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Equipment Manual

SIMATIC

MICRO-DRIVE Servo Drive System

PDC1000 Drive Controller

www.siemens.com/drives

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SIMATIC

MICRO-DRIVE
PDC1000 Drive Controller

Equipment Manual

12/2023
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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.

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> ⚠ **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.

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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.

Preface

Purpose of the documentation

This manual supplements the system manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/https://support.industry.siemens.com/cs/ww/en/view/109797859ww/en/view/109774126). The manual contains a compact description of the device-specific information. The system-related functions are described in the system manual. All system-spanning functions are described in the function manuals.

The information provided in this manual and the system manual enables you to commission the PDC1000 drive controller.

Conventions

The currents specified in this document with unit "A" correspond to the torque-generating current. Due to internal scaling, this value accurately corresponds to the peak value of the alternating change.

To distinguish, the effective value is marked with "A_{eff}".

STEP 7: In this documentation "STEP 7" is used as a synonym for all versions of the configuration and programming software "STEP 7 (TIA Portal)".

Please also observe notes marked as follows:

Note

A note contains important information on the product described in the documentation, on the handling of the product or on the section of the documentation to which particular attention should be paid.

Recycling and disposal

For environmentally friendly recycling and disposal of your old equipment, contact a certified electronic waste disposal company and dispose of the equipment according to the applicable regulations in your country.

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Siemens provides products and solutions with industrial cybersecurity 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 cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

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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.

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You can find current information on the following topics quickly and easily here:

- **Product support**
  All the information and extensive know-how on your product, technical specifications, FAQs, certificates, downloads, and manuals.

- **Application examples**
  Tools and examples to solve your automation tasks – as well as function blocks, performance information and videos.

- **Services**
  Information about Industry Services, Field Services, Technical Support, spare parts and training offers.

- **Forums**
  For answers and solutions concerning automation technology.

- **mySupport**
  Your personal working area in Industry Online Support for messages, support queries, and configurable documents.

This information is provided by the Siemens Industry Online Support in the Internet (https://support.industry.siemens.com).

SiePortal

SiePortal is the catalog and ordering system of Siemens AG for automation and drive solutions on the basis of Totally Integrated Automation (TIA) and Totally Integrated Power (TIP).

You can find catalogs for all automation and drive products on the Internet (https://mall.industry.siemens.com).

Open-source software

Open-source software is used in the firmware of the SIMATIC Drive Controller. The open-source software is provided free of charge. We are liable for the product described, including the open-source software contained in it, pursuant to the conditions applicable to the product. Siemens accepts no liability for the use of the open-source software over and above the program sequence intended for our product, or for any faults caused by modifications to the software. For legal reasons, we are obliged to publish the original text of the license conditions and copyright notices.
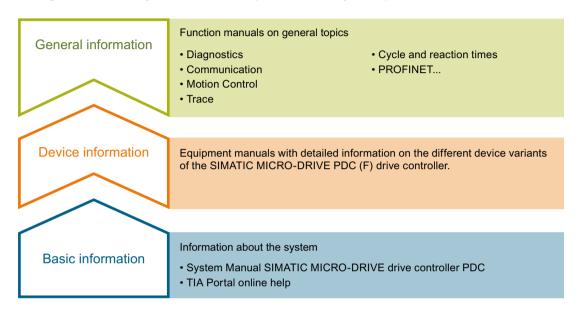
You will find these on the Internet with the firmware downloads

Table of contents

Documentation guide

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The documentation for the MICRO-DRIVE servo drive system is arranged into three areas. This arrangement enables you to access the specific content you require.

General information	Function manuals on general topics
	• Diagnostics • Cycle and reaction times
	• Communication • PROFINET...
	• Motion Control
	• Trace
Device information	Equipment manuals with detailed information on the different device variants of the SIMATIC MICRO-DRIVE PDC (F) drive controller.
Basic information	Information about the system
	• System Manual SIMATIC MICRO-DRIVE drive controller PDC
	• TIA Portal online help

Basic information

The system manual describes in detail the configuration, installation, wiring and commissioning of the PDC drive controller. The STEP 7 online help supports you in the configuration and programming.

Device information

The manual contains a compact description of the device-specific information, such as properties, interfaces, wiring diagrams, display and operator controls and technical specifications.

General information

The function manuals contain detailed descriptions on general topics regarding the MICRO-DRIVE servo drive system and SIMATIC S7-1500 automation system, such as diagnostics, communication, Motion Control, Web server and OPC UA.

You can download the documentation free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/ps/25460).

SIMATIC S7-1500

You can download general information about the SIMATIC S7-1500/ET 200MP systems free of charge from the Internet (https://support.industry.siemens.com/cs/ww/en/view/109742691).

Changes and supplements to the manuals are documented in a Product Information. You can download the Product Information free of charge from the Internet (https://support.industry.siemens.com/cs/us/en/view/68052815).

SIMATIC S7-1200

The system manual S7-1200 Programmable Controller (https://support.industry.siemens.com/cs/ww/en/view/109741593)provides information on the entire S7-1200 product family. In addition to the system manual, the S7-1200 Easy Book provides a general overview of the capabilities of the S7-1200 family. You can download or view the electronic manuals on the Siemens Industry Online Support (https://support.industry.siemens.com) website.

The Update to the S7-1200 System Manual (https://support.industry.siemens.com/cs/ww/en/view/109743003) contains updates to the system manual "SIMATIC S7-1200 Programmable Controller" that occurred after its publication.

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You must register once to use the full functionality of "mySupport".

You can find "mySupport" on the Internet (https://support.industry.siemens.com/My/ww/en).

"mySupport" - Documentation

In the Documentation area of "mySupport", you have the possibility to combine complete manuals or parts of them to make your own manual.
You can export the manual in PDF format or in an editable format.

You can find "mySupport" - Documentation on the Internet (https://support.industry.siemens.com/My/ww/en/documentation).

"mySupport" - CAx data

In the CAx data area of "mySupport", you can access the latest product data for your CAx or CAe system.

You configure your own download package with a few clicks.

In doing so you can select:

- Product images, 2D dimension drawings, 3D models, internal circuit diagrams, EPLAN macro files

- Manuals, characteristics, operating manuals, certificates

- Product master data

You can find "mySupport" - CAx data on the Internet (https://support.industry.siemens.com/my/ww/en/CAxOnline).

Application examples

The application examples support you with various tools and examples for solving your automation tasks. Solutions are shown in interplay with multiple components in the system - separated from the focus on individual products.

You will find the application examples on the Internet (https://support.industry.siemens.com/sc/ww/en/sc/2054).

TIA Selection Tool

With the TIA Selection Tool, you can select, configure and order devices for Totally Integrated Automation (TIA).
This tool is the successor of the SIMATIC Selection Tool and combines the known configurators for automation technology into one tool.
An integral component of the TIA Selection Tool is the calculation tool for the design and component selection of the SIMATIC MICRO-DRIVE drive system.

With the TIA Selection Tool, you can generate a complete order list from your product selection or product configuration.

You can find the TIA Selection Tool on the Internet (https://www.siemens.com/global/en/products/automation/topic-areas/tia/tia-selection-tool.html).

SIMATIC Automation Tool

You can use the SIMATIC Automation Tool to perform commissioning and maintenance activities simultaneously on various SIMATIC S7 stations and PROFINET devices as a bulk operation independent of the TIA Portal. For example:

- Searching of the network and creation of a table showing the accessible devices in the network.

- Flashing of device LEDs or HMI displays to locate a device

- Loading addresses (IP, subnet, gateway) to a device

- Downloading of the PROFINET name (station name) to a device

- Resetting of devices to factory settings (resetting interface parameters)

- Downloading of a firmware update to a device

You can find the SIMATIC Automation Tool on the Internet (https://support.industry.siemens.com/cs/ww/en/view/98161300).

PRONETA

SIEMENS PRONETA (PROFINET network analysis) allows you to analyze the plant network during commissioning. PRONETA features two core functions:

- The topology overview automatically scans the PROFINET and all connected components.

- PRONETA also scans: configuration of the station name, IP subnet mask and identification and maintenance data (I&M1..3)

You can find SIEMENS PRONETA on the Internet (https://support.industry.siemens.com/cs/ww/en/view/67460624).

Product overview

<div align="right">2</div>

2.1   Area of application of the PDC drive controller

Areas of application

You can use the SIMATIC MICRO-DRIVE drive system in different industry sectors that require powerful positioning drives. SIMATIC MICRO-DRIVE has proven to be an ideal drive in numerous applications. The system excels in dynamic positioning tasks in production and manufacturing and in innovative application areas.

Examples of applications:

- Packaging machines

- Automatic assembly machines

- Metal forming machines

- Printing and labeling machines

- Winders/unwinders, e.g. in the textile, packing and printing industries and in electronics manufacturing

- Driving of shuttles for storage and retrieval machines and storage rack systems

- Automated guided vehicle systems (battery operation)

- Medical applications such as safe movement of MRI tables and exact automated alignment of ceiling-mounted X-ray devices.

2.2   Properties

Article number

PDC1000 drive controller	6BK1630-1BA00-0AA0

View of the device

The figure below shows the PDC1000 drive controller.

Figure 2-1   Product image PDC1000

Properties

The PDC1000 has the following technical properties:

Property	Description	Additional information
Control of EC motors	The PDC1000 is a motor controller for three-phase motors (EC) with supply voltages to 48 V DC and permanent magnets. DC motors are **not** supported.	Section Connecting the motor (Page 26).
Use in protective extra low voltage range < 42.4 V/60 V (SELV/PELV)	Supply voltage: • 24 V DC for the logic unit (1L+, 2L+) • 24 V DC to 48 V DC for the power unit (4L+) Maximum voltage of the power supply units under fault conditions: • < 42.4 V DC for the logic unit (1L+, 2L+) • < 60 V DC for the power unit (4L+)	Section Technical specifications (Page 35).

Property	Description	Additional information

Current/Power	Output phase current for an EC motor:
	• Horizontal mounting:
	  – Maximum 24.5 A or 17.3 A_{eff}
	  – Maximum 49 A or 34.6 A_{eff}
	• Vertical mounting:
	  – Maximum 20.8 A or 14.7 A_{eff}
	  – Maximum 41.7 A or 29.5 A_{eff}
	Typical power output with 48 V supply:
	• Horizontal mounting:
	  – Nominal 1000 W
	  – Maximum 2000 W
	• Vertical mounting:
	  – Nominal 850 W
	  – Maximum 1700 W
		Section Technical specifications (Page 35).

Braking resistor	The PDC1000 has **no** internal braking resistor. To absorb the regenerative energy of the motor, you must connect an external braking resistor or switch on the energy recovery in the drive controller (see p0205).	System Manual SIMATIC MICRO-DRIVE Drive controller PDC
Connection of external braking resistor (X5051)	The connection terminal (X5051) for an external braking resistor is designed for an average current of 15 A.	
Hardware TO	"Hardware TO" (Torque Off) drive function Torque shutdown via onboard terminal (STO + and STO-)	-
PROFINET		
PROFINET interface with two ports (X2050 Port 1, X2060 Port 2).	You connect PROFINET IO via the RJ45 bus connector.	System Manual SIMATIC MICRO-DRIVE Drive controller PDC

Accessories

You can find information on the topic of "Accessories/spare parts" in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

2.3 Power supply

Infeed points

You supply the PDC at the logic unit (1L+, 2L+) and power unit (4L+) infeed points with the following voltages:

Table 2-1   Supply voltage of PDC

Infeed point	Nominal sup-ply voltage	Static supply voltage	Dynamic supply voltage	Maximum voltage under fault condi-tions (power supply) for maintaining elec-trical and functional safety	Fusing
Logic unit 1L+, 2L+	24 V DC	19.2 to 28.8 V	18.5 to 30.2 V Non-periodic over-voltage max. 35 V for max. 500 ms with a recovery time of 50 s	Max. 42.4 V	Internal fusible link, not replaceable by user. Fusing on installation side necessary for through-wiring!
Power unit 4L+	24 to 48 V DC	16.8 to 52.8 V1)	16.8 to 52.8 V1)	Max. 60 V	Two-pole miniature cir-cuit breaker

[1] When energy recovery is activated, a supply voltage above 52.8 V DC (maximum value 58.8 V) is also permitted. Use a suitable bi-directional supply to ensure that the voltage at 4L+ never exceeds 60 V DC during operation or under fault conditions. It is essential that you observe the information on recovery in the section "Energy recovery" in the system manual SIMATIC MICRO-DRIVE Drive controller PDC Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

> ⚠ **WARNING**
>
> Use separate power supply units to supply the logic unit and the power unit or a filter between the shared power supply unit and the power supply.

Power supply for the power unit

You must feed the power supply for the power unit via terminals 4L+ and 4M at the X5050 interface (Figure 3-1 Connections of PDC1000 drive controller with pin assignment (Page 19)).

> **NOTICE**
>
> A two-pole miniature circuit breaker according to UL category DIVQ (UL 498) must be inserted in the 4L+ and 4M feed line. You can find the article numbers of the miniature circuit breakers to be used in the section "Accessories/Spare parts" in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).
>
> The miniature circuit breaker must be implemented with two poles even when using PELV.

In order for the DC link capacitors to be charged slowly when 4L+ is switched on, we recommend a primary-switched electronic power supply with current limitation. Only the required miniature circuit breaker has to be installed between the power supply and PDC, and not an operational switch.

If 4L+ is switched on via a suitable miniature circuit breaker, the following characteristic values result:

- Peak current: < 300 A

- Half value stream width: < 500 µs

NOTICE

The 4L+ input has no switch-on current limitation. Do not connect the terminals while live. This must also be observed for any upstream switching devices or miniature circuit breakers.

If, for operational reasons, the supply of 4L+ must be switched, we recommend implementing an pre-charging input circuit on the installation side. After pre-charging is finished, the pre-charging resistor must be bypassed by a suitable circuit before normal operation is started.

Key data for the dimensioning:

- Zero-signal current consumption 4L+: Approx. 15 mA (PDC not in operation)

- Internal DC link capacitance: 4000 µF +/-20%

- Pre-charging resistor is rated for the maximum voltage under fault conditions of the power supply unit ≤ 60 V
When energy recovery is activated, a supply voltage above 57.6 V DC is also permitted. Use a suitable bi-directional supply to ensure that the voltage at 4L+ never exceeds 60 V DC during operation or under fault conditions.

- The power of the pre-charging resistor must be rated for continuous power (voltage at the pre-charging resistor is constantly equal to the maximum power supply voltage) or appropriate measures must be taken to protect against overtemperature/overload.

⚠ **WARNING**

Operation above the voltage setting range

Under the given application conditions, ensure that the motor is not operated above the voltage setting range by selecting the appropriate motor and gear unit; otherwise, the DC-link voltage can increase above 60 V DC with inactive control.

Reference

Note the detailed information on the power supply in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

See also

Terminal assignment (Page 19)

2.4 Calculating the overload capability of the power unit

The following table shows the relationship between overload and recovery of the power unit.

Calculation

Table 2-2   Relationship between overload and recovery of the power unit

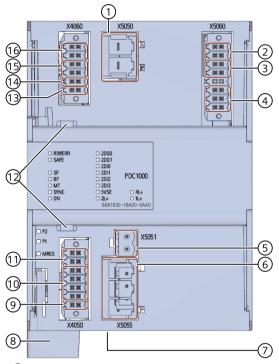|	PDC1000
Rated power unit current (r0208)	24.5 A or 17.3 A_{eff}
Peak current, power unit (r0209)	49 A or 34.6 A_{eff}
Duration of overload (with peak current r0209)	3 s
Duration of recovery (with $I_{recovery}$)	17 s
Reduced current $I_{recovery}$ (recovery of power unit)	16.8 A or 11.9 A_{eff}
$I_{recovery}$ referenced to rated current (r0208)	69%

Reference

Note the detailed information on overload protection in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).
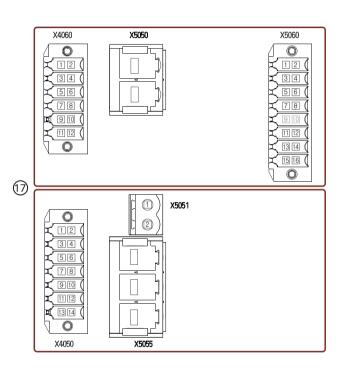
Connecting

3

3.1　　Terminal assignment

Connection options on the PDC1000

The figure below shows the connection possibility on the PDC1000 drive controller.

①	Power supply of power unit (X5050)
②	Logic supply of PDC (X5060)
③	Hardware TO (X5060)
④	SSI absolute encoder (X5060)
⑤	External braking resistor (X5051)
⑥	Motor phases (X5055)
⑦	Connection for grounding strap of the functional ground, covered, access from below
⑧	PROFINET Port 1 (X2050) and Port 2 (X2060), covered, access from below
⑨	Reference potential of encoder/Hall sensor supply (X4050)
⑩	Incremental encoder (X4050)
⑪	Hall sensor (X4050)
⑫	Wiring duct for connection cables
⑬	Reference potential of digital inputs/outputs (X4060)
⑭	2 digital outputs (X4060)

⑮   4 digital inputs (X4060)

⑯   Supply of inputs/outputs (X4060)

⑰   Pin assignment

Figure 3-1   Connections of PDC1000 drive controller with pin assignment

⚠ **DANGER**
Hazardous Voltage **Can Cause Death, Serious Injury, or Property Damage.**
Hazardous electrical voltage can cause electric shock, burns and property damage.
Disconnect the system and devices from the supply before commencing work.

References

Note the detailed information on selection of the installation location, mounting position, ambient temperature, minimum clearances, etc. in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

You can also find information on the topic of "Accessories/spare parts" in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC.

The SIMATIC MICRO-DRIVE drive system is compatible with motors (Dunkermotoren, ebm-papst) and connecting cables (Harting, KnorrTec) of proven product partners of Siemens. This allows you to optimally combine suitable products from proven product partners for your individual application. You can find more information about the Siemens Product Partner Program on the Internet (https://new.siemens.com/global/en/company/topic-areas/partners/product-partners-industry.html).

Interfaces, cable lengths and cable types

The following cable lengths and cable types are permitted for the interfaces.

Table 3-1   Wiring rules for the interfaces

Plug connec-tor	Function	Maximum cable length	Cable type	Cable cross-section
X100	Functional ground	0.1 m	Grounding strap	$\geq 4\ mm^2$
X2050	PROFINET Port 1	100 m	Shielded cable, 2 x twisted pair, Cat 5	-
X2060	PROFINET Port 2	100 m	Shielded cable, 2 x twisted pair, Cat 5	-

Plug connector	Function	Maximum cable length	Cable type	Cable cross-section
X4050	Incremental encoder signals and supply	10 m	Shielded For differential wiring, one twisted pair per signal pair	Solid and stranded supply cable: AWG*: 22 to 16 or 0.34 mm² to 1.5 mm²
	Hall sensor signals and supply	10 m	Shielded	
	Encoder and Hall interface with "All-in-one" plug-in cable	10 m	Shielded in "All-in-one" plug-in cable	
X4060	I/O, inputs and outputs	20 m	• < 2 m unshielded • ≥ 2 m shielded	Solid and stranded supply cable: AWG*: 22 to 16 or 0.34 mm² to 1.5 mm² For through-wiring for maximum permissible terminal currents, use AWG* 16 or 1.5 mm².
	Supply of inputs/outputs	20 m	• < 2 m unshielded • ≥ 2 m shielded	
X5050	Power supply of power unit (4L+, 4M)	20 m	• < 2 m unshielded • ≥ 2 m shielded	Solid and stranded supply cable: AWG*: 20 to 10 or 0.5 mm² to 4 mm² Use AWG* 10 or 4 mm² for the recommended circuit breaker.
X5051	Connection of external braking resistor (4R+, 4R-)	2 m	Unshielded	Solid and stranded supply cable: AWG*: 18 to 16 or 1.0 mm² to 1.5 mm²
X5055	Motor phases	10 m	Shielded	Solid and stranded supply cable: AWG*: 18 to 10 or 1.0 mm² to 4 mm²
	Motor phases with "All-in-one" plug-in cable	10 m	Shielded in "All-in-one" plug-in cable	

Plug connector	Function	Maximum cable length	Cable type	Cable cross-section
X5060	Logic supply PDC (1L+, 1M)	20 m	• < 2 m unshielded • ≥ 2 m shielded	Solid and stranded supply cable: AWG*: 20 to 16 or 0.5 mm² to 1.5 mm² For through-wiring for maximum permissible terminal currents, use AWG* 16 or 1.5 mm².
	Torque Off	20 m	• < 2 m unshielded • ≥ 2 m shielded	Solid and stranded supply cable: AWG*: 20 to 16 or 0.5 mm² to 1.5 mm² For through-wiring for maximum permissible terminal currents, use AWG* 16 or 1.5 mm².
	SSI interface	20 m	Shielded, one twisted pair per signal pair	Solid and stranded supply cable: AWG*: 22 to 16 or 0.34 mm² to 1.5 mm²

* American Wire Gauge

CABLE SPEC.	Note that connected mains lines must be designed according to the expected minimum and maximum ambient temperature. For the temperature increase at the terminal point, take into account an extra 20 °C as compared to the ambient temperature.

Installing/removing the connection plug
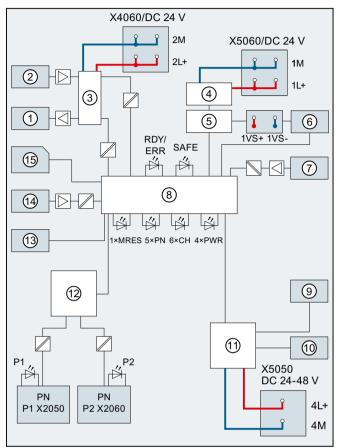
Installing the connection plug

Insert all plugs into the plug-in connector as far as they will go. In the case of possible vibration load, fasten the connectors to the PDC with the captive screws.

Removing the connection plug

Loosen the screwed connections of the connectors. Remove the connectors.

3.2 Schematic circuit diagram

The following figure shows the schematic circuit diagram of the PDC1000 drive controller.

①	X4060: Connection for digital outputs	X4060 24 V DC	Infeed of supply voltage for digital inputs/outputs
②	X4060: Connection for digital inputs	X5060 24 V DC	Infeed of supply voltage for logic unit
③	Supply for digital inputs/outputs	X5050 24 - 48 V DC	Infeed of supply voltage for power unit
④	Supply for logic unit	PN P1 X2050	PROFINET interface Port 1
⑤	EMC filter, current limitation	PN P2 X2060	PROFINET interface Port 2
⑥	X5060: SSI encoder connection	xL+	Supply voltage
⑦	X5060: Hardware TO input	xM	Ground
⑧	Microcontroller unit, consisting of drive controller, diagnostics controller and communication controller	RDY/ ERR	PDC status LED (green/red)
⑨	X5055: Motor phases	SAFE	Safety function status LED (yellow)

⑩	X5051: Connection for external braking resistor	MRES	Service button LED
⑪	Supply for power unit	PN	PROFINET status display LEDs
⑫	2-port switch	CHx	Input/output LEDs
⑬	Service button	PWR	Supply voltage LEDs
⑭	X4050: Rotational speed acquisition (Hall sensor, incremental encoder)		
⑮	microSD memory card		

Figure 3-2   Schematic circuit diagram PDC1000

3.3 Connecting the supply voltages

Introduction

You connect the 24 V DC supply voltage for the PDC logic unit and the inputs/outputs to terminal connectors X5060 (1L+ and 1M) and X4060 (2L+ and 2M).
Pins 3/4 (2L+) and Pins 1/2 (2M) of interface X4060 are electrically connected to one another. If you connect the supply voltage to Pin 3 (2L+) and Pin 1 (2M), you can use terminals 4 (2L+) and 2 (2M) to loop through the potential to Pins 3 (1L+) and 1 (1M) of interface X5060.

You connect the 24 V DC to 48 V DC supply voltage for the power unit to connector X5050 (4L+ and 4M).

Requirements

- Only wire the connection plug when the supply voltage is turned off.

- Observe the rules and regulations on operation described in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

- Observe the rules and regulations described in section Product overview (Page 13).

Required tool

Screwdriver (recommended):

- For double-level terminal connector, size 0.4 x 2.5 mm

- For single-level terminal connector, size 0.6 x 3.5 mm

Connection of supply voltages for the PDC logic unit and the inputs/outputs (24 V DC)

- Pin assignment: Interface X4060 for supply voltage of inputs/outputs

Table 3-2   Pin assignment: Interface X4060 for supply voltage of inputs/outputs

Pin	Designation	Function	Pin	Designation	Function
1	2M	Reference potential of supply of inputs/outputs	2	2M	Reference potential of supply of inputs/outputs
3	2L+	Supply of inputs/outputs	4	2L+	Supply of inputs/outputs

- Pin assignment: Interface X5060 for supply voltage of logic supply of PDC

Table 3-3   Pin assignment: Interface X5060 for supply voltage of logic supply of PDC

Pin	Designation	Function	Pin	Designation	Function
1	1M	Reference potential of logic supply of PDC	2	1M	Reference potential of logic supply of PDC
3	1L+	Logic supply of PDC	4	1L+	Logic supply of PDC

The logic supply voltages 1L+, 2L+ with associated ground potentials 1M, 2M are electrically isolated from one another.

Connection of supply voltage for the power unit (24 V DC to 48 V DC)

The figure below shows the connection of the 24 V DC to 48 V DC supply voltage for the power unit to the interface X5050:
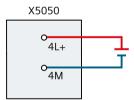

Figure 3-3   Connection of power unit supply

- Pin assignment: Interface X5050 for power supply of power unit

Table 3-4   Pin assignment: Interface X5050 for supply of power unit

Designation	Function
4L+	Power supply of power unit
4M	Reference potential of power supply of power unit

Connecting of solid conductors and stranded conductors (stranded wire) with end sleeve

To connect a wire, proceed as follows:

1. Strip 8 to 11 mm of insulation from the wires.

2. Crimp the stranded conductors with end sleeves.

3. Insert the wire into the spring-loaded terminal as far as it will go.

4. Push the wired connection plug into the socket of the PDC.

5. After connecting, check that the stranded wire or solid conductor cannot be pulled out again.

Connecting of conductors: stranded, without end sleeve, unprocessed

To connect a wire without end sleeve, follow these steps:

1. Strip 8 to 11 mm of insulation from the wires.

2. Press the spring release with the screwdriver, and insert the wire into the spring-loaded terminal as far as it will go.

3. Let go of the spring release with the screwdriver.

4. Push the wired connection plug into the socket of the PDC.

5. After connecting, check that the stranded wire cannot be pulled out again.

Disconnecting a cable

Press the spring release as far as it will go with the screwdriver. Remove the wire.

Reference

Note the detailed information on the topic "Connecting" in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

3.4 Connecting the motor

Reference

The SIMATIC MICRO-DRIVE drive system is compatible with motors (Dunkermotoren, ebm-papst) and connecting cables (Harting, KnorrTec) of proven product partners of Siemens. This allows you to optimally combine suitable products from proven product partners for your individual application. You can find more information about the Siemens Product Partner Program on the Internet (https://new.siemens.com/global/en/company/topic-areas/partners/product-partners-industry.html).

Connections for motor phases

The figure below shows the connection of the motor phases to the interface X5055:
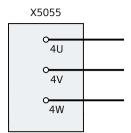
X5055

Figure 3-4   Connection of motor phases

> ⚠️ **WARNING**
>
> **Operation above the voltage setting range**
>
> Under the given application conditions, ensure that the motor is not operated above the voltage setting range by selecting the appropriate motor and gear unit; otherwise, the DC-link voltage can increase above 60 V DC with inactive control.

Pin assignment

- Interface X5055 for motor phases

Table 3-5   Pin assignment: Interface X5055 for motor phases

Designation	Function
4U	Motor phase U
4 V	Motor phase V
4W	Motor phase W

Reference

Note the detailed information on the topic "Connecting" in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

3.5 Connecting an external braking resistor

Connecting an external braking resistor

⚠️ **WARNING**

Damage to braking resistor - Risk of fire!

You must implement fire prevention measures for the external braking resistor (e.g. fire protection housing, temperature fuse). The resistance of the externally connectable braking resistor must be at least 3 ohms.

Note

V2.0 or higher

The connection terminal (X5051) for an external braking resistor is monitored by the drive controller. In the event of a corresponding overload, warning A61059.22 (warning threshold I2t monitoring connection of external braking resistor reached) is reported. If the limit value is exceeded, the system is switched off with the alarm message F61059.18 (limit I2t monitoring connection of external braking resistor exceeded).

The figure below shows the connection of an external braking resistor to interface X5051 (and X4060):

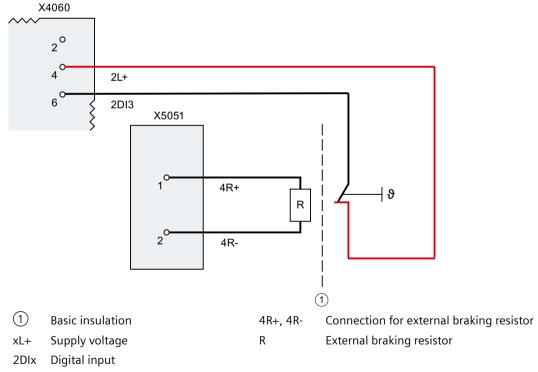| ①	Basic insulation	4R+, 4R-	Connection for external braking resistor
xL+	Supply voltage	R	External braking resistor
2DIx	Digital input		

Figure 3-5   Connection of external braking resistor (example)

Pin assignment

- Interface X5051 for ext. braking resistor (2-pole)

- Interface X4060, for example, interconnected with external temperature sensor

Table 3-6   Pin assignment: Connecting an external braking resistor

Pin	Designation	Function
Interface X5051		
1	4R+	Connection of external braking resistor
2	4R-	
Interface X4060 (example)		
4	2L+	For example, interconnected with external temperature sensor
6	2DI3	

Reference

Note the detailed information on connection of an external braking resistor in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

You can also find information on the topic of "Accessories/spare parts" in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC.

Alarms, diagnostics, error messages and system events

<div style="text-align: right; font-size: 2em;">**4**</div>

4.1 Status and error display

The PDC has LED displays for indicating the current operating state and the diagnostics status.

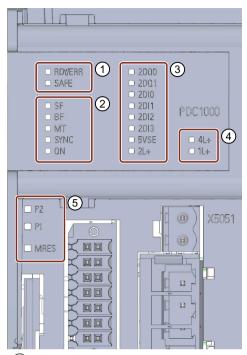The "RDY/ERR" LED indicates the status of the drive state.

Table 4-1   Meaning of the LEDs

RDY/ERR LED	Meaning
▢ LED off	The drive is ready for operation.
▪ LED lit green	The drive is in operation.
☼ LED flashes red	There is an operating fault.

The LEDs assume different statuses during startup. The displays of the LEDs operate independent of one except during firmware update.

The figure below shows the various LED displays on the PDC.

① Diagnostic LEDs for the drive controller:

- RDY/ERR = Drive status

- SAFE = TO function status

② Diagnostic LEDs for the PROFINET communication:

- SF = PROFINET group error

- BF = PROFINET bus error

- MT = PROFINET maintenance request

- SYNC = PROFINET isochronous mode (IRT)

- ON = PROFINET communication started

③ Diagnostic LEDs for the sensor unit:

- 2DQx/2DIx = Status of digital inputs/outputs

- 5VSE = Output of supply voltage of motor encoder

- 2L+ = Infeed of supply voltage for the sensor unit

④ Diagnostic LEDs for power unit and logic unit:

- 4L+ = Infeed of supply voltage of power unit

- 1L+ = Infeed of supply voltage of logic unit

⑤ Diagnostic LEDs PROFINET ports and service (behind the lower front cover):

- P1/P2 = Status information of PROFINET port

- MRES = Service function status

Figure 4-1   LED displays

Table 4-2   Meaning of the SAFE LED on the PDC1000 (6BK1630-1BA00-0AA0)

LED is off	No power supply
LED is on	TO function is not active

| LED flashes slowly | TO function is active. Drive is free of torque. |
| LED flashes rapidly | A malfunction was detected in the drive. |

You can find detailed information and descriptions for the individual fault and alarm messages and the meanings of the LEDs for the status of the drive controller in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

You can find additional information on the topic of "Interrupts" in the STEP 7 online help.

You can find additional information on the topic of "Diagnostics" and "System alarms" in function manual Diagnostics (https://support.industry.siemens.com/cs/ww/en/view/59192926).

Technical specifications

<div style="text-align: right; font-size: 2em;">5</div>

5.1 Technical specifications

Technical specifications of the PDC1000 (article number 6BK1630-1BA00-0AA0)

The following table shows the technical specifications of the PDC1000 as of 02/2020.

You can find a data sheet including daily updated technical specifications on the Internet (https://support.industry.siemens.com/cs/ww/en/pv/6BK1630-1BA00-0AA0/td?dl=en).

Article number	6BK1630-1BA00-0AA0
General information	
Product type designation	EC motor controller
HW functional status	FS02
Product description	Control of EC motors
Mean time between failures (MTBF)	100 000 h
Product function	
• Isochronous mode	Yes
• Four-quadrant operation	Yes
• Speed control with encoder	Yes
• Speed control without encoder	No
• Safety Functions	No
Protection function	
• Undervoltage protection	Yes
• Overvoltage protection	Yes
• Overload protection	Yes
• Short-circuit protection	Yes
Installation type/mounting	
Mounting type	35 millimeter rail and mounting plate screw connection
Type of ventilation	Convection cooling
Supply voltage	
Design of the power supply	DC
Rated value (DC)	24 V
permissible range, lower limit (DC)	19.2 V
permissible range, upper limit (DC)	28.8 V
Supply voltage of the motor	
• Type of motor voltage	24 ... 48 V DC, SELV / PELV
• permissible range, lower limit (DC)	16.8 V
• supply voltage / of the motor / at DC / rated value / maximum	52.8 V
Input current	
Current consumption for the electronics, max.	0.9 A
Inrush current, max.	1.6 A
Output current	
Current output (rated value)	17.3 A
Output current, max.	34.6 A
Output frequency	500 Hz
Power loss	
Power loss, max.	22 W
Digital inputs	
Number of digital inputs	5

Article number	6BK1630-1BA00-0AA0
Number of safety inputs	0
Digital outputs	
Number of digital outputs	2; 24 V DC, 1 A
Number of safety outputs	0
Encoder	
Connectable encoders	
• Incremental encoder (symmetrical)	Yes; Up to 200 kHz
• Absolute encoder (SSI)	Yes; With SSI interface
Interfaces	
Number of industrial Ethernet interfaces	0
Number of PROFINET interfaces	2
Standards, approvals, certificates	
CE mark	Yes
CSA approval	No
UL approval	No
cULus	No
FM approval	No
RCM (formerly C-TICK)	No
KC approval	No
EAC (formerly Gost-R)	Yes
RoHS conformity	Yes
China RoHS compliance	No
Ambient conditions	
Ambient temperature during operation	
• min.	-20 °C
• max.	60 °C
Ambient temperature during storage/transportation	
• Storage, min.	-20 °C
• Storage, max.	80 °C
Relative humidity	
• Operation, max.	90 %; no condensation
• Storage, max.	95 %; no condensation
Vibrations	
• Vibration resistance during operation acc. to IEC 60068-2-6	5 ... 8.5 Hz / 3.5 mm, 8.5 ... 150 Hz / 1 g; for wall mounting: 9 ... 29 Hz / 1.5 mm, 29 ... 200 Hz / 5 g
• Vibration resistance during storage acc. to IEC 60068-2-6	5 ... 9 Hz / 3.5 mm, 9 ... 500 Hz / 1 g
Shock testing	
• Shock resistance during operation acc. to IEC 60068-2-27	15 g / 11 ms; for wall mounting: 10 g / 30 ms, 25 g / 6 ms
Cables	
Cable length for motor, shielded, max.	10 m
Connection method	

Article number	6BK1630-1BA00-0AA0
Type of connection	Plug-in terminal
Dimensions	
Width	90 mm
Height	125 mm; 136 mm with protective collar for PN connector
Depth	120 mm
Weights	
Weight, approx.	0.65 kg
Other	
Brake design	Holding brake
Braking chopper	Yes; External resistance

You can find information on the general technical specifications, such as standards and approvals, electromagnetic compatibility, protection class, etc., in the System Manual SIMATIC MICRO-DRIVE Drive controller PDC (https://support.industry.siemens.com/cs/ww/en/view/109774126).

5.2   Drive controller derating

The maximum permissible output current for PDCs of performance class 1000 W must be reduced as follows depending on the installation altitude, mounting position and ambient temperature.

The derating relates to the rated current of the power unit. The maximum current from the power unit may be taken at an average speed of > 10 Hz (corresponds to the rotating field frequency > 10 Hz for EC motors over a period of 20 s). At frequencies < 10 Hz, the maximum permissible current corresponds to the rated current of the power unit.

Derating as a function of the installation altitude

For all permissible mounting types, starting from an installation altitude of 1000 m, a derating of 10% current per additional 1000 m elevation gain applies. In this case, the motor current and the output current of the digital outputs must be reduced.

All other functions do not have to be reduced up to the maximum installation altitude.

The figure below shows the maximum permitted output current as a function of installation altitude for the derating.
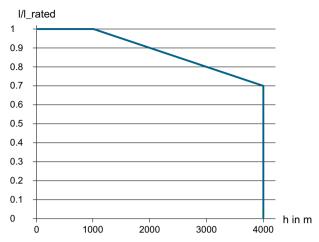
Figure 5-1   Derating for PDC1000 as a function of the installation altitude

Derating as a function of the mounting position

For vertical mounting (vertical mounting rail), the nominal output phase current must be reduced to 14.7 A_{eff} and the maximum output phase current to 34.6 A_{eff} up to an ambient temperature of 40 °C.

For horizontal mounting (horizontal mounting rail), no restrictions are necessary for the PDC1000 up to an ambient temperature of 40 °C.

Derating depending on the ambient temperature

From an ambient temperature of 40 °C up to a maximum temperature of 60 °C, a derating of 1.2%/K must be observed. The motor current must be reduced.

The figure below shows the maximum permitted output current as a function of the ambient air temperature for the derating.
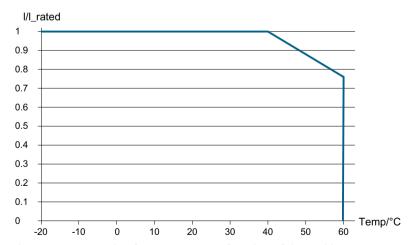

Figure 5-2   Derating for PDC1000 as a function of the ambient temperature

Coincidence factors of inputs/outputs

Also note the permissible coincidence factors of the inputs/outputs.

All outputs (DQ) may be operated simultaneously up to 60 °C. No deratings with respect to ampacity exist as a function of ambient temperature.

All inputs (DI) may be operated simultaneously up to 60 °C. No deratings with respect to ampacity exist as a function of ambient temperature.

Dimension drawing $\qquad$ A

This appendix contains the dimension drawings of the SIMATIC MICRO-DRIVE PDC1000 installed on a mounting rail. You must take into account the dimensions for installation in cabinets, control rooms, etc.

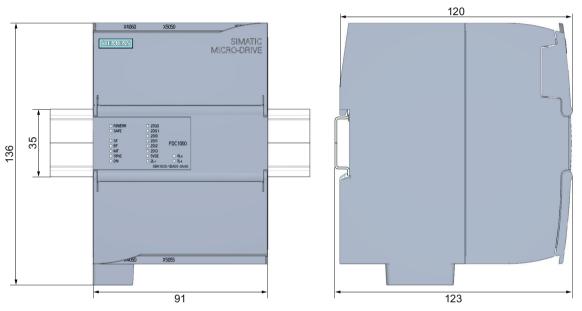**Dimension drawings of the SIMATIC MICRO-DRIVE PDC1000**

Figure A-1   Dimension drawings of SIMATIC MICRO-DRIVE PDC1000, front and side view (as examples, depending on mounting rail type used)