SIEMENS

Operating Instructions

SIPLUS HCS

IO Systems for heating elements

HCS4300 PROFINET/PROFIBUS DP

Edition 08/2021

siemens.com

SIEMENS

IO systems for heating elements

Heating control system SIPLUS HCS4300 PROFINET/PROFIBUS DP

Operating Instructions

08/2021

A5E35452705A/006

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

A5E35452705A/006
Ⓟ 10/2021 Subject to change

Table of contents

Introduction

1

1.1 Introduction

Purpose of this documentation

These operating instructions contain the information you require to commission, operate and service the HCS4300 heating control system.

Target group

The documentation is intended for qualified personnel in the following specialist fields:

- Operators, project engineers, programmers
- Electrically skilled personnel who assemble, connect and start up the device.

Required basic knowledge

- These operating instructions require prior knowledge of programming an S7 controller or SIMOTION.
- Knowledge of working with the PROFINET or PROFIBUS fieldbus is also necessary.

History

The following earlier release versions of these operating instructions have been published:

Edition	Comment
11/2014	First edition
10/2015	Expansion with POM with panel mounting, PROFIBUS, I/O modules, extension module for additional 2 × 8 POMs
12/2016	Expansion with configuration control Commissioning support using PRONETA
04/2018	Expansion with phase control functionality for POM4320
10/2019	Expansion with POM4320 Highend
08/2021	Extension of functionality POM4320 and POM4320 Highend

Scope of the document

This document is valid for all components of the SIPLUS HCS4300 specified below and describes the current delivery state.

Note

Applicable for devices up to firmware version 1.x of the CIM:

- A maximum of 6 POMs can be operated.
- Extension module, PMs and the DP connection are not available.
- The following applies for reading data records 152, 200 and 201: The information that is read is always for the full configuration, i.e. for 54 channels or 6 POMs.
- The data records 160, 190 and 202 are not available.

Applicable for devices up to firmware version 2.1 of the CIM:

- No phase control can be configured for a POM4320.
- Data record 50 is not available.

Applicable for devices up to firmware version 2.3 of the CIM:

- POM4320 Highend cannot be configured.
- Data record 51 is not available.

Applicable for devices as of firmware version 2.3 of the CIM:

- The "Phase control" mode is only available for POM4320 with MLFB -0AA2 as of HW version 02.

Applicable for devices up to firmware version 2.4.1:

- The parameter "Soft start for each channel switch-on operation" is not available for the POM4320.
- The connection types "Connection between phase and phase (closed star)", "Connection between phase and phase (economy circuit closed delta)" and "Connection between phase and phase (economy circuit closed star)" are not available for the POM4320 Highend.

Naming conventions and abbreviations

Instead of product labels, the following abbreviations are also used in this document.

The following product labels and abbreviations are used:

Product label	Abbreviation
Central Interface Module	CIM
I/O module	PM
Power Output Module	POM
SIPLUS HCS4300	HCS

Registered trademarks

SIPLUS ® is a registered trademark of Siemens AG.

Safety guidelines

2

2.1 Safety notes

This device corresponds to the approvals printed on the type plate. If you have questions about whether it is permissible to install the device in the planned environment, contact your service representative.

NOTICE
• Alterations to the devices are not permitted. Failure to observe these guidelines shall constitute a revocation of the approvals and manufacturer's warranty. • The HCS4300 heating control system is not a safety product. In the event of a fault, the machine must be brought to the safe state on the plant side.

Warning symbols on the device

⚠ WARNING
Electric shock hazard **Can cause death or serious injury** When this warning symbol ⚠ appears on the device, you must consult the operating instructions for the device. The operating instructions contain information about the potential risks and enable you to recognize risks and implement countermeasures.

Note before connecting the device

⚠ WARNING
Electric shock hazard **Can cause death or serious injury** The supply system to which the heating control system is connected must have a circuit breaker. The device must be switched off and secured against switching on again, before connecting to the line voltage. Otherwise, there is a risk of electric shock.

Working on the device or on components connected to it

⚠ WARNING

Electric shock hazard

Can cause death or serious injury

- Voltages of more than 60 V can occur in the control cabinet. Suitable safety precautions to prevent contact must therefore be taken before and during commissioning and maintenance work.
- Before working on the heating control system or the connected components, ensure the system is disconnected.

Fuse replacement

NOTICE

Use only the prescribed fuse types. If you operate a heating controller with unapproved fuses, the device could be destroyed.

Repairs

⚠ WARNING

No user-serviceable parts

Can cause death or serious injury

Incorrectly performed repairs can result in substantial damage to equipment or endanger the user. Return the device to Siemens for repair.

Protective measures for the HCS4300 heating control system

NOTICE

Only authorized personnel are permitted to access the system and make changes to it.

2.2 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit (https://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customers' exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed visit (https://www.siemens.com/industrialsecurity).

2.3 Network settings of the HCS

Network settings

The following table shows the network settings of the HCS for communication:

Protocol	Transport protocol	Port number	Function
PROFINET IO	UDP	161	Port is used for the SNMPv1 service.
PROFINET IO	UDP	34964	Port is used for establishing connection.
PROFINET IO	UDP	49152...65535	Range from which a port that is used for acyclic communication between the IO controller and S7 CPU is defined while connection is established.
	TCP	998	Port is only used for servicing when reading the event storage. The communication between a PC and the HCS is only possible with interrupted PN connection.
	TCP	999	Port is only used as part of a service case when updating the firmware. The communication between a PC and the HCS is only possible with interrupted PN connection.

System overview

3

3.1 Area of application

The SIPLUS HCS 4300 heating control system is used to activate and switch heating elements in industry, such as quartz, ceramic, flash, halogen or infrared emitters. It is of modular design and can be flexibly adapted to suit the specific requirements of the respective application.

Typical application areas are:

- PET blow molding
- Drying of enamels and coatings
- Thermal treatment of fabric and plastics
- Welding of plastic parts
- Handling of carbon materials

In general, the HCS4300 can be used wherever compact or modular concepts are required with high levels of power output.

3.2 Features

An HCS4300 system comprises one Central Interface Module (CIM) and up to 24 Power Output Modules (POM). As an option, one I/O module can be operated on the CIM.

The following figure shows an example of an HCS4300, consisting of a CIM4310 for PROFINET, a POM4320, as well as a POM4320 Highend for busbar mounting.

Figure 3-1 HCS4300 consisting of CIM ①, POM4320 ② and POM4320 Highend ③

The following types of system component are available:

System component	Version	Description
Central Interface Module (CIM)	• CIM4310 PROFINET • CIM4310 PROFIBUS	A maximum of 8 POM4320 or 6 POM4320 Highend can be operated at a CIM.
I/O module	• PM4000 DI/DO	8 digital outputs and 8 configurable inputs/outputs.
	• PM4000 U/I	Inputs for measuring line voltage and line current.
	• PM4000 Temperature	4 analog inputs for 0 mA to 20 mA and 4 measuring inputs for temperature
Power Output Module (POM)	• POM4320 busbar mounting	9 power outputs with diagnostic function and fault indication per channel.
	• POM4320 panel mounting	
	• POM4320 Highend busbar mounting	6 power outputs with diagnostics and error display per channel.
	• POM4320 Highend for panel mounting	
Extension module	• EM4315	Enables operation of up to 8 additional POM4320 or 6 POM4320 Highend.

Features

- Modular (centralized) and compact (distributed) configurations possible
- Communication via PROFINET/PROFIBUS
- Parameter assignment, commissioning, visualization, diagnostics and FW update via Siemens TIA Portal
- Support of configuration and commissioning of the PROFINET network with PRONETA
- Integrated diagnostics and monitoring functions
- Control modes: Half-wave control, soft start and phase control
- Line voltage compensation for smoothing line voltage fluctuations integrated
- Only one 24 V power supply required for up to 8 POM4320 or 6 POM4320 Highend
- Slot for one I/O module (PM)
- Extension module (optional) with 24 V power supply for operation of an additional 2 x 8 POM4320 or 2 x 6 POM4320 Highend

3.3 System configuration

System components

A complete heating control system with HCS4300 includes the following components:

- Central Interface Module (CIM) 4310 with PROFINET or PROFIBUS
- Power Output Module (POM) 4320 for busbar or panel mounting
- Higher-level controller, e.g. SIMATIC S7-1500 automation system with PROFINET/PROFIBUS
- Field PG, optional for commissioning and diagnostics
- HMI panel, optional, e.g. SIMATIC HMI TP1500
- Heat emitter array

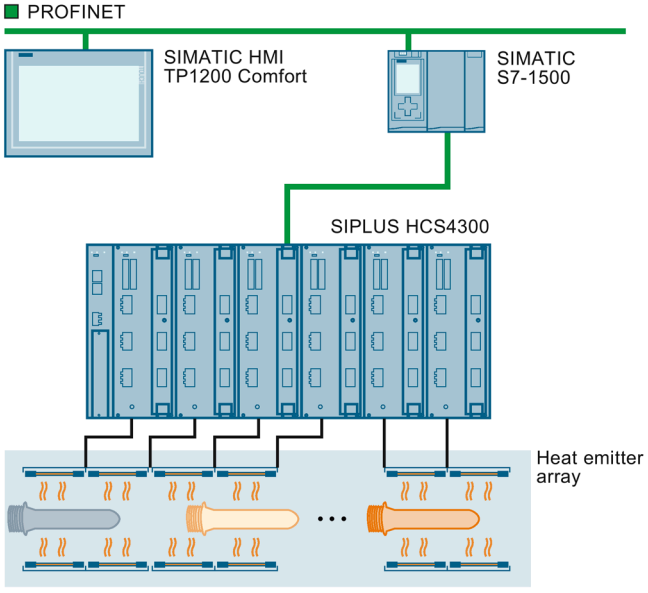


Figure 3-2 System components

Centralized and distributed heating application

A maximum of 8 POM4320 or 6 POM4320 Highend can be operated at a CIM. In the maximum configuration with 2 extension modules, up 24 POM4320 or 18 POM4320 Highend can be operated.

System configurations can be realized for distributed, decentralized heating applications, such as PET blow molding, where the heating controller is located below the heating boxes, as well as central heating applications, for example, in thermoforming, where the heating elements are implemented in numerous arrays and the modular heating control system is located in a central control cabinet.

Communication via PROFINET or PROFIBUS

PROFINET combines the industrial experience of PROFIBUS with the openness and flexible options of Ethernet. PROFINET enables high-speed and secure data exchange at all levels, thus making it possible to implement innovative machine and plant concepts.

PROFIBUS has been established for years as the fieldbus for machines and plants. Based on serial bus technology, it is the foundation for the distributed concepts that are common today.

Combined operation with HCS4200 heating controller

You can operate a POM4320 with the HCS4200. See SIPLUS HCS4200 PROFINET/PROFIBUS DP operating instructions.

Combined operation of a POM4320 Highend with the HCS4200 heating controller is not possible.

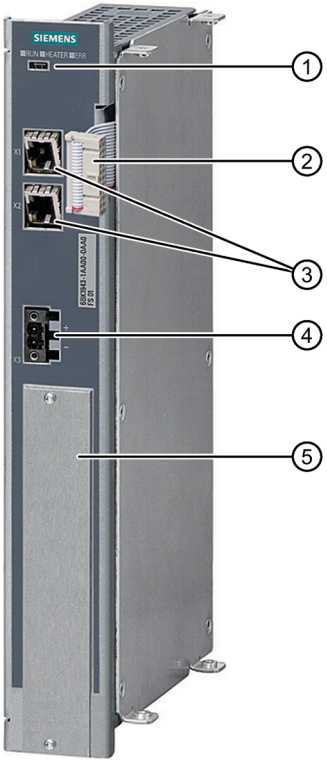
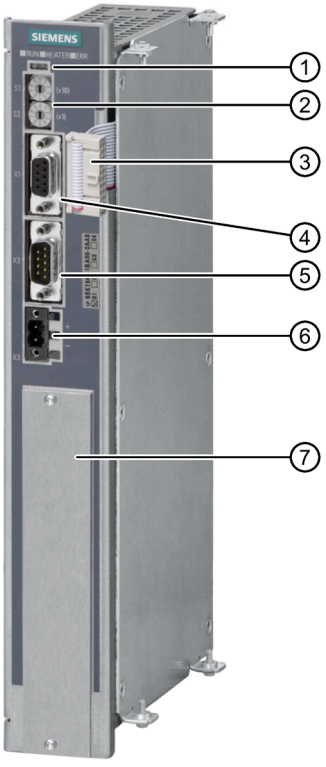
3.4 Central interface module (CIM)

3.4.1 Function and design

Function

The Central Interface Module (CIM) handles the communication with the higher-level controller and with the connected Power Output Modules (POM). In addition, the CIM provides the 24 V DC power supply for the connected POMs. The CIM is available in two versions: with a PROFINET interface or with a PROFIBUS interface.

Design

CIM4310 PROFINET		CIM4310 PROFIBUS	
			
①	Status LEDs	①	Status LEDs
②	System interface for POM	②	Address selector switches S1 and S2 for PROFIBUS
③	PROFINET interface X1 and X2	③	System interface for POM
④	24 V DC supply X3	④	PROFIBUS DP interface X1
⑤	Slot for I/O module	⑤	Service interface X2
		⑥	24 V DC supply X3
		⑦	Slot for I/O module

3.5 Power output module (POM)

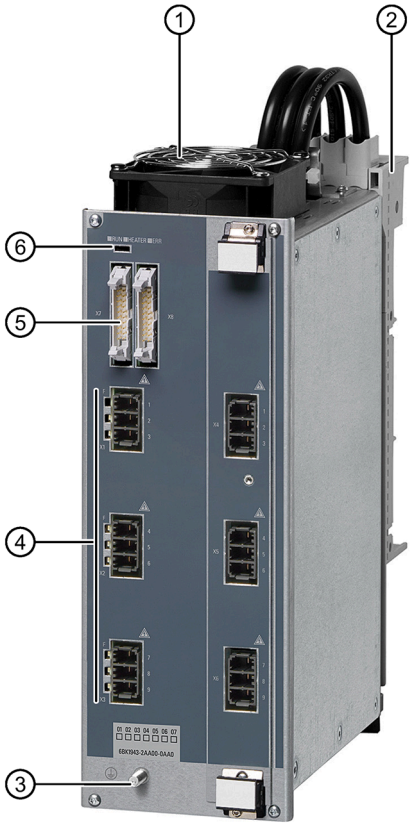
3.5.1 Function and design

Function

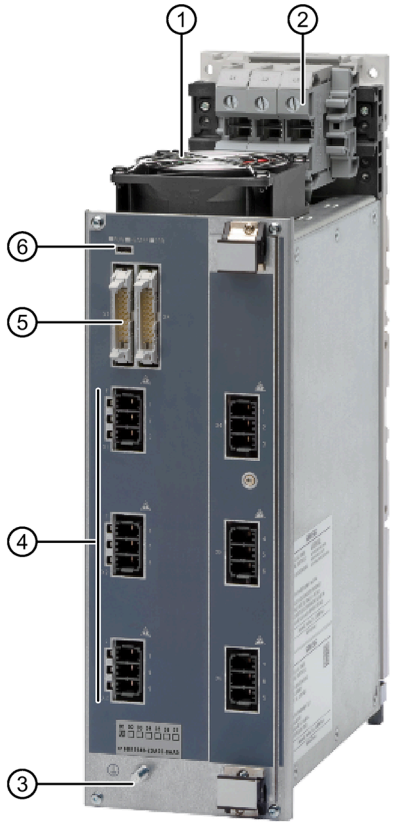
The Power Output Module (POM) provides power outputs for resistive loads and must be operated in TN and TT networks.

The POM is available in versions for busbar or panel mounting.

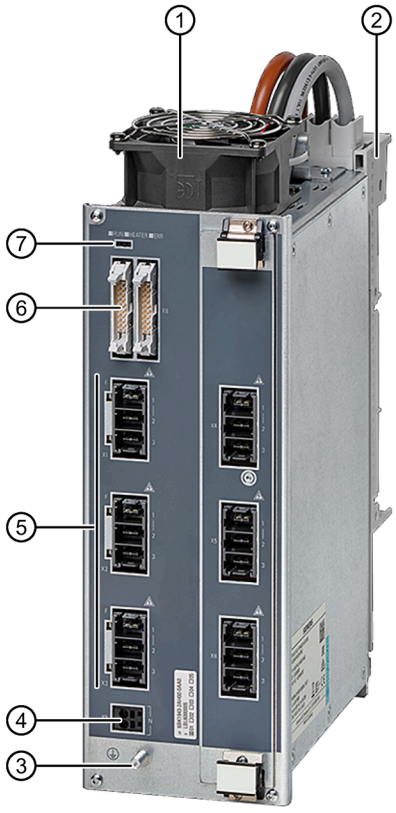
POM4320 design for busbar mounting

POM4320 for busbar mounting	Item	Description
	①	Fan
	②	Busbar adapter
	③	Protective conductor connector
	④	3 x 3 power outputs including incoming, error LED for each power output
	⑤	HCS system interface
	⑥	Status LEDs

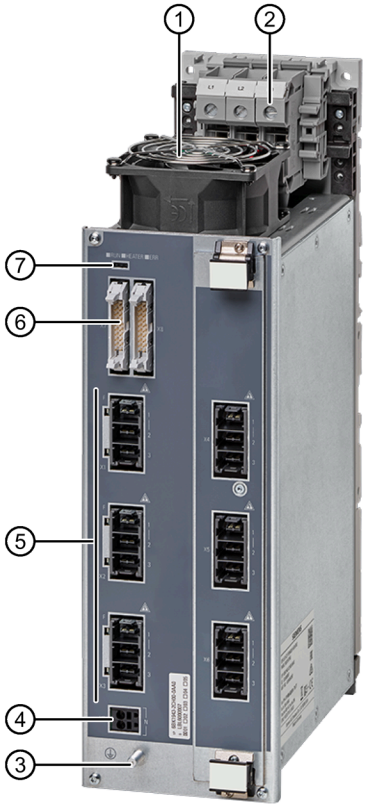
POM4320 design for panel mounting

POM4320 for panel mounting	Item	Description
	①	Fan
	②	Mains connection L1, L2, L3
	③	Protective conductor connector
	④	3 x 3 power outputs including incoming, error LED for each power output
	⑤	HCS system interface
	⑥	Status LEDs

POM4320 Highend design for busbar mounting

POM4320 Highend for busbar mounting	Item	Description
	①	Fan
	②	Busbar adapter
	③	Protective conductor connector
	④	Neutral conductor
	⑤	3 x 2 power outputs including incoming, error LED for each power output
	⑥	HCS system interface
	⑦	Status LEDs

POM4320 Highend design for panel mounting

POM4320 Highend for panel mounting	Item	Description
	①	Fan
	②	Mains connection L1, L2, L3
	③	Protective conductor connector
	④	Neutral conductor
	⑤	3 x 2 power outputs including incoming, error LED for each power output
	⑥	HCS system interface
	⑦	Status LEDs

3.6 I/O modules

3.6.1 PM4000 DI/DO

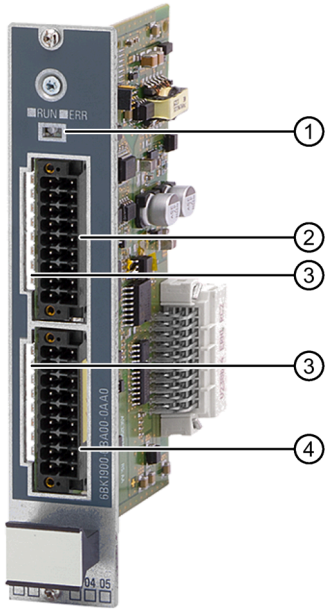
Function

The I/O module PM4000 DI/DO provides 8 digital outputs and 8 configurable inputs/outputs.

The digital I/O modules are controlled by the S7-CPU using the process image.

NOTICE
The PM4000 DI/DO must not be used for safety-relevant functions.

Design

PM4000 DI/DO	Item	Description
	①	Status LEDs • RUN LED lights up green: – Power ON – Initialization status • ERR LED lights up red: fault
	②	Digital outputs 1 ... 8
	③	LED to display switching status, one LED each per input/output • LED on: H state • LED off: L state
	④	Digital inputs/outputs 9 ... 16, switchable per channel

3.6.2 PM4000 U/I

Function

The I/O module PM4000 U/I provides inputs for measuring mains voltage and mains current.

- Voltage measurement

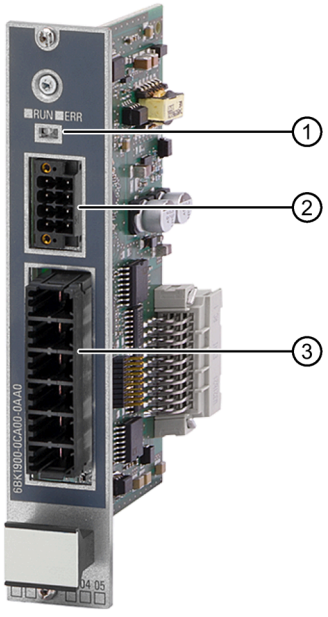
  Either the supplied line-to-line voltage or the star voltage is measured (parameterizable) The rms effective value is calculated from the measured values.

- Phase current measurement

  Three current transformers can be connected to the module (L1, L2, L3). The rms effective value is calculated from the measured values. The measuring accuracy depends on the current transformers used.

The measured values are transferred via the fieldbus and can be evaluated and further processed by the user.

Design

PM4000 U/I	Item	Description
	①	Status LEDs • RUN LED lights up green: – Power ON – Initialization status • ERR LED lights up red: Fault
	②	Measuring inputs, line current
	③	Measuring inputs mains voltage

3.6.3 PM4000 Temperature

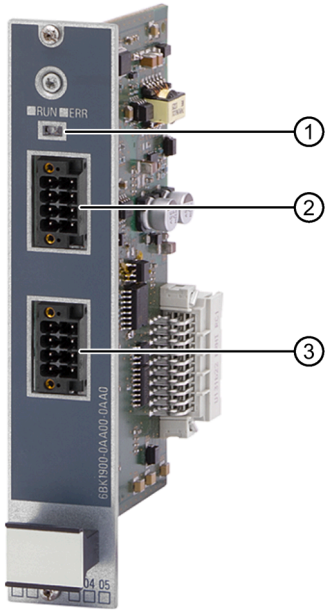
Function

I/O module temperature for HCS Central Interface Module (CIM).

- Four measuring inputs for temperature in two-wire technology or two measuring inputs for temperature in four-wire technology.
- Four analog inputs for 0 mA to 20 mA

The measured values are transferred via the fieldbus and can be evaluated and further processed by the user.

Design

PM4000 Temperature	Item	Description
	①	Status LEDs • RUN LED lights up green: – Power ON – Initialization status • ERR LED lights up red: fault
	②	Analog inputs 1 ... 4
	③	Measuring inputs 1 ... 4 for temperature

3.7 EM4315 extension module

3.7.1 Design

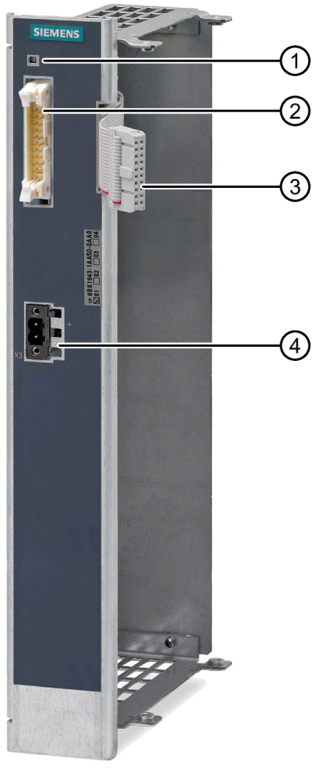
Function

In the basic configuration with one CIM, a maximum of 8 POM4320 or 6 POM4320 Highend can be operated. An EM4315 extension module enables operation of up to 8 additional POM4320 or 6 POM4320 Highend.

Two EM4315 extension modules can be used in the maximum configuration. This means the following can be operated on one CIM in total:

- 24 POM4320 or
- 18 POM4320 Highend

Design

EM4315 extension module	Item	Description
	①	Status LEDs
	②	System interface to last POM
	③	System interface to next POM
	④	24 V DC supply

Application planning

4

4.1 Shipping

Shipping

NOTICE
Damage to the device
The device can be damaged by inappropriate shipping. Transport the device, therefore, only in the original packaging. This will give it the necessary protection against shock and impact.

Lifting and carrying the power output module (POM)

NOTICE
Damage to the device
The power output module (POM) is connected to the busbar adapter with 3 leads.
Do not use these leads to lift or carry the POM.

4.2 Storage

It is absolutely essential that the device is stored in compliance with the storage conditions as described in Chapter Technical specifications (Page 167). In the event of ingress of dirt or liquid into the equipment, formation of condensation, damage or any other failures to comply with the prescribed storage conditions, the equipment must not be commissioned until the correct remedial procedure has been discussed with Siemens AG.

4.3 Scope of delivery

Depending on the components ordered, the scope of delivery includes:

Component	Included in the scope of supply
HCS4300 CIM	• CD with license information (CIM PROFINET) • 1 plug connector, 2-pin • Compact operating instructions
HCS POM4320	• Connecting cables 100 mm for system interface • 6 plug connectors for connecting heating elements • 18 Fuses inserted • Compact operating instructions
HCS POM4320 Highend	• Connecting cables 100 mm for system interface • 3 plug connectors for connecting heating elements • 6 Fuses inserted • Compact operating instructions
EM4315 extension module	• Compact operating instructions • 1 plug connector, 2-pin
HCS PM4000 Temperature	• Compact operating instructions • 2 plug connectors, 8-pin
HCS PM4000 DI/DO	• Compact operating instructions • 2 plug connectors, 18-pin
HCS PM4000 U/I	• Compact operating instructions • One 6-pin and one 8-pin plug connector

Unpacking and checking the delivery

1. Unpack the device.
2. Make sure that the package is complete.
3. Check the device for transport damage by visual inspection.

NOTICE
Damage to the system
Damaged parts can result in damage to the system. Only put undamaged parts into operation.

4.4 Installation location

Installation location requirements

⚠ WARNING

Electric shock hazard

Can cause death or serious injury

In order to reliably prevent hazards for the operating personnel, the control cabinet must satisfy the following requirements:

- Closed cabinet
- Grounded cabinet
- The control cabinet and device connection box must satisfy the regulations regarding fire protection housing.
- Boards and components on the reverse side of the rack must not come into contact with cables that have only single insulation and are routed through the control cabinet.

⚠ WARNING

Electric shock hazard

Can cause death or serious injury

The mains power input to which the device is connected must have a circuit breaker or a fuse. The circuit breaker or fuse must be easily accessible and clearly assigned to the device. We recommend locating the circuit breaker or fuse close to the device. Take the maximum current consumption of the heating control system into consideration when selecting the circuit breaker or fuse.

The following requirements apply for UL:

- POM4320: Circuit breaker according to UL489 or UL-listed branch circuit fuse
- Pay attention to the SCCR rating on the labeling plate. Only use the device in electric circuits limited accordingly.
- You must use copper cables with a minimum rating of 75 °C for the cabling.

⚠ WARNING

Electric shock hazard

Can cause death or serious injury

The use of a residual current device as the sole protection against indirect contact is forbidden.

Note

Installation in control cabinet/device connection box

The SIPLUS HCS4300 heating control system is intended for installation in a control cabinet or a device connection box.

- In these cases, only the LEDs on the front of the device will remain visible during commissioning. Take this into consideration for subsequent operation of the device.
- The control cabinet / device connection box must satisfy the regulations regarding fire-protection housing.
- Ensure that all cables and leads that protrude externally are equipped with adequate strain relief.

Mounting position and clearance dimensions

- The device is installed and operated vertically.
- Ensure that the permissible ambient temperature range is not exceeded (see section Technical specifications (Page 167)).
- Maintain the minimum clearances from walls and other devices:
  - Sides 0 mm (side-by-side mounting permitted), top 100 mm, bottom 100 mm for ventilation and deaeration

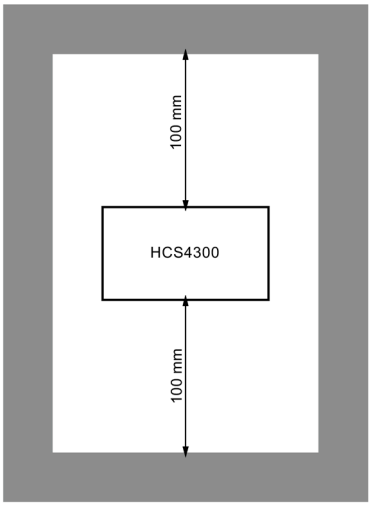


Figure 4-1 Clearances for installing an HCS4300

NOTICE
Damage due to overheating You must comply with all the instructions regarding the installation site and mounting position. Otherwise, the device might malfunction or incur permanent damage as a result of overheating.

Degree of pollution

SIPLUS HCS4300 is designed for pollution degree 2. Pollution degree 2 is defined as follows: In normal circumstances, only non-conductive pollution occurs. However, conductivity can occur occasionally and temporarily due to condensation when the device is out of service.

Overvoltage protection

NOTICE
Damage to the device Inadequately dimensioned overvoltage protection can result in severe damage to the device. Always ensure, therefore, that the overvoltage protection is adequate (see section Connect 24 V DC power supply (Page 53)).

Power loss of the POM4320

When planning and designing the cabinet cooling, take into consideration the power loss of the POMs. The power loss of a POM is calculated as follows:

$P_{LossPOM} = P_{LossChannel1} + P_{LossChannel2} + ... + P_{LossChannel9} + 6\ W$

$P_{vChannel\ (x)} = I(x)^2 \bullet 0.04\ \Omega + I(x) \bullet 0.8\ V$

x represents the channel number

This power loss occurs at 100% activation of the channels. If the channels are not 100% activated, the power loss $P_{LossChannel\ (x)}$ reduces proportionately.

Power loss of the POM4320 Highend

The calculation formula specified for the POM4320 also applies to the POM4320 Highend with internal incoming fuse.

If the incoming fuse is missing (e.g. with star connection or the fuse is implemented externally), the following formula applies:

$P_{vChannel\ (x)} = I(x)^2 \bullet 0.033\ \Omega + I(x) \bullet 0.8\ V$

Restriction of the switching power

Due to the different physical properties of heat emitters, restrictions can be imposed on their permissible switching capacity depending on the type of heat emitter.
Short-wave halogen or infrared emitters ("flash emitters") have a high starting current due to their relatively low cold resistance. The starting current can be several times the rated current, especially during the first half waves.
Overloading of the internal fuses of the POM can occur depending on the number of switching operations as well as the duration of switching operations and pause times.

NOTICE
Restriction of the switching power The power limit for each POM is set by the technical parameter "Current carrying capacity per output, max. for heating elements with high inrush current" (see Technical specifications (Page 167)) for each POM. Therefore, we recommend you to have Siemens AG measure radiation sources with a high inrush current

In this regard, read the information about using Category AC 3 contactors (see Connecting the three-phase line supply (Page 55)).

Selection of the incoming fuse for POM4320 Highend

Depending on the selected connection type, an incoming fuse is also required for the POM4320 Highend. This fuse must only meet the requirements for line protection. This means that gG fuses of size 14x51 can be used. The nominal value of the current depends on the connected load.

Recommended fuses: e.g. Siemens SENTRON, cylindrical fuse-link, 14x51 mm, 3NW61

If you connect channels in parallel, only one fuse is possible up to a current of 50 A. You must use 2 identical fuses for higher values.

For UL applications, you must use the same fuses as for fusing the outgoing line.

Derating of fuses

Note that fuses are subject to derating at high ambient temperatures, i.e. the rated current for a fuse is reduced.

Restrictions when using POM4320 Highend

Owing to the power requirement of the POM4320 Highend, there arise restrictions in the number of POMs that can be run on a CIM. You can determine the maximum possible combinations from the following table:

POM	**Possible POM combinations**																		
POM4320 Highend	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
POM320	24	22	21	20	18	17	16	14	13	12	10	9	8	6	5	4	2	1	0

4.5 POM4320 power rating

POM4320 IEC power rating

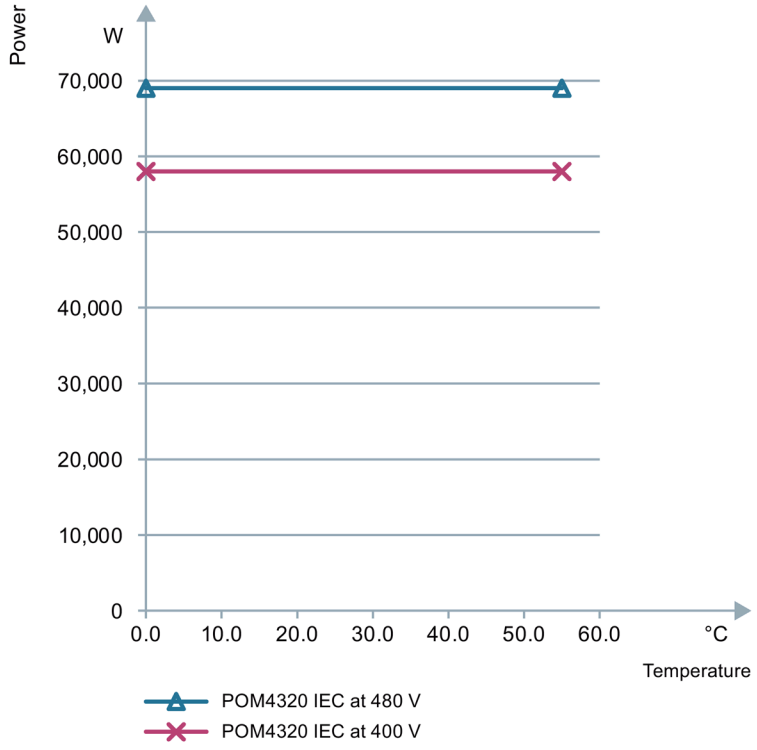


Figure 4-2 POM4320 IEC power rating

Power rating POM4320 UL

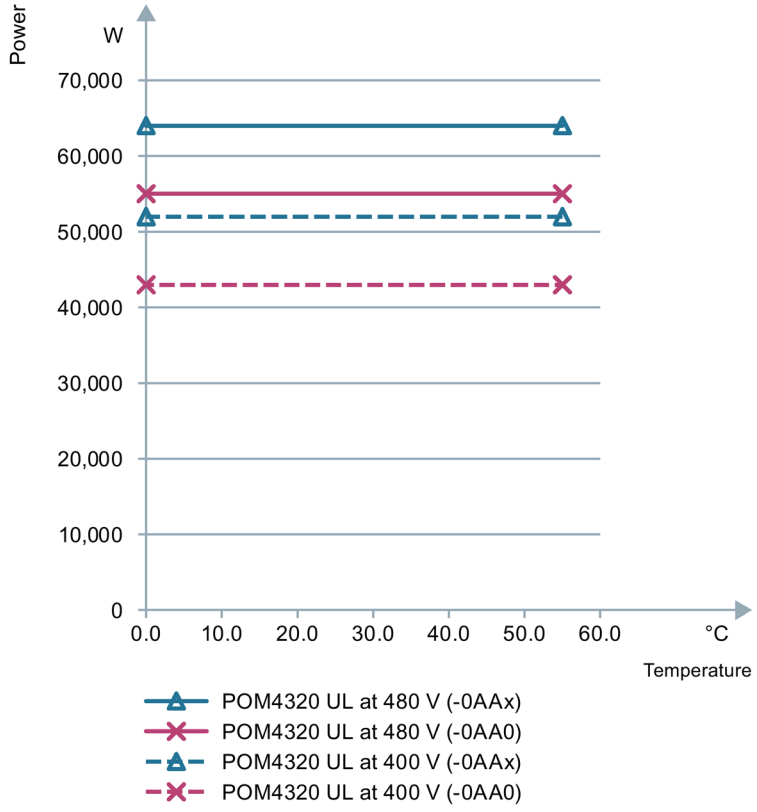


Figure 4-3 POM4320 UL power rating

4.6 Power rating of the POM4320 Highend

Power rating of the POM4320 Highend

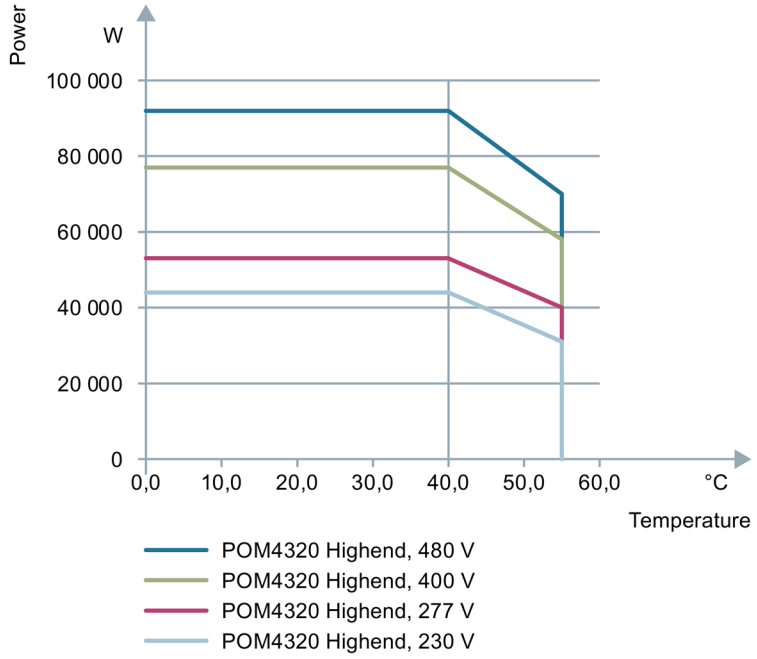
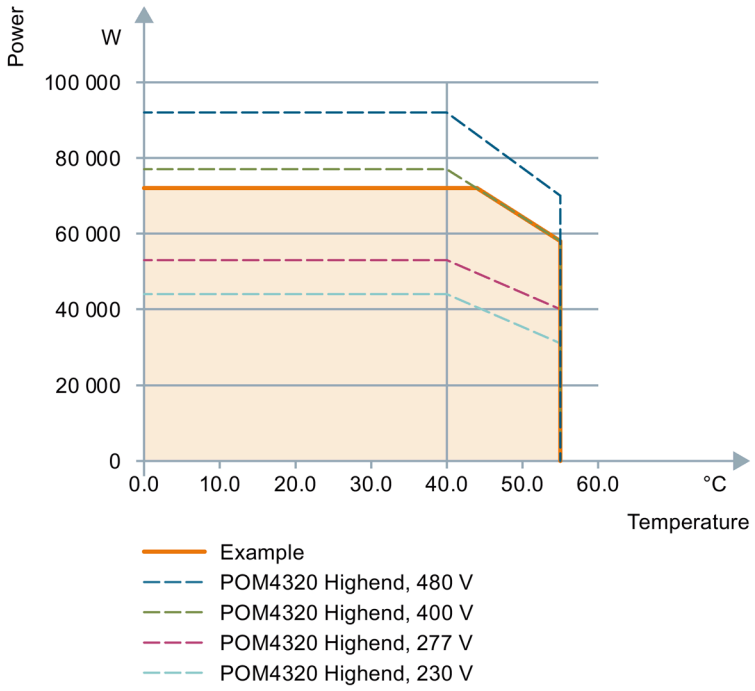


Figure 4-4 Power rating of the POM4320 Highend depending on ambient temperature and line voltage

Example

You can find the power ratings for the example in section POM4320 Highend for wall mounting (Page 39), section "Connecting between phase and phase (400/480 V), single connection of outputs".

- Incoming fuse, internal, IEC
- Delta connection, open
- Total device performance at 400 V


Power
W
100 000
80 000
60 000
40 000
20 000
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
°C
Temperature
Example
POM4320 Highend, 480 V
POM4320 Highend, 400 V
POM4320 Highend, 277 V
POM4320 Highend, 230 V

4.7 POM4320 Highend power rating

There is a configurator available as an aid for configuring the heating controller. More information can be found on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109799564).

4.7.1 POM4320 Highend for busbar adapter

Connection between phase and phase (400 V/480 V), single connection of outputs

Table 4- 1 POM4320 Highend for busbar adapter. connection between phase and phase (400 V/480 V), single connection of outputs

Line voltage 400 V and 480 V	Incoming fuse		
	Internal, IEC	External, IEC	Not required, IEC
Delta connection, open			
Total device performance at 400 V	57,600 W	76,800 W	–
Total device performance at 480 V	69,120 W	92,160 W	–
Delta connection and star connection, closed			
Total device performance at 400 V	–	–	44,341 W
Total device performance at 480 V	–	–	53,209 W
2-pin switching, phase – phase			
Total device performance at 400 V	–	–	38,400 W
Total device performance at 480 V	–	–	46,080 W
economy circuit delta and star			
Total device performance at 400 V	57,600 W	66,511 W	-
Total device performance at 480 V	69,120 W	79,813 W	-

You can find block diagrams for the connection types in the section Connection between phase and phase (400/480 V) (Page 60).

Connection between phase and phase (400 V/480 V), parallel connection of outputs

Table 4- 2 POM4320 Highend for busbar adapter. connection between phase and phase (400 V/480 V), parallel connection of outputs

Line voltage 400 V and 480 V	Incoming fuse		
	Internal, IEC	External, IEC	Not required, IEC
Delta connection, open			
Total device performance at 400 V	57,600 W	72,000 W	–
Total device performance at 480 V	69,120 W	86,400 W	–
Delta connection and star connection, closed			
Total device performance at 400 V	–	–	41,569 W
Total device performance at 480 V	–	–	49,883 W

You can find block diagrams for the connection types in the section Connection between phase and phase (400/480 V) (Page 60).

Connection between phase and neutral conductor (230 V/277 V)

Table 4- 3 POM4320 Highend for busbar adapter, connection between phase and neutral conductor (230 V/277 V)

Line voltage 230 V and 277 V	Single connection of outputs, IEC	Parallel connection of outputs, IEC
Star connection, open		
Total device performance at 230 V	44,160 W	41,400 W
Total device performance at 277 V	53,184 W	49,860 W

You can find block diagrams for the connection types in the section Connection between phase and neutral conductor (230/277 V) (Page 76).

4.7.2 POM4320 Highend for wall mounting

Connection between phase and phase (400 V/480 V), single connection of outputs

Table 4- 4 POM4320 Highend for wall mounting, connection between phase and phase (400 V/480 V), single connection of outputs

Line voltage 400 V and 480 V	Incoming fuse					
	Internal, IEC	Internal, UL	External, IEC	External, UL	Not required, IEC	Not required, UL
Delta connection, open						
Total device performance at 400 V	72,000 W	62,400 W	76,800 W	72,000 W	–	–
Total device performance at 480 V	86,400 W	74,880 W	92,160 W	86,400 W	–	–
Delta connection and star connection, closed						
Total device performance at 400 V	–	–	–	–	44,341 W	41,569 W
Total device performance at 480 V	–	–	–	–	53,209 W	49,883 W
2-pin switching, phase – phase						
Total device performance at 400 V	–	–	–	–	38,400 W	36,000 W
Total device performance at 480 V	–	–	–	–	46,080 W	43,200 W
economy circuit delta and star						
Total device performance at 400 V	66,511 W	62,354 W	66,511 W	62,354 W	-	-
Total device performance at 480 V	79,813 W	74,825 W	79,813 W	74,825 W	-	-

You can find block diagrams for the connection types in the section Connection between phase and phase (400/480 V) (Page 60).

Connection between phase and phase (400 V/480 V), parallel connection of outputs

Table 4- 5 POM4320 Highend for wall mounting, connection between phase and phase (400 V/480 V), parallel connection of outputs

Line voltage 400 V and 480 V	Incoming fuse					
	Internal, IEC	Internal, UL	External, IEC	External, UL	Not required, IEC	Not required, UL
Delta connection, open						
Total device performance at 400 V	72,000 W	62,400 W	72,000 W	64,800 W	–	–
Total device performance at 480 V	86,400 W	74,880 W	86,400 W	77,760 W	–	–
Delta connection and star connection, closed						
Total device performance at 400 V	–	–	–	–	41,569 W	37,412 W
Total device performance at 480 V	–	–	–	–	49,883 W	44,895 W

You can find block diagrams for the connection types in the section Connection between phase and phase (400/480 V) (Page 60).

Connection between phase and neutral conductor (230 V/277 V)

Table 4- 6 POM4320 Highend for wall mounting, connection between phase and neutral conductor (230 V/277 V)

Line voltage 230 V and 277 V	Single-channel connection		Parallel connection, IEC	
	IEC	UL	IEC	UL
Star connection, open				
Total device performance at 230 V	44,160 W	41,400 W	41,400 W	37,260 W
Total device performance at 277 V	53,184 W	49,860 W	49,860 W	44,874 W

You can find block diagrams for the connection types in the section Connection between phase and neutral conductor (230/277 V) (Page 76).

Installing/mounting

5

5.1 Requirements

Safety guidelines

⚠ WARNING

Hazardous voltages on the heating control system

Can cause death, serious injury or damage to property

Before starting installation or connection work on the HCS4300 heating control system, you must switch off the heating control system and secure it from being switched on again.

5.2 Installing the Power Output Module (POM)

5.2.1 Busbar mounting

5.2.1.1 Preparations

Busbar system

The mains infeed for the power output module is connected via a 3-phase busbar system. These include the following busbar systems:

- Siemens AG, SENTRON 60 mm
- Wöhner GmbH & Co. KG, 60 mm EQUES

⚠ WARNING

Dangerous voltages on the busbar system

Can cause death, serious injury or damage to property

Dangerous voltages can be present on the busbar system.
The busbar system must therefore be isolated and secured against reclosing before work begins for mounting and connecting the HCS4300 heating control system.

NOTICE
Clockwise rotating field When connecting the busbar system, make sure that the energy system is connected clockwise.

Note

Residual current protective device

If a residual current protective device is provided for the busbar system, a residual current circuit breaker of Type A is sufficient for the HCS4300.

Note

Due to the weight of the POM4320 we recommend mounting a busbar support after three devices.

5.2.1.2 Adjusting the busbar adapter

Tool

You need a Phillips screwdriver, size 0.6 x 3.5 mm.

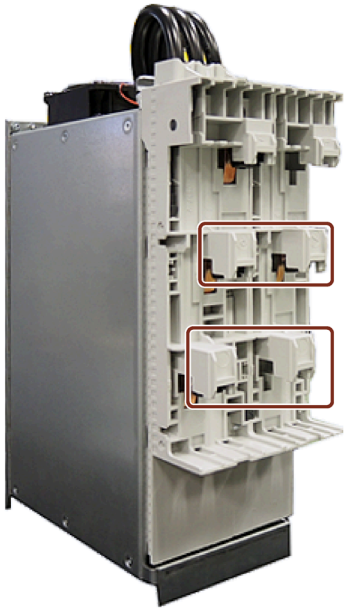
Adjusting the busbar adapter to the thickness of the busbar

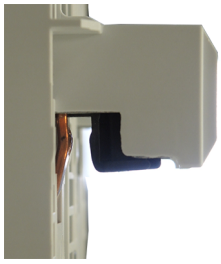
The busbar adapter of the POM can be adjusted for the following busbar thicknesses:

- 5 mm (delivery state)
- 10 mm

On the busbar adapter of the POM, there are four fastening blocks, which you can use to adjust the busbar adapter to the rail thickness. The following figure shows the position of the fastening blocks.

POM busbar adapter

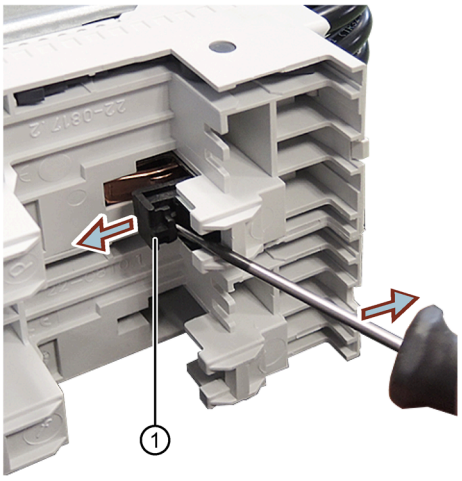
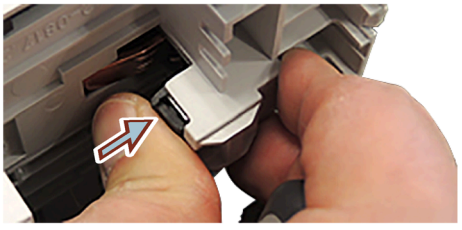




Fastening block set to 5 mm

Fastening block set to 10 mm

Proceed as follows for each of the four fastening blocks:

Steps		
1	Use the screwdriver to push out the fastening block ①.	
2	Position the mounting block according to the rail thickness at 5 mm or 10 mm.	
3	Push the mounting block inwards until it clicks into place.	

5.2.1.3 Mounting the POM (busbar adapter)

The mounting of the POM on the busbar is carried out without the need for tools via the POM busbar adapter.

Installing the POM

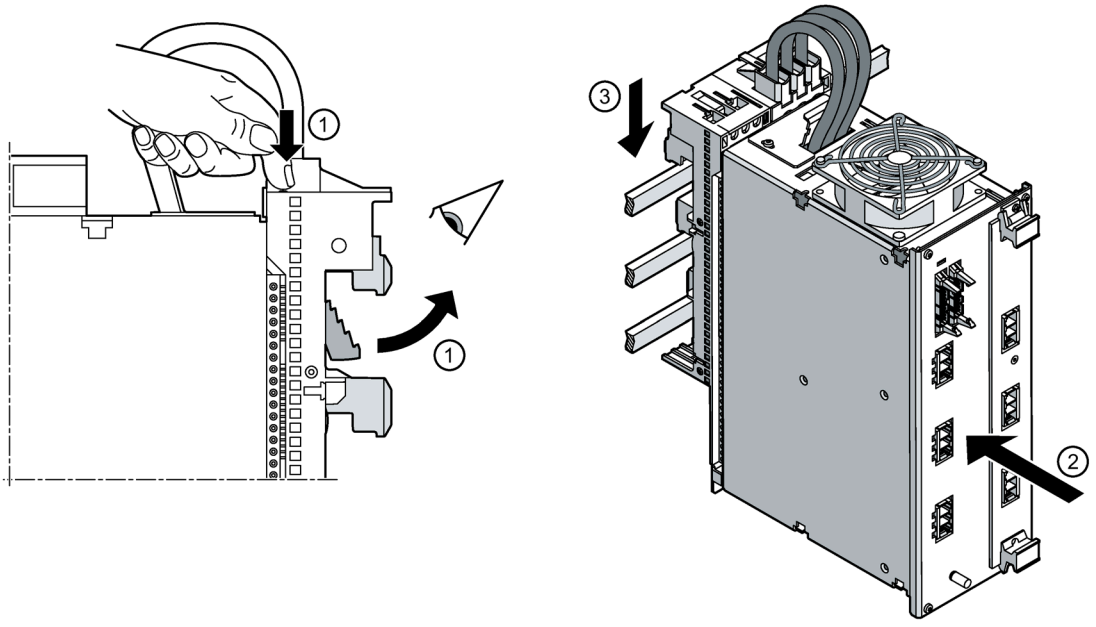


Figure 5-1 Installing the POM

Steps	
1	Press the button on the top of the busbar adapter ①. The holder must protrude beyond the busbar adapter as shown in the figure.
2	Place the busbar adapter on the busbar from above ②.
3	Press on the busbar adapter from above until the busbar adapter engages ③.

5.2.2 Panel mounting

5.2.2.1 POM mounting (panel mounting)

Installing the Power Output Modul (POM)

1. Predrill the holes in the rear panel for mounting.

   The required hole spacing is shown in the diagram below.

2. Screw the POM into place on the rear panel with four screws M5.

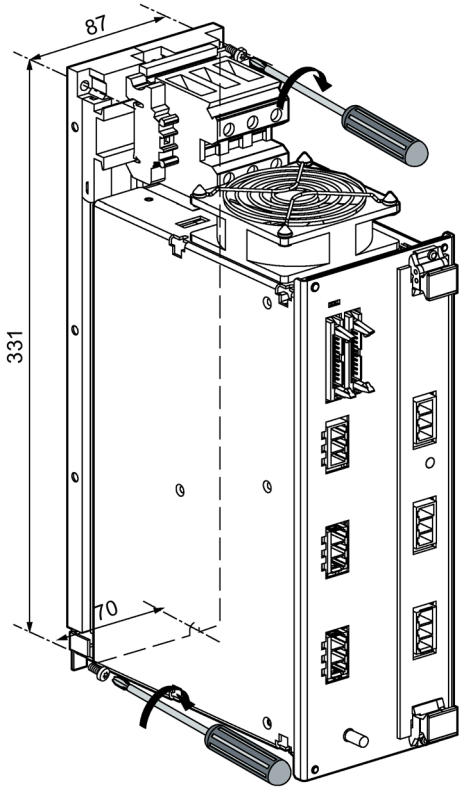


Figure 5-2 POM4320: Position of the mounting holes

Minimum spacing

Natural convection must be possible above and below the device. A clearance of 100 mm must be observed in both cases.

5.3 Installing the Central Interface Module

Tool

You will need a Torx T10 screwdriver.

Mounting the Central Interface Module (CIM)

The CIM is screwed directly onto the POM. The mounting procedure is described below:

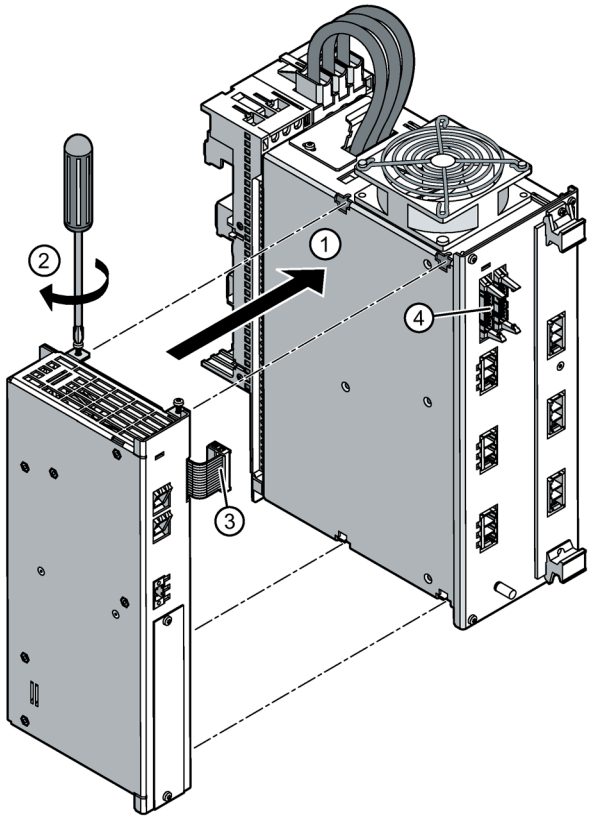


Figure 5-3 Mounting the CIM

Steps	
1	Plug the CIM into the POM by means of the four connecting lugs ①.
2	Tighten the four screws ②.

5.4 Installing the EM4315 extension module

Tool

You will need a Torx T10 screwdriver.

Installing the EM4315 extension module

Proceed as described in Section Installing the Central Interface Module (Page 47).

5.5 Installing the I/O module (PM)

The CIM is equipped with a receptacle for one I/O module.

Note

The I/O module may only be inserted or removed when the power is off.

Tool

You will need a Torx T8 screwdriver.

Installing an I/O module

The steps for mounting an I/O module are described below:

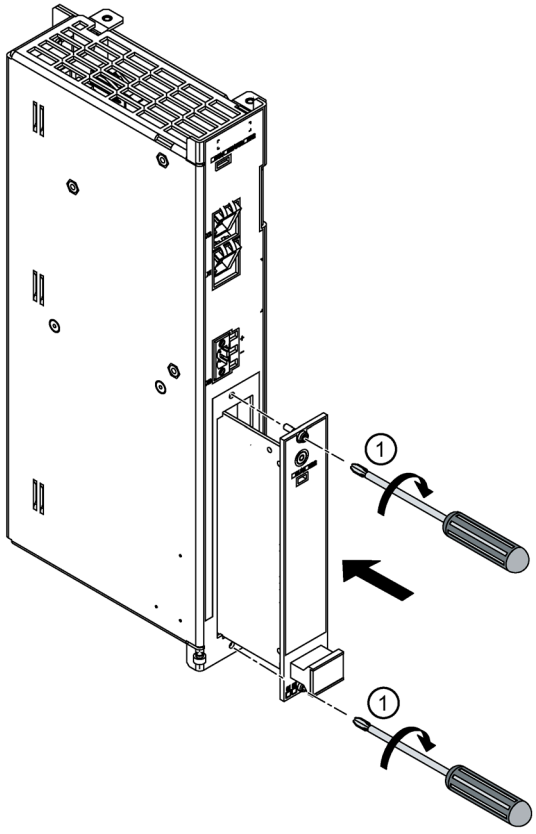


Figure 5-4 Installing an I/O module

Steps	
1	Dismantling the blanking cover of the receptacle on the CIM
2	Insert the I/O module into the receptacle and push it in as far as it will go.
3	Secure module tightly with screws ①

Wiring

6

6.1 Safety instructions and guidelines

Safety instruction

⚠ WARNING

Hazardous voltages from the mains power input or heating element feeder cables Will cause death, serious injury or damage to property

Dangerous voltages might be present on mains from the supply and to heating elements.

Before work starts on connecting the HCS4300 heating control system, the mains and heating element lines must be disconnected and secured against being switched on again.

⚠ WARNING

Electric shock hazard

Can cause death or serious injury

- Voltages of more than 60 V can occur in the control cabinet. Suitable safety precautions to prevent contact must therefore be taken before and during commissioning and maintenance work.
- Before working on the heating control system or the connected components, ensure the system is disconnected.

⚠ WARNING

Electric shock hazard

Can cause death or serious injury

The mains supply to which the device is connected must have a circuit breaker or a fuse. The circuit breaker or fuse must be easily accessible and clearly assigned to the device. We recommend locating the circuit breaker or fuse near to the device. Take the maximum current consumption of the heating control system into consideration when selecting the circuit breaker or fuse.

The following apples to the UL version of the heating control system:

- The mains supply to which the device is connected must have a circuit breaker (according to UL489) or a fuse (UL-listed branch circuit fuse).
- Observe the SCCR rating on the rating plate. Only use the device in circuits limited accordingly.
- Only use 60/75°C copper cables for the cabling.

Connection requirements

- The device is installed.
- The mains supply is disconnected at the installation location of the device and secured against secured against reconnection.
- The mains voltage is secured by an easily accessible isolating mechanism. It is recommended that the external isolating mechanism is located close to the device.
- The cables to be connected are not live.

6.2 Connecting the protective conductor

Connecting the protective conductor

Connect the POM to the protective conductor (PE). An M6 threaded bolt ① is provided on the front of the POM for connection of the protective conductor.

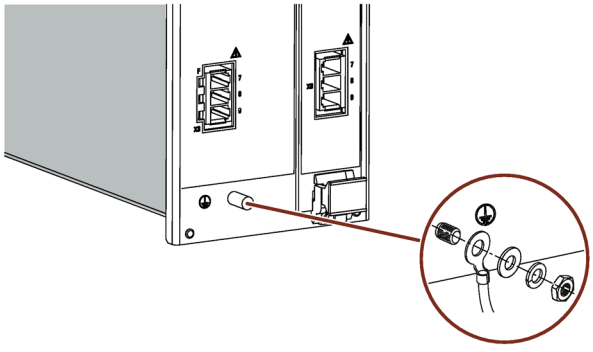


Figure 6-1 POM4320: Connecting the protective conductor

⚠ WARNING

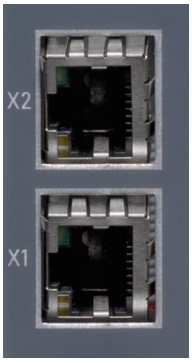
Electric shock hazard

Can cause death or serious injury

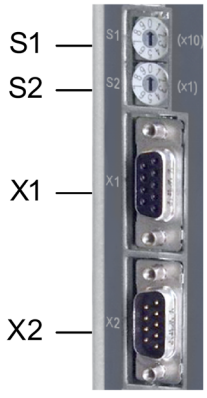
- The protective conductor must be connected to the threaded bolt indicated.
- The cross-section of the lead to the protective conductor must be at least 16 mm^2.
- The cable lug used must have a tinned surface to guarantee corrosion protection.
- When connecting the protective conductor, the applicable national or local regulations must be complied with.
- Torque for protective conductor connection: 6 Nm

6.3 Connecting PROFINET and PROFIBUS fieldbus

Connecting PROFINET

CIM PROFINET connection X1 / X2	
	Connect X1 / X2 to the higher-level controller and/or the next PROFINET device using an Ethernet cable according to the PROFINET specification. Use shielded Ethernet cables for this purpose.

Connecting PROFIBUS / setting PROFIBUS address

CIM PROFIBUS connection X1	
	• The PROFIBUS address is assigned using the S1 / S2 address selector switches. Addresses can be set from 0 to 99. • Connect X1 to the higher-level controller and/or the next PROFIBUS device via cable in accordance with the PROFIBUS specification.

6.4 Connect 24 V DC power supply

Power is supplied to the Central Interface Module (CIM) and EM4315 extension module via an external 24 V DC supply. Use a power supply unit with protection class III (PELV, e.g. according to EN61010-1) as the power supply. Power supply units from the SITOP product line are suitable, for example.

The CIM and the EM4315 can both also supply up to 8 POM4320 or 6 POM4320 Highend via the HCS system interface.

Design of the 24 V DC power supply

You can determine the design of the 24 V DC power supply using the following calculation formula:

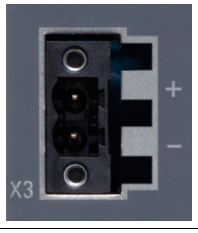
Minimum power =
3 W + (number of POM4320 • 8 W) + (number of POM4320 Highends • 10 W) + (number of I/O modules • 1 W)

Example:

Supply of an HCS4300 consisting of CIM4310 PROFINET with one I/O module and 6 connected POM4320.

The minimum power rating in accordance with the formula above is 52 W, i.e. the power pack must be able to supply current of at least 2167 mA.

Connect 24 C DC supply voltage to CIM and EM4315

24 V connection CIM and EM4315		
	Connect the 24 V DV supply voltage to the device as follows:	
	+	+24 V DC
	-	GND

External lightning protector

Note

An external lightning protection element should be connected upstream in the 24 V DC supply line:
Dehn, Blitzductor BVT Type AD24, No. 918402 or equivalent.

When using other items, you must ensure that the model used is equivalent (consult with lightning protection manufacturer).

The lightning protection module must be installed and used in accordance with the manufacturer's specifications.

- The following interference immunity is obtained with a lightning protection component:
  - 1.0 kV symmetrical with R_i = 2 Ω; assessment criterion B
  - 2.0 kV asymmetrical with R_i = 12 Ω; assessment criterion B
- Without lightning protection, the following interference immunity is obtained:
  - 0.5 kV symmetrical with R_i = 2 Ω; assessment criterion B
  - 0.5 kV asymmetrical with R_i = 12 Ω; assessment criterion B

6.5 Connecting the heating elements and three-phase line supply

6.5.1 Connecting the three-phase line supply

In the case of POM4320 for busbar mounting, the network infeed is via a 3-phase busbar system. See section Busbar mounting (Page 41).

With the POM4320 for panel mounting, three screw terminals, L1, L2 and L3, provide the mains supply. The position of the screw terminals on the POM is shown in section Function and design (Page 19).

Depending on the snubber circuit, with the POM4320 Highend, the N-conductor must be additionally connected to terminal X9 (push-in), see the block diagrams (Page 59). Both the clamping units are connected to each other.

Note

When using radiation sources with inrush current, we recommend using Category AC 3 contactors.

Note

The permissible tightening torque for the terminals of the devices for panel mounting is 3.5 Nm.

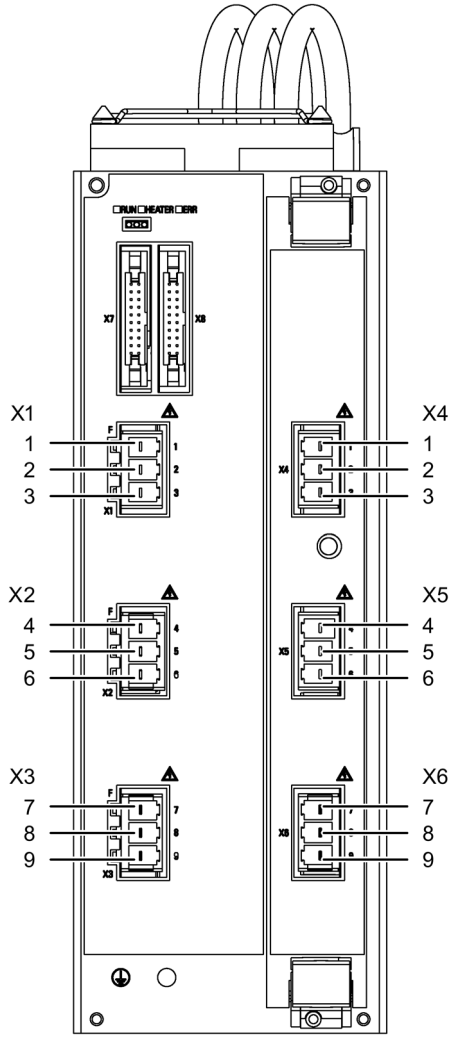
6.5.2 Connecting heating elements

Connecting heating elements to the POM4320

Heating elements are connected to the POM using six 3-pole connectors.

Note

The connected loads, e.g. heating elements, must not exceed the permissible line current of ≤ 83 A.

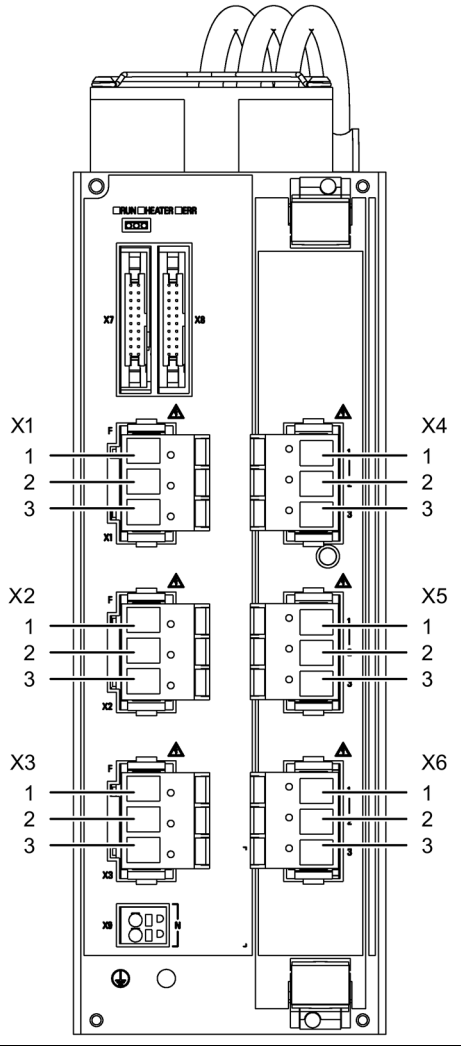
Location of the connections	Pin assignments X1 to X6	
	X1	3-pin connector for L1: Power output 1 ... 3 outgoing
	X2	3-pin connector for L2: Power output 4 ... 6 outgoing
	X3	3-pin connector for L3: Power output 7 ... 9 outgoing
	X4	3-pin connector for L2: Power output 1 ... 3 incoming
	X5	3-pin connector for L3: Power output 4 ... 6 incoming
	X6	3-pin connector for L1: Power output 7 ... 9 incoming

Connecting heating elements to the POM4320 Highend

Note

The connected loads, e.g. heating elements, must not exceed the permissible line current:

- Busbar mounting ≤ 83 A
- Wall mounting ≤ 105 A
- UL ≤ 90 A

Location of the connections	Pin assignments X1 to X6	
	X1	3-pin plug for L1: Power output 1 and 2, outgoing
	X2	3-pin plug for L2: Power output 3 and 4, outgoing
	X3	3-pin plug for L3: Power output 5 and 6, outgoing
	X4	3-pin plug for L2: Power output 1 and 2, incoming
	X5	3-pin plug for L3: Power output 3 and 4, incoming
	X6	3-pin plug for L1: Power output 5 and 6, incoming

See also

Function and design (Page 19)

Busbar mounting (Page 41)

6.6 Block diagram POM4320

Block diagram POM4320

The figure below shows the main connections between the HCS4300 heating controller and the main supply and heating elements. The power outputs are protected internally with two fuses per power output.

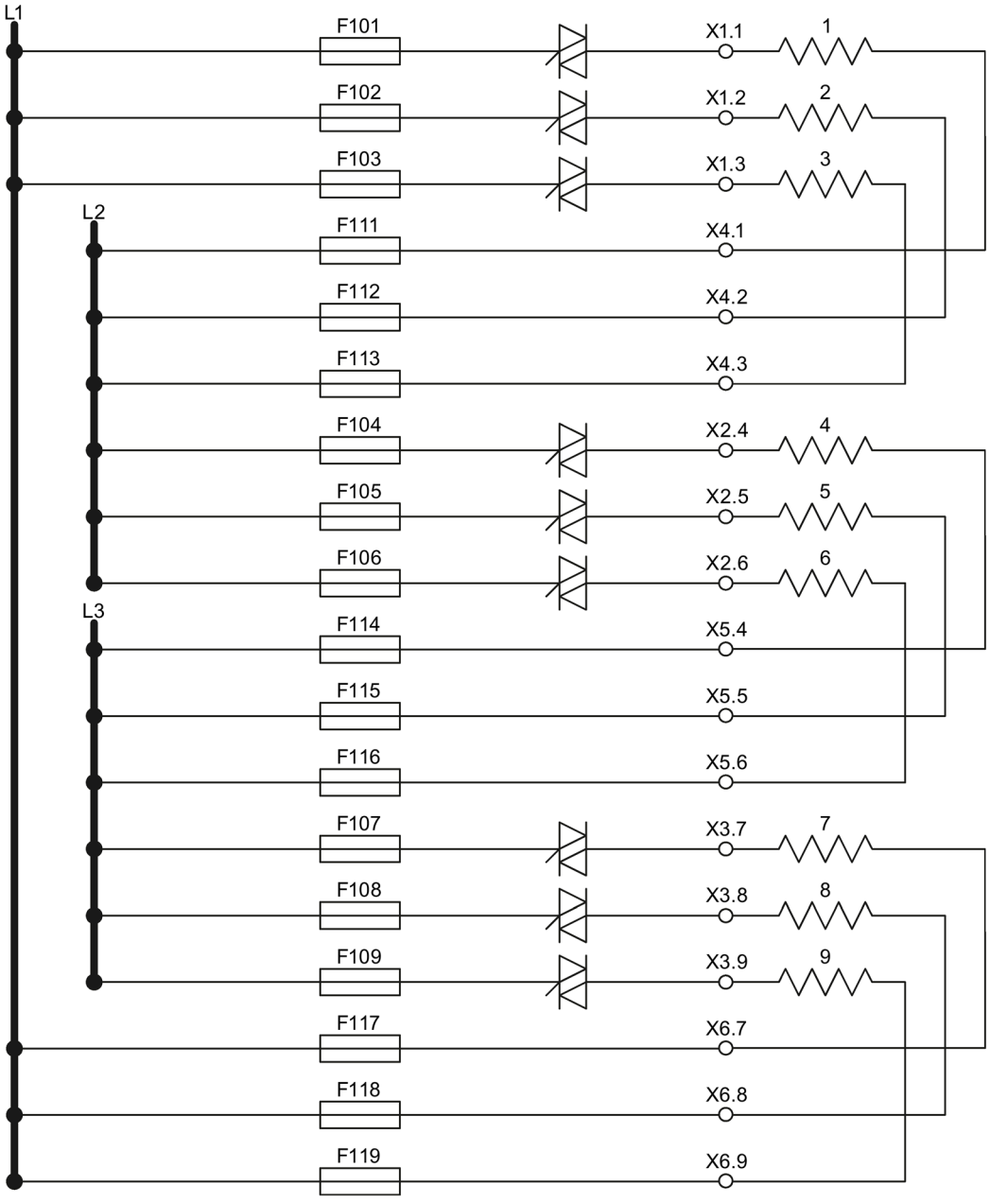


Figure 6-2 POM4320 power outputs

6.7 Block diagrams POM4320 Highend

6.7.1 Overview of connection types

The following connection types are available for the POM4320 Highend:

Connection between phase and phase, 400/480 V

- Single connection of outputs, all fuses internal
- Single connection of outputs, external incoming fuses
- Single connection of outputs, 2-pin connection
- Single connection of outputs, closed delta
- Single connection of outputs, closed star
- Parallel connection of outputs with jumper, 1 internal incoming fuse, ≤ 50 A
- Parallel connection of outputs with jumper, 2 internal incoming fuses, same nominal value for both fuses
- Parallel connection of outputs with jumper, external incoming fuses
- Parallel connection of outputs with jumper, closed delta
- Parallel connection of outputs with jumper, closed star
- Economy circuit connection of outputs, delta, all fuses internal
- Economy circuit connection of outputs, delta, additional fuses external
- Economy circuit connection of outputs, star, all fuses internal
- Economy circuit connection of outputs, star, additional fuses external

Connection between phase and neutral conductor, 230/277 V

- Single connection of outputs
- Parallel connection of outputs with jumpers

Note

With some connection types, connectors and fuses are also required for the return conductor. They are not included in the scope of supply: See "Selection of the incoming fuse for POM4320 Highend (Page 29)"

6.7.2 Connection between phase and phase (400/480 V)

Single connection of outputs, all fuses internal

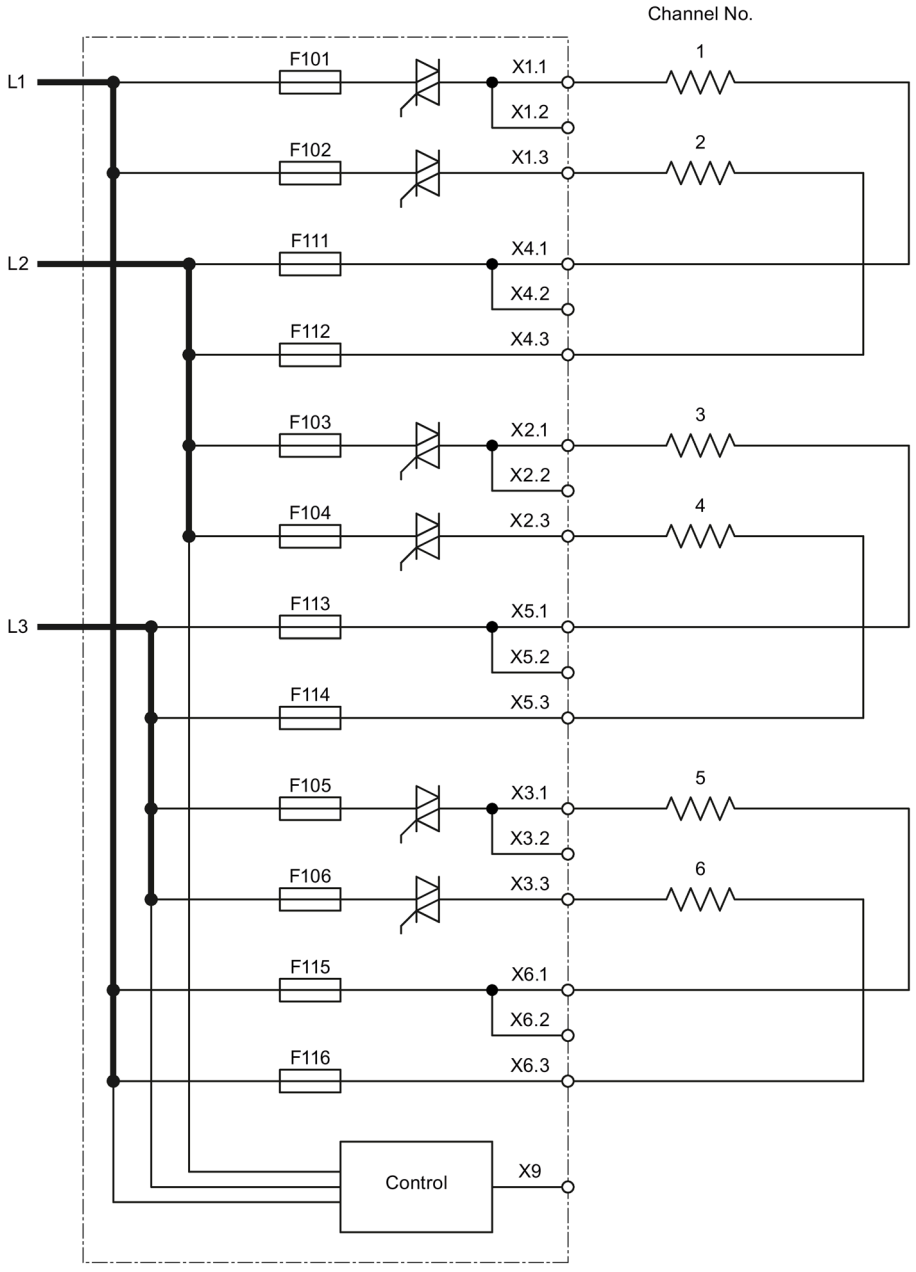


Figure 6-3 POM4320 Highend – connection between phase and phase: Single connection of outputs, all fuses internal

Single connection of outputs, external incoming fuses

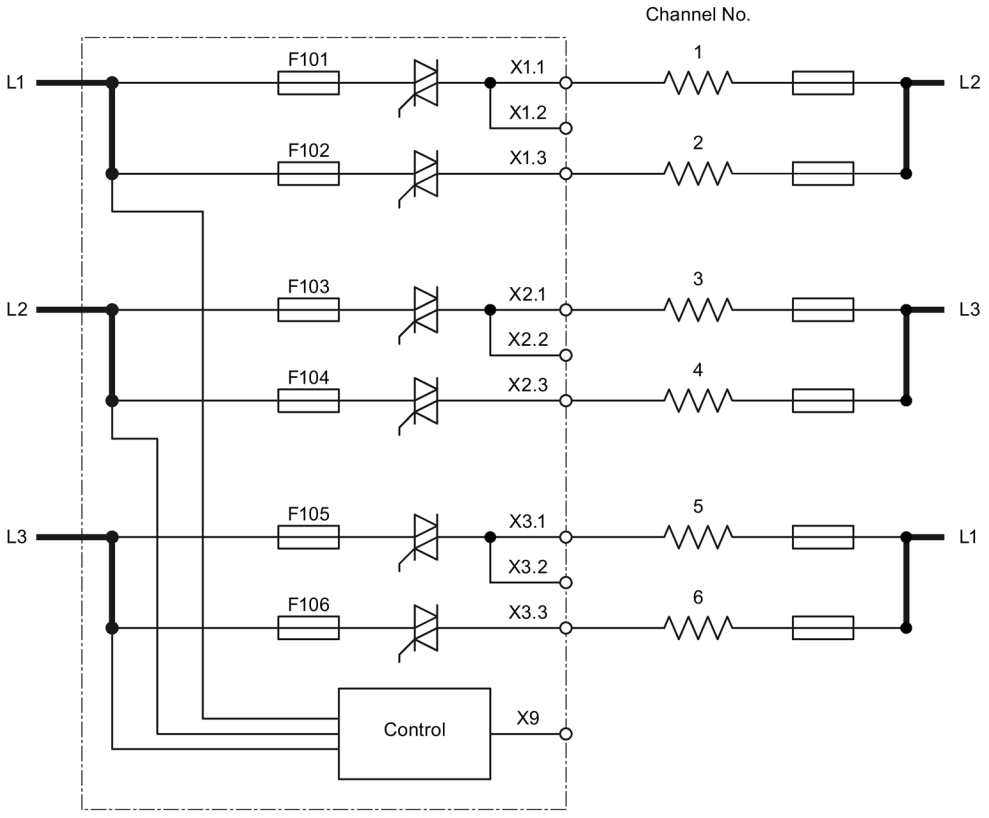


Figure 6-4 POM4320 Highend – connection between phase and phase: Single connection of outputs, external incoming fuses

Single connection of outputs, 2-pin connection

For 2-pin switching of the outputs, the loads must be switched via the power semiconductors from two channels. This has the following advantage: In case of a breakdown of the depletion layer of one of the two main power semiconductors (short-circuit), operation is still possible, or the load can be turned off.

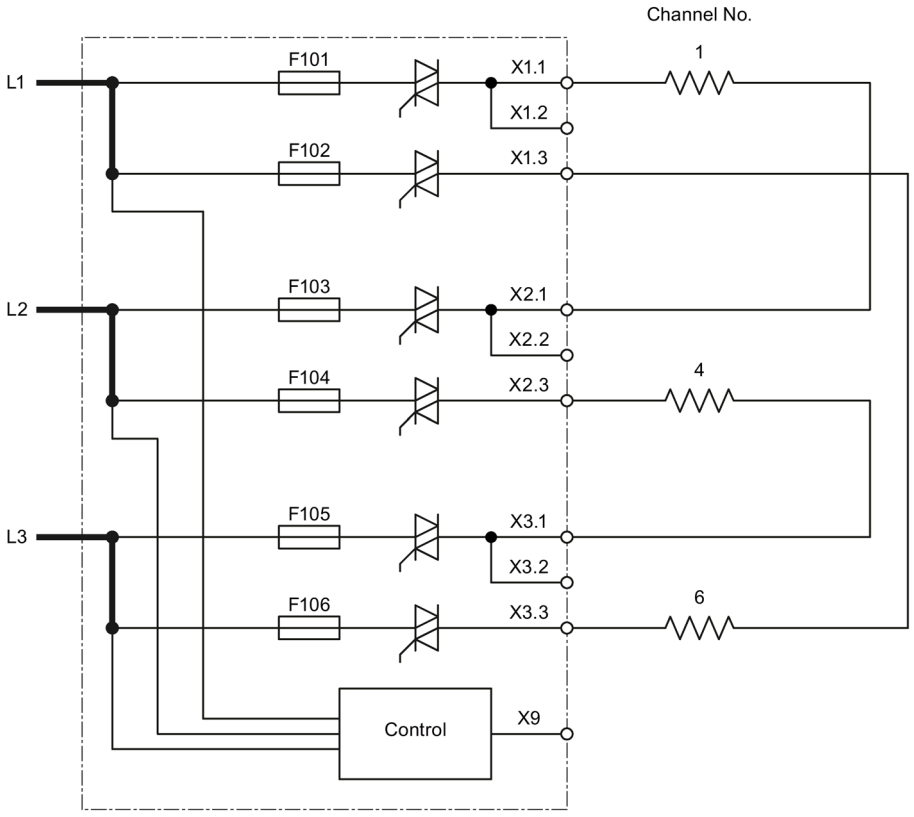


Figure 6-5 POM4320 Highend – connection between phase and phase: Single connection of outputs, 2-pin connection

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Single connection of outputs, closed delta

With a closed delta, a 3-pole delta load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the delta load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.

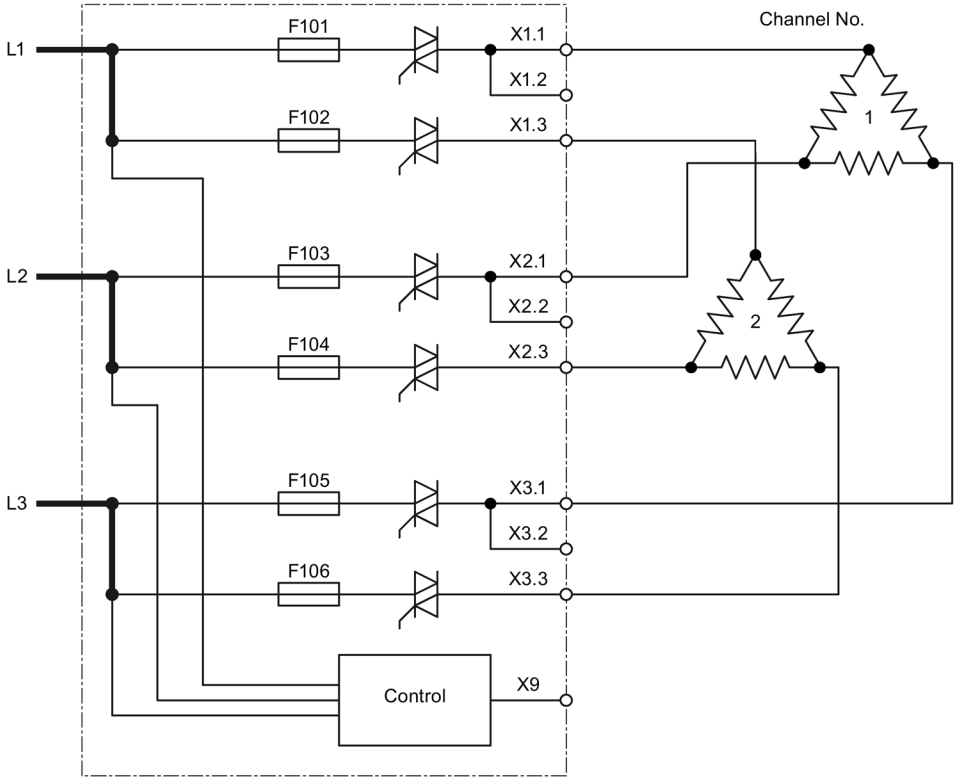


Figure 6-6 POM4320 Highend – connection between phase and phase: Single connection of outputs, closed delta

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Single connection of outputs, closed star

With a closed star, a 3-pole star load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the star load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.

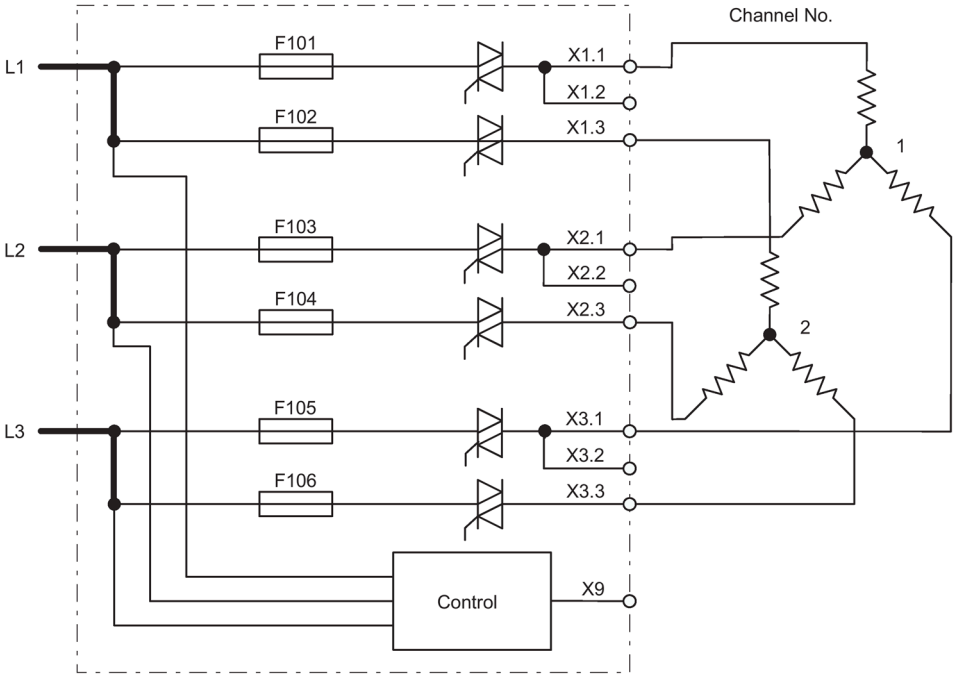


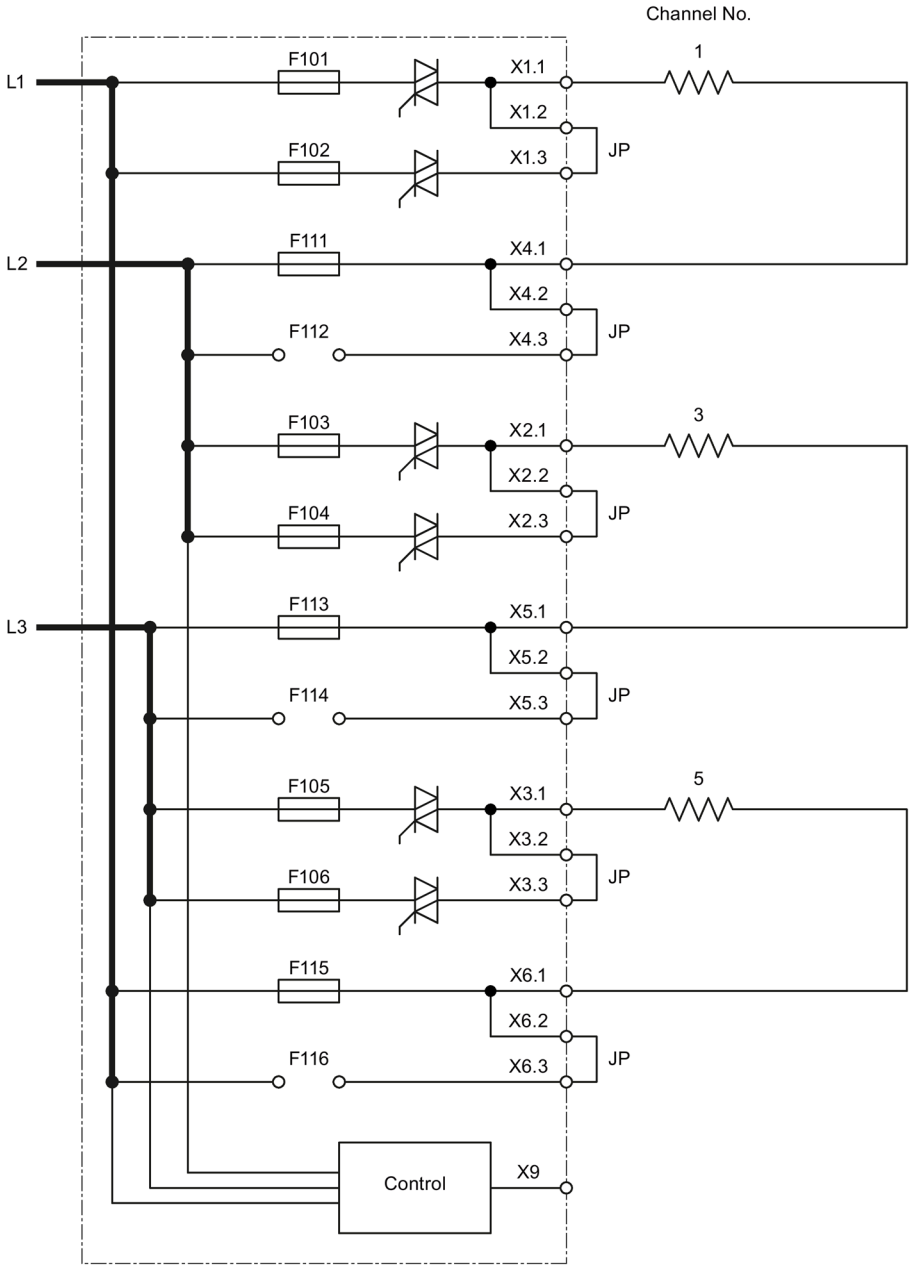
Figure 6-7 POM4320 Highend – connection between phase and phase: Single connection of outputs, closed star

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Parallel connection of outputs with jumper, 1 internal incoming fuse, ≤ 50 A

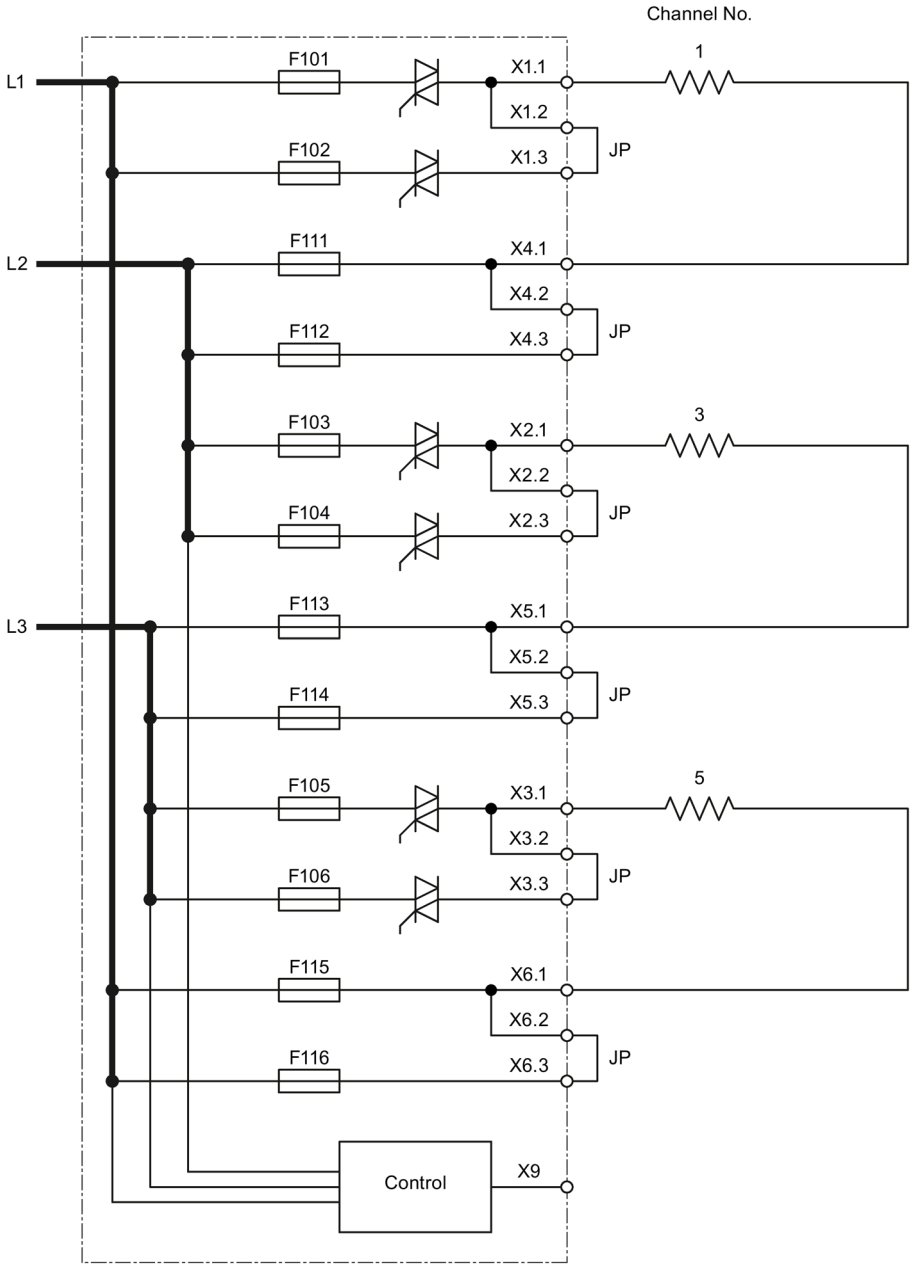


JP Jumper plug for parallel connection

Figure 6-8 POM4320 Highend – connection between phase and phase: Parallel connection of outputs with jumper, 1 internal incoming fuse, ≤ 50 A

Parallel connection of outputs with jumper, 2 internal incoming fuses, same nominal value for both fuses

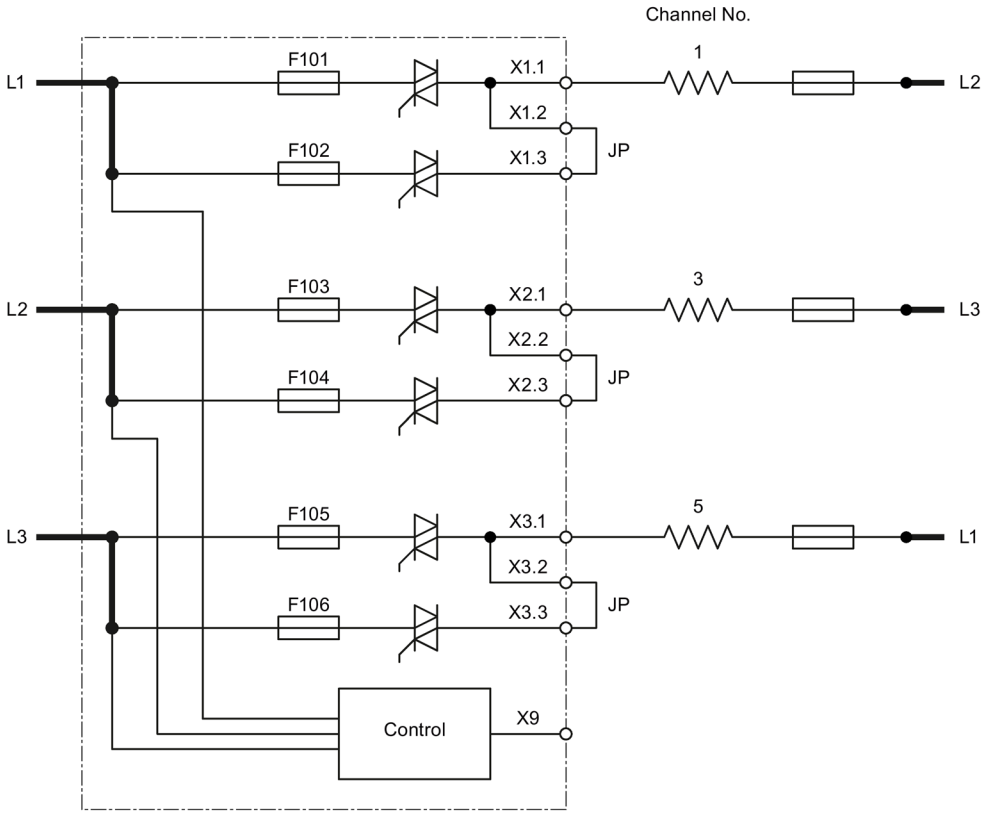
Two 32 A fuses are permissible for the following block diagram.



JP Jumper plug for parallel connection

Figure 6-9 POM4320 Highend – connection between phase and phase: Parallel connection of outputs with jumper, 2 internal incoming fuses, same nominal value for both fuses

Parallel connection of outputs with jumper, external incoming fuses



JP Jumper plug for parallel connection

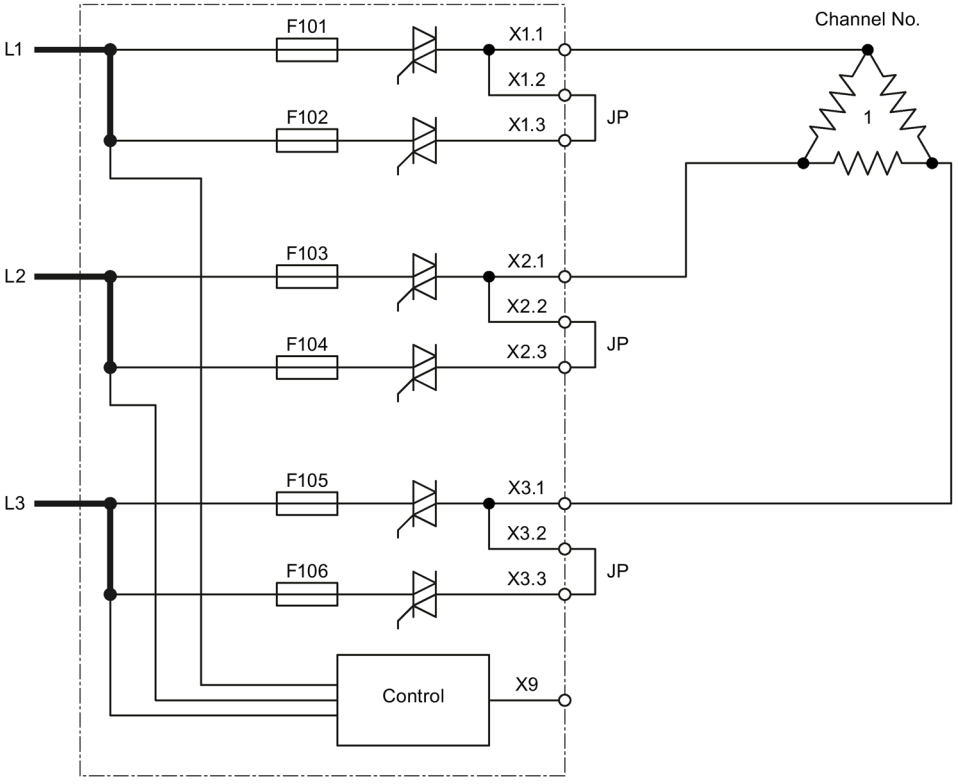
Figure 6-10 POM4320 Highend – connection between phase and phase: Parallel connection of outputs with jumper, external incoming fuses

Parallel connection of outputs with jumper, closed delta

With a closed delta, a 3-pole delta load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the delta load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.



JP Jumper plug for parallel connection

Figure 6-11 POM4320 Highend – connection between phase and phase: Parallel connection of outputs with jumper, closed delta

Note

Please note the particularities of this type of connection regarding the following aspects:

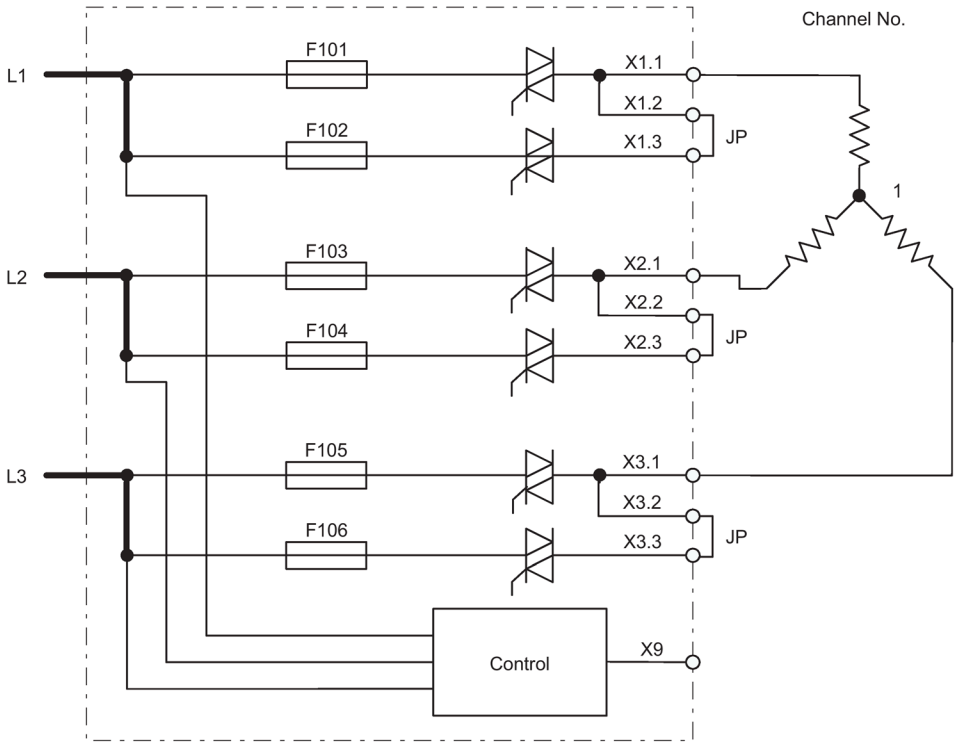
- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Parallel connection of outputs with jumper, closed star

With a closed star, a 3-pole star load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the star load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.



JP Jumper plug for parallel connection

Figure 6-12 POM4320 Highend – connection between phase and phase: Parallel connection of outputs with jumper, closed star

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Economy circuit connection of outputs, delta, all fuses internal

With a closed delta, a 3-pole delta load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the delta load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.

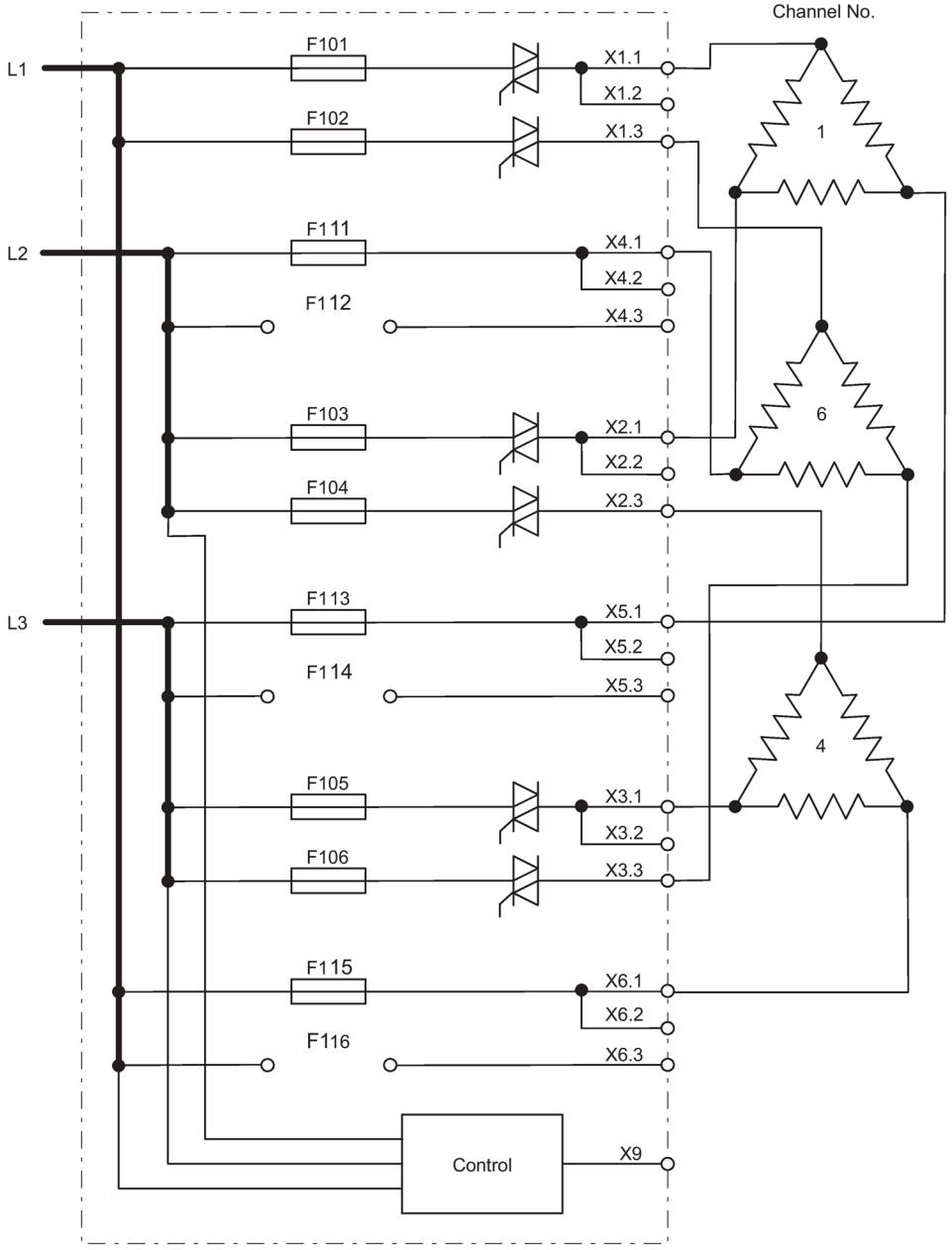


Figure 6-13 POM4320 Highend – connection between phase and phase: Economy circuit connection of outputs, delta, all fuses internal

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Economy circuit connection of outputs, delta, additional fuses external

With a closed delta, a 3-pole delta load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the delta load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.

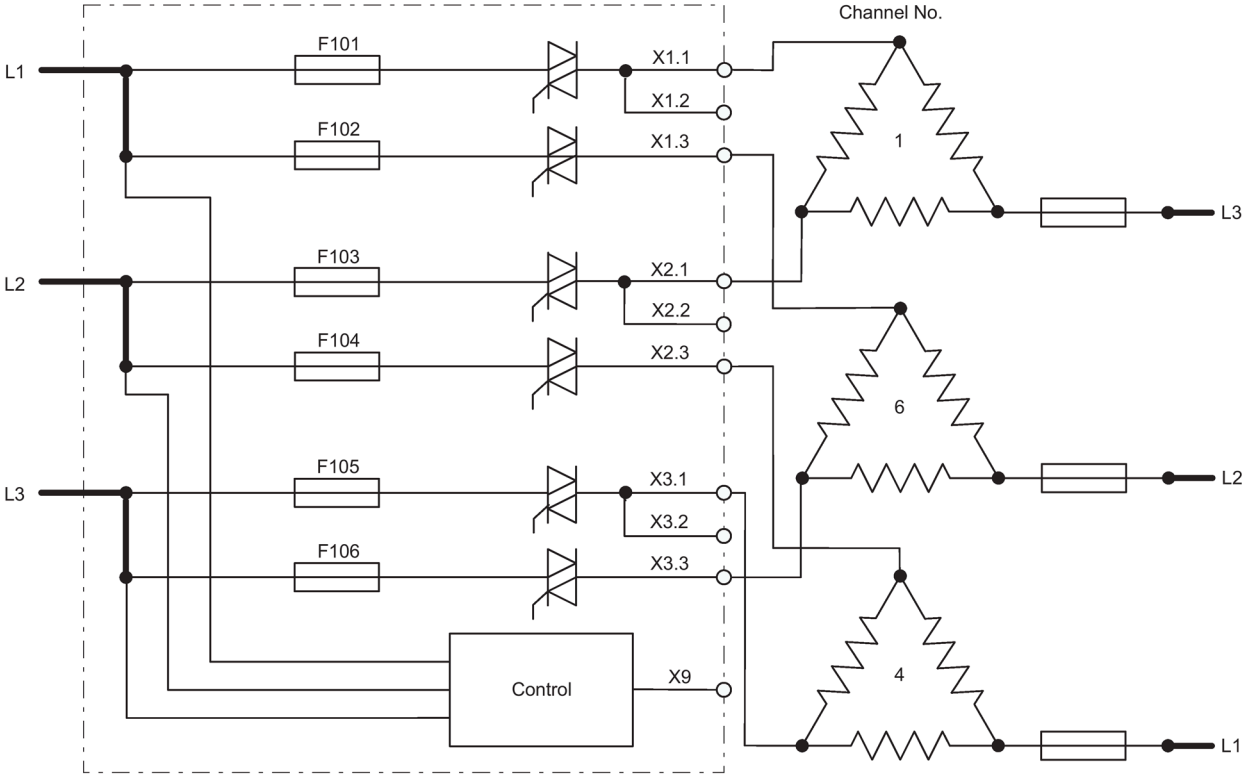


Figure 6-14 POM4320 Highend – connection between phase and phase: Economy circuit connection of outputs, delta, additional fuses external

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Economy circuit connection of outputs, star, all fuses internal

With a closed star, a 3-pole star load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the star load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.

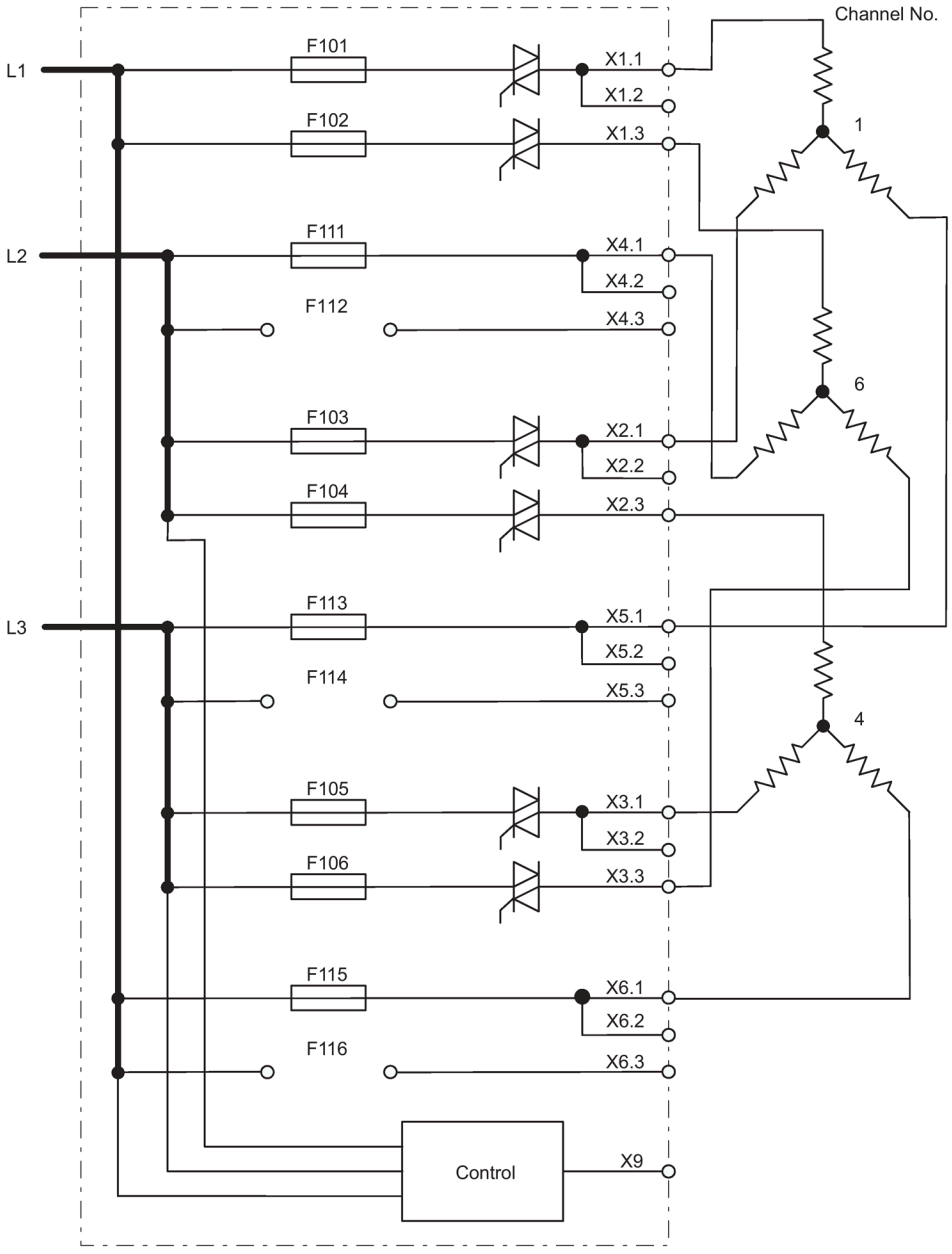


Figure 6-15 POM4320 Highend – connection between phase and phase: Economy circuit connection of outputs, star, all fuses internal

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

Economy circuit connection of outputs, star, additional fuses external

With a closed star, a 3-pole star load is connected as shown in the block diagram.

Requirements:

- The three resistance values of the star load must be identical.
- Only loads with low temperature coefficients may be used. Radiators with tungsten heating coils, for example, are not permitted.

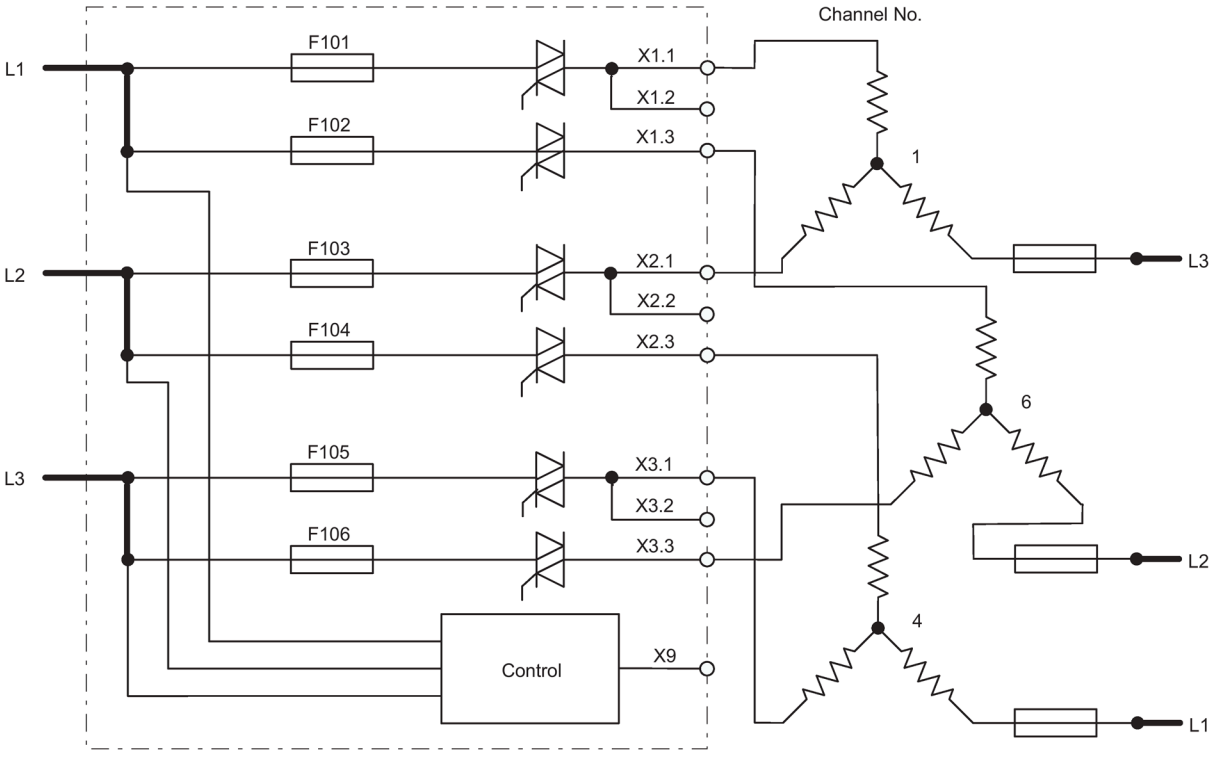


Figure 6-16 POM4320 Highend – connection between phase and phase: Economy circuit connection of outputs, star, additional fuses external

Note

Please note the particularities of this type of connection regarding the following aspects:

- Configuration parameters (see Configuration parameters (Page 90) for CIM and POM)
- Cyclic data (see Cyclic data exchange (Page 126))
- Measured values (see Acyclic input data (Page 138))
- Error messages (see Manufacturer-specific error codes (Page 144))

6.7.3 Connection between phase and neutral conductor (230/277 V)

Single connection of outputs

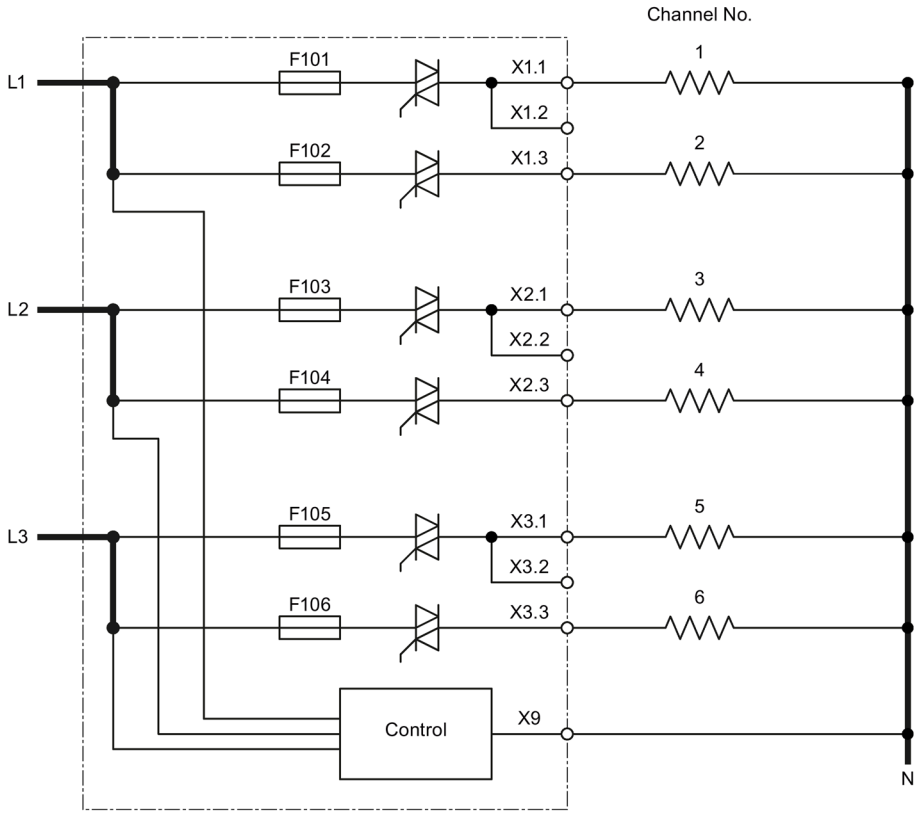
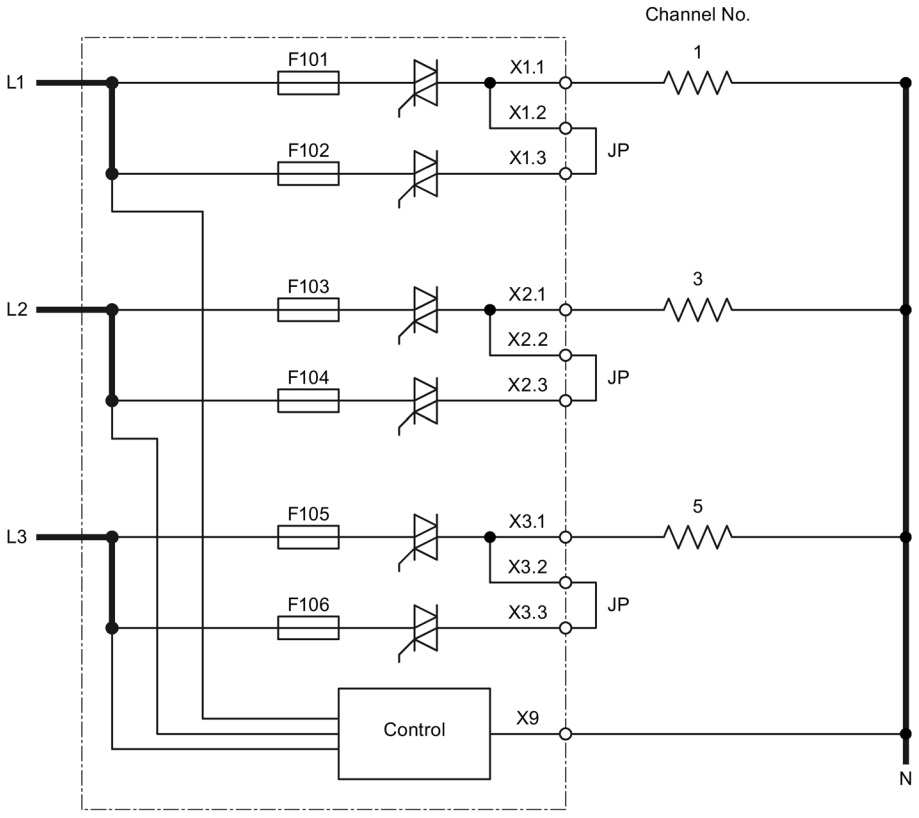


Figure 6-17 POM4320 - connection between phase and neutral conductor Single connection of outputs

Parallel connection of outputs with jumpers

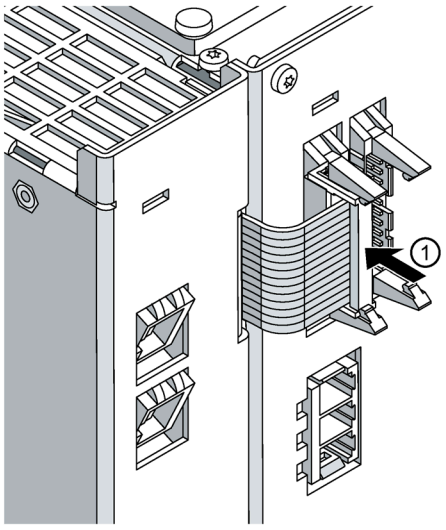


JP Jumper plug for parallel connection

Figure 6-18 POM4320 Highend – connection between phase and neutral conductor: Parallel connection of outputs with jumpers

6.8 Connecting system interfaces

Connecting system interfaces (front)

System interface CIM or EM4315 to POM	
	Attach the connecting cable between the CIM / EM4315 and POM ①. You can operate up to 8 POM4320 or 6 POM4320 Highend at a CIM / EM4315. Additional POMs can be connected with a ribbon cable to the preceding POM.

Note

The last bus connector remains open at the last POM.

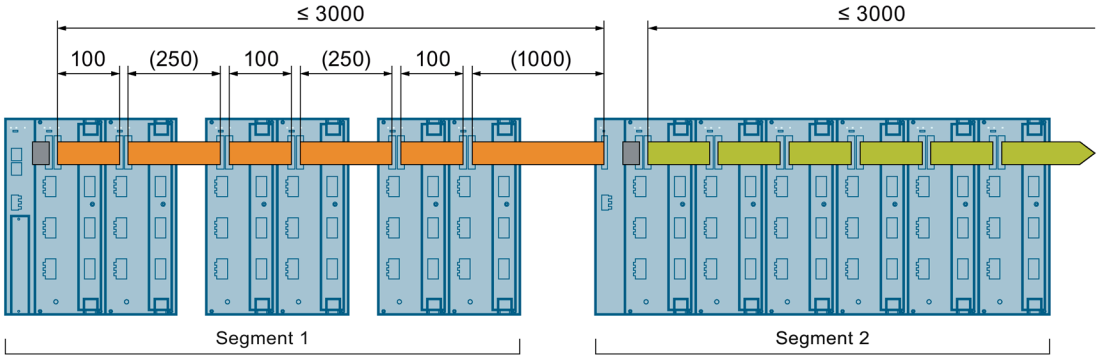
Cable length of connecting cable

Note

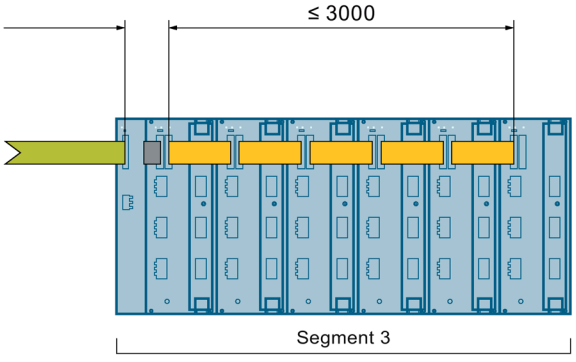
The total length of all connecting cables per segment at the system interface of the CIM4310 and EM4315 must be ≤ 3 m.

The following figure shows cable lengths which correspond to the permissible total length ≤ 3 m:

100 + 250 + 100 + 250 + 100 + 1000 ≤ 3000



All data in mm.



6.9 Connecting I/O modules

6.9.1 PM4000 DI/DO

Connecting the digital inputs/outputs

The connection is made by means of two 18-pin plug connectors of the PM4000 DI/DO.

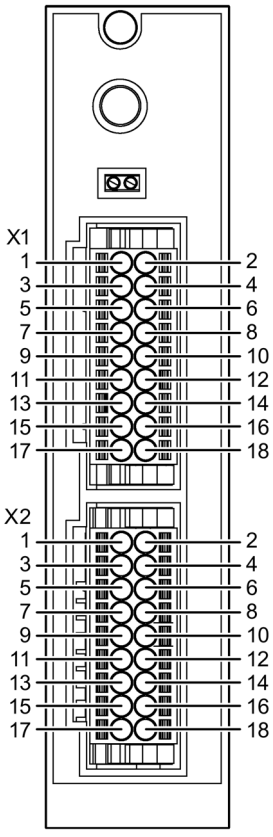


Figure 6-19 PM4000 DI/DO pin assignment

Note

The connection cables are to be shielded if longer than 30 m.

For each connector, one pin each is available for the connection or the reintroduction of the 24 V supply voltage and the 0 V supply voltage. All 24 V and GND pins of both connectors are respectively connected so that, with consideration to the maximum current, a looping-through of the supply voltage is possible (daisy chain).

Note

The maximum permission current of the connector is 8 A.

X1: Digital outputs:

18-pin connector with spring-loaded connection and interlock. The mating connectors are included in the scope of supply.

Pin	Assignment		Pin
1	GND	Digital output 1	2
3	GND	Digital output 2	4
5	GND	Digital output 3	6
7	GND	Digital output 4	8
9	GND	Digital output 5	10
11	GND	Digital output 6	12
13	GND	Digital output 7	14
15	GND	Digital output 8	16
17	GND	P24	18

X2: Digital inputs / outputs

18-pin connector with spring-loaded connection and interlock. The mating connectors are included in the scope of supply.

Pin	Assignment		Pin
1	GND	Digital input/output 9	2
3	GND	Digital input/output 10	4
5	GND	Digital input/output 11	6
7	GND	Digital input/output 12	8
9	GND	Digital input/output 13	10
11	GND	Digital input/output 14	12
13	GND	Digital input/output 15	14
15	GND	Digital input/output 16	16
17	GND	P24	18

6.9.2 PM4000 U/I

Connecting line measurement inputs

Connecting to mains power is done via the 8-pin plug-in connector X1 of the PM4000 U/I.

Connecting to mains voltage is done via the 6-pin plug-in connector X2 of the PM4000 U/I.

⚠ WARNING

Voltage hazards

Danger to life

Before working on the heating control system or the connected components, ensure the system is disconnected.

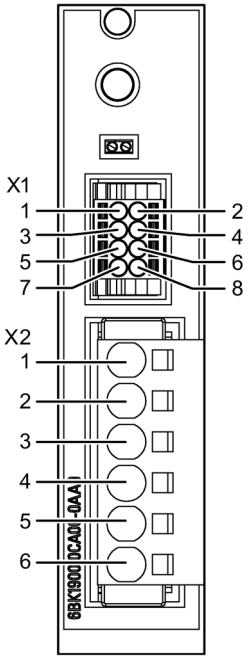


Figure 6-20 Line measurement inputs, pin assignment

X1: Current measurement

8-pin connector with spring-loaded connection and interlock. The mating connectors are included in the scope of supply.

Pin	Assignment		Pin
1	I1 -	I1 +	2
3	I2 -	I2 +	4
5	I3 -	I3 +	6
7	Reserved	Reserved	8

Note

The connection cable for the current measurement must not be longer than 30 m.

X2: Voltage measurement

6-pin connector with spring-loaded connection and interlock. The mating connectors are included in the scope of supply.

Pin	Assignment
1	Reserved
2	Phase 1
3	Phase 2
4	Phase 3
5	Neutral conductor
6	Reserved

6.9.3 PM4000 Temperature

Connecting the measurement inputs

The analog inputs 0...20 mA are connected by means of the 8-pin plug connector X1 of the PM4000 Temperature.

The measurement inputs for temperature are connected by means of the 8-pin plug connector X2 of the PM4000 Temperature.

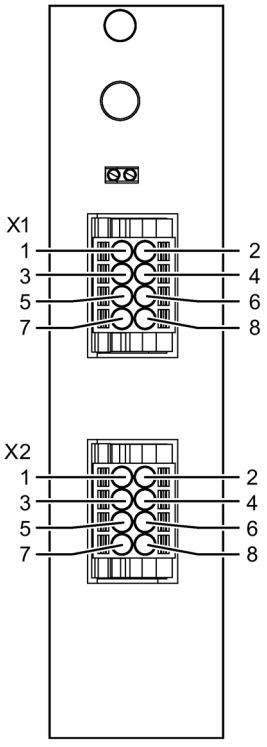


Figure 6-21 PM4000 Temperature pin assignment

X1: Four analog inputs 0 ... 20 mA

8-pin connector with spring-loaded connection. The mating connectors are included in the scope of supply.

Pin	Assignment		Pin
1	Analog channel 1 -	Analog channel 1 +	2
3	Analog channel 2 -	Analog channel 2 +	4
5	Analog channel 3 -	Analog channel 3 +	6
7	Analog channel 4 -	Analog channel 4 +	8

X2: Temperature measuring inputs

8-pin connector with spring-loaded connection. The mating connectors are included in the scope of supply.

2-wire measurement

Pin	Assignment		Pin
1	Temperature channel 1 -	Temperature channel 1 +	2
3	Temperature channel 2 -	Temperature channel 2 +	4
5	Temperature channel 3 -	Temperature channel 3 +	6
7	Temperature channel 4 -	Temperature channel 4 +	8

4-wire measurement

Pin	Assignment		Pin
1	Temperature channel 1 U-	Temperature channel 1 U+	2
3	Temperature channel 1 I-	Temperature channel 1 I+	4
5	Temperature channel 3 U-	Temperature channel 3 U+	6
7	Temperature channel 3 I-	Temperature channel 3 I+	8

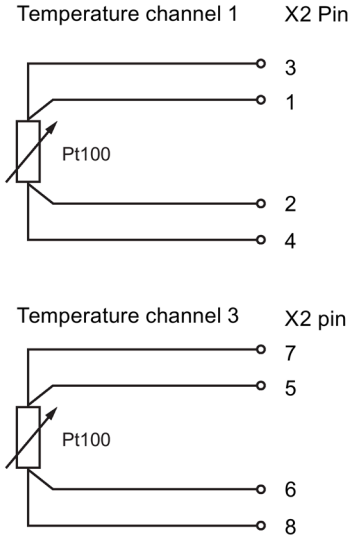


Figure 6-22 Wiring of the measuring inputs to X2 for 4-wire measurement using example of Pt100

Commissioning 7

7.1 Requirements

Before commissioning starts, the system components must be installed and wired up.

The following is necessary:

- A SIMATIC S7 CPU / SIMOTION with PROFINET/PROFIBUS interface
- A SIPLUS HCS4300 heating control system, comprising one central interface module (CIM) and at least one power output module (POM).

7.2 Commissioning

Procedure

1. Switch on the 24 V DC power supply.
2. Switch on the three-phase power supply for the heating control system.

   The components CIM, POM and PM, if installed, of the heating control system start up. Observe the operating mode indicators (see section Process and system messages, error handling (Page 148)).

The heating control system is in operation.

7.3 Insulation test

With the POM4320 Highend, there are Y-capacitors in the mains supply input. Therefore, we recommend a DC measurement for the insulation test.

If there are several devices in one circuit, you must allow for the parallel connection of the impedances. If necessary, you must remove the device from the circuit before the insulation test.

Protective conductor current

Due to the protective impedances, the following protective conductor current flows under normal operating conditions:

Voltage	Protective conductor current
400 V, 50 Hz	<1.1 mA
480 V, 60 Hz	<1.4 mA

Configuring/Programming

8

8.1 Integrating the HCS4300 into the PROFINET configuration

Procedure with SIMATIC S7

If the hardware catalog of your configuration software does not feature the HCS4300 yet, it can be integrated by installing an HSP. An HSP is available for TIA Portal and can be downloaded from the Siemens Service&Support area (http://www.siemens.com/automation/service&support /).

Procedure with non-Siemens controllers

For PROFINET configuration you will need the language-specific GSDML file. The GSDML file must be installed in the configuration software.

The GSDML file "GSDML-V2.34-Siemens-002A-HCS4300-*yyyymmdd*" can be downloaded from the Siemens Service&Support area (http://www.siemens.com/automation/service&support).

If a non-Siemens PROFINET controller is used, install the GSDML file as described in the manufacturer's instructions.

8.2 Integrating the HCS4300 into the PROFIBUS configuration

Procedure with SIMATIC S7

If the hardware catalog of your configuration software does not feature the HCS4300 yet, it can be integrated by installing the GSD file. The file is available in German (SIEM81C5.gsg) and English (SIEM81C5.gse) and can be downloaded from the Siemens Service&Support area (http://www.siemens.com/automation/service&support /).

Procedure with non-Siemens controllers

You will need the language-specific GSD file for PROFIBUS configuration. The SIEM81C5.gsx files can be downloaded from the Siemens Service&Support area (http://www.siemens.com/automation/service&support /).

If a non-Siemens PROFIBUS controller is used, install the GSD file as described in the manufacturer's instructions.

8.3 Device/hardware configuration in the TIA Portal

8.3.1 PROFINET device configuration

Device configuration

In the case of PROFINET, the structure of the hardware is mirrored in the TIA device configuration:

<table>
<tr><th></th><th colspan="2">CIM</th><th>POM 1</th><th>POM 2</th><th>POM 3</th><th>...</th><th>Last POM</th></tr>
<tr><td rowspan="3">Slot number</td><td colspan="2">0
(PROFINET IO)</td><td rowspan="3">2</td><td rowspan="3">3</td><td rowspan="3">4</td><td rowspan="3"></td><td rowspan="3">n</td></tr>
<tr><td rowspan="2">1</td><td>CIM head
Subslot 1.1</td></tr>
<tr><td>I/O module
Subslot 1.2</td></tr>
</table>

The configuration rules are as follows:

CIM

Slot 0 represents the PROFINET connection with the two ports. The CIM provides a slot for an I/O module. The CIM module and the CIM I/O module are assigned to slot 1 and are designed as submodules. If an I/O module is not used, subslot 1.2 remains empty.

POM

A maximum of 24 POMs can be operated on one CIM.

Note

The device configuration in the project engineering must match the actual configuration of the HCS.

Otherwise, the system cannot start up. Exception: Using the configuration control (see Configuration control (Page 97)).

8.3.2 PROFIBUS device configuration

Device configuration

In the case of PROFIBUS, the structure of the hardware in the device configuration is as follows:

Slot	CIM	PM	POM 1	POM 2	POM 3	...	Last POM
Number	1	2	3	4	5	...	n

The device configuration rules are as follows:

- CIM

  The CIM module includes the PROFIBUS-connection and is permanently present in slot 1.

- PM

  The CIM I/O module is present in slot 2. If no I/O module PM is used, an empty space must be configured here.

- POM

  A maximum of 24 POMs can be operated on one CIM.

Note

The device configuration in the project engineering must match the actual configuration of the HCS. Otherwise, the system cannot start up.

Restrictions for PROFIBUS connection

The following functions are not available or only available with limited functionality with a PROFIBUS connection:

- Configuration control is not available
- Phase control cannot be configured for operation of a POM4320
- Operation of a POM4320 Highend is not possible

8.3.3 Configuration parameters

8.3.3.1 CIM / POM configuration parameters

The configuration parameters are directly assigned to the respective module and are set during device configuration. The transfer is performed automatically upon start-up and during re-parameterization.

Configuration parameters CIM

Description	Value range
Rated voltage for line voltage compensation	• 360 V to 520 V
Configuration control	• No (default) • Yes

Configuration parameters POM4320

Description	Value range
Control mode (Set once per POM)	• Half-wave control (default) • Half-wave control with soft start variant 1 • Half-wave control with soft start variant 2 • Half-wave control with soft start variant 3 • Phase control • Phase control with soft start variant 1 • Phase control with soft start variant 2 • Phase control with soft start variant 3
Response to errors (setting per channel)	• Channel substitute value 0 (default) • Channel value retained

Configuration parameters POM4320 Highend

Description	Value range
Control type (setting once per POM)	• Half-wave control (default) • Half-wave control with soft start variant 1 • Half-wave control with soft start variant 2 • Half-wave control with soft start variant 3 • Half-wave control with adaptive soft start • Phase control • Phase control with soft start variant 1 • Phase control with soft start variant 2 • Phase control with soft start variant 3 • Phase control with adaptive soft start
Connection type (setting once per POM)	• Connection between phase and phase (internal fuse) (default) • Connection between phase and phase (external fuse) • Connection between phase and neutral conductor • 2-pin connection between phase and phase • Connection between phase and phase (closed delta) • Connection between phase and phase (closed star) • Connection between phase and phase (economy circuit delta, fuse internal) • Connection between phase and phase (economy circuit delta, additional fuse external) • Connection between phase and phase (economy circuit star, fuse internal) • Connection between phase and phase (economy circuit star, additional fuse external)
Soft start for each channel switch-on operation (setting once per POM)	• No (default) • Yes
Enable output control (setting once per POM)	• No (default) • Yes
Parallel connection of channels	• No (default) • All channels • One channel (1-2) • One channel (3-4) • One channel (5-6) • Two channels (1-2, 3-4) • Two channels (1-2, 5-6) • Two channels (3-4, 5-6)

Description	Value range
Enable fault current monitoring (setting once per POM)	• No (default) • Yes
Threshold for fault current monitoring	• 400 mA to 2,000 mA
Response to faults (setting per channel)	• Channel substitute value 0 (default) • Channel value retained
Parallel connection of loads (setting per channel)	• No (default) • Yes
Total power rating (setting per channel)	• 500 W to 28,800 W
Maximum permitted deviation from total power (setting per channel)	• 100 W to 8,000 W

Note

With parallel connection of loads, all partial loads must be above the minimum load. Otherwise, this can result in faulty diagnostics.

Note

Scaling the total power for parallel connection of loads

- For a connection of the load between phase and neutral conductor, the power ratings to be configured must be scaled to 230 V.
- For a connection of the load between phase and phase, the power ratings to be configured must be scaled to 400 V.

Note

We recommend half the (standardized) power of the lowest parallel switched load as the maximum permissible deviation from the total power.

Calculation example for interconnection of phase - neutral conductor

Scaling:

$P_{scaled} = P_{load} * (230\ V/U_{load})^2$

Load with $U_{rated} = 240$ V; $P_{rated} = 1500$ W

$P_{scaled} = 1500\ W * (230\ V/240\ V)^2$

$P_{scaled} = 1378$ W

Calculation example for interconnection of phase - phase

Scaling:

$P_{scaled} = P_{load} * (400\ V/U_{load})^2$

Load with $U_{rated} = 480$ V; $P_{rated} = 6000$ W

$P_{scaled} = 6000\ W * (400\ V/480\ V)^2$

$P_{scaled} = 4167$ W

8.3.3.2 Configuration parameters for I/O modules

The configuration parameters are directly assigned to the respective I/O modules and are set during device configuration. They are transferred on start-up and during re-parameterization.

Configuration parameters PM4000 temperature

Description	Value range
Analog channel 1 measuring range ... Analog channel 4 measuring range	• Not connected (default) • 0 mA to 20 mA • 4 mA to 20 mA (open-circuit detection)
Temperature channel 1 sensor type Temperature channel 3 sensor type	• None (default) • Pt 100 • Pt 100 (four-wire) • Pt 1000 • Pt 1000 (four-wire) • Type J thermocouple • Type K thermocouple • Type L thermocouple
Temperature channel 2 sensor type Temperature channel 4 sensor type	• None (default) • Pt 100[1)] • Pt 1000[1)] • Type J thermocouple • Type K thermocouple • Type L thermocouple
Compensation procedure	• No compensation (default) • Internal sensor • External value

[1)] When setting Pt 100/1000 (four-wire) for temperature channel 1 / 3, "none" must be selected for temperature channel 2 / 4.

Configuration parameters PM4000 DI/DO

Description	Value range
Digital channel 9 ... Digital channel 16	• Input (default) • Output
Output 1 Response to errors ... Output 16 Response to errors	• Shutdown (default) • Keep last value • Switching on
Alarm at wire break	• No (default) • Yes Note: If power outage monitoring is enabled, unused outputs must be closed or controlled with "1".
Alarm on absence of 24 V power supply	• No (default) • Yes

Configuration parameters PM4000 U/I

Description	Value range
Type of voltage connection	• Star (default) • Delta • None
Type of current converter	• None (default) • 1 A • 5 A

8.4 Software tools for commissioning support

8.4.1 Overview of tools for commissioning support

Listed below are the tools that can provide support with configuration and commissioning.

SIMATIC WinCC

A library in TIA Portal for SIMATIC WinCC is available for integration in an HMI system. This library contains a specific number of channels and fields; setpoints can be assigned and actual values can be displayed.

Example application

An example project and a block library for TIA Portal are available for the SIMATIC S7-1500 automation systems to support commissioning of the heating control system. More information can be found on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109478117).

Note

There is no example project or block library for STEP 7 Classic.

HTML pages (SIMATIC S7)

SIMATIC controllers with PROFINET interface (e.g. S7-1500) have an integrated web server that contains web pages for displaying diagnostics data. This web server can be accessed via a standard web browser.

This supports scanning of the firmware version, diagnostics buffer, tag tables and module status, as well as monitoring of communication links and displaying the topology of the plant.

In the event of a fault, the user can view the exact error message in plain text in the detail view for the module.

Note

Requirement

This function requires the use of the example application or at least the data structure of the example application.

PRONETA

SIEMENS PRONETA PC-based software tool that is provided free-of-charge, which simplifies the commissioning of PROFINET systems by performing the following tasks:

- Topology overview that automatically scans PROFINET and displays all connected components. This overview can be exported in the form of a device list. You have the option of "Initializing" the components and performing other simple configuration tasks, as well as comparing the actual configuration with a required configuration.
- IO check to quickly test the wiring of a plant and the module configuration of the components. By reading and writing the inputs and outputs, PRONETA makes sure that the distributed I/O devices with their sensors and actuators are correctly wired. PRONETA can create test profile templates and store test logs to document the test results.
- All tasks can be performed even before a CPU is integrated into the network. Moreover, since no other engineering tools or hardware are required, PRONETA enables fast and convenient checking of a plant configuration at an early stage. You can find additional information on the PRONETA here (http://support.automation.siemens.com/WW/view/en/67460624).

8.5 Configuration control

8.5.1 Configuration control

Introduction

Configuration control (option handling) is used to operate various standard machine configuration levels in one project without changing the configuration or the user program.

Operating principle of configuration control

You can use the configuration control to operate different expansion levels of a series machine with a single configuration of the HCS.

- A station master is configured in a project (maximum configuration). The station master comprises all modules needed for all possible plant parts of a modular standard machine.
- The project's user program provides for several station options for various standard machine configuration levels as well as selection of a station option. For example, a station option uses only some of the modules of the station master.
- The standard machine manufacturer selects a station option for a configuration of the standard machine. To do this, the project need not be modified, and it is not necessary to load a modified configuration.

Using a custom control data record, you inform the HCS which modules in a station option are missing or are located in a different slot as compared to the station master. The configuration control does not have an impact on the parameter assignment of the modules.

The following figure shows 3 expansion levels of a heating control system with the associated station options.

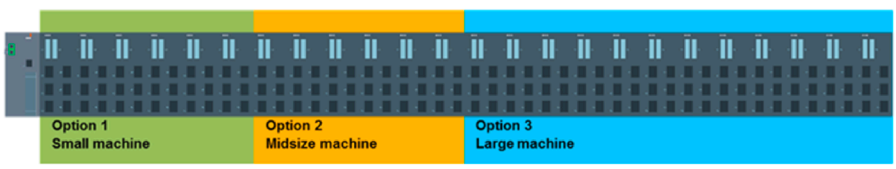


Figure 8-1 Configuration control

Advantages

- Simple project execution and commissioning by using a single STEP 7 project for all station options.
- Easy handling during maintenance, versioning and upgrades:
- Savings potential in the creation, commissioning and the documentation for standard machines.

Procedure

To set up the configuration control, follow these steps:

Step	Procedure	See section
1	Enable configuration control in STEP 7	Configuring (Page 98)
2	Create control data record	Control data record (Page 99)
3	Transfer control data record	Transferring the control data record in the startup program of the CPU (Page 101)

8.5.2 Configuring

Requirements

- Configuration control only works with PROFINET.
- One CIM4310 PROFINET version V2.1 and higher

Required steps

When configuring the CIM4320 in STEP 7 (TIA Portal), enable the "Configuration control on" parameter.

8.5.3 Control

8.5.3.1 Slot assignment

Slot assignment

The following table shows the possible slots for the various modules:

Table 8- 1 Slot assignment

Modules	Possible slots	Comment
CIM PN	0	The PN connection of the CIM is not an element of the configuration control.
CIM	1.1	The header of the CIM (subslot) is not an element of the configuration control, but instead controls it.
PM	1.2	As a sub-slot part of the configuration control (handled here as a slot 1).
POM	2 to 25	Without empty slot directly after the CIM.

8.5.3.2 Control data record

Operating principle

You define a control data record 196 V1.0, which includes a slot assignment for the configuration control of an HSC. The control data record can also be read back.

The control data record is only processed with configured configuration control; otherwise it is rejected.

Rules

Observe the following rules:

- The entry for slot 1 only identifies the PM (see also Table 8-1 Slot assignment (Page 98)).
- All modules up to the maximum possible configuration of the HCS must be registered in control data record.
- The entries up to at least the last slot of the station master must be contained in the control data record. Entries beyond the last slot must be pre-assigned with "Module not available".
- Multiple configured slots must not be assigned to the same actual slot. In other words, each station option slot can be present only once in the control data record.
- Gaps are not permitted.
- Moving modules is not allowed.

Control data record

The table below shows the structure of a control data record with explanations of the individual elements. The control data record can also be read back.

Table 8- 2 Structure of the simplified control data record V1.0

Byte	Element	Code	Explanation
0	Block length	4 + maximum slot	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Slot 1 of the station master	Slot assignment in the station option	**Control element** Contains the information on which module is inserted in which slot. The value that you need to enter in the corresponding byte depends on the following rule: • If the module is included in the station option, enter the slot number of the module from the station master. • If the module does not exist in the station option, enter 0.
5	Slot 2 of the station master	Slot assignment in the station option	
...	...	...	
28	Slot 25 of station master	Slot assignment	
...	...	...	...

8.5.3.3 Feedback data record

Operating principle

The feedback data record informs you about the accuracy of the module assignment and gives you the option of detecting assignment errors in the control data record. The feedback data record is mapped via a separate data record 197 V2.0. The feedback data record is only processed with configured configuration control; otherwise it is rejected.

Rules

Observe the following rules:

- The feedback data record refers to the configured station configuration and always includes the maximum configuration limits, which is 25 modules.
- Partial reading of the feedback data record is not possible.
- As long as a control data record is not sent, it is assumed that no modules are inserted (DS197 has status "0").

Feedback data record

Table 8- 3 Feedback data record

Byte	Element	Code	Explanation
0	Block length	4 + number of slots x 2	Header
1	Block ID	197	
2	Version	2	
3		0	
4	Slot 1 status	0/1	Status = 1: • Module from station master is inserted in the station option • Slot is marked as not available in the control data record Status = 0: • Module pulled • Incorrect module inserted in the station option*
5	Reserved	0	
6	Slot 2 status	0/1	
7	Reserved	0	
...	...	...	
53	Status of slot 25	0/1	
54	Reserved	0	

* Not possible if the slot is marked as not available.

8.5.3.4 Transferring control data record in the startup program of the CPU

Required steps

Transfer the created control data record 196 to the CIM using the WRREC (Write data record) instruction.

To verify the configuration, the feedback data record 197 can be queried by the CIM with the RDREC instruction (read data).

Parameters of the instruction WRREC

Below, you will find explanations of individual parameters of the WRREC instruction which you must supply with specific values in the configuration control context. You can find additional information on the WRREC instruction in the STEP 7 online help.

ID	Hardware identifier
INDEX	Data record number: 196 (decimal)
RECORD	Control data record to be transferred. For the structure of the control data record, see table (Page 99).

In case of an error, the WRREC instruction returns the following error messages through the STATUS block parameter:

Table 8- 4 Error message WRREC

Error code	Meaning
80B1H	Invalid length; the length information in data record 196 is not correct.
80B5H	Configuration control parameters not assigned.
80E2H	Data record was transferred in the wrong OB context. The data record must be transferred in the startup program.
80B8H	Parameter error A parameter error is caused by: • Incorrect block ID in the header (not equal to 196) • Invalid version identifier in the header • A reserved bit was set • An invalid slot in the station option has been assigned to a slot of the station master • Multiple slots in the station master are assigned to the same slot in the station option • Gap not permitted

Parameters of the RDREC instruction

Below, you will find explanations of individual parameters of the RDREC instruction which you must supply with specific values in the configuration control context. You can find additional information on the RDREC instruction in the STEP 7 online help.

ID	Hardware identifier
INDEX	Data record number: 197 (decimal)
RECORD	Feedback data record to read For the structure of the control data record, see table (Page 99).

In case of an error, the RDREC instruction returns the following error messages through the STATUS block parameter:

Table 8- 5 Error message RDREC

Error code	Meaning
80B1H	Invalid length; the length information in data record 197 is not correct.
80B5H	Configuration control not configured
80B8H	Parameter error The following events cause a parameter error: • Incorrect block ID in the header (not equal to 197) • Invalid version identifier in the header • A reserved bit was set • Multiple slots in the station master are assigned to the same slot in the station option

Special requirements relating to the transfer of the control data record

- If you have enabled configuration control, the HCS is not ready for operation without a control data record. As long as no valid control data record has been transferred, the I/O modules are considered as failed by the CPU and exhibit substitute value behavior. The CIM continues to be in data exchange.
- The control data record is stored retentively in the CIM. Note:
  - If there have been no changes to the configuration, you do not need to rewrite the control data record 196 during restart.
  - When you write a control data record to the CIM for the first time or with modified configuration, it results in a reset of the HCS (station failure). The original data record 196 is deleted and the new data record 196 is saved retentively. The station will then restart with the modified configuration.

8.5.3.5 Behavior during operation

Response when modules are missing

If modules are entered as not present in the control data record, the automation system behaves as follows:

- Any modules identified as not present in the control data record do not return any diagnostics. Its state is always OK. The value status is OK.
- Direct write access to the outputs that are not present or write access to the process image of the outputs that are not present: Remains without effect; no access error is signaled.
- Direct read access to the inputs that are not present or read access to the process image of the inputs that are not present:

  Value "0" is supplied; no access error is signaled.

Note

The configuration from the control data record DS196 must match the actual available configuration of the HCS.

Otherwise the system cannot start up.

8.5.4 Examples of configuration control

8.5.4.1 Station master HCS4300

Station master HCS4300

In the following a station master, comprising CIM4310, PM Temp, three POM4320s, is configured.

Figure 8-2 Station master HCS4300

With configuration control, the following station options are derived from the station master:

Station option with no PM

Figure 8-3 Station option with no PM

The associated control data record DS196 must be pre-assigned as follows:

Byte	Element	Code	Description
0	Block length	4 + 25	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Slot 1 of station master	0	PM is not inserted in the station options
5	Slot 2 of station master	2	POM available
6	Slot 3 of station master	3	POM available
7	Slot 4 of station master	4	POM available
8	Slot 5 of station master	0	Module not available
...	...		
28	Slot 25 of station master	0	Module not available

The data record can also be written in abbreviated form with length 4+4; the last entry is byte 7 in this case.

In an error-free case, the feedback data record DS197 contains the following entries:

Byte	Element	Code	Description
0	Block length	4 + 50	Header
1	Block ID	197	
2	Version	2	
3	Version	0	
4	Slot 1 of station master	1	Module is actually not available
5	Slot 2 of station master	1	Module is actually available
6	Slot 3 of station master	1	Module is actually available
7	Slot 4 of station master	1	Module is actually available
8	Slot 5 of station master	1	Module is actually not available
...	...		
28	Slot 25 of station master	1	Module is actually not available

Station option with no POMs

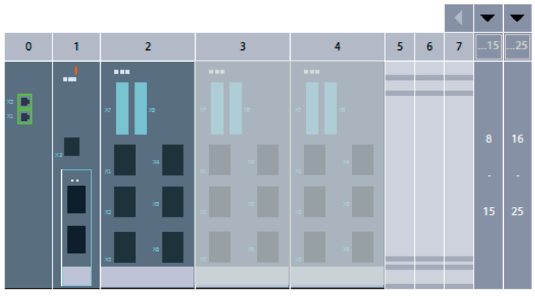


Figure 8-4 Station option with no POMs

The associated control data record DS196 must be pre-assigned as follows:

Byte	Element	Code	Description
0	Block length	4 + 25	Header
1	Block ID	196	
2	Version	1	
3	Version	0	
4	Slot 1 of station master	1	PM available
5	Slot 2 of station master	2	POM available
6	Slot 3 of station master	0	POM is not inserted in the station options
7	Slot 4 of station master	0	POM is not inserted in the station options
8	Slot 5 of station master	0	Module not available
...	...		
28	Slot 25 of station master	0	Module not available

The data record can also be written in abbreviated form with length 4+4; the last entry is byte 7 in this case.

In an error-free case, the feedback data record DS197 contains the following entries:

Byte	Element	Code	Description
0	Block length	4 + 50	Header
1	Block ID	197	
2	Version	2	
3	Version	0	
4	Slot 1 of station master	1	Module is actually not available
5	Slot 2 of station master	1	Module is actually available
6	Slot 3 of station master	1	Module is actually not available
7	Slot 4 of station master	1	Module is actually not available
8	Slot 5 of station master	1	Module is actually available
...	...		
28	Slot 25 of station master	1	Module is actually not available

Functions

9

9.1 Function overview

The following table shows which functions are available for the various POM versions.

Function	POM4320	POM4320 Highend
Half-wave control	x	x
Phase control	x[1)]	x
Defined soft start (fixed number of half-waves)	x[1)]	x
Adaptive soft start	-	x
Explicit power-on of the heater	x	x
Time-delayed channel start-up	x	x
Soft start during heating operation	x	x
Channel control via setpoints	x	x
Channel control via fields	x	x
Line voltage compensation	x	x
Power control	-	x
Parameterization of the behavior of the power outputs	x	x
Phase connection monitoring	x	x
Rotating field check	x	x[2)]
Line supply voltage monitoring	x	x
Frequency monitoring	x	x
Temperature monitoring	x	x
Power channel monitoring	x	x
Power channel monitoring with loads connected in parallel	-	x
Parallel connection of channels	-	x
Fault current monitoring	-	x

1) POM4320 as of MLFB -0AA2 is designed for phase control

2) Only when three-phase loads are used (for example, closed delta)

9.2 Status and actual displays

The following options are available to obtain information on the current status of the device, system or process:

Operating state display via LEDs

The LEDs on the control interface module (CIM) as well as on the power output module (POM) provide information about the current operating state of the device or the heating system.

For detailed information on the meaning of the LED displays, see Section "Central Interface Module (CIM) (Page 148)" and Section "LED operating display for POM (Page 149)".

9.3 Power output control

9.3.1 Half-wave control

Half-wave control can be parameterized for activating the heating elements. This parameterization is performed for each POM and applies to all channels of the POM.

Principle of half-wave control

The power outputs are controlled in half-waves: For each half-wave, the controller supplies On/Off information to the triac and this switches as specified.

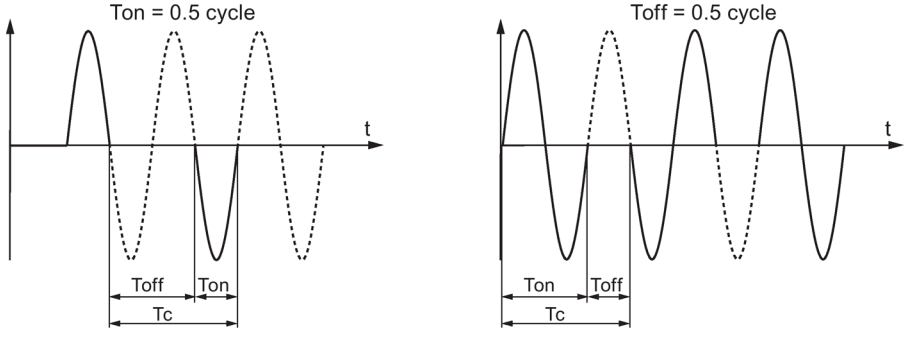


Figure 9-1 Half-wave control example: 33% and 66%

The setpoints for controlling the power outputs lie within a value range of 0% to 100% (reference value: 100 half-waves).

Depending on the specified setpoint, the power outputs are controlled with an equal number of positive and negative half-waves (reference value: 200 half-waves).

To avoid excessively high inrush currents, the power outputs are switched on time-delayed. See Switch on heating (Page 112).

A static table is used for control so that a too frequent change of the setpoints can result in a significantly deviating setpoint. For this reason, the setpoints are only forwarded in time intervals of approx. 600 ms.

Note

If it is required for an application that a changed setpoint value is applied immediately, you can switch off this time grid (see Acyclic output data (Page 132)).

When you disable the time scale, you must ensure that the setpoints are not changed too frequently within the reference period of 100 half-waves.

9.3.2 Phase angle control

The control mode phase control can be parameterized for controlling the heating elements.

This parameterization is performed for each POM and applies to all channels of the POM.

Operating principle of phase control

The power outputs are controlled in the parts of a half wave: The HCS specifies the switch-on signal at the corresponding time in every half-wave depending on the setpoint for the Triac, which is then switched on until the next zero crossing.

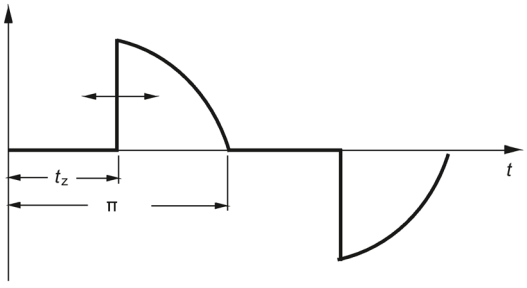


Figure 9-2 Phase control

The setpoints for controlling the power outputs are within a value range of 0% to 100% (reference value: U^2). To avoid excessively high inrush currents, the power outputs are switched on time-delayed. See Switch on heating (Page 112).

Note

The control value is based on an ideal sine and not on the actual voltage curve.

Note

The disturbances caused on the supply cables by the phase control are filtered on the line side. This is necessary to comply with the EU directive for EMC. For example, a suitable 3-phase filter is:

- TDK/EPCOS B84143A0080R106

Note

A setpoint of 1% to 4% leads to an activation of 5% for the POM4320.

9.3.3 Soft starting function

Operating principle

Soft starting can be parameterized for activating the channels in order to control loads with a high inrush current. This parameterization is performed for each POM and applies to all channels of the POM. Soft starting means that when switched on, the channels are controlled with a fixed number of half waves with phase control before half-wave mode or phase control mode is activated.

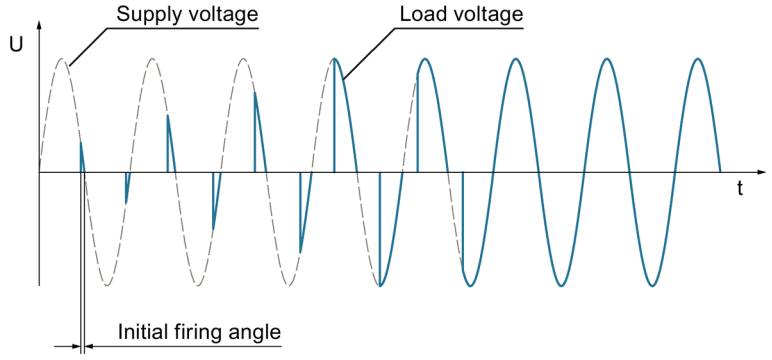


Figure 9-3 Softstart ramp with resistive load

Note

The disturbances caused on the supply cables by the soft starting are to be filtered on the line side. For suitable filters, see the note in the section Phase angle control (Page 110).

During a soft start, we distinguish between two procedures:

- The "defined soft start" (3 variants)
- The "adaptive soft start"

Defined soft start

The soft start occurs with a fixed number of half-waves. While with half-wave control, this number is always constant (depending on the choice of variant), for phase control, the soft start is already ended on reaching the setpoint.

The following soft start variants can be configured in order to adapt to the conditions of the application:

Soft start variant	Description
1	Time-optimized variant of the soft start, enabling the heating elements to be warmed up very quickly. The time required for one channel is about 100 ms.
2	Slower variant of the soft start that ensures the heating element is not unduly loaded. The time required for one channel is about 2 seconds.
3	Reserved for future variant, currently corresponds to variant 2.

Adaptive soft start

With adaptive soft start, the phase angle is adjusted during runtime at the available radiators so that tripping of the fuse is avoided but the maximum possible start-up speed is reached. The duration of the soft start thus depends on the radiator used. While with half-wave control, the soft start only ends with a complete half-wave, phase control is already ended when the specified setpoint value is reached. If the soft start is not possible, an error message is generated. The radiator can thus not be operated on the POM.

9.3.4 Switch on heating

To control the power outputs, the heating must first be activated. This is done via the cyclic data.

Heating status	Meaning
On	Channels are activated
Off	Channels are deactivated.

Time-delayed channel start-up

To reduce the load on the supply system to a minimum, the power outputs are always switched on in sequence upon start-up. The sequence is as follows:

1	The user has specified the field setpoints and the channel setpoints.
2	The user activates the required operating mode
3	The user switches the heating "On"
4	Several POMs are activated with a time offset in ascending slot order
5	Within each POM, the channels of a phase are also started in sequence. The channels of the three phases are controlled "simultaneously" per POM4320. With the POM4320 Highend, the 6 channels are started one after the other regardless of the phase.

Depending on the configuration, overall startup can take up to 3 seconds.

With the POM4320, if a channel is switched off during operation (setpoint 0%) and then switched on again, then depending on the configuration, switching on takes place immediately or with a soft start.

9.3.5 Soft start during heater operation

If a channel is switched off during operation (setpoint 0 %) and then on again, this switch-on can take place via soft start if configured accordingly.

9.3.6 Channel control via setpoints

It is possible to control the channels using only the setpoints in the cyclic data. In this mode, it is not necessary to combine channels into fields and to assign field setpoints.

The operating mode setting in the cyclic data (production, standby) is not relevant in this case.

9.3.7 Channel control via fields

It is possible to control the channels via fields. For this, it is necessary to combine the channels into fields, and to assign setpoints for channels and fields.

Operating modes

The operating mode can be pre-selected via the cyclic data. This makes it possible to change conveniently between two setpoints.

Heating mode	Meaning
Standby	The channel setpoint is multiplied by the "Standby" field setpoint.
Production	The channel setpoint is multiplied by the "Production" field setpoint.

Combining channels into fields

The user can combine channels into fields, which can then be controlled by means of field setpoints.

There are two types of field:

- Field type 1: Channel series
  This field is described by specifying the numbers of the first and last channels in the field
- Field type 2: Specific field
  This field is described by specifying the number of channels and the channel numbers.

Two setpoints can be specified for fields:

- Field setpoint for "Standby" mode
- Field setpoint for "Production" mode

The field setpoints are used as follows in the calculation of the resulting setpoints in accordance with the set mode:

Resulting setpoint = field setpoint * channel setpoint/100

Note

Ensure that channels which you have not assigned to any field by default remain in a field with field number 0, whose field setpoints are preset with 100%.

9.3.8 Line voltage compensation

Line voltage compensation

Line voltage compensation makes it possible to achieve a balanced output on the power outputs, even when the voltage deviates from standard values. The function can be switched on and off by the user.

The compensation factor, or the setpoint, is calculated as follows:

$$\text{Correction factor} = \left(\frac{\text{normal voltage value}}{\text{measured voltage value}} \right)^2$$

$$\text{New setpoint} = \text{correction factor} * \text{specified setpoint}$$

The correction factors for the channels of a POM are calculated using the measured values of this POM.

Note

For POM4320 Highend connection between phase and neutral conductor:

The standard voltage value is calculated as follows:

Standard voltage value POM4320 = CIM parameter/√3

9.3.9 Behavior of the power outputs

Parameterizable response

The response of the power outputs to an interruption in communication with the higher-level controller can be defined. The same is true in case the higher-level control sends invalid data, for example, when the S7 CPU is in Stop. Each individual power output can be parameterized as follows:

- Power output is "deactivated"

  This is the default and ensures "secure response" of the power outputs.
- The power output continues to operate with the most recent valid value.

Non-parameterizable response

The following events always result in deactivation of the power outputs:

- Overtemperature.
- Voltage not within in range from 360 V to 520 V
- Failure of the 24 V supply voltage on the CIM or POM
- Violation of the permissible frequency range for POM4320 Highend

Overvoltage protection

The POM4320 features integrated overvoltage protection, which activates the triac for its own protection when the permissible supply voltage is exceeded.

Behavior during startup

The power outputs remain "deactivated" until a connection to the higher-level controller has been established and user data has been transferred.

9.3.10 Power control

Operating principle

With power control, the setpoint specification does not occur with values between 0% and 100%, but rather as an output value between 0 W and 28,800 W. The output control can be combined with the control modes half-wave control and phase control as well as with all soft start options.

If the specified output cannot be reached, an error message is generated. The channel is not switched off, however.

It is also possible to use fields. You must ensure that the field setpoint value continues to be given in percent.

Output control with half-wave control

For each channel, based on the power rating, a setpoint value for control is calculated and generated, as described in section Half-wave control (Page 109).

The time basis for output control for 100 half-waves is:

Every 100 half-waves, a new setpoint value is calculated and controlled. This time cannot be changed by the user.

- Switching on a heating element without soft start

  Switching on is controlled with a certain number of half-waves at 100%. Thereafter, it switches to output control.

- Switching on a heating element with soft start

  The transition to output control occurs upon ending the soft start.

Output control with phase control

For each channel, based on the power rating, a setpoint value for control is calculated and generated, as described in section Phase angle control (Page 110).

The time basis for output control is 21 half-waves:

Every 21 half-waves, a new setpoint value is calculated and controlled. This time cannot be changed by the user.

- Switching on a heating element without soft start

  Switching on is controlled with a certain number of half-waves at 100%. Thereafter, it switches to output control.

- Switching on a heating element with soft start

  The transition to output control occurs upon ending the soft start.

Response time of the power control

Due to the operating mode and the measurement technology, a changed control value is only output after the following time:

- Half-wave control: 1 s
- Phase control: 210 ms
- Star / delta closed: 4.13 s
- Economy circuit: 3.14 s

9.3.11 Parallel connection of channels

It is possible to control one load over two power outputs. It must be noted that in case of "Connection between phase and phase (internal fuse)" the return must be in parallel design as well.

Parallel connection of channels is not possible in the connection types two-pole circuit and economy circuit.

9.4 Digital inputs/outputs

Note

A PM4000 DI/DO must be available for the processing of digital inputs/outputs.

No links of any kind to the functionality of the heating control are available.

Digital outputs

The PM4000 DI/DO provides 8 digital outputs that the user can control directly. What is more, 8 further digital outputs are available if no digital inputs are used (configurable).

The status of the digital outputs in the event of a communication error is configurable.

Digital inputs

The PM4000 DI/DO provides as many as 8 digital inputs with which the user can read signals directly from the process. The inputs are only available if they are not used as outputs.

Behavior of the digital outputs

Parameterizable response

The response of the digital outputs to an interruption in communication with the higher-level controller can be defined. For each individual digital output, the following can be parameterized:

- Output is "deactivated" (default)
- The output continues to operate with the most recent valid value.
- Output is "activated"

Non-parameterizable, permanently defined response

The following events always result in deactivation of the outputs:

- Failure of the 24 V supply voltage on the CIM

Behavior during start up

The digital outputs remain "deactivated" until a connection to the higher-level controller has been established and user data has been transferred.

9.5 Recording of analog measured line values

Note

For the recording of analog measured line values a PM4000 U/I must be available.

No links of any kind are available to the functionality of the heating control system.

Line current

3 inputs are available for recording of measured current values. IL1, IL2 and IL3 can be connected.

The measuring range (current converter output) is adjustable.

The value measured at the current transformer output is displayed, not the value of the primary side. The latter must be determined by the user (transformation ratio of current converter).

2 measured values per current input are determined:

- RMS over 16 half-waves
- Average value over a control period of 100 half-waves at power output

Supply voltage

4 inputs are available for recording of measured voltage values. It is possible to connect UL1, UL2, UL3 and N. Measurement can be performed in a star or delta circuit.

Line power

The same applies for the line power as for the line current:

The measured value refers to the output value of the current converter. The user must determine the measured line value of the primary side (transformation ratio of current converter).

2 measured values per phase are determined:

- Measured value over 16 half-waves
- Measured value averaged over a control period of 100 half-waves at the power output

9.6 Recording of analog measured values

Note

For the recording of analog measured values a PM4000 U/I Temperature must be available.

No links of any kind to the functionality of the heating control are available.

Analog inputs 0 mA to 20 mA

Four inputs are available for recording of measured current values for a current measuring range of 0 mA to 20 mA.

The measured current values can, for example, be used with a pyrometer for temperature measurement.

If values are measured outside the measuring range, an error message is generated and an invalid measured value (-32,767) is displayed.

Temperature measuring inputs

Four measuring inputs are available for recording measured temperature values. Measured values for Pt100 and Pt1000 can be recorded, as well as for thermocouples of types J, K and L.

If values are measured outside the measuring range, an error message is generated and an invalid measured value (-32,767) is displayed.

Compensation procedure

Various compensation procedures are available for recording measured values of thermocouples:

- Internal compensation: In this procedure, the temperature is recorded at the terminal and included in the calculation of the temperature of the thermocouple.
- External compensation: In this procedure, the user can transmit the compensation value for the temperature calculation of a thermocouple which is recorded, for example, by means of a Pt100 outside the HCS.

9.7 Monitoring functions

9.7.1 Phase connection monitoring

The line voltage connection is monitored as to whether or not all phases are connected. If at least one phase is missing, an error message is generated (see Fault reporting through diagnostics data (Page 150)) and heating stops.

9.7.2 Rotating-field test

POM4320

The rotating field is tested for connecting the phase voltages of each POM. The POM requires a clockwise phase sequence. Otherwise, an error message is generated.

Heating operation is also possible with a counterclockwise phase sequence. However, it is not possible to diagnose a defective heating element at a channel setpoint of 100%.

POM4320 Highend

If three-phase loads are used, a rotating field check is carried out.

The POM requires a clockwise phase sequence. Otherwise, an error message is generated.

In case of an incorrect rotating field, no output switch-on occurs.

See section "Connection between phase and phase (400/480 V) (Page 60)".

9.7.3 Line supply voltage monitoring

The power output module (POM) can be operated in TN systems and TT systems. The permitted voltage range is:

- For "Connection between phase and phase" 360 V AC to 520 V AC
- For "Connection between phase and neutral conductor" 207 V AC to 300 V AC

The actual line voltage per POM and per phase is measured and monitored. The actual voltage measurement is reported to the user (see section Cyclic input data (Page 129)).

If the voltage lies outside the admissible range, error message 5102 is generated (see section Manufacturer-specific error codes (Page 144)) and heater operation stops. Heating can only be switched on again when the voltage has returned to the admissible range.

NOTICE
Excessive voltages can damage the device
It is the responsibility of the user to ensure compliance with the maximum voltage limits.

9.7.4 Monitoring of the 24 V DC supply voltage

The 24 V DC supply voltage is monitored on the CIM. If the 24 V fails, the power outputs of the POMs are automatically deactivated. There is no manufacturer-specific diagnostics alarm in the case of failure of the 24 V supply. Instead, the PROFINET/PROFIBUS controller detects and signals the failure of the HCS system or modules.

9.7.5 Frequency monitoring

Frequency monitoring

The frequency of the applied line voltage is automatically detected and monitored. The frequency value can be read by the user.

Frequency	Valid range
50 Hz	47 Hz to 53 Hz
60 Hz	57 Hz to 63 Hz

Frequency fault

If the frequency of the phases is outside of the permissible range for multiple subsequent measurements (e.g. interferences over a long period of time), a frequency error is signaled to the user (see section Manufacturer-specific error codes (Page 144)).

This error is a group error across all possible POMs.

- Error reaction POM4320

  The heater is not turned off and the measured value for the last recognized and valid frequency remains.

- Error reaction POM4320 Highend

  The heater is turned off. No measured values except for the heat sink temperature are output in case of a shutdown due to a frequency error.

9.7.6 Temperature monitoring

Internal temperature monitoring

A sensor is installed inside the heating control system (POM) to measure the internal temperature.

An alarm threshold is defined for the internal temperature. The following reactions are triggered when the threshold is overshot:

- Signal to the higher-level controller.
- The channels are deactivated - regardless of which channel response was configured for the error (see section Behavior of the power outputs (Page 115)).

Note

If an internal temperature of 0°C is reported, this means that a temperature sensor has been torn off.

Cooling via fan

To achieve even heat distribution, an external fan is mounted on the POM enclosure. The fan is controlled depending on the internal temperature.

If it should prove necessary to control the fans continuously, this can be done by the user.

9.7.7 Power channel monitoring

Power output diagnostics

The Power Output Module has a diagnostics function to detect power output faults. In every half-wave, the status of the power output is requested and checked at a fixed point in time.

The following faults are detected:

Fault	Description and special characteristics
Heating element or radiator wire defective	For POM4320 Highend: For "phase-phase" connection and external fuse, even in case of failure of the incoming fuse.
Triac breakdown	"Breakdown" means the triac is defective and conducts continuously even without being activated. This fault can only be detected if the power output is switched off. For a 100% setpoint, the fault can be neither detected nor indicated.
Incoming fuse has tripped	For POM4320 Highend: For "phase-phase" connection and internal fuse.
Outgoing fuse ruptured or triac has high resistance	This fault can only be detected if the power output is switched on. For a 0% setpoint, the fault is not detected and also cannot be indicated.

Reporting channel errors

Error states are only reported when the heater is switched on (Switch on heating (Page 112)).

The only exception is the "Triac breakdown" error. This error is always reported regardless of the heater status.

Suppression of channel errors

By default, errors are reported for all power outputs and channels. The user can, however, define a list of channels for which errors should not be reported. This is appropriate when some channels are not wired up in the plant.

9.7.8 Power channel monitoring for loads connected in parallel

Diagnostics for loads connected in parallel

If several loads are connected in parallel at one output, in addition to the aforementioned faults, the failure of at least one heating element can be detected.

For this, the corresponding details on the total output power and permitted deviation from total power for the output must be entered (see section CIM / POM configuration parameters (Page 90)).

The following fault is detected:

Fault	Points to note
Partial load failure	Error message when power is too small

Note

A parallel connection of flash radiators can result to a faulty diagnostics under the following circumstance:

The setpoint with which the output is controlled falls short of 90%.

9.7.9 Current load monitoring

The current load per power output is monitored. If the measured current is above the permitted operating range in normal operation (not startup after heating ON), an error message "current load too high" is issued. The output can still be controlled, however.

9.7.10 Fault current monitoring

Any current which does not flow across the load connections, but rather irregularly over another path (e.g. via the housing of the load), is referred to as fault current.

Fault current is monitored for connection type "2-pin switching" via a channel pair. The threshold is set for each channel. In case the configured threshold is exceeded, an error message is generated; however, this does not result in switch-off of the output. Heating remains possible.

Conditions for secure control of the channels

NOTICE

Physical damage can occur

If the electric resistance through which the fault current flows exceeds twice the electric resistance of the load, the corresponding channel can no longer be correctly controlled.

Therefore comply with the following condition for secure control of the channel:
$R_{fault} > 2 \bullet R_{load}$

Displayed and actual fault current

⚠ WARNING

Electric shock hazard

Can cause death or serious injury

The fault current is the current value averaged over 200 half-waves in case of half-wave control. Due to the pulse pattern of semi-wave control, the fault current in individual semi-waves might be higher than the displayed fault current.

Determining peak fault current

Peak fault current can be determined using a setpoint value correction:

Peak fault current = fault current / setpoint

Example: Fault current 400 mA; setpoint value 80%

Peak fault current = 400 mA / 0.8 = 500 mA

9.7.11 Power control monitoring

When using power control, reaching the nominal output is monitored. If nominal output is not achieved at 100 % of the setpoint, an error message is generated. This does not cause the output to switch off, heating is still possible.

9.7.12 Monitoring of adaptive soft start

When using a control mode with adaptive soft start, it is monitored whether the connected heating element can actually be controlled by the POM. If this is not possible, an error message is generated. The channel is not controlled in that case. The error message then disappears when switching off the heater.

Communications

10

The information provided in the section "Communication" refers to Siemens SIMATIC S7 controllers, but this also applies to other controllers with PROFINET/PROFIBUS due to the standardized PROFINET/PROFIBUS communication.

10.1 Cyclic data exchange

10.1.1 Cyclic output data

Cyclic data exchange between the heating control system and the S7 controller takes place via the process and /I/O address area of the CPU. The cyclic data can be addressed in the S7 controller through the process image or I/O commands.

Cyclic output data for CIM

Byte	Control bit	Meaning
0	0	Heater 0: Switch off heating 1: Switch on heating
	1	Operating mode 0: Select "Production" mode 1: Select "Standby" mode
	2	Line voltage compensation 0: Switch off 1: Switch on
	3	0 (not in use)
	4	0 (not in use)
	5	0 (not in use)
	6	0 (not in use)
	7	0 (not in use)
1	–	0 (not in use)

Cyclic output data for POM4320

Byte	Meaning
0	Power output 1 setpoint
1	Power output 2 setpoint
2	Power output 3 setpoint

Byte	Meaning
3	Power output 4 setpoint
4	Power output 5 setpoint
5	Power output 6 setpoint
6	Power output 7 setpoint
7	Power output 8 setpoint
8	Power output 9 setpoint

Cyclic output data for POM4320 Highend

Byte	Meaning
0...1	Power output 1 setpoint
2...3	Power output 2 setpoint
4...5	Power output 3 setpoint
6...7	Power output 4 setpoint
8...9	Power output 5 setpoint
10...11	Power output 6 setpoint

The range of values is 0% to 100%, or the output control 0 W to 28,800 W.

Note

The following setpoints are relevant, depending on the connection type:

- For the connection type "2-pin between phase and phase", "Connection between phase and phase (economy circuit delta)" and "Connection between phase and phase (economy circuit star)", only the setpoints for channels 1, 4 and 6 are relevant.
- For the connection types "Connection between phase and phase (closed delta)", and "Connection between phase and phase (closed star)" only the setpoints for channels 1 and 2 are relevant.
- For the parallel connection of channels, only the setpoint of the first channel of a channel pair is relevant.

Cyclic output data for PM4000 temperature

Byte	Meaning
0...1	Compensation temperature

Cyclic output data for PM4000 DI/DO

Byte	Bit	Meaning
0	0	Digital output 1
	1	Digital output 2
	2	Digital output 3
	3	Digital output 4

Byte	Bit	Meaning
	4	Digital output 5
	5	Digital output 6
	6	Digital output 7
	7	Digital output 8
1	0	Digital output 9
	1	Digital output 10
	2	Digital output 11
	3	Digital output 12
	4	Digital output 13
	5	Digital output 14
	6	Digital output 15
	7	Digital output 16

10.1.2 Cyclic input data

Cyclic data exchange between the heating control system and the S7 controller takes place via the process and /I/O address area of the CPU. The cyclic data can be addressed in the S7 controller through the process image or I/O commands.

Cyclic input data for CIM

Byte	Status bit	Meaning
0	0	Heater 0: Heating is switched off 1: Heating is switched on
	1	Operating mode 0: "Production" mode 1: "Standby" mode
	2	Line voltage compensation 0: Is Off 1: Is On
	3	0 (not in use)
	4	0 (not in use)
	5	0 (not in use)
	6	0 (not in use)
	7	0 (not in use)
1	–	0 (not in use)
2...3	–	Measured value[1] Line voltage L12 (with one decimal place)
4...5	–	Measured value[1] Line voltage L23 (with one decimal place)
6...7	–	Measured value[1] Line voltage L31 (with one decimal place)

[1] The measured values represent the measured values of the POM 1.

Cyclic input data for POM4320

Byte	Meaning
0	Power output 1 actual value
1	Power output 2 actual value
2	Power output 3 actual value
3	Power output 4 actual value
4	Power output 5 actual value
5	Power output 6 actual value
6	Power output 7 actual value
7	Power output 8 actual value
8	Power output 9 actual value

Cyclic input data for POM4320 Highend

Byte	Meaning
0...1	Power output 1 actual value
2...3	Power output 2 actual value
4...5	Power output 3 actual value
6...7	Power output 4 actual value
8...9	Power output 5 actual value
10...11	Power output 6 actual value

The range of values is 0% to 100%, or the output control 0 W to 28 800 W.

Note

The following actual values are relevant, depending on the connection type:

- For the connection type "2-pin between phase and phase", "Connection between phase and phase (economy circuit delta)" and "Connection between phase and phase (economy circuit star)", only the setpoints for channels 1, 4 and 6 are relevant.
- With "Connection between phase and phase (closed delta)", and "Connection between phase and phase (closed star)", only the actual values for channels 1 and 2 are relevant.
- For the parallel connection of channels, only the actual value of the first channel of a channel pair is relevant.

Cyclic input data for CIM PM4000 temperature

Byte	Meaning
0...1	Analog channel 1 (value in mA with two decimal places)
2...3	Analog channel 2 (value in mA with two decimal places)
4...5	Analog channel 3 (value in mA with two decimal places)
6...7	Analog channel 4 (value in mA with two decimal places)
8...9	Temperature channel 1 (value in °C with one decimal place)
10...11	Temperature channel 2 (value in °C with one decimal place)
12...13	Temperature channel 3 (value in °C with one decimal place)
14...15	Temperature channel 4 (value in °C with one decimal place)

Cyclic input data for CIM PM4000 DI/DO

Byte	Bit	Meaning
0	0	Digital input 9
	1	Digital input 10
	2	Digital input 11
	3	Digital input 12
	4	Digital input 13
	5	Digital input 14
	6	Digital input 15
	7	Digital input 16

Cyclic input data for CIM PM4000 U/I

Byte	Meaning
0...1	Measured value for line supply voltage L1/L12 (with one decimal place)
2...3	Measured value for line supply voltage L2/L23 (with one decimal place)
4...5	Measured value for line supply voltage L3/L31 (with one decimal place)

10.2 Acyclic data exchange

10.2.1 Acyclic data exchange - Overview

Addressing

S7 has system function blocks for writing / reading this data. The following data is transferred for addressing:

Index	Dataset number
ID	• TIA: Hardware identification of the hardware module (DP/PROFINET IO) • STEP 7 classic: Logical address of the PROFINET IO component / DP slave component (module)
Length	• When writing: Length of the data in the dataset • When reading: Maximum number of data items that can be received.

Note

The following applies for PROFIBUS DP:

The following data sets can be used via the C1 channel only, depending on the application.

Acyclic data for HCS

We distinguish between two types of acyclic data for HCS:

- Acyclic output/input data which relate to the overall functionality and therefore address the HCS. This data applies to the entire HCS.
- Acyclic output/input data which relate to only one module and therefore only address one module. This data applies to one function of the module.

Addressing is described for the individual data sets.

10.2.2 Acyclic output data

Data record 100 "Field type 1"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0...1	Start channel for field 1
2...3	End channel for field 1
...	...
124...125	Start channel for field 32
126...127	End channel for field 32

Using this data record, fields of type 1 can be defined. This field type comprises one channel range that is described by the first and last channel of the field.

Application range:

- Thermoforming
- Clustering of channels that are located next to each other

Definition is via an array [1 to 32] with two elements of type "Word". Up to 32 fields can be defined.

The field number corresponds to the array index. Field number 0 cannot be used. It exists automatically in the HCS and contains all the channels of the HCS by default. Production and standby setpoints are preset to 100%.

All channels that are not explicitly assigned to a new field remain in this default field.

If users want to use fields, they must ensure that all existing channels are assigned to a user field.

A field can be erased by entering a 0 for the number of the start channel and the end channel.

Note

If a data record 100 was written, it is no longer possible to use the data records for field type 2.

Data record 101 to 132 "Field type 2"

The data records describe an HCS function and address the HCS.

Byte	Meaning
0...1	Number of channel 1 of field (data record number minus 100)
1...2	Number of channel 2 of field (data record number minus 100)
...	...
44...45	Number of channel 23 of field (data record number minus 100)
46...47	Number of channel 24 of field (data record number minus 100)

Using these data records, fields of type 2 can be defined. This field type comprises channels that are directly assigned.

Application range:

- Blow molding
- Formation of a layer across all POMs, for example, every first channel of a POM

Definition is performed directly via the type "Word". Up to 24 channels can be defined.

The field number corresponds to the data record number minus 100. Field number 0 cannot be used. It exists automatically in the HCS and contains all the channels of the HCS by default. Production and standby setpoints are preset to 100%.

All channels that are not explicitly assigned to a new field remain in this default field. If users want to use fields, they must ensure that all existing channels are assigned to a user field.

A field can be erased by entering a 0 for all channels ("0" refers to the data record length).

Note

When one of the data records 101 to 132 is written, it is no longer possible to use the data record for field type 1.

Data record 150 "Production field value"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0	Setpoint for field 1
1	Setpoint for field 2
...	...
31	Setpoint for field 32

Definition is via an array [1 to 32] with one element of type "Byte".

The field number corresponds to the array index.

Data record 151 "Standby field value"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0	Setpoint for field 1
1	Setpoint for field 2
...	...
31	Setpoint for field 32

Definition is via an array [1 to 32] with one element of type "Byte".

The field number corresponds to the array index.

Data record 152 "Channels without diagnostic alarm"

The data record describes an HCS function and addresses the HCS.

Byte	Bit	Meaning
0	0	Setting for channel 1 0: Error message is output (default) 1: Error message is suppressed
	1	Setting for channel 2
	2	Setting for channel 3
	3	Setting for channel 4
	4	Setting for channel 5
	5	Setting for channel 6
	6	Setting for channel 7
	7	Setting for channel 8
1	0 to 7	Setting for channel 9 to 16
2	0 to 7	Setting for channels 17 to 24
3	0 to 7	Setting for channel 25 to 32
4	0 to 7	Setting for channels 33 to 40
5	0 to 7	Setting for channels 41 to 48
...	...	...
26	0 to 7	Setting for channels 209 to 216

Definition is via an array [1 to 216] with one element of type "Bool".

Each bit is assigned to one channel. The size of the array depends on the maximum configuration possible for the HCS (number of POMs, number of channels per POM).

Note

For the POM4320 Highend, if a channel with suppressed error message should report all errors again, then you need to switch the heating off and on again after writing the DS152 data set.

Data record 160 "Control of internal fans"

The data record describes an HCS function and addresses the HCS.

Byte	Bit	Meaning
0	0	Control of internal fans 0: Temperature controlled internally (default) 1: All fans are switched on
	1...7	0

Definition is via an element of the type "Byte".

Data record 190 "System reset by user"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0	"R"
1	"E"
2	"S"
3	"E"
4	"T"
5	"!"

An array with 6 entries of the type "Char" is used here.

Note

The data entered must not be modified.

The data record is acknowledged before the controller performs a reset about 2 seconds later.

Data record 2 "POM4320 Highend configuration data"

The data record describes a function of the POM4320 Highend and addresses a POM.

Byte	Bit	Meaning
0...1	-	Total power for channel 1
2...3	-	Maximum permitted deviation from total power for channel 1
4...5	-	Total power for channel 2
6...7	-	Maximum permitted deviation from total power for channel 2
8...9	-	Total power for channel 3
10...11	-	Maximum permitted deviation from total power for channel 3
12...13	-	Total power for channel 4
14...15	-	Maximum permitted deviation from total power for channel 4
16...17	-	Total power for channel 5
18...19	-	Maximum permitted deviation from total power for channel 5
20...21	-	Total power for channel 6
22...23	-	Maximum permitted deviation from total power for channel 6
24	0	Parallel connection of loads at channel 1 0: No (default) 1: Yes
	1	Parallel connection of loads at channel 2
	2	Parallel connection of loads at channel 3
	3	Parallel connection of loads at channel 4
	4	Parallel connection of loads at channel 5
	5	Parallel connection of loads at channel 6
25	0	

Definition is via an array [1 to 6] with two elements of the type "Integer". The data record corresponds to the information from the configuration (Page 90) and allows overwriting of the configuration during operation.

The data record is answered with errors if no POM4320 Highend is addressed.

Data record 50 "Direct switching of the outputs"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0...25	!SETPOINT WITHOUT TRIGGER!

This data record can be used to disable the time scale with which the setpoints are activated in the HCS (see section Half-wave control (Page 109)).

The operation cannot be undone.

Definition is via an array [0 to 25] of the char type. The introductory text must correspond exactly to the specification; otherwise, the data record is rejected with an error and is not executed.

Data record 51, "Suppression of supply voltage errors with heating OFF"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0...22	!WITHOUT VOLTAGE ERROR!

The following errors are suppressed for heating OFF with this data record:

- Line voltage outside the range
- Frequency outside the range
- At least one phase is not connected
- Phase LX1/LX3 is not connected

The operation cannot be undone.

Definition is effected via an Array[0 ... 22] of the char type. The introductory text must correspond exactly to the specification; otherwise, the data record is rejected with an error and is not executed.

10.2.3 Acyclic input data

The data records and values described in section "Acyclic output data (Page 132)" can also be read.

Data record 100 "Field type 1"

One data record of the maximum possible length (32 fields) is always returned. A non-assigned field is entered as channel number 0.

Data record 101 to 132 "Field type 2"

One data record of the maximum possible length (24 channels) is always returned. Unassigned channels are entered as 0, the same applies to an unassigned field.

Data record 150 "Production field value"

One data record of the maximum possible length (32 fields) is always returned. Setpoint 0 is entered for unused fields.

Data record 151 "Standby field value"

One data record of the maximum possible length (32 fields) is always returned. Setpoint 0 is entered for unused fields.

Data record 152 "Channels without diagnostic alarm"

The data returned is the data of the channels actually available that belong to the POMs used.

Data record 160 "Control of internal fans"

The current setting for the fan controller is returned.

Data record 2 "POM4320 Highend configuration data"

All current configuration parameters of the addressed POM are returned.

Data record 50 "Direct switching of the outputs"

When the function is switched on, the text of the writing data record is returned. This text usually consists of spaces.

Data record 51, "Suppression of supply voltage errors with heating OFF"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0...22	!WITHOUT VOLTAGE ERROR!

The following errors are suppressed for heating OFF with this data record:

- Line voltage outside the range
- Frequency outside the range
- At least one phase is not connected
- Phase LX1/LX3 is not connected

The operation cannot be undone.

Definition is effected via an Array[0 ... 22] of the char type. The introductory text must correspond exactly to the specification; otherwise, the data record is rejected with an error and is not executed.

Data record 200 "Measured values"

The data record describes an HCS function and addresses the HCS.

	Byte	Meaning
Data POM 1	0	Internal temperature
	1	Reserved
	2...3	Frequency with one decimal place
	4...5	Voltage measured value L1/L12 (with one decimal place)
	6...7	Measured voltage value L2/L23 (with one decimal place)
	8...9	Voltage measured value L3/L31 (with one decimal place)
Data POM 2	...	...
...	...	...
Data for POM 24	...	...

Definition is via an array [1 to 24] with one element of the "Structure" type. This comprises two elements of type "Byte" and four elements of type "Word".

The POM number corresponds to the array index.

The length of the data record corresponds to the number of POMs that are used.

Data record 201 "Versions"

The data record describes an HCS function and addresses the HCS.

	Byte	Meaning
CIM / PM	0...3	FW version of CIM fieldbus controller
	4...7	FW version of CIM HCS master
	8	HW version of CIM
	9	HW version of PM
	10...13	FW version of PM
POM 1	14...17	Firmware version POM 1
	18	Hardware version triac POM 1
	19	Hardware version fuse POM 1
POM 2	...	...
...	...	...
POM 24	...	...

All firmware versions contain one element of type "Char" and three elements of type "Byte". The hardware versions are all of type "Byte".

Definition of the POM versions is via an array [1 to 24] with one element of type "Structure".

The POM number corresponds to the array index.

The length of the data record corresponds to the number of POMs that are used. The entry for CIM with PM is always available, even if the PM is not plugged in.

Data record 202 "Measured values for PM4000 U/I"

The data record describes an HCS function and addresses the HCS.

Byte	Meaning
0...1	Frequency with one decimal place
2...3	Voltage measured value L1/L12 in [V] (with one decimal place)
4...5	Measured voltage value L2/L23 in [V] (with one decimal place)
6...7	Measured voltage value L3/L31 in [V] (with one decimal place)
8...9	Current measured value RMS L1/L12 in [A] (with three decimal places)
10...11	Current measured value RMS L2/L23 in [A] (with three decimal places)
12...13	Current measured value RMS L3/L31 in [A] (with three decimal places)
14...15	Current measured mean value RMS L1/L12 in [A] (with three decimal places)
16...17	Current measured mean value RMS L2/L23 in [A] with (three decimal places)
18...19	Current measured mean value RMS L3/L31 in [A] (with three decimal places)
20...21	Power L1/L12 in [W] (with one decimal place)
22...23	Power L2/L23 in [W] (with one decimal place)
24...25	Power L3/L31 in [W] (with one decimal place)
26...27	Power mean value L1/L12 in [W] (with one decimal place)
28...29	Power mean value L2/L23 in [W] (with one decimal place)
30...31	Power mean value L3/L31 in [W] (with one decimal place)

The definition is by means of a structure with elements of type "INT".

The data record is answered with errors if no PM U/I is present.

Data record 203 "Measured values", HCS4300 with POM4320 Highend

The data record describes a function of the POM4320 Highend and addresses a POM.

Byte	Meaning
0...1	Current measured value RMS channel 1 in ampere (A) with two decimal places
...	...
10...11	Current measured value RMS channel 6 in ampere (A) with two decimal places
12...13	Power channel 1 in [W]
...	...
22...23	Power channel 6 in [W]
24...25	Fault current channel 1/3 in mA[1]
26...27	0
28...29	0
30...31	Fault current channel 4/5 in mA[1]
32...33	0
34...35	Fault current channel 6/2 in mA[1]

[1] Only with "2-pin connection between phase and phase", even without activated fault current monitoring. The value is "0" for all other connection types. The entire data record is always returned. The data record is answered with errors if no POM4320 Highend is addressed.

Note

For the connection type "2-pin between phase and phase", "Connection between phase and phase (economy circuit delta)" and "Connection between phase and phase (economy circuit star)", only the setpoints for channels 1, 4 and 6 are relevant.

For the connection types "Connection between phase and phase (closed delta)", and "Connection between phase and phase (closed star)", for the current and power, only the measured values of channels 1 and 2 are relevant.

Note

Since the current and voltage values are RMS values, the power cannot be determined by simple multiplication.

10.3 Transfer of diagnostic alarms to the controller

10.3.1 Transferring diagnostic alarms to the controller: PROFINET

Diagnostics alarms

Diagnostics alarms are transferred as diagnostic interrupts using the channel diagnostics (identifier 8000h) as the diagnostic type.

The PROFINET device identification number is required for identifying a diagnostic interrupt.

The HCS4300 has the identification number 1002h.

The evaluation in SIMATIC is performed via I/O_FLT1 (OB82) and RALRM (SFB54).

Structure of the diagnostic alarm

Channel diagnosis comprises 6 bytes:

Byte	Description
0...1	Channel number The following applies for channel numbers: • Channel number = 0: Diagnostic information relates to one module (CIM, POM, PM) • Channel numbers <> 0: Diagnostic information relates to one channel (for POM, PM only) The channel numbers are counted across the entire HCS.
2	Channel type, fault type
3	Data format
4...5	Error type (see Manufacturer-specific error codes (Page 144))

10.3.2 Transferring diagnostic alarms to the controller: PROFIBUS

Diagnostics alarms

Diagnostic alarms are transferred as diagnostic interrupts. The PROFIBUS device identification number is required for identifying a diagnostic interrupt.

The HCS4300 has the identification number 81C5h.

The evaluation in SIMATIC is performed via I/O_FLT1 (OB82) and RALRM (SFB54).

Structure of the diagnostic alarm

The interrupt message consists of 4 bytes of header (standardized) and 4 bytes of user-specific data. These are to be interpreted as follows:

Byte	Description
4...5	Channel number The following applies for channel numbers: • Channel number = 0: Diagnostic information relates to one module (CIM, POM, PM) • Channel numbers <> 0: Diagnostic information relates to one channel (for POM, PM only) The channel numbers are counted across the entire HCS.
6...7	Error type (see Manufacturer-specific error codes (Page 144))

10.3.3 Manufacturer-specific error codes

Error codes CIM4310

Error code (hex)	Description	CIM4310
5102	Line voltage is outside the permissible range. The error message applies to the values of PM4000 U/I and of POMs with their own voltage measurement.	✓
5103	Frequency is outside the permissible range. The error message can be initiated by any POM.	✓
510D	Communication fault internal	✓

Error codes POM

Error code (hex)	Description	POM4320	POM4320 Highend
5101	Communication error on HCS bus	✓	✓
5104	Channel fault: Triac breakdown	✓	✓
5105	Channel fault: • Triac has high resistance • Outgoing fuse defective	✓	✓
5106	Channel fault: Incoming fuse defective	✓	✓
5107	Channel fault: • Defective heating element • External fault	✓	✓
5109	Switch-off threshold for internal device temperature	✓	✓
510B	At least one voltage is not connected	✓	✓
510C	Channel fault: Undefined	✓	✓
510E	Rotating field fault	✓	✓[1)]
5113	Channel fault: Partial load failure	–	✓
5114	Channel fault: Current load too high	–	✓
5117	Channel fault: Power setpoint is not reached	–	✓
5118	Channel fault: Fault current too high	–	✓
5119	Channel fault: Adaptive soft start cannot be ended	–	✓

[1)] Rotating field errors are only detected when three-phase loads are used

Special features of POM4320 Highend

Connection between phase and phase (internal fuse), connection between phase and phase (external fuse) or connection between phase and neutral conductor, each with parallel connection of channels.			
Error code	Meaning		Description
5106	Channel 1, channel 3 or channel 5	One or both incoming fuses are defective	Channel fault: Incoming fuse defective
	Channel 2, channel 4 or channel 6	–	–

2-pin connection between phase and phase			
Error code	Meaning		Description
5104	Channel 1, 4 and 6	Both Triacs have broken down	The error message is generated via channels 1, 4 and 6.
	Channel 3, 5 and 2	Exactly one Triac has broken down	The error message is generated via channels 3, 5 and 2.
5105	–	–	–
5107	Channel 1, 4 and 6	• External fault • Fuse F1 ... F6 is defective • Triac 1 ... 6 has high resistance	The error message is generated via channels 1, 4 and 6. No distinction is possible between an external fault and a fuse fault. Therefore, the error code 5107 includes the following errors: • Channel fault "Triac has high resistance" and "outgoing fuse defective" • Channel fault "external fault" See section Fault reporting through diagnostics data (Page 150)
	Channel 3, 5 and 2	–	–

Connection between phase and phase (closed delta) and connection between phase and phase (closed star)			
Error code	Meaning		Description
5105	Channel 1, 3 and 5 Channel 2, 4 and 6	At least one of the channel fuses is defective	A distinction which fuse is defective is not possible
5107	Channel 1, 3 and 5 Channel 2, 4 and 6	At least one of the loads connected to the channels is defective	A distinction which of the loads is defective is not possible

Connection between phase and phase (closed delta) and connection between phase and phase (closed star), each with parallel connection of channels			
Error code	Meaning		Description
5107	Channel 1 and 2 Channel 3 and 4 Channel 5 and 6	• External fault • one of the two fuses (F1... F6) is faulty • one of the two triacs is high-resistance	No distinction is possible between an external fault and a fuse fault. Therefore, the error code 5107 includes the following errors: • Channel fault "Triac has high resistance" and "Outgoing fuse defective" • Channel fault "external fault". See the section Error messages about diagnostics data (Page 150)

Connection between phase and phase (economy circuit delta) and connection between phase and phase (economy circuit star)			
Error code	Meaning		Description
5107	Channel 1 and 3 Channel 4 and 6 Channel 6 and 2	• External fault • one of the two fuses (F1... F6) is faulty • one of the two triacs is high-resistance	No distinction is possible between an external fault and a fuse fault. Therefore, the error code 5107 includes the following errors: • Channel fault "Triac has high resistance" and "Outgoing fuse defective" • Channel fault "external fault". See the section Error messages about diagnostics data (Page 150)

PM error codes

Error code (hex)	Description	PM Temperature	PM DI/DO	PM U/I
0001	Short-circuit	–	✓	–
0006	Wire break	✓	✓	–
0007	Measurement range, high limit exceeded	✓	–	–
0008	Measurement range, low limit violated	✓	–	–
0011	No supply voltage	–	✓	–
5101	Communication error on HCS bus	✓	✓	✓
510C	Undefined error	✓	✓	–
5112	Polarity reversal at measuring input	✓	–	–

Note

The following applies for PM4000 DI/DO:

The error codes for short-circuit and wire break are each signaled for one group of 4 channels only. The number of the first channel of the group of 4 is entered as the channel number.

Causes of error and solutions

You will find information about possible causes of error and solutions in section Fault reporting through diagnostics data (Page 150).

Note

The following applies to channel faults 0x5104 to 0x5107 and 0x510C:

If a fault status changes on a channel, the first fault to be reported is retained.

Process and system messages, error handling 11

11.1 Central Interface Module (CIM)

The device has 3 LEDs on the front: The LEDs shows information about the operating state of the device or system.

Meaning of LEDs

READY green	HEATING ON yellow	ERROR red	Description
○	○	○	Power OFF, device switched off
✸	○	○	Initialization: The LED flashes until the HCS is detected and accepted as a bus node by the higher-level control system. **Note** If a defective configuration is loaded for re-configuration, this culminates in the error display green=on and red=on.
●	○	○	Device has started up and is ready.
●	●	○	Heating "ON"
●	○	●	A general error has occurred: • Fieldbus communication error • Error in HCS communication
●	●	●	

Causes of error and possible solutions

Error code	Description	Possible causes and solutions
5102	Line voltage is outside the permissible range.	• Check voltage supply and cabling • Connect the missing voltage
5103	Frequency is outside the permissible range. The error message can be initiated by any POM.	
510D	Communication fault internal	• Check connecting cable for system interface

11.2 Power Output Module (POM)

11.2.1 LED operating display for POM

The device has 3 LEDs on the front: The LEDs provide information about the operating mode of the device/system.

Meaning of LEDs

READY green	HEATING ON yellow	ERROR red	Meaning
○	○	○	Power OFF, device switched off
✸	○	○	Initialization: The LED flashes until the device has been detected and addressed by the CIM.
●	○	○	Device is ready
●	●	○	Heating "ON"
●	○	●	A general fault has occurred, e.g. communication, line voltage, temperature
●	●	●	

Channel error red	Meaning
●	• LED x off: Channel x is OK • LED x on: Channel x error

11.2.2 Fault reporting through diagnostics data

The device-internal monitoring functions recognize specific faults in the power output module. The corresponding information is provided in the diagnostics data.

More information can be found in the section Monitoring the power channels (Page 123).

Causes of error and possible solutions

Error code	Description	Possible causes / Corrective action
5104	Channel fault: Triac breakdown "Breakdown" means the triac is defective and conducts continuously even without being activated.	• Triac is defective → Return POM
5105	Channel fault: Fuse tripped or triac has high resistance	• Switch off machine, check fuse, cabling and heating element and rectify fault, restart • Triac is defective → Return POM
5106	Incoming fuse has tripped	• Switch off machine, check incoming fuse, cabling and heating element and rectify fault, restart
5107	Channel fault: Defective heating element/radiator wire	• Switch off machine, check cabling and heating element and rectify fault, restart • For POM4320 Highend with "connection between "phase and phase" (external fuse)" also check incoming fuse
5109	Switch-off threshold for internal device temperature	Trip threshold overshot: The heating is switched off automatically by the device. Actions: • Check function of the fan • Switch off the machine, rectify the fault (e.g. cooling malfunction), restart
510B	At least one voltage is not connected	• Check voltage supply and cabling • Connect the missing voltage
510E	Rotating field fault	
5113	Channel fault: Partial load failure	• Switch off the machine. • Check cabling and heating elements • Rectify fault • Restart
5114	Channel fault: Current load too high	
5117	Channel fault: Power setpoint is not reached	• Check setpoint value specification • Check heating element
5118	Channel fault: Fault current too high	• Check heating element
5119	Channel fault: Adaptive soft start cannot be ended	• Check heating element and, if needed, have looked at by Siemens

11.3 I/O modules

LED status display

The I/O module has 2 LEDs on the front. The LEDs provide information about the operating state of the device or system.

Meaning of LEDs

RUN green	ERROR red	Meaning
○	○	Power OFF, device switched off
✸	○	Initialization: The LED flashes until the HCS is detected and accepted as a bus node by the higher-level control system.
●	○	Device has started up and is ready.
●	●	An error has occurred: • Error during general monitoring • Error in HCS communication For PM U/I: Line voltage monitoring

PM4000 DI/DO has one LED per input/output for indicating the switching status.

Channel LED	Meaning
○	LED off: "L" state
●	LED on: "H" state

Causes of errors and possible remedies

Error code	Description	Possible causes and solutions
0001	Short-circuit	• Switch off the machine. • Check cabling and rectify fault • Restart
0006	Wire break	
0011	No supply voltage	
5112	Polarity reversal at measuring input	

Servicing and maintenance 12

12.1 Maintenance work

The following work must be carried out at regular intervals to guarantee smooth operation of the device.

Maintenance work	
Fan Power output module (POM)	• Check regularly that the fan is functional. • Remove dust deposits with a cleaning brush and vacuum cleaner.

12.2 Firmware update

12.2.1 PROFINET firmware update

Delivery condition

The current firmware version is already loaded on the module when the HCS4300 is shipped.

Firmware update via PC tool

If required, a PC tool and the necessary update files for updating the firmware are available to you at Customer Support (https://support.industry.siemens.com/cs/start?lc=en-WW).

Note

The PC tool does not have its own access protection against unauthorized use. Ensure that it cannot be used by unauthorized persons. Also observe the IT security guidelines.

Observe the following information when updating the firmware:

Requirements

The following conditions must be met for you to carry out an update:

Connect the PC to an Ethernet port (X1 or X2) of the CIM.

Either the Central Interface Module (CIM) must be assigned an IP address (delivery state 0.0.0.0), or the CIM must have been in operation on a PROFINET CPU (IP address from PROFINET configuration).

Before the update, the connection to the CPU must be stopped or interrupted.

Note

If the connection is not interrupted, an error message appears in the PC tool, but this can be delayed.

CIM

The update encompasses two firmware parts and is not completed until both parts have been successfully loaded.

After the update, the HCS4300 restarts automatically. Only in the event of a fault when the update has not been correctly completed do you have to restart the HCS4300.

POM

In a firmware update, new firmware is downloaded to all power output modules (POMs) operated on a Central Interface Module (CIM).

After the update, the HCS4300 restarts automatically. Only in the event of a fault when the update has not been correctly completed do you have to restart the HCS4300.

I/O module PM:

In the event of a firmware update, new firmware is loaded into the inserted PM. After the update, the HCS4300 restarts automatically. Only in the event of a fault, if the update has not been correctly completed, is it necessary to restart the HCS4300.

Firmware update via TIA Portal

An update is possible as of TIA Portal V16. You can download the updates files from the Siemens Service&Support area (https://support.industry.siemens.com/cs/start?lc=en-WW).

See also

SHB_ET200SP (https://support.industry.siemens.com/cs/ww/en/view/58649293)

12.2.2 PROFIBUS firmware update

Delivery condition

The current firmware version is already loaded on the module when the HCS4300 is shipped.

Firmware update via PC tool

If required, a PC tool and the necessary update files for updating the firmware are available to you at Customer Support.

NOTICE
The PC tool has no access protection against unauthorized users. Ensure that it cannot be used by unauthorized persons. Also observe the IT security guidelines.

Observe the following information when updating the firmware:

Requirements

The following conditions must be met for you to carry out an update:

Connect the service interface X2 of the CIM to the computer using a 9-pin null modem cable. To do this, it might be necessary to remove the PROFIBUS connector first.

Before starting the updates, the HCS4300 heating control system must be switched off.

Procedure

1. Start the PC tool, select firmware and COM port and start update
2. Switch on the HCS4300

CIM:

The update encompasses two firmware parts and is not completed until both parts have been successfully loaded.

After the update, the HCS4300 restarts automatically. Only in the event of a fault when the update has not been correctly completed do you have to restart the HCS4300.

POM:

In a firmware update, new firmware is downloaded to all Power Output Modules (POMs) operated on a Central Interface Module (CIM).

After the update, the HCS4300 restarts automatically. Only in the event of a fault when the update has not been correctly completed do you have to restart the HCS4300.

I/O module PM:

In the event of a firmware update, new firmware is loaded into the inserted PM. After the update, the HCS4300 restarts automatically. Only in the event of a fault, if the update has not been correctly completed, is it necessary to restart the HCS4300.

12.3 Fuse replacement

Safety guidelines

⚠ WARNING

Voltage hazards

Can cause death or serious injury

- The fuse board must only be disconnected and connected in the de-energized state.
- The CIM must be isolated from the 24 VDC supply.
- Before changing a fuse, you must isolate the load circuit from the supply and secure it against switching on again.
- Before working on the heating control system or the connected components, ensure the system is disconnected.

NOTICE

Use only the prescribed fuse types (see section Ordering data (Page 202)). If you operate the device with unapproved fuses, the device could be destroyed.

Removing the fuse board

To replace the channel fuses, the board on which the fuse to be replaced is located must be removed from the POM.

NOTICE

ESD-sensitive components

Before you remove the board, note the ESD information in section ESD Guidelines (Page 203).

Tool

You will need a Torx T8 screwdriver.

Proceed as follows to remove it:

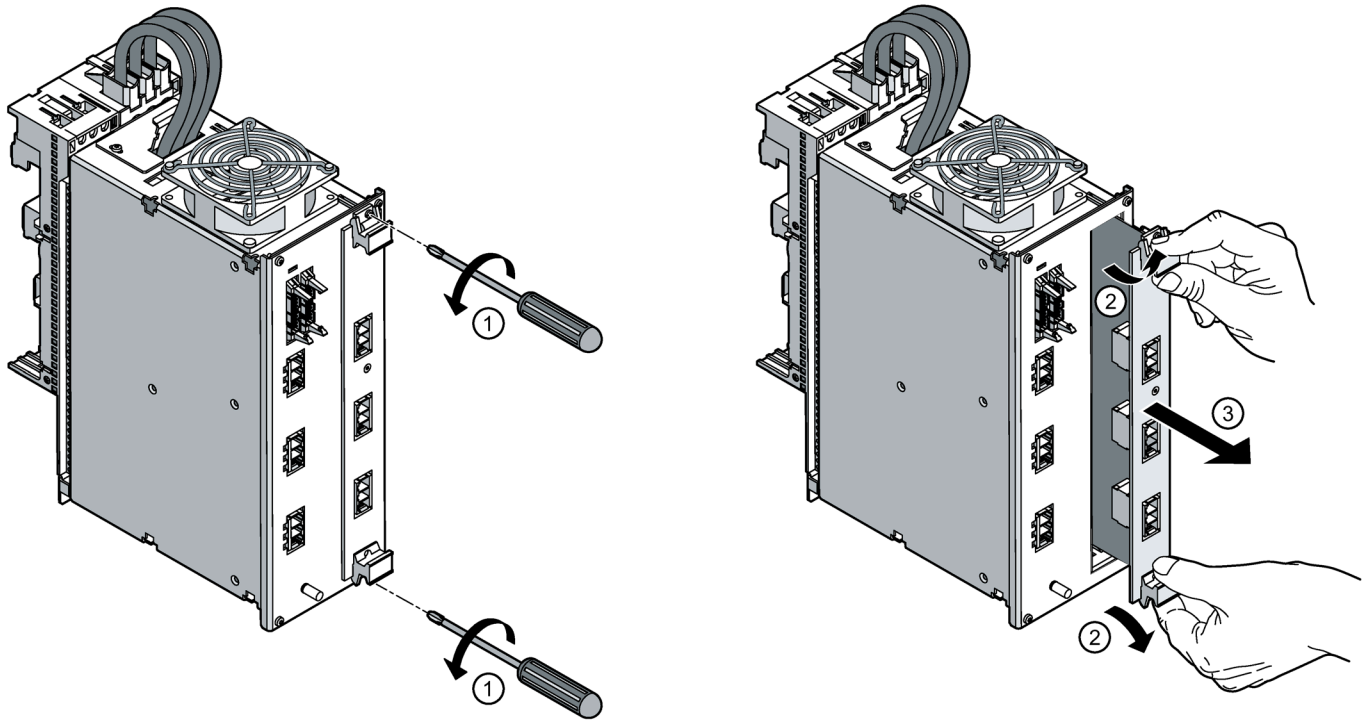


Figure 12-1 Removing the fuse board

Steps	
1	Loosen the two screws on the top and bottom of the fuse module ①
2	Unlatch retainer ②
3	Remove board ③
4	Place board on an ESD-compatible surface

Position of fuses on the fuse board

The example in the following figure shows the arrangement of the fuses for the POM4320.

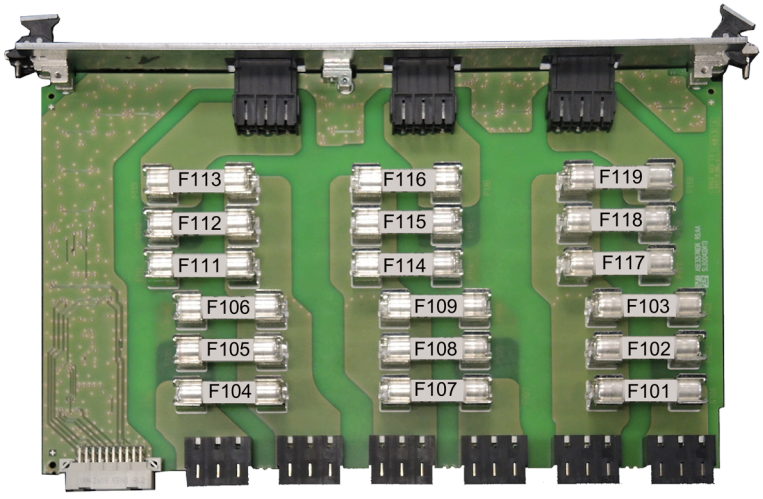


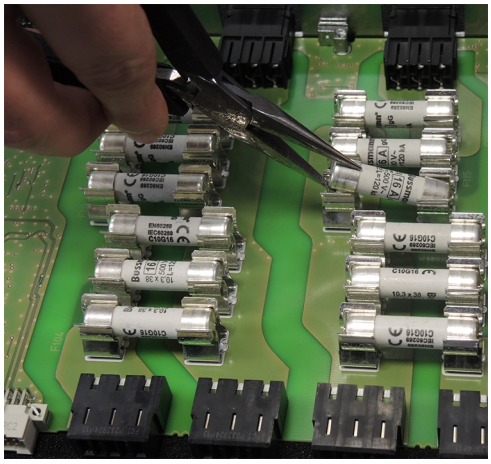
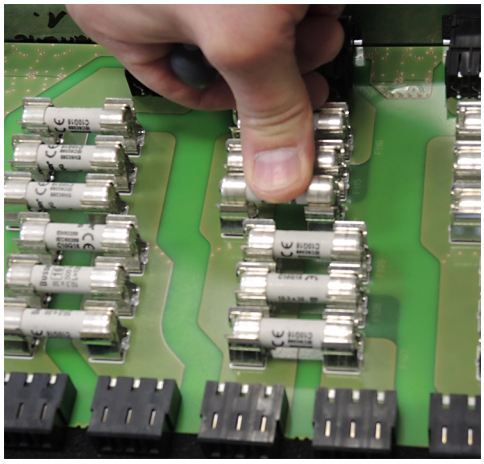
Figure 12-2 POM4320 position of fuses on the fuse board

The assignment of the fuses is shown in the block diagram for the interconnection used. The fuses are marked on the printed circuit board.

Checking/replacing fuses

NOTICE
Electronic components are fitted to the rear of the board. When replacing fuses, ensure that these components are not damaged.

1. Check for ruptured or defective fuses (refer to fault information in the section Fault reporting through diagnostics data (Page 150))
2. Remove the defective fuse with a suitable tool (e.g. flat-nose pliers).
3. Insert the new fuse in the fuse holder.

Replacing a fuse	
	
Remove the defective fuse	Insert the new fuse

Re-installing the fuse board

Proceed as follows:

Steps	
1	Place board in the guides
2	Push board in as far as the stop CAUTION: During insertion, ensure that none of the components on the soldered side of the board are damaged.
3	Fix the board in place again using the screws ① (0.5 Nm)

Re-commissioning the device

Proceed as described in section Commissioning (Page 86).

12.4 Replace fan

Requirements

WARNING

Electric shock hazard

The device is energized. Before you begin to replace components, you must:

- Disconnect the power supply of the busbar system and secure it against reclosing.
- Disconnect the 24 V DC voltage supply and secure it against reconnection.

Tools required:

You require a slotted screwdriver, size 0.4 mm x 2.5 mm (blade width x blade length) for levering out the plastic rivet.

Replacing the fan

Proceed as follows to replace the fan:

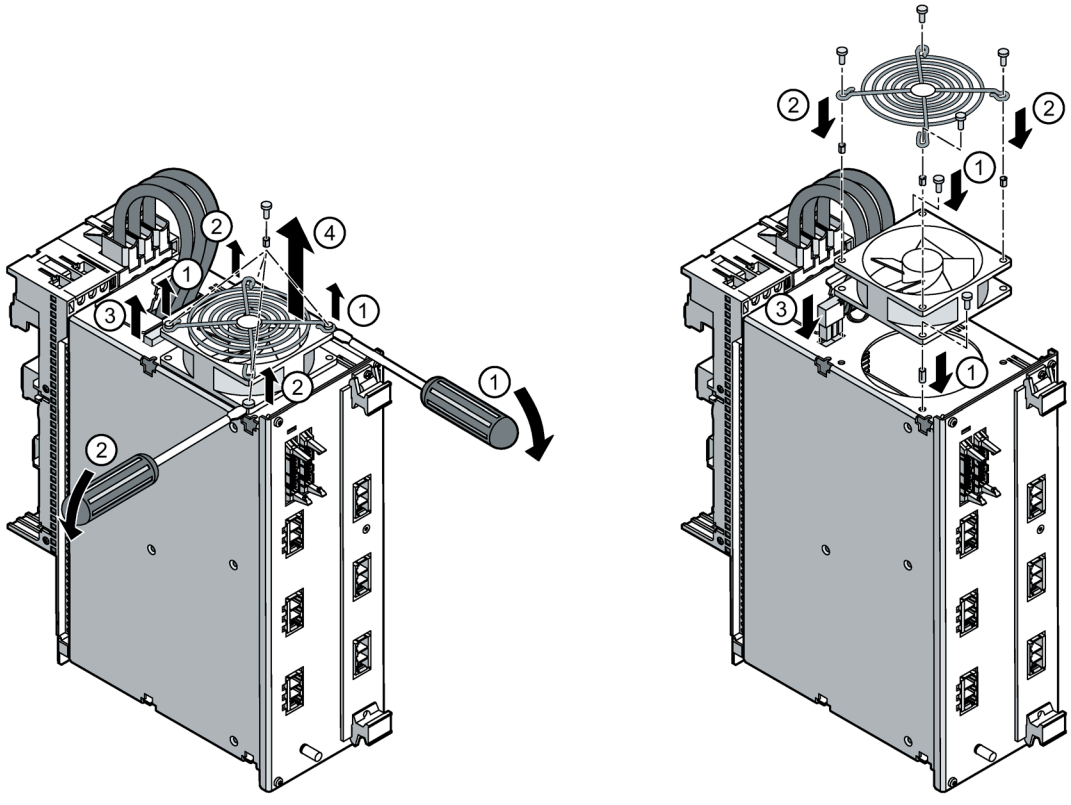


Figure 12-3 Replacing the fan

Procedure for removing the fan	
1	Remove the four plastic rivets of the fan grille. Use a screwdriver ①.
2	Remove the fan grille
3	Remove the two plastic rivets ② of the fan (proceed as for fan grille).
4	Unplug 24 V DC connectors of the defective fan ③.
5	Lift off fan ④

Procedure for installing the new fan	
1	Position the new fan on the device
2	Re-insert the two plastic rivets of the fan ①. • Insert sleeve • Push in pin
3	Place fan grille on the new fan
4	Re-insert the four plastic rivets of the fan grille ②. • Insert sleeve • Push in pin
5	Plug in 24 V DC connector of the new fan ③.

12.5 Replacing the Power Output Module (POM)

Requirements

- The busbar system or the mains supply is disconnected at the mounting location of the device and secured against reconnection.
- Disconnect the 24 V DC voltage supply and secure it against reconnection.

Tool

- 4 mm screwdriver
- Open-ended, ring or socket spanner size 10 for the nuts of the ground screw

Preparations

1. Remove all connectors from the POM.
2. Disconnect the ground connection for the device at the front screw terminal.

Removing the POM (power bus mounting)

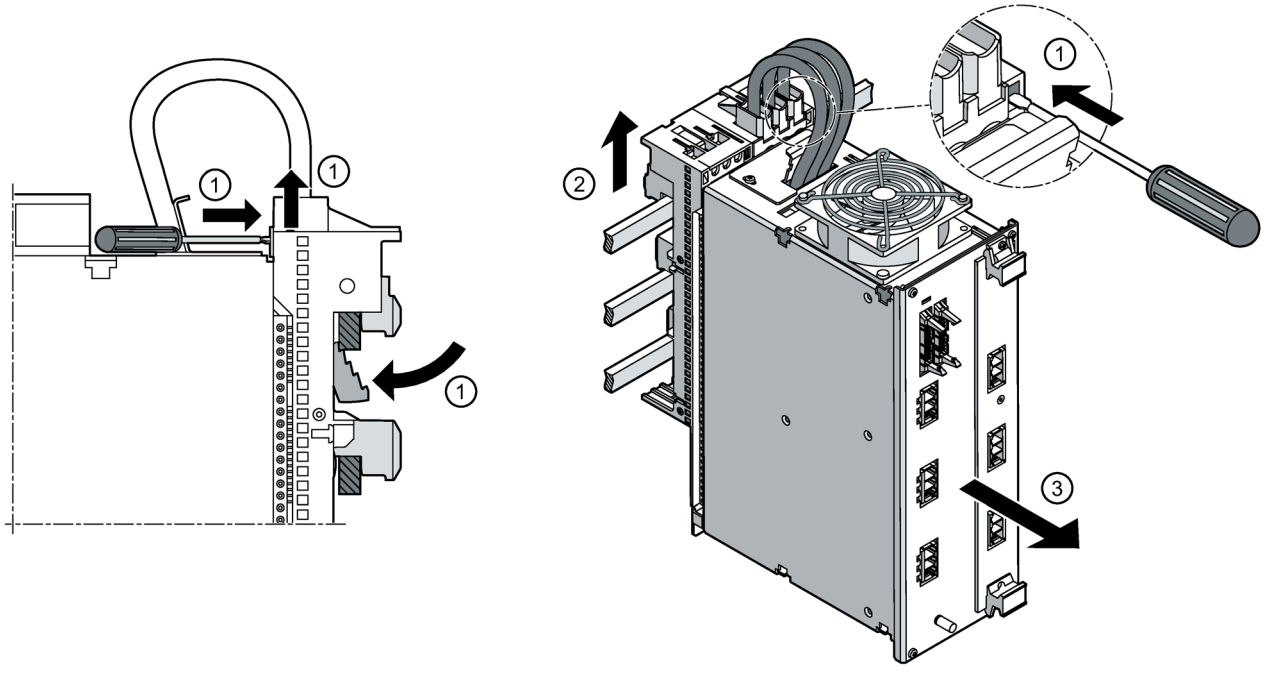


Figure 12-4 Removing the POM

Steps	
1	From the front, insert a screwdriver in the opening in the busbar adapter ①. The button on top of the busbar adapter must snap upwards.
2	Remove the busbar adapter by first pushing it upwards ②, and then pulling it forwards ③.

Removing the POM (panel mounting)

Remove the four screws that secure the module to the rear panel. See Panel mounting (Page 46)

Assembly, connection and commissioning

1. Follow the instructions in this section: "Installing the Power Output Module (POM) (Page 41)"
2. Follow the instructions in this section: "Wiring (Page 50)"
3. Follow the instructions in this section: "Commissioning (Page 86)"

12.6 Replacing the Central Interface Module (CIM)

Requirements

- The AC power supply is disconnected from the supply at the mounting location of the device and secured against switching on again.
- The 24 V DC supply voltage must be disconnected.

Tool

You will need a Torx T10 screwdriver.

Removing the CIM

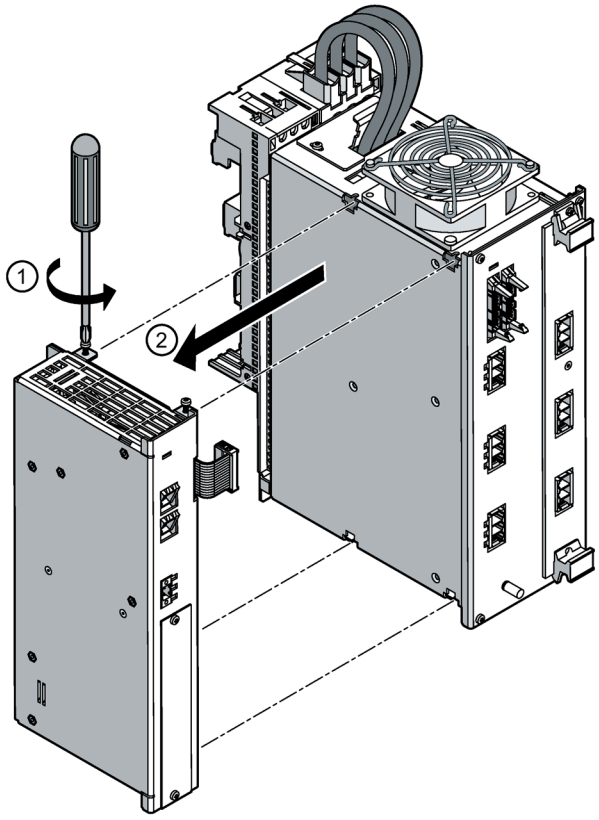


Figure 12-5 Removing the CIM

Procedure for removing the CIM	
1	• Remove all connectors from the CIM. • Detach the connector from the system interface to the POM.
2	Remove the four screws ① and detach the CIM from the POM ②.

12.7 Replacing an I/O module

Requirement

- The AC power supply must be disconnected from the supply at the mounting location of the device and secured against switching on again.
- The 24 V DC supply voltage must be disconnected.

Preparations

Remove all connectors from the PM before dismantling the I/O module.

Note

To unlock the connectors, press down the two levers on the sides of the plug connectors.

Tool

You will need a Torx T8 screwdriver.

Removing the I/O module

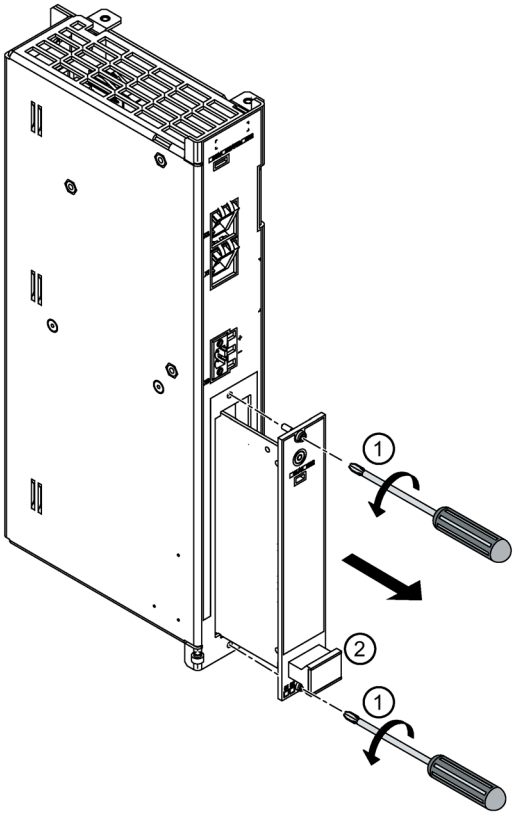


Figure 12-6 Removing the PM

1. Undo the two fixing screws ① on the PM
2. Release the PM using the ejector lever ② and pull PM out
3. Place board on an ESD-compatible surface

12.8 Recycling and disposal

Note

The POM and CIM modules of the HCS4300 heating control system fulfill the requirements of RoHS-II and REACH.

The components can be recycled due to their lack of harmful materials. Contact a certified electronic scrap disposal company in order to ensure the environmentally-friendly recycling and disposal of your used device.

Technical specifications 13

13.1 Technical specifications for CIM

Article number	6BK1943-1AA00-0AA0	6BK1943-1BA00-0AA0
General information		
Product type designation	CIM4310 PROFINET	CIM4310 PROFIBUS
Installation type/mounting		
Mounting type	Screw mounting to POM	
Mounting position	vertical	
Type of ventilation	Forced ventilation	
Supply voltage		
Type of supply voltage	DC	
Rated value (DC)	24 V	
relative symmetrical tolerance of the supply voltage	20 %	
Connection method		
• Design of electrical connection for supply voltage		
– Connectable conductor cross-sections, solid	1x (0.2 ... 2.5 mm²)	
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.2 ... 2.5 mm²)	
– Connectable conductor cross-sections for AWG cables	1x (26 ... 12)	
Power		
Active power input	3 W	
Hardware configuration		
Type of power output connectable	POM4320	
Slots		
• Number of slots	1	
Interfaces		
Interfaces/bus type	PROFINET IO	PROFIBUS DP
Transmission rate, max.	100 Mbit/s	12 Mbit/s
PROFIBUS DP		
• Design of electrical connection		9-pin sub D socket
Supports protocol for PROFINET IO		
• Design of electrical connection of PROFINET interface	2x RJ45	
Protocols		
Supports protocol for PROFINET IO	Yes	No

Article number	6BK1943-1AA00-0AA0	6BK1943-1BA00-0AA0
PROFIBUS DP	No	Yes
EtherNet/IP	No	
Interrupts/diagnostics/status information		
Number of status displays	3	
LED status display	LED green = ready, LED yellow = heating on/off, LED red = error display	
Isolation		
Overvoltage category	III	
Degree of pollution	2	
EMC		
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011	
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge	
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)	
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV power supply lines, 2 kV PROFINET cables	2 kV power supply lines / 2 kV PROFIBUS cables
Conducted interference due to surge acc. to IEC 61000-4-5	DC supply lines: 0.5 kV symmetrical and asymmetrical PROFINET cables: 1 kV asymmetrical	DC supply lines: 0.5 kV symmetrical and asymmetrical PROFIBUS lines: 1 kV asymmetrical
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)	
Degree and class of protection		
IP degree of protection	IP20	
Standards, approvals, certificates		
reference designation according to IEC 81346-2 (2009)	K	
Ambient conditions		
Ambient temperature during operation		
• min.	0 °C	
• max.	55 °C	
Ambient temperature during storage/transportation		
• Storage, min.	-25 °C	
• Storage, max.	70 °C	
• Transportation, min.	-25 °C	
• Transportation, max.	70 °C	
Air pressure acc. to IEC 60068-2-13		
• Operation, min.	860 hPa	
• Operation, max.	1 080 hPa	
• Storage, min.	660 hPa	
• Storage, max.	1 080 hPa	
Altitude during operation relating to sea level		

Article number	**6BK1943-1AA00-0AA0**	**6BK1943-1BA00-0AA0**
• Installation altitude above sea level, max.	2 000 m	
Relative humidity		
• Operation at 25 °C, max.	95 %	
• Operation at 50 °C, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C	
Vibrations		
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g	
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g	
Shock testing		
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis	
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis	
Dimensions		
Width	56 mm	
Height	285 mm	
Depth	136 mm	

13.2 Technical Specifications POM4320

Technical specifications of POM4320 busbar mounting (-0AA2)

Article number	6BK1943-2AA00-0AA2	6BK1943-2BA00-0AA2
General information		
Product type designation	POM4320 BUSBAR MOUNTING (IEC)	POM4320 BUSBAR MOUNTING (UL)
Installation type/mounting		
Mounting type	Busbar mounting	
Mounting position	vertical	
Type of ventilation	Self-ventilation	
Supply voltage		
Type of supply voltage	AC	
Rated value (AC)	400 V; Phase - phase	
• Relative negative tolerance	10 %	
• Relative positive tolerance	30 %	
2nd rated value (AC)	480 V; Phase - phase	
• Relative negative tolerance	25 %	
• Relative positive tolerance	8 %	
Line frequency		
• Rated value 50 Hz	Yes	
• Rated value 60 Hz	Yes	
• Relative symmetrical tolerance	5 %	
Mains buffering		
• Recovery time after power failure, typ.	1 s	
Connection method		
• Design of electrical connection for supply voltage	Busbar mounting, 3-pole + PE	
Input voltage		
device version of the power supply for electronics	Power supply via CIM	
Power		
Active power input, max.	8 W	
Power electronics		
Type of load	Ohmic load	
Power capacity, max.	57.6 kW; At 400 V AC	64.8 kW; At 480 V AC
• For phase against phase with fan at 40 °C, max.	57.6 kW; At 400 V AC	64.8 kW; At 480 V AC
Switching capacity current per phase, max.	83 A	80 A
Short-time withstand current (SCCR) acc. to UL 508A		100 kA

Article number	6BK1943-2AA00-0AA2	6BK1943-2BA00-0AA2
Control of heating elements		
• Half-wave control	Yes	
• Soft start	Yes	
• Phase control	Yes	
Load connection type		
• Star connection with neutral conductor (single-phase)	No	
• Open delta connection (single-phase)	Yes; Incoming fuse contained in the device	
• Closed delta connection (3-phase)	No	
• Star connection with neutral conductor (2-phase)	No	
• 2-pole switching	No	
Setpoint input		
• Percent	Yes	
• Watts	No	
Heating power		
• Number of digital outputs	9	
• Number of heating elements per output, max.	1	
• Output voltage for heating power	400 V	
• 2nd output voltage for heating power	480 V	
• Power carrying capacity per output, min.	200 W; At 400 V AC	240 W; At 480 V AC
• Power carrying capacity per output, max.	6 400 W; At 400 V AC	7 200 W; At 480 V AC
– for heating elements with high inrush current, max.	4 000 W; At 400 V AC	4 000 W; At 480 V AC
• Output current for heating power	16 A; max.	15 A; max.
• Melting I2t value	250 $A^2 \cdot s$	400 $A^2 \cdot s$
• Design of short-circuit protection per output	Fuse 16 A	Melting fuse 20 A
• Design of overvoltage protection	Transil Diode	

Article number	**6BK1943-2AA00-0AA2**	**6BK1943-2BA00-0AA2**
Connection method		
• Design of electrical connection at output for heating and fan	plug, 3-pole with spring-type terminal, push-in	
– Connectable conductor cross-sections, solid	1x (0.2 … 10 mm²)	
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.25 … 6 mm²)	
– Connectable conductor cross-sections for AWG cables, stranded	1x (24 … 8)	
Interfaces		
Interfaces/bus type	system interface	
Interrupts/diagnostics/status information		
Number of status displays	12	
LED status display	LED green = ready, LED yellow = heating on/off, LED red = error display, LED red = error for each channel	
Diagnostics function	Voltage diagnostics	
Diagnoses		
• Fuse blown	Yes	
• Load failure	Yes	
• Triac error	Yes	
• Switch-off threshold for internal device temperature	Yes	
• Parallel-connected heating elements	No	
• Rotating field fault	Yes	
• Communication error	Yes	
• Supply voltage not connected	Yes	
• Line voltage outside the permissible range	Yes	
• Frequency outside the permissible range	Yes	
• Fault current too high	No	
Integrated Functions		
Monitoring functions		
• Temperature monitoring	Yes	
• Type of temperature monitoring	NTC thermistor	
Measuring functions		
• Voltage measurement	Yes	
• Current measurement	No	
• Fault current detection	No	

Article number	6BK1943-2AA00-0AA2	6BK1943-2BA00-0AA2
Potential separation		
Design of electrical isolation	Optocoupler and/or protective impedance between main circuit and PELV	
between the outputs	No	
Isolation		
Overvoltage category	III	
Degree of pollution	2	
EMC		
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011	
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge	
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)	
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV power supply lines, 2 kV load lines	
Conducted interference due to surge acc. to IEC 61000-4-5	on supply and load lines: 1 kV symmetric, 2 kV unsymmetric	
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)	
Degree and class of protection		
IP degree of protection	IP20	
Standards, approvals, certificates		
reference designation according to IEC 81346-2 (2009)	Q	
Ambient conditions		
Ambient temperature during operation		
• min.	0 °C	
• max.	55 °C	
Ambient temperature during storage/transportation		
• Storage, min.	-25 °C	
• Storage, max.	70 °C	
• Transportation, min.	-25 °C	
• Transportation, max.	70 °C	
Air pressure acc. to IEC 60068-2-13		
• Operation, min.	860 hPa	
• Operation, max.	1 080 hPa	
• Storage, min.	660 hPa	
• Storage, max.	1 080 hPa	
Altitude during operation relating to sea level		
• Installation altitude above sea level, max.	2 000 m	

Article number	6BK1943-2AA00-0AA2	6BK1943-2BA00-0AA2
Relative humidity		
• Operation at 25 °C, max.	95 %	
• Operation at 50 °C, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C	
Vibrations		
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g	
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g	
Shock testing		
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis	
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis	
Dimensions		
Width	104 mm	
Height	340 mm	
Depth	250 mm	

Technical specifications of POM4320 rear panel mounting (-0AA2)

Article number	6BK1943-2CA00-0AA2	6BK1943-2DA00-0AA2
General information		
Product type designation	POM4320 rear panel mounting (IEC)	POM4320 rear panel mounting (UL)
Installation type/mounting		
Mounting type	Backplane mounting	
Mounting position	vertical	
Type of ventilation	Self-ventilation	
Supply voltage		
Type of supply voltage	AC	
Rated value (AC)	400 V; Phase - phase	
• Relative negative tolerance	10 %	
• Relative positive tolerance	30 %	
2nd rated value (AC)	480 V; Phase - phase	
• Relative negative tolerance	25 %	
• Relative positive tolerance	8 %	
Line frequency		
• Rated value 50 Hz	Yes	
• Rated value 60 Hz	Yes	
• Relative symmetrical tolerance	5 %	

Article number	6BK1943-2CA00-0AA2	6BK1943-2DA00-0AA2
Mains buffering		
• Recovery time after power failure, typ.	1 s	
Connection method		
• Design of electrical connection for supply voltage	terminal, 3-pole + PE	
– Connectable conductor cross-sections, solid	1x (1.5 ... 50 mm²)	
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (1.5 ... 35 mm²)	
– Connectable conductor cross-sections for AWG cables	1x (16 ... 1)	
Input voltage		
device version of the power supply for electronics	Power supply via CIM	
Power		
Active power input, max.	8 W	
Power electronics		
Type of load	Ohmic load	
Power capacity, max.	57.6 kW; At 400 V AC	64.8 kW; At 480 V AC
• For phase against phase with fan at 40 °C, max.	57.6 kW; At 400 V AC	64.8 kW; At 480 V AC
Switching capacity current per phase, max.	83 A	80 A
Short-time withstand current (SCCR) acc. to UL 508A		100 kA
Control of heating elements		
• Half-wave control	Yes	
• Soft start	Yes	
• Phase control	Yes	
Load connection type		
• Star connection with neutral conductor (single-phase)	No	
• Open delta connection (single-phase)	Yes; Incoming fuse contained in the device	
• Closed delta connection (3-phase)	No	
• Star connection with neutral conductor (2-phase)	No	
• 2-pole switching	No	
Setpoint input		
• Percent	Yes	
• Watts	No	

Article number	6BK1943-2CA00-0AA2	6BK1943-2DA00-0AA2
Heating power		
• Number of digital outputs	9	
• Number of heating elements per output, max.	1	
• Output voltage for heating power	400 V	
• 2nd output voltage for heating power	480 V	
• Power carrying capacity per output, min.	200 W; At 400 V AC	240 W; At 480 V AC
• Power carrying capacity per output, max.	6 400 W; At 400 V AC	7 200 W; At 480 V AC
– for heating elements with high inrush current, max.	4 000 W; At 400 V AC	4 000 W; At 480 V AC
• Output current for heating power	16 A; max.	15 A; max.
• Melting I2t value	250 $A^2 \cdot s$	400 $A^2 \cdot s$
• Design of short-circuit protection per output	Fuse 16 A	Melting fuse 20 A
• Design of overvoltage protection	Transil Diode	
Connection method		
• Design of electrical connection at output for heating and fan	plug, 3-pole with spring-type terminal, push-in	
– Connectable conductor cross-sections, solid	1x (0.2 ... 10 mm^2)	
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.25 ... 6 mm^2)	
– Connectable conductor cross-sections for AWG cables, stranded	1x (24 ... 8)	
Interfaces		
Interfaces/bus type	system interface	
Interrupts/diagnostics/status information		
Number of status displays	12	
LED status display	LED green = ready, LED yellow = heating on/off, LED red = error display, LED red = error for each channel	
Diagnostics function	Voltage diagnostics	
Diagnoses		
• Fuse blown	Yes	
• Load failure	Yes	
• Triac error	Yes	
• Switch-off threshold for internal device temperature	Yes	

Article number	**6BK1943-2CA00-0AA2**	**6BK1943-2DA00-0AA2**
• Parallel-connected heating elements	No	
• Rotating field fault	Yes	
• Communication error	Yes	
• Supply voltage not connected	Yes	
• Line voltage outside the permissible range	Yes	
• Frequency outside the permissible range	Yes	
• Fault current too high	No	
Integrated Functions		
Monitoring functions		
• Temperature monitoring	Yes	
• Type of temperature monitoring	NTC thermistor	
Measuring functions		
• Voltage measurement	Yes	
• Current measurement	No	
• Fault current detection	No	
Potential separation		
Design of electrical isolation	Optocoupler and/or protective impedance between main circuit and PELV	
between the outputs	No	
Isolation		
Overvoltage category	III	
Degree of pollution	2	
EMC		
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011	
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge	
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)	
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV power supply lines, 2 kV load lines	
Conducted interference due to surge acc. to IEC 61000-4-5	on supply and load lines: 1 kV symmetric, 2 kV unsymmetric	
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)	
Degree and class of protection		
IP degree of protection	IP20	
Standards, approvals, certificates		
reference designation according to IEC 81346-2 (2009)	Q	
Ambient conditions		
Ambient temperature during operation		

Article number	**6BK1943-2CA00-0AA2**	**6BK1943-2DA00-0AA2**
• min.	0 °C	
• max.	55 °C	
Ambient temperature during storage/transportation		
• Storage, min.	-25 °C	
• Storage, max.	70 °C	
• Transportation, min.	-25 °C	
• Transportation, max.	70 °C	
Air pressure acc. to IEC 60068-2-13		
• Operation, min.	860 hPa	
• Operation, max.	1 080 hPa	
• Storage, min.	660 hPa	
• Storage, max.	1 080 hPa	
Altitude during operation relating to sea level		
• Installation altitude above sea level, max.	2 000 m	
Relative humidity		
• Operation at 25 °C, max.	95 %	
• Operation at 50 °C, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C	
Vibrations		
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g	
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g	
Shock testing		
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis	
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis	
Dimensions		
Width	104 mm	
Height	344 mm	
Depth	217 mm	

13.3 Technical Specifications POM4320 Highend

Article number	6BK1943-2AH00-0AA0	6BK1943-2CH00-0AA0
General information		
Product type designation	POM4320 Highend	
Installation type/mounting		
Mounting type	Busbar mounting	Backplane mounting
Mounting position	vertical	
Type of ventilation	Self-ventilation	
Supply voltage		
Type of supply voltage	AC	
Rated value (AC)	230 V; phase - neutral conductor	
• Relative negative tolerance	10 %	
• Relative positive tolerance	30 %	
2nd rated value (AC)	277 V; phase - neutral conductor	
• Relative negative tolerance	25 %	
• Relative positive tolerance	8 %	
3rd rated value (AC)	400 V; Phase - phase	
• Relative negative tolerance	10 %	
• Relative positive tolerance	30 %	
4th rated value (AC)	480 V; Phase - phase	
• Relative negative tolerance	25 %	
• Relative positive tolerance	8 %	
Line frequency		
• Rated value 50 Hz	Yes	
• Rated value 60 Hz	Yes	
• Relative symmetrical tolerance	5 %	
Mains buffering		
• Recovery time after power failure, typ.	1 s	
Connection method		
• Design of electrical connection for supply voltage	Busbar adapter, 3-pole + N + PE	Terminal, 3-pole + N + PE
– Connectable conductor cross-sections, solid		1x (1.5 ... 50 mm²)
– Connectable conductor cross-sections, finely stranded with wire end processing		1x (1.5 ... 35 mm²)
– Connectable conductor cross-sections for AWG cables		1x (16 ... 1)
– Cable cross-sections for N	1x (0.2 ... 2.5 mm²)	
Input voltage		
device version of the power supply for electronics	Power supply via CIM	

Article number	6BK1943-2AH00-0AA0	6BK1943-2CH00-0AA0
Power		
Active power input, max.	10 W	
Power electronics		
Type of load	Ohmic load	
Power capacity, max.	76.8 kW; At 400 V AC	
• For phase against phase with fan at 40 °C, max.	76.8 kW; At 400 V AC	
• For phase against neutral with fan at 40 °C, max.	44.16 kW; at 230 V AC	
Switching capacity current per phase, max.	83 A	105 A; 90 A (UL)
Short-time withstand current (SCCR) acc. to UL 508A		100 kA
Control of heating elements		
• Half-wave control	Yes	
• Soft start	Yes	
• Phase control	Yes	
Load connection type		
• Star connection with neutral conductor (single-phase)	Yes	
• Open delta connection (single-phase)	Yes; Incoming fuse in the device optionally possible	
• closed delta connection (2-phase)	Yes; Economy circuit	
• Closed delta connection (3-phase)	Yes	
• Star connection with neutral conductor (2-phase)	Yes; Economy circuit	
• star connection without neutral conductor (3-phase)	Yes	
• 2-pole switching	Yes; Phase - phase	
Setpoint input		
• Percent	Yes	
• Watts	Yes	
Heating power		
• Number of digital outputs	6; Possible parallel switching of 2 outputs	
• Number of heating elements per output, max.	5	
• Output voltage for heating power	230 V	
• 2nd output voltage for heating power	277 V	
• 3rd output voltage for heating power	400 V	
• 4th output voltage for heating power	480 V	
• Power carrying capacity per output, min.	1 200 W; At 400 V AC	

Article number	**6BK1943-2AH00-0AA0**	**6BK1943-2CH00-0AA0**
• Power carrying capacity per output, max.	12 800 W; At 400 V AC	
– for heating elements with high inrush current, max.	6 000 W; At 400 V AC	
• Output current for heating power	32 A; max.	
• Melting I2t value	250 $A^2 \cdot s$	
• Design of short-circuit protection per output	Melting fuse 32 A	
• Design of overvoltage protection	Transil Diode	
Connection method		
• Design of electrical connection at output for heating and fan	plug, 3-pole, with operating lever, push-in	
– Connectable conductor cross-sections, solid	1x (0.75 ... 16 mm^2)	
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.75 ... 16 mm^2)	
– Connectable conductor cross-sections for AWG cables, stranded	1x (18 ... 4)	
Interfaces		
Interfaces/bus type	system interface	
Interrupts/diagnostics/status information		
Number of status displays	9	
LED status display	LED green = ready, LED yellow = heating on/off, LED red = error display, LED red = error for each channel	
Diagnostics function	Voltage and current diagnosis	
Diagnoses		
• Fuse blown	Yes	
• Load failure	Yes	
• Triac error	Yes	
• Switch-off threshold for internal device temperature	Yes	
• Parallel-connected heating elements	Yes	
• Rotating field fault	Yes	
• Communication error	Yes	
• Supply voltage not connected	Yes	
• Line voltage outside the permissible range	Yes	
• Frequency outside the permissible range	Yes	
• Fault current too high	Yes	
Integrated Functions		
Monitoring functions		
• Temperature monitoring	Yes	
• Type of temperature monitoring	NTC thermistor	

Article number	6BK1943-2AH00-0AA0	6BK1943-2CH00-0AA0
Measuring functions		
• Voltage measurement	Yes	
• Current measurement	Yes	
• Fault current detection	Yes; For 2-pole switching	
Potential separation		
Design of electrical isolation	Optocoupler and/or protective impedance between main circuit and PELV	
between the outputs	No	
Isolation		
Overvoltage category	III	
Degree of pollution	2	
EMC		
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011	
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge	
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)	
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV power supply lines, 2 kV load lines	
Conducted interference due to surge acc. to IEC 61000-4-5	on supply and load lines: 1 kV symmetric, 2 kV unsymmetric	
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)	
Degree and class of protection		
IP degree of protection	IP20	
Standards, approvals, certificates		
reference designation according to IEC 81346-2 (2009)	Q	
Ambient conditions		
Ambient temperature during operation		
• min.	0 °C	
• max.	55 °C	
Ambient temperature during storage/transportation		
• Storage, min.	-25 °C	
• Storage, max.	70 °C	
• Transportation, min.	-25 °C	
• Transportation, max.	70 °C	
Air pressure acc. to IEC 60068-2-13		
• Operation, min.	860 hPa	
• Operation, max.	1 080 hPa	
• Storage, min.	660 hPa	
• Storage, max.	1 080 hPa	

Article number	6BK1943-2AH00-0AA0	6BK1943-2CH00-0AA0
Altitude during operation relating to sea level		
• Installation altitude above sea level, max.	2 000 m	
Relative humidity		
• Operation at 25 °C, max.	95 %	
• Operation at 50 °C, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C	
Vibrations		
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g	
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g	
Shock testing		
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis	
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis	
Dimensions		
Width	104 mm	
Height	340 mm	344 mm
Depth	250 mm	217 mm

13.4 Technical specifications for I/O module

PM4000 DI/DO

Article number	**6BK1900-0BA00-0AA0**
General information	
Product type designation	PM4000 DI/DO
Installation type/mounting	
Mounting type	Screw mounting to CIM
Mounting position	vertical
Type of ventilation	Forced ventilation
Supply voltage	
Design of the power supply	Power supply via CIM
Power	
Active power input, max.	1 W
Digital inputs	
Number of digital inputs	8
Connection method	
• Design of electrical connection at the digital inputs	
– Connectable conductor cross-sections, solid	1x (0.2 ... 1.5 mm²)
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.25 ... 1.5 mm²)
– Connectable conductor cross-sections for AWG cables	1x (24 ... 16)
Digital outputs	
Type of digital output	semiconductor output (high side switch)
Number of digital outputs	16
Switching performance	monostable
short-circuit proof	Yes
Output voltage	
• Type of output voltage	DC
• Rated value (DC)	24 V
• permissible voltage at output, min.	19.2 V
• permissible voltage at output, max.	28.8 V
Output current	
• for signal "1" permissible range, max.	500 mA

Article number	**6BK1900-0BA00-0AA0**
Connection method	
• Design of electrical connection at the digital outputs	
– Connectable conductor cross-sections, solid	1x (0.2 ... 1.5 mm²)
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.25 ... 1.5 mm²)
– Connectable conductor cross-sections for AWG cables	1x (24 ... 16)
• Design of electrical connection for control supply voltage	
– Connectable conductor cross-sections with wire end processing	1x (0.25 ... 1.5 mm²)
– Connectable conductor cross-sections for AWG cables	1x (24 ... 16)
Interfaces	
Interfaces/bus type	system interface
Interrupts/diagnostics/status information	
Number of status displays	18
LED status display	LED green = Ready, LED red = Error display, 1 LED yellow per output: LED on - H status; LED off -L status
Potential separation	
between outputs and system interface	Yes
Isolation	
Overvoltage category	III
Degree of pollution	2
EMC	
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV signal lines
Conducted interference due to surge acc. to IEC 61000-4-5	DC supply cables: 0.5 kV balanced and unbalanced
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)
Degree and class of protection	
IP degree of protection	IP20
Standards, approvals, certificates	
reference designation according to IEC 81346-2 (2009)	K

Article number	**6BK1900-0BA00-0AA0**
Ambient conditions	
Ambient temperature during operation	
• min.	0 °C
• max.	55 °C
Ambient temperature during storage/transportation	
• Storage, min.	-25 °C
• Storage, max.	70 °C
• Transportation, min.	-25 °C
• Transportation, max.	70 °C
Air pressure acc. to IEC 60068-2-13	
• Operation, min.	860 hPa
• Operation, max.	1 080 hPa
• Storage, min.	660 hPa
• Storage, max.	1 080 hPa
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	2 000 m
Relative humidity	
• Operation at 25 °C, max.	95 %
• Operation at 50 °C, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C
Vibrations	
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g
Shock testing	
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis
Dimensions	
Width	27 mm
Height	141 mm
Depth	110 mm

PM4000 U/I

Article number	6BK1900-0CA00-0AA0
General information	
Product type designation	For PM4000 U/I
Installation type/mounting	
Mounting type	Screw mounting to CIM
Mounting position	vertical
Type of ventilation	Forced ventilation
Supply voltage	
Design of the power supply	Power supply via CIM
Power	
Active power input, max.	1 W
Interfaces	
Interfaces/bus type	system interface
Interrupts/diagnostics/status information	
Number of status displays	2
LED status display	LED green = Ready, LED red = Error display
Integrated Functions	
Measuring functions	
• Voltage measurement	Yes
• Current measurement	Yes
Operating mode for measured value acquisition	
– Operating frequency, min.	50 Hz
– Operating frequency, max.	60 Hz
Measuring inputs for voltage	
– Voltage measurement range, min.	230 V
– Voltage measuring range, max.	480 V
– Relative measuring accuracy voltage	0.5 %
– Design of electrical connection at the measuring inputs for voltage	plug, 6-pole with spring-type terminal, push-in
– Connectable conductor cross-sections, solid	1x (0.2 ... 10 mm²)
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.25 ... 6 mm²)
– Connectable conductor cross-sections for AWG cables	1x (24 ... 8)
Measuring inputs for current	
– Current measurement range, min.	0 A
– Current measurement range, max.	5 A
– Relative measuring accuracy current	0.5 %
– Design of electrical connection at the measuring inputs for current	plug, 8-pole with spring-type terminal, push-in

Article number	**6BK1900-0CA00-0AA0**
– Connectable conductor cross-sections, solid	1x (0.2 ... 1.5 mm²)
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.2 ... 1.5 mm²)
– Connectable conductor cross-sections for AWG cables	1x (24 ... 16)
Isolation	
Overvoltage category	III
Degree of pollution	2
EMC	
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV signal lines
Conducted interference due to surge acc. to IEC 61000-4-5	Voltage measurement inputs: 1 kV balanced, 2 kV unbalanced
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)
Degree and class of protection	
IP degree of protection	IP20
Standards, approvals, certificates	
reference designation according to IEC 81346-2 (2009)	K
Ambient conditions	
Ambient temperature during operation	
• min.	0 °C
• max.	55 °C
Ambient temperature during storage/transportation	
• Storage, min.	-25 °C
• Storage, max.	70 °C
• Transportation, min.	-25 °C
• Transportation, max.	70 °C
Air pressure acc. to IEC 60068-2-13	
• Operation, min.	860 hPa
• Operation, max.	1 080 hPa
• Storage, min.	660 hPa
• Storage, max.	1 080 hPa
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	2 000 m

Article number	6BK1900-0CA00-0AA0
Relative humidity	
• Operation at 25 °C, max.	95 %
• Operation at 50 °C, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C
Vibrations	
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g
Shock testing	
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis
Dimensions	
Width	27 mm
Height	141 mm
Depth	110 mm

PM4000 Temperature

Article number	6BK1900-0AA00-0AA0
General information	
Product type designation	PM4000 temperature
Installation type/mounting	
Mounting type	Screw mounting to CIM
Mounting position	vertical
Type of ventilation	Forced ventilation
Supply voltage	
Design of the power supply	Power supply via CIM
Power	
Active power input, max.	1 W
Analog inputs	
Number of analog inputs	
• for 2-wire system	4
• for 4-wire system	2
Sensor current, typ.	210 µA
Impulse voltage resistance, max.	15 V
Input ranges	
• Thermocouple	Yes
• Resistance thermometer	Yes

Article number	**6BK1900-0AA00-0AA0**
Measuring range	
• Temperature for type J thermocouple, min.	0 °C
• Temperature for type J thermocouple, max.	650 °C
• Temperature for type K thermocouple, min.	0 °C
• Temperature for type K thermocouple, max.	440 °C
• Temperature for type L thermocouple, min.	0 °C
• Temperature for type L thermocouple, max.	640 °C
• Temperature for Pt 100 according to IEC 60751, min.	0 °C
• Temperature for Pt 100 according to IEC 60751, max.	410 °C
• Temperature for Pt 1000 according to IEC 60751, min.	0 °C
• Temperature for Pt 1000 according to IEC 60751, max.	850 °C
Connection method	
• Design of electrical connection for temperature sensors	plug, 8-pole with spring-type terminal, push-in
– Connectable conductor cross-sections for AWG cables	1x (24 ... 16)
– Connectable conductor cross-sections, solid	1x (0.2 ... 1.5 mm²)
– Connectable conductor cross-sections with wire end processing	1x (0.25 ... 1.5 mm²)
Analog value generation for the inputs	
Type of A/D conversion	Sigma Delta
Conversion time	150 ms
Errors/accuracies	
Measuring accuracy	±1 K
Temperature drift per °C, typ.	0.05 %/°C
Temperature offset per K, max.	0.1 K/K
Interfaces	
Interfaces/bus type	system interface
Interrupts/diagnostics/status information	
Number of status displays	2
LED status display	LED green = Ready, LED red = Error display
Integrated Functions	
Measuring functions	
• Current measurement	Yes

Article number	**6BK1900-0AA00-0AA0**
Measuring inputs for current	
– Current measurement range, min.	0 mA
– Current measurement range, max.	20 mA
– Relative measuring accuracy current	0.5 %
– Design of electrical connection at the measuring inputs for current	plug, 8-pole with spring-type terminal, push-in
– Connectable conductor cross-sections, solid	1x (0.2 ... 1.5 mm²)
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.25 ... 1.5 mm²)
– Connectable conductor cross-sections for AWG cables	1x (24 ... 16)
Potential separation	
between the channels	No
Isolation	
Overvoltage category	III
Degree of pollution	2
EMC	
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV signal lines
Conducted interference due to surge acc. to IEC 61000-4-5	Not applicable
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)
Degree and class of protection	
IP degree of protection	IP20
Standards, approvals, certificates	
reference designation according to IEC 81346-2 (2009)	K
Ambient conditions	
Ambient temperature during operation	
• min.	0 °C
• max.	55 °C
Ambient temperature during storage/transportation	
• Storage, min.	-25 °C
• Storage, max.	70 °C
• Transportation, min.	-25 °C
• Transportation, max.	70 °C

Article number	**6BK1900-0AA00-0AA0**
Air pressure acc. to IEC 60068-2-13	
• Operation, min.	860 hPa
• Operation, max.	1 080 hPa
• Storage, min.	660 hPa
• Storage, max.	1 080 hPa
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	2 000 m
Relative humidity	
• Operation at 25 ℃, max.	95 %
• Operation at 50 ℃, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C
Vibrations	
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g
Shock testing	
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis
Dimensions	
Width	27 mm
Height	141 m
Depth	110 mm

13.5 Technical specifications for EM4315 extension module

Article number	6BK1943-1AA50-0AA0
General information	
Product type designation	EM4315
Installation type/mounting	
Mounting type	Screw mounting to POM
Mounting position	vertical
Type of ventilation	Forced ventilation
Supply voltage	
Type of supply voltage	DC
Rated value (DC)	24 V
relative symmetrical tolerance of the supply voltage	20 %
Connection method	
• Design of electrical connection for supply voltage	
– Connectable conductor cross-sections, solid	1x (0.2 ... 2.5 mm²)
– Connectable conductor cross-sections, finely stranded with wire end processing	1x (0.2 ... 2.5 mm²)
– Connectable conductor cross-sections for AWG cables	1x (26 ... 12)
Power	
Active power input	1 W
Hardware configuration	
Type of power output connectable	POM4320
Slots	
• Number of slots	0
Interfaces	
Interfaces/bus type	system interface
Protocols	
Supports protocol for PROFINET IO	No
PROFIBUS DP	No
EtherNet/IP	No
Interrupts/diagnostics/status information	
Number of status displays	1
LED status display	LED green = ready
Isolation	
Overvoltage category	III
Degree of pollution	2

Article number	**6BK1943-1AA50-0AA0**
EMC	
EMC interference emission	Limit value in accordance with IEC 61000-6-4:2007 + A1:2011
Electrostatic discharge acc. to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge
Field-related interference acc. to IEC 61000-4-3	10 V/m (80 ... 1 000 MHz), 3 V/m (1.4 ... 2.0 GHz), 1 V/m (2.0 ... 2.7 GHz)
Conducted interference due to burst acc. to IEC 61000-4-4	2 kV power supply lines
Conducted interference due to surge acc. to IEC 61000-4-5	On DC supply lines: 0.5 kV symmetrical and asymmetrical
Conducted interference due to high-frequency radiation acc. to IEC 61000-4-6	10 V (0.15 ... 80 MHz)
Degree and class of protection	
IP degree of protection	IP20
Standards, approvals, certificates	
reference designation according to IEC 81346-2 (2009)	K
Ambient conditions	
Ambient temperature during operation	
• min.	0 °C
• max.	55 °C
Ambient temperature during storage/transportation	
• Storage, min.	-25 °C
• Storage, max.	70 °C
• Transportation, min.	-25 °C
• Transportation, max.	70 °C
Air pressure acc. to IEC 60068-2-13	
• Operation, min.	860 hPa
• Operation, max.	1 080 hPa
• Storage, min.	660 hPa
• Storage, max.	1 080 hPa
Altitude during operation relating to sea level	
• Installation altitude above sea level, max.	2 000 m
Relative humidity	
• Operation at 25 °C, max.	95 %
• Operation at 50 °C, max.	50 %; 95 % at 25 °C, decreasing linearly to 50 % at 50 °C
Vibrations	
• Vibration resistance during operation acc. to IEC 60068-2-6	10 ... 58 Hz / 0.075 mm, 58 ... 150 Hz / 1 g
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 500 Hz / 1 g

Article number	**6BK1943-1AA50-0AA0**
Shock testing	
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms / 3 shocks/axis
• Shock resistance during storage acc. to IEC 60068-2-29	25 g / 6 ms / 1 000 shocks/axis
Dimensions	
Width	56 mm
Height	285 mm
Depth	122 mm

13.6 Dimension drawings

Dimension drawing CIM4310

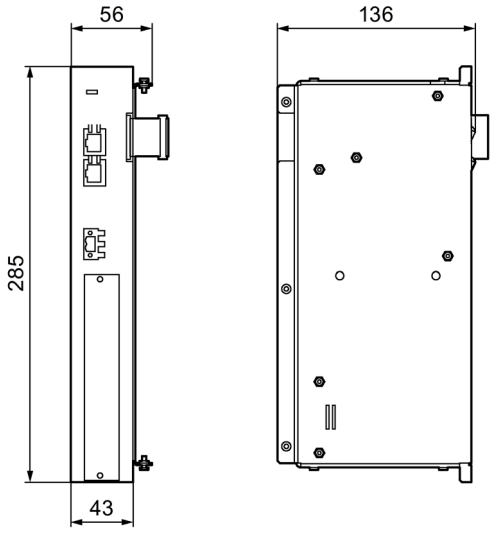


Figure 13-1 Dimension drawing CIM4310

Dimension drawing of POM4320 for busbar mounting

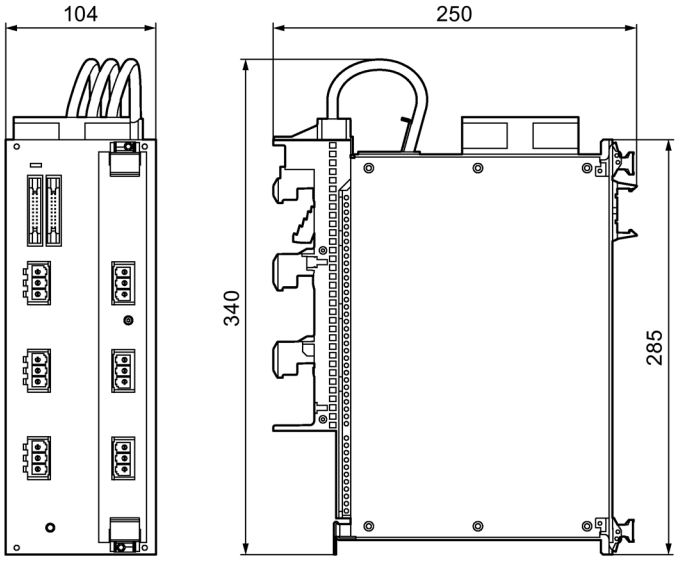


Figure 13-2 Dimension drawing of POM4320 for busbar mounting

Dimension drawing of POM4320 for panel mounting

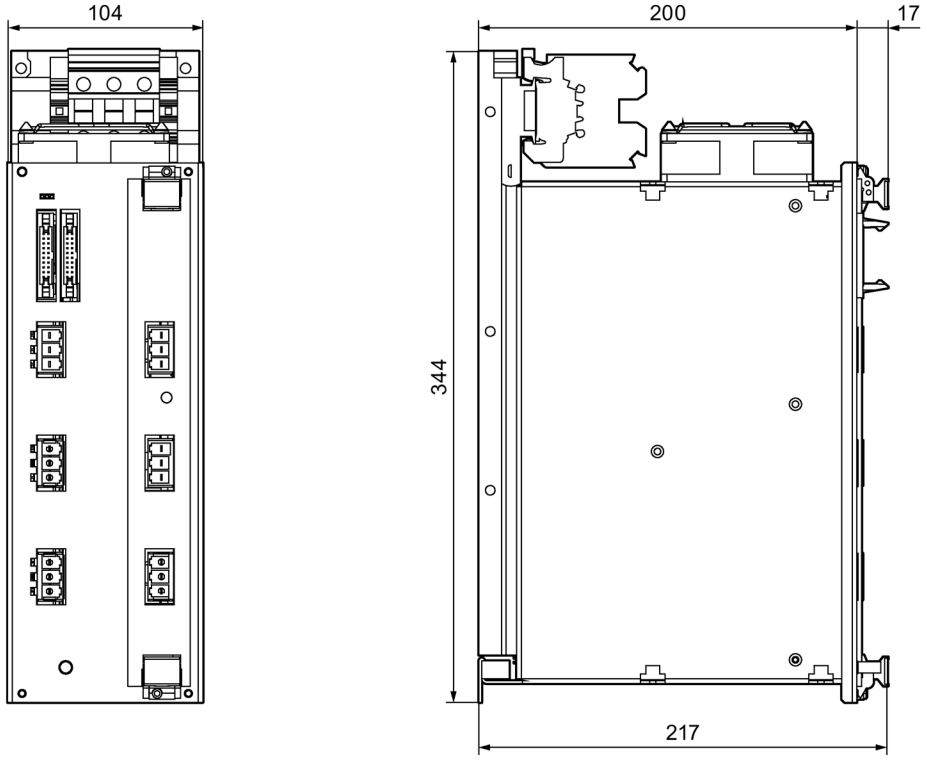


Figure 13-3 Dimension drawing of POM4320 for panel mounting

Dimension drawing POM4320 Highend for busbar mounting

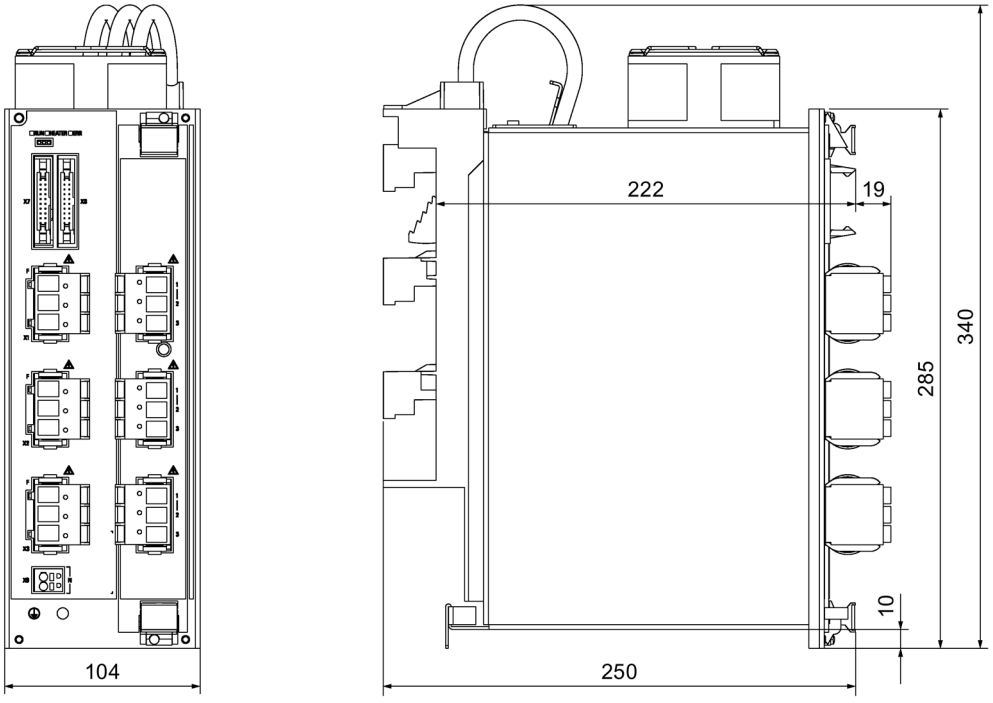


Figure 13-4 Dimension drawing POM4320 Highend for busbar mounting

Dimension drawing POM4320 Highend for panel mounting

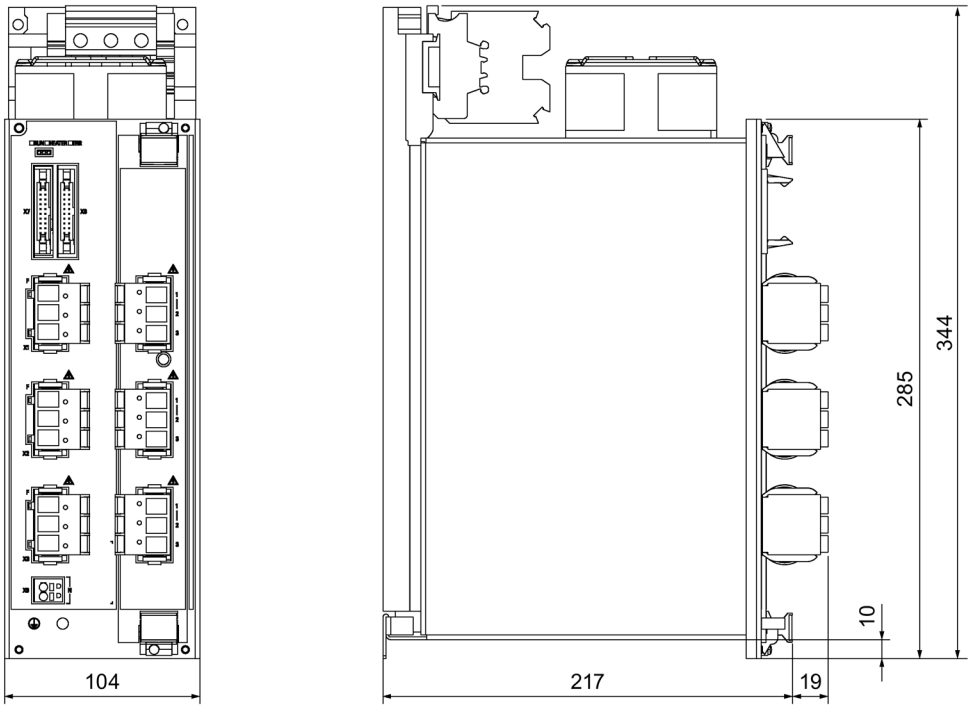


Figure 13-5 Dimension drawing POM4320 Highend for panel mounting

Dimension drawing for EM4315 expansion module

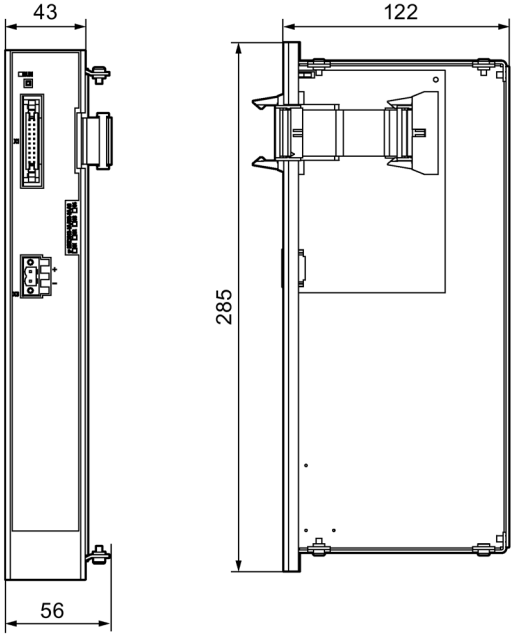


Figure 13-6 Dimension drawing for EM4315 expansion module

Appendix

A

A.1 Certificates and approvals

A.1.1 Certificates and approvals

Note

Approvals are only valid when marked on the product

The specified approvals apply only when the corresponding mark is printed on the product. You can check which of the following approvals have been granted for your product by the markings on the type plate.

Note

For every product, the EU directive and the reference norm that have been satisfied can be looked up via the MLFB on the SIOS Internet pages.

EC directives

SIPLUS HCS4300 products conform to the requirements and safety objectives of the EC Directives listed below.

Low voltage guideline

SIPLUS HCS4300 products comply with the requirements of the directive: 2014/35/EU "Electrical Safety".

EMC directive (electromagnetic compatibility)

SIPLUS HCS4300 products meet the requirements of the EC Directive: 2014/30/EU "Electromagnetic Compatibility"

The product is designed for operation in **industrial areas** with the following requirements:

- Interference emission according to EN 61000-6-4
- Noise immunity according to EN 61000-6-2

RoHS Guideline

SIPLUS HCS4300 products meet the requirements of the RoHS Directive 2011/65/EU (RoHs II):

Note for the manufacturers of machines

This product is not a machine in the sense of the EC Machinery Directive. Therefore, there is no declaration of conformity relating to the EC Machinery Directive 2006/42/EC for this product.

A.2 Article numbers for spare parts/accessories

A.2.1 Ordering data

Ordering data	
Single part	**Article No.**
HCS CIM4310 with PROFINET	6BK1943-1AA00-0AA0
HCS CIM4310 with PROFIBUS	6BK1943-1BA00-0AA0
HCS POM4320, busbar mounting, CE version	6BK1943-2AA00-0AAx
HCS POM4320, panel mounting, CE version	6BK1943-2CA00-0AAx
HCS POM4320, busbar mounting, UL version	6BK1943-2BA00-0AAx
HCS POM4320, panel mounting, UL version	6BK1943-2DA00-0AAx
HCS POM4320 Highend, busbar mounting	6BK1943-2AH00-0AA0
HCS POM4320 Highend, panel mounting	6BK1943-2CH00-0AA0
HCS EM4315 extension module	6BK1943-1AA50-0AA0
HCS PM4000 Temperature	6BK1900-0AA00-0AA0
HCS PM4000 DI/DO	6BK1900-0BA00-0AA0
HCS PM4000 U/I	6BK1900-0CA00-0AA0
HCS fuse 16 A/500 V 10x38 gG (50 units) For all POM4320 IEC variants 6BK1943-2AA00-0AAx and 6BK1943-2CA00-0AAx	6BK1943-6BA00-0AA0 Alternatively: Cooper Bussmann (www.cooperindustries.com), article number: C10G16
HCS fuse 32 A/690 V 14x51 (10 units) For POM4320 Highend	6BK1943-6EA00-0AA0 Alternatively: SIBA (www.siba.de), article number: 50 124 34.32
SENTRON, cylinder fuse, Class CC, 15 A, slow, Un AC: 600 V For POM4320 UL variants with MLFB number 6BK1943-2BA00-0AA0 and 6BK1943-2DA00-0AA0	3NW1150-0HG Alternatively: Cooper Bussmann (www.cooperindustries.com), article number: LP-CC-15
SENTRON, cylinder fuse, Class CC, 20 A, slow, Un AC: 600 V For POM4320 UL variants with MLFB number 6BK1943-2BA00-0AA2 and 6BK1943-2DA00-0AA2	3NW1200-0HG Alternatively: Cooper Bussmann (www.cooperindustries.com), article number: LP-CC-20
HCS Fan SIPLUS HCS Power Output Module 80 mm	6BK1700-2GA00-0AA0
HCS Fan POM4320 Highend (1 unit)	6BK1943-6GA00-0AA0
Cable SIPLUS HCS4300 POM/POM 100 mm (10 units)	6BK1943-5AA00-0AA0
Cable SIPLUS HCS4300 POM/POM 250 mm (10 units)	6BK1943-5BA00-0AA0
Cable SIPLUS HCS4200/4300 1000 mm (10 units)	6BK1943-5CA00-0AA0
Cable SIPLUS HCS4300 POM/POM 1500 mm (5 units)	6BK1943-5DA00-0AA0
HCS connector set 3-pin, POM4320/POM4220 Lowend (10 units)	6BK1943-6AA00-0AA0
HCS connector set for POM4320 Highend (9 units)	6BK1943-6FA00-0AA0
HCS Jumper POM4320 Highend (12 units) Jumper plug for parallel connection	6BK1943-6HA00-0AA0
HCS connector set 2-pin, 24 V DC CIM4310 (20 units)	6BK1942-6FA00-0AA0
HCS connector set, 18-pin, PM4000 DI/DO (8 units)	6BK1900-6AA00-0AA0
HCS connector set 8-pin, PM4000 temperature / PM4000 U/I (10 units)	6BK1900-6BA00-0AA0

A.3 ESD Guidelines

Definition of ESD

All electronic modules are equipped with large-scale integrated ICs or components. Due to their design, these electronic elements are highly sensitive to overvoltage, and thus to any electrostatic discharge.

The electrostatic sensitive components/modules are commonly referred to as ESD devices. This is also the international abbreviation for such devices.

ESD modules are identified by the following symbol:

NOTICE
ESD devices can be destroyed by voltages well below the threshold of human perception. These static voltages develop when you touch a component or electrical connection of a device without having drained the static charges present on your body. The electrostatic discharge current may lead to latent failure of a module, that is, this damage may not be significant immediately, but in operation may cause malfunction.

Electrostatic charging

Anyone who is not connected to the electrical potential of their surroundings can be electrostatically charged.

The figure below shows the maximum electrostatic voltage which may build up on a person coming into contact with the materials indicated. These values correspond to IEC 801-2 specifications.

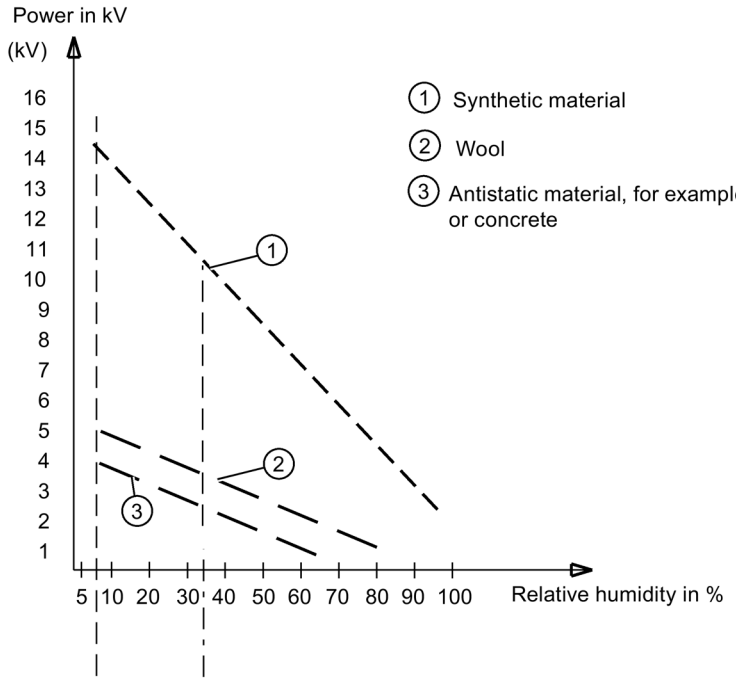


Figure A-1 Electrostatic voltages on an operator

Basic protective measures against electrostatic discharge

- Ensure good equipotential bonding:
  When handling electrostatic sensitive devices, ensure that your body, the workplace and packaging are grounded. This prevents electrostatic charge.
- Avoid direct contact:
  As a general rule, only touch electrostatic sensitive devices when this is unavoidable (e.g. during maintenance work). Handle the modules without touching any chip pins or PCB traces. In this way, the discharged energy cannot affect the sensitive devices.

  Discharge your body before you start taking any measurements on a module. Do so by touching grounded metallic parts. Always use grounded measuring instruments.

A.4 Service & Support

Contacts

Please talk to your Siemens contact (http://www.siemens.com/automation/partner) at one of our agencies or local offices if you have any questions about the products described here and do not find the answers in this manual.

Siemens Industry Online Support

You can find various services on the Support homepage (http://support.automation.siemens.com) on the Internet.

There you will find the following information, for example:

- The correct documents for you via product-related search functions
- Online support request form
- Your local representative
- Information about on-site service, repairs, and spare parts.
- A forum for exchanging information among users and specialists, all over the world.
- Our newsletter containing up-to-date information on your products.

Online catalog and ordering system

The online catalog and the online ordering system can also be found at Industry Mall Homepage (http://www.siemens.com/industrymall)

SIPLUS HCS heating control systems on the Internet

Current information on SIPLUS HCS is provided as part of our online presence (http://www.siemens.com/siplus-hcs).

A.4.1 Application example

An example application for SIMATIC S7 is available as a guide and basis for your own applications. This application example explains the mode of operation of the heating control system.

You can download the application example from the Siemens Service&Support area (http://support.automation.siemens.com/).

A.4.2 Frequently asked questions (FAQ)

At Siemens Online Support, you can find answers to frequently asked questions (FAQs) on the topic of IO system for heating elements (https://support.industry.siemens.com/cs/ww/en/ps/18243/faq).

Index

O

P

Q

R

S

T