

SIEMENS



Heating Control Systems

SIPLUS

Heating control system HCS3200

Operating Instructions

Edition

03/2013

Answers for the industry.

Heating Control Systems

Heating control system SIPLUS HCS3200

Operating Instructions

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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.

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Introduction

1.1 Introduction

Purpose of this documentation

These operating instructions contain all the information you require to commission and operate the HCS3200 heating controller.

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 PROFIBUS DP fieldbus is also necessary.

History

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

Edition	Note
03/2013	First edition

Registered trademarks

SIPLUS ® is a registered trademark of Siemens AG.

Safety notes

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, please 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.

Warning symbols on the device



⚠ WARNING

Electric shock hazard

May 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

May 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 May cause death or serious injury <ul style="list-style-type: none">• Before opening the enclosure door, you must disconnect the line voltage and secure it against switching on again.• 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 May cause death or serious injury <p>Incorrectly performed repairs may result in substantial damage to equipment or endanger the user. Return the device to Siemens for repair.</p>

2.2 IT security

IT security guidelines

Siemens offers IT security mechanisms for its automation and drive product portfolio in order to support the safe operation of the plant/machine. We recommend that you inform yourself regularly on the IT security developments regarding your products. For information on this topic, refer to: <http://support.automation.siemens.com>. Here, you can register for a product-specific newsletter.

For the secure operation of a plant/machine, however, it is necessary to integrate the automation components in a full IT security concept for the entire plant/machine that represents the state of the art in IT technology. You can find information on this at: <http://www.siemens.com/industrialsecurity>. Products used from other manufacturers should also be taken into account here.

Description

3.1 Area of application of HCS3200

The HCS3200 heating controller is used for controlling heating elements used in industry. The preferred area of application for the HCS3200 is in the control of infrared emitters in PET stretch blow molding machines.

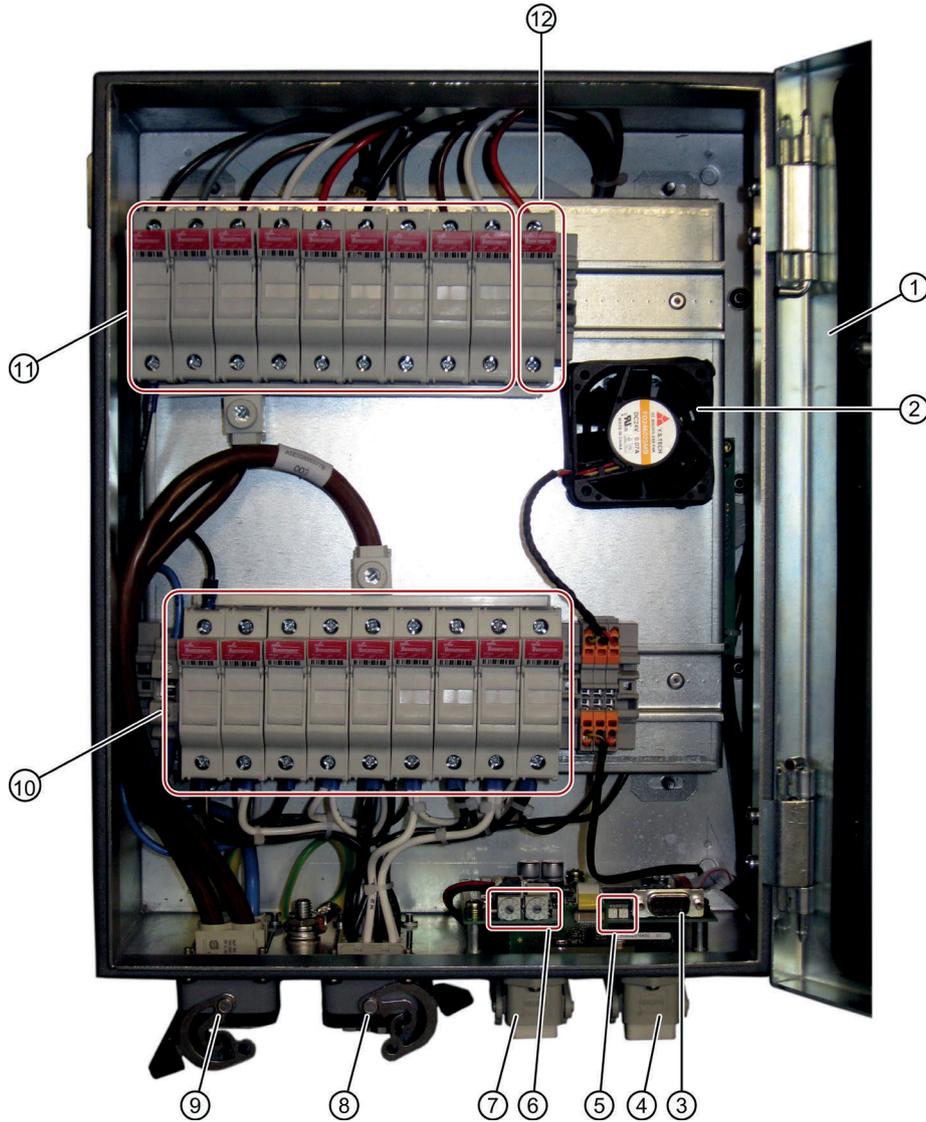
In principle, the HCS3200 can be used wherever resistive loads have to be switched and monitored.

3.2 Features

Features

HCS3200 heating controller	Features
	<ul style="list-style-type: none"> • 9 power outputs with a maximum switching power of 4 kW at 400 V AC • 1 output for activating an external fan, 230 V AC • Total switching power of the device: 25200 W • 16 A fuse per power output (internally accessible) • 4 A fuse for external fan (internally accessible) • Connection of the line voltage, heating elements/fan and PROFIBUS DP/24 V DC via connectors underneath the device • Diagnostics per power output, for detecting internal and external faults • Internal temperature monitoring through NTC thermistor • Voltage monitoring • Line voltage compensation • PROFIBUS DP address setting with rotary switch (internally accessible) • Station status LED indicators (internally accessible) • Serial interface for firmware updates (internally accessible)

3.3 Structure



- ① Enclosure door, grounded
- ② Internal fan
- ③ RS232 interface for loading new software
- ④ X4: PROFIBUS DP and 24 V DC supply
- ⑤ LEDs: for displaying the system operating status
- ⑥ 2 rotary switches: for setting the address of the PROFIBUS DP interface
- ⑦ X3: PROFIBUS DP and 24 V DC supply
- ⑧ X2: for controlling up to 9 heating elements and one external fan
- ⑨ X1: Line voltage and protective earth PE
- ⑩ Lower fuse block: for fuses F111 (left) to F119 (right) along the incoming lines for heating elements 1 to 9.
- ⑪ Upper fuse block: for fuses F101 (left) to F109 (right) along the outgoing lines for heating elements 1 to 9.
- ⑫ Fuse F110 for connecting the external fan

3.4 System configuration

System components

The SIPLUS HCS3200 heating control system is a distributed I/O device. It communicates via the PROFIBUS DP fieldbus with the SIMATIC S7 controller.

A complete system includes the following components:

- HCS3200 heating controller
- Higher-level control through SIMATIC S7 automation system with integrated interface for PROFIBUS DP or SIMOTION
- PROFIBUS DP
- Cabling
- Heat emitter array
- HMI panel (optional)

System configuration

The following diagram shows an example of the interaction between the system components described:

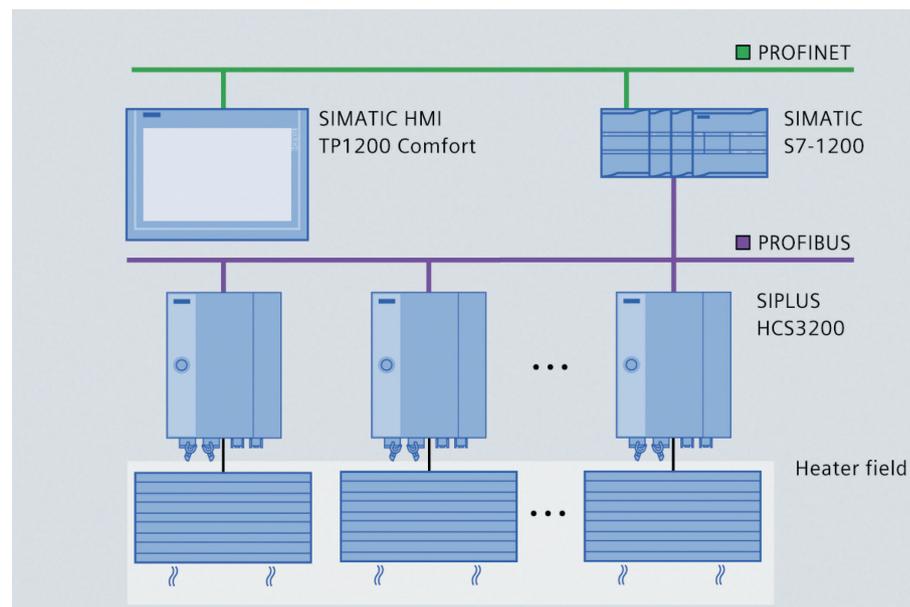


Figure 3-1 Example: System configuration

3.4 System configuration

Application planning

4.1 Shipping

NOTICE
Securing the device during transportation
Transport the device only in the original packaging which will give it the necessary protection against shock and impact.

4.2 Unpacking and checking the delivery

Unpacking the device

1. Unpack the device and the supplied components.
2. Check the shipment for completeness.
3. Make a visual check of the device and the components for transport damage.

Keep the packaging material in case you have to return the device.

Scope of delivery

- HCS3200 device
- Mounting hardware
- Compact Operating Instructions

4.3 Requirements regarding the mounting location

Environmental requirements

SIPLUS HCS3200 must only be installed indoors. The main environmental requirements are described below:

mounting position		vertical
Ambient temperature		
• during operating	°C	0 ... 50
Installation altitude at a height over sea level maximum	m	2000
Vibration resistance during operating phase to IEC 60068-2-6		10 ... 58 Hz / 0.15 mm, 58 ... 150 Hz / 1g
Resistance against shock according to IEC 60068-2-27		15g / 11 ms / 3 shocks / axis
Relative humidity at 25 °C during operating maximum	%	95
Relative humidity at 50 °C during operating maximum	%	50
• note		linear decreasing to 50 %

Incoming supply

<p> WARNING</p> <p>Electric shock hazard May cause death or serious injury</p> <ul style="list-style-type: none"> • The line voltage to which the device is connected must have a circuit breaker. • The circuit breaker must be easily accessible and uniquely assigned to the device. • It is recommended that the external circuit breaker is located close to the device. • The maximum current consumption for the device must be taken into consideration when selecting the circuit breaker.

External lightning protector

NOTICE

An external lightning protector must be connected in the 24 V DC supply line:
Dehn, "Blitzductor BVT" type AD24, No. 918402 (or equivalent).

If other lightning protectors are used, you must ensure that the types are equivalent (check with the manufacturer of the lightning protector).

The lightning protector must be installed and used in accordance with the instructions of the manufacturer.

With a lightning protector, the following interference immunity is achieved:

1.0 kV symm. with $R_i = 2 \Omega$; evaluation criterion B

2.0 kV unsymmetrical with $R_i = 12 \Omega$; evaluation criterion B

Without a lightning protector, the following interference immunity is achieved:

0.5 kV symm. with $R_i = 2 \Omega$; evaluation criterion B

0.5 kV unsymmetrical with $R_i = 12 \Omega$; evaluation criterion B

Mounting

5.1 Preparations

The HCS3200 device can be mounted either on a wall or in a steel frame.

NOTICE

The temperature of the cooling fins can reach 80 °C

When mounting the device on a wall, ensure that the wall is designed to withstand temperatures up to around 80 °C.

Minimum clearances

Maintain the following minimum clearances from other devices:

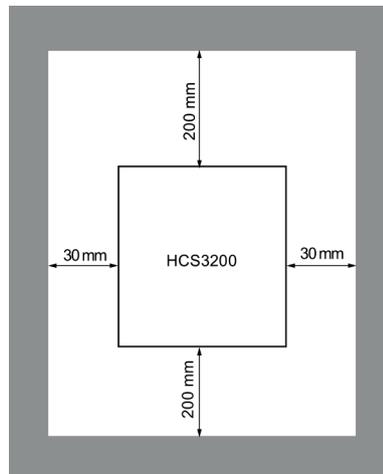


Figure 5-1 Clearances for mounting an HCS3200

Note

- Natural convection must be possible above and below the device. A clearance of 200 mm must be observed.
- When two heating controllers are mounted one above the other, you must ensure that the heat emitted from the lower device is routed past the upper device.

Remove surface protection

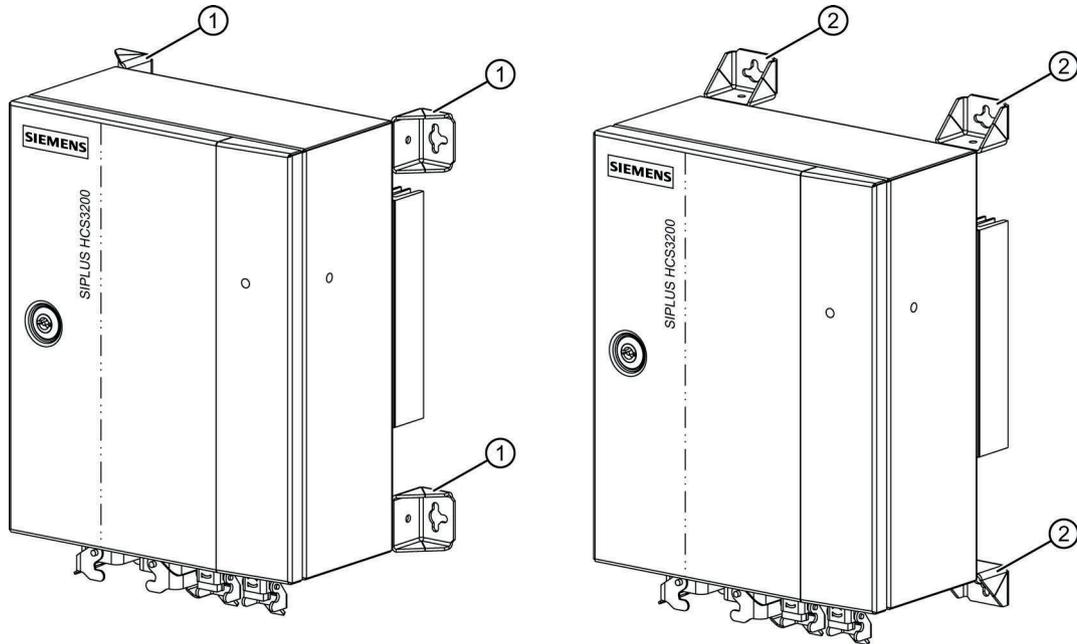
Remove the surface protection on the front and rear of the device before installation.

5.2 Mounting the device

Position of the mounting brackets

The figure below shows two variations for attaching the mounting brackets which hold the device in place.

You can attach the 4 mounting brackets to the 4 corners of the device horizontally, vertically or in a combination thereof, as required.



- ① Mounting bracket, horizontal mounting on the device
- ② Mounting bracket, vertical mounting on the device

Figure 5-2 Position of the mounting brackets

Fixing the mounting brackets

Screw the 4 mounting brackets in the required positions (vertical or horizontal) on the corners of the device.

Mounting/installing the device

- When attaching to a wall: Make sure that the wall can support the total weight of the device.
- Permitted mounting position: The device may only be operated in the vertical position.

The exact positions of the fixing points and drill holes are shown in the dimension drawing (see section Dimension drawings (Page 65)).

5.3 Final work

The cage clamps of the fuse holder may have loosened during transport. We recommend that you tighten the cage clamps before commissioning with a torque of 2.1 Nm.

Connection

6.1 Preparations

Safety instruction

 WARNING
Hazardous voltages from the mains power input or heating element feeder cables May cause death, serious injury or damage to property
Dangerous voltages may be present on incoming lines from the supply and to heating elements. Before work starts on connecting the HCS3200 heating controller, the incoming supply and heating element lines must be disconnected and secured against being switched on again.

Connection requirements

- The device is installed.
- The incoming supply is disconnected at the mounting location of the device and secured against being switched on again.
- The mains power input is secured by an easily accessible circuit breaker. It is recommended that the external circuit breaker is located close to the device.
- The cables to be connected are not live.

6.2 Block diagram

Block diagram

The figure below shows the main connections between the HCS3200 heating controller and the main supply and heating elements. The power outputs are internally secured by two fuses per power output.

It is essential to connect an external circuit breaker. An external fan can be connected to connector X2.

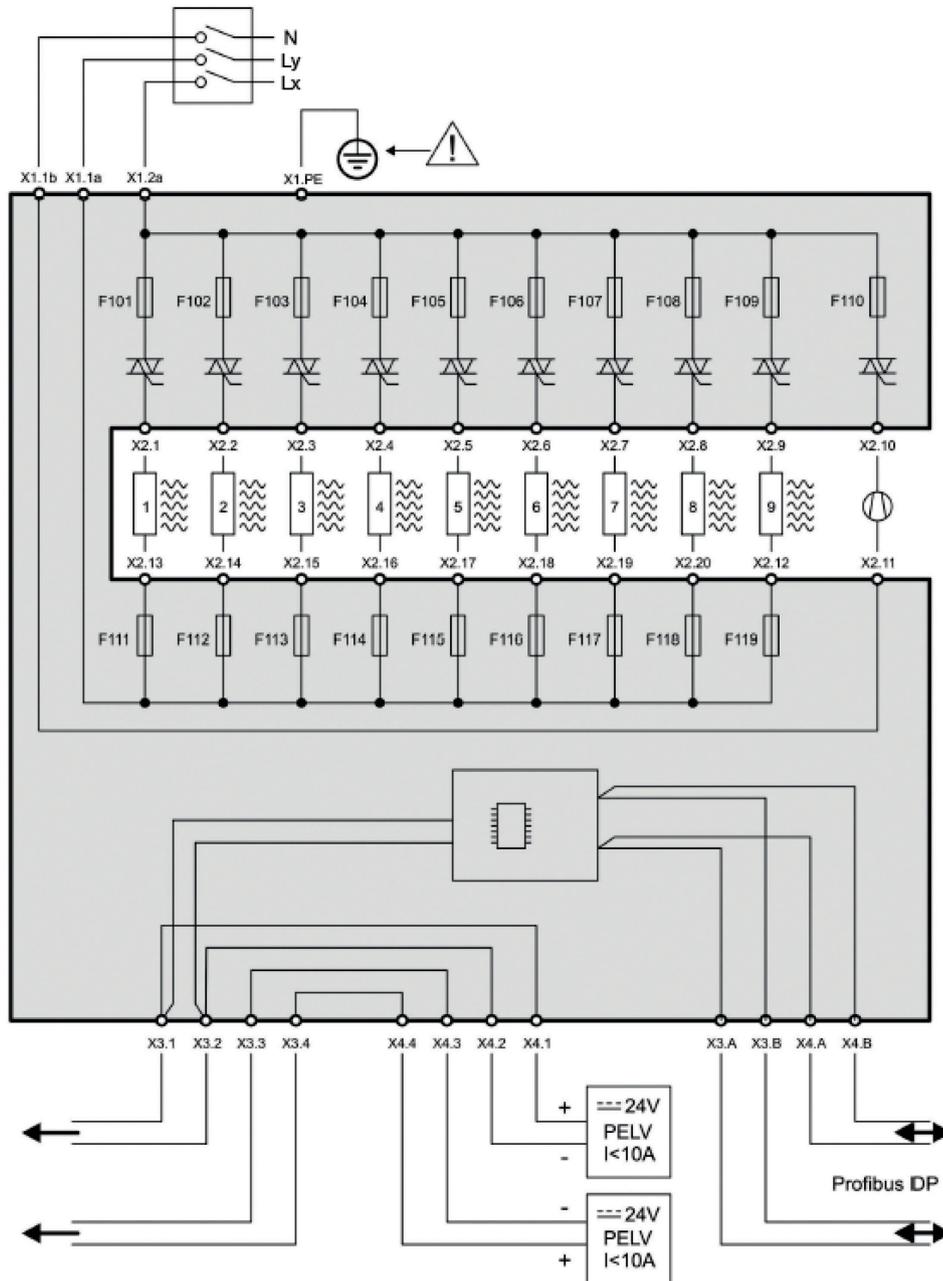
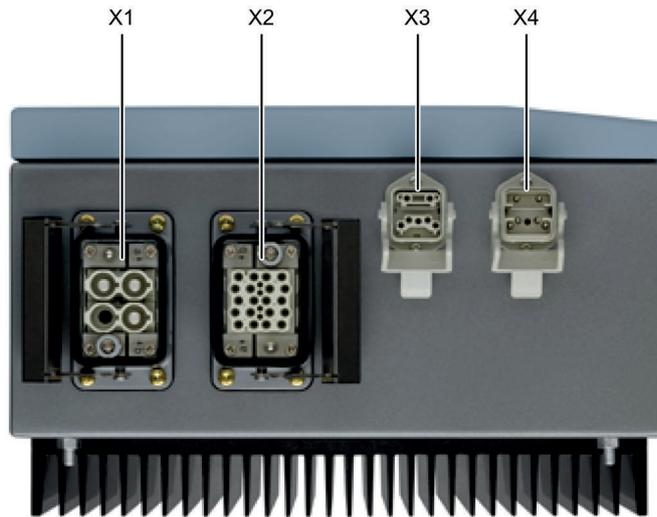


Figure 6-1 Block diagram of HCS3200

6.3 Connection element locations

Connection element locations

The position of the connection elements of the HCS3200 heating controller on the underside of the device is shown in the figure below.



- X1 Mains connection
- X2 Heating elements / fan connector
- X3 PROFIBUS DP / 24 V DC supply voltage
- X4 PROFIBUS DP / 24 V DC supply voltage

Figure 6-2 Connector element locations - Underside of device

6.4 X1 (mains connection / grounding)

Socket X1 is used to connect the mains supply.
The incoming supply line must be secured by an easily accessible external circuit breaker that can be uniquely assigned to a device.

X1 pin assignment

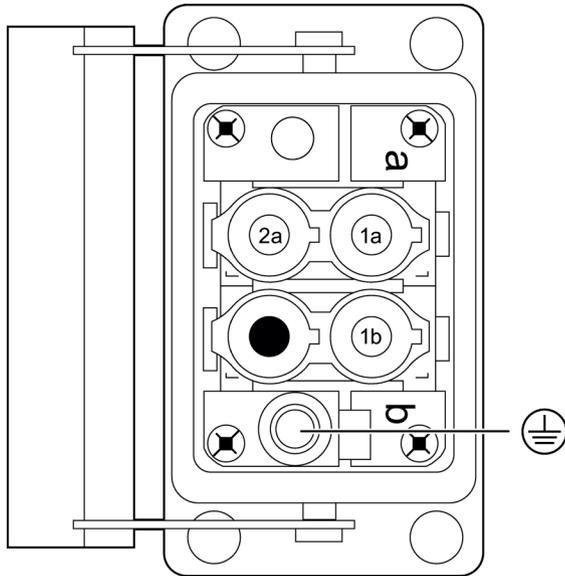


Figure 6-3 X1 pin assignment

Pin	Assignment
1a	Connection of phase Lx
2a	Connection of phase Ly
1b	Connection of N conductor
2b	n. c.
Enclosure	PE

Note

Ensure that the phase sequence Lx to Ly is clockwise (phase Lx is 120° ahead of Ly).
Otherwise fault diagnosis will not function correctly for the external fan.

Recommended connectors

2x Harting 70A crimp module	Article number: 09 14 002 3141
1x articulated frame, size 6B	Article number: 09 14 006 0303
1x enclosure, size 6B	Must be selected according to the mounting situation
1x cable gland	Must be selected according to the connecting cable used. IP65 degree of protection must be maintained here.
1x PE expansion	Article number: 09 14 000 9912
3x crimp contact	Article number: 09 11 000 6233

You can obtain detailed information regarding the electrical and mechanical properties of the connection plug from the manufacturer (www.harting.com).

<p> WARNING</p> <p>Protective conductor connection - Electric shock hazard May cause death or serious injury</p> <p>This connector is used for protective conductor connection for the device. The protective conductor must be connected to the connector according to the instructions of the manufacturer.</p>

6.5 X2 (heating element connection / fan connection)

Heating element connection

You can connect up to 9 heating elements/loads at connection socket X2.

NOTICE

The connected loads (heat emitters and fan) must not exceed the total power output of the device of 25200 W.

External fan

Pins 10 and 11 of connection socket X2 are provided for connection of an external 230 V AC fan.

X2 pin assignment

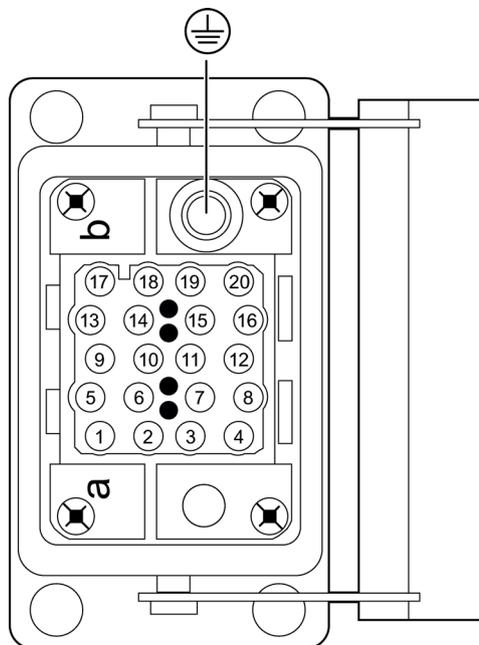


Figure 6-4 X2 pin assignment

Table 6- 1 20-pin connection for controlling 9 heating elements and 1 fan

Pin	Assignment	Pin	Assignment
1	Power output 1 outgoing	11	External fan (N) incoming
2	Power output 2 outgoing	12	Power output 9 incoming
3	Power output 3 outgoing	13	Power output 1 incoming
4	Power output 4 outgoing	14	Power output 2 incoming
5	Power output 5 outgoing	15	Power output 3 incoming
6	Power output 6 outgoing	16	Power output 4 incoming
7	Power output 7 outgoing	17	Power output 5 incoming
8	Power output 8 outgoing	18	Power output 6 incoming
9	Power output 9 outgoing	19	Power output 7 incoming
10	External fan outgoing (Lx)	20	Power output 8 incoming
Enclosure	PE		

Recommended plug

Harting Han EEE module	Article number: 09 14 020 3001
1x articulated frame, size 6B	Article number: 09 14 006 0303
1x enclosure, size 6B	Must be selected according to the mounting situation
1x cable gland	Must be selected according to the connecting cable used. IP65 degree of protection must be maintained here.
20x crimp contact	Article number: 09 33 000 6102

You can obtain detailed information regarding the electrical and mechanical properties of the connection plug from the manufacturer (www.harting.com).

Insulation of the connecting cables

<p> WARNING</p> <p>Electric shock hazard / Risk of fire May cause death or serious injury</p> <p>Voltages with respect to ground of 230 V AC can be present on X2. The connecting cables must be double-insulated or have reinforced insulation.</p>
--

6.6 X3/X4 (PROFIBUS DP / 24 V DC)

PROFIBUS DP

To enable communication between SIMATIC S7 / SIMOTION and the heating controller, connect PROFIBUS DP to the CPU module through plug connection X3 / X4.

A bus terminating resistor is required for terminating the bus.

If the bus connector is located at the start or the end of a bus segment, the terminating resistor must be connected. The bus terminating resistors are already integrated into the Siemens bus terminators (6GK1 905-0DA10).

Make sure that stations with an activated terminating resistor are always supplied with power during startup and operation.

Unused connectors must be fitted with a cover in the plant.

24 V DC power supply

The 24 V infeed is supplied via pins 1/2 or 3/4 of the PROFIBUS connector. The user must ensure that the maximum current-carrying capacity of the connector of 10 A is not exceeded.

Pin assignment X3 / X4

Connection sockets X3 and X4 have the same pin assignment. Both connections are internally linked 1:1. The signals can be transmitted further using daisy chaining.

Table 6-2 6-pin connection for 24 V DC and PROFIBUS DP

Pin	Assignment
1	Supply voltage 1: 24 V DC, for heating controller
2	Reference potential 1, for heating controller
3	Reference potential 2
4	Supply voltage 2: 24 V DC
Q	PROFIBUS DP, A signal
B	PROFIBUS DP, B signal

Recommended connection material

Plug X3:	Harting: Han-Brid Cu, article number: 61 83 521 4011
	Siemens: article number 6GK1905-0CA00 (straight outlet) or 6GK1905-0CC00 (angled outlet)
Plug X4:	Harting: Han-Brid Cu, article number: 61 83 521 4012
	Siemens: article number 6GK1905-0CB00 (straight outlet) or 6GK1905-0CD00 (angled outlet)
Bus terminator	Siemens 6GK1 905-0DA10 or compatible

You can obtain detailed information regarding the electrical and mechanical properties of the connection plug from the manufacturer of the plug.

6.7 RS232 interface

The RS-232 interface is only used for firmware updates and is not accessible during operation.

The RS-232 interface is connected via a 9-pin sub D connector that is located on the CPU module which can only be accessed by opening the enclosure cover.

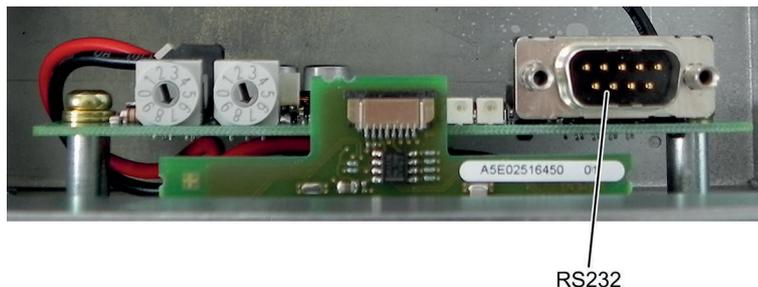


Figure 6-5 Location of the RS-232 interface

Pin assignment

The table below shows the terminal assignments for the 9-pin sub D male connector in the front panel of the CPU module.

X 5, 9-pin sub D	Pin	Designation
	1	Not assigned
	2	Receive data, RxD
	3	Transmit data, TxD
	4	Not assigned
	5	Signal ground, GND
	6	Not assigned
	7	Not assigned
	8	Not assigned
	9	Not assigned

Connecting cables

Null modem cables of various lengths are generally available for connecting a PC which also has a 9-pin sub D male connector.

Please note that you must only use shielded connector casings and cables. A large surface area of both sides of the cable shield must be in contact with the connector casing.

Commissioning

7.1 Requirements

7.1.1 Hardware requirements

Requirements for commissioning

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

The following is necessary:

- SIMATIC S7 CPU / SIMOTION with PROFIBUS DP interface
- PROFIBUS DP
- SIPLUS HCS3200 heating controller

7.1.2 Integrating the GSD file

You will need the language-specific GSD file "SIEM81A4.GSx" for PROFIBUS configuration. For this purpose, the GSD file must be installed in the configuration software.

You can download the GSD file from the Siemens Service&Support website (<http://www.siemens.com/automation/service&support>).

Procedure

If this GSD file is not yet available in your configuration software version, integrate the GSD file in STEP 7 V5.x or in STEP 7 V11 and higher (TIA Portal) in accordance with the online help for STEP 7.

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

Quantity structure of the *DP slave*

- 10 bytes output data
- 3 words input data
- 21 bytes of diagnostic data
- Baud rates up to 12 Mbaud
- Supported standard: PROFIBUS DP

7.1.3 Configuring the device-specific parameters

Setting the device-specific parameters

Three parameters are described in the GSD file that require setting. Configuration is performed in STEP 7 using HW Config by selecting the object properties for slot 0.

Parameter name	Value	Note
Response to CPU/master STOP	Switch substitute value	If bus communication is interrupted, a substitute value is switched in (see next parameter) Default setting
	Keep last value	If bus communication is interrupted, the last value is retained
Substitute value for fan	0	Fan is switched off Default setting
	1	Fan is switched on

7.1.4 Setting the bus address

To enable communication between SIMATIC S7-300/SIMOTION and the heating controller via the PROFIBUS DP fieldbus, set the bus address on the CPU module.

Settable bus addresses

You can set a bus address between 0 and 99 on the heating controller.

Tools required

Slotted screwdriver, size 0.4 x 2.5 mm (blade width x blade length)

Procedure

⚠ WARNING
Electric shock hazard
May cause death or serious injury
Before opening the enclosure door, you must disconnect the line voltage and secure it against switching on again.

Set the bus address using the rotary switches.

Location of the rotary switch for setting the bus address	
	
①	Tens digit of PROFIBUS DP address
②	Ones digit of PROFIBUS DP address

7.2 Commissioning

7.2.1 Commissioning steps

Requirements

- The device has been installed and connected by a qualified person.
- The line voltage is switched off and secured against reactivation.
- The PROFIBUS DP bus address is set correctly (see section Setting the bus address (Page 37))
- The DP master is configured and in operation.

Procedure

1. Switch the 24 V DC power supply on again.
2. The device starts up. Check the LED status for the operating state.

Error-free power-up: Green LED is on, red LED is off

This LED display means: System is active; PROFIBUS communication is taking place

1. Close the enclosure door.
2. Switch on the line voltage. The device is in operation.

Note

When power up is not completed without errors, the current operating state or error is indicated by the appropriate LED display (see section Status and fault display with LEDs (Page 49)).

Functions

8.1 Power output control

Power output control

Zero-point switching solid state relays are used for controlling the heating elements. Nine individually-controllable power outputs are implemented.

They are controlled in half-waves: For each half-wave, the controller supplies On/Off information to the relay and this switches as specified at the next zero point.

The setpoints for controlling the power outputs lie within a value range of 0 % to 99 % (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.

8.2 Power output diagnostics

Power output diagnostics

The device features a diagnostics function for detecting 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:

- Heating element fault
- Breakdown of a solid state relay (SSR)
- Incoming fuse has tripped
- Outgoing fuse ruptured or SSR has high resistance

Requirements for diagnostics

The "SSR breakdown" fault is always indicated (provided the mains voltage is connected), regardless of heating status; all other faults are only indicated when heating is enabled (heating is "ON").

Diagnostic functions

The faults that can be detected are listed in the table below complete with their error codes:

Fault	Error code	Description / Special characteristics
Heating element fault	1	-
SSR breakdown	2	"Breakdown" means the SSR (solid state relay) is defective and conducts continuously even without being activated.
Incoming fuse has tripped	3	-
Outgoing fuse ruptured or SSR has high resistance	4	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.

You will find information about the causes of faults and possible rectification measures in the Fault reporting through diagnostics data (Page 50) section.

8.3 Line supply voltage monitoring

Line supply voltage monitoring

The heating controller is designed for operation in a TN system with 400 V AC. The maximum permissible variation is $\pm 10\%$. The supply voltage is measured with a tolerance of $\pm 0.5\%$ and the measured value is checked against the valid working range. The actual voltage measurement is reported to the user (see section Cyclic input data (Page 45)).

If the voltage lies outside the permissible range, a warning will be generated (see section Diagnostics data (Page 47)) and heater operation continues. It is the responsibility of the user to respond.

Note

Due to the measuring principle, the voltage measuring range lies between 320 V and 480 V.

- Voltages below this are indicated as 0 V.
- Voltages above this are indicated as the full-scale value.

The full-scale value can vary between devices by a tolerance of 1 %.

If the voltage lies outside the measuring range, an error message will be generated (see section Diagnostics data (Page 47)) and heater operation stops. Heating can only be switched on again when the voltage has returned to the measuring range.

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

8.4 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 normal values.

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 normal voltage value is permanently set as 400 V. The setpoint that can result from the calculation lies between 0 % and 99 %.

The accuracy of the calculation is determined by the accuracy of the measured value acquisition and the fine tuning of the control that results from the half-wave controller. This can be up to 2 %.

8.5 Frequency monitoring

Frequency monitoring

The frequency of the applied line voltage is continuously monitored. If the frequency lies between the permissible limits, it is evaluated as valid and reported to the user (see section Diagnostics data). A distinction is made between the following frequencies in the message:

Frequency	Valid range
50 Hz	47 Hz to 55 Hz
60 Hz	55 Hz to 63 Hz

Frequency fault

If the frequency lies outside the permissible range for several consecutive measurements (e.g. due to disturbance over an extended period), a frequency fault will be reported to the user (see section Diagnostics data (Page 47)). The heating is not switched off and the previous frequency value measured is retained.

8.6 Temperature monitoring

Internal temperature monitoring

A sensor is installed inside the heating controller to measure the internal temperature.

When a temperature threshold that is permanently set in the hardware is overshoot, all outputs (power outputs and external fan) are automatically switched off to prevent damage to the device. The outputs can only be controlled again when the temperature has returned to the valid range.

The following data or states are reported to the user:

- Current temperature measured value (see section Cyclic input data (Page 45))
- Disconnection due to excessively high temperature (see section Diagnostics data (Page 47))

Heat distribution by means of internal fan

To achieve even heat distribution within the enclosure, an internal fan is used. The fan is controlled depending on the internal temperature and is also monitored. If the fan is not functioning correctly, a fault is reported to the user (see section Diagnostics data (Page 47)). The fault does not cause the heating to be switched off.

8.7 Control of external fan

External fan

The heating controller supports the operation of an external 230 V AC fan.

The external fan can be switched on and off via a bit in the process image output (see section Cyclic output data (Page 46)).

The function of the fan is not linked to the function of the heating controller.

The fan output has a fuse to protect the cable and the semiconductor switch. When the fan is operating, diagnostics are run for the purpose of detecting the following faults:

- Fuse tripped
- SSR has high resistance

If additional monitoring of the fan is required, this must be separately implemented on the line side.

NOTICE
The fan output does not provide any protection for the fan motor.
If motor protection is required for the fan, it must be implemented by the user.

Communication

9.1 Cyclic data transfer

Communication between the DP master and heating controller is performed exclusively via cyclic data.

You can access the cyclic data in the PLC software via the inputs (message data) and the outputs (control data).

9.2 Cyclic input data

The cyclic input data can be addressed in the S7 through the process image or I/O commands.

Process image inputs (PII)

The process image for the inputs PII contains the status information for the individual modules. All addresses are specified as an offset relative to the base address 0.0. The actual addresses are obtained from the configuration of the overall system.

Table 9- 1 Addressing of inputs

Byte	Bit	Meaning	Description
0	0	= 0: Heating switched off = 1: Heating switched on	Refer to section Power output control (Page 39)
	1	= 0: Line voltage compensation is not active = 1: Line voltage compensation is active	Refer to section Line voltage compensation (Page 42)
	2	= 0: External fan Off = 1: External fan On	Refer to section Control of external fan (Page 43)
	3 ... 7	0 (reserved)	
1		0 (reserved)	
2		Temperature measurement in °C	Refer to section Temperature monitoring (Page 43)
3		Factor for line voltage compensation in %	Refer to section Line voltage compensation (Page 42)
4		Voltage measured value Lxy	Refer to section Line supply voltage monitoring (Page 41)
5			

9.3 Cyclic output data

The cyclic output data can be addressed in the S7 through the process image or I/O commands.

Process image output (PIQ)

The process image for the outputs PIQ contains the control data for the individual modules. All addresses are specified as an offset relative to the base address 0.0. The actual addresses are obtained from the configuration of the overall system.

Table 9- 2 Addressing of outputs

Byte	Bit	Meaning	Description
0	0	= 0: Heating Off = 1: Heating On	Refer to section Power output control (Page 39)
	1	= 0: Line voltage compensation Off = 1: Line voltage compensation On	
	2	= 0: External fan Off = 1: External fan On	
	3 ... 7	0 (reserved)	
1		Power output 1 setpoint	Refer to section Power output control (Page 39)
2		Power output 2 setpoint	
3		Power output 3 setpoint	
4		Power output 4 setpoint	
5		Power output 5 setpoint	
6		Power output 6 setpoint	
7		Power output 7 setpoint	
8		Power output 8 setpoint	
9		Power output 9 setpoint	

9.4 Diagnostics data

if new diagnostic data is available, this causes an OB82 call (diagnostic alarm OB). The data can be read using system function SFC13 (DPNRM_DG).

Table 9- 3 Diagnostics data

Byte	Bit	Meaning	Description
0 ... 5		Standardized diagnostic information	-
6 ... 9		Reserved	-
10	0	= 0: Temperature OK = 1: Temperature trip threshold reached	Refer to section Temperature monitoring (Page 43)
	1	= 0: Internal fan OK = 1: Internal fan fault	Refer to section Temperature monitoring (Page 43)
	2	= 0: Frequency OK = 1: Frequency fault	Refer to section Frequency monitoring (Page 42)
	3	= 0: Line voltage OK = 1: Line voltage outside the working range	Refer to section Line supply voltage monitoring (Page 41)
	4	= 0: Line voltage OK = 1: Line voltage outside the measuring range	
	5	= 0: External fan OK = 1: External fan fault (fuse/SSR high resistance)	Refer to section Control of external fan (Page 43)
	6 ... 7	0 (reserved)	-
11		Frequency 50 / 60 / 0 (not recognized)	Refer to section Frequency monitoring (Page 42)
12		Error information for power output 1 (error code 1 ... 4)	Refer to section Power output diagnostics (Page 40)
13		Error information for power output 2 (error code 1 ... 4)	
14		Error information for power output 3 (error code 1 ... 4)	
15		Error information for power output 4 (error code 1 ... 4)	
16		Error information for power output 5 (error code 1 ... 4)	
17		Error information for power output 6 (error code 1 ... 4)	
18		Error information for power output 7 (error code 1 ... 4)	
19		Error information for power output 8 (error code 1 ... 4)	
20		Error information for power output 9 (error code 1 ... 4)	

In the case of the following messages, the diagnosis is "Fault", i.e. a fault exists that must be rectified:

- Temperature trip threshold reached
- Line voltage outside the measuring range
- All power output faults (error code 1 ... 4)

All other signals are transmitted as status signals.

Error handling

10.1 Status and fault display with LEDs

Two LEDs are used to display operating states and for localizing faults. The LEDs are inside the device and are only visible if the enclosure door of the HCS3200 heating controller is open.

 WARNING
Electric shock hazard
May cause death or serious injury
The line voltage has to be disconnected and secured against switching on again before opening the enclosure door.

Indication of operating states / faults

Green LED	Red LED	Meaning
On	On	System startup; this status is only active for a short period of time after connecting the supply voltage
Off	Off	System initialization
Off	On	System is active; PROFIBUS communication is not taking place Possible causes: <ul style="list-style-type: none"> • CPU has been stopped • No connection • Incorrect address
On	Off	System is active; PROFIBUS communication is active
On	On	During a firmware update: <ul style="list-style-type: none"> • Loading is active • No firmware loaded (e.g. when charging has been interrupted)
Flashes x times	On / Off	Internal fault; device is not ready for operation If the fault still occurs after the 24 V power supply has been switched off and on again, the device is defective and must be replaced.

10.2 Fault reporting through diagnostics data

The device-internal monitoring functions recognize specific faults in the HCS3200 heating controller. The corresponding information is provided in the diagnostics data.

Causes of error and possible remedies

Power output fault	Possible causes / Corrective action
Heating element defective (error code 1)	Corrective action: Switch off machine, check cabling/heating element and rectify fault, restart
SSR breakdown (error code 2)	Solid state relay (SSR) is defective ⇒ Return device.
Incoming fuse tripped (error code 3)	Corrective action: Switch off machine, check fuse/cabling/heating element and rectify fault, restart
Outgoing fuse tripped or SSR has high resistance (error code 4)	Corrective action: Switch off machine, check fuse/cabling/heating element and rectify fault, restart Solid state relay (SSR) is defective => Return device

Overtemperature	Possible causes / corrective action
Temperature in enclosure > nn °C	<p>If an excessively high temperature occurs in the enclosure, this means the power output module is operating outside the performance profile.</p> <p>At an excessively high temperature: The heating is switched off automatically by the device.</p> <p>Corrective action:</p> <ul style="list-style-type: none"> • Check the status of the internal fan in the diagnostics data • Switch off the machine, rectify the fault (e.g. cooling malfunction), restart

Internal fan	Possible causes / corrective action
Fan defective	Check temperature if fault is reported. Corrective action: Replace fans promptly.

External fan	Possible causes / Corrective action
Fuse tripped or SSR has high resistance	<p>Corrective action:</p> <p>Switch off machine, check fuse/cabling and rectify fault, restart</p> <p>Solid state relay (SSR) is defective ⇒ Return device</p>

Service and maintenance

11.1 Maintenance work

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

Maintenance work	
Heat sink	Check regularly that the cooling ducts on the rear of the device are free from coarse soiling. If dirt is visible, clean the cooling channels with a vacuum cleaner.
Internal fan	Check regularly that the internal fan is functional. Remove dust deposits with a cleaning brush and vacuum cleaner.

11.2 Firmware update

Delivery condition

The current firmware version is already loaded on the module when the HCS3200 is shipped.

In the event of a fault or if an update is necessary, you can load the firmware by means of the "HCSSetup.exe" program. You can download the "HCSSetup.exe" program from the Siemens Service&Support (<http://www.siemens.com/automation/service&support>) website.

Note

The HCS3200 is delivered as standard with the current firmware version and is ready to switch on.

The steps described below only have to be performed if the HCS3200 is to be updated with a different firmware version.

Prerequisite for loading the firmware

You need a null modem cable (9-pin) for loading the firmware. If you do not have such a cable, a cable with the following pin assignment is sufficient:

RxD 2-----3 TxD

TxD 3-----2 RxD

Gnd 5-----5 Gnd

Note

If you use a 25-pin connector, Pin 7 is to be used for Gnd instead of Pin 5!

 WARNING
Electric shock hazard
May cause death or serious injury
Before opening the enclosure door, you must disconnect the line voltage and secure it against switching on again.

To install the firmware, proceed as follows:

1. Switch off the line voltage and secure against switching on again
2. Switch off the 24 V DC power supply of the HCS3200
3. Open the enclosure door
4. Connect the RS232 serial interface of the HCS3200 via a "null modem" cable to COM1 or COM2 on the PC.
5. Call "HCSSetup.exe" and enter the interface which is used on the PC (COM1 or COM2).
6. Switch on the 24 V DC supply for the HCS3200.
7. All the remaining steps are carried out automatically. You can follow the progress of the loading process on the PC.
The green and red LEDs of the HCS are continuously lit during the loading process; the green LED also flashes rapidly for short periods.
8. Disconnect the connecting cable from the PC
9. Close the enclosure door
10. Switch on the supply voltage again
11. Restart the HCS3200 by switching the supply voltage off and on again.

Note

If the voltage supply or the serial connection is interrupted before the end of loading, you can repeat the process.

11.3 Fuse replacement

Safety guidelines

 WARNING
Voltage hazards May cause death or serious injury <ul style="list-style-type: none">• Before changing a fuse, you must isolate the load circuit from the supply.• 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 68)). If you operate the device with unapproved fuses, the device could be destroyed.

Location of the fuses

The figure below shows the position of the fuses in the enclosure of the heating control system.

- Upper fuse block: for fuses F101 to F109 on the outgoing lines of heating elements 1 to 9; for fuse F110 for connection of the external fan
- Lower fuse block: for fuses F111 to F119 along the incoming lines for heating elements 1 to 9.

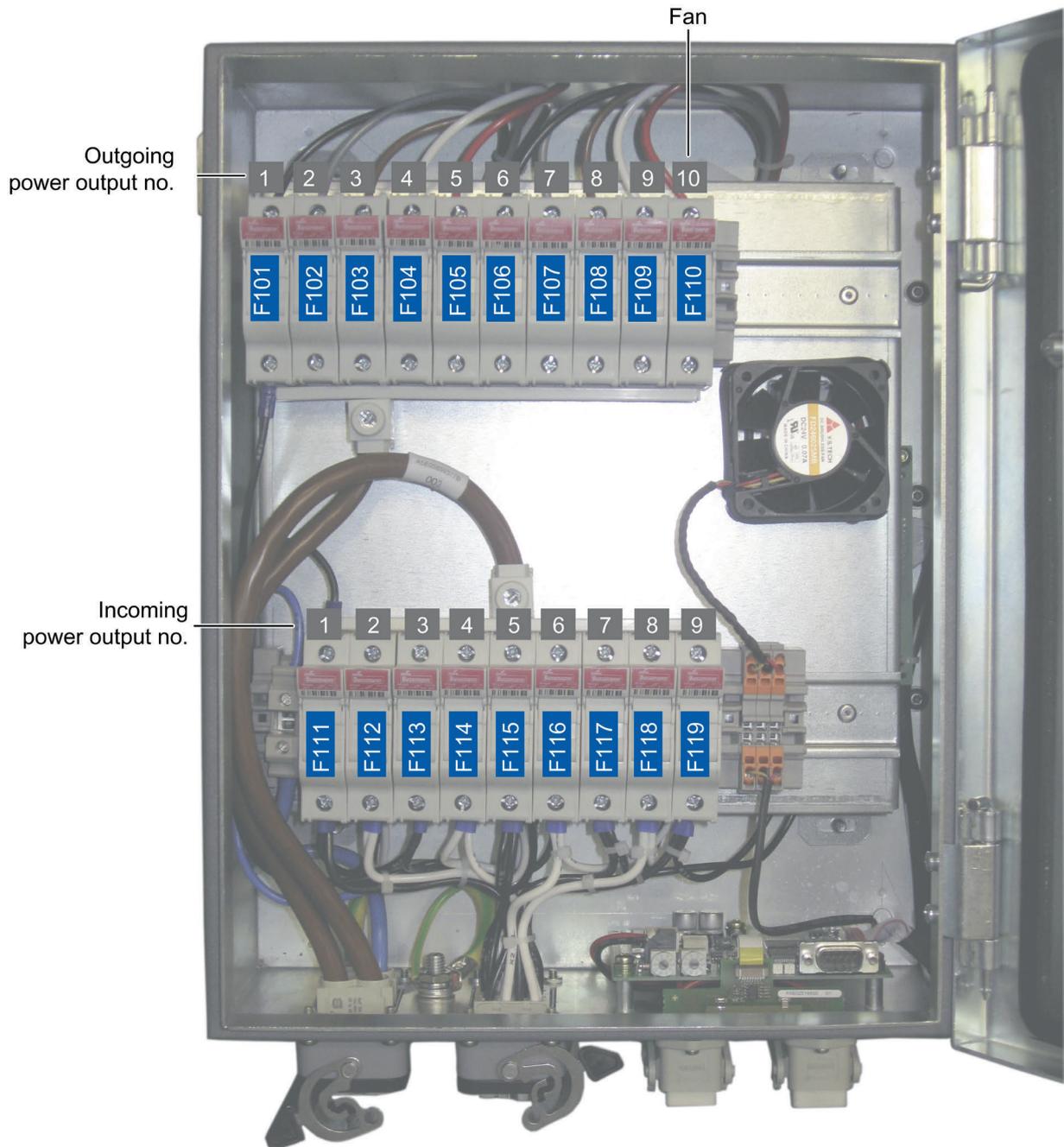


Figure 11-1 Location of the fuses

Checking/replacing fuses

Proceed as follows:

1. Switch off the line voltage and secure against switching on again
2. Open the enclosure door
3. Check for ruptured or defective fuses (refer to fault information in the section Diagnostics data (Page 47))
4. Replace defective fuses
5. Check corresponding heating elements
6. Close the enclosure door
7. Connect the line voltage
8. Reactivate the device

11.4 Fan replacement

 **WARNING**

Electric shock hazard

May cause death or serious injury

The line voltage has to be disconnected and secured against switching on again before opening the enclosure door.

NOTICE

You must install a fan of the same type in the device.

You will find a replacement fan in section Ordering data (Page 68).

Preparations

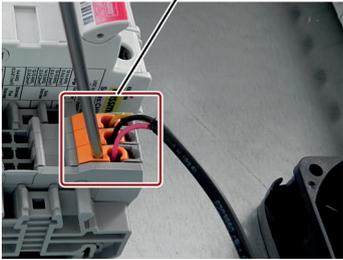
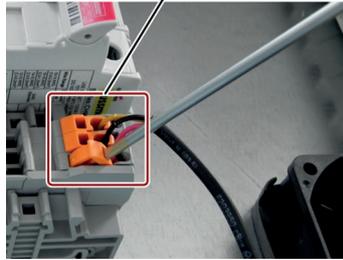
1. Switch off the line voltage and secure against switching on again
2. Switch off the 24 V DC power supply of the HCS3200
3. Open the enclosure door

Tool

You will need a 2.5 mm slot screwdriver.

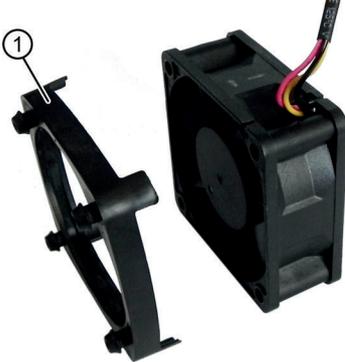
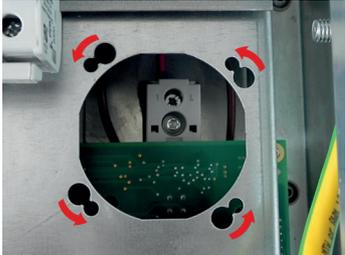
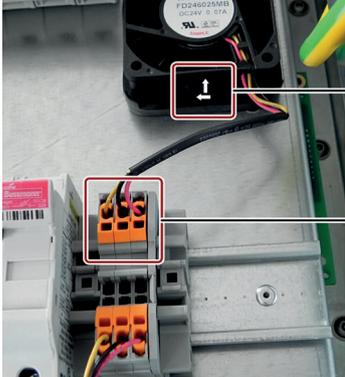
Removing the fan

Proceed as follows to remove the fan:

Steps	
1	Open the 3 plug-in terminals ① using a screwdriver as a lever and detach the fan leads.
 <p>Terminal closed</p>	 <p>Terminal open</p>
2	The internal fan of the HCS3200 is fixed without screws. Rotate the fan unit in the clockwise direction as far as the stop and then remove it.
 <p>Fan fixed in place</p>	 <p>Fan released</p>

Installing the new fan

Proceed as follows to install the new fan:

Steps		
1	<p>Remove the gaiter clamp ① from the previously installed fan and attach it to the new fan.</p>	 <p>Fan with gaiter clamp</p>
2	<ul style="list-style-type: none"> • Insert the mushroom-shaped feet of the fan unit into the larger fastening holes • Rotate fan unit counterclockwise into the smaller holes. 	 <p>Position of the mounting holes</p>
3	<p>The picture shows the correct fan mounting position. Note the direction of the arrow shown on the fan ①</p>	
4	<p>Insert the fan leads into the 3 insulation displacement terminals ②. Lock the leads in place using the screwdriver as a lever.</p> <p>Note: There is no need to strip the leads beforehand.</p>	 <p>Fan installed and connected</p>

11.5 Replacing the device

Decommissioning and dismantling the old device

Steps	
1	Switch off the mains power input at the external circuit breaker and ensure that no voltage is present.
2	Switch off the connected heating elements and ensure that no voltage is present.
3	Switch off the 24 V DC power supply.
4	Remove plugs X1 to X4 from the old device.
5	Remove the four screws used to fix the device in place, remove the device and place it on a suitable surface (see section Mounting the device (Page 22)).

Installing and connecting the new device

Installation steps	
1	Install the replacement device. (see section Mounting the device (Page 22))
2	Reconnect all plugs to the replacement device. (see section Connection element locations (Page 27))

Commissioning the new inverter

Steps for commissioning	
1	Set the correct bus address. (see section Setting the bus address (Page 37))
2	Connect the supply voltage to the device and to the heating element array.

11.6 Recycling and disposal

Note

Since the HCS heating controller components only contain low levels of harmful substances, they are suitable for recycling. Contact a certified electronic scrap disposal company in order to ensure the environmentally-friendly recycling and disposal of your used device.

Technical data

12.1 Technical specifications

General technical specifications

	6BK1 932-0BA00-0AA0
product designation	HCS3200 fan, IP65, 9 output channels, fan output
Type of control of heat emitters	Half-wave control
Type of load	Ohmic load
Verification of suitability	CE

Power circuit

Switching capacity current per phase maximum	A	63
Type of voltage of supply voltage		AC
Supply voltage for AC rated value	V	400
Relative symmetrical tolerance of the supply voltage	%	10
Supply voltage frequency		
• 1 rated value	Hz	50
• 2 rated value	Hz	60
Relative symmetrical tolerance of the supply voltage frequency	%	5

Power electronics

Number of outputs for heating power		9
Number of heat emitters per output maximum		1
Output voltage at output for heating power	V	400
Relative symmetrical tolerance of the output voltage	%	10
Output current at output for heating power rated value	A	10
Power carrying capacity for heating power		
• at 40 °C per output maximum	W	4000
• at 50 °C per output maximum	W	4000
• per output minimum	W	200
Design of short-circuit protection for heating power per output		Safety fuse 16 A
Design of the electrical isolation		Optocoupler between main circuit and PELV
Galvanic isolation between the outputs		No

Motor control functions

Number of outputs for fan		1
Output voltage at output for fan minimum	V	230
Power carrying capacity for fan		
• per output	W	60 ... 500
Design of short-circuit protection at output for fan		Safety fuse 4 A

Communication

Protocol is supported PROFIBUS DP protocol		Yes
Transfer rate for PROFIBUS DP maximum	Mbit/s	12

Display

Number of status displays		2
Type of display as status display by LED		LED green = status indicator, LED red = fault indicator

Supply voltage

type of voltage		DC
Supply voltage for electronics	V	24
Relative symmetrical tolerance of input voltage	%	20
Buffer time at 24 V with DC for power failure	ms	20
Recovery time after mains power cut typical	s	1
Current consumption without electronics maximum	A	0.25

Electrical connections

Design of the electrical connection	
<ul style="list-style-type: none"> at the input for main current circuit 	Connector, 5-pole
<ul style="list-style-type: none"> at output for heating and fan 	Connector, 20-pole
<ul style="list-style-type: none"> of the PROFIBUS interface 	ECOFAST
Type of the connectable conductor cross-sections	
<ul style="list-style-type: none"> of main circuit at input <ul style="list-style-type: none"> finely stranded with end sleeve for AWG cables for heating and fan finely stranded with end sleeve for AWG conductors stranded 	3x (6 ... 25 mm ²) and 1x PE (6 ... 16 mm ²) 3x (8 ... 4) 20x (1.5 ... 4 mm ²), 1x PE (1.5 ... 16 mm ²) 20x (18 ... 12), 1x PE (16 ... 6)

Monitoring functions

Type of the temperature monitoring	NTC thermistor
------------------------------------	----------------

Mechanical features

mounting position		vertical
Type of mounting		screw fixing
Nature of the ventilation		Self-ventilation
Resistance against shock according to IEC 60068-2-27		15g / 11 ms / 3 shocks / axis
Vibration resistance during storage in accordance with IEC 60068-2-6		5 ... 9 Hz / 3.5 mm, 9 ... 500 Hz / 1g
Protection class IP		IP65
Depth	mm	200
Height	mm	380
Width	mm	300

Electromagnetic compatibility

EMC emitted interference	Limit value class A in accordance with EN 61000-6-4:2007 + A1:2011 Group 1
Electrostatic discharge according to IEC 61000-4-2	4 kV contact discharge / 8 kV air discharge
Field-bound parasitic coupling according to IEC 61000-4-3	10 V/m (80 MHz ... 1000 MHz), 3 V/m (1,4 GHz ... 2.0 GHz), 1 V/m (2.0 GHz ... 2.7 GHz)
Conductor-bound parasitic coupling BURST according to IEC 61000-4-4	2 kV power supply lines / 1 kV signal lines
Conductor-bound parasitic coupling SURGE according to IEC 61000-4-5	On supply lines: 1 kV symmetrical, 2 kV asymmetrical, (24 V DC supply only with external protective measure) PROFIBUS cable asymmetrical 1 kV
Conducted interference as high-frequency radiation according to IEC 61000-4-6	10 V (0.15 ... 80 MHz)
Overvoltage class	Installation category III

Climatic environmental conditions

Ambient temperature		
<ul style="list-style-type: none"> during transport 	°C	-40 ... +70
<ul style="list-style-type: none"> during storage 	°C	-40 ... +70
<ul style="list-style-type: none"> during operating 	°C	0 ... 50
Installation altitude at a height over sea level maximum	m	2000
Air pressure		
<ul style="list-style-type: none"> during storage 	hPa	660 ... 1080
<ul style="list-style-type: none"> during operating phase 	hPa	860 ... 1080
Relative humidity at 25 °C during operating maximum	%	95
Relative humidity at 50 °C during operating maximum	%	50
<ul style="list-style-type: none"> note 		linear decreasing to 50 %

12.2 Dimension drawings

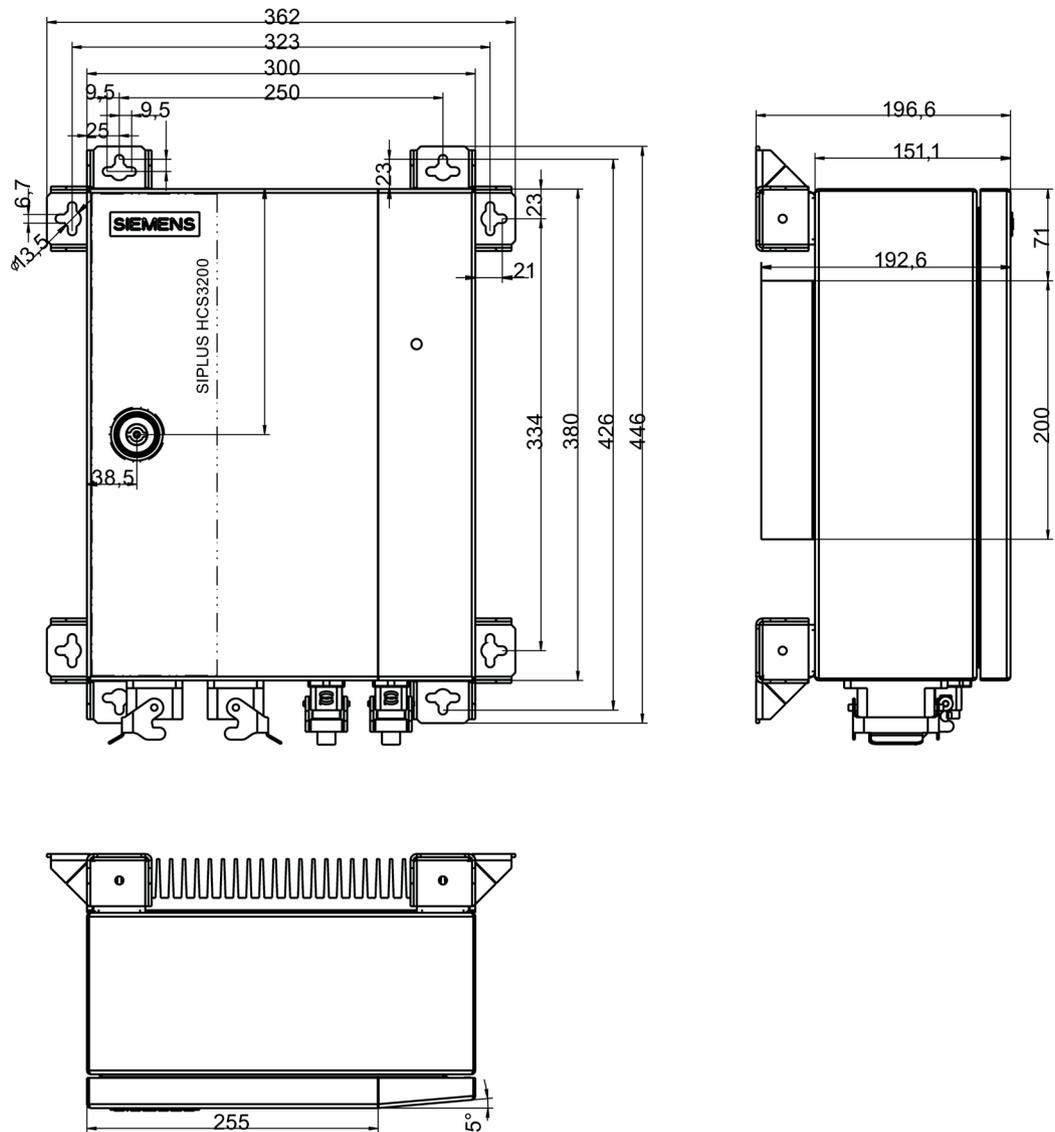


Figure 12-1 SIPLUS HCS3200 dimension drawing

Appendix

A.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.

EC directives

SIPLUS HCS3200 products conform to the requirements and safety objectives of the EC Directives listed below.

Low-voltage directive

SIPLUS HCS3200 products meet the requirement of the EC Directive: 2006/95/EC "Electrical Safety". The product is designed in accordance with EN 61010-1.

EMC directive (electromagnetic compatibility)

SIPLUS HCS3200 products meet the requirements of the EC Directive: 2004/108/EC "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

Note for the manufacturers of machines

This product is not a machine in the sense of the EC Machinery Directive. There is therefore no declaration of conformity relating to the EC Machinery Directive 89/392/EEC for this product.

Approvals

Certifications	Standard	Marking
CE	EN 61000-6-2 EN 61000-6-4 EN 61010-1	

A.2 Order numbers for spare parts/accessories

A.2.1 Ordering data

Ordering data	
Single part	Order number
HCS3200 device (IEC variant)	6BK1932-0BA00-0AA0
Spare fuse for heat emitter connection (F101-F109, F111-F119): Cylindrical fuse, operating class gG 10x38 16A	Manufacturer: Siemens, Order No.: 3NW6005-1
	Manufacturer: Cooper Bussmann (www.cooperindustries.com), Order No.: C10G16
Spare fuse for fan connection (F110), cylindrical fuse Class gG 10x38 4A	Manufacturer: Siemens, Order No.: 3NW6004-1
	Manufacturer: Cooper Bussmann (www.cooperindustries.com), Order No.: C10G4
Internal fan	6BK1932-6AA00-0AA0
Double-bit key for 3 mm lug	8GD9290
Wall bracket set (wall bracket and mounting material)	6BK1932-6BA00-0AA0

A.3 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.

Technical Support

You can contact Technical Support for SIPLUS HCS systems as follows:

- Phone: + 49 (0) 911 895 5900
- E-mail (<mailto:technical-assistance@siemens.com>)
- Internet: Online support request form: (<http://www.siemens.com/automation/support-request>)

Service & support for industrial automation and drive technologies

You can find various services on the Support homepage (<http://www.siemens.com/automation/service&support>) of IA/DT on the Internet.

There you will find the following information, for example:

- Our newsletter containing up-to-date information on your products.
- Relevant documentation for your application, which you can access via the search function in "Product Support".
- A forum for global information exchange by users and specialists.
- Your local contact for IA/DT on site.
- Information about on-site service, repairs, and spare parts. Much more can be found under "Our service offer".

Heater controller homepage

For general information about the Siemens AG heater controllers, visit Homepage (<http://www.automation.siemens.com/mcms/topics/en/siplus/industrial-heating-control/Pages/default.aspx>).

Online catalog and ordering system

The online catalog and the online ordering system can also be found on the Industry Mall Homepage (<http://www.siemens.com/industrymall>).

A.3.1 Application example

Application example

An example application for S7 and SIMOTION is available as a guide and basis for your own applications. This application example explains the mode of operation of the heater control.

You can download the application example from the Siemens Service&Support website.

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Technical Assistance
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Siemens AG
Industry Sector
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