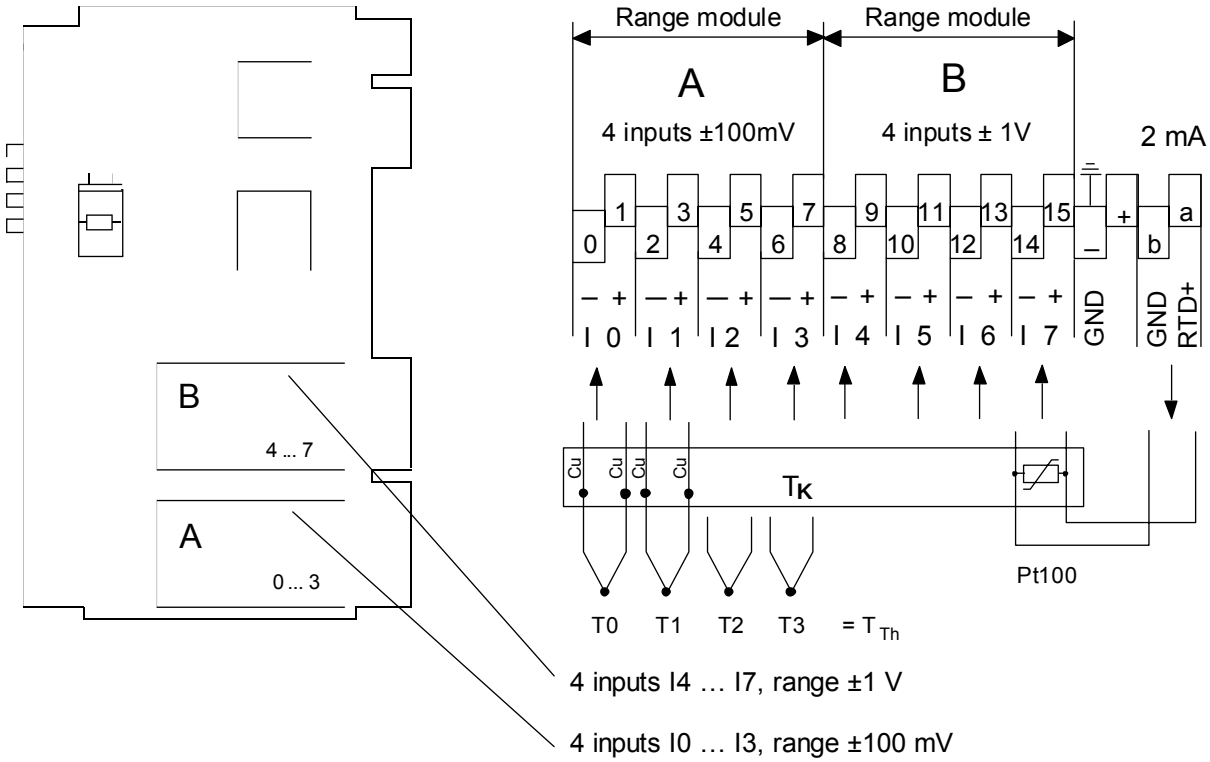
In order to obtain the real temperature, the temperature of the connector must be recorded, which can be done using an additional Pt 100 thermocouple.

The real temperature T_W therefore :

$\mathbf{T_W = T_{TH} + T_K}$

T_{TH} = Temperature difference

T_K = Temperature of the thermocouple connectors



Installing at space A

Range module

PCD7.W102 (±100 mV) for 4 thermocouples

Installing at space B

Range module

PCD7.W101 (±1 V) for 1 x Pt 100 input
(3 inputs of ±1 V are free for other uses)

The 2 mA constant current for the resistive temperature sensor Pt 100 is supplied by the RTD+ terminal.

9.3 PCD4.W400 Analogue output module, 8 channels, 8 bit resolution

Application

Rapid output module with 8 output channels of 8 bits respectively. Different output signals can be reversed with the aid of insertable jumpers. Suited for processes in which a large numbers of actuators must be controlled such as in the chemical industry and building automation.

Base module

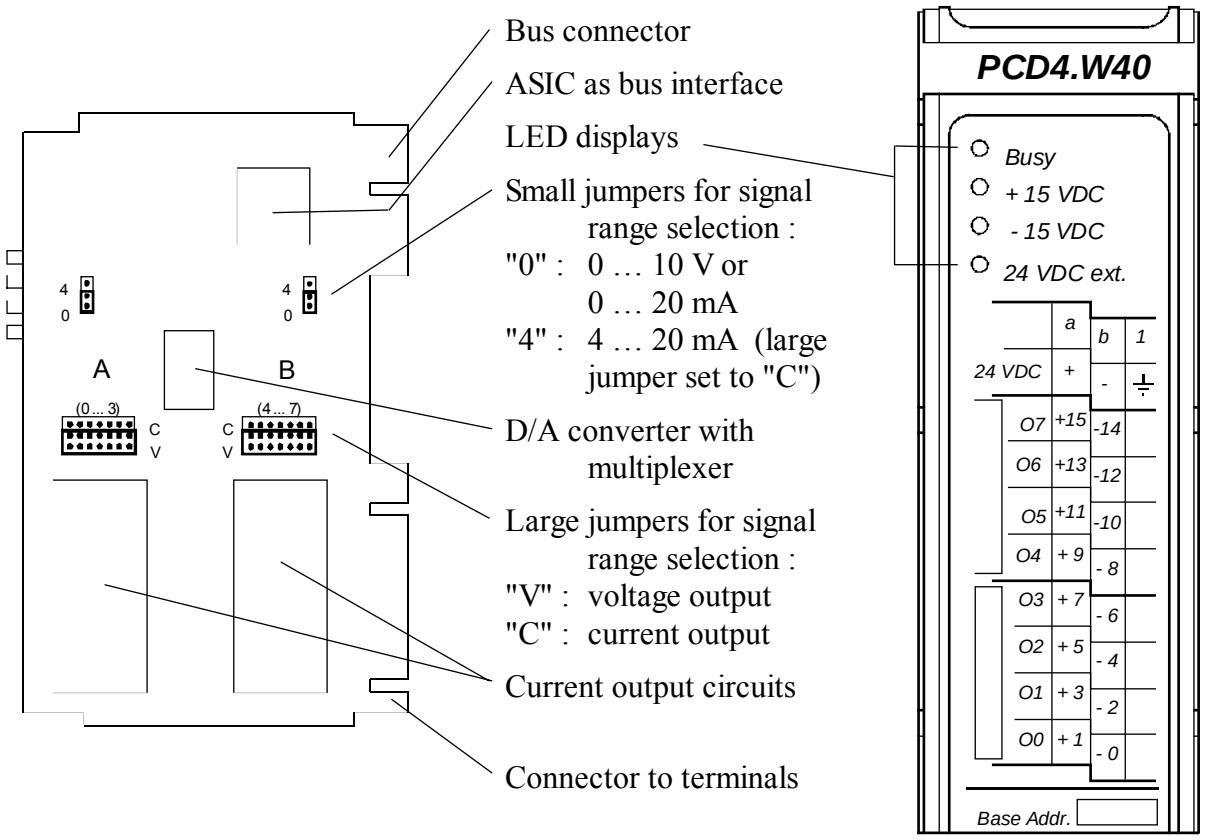
PCD4.W400 : Universal module with 8 output channels of 8 bits respectively, signals can be selected (4 outputs respectively) for 0 ... 10 V, 0 ... 20 mA or 4 ... 20 mA.

Technical data of the base module

Number of output channels	8 (in 2 groups), short-circuit protected
Potential separation	No
Output ranges	0 … 10 V *) } selectable with 0 … 20 mA } jumpers in groups 4 … 20 mA } of 4 outputs each *) Factory setting
Resolution (digital representation)	8 bits (0 ... 255)
D/A conversion time	< 5 µs
Load impedance	0 … 10 V : ≥ 3 kΩ 0 … 20 mA : 0 … 500 Ω 4 … 20 mA : 0 … 500 Ω
Accuracy (referred to output value)	0 … 10 V : 1 % ± 50 mV 0 … 20 mA : 1 % ± 0.2 mA 4 … 20 mA : 1 % ± 0.2 mA
Residual ripple	0 ... 10 V : < 15 mV pp 0 ... 20 mA : < 50 µA pp 4 ... 20 mA : < 50 µA pp
Temperature error (typical)	0.2 % across temp. range 0 ... 50°C

External supply 24 VDC	max. 0.2 A (required for current outputs only) Tolerance : as power supply for PCD4.N2..
Ambient temperature	Operating : 0 ... +50°C Storage : –20 ... +85°C
Resistance to interference according to IEC 801-4	1 kV under capacitance coupling, with cables not shielded 2 kV under capacitance coupling, with cables shielded
Internal current consumption (from the bus)	+5 V : 10 mA +15 V : 20 mA + 3.5 mA/channel –15 V : 25 mA

Presentation



Factory setting of jumpers : " V " : voltage output
" 0 " : range 0 ... 10 V

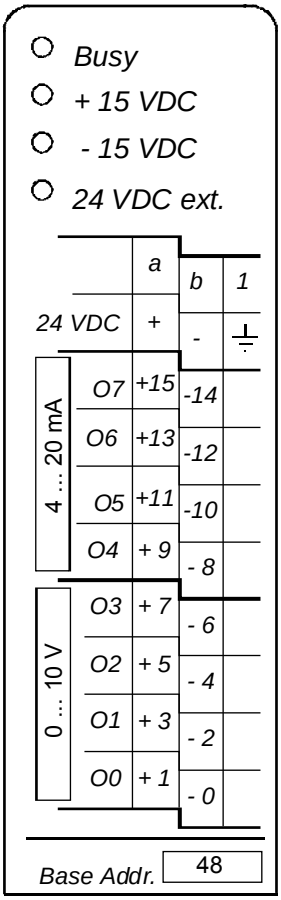
Reinsertion of jumpers

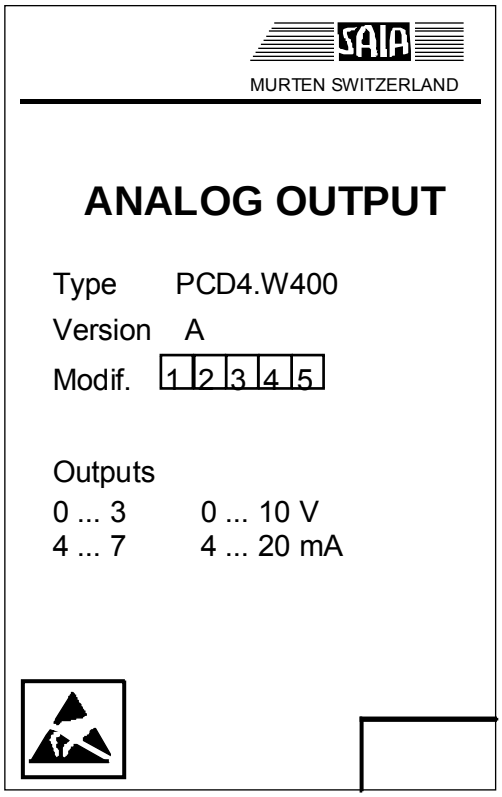
The base printed circuit board must first be removed from the module housing in order to reinsert the jumpers. This is done by pressing in the snap fastenings on either side of the front panel. Then the PCB fastening screw on the upper left hand side of the module is unscrewed, so that the PCB can be removed from the casing.

After reinserting the jumpers, close the housing and tighten up the PCB fastening screw again.

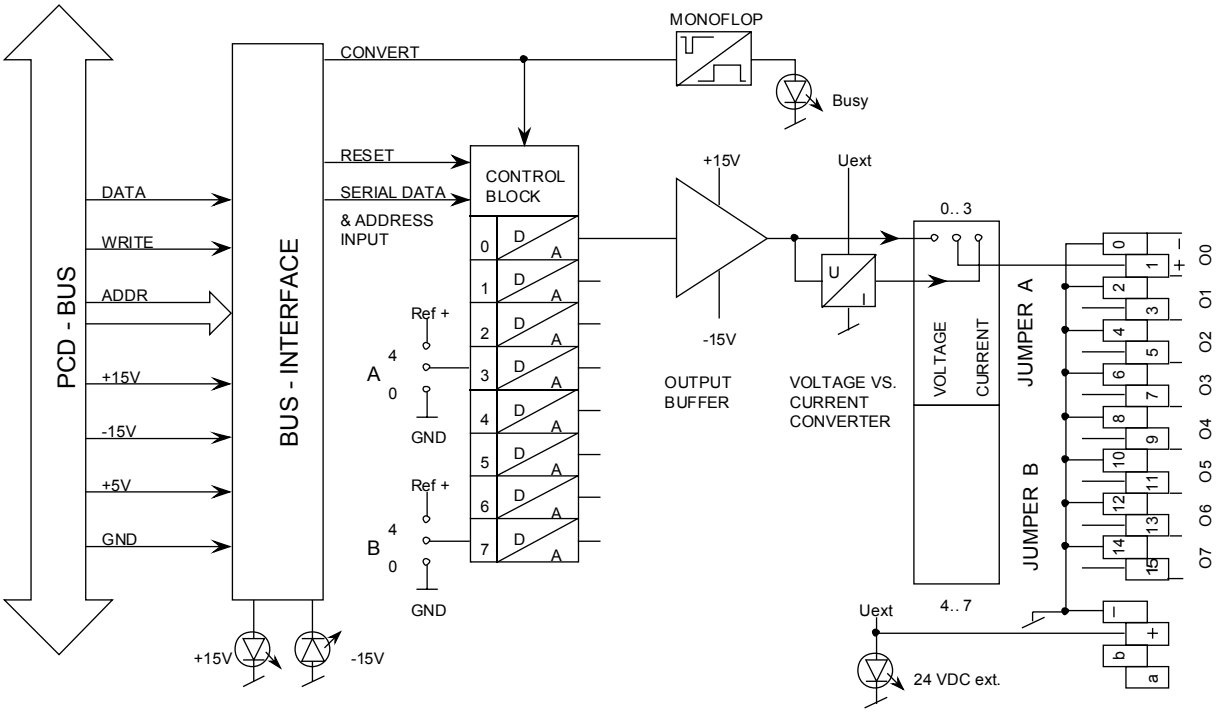
Caution : The entire base PCB incorporates components which are sensitive to electrostatic discharges.

In order to keep the internal equipment obvious to outside inspection, remember to write the I/O type on the labels provided on the front and side panel (see example below).

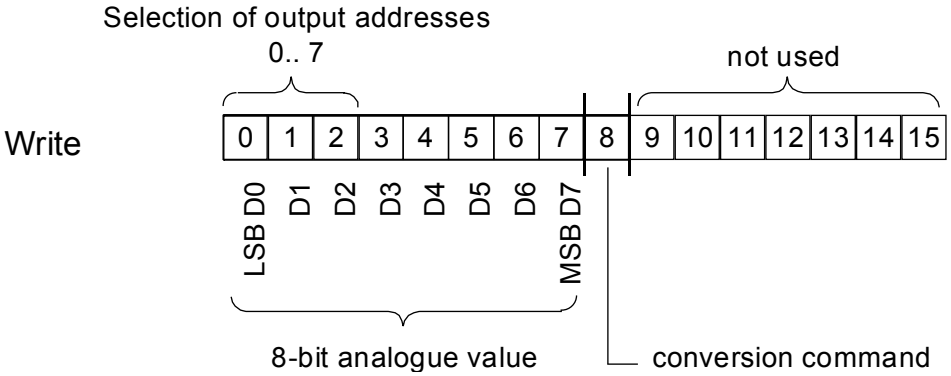




Block diagram



Meaning of the 16 addresses



Analogue value output procedure :

The address of the desired output channel (0 ... 7 binary) is written to bits 0 ... 2. The 8 bits for the analogue value to be output are subsequently set. Finally, bit 8 is set to 1 to trigger D/A conversion. The output address and data is entered serially. There is no need to wait for a "Busy" because of the short D/A conversion time.

User program

The value of register R150 must be output via output O50. Therefore, only the lower 8 bits of R150 are important.

Output O50 can be found on the W400 module with basic address 48. The relative output address is 50 – 48 = 2.

```
(ACC   H )          (ACCU must be 1)
LD     R 151      ; The relative address of the output
         2  *)    ;  channel is loaded into R151

BITOR    3        ; Relative output address 2
       R 151      ;  (from R151) is loaded into
       O 48  **)  ;  the D/A converter of module 48

BITOR    8        ; The value to be output (8 bits)
       R 150      ;  is loaded from register 150 into
       O 48  **)  ;  the D/A converter of module 48

SET    O 56  **)  ; D/A conversion is triggered by
                  ;  activation of bit 8
                  ;  (48 **) + 8 = 56)
```

*) The **relative output address** (without basic address) is stated.

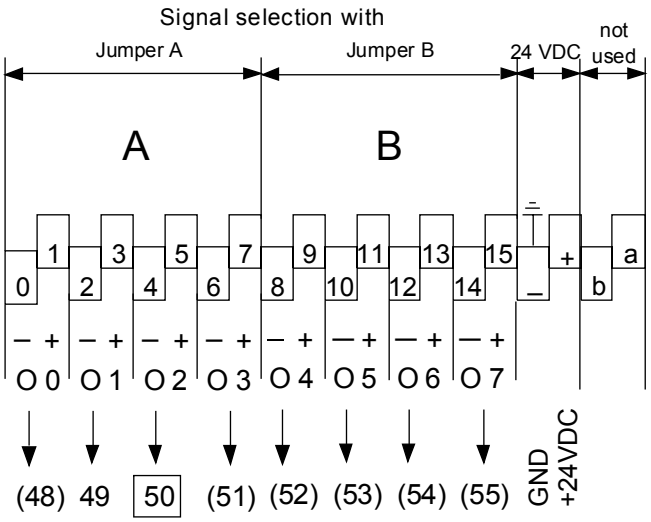
) The **basic address of the module must be stated here.

Digital/analogue values and jumper positions

Large jumper	V / C	V	C	C
Small jumper	0 / 4	0	0	4
Signal range		0 … 10 V	0 … 20 mA	4 … 20 mA
Digital values	255	10.0 V	20 mA	20 mA
	128	5.0 V *)	10 mA *)	12 mA *)
	0	0 V	0 mA	4 mA

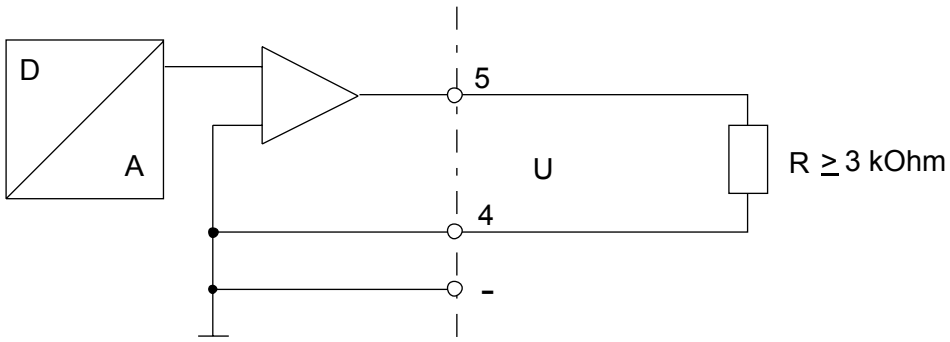
*) The exact values are 1/255 higher

Module connection of analogue outputs

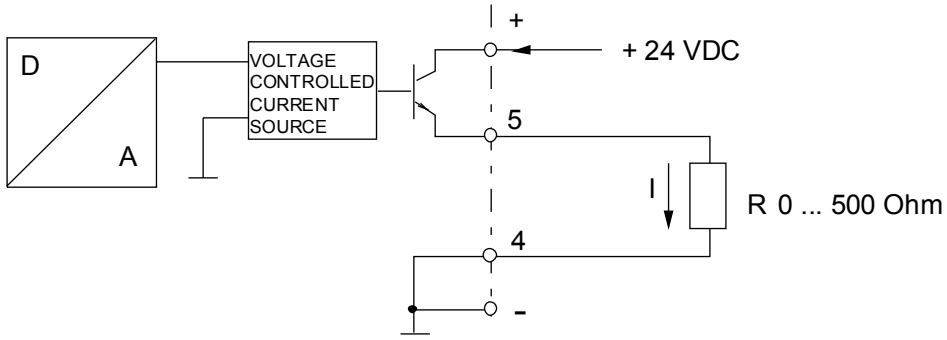


(User program example)

- **Voltage outputs for range : 0 … 10 V :**



- **Current outputs for range : 0 … 20 mA or 4 … 20 mA**
  (selectable with jumpers)



An external 24 VDC supply voltage is required for current outputs.

9.4 PCD4.W500 Analogue input module, 8 channels, 12/15 bit resolution, with galvanic isolation

Application

Intelligent analogue input module with galvanic isolation, 12/15-bit resolution and A/D conversion time of 100 µs (single shot). As a range module it is used with PCD7.Wlx0 modules. The following connections are therefore possible :

- 8 inputs for voltage range 0 ... +10 V
- 8 inputs for current range 0 ... 20 mA
- 8 inputs for Pt/Ni 1000 resistive temperature sensors, 2 wires
- 4 inputs for Pt 100/1000 or Ni 100/1000 resistive temperature sensors, 4 wires

A microcontroller enables intelligent functions to be executed locally without burdening the central processor module :

- single-shot - continuous measurement
- formats : - 12 bit (single shot) or 12/15 bit (continuous),
  - proportional to input size,
  - user definable scaling
- comparator function with two limiting values per input and adjustable hysteresis
- linearization and conversion to °C when standard temperature sensors are used
- connection of resistive temperature sensors (Pt 100/1000, Ni 100/100)
- status information, such as wire break, short-circuit or error

Module overview

Base module :

PCD4.W500 : containing the galvanically isolated DC/DC converter to supply the plug-in range modules, the input multiplexer, A/D converter, programmable current source, optocoupler for galvanic isolation from the PCD processor, microcontroller with its peripheral components, such as the I/O bus interface.

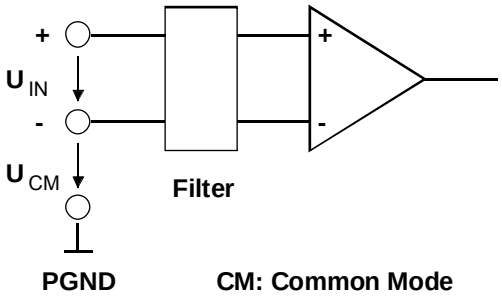
Range modules :

PCD7.W100 :	4 channels, ranges	0 ... 10 V or ±10 V
PCD7.W101 :	4 channels, ranges	0 ... 1 V or ±1 V (4 wires Pt/Ni 100/1000)
PCD7.W103 :	4 channels, range	0 ... 20 mA (or 4 ... 20 mA)
PCD7.W104 :	4 channels, range	4 ... 20 mA for 2 wire measuring transducer
PCD7.W110 :	4 channels for Pt 1000, temperature range –50 ... +150°C, 2-wire measurement	
PCD7.W111 :	4 channels for Ni 1000, temperature range –50 ... +150°C, 2-wire measurement	
PCD7.W120 :	4 channels for Pt/Ni 100/1000, constant current outputs	

The input filter time constant is 1 ms

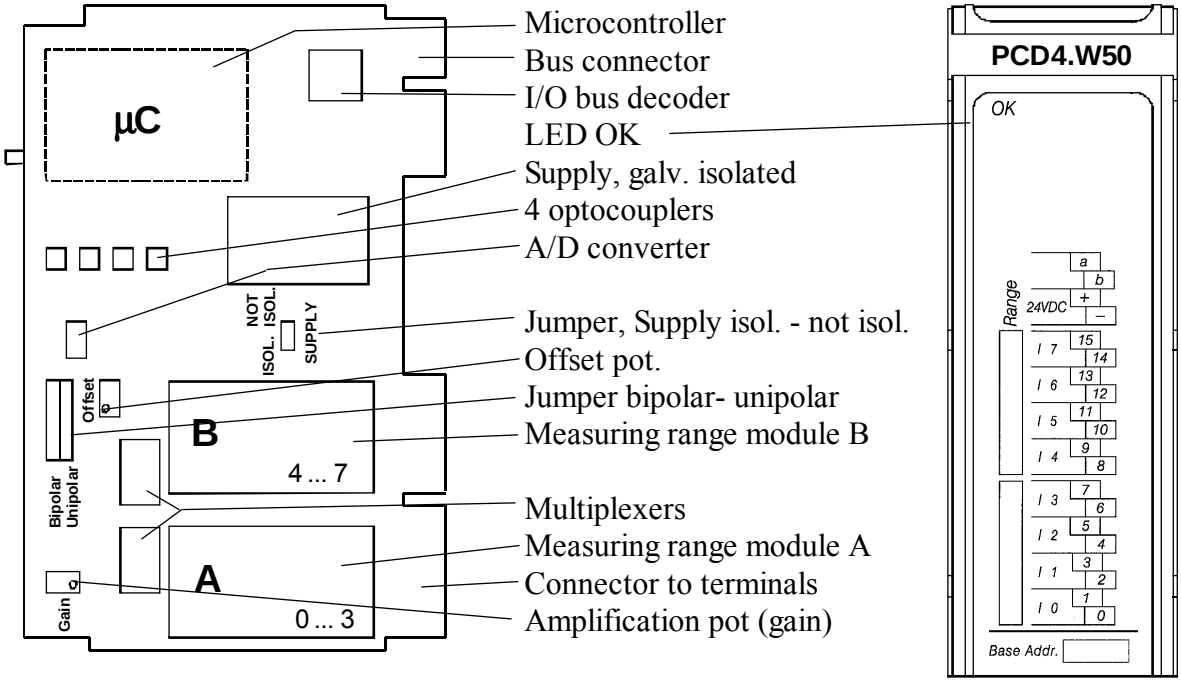
Technical data of the base module

Number of input channels	8 voltage or current inputs, or 8 or 4 inputs for resistive temperature sensors (Pt 100/1000 or Ni 100/1000)
Potential separation	Yes, between PCD-GND and module GND 500 VDC, 1 min
Measuring principle	Differential
Input ranges	See section "range modules"
Resolution (digital representation)	12 bit (0 ... 4095), single-shot mode
A/D conversion time	max. 100 µs single shot max. 65 µs continuous
Admissible over-voltage at analogue inputs	60 VDC
Accuracy (referred to range end value)	±0.25 % ± 2 LSB
Repeating accuracy	± 2 LSB
Temperature error	± 0.02% /°C
Current outputs	0 ... 10 mA constant current for resistive temperature sensors (for use with PCD7.W120 range module only). Standard value : 2 mA Resolution : 8 bit
Resistance to interference (burst)	2 kV under capacitive coupling with screening
Common-mode behaviour	$U_{IN} + U_{CM} \leq \pm 10$ V CMR > 75 dB



External supply 24 VDC	as PCD4.N210 (transformer 19 V, bridge rectifier)
Current consumption	internal from PCD4 bus +5 V : 150 mA external for current output +24 V : 100 mA

Presentation



The following functional blocks can be seen :

- Basic card with bus interface, address decoding, microcontroller system, optocouplers, multiplexers and two spaces for insertion of range modules.

- Space A for insertion of range module with addresses 0 ... 3 and space B for insertion of range module with addresses 4 ... 7.

The "Offset" and "Gain" potentiometers are pre-set in the factory and should not be adjusted.

For more detailed information, please consult the manual :

"Intelligent analogue input/output modules"

Order reference : PUBLI-26/747 E.

9.5 PCD4.W600 Analogue output module, 8 channels, 12 bit resolution, with galvanic isolation

Application

Intelligent analogue output module with galvanic isolation, 12-bit resolution and 8 outputs for voltage range 0 ...10 V and ±10 V or current range 0 ... 20 mA and 4 ... 20 mA.

A microcontroller enables intelligent functions to be executed locally without burdening the PCD's CPU :

- single output or synchronous updating
- conversion of digital value to a range-proportional format
- user definable scaling for range and offset
- identification of the module in user program and identification of range modules

Module overview

Base module :

PCD4.W600 : containing the galvanically isolated DC/DC converter to supply the plug-in range modules, the microcontroller with its peripheral components, and the I/O bus interface.

Range modules :

These contain the optocoupler for galvanic isolation from the PCD processor, the D/A converter and the output stages.

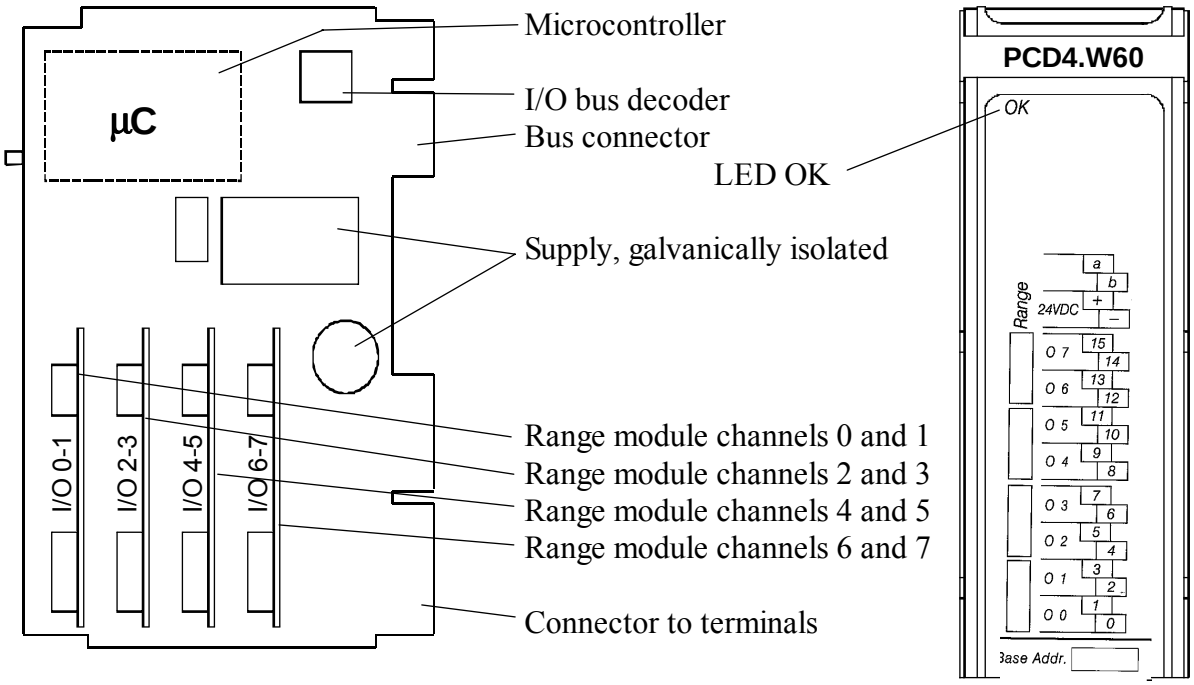
PCD7.W300 :	2 channels, range	0 ... 10 V
PCD7.W302 :	2 channels, range	±10 V
PCD7.W304 :	2 channels, range	0 ... 20 mA
PCD7.W305 :	2 channels, range	4 ... 20 mA

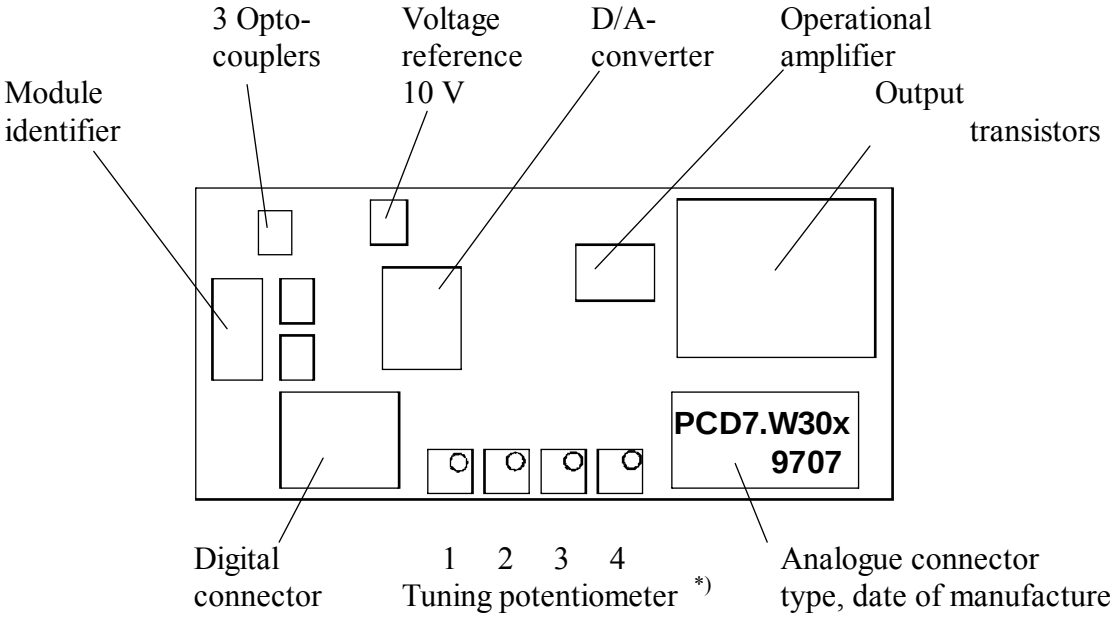
Technical data of the base module

Number of output channels	8 voltage or current outputs (in 4 groups), short-circuit proof
Potential separation	Yes, between PCD-GND and module GND 500 VDC, 1 min
Output ranges	See section "range modules"
Resolution (digital representation)	12 bit (0 ... 4095)
D/A conversion time	0.1 ms for voltage (resistive load) 0.8 ms for voltage (capacitive load) 0.3 ms for current
Load impedance	Voltage : ≥ 3 kΩ Current : 0 ... 500 Ω capacitive load < 1 µF inductive load < 1 mH
Accuracy (referred to range end value)	Voltage : ± 0.15 % ±5 mV Current : ± 0.2 % ±20 µA 4 mA : ±20 µA
Temperature error	± 0.02 %/°C
Linearity error	Voltage : ± 0.05 % Current : ± 0.1 %
Repeating accuracy	± 0.05 %
Residual ripple	Voltage : ± 0.05 % Current : ± 0.1 %
Current consumption	internal from PCD4 bus +5 V : 200 mA external +24 V *) : 100 mA + 20 mA per current output

*) Requirement as PCD4.N210

Presentation of the main module and a range module





*) These potentiometers are factory set and **should not be** adjusted by the user.

For more detailed information, please consult the manual :

"Intelligent analogue input/output modules"

Order reference : PUBLI-26/747 E.

10. Manual operation modules

The SAIA® PCD is increasingly used in building automation. In order to guarantee the necessary manual overrides for this area of application, specific manual operation modules have been developed for the PCD4 series.

These manual operation modules are based on digital and analogue output modules and are activated either via the user program or via manual switches. Like all I/O modules, the manual operation modules are plugged onto the PCD4.C2x0 I/O bus modules.

PCD4.A810 : Digital manual operation module, single-stage, 8 channels

8 relays, each with 1 'make' contact with switching "Automatic" - "Manual 1-0"

PCD4.A820 : Digital manual operation module, dual-stage, 4 channels

4 x 2 relays, each with 1 'make' contact with switching "Automatic" - "Manual 1-0-2"

PCD4.W800 : Analogue manual operation module, 8 bits, 4 channels

with switching "Automatic" - "Manual"

Signal ranges :	0 ... 10 V, 0 ... 20 mA or 4 ... 20 mA
Display :	10 LED array for each channel
Potentiometer :	0 ... 100 % for each channel

PCD4.C225 : Bus module for operating the above-mentioned manual control modules with a PCD2.M…, with the exception of the PCD2.M110 (see detailed information in part 3.6)

Notes :

10.1 PCD4.A810 Digital output module with manual overrides, 1 level

PCD4.A810 : 8 relay contacts (make contacts) with switching between automatic and manual

Functional description

The module has eight relay outputs (channels). Each channel has a switch with the positions AUTO, MAN 0, MAN 1.

- On AUTO the relay can be switched on or off normally by the user program.
- On MAN 0 the relay is switched off.
- On MAN 1 it is switched on.

A red LED shows the state of the relay. When the switch is not on AUTO, a yellow LED is illuminated and a reply signal can be read in the user program.

As long as it is connected externally to 24 V, manual operation and the alarm function work, even when the CPU or internal +5 V is switched off.

In automatic operation the outputs are handled in the same way as a normal PCD4 output module, i.e. the outputs are reset for a CPU restart cold, for an external reset and for a power down.

This module can also be coupled to a PCD2.M… (except PCD2.M110) by means of the PCD4.C225 bus module and the cables PCD2.K2x0.

Programming model

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Write	A0	A1	A2	A3	A4	A5	A6	A7	¦---------- empty ----------¦							
Read	A0	A1	A2	A3	A4	A5	A6	A7	/M0	/M1	/M2	/M3	/M4	/M5	/M6	/M7

A0 ... 7 : Relay output 0 ... 7 Automatic
/M0 ... 7 : Reply "Man" - "Auto" (Man = L)

It is not the purpose of this document to give further detailed information on programming (e.g. HLK-FB handling, technical considerations of security for programming, etc.). The intention here is only to provide information on the functions made available by the hardware.

Alarm function

A special input signal influences each individual CHANNEL, depending on jumper setting.

The following jumper settings are possible :

- DISABLE,
- ACTIVE OFF,
- ACTIVE ON.

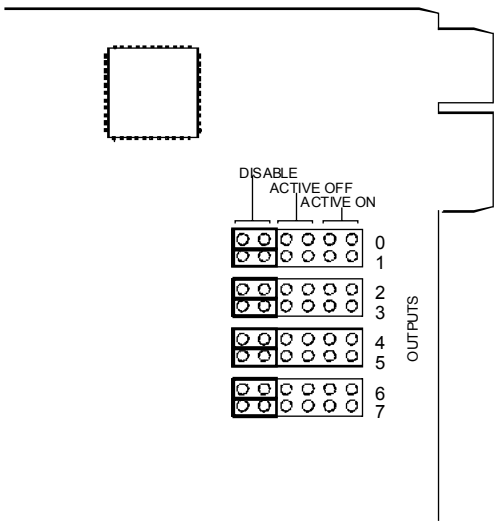
Important : The alarm signal is active = Low !

a) DISABLE
The channel preserves the momentary state.

b) ACTIVE OFF
Regardless of any switch position, the relay is released, the corresponding red LED is not illuminated, the /Mx signal is zeroed and the yellow LED is on.

c) ACTIVE ON
Regardless of any switch position, the relay is active, the corresponding red LED lights up, the /Mx signal is zeroed and the yellow LED is on.

The jumper settings can only be changed if the printed circuit board is removed from the module cassette.



Jumpers for alarm function

Function table

Example : channel 0 as an example)

a : Alarm input (H = 24 V, L = 0 V)
A0 : Relay output 0 automatic
/M0 : Reply "Man" - "Auto" (Man = L)

a) Jumper on alarm "DISABLE"

a	Switch	A0	Relay + Red LED	/M0	Yellow LED
X	AUTO	0 1	OFF ON	H H	OFF OFF
	MAN 0 MAN 1	X X	OFF ON	L L	ON ON

b) Jumper on alarm "ACTIVE OFF"

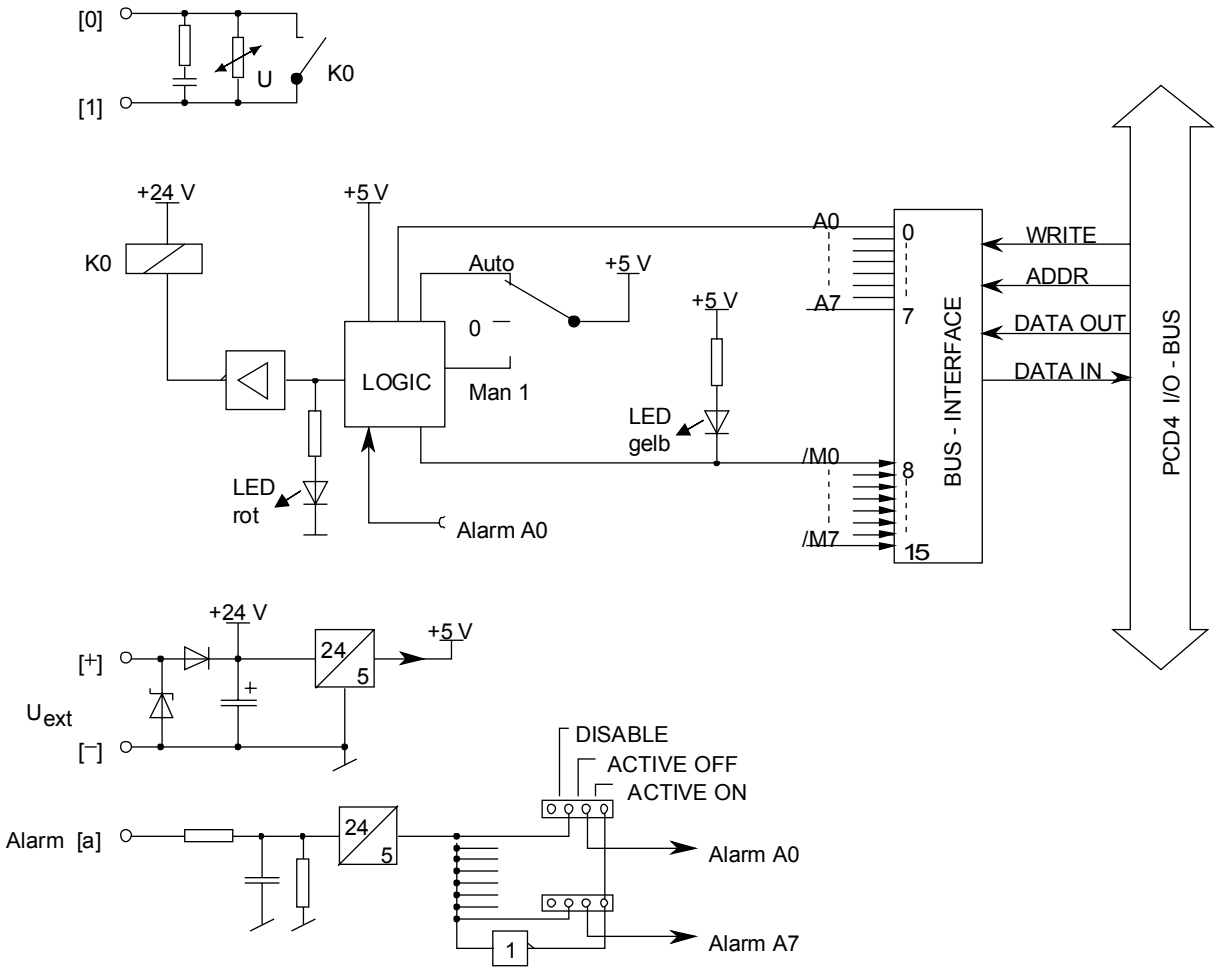
a	Switch	A0	Relay + Red LED	/M0	Yellow LED
H H	AUTO	0 1	OFF ON	H H	OFF OFF
H H	MAN 0 MAN 1	X X	OFF ON	L L	ON ON
L L	AUTO	0 1	OFF OFF	L L	ON ON
L L	MAN 0 MAN 1	X X	OFF OFF	L L	ON ON

c) Jumper on alarm "ACTIVE ON" *)

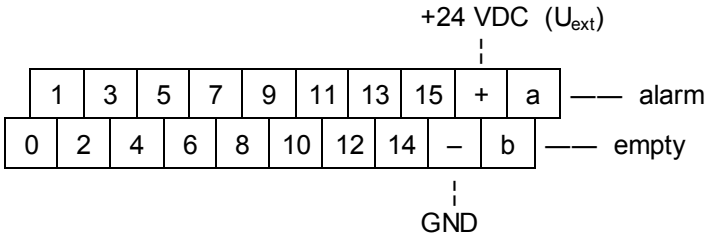
a	Switch	A0	Relay + Red LED	/M0	Yellow LED
H H	AUTO	0 1	OFF ON	H H	OFF OFF
H H	MAN 0 MAN 1	X X	OFF ON	L L	ON ON
L L	AUTO	0 1	ON ON	L L	ON ON
L L	MAN 0 MAN 1	X X	ON ON	L L	ON ON

*) With the jumper in the "ACTIVE ON" position, the relays can be enabled momentarily when the supply is either switched on or off.

Block diagram

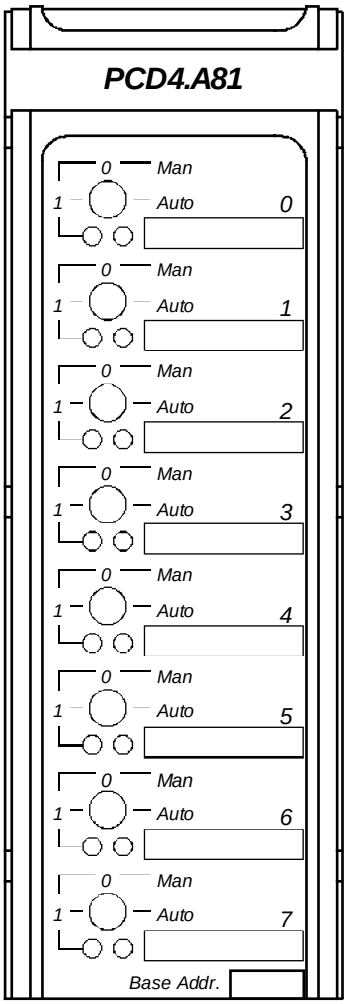


Connection diagram for the user

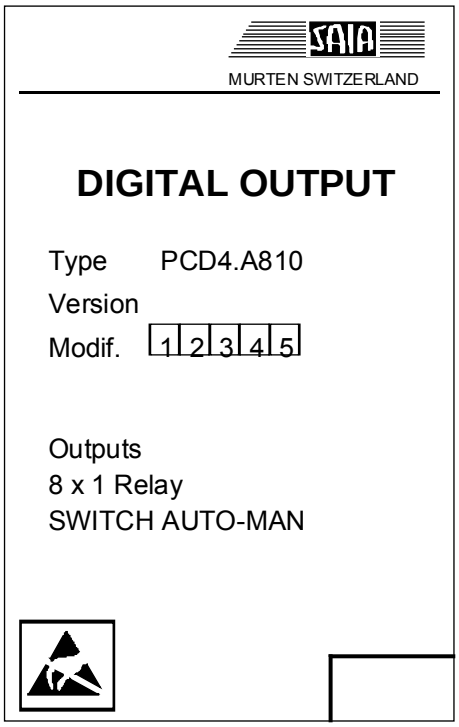


Address A	0	1	2	3	4	5	6	7
Terminal	0 1	2 3	4 5	6 7	8 9	10 11	12 13	14 15
Channel	0	1	2	3	4	5	6	7

Front panel and nameplate



Front panel



Nameplate

Coding port

Inputs/outputs connector

Electrical data

- Internal power supply

+5 V : 5 ... 45 mA
+15 V : 3 mA

- External power supply

For the operation of this module the user must provide a supply for the relays.

Voltage tolerance dependent on ambient temperature :

Temperature	Smoothed DC	Pulsating DC
20°C	18.5 … 30 V	14 … 21 V
30°C	19.5 … 30 V	15 … 21 V
40°C	20.5 … 30 V	16 … 21 V
50°C	21.5 … 30 V	17 … 21 V

Current consumption at 24 V : 10 ... 150 mA

The connection has reverse bias protection, and protection against transitory overvoltages ensured by a suppressor diode of 39 V ±10 %.

- Connection value of contacts

Breaking capacity :	2 A,	250 VAC	AC1	
	1 A,	250 VAC	AC11	
	2 A,	50 VDC	DC1	
	1 A,	50VDC	DC11	(only with recovery diode)
Contact lifetime : (AC1)	2 A,	220 VAC	0.2 x 10^6 operations	
	1 A,	220 VAC	0.8 x 10^6 operations	
	0.4 A,	220 VAC	5.0 x 10^6 operations	

- Insulation resistance

All contacts against +, –, PGND, GND, +5 V and ±15 V :

500 VDC 10 MOhm (Ref. GL B.2)

- Insulation voltage

All contacts against +, –, PGND, GND, +5 V and ±15 V :

2000 VAC 1 min (Ref. GL B.14)

- Insulating distance

All contacts against +, –, PGND, GND, +5 V and ±15 V : 3.2 mm

Contact to contact : 1.6 mm

- Characteristics of the alarm input

The input is designed for source operation. The signal voltage used can be smoothed DC or pulsating DC.

Input voltage level

- Alarm active : –30 ... +5 V (or contact open)
- Alarm disable : +15 ... +30 V

Input current : 5 mA at 24 V

Switch on/off delay time : 4 ... 12 ms

Commissioning

The user must set the available jumpers according to his application.

- The jumpers for the alarm functions are on DISABLE.

Switching inductive loads

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

Is should be noted here that, as part of the harmonization of standards throughout the EU, the EMC standards are valid from 1996 (EMC Directive 89/336/EG). Two principles should therefore be emphasized :

1) THE PROTECTION AGAINST INTERFERENCES FROM INDUCTIVE LOADS IS IMPERATIVE.

2) INTERFERENCE SHOULD BE ELIMINATED AS CLOSE AS POSSIBLE TO ITS SOURCE.

It is therefore recommended that a protection circuit should be fitted at the load (often available as normal components on standardized contactors and valves).

When switching direct voltage it is urgently recommended that a recovery diode is fitted above the load. This should even take place when, theoretically, an Ohmic load is switched.

In practice, there will always be a proportion which is inductive (connection cable, resistance coil, etc.). In this case it should be noted that the switch-off time will be longer :

$$Ta \text{ approx. } L/RL * \sqrt{(RL * IL/0.7)}$$

Safety regulations

For reasons of safety it is **not allowed** that low voltages (up to 50 V) and higher voltages (50 ... 250 V) are connected to the same module.

In the case of low voltage, only one phase per module via a common fuse is permissible. However, the individual load circuits can then be fused individually.

General technical data

Surrounding atmospheric conditions

- Temperature (Fresh air temperature measured at the base of PCD4)

Operation :	–20 ... +55°C	IEC1131-2, 2.1.1.1
Storage/Transport :	–25 ... +70°C	IEC1131-2, 2.1.1.2

- Relative humidity

5 ... 95 % (indoor) without condensation IEC1131-2, 2.1.1.3
(as DIN 40040 class F)

Surrounding mechanical conditions

- Vibrations

IEC1131-2, 2.1.3.1 (as IEC68-2-6)

10 ... 57 Hz	0.075 mm
57 ... 150 Hz	1.0 g

- Shock

IEC1131-2, 2.1.3.2 (as IEC68-2-27)

Half sine 15 g / 11 ms in 3 axes (12 times)

- Toppling and rolling

IEC1131-2, 2.1.3.3 (as IEC68-2-31)

Drop height : 100 mm

Electromagnetic compatibility (EMC)

IEC1131-2, Annex C

- ESD IEC 801-2 Draft 4

  4 kV HVR 4 kV Air Discharge

  (Divergence from IEC1131-2 : 8kV min)

- Burst IEC 801-4

  + / – connections, all contacts : 4 kV direct

  all contacts : 2 kV capacitive bunched cables

- 1.2 / 50 µs Impulse IEC 255-4 and IEC 805-5

  + / – connections, all contacts : 3 kV disconnected from power source

Standards complied with

IEC 1131-2 (previously IEC 65A (Central Office)	1992 22 Nov. 1988)
VDE110 Part 1	1989
Germanischer Lloyd GL	Sept. 1990
Svensk Standard SEN SS 4361503	1986

10.2 PCD4.A820 Digital output module with manual overrides, 2 levels

PCD4.A820 : 8 relay contacts (make contacts) with switching between automatic and manual (1 - 0 - 2 positions)

Functional description

The module has eight relay outputs (2 per channel). Each channel has two switches : switch 1 with the AUTO and MAN positions and switch 2 with the 1-0-2 positions.

- On AUTO both relays can be switched on or off normally via the user program.
- On MAN activation via the user program is interrupted and the relays are enabled using switch 2 (see function table).

A red LED shows the state of the relay (only when 24 V connected externally). When switch 1 is on MAN, a yellow LED is illuminated and a reply signal can be read in the user program.

As long as it is connected externally to 24 V, manual operation and the alarm function work, even when the CPU or internal +5 V is switched off.

In automatic operation the outputs are handled in the same way as a normal PCD4 output module, i.e. the outputs are reset for a CPU restart cold, for an external reset and for a power down.

This module can also be coupled to a PCD2.M… (except PCD2.M110) by means of the PCD4.C225 bus module and the cables PCD2.K2x0.

Programming model

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Write	A0	A1	A2	A3	A4	A5	A6	A7	¦---------- empty ----------¦							
Read	A0	A1	A2	A3	A4	A5	A6	A7	/M0	/M1	/M2	/M3				

A0 ... 7 : Relay output 0 ... 7 Automatic
/M0 ... 7 : Reply "Man" - "Auto" (Man = L)

It is not the purpose of this document to give further detailed information on programming (e.g. HLK-FB handling, technical considerations of security for programming, etc.). The intention here is only to provide information on the functions made available by the hardware.

Alarm function

A special input signal influences each individual RELAY, depending on jumper setting.

The following jumper settings are possible :

- DISABLE,
- ACTIVE OFF,
- ACTIVE ON.

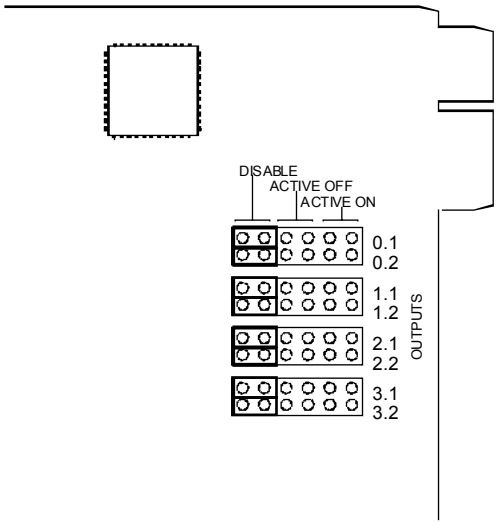
Important : The alarm signal is active = Low!

a) DISABLE
The relay preserves the momentary state.

b) ACTIVE OFF
Regardless of any switch position, the relay is released, the corresponding red LED is not illuminated, the /Mx signal is zeroed and the yellow LED is on.

c) ACTIVE ON
Regardless of any switch position, the relay is active, the corresponding red LED lights up, the /Mx signal is zeroed and the yellow LED is on.

The jumper settings can only be changed if the printed circuit board is removed from the module cassette.



Jumpers for alarm function

Function table

Example : channel 0 as an example

a : Alarm input (H = 24 V, L = 0 V)
A0 : Relay output 0 automatic
/M0 : Reply "Man" - "Auto" (Man = L)

a) Jumper on alarm "DISABLE"

a	Switch 1	Switch 2	A0	A1	Relay 1 + Red LED 1	Relay 2 + Red LED 2	/M0	Yellow LED
X	AUTO	X X X	0 1 0	0 0 1	OFF ON OFF	OFF OFF ON	H H H	OFF OFF OFF
	!)	X	1	1	ON	ON	H	OFF
	MAN	0 1 2	X X X	X X X	OFF ON OFF	OFF OFF ON	L L L	ON ON ON

b) Jumper on alarm "ACTIVE OFF"
(Only on relay 1 as an example. Relay 2 operates identically.)

a	Switch 1	Switch 2	A0	A1	Relay 1 + Red LED 1	Relay 2 + Red LED 2	/M0	Yellow LED
H	AUTO	X X X	0 1 0	0 0 1	OFF ON OFF	OFF OFF ON	H H H	OFF OFF OFF
	!)	X	1	1	ON	ON	H	OFF
	MAN	0 1 2	X X X	X X X	OFF ON OFF	OFF OFF ON	L L L	ON ON ON
L	AUTO	X X X	0 1 0	0 0 1	OFF OFF OFF	OFF OFF ON	L L L	ON ON ON
	!)	X	1	1	OFF	ON	L	ON
	MAN	0 1 2	X X X	X X X	OFF OFF OFF	OFF OFF ON	L L L	ON ON ON

!) Caution : In automatic operation this possibility is not latched.
The user must take measures using appropriate programming.
Normally latching is also implemented at the level of the power contactor.

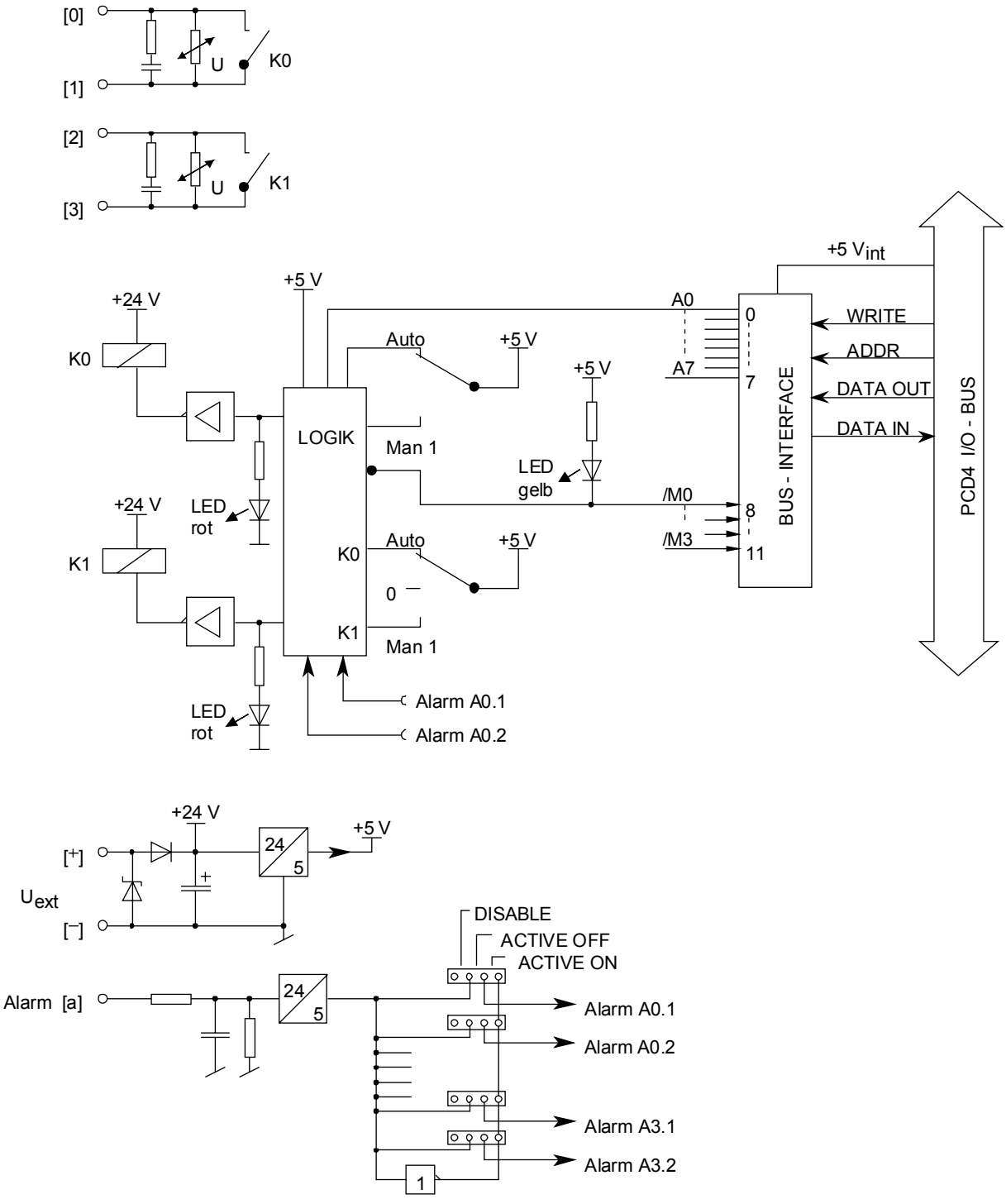
c) Jumper on alarm "ACTIVE ON" *)
(Only on relay 1 as an example. Relay 2 operates identically.)

a	Switch 1	Switch 2	A0	A1	Relay 1 + Red LED 1	Relay 2 + Red LED 2	/M0	Yellow LED
H	AUTO	X X X	0 1 0	0 0 1	OFF ON OFF	OFF OFF ON	H H H	OFF OFF OFF
	!)	X	1	1	ON	ON	H	OFF
	MAN	0 1 2	X X X	X X X	OFF ON OFF	OFF OFF ON	L L L	ON ON ON
L	AUTO ! !)	X X X	0 1 0	0 0 1	ON ON ON	OFF OFF ON	L L L	ON ON ON
	!)	X	1	1	ON	ON	L	ON
	MAN ! !)	0 1 2	X X X	X X X	ON ON ON	OFF OFF ON	L L L	ON ON ON

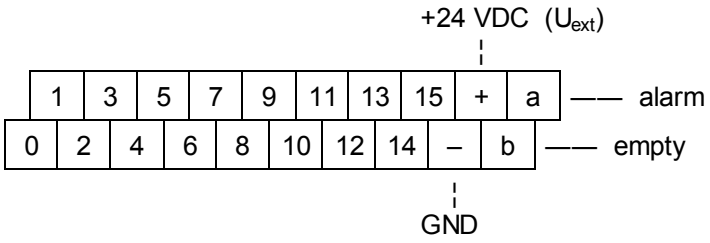
!) and ! !) Caution : These output states, which arise in case of an alarm, are not allowed under certain circumstances. When "programming" the alarm functions, extreme caution should therefore be exercised. Normally latching should also be implemented at the level of the power contactor.

*) With the jumper in the "ACTIVE ON" position, the relays can briefly be excited when the supply is either switched on or off.

Block diagram



Connection diagram for the user

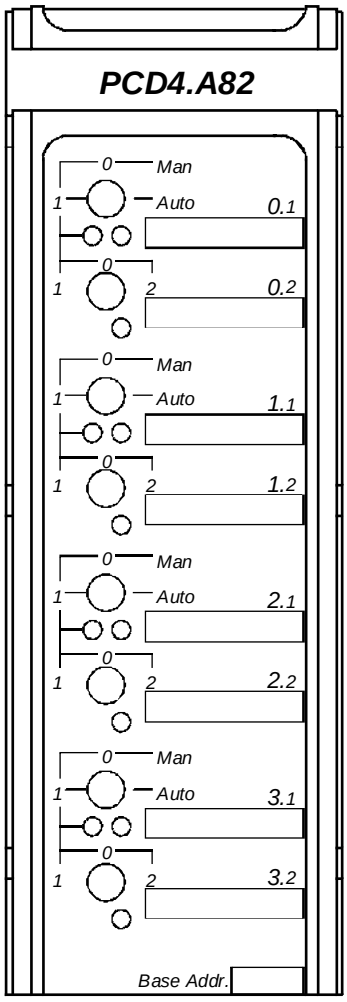


Address A	0	1	2	3	4	5	6	7
Terminal	0 1	2 3	4 5	6 7	8 9	10 11	12 13	14 15
Channel	0.1	0.2	1.1	1.2	2.1	2.2	3.1	3.2

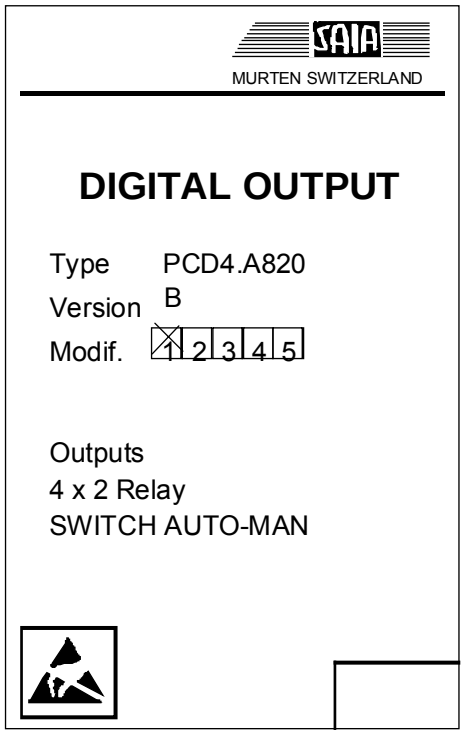
Coding port

Inputs/outputs connector

Front panel and nameplate

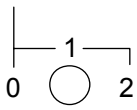


Front panel



Nameplate

Caution ! On the modules with hardware version " A " the 3-positions switch has a different reaction (0 - 1 - 2 positions instead of 1 - 0 - 2).



Electrical data

- Internal power supply

  +5 V : 5 ... 45 mA
  +15 V : 3 mA

- External power supply

For the operation of this module the user must provide a supply for the relays.

Voltage tolerance dependent on ambient temperature :

Temperature	Smoothed DC	Pulsating DC
20°C	18.5 … 30 V	14 … 21 V
30°C	19.5 … 30 V	15 … 21 V
40°C	20.5 … 30 V	16 … 21 V
50°C	21.5 … 30 V	17 … 21 V

Current consumption at 24 V : 10 ... 150 mA

The connection has reverse bias protection, and protection against transitory overvoltages ensured by a suppressor diode of 39 V ±10 %.

- Connection value of contacts

Breaking capacity :	2 A,	250 VAC	AC1	
	1 A,	250 VAC	AC11	
	2 A,	50 VDC	DC1	
	1 A,	50VDC	DC11	(only with recovery diode)
Contact lifetime : (AC1)	2 A,	220 VAC	0.2 x 10^6 operations	
	1 A,	220 VAC	0.8 x 10^6 operations	
	0.4 A,	220 VAC	5.0 x 10^6 operations	

- Insulation resistance

All contacts against +, –, PGND, GND, +5 V and ±15 V :

500 VDC 10 MOhm (Ref. GL B.2)

- Insulation voltage

All contacts against +, –, PGND, GND, +5 V and ±15 V :

2000 VAC 1 min (Ref. GL B.14)

- Insulating distance

All contacts against +, –, PGND, GND, +5 V and ±15 V : 3.2 mm

Contact to contact : 1.6 mm

- Characteristics of the alarm input

The input is designed for source operation. The signal voltage used can be smoothed DC or pulsating DC.

Input voltage level

- Alarm active : –30 ... +5 V (or contact open)
- Alarm disable : +15 ... +30 V

Input current : 5 mA at 24 V

Switch on/off delay time : 4 ... 12 ms

Commissioning

The user must set the available jumpers according to his application.

- The jumpers for the alarm functions are on DISABLE.

Switching inductive loads

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

Is should be noted here that, as part of the harmonization of standards throughout the EU, the EMC standards are valid from 1996 (EMC Directive 89/336/EG). Two principles should therefore be emphasized :

1) THE PROTECTION AGAINST INTERFERENCES FROM INDUCTIVE LOADS IS IMPERATIVE.

2) INTERFERENCE SHOULD BE ELIMINATED AS CLOSE AS POSSIBLE TO ITS SOURCE.

It is therefore recommended that a protection circuit should be fitted at the load (often available as normal components on standardized contactors and valves).

When switching direct voltage it is urgently recommended that a recovery diode is fitted above the load. This should even take place when, theoretically, an Ohmic load is switched.

In practice, there will always be a proportion which is inductive (connection cable, resistance coil, etc.). In this case it should be noted that the switch-off time will be longer :

$$Ta \text{ approx. } L/RL * \sqrt{(RL * IL/0.7)}$$

Safety regulations

For reasons of safety it is **not allowed** that low voltages (up to 50 V) and higher voltages (50 ... 250 V) are connected to the same module.

In the case of low voltage, only one phase per module via a common fuse is permissible. However, the individual load circuits can then be fused individually.

General technical data

Surrounding atmospheric conditions

- Temperature (Fresh air temperature measured at the base of PCD4)

Operation :	–20 ... +55°C	IEC1131-2, 2.1.1.1
Storage/Transport :	–25 ... +70°C	IEC1131-2, 2.1.1.2

- Relative humidity

5 ... 95 % (indoor) without condensation IEC1131-2, 2.1.1.3
(as DIN 40040 class F)

Surrounding mechanical conditions

- Vibrations

IEC1131-2, 2.1.3.1 (as IEC68-2-6)

10 ... 57 Hz	0.075 mm
57 ... 150 Hz	1.0 g

- Shock

IEC1131-2, 2.1.3.2 (as IEC68-2-27)

Half sine 15 g / 11 ms in 3 axes (12 times)

- Toppling and rolling

IEC1131-2, 2.1.3.3 (as IEC68-2-31)

Drop height : 100 mm

Electromagnetic compatibility (EMC)

IEC1131-2, Annex C

- ESD IEC 801-2 Draft 4

  4 kV HVR 4 kV Air Discharge

  (Divergence from IEC1131-2 : 8kV min)

- Burst IEC 801-4

  + / – connections, all contacts : 4 kV direct

  all contacts : 2 kV capacitive bunched cables

- 1.2 / 50 µs Impulse IEC 255-4 and IEC 805-5

  + / – connections, all contacts : 3 kV disconnected from power source

Standards complied with

IEC 1131-2 (previously IEC 65A (Central Office)	1992 22 Nov. 1988)
VDE110 Part 1	1989
Germanischer Lloyd GL	Sept. 1990
Svensk Standard SEN SS 4361503	1986

10.3 PCD4.W800 Analogue output module with manual overrides

PCD4.W800 : 4 x 8 bit analogue outputs with switching between automatic and manual 0 ... 100 %

Functional description

The module has four analogue outputs with 8-bit resolution. A two-way switch on each output enables switching between automatic and manual operation.

- In the AUTO position this module works as a standard PCD4.W400, so this function is not explained in detail in this document. (for details, see chapter 9.3).
- In the MAN position, automatic operation is interrupted and the output voltage or current can be adjusted via a potentiometer. In this case a yellow LED is illuminated and a reply signal can be read in the user program.

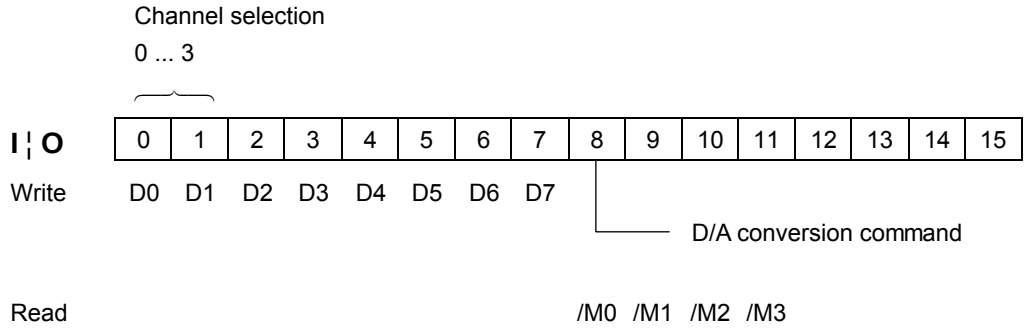
A ten-level LED bar scale indicates the output value from 0 ... 100 % in both AUTO and MAN operation. The LED bar scale is powered by the external power supply.

As long as it is connected externally to 24 V, manual operation and the alarm function work, even when the CPU or internal +5 V is switched off.

In automatic operation the outputs are handled in the same way as a normal PCD4.W400 analogue module, i.e. the outputs are reset to 0 V or 0/4 mA for a CPU restart cold, for an external reset and for a power down.

This module can also be coupled to a PCD2.M… (except PCD2.M110) by means of the PCD4.C225 bus module and the cables PCD2.K2x0.

Programming model



/M0 … /M3 : Reply "Man" - "Auto" (Man = L)

Procedure to output analogue value

The address of the desired output channel is written to bits D0 and D1 :

Value 0 = channel 0 → I¦O 0 = L, I¦O 1 = L
Value 1 = channel 1 → I¦O 0 = L, I¦O 1 = H
Value 2 = channel 2 → I¦O 0 = H, I¦O 1 = L
Value 3 = channel 3 → I¦O 0 = H, I¦O 1 = H

The 8 bits are then set for the analogue output value. Finally, D/A conversion is activated by setting bit 8 high.

Example : A value (0 ... 255) from register R 1000 is to be output on output channel 1.

```
BA     EQU I¦O

(ACC   H )          (ACCU must be 1)
LD     R 151      ; The relative address of the output
         1        ;  channel is loaded into R151

BITOR    3        ; Channel selection as
       R 151      ;  above table)
         BA+0

BITOR    8        ; The output value (8 bits) is
       R 1000     ;  loaded from register R 1000
         BA+0     ;  to the D/A converter

SET      BA+8     ; D/A conversion is triggered by
                  ;  activation of bit 8
```

Programming with channel selection from a register, as described for the PCD4.W400 module, can also be used here.

Alarm function

A special input signal influences each individual OUTPUT, depending on jumper setting.

The following jumper settings are possible :

- DISABLE,
- ACTIVE OFF,
- ACTIVE ON.

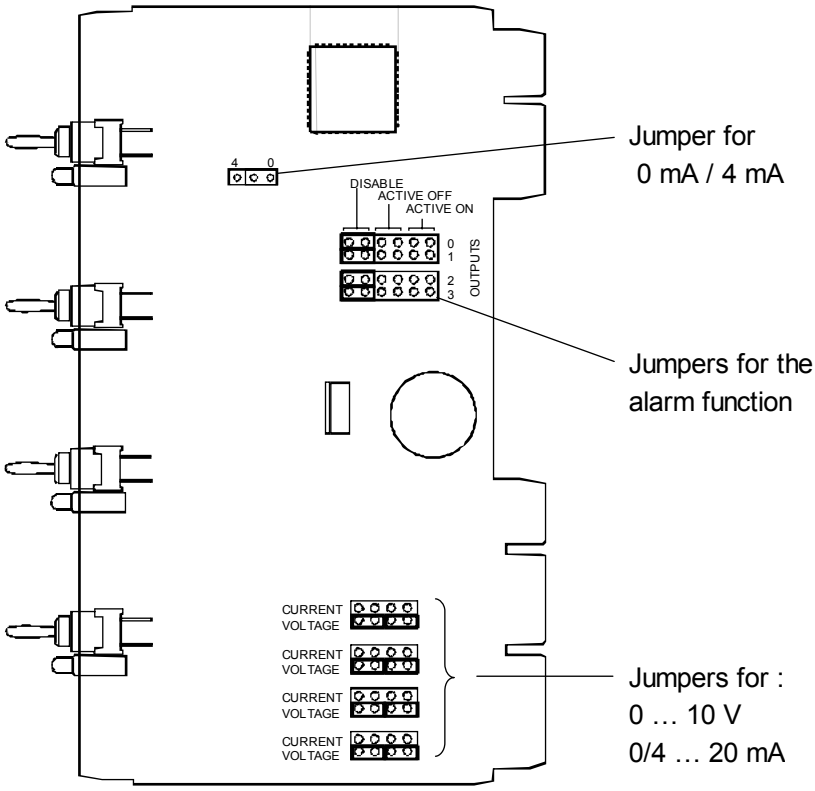
Important : The alarm signal is active = Low !

a) DISABLE
The channel preserves the momentary state.

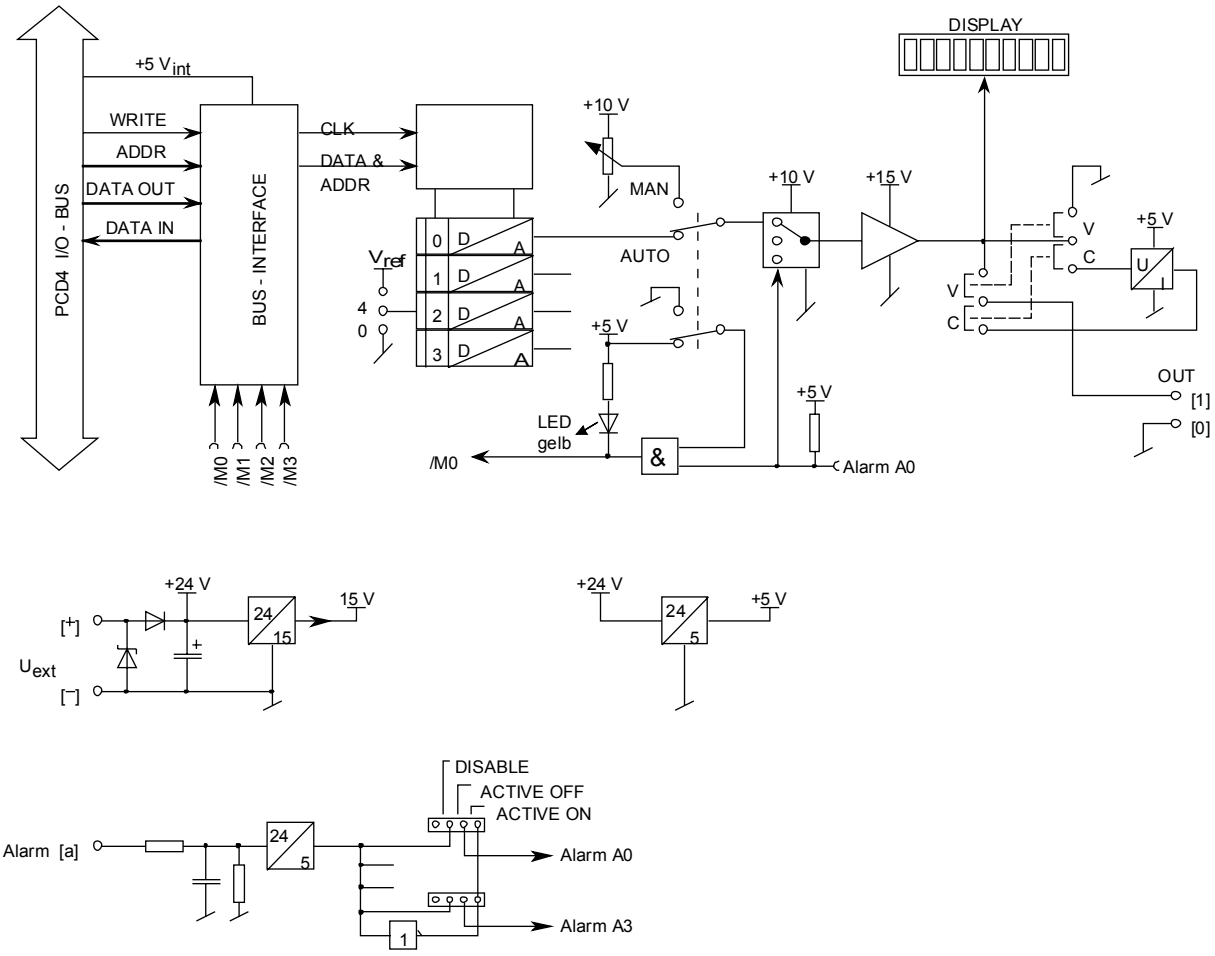
b) ACTIVE OFF
Regardless of the current output value, the output is switched to 0 %. The /Mx signal is zeroed and the yellow LED is on.

c) ACTIVE ON
Regardless of the current output value, the output is switched to 100 %. The /Mx signal is zeroed and the yellow LED is on.

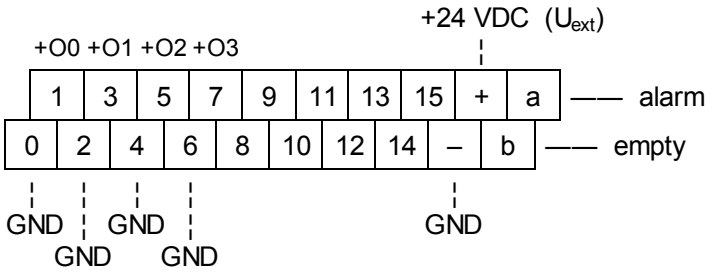
The jumper settings can only be changed if the printed circuit board is removed from the module cassette.



Block diagram

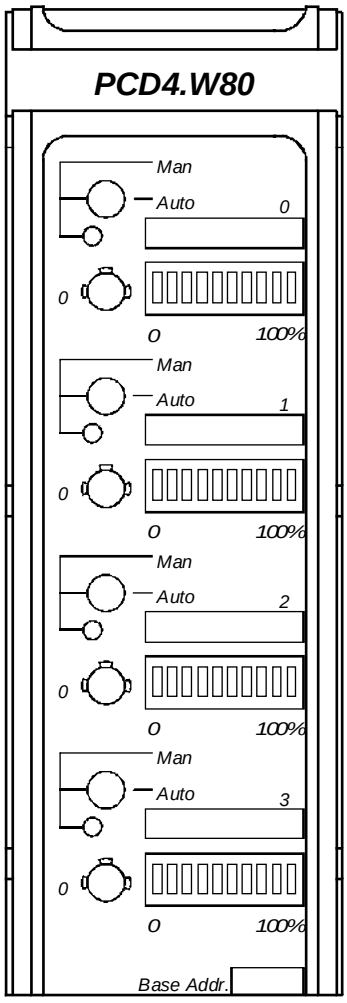


Connection diagram for the user

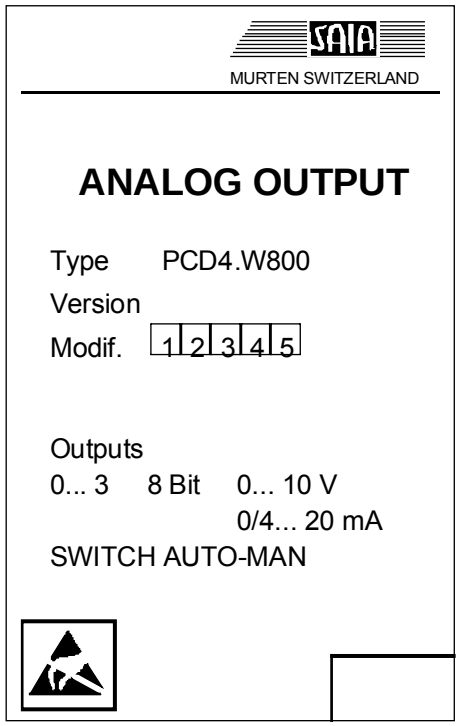


Pins 8 ... 15 are not connected.

Front panel and nameplate



Front panel



Nameplate

Coding port

Inputs/outputs connector

Electrical data

- Internal power supply

+5 V :	30 mA
+15 V :	10 mA

- External power supply

For operation of the module, the user must supply 24 VDC ±20 % or 18 VDC from a full-wave rectifier ±15 %, without filter capacitor.

The connection has reverse bias protection, and protection against transitory overvoltages ensured by a suppressor diode of 39 V ±10 %.

- Output characteristics

Signal range :	0 ... 10 V
	0 ... 20 mA
	4 ... 20 mA

Current/voltage is jumper selectable for each channel. Offset 0/4 can only be selected module by module.

The jumper settings can only be changed if the printed circuit board is removed from the module cassette.

For signal range 4 ... 20 mA, the LED bar scale does not return to 0 %.

Load impedance :	voltage	≥ 3 kΩ
	current	≤ 500 Ω
Accuracy :	voltage	1 % ±50 mV
	current	1 % ±0.2 mA
Residual ripple :	voltage	< 15 mV pp
	current	< 50 µA pp
Current consumption at 24 V:		10 ... 150 mA

- Characteristics of the alarm input

The input is designed for source operation. The signal voltage used can be smoothed DC or pulsating DC.

Input voltage level

- Alarm active (L) : –30 ... +5 V (or contact open)
- Alarm disable (H) : +15 ... +30 V

Input current : 5 mA at 24 V

Switch on/off delay time : 4 ... 12 ms

Commissioning

The user must set the available jumpers according to his application.

- For all outputs the factory setting of jumpers is 0 ... 10 V.
- The jumpers for the alarm functions are on DISABLE.

General technical data

Surrounding atmospheric conditions

- Temperature (Fresh air temperature measured at the base of PCD4)

Operation :	–20 ... +55°C	IEC1131-2, 2.1.1.1
Storage/Transport :	–25 ... +70°C	IEC1131-2, 2.1.1.2

- Relative humidity

5 ... 95 % (indoor) without condensation IEC1131-2, 2.1.1.3
(as DIN 40040 class F)

Surrounding mechanical conditions

- Vibrations

IEC1131-2, 2.1.3.1 (as IEC68-2-6)

10 ... 57 Hz	0.075 mm
57 ... 150 Hz	1.0 g

- Shock

  IEC1131-2, 2.1.3.2 (as IEC68-2-27)

  Half sine 15 g / 11 ms in 3 axes (12 times)

- Toppling and rolling

  IEC1131-2, 2.1.3.3 (as IEC68-2-31)

  Drop height : 100 mm

Electromagnetic compatibility (EMC)

IEC1131-2, Annex C

- ESD IEC 801-2 Draft 4

  4 kV HVR 4 kV Air Discharge

  (Divergence from IEC1131-2 : 8kV min)

- Burst IEC 801-4

+ / – connections, all contacts :	4 kV direct
Alarm input :	2 kV capacitive bunched cables
Analogue outputs :	2 kV capacitive bunched cables

- 1.2 / 50 µs Impulse IEC 255-4 and IEC 805-5

+ / – connections, all contacts :	3 kV	disconnected from
Analogue outputs :	1 kV	power source

Standards complied with

IEC 1131-2 (previously IEC 65A (Central Office)	1992 22 Nov. 1988)
Germanischer Lloyd GL	Sept. 1990
Svensk Standard SEN SS 4361503	1986

11. Fast counter and positioning modules

PCD4.H120 **'Fast counting and measuring module'** for the acquisition of counting pulses up to 166 kHz at a counting capacity of 999 999. It is also possible to output pulse strings with a programmable frequency. The module can also be used to measure pulse lengths, period lengths and frequencies.

Every module contains 2 separate systems.

PCD4.H2x0 **'Motion control modules for stepper motors'** for controlling 1 or 2 stepper motor driven axes with a step frequency of 33 Hz to 20 k Hz. Programmable acceleration and deceleration ramp. Maximum positioning distance 16 777 216 steps, maximum number of ramp steps 65 535 steps. Inputs for reference and limit switches 24 VDC. Outputs for controlling motor power amplifiers and for connection to display module PCA2.D14.

Phased out modules, no longer available

Various versions for controlling one or two axes.

PCD4.H225 **New motion control module for stepper motors,** always with two axes, equipped with the new HSMC20-98-P processor.

This module is extensively compatible with the older module PCD4.H220. The differences are described in a supplement manual.

PCD4.H3xx **'Motion control modules for servo drives'** for controlling 1 or 2 servomotor driven axes with shaft encoder. PID-controlled position and speed. Phase encoder signals up to 100 kHz. Digital inputs for reference and limit switches 24 VDC. Analogue output ±10 V or pulse width modulated output (PWM) for controlling the motor power amplifier. Digital output or connection to display module PCA2.D14.

Various versions for controlling one or two axes.

PCD4.H4x0 **'Motion control modules for servo drives with linear and circular interpolation'** using the latest DSP (digital signal processor) technology, the PCD4.H4x0 module is able to control 2 or 4 servo motor axes either independently or with linear or circular interpolation. The resultant S-shaped velocity profile produces motion which is both rapid and smooth.

With its own memory and a high level of integrated intelligence, the PCD4.H4x0 module takes almost all the load from the PCD4's CPU, leaving it completely free for actual process control. Useful function boxes and a powerful software package make programming and commissioning extremely simple. The novice programmer is supported by readily comprehensible test and diagnostic information with appropriate help functions, all of which make the processes transparent.

More information in the following manuals :

PCD4.H120 : Manual 26/731 E

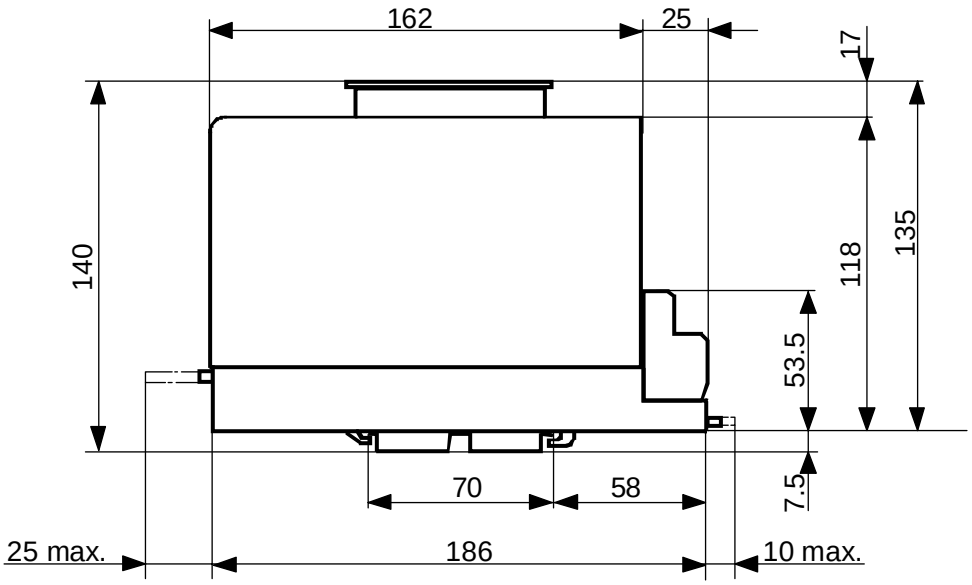
PCD4.H2x0 : Manual 26/730 E

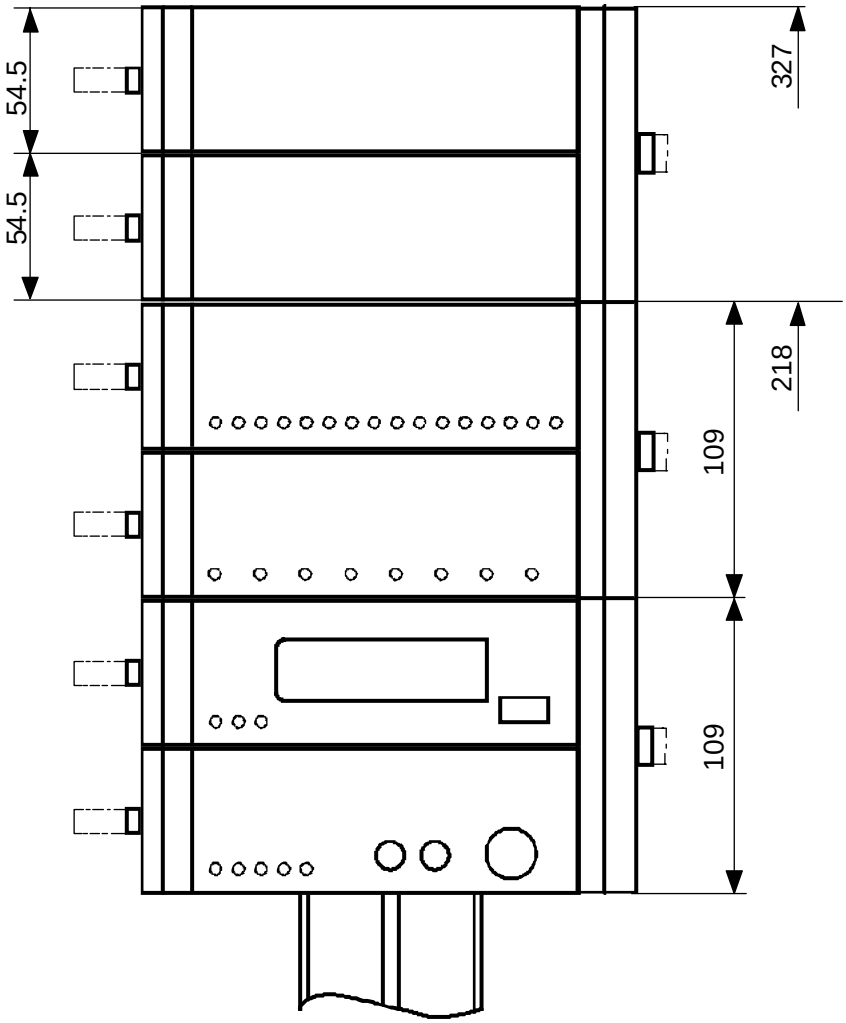
PCD4.H225 : Supplement to existing manual 26/730 E

PCD4.H3xx : Manual 26/729 E

PCD4.H4x0 : Manual 26/752 E

12. Dimensions of the PCD4





Ordering information

Type	Description	Weight
PCD4.M170 F..	**The PCD4.M170 Fnx processor module is supplied ready configured:** "n" defines the ..F.. module at socket B1 and "x" defines the ..F.. module at socket B2	380 g
	n (socket B1) **0** = not equipped **1** = PCD7.F700 (PROFIBUS FMS) **2** = PCD7.F750 (PROFIBUS DP master) **3** = PCD7.F770 (PROFIBUS DP slave)	**x** (socket B2) **0** = not equipped **2** = PCD7.F750 (PROFIBUS DP master) **3** = PCD7.F770 (PROFIBUS DP slave) **4** = PCD7.F772 (PROFIBUS DP slave, RS485) **7** = PCD2.F520 (RS232/422, RS485) **8** = PCD2.F522 (RS232) **9** = PCD7.F65x (Ethernet-TCP/IP)
PCD7.R400	**Flash card** with 1 MByte for backup of the user program	6 g
4'507'4817'0	Lithium battery (replacement)	10 g
	Processor modules	
PCD4.M110	with PGU/RS232 interface	250 g
PCD4.M125	supports 1 additional serial data port	250 g
PCD4.M145	supports 3 additional serial data ports	310 g
PCD4.M445	with dual processor, co-processor PROFIBUS FMS, 3 additional serial data ports	390 g
4'507'1360'0	NiCd battery (replacement)	10 g
	Public memory modules (for preceding processor modules)	
PCD7.R110	with 2 sockets for EPROM or RAM memory components up to 256 KBytes	70 g
PCD7.R310	for up to 428 KBytes, equipped with 172 KBytes RAM (for DB/TX) and 2 sockets for additional EPROM or RAM memory components up to 256 KByte	80 g
	Memory components (2 chips required for each module)	
4'502'5414'0 [1]	2 × RAM chip, 64 KBytes user memory	8 g
4'502'7013'0 [1]	2 × RAM chip, 256 KBytes user memory	8 g
4'502'5327'0	2 × EPROM chip, 64 KBytes user memory	12 g
4'502'3958'0	2 × EPROM chip, 128 KBytes user memory	12 g
4'502'7126'0	2 × EPROM chip, 256 KBytes user memory	12 g
26/734 E	**PCD4 series hardware manual**	
PCD4.C100	**CPU bus module** with 2 sockets for the power supply and the processor module, without additional serial data port	380 g
PCD4.C340	**Combined bus module** with sockets for processor module, power supply module, 4 I/O modules and 3 sockets for communications modules PCD7.F1..	1100 g
	Communications modules for plugging onto PCD4.C340	
PCD7.F110	RS422/RS485 interface, electrically connected	8 g
PCD7.F120	RS232 interface (suitable for modem connection)	8 g
PCD7.F130	20 mA current loop interface	8 g
PCD7.F150	RS485 interface, electrically isolated	8 g
	I/O bus modules, connector to the preceding bus module is supplied with each I/O module	
PCD4.C220	with 2 I/O module sockets	375 g
PCD4.C260	with 6 I/O module sockets	1100 g
	Bus extension cables, shielded, with screw-mounted connectors	
PCD4.K200	for 2-row mounting, up to max. 256 I/Os, length 100 cm	160 g
PCD4.K210	for 2-row mounting, up to max. 256 I/Os, length 80 cm	140 g
PCD4.K250	for 2-row mounting, more than 256 I/Os, length 36 cm	105 g
PCD4.K260	for 3 and 4-row mounting, more than 256 I/Os, length 72 cm	140 g
4'421'8698'0	Bus connector set (supplementary)	20 g
	Power supply modules	
PCD4.N200	for digital I/O modules only	340 g
PCD4.N210	for all digital and analogue I/O modules and the ..H.. function modules	380 g
4'104'5195'0	**Empty module housing** to cover an unused socket on the bus module	110 g

[1] Risk of data loss if non-SAIA RAM components are used.

Type	Description	Weight
	Digital input modules	
PCD4.E110	16 inputs 24 VDC, input delay typ. 8 ms	160 g
PCD4.E111	16 inputs 24 VDC, input delay typ. 0.1 ms	160 g
PCD4.E600	16 inputs 24 VDC, input delay typ. 8 ms, electrically isolated	160 g
PCD4.E601	16 inputs 24 VDC, input delay typ. 0.3 ms, electrically isolated	160 g
	Relay output modules	
PCD4.A200	8 "make" contacts 2 A/250 VAC or 2 A/50 VDC	270 g
PCD4.A250	16 "make" contacts 2 A/250 VAC or 2 A/50 VDC	250 g
	Transistor output modules	
PCD4.A350	8 outputs 24 VDC/2 A	330 g
PCD4.A400	16 outputs 24 VDC/0.5 A	170 g
PCD4.A410	16 outputs 24 VDC/0.5 A, electrically isolated	170 g
	Combined input/output module	
PCD4.B900	with 16 inputs 24 VDC/9 ms and 16 transistor outputs 0.5 A/5…32 VDC	250 g
	Additional set of front tags for digital I/O modules	
4'310'8567'0	for address range 0…127	
4'310'8568'0	for address range 128…254	
4'310'8569'0	for address range 255…510	
4'310'8570'0	for ..W.. and ..H.. modules	
	Analogue input/output modules, electrically connected	
PCD4.W100	**Basic module** for 4 input channels and up to 2 output channels, resolution 12 bit	190 g
	Plug-in range modules, signal ranges (load impedance):	
PCD7.W101 [1]	4 input channels for 0…10 V, ±10 V, ±5 V or 2 Pt/Ni 1000 (four wires) plus 2 × 0…10 V	15 g
PCD7.W105	4 input channels for 0…20 mA, ±20 mA, ±10 mA (4…20 mA via user program)	15 g
PCD7.W200	1 output channel 0…10 V (≥3 kΩ)	15 g
PCD7.W201	1 output channel 0…1 V (≥300 Ω)	15 g
PCD7.W202	1 output channel ±10 V (≥3 kΩ)	15 g
PCD7.W203	1 output channel ±1 V (≥300 Ω)	15 g
PCD7.W204	1 output channel 0…20 mA (≤500 Ω)	15 g
PCD7.W205	1 output channel 4…20 mA (≤500 Ω)	15 g
PCD7.W206	1 output channel –10…0 V (≥3 kΩ)	15 g
	Analogue input module, electrically connected	
PCD4.W300	**Basic module** for 8 input channels, resolution 12 bit + sign bit	190 g
	1 or 2 plug-in range modules, signal ranges (load impedance):	
PCD7.W100 [1]	Range module for 4 channels ±10 V or 4 Pt/Ni 1000 (four wires)	15 g
PCD7.W101 [1]	Range module for 4 channels ±1 V or 4 Pt/Ni 100 (four wires)	15 g
PCD7.W102	Range module for 4 channels ±100 mV	15 g
PCD7.W103	Range module for 4 channels ±20 mA or 4…20 mA	15 g
PCD7.W104	Range module for 4 channels 4…20 mA for two-wire transducers	15 g
PCD7.W110	Range module for 4 channels Pt 1000 with a temperature range of –50…+150 °C and a resolution of 0.1 °C (two-wire connection)	15 g
PCD7.W111	Range module for 4 channels Ni 1000 with a temperature range of –50…+150 °C and a resolution of 0.1 °C (two-wire connection)	15 g
PCD7.W120	4 stabilized current outputs of 2 mA for 4 Pt/Ni 100 and Pt/Ni 1000 resistance thermometer (four-wire connection)	15 g
	Analogue output module, electrically connected	
PCD4.W400	**Analogue module with 8 output channels** (2 × 4), resolution 8 bit, can be allocated by jumper to different output signals in groups of 4: 0…10 V (≥3 kΩ), 0…20 mA (≤500 Ω) and/or 4…20 mA (≤500 Ω)	170 g
	Analogue input module, electrically isolated	
PCD4.W500	**Basic module** for up to 8 input channels, resolution 12 up to 15 bit	190 g
	1 or 2 plug-in range modules, signal ranges (load impedance):	
PCD7.W100	Range module for 4 channels ±10 V or 4 Pt/Ni 1000 (four wires)	15 g
PCD7.W101	Range module for 4 channels ±1 V or 4 Pt/Ni 100 (four wires)	15 g
PCD7.W103	Range module for 4 channels ±20 mA or 4…20 mA	15 g
PCD7.W104	Range module for 4 channels 4…20 mA for two-wire transducers	15 g
PCD7.W110	Range module for 4 channels Pt 1000 with a temperature range of –50…+150 °C and a resolution of 0.1 °C (two-wire connection)	15 g
PCD7.W111	Range module for 4 channels Ni 1000 with a temperature range of –50…+150 °C and a resolution of 0.1 °C (two-wire connection)	15 g
PCD7.W120	4 stabilized current outputs of 2 mA for 4 Pt/Ni 100 and Pt/Ni 1000 resistance thermometer (four-wire connection)	15 g

[1] Other signal ranges on request

Ordering information

Type	Description	Weight
	Analogue output module, electrically isolated	
PCD4.W600	**Basic module** for up to 8 output channels, resolution 12 bit	190 g
	1...4 plug-in range modules, signal ranges (load impedance):	
PCD7.W300	2 output channels 0...10 V (≥3 kΩ)	15 g
PCD7.W302	2 output channels ±10 V (≥3 kΩ)	15 g
PCD7.W304	2 output channels 0...20 mA (≤500 Ω)	15 g
PCD7.W305	2 output channels 4...20 mA (≤500 Ω)	15 g
	Manual operation modules	
PCD4.A810	Digital, single-stage manual operation module with 8 "make" contacts 2 A/250 VAC or 2 A/50 VDC	240 g
PCD4.A820	Digital, dual-stage manual operation module with 2 × 4 "make" contacts 2 A/250 VAC or 2 A/50 VDC	240 g
PCD4.W800	Analogue manual operation module with 8 output channels, resolution 8 bit	225 g
PCD4.H120	**Counting and measuring module,** up to 166 kHz, with 2 independent systems	180 g
26/731 E	PCD4.H120 manual	
PCD4.H225	**Motion control module for stepper motors,** up to 20 kHz, for 2 axes	200 g
26/730 E	PCD4.H2.. manual supplement	
	Motion control modules for servo drives, up to 100 kHz	
PCD4.H310	for 1 axis, encoder signals 24 VDC	195 g
PCD4.H320	for 2 axes, encoder signals 24 VDC	225 g
PCD4.H311	for 1 axis, encoder signals 5 V/RS 422	300 g
PCD4.H321	for 2 axes, encoder signals 5 V/RS 422	330 g
PCD8.H340 30E	Commissioning software to the modules ..H3..	
26/729 D	PCD4.H3.. manual	
	Motion control modules for servo drives, up to 150 kHz	
PCD4.H420	for 2 axes, encoder signals 24 VDC or 5 V/RS 422	380 g
PCD4.H440	for 4 axes, encoder signals 24 VDC or 5 V/RS 422	700 g
PCD8.H340 40E	Programming and commissioning tool	
26/752 E	PCD4.H4.. manual	
PCD7.D120	**Display module** for control panel installation with 6-digit display (7-segment LED)	175 g

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