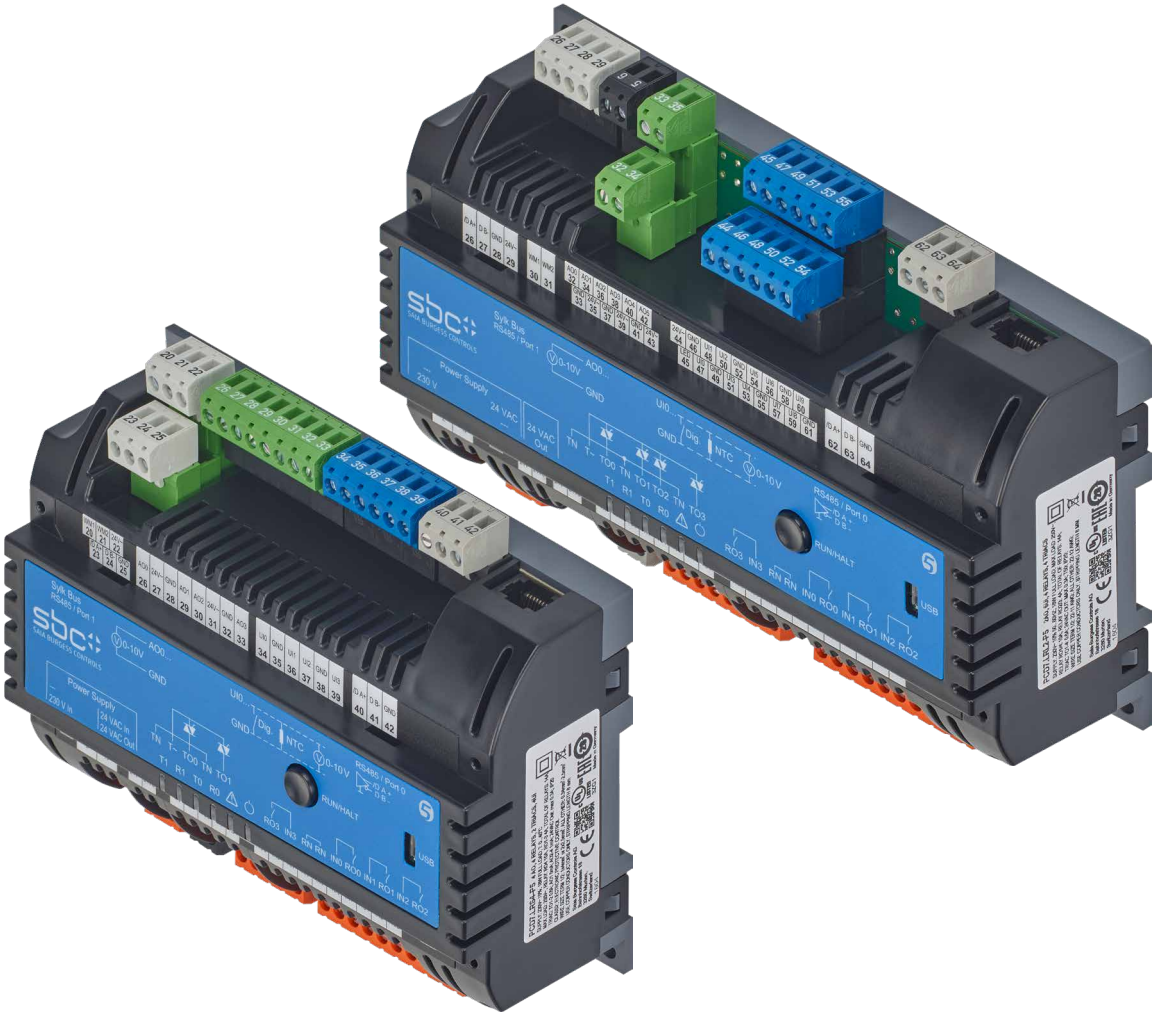
SAIA BURGESS CONTROLS



PCD7.LRxx-P5
Saia PG5® programmable room controller

Document 27-653 | Version ENG08 | 2021-02-16

0

0 Table of contents

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3 Room controller / CPU

4 Inputs and outputs

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0.1 Document history

Version	Changed	Published	Chapter	Remarks
ENG02	2018-06-07	2018-06-07	Manual	- New document
ENG03	2018-07-17	2018-07-17	5.3.5.6	- Modbus specification added
ENG04	2018-09-21	2018-09-21	3.2.2 4.2 4.2.3 5.4 7 Manual	- MaxPower consumption in W - Corex in table “input properties” - Programming - Corex Modbus specification - Operating devices more detail - Various pictures changed and and details corrected throughout the book
ENG05	2018-11-12	2019-01-14	3.9 5.4.3 A.4.2 4 Manual	- Corex table operating status - Media mapping table corex - Corex table sensor properties “NTC 20 kΩ” “Applied voltage [V]” for 69 “Temp [°C]” is 1.13 - Chapter optimization - Spelling correction
ENG06	2019-02-07	2019-02-07	3.3.3	- Correction: max. Current and connection examples change
ENG07	2019-03-21	2019-03-22	4.5 5.5	- Connection example with wall module device-specific corrected or supplemented. - Modbus specifications 7-bit data mode removed.
ENG08	2021-02-16	2021-02-16	2.6	- Declaration of REACH conformity added

0.2 Trademarks

Saia PCD® is a registered trademark of Saia-Burgess Controls AG.

Subject to technical changes in line with the latest technological developments.

Published in Switzerland

1 Graphic overview

1.1 Go to ..

The graphic overviews show some of the most important points in the operating instructions.

Clicking the descriptive text for the connections allows you to jump directly to the corresponding section of the document.
The numbers below the descriptive text correspond to the section numbers, with full stops separating individual chapters and sections.

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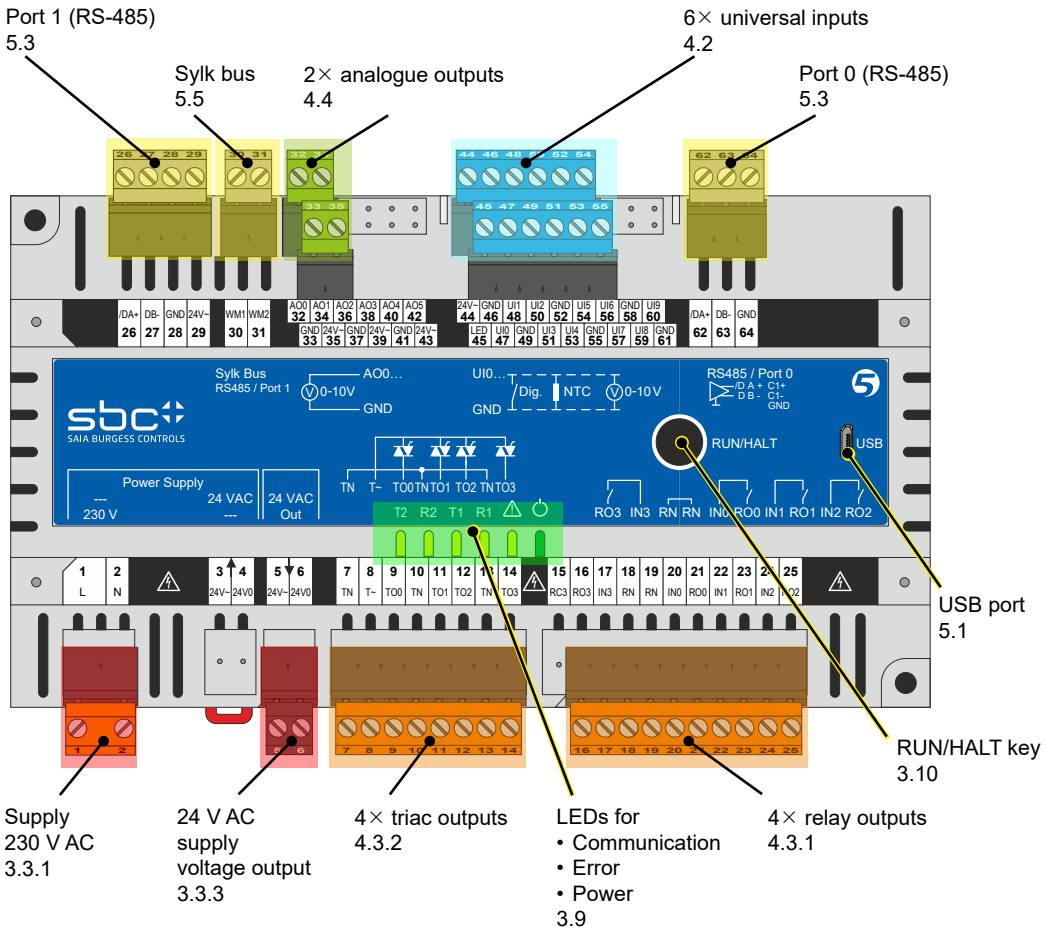
1.2 PCD7.LRL2-P5 (230 V AC)



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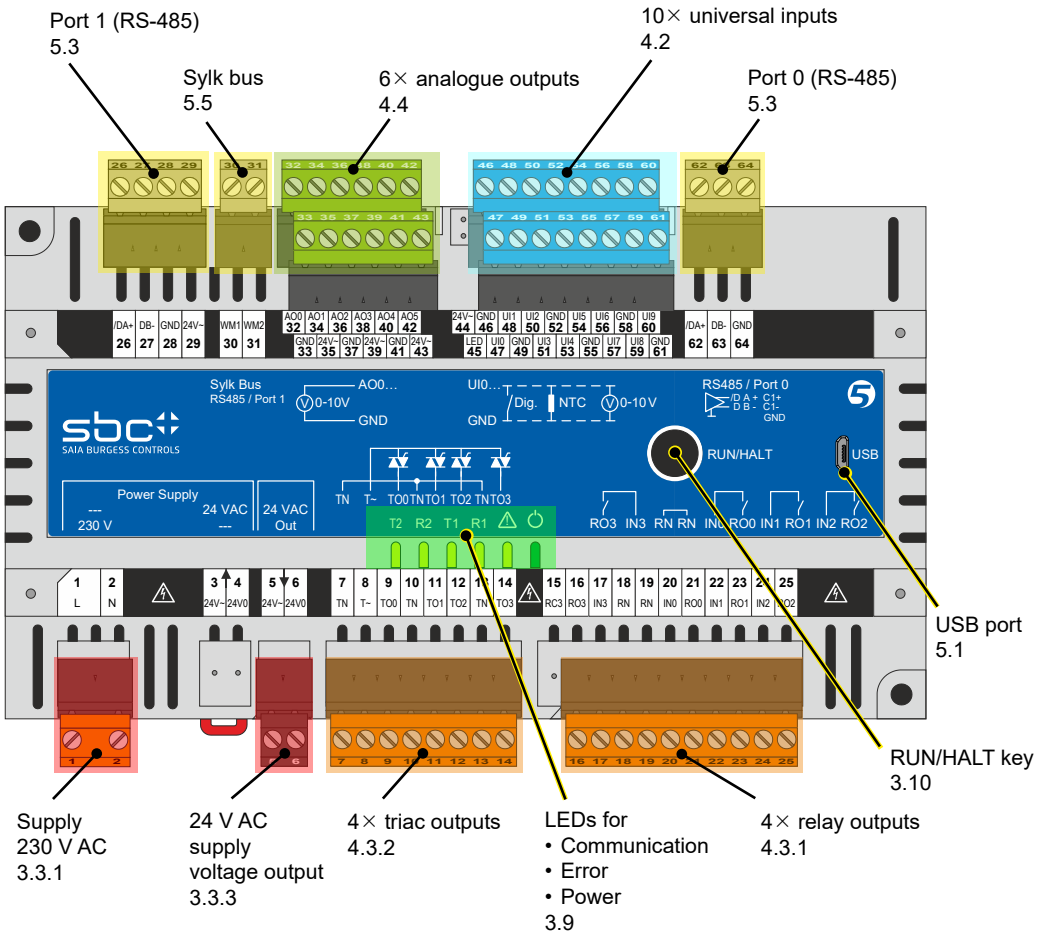
1.3 PCD7.LRL4-P5 (230 V AC)



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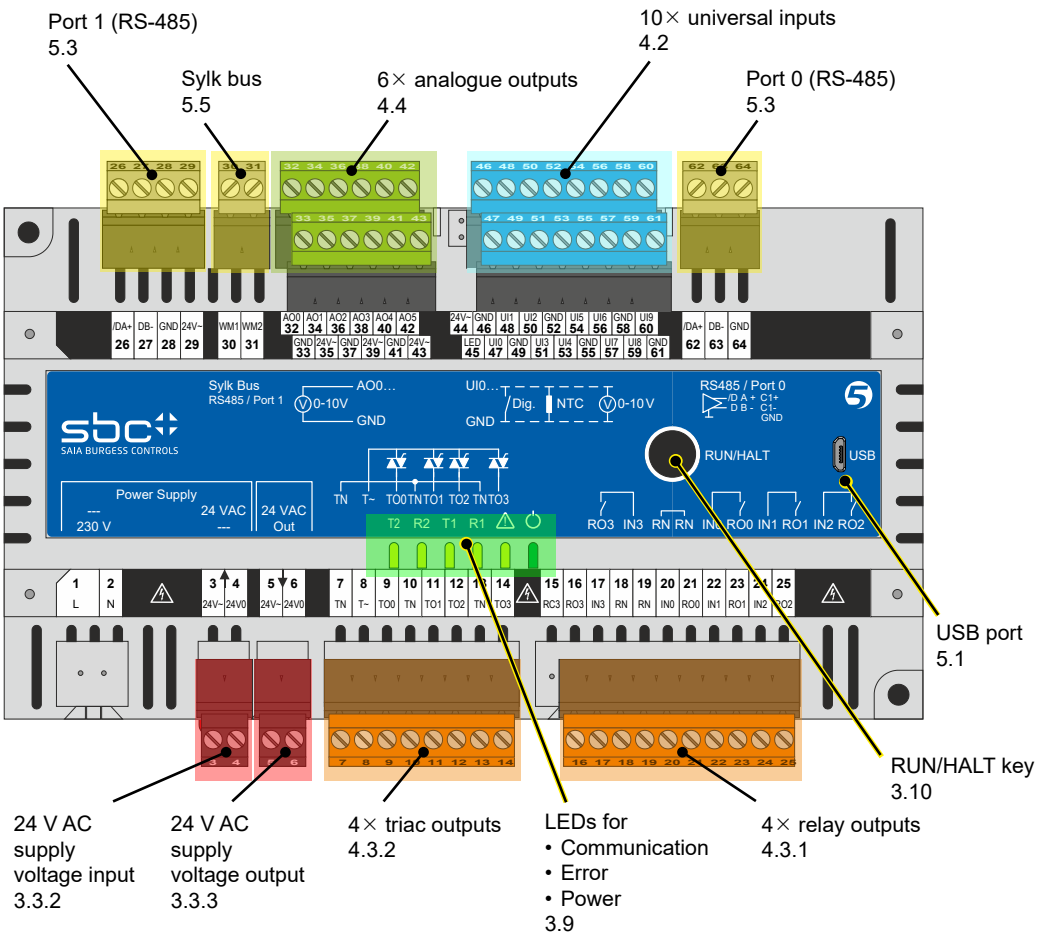
1.4 PCD7.LRL5-P5 (24 V AC)



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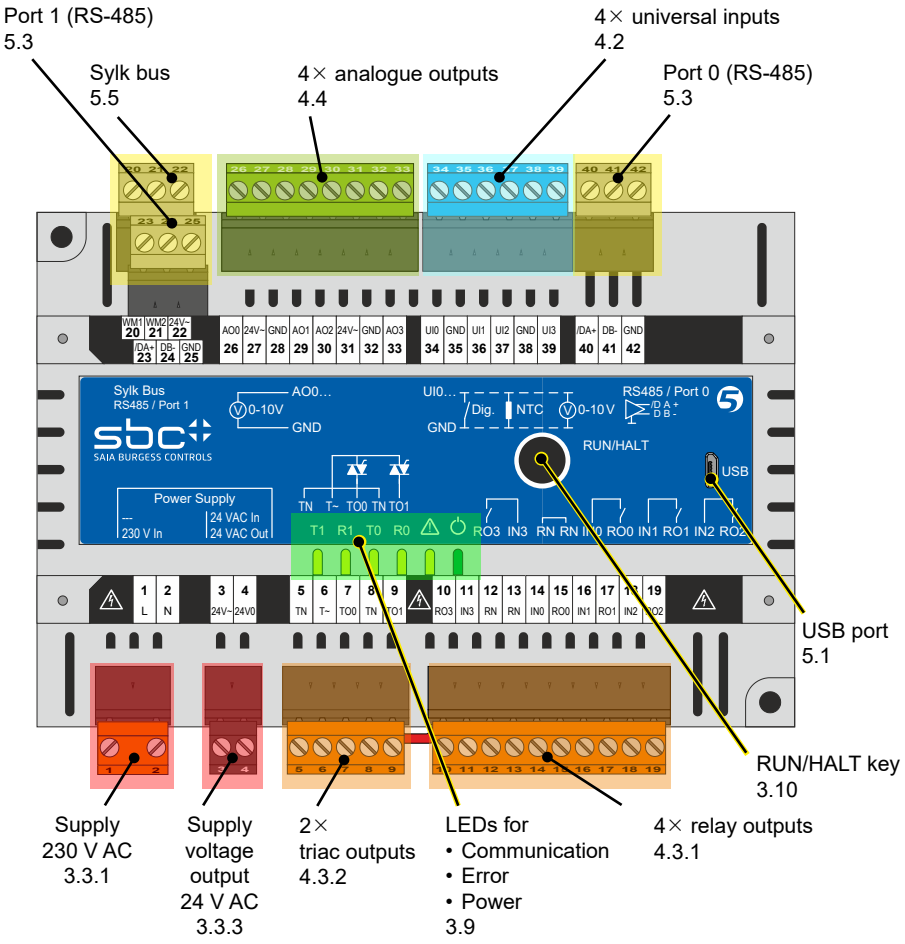
1.5 PCD7.LRS4-P5 (230 V AC)



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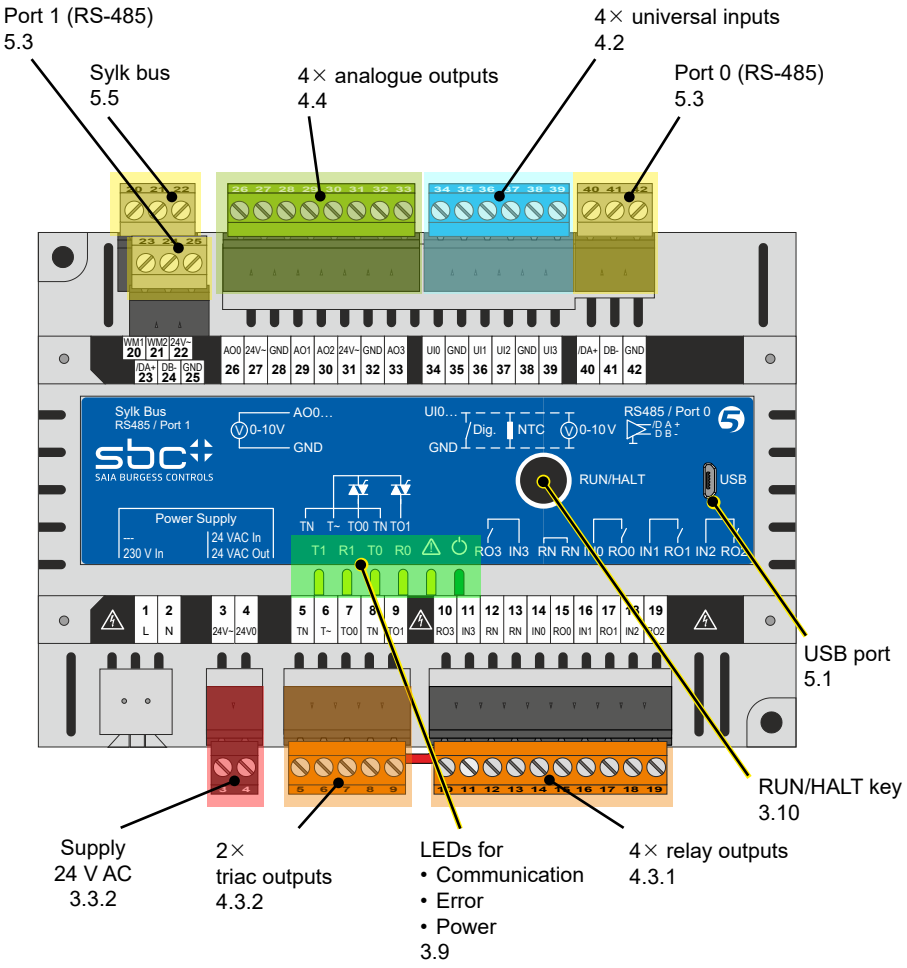
1.6 PCD7.LRS5-P5 (24 V AC)



2 General guidance

2.1 Information on how to use this manual

This manual describes the technical details of the components. The meaning of the symbols and abbreviations used in this manual and general technical information can be found in the Appendix.

This section aims to help you identify and implement the basic principles of planning and installing control systems.

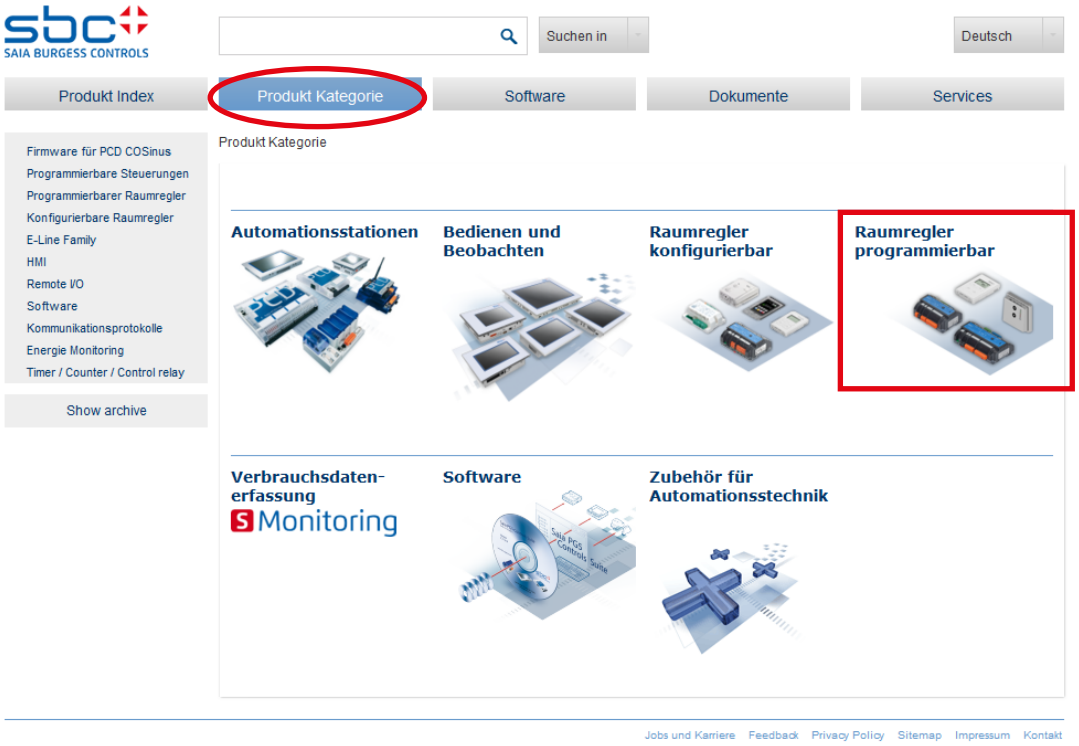
Details regarding hardware, software, configuration, maintenance and troubleshooting are covered in the relevant sections.

In this manual, some product designations contain lowercase “x”s. These are placeholders that stand for variants of the specified product.
Example:
PCD7.LRSx-P5 refers to devices PCD7.LRS4-P5 and PCD7.LRS5-P5.

2.2 Documents

Comprehensive information and downloadable manuals, flyers, etc. can be found on the following websites.

Support: www.sbc-support.com
PCD homepage: www.saia-pcd.com



The following documents are recommended as supplements to this manual:

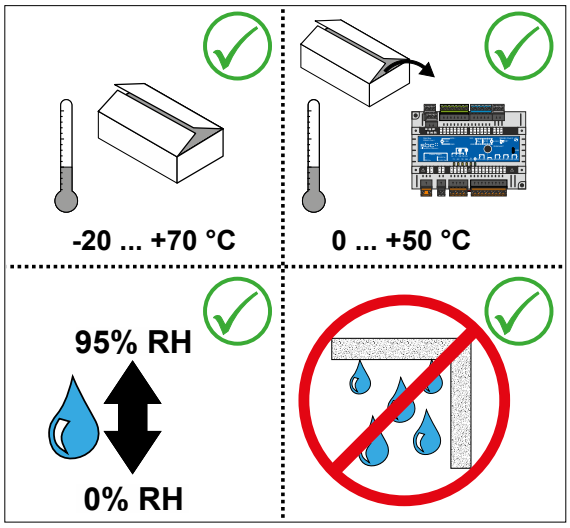
Subject	Document number
Data sheets	
PCD7LRxx-P5 PG5 Room Controller	PP31-405
PCD7.LR-TR42x Wall Modules	PP31-409
Q.RCU-A-xxxx Analogue Room Control Unit	PP31-049
Manuals	
Saia PG5® user manual	26-732
Saia PG5® instruction list	26-733
System cables and power supply adapters	26-792
RS-485 network	26-740
PCD7.L63x Room Controller Units	26-859
Others	
System catalogue	26-215
Accompanying slip/mounting instructions PCD7.LRx-P5	MU1B-0643GE51 R1217A_MI

2.3 Package contents

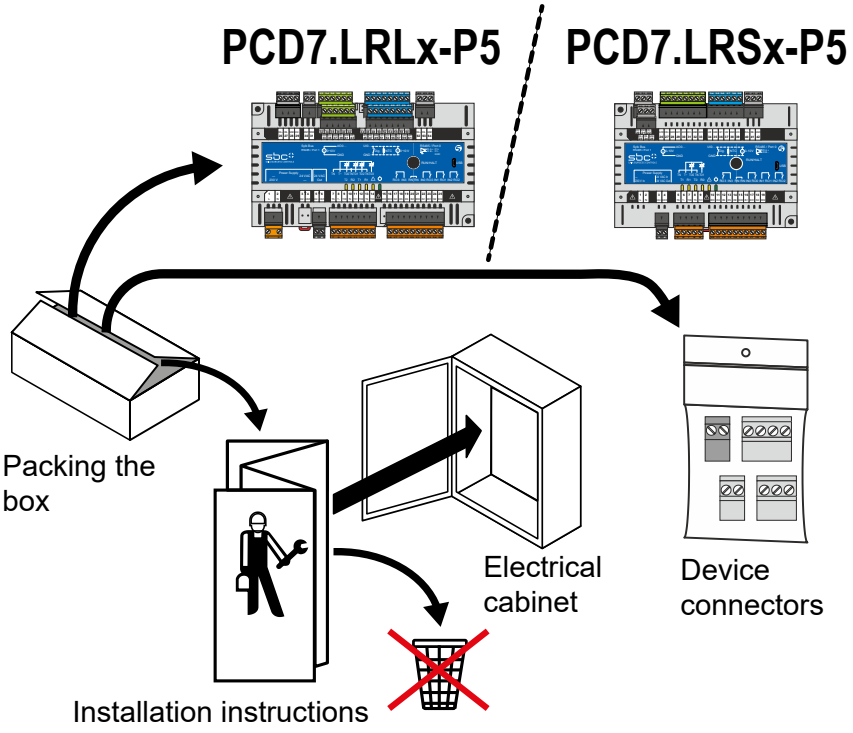
Package contents	
1	PCD7.LRxx-P5 device
1	Plastic bag with connectors
1	Installation instructions

Not included, but required for commissioning etc.	
-	Connecting cable between PCD7.LRxx-P5 device and PC USB A male to Micro-USB B male
-	Power supply for the PCD7.LRxx-P5 device
-	Saia PG5® programming and commissioning software V2.3.x Included PDF documents: - «26-732 Saia PG5® User manual» - «Installation instructions PG5®» (with minimum PC requirements) - «What´s new»
-	Personal Computer (Minimum requirements, see «Installation instructions PG5®»)

2.3.1 Storage information



2.3.2 Tips for unpacking



If the following instructions are observed, the packaging and device repair tools can be reused multiple times.

Procedure:

- Open the box.
- Remove everything from the box. The device is secured to an internal box with plastic film.
  Please note: Do not cut the film → read on!
- Hold this internal box with the device lengthwise using both hands, so that the long side of the box is facing away from your body.
- Align the two upright ends at the front and back with the bottom of the box, so that the box is held level in your hands.
- Then unfold the two side parts on the back of the box (to the left and right). The film will relax (caution: the device may slip out if the box is tilted).
- Remove the device. (Take care to protect the labels with the barcode.)
- All the packaging parts can be easily stored in the box for reuse.
- It is obligatory to pay attention to the numbers indicated on the connectors. The connectors must be placed according to the numbers indicated on the device.

2.4 Recommended installation material

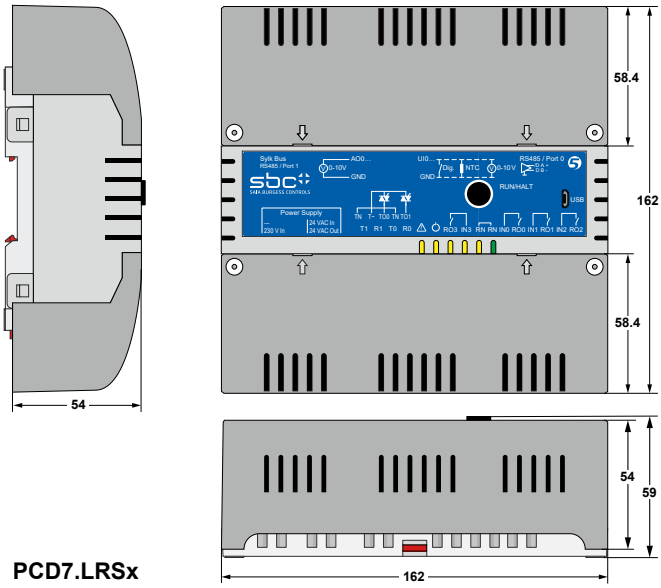
Pieces	Description
2	Screws for wall mounting (screws as per DIN EN ISO 7049 – ST4.2x22 - C - H)
4	Screws for mounting the protective terminal covers (screws as per DIN EN ISO 7049 – ST2.9x9.5 - C (F) - H)
1	Mounting rail as per DIN EN 60715 TH35
Cables	Cable ties (width max. 3 mm) for affixing cables to the bottom of the housing (see section 2.7 “Wiring”)

2.5 IP30 protective terminal covers (optional)

If the controllers are installed outside a control cabinet, the protective terminal covers must be mounted before being connected to the device's power supply in order to achieve IP30 conformity.

IRM-RxC Set of 10 covers
(two covers are needed each PCD7.LRxx-P5,
not included in the PCD7.LRxx-P5 package contents)

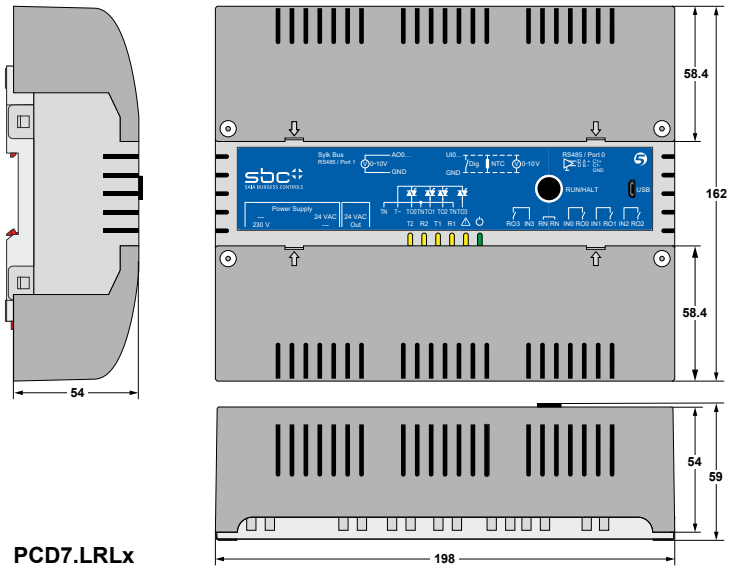
The covers can be secured using optional screws for plastic as per DIN EN ISO 7049 – ST2.9x9.5 - C (F) - H (not included in package contents).



Order no.:
For small housing
IRM-RSC
without screws
(two needed for each device)

PCD7.LRSx

Small housing with IRM-RSC protective terminal covers, dimensions (in mm)



Order no.:
For large housing
IRM-RLC
without screws
(two needed for each device)

PCD7.LRLx

Large housing with IRM-RLC protective terminal covers, dimensions (in mm)

2.6 Declaration of REACH conformity

2.6.1 Article 33 Communication

REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006

Saia-Burgess Controls AG takes compliance with REACH very seriously.

According to Article 33 “Duty to communicate information on substances in articles”:

1. Any supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above 0.1 % weight by weight (w/w) shall provide the recipient of the article with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance.

2. On request by a consumer any supplier of an article containing a substance meeting the criteria in Article 57 and identified in accordance with Article 59(1) in a concentration above 0.1 % weight by weight (w/w) shall provide the consumer with sufficient information, available to the supplier, to allow safe use of the article including, as a minimum, the name of that substance. Our duty is to inform you that the substance(s) listed below may be contained in these products above the threshold level of 0.1% by weight of the listed article.

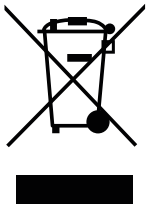
SVHC Substance	CAS Number
Lead	7439-92-1
Boric acid	10043-35-3

Any further information will be available on request.

The declaration does not concern the supply of components by the customer, intended to be part of the finished product to be supplied to the customer.

We confirm that our products do not use any other REACH restricted materials during the manufacturing, storage or handling process.

2.6.2 Disposal



WEEE Directive 2012/19/EC Waste Electrical and Electronic Equipment directive

At the end of the product life dispose of the packaging and product in a corresponding recycling centre. Do not dispose of the unit with the usual domestic refuse. Do not burn the product !

2.7 Information for commissioning

2.7.1 Safety information

To ensure safe operation, the PCD7.LRxx-P5 room controllers must only be operated by qualified personnel in accordance with the information in the operating instructions and in accordance with the technical data provided. Qualified personnel are persons who are trained in the installation, commissioning and operation of these devices and have the appropriate qualifications for this work.

During use, the applicable legal and safety regulations for the application in question must also be observed.

The room controllers have undergone extensive output testing, ensuring they left the factory in perfect condition.

Before commissioning, the devices must be inspected for possible damage due to improper transport or storage.

If the label numbers are removed, the warranty is rendered invalid.

Ensure that the limits specified in the technical data are not exceeded. Failure to observe these limits can lead to defects in the modules and connected peripheral devices. We do not accept any responsibility for damage resulting from improper use.

The plug connections must never be connected or disconnected when live. Ensure that all components are switched off during installation or removal of the modules.

Please read this manual carefully before installing and commissioning the modules. The manual contains information and warnings that must be observed in order to ensure safe operation.

2.8 Introduction

2.8.1 Overview

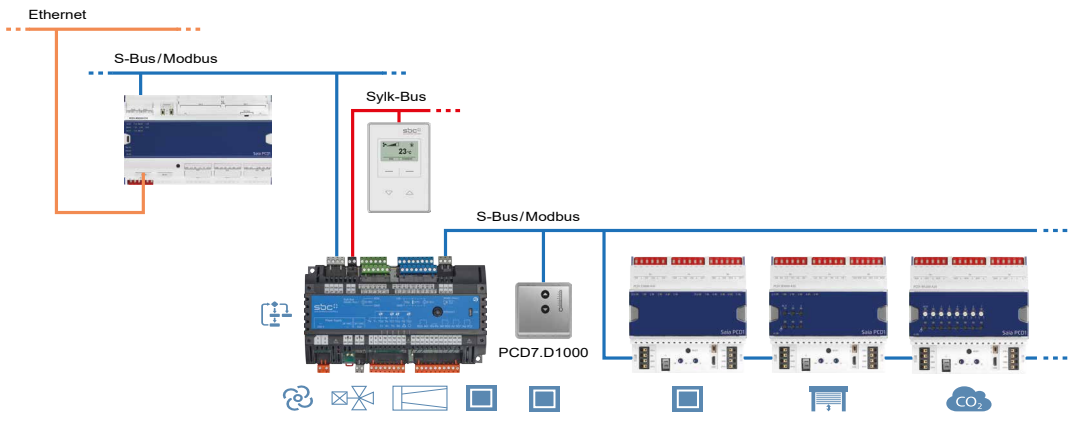
Freely programmable room automation solution with two serial ports for S-Net or Modbus master or slave communication and up to 24 inputs/outputs.

2

Model overview

Item number	Housing	Power supply	Analogue outputs (AO)	Universal inputs (UI)	Relay	Triacs (24/230 VAC)	I/O total	Micro-USB	2× RS-485	All connections with plug	72h real time clock power reserve	24 VAC output for field devices and triac outputs
PCD7.LRL2-P5	Large	230 VAC	2	6	4	4	16	×	×	×	×	max. 300 mA
PCD7.LRL4-P5	Large	230 VAC	6	10	4	4	24	×	×	×	×	max. 300 mA
PCD7.LRL5-P5	Large	24 VAC	6	10	4	4	24	×	×	×	×	max. 600 mA
PCD7.LRS4-P5	Small	230 VAC	4	4	4	2	14	×	×	×	×	max. 300 mA
PCD7.LRS5-P5	Small	24 VAC	4	4	4	2	14	×	×	×	×	max. 600 mA

Each PCD7.LRxx-P5 room controller is a PG5 freely programmable room automation system based on serial S-Net or Modbus networks and can be used for HVAC applications like fan coil devices, radiators, cooled ceilings and CO2 air quality control via damper. A second RS-485 interface can be used to connect E-Line RIO modules for I/O extension for HVAC, light or shade control. This makes it possible to create cross-plant room automation functions and thus attain the highest possible class of energy efficiency in accordance with DIN EN 15232, significantly reducing energy costs while at the same time ensuring a high degree of comfort.

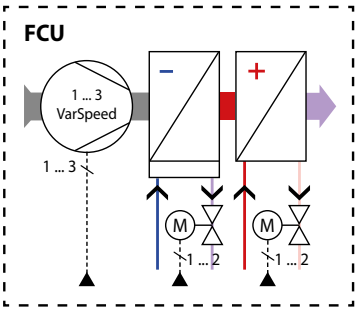


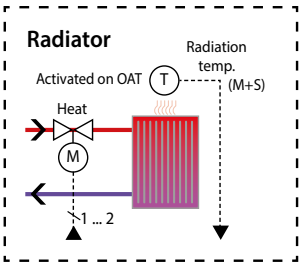
2.8.2 Room HVAC sample application template

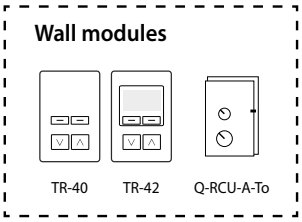
There is a room HVAC sample application template for the PCD7.LRxx-P5 room controller, which can be used as a starting point for the following applications:

The room HVAC application is designed for

- Heating
- Cooling
- Second-stage cooling
- CO2 air quality control
- Fan
- User interaction via wall module



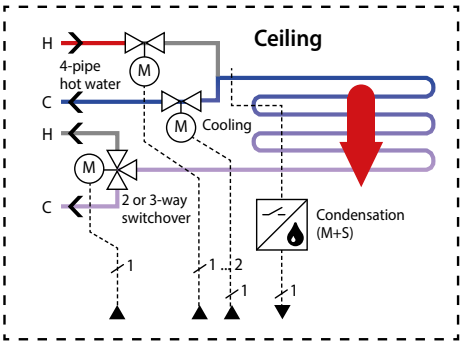


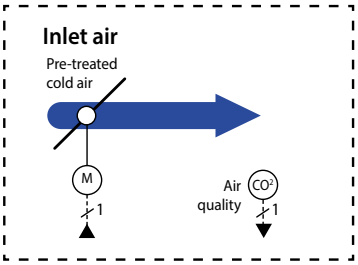


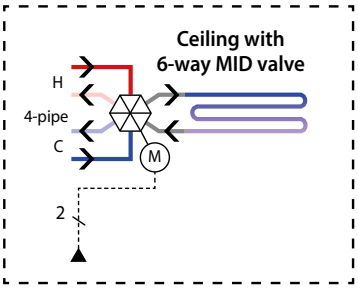
Heating and cooling can be used for a two-pipe application with changeover, a four-pipe application with single valve drives (analogue or digital PWM) or a six-way valve drive.

Second-stage cooling and CO2 air quality control handles the proportion of fresh air via damper and is supplied by a central air handling unit.

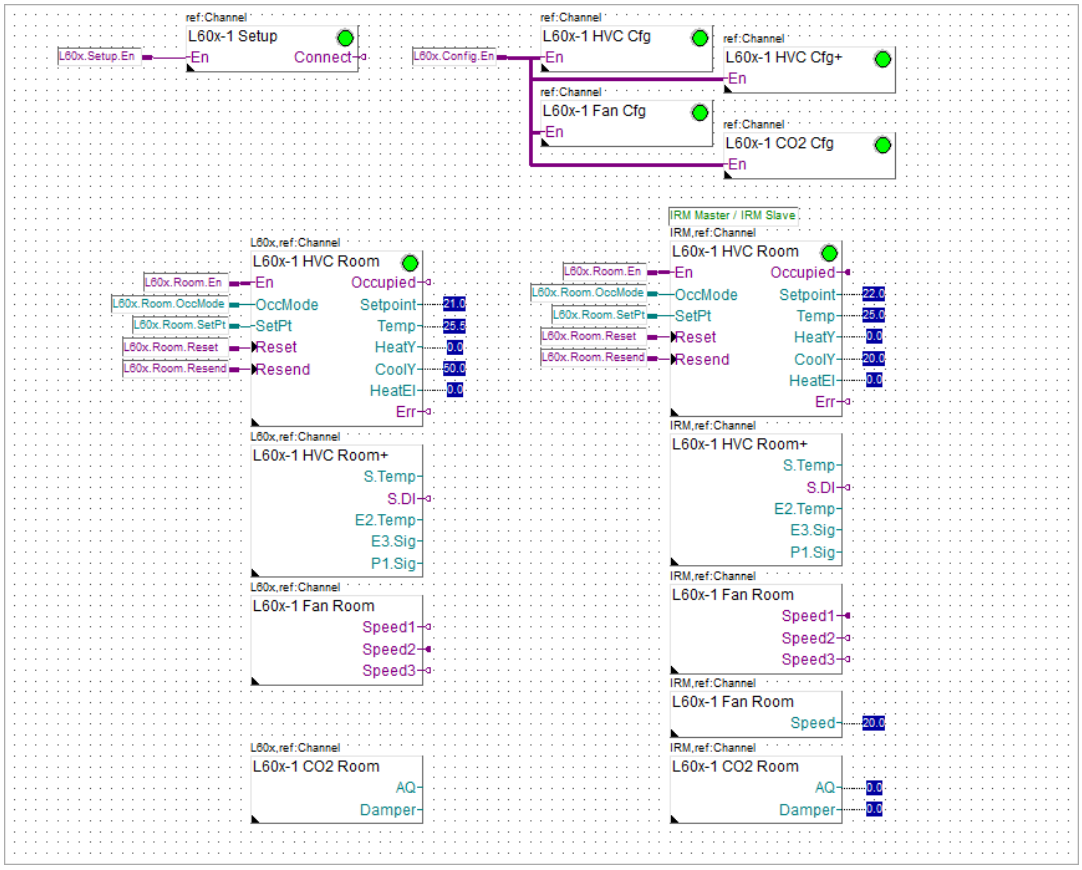
Fan is controlled by heating, cooling and CO2 air quality. Up to three speeds or continuous speed are supported.







2.8.3 Legacy PCD7.L60x-1 room controller emulation



The template is also designed to emulate an L60x room controller (to a certain extent), making it easy to replace an L60x room controller with a freely programmable device.

The focus, in this case, is on avoiding changes to the master PLC where the L60x FBoxes are used.

The room application should be connected with the same parameter used by the L60x FBoxes.

This means that the room HVAC sample application should “emulate” an L60x room controller. However, the L60x controller has so many options and settings that true emulation would soon be very complex and difficult to understand, especially if adjustments are required.

For this reason, only the basic functionalities and application modes are emulated. This is achieved simply by mapping the L60x register with the registers/flags in the room application.

This is done in the PB Block_L60x. As soon the PB is accessed, a large amount of data is copied from the L60x register (= addresses used by the L60x) to the FBoxes in the room application, or vice versa.

For more detailed information, please refer to the separate document for the manual room template, found at www.sbc-support.com.

2.8.4 System compatibility

The following versions are recommended for optimal FBox library use with PG5:

- PG5 >= V2.3.113
- Firmware PCD7.LRxx-xx (IRM) >= 1.1.0.07
- Firmware PCD (PCD plus system) >= 1.26.xx
- Firmware PCD (PCD system) >= 1.24.67
- Firmware remote IO (L series) >= 1.04.xx
- Firmware remote IO (S series) >= 1.08.xx

2.8.5 Addressing the room controllers

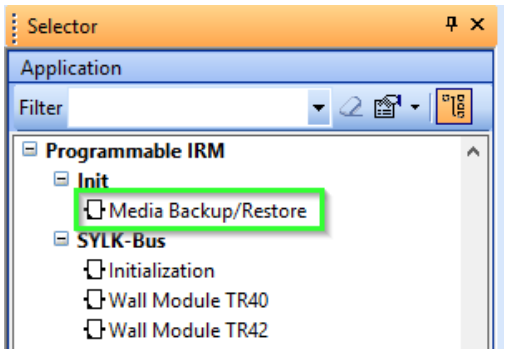
We recommend setting the S-Bus address (or Modbus address) for the room controllers before installation with PG5 via the Micro-USB port, then writing down the S-Bus address (or Modbus address) on a separate sticker to be affixed or attached to the room controller or building floor plan.

This has the advantage that after installation, the room controller can be commissioned and the application program can be downloaded (along with any FW updates) via the RS-485 bus, making it unnecessary to configure each room controller directly in situ.

2.8.6 Media Backup/Restore

Description

This FBox must be used on a programmable IRM whenever an FBox from the library [programmable IRM] is used, and it must also be used to “Media Backup/Restore” adjustment parameters for any FBoxes from other libraries or user-defined symbols that should also be backed up/restored automatically.



Functional

No media on programmable IRM are battery-protected; they are all volatile. The adjustment parameters are initialised with the default settings after download, but may be changed during operation by the user. Those values will be lost if the power is switched off and on, after which the device will reset to the default values.

This FBox is required to backup and restore values modified during operation. A backup/restore mechanism for a maximum 1000 elements in total (only registers or flags) has been introduced. PG5 automatically detects adjustment parameters

in FBoxes that can be modified during operation (“online parameters”) and adds them to a list of parameters to be backed up and restored.

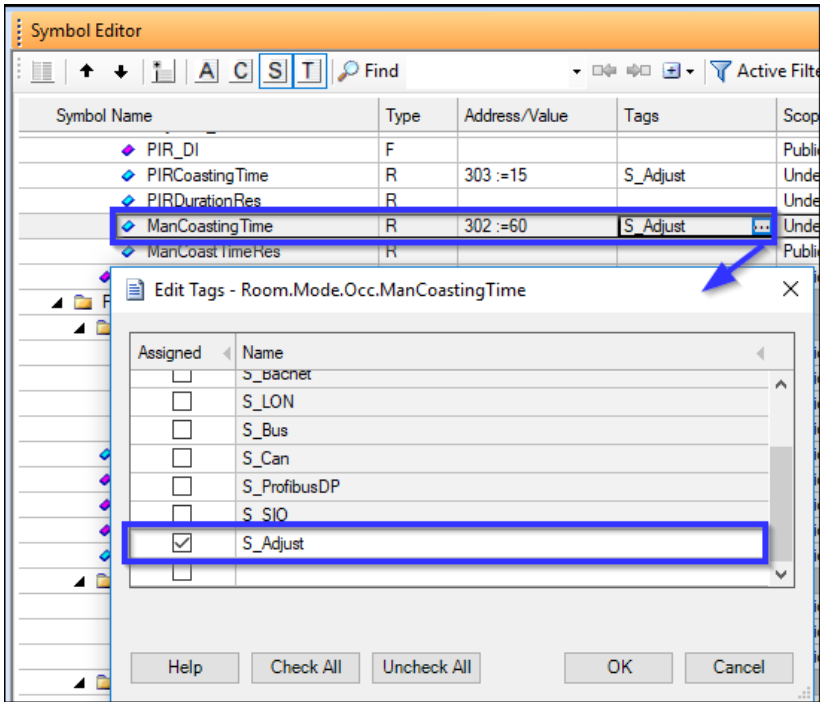
When the program is downloaded, the FBox detects that the CRC has been changed and backs up the adjustment parameters. A restore operation is carried out at power-up, cold start/restart or if the same program is downloaded again.

The backup operation runs cyclical checks (parameter [Backup Automatic cycle (s)]) to determine whether adjustment parameters have been changed; if so, it stores the changed values.

The backup operation can be forced via adjustment parameter [Manual Backup] or via input [Backup] to store data immediately when values have been changed.

Note: The parameter [Number of Backups since start] is reset to zero at power-up and increases incrementally if a backup operation (cyclical or forced) has detected value changes. If no value has been changed, the counter does not go up.

If user-defined symbols are also to be backed up/restored, tag [S_Adjust] must be assigned in the symbol table:



As soon a symbol is tagged with [S_Adjust] it will be covered by the backup/restore mechanism. Keep in mind that only registers and flags can be used.

PG5 checks the number of parameters to be backed up/restored and issues an error during the build if the maximum of 1000 items is exceeded:

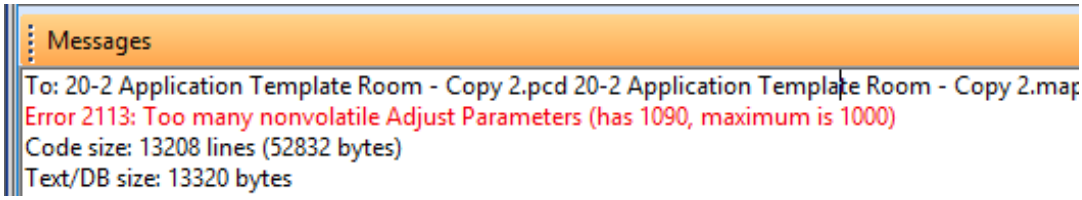


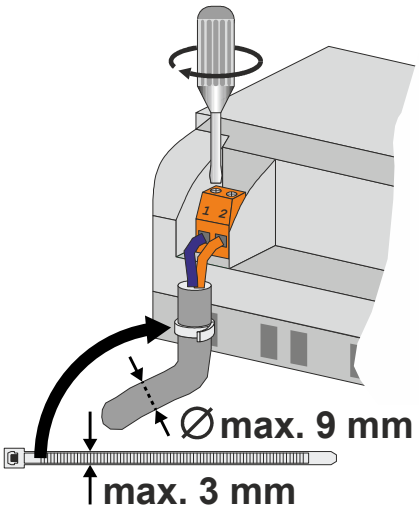
Image: S_Adjust_Max

If this happens, the program cannot be built and downloaded. The number of parameters to be backed up/restored must be reduced.

2.9 Wiring

Appropriate use by trained personnel

- The PCD7.LRxx-P5 room controllers have slots under their terminals for cable ties to secure cables and provide strain relief.



- 230 VAC supply lines and data lines must be wired separately with a minimum distance of 10 cm between them. We recommend leaving space between the supply and data lines inside the control cabinet as well.
- Digital data/bus lines and analogue data/sensor lines should be wired separately.
- We recommend using shielded cables for analogue data lines.
- The shielding should be earthed at the entry IN or exit OUT point of the control cabinet. The shielding should be as short as possible and have as large a cross-section as possible. The central earthing point should be > 10 mm² and connected to the earthing cable using the shortest possible route.
- The shielding is normally only connected to the control cabinet on one side, unless equipotential bonding is installed with significantly lower resistance than the shielding resistance.
- Inductive loads installed in the same control cabinet, e.g. protective coils, must be equipped with suitable snubbers (RC elements).
- Control cabinet components with a high field strength, e.g. transformers or frequency converters, should be shielded with baffle plates with a good earth connection.

2.9.1 Overvoltage protection for large distances or external lines

- When laying lines outside buildings or across large distances, suitable overvoltage measures must be implemented. These measures are especially crucial for bus lines.
- Lines laid outdoors must have shielding with an appropriate power line capacity and must be earthed at both ends.
- The overvoltage conductor should be installed at the control cabinet entry point.

2.9.2 Addressing inputs and outputs (I/O)

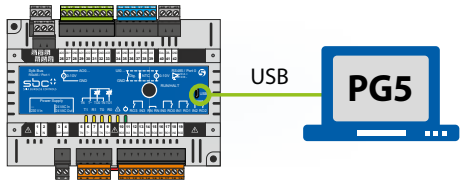
All of the inputs and outputs located on the room controller are assigned to flags and registers using the device configurator in the PG5 tool by the programmer (media mapping). An overview of the connections can be found starting in section 4.

2.10 Programming

The PCD7.LRxx-P5 room controllers are programmed with Saia PG5® directly over Micro-USB or over an S-Bus Master Gateway controller via S-Bus.

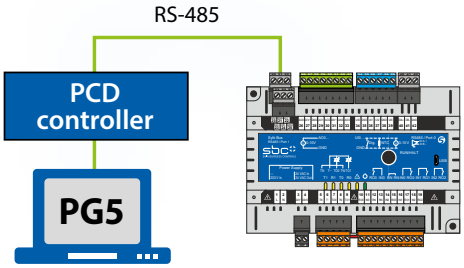
Programming directly via USB

PCD7.LRxx-P5 room controllers have a Micro-USB port on the front.
By directly connecting the PC to the module via the USB port, the user program can be loaded on to the connected room controller, for example, or a firmware update can be carried out.



Programming using a master controller (PCDx.Mxxxx)

The master controller, which is connected to the freely programmable room controllers, uses the RS-485 bus (S-Bus) to load the user program or a firmware update, for example, on to the corresponding room controllers. The master controller is used as a gateway in this case.

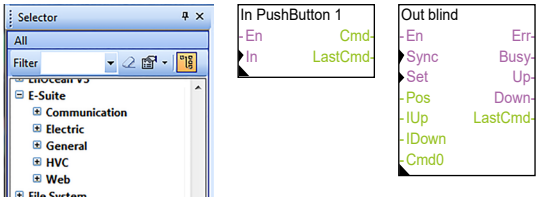


The room controllers are project-engineered with Saia PG5® using FBoxes or IL. There is a selection of FBoxes available for this purpose, which makes engineering easier.

List of supported libraries:

- Binary
- Blinker
- Block Control (no SB)
- Buffers
- Com.Text (not interpreted)
- Converter
- Counter
- DALI E-Line Driver (new)
- Data Block
- Data Buffer
- EnOcean (partial)
- Flip-Flop
- Floating Point (IEEE only)
- HVC (partial)
- Indirect
- Integer
- Ladder
- Move In/Out
- Modbus (E-Suite)
- Regulation (partial)
- Special, Sys Info (partial)
- Timer

In addition to these libraries, a new library “E-Suite V2” is available for specific applications that can be implemented using the Saia PCD1 E-Line modules.
For electrical building services, for example: blind control, dimming of lighting, etc.



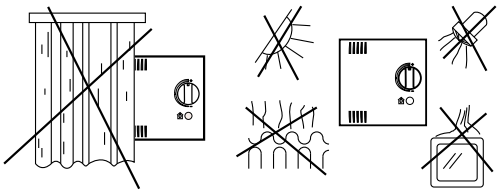
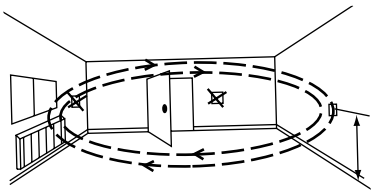
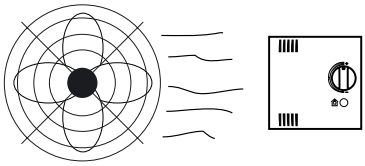
Compared to a PCDx.Msss controller, not all functions are available. For example, these modules do not have an automation server and the resources are limited (see section 3.5 “System resources”).

To support the PCD7.LRxx-P5 room controllers with E-Line devices, the library E-Line V1.3 or higher must be installed on the PG5.

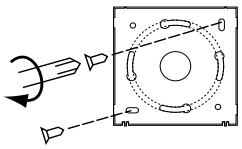
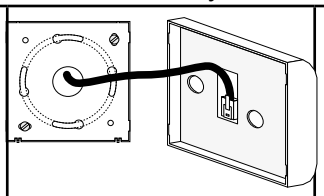
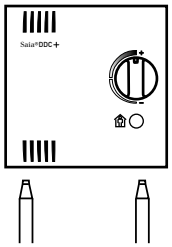
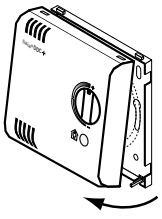
The required PCD, IRM and E-Line firmware is described in the aforementioned help library V1.3 or higher.

2.11 Installation information for room operating devices

- The room operating devices must only be installed and connected by a qualified expert as per the circuit diagram. Existing safety regulations must be observed.
- The room operating devices are only used to control the temperature in dry, closed rooms. The permissible relative air humidity is max. 90%, non-condensing.
- For as accurate a temperature measurement as possible, certain requirements for the installation location of the temperature sensor must be met. This is true both for the room controller itself and for the externally-connected temperature sensor.
- The devices are to be installed directly on the wall or in a recessed socket.

	Avoid direct sunlight or lighting from powerful lamps. Do not install close to heat sources such as radiators, refrigerators, lamps, etc.
	Do not install close to windows and doors because of draughts.
	Do not position the room operating device in the path of air currents emanating from air conditioning or ventilation systems.

Ensure that
- all wires are screwed in tightly.
- the connector has clicked into place correctly.
- the ventilation slots are located at the top and bottom (installation position).
- the device is installed horizontally.

			
1 Installing the housing bottom	2 Wiring the device	3 Unlocking	4 Removing the housing

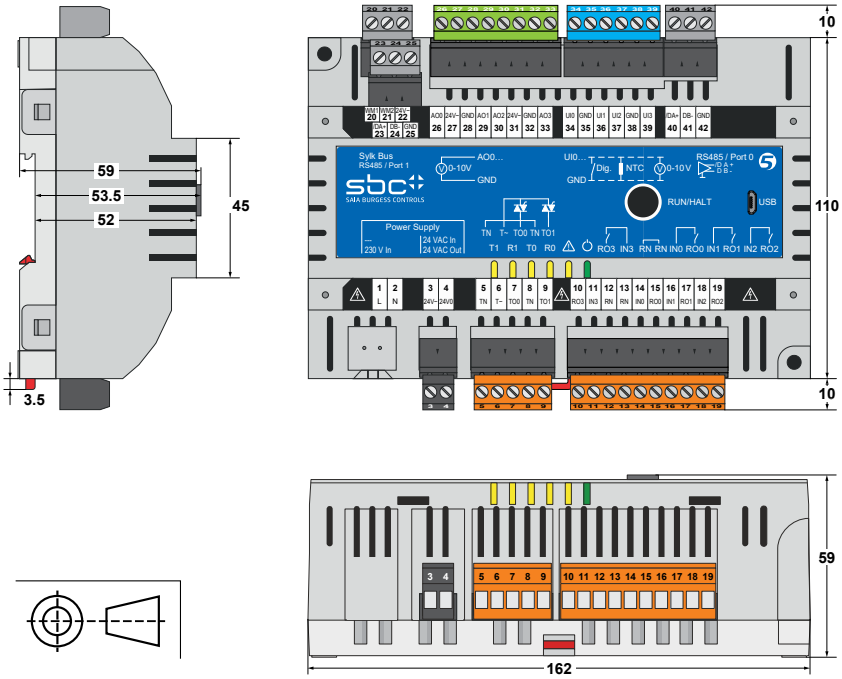
3 Room controller / CPU

3.1 Dimensions/device installation

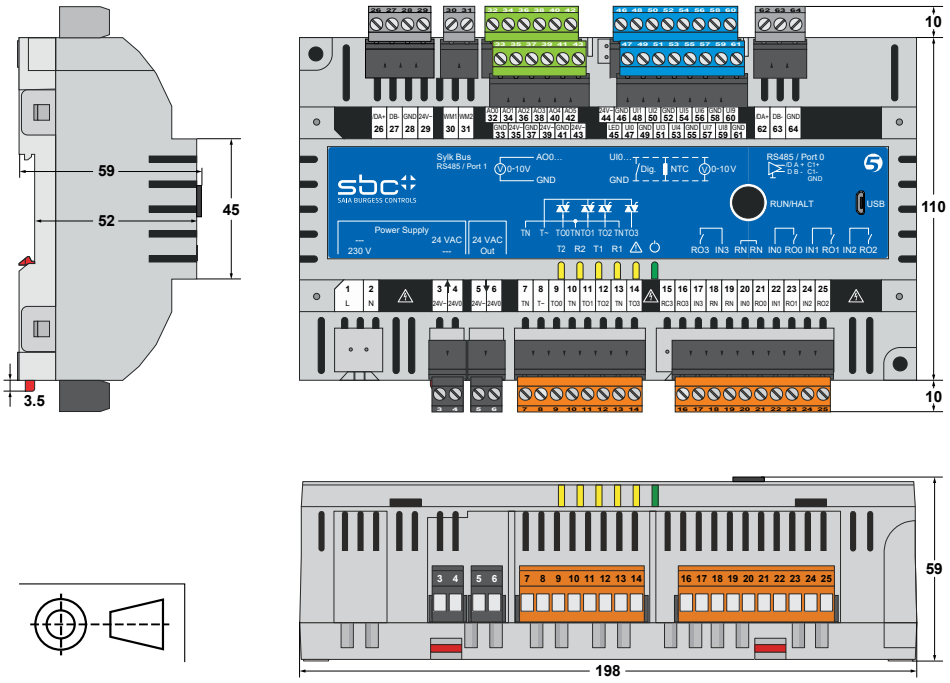
3.1.1 Dimensions without protective terminal covers

The controller is available in two IP20-compliant housing sizes:

PCD7.LRSx-P5 (small housing):
W × L × H = 130 × 162 × 59 mm



PCD7.LRLx-P5 (large housing):
W × L × H = 130 × 198 × 59 mm



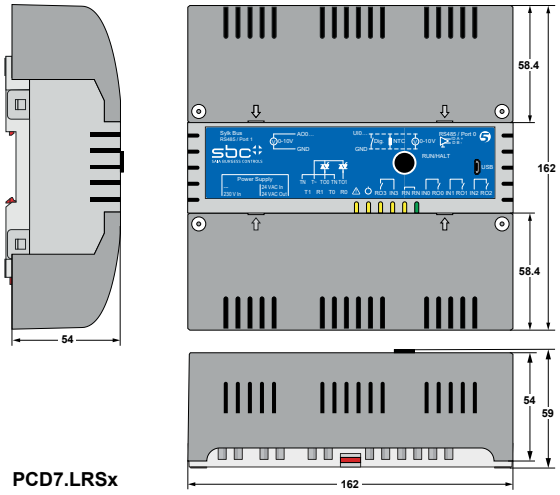
3.1.2 Dimensions with protective terminal covers

IP30-compliant protective terminal covers in large package, set of 10 individual protective covers. Two covers are required for each device:

for
PCD7.LRSx-P5 (small housing)

Item number:
IRM-RSC

Total external dimensions
W × L × H = 162 × 162 × 59 mm

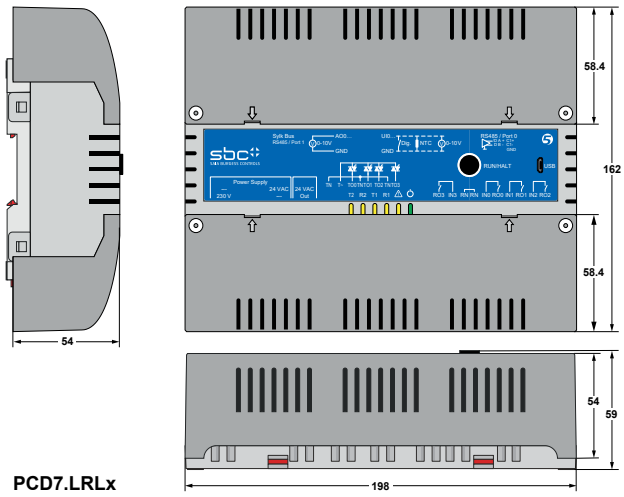


PCD7.LRSx

for
PCD7.LRLx-P5 (small housing)

Item number:
IRM-RLC

Total external dimensions
W × L × H = 162 × 198 × 59 mm

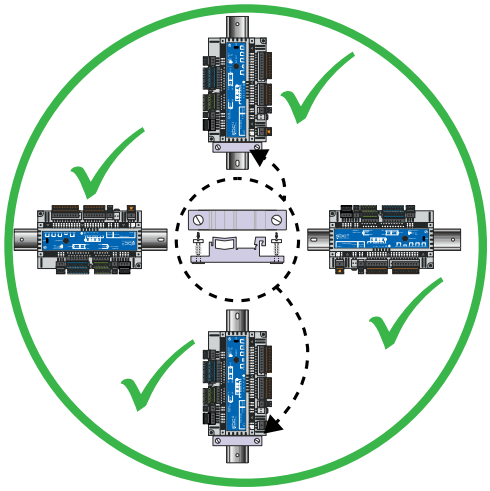


PCD7.LRLx

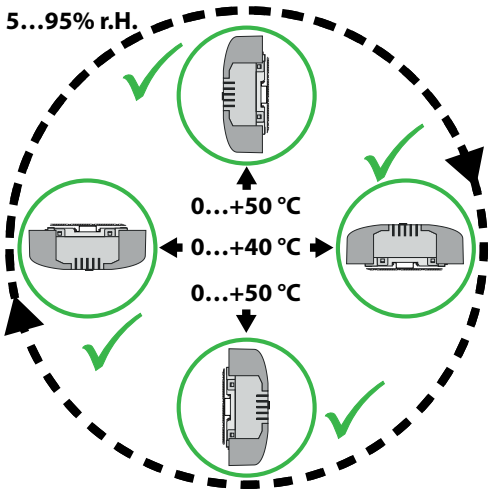
3.1.3 Installation position and ambient temperature

Normally, a horizontal or vertical surface is used for mounting the module support. Vertical mounting is preferred. In this installation position, an ambient temperature between 0°C and 50°C is permissible.

In all other positions, the air flow is less favourable and an ambient temperature of 40°C must not be exceeded.



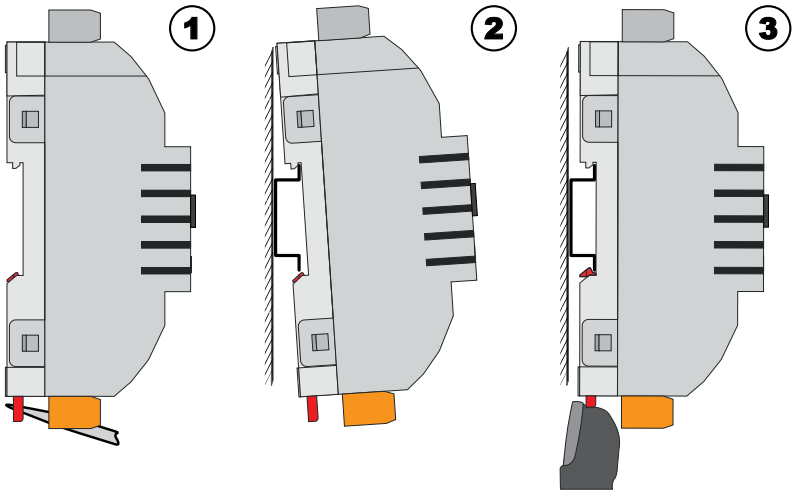
Installation position



Ambient temperature

3.1.4 Installation on mounting rails

The PCD7.LRxx-P5 room controller can be clicked into place on a horizontal mounting rail (35 mm as per DIN EN 60715 TH35).



1. Use a slotted screwdriver, for example, push back or move the slide lock(s) on the bottom of the PCD7.LRxx-P5 until an audible click is heard.
2. Fit the PCD7.LRxx-P5 on the top edge of the mounting rail using the two hooks. Push the device on to the mounting rail. Ensure that the underside sits evenly

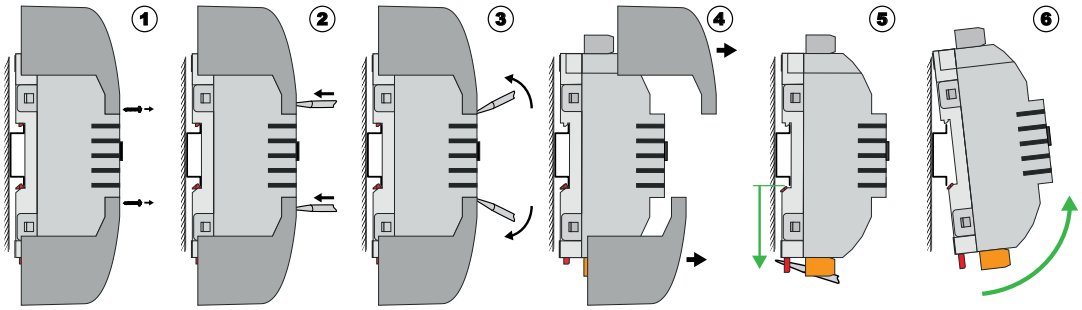
and flush on the mounting rail.

3. Push the slide lock(s) back into the initial position until another audible click is heard.
   Ensure that the PCD7.LRxx-P5 is hooked in correctly and is locked into place.

The room controller can then be wired.

If installing vertically on a DIN rail, the device must be secured from slipping using a stop.

3.1.5 Removal from mounting rails



1. Remove the fastening screws on the protective terminal covers and use a slotted screwdriver to disengage the lock at the points marked with arrows.

2. Remove the two protective terminal covers individually and vertically from the device.

3. Label the connection wiring.
   Remove all wired connectors.

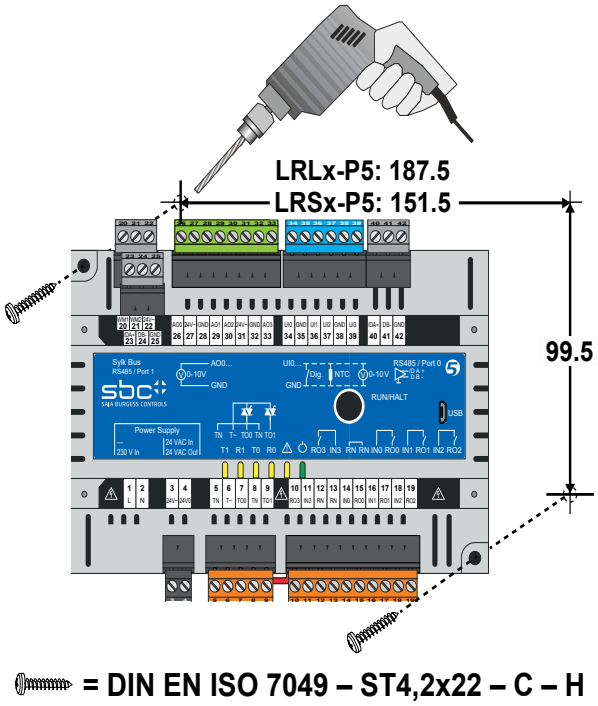
4. Use a slotted screwdriver, for example, to push back or move the slide lock(s) on the bottom
   of the PCD7.LRxx-P5 until an audible click is heard.

5. Lift the bottom part of the room controller from the bottom edge of the mounting rail (pull it out approx. 5 mm) and raise it over the top edge of the mounting rail.
   Remove the room controller.
   Push the two slide locks back into the initial position until an audible click is heard again.

3.1.6 Wall mounting

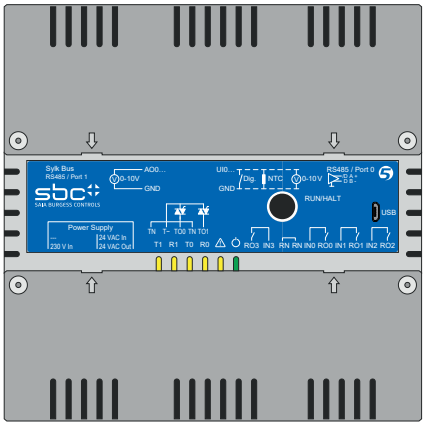
The device can be mounted on any even surface in any desired position. (See also section “Ambient condition thresholds” on page 18 for temperature range restrictions when installing on the floor or ceiling.)

The device is installed by inserting optional screws through the corresponding screw holes.



= DIN EN ISO 7049 – ST4,2x22 – C – H

After mounting the device on the wall, the protective terminal covers optionally available for the device (see Fig. 3) should be installed.



If mounting on a wall, the otherwise optional protective terminal covers (section “2.5 IP30 protective terminal covers”) must be installed.

The covers can be secured using optional screws as per DIN EN ISO 7049 – ST2.9x9.5 - C (F) - H (not included in scope of supply).

3.1.7 Removal from the wall

Follow the instructions in reverse order to remove.
For details see section “3.1.5 Removal from mounting rails”

3.2 Electrical data

3.2.1 PCD7.LRL2-P5, -.LRL4-P5 and -.LRS4-P5 (230 VAC models)

Power supply	
Terminals 1 + 2	230 VAC +10%/-15%, 50/60 Hz
Max. power consumption (unloaded)	8 W
Max. power consumption (loaded)	18 W

The controller is “unloaded” when no external load is applied. Therefore, the only load placed on the controller is the inherent load (8 W) of the electronics themselves. The heat dissipation amounts to 8 W.

The controller is “loaded” when, in addition to the inherent load, an extra total load of max. 300 mA is applied at the 24 VAC output terminals. The max. no-load output voltage at terminals 3 and 4 is 33 VAC (typically:29.5 VAC).

3.2.2 PCD7.LRL5-P5 and PCD7.LRS5-P5 (24 VAC)

Power supply	
Terminals 3 + 4	24 VAC ±20%, 50/60 Hz
Max. power consumption (unloaded)	7.2 W
Max. power consumption (loaded)	21.6 W

The controller is “unloaded” when no external load is applied.
The heat dissipation amounts to 7 W.

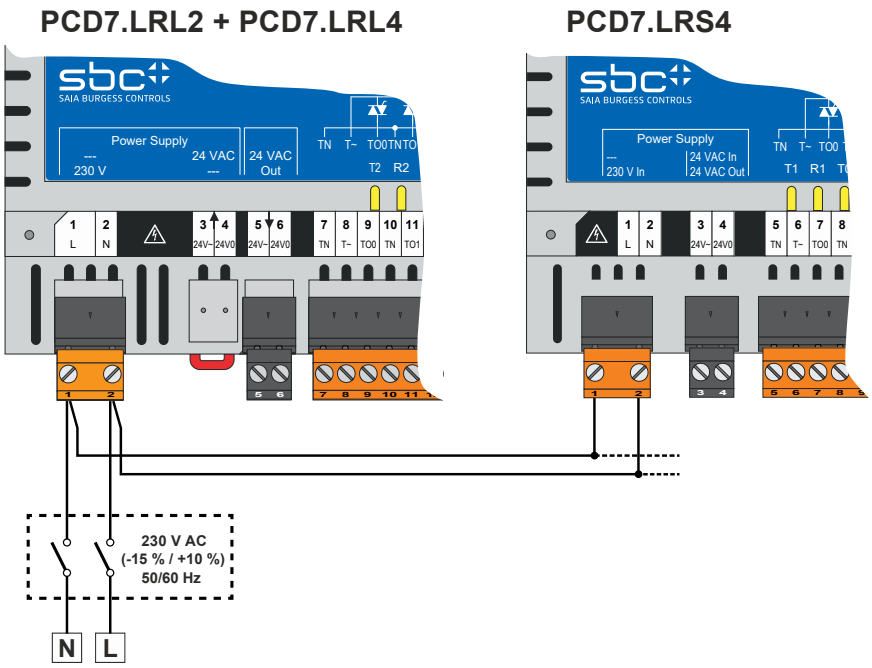
The controller is “loaded” when an additional total load of max. **600 mA** is applied at the 24 VAC output terminals.

3.3 Power supply and earthing concept

3.3.1 Devices with a 230 VAC supply

The controllers are supplied with power via an orange plug-in screw-type terminal block (terminals 1 + 2). See figure below.

These terminals 1 and 2 support cables with 1 × 4 mm² or 2 × 2.5 mm²



Multiple 230 VAC controllers connected to a single power supply adapter

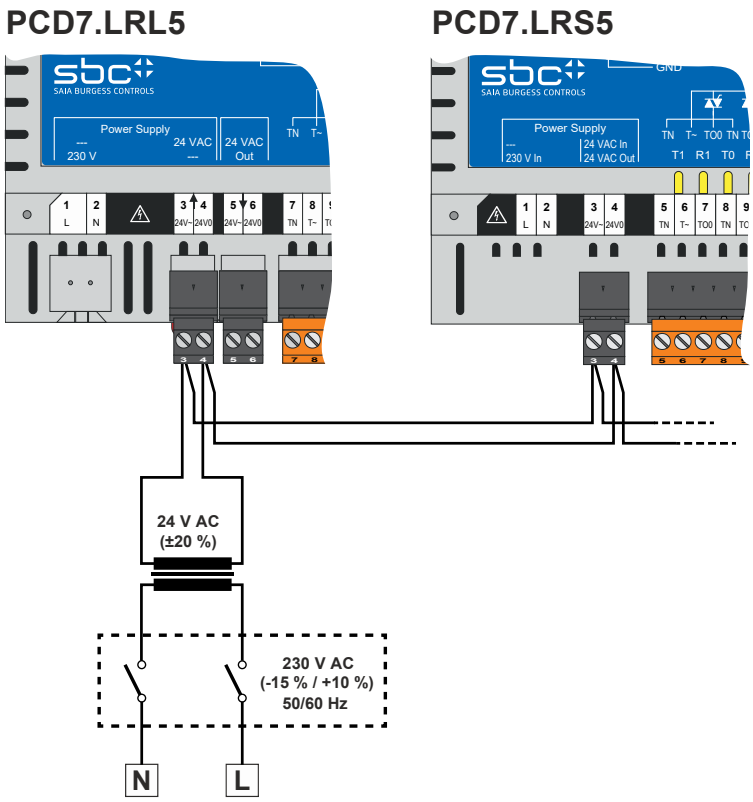
More technical data can be found in Section “3.5 General technical details”

CAUTION
RISK OF EQUIPMENT DAMAGE [AND/OR PERSONAL INJURY]!
DO NOT USE TERMINALS 3+4 OF 230-V MODELS (24VAC POWER OUTPUT FOR AUXILIARY DEVICES) AS A POWER INPUT!

3.3.2 Devices with a 24 VAC supply

The 24 VAC models are supplied via a black removable connector (terminals 3 + 4) that allows the power supply adapter connection to be interlinked. See next figure.

These terminals support cables with 1 × 2.5 mm² or 2 × 1.5 mm².



Multiple 24 VAC controllers connected to a single power supply adapter

More technical data can be found in Section “3.5 General technical details”

CAUTION
RISK OF EQUIPMENT DAMAGE [AND/OR PERSONAL INJURY]!
DO NOT USE TERMINALS 3+4 OF 230-V MODELS (24VAC POWER OUTPUT FOR AUXILIARY DEVICES) AS A POWER INPUT!

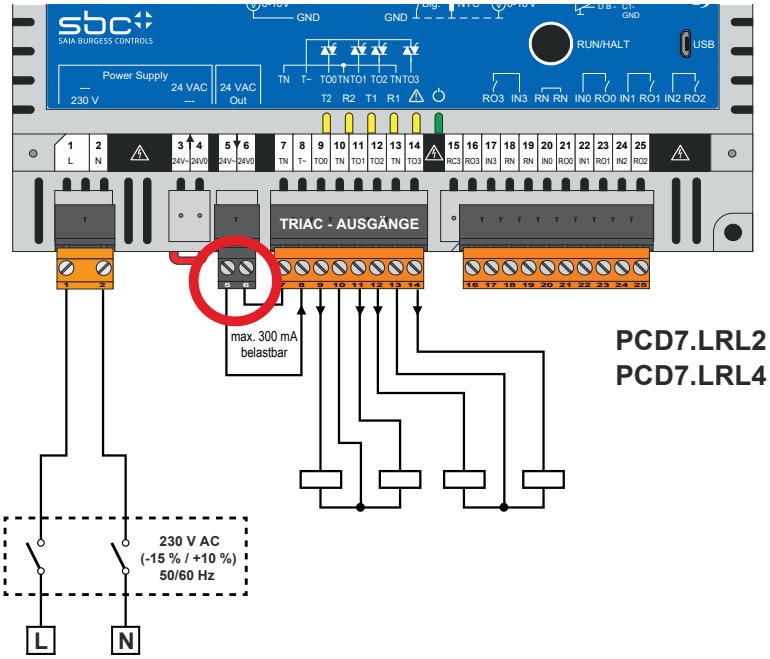
3.3.3 Internal 24 VAC supply voltage output for auxiliary or field devices

The 24 VAC* auxiliary power supply terminals deliver a maximum:

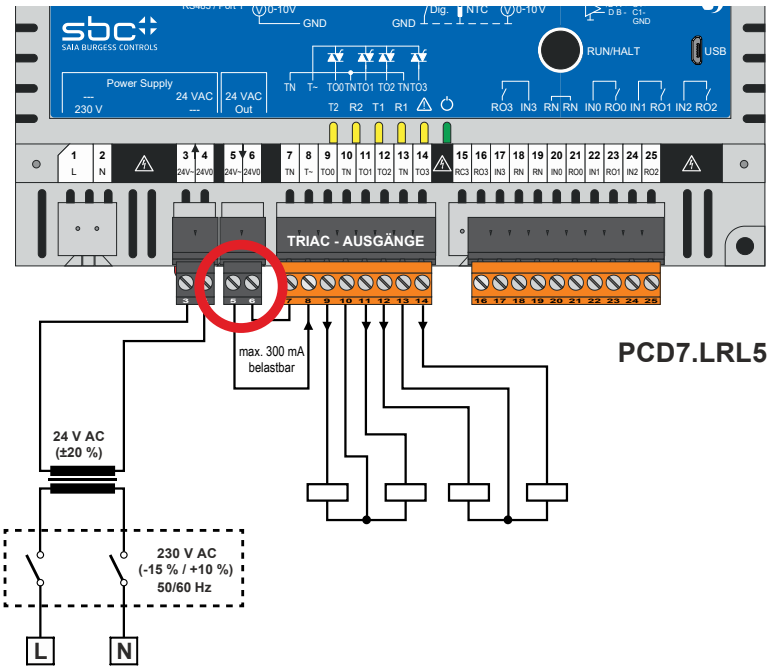
- ► PCD7.LR5 (24 VAC): 600 mA
- ► PCD7.LR2 (230 VAC)
  PCD7.LR4 (230 VAC): 300 mA (or 320 mA for max. 2 minutes)

Terminals support cables with 1 × 2.5 mm² or 2 × 1.5 mm².

Connection examples for triac connections:



PCD7.LRL2
PCD7.LRL4

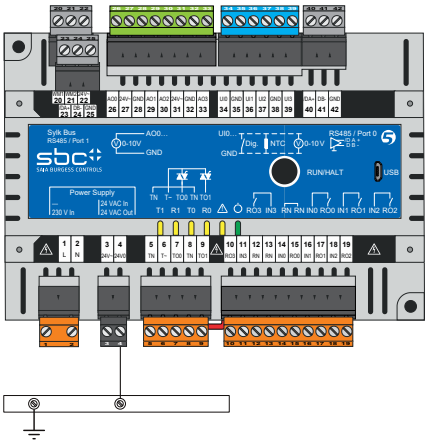


PCD7.LRL5

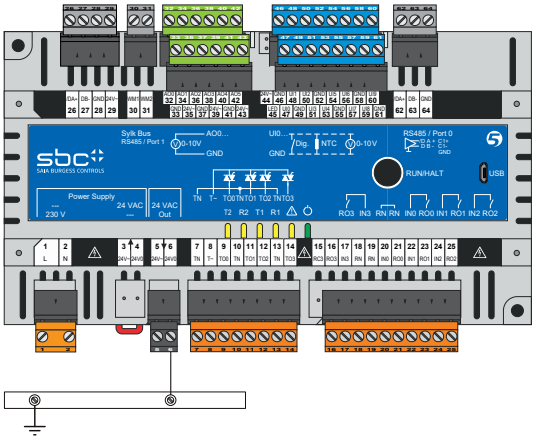
* to be found by the serial interface, the analogue outputs and the triac outputs.

3.3.4 Earthing concept

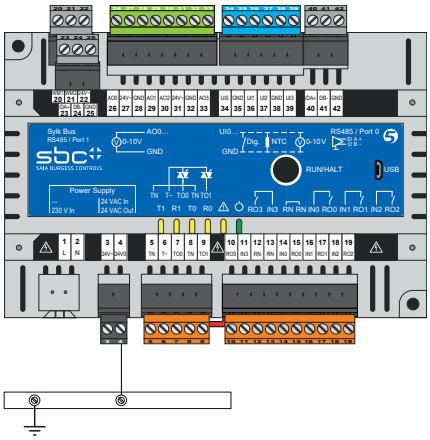
The terminal "24V0" should be connected to the earthing rail using the shortest possible cable (< 25 cm) with a cross-section of 1.5 mm^2.



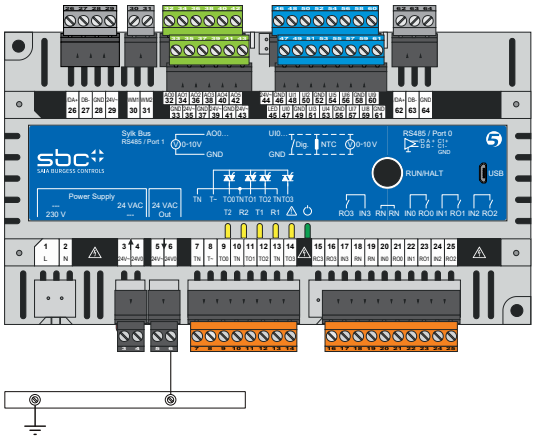
PCD7.LRS4-P5



PCD7.LRL2-P5 and PCD7.LRL4-P5



PCD7.LRS5-P5



PCD7.LRL5-P5

3.4 CPU properties

Properties	PCD7.LRxx
General characteristics	
Max. number of inputs/outputs	up to 24
Processor	Cortex M4
Firmware, firmware update (firmware memory soldered)	Can be downloaded from Saia PG5® environment
Programmable with Saia PG5®	from V2.3.100
User program/DB/TEXT (FLASH)	128 kB
Main memory/DB/TEXT (RAM)	10 kB
Data remanence possible due to flash backup	up to 1000 registers/flags
Hardware clock [1)]	✓
Hardware clock accuracy	Deviation of less than 1 min/month
Buffering [1)]	max. 72 h
Interfaces	
Programming interface	Micro-USB type B [2)]
Ports 0 + 1	RS-485, up to 115 kbit/s
Sylk Bus	✓
Fieldbus connections on Ports 0 + 1	
Serial S-Net	✓
Modbus	✓
If PCD7.LRxx-P5 acts as an S-Bus client, max. number of E-Line slaves that can be connected	10 E-Line slaves
If PCD7.LRxx-P5 acts as an S-Bus or Modbus server: max. number of PCD7.LRxx-P5 that can be connected to the RS485 port, per segment, without repeater	128 PCD7.LRxx-P5

1) When switched off, the power reserve of the hardware clock lasts for max. 72 hours.
2) The “USB 1.1 Slave Device 12 Mbps” port is used for programming.

3.5 General technical details

Power supply (external and internal)	
Supply voltage	24 VAC ±20% / 230 VAC +10%/-15%
Power consumption	Typically 8 W
Ambient conditions	
Ambient temperature	Vertical installation: 0…+50°C In other installation positions a reduced temperature range applies: 0…+40°C
Storage temperature	-20…+70°C
Relative air humidity	5…95% non-condensing
Vibration resistance	
Vibrations	As per EN/IEC 61131-2: - 5…13.2 Hz, constant amplitude (1.42 mm) - 13.2…150 Hz, constant acceleration (1 g)
Electrical safety	
Protection class	IP20 as per EN 60529 (IP30 with terminal covers)
Clearance/creepage distance	As per EN 61131-2 and EN 50178: between circuits and housings, and between electrically isolated circuits: overvoltage class II, degree of pollution 2
Nominal pulse voltage	500 V for nominal input voltage 24 VAC 2500 V for nominal input voltage 230 VAC
Electromagnetic compatibility	
Interference immunity	As per EN 61000-6-2
Electrostatic discharge	As per EN 61000-4-2: - 4 kV contact discharge, - 8 kV air discharge
High-frequency electromagnetic fields, amplitude modulated	As per EN 61000-4-3: field strength - 2.0…2.7 GHz 1 V/m - 1.4…2.0 GHz 3 V/m - 80…1000 MHz 3 V/m
Electrical bursts	As per EN 61000-4-4: - 1 kV for AC supply lines, - 0.5 kV for I/O signal lines and data communication
High-energy voltage surges	As per EN 61000-4-5: - 2 kV CM and 1 kV DM for AC supply lines
Conducted disturbance, induced by high-frequency fields	As per EN 61000-4-6: 3 V 150 kHz–80 MHz
Emitted interference	As per EN 61000-6-3: for residential areas

3.6 Firmware/Operating system

The firmware is backed up to flash memory. A firmware update can be downloaded to the PCD7.LRxx-P5 at any time using the Saia PG5®.

To do this, proceed as follows:

Go to www.sbc-support.com and download the latest firmware version.

- Connect the Saia PG5® to the controller via USB.
- Open the “Online Configurator” and go online.
- In the “Tools” menu, select “Firmware Downloader” and then “Browse” to select the path to the file with the new firmware version. Ensure that only one file is selected for download.
- Start the download.

3.7 System memory structure

Memory	
PCD media with FRAM technology	Registers: 4050 Flag: 4050 Timer/counter: 400 DB/text 100
User program code including ROM DB/text	128 kB saved in file system
Main memory with RAM technology (volatile)	10 kB DB/text

Resources	
Flag	0...3999/4000../4049 mapping
Timer/counter	0...399
Registers	0...3999/4000../4049 mapping
Text/data block	100 RAM/ROM
Program structure	100 FB/100 PB (7 levels)

A total of max. 1000 flags/registers can be saved to the flash memory.

3.8 System resources

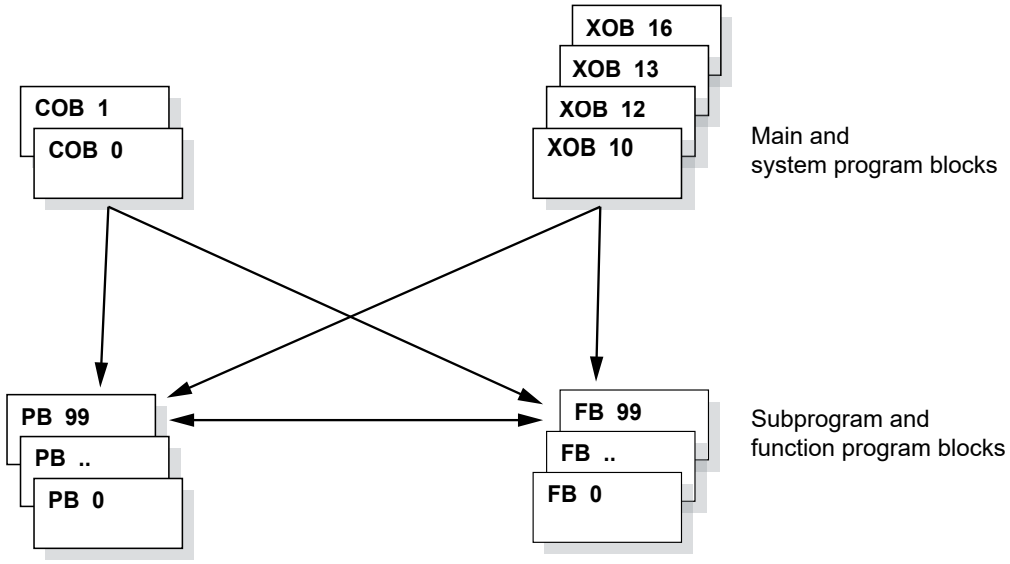
3.8.1 User program in block structure

The user program parts are stored by the programmer in blocks assigned according to their function.

Type	Number	Addresses	Remarks
Cyclical organisation blocks (COB)	2*	0...1	Main program elements
Exception/system-dependent organisation blocks (XOB)	4	10, 12, 13, 16	Accessed by system
Program blocks (PB)	100	0...99	Subprograms
Function blocks (FB)	100	0…99	Subprograms with parameters

* When the device is programmed with Fupla, it automatically creates a COB in the background. Thus, only 1 COB is available to the programmer. If programmed exclusively with IL, both COB are available.

Program block structure



3.8.2 Data types/value ranges

Type	Area	Remarks
Integer	-2,147,483,648 to +2,147,483,647	Format: Decimal, binary, BCD or hexadecimal
IEEE single precision	$\pm 1.401 \times 10^{-45}$ to 3.403×10^{38}	

3.8.3 Resource elements

Type	Number	Addresses	Remarks
Flags (1 bit)	4050	F 0…4049	
Registers (32 bit)	4050	R 0…4049	For integer or floating point values
Text/data blocks	100	X or DB 0...99	For text and DB
Timer/counter (31 bit)	400[1)]	T/C 0…399	The timer and counter breakdown can be configured. Timers are periodically counted down by the operating system; the base time unit can be set between 10 ms and 10 seconds.
Constants with media code K	any	0...16,383	These values can be used in instructions in place of registers
Constants without media code	any	-2,147,483,648 to +2,147,483,647	Can only be loaded in a register with an LD command and cannot be used in instructions in place of registers.

[1)] The number of configured timers should not be greater than necessary in order to avoid unnecessary CPU loads

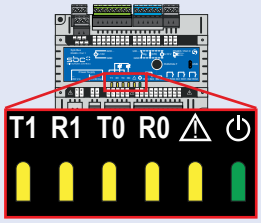
3.8.4 RTC/internal hardware clock

If the PCD7.LRxx-P5 is switched off, the power reserve for the internal hardware clock (RTC) is ensured by a supercap for max. 72 h.

The PCD7.LRxx-P5 room controllers are maintenance-free and do not need any batteries.

3.9 LED/operating states

The colour LEDs indicate the possible operating statuses of the CPU, as shown in the following table.

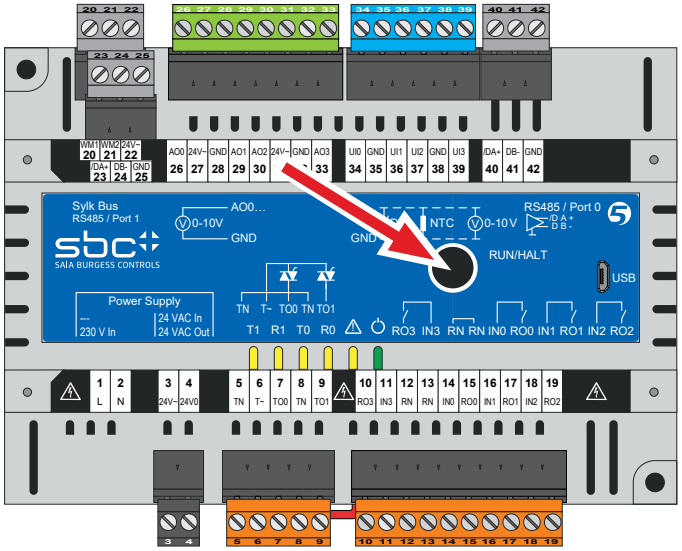
Meaning of LEDs						
Function	**Com Port #1**		**Com Port #0**		**STOP/HALT**	**RUN**
Labelling	**T1**	**R1**	**T0**	**R0**	⚠	⏻
Description						
Data transfer via RS-485 interface #1	flashes	–	–	–		
Data receipt via RS-485 interface #1	–	flashes	–	–		
Data transfer via RS-485 interface #0	–	–	flashes	–		
Data receipt via RS-485 interface #0	–	–	–	flashes		
Switched off	–	–	–	–	off	off
RUN (program running)	–	–	–	–	off	on
RUN Until (program running)	–	–	–	–	off	flashes at 1 Hz
STOP (no program running)	–	–	–	–	on	flashes at 1 Hz
HALT (no program running)	–	–	–	–	on	off
FW download	–	–	–	–	flashes at 1 Hz	flashes at 1 Hz
RESET/service key pressed	–	–	–	–	flashes at 2Hz	flashes at 2 Hz

Legend:

	LED off
	LED on
	LED flashing

Operating status	
Start	Self-diagnostics for approx. 1 s after power-on or restart
Run	Normal processing of user program after start
Run Until	Conditional run status. A condition has been set in the debugger that has not yet been met
Stop	- The “Stop” status occurs in the following cases: - Programming unit connected in PGU mode while the CPU was switched on - PGU stopped by programming unit - Condition for “Run Until” has been met
HALT	- The “HALT” status occurs in the following cases: - RUN/HALT key pressed - HALT instruction processed - Critical error in user program - Hardware error - No program loaded - No communication mode with S-Bus PGU or gateway master port
System diagnostics	
Reset	- The RESET status is caused by the following: - Supply voltage too low - Firmware not started

3.10 RUN/HALT key



Take care to avoid inadvertently pressing the RUN/HALT key during operation (see below)!

3.10.1 Multiple uses for the RUN/HALT key

The RUN/HALT key on the controller is used to trigger special functions:

➔ **RUN/HALT**
If the RUN/HALT key is briefly pressed during operation, the controller switches to the HALT status. Pressing the key again initiates a cold start (program restart).

➔ **Controller RESET**
If the RUN/HALT key is held down for between 6 and 10 seconds while the controller is being switched on, the controller will be reset to the factory settings (user program and configuration will be deleted).

➔ **Firmware update**
If the RUN/HALT key is pressed for less than 6 seconds while the controller is being switched on, the controller stays in “boot mode”
(firmware update possible).

Operating status LED feedback for FW Update Mode	Display
The two LEDs flash at 1 Hz.	

3.10.2 Restart the controller with RUN/HALT button

Action	Display
Controller program is running (operation = RUN). (RUN/HALT key has not yet been pressed.)	
RUN/HALT key has been pressed, which has led to a program STOP. The controller indicates this with a yellow LED below the symbol consisting of an exclamation mark inside a triangle.	
Pressing the RUN/HALT key again restarts the controller.	

3.11 Watchdog (software)

A software watchdog (in which the processor monitors itself and the CPU is re-started in the event of a malfunction or a loop) is sufficient for non-critical applications.

The core of the software watchdog is the STL command SYSWR K 1000, which is also used in the “Software Watchdog” FBox.

Function

When this is output for the first time, the watchdog function will be enabled. This instruction must then be output at least every 200 ms, otherwise the watchdog will be triggered and the PCD restarted.

FUPLA FBox example:

FBox Selector -> System Information -> Software Watchdog

Instruction in STL code:

Label	Command	Operand	Comment
	SYSWR	K 1000	; Software watchdog instruction
		R/K x	; Parameters as per the following table ; K = constant or R = register ; followed by a space. ; x = 0 The software watchdog is ; disabled. ; x = 1 The software watchdog is ; enabled. If the instruction ; is not repeated within 200 ms, ; a cold start is ; initiated. ; x = 2 The software watchdog is ; enabled. If the instruction ; is not repeated within 200 ms, ; XOB 0 is called up, then ; a cold start is ; initiated.

“XOB 0” call-ups are entered in the PCD history as follows:

“XOB 0 WDOG START”	if XOB 0 was triggered by the software watchdog
“XOB 0 START EXEC”	if XOB 0 was triggered by a supply failure

4 Inputs and outputs

This section describes the inputs and outputs of the PCD7.LRxx-P5 controllers in terms of their function and terminal assignment.

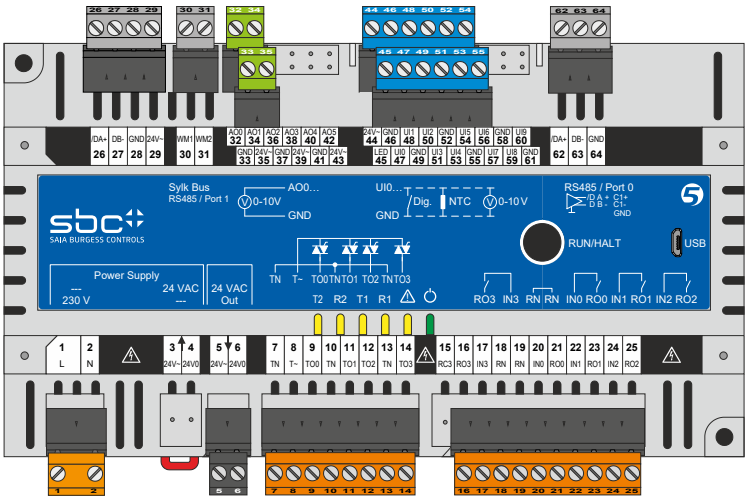
Please note: There is one labeling foil per housing size. Means that terminal names are present but the terminals are physically missing. The following two tables “4.1 Connection overview and functions (by model)” provide information about this.

Inputs and outputs can be found in two locations. These are:

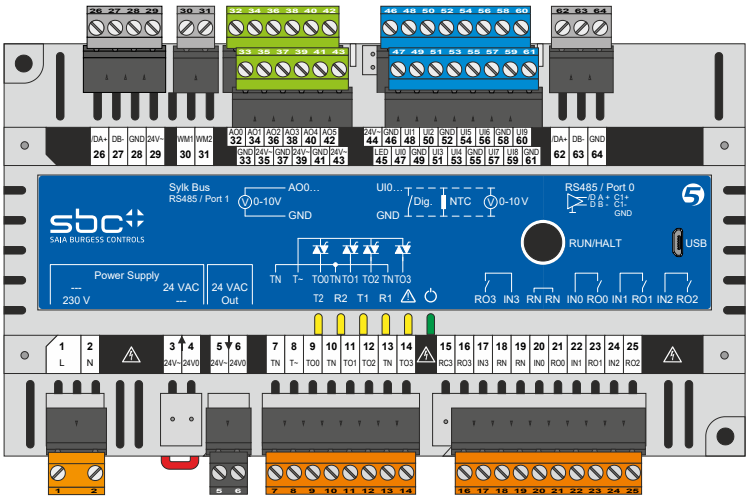
- on-board (in the controller)
- on E-Line RIOs
  (external via RS-485 interface: see section 5.3.5 “RS-485 interface Port1”)

4.1 Connection overview and functions

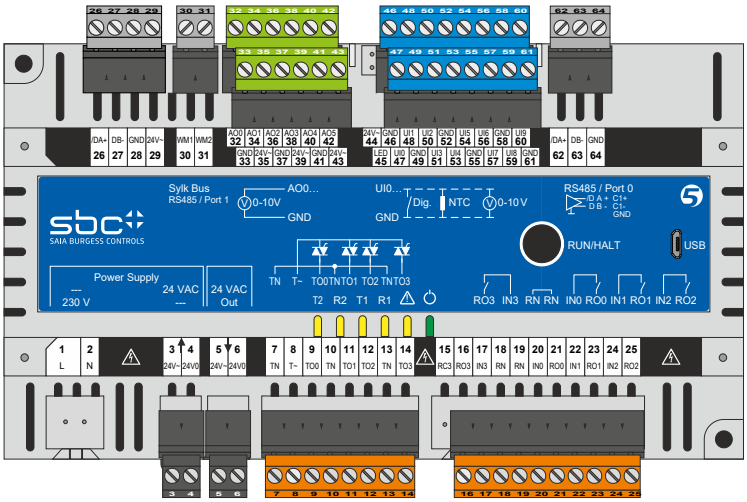
PCD7.LRL2-P5



PCD7.LRL4-P5



PCD7.LRL5-P5



See next page for terminal assignment overview.

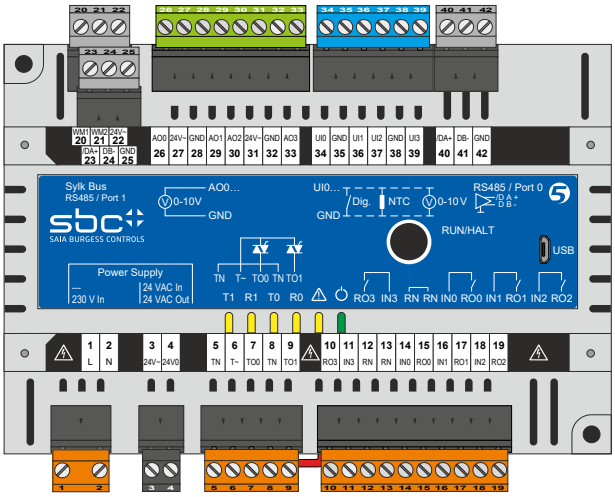
PCD7.LRLx-P5 room controllers
Overview of connections and functions (by model)

Terminal 2.5 mm²	Label	Function	PCD7._ _ _ _-P5		
			LRL2	LRL4	LRL5
1, 2 (4 mm²)	“L”, “N”	230 V power supply (terminal 1 × 4 mm² or 2 × 2.5 mm²)	×	×	---
3, 4	“24V~”, “24V0”	24 VAC supply voltage input	–	–	×
5, 6	“24V~”, “24V0”	Auxiliary output voltage (24 VAC) for all triacs	×	×	×
7, 10, 13	“TN”	Auxiliary connections for triac output wiring (internally connected)	×	×	×
8	“T~”	Input voltage (24 VAC/230 VAC) for all triacs	×	×	×
9	“TO0”	Triac-switched output	Type 3	Type 3	Type 3
11	“TO1”	Triac-switched output	Type 3	Type 3	Type 3
12	“TO2”	Triac-switched output	Type 3	Type 3	Type 3
14	“TO3”	Triac-switched output	Type 3	Type 3	Type 3
15		Not used	–	–	–
16, 17	“RO3”, “IN3”	Output for relay 3; input for relay 3	Type 2	Type 2	Type 2
18, 19	“RN”	Auxiliary connections for relay output wiring (internally connected)	×	×	×
20, 21	“IN0”, “RO0”	Input for relay 0; output for relay 0	Type 2	Type 2	Type 2
22, 23	“IN1”, “RO1”	Input for relay 1; output for relay 1	Type 1	Type 1	Type 1
24, 25	“IN2”, “RO2”	Input for relay 2; output for relay 2	Type 1	Type 1	Type 1
26, 27, 28	“/DA+”, “DB-”, “GND”	RS-485 Modbus interface #1, common ground	×	×	×
29	“24V~”	24 VAC power supply for field devices	×	×	×
30, 31	“WM1”, “WM2”	Sylk bus interface	×	×	×
33, 37, 41	“GND”	Common ground	×	×	×
35, 39, 43	“24V~”	24 VAC power supply for field devices	×	×	×
32	“AO0”	Analogue output 0	Type 6	Type 6	Type 6
34	“AO1”	Analogue output 1	Type 6	Type 6	Type 6
36	“AO2”	Analogue output 2	–	Type 4	Type 4
38	“AO3”	Analogue output 3	–	Type 4	Type 4
40	“AO4”	Analogue output 4	–	Type 4	Type 4
42	“AO5”	Analogue output 5	–	Type 4	Type 4
44	“24V~”	24 VAC power supply for field devices	×	–	–
45	“LED”	Output for LED from PCD7.L632, Q.RCU-A-TSOx and T7460C, E, F	×	–	–
46, 49, 52 55, 58, 61	“GND”	Common ground	×	×	×
47	“UI0”	Universal input 0	Type 7	Type 7	Type 7
48	“UI1”	Universal input 1	Type 7	Type 7	Type 7
50	“UI2”	Universal input 2	Type 7	Type 7	Type 7
51	“UI3”	Universal input 3	Type 7	Type 7	Type 7
53	“UI4”	Universal input 4	Type 7	Type 7	Type 7
54	“UI5”	Universal input 5	Type 7	Type 7	Type 7
56	“UI6”	Universal input 6	–	Type 8	Type 8
57	“UI7”	Universal input 7	–	Type 8	Type 8
59	“UI8”	Universal input 8	–	Type 8	Type 8
60	“UI9”	Universal input 9	–	Type 8	Type 8
62, 63, 64	“/DA+”, “DB-”, “GND“	RS-485 interface #0, Common ground	×	×	×

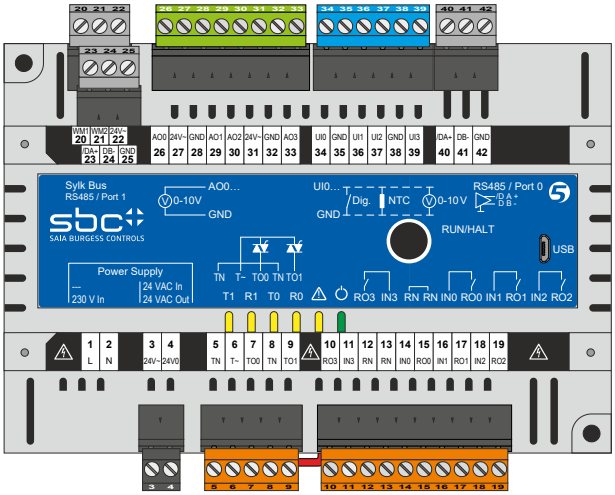
CAUTION
RISK OF EQUIPMENT DAMAGE [AND/OR PERSONAL INJURY]!
DO NOT USE TERMINALS 3+4 OF 230-V MODELS (24VAC POWER OUTPUT FOR AUXILIARY DEVICES) AS A POWER INPUT!

Description of columns PCD7._ _ _ _-P5		
×	Terminal available	
–	Terminal not available	
Type 1 + Type 2	Relay output types	See section 4.3.1
Type 3	Triac output types	See section 4.3.2
Type 4 … Type 6	Analogue output types	See section 4.4
Type 7 + Type 8	Universal input types	See section 4.2

PCD7.LRS4-P5



PCD7.LRS5-P5



See next page for terminal assignment overview.

PCD7.LRSx-P5 room controllers
Overview of connections and functions (by model)

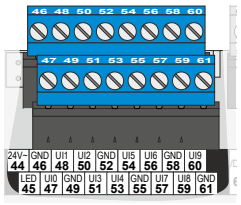
Terminal 2.5 mm²	Label	Function	PCD7._ _ _ _-P5	
			LRS4	LRS5
1, 2 (4 mm²)	"L", "N"	230 V power supply (terminal 1 × 4 mm² or 2 × 2.5 mm²)	×	–
3, 4	"24 V~", "24V0"	24 V power supply	–	×
3, 4	"24 V~", "24V0"	Auxiliary output voltage (24 VAC) for all triacs	×	–
5, 8	"TN"	Auxiliary connections for triac output wiring (internally connected)	×	×
v	"T~"	Triac input voltage (24 VAC/230 VAC) for all triacs	×	×
7	"TO0"	Triac-switched output	Type 3	Type 3
9	"TO1"	Triac-switched output	Type 3	Type 3
10, 11	"RO3", "IN3"	Output for relay 3; input for relay 3	Type 2	Type 2
12, 13	"RN"	Auxiliary connections for relay output wiring (internally connected)	×	×
14, 15	"IN0", "RO0"	Input for relay 0; output for relay 0	Type 1	Type 1
16, 17	"IN1", "RO1"	Input for relay 1; output for relay 1	Type 1	Type 1
18, 19	"IN2", "RO2"	Input for relay 2; output for relay 2	Type 1	Type 1
20, 21	"WM1", "WM2"	Sylk bus interface	×	×
22	"24V~"	24 VAC power supply for field devices	×	×
23, 24, 25	"/DA+", "DB-", "GND"	RS-485 interface #1, common ground	×	×
28, 32	"GND"	Common ground	×	×
27, 31	"24V~"	24 VAC power supply for field devices	×	×
26	"AO0"	Analogue output 0	Type 5	Type 5
29	"AO1"	Analogue output 1	Type 4	Type 4
30	"AO2"	Analogue output 2	Type 4	Type 4
33	"AO3"	Analogue output 3	Type 4	Type 4
35, 38	"GND"	Common ground	×	×
34	"UI0"	Universal input 0	Type 7	Type 7
36	"UI1"	Universal input 1	Type 7	Type 7
37	"UI2"	Universal input 2	Type 7	Type 7
39	"UI3"	Universal input 3	Type 7	Type 7
40, 41, 42	"/DA+", "DB-", "GND"	RS-485 interface #0, common ground	×	×

CAUTION
RISK OF EQUIPMENT DAMAGE [AND/OR PERSONAL INJURY]!
DO NOT USE TERMINALS 3+4 OF 230-V MODELS (24VAC POWER OUTPUT FOR AUXILIARY DEVICES) AS A POWER INPUT!

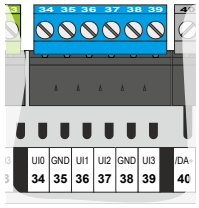
Description of columns PCD7._ _ _ _-P5		
×	Terminal available	
–	Terminal not available	
Type 1 + Type 2	Relay output types	See section 4.3.1
Type 3	Triac output types	See section 4.3.2
Type 4 … Type 6	Analogue output types	See section 4.4
Type 7 + Type 8	Universal input types	See section 4.2

4.2 UIx - Universal inputs

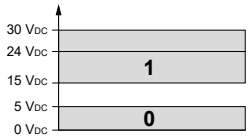
PCD7LRLx-P5



PCD7LRSx-P5



4

Technical information		PCD7._ _ _ _-P5		
		LRL2	LRL4 LRL5	LRSx
Number of universal inputs	Electrically connected	6	10	4
Terminal block colour	-	Blue		
Terminal label	-	UI0…5	UI0…9	UI0…3
Terminal type	Plug-in screw-type terminals up to 2.5 mm²	Yes		
Galvanic isolation	From supply and other I/Os	No		
Input voltage	Typically V DC (15...30 V DC)	Yes		
Input current	Typically 0.1 mA with 24 V DC	Yes		
Input delay	12 ms	Yes		
Switching level	Low: 0…5 V, high: 15…30 V DC	Yes		
Overvoltage protection	-	No		
LED	I/O optical digital display	No		
Definition of input signals for 24 V DC				

The numbers on the table below define the maximum possible amount of UIs for the selected usage.

Usage as …	Type 7*	Type 7* Type 8	Type 7*
Digital input 24 V DC with source operation	6	10	4
Digital input 24 V DC with sink operation	6	6	4
Digital input as dry contact	6	6	4
Analogue input with 0…10V	6	10	4
Analogue input as resistance measurement 0…2,5 kOhm	---	4	---
Analogue input as resistance measurement 0…10 kOhm	---	4	---
Analogue input as resistance measurement 0…100 kOhm	6	6	4
Analogue input as temp. measurement PT/NI1000 L&S	---	4	---

* Description of Types 7 and 8 see next page

The universal inputs are protected against voltages of max. 29 VAC and 30 V DC (e.g. against incorrect wiring).

Universal input Properties, types and PG5 Device Configurator settings			
Properties	**Type 7[1)]**	**Type 8[1)]**	**PG5 Device Configurator settings [2)]**
0…10 V	Yes	Yes	0…10 V
2.5 kΩ	No	Yes	2.5 kΩ
10 kΩ	No	Yes	0…10 kΩ
100 kΩ (NTC 20 kΩ) and (NTC 10 kΩ)	Yes	No	0…100 kΩ
PT/NI 1000	No	Yes	PT/NI 1000 L&S
Dry contact closed: Resistance < 10 kΩ open: Resistance > 20 kΩ Pull-up voltage: 10 V	Yes	No	dry contact
Digital Input 24 VDC Input delay: min. 16 ms closed: Voltage < 1 V open: Voltage > 5 V	Yes	Yes	digital

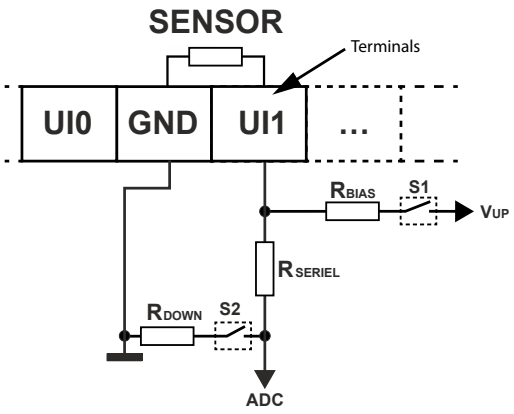
[1)] See also bottom of table. .
PCD7.LRSx-P5 room controllers: Overview of connections and functions (by model)
or
PCD7.LRLx-P5 room controllers: Overview of connections and functions (by model)

[2)] PG5 (V2.3) Device Configurator settings

4

Internal wiring of the universal inputs

Each universal input has a bias resistor.



Circuit diagram showing universal inputs and bias resistors.

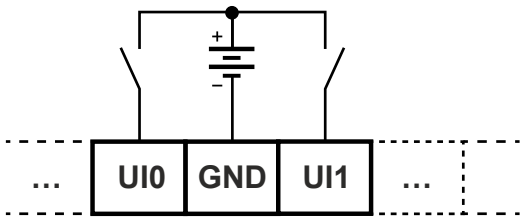
Legend

S1 + S2	Software switch for PG5 “Device Configurator” connected.
VUPSTREAM	10 V
RBIAS	Bias resistor (with a resistance of 24.9 kΩ in the case of NTC10 kΩ and NTC20 kΩ or 7.5 kΩ for PT/NI1000 sensors) can be switched off via the software through S1 to support 0–10 V inputs without bias (“high impedance”).
RSERIAL	Serial resistor for voltage separation and filtering (with a resistance of 150 kΩ).
RDOWNSTREAM	An internal load resistor (with a resistance of 50 kΩ). Depending on the type of sensor connected, the firmware can switch this resistor off for type 8 universal inputs.

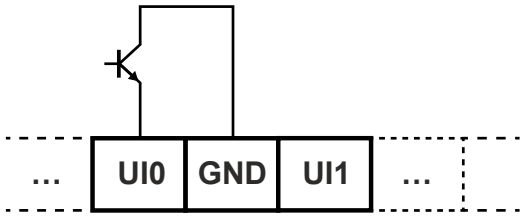
4.2.1 Use as digital inputs

- Digital input 24 VDC with source operation
- Digital input 24 VDC with sink operation
- Digital input as dry contact

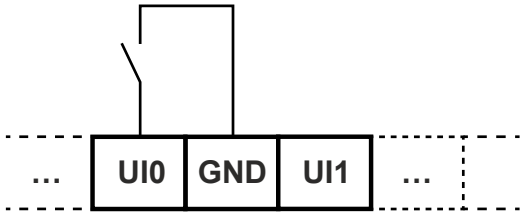
4.2.1.1 Digital input 24 VDC with source operation

Connection example	Mode selection Device Configurator
	digital

4.2.1.2 Digital input 24 VDC with sink operation

Connection example	Mode selection Device Configurator
	digital

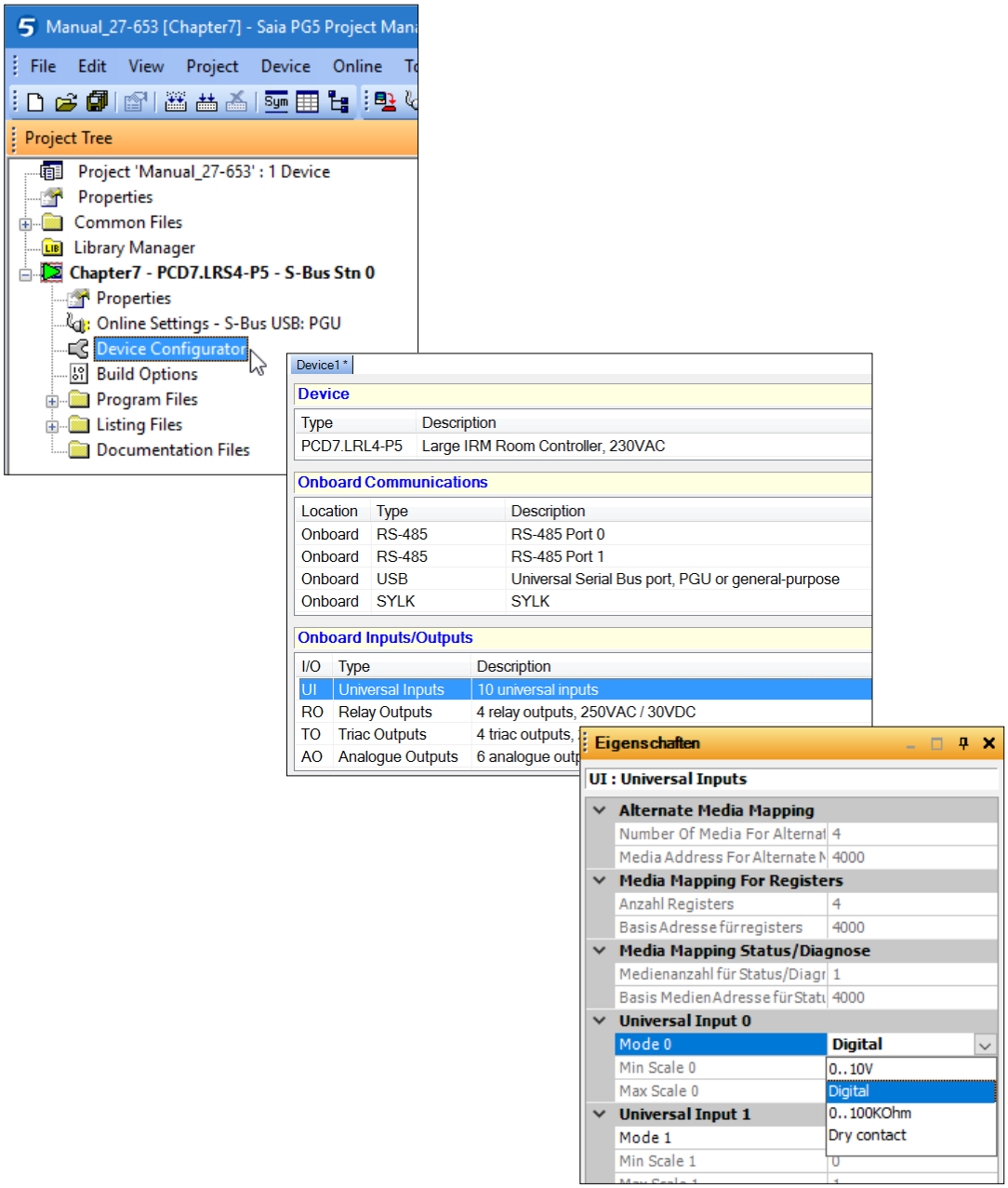
4.2.1.3 Digital input as dry contact

Connection example	Mode selection Device Configurator
	dry contact

4

4.2.1.4 Device configuration for defining digital inputs

The digital input mode is selected using the PG5 “Device Configurator”.



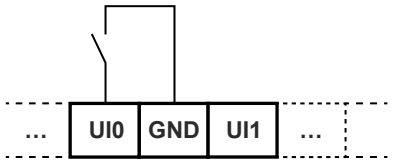
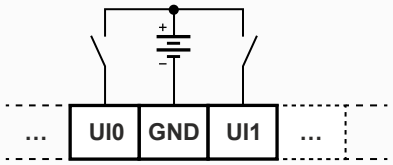
Media mapping of UI if they are used as digital inputs

Mapping to flags is possible since FW 1.10.07 and PG5 2.3.161

Slots / Symbols	Type	Address	Comments	Scope	Tags
PCD7.LRL4-P5, Large IRM Room Controller, 230VAC					
UI, Universal Inputs, 10 universal inputs					
S.IRM.BaseRegister	R [10]	4000		Public	S_IO
IO.UniversalInput0	R	S.IRM.BaseRegister + 0	Universal input 0 state	Public	S_IO
IO.UniversalInput1	R	S.IRM.BaseRegister + 1	Universal input 1 state	Public	S_IO
IO.UniversalInput2	R	S.IRM.BaseRegister + 2	Universal input 2 state	Public	S_IO
IO.UniversalInput3	R	S.IRM.BaseRegister + 3	Universal input 3 state	Public	S_IO
IO.UniversalInput4	R	S.IRM.BaseRegister + 4	Universal input 4 state	Public	S_IO
IO.UniversalInput5	R	S.IRM.BaseRegister + 5	Universal input 5 state	Public	S_IO
IO.UniversalInput6	R	S.IRM.BaseRegister + 6	Universal input 6 state	Public	S_IO
IO.UniversalInput7	R	S.IRM.BaseRegister + 7	Universal input 7 state	Public	S_IO
IO.UniversalInput8	R	S.IRM.BaseRegister + 8	Universal input 8 state	Public	S_IO
IO.UniversalInput9	R	S.IRM.BaseRegister + 9	Universal input 9 state	Public	S_IO
S.IRM.BaseRegister	R [3]	4000		Public	S_IO
IO.UniversalInputStatus0	R	S.IRM.BaseRegister + 10	Universal input 0..3 status	Public	S_IO
IO.UniversalInputStatus1	R	S.IRM.BaseRegister + 11	Universal input 4..7 status	Public	S_IO
IO.UniversalInputStatus2	R	S.IRM.BaseRegister + 12	Universal input 8..9 status	Public	S_IO
S.IRM.BaseFlag	F [10]	4000		Public	S_IO
IO.UniversalInputF0	F	S.IRM.BaseFlag + 0	Mirror Universal input 0	Public	S_IO
IO.UniversalInputF1	F	S.IRM.BaseFlag + 1	Mirror Universal input 1	Public	S_IO
IO.UniversalInputF2	F	S.IRM.BaseFlag + 2	Mirror Universal input 2	Public	S_IO
IO.UniversalInputF3	F	S.IRM.BaseFlag + 3	Mirror Universal input 3	Public	S_IO
IO.UniversalInputF4	F	S.IRM.BaseFlag + 4	Mirror Universal input 4	Public	S_IO
IO.UniversalInputF5	F	S.IRM.BaseFlag + 5	Mirror Universal input 5	Public	S_IO
IO.UniversalInputF6	F	S.IRM.BaseFlag + 6	Mirror Universal input 6	Public	S_IO
IO.UniversalInputF7	F	S.IRM.BaseFlag + 7	Mirror Universal input 7	Public	S_IO
IO.UniversalInputF8	F	S.IRM.BaseFlag + 8	Mirror Universal input 8	Public	S_IO
IO.UniversalInputF9	F	S.IRM.BaseFlag + 9	Mirror Universal input 9	Public	S_IO
RO, Relay Outputs, 4 relay outputs, 250VAC / 30VDC					

Accessible via PG5 Device Configurator > Menu > View > Media mapping window or ALT + F5.

Overview of the flag status in relation to the usage of the UI

Usage		Status of flag If contact is open	Status of flag If contact is closed
	Dry contact (GND on UI)	1	0
	Digital (24 V = on UI)	0	1

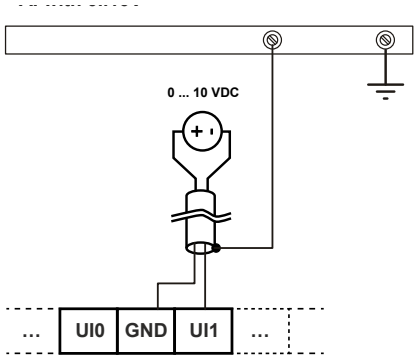
4.2.1.5 Programming digital inputs

The mapped flags of universal inputs, configured as digital inputs, could be used as common in the program application.

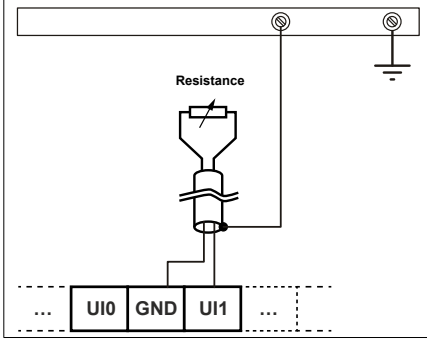
4.2.2 Use as analogue inputs

- Analogue input with 0…10V
- Analogue input as resistance measurement
- Analogue input as temp. measurement

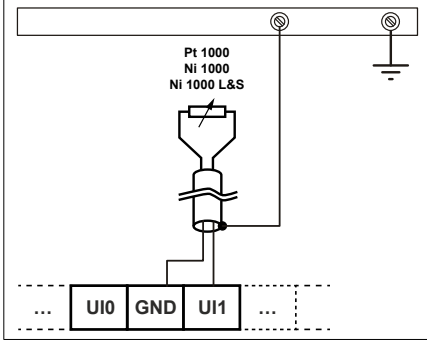
4.2.2.1 Analogue input with 0…10V

Connection example	Mode selection Device Configurator
	0 …10 V

4.2.2.2 Analogue input as resistance measurement

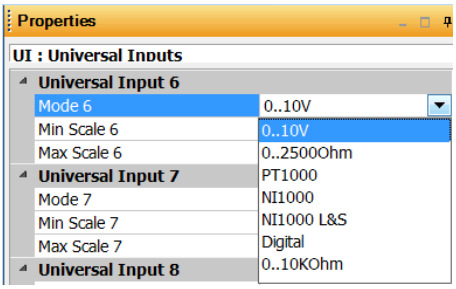
Connection example	Mode selection Device Configurator
	0 … 2,5 kΩ 0 … 10 kΩ 0 …100 kΩ

4.2.2.3 Analogue input as temp. measurement

Connection example	Mode selection Device Configurator
	PT1000 Ni 1000 NI 1000 L&S

4.2.2.4 Configuring analogue input channels

Same as chapter «4.2.3 UIx - Device configuration for defining digital inputs»



Slots / Symbols	Type	Address	Comments	Scope	Tags
PCD7.LRL4-P5, Large IRM Room Controller, 230VAC					
UI, Universal Inputs, 10 universal inputs					
S.IRM.BaseRegister	R [10]	4000		Public	S_IO
IO.UniversalInput0	R	S.IRM.BaseRegister + 0	Universal input 0 state	Public	S_IO
IO.UniversalInput1	R	S.IRM.BaseRegister + 1	Universal input 1 state	Public	S_IO
IO.UniversalInput2	R	S.IRM.BaseRegister + 2	Universal input 2 state	Public	S_IO
IO.UniversalInput3	R	S.IRM.BaseRegister + 3	Universal input 3 state	Public	S_IO
IO.UniversalInput4	R	S.IRM.BaseRegister + 4	Universal input 4 state	Public	S_IO
IO.UniversalInput5	R	S.IRM.BaseRegister + 5	Universal input 5 state	Public	S_IO
IO.UniversalInput6	R	S.IRM.BaseRegister + 6	Universal input 6 state	Public	S_IO
IO.UniversalInput7	R	S.IRM.BaseRegister + 7	Universal input 7 state	Public	S_IO
IO.UniversalInput8	R	S.IRM.BaseRegister + 8	Universal input 8 state	Public	S_IO
IO.UniversalInput9	R	S.IRM.BaseRegister + 9	Universal input 9 state	Public	S_IO
S.IRM.BaseRegister	R [3]	4000		Public	S_IO
IO.UniversalInputStatus0	R	S.IRM.BaseRegister + 10	Universal input 0..3 status	Public	S_IO
IO.UniversalInputStatus1	R	S.IRM.BaseRegister + 11	Universal input 4..7 status	Public	S_IO
IO.UniversalInputStatus2	R	S.IRM.BaseRegister + 12	Universal input 8..9 status	Public	S_IO
S.IRM.BaseFlag	F [10]	4000		Public	S_IO
IO.UniversalInputF0	F	S.IRM.BaseFlag + 0	Mirror Universal input 0	Public	S_IO
IO.UniversalInputF1	F	S.IRM.BaseFlag + 1	Mirror Universal input 1	Public	S_IO
IO.UniversalInputF2	F	S.IRM.BaseFlag + 2	Mirror Universal input 2	Public	S_IO
IO.UniversalInputF3	F	S.IRM.BaseFlag + 3	Mirror Universal input 3	Public	S_IO
IO.UniversalInputF4	F	S.IRM.BaseFlag + 4	Mirror Universal input 4	Public	S_IO
IO.UniversalInputF5	F	S.IRM.BaseFlag + 5	Mirror Universal input 5	Public	S_IO
IO.UniversalInputF6	F	S.IRM.BaseFlag + 6	Mirror Universal input 6	Public	S_IO
IO.UniversalInputF7	F	S.IRM.BaseFlag + 7	Mirror Universal input 7	Public	S_IO
IO.UniversalInputF8	F	S.IRM.BaseFlag + 8	Mirror Universal input 8	Public	S_IO
IO.UniversalInputF9	F	S.IRM.BaseFlag + 9	Mirror Universal input 9	Public	S_IO
RO, Relay Outputs, 4 relay outputs, 250VAC / 30VDC					

Overview of the accuracy of analogue inputs in relation to the mode.

Mode		Accuracy (with TAmbient = 25°C)		Display
Voltage	0 … 10 V	+/– 100 mV		0 …10000
Resistance	0 …2.5 kΩ	+/– 0.7 %	+/– 5 Ω	0 … 2500
	0 … 10 kΩ	+/– 0.7 %	+/– 20 Ω	0 …10000

Mode	Measured value	Accuracy	Display
0…100 kΩ range	0 … 10 kΩ	+/– 150 Ω	0…100000
	10 … 20 kΩ	+/– 380 Ω	0…100000
	20 … 30 kΩ	+/– 1100 Ω	0…100000
	30 … 60 kΩ	+/– 2300 Ω	0…100000
	60 … 80 kΩ	+/– 3800 Ω	0…100000
	80 …100 kΩ	+/– 5800 Ω	0…100000

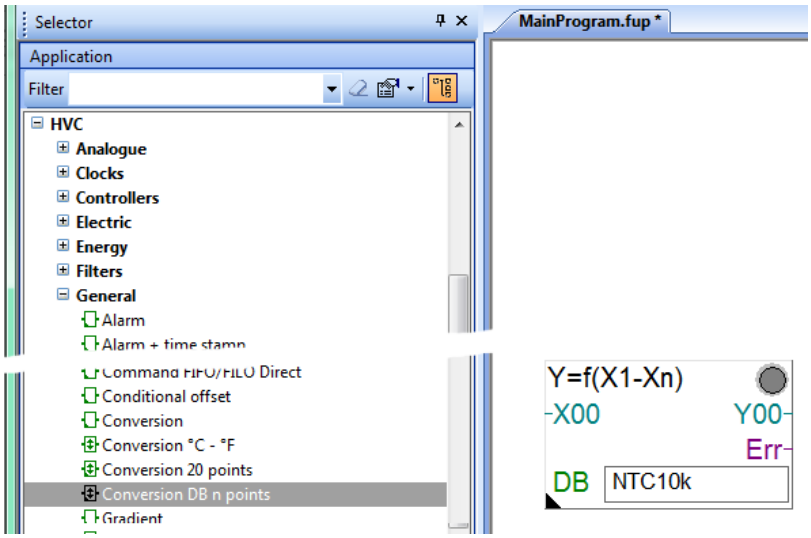
Sensor temperature range		Typical hardware measurement errors (without sensor tolerance)				
°Celsius	(°Fahrenheit)	Pt1000	Ni1000	Ni1000/Tk5000	NTC10k[*1]	NTC20k[*1]
-50 …-20°C	(-58 … -4°F)	≤1.2°C	≤1.2°C	≤1.2°C	≤5.5°C	≤5.0°C
-20 … 0°C	(-4 … 32°F)	≤0.7°C	≤0.7°C	≤0.7°C	≤1.2°C	≤1.0°C
0 …-30°C	(32 … 86°F)	≤0.5°C	≤0.5°C	≤0.5°C	≤0.4°C	≤0.3°C
30 … 70°C	(86 …158°F)	≤0.7°C	≤0.7°C	≤0.7°C	≤0.6°C	≤0.5°C
70 …100°C	(158 …212°F)	≤1.2°C	≤1.2°C	≤1.2°C	≤1.2°C	≤1.0°C
100 …130°C	(212 …266°F)	≤1.2°C	≤1.2°C	≤1.2°C	---	≤3.0°C
130 …150°C	(266 …302°F)	≤1.2°C	---	---	---	≤5.5°C
Display in 1/10°C		-500…4000	-500…2100	-300…1400	-200…1000	-70…1500

[1] These temperature curves are not standardised. They differ depending on the NTC manufacturer.
The temperatures can be displayed using a characteristic curve file (“Name.saiadbe”, available from Saia PCD Support) and the “Conversion DB n Points” FBox.

4.2.2.5 Programming analogue inputs

The mapped registers of the universal inputs, configured as analogue inputs, could be used as common in the program application.

For NTC 10k temperature sensors, the conversion FBox could be used.
Conversion tables for NTC 10k and NTC 20k are available on appendix A.4.2.



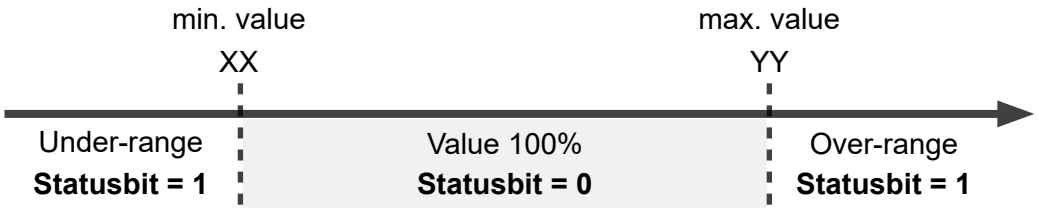
Conversion FBoxes

4.2.2.6 Definitions of range, over/under-range and status flag

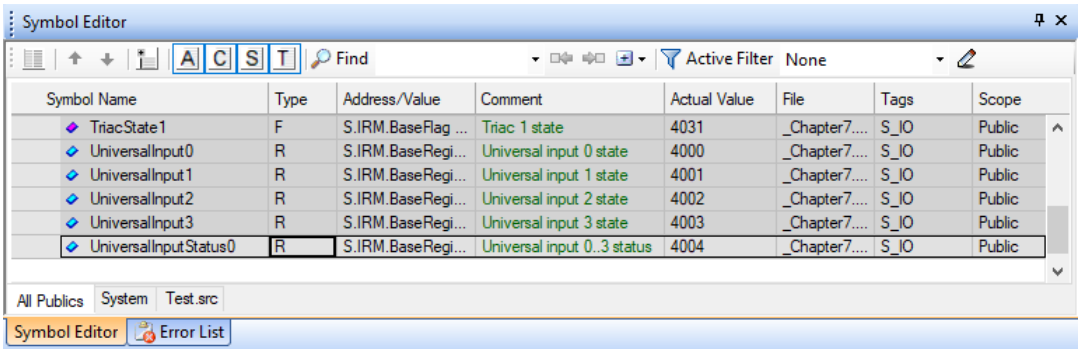
Temperature inputs:

Type	Status flag min./max.	Limits for range values
0 ... 10 V	- / -	10
0 ... 2.5 kΩ	0 / 2500	0 ... 2500
0 ... 10 kΩ	0 / 10,000	10000
0 ... 100 kΩ	0 / 100,000	0 ... 100,000
Pt1000 (-50…400°C)	-500 / 4000	-500 ... 4000
Ni1000 (-50…210°C)	-500 / 2100	-500 ... 2100
Ni1000L&S (-30…140°C)	-300 / 1400	–300 ... 1400

As soon as the min./max. values are reached, the min./max. status bit is set.



4.2.2.7 Status registers



An analogue value may exceed or fall below the defined value.
In order for the program to detect this, the “IO.UniversalInputStatus” registers are used.

An “IO.UniversalInputStatus” register contains four bytes, where each byte stands for the status of an analogue input exceeding or falling below the defined value.

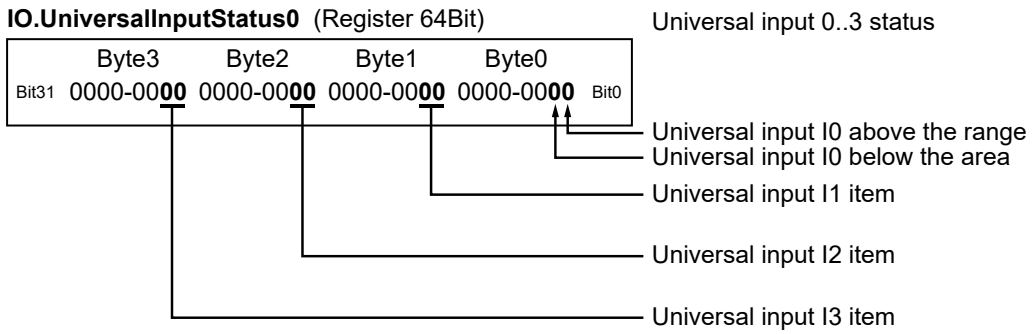
When there are more than four analogue inputs per system, more “IO.UniversalInputStatus” registers are used in proportion to the number of inputs. The registers are thus counted up from the address number 0 in the process.

IO.UniversalInputStatus0 (R with 4 bytes = status of 4 analogue inputs)
IO.UniversalInputStatus1 (R with 4 bytes = status of 4 analogue inputs)
... etc.

The status of the relevant bit0 of each byte in the “IO.UniversalInputStatus” register indicates whether a value has exceeded the upper range, or with bit1, the lower range.

The status registers are updated at the end of each COB.

The following figure shows the entire register in visual form:



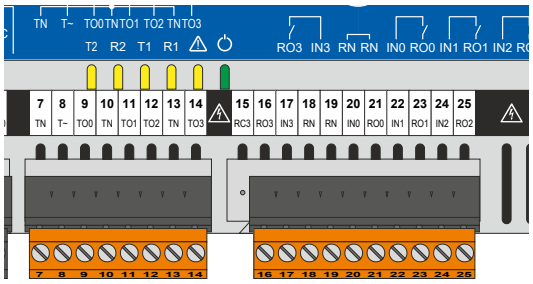
The Bit for below the area works only by mode Pt1000, Ni1000 and Ni1000L&S.

4.3 ROx/TOx - Digital outputs

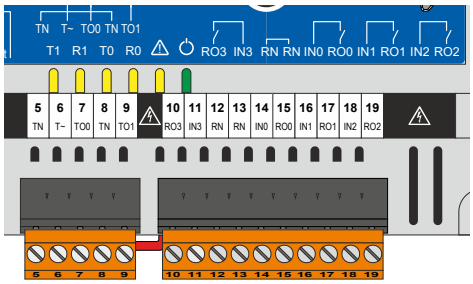
VDE guidelines do not permit different operating voltages to be mixed on relays and triacs.

Technical information	PCD7. LRLx-P5	PCD7. LRSx-P5
Number of digital outputs	8	6
Terminal block colour	Orange	
Plug-in screw-type terminals up to 2.5 mm²	yes	

PCD7LRLx-P5

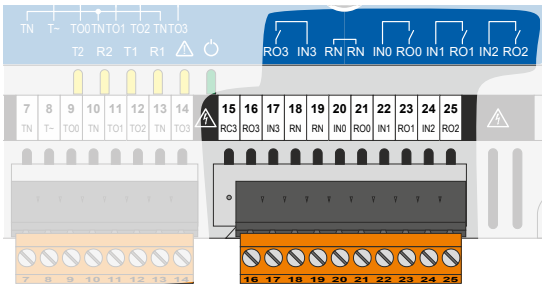


PCD7LRSx-P5

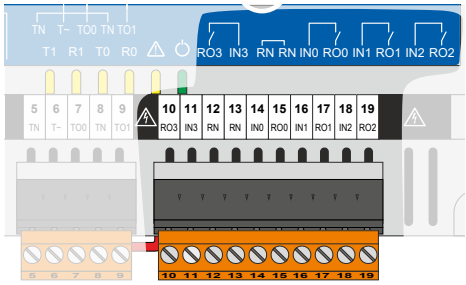


4.3.1 ROx - Relay outputs

PCD7LRLx-P5



PCD7LRSx-P5



Property	Type 1 (standard)	Type 2 (high switch-on current)	PCD7 LRLx-P5	PCD7. LRSx-P5
Number of relay ouputs			4	4
Terminal label Relay outputs for RSxx	RO0, RO1, RO2	RO3	no	yes
Terminal label Relay outputs for RLxx	RO1, RO2	RO0, RO3	yes	no
Contact	Normally open contact	Normally open contact	yes	yes
Min. load	5 VAC, 100 mA	24 VAC, 40 mA	yes	yes
Switching voltage range	5…253 VAC	24…253 VAC	yes	yes
Continuous load at 250 VAC (cos φ = 1)	4 A	10 A	yes	yes
Continuous load at 250 VAC (cos φ = 0.6)	4 A	10 A	yes	yes
Switch-on current (20 ms)	---	80 A	yes	yes

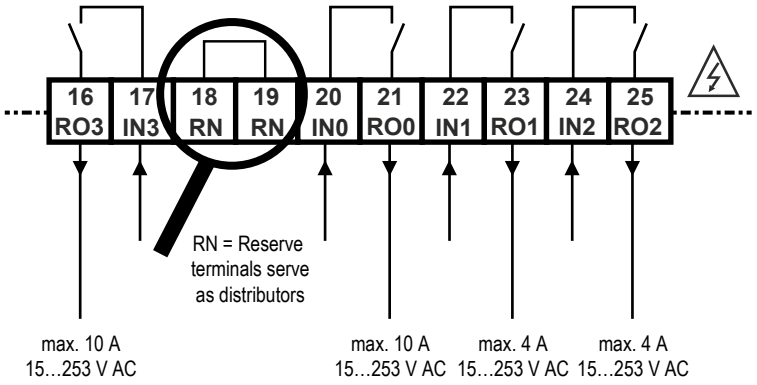
Property	Type 1 (standard)	Type 2 (high switch-on current)	PCD7 LRLx-P5	PCD7. LRSx-P5
Electrical endurance	70,000 cycles 4 A at 250 VAC (cosφ =1)	100,000 cycles 10 A at 250 VAC (cosφ =1)	yes	yes
Application	Fan motor, light	Switching of light, fan motor and electrical heater	yes	yes

If inductive components are connected to the relays and these relays switch more than once every two minutes, these components must not cause any harmful interference to radio or TV reception (conformity with EN 45014). Corresponding snubbers must be fitted on site.

4

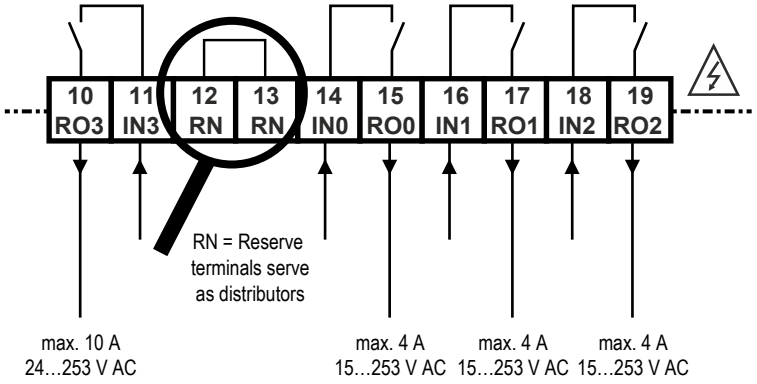
Connection schematic:

PCD7.LRLx-P5



OUTPUTS - RELAYS

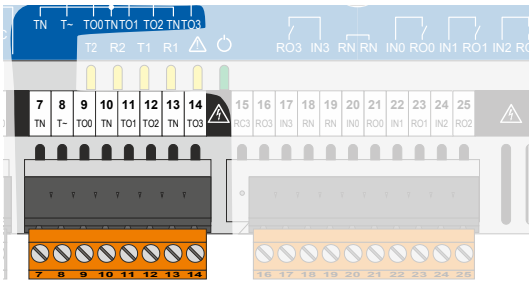
PCD7.LRSx-P5



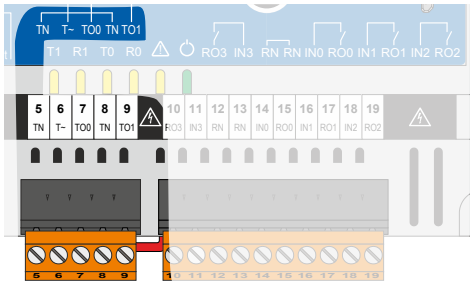
OUTPUTS - RELAYS

4.3.2 TOx - Triac outputs

PCD7LRLx-P5



PCD7LRSx-P5



Property	Type 3	
	PCD7.LRLx-P5	PCD7.LRSx-P5
Terminal label	TO0 … TO3	TO0 … TO1
Number of triac outputs	4	2
Switching voltage range	15…253 VAC	
Max. load per triac	600 mA*	
maximum current (sum of triac-outputs)	2400 mA	1200 mA
Application	Valves, lamps	

* To increase the switching capacity, triac outputs can be connected in parallel.

Recommended fuse (F1): 1.25 A slow-blow fuse (IEC). The user must take the correct voltage and max. switching capacity/interruption rate into account (a mains supply voltage is in critical need of a high switching capacity/interruption rate).

4.3.3 Current limitations for the terminal «24 VAC Out»

The following applies to 230 VAC versions of the controller if the triacs are supplied with 24 VAC supply voltage from the controller's internal transformer:

➔ Maximum 300 mA (or 320 mA for max. 2 minutes), i.e. one thermal drive for heating and one thermal actuator for cooling can be operated at maximum (provided that the heating and cooling do not take place at the same time).

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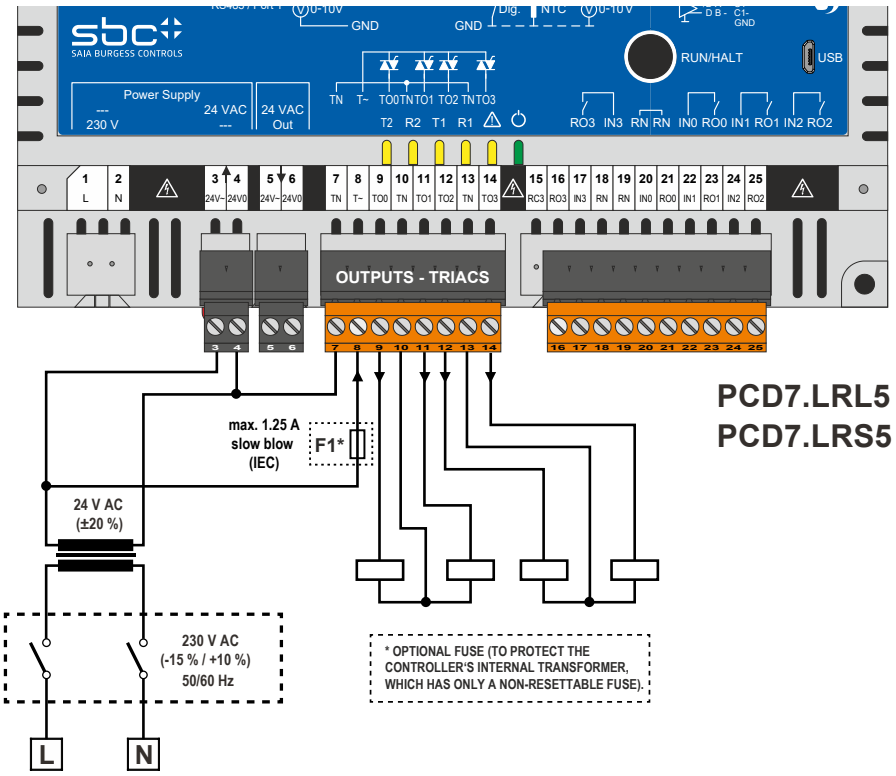
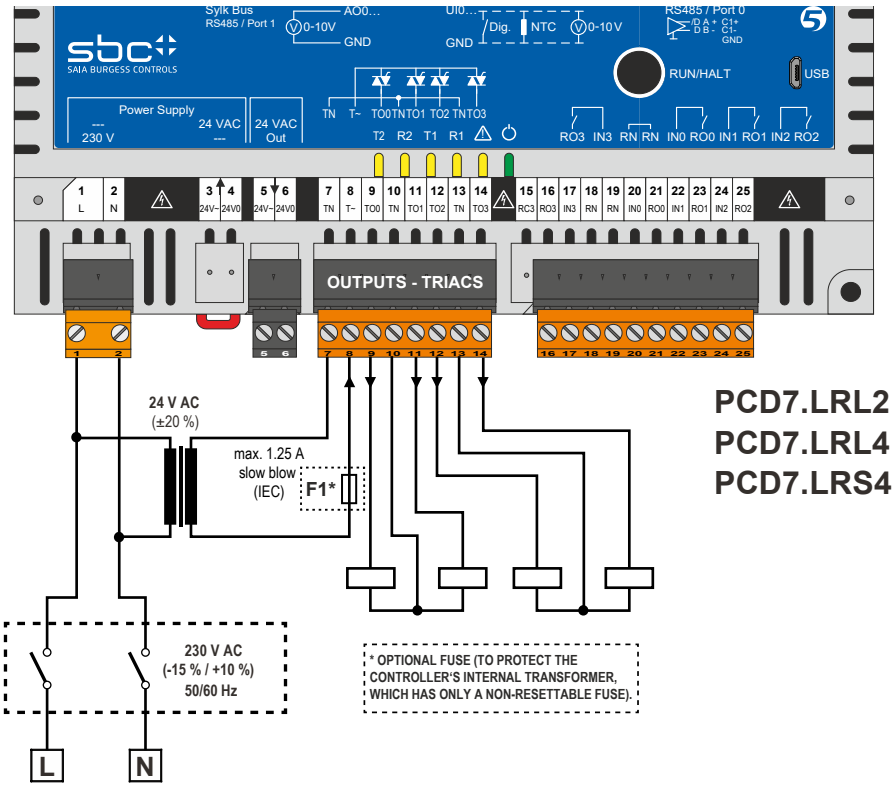
4.3.4 Connection examples for Triac Outputs

4.3.4.1 Triac outputs 24VAC external power supply

Power supply for triac outputs with external 24 VAC supply (if the connected valves have a simultaneous total power consumption higher than 300 mA).



PCD7.LRL5
PCD7.LRS5

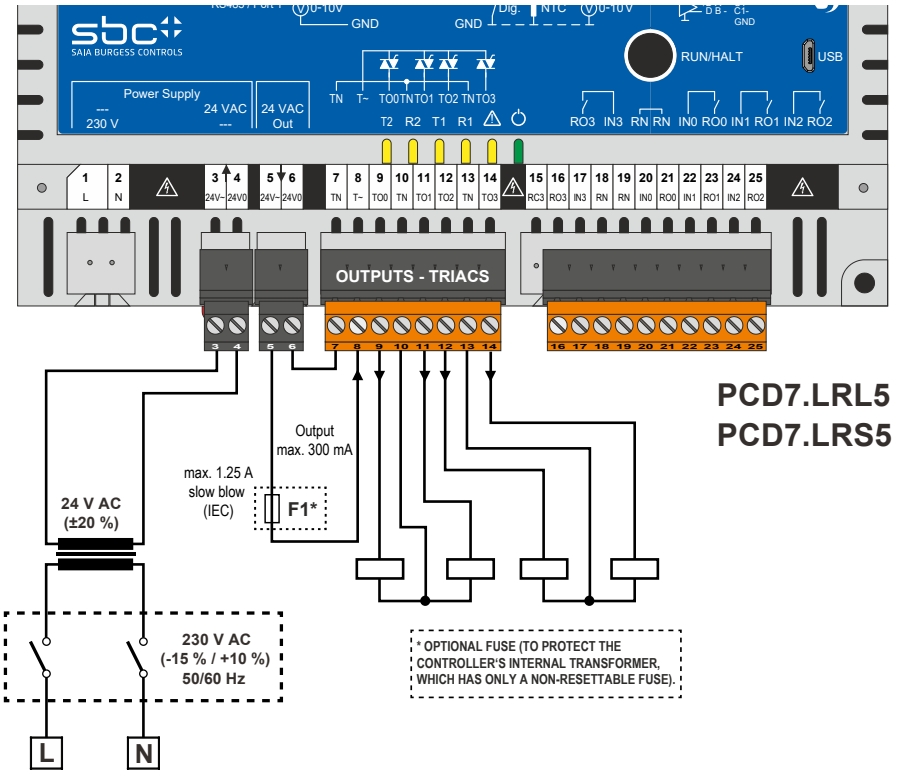


PCD7.LRL2
PCD7.LRL4
PCD7.LRS4

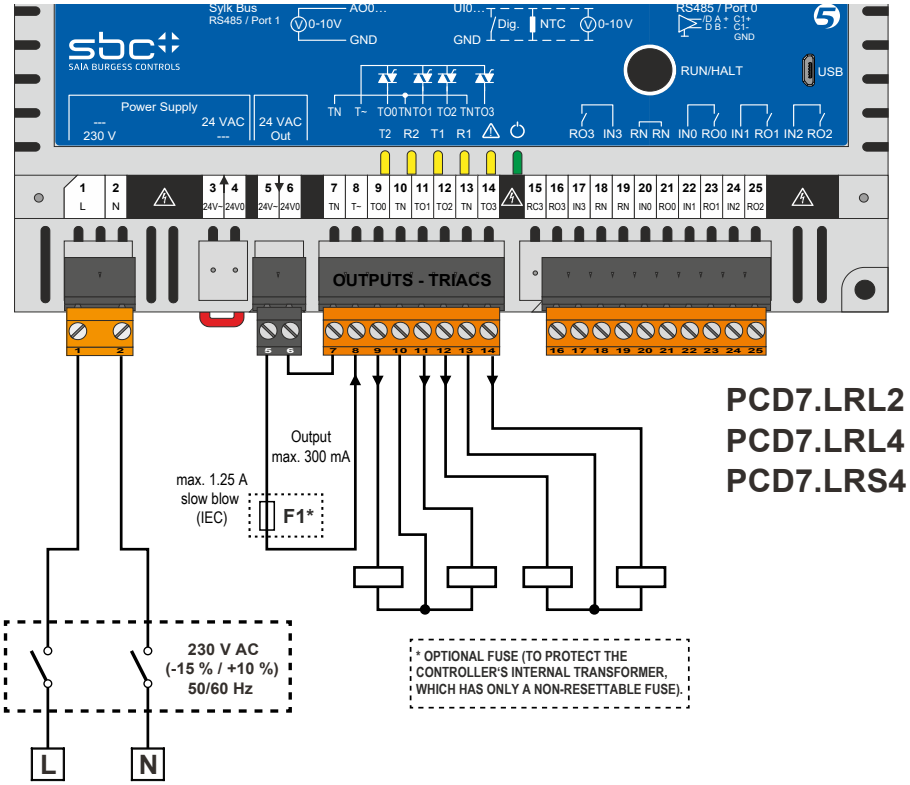
4

4.3.4.2 Triac outputs 24VAC internal powered

Switching currents for the triac outputs are supplied by the controller's internal transformer when the connected valves have a smaller simultaneous total power consumption than 300 mA.

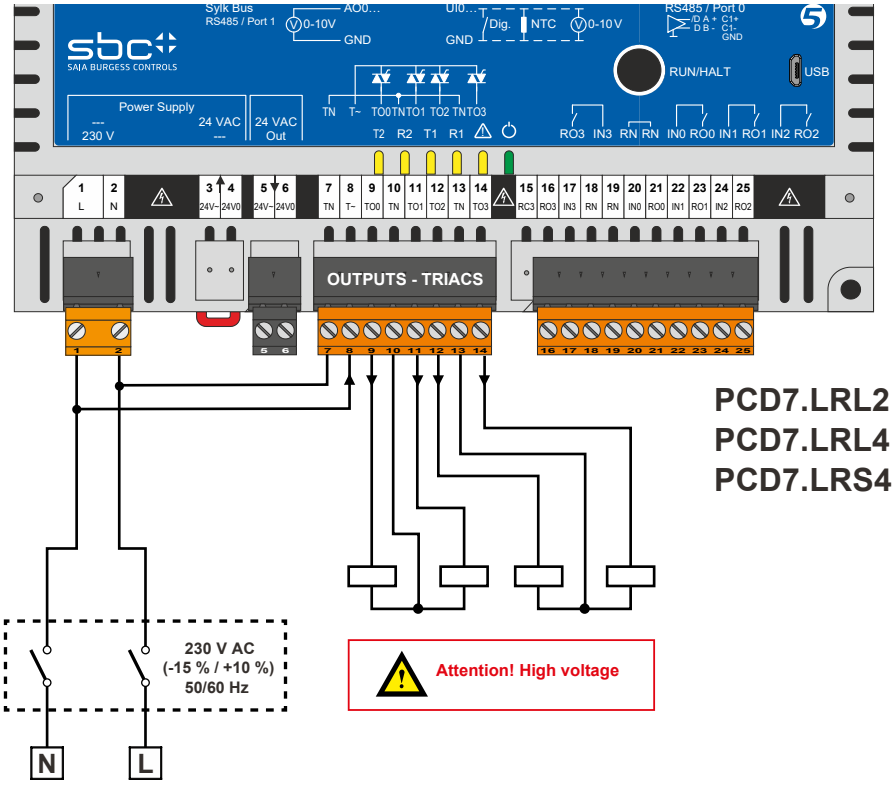


PCD7.LRL5
PCD7.LRS5



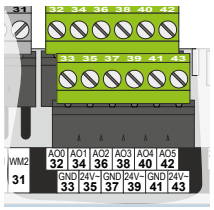
PCD7.LRL2
PCD7.LRL4
PCD7.LRS4

4.3.4.3 Triac outputs 230VAC external power supply

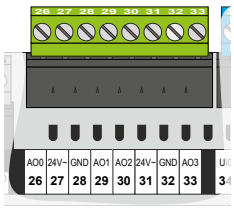


4.4 AOx - Analogue outputs

PCD7LRLx-P5



PCD7LRSx-P5



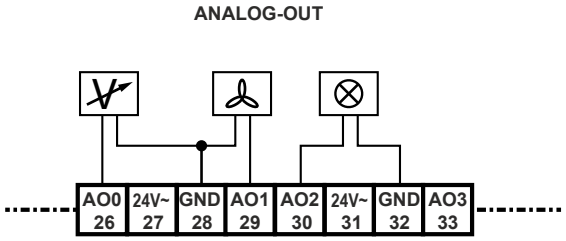
Technical information	PCD7		
	LRL2-P5	LRL4-P5	LRSx-P5
Number of analogue outputs	2	6	4
Terminal block colour	Green		
Plug-in screw-type terminals up to 2.5 mm2	yes		
Usage as ..	**Type 4**	**Type 5**	**Type 6**
Output voltage	0…10 V		
Output current	0…1 mA	0…5 mA	0…10 mA
Min. accuracy	±150 mV		
Max. ripple	±100 mV		
Accuracy at zero point	0…10 V		

The analogue outputs of the PCD7.LRLxx controller (large housing) are protected against voltages of max. 29 VAC and 30 V DC (e.g. against incorrect wiring).

Connecting 24 VAC to any of the analogue outputs of the PCD7.RSxx controller (small housing) damages the device.

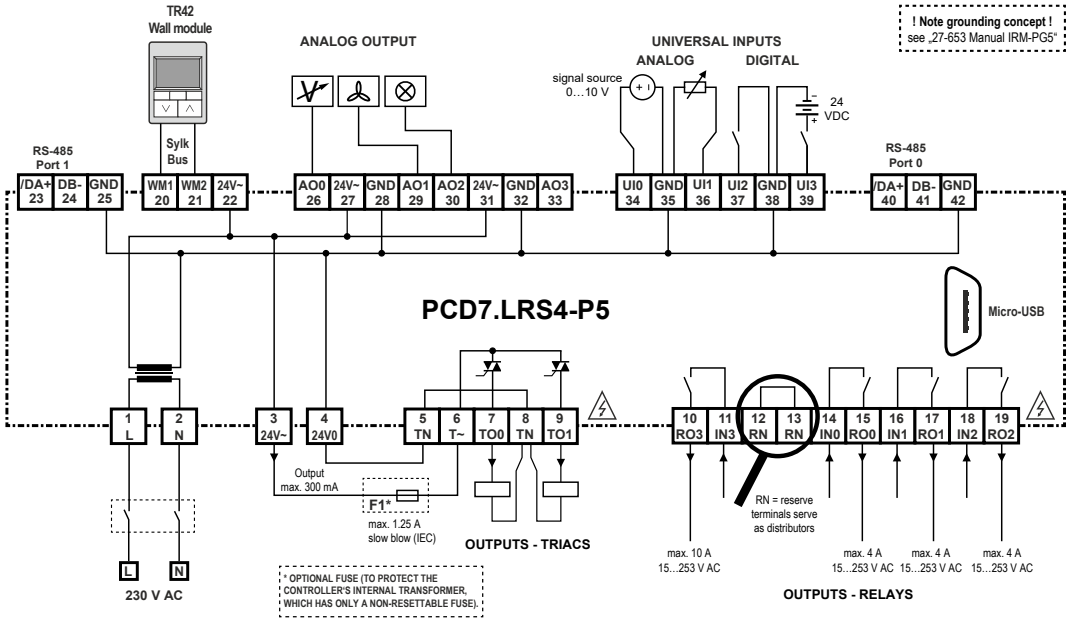
Connection schematic:

PCD7.LRLx-P5 / PCD7.LRSx-P5

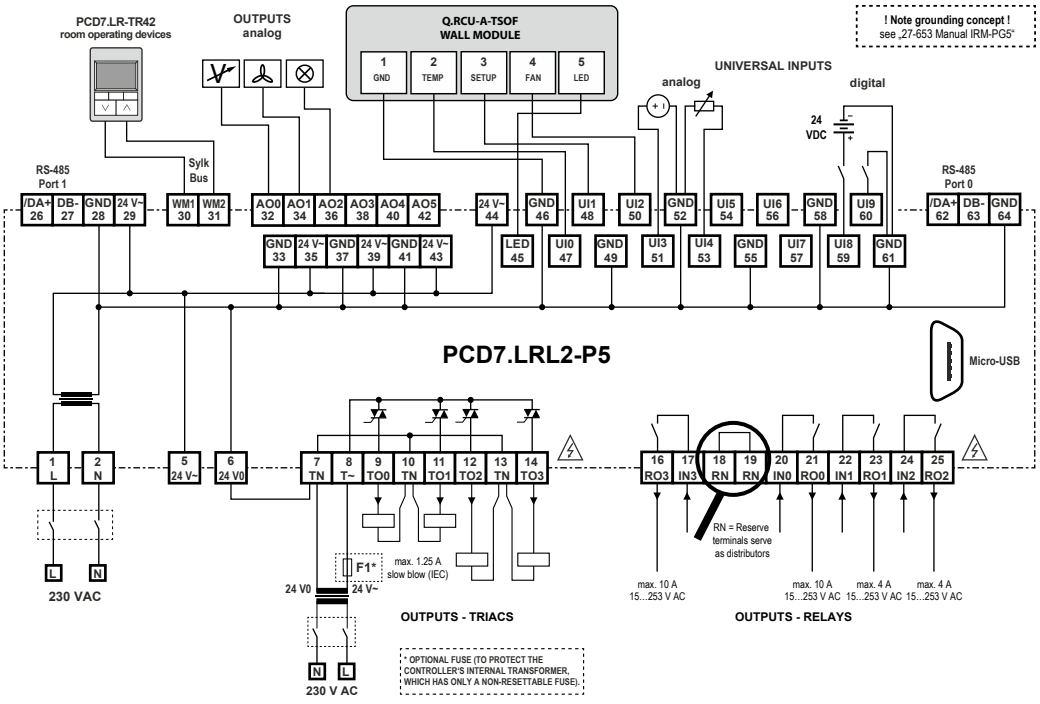


4.5 Connection examples

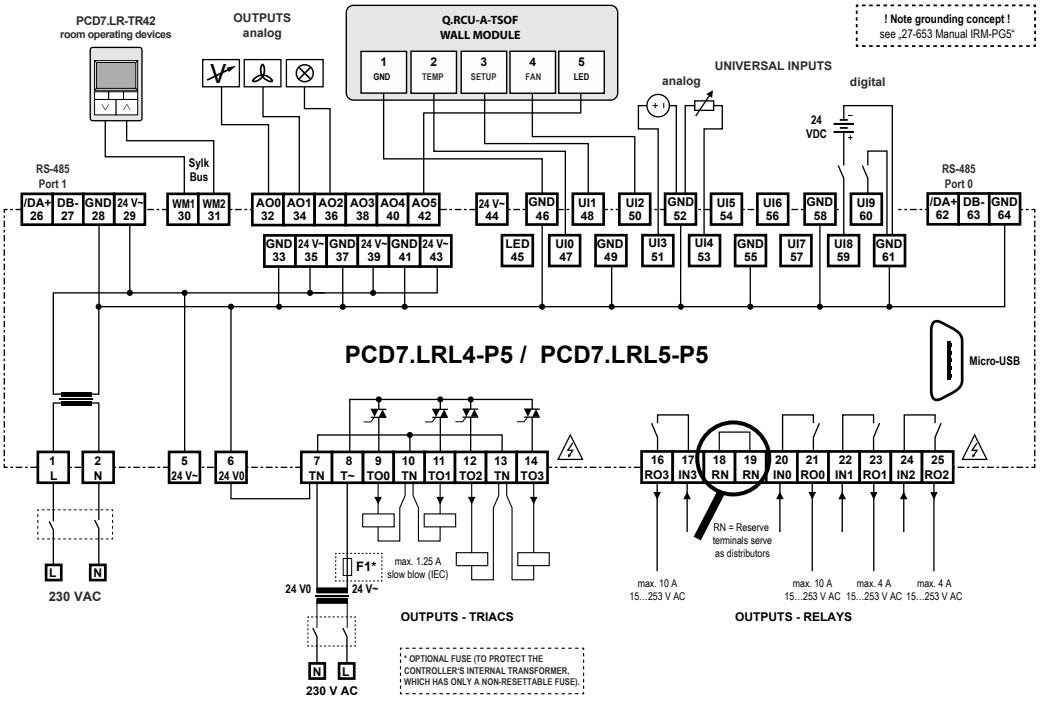
The following two examples show possible connections for the large and small controllers.



PCD7.LRS4-P5 sample wiring internally powered



Example wiring PCD7.LRL2-P5 with wall module Q-RCU-A-TSOF (LED at terminal 45).

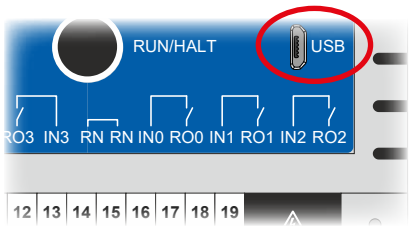


Example wiring PCD7.LRL4-P5 / PCD7.LRL5-P5 with wall module Q-RCU-A-TSOF (eg: LED at terminal 42).

5 Communication interfaces

The term “communication interface” will be referred to as a “port” starting from this point in this manual, for the sake of simplicity.

5.1 PGU (Micro-USB port) programming interface



Connector: Micro-USB type B (device connector)

Standard: USB 1.1 device (slave), full speed 12 Mbps, with SoftConnect

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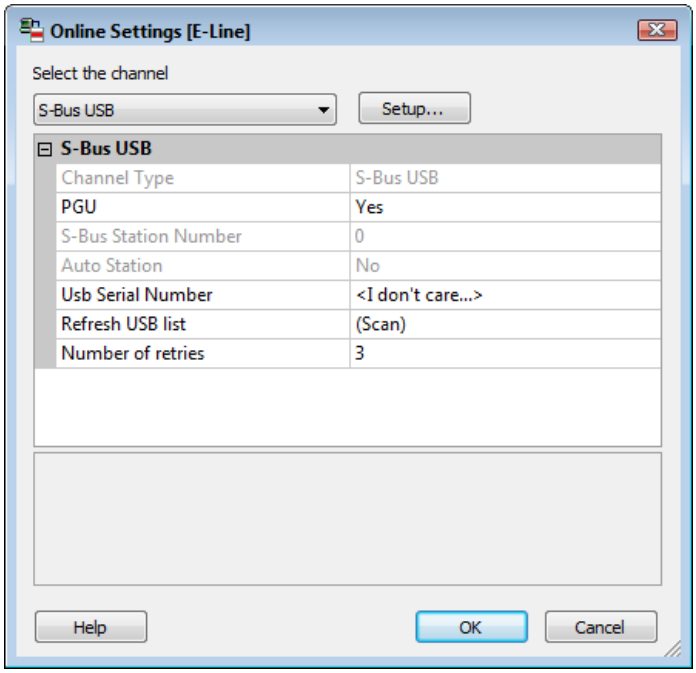
The USB port is only used as the PGU interface. In order to use the USB interface, the PG5 program suite version 2.3 or higher must be installed on the PC.

If a PCD7.LRxx-P5 is connected to a PC via the USB port for the first time, the PC operating system (Windows) automatically installs the corresponding USB driver. The PCD7.LRxx-P5 is connected via USB by defining the following setting in the PG5 project folder on the device in question under “Online Settings”:



Activating the “PGU Option” ensures the PC can connect directly with the PCD7. LRxx-P5, regardless of the configured S-Bus address.

5.2 Using the SBC S-Bus protocol

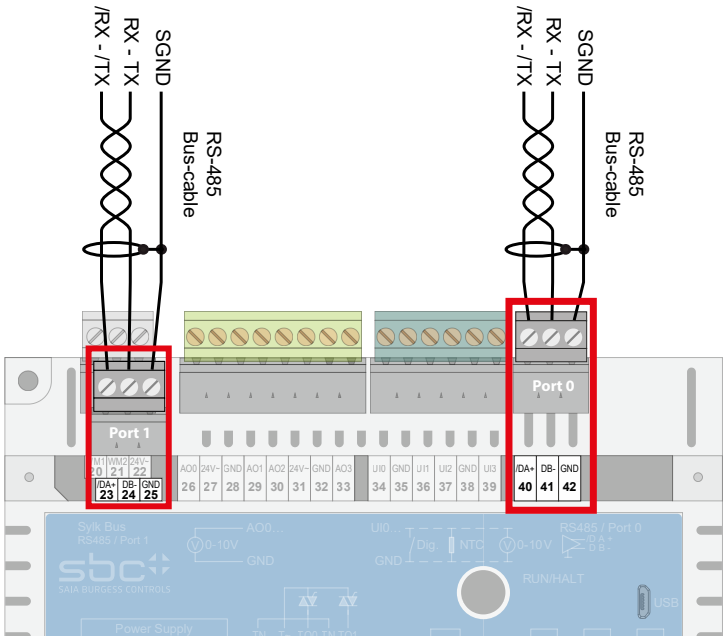
The SBC S-Bus stands for the proprietary communication protocol of the Saia PCD®. More information can be found in the manual “26-739_DE_Handbuch_SBC-SBus.pdf”.

The SBC S-Bus is essentially designed for communication with the engineering and debugging tools, as well as connecting management levels/process control systems/room controllers.
It is not suitable or approved for the connection of field devices from different manufacturers. In this case, an open and manufacturer-independent fieldbus is more practical.

5.3 RS-485 interfaces (ports 0 + 1) in general

Up to two RS-485 interfaces can be used independently without additional hardware.

S-Bus and Modbus communication modes can be implemented via port 0 and/or port 1.

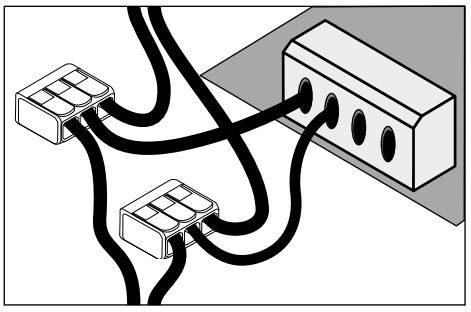


RS-485 terminals for port 1 and port 0

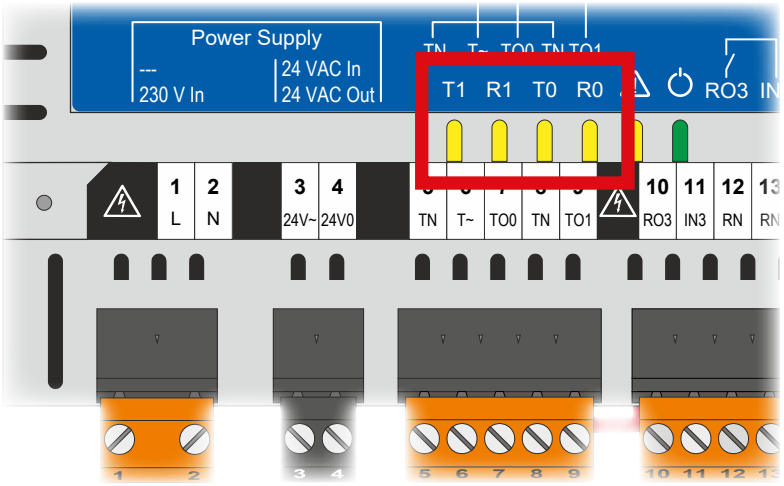
All PCD7.LRxx-P5 room controller communication/signal terminals (except for the Sylk bus – see following table) support cables with 1 × 2.5 mm² or 2 × 1.5 mm².

Each of the two bus lines are connected to each other as shown, e.g. using a three-connection terminal (including a connection cable for this cable group and its mounting on the connection block).

Deviating from this rule can lead to a faulty electrical connection. Local wiring regulations can take precedence over this recommendation.



Wire terminal example



LEDs for RS-485 port 1 and port 0

The LEDs shown above indicate the data communication on the RS-485 port in question.

Tx = send

Rx = receive

(x stands for the port number)

Ensure that the AC cables are separated from the signal wiring!

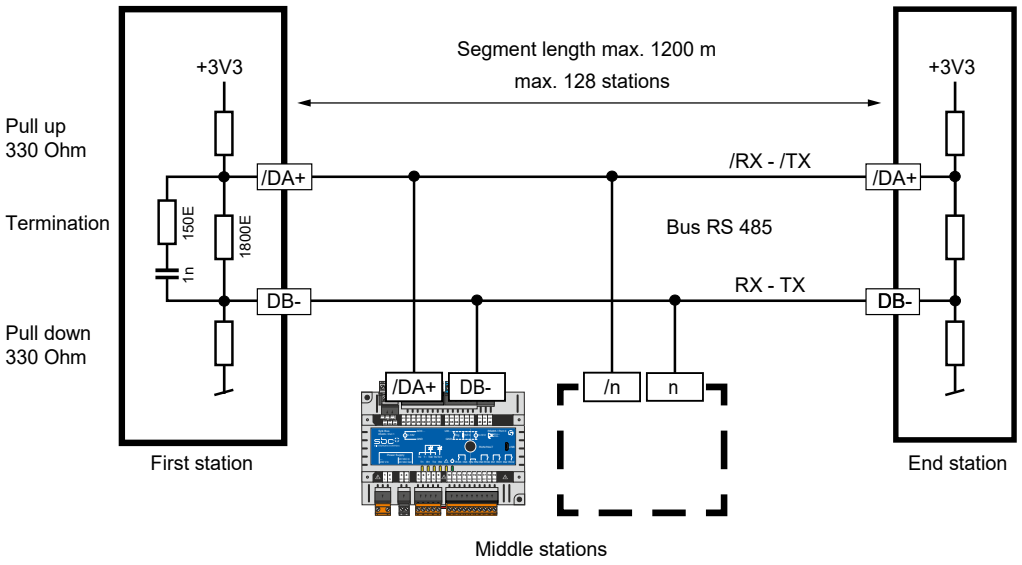
5.3.1 Schematic diagram of a PCD7.LRxx-P5 room controller in an RS-485 bus with terminating resistors

An RS-485 bus must be terminated at both ends of its cable with terminating resistors (see following figure). Since the PCD7.LRxx-P5 devices do not provide this termination, it must be provided using other devices.

S-Bus cables must be connected in a line topology. Stubs are not allowed, and both ends of the cable must be terminated with a resistor (approx. 120 Ω) between the D and /D cables. The best signal quality is achieved through active bus termination, each with a resistance to +5 V and GND.

Devices that can do this on both sides of the S-Bus cable without much effort are:

- ► All Saia PCD® CPUs
- ► Termination boxes PCD7.T161 (230 VAC) or PCD7.T162 (24 V DC)
- ► Third-party devices with this function are suitable for this purpose.



More details on topics such as cable quality etc. can be found in
“26-740_Manual_RS-485-Components”
(available at www.sbc-support.com)

5.3.2 Bus cable for serial S-Net (S-Bus/RS-485)

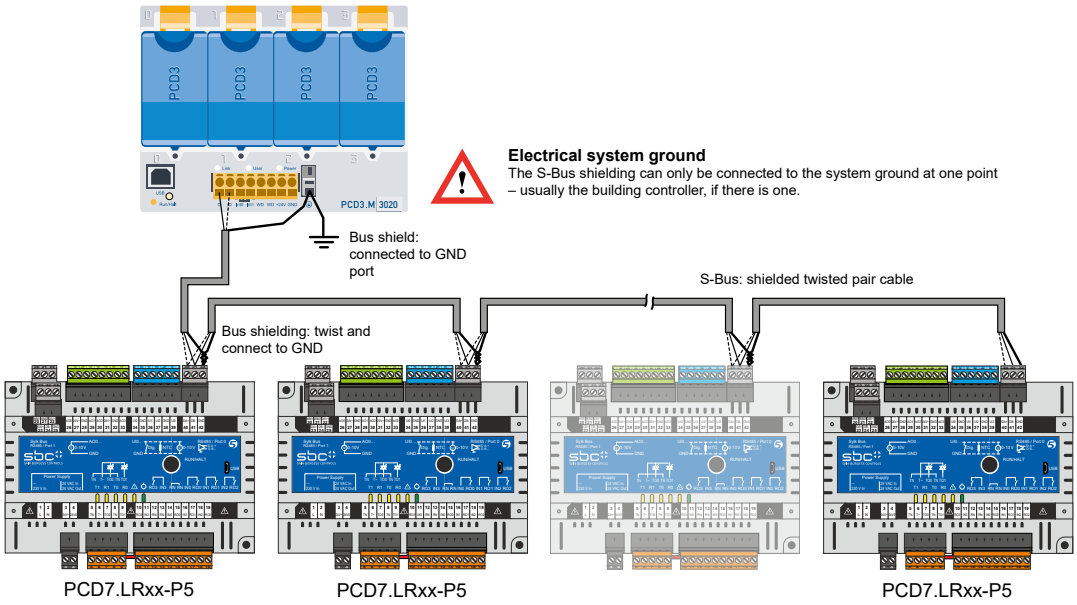
A two-wire, twisted and shielded bus cable with cable strands of at least 0.5 mm^2 must be used.

Further information on S-Bus communication-modus can be found in
“26-739_Manual_SBC-SBus”
(available at www.sbc-support.com).

5

5.3.3 Requirements for the S-Bus (RS-485) shielding

The shielding for each S-Bus segment can only be connected to the electrical system ground at one point. The following shows an example using a PCD3 as a master station.

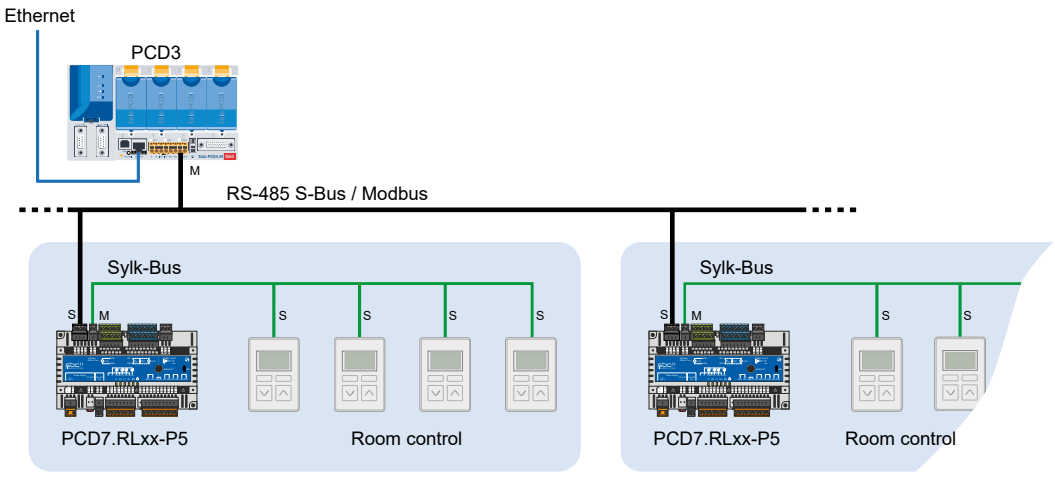


To avoid problems with large differences in potential between the room controllers, the shielding of the S-Bus cable should be connected to the GND of the room controllers.

5.3.4 RS-485 interface port0

Example of a larger network in home automation

Port0 is recommended as a standard connection with superordinate master PCD.

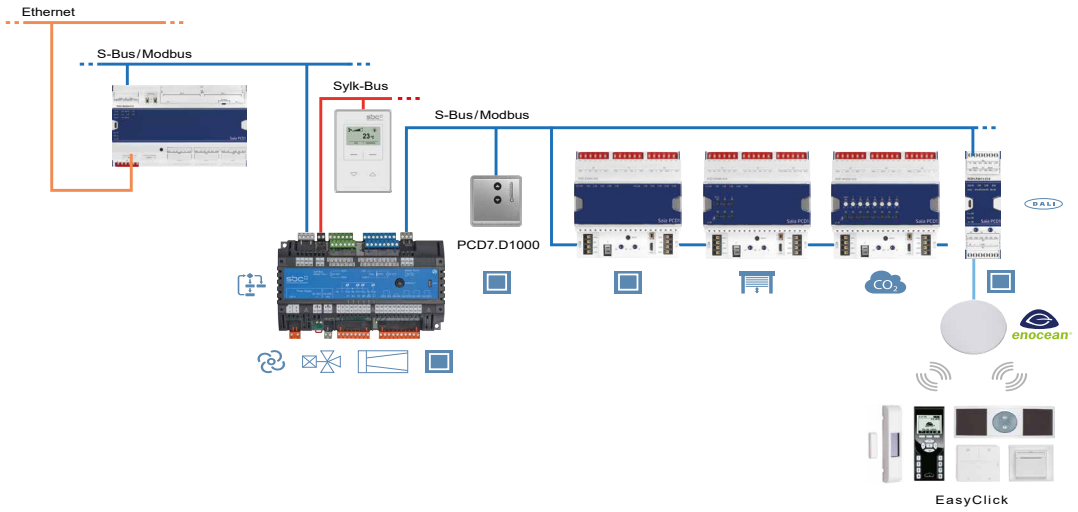


5.3.5 RS-485 interface port 1

Port 1 is recommended, among other things, as an I/O extension and a connection for room operating devices.

5.3.5.1 Sample system architecture for I/O extension

A second RS-485 interface can be used to connect E-Line RIO modules for I/O extension for HVAC, light or shade control. This makes it possible to create cross-plant room automation functions and thus attain the highest possible class of energy efficiency in accordance with DIN EN 15232, significantly reducing energy costs while at the same time ensuring a high degree of comfort.



5.3.5.2 Limitations for I/O extension with E-Line modules

No more than 10 S-Bus slaves or 10 Modbus slaves, such as E-Line modules, can be connected via the second RS-485 interface of the PCD7.LRxx-P5 room controller.

The following points must be observed in order to determine the feasible amount of S-Bus/Modbus slaves:

- Bus cycle time => use only for HVAC, lighting or blinds
- Application program resource requirement:
  The more E-Line modules connected to the second RS-485 interface of the PCD7.LRxx-P5, the less memory space there is for the application program.

Resource requirement for different E-Line modules (FBoxes) on a master PCD7.
LRxx-P5 room controller:

E-Line functions (FBoxes)	Registers	Flags	Program size	Size of RAM data blocks	DB RAM
			[Lines] *	[Byte]	
EL + S-Bus master	196	119	547	2064	2
PCD1.A1000	54	124	1753	168	1
PCD1.A2000	40	90	1493	120	1
PCD1.B1000	38	127	1315	60	1
PCD1.B1010	38	147	1315	60	1
PCD1.B1020	32	91	1147	36	1
PCD1.B5000	37	72	1433	112	1
PCD1.B5010	37	72	1433	112	1
PCD1.E1000	42	45	687	60	1
PCD1.G2000	70	58	2177	200	1
PCD1.G2100	44	33	957	108	1
PCD1.G2200	76	62	1929	208	1
PCD1.G5000	84	135	2191	196	1
PCD1.G5010	121	111	2415	276	1
PCD1.G5020	106	95	2391	276	1
PCD1.W5200	94	82	1722	172	1

* Program line corresponds to four-byte memory.

These tables are developed from measurements for library E-Line 1.3.007; any adjustment to the library may result in a deviation from the estimates below.

This data is provided as an estimate; they are not exact values.

Example 1:

What is the resource requirement for a network with a PCD7.LRxx-P5 room controller with one:

1× HVAC (for one zone)	room template application
1× PCD7.LRxx-P5	room controller
2× PCD1.E1000-A10	digital inputs
2× PCD1.A1000-A20	digital outputs
2× PCD1.A2000-A20	digital outputs
2× PCD1.G2200-A20	digital inputs and outputs
2× PCD1.W5200-A20	analogue outputs

E-Line FBoxes	Registers	Flags	Program size	Size of RAM data blocks	DB RAM	Non-volatile data (in flash)
			[Byte]	[Byte]		[Flags or registers]
One HVAC room template	700	500	35404			250
EL + S-Bus master	196	119	2188	2064	2	
2× PCD1.A1000	108	248	14024	336	2	
2×PCD1.A2000	80	180	11944	240	2	
2×PCD1.G2200	152	124	15432	416	2	
2× PCD1.W5200	188	164	13776	344	2	
2× PCD1.E1000	84	90	5496	120	2	
Necessary resources	1508	1425	98264	3520	12	250
% usage of PCD7.LRxx-P5	38%	36%	77%	35%	12%	25%

In this example, for one zone with 10 E-Line RIOs, the critical resource would be the program size, where only approximately 20 kB of the user program is left for implementing the E-Line RIO logic and serving as the flash for non-volatile data storage of flags or registers from the application program.

Example 2:

What is the resource requirement for a network with a PCD7.LRxx-P5 room controller with four HVAC room template applications (for four zones):

4× HVAC (for four zone)	room template application
1× PCD7.LRxx-P5	room controller
1× PCD1.E1000-A10	digital inputs
1× PCD1.A1000-A20	digital outputs
1× PCD1.G2000-A20	digital/analogue inputs and outputs
3× PCD1.B5000-A20	digital/analogue inputs and outputs

E-Line FBoxes	Registers	Flags	Program size	Size of RAM data blocks	DB RAM	Non-volatile data (in flash)
			[Byte]	[Byte]		[Flags or registers]
4 HVAC room templates	1700	1400	70444			866
EL + S-Bus master	196	119	2188	2064	2	
3× PCD1.B5000	111	216	17196	336	3	
1× PCD1.G2000	70	58	8708	200	1	
1× PCD1.A1000	54	124	7012	168	1	
Necessary resources	2131	1917	105548	2768	7	866
% usage of PCD7.LRxx-P5	53%	48%	82%	28%	7%	87%

In this example, for four zones with five E-Line RIOs, the critical resource would be the program size, where only approximately 14 kB of the user program is left for implementing the E-Line RIO logic and serving as the flash for non-volatile data storage of flags or registers from the application program.

5.3.5.3 Recommendations for use with lighting or blind control

When switching lighting or blind outputs, the response times should not be more than 250 ms so that a switching command will not be perceived as delayed.

The following points must be observed to achieve this:

- S-Bus/Modbus setting 115 kbit/s
- only E-Line modules on second RS-485 (e.g. no energy counters)
- no more than four E-Line modules on the second RS-485
- disable the manual operating level for E-Line modules
- the user program must not be too big so that the PCD7.LRxx-P5 room controller can still process at least 14 cycles per second. This can be achieved with a normal program of max. 60 kB (approx. 40 Fupla pages filled as normal).

Enabling the manual operating level for the E-Line modules would require additional telegrams, thus limiting the maximum number of E-Line modules to two to still be able to achieve the 250 ms response times.

If manual commands are nevertheless required, “read cyclically” should be configured instead of “continuous”.

Performance example:

Application: with two rooms for fan coil application and four on/off lighting groups and four blinds with slat adjustment and disabled manual operating level

- 2× HVAC room template applications in PCD7.LRxx-P5 room controller
- 1× PCD1.E1000-A10 with four inputs for light on/off switch and eight inputs for two rocker switches for blinds
- 1× PCD1.A2000-A20 with four relays for light on/off and two relays for one set of blinds
- 1× PCD1.A2000-A20 with six relays for three blinds
- 1× PCD1.B5000-A20 with three relays for second fan coil

In this configuration, the PCD7.LRxx-P5 room controller can process 16 cycles/second, and a response time of max. 250 ms between the press of a switch and the output switching can still be achieved.

If more lighting or blind outputs are required, another option would be to use the programmable E-Line modules for lighting and blind switching and to use their inputs for connecting the switches/buttons.

It is not a good idea to establish a master/slave connection between two (or more) PCD7.LRxx-P5 controllers for lighting or blind outputs. The response time between pressing the switch on one controller and an output’s response on another controller (and its connected E-Line RIO) would usually be greater than 250 ms, due to the communication cycle time.

5.3.5.4 DALI with E-Line (PCD1.F2611-C15 module)

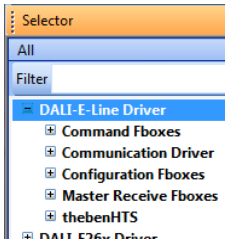
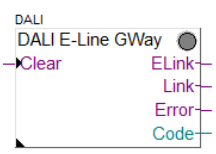
The freely programmable module with a housing width of 35 mm (2 HP) can be controlled via RS-485 and enables the direct control of 64 DALI subscribers. It has the DALI line as well as four digital inputs. The user can implement the digital inputs to connect electrical sensors.

The DALI module cannot be configured via the PCD7.LRxx-P5 room controller.

The configuration FBox for the PCD1.F2611 DALI module requires more memory than the PCD7.LRxx-P5 possesses.

The DALI module must therefore be configured via the PCD plant controller with the gateway FBox.

It is, however, possible to send DALI commands from the PCD7.LRxx-P5 controller.

DALI library	DALI E-Line driver library	E-Line gateway driver
The DALI master module supports up to 64 DALI devices, including the bus power supply. The extensive PG5 Fbox library provides function blocks for commissioning, operation and service for the PLC program. The “DALI E-Line driver” library is contained in the “DALI F26xx driver” library. Only smaller DALI controls can be implemented with the PCD1.F2611-C15 E-Line DALI module.		

Further information, including which FBoxes are supported, “Getting started”, etc., can be found on our support page www.sbc-support.com.

5.4 Modbus on PCD7.LRxx-P5 RS-485 interfaces

Supported Modbus protocol	Modbus/RTU
Supported Modbus functionality	Modbus client and Modbus server*
Supported baud rates	1.2 kbps, 2.4 kbps, 4.8 kbps, 9.6 kbps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps
Supported data formats (Bits-Parity-Stop)	8-N-1 8-O-1 8-E-1 8-N-2 8-O-2 8-E-2
Supported IRM ports	Port 0 and 1
Possible to use at the same time	- one port as Modbus client and the other as Modbus server - both ports as Modbus client - both ports as Modbus server
Supported Modbus functions	**Function Code** / **Description** 1 / Read Coils 3 / Read Multiple Holding Registers 15 / Write Multiple Coils 16 / Write Multiple Holding Registers
Access with Modbus to PCD7.LRxx-P5 media	All registers and flags

* 7 data bit mode is not supported.

5.4.1 Limitations

- Only default mapping from PCD registers/flags to Modbus holding registers/ coils is supported, user-specific mapping is NOT implemented. The FBoxes ‘Define Mapping Binary/Float/Integer’ are not supported.
- Access to all PCD registers/flags over Modbus, not possible to prevent access over Modbus to individual registers or flags
- Access to other media like timer/counter/DB/text is not possible.
- Only one “Def Unit Server” FBox can be placed.
- For the Def Unit Server FBox, only the FIX UID is supported; the offset, 32-bit swap, 32-bit holes and active default mapping are NOT implemented.

5.4.2 Addressing

Coils

You can use standard Modbus functions 1 and 15 for reading/writing media flags, using the same address.
This means the PCD FBox read/write BIN just reads/writes flags at the given address.

Modbus coils (C0..C4040) are mapped to PCD Flags (F0..F4040)

Modbus Coils Address	PCD Flags Address
C0	F0
C1	F1
C2	F2
…	…
C4040	F4040

Holding Registers

The media register area is seen by Modbus as an array of 16-bit holding registers.

As the size of the media registers (used internally by the PCD) is 32 bits and Modbus uses only 16-bit registers, 2 Modbus holding registers are needed for each PCD register:

Modbus Holding Registers (HR0..HR8051) are mapped to
PCD Register (R0..R4025)

Modbus Holding Registers Address (16 bits)	PCD Media Registers Address (32 bits)
HR0	R0
HR1	
HR2	R1
HR3	
...	...
...	
HR8050	R4025
HR8051	

If the Modbus master supports 32-bit read/write, it is easier to use.

When reading or writing media registers with Modbus, the main point is that you need to multiply the register address by 2.

E.g. the Modbus PCD FBox for a 32 bits signed integer must read on even addresses (with any length value):

1. Address 0, length 1 will copy R0 in Rbase
2. Address 2, length 1 will copy R1 in Rbase
3. Address 4, length 1 will copy R2 in Rbase

If only 16-bit accesses are supported (Modbus standard), you must read/write 2 consecutive holding registers starting at an even address, with an even length. E.g. with the Modbus PCD FBox for a 16 bits signed integer:

1. Address 0, length 4 will copy
   HR0 in Rbase,
   HR1 in Rbase+1,
   HR2 in Rbase+2,
   HR3 in Rbase+3

2. Address 2, length 2 will copy
   HR2 in Rbase,
   HR3 in Rbase+1

5.4.3 Media Mapping

PCD7.LRxx-P5

The following tables are a complete and detailed view, including Modbus addressing.

Modbus-Coils / PCD-Flags

	PCD7.LRL2-P5		PCD7-LRL4-P5		PCD7.LRL5-P5		PCD7.LRS4-P5		PCD7.LRS5-P5	
Description	Modbus coil address	PCD flag address	Modbus coil address	PCD flag address	Modbus coil address	PCD flag address	Modbus coil address	PCD flag address	Modbus coil address	PCD flag address
PLC variables	0	0	0	0	0	0	0	0	0	0
	...	...	...	...	...	...	...	...	...	...
	3999	3999	3999	3999	3999	3999	3999	3999	3999	3999
Universal Input 0	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Universal Input 1	4001	4001	4001	4001	4001	4001	4001	4001	4001	4001
Universal Input 2	4002	4002	4002	4002	4002	4002	4002	4002	4002	4002
Universal Input 3	4003	4003	4003	4003	4003	4003	NA	NA	NA	NA
Universal Input 4	4004	4004	4004	4004	4004	4004	NA	NA	NA	NA
Universal Input 5	4005	4005	4005	4005	4005	4005	NA	NA	NA	NA
Universal Input 6	NA	NA	4006	4006	4006	4006	NA	NA	NA	NA
Universal Input 7	NA	NA	4007	4007	4007	4007	NA	NA	NA	NA
Universal Input 8	NA	NA	4008	4008	4008	4008	NA	NA	NA	NA
Universal Input 9	NA	NA	4009	4009	4009	4009	NA	NA	NA	NA
...	...	...	...	...	...	...	...	...	...	...
Relay 0	4020	4020	4020	4020	4020	4020	4020	4020	4020	4020
Relay 1	4021	4021	4021	4021	4021	4021	4021	4021	4021	4021
Relay 2	4022	4022	4022	4022	4022	4022	4022	4022	4022	4022
Relay 3	4023	4023	4023	4023	4023	4023	4023	4023	4023	4023
...	...	...	...	...	...	...	...	...	...	...
Triac 0	4030	4030	4030	4030	4030	4030	4030	4030	4030	4030
Triac 1	4031	4031	4031	4031	4031	4031	4031	4031	4031	4031
Triac 2	4032	4032	4032	4032	4032	4032	NA	NA	NA	NA
Triac 3	4033	4033	4033	4033	4033	4033	NA	NA	NA	NA
...	...	...	...	...	...	...	...	...	...	...
LED Output	4040	4040	NA	NA	NA	NA	NA	NA	NA	NA

The status of universal inputs (addresses 4000 to 4009) are only available in digital mode (Digital in & Dry contact).

Registers - PCD Variables

	PCD7.LRL2-P5		PCD7-LRL4-P5		PCD7.LRL5-P5		PCD7.LRS4-P5		PCD7.LRS5-P5	
Description	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address
PLC variables	0	0	0	0	0	0	0	0	0	0
	1		1		1		1		1	
	2	1	2	1	2	1	2	1	2	1
	3		3		3		3		3	
	...	...	...	...	...	...	...	...	...	...
	...		...		...		...		...	
	7998	3999	7998	3999	7998	3999	7998	3999	7998	3999
	7999		7999		7998		7999		7999	

Registers - Universal Inputs

	PCD7.LRL2-P5		PCD7-LRL4-P5		PCD7.LRL5-P5		PCD7.LRS4-P5		PCD7.LRS5-P5	
Universal Input	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address
UI 0	8000	4000	8000	4000	8000	4000	8000	4000	8000	4000
	8001		8001		8001		8001		8001	
UI 1	8002	4001	8002	4001	8002	4001	8002	4001	8002	4001
	8003		8003		8003		8003		8003	
UI 2	8004	4002	8004	4002	8004	4002	8004	4002	8004	4002
	8005		8005		8005		8005		8005	
UI 3	8006	4003	8006	4003	8006	4003	8006	4003	8006	4003
	8007		8007		8007		8007		8007	
UI 4	8008	4004	8008	4004	8008	4004	NA	NA	NA	NA
	8009		8009		8009		NA		NA	
UI 5	8010	4005	8010	4005	8010	4005	NA	NA	NA	NA
	8011		8011		8011		NA		NA	
UI 6	NA	NA	8012	4006	8012	4006	NA	NA	NA	NA
	NA		8013		8013		NA		NA	
UI 7	NA	NA	8014	4007	8014	4007	NA	NA	NA	NA
	NA		8015		8015		NA		NA	
UI 8	NA	NA	8016	4008	8016	4008	NA	NA	NA	NA
	NA		8017		8017		NA		NA	
UI 9	NA	NA	8018	4009	8018	4009	NA	NA	NA	NA
	NA		8019		8019		NA		NA	

Registers - Universal Input Status

	PCD7.LRL2-P5		PCD7-LRL4-P5		PCD7.LRL5-P5		PCD7.LRS4-P5		PCD7.LRS5-P5	
Universal Input	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address
UI Status [0..3]	8012	4006	8020	4010	8020	4010	8008	4004	8008	4004
	8013		8021		8021		8009		8009	
UI Status [4..7]	8014	4007	8022	4011	8022	4011	NA	NA	NA	NA
	8015		8023		8023		NA		NA	
UI Status [8..9]	NA	NA	8024	4012	8024	4012	NA	NA	NA	NA
	NA		8025		8025		NA		NA	

Registers - Analogue Outputs

	PCD7.LRL2-P5		PCD7-LRL4-P5		PCD7.LRL5-P5		PCD7.LRS4-P5		PCD7.LRS5-P5	
Analogue Output	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address	Modbus register address	PCD register address
AO 0	8040	4020	8040	4020	8040	4020	8040	4020	8040	4020
	8041		8041		8041		8041		8041	
AO 1	8042	4021	8042	4021	8042	4021	8042	4021	8042	4021
	8043		8043		8043		8043		8043	
AO 2	NA	NA	8044	4022	8044	4022	8044	4022	8044	4022
	NA		8045		8045		8045		8045	
AO 3	NA	NA	8046	4023	8046	4023	8046	4023	8046	4023
	NA		8047		8047		8047		8047	
AO 4	NA	NA	8048	4024	8048	4024	NA	NA	NA	NA
	NA		8049		8049		NA		NA	
AO 5	NA	NA	8050	4025	8050	4025	NA	NA	NA	NA
	NA		8051		8051		NA		NA	

Example of storage of Modbus data in PCD register, depending on the options selected (16/32-bit, signed, swapped)

PCD1/2/3 read Modbus values from PCD7.LRxx-P5

PCD7.LRxx-P5			PCD 1/2/3				
Media mapping on the PCD7.LRxx-P5 acting as Modbus server			PCD 1/2/3 acting as Modbus client, reading 16-bit or 32-bit values from the server. Example: if the client reads out 12 Modbus objects, where the content of the Modbus objects is defined as 11112222 hex for HR0 / HR1, 33334444 hex for HR2 / HR3 … as shown on the left side of the table.				
PCD7.LRxx-P5 Register Number	Modbus Holding Register Number	Example for value stored on the PCD register of the PCD7. LRxx-P5	PCD 1/2/3 Register Number on the Modbus client	PCD 1/2/3 register content if value is stored as 16 bit unsigned	PCD 1/2/3 register content if value is stored as 16 bit signed	PCD 1/2/3 register content if value is stored as 32 bit	PCD 1/2/3 register content if value is stored as 32 bit swapped
PCD Reg 0	HR0 / HR1	11112222 hex	PCD Reg	00001111 hex	00001111 hex	11112222 hex	22221111 hex
PCD Reg 1	HR2 / HR3	33334444 hex	PCD Reg+1	00002222 hex	00002222 hex	33334444 hex	44443333 hex
PCD Reg 2	HR4 / HR5	55556666 hex	PCD Reg+2	00003333 hex	00003333 hex	55556666 hex	66665555 hex
PCD Reg 3	HR6 / HR7	77778888 hex	PCD Reg+3	00004444 hex	00004444 hex	77778888 hex	88887777 hex
PCD Reg 4	HR8 / HR9	9999AAAA hex	PCD Reg+4	00005555 hex	00005555 hex	9999AAAA hex	AAAA9999 hex
PCD Reg 5	HR10 / HR11	BBBBCCCC hex	PCD Reg+5	00006666 hex	00006666 hex	BBBBCCCC hex	CCCCBBBB hex
PCD Reg 6	HR12 / HR13	DDDDEEEE hex	PCD Reg+6	00007777 hex	00007777 hex	DDDDEEEE hex	EEEEDDDD hex
PCD Reg 7	HR14 / HR15	FFFF1111 hex	PCD Reg+7	00008888 hex	00008888 hex	FFFF1111 hex	1111FFFF hex
PCD Reg 8	HR16 / HR17	22223333 hex	PCD Reg+8	00009999 hex	00009999 hex	22223333 hex	33332222 hex
PCD Reg 9	HR18 / HR19	44445555 hex	PCD Reg+9	0000AAAA hex	0000AAAA hex	44445555 hex	55554444 hex
PCD Reg 10	HR20 / HR21	66667777 hex	PCD Reg+10	0000BBBB hex	0000BBBB hex	66667777 hex	77776666 hex
PCD Reg 11	HR22 / HR23	88889999 hex	PCD Reg+11	0000CCCC hex	0000CCCC hex	88889999 hex	99998888 hex
PCD Reg 12	HR24 / HR25	AAAABBBB hex	PCD Reg+12	Untouched	Untouched	Untouched	Untouched

PCD7.LRxx-P5 read Modbus values from PCD1/2/3

PCD 1/2/3			PCD7.LRxx-P5				
Media mapping on the PCD 1/2/3 acting as Modbus server			PCD7.LRxx-P5 acting as Modbus client, reading 16-bit or 32-bit values from the server. Example: if client reads out 12 Modbus objects, where the content of the Modbus objects is defined as 11112222 hex for HR0 / HR1, 33334444 hex for HR2 / HR3 … as shown on the left side of the table.				
PCD 1/2/3 Register Number on the IRM-P5	Modbus Holding Register Number	Example for value stored on the PCD register of the PCD 1/2/3	PCD7.LRxx-P5 Register Number	PCD7.LRxx-P5 Register content if value is stored as 16 bit unsigned Modbus object number = PCD register number	PCD7.LRxx-P5 Register content if value is stored as 16 bit signed Modbus object number = PCD register number	PCD7.Lxx-P5 Register content if value is stored as 32 bit Modbus object range 10001 and higher must be used on the PCD 1/2/3. To access register 600, it is necessary to access the Modbus object 11201 (2 x 600 + 10001)	PCD7.LRxx-P5 Register content if value is stored as 32 bit swapped Modbus object range 10001 and higher must be used on the PCD 1/2/3. To access register 600, it is necessary to access the Modbus object 11201 (2 x 600 + 10001)
PCD Reg	HR0 / HR1	11112222 hex	PCD Reg	00002222 hex	00002222 hex	11112222 hex	22221111 hex
PCD Reg+1	HR2 / HR3	33334444 hex	PCD Reg + 1	00004444 hex	00004444 hex	33334444 hex	44443333 hex
PCD Reg+2	HR4 / HR5	55556666 hex	PCD Reg + 2	00006666 hex	00006666 hex	55556666 hex	66665555 hex
PCD Reg+3	HR6 / HR7	77778888 hex	PCD Reg + 3	00008888 hex	FFFF8888 hex	77778888 hex	88887777 hex
PCD Reg+4	HR8 / HR9	9999AAAA hex	PCD Reg + 4	0000AAAA hex	FFFFAAAA hex	9999AAAA hex	AAAA9999 hex
PCD Reg+5	HR10 / HR11	BBBBCCCC hex	PCD Reg + 5	0000CCCC hex	FFFFCCCC hex	BBBBCCCC hex	CCCCBBBB hex
PCD Reg+6	HR12 / HR13	DDDDEEEE hex	PCD Reg + 6	0000EEEE hex	FFFFEEEE hex	DDDDEEEE hex	EEEEDDDD hex
PCD Reg+7	HR14 / HR15	FFFF1111 hex	PCD Reg + 7	00001111 hex	00001111 hex	FFFF1111 hex	1111FFFF hex
PCD Reg+8	HR16 / HR17	22223333 hex	PCD Reg + 8	00003333 hex	00003333 hex	22223333 hex	33332222 hex
PCD Reg+9	HR18 / HR19	44445555 hex	PCD Reg + 9	00005555 hex	00005555 hex	44445555 hex	55554444 hex
PCD Reg+10	HR20 / HR21	66667777 hex	PCD Reg + 10	00007777 hex	00007777 hex	66667777 hex	77776666 hex
PCD Reg+11	HR22 / HR23	88889999 hex	PCD Reg +11	00009999 hex	FFFF9999 hex	88889999 hex	99998888 hex
PCD Reg+12	HR24 / HR25	AAAABBBB hex	PCD Reg + 12	Untouched	Untouched	Untouched	Untouched

PCD 1/2/3 write Modbus values to PCD7.LRxx-P5

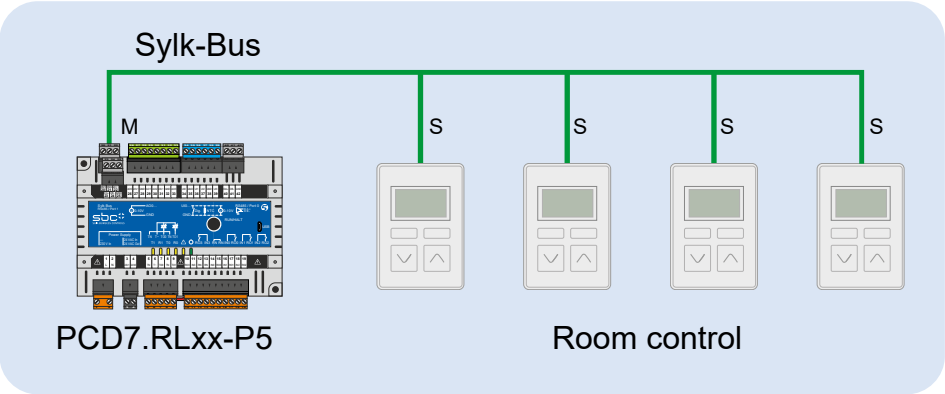
PCD 1/2/3			PCD7.LRxx-P5				
PCD 1/2/3 acting as Modbus client and writing 16-bit or 32-bit values to the PCD7.LRxx-P5			Media mapping on the PCD7.LRxx-P5 acting as Modbus server: Example: if client writes 12 Modbus objects, where the content of the PCD register on the client is defined as 11112222 hex for PCD Reg 33334444 hex for PCD Reg +1 … as shown on the left side of the table.				
PCD 1/2/3 Register Number	Example for value stored on the PCD 1/2/3 register		Modbus Holding Register Number	PCD7.LRxx-P5 Register Number	PCD7.LRxx-P5 Register content if written with 16 bits	PCD7.LRxx-P5 Register content if written with 32 bits	PCD7.LRxx-P5 Register content if written with 32 bits swapped
PCD Reg	11112222 hex		HR0 / HR1	PCD Reg 0	22224444 hex	11112222 hex	22221111 hex
PCD Reg+1	33334444 hex		HR2 / HR3	PCD Reg 1	66668888 hex	33334444 hex	44443333 hex
PCD Reg+2	55556666 hex		HR4 / HR5	PCD Reg 2	AAAACCCC hex	55556666 hex	66665555 hex
PCD Reg+3	77778888 hex		HR6 / HR7	PCD Reg 3	EEEE1111 hex	77778888 hex	88887777 hex
PCD Reg+4	9999AAAA hex		HR8 / HR9	PCD Reg 4	33335555 hex	9999AAAA hex	AAAA9999 hex
PCD Reg+5	BBBBCCCC hex		HR10 / HR11	PCD Reg 5	77779999 hex	BBBBCCCC hex	CCCCBBBB hex
PCD Reg+6	DDDDEEEE hex		HR12 / HR13	PCD Reg 6	---	DDDDEEEE hex	EEEEDDDD hex
PCD Reg+7	FFFF1111 hex		HR14 / HR15	PCD Reg 7	---	FFFF1111 hex	1111FFFF hex
PCD Reg+8	22223333 hex		HR16 / HR17	PCD Reg 8	---	22223333 hex	33332222 hex
PCD Reg+9	44445555 hex		HR18 / HR19	PCD Reg 9	---	44445555 hex	55554444 hex
PCD Reg+10	66667777 hex		HR20 / HR21	PCD Reg 10	---	66667777 hex	77776666 hex
PCD Reg+11	88889999 hex		HR22 / HR23	PCD Reg 11	---	88889999 hex	99998888 hex
PCD Reg+12	AAAABBBB hex		HR24 / HR25	PCD Reg 12	---	---	---

5

PCD7.LRxx-P5 write Modbus values to PCD 1/2/3

PCD7.LRxx-P5		PCD 1/2/3				
PCD7.LRxx-P5 acting as Modbus client and writing 16-bit or 32-bit values to the PCD 1/2/3		Media mapping on the PCD 1/2/3 acting as Modbus server: Example: if client writes 12 Modbus objects, where the content of the PCD register on the client is defined as 11112222 hex for PCD Reg 33334444 hex for PCD Reg +1 … as shown on the left side of the table.				
PCD7.LRxx-P5 Register Number	Example of value stored on the PCD7.LRxx-P5 register	Modbus Holding Register Number	PCD 1/2/3 Register Number on the PCD 1/2/3	PCD 1/2/3 Register content if written with 16 bits Modbus object number = PCD register number	PCD 1/2/3 Register content if written with 32 bits Modbus object range 10001 and higher must be used on the PCD 1/2/3. To access register 600, it is necessary to access the Modbus object 11201 (2 x 600 + 10001)	PCD 1/2/3 Register content if written with 32 bits swapped Modbus object range 10001 and higher must be used on the PCD 1/2/3. To access register 600, it is necessary to access the Modbus object 11201 (2 x 600 + 10001)
PCD Reg	11112222 hex	HR0 / HR1	PCD Reg 0	00002222 hex	11112222 hex	22221111 hex
PCD Reg+1	33334444 hex	HR2 / HR3	PCD Reg 1	00004444 hex	33334444 hex	44443333 hex
PCD Reg+2	55556666 hex	HR4 / HR5	PCD Reg 2	00006666 hex	55556666 hex	66665555 hex
PCD Reg+3	77778888 hex	HR6 / HR7	PCD Reg 3	00008888 hex	77778888 hex	88887777 hex
PCD Reg+4	9999AAAA hex	HR8 / HR9	PCD Reg 4	00008888 hex	9999AAAA hex	AAAA9999 hex
PCD Reg+5	BBBBCCCC hex	HR10 / HR11	PCD Reg 5	0000CCCC hex	BBBBCCCC hex	CCCCBBBB hex
PCD Reg+6	DDDDEEEE hex	HR12 / HR13	PCD Reg 6	0000EEEE hex	DDDDEEEE hex	EEEEDDDD hex
PCD Reg+7	FFFF1111 hex	HR14 / HR15	PCD Reg 7	00001111 hex	FFFF1111 hex	1111FFFF hex
PCD Reg+8	22223333 hex	HR16 / HR17	PCD Reg 8	00003333 hex	22223333 hex	33332222 hex
PCD Reg+9	44445555 hex	HR18 / HR19	PCD Reg 9	00005555 hex	44445555 hex	55554444 hex
PCD Reg+10	66667777 hex	HR20 / HR21	PCD Reg 10	00007777 hex	66667777 hex	77776666 hex
PCD Reg+11	88889999 hex	HR22 / HR23	PCD Reg 11	00009999 hex	88889999 hex	99998888 hex
PCD Reg+12	AAAABBBB hex	HR24 / HR25	PCD Reg 12	---	---	---

5.5 Sylk bus



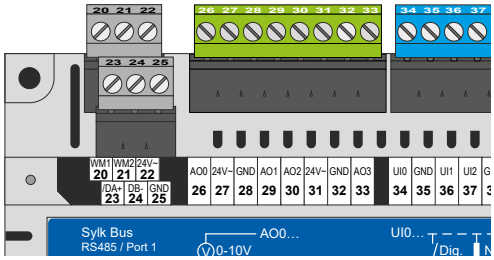
5.5.1 Key information about the bus

- Two-wire bus; polarity can be reversed
- Sylk™ bus cable length up to 150 m
- Communication and power supply via the same wires
- Multiple devices, such as room operating devices
  - PCD7.LR-TR4x,
  - PCD7.LR-TR4x-H,
  - PCD7.LR-TR4x-CO2,
  - PCD7.LR-TR4x-H-CO2
- Up to 4 Sylk bus devices on the same bus

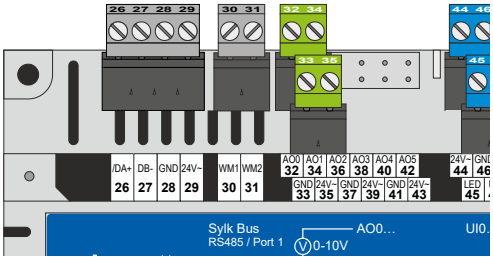
5.5.2 Recommendations regarding the PCD7.LR-TR40x/TR42x wall modules

Sylk Bus-capable devices (e.g. the TR40x/T42x) can be connected to the controller's Sylk Interface.

PCD7.LRSx: terminals 20 and 21



PCD7.LRLx: terminals 30 and 31



Cable specifications

no	single twisted pair, non-shielded, stranded or solid [A]		standard non-twisted thermostat wire, shielded or non-shielded, stranded or solid [B], [C]
	0.33…0.82 mm² (18…22 AWG)	0.20 mm² (24 AWG)	0.20…0.82 mm² (18…24 AWG)
2	150 m (500 ft)	120 m (400 ft)	30 m (100 ft)

[A] As a rule of thumb, a single twisted pair (only two wires per cable), thicker gauge, non-shielded cable yields the best results for longer runs.
[B] The 30 m (100 ft) distance for standard thermostat wire is conservative but is meant to reduce the impact of any sources of electrical noise (incl. but not limited to VFDs, electronic ballasts, etc.). A shielded cable is recommended only if there is a need to reduce the effect of electrical noise.
[C] These distances also apply for a shielded twisted pair.

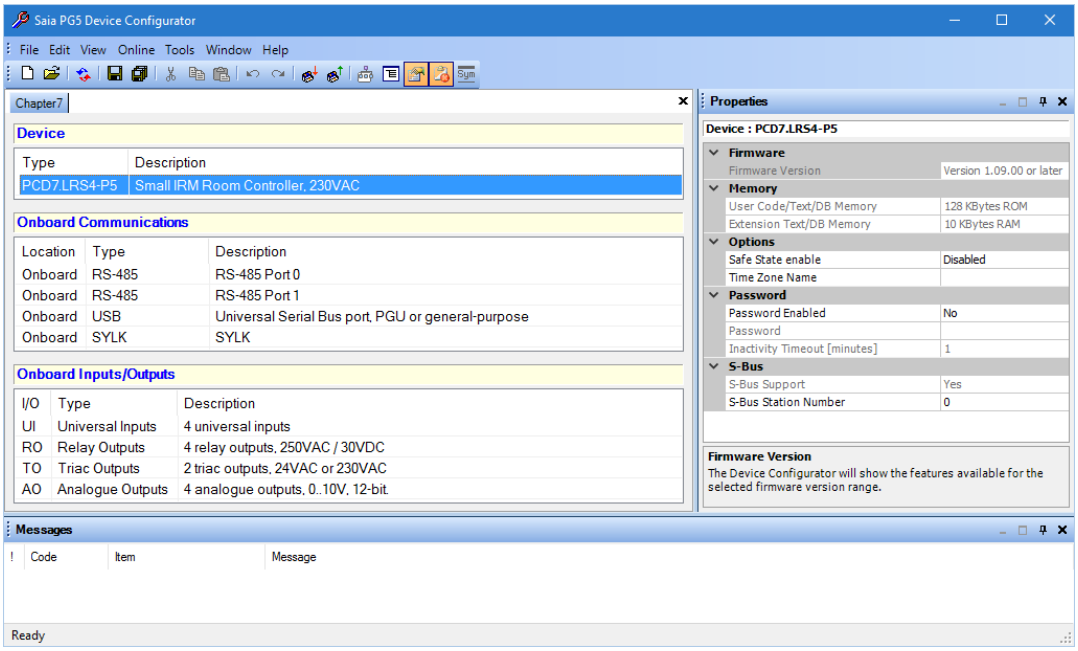
5.5.3 Devices and Programming/FBoxes

See chapter "7.2 Sylk bus FBoxes"

6 Configuration
(PG5 Device Configurator)

6.1 The PG5 “Device Configurator” program

This PG5 program can be used to configure devices.



The “Device Configurator” window (default view)

6.1.1 Requirement for operation

The following description assumes you are familiar with the PG5 software.

Information on the PG5 software, programming, tools, etc. can be found in the manual “26-732_ENG_Manual_PG5”.

Manuals are never as up-to-date as the help pages for the relevant PG5 suite tool.

6.1.2 General

This section describes how the Saia PG5® Device Configurator is used.

The Device Configurator defines:

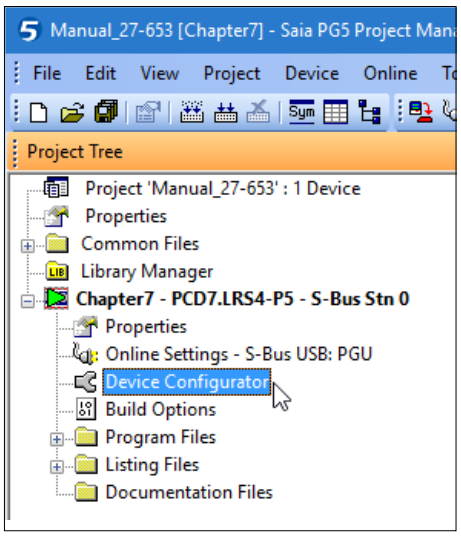
- Cyclical media mapping to facilitate a link between peripheral I/O module values and the device resources (e.g. PCD flags and registers).
- Direct access to programming instructions to read out or hand over values from the peripheral module.

6.2 Using the Device Configurator

The PCD7.LRS4-P5 controller is used in this section and the following instructions.

6.2.1 Starting the Device Configurator

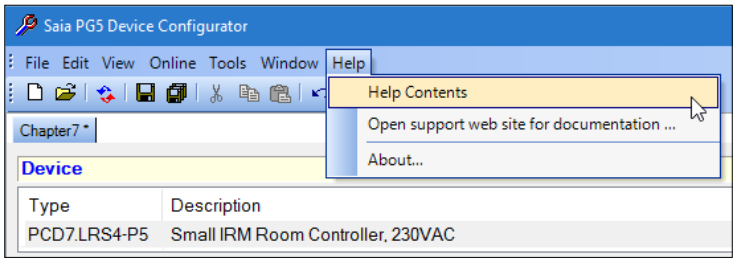
The Device Configurator must be used to set up hardware configurations and protocols and to determine how I/Os are handled.



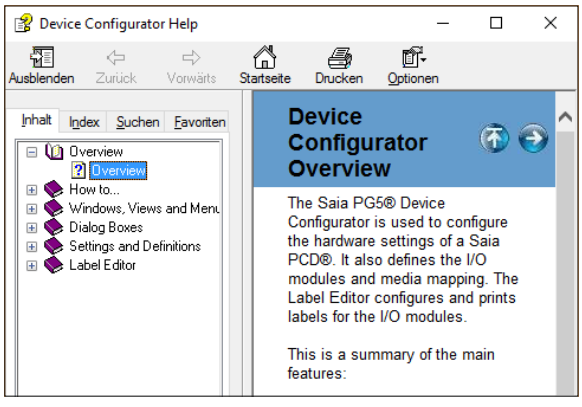
The program is started by double-clicking on “Device Configurator” in the project folder tree.

6.2.2 Help for the Device Configurator

Help for the Device Configurator can be found in the menu “Help” → “Help Topics”:



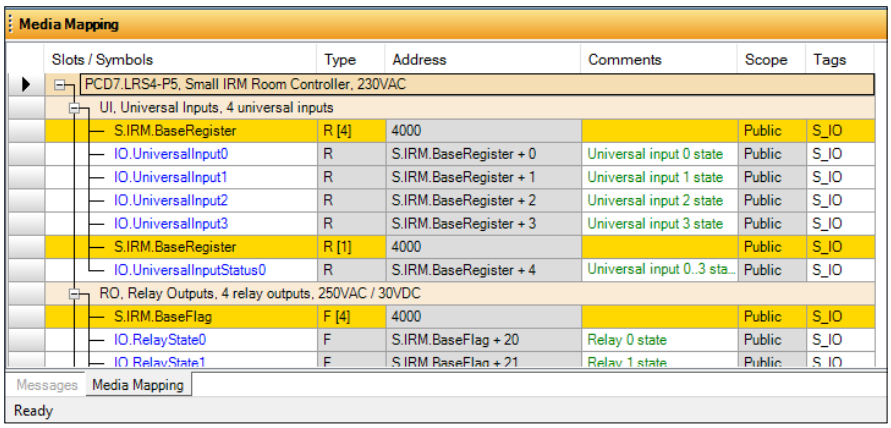
Click on one of the help topics:



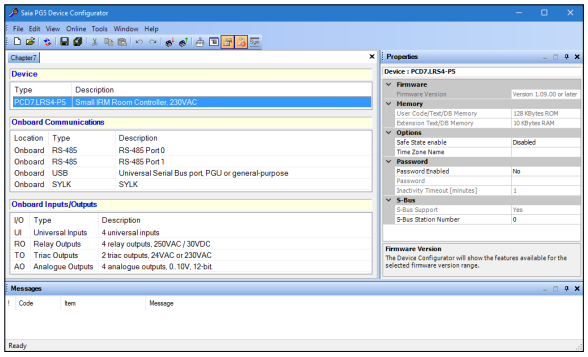
6.2.3 Media mapping view

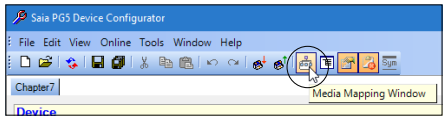
Media mapping is the process of assigning digital and analogue I/O electronics to flags and registers in the software using a table.

Example of a media mapping view



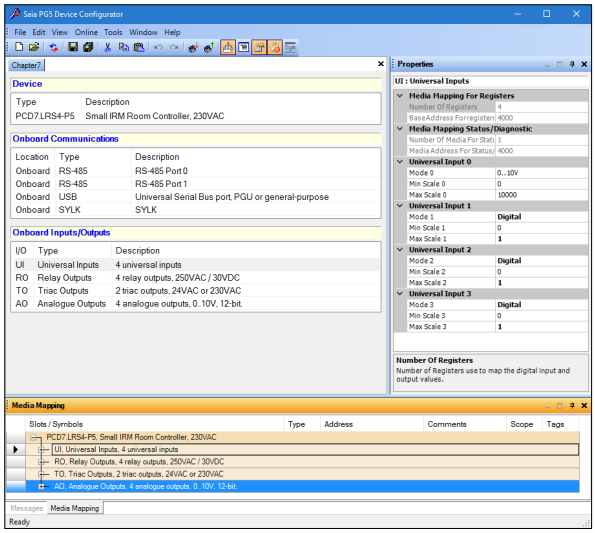
To be able to view the relevant information regarding media mapping for the resources in question, the associated window must be opened. There are two ways to do this:





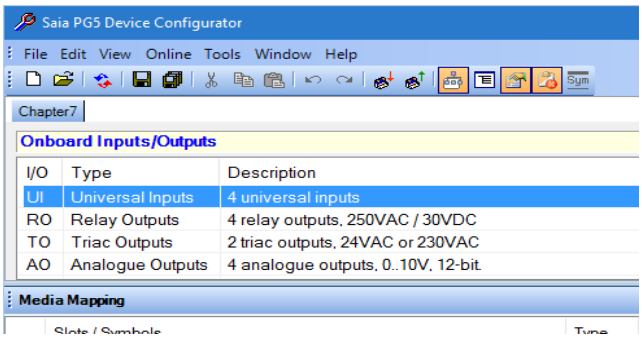
or

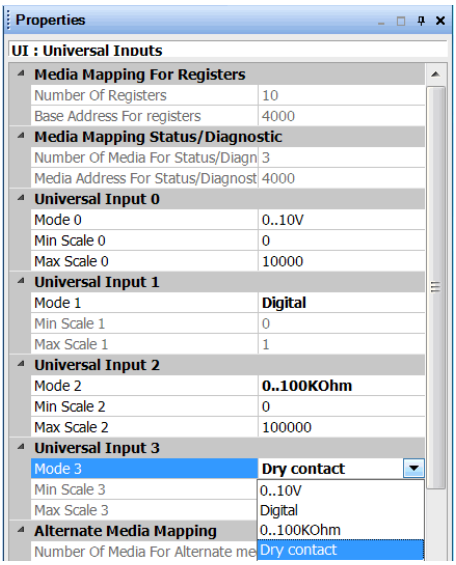
using the key combination ALT+F5

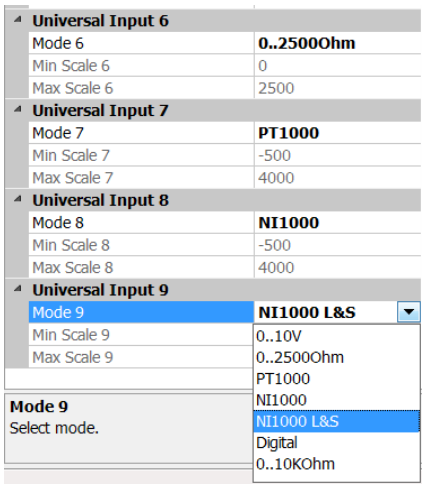


6.2.4 Digital/analogue universal inputs

Each of the universal inputs can be configured as follows:







Mapping table for universal inputs

Slots / Symbols	Type	Address	Comments	Scope	Tags
PCD7.LRL4-P5, Large IRM Room Controller, 230VAC					
UI, Universal Inputs, 10 universal inputs					
S.IRM.BaseRegister	R [10]	4000		Public	S_IO
IO.UniversalInput0	R	S.IRM.BaseRegister + 0	Universal input 0 state	Public	S_IO
IO.UniversalInput1	R	S.IRM.BaseRegister + 1	Universal input 1 state	Public	S_IO
IO.UniversalInput2	R	S.IRM.BaseRegister + 2	Universal input 2 state	Public	S_IO
IO.UniversalInput3	R	S.IRM.BaseRegister + 3	Universal input 3 state	Public	S_IO
IO.UniversalInput4	R	S.IRM.BaseRegister + 4	Universal input 4 state	Public	S_IO
IO.UniversalInput5	R	S.IRM.BaseRegister + 5	Universal input 5 state	Public	S_IO
IO.UniversalInput6	R	S.IRM.BaseRegister + 6	Universal input 6 state	Public	S_IO
IO.UniversalInput7	R	S.IRM.BaseRegister + 7	Universal input 7 state	Public	S_IO
IO.UniversalInput8	R	S.IRM.BaseRegister + 8	Universal input 8 state	Public	S_IO
IO.UniversalInput9	R	S.IRM.BaseRegister + 9	Universal input 9 state	Public	S_IO
S.IRM.BaseRegister	R [3]	4000		Public	S_IO
IO.UniversalInputStatus0	R	S.IRM.BaseRegister + 10	Universal input 0..3 status	Public	S_IO
IO.UniversalInputStatus1	R	S.IRM.BaseRegister + 11	Universal input 4..7 status	Public	S_IO
IO.UniversalInputStatus2	R	S.IRM.BaseRegister + 12	Universal input 8..9 status	Public	S_IO
S.IRM.BaseFlag	F [10]	4000		Public	S_IO
IO.UniversalInputF0	F	S.IRM.BaseFlag + 0	Mirror Universal input 0	Public	S_IO
IO.UniversalInputF1	F	S.IRM.BaseFlag + 1	Mirror Universal input 1	Public	S_IO
IO.UniversalInputF2	F	S.IRM.BaseFlag + 2	Mirror Universal input 2	Public	S_IO
IO.UniversalInputF3	F	S.IRM.BaseFlag + 3	Mirror Universal input 3	Public	S_IO
IO.UniversalInputF4	F	S.IRM.BaseFlag + 4	Mirror Universal input 4	Public	S_IO
IO.UniversalInputF5	F	S.IRM.BaseFlag + 5	Mirror Universal input 5	Public	S_IO
IO.UniversalInputF6	F	S.IRM.BaseFlag + 6	Mirror Universal input 6	Public	S_IO
IO.UniversalInputF7	F	S.IRM.BaseFlag + 7	Mirror Universal input 7	Public	S_IO
IO.UniversalInputF8	F	S.IRM.BaseFlag + 8	Mirror Universal input 8	Public	S_IO
IO.UniversalInputF9	F	S.IRM.BaseFlag + 9	Mirror Universal input 9	Public	S_IO
RO, Relay Outputs, 4 relay outputs, 250VAC / 30VDC					

Universal input Properties, types and PG5 Dev. Config. Settings			
Properties	**Type 7[1)]**	**Type 8[1)]**	**PG5 Device Configurator Settings [2)]**
0…10 V	Yes	Yes	0…10 V
2.5 kΩ	No	Yes	2.5 kΩ
10 kΩ	No	Yes	0…10 kΩ
100 kΩ (NTC 20 kΩ) and (NTC 10 kΩ	Yes	No	0…100 kΩ
PT/NI 1000	No	Yes	PT/NI 1000 L&S
Dry contact Closed: Resistance < 10 kΩ Open: Resistance > 20 kΩ Pull-up voltage: 10 V	Yes	No	Dry contact
Digital Input 24 VDC Input delay: Min. 16 ms Closed: Voltage < 1 V Open: Voltage > 5 V	Yes	Yes	Digital

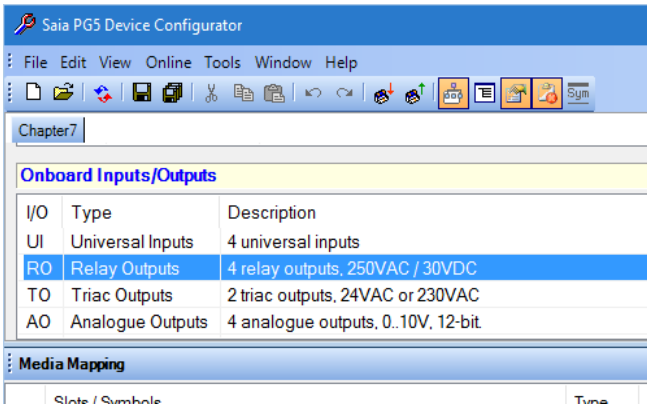
[1)] See also bottom of table. .
PCD7.LRSx-P5 room controllers: Overview of connections and functions (by model)
or
PCD7.LRLx-P5 room controllers: Overview of connections and functions (by model)

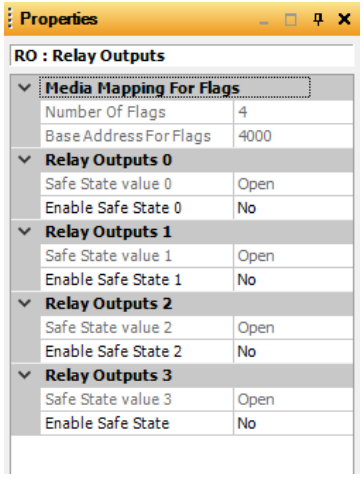
[2)] PG5 (V2.3) Device Configurator settings

6

6.2.5 Relay outputs

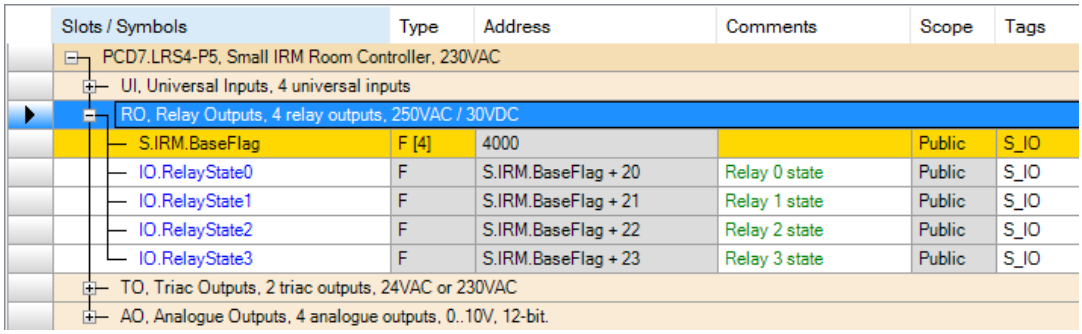
The relay outputs are configured as follows:





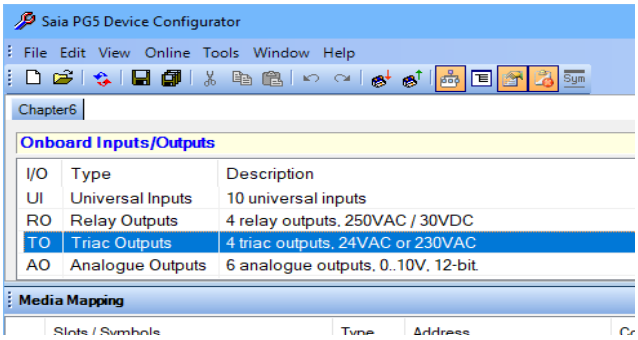
Properties		
Number of flags	Number of flags	4
Base address for flags	Base address for flags	4020
Safe state value	In the event of a fault, relay contact is...	open/closed
Enable safe state	Maintain status	yes/no

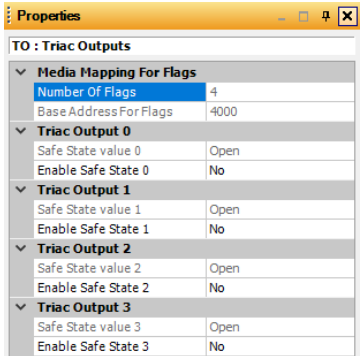
Mapping table for relay outputs



6.2.6 Triac outputs

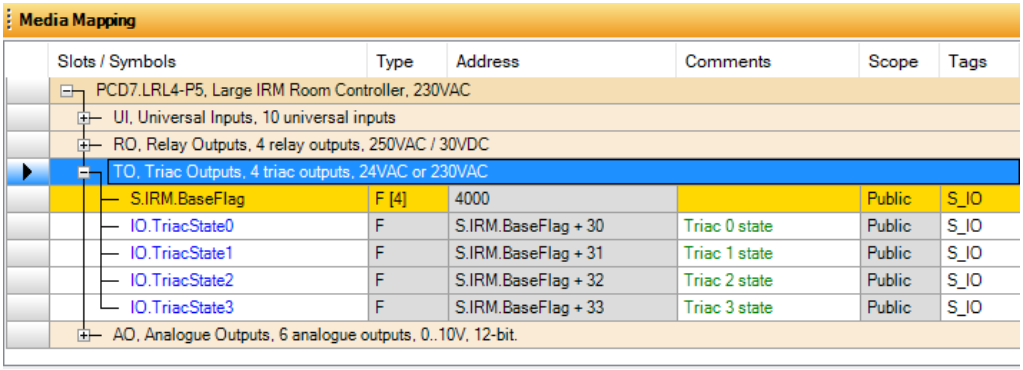
This type of output can be configured as follows:





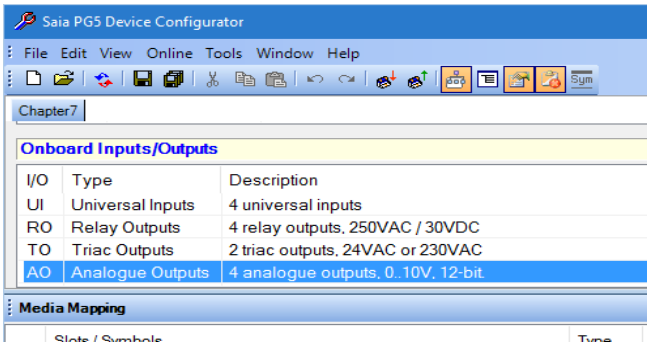
Properties		
Number of flags	Number of flags	4
Base address for flags	Base address for flags	4030
Safe state value	In the event of a fault, relay contact is...	open/closed
Enable safe state	Maintain status	yes/no

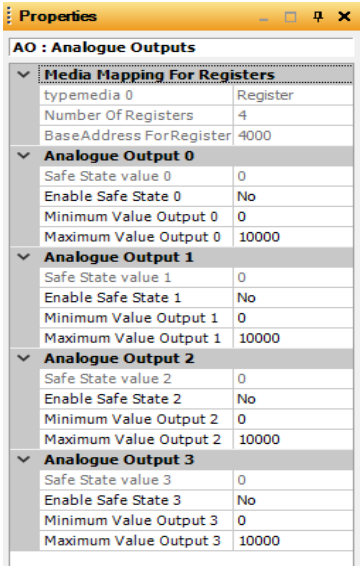
Mapping table for triac outputs



6.2.7 Analogue outputs

Analogue outputs can be configured as follows:





Properties		
Safe state value x	In the event of a fault, output is...	0 / 1
Enable safe state x	Maintain status	yes/no
Minimum value output x	Minimum output value	0
Maximum value output x	Maximum output value	10000

Mapping table for analogue outputs

Slots / Symbols	Type	Address	Comments	Scope	Tags
PCD7.LRS4-P5, Small IRM Room Controller, 230VAC					
UI, Universal Inputs, 4 universal inputs					
RO, Relay Outputs, 4 relay outputs, 250VAC / 30VDC					
TO, Triac Outputs, 2 triac outputs, 24VAC or 230VAC					
AO, Analogue Outputs, 4 analogue outputs, 0..10V, 12-bit.					
S.IRM.BaseRegister	R [4]	4000		Public	S_IO
IO.AoutValue0	R	S.IRM.BaseRegister + 20	Analogue output 0 val...	Public	S_IO
IO.AoutValue1	R	S.IRM.BaseRegister + 21	Analogue output 1 val...	Public	S_IO
IO.AoutValue2	R	S.IRM.BaseRegister + 22	Analogue output 2 val...	Public	S_IO
IO.AoutValue3	R	S.IRM.BaseRegister + 23	Analogue output 3 val...	Public	S_IO

7 Room operating devices

7.1 Overview of room operating devices

The following room operating devices can be used together with the controller to record the room temperature, define setpoints, change the occupancy status and adjust the fan speed.

Operating devices	Communi-cation type / Terminal on PCD7.LRLx* PCD7.LRSx*
 **PCD7.D1000**	S-Bus Slave, Modbus / Port 0, Port 1
 **PCD7.LR-TR40** **PCD7.LR-TR40-H** **PCD7.LR-TR40-CO2** **PCD7.LR-TR40-H-CO2**  **PCD7.LR-TR42** **PCD7.LR-TR42-H** **PCD7.LR-TR42-CO2** **PCD7.LR-TR42-H-CO2**	Sylk Bus / WM1, WM2
 **PCD7.L630**  **PCD7.L631**  **PCD7.L632**  **Q.RCU-A-T**  **Q.RCU-A-TS**  **Q.RCU-A-TSO**  **Q.RCU-A-TSOF**	Input / UI0 … UI2, GND, LED

* Example of connection wiring: see chapter “4.5 Connection examples”

Furthermore, the LEDs on the PCD7.L632, Q.RCU-A-TSO and the LC display of the PCD7.LR-TR42x can be configured to provide information on the following:

- Overriding of the controller, e.g. by pressing the “Occupancy” key on the room operating device or by receiving a network command via the controller (see section “LEDs on room operating devices for displaying information on overrides” below).
- Effective occupancy mode of the controller (see the following section “Configuring the LEDs on room operating devices for displaying information concerning occupancy”).

Supported functions of Q.RCU-A-txxx room operating devices

	Temp. setting	Setpoint setting	Presence button	Fan speed override	LED*	Required UI controller inputs
Q.RCU-A-T	●	–	–	–	–	1
Q.RCU-A-TS	●	●	–	–	–	2
Q.RCU-A-TSO	●	●	●	–	●	2
Q.RCU-A-TSOF	●	●	●	auto-0-1-2-3	●	3

Supported functions of PCD7.L63x room operating devices

	Temp. setting	Setpoint setting	Presence button	Fan speed override	LED*	Required UI controller inputs
PCD7.L630	●	–	–	–	–	1
PCD7.L631	●	●	–	–	–	2
PCD7.L632	●	●	●	–	●	2

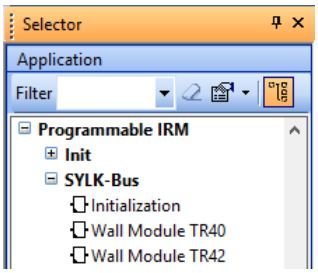
* An output is additionally needed to operate the LED. Only the PCD7.LRL2-P5 has a dedicated LED output. Other variants require an AO that can operate at a minimum of 5 mA.

7.2 Sylk bus FBoxes

An FBox family is available for integrating the Sylk bus wall devices type PCD7.LR-TR40-xxx (sensor only) and PCD7.LR-TR42-xxx (with display and keys).

PCD7LR-TR42-xxx

The application FBox view contains the “Programmable IRM” group with a subgroup “SYLK bus”, which contains the required FBoxes:

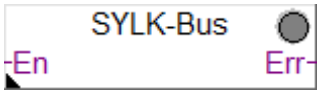


7

Changes are always made to FBoxes. For this reason, the PG5 help pages are always the most up-to-date, provided updates are done. It is a good idea to consult these pages when in doubt.

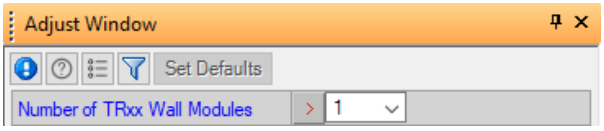
7.2.1 Initialising the Sylk bus interface

The Sylk bus interface must first be initialised. The “Initialization” FBox is used for this purpose. Since there is only one Sylk bus interface on a PCD7.LRxx-P5, configuration is extremely simple, as neither the port number nor the transfer speed needs to be set.



The “En” input initialises the interface, and the “Err” output indicates an initialisation that has failed. This can only happen if the firmware used is obsolete (prior to 1.09.00).

Only the number of connected PCD7.LR-TRxx devices needs to be defined in the adjustment parameters. This is necessary because the FBox also configures the PCD7.LR-TRxx devices as soon as they are detected on the Sylk bus.



Up to four PCD7.LR-TRxx devices can be connected, and any variant of the PCD7.LR-TRxx can be used.

The Sylk bus supports device addresses 1–15, whereas the PCD7.LRxx-P5 always uses device address 15. Addresses 1–4 can be set in the FBoxes to suit the PCD7.LR-TRxx.

If a PCD7.LR-TRxx device is detected on the Sylk bus and its address is used by a PCD7.LR-TRxx FBox, the “SYLK bus” FBox sends the configuration to the wall device. With a PCD7.LR-TR40-xxx, this process is invisible, whereas with a PCD7.LR-TR42-xxx, “FILE TRANSFER” can be read on the display during configuration.

7.2.2 PCD7.LR-TR40-xxx wall device without LC display

An FBox is available for the PCD7.LR-TR40 device family. Referencing via name/ref on the “SYLK bus” FBox is not necessary because there is only one Sylk bus interface per PCD7.LRxx-P5.

PCD7LR-TR40-xxx

The FBox indicates whether the PCD7.LR-TR40 is being used for communication via the LED and the “Offline” output.
If no data is being received by the PCD7.LR-TR40, the LED turns red and the “Offline” output switches to high.
As soon as the PCD7.LR-TR40 is detected and configured (by the “SYLK bus” FBox) and values are sent, the LED turns green and the “Offline” output switches to low.

The PCD7.LR-TR40-xxx is available in different variants, e.g.

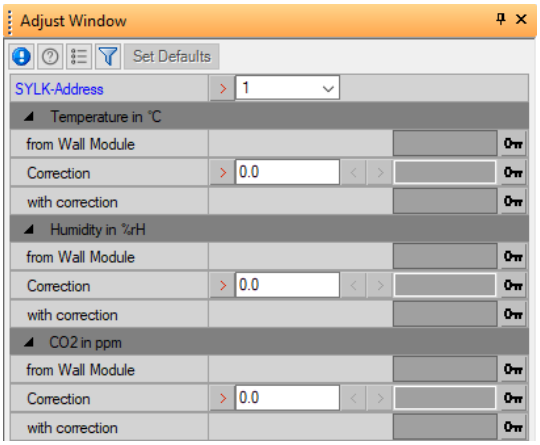
- Temperature only
- Temperature + CO2
- Temperature + rel. humidity
- Temperature +CO2 + rel. humidity

The FBox automatically detects which values are sent from the connected PCD7.LR-TR40-xxx. Unavailable measured values are always displayed as 0.0 at the output.

The Sylk bus address for the PCD7.LR-TR40-xxx must be configured in the adjustment parameters. The default address is 1. If only one PCD7.LR-TRxx module is connected to the Sylk bus, the default values are correctly preset in the FBoxes.

If multiple PCD7.LR-TR40-xxx devices (max. four) are used, the Sylk bus address in the FBox and on the associated device must be set to the same value using the DIP switch. Permissible Sylk bus addresses are 1 to 4.

A corrective value can be set for each measured value in the Adjust window FBox. The received value from the PCD7.LR-TR40-xxx is displayed with this correction both in the “Adjust window” and at the outputs.

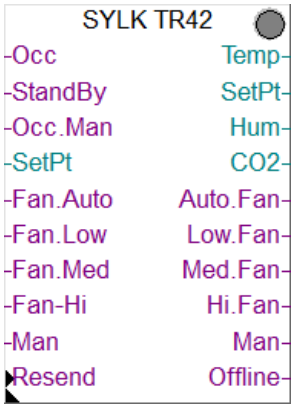


7.2.3 PCD7.LR-TR42-xxx wall device with LC display

An FBox is available for the PCD7.LR-TR42 device family. Referencing via name/ref on the “SYLK bus” FBox is not necessary because there is only one Sylk bus interface per PCD7.LRxx-P5.


PCD7.LR-TR42-xxx

The FBox indicates via the LED and the “Offline” output whether the PCD7.LR-TR42 is being used for communication. If no data is being received by the PCD7.LR-TR42, the LED turns red and the “Offline” output switches to high. As soon as the PCD7.LR-TR42 is detected and configured (by the “SYLK bus” FBox) and values are sent, the LED turns green and the “Offline” output switches to low.



The PCD7.LR-TR42-xxx is available in different variants, e.g.

- Temperature only
- Temperature + CO2
- Temperature + rel. humidity
- Temperature + CO2 + rel. humidity

The FBox automatically detects which values are sent from the connected PCD7.LR-TR42-xxx.
Unavailable measured values are always displayed as 0.0 at the output.

The Sylk bus address for the PCD7.LR-TRxx must be configured in the adjustment parameters. The default address is 1. If only one PCD7.LR-TRxx module is connected to the Sylk bus, the default values are correctly preset in the FBoxes.

If multiple PCD7.LR-TRxx devices (max. four) are used, the Sylk bus address in the FBox and on the associated device must be set to the same value using the DIP switch. Permissible Sylk bus addresses are 1 to 4.

A corrective value can be set for each measured value in the FBox. The received value from the PCD7.LR-TR40-xxx is displayed with this correction both in the “Adjust window” and at the outputs.

Depending on the desired function, the display can still be controlled.

- The setpoint can be set as an absolute value (e.g. 18.0 to 28.0) or as a corrective value (e.g. -3.0 to +3.0). In the case of an absolute value, the value is displayed; for corrective values, a slider with +/- is displayed.
- Rel. humidity, if available, can be displayed on the home screen or when cycling through the available values.
- Air quality in CO2 ppm, if available, can be displayed on the home screen or when cycling through the available values.
- The adjustment option for the fan can be completely deactivated so that no icon can be seen on the display. If this is activated, the user can choose between multiple speeds, depending on the configuration. The speed selected by the user is displayed at the “xxx.Fan” outputs.
- Manual operation by the user can be disabled completely. If this is enabled, the user can manually set the presence using the top right key. An additional hand symbol indicates manual operation. Manual operation is displayed at the “Man” output.
- Home screen. When the default display is set to home screen, the value to be displayed can be defined: setpoint, temperature, rel. humidity, air quality CO2, without a value, or to be “rolling” through the enabled values every few seconds.

The icon for the occupancy status can be controlled using the “Occ”, “StandBy” and “Occ.Man” inputs:

- “Occ” high = room in use, the "little man" icon is in his house.
- “StandBy” high = room ready, the "little man" icon is halfway in his house.
- If none of the aforementioned inputs is active, the room is unoccupied, and the "little man" icon is outside his house.
- “Occ.Man” high = room in use, the "little man" icon is in his house and a hand symbol is displayed next to this. The “Man” output is usually linked to the “Occ. Man” input, which corresponds to a presence button.

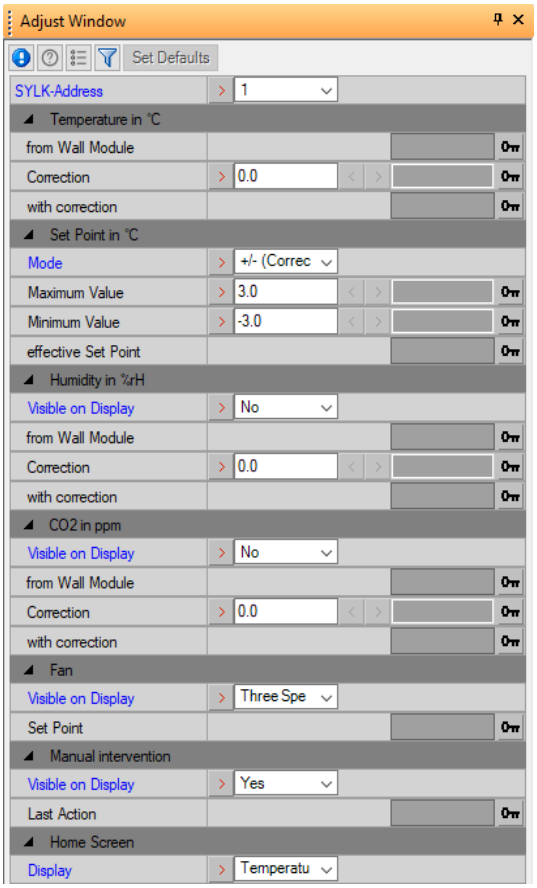
The “SetPt” input represents the base setpoint.

- If the setpoint is configured as an absolute value, this is the default value and can be adjusted by the user. The effective setpoint is displayed at the “SetPt” output.
- If the setpoint is configured as a corrective value, the default value is 0.0 and this can be adjusted by the user. The setpoint for the input + the correction by the user is displayed at the “SetPt” output.

The “xxx.Fan” inputs can be used to preset the default operating mode for the fan.

The “Man” input can be used to override the manual operation of the user or reset it. The input has the same function and effect.

The values at the inputs are sent to the PCD7.LR-TR42 when a value is changed. If no values are changed at the inputs, but the PCD7.LR-TR42 is to be reset to these values at the end of the day, this can be initiated using the “Resend” input.



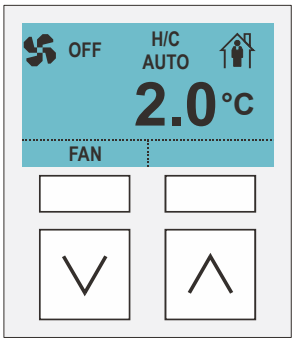
7.2.3.1 PCD7.LR-TR42-xxx “Occupancy” LC display configuration

The LCD of a PCD7.LR-TR42 can be configured to display the different symbols of the actual occupancy mode of the controller.

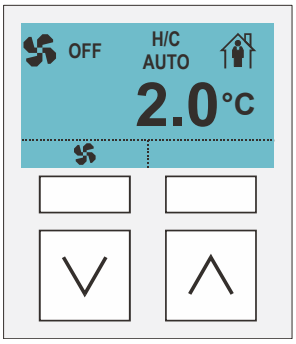
The following applies in this case:

“Occupied” mode

CONFIGURED FOR DISPLAY OF
ENGLISH



CONFIGURED FOR DISPLAY OF
SYMBOLS



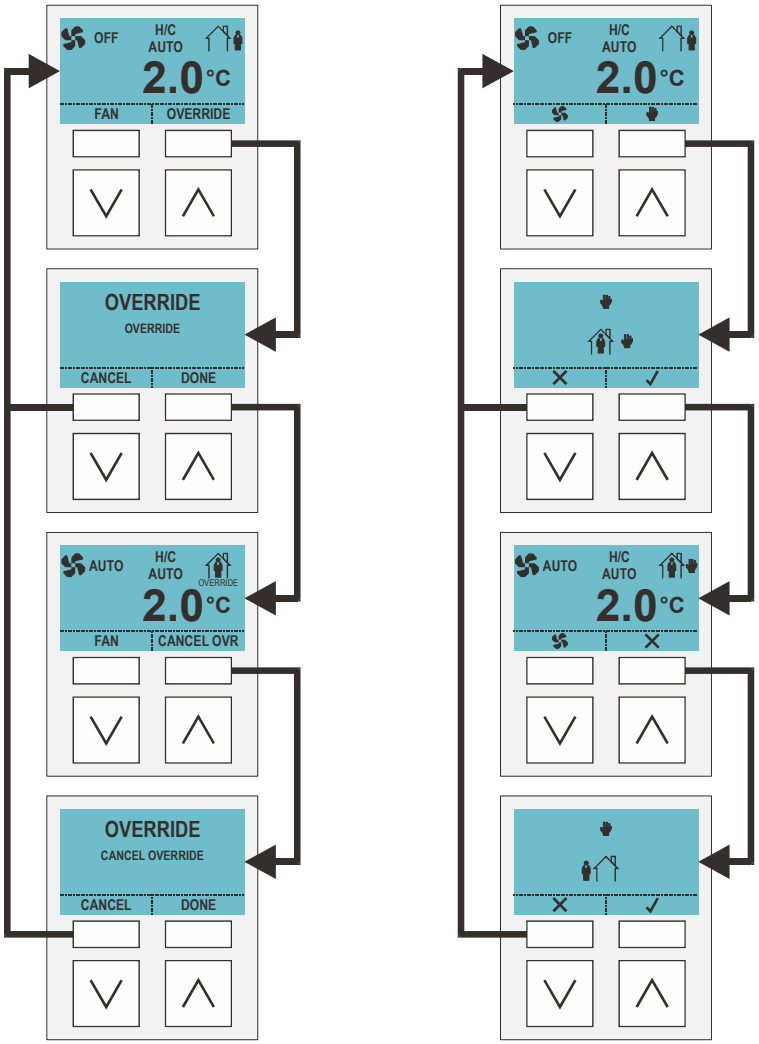
“Occupied” example is displayed

If  is displayed, the controller is in “Occupied” mode.

“Unoccupied” mode

CONFIGURED FOR DISPLAY OF **ENGLISH**

CONFIGURED FOR DISPLAY OF **SYMBOLS**



“Unoccupied” example is displayed

If  is displayed, the controller is in “Unoccupied” mode.

The user can override the “Unoccupied” mode by pressing the right-hand software key.

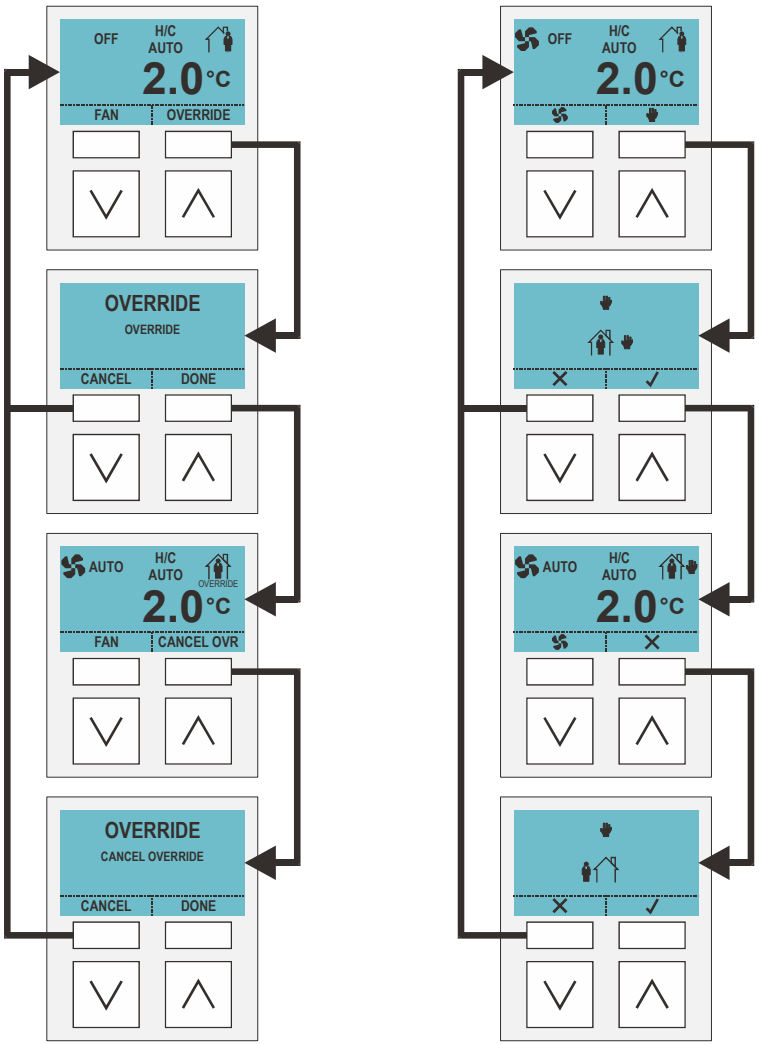
An intermediate display flashes for a few seconds, giving the user the opportunity to press either “Cancel” (left-hand software key) or “Confirm” (right-hand software key).

If the user does not press either key, this is taken as a confirmation and the controller is switched to the “Override/bypass” mode. If the user cancels the process, the controller switches back to the “Unoccupied” mode.

“Ready” mode

CONFIGURED FOR DISPLAY OF **ENGLISH**

CONFIGURED FOR DISPLAY OF **SYMBOLS**



“Ready” example is displayed

If  is displayed, the controller is in “Ready” mode.

The user can override the “Ready” mode by pressing the right-hand software key. An intermediate display flashes for a few seconds, giving the user the opportunity to press either “Cancel” (left-hand software key) or “Confirm” (right-hand software key).

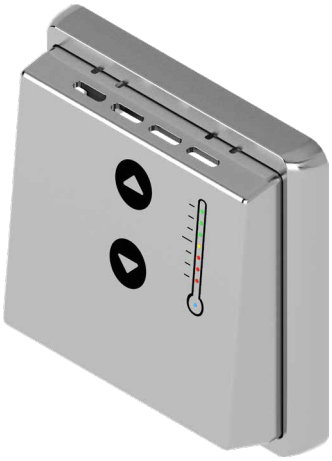
If the user does not press either key, this is taken as a confirmation and the controller is switched to the “Override/bypass” mode. If the user cancels the process, the controller switches back to the “Ready” mode.

7.2.3.2 PCD7.LR-TR42-xxx “Fan” LC display configuration

If 

is displayed, the fan is switched off. Depending on the configuration of the given application, the effective control mode for underfloor heating, radiators, ceiling heating and ceiling cooling can also be switched off.

7.3 PCD7.D1000 S-Bus/Modbus room operating device on RS-485 interface



Wall unit for room temperature measurement, setpoint offset control and quick cool operation. The design matches the PEHA Dialog Aluminium wall switch range.

The wall unit is connected to a Saia PCD by a RJ9 cable including 24 V DC power supply and bus communication. It is controlled via RS-485 serial communication protocol S-Bus or Modbus.

Data points can be read and written from the controller via S-Bus and Modbus registers.

For more detailed information, please refer to the data sheet which can be found at www.sbc-support.com.

7

Features

- Design according PEHA Dialog Aluminium
- Room temperature sensor 0…40°C
- Setpoint offset control +/- 3 K in increments of 0.5 K
- Seven LEDs for signalling the setpoint offset
- Two plug-in RJ9 connectors for daisy chain connection of up to six wall units
- S-Bus/Modbus protocol for data exchange with Saia PCD systems

With Modbus, the standard Modbus library can be used and FBoxes can be sent and received

Recommended max. distance between room controllers and room operating devices type PCD7.LR-TR40x / PCD7.LR-TR42x

Single twisted pair, no shielding, stranded or wire[A)]		Standard untwisted thermostatic cable, with or without shielding, stranded or wire[B), C)]
0.33…0.82 mm² (18…22 AWG)	0.20 mm². (24 AWG)	0.20…0.82 mm² (18…24 AWG)
150 m (500 feet)	120 m (400 feet)	30 m (100 feet)

A) As a general rule of thumb, a twisted pair (just two wires per cable), thicker diameter and unshielded cable achieves the best results for longer lengths.

B) The 30 m distance is conservative for standard thermostat cables, but this limit only serves to reduce the effects of sources of interference (including but not limited to frequency converters, electronic ballasts, etc.) Shielded cables are only recommended where necessary to reduce the effect of electrical interference.

C) These distances also apply to twisted wire pairs.

8 Maintenance

8.1 Maintenance-free

PCD7.LRxx-P5 room controllers devices do not contain any parts that can be replaced by the user. If hardware problems occur, the components can be sent back to
Saia-Burgess Controls AG (see Appendix for address).

PCD7.LRxx-P5 room controllers are maintenance-free.

A Appendix

A.1 Symbols

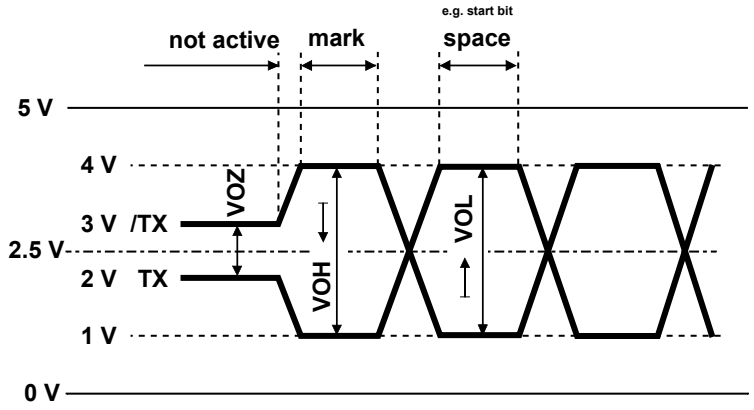
In operating instructions, this symbol points the reader to further information in these instructions, in other instructions or in technical documents. No direct link to these documents is given.

Instructions with this symbol must always be followed.

Appropriate use by trained personnel

A

A.2 RS-485 signal level



VOZ =0.9 V min.
VOH = 1.5 Vmin. (with load) … 3.6 V max. (without load)
VOL = -1.5 Vmin. (with load) … -3.6 V max. (without load)

Signal type	Logical status	Polarity
Data signal	0 (blank) 1(symbol)	RX-TX positive at /RX-/TX /RX-/TX positive at RX-TX

A

Not all manufacturers use the same connection configuration, so it may be necessary to cross data lines.

In order to ensure problem-free operation of an RS-485 network, the network should be connected at both ends. Cables and terminating resistors should be selected in accordance with manual 26-740 “Installation components for RS-485 networks”.

A.3 Installation regulations and relay contacts

A.3.1 Installation regulations for switching low voltages

For safety reasons, voltages of max. 50 V may be switched on this module.

The safety standard concerning clearance and creepage distances between neighbouring channels is not specified for higher voltages (50...250 V) for this module.

Note that all connections to the relay contacts of module ..A250 must be connected to the same circuit, i.e. only one phase is permitted per module. The individual circuits can be protected by separate fuses.

A.3.2 Switching inductive loads

Due to the physical properties of inductivity, switching off inductivity without causing problems is impossible. These faults must be minimised as far as possible. While the Saia PCD® is immune to these faults, there are other devices that may be affected.

It should also be noted that the EMC standards (EMC Directive 89/336/EC) have been in force since 1996 as part of the harmonisation of standards within the EU. Therefore two basic principles can be stipulated:

- THE SUPPRESSION OF INDUCTIVE LOADS IS ABSOLUTELY NECESSARY!
- FAULTS ARE TO BE CORRECTED AT THE SOURCE OF INTERFERENCE WHERE POSSIBLE!

The relay contacts on this module are interconnected. Nevertheless, it is a good idea to connect a snubber to the load.

(Often, these are available as standard components for standardised contactors and valves.)

When direct voltage is switched, it is strongly recommended to attach a free-wheeling diode over the load. This is true even if theoretically an ohmic load is being switched. An inductive proportion can always be found in practice (connection cable, resistance coil, etc.) In doing so, ensure that the switch-off time is extended.

(Ta approx. L/RL * √ (RL * IL/0.7).

Transistor output modules are recommended for direct voltage.

A.3.3 Information from the relay manufacturers on dimensioning the RC element

Contact protection networks:

The purpose of contact protection networks is to suppress switch arcs (“switching sparks”) and achieve a longer service life for the contacts. Each protective network has its advantages and disadvantages. See the nearby figure for arc elimination via RC network.

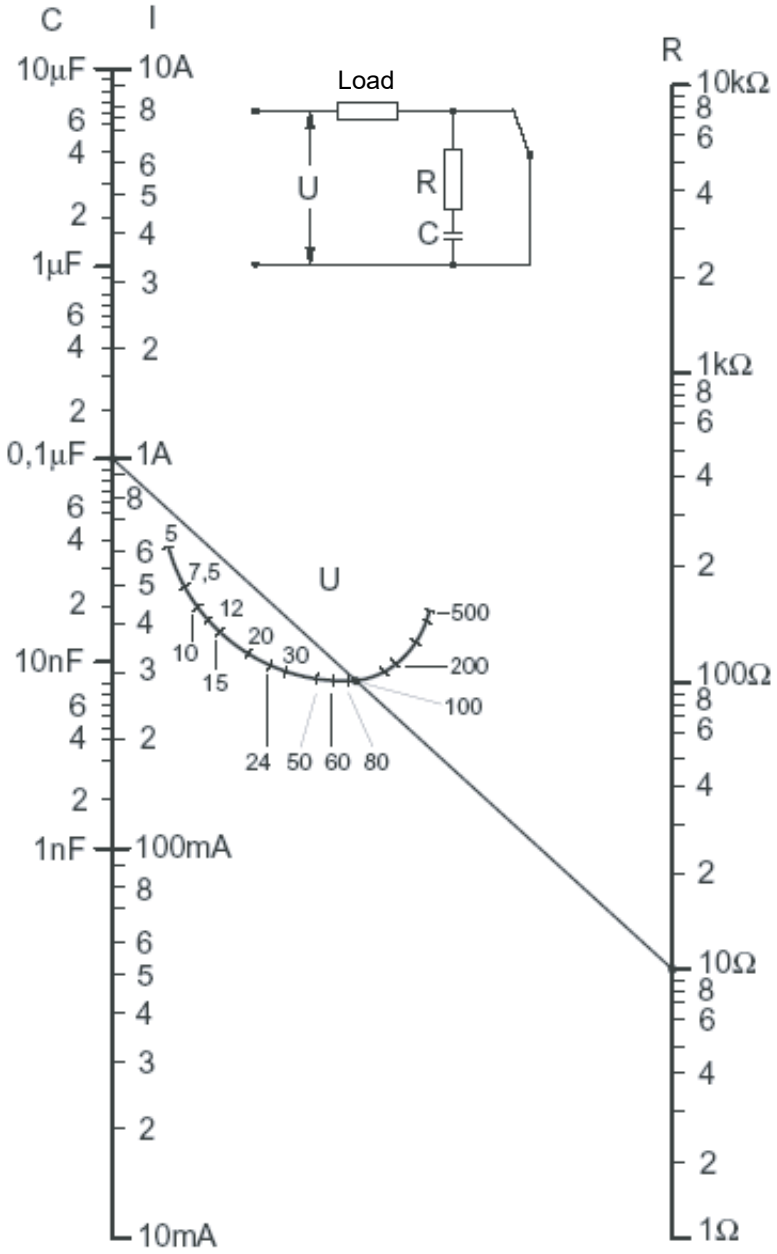
When switching off circuits with inductive components (e.g. relay coils and magnetic coils), the interruption in the current at the switching contacts causes an overvoltage (self-induction voltage), which can be much higher than the operating voltage and can pose a threat to the insulation at the circuit. The resulting sparks quickly lead to wear on the relay contacts. For this reason, contact protection networks are especially important for inductive circuits. The values for the RC combination can also be determined from the nearby diagram, except that the voltage U should be replaced with the overvoltage that occurs when the current is interrupted (measured with an oscillograph, for example).The current must be calculated from this voltage and the known resistance where it was measured.

Only interference-suppression capacitors that conform to VDE 0565 T1 class X2 are permitted for use in interference-suppression networks. These capacitors are switch-proof and designed for especially high switch overvoltages. Direct operation on the mains voltage is also possible.

The resistors used must withstand high voltages (pulse strength). Low-value resistors are especially susceptible to voltage flashovers at the helical cut for manufacturing reasons. Carbon composition resistors are therefore particularly commonly used for interference-suppression networks. Glass-coated wire resistors or cement resistors with a large helical cut pitch are also suitable.

Dimensioning aid:

The value for C is taken directly from the current to be switched. The value for the resistance R is found by placing a straight line through the corresponding points on the I and U curves and reading off the resistance at the point of intersection with the R curve.



Example:

U = 100 V I = 1 A

C is given directly as 0.1 µF

R = 10 Ω (point of intersection with R curve)

A

A.4 Sensor properties

A.4.1 Sensor input accuracy

The internal sensor inputs of the controller support NTC10kΩ and NTC20kΩ sensors. The following table shows the typical minimum accuracies for the hardware and software for these temperature sensors.

Sensor temperature range		Typical hardware measurement errors (without sensor tolerance)	
°Celsius	(°Fahrenheit)	NTC10k*1	NTC20k*1
-50 …-20°C	(-58 … -4°F)	≤5.5°C	≤5.0°C
-20 … 0°C	(-4 … 32°F)	≤1.2°C	≤1.0°C
0 …-30°C	(32 … 86°F)	≤0.4°C	≤0.3°C
30 … 70°C	(86 …158°F)	≤0.6°C	≤0.5°C
70 …100°C	(158 …212°F)	≤1.2°C	≤1.0°C
100 …130°C	(212 …266°F)	---	≤3.0°C
130 …150°C	(266 …302°F)	---	≤5.5°C
Display in °C		-20…100	-7…150

[1] These temperature curves are not standardised. They differ depending on the NTC manufacturer. The temperatures can be displayed using a characteristic curve file (“Name.saiadbe”, available from Saia PCD Support) and the “Conversion DB n Points” FBox.

This is only the accuracy of the internal sensor input (hardware + software [linearisation]). This table does not contain the properties of the sensors themselves (see the following section “Sensor property tables”). If another sensor or accuracy is required, the inputs for a connected panel I/O module, for example, can be used instead.

A.4.2 Sensor property tables

The properties (resistance as a function of temperature) of the sensors and the resulting voltage can be seen on the following pages. The specified values do not include any failures caused by: sensor faults, wiring resistance or wiring errors, faulty readings due to a measuring instrument connected to the measured resistance, or voltage applied at an input.

The two tables for **NTC 10 kΩ** and **NTC 20 kΩ** for “resistance as a function of temperature” are shown on the next two pages.

NTC 10 kΩ

Temp. [°C]	Resistance [kΩ]	Applied voltage [V]
–30	177	7.904
–29	166.35	7.848
–28	156.413	7.790
–27	147.136	7.730
–26	138.47	7.666
–25	130.372	7.601
–24	122.8	7.534
–23	115.718	7.464
–22	109.089	7.392
–21	102.883	7.318
–20	97.073	7.241
–19	91.597	7.161
–18	86.471	7.080
–17	81.667	6.996
–16	77.161	6.910
–15	72.932	6.821
–14	68.962	6.731
–13	65.231	6.639
–12	61.723	6.545
–11	58.424	6.448
–10	55.321	6.351
–9	52.399	6.251
–8	49.648	6.150
–7	47.058	6.047
–6	44.617	5.943
–5	42.317	5.838
–4	40.15	5.732
–3	38.106	5.624
–2	36.18	5.516
–1	34.363	5.408
0	32.65	5.299
1	31.027	5.189
2	29.494	5.079
3	28.047	4.969
4	26.68	4.859
5	25.388	4.750
6	24.166	4.641
7	23.01	4.532
8	21.916	4.423
9	20.88	4.316
10	19.898	4.209
11	18.968	4.103
12	18.087	3.998
13	17.252	3.894
14	16.46	3.792
15	15.708	3.690
16	14.995	3.591
17	14.319	3.492
18	13.678	3.396
19	13.068	3.300
20	12.49	3.207
21	11.94	3.115
22	11.418	3.025
23	10.921	2.937
24	10.449	2.850
25	10	2.767
26	9.572	2.684
27	9.165	2.603
28	8.777	2.524
29	8.408	2.447
30	8.057	2.372
31	7.722	2.299
32	7.402	2.228
33	7.098	2.159
34	6.808	2.091
35	6.531	2.025
36	6.267	1.962
37	6.015	1.900
38	5.775	1.840
39	5.546	1.781
40	5.327	1.724
41	5.117	1.669
42	4.917	1.616
43	4.726	1.564
44	4.543	1.514
45	4.369	1.465
46	4.202	1.418
47	4.042	1.373
48	3.889	1.329
49	3.743	1.286
50	3.603	1.244
51	3.469	1.204
52	3.34	1.166
53	3.217	1.128
54	3.099	1.092
55	2.986	1.057
56	2.878	1.023
57	2.774	0.990
58	2.675	0.959
59	2.579	0.928
60	2.488	0.898
61	2.4	0.870
62	2.316	0.842
63	2.235	0.815
64	2.158	0.790
65	2.083	0.765
66	2.011	0.740
67	1.943	0.718
68	1.877	0.695
69	1.813	0.673
70	1.752	0.652
71	1.694	0.632
72	1.637	0.612
73	1.583	0.593
74	1.531	0.575
75	1.481	0.557
76	1.433	0.541
77	1.387	0.524
78	1.342	0.508
79	1.299	0.493
80	1.258	0.478
81	1.218	0.464
82	1.179	0.450
83	1.142	0.436
84	1.107	0.423
85	1.072	0.411
86	1.039	0.399
87	1.007	0.387
88	0.976	0.375
89	0.947	0.365
90	0.918	0.354
91	0.89	0.344
92	0.863	0.334
93	0.838	0.324
94	0.813	0.315
95	0.789	0.306
96	0.765	0.297
97	0.743	0.289
98	0.721	0.280
99	0.7	0.276
100	0.68	0.265

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NTC 20 kΩ

Temp. [°C]	Resist-ance [kΩ]	Applied voltage [V]
−50	1659	8.78
−49	1541	8.77
−48	1432	8.76
−47	1331	8.75
−46	1239	8.74
−45	1153	8.72
−44	1073	8.71
−43	1000	8.70
−42	932	8.69
−41	869	8.67
−40	811	8.66
−39	757	8.64
−38	706	8.62
−37	660	8.60
−36	617	8.58
−35	577	8.56
−34	539	8.54
−33	505	8.52
−32	473	8.49
−31	443	8.47
−30	415	8.44
−29	389	8.41
−28	364	8.38
−27	342	8.35
−26	321	8.32
−25	301	8.28
−24	283	8.25
−23	266	8.21
−22	250	8.17
−21	235	8.13
−20	221	8.08
−19	208	8.04
−18	196	7.99
−17	184	7.94
−16	174	7.89
−15	164	7.83
−14	154	7.78
−13	146	7.72
−12	137	7.66
−11	130	7.60
−10	122	7.53
−9	116	7.46
−8	109	7.39
−7	103	7.32
−6	97.6	7.25
−5	92.3	7.17
−4	87.3	7.09
−3	82.6	7.01
−2	78.2	6.93
−1	74.1	6.85

Temp. [°C]	Resist-ance [kΩ]	Applied voltage [V]
0	70.2	6.76
1	66.5	6.67
2	63.0	6.58
3	59.8	6.49
4	56.7	6.40
5	53.8	6.30
6	51.1	6.20
7	48.5	6.10
8	46.0	6.00
9	43.7	5.90
10	41.6	5.80
11	39.5	5.70
12	37.6	5.59
13	35.7	5.49
14	34.0	5.38
15	32.3	5.28
16	30.8	5.17
17	29.3	5.07
18	27.9	4.96
19	26.6	4.85
20	25.3	4.75
21	24.2	4.64
22	23.0	4.53
23	22.0	4.43
24	21.0	4.32
25	20.0	4.22
26	19.1	4.12
27	18.2	4.01
28	17.4	3.91
29	16.6	3.81
30	15.9	3.71
31	15.2	3.62
32	14.5	3.52
33	13.9	3.43
34	13.3	3.33
35	12.7	3.24
36	12.1	3.15
37	11.6	3.06
38	11.1	2.97
39	10.7	2.89
40	10.2	2.81
41	9.78	2.72
42	9.37	2.64
43	8.98	2.57
44	8.61	2.49
45	8.26	2.42
46	7.92	2.34
47	7.60	2.27
48	7.29	2.20
49	7.00	2.14

Temp. [°C]	Resist-ance [kΩ]	Applied voltage [V]
50	6.72	2.07
51	6.45	2.01
52	6.19	1.94
53	5.95	1.88
54	5.72	1.82
55	5.49	1.77
56	5.28	1.71
57	5.08	1.66
58	4.88	1.61
59	4.69	1.56
60	4.52	1.51
61	4.35	1.46
62	4.18	1.41
63	4.03	1.37
64	3.88	1.32
65	3.73	1.28
66	3.59	1.24
67	3.46	1.20
68	3.34	1.16
69	3.21	1.13
70	3.10	1.09
71	2.99	1.06
72	2.88	1.02
73	2.78	0.991
74	2.68	0.960
75	2.58	0.929
76	2.49	0.900
77	2.41	0.872
78	2.32	0.844
79	2.24	0.818
80	2.17	0.792
81	2.0	0.767
82	2.02	0.744
83	1.95	0.720
84	1.89	0.698
85	1.82	0.676
86	0 1.76	0.655
87	1.70	0.635
88	1.65	0.616
89	1.59	0.597
90	1.54	0.578
91	1.49	0.561
92	1.44	0.544
93	1.40	0.527
94	1.35	0.511
95	1.31	0.496
96	1.27	0.481
97	1.23	0.466
98	1.19	0.452
99	1.15	0.439

Temp. [°C]	Resist-ance [kΩ]	Applied voltage [V]
100	1.11	0.425
101	1.08	0.413
102	1.05	0.401
103	1.01	0.389
104	0.98	0.378
105	0.95	0.367
106	0.92	0.356
107	0.90	0.346
108	0.87	0.336
109	0.84	0.326
110	0.82	0.317
111	0.79	0.308
112	0.77	0.299
113	0.75	0.290
114	0.73	0.282
115	0.70	0.274
116	0.68	0.266
117	0.66	0.259
118	0.64	0.252
119	0.63	0.245
120	0.61	0.238
121	0.59	0.231
122	0.57	0.225
123	0.56	0.219
124	0.54	0.213
125	0.53	0.207
126	0.51	0.201
127	0.50	0.196
128	0.49	0.191
129	0.47	0.186
130	0.46	0.181
131	0.45	0.176
132	0.43	0.171
133	0.42	0.167
134	0.41	0.162
135	0.40	0.158
136	0.39	0.154
137	0.38	0.150
138	0.37	0.146
139	0.36	0.142
140	0.35	0.139
141	0.34	0.135
142	0.33	0.132
143	0.32	0.128
144	0.32	0.125
145	0.31	0.122
146	0.30	0.119
147	0.29	0.116
148	0.29	0.113
149	0.28	0.110
150	0.27	0.107

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A.5 Approvals/certifications

- ► UL 60730-1, Automatic Electrical Controls for Household and Similar Use - Part 1: General Requirements
- ► CAN/CSA-E60730-1:02, Automatic Electrical Controls for Household and Similar Use - Part 1: General Requirements
- ► UL916 (supplementary list), CSA C22.2 no. 205
- ► EAC approval
- ► SASO approval
- ► CE approval
- ► FCC part 15 B conformity. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
  This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation.

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If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment to an outlet on a circuit different from that of the receiver
- Consult the dealer or an experienced radio/TV technician for help.

A.5.1 Classification under EN 60730-1

EN 60730 subsection	EN 60730-2-9
Ambient conditions	For use in environments in residential buildings (residential, commercial and light industry)
Construction	Independently-mounted controller for panel mounting
Action	Type 1.C
Nominal pulse voltage	2500 V at 230 V, 500 V at 24 V
Degree of pollution	2
Protection against impact	Class 0 (without terminal covers) Class II (with terminal covers)
Software class	Class A

A.5.2 Classification under EN 60529

(Protection class provided by the housing)

IP20 In the case of controllers that are installed outside a control cabinet, the protective terminal covers (large pack of ten, order no. IRM-RLC for large housing and IRM-RSC for small housing) must be mounted before connection to the device's power supply in order to achieve IP30 conformity.

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A.6 Glossary

Backup	Data backup on second data carrier
Base address	First numerical address of the I/O module slots
CPU	Central processing unit. In the case of the Saia PCD® family, this refers to the main housing with the central unit.
Device	Device → controller (integral part of a project in Saia PG5® Project Manager)
Download	Abbreviation: “DnLd” → saving data to the PCD
Element	For the Saia PCD® family, this refers to the inputs and outputs, flags, registers, counters, timers, etc.
Flash memory	Digital non-volatile memory. Retains data when switched off without a connected power supply.
Media	This refers to inputs/outputs, flags, registers, etc. in the PCD family.
Media mapping	Media mapping is the process of assigning digital and analogue I/O electronics to flags and registers in the software using a list.
Modules	Carrier cards for input/output electronics with suitable connection technology
Ni	Element: nickel (temperature sensors made of nickel) Temperature coefficient $\alpha = 6.0 \cdot 10^{-3}$ [K^{-1}]
NTC	NTC thermistor: temperature sensors with negative temperature coefficient
IL	Instruction list (program code line by line)
PGU	Programmable Unit
PLC	Process logic controller
Port	Interface designation
Pt	Element: platinum (temperature sensors made of platinum) Temperature coefficient $\alpha = 3.92 \cdot 10^{-3}$ [K^{-1}]
Buffer battery	Retains memory content and keeps the clock running after the power supply is switched off.
RAM	Random access memory → digital volatile memory of the computer. Does not retain data without power.
Resources	Elements of → inputs, outputs, flags, registers, counters, timers, etc.
SPM	Saia PG5® Project Manager, main program of the Saia PG5® software suite.
x, xx or xxx	“x” in a product designation stands for a number 0...9 or letter. Example: PCD7.LRxx = PCD7.LRL4 or PCD7.LRS5, etc.

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A.7 Contact

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