

SIEMENS

SINUMERIK

SINUMERIK 828D PPU and components

Manual

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Valid for:
SINUMERIK 828D
PPU 24x.3 BASIC
PPU 26x.3
PPU 28x.3

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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.
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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

SINUMERIK documentation

The SINUMERIK documentation is organized into the following categories:

- General documentation
- User documentation
- Manufacturer/service documentation

Additional information

You can find information on the following topics under the link (www.siemens.com/motioncontrol/docu):

- Ordering documentation / current documentation overview
- Additional links to download documents
- Using documentation online (finding and searching in manuals/information)

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following address:
(<mailto:docu.motioncontrol@siemens.com>)

My Documentation Manager (MDM)

Under the following link you will find information to individually compile OEM-specific machine documentation based on the Siemens content: MDM (www.siemens.com/mdm)

Training

For information about the range of training courses, refer to:

- SITRAIN (www.siemens.com/sitrain) - training courses from Siemens for automation products, systems and solutions
- SinuTrain (www.siemens.com/sinutrain) - training software for SINUMERIK

FAQs

You can find Frequently Asked Questions in the Service&Support pages under Product Support (www.siemens.com/automation/service&support).

SINUMERIK

You can find information on SINUMERIK under the following link: (www.siemens.com/sinumerik)

Target group

This documentation is intended for manufacturers of machine tools, particularly:

- Project engineers, electricians and installers
- Maintenance and service personnel

Benefits

The information in this manual facilitates installation and connection of the SINUMERIK 828D numerical control.

Standard version

This documentation only describes the functionality of the standard version. Extensions or changes made by the machine manufacturer are documented by the machine manufacturer.

Other functions not described in this documentation might be executable in the control. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing.

Further, for the sake of simplicity, this documentation does not contain all detailed information about all types of the product and cannot cover every conceivable case of installation, operation or maintenance.

Technical support

Country-specific telephone numbers for technical support are provided in the Internet under "Contact" (www.siemens.com/automation/service&support).

EC Declaration of Conformity

The EC declaration of conformity for the EMC directive can be found in the Internet (<http://support.automation.siemens.com/WW/view/de/10805517/134200>).

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Fundamental safety instructions

1.1 General safety instructions



DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
 - Switch off the machine.
 - Wait until the discharge time specified on the warning labels has elapsed.
 - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
 - Check whether the existing auxiliary supply circuits are de-energized.
 - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

After you have completed the work, restore the operational readiness in the inverse sequence.



WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

Touching live components can result in death or severe injury.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.



WARNING

Danger to life when live parts are touched on damaged devices

Improper handling of devices can cause damage.

For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.



WARNING

Danger to life through electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the cores of cables that are not used at one end at the grounded housing potential.



WARNING

Danger to life due to electric shock when not grounded

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.



WARNING

Danger to life due to fire spreading if housing is inadequate

Fire and smoke development can cause severe personal injury or material damage.

- Install devices without a protective housing in a metal control cabinet (or protect the device by another equivalent measure) in such a way that contact with fire is prevented.
- Ensure that smoke can only escape via controlled and monitored paths.

**WARNING****Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones**

Using mobile wireless devices or mobile phones with a transmit power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.

- Switch the wireless devices or mobile phones off in the immediate vicinity of the components.

**WARNING****Danger to life due to fire if overheating occurs because of insufficient ventilation clearances**

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

**WARNING****Danger to life when safety functions are inactive**

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note**Important safety notices for Safety Integrated functions**

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.

1.2 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.



NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber or aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
 - Wearing an ESD wrist strap
 - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.3 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit Hotspot-Text (<http://www.siemens.com/industrialsecurity>).

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit Hotspot-Text (<http://support.automation.siemens.com>).



WARNING

Danger as a result of unsafe operating states resulting from software manipulation

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can result in death, severe injuries and/or material damage.

- Keep the software up to date.
You will find relevant information and newsletters at this address (<http://support.automation.siemens.com>).
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
You will find further information at this address (<http://www.siemens.com/industrialsecurity>).
- Make sure that you include all installed products into the holistic industrial security concept.

1.4 Residual risks of power drive systems

The control and drive components of a drive system are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used.

These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety instructions on the components and in the associated technical user documentation.

When assessing the machine's risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example,
 - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
 - Response times of the control system and of the drive
 - Operation and/or environmental conditions outside the specification
 - Condensation/conductive contamination
 - Parameterization, programming, cabling, and installation errors
 - Use of wireless devices/mobile phones in the immediate vicinity of the control system
 - External influences/damage
2. In the event of a fault, exceptionally high temperatures, including an open fire, as well as emissions of light, noise, particles, gases, etc. can occur inside and outside the inverter, e.g.:
 - Component failure
 - Software errors
 - Operation and/or environmental conditions outside the specification
 - External influences/damage

Inverters of the Open Type/IP20 degree of protection must be installed in a metal control cabinet (or protected by another equivalent measure) such that contact with fire inside and outside the inverter is not possible.
3. Hazardous shock voltages caused by, for example,
 - Component failure
 - Influence during electrostatic charging
 - Induction of voltages in moving motors
 - Operation and/or environmental conditions outside the specification
 - Condensation/conductive contamination
 - External influences/damage

4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly

Note

The components must be protected against conductive contamination (e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12).

Assuming that conductive contamination at the installation site can definitely be excluded, a lower degree of cabinet protection may be permitted.

For more information about residual risks of the components in a drive system, see the relevant sections in the technical user documentation.

System description

2.1 Controller features

Features

SINUMERIK 828D is a tailored CNC solution for machine tools with different technologies in the medium performance range.

SINUMERIK 828D is a panel-based CNC (panel processing unit). A CNC, PLC, operator panel and axis control for six drives (standard) are combined in a single unit. This design provides a high degree of robustness by eliminating the need for hardware interfaces between the CNC electronics board and the operator panel. In order to guarantee that operation is as low-maintenance as possible, there are no wearing parts such as fans or back-up batteries.

- CNC operator panel with tailor-made system software versions for turning, milling and grinding: PPU 28x, PPU 26x and PPU 24x BASIC
- Two operator panel versions for horizontal and vertical operator panel housings.
- Integrated full QWERTY CNC keyboard with mechanical short-stroke keys.
This enables the user to enter text for part-program names or tool identifiers and plain-text language commands directly, without using the keys of the second input level (shift key).
The keys have IP65 degree of protection.
- USB, CompactFlash card and Ethernet interface on the operator panel front.
- Additional Ethernet interface on the rear of the CNC for a permanent factory network.
- PLC I/O Interface based on PROFINET for the connection of PLC I/O devices and a machine control panel.
- PP 72/48D PN and PP 72/48D 2/2A PN as PLC I/O module.
- Three handwheels can be connected.
- Optional GSM modem connection possible.
- Up to 8 axes/spindles for milling applications and up to 10 axes/spindles for turning and grinding applications.
- 2 auxiliary axes via PROFINET with the PPU 26x.3 and the PPU28x.3. A CU310-2 PN or CU320-2 PN Control Unit is required for operating auxiliary axes via PROFINET.
- 1 machine channel and 1 mode group for milling applications.
- A maximum of 2 machine channels and 2 mode groups for turning and grinding applications.
- Integrated PLC based on the SIMATIC S7-200 command set with ladder logic programming.
- Standardized 3/8" threads are embedded in the upper edges of the operator panel. These threads can be used for attaching commercially available additional components such as holders for diagrams or similar.

Control system versions

SINUMERIK 828D is available in different versions (horizontal or vertical; turning, grinding and milling).

The SINUMERIK 828D is available in the following versions:

- PPU 240.3 BASIC (vertical operator panel)
- PPU 241.3 BASIC (horizontal operator panel)
- PPU 260.3 (vertical operator panel)
- PPU 261.3 (horizontal operator panel)
- PPU 280.3 (vertical operator panel)
- PPU 281.3 (horizontal operator panel)

Quantity structure

The following tables show the quantity structures for the different control versions:

Function	PPU 240.3 / 241.3 BASIC			PPU 260.3 / 261.3		
	Grinding	Turning	Milling	Grinding	Turning	Milling
Non-volatile memory (NVRAM):						
• For OEM data	512 kB	512 kB	512 kB	512 kB	512 kB	512 kB
• For user data	3 MB	3 MB	3 MB	5 MB	5 MB	5 MB
Number of axes/spindles	2	3	4	2	3	4
Maximum number of axes/spindles	5	5	5	6	6	6
Maximum number of axes with drive-based Safety Integrated	5	5	5	6	6	6
Additional auxiliary axes via PRO-FINET	--	--	--	2	2	2
Axis expansion with NX10.3	--	--	--	--	--	1
Axis expansion with NX15.3	--	--	--	--	--	--
Number of DRIVE-CLiQ interfaces	3	3	3	3	3	3
Maximum number of I/O modules (digital/analog)	3	3	3	5	4	4

Function	PPU 280.3 / 281.3		
	Grinding	Turning	Milling
Non-volatile memory (NVRAM):			
• For OEM data	512 kB	512 kB	512 kB
• For user data	10 MB ¹⁾	8 / 10 MB ¹⁾	8 / 10 MB ¹⁾
Number of axes/spindles	2	3	4
Maximum number of axes/spindles	6 / 8 / 10	6 / 8 / 10	6 / 8
Maximum number of axes with drive-based Safety Integrated	6 / 8 / 10	6 / 8 / 10	6 / 8

Function	PPU 280.3 / 281.3		
Additional auxiliary axes via PROFI-NET	2	2	2
Axis expansion with NX10.3	1	1	1
Axis expansion with NX15.3	1	1	1
Number of DRIVE-CLiQ interfaces	3	3	3
Maximum number of I/O modules (digital/analog)	5	5	5

^{*)} 10 MB for user data is available with Advanced Software.

Note

Additional axes for the PPU 28x.3

Using a NX10.3, the following extensions are possible:

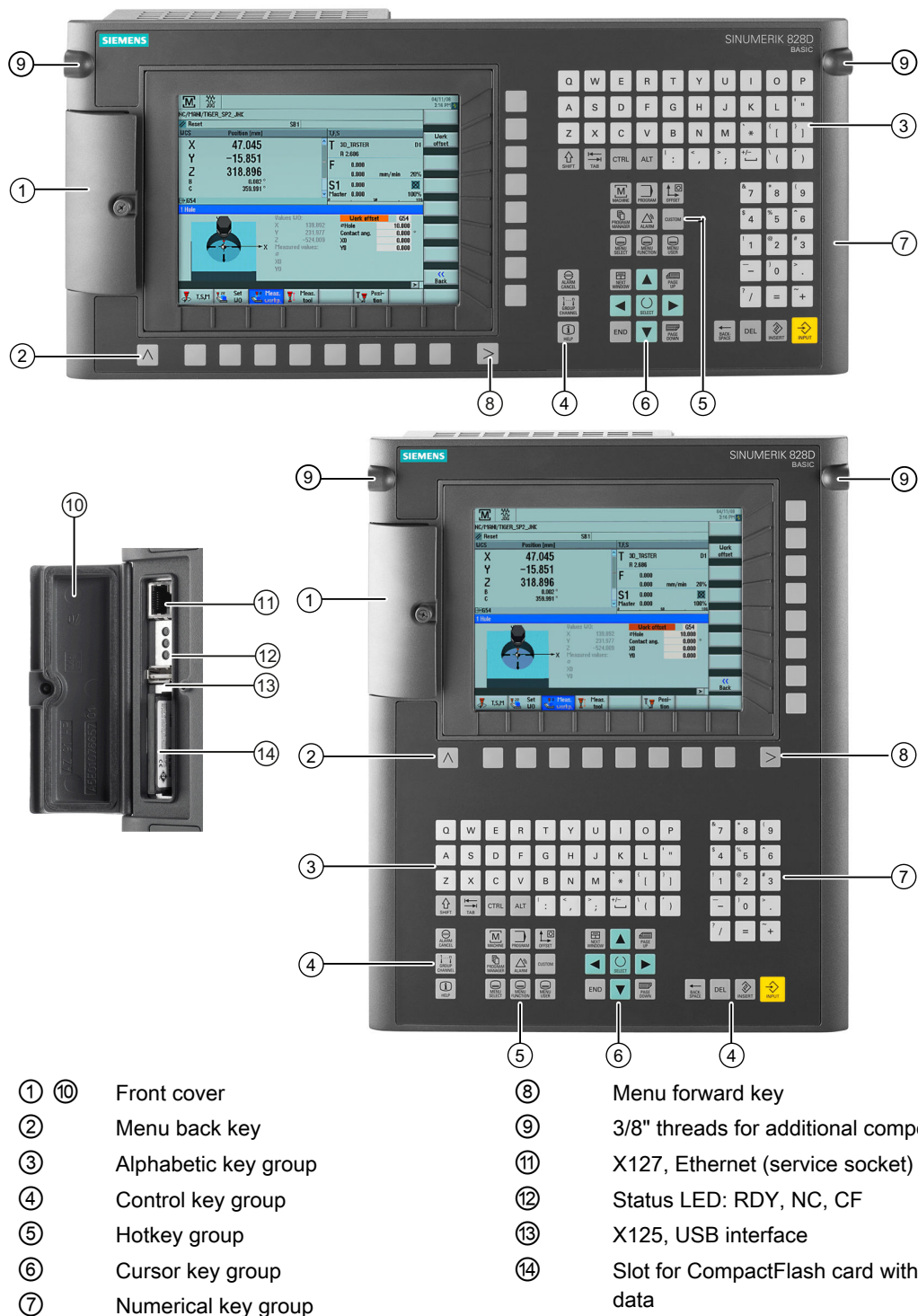
- The maximum number of axes can be increased to eight, six of which can be connected to the PPU and two to the NX10.3.
- One high-speed spindle (e.g. 24,000 rpm with four pole pairs) can be connected to the NX10.3 and five axes to the PPU.

Using an NX15.3, the following extensions are possible:

- The maximum number of axes can be increased to 10, of which 6 axes can be connected to the PPU and 4 axes to the NX15.3.

2.2 PPU version 24x.3 BASIC

Front side of the PPU 24x.3 BASIC



Rear side of the PPU 24x.3 BASIC

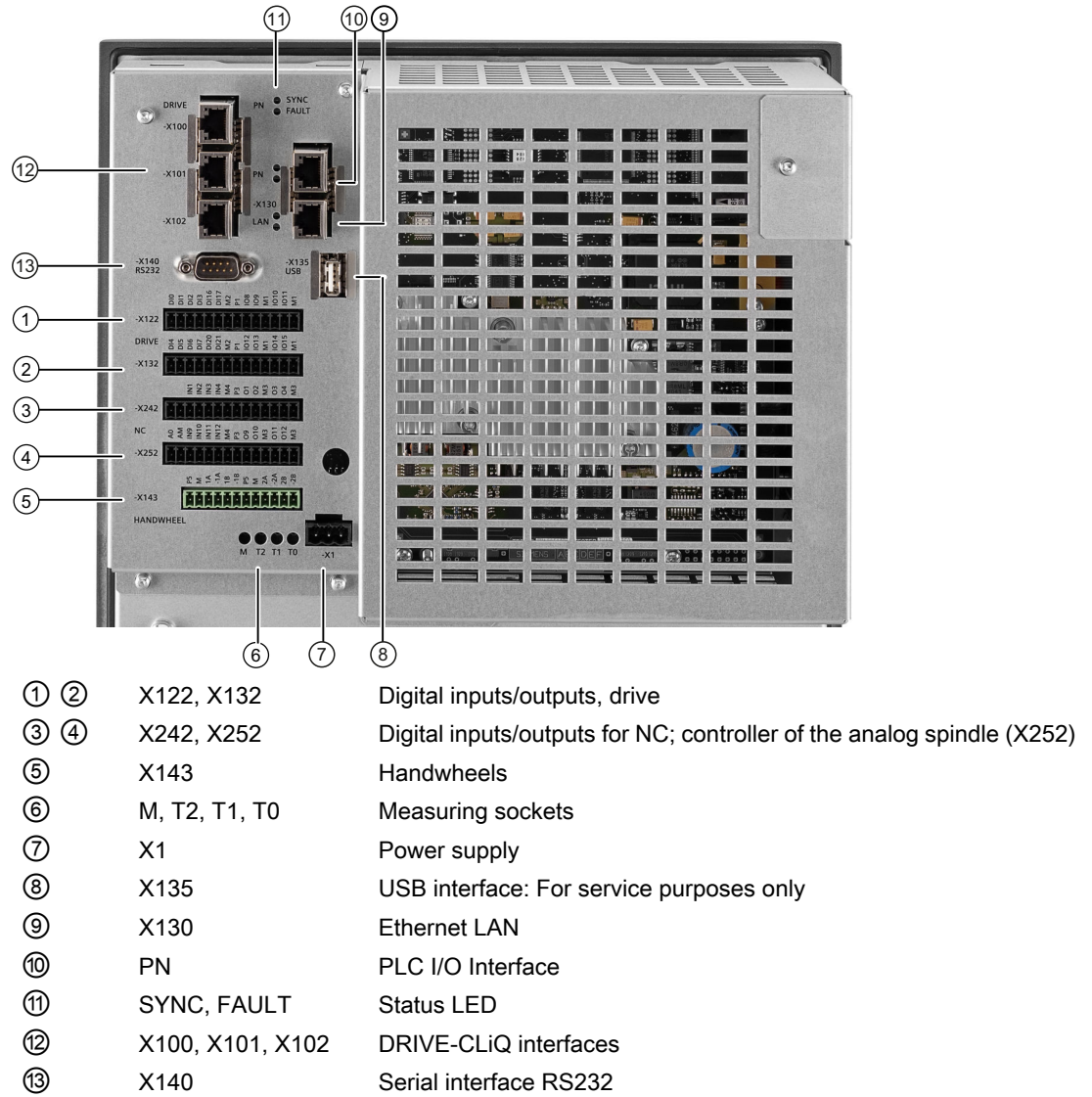
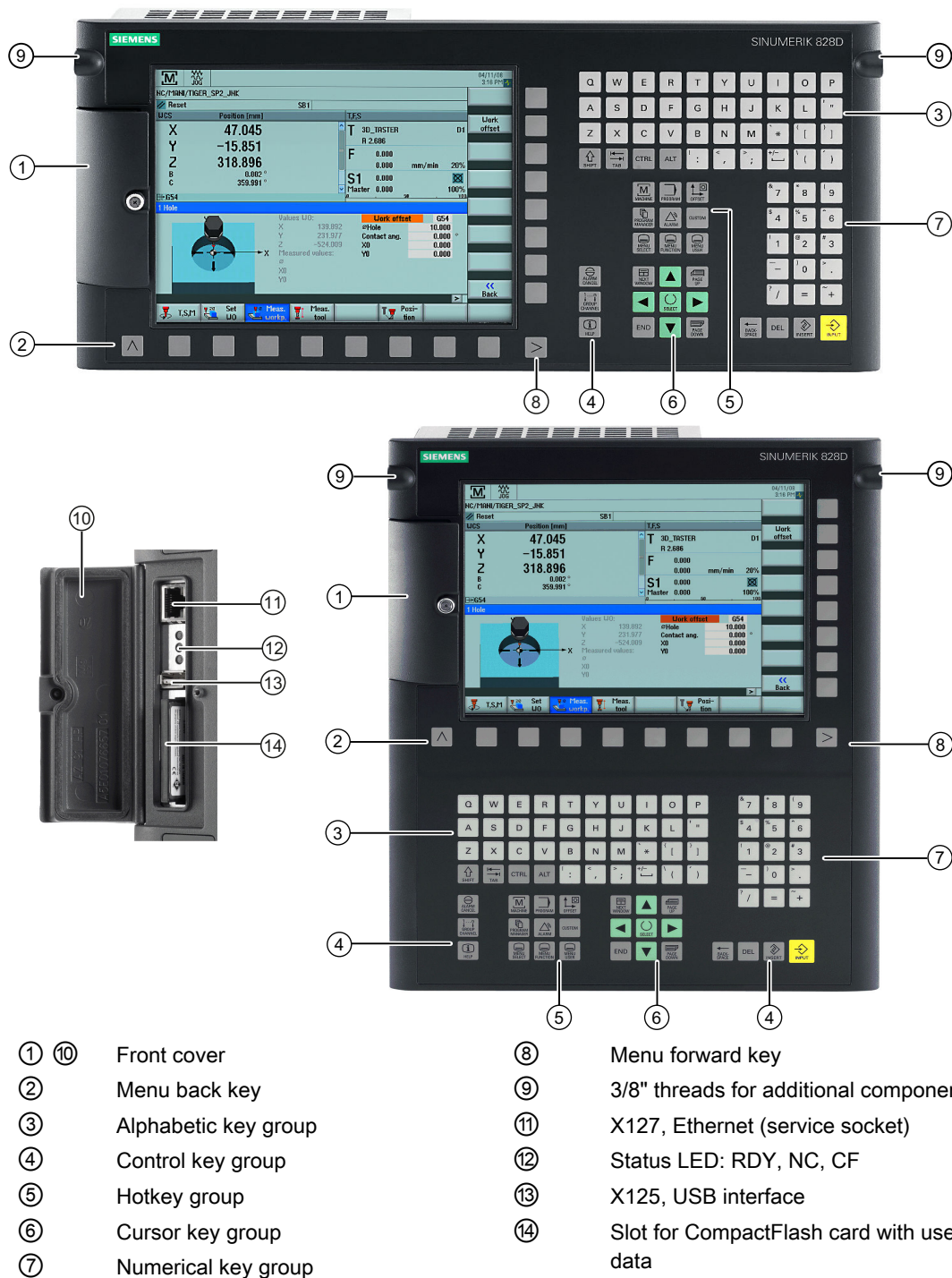


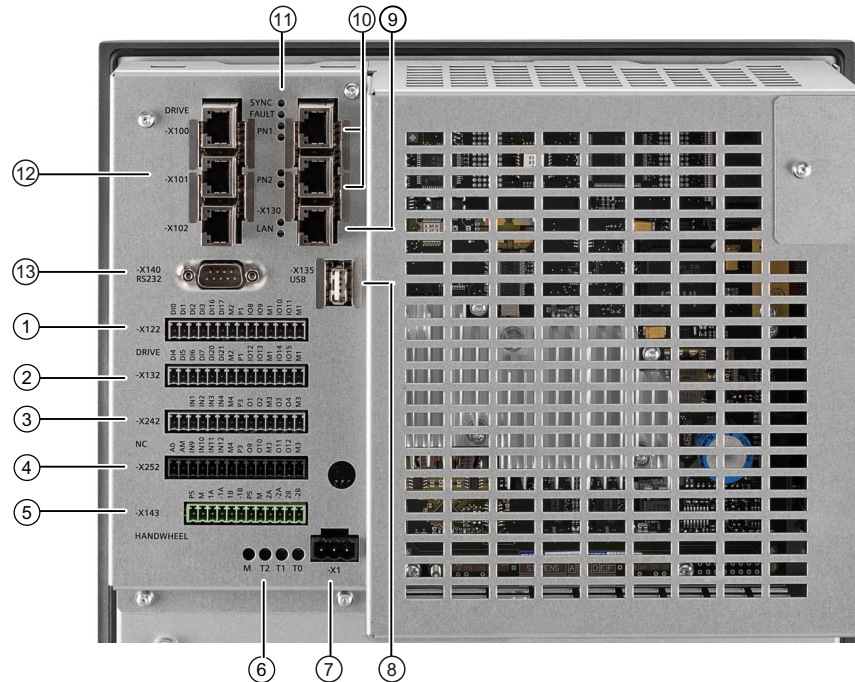
Figure 2-1 Interfaces at the rear

2.3 PPU versions 26x.3 and 28x.3

Front of the PPU versions 26x.3 and 28x.3



Rear of the PPU versions 26x.3 and 28x.3



① ②	X122, X132	Digital inputs/outputs, drive
③ ④	X242, X252	Digital inputs/outputs for NC; controller of the analog spindle (X252)
⑤	X143	Handwheels
⑥	M, T2, T1, T0	Measuring sockets
⑦	X1	Power supply
⑧	X135	USB interface: For service purposes only
⑨	X130	Ethernet LAN
⑩	PN 1, PN 2	PLC I/O Interface
⑪	SYNC, FAULT	Status LED
⑫	X100, X101, X102	DRIVE-CLiQ interfaces
⑬	X140	Serial interface RS232

Figure 2-2 Interfaces at the rear of the PPU

2.4 Operator controls and display elements

TFT color display

The TFT color display has a diagonal size of 10.4" (PPU 26x.3/28x.3) or 8.4" (PPU 24x.3). The resolution is 800 x 600 pixels. The softkeys are arranged in an 8 + 8 layout; this makes the CNC easy to operate using only a very small number of menu levels.

Note

Pixel error acc. to DIN EN ISO 13406-2 Class II.

Keyboard

Several keys and key pads are installed on the operator panel front:

- The alphabetic key group contains the letters A ... Z and the space character for entering text.
- The numeric key group contains the digits 0 - 9, arithmetic/special characters and the decimal point for entering numeric characters and operators.
- The cursor key group is used to navigate on the screen.
- The control key group includes special functions.
- The area changeover displays the operating areas.
- The menu forward key allows the horizontal softkey bar to be extended in the same menu.
- The softkeys call up functions that are available on screen via a menu bar.
- The machine area key switches directly into the "Machine" operating area.
- The menu back key returns to the superordinate menu, one window is closed.

The keys used on the operator panel front along with the corresponding function keys on the PC keyboard are shown in the following overview:

Key	Function corresponds to PC key function	Key	Function corresponds to PC key function
	Esc		End
	F11		Backspace
	F12		Tabulator
	Spaces		(only for internal keyboard changeover)

Key	Function corresponds to PC key function	Key	Function corresponds to PC key function
	Home		CTRL key
	Page up		ALT key
	Page down		Delete
	Cursor up		Insert
	Cursor left		Enter
	Cursor right		F9
	Cursor down		F10
	5 (in numeric key group)	A ... Z	A ... Z
	<Shift> F9		<Shift> F10

2.5 Type plate

Type plates

The PPU type plate is located on the rear side.

Note

The contents of the individual type plate fields on the current controller may differ from those described in this Manual (e.g. updated product status, approvals and identifications not yet issued, etc.).

The following images display all the information required to uniquely identify a PPU.

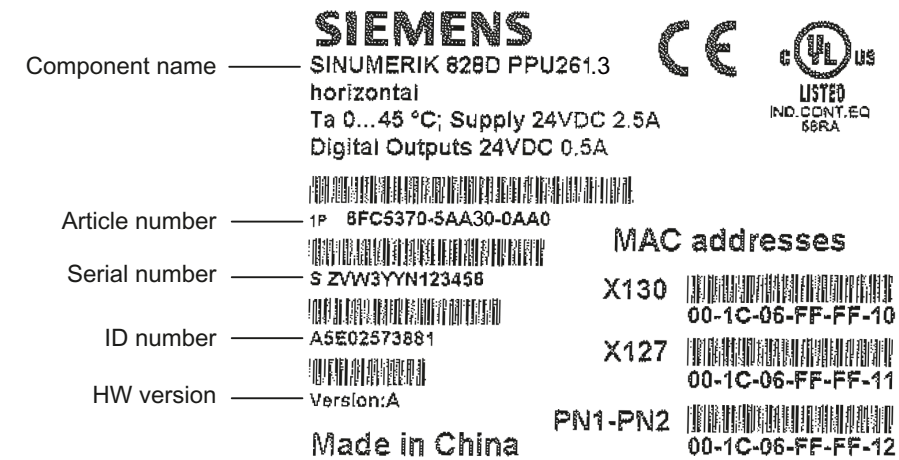


Figure 2-3 Horizontal PPU type plate

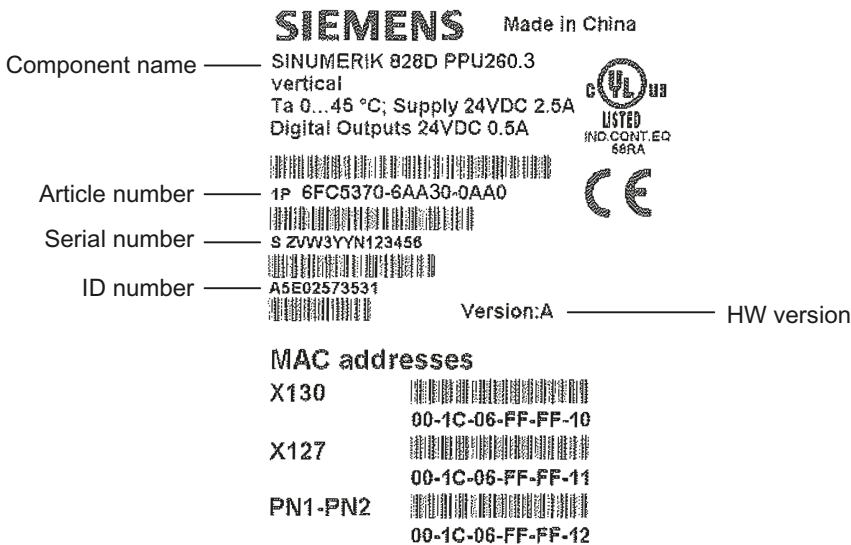


Figure 2-4 Vertical PPU type plate

Note

MAC addresses

The MAC addresses printed on the type plate of the PPU are required for configuring the PLC I/O Interface communications networks based on PROFINET and Industrial Ethernet.

There is a similar situation for the machine control panels and the I/O modules.

2.6 System overview

Configuration with four axes (basic configuration)

The following configuration shows a typical example with SINAMICS S120 booksize:

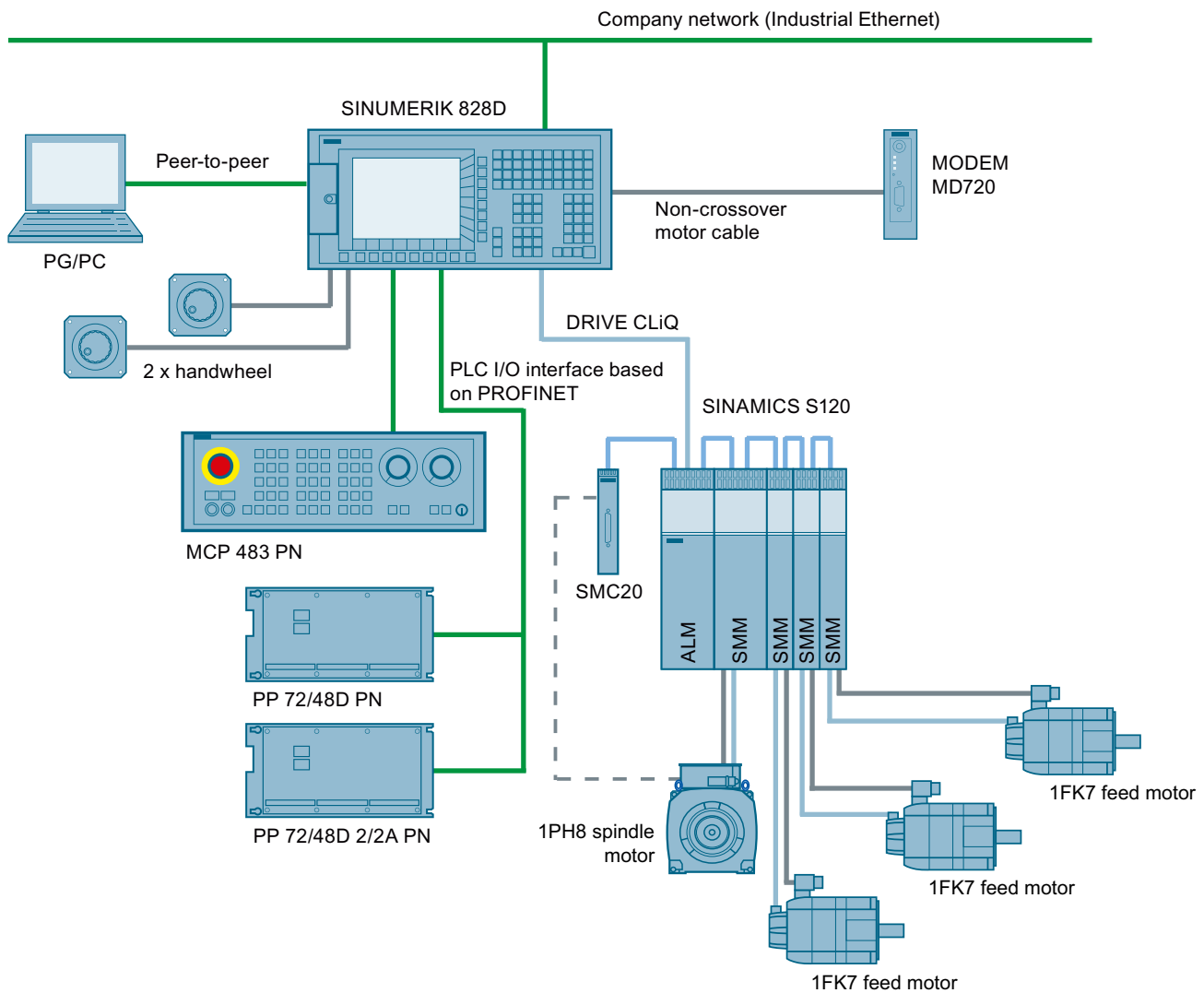


Figure 2-5 Configuration example 1: Basic configuration with four axes

Configuration with S120 Combi and six axes

The following configuration shows the maximum expansion stage with SINAMICS S120 Combi:

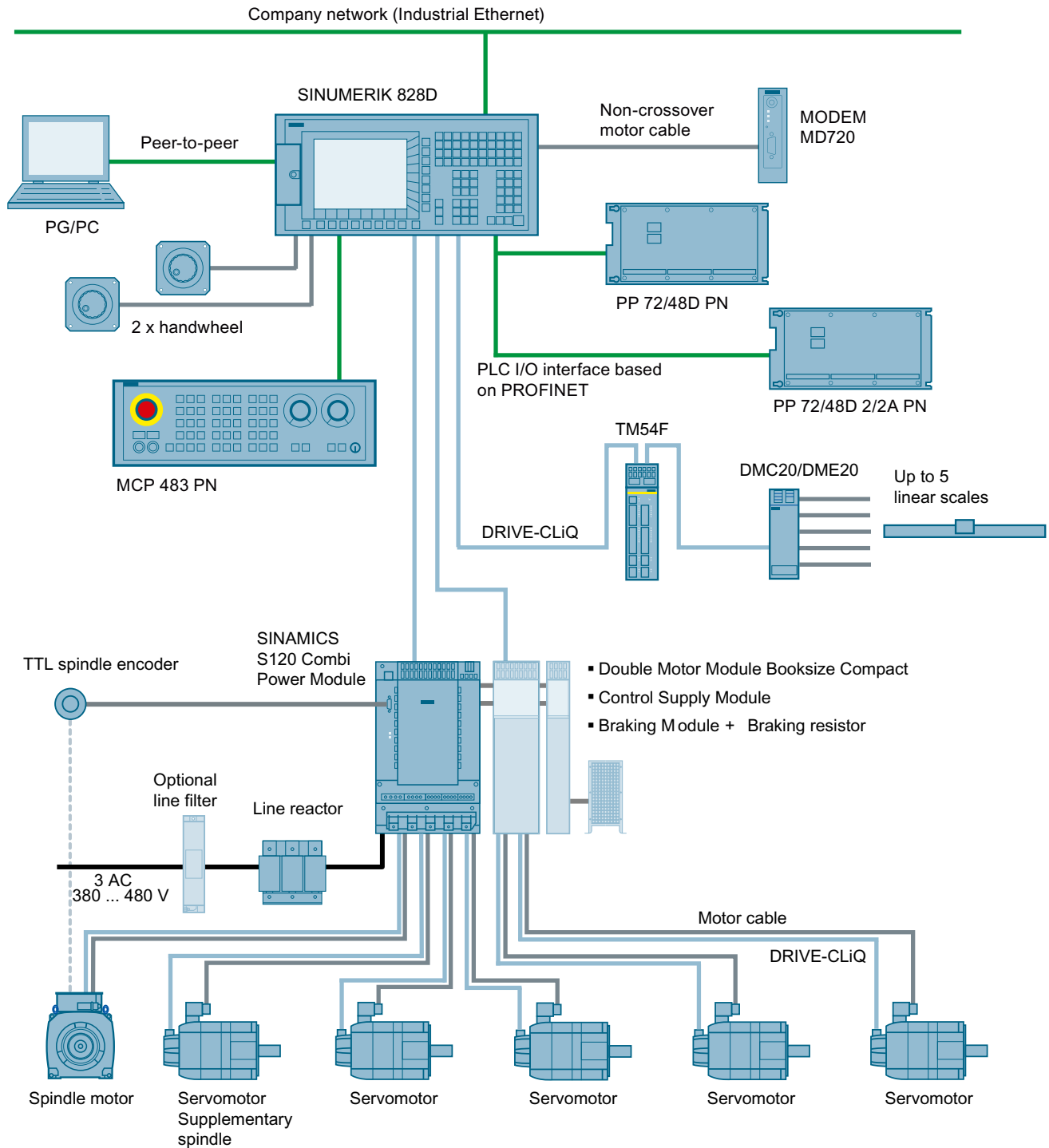


Figure 2-6 Configuration example 2: Maximum expansion stage with six axes and with Safety Integrated

2.7 Connectable components

Component overview

The following components can be connected to the PPU:

- **Machine control panels in a horizontal/vertical version**
Includes the buttons and switches required to operate a machine tool and is connected via PROFINET or USB.
- **Interface module MCP Interface PN**
The MCP Interface PN module enables customer-specific machine control panels to be connected. Further, a 3rd handwheel can be connected using the module.
- **Handwheels**
A maximum of three handwheels can be connected.
- **Mini handheld unit**
A mini HHU can be integrated into the SINUMERIK 828D system using a connection kit.
- **PP 72/48D PN / PP 72/48D 2/2A PN I/O modules**
The modules are used to connect digital as well as analog inputs and outputs. To supply the module and the outputs, an external power supply unit (24 VDC) is required, which provides safety isolation from dangerous voltages.
- **NX10.3 / NX15.3 axis expansion modules**
You can increase the number of axes using NX modules. Each NX10.3 can control up to three additional axes and each NX15.3 can control up to six additional axes.
- **GSM modem**
Connecting a MODEM MD720 to send and receive data via a serial RS232 interface.
- **PN/PN coupler**
A PN/PN coupler can be connected in order to link a SINUMERIK 828D to PROFINET networks.
- **SETRON PAC3200 / PAC4200**
When connecting a SETRON PAC3200/PAC4200, functions are available to increase the energy efficiency of a machine tool.

SINAMICS S120 drive system

Only the SINAMICS S120 Line Modules and Motor Modules are used for drive control. Motor Modules can be used to connect **servomotors** as type 1FK7, 1FT7, and 1PH8 feed and main spindle motors. Type 1FW6 **torque motors** can also be connected.

See also

Connectable components (Page 97)

SINAMICS components (Page 89)

- Rules for permitted topologies (Page 55)
- Interface description (Page 71)

2.8 CompactFlash Cards

2.8.1 CompactFlash card system

Overview

The PPU has two slots for CompactFlash cards:

- The slot for the user CompactFlash card is located at the front behind the front flap.
- The slot for the system CompactFlash card with the system software is at the rear.

CompactFlash card with system software

The system CompactFlash card is shipped in a bootable condition. It is not supplied with the PPU and must be ordered as a separate component.

The system CompactFlash card is essential for the operation of the PPU.

In addition to the technology-specific system software for SINUMERIK 828D and the firmware for SINAMICS, the system CompactFlash card also contains:

- Version information (serial number, version, type designation)
- License key: Allows the CompactFlash card to be inserted into another PPU without having to change the licenses.

Note the following when using a system CompactFlash card:

- SINUMERIK CNC supports the file systems FAT16 and FAT32 for CompactFlash cards. You may need to format the memory card if you want to use a memory card from another device or if you want to ensure the compatibility of the memory card with the SINUMERIK. However, formatting the memory card will permanently delete all data on it.
- Do not remove the memory card while it is being accessed. This can lead to damage of the memory card and the SINUMERIK as well as the data on the memory card.
- If you cannot use a memory card with the SINUMERIK, it is probably because the memory card is not formatted for the control system (e.g. Ext3 Linux file system), the memory card file system is faulty or it is the wrong type of memory card.
- Insert the memory card carefully and the right way round into the memory card slot (observe indicators such as arrow or similar). This way you avoid mechanical damage to the memory card or the device.

- Only use memory cards that have been approved by Siemens for use with SINUMERIK. Even though SINUMERIK follows general industry standards for memory cards, it is possible that memory cards from some manufacturers will not function perfectly in this device or are not completely compatible with it (you can obtain information on compatibility from the memory card manufacturer or supplier).
- For SINUMERIK 828D, only the memory card (2 GB) with order number 6FC5313-5AG00-0AA2 is permitted.

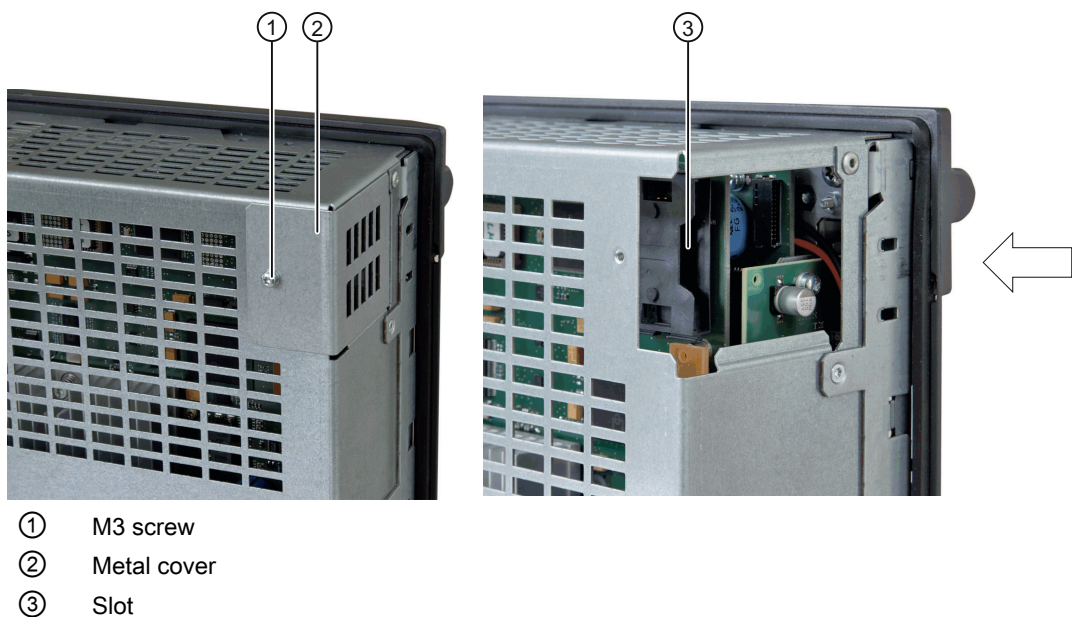
NOTICE

CompactFlash card system

- The CompactFlash card always comes formatted! **You must not reformat it under any circumstances!**
- To ensure that the system CompactFlash card functions properly, the card must not be repartitioned.
- In the event of a defect, the system software card must be replaced. For information about restoring your system using an empty CompactFlash card, refer to the Service Manual.

2.8.2 Inserting the system CompactFlash Card

Slot and mounting position



The CompactFlash card has an edge on the opposite side to the pins. This edge must always be on the right when inserting the card.



Figure 2-7 Mounting position

Replacing the system CompactFlash card

⚠ CAUTION

Electrostatic Device (ESD)

Before you touch a CompactFlash card, discharge yourself at the cabinet or at the ground terminal.

The CompactFlash cards may only be inserted or removed when the control unit is disconnected from the power supply.

Procedure:

1. Switch off the power supply.
2. Loosen the screw ①.
3. Swing the metal cover ② to the side and remove.



4. Pull out the CompactFlash card sideways.



5. Gently insert the new CompactFlash card into slot ③ until it clicks into place.
6. Re-attach the metal cover ② by first guiding it in backward, then tilting into the end position and finally screwing in the screw ① (max. tightening torque, 0.8 Nm).

NOTICE

Plugging in the CompactFlash card

Please ensure that the CompactFlash card is inserted with care. Otherwise, the card may be damaged.

7. Switch the power supply on again.

2.8.3 CompactFlash card for user data

CompactFlash card for user data

You can write to the user CompactFlash card as follows:

- The user CompactFlash card is inserted in the front slot of the PPU and is written to via the operating software.
- The user CompactFlash card can be written to using a suitable memory card adapter directly via the PG/PC.

Note

A permanently inserted CompactFlash card can also be used as an extension of the CNC user memory, e.g. for oversized mold making programs, which exceed the storage capacity integrated in the CNC user memory.

Inserting the CompactFlash card

To correctly insert the CompactFlash card in the slot, note the position the edge (arrow) in the figure below:



Figure 2-8 Direction to insert the user CompactFlash card

Application planning

3.1 Secondary electrical conditions

3.1.1 Protective Separation as per EN 61800-5-1

Protective separation of the interfaces

Note

By using an extra-low voltage, all interfaces have protective separation according to Class DVC A (SELV/PELV).

3.1.2 Grounding concept

Components

The SINUMERIK 828D system consists of a number of individual components which have been designed so that the system complies with the appropriate EMC and safety standards. The individual system components are:

- Panel Processing Unit PPU
- Machine Control Panel
- PLC I/O modules

Grounding measures

The PPU and MCP are attached with tensioners to a metal panel on the operator panel. Both have a protective conductor connection for grounding (grounding screw) at the rear of the device, which must be connected to the grounding bar of the control cabinet.

The SINAMICS S120 drive system is installed in the control cabinet. The electronics unit grounds of the modules are connected to each other via DRIVE-CLiQ. The modules are grounded either via the galvanized mounting plate or via the grounding lugs on the front of the modules.

The PLC I/O device modules are installed in the control cabinet and grounded via a grounding screw.

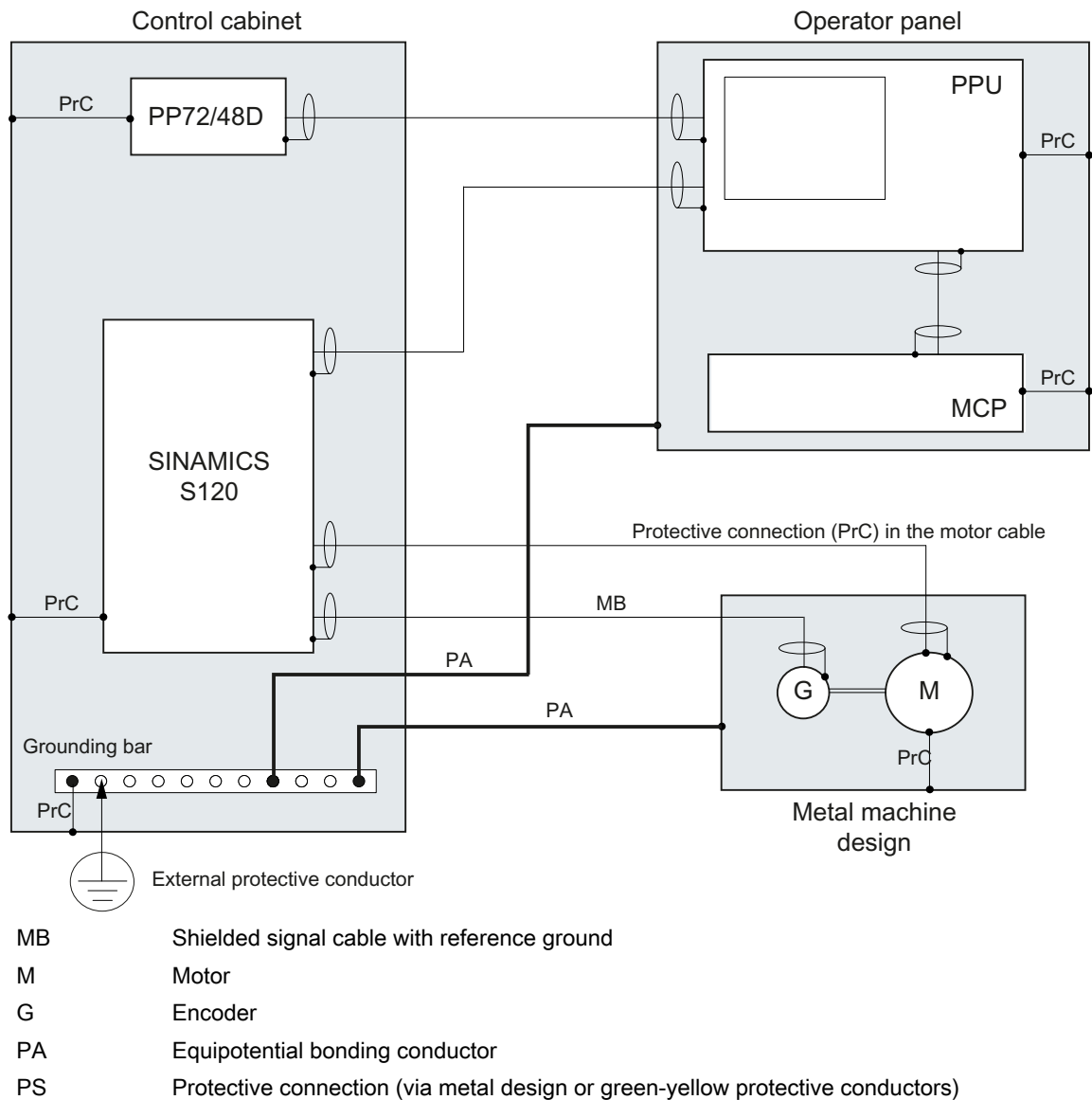


Figure 3-1 Grounding concept

The following rules apply for external cable cross sections:

- PA cross-section $\geq 10 \text{ mm}^2$
- The conductor cross-section of the external protective conductor is calculated from the conductor cross-section of the line connection as follows:

Line connection S (mm ²)	External protective conductor min. (mm ²)
$S \leq 16$	S
$16 \leq S \leq 35$	16
$S \geq 35$	S/2

3.1.3 RI suppression measures

Shielded signal cables

In addition to the protective grounding of system components, special precautions must be taken to ensure safe, fault-free operation of the system. These measures include shielded signal cables, special equipotential bonding, isolation, and shielding measures.

- For safe and fault-free operation of the system, the specified cables must be used.
- For digital signal transmission, the shield must have a conductive connection at both sides of the housing.

Exception:

Standard shielded cables grounded on only one side can be used for devices from other manufacturers (printers, programming devices, etc.). However, these devices must not be connected to the controller during normal operation. However, if the system cannot operate without them, then the cable shields must be connected at both ends. Furthermore, the non-Siemens device must be connected to the controller via an equipotential bonding cable.

Cable definitions

The following cables are permissible:

- Signal cables:
 - Data cables (Ethernet, PROFINET, DRIVE-CLiQ, sensor cables, etc.)
 - Ribbon cables for digital inputs/outputs
 - Emergency Stop cables
- Power cables:
 - Low-voltage supply cables (230 VAC, 24 VDC, etc.)
 - Supply cables to contactors (primary and secondary circuit)

Rules for routing cables

In order to maximize noise immunity for the complete system (controller, power section, machine) the following EMC measures must be observed:

- Signal cables and power cables must be routed at the greatest possible distance from one another.
- If necessary, signal and power cables may cross one another (if possible at an angle of 90°), but must never be laid close or parallel to one another.
- Signal cables may not be routed close to strong external magnetic fields (e.g. motors and transformers).
- Pulse-loaded HC/HV lines must always be laid completely separately from all other lines.

3.1 Secondary electrical conditions

- If signal lines cannot be routed a sufficient distance away from other cables, they must be installed in grounded cable ducts (metal).
- The clearance (interference injection area) between the following lines must be kept to a minimum:
 - Signal line and electrical circuit signal line (twisted)
 - Signal line and associated equipotential bonding conductor
 - Equipotential bonding conductor and protective conductor (routed together)

References

For more information about interference suppression measures and connection of shielded cables and specified cables:

- EMC Installation Guideline Configuration Manual/Basic system requirements
- SINAMICS S120 Combi Manual

EMC limit values in South Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

The EMC limit values to be complied with for South Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3, Category C2, or limit value class A, Group 1 according to EN 55011. By applying suitable supplementary measures, the limit values according to Category C2 or according to limit value class A, Group 1, are maintained. Further, additional measures may be required, for instance, using an additional radio interference suppression filter (EMC filter).

The measures for EMC-compliant design of the system are described in detail in this manual respectively in the Installation Guideline EMC.

Please note that the final statement on compliance with the standard is given by the respective label attached to the individual unit.

3.2 Climatic and mechanical environmental conditions

3.2.1 Ambient conditions

Observing the ambient conditions

The controller is tested for compliance with the ambient conditions specified below. Fault-free operation is only ensured if:

- These ambient conditions are maintained when storing, transporting and operating the equipment.
- Original components and spare parts are used. This applies in particular to the use of specified cables and connectors.
- The equipment is correctly installed and commissioned.

Standard requirements

The SINUMERIK 828D system components meet the following standard requirements:

Long-term storage	EN 60721-3-1
Transport	EN 60721-3-2
Stationary operation	EN 60721-3-3

Assistance and support

Compliance with environmental requirements must be ensured during installation of the complete system. Please contact your sales representative for assistance and support.

3.2.2 Transport and Storage Conditions

Components in original packaging

The following specifications apply to components in transport packaging:

	Transport	Storage
Standard / class	EN 60721-3-2 / 2K4	EN 60721-3-1 / 1K4
Temperature range	-20 ... + 60 °C	-25 ... + 55 °C
Temperature change	-40 °C/+30 °C and +70 °C/+15 °C ^{*)}	< 0.5 K / min (Δ 30 K / h) averaged over 5 minutes
Relative humidity	5 ... 95 %	10 ... 100 %
permissible change of the relative humidity	max. 0.1% / min (Δ 6% / h)	

^{*)} A direct change between the specified temperatures in the air is assumed

3.2.3 Operating Conditions

Note

Before commissioning components with display, remove the foil which is used to protect the components during transport.

Climatic environmental conditions

If the specified values cannot be maintained, then a heat exchanger or air conditioner must be provided.

Temperature range	Front side: 0 ... 45 °C Rear side: 0 ... 55 °C		
Temperature change	< 0.5 K / min ($\pm$ 30 K / h) averaged over 5 minutes		
Humidity	Relative: 5 ... 90 %		
permissible change of the relative humidity	max. 0.1% / min ($\pm$ 6% / h)		
Moisture condensation and ice formation	Not permissible		
Dripping water, spray, splash water, water jets	Permissible		
Supply air	Without aggressive gases, dusts and oils		
Air pressure	106 to 92 kPa or 0 to 1000 m above sea level		
Derating	At altitudes over 1,000 to 4,000 m above sea level, the upper temperature limit must be reduced by 3.5 °C / 500 m.		
Active environmental conditions	Chemical: Class 3C2	Mechanical: Class 3S2	Biological: Class 3B1

Function-impairing dust

When working in areas where gases, dust and oils may be hazardous to functionality, the control system must be operated in an enclosure with a heat exchanger or with suitable supply air. Dust deposits must be removed at regular intervals.

Maximum permissible amount of dust in the ambient air:

Suspended component	0.2 mg/m ³
Deposits	1.5 mg/m ² h

Limit values for radio interference suppression in industrial environments

	Limit class according to EN 61800-3
Conducted radio interference	C3
Radio interference	C3

Note

The user must consider interference radiation for the complete system. Particular attention should be paid to cabling. Please contact your sales representative for assistance and support.

If compliance with limit value class C2 is required, please contact your local Siemens sales partner.

Literature:

Please see the relevant SINAMICS documentation for EMC notes on how to deal with line filters and reactors.

3.3 Recycling and disposal

Products should be disposed of corresponding to the relevant national regulations. The products described in this manual can be mostly recycled due to the fact that they contain very few damaging substances. To recycle and dispose of your old device in an environmentally friendly way, please contact an appropriate disposal company.

Installing

Installation notes

PPU modules may only be installed in housings, cabinets or in isolated electrical business establishments. Housings, cabinets, or isolated electrical business establishments may only be accessed by trained or authorized personnel.



DANGER

Risk of electric shock

The entire system must be voltage-free when mounting or wiring the SINUMERIK 828D.

Components in the control cabinet

The SINAMICS components and the axis expansion modules are installed in a control cabinet.

References

Notes for mounting components of the SINAMICS S120 product family are contained in the following manuals:

- SINAMICS S120 Booksize Power Units Manual
- SINAMICS S120 Combi Manual

For further details on the control cabinet installation, refer to:

- "Control Cabinet Integration, SINAMICS S120 Booksize / SIMODRIVE" System Manual

4.1 Mounting positions

Permitted mounting positions

The PPU is secured with special tensioning elements and tensioners in the operator panel housing. The tensioners are included in the scope of delivery.

Note

Installing the PPU

The maximum permissible tightening torque for the tensioning screws is 0.5 Nm and this value must not be exceeded.

Installation of the horizontal PPU variant

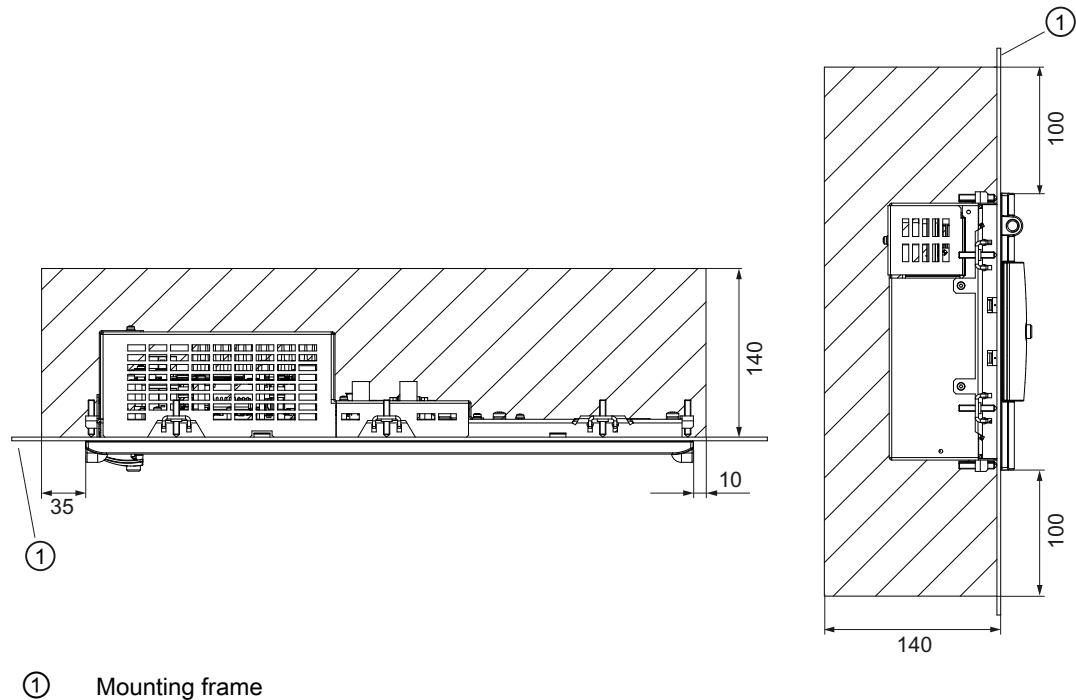


Figure 4-1 Clearance for ventilation and cables in the horizontal PPU

Panel cutout of the horizontal PPU variant

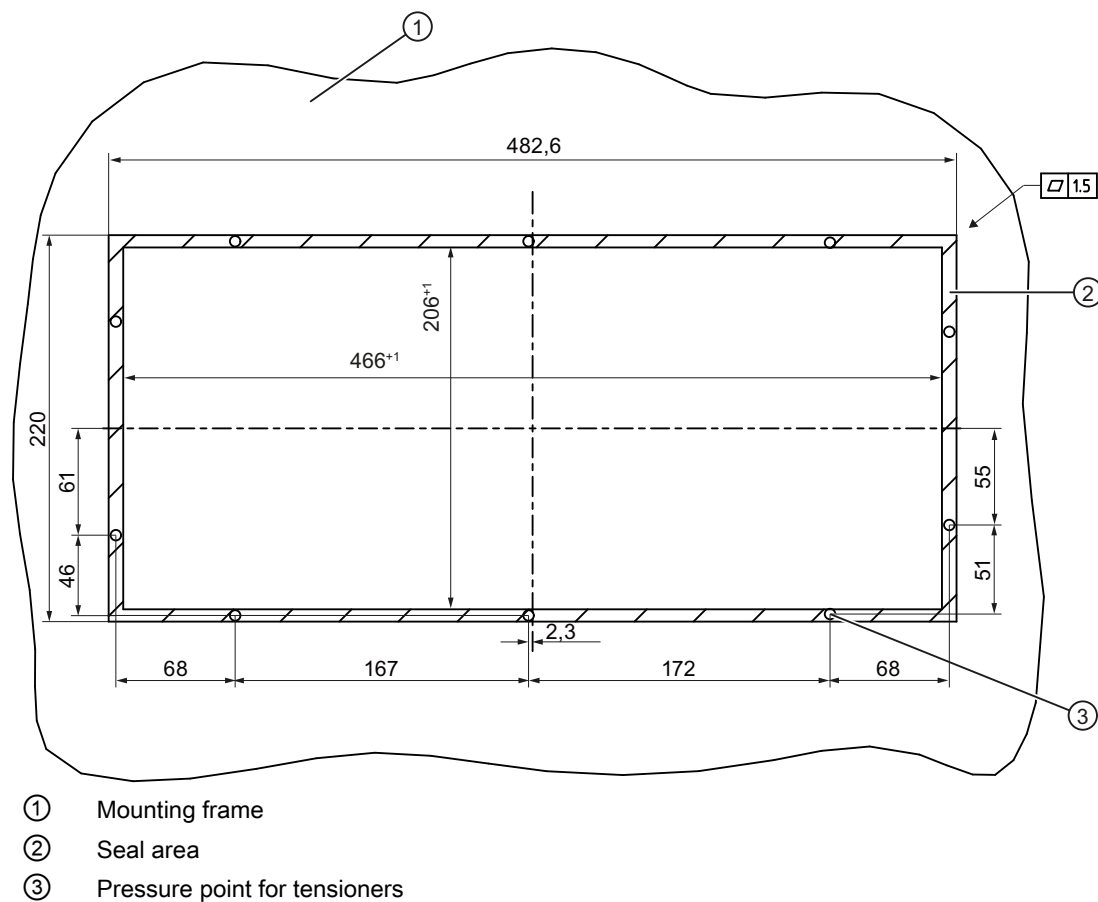
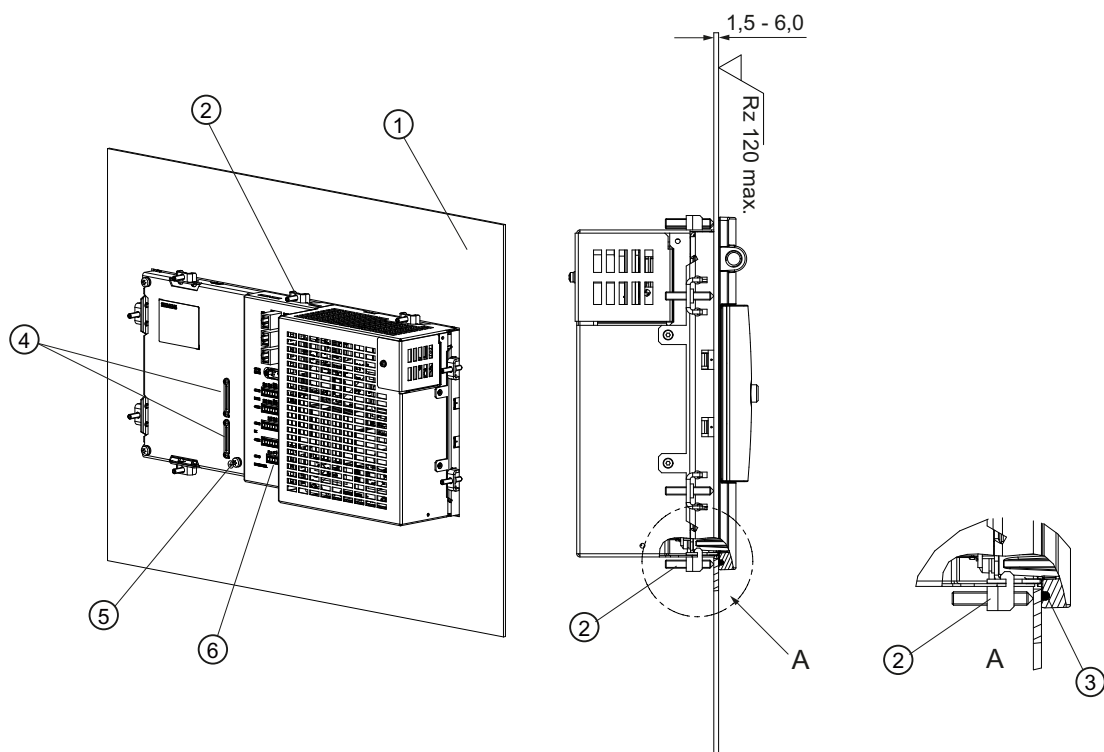


Figure 4-2 Horizontal PPU panel cutout

4.1 Mounting positions



- ① Mounting frame
- ② Tensioner (10 parts)
- ③ Seal
- ④ Shield contact
- ⑤ Grounding screw M5
- ⑥ Interfaces

Figure 4-3 Horizontal PPU mounting

Installation of the vertical PPU variant

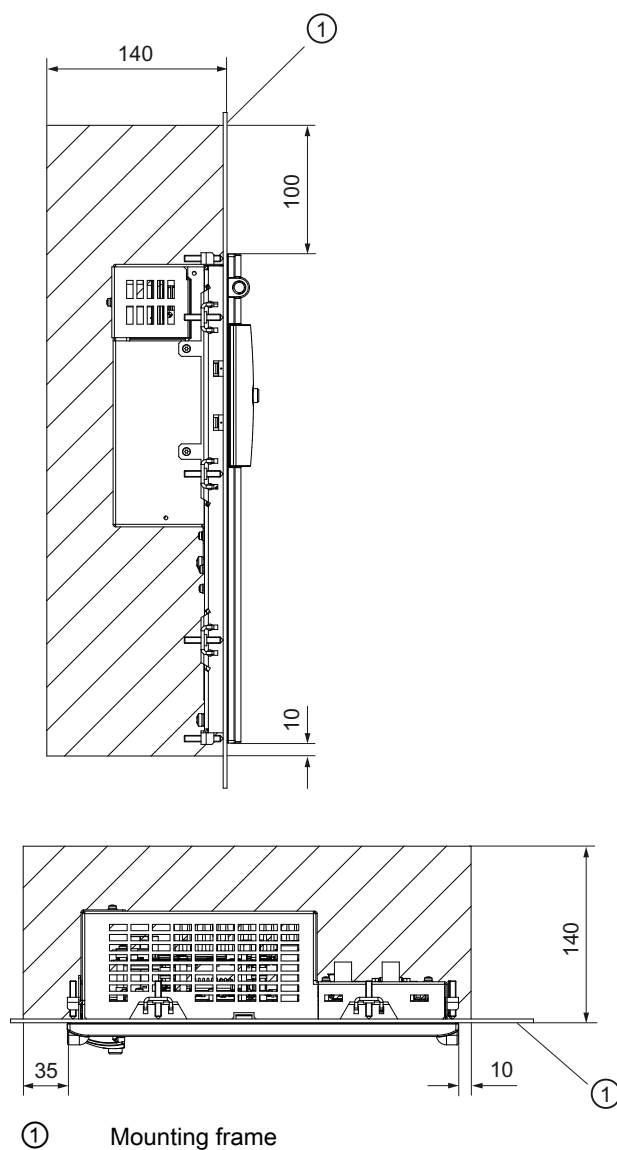


Figure 4-4 Clearance for ventilation and cables in the vertical PPU

Panel cutout of the vertical PPU variant

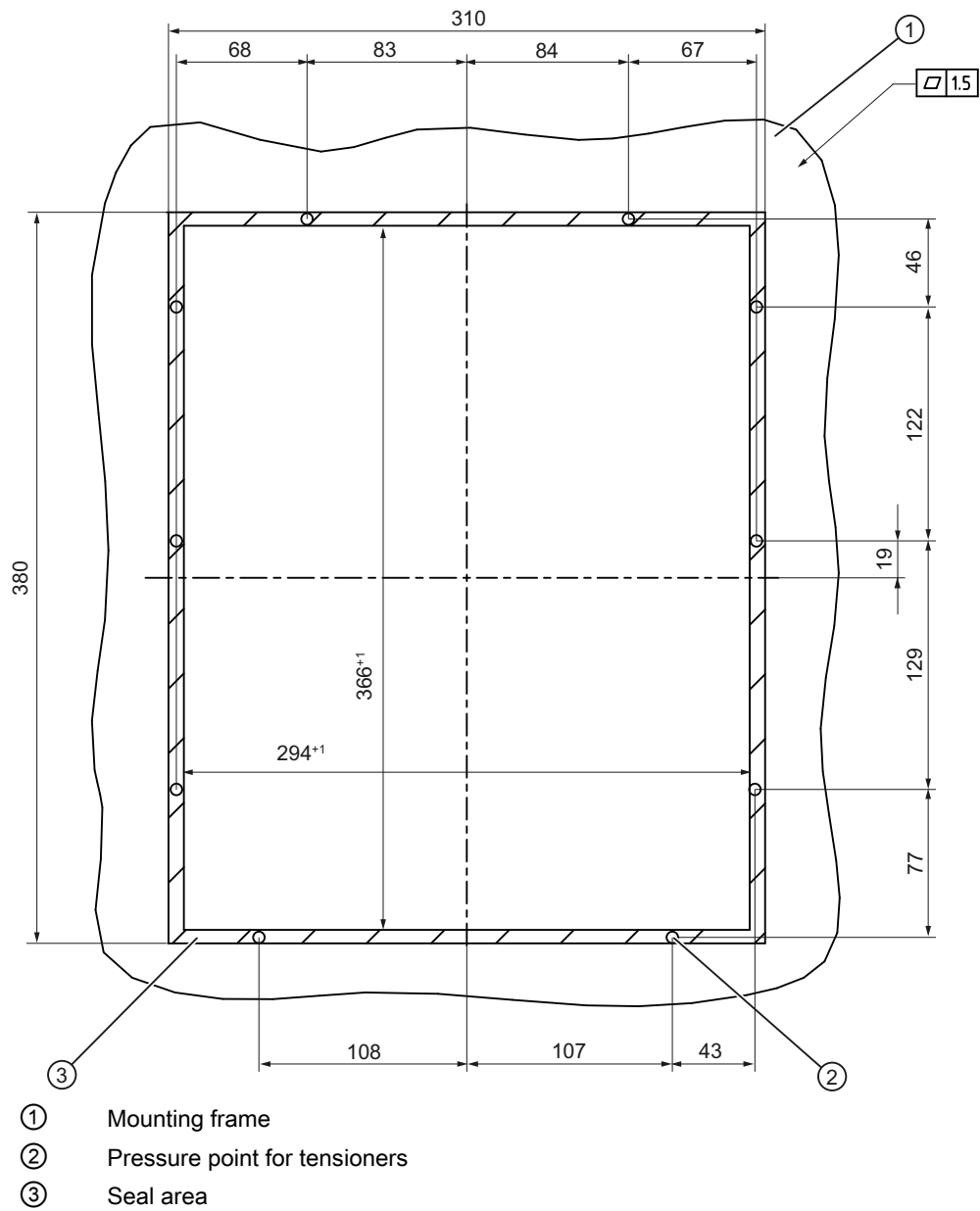


Figure 4-5 Vertical PPU panel cutout

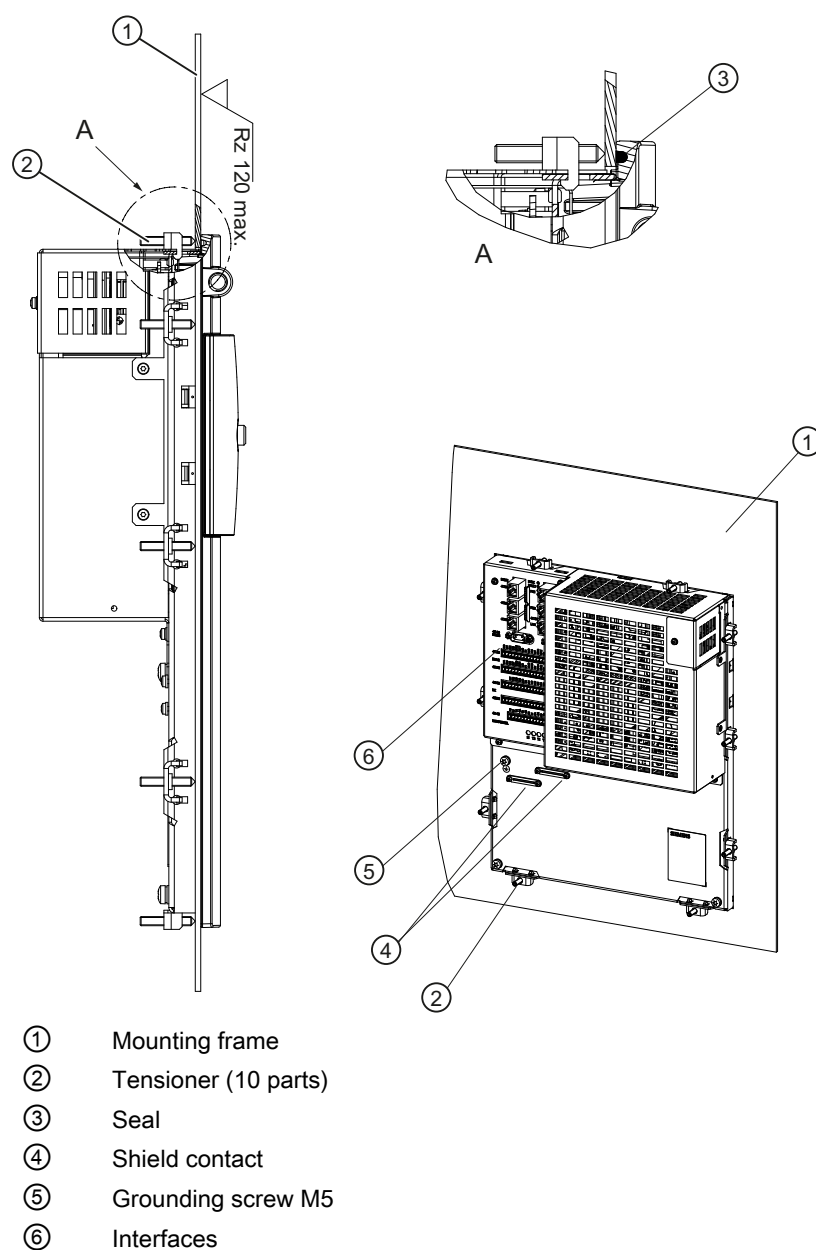


Figure 4-6 Installation of the vertical PPU variant

4.2 Dimension drawings

PPU horizontal

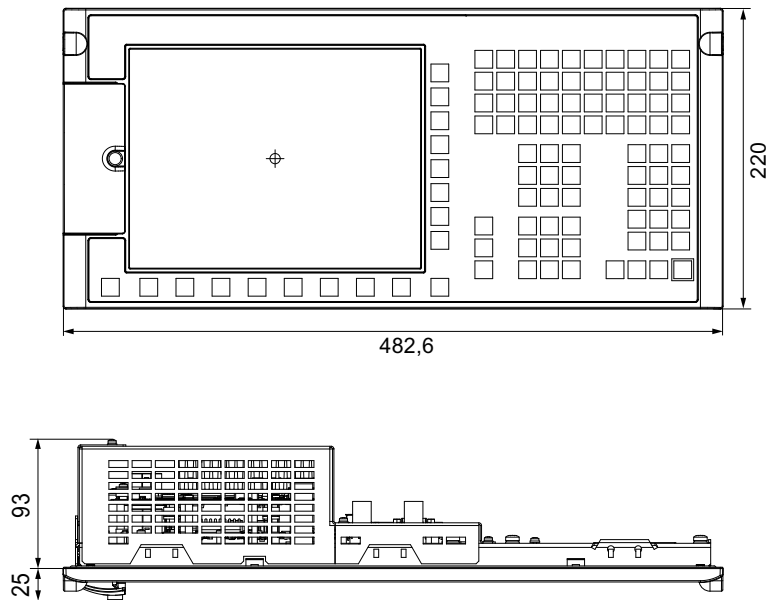


Figure 4-7 Horizontal PPU dimensioning

PPU vertical

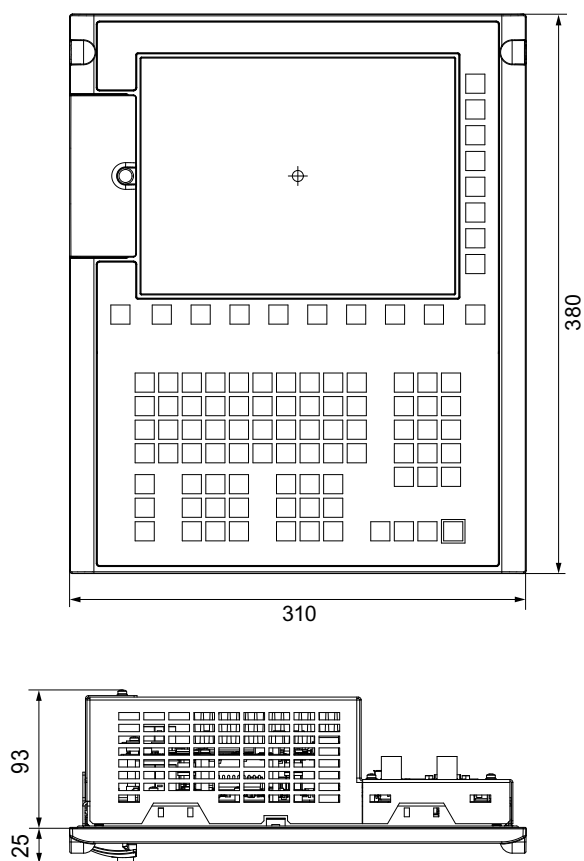


Figure 4-8 Vertical PPU dimensioning

Rules for permitted topologies

5.1 Topology rules for S120 Combi

Topology rules for DRIVE-CLiQ

There are fixed DRIVE-CLiQ topology rules for the S120 Combi. These rules must be observed. If these rules are violated, then a corresponding alarm is displayed.

Assigning the DRIVE-CLiQ interfaces

Table 5-1 Assigning the DRIVE-CLiQ interfaces on the S120 Combi

DRIVE-CLiQ interface	Connection with
X200	X100 of the PPU
X201	Motor encoder, spindle
X202	Motor encoder, feedrate 1
X203	Motor encoder, feedrate 2
X204	Motor encoder feed 3 → only for 4-axis S120 Combi Remains empty for 3-axis S120 Combi
X205	Optional: 2. direct sin/cos encoder for spindle (via SMx20) ¹⁾ Remains empty when connecting a direct TTL spindle encoder via X220

¹⁾ In this case, the TTL encoder interface X220 remains free

Table 5-2 Assigning the DRIVE-CLiQ interfaces to the SINUMERIK 828D (PPU)

DRIVE-CLiQ interface	Connection with
X100	X200 of the S120 Combi
X101	X200 of a Single Motor Module or Double Motor Module
X102	X500 of the Terminal Module TM54F X500 of the Hub Modules (DMx20) ¹⁾

¹⁾ When using a TM54F, the DMx20 is connected in series at the TM54F via the DRIVE-CLiQ interface X501

Table 5-3 Assigning the DRIVE-CLiQ interfaces of the expansion axes

DRIVE-CLiQ interface	Connection with
First Single Motor Module	
X200	X101 of the PPU
X201 ¹⁾	X200 of the second Single Motor Module
X202	Motor encoder for feedrate 1st expansion axis (via Sensor Module)

5.1 Topology rules for S120 Combi

DRIVE-CLiQ interface	Connection with
Second Single Motor Module	
X200	X201 of the first Single Motor Module
X201	Remains empty
X202	Motor encoder for feedrate 2nd expansion axis (via Sensor Module)
Double Motor Module	
X200	X101 of the PPU
X201	Remains empty
X202	Motor encoder for feedrate 1st expansion axis
X203	Motor encoder for feedrate 2nd expansion axis

¹⁾ Remains empty if only one Single Motor Module is used

Table 5-4 Assigning the DRIVE-CLiQ interfaces at the DMx20 to assign a direct measuring system to the feed axes.

DRIVE-CLiQ interface	Feed axis
X500	X501 of the TM54F X102 of the PPU (if a TM54F is not being used)
X501	Direct encoder, feedrate 1 at the S120 Combi
X502	Direct encoder, feedrate 2 at the S120 Combi
X503	Direct encoder, feedrate 3 at the S120 Combi → only for 4-axis S120 Combi Remains empty for 3-axis S120 Combi
X504	Feedrate 1st expansion axis at the Motor Module
X505	Feedrate 2nd expansion axis at the Motor Module

Table 5-5 Assigning the DRIVE-CLiQ interfaces at the TM54F

DRIVE-CLiQ interface	
X500	X102 of the control (PPU)
X501	X500 of the DMx20 If a DMx20 is not being used, then this interface remains empty.

5.2 Topology rules for S120 Booksize

Introduction

The following rules apply for wiring components with DRIVE-CLiQ. A distinction is made between **DRIVE-CLiQ rules** which must always be observed, and **recommended rules** which, when observed, do not require any subsequent changes to the topology when expansions are made.

The maximum number of DRIVE-CLiQ components and the possible wiring form depend on the following points:

- The binding DRIVE-CLiQ wiring rules
- The number and type of activated drives and functions on the respective Control Unit
- The computing power of the respective Control Unit
- The set processing and communication cycles

In addition to the binding wiring rules that must be observed, some additional recommendations as well as topology examples for DRIVE-CLiQ wiring are provided in the PPU manual.

The components used in these examples can be removed, replaced with others or supplemented. If components are replaced by another type or additional components are added, the SIZER tool should be used to check the topology.

Note

Every topology that SIZER permits can also run and is therefore correct (SINAMICS S120 D Function Manual /FH1/).

DRIVE-CLiQ rules

The wiring rules below apply to standard cycle times (servo 125 µs). For cycle times that are shorter than the corresponding standard cycle times, additional restrictions apply due to the computing power of the Control Unit.

The rules below apply on a general basis, unless limited, as a function of the firmware version.

- A maximum of eight DRIVE-CLiQ nodes can be connected in one row. A row is always seen from the perspective of the Control Unit.
This number reduces to a maximum of four DRIVE-CLiQ nodes in one row when the extended functions of drive-based Safety Integrated are configured.
- A maximum of 14 nodes can be connected to one DRIVE-CLiQ line on a Control Unit.

- Ring wiring is not permitted.
- Components must not be double-wired.

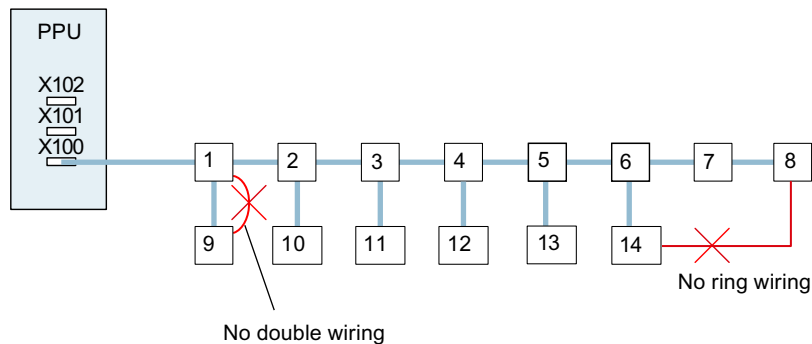


Figure 5-1 Example: DRIVE-CLiQ line at the X100 terminal (without Safety Integrated)

- The following applies to the booksize format:
 - In the servo control and vector U/f control operating modes, only one Line Module may be connected to the Control Unit. In the vector control operating mode, a maximum of three further Line Modules may be connected in parallel (i.e. a total of four Line Modules).
 - It is permissible that one Line Module and Motor Modules are connected together to one DRIVE-CLiQ line in the servo control mode.
 - One Line Module and Motor Modules must be connected to separate DRIVE-CLiQ lines in the vector control mode.
 - For booksize format, a parallel connection of Infeed Modules or Motor Modules is not possible.
- The following applies to the chassis format: Line Modules (Active Line, Basic Line, Smart Line) and Motor Modules must be connected to separate DRIVE-CLiQ lines.
- The default sampling times may be changed.
- An NX10.3 / NX15.3 must be connected to the PPU at X102.
- A maximum of 16/20 measuring systems can be connected to a PPU with NX10.3/NX15.3:
 - Example 1:** PPU with six axes with six motor measuring systems and six direct measuring systems as well as NX10.3 with two motor measuring systems and two direct measuring systems.
 - Example 2:** PPU with five axes with five motor measuring systems and five direct measuring systems as well as NX10.3 with three motor measuring systems and three direct measuring systems.
 - Example 3:** PPU with six axes with six motor measuring systems and six direct measuring systems as well as NX15.3 with four motor measuring systems and four direct measuring systems.
- Only one TM54F is permitted for each PPU and for each NX10.3/NX15.3.

- The Active Line Module Booksize and the Motor Modules Booksize can be connected to one DRIVE-CLiQ line.
- Chassis Line Module and Motor Module are connected in series.
- To allow the following modules to be assigned automatically during the commissioning (device identification), they should be connected to a free DRIVE-CLiQ port on the associated Active Line Module / Motor Module:
 - Voltage Sensing Module (VSM)
 - Terminal Module TM120

Note

If the TM120 is connected without observing this rule, the commissioning engineer must use BICO technology to assign the temperature channels to the drive.

- The sampling times (p0115[0] and p4099) of all components that are connected to a DRIVE-CLiQ line must be divisible by one another with an integer result. If the current controller sampling time on a DO has to be changed to another pattern that does not match the other DOs on the DRIVE-CLiQ line, the following options are available:
 - Reconnect the DO to a separate DRIVE-CLiQ line.
 - Also change the current controller sampling time and the sampling time of the inputs/outputs of the DO not involved so that they again fit into the time grid.

Note

A Double Motor Module, a DMC20, and a TM54F each correspond to two DRIVE-CLiQ nodes. This also applies to Double Motor Modules, of which just one drive is configured.

To enable the function "Automatic configuration" to assign the encoders to the drives, the recommended rules below must be observed.

Recommended rules:

- The DRIVE-CLiQ cable from the Control Unit must be connected as follows:
 - To X200 of the first booksize power unit
 - To X400 of the first chassis power unit
- The DRIVE-CLiQ connections between the power units must each be connected from interface X201 to X200 or from X401 to X400 on the follow-on component.

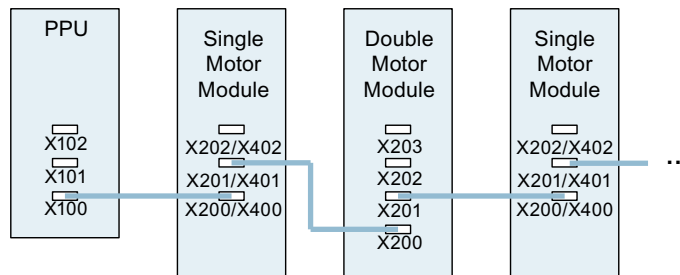


Figure 5-2 Example: DRIVE-CLiQ line

- The motor encoder must be connected to the associated power unit.

Component	Connecting the motor encoder via DRIVE-CLiQ
Single Motor Module booksize	X202
Double Motor Module booksize	• Motor connection X1: Encoder at X202 • Motor connection X2: Encoder at X203
Single Motor Module chassis	X402
Power Module chassis	X402

Note

If an additional encoder is connected to a Motor Module, it is assigned to this drive as encoder 2 in the automatic configuration. At a Double Motor Module, an encoder at X201 is assigned to the 2nd feedrate as 2nd measuring system.

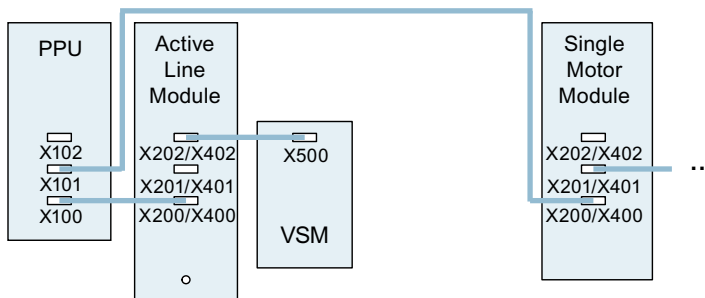


Figure 5-3 Example: Topology with VSM for booksize and chassis components

Component	VSM connection
Active Line Module booksize	X202
Active Line Module (chassis)	X402
Power Modules	The VSM is not supported.

5.3 Topology rules for Safety Integrated functions

Number of axes	Port 1 at the PPU X100	Port 2 at the PPU X101	Port 3 at the PPU X102	Example in the figure:
<i>SINAMICS S120 booksize</i>				
5	1 x LM 4 x MoMo 1 x SMY at the 4th MoMo	1 x TM54F 1 x MoMo 1 x hub DMx 4 x SMY at the hub DMx	not used	---
6	1 x LM 4 x MoMo 1 x SMY at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMY at the hub DMx	not used	---
7	1 x LM 4 x MoMo 1 x SMY at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMY at the hub DMx	1 x NX10.3 1 x TM54F 1 x MoMo 1 x SMY at the MoMo	---
8	1 x LM 4 x MoMo 1 x SMY at the 4th MoMo	1 x TM54F 1 x MoMo 1 x hub DMx 4 x SMY at the hub DMx	1 x NX10.3 1 x TM54F 3 x MoMo 1 x SMY at NX10.3 1 x SMY at TM54F 1 x SMY at the 3rd MoMo	Topology with SINAMICS S120 Booksize 5+3 axes (Page 65)
8	1 x LM 4 x MoMo 1 x SMY at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMY at the hub DMx	1 x NX10.3 1 x TM54F 2 x MoMo 1 x SMY at NX10.3 1 x SMY at the 2nd MoMo	Topology with SINAMICS S120 Booksize and 6+2 axes (Page 65)
10	1 x LM 4 x MoMo 1 x SMY at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMY at the hub DMx	1 x NX15.3 1 x TM54F 4 x MoMo 1 x SMY at the NX15.3 3 x SMY at the hub DMx	Topology with SINAMICS S120 Booksize and 6+4 axes (Page 65)
<i>SINAMICS S120 Combi</i>				
3	3x Combi 1xSMY at the Combi	not used	1 x TM54F 1 x hub DMx 2 x SMY at the hub DMx	---
4	3x Combi 1xSMY at the Combi	1 x booksize compact	1 x TM54F 1 x hub DMx 3 x SMY at the hub DMx	---
4	4x Combi 1xSMY at the Combi	not used	1 x TM54F 1 x hub DMx 3 x SMY at the hub DMx	---
5	4x Combi 1xSMY at the Combi	1 x booksize compact	1 x TM54F 1 x hub DMx 4 x SMY at the hub DMx	---
6	4x Combi 1xSMY at the Combi	2 x booksize compact	1 x TM54F 1 x hub DMx 5 x SMY at the hub DMx	---

5.4 Topology example without Safety Integrated functions

Note

These wiring examples are valid using the standard clock cycle setting and do not take into account any Safety Integrated functions.

For further notes on Safety Integrated functions, see the SINAMICS S120 Safety Integrated Function Manual.

Topology for the maximum configuration with SINAMICS S120 booksize and 6 axes

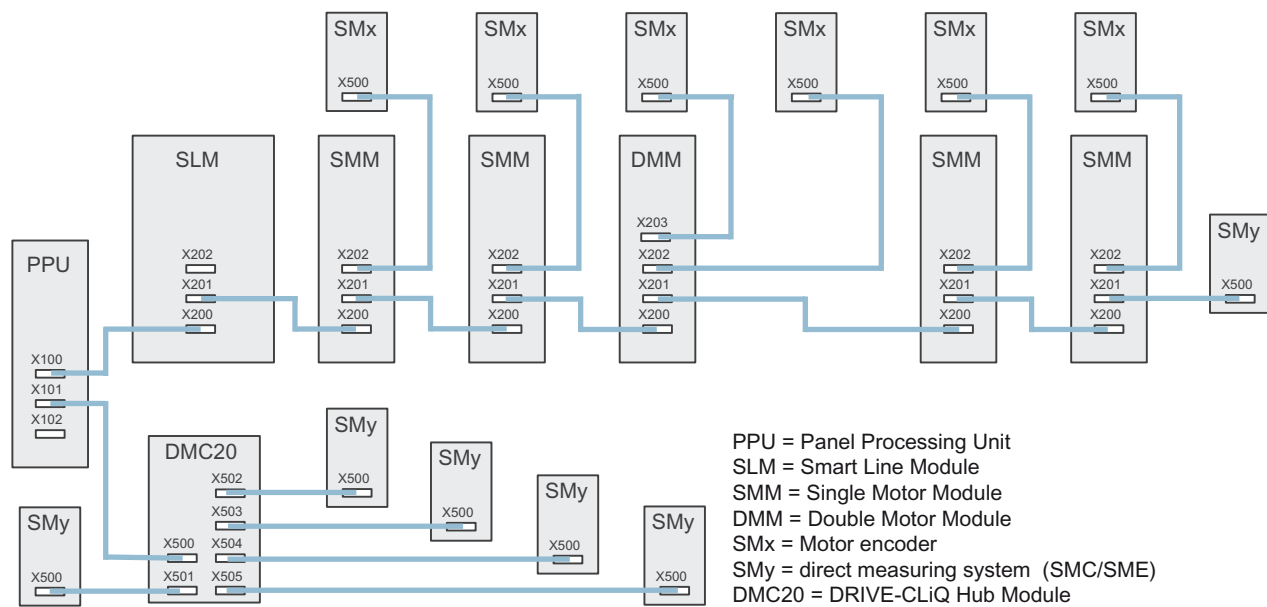


Figure 5-4 DRIVE-CLiQ wiring without NX

[illegible]

Figure 5-5 DRIVE-CLiQ wiring with NX10.3

Topology with SINAMICS S120 chassis and SINAMICS S120 booksize and 8 axes

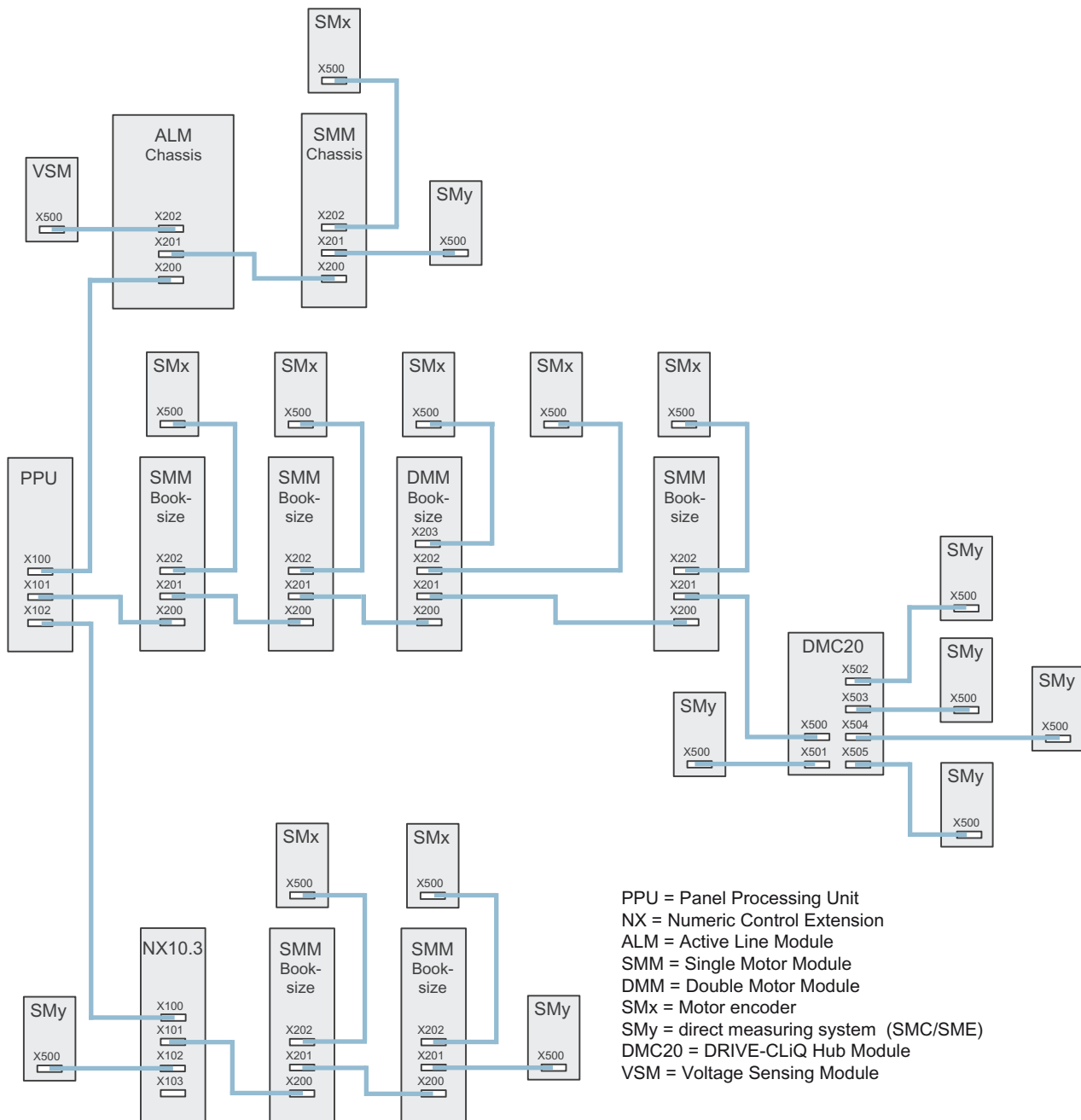


Figure 5-6 DRIVE-CLiQ wiring with NX10.3

5.5 Topology example with Safety Integrated functions

Note

Additional notes on Safety Integrated functions are available under:
SINAMICS S120 Safety Integrated Function Manual.

Topology with SINAMICS S120 booksize and 6 plus 2 axes

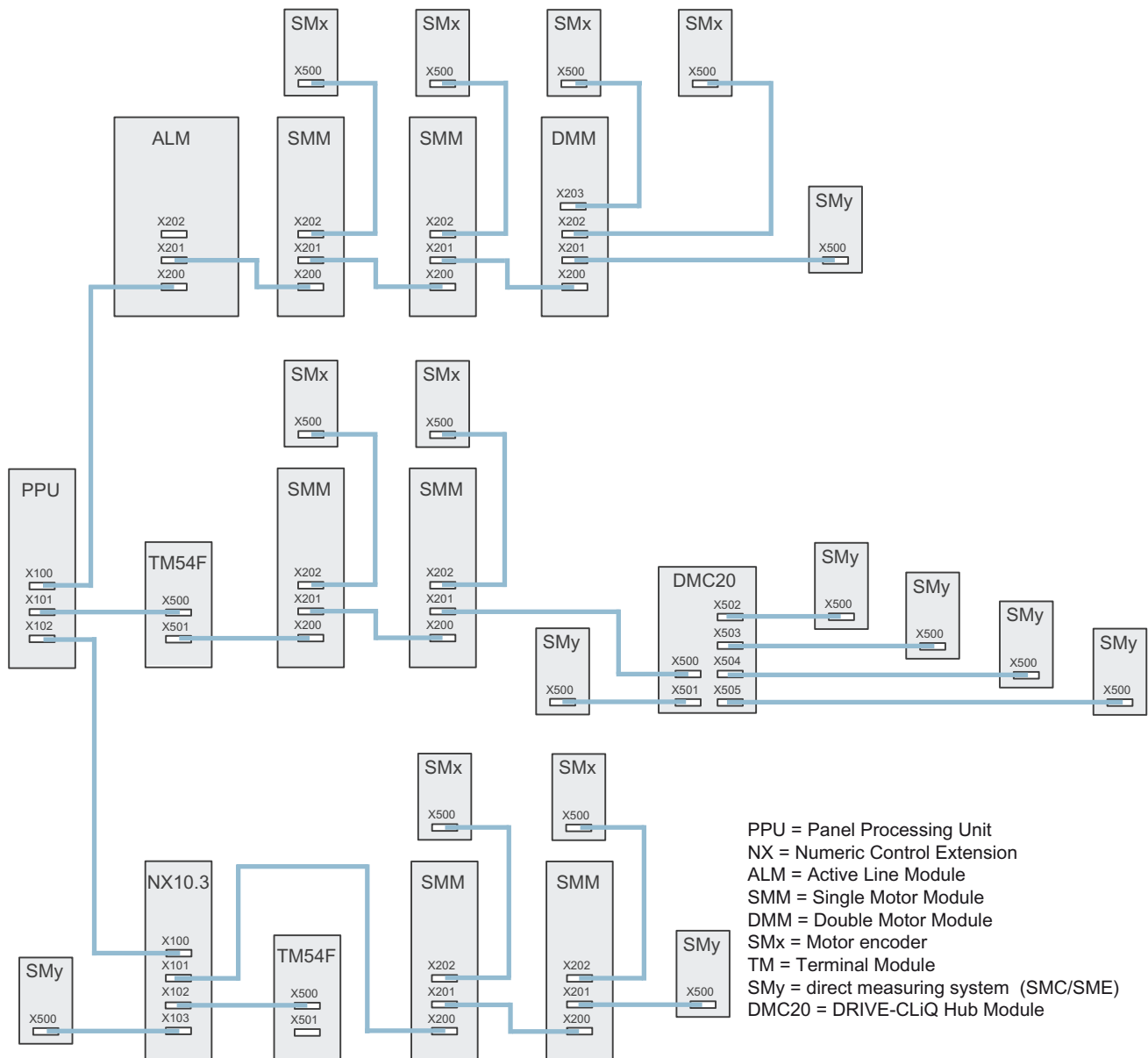


Figure 5-7 DRIVE-CLiQ wiring with Safety Integrated functions and NX10.3

Topology with SINAMICS S120 booksize and 5 plus 3 axes

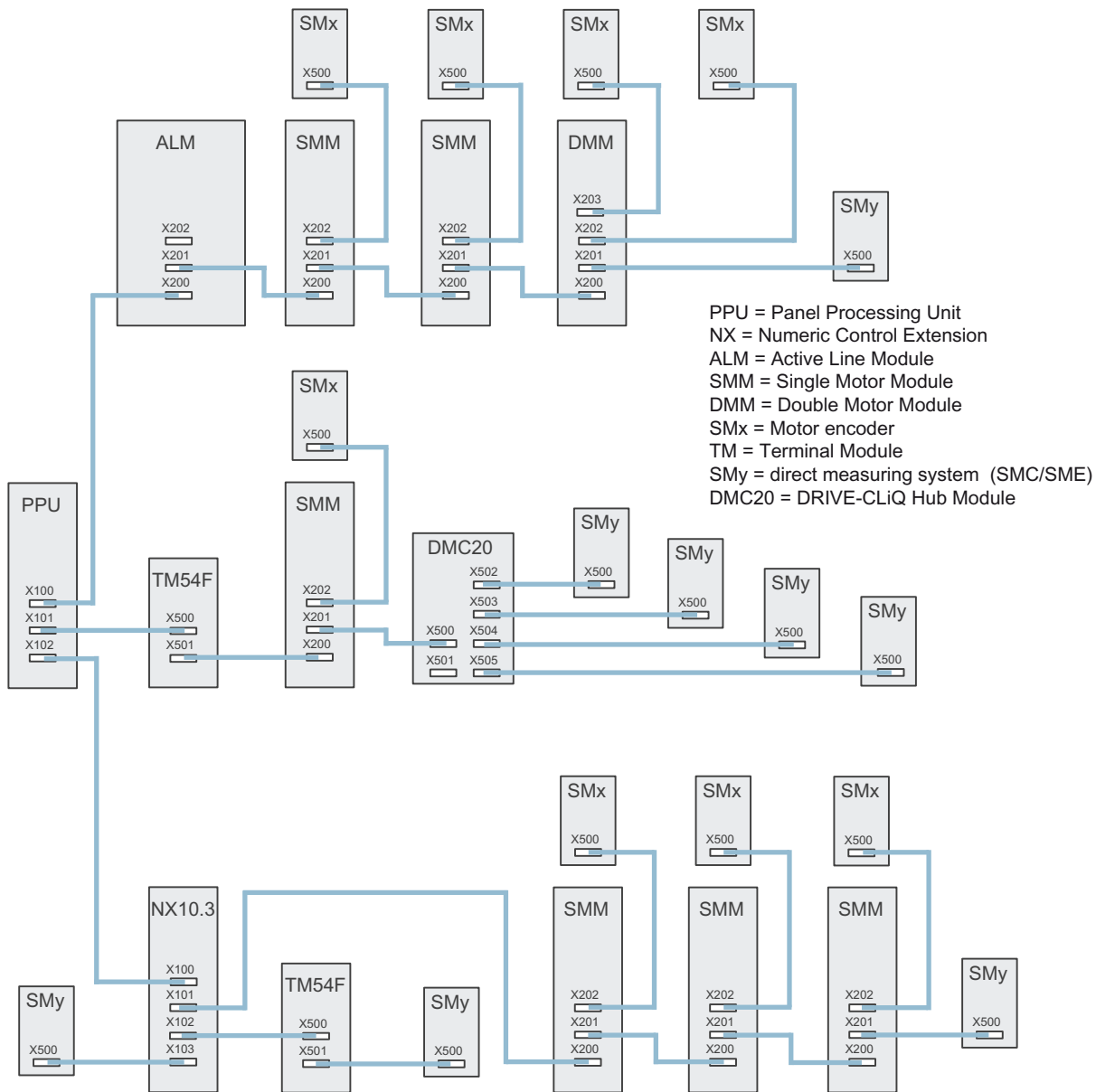


Figure 5-8 DRIVE-CLiQ wiring with Safety Integrated functions and NX10.3

Topology with SINAMICS S120 booksize and 6 plus 4 axes

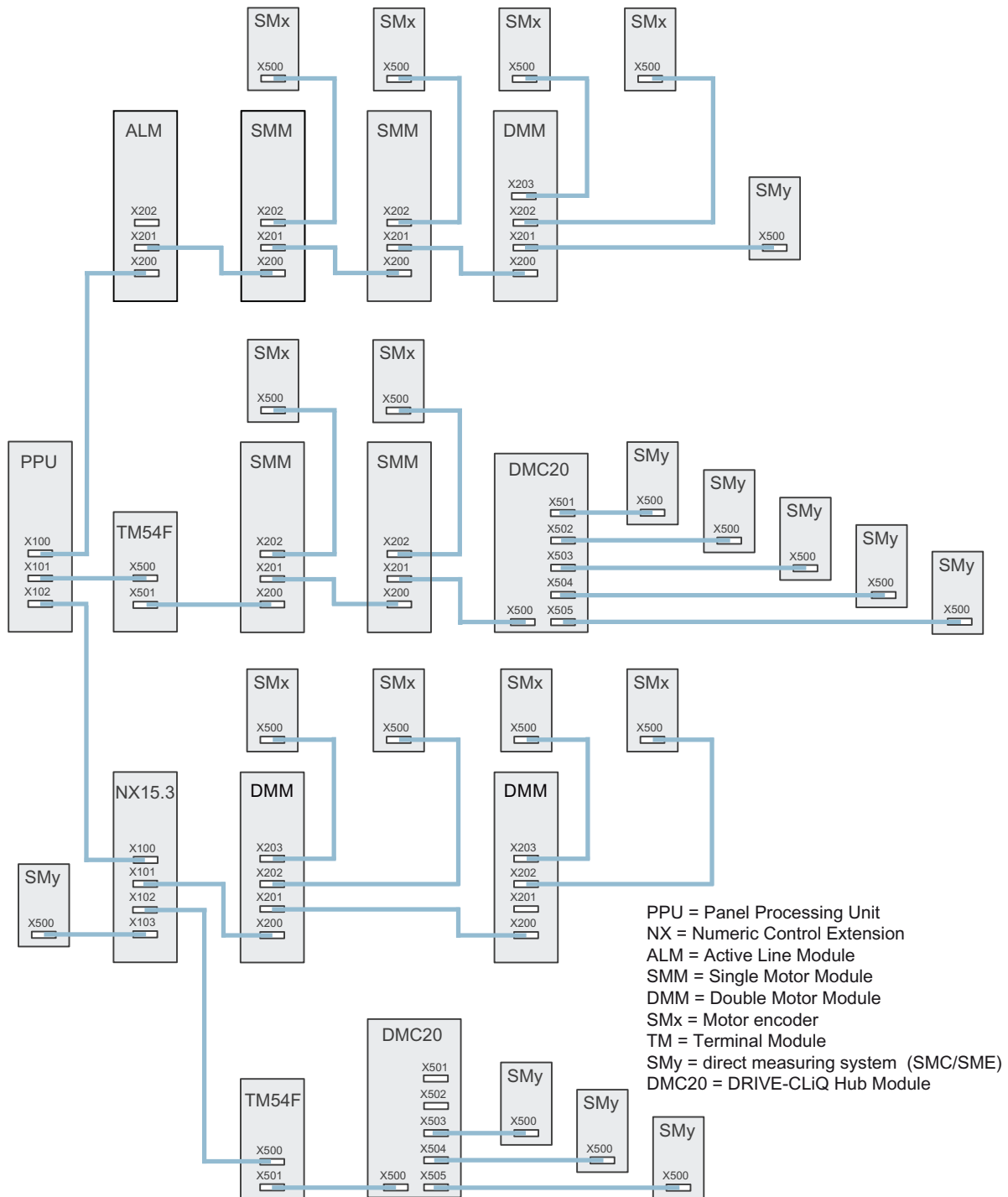


Figure 5-9 DRIVE-CLiQ wiring with Safety Integrated functions and NX15.3

Note

Please note the following conditions for the examples below:

1. Chassis Line Modules must be based on a DAC-ASIC
2. With Safety Integrated functions
3. Standard cycles: $T_{ireg}/T_{nreg} = 125 \mu s$, $LM = 250 \mu s$, monitoring cycle = 12 ms, $T_{dp} = 1.5$ ms

Topology with SINAMICS S120 chassis and SINAMICS S120 booksize and 6 axes

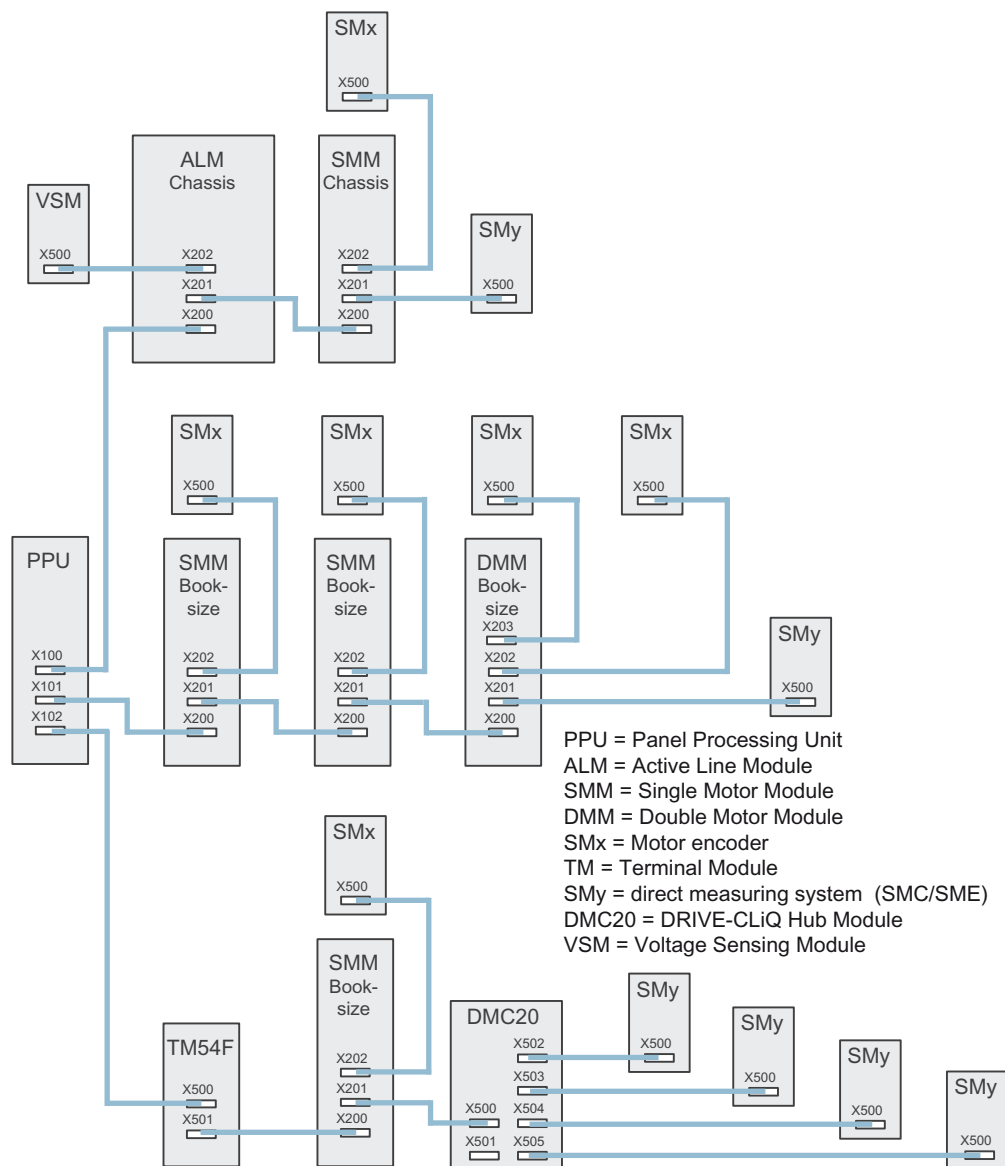


Figure 5-10 DRIVE-CLiQ wiring with Safety Integrated functions and without NX

Topology with SINAMICS S120 chassis and SINAMICS S120 booksize and 8 axes

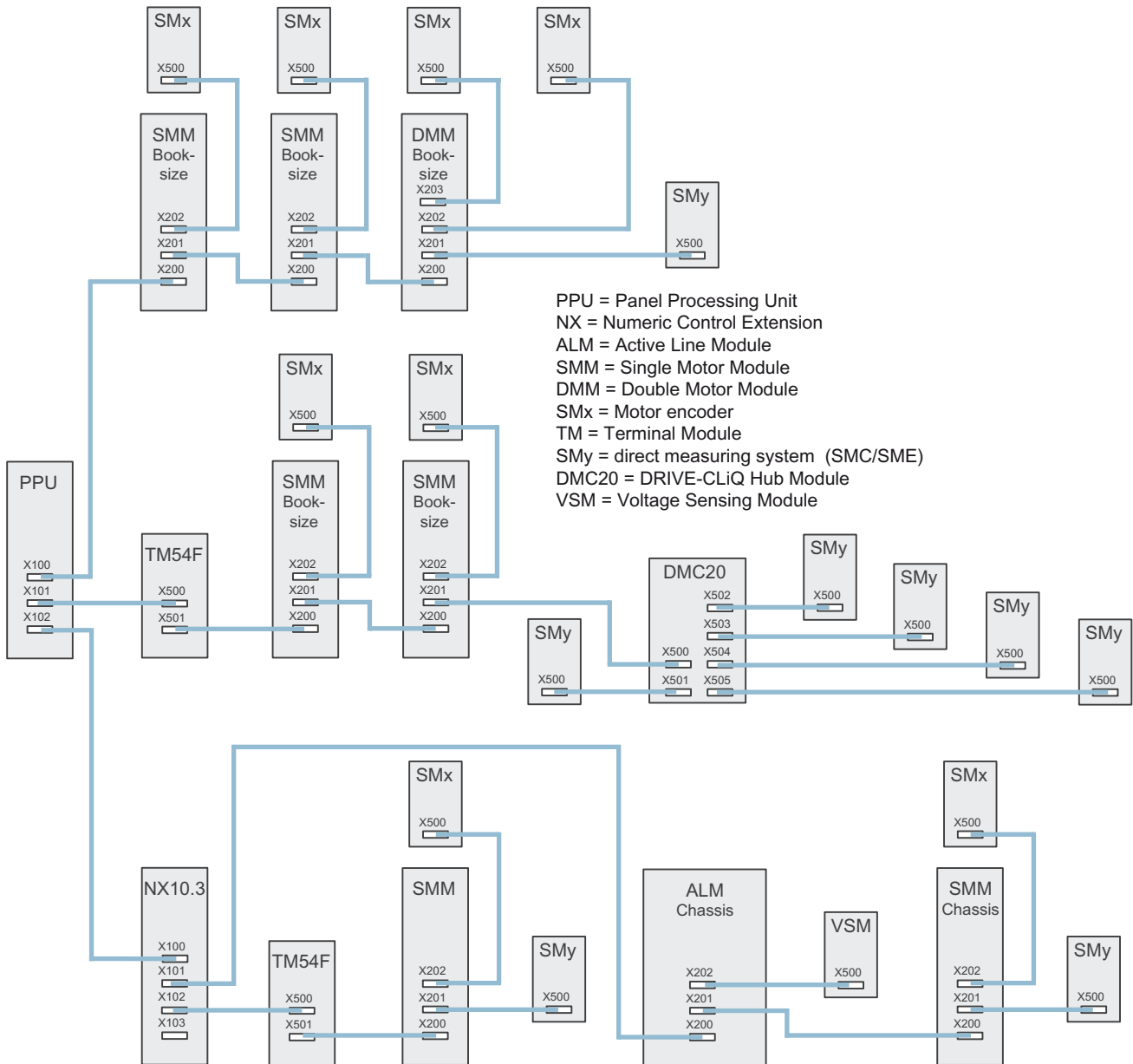


Figure 5-11 Example with Safety Integrated functions and with NX10.3

Note

You can find an example with SINAMICS S120 Combi and Safety Integrated functions under Controller features (Page 17) or in the SINAMICS S120 Combi Manual.

Interface description

6.1 Interface overview

Requirement

 DANGER
Risk of electric shock
Before you mount the SINUMERIK 828D or cable it, the complete system must be in a no-voltage condition.

Definition

The abbreviations used in "Signal type" column in the tables showing the pin assignment have the following meaning:

B	Bidirectional
GND	Grounding
I	Input
O	Output
VI	Voltage input (supply voltage)
VO	Voltage output (supply voltage)

Note

If your axis grouping contains a Smart Line Module without DRIVE-CLiQ (5 kW or 10 kW), you must assign the Smart Line Module enabling signal to the X122.1 digital input on the PPU.

Connection options

The following overview shows the interfaces and their connection options:

SINUMERIK 828D PPU 240.3/PPU 241.3 PPU 260.3/PPU 261.3 PPU 280.3/PPU 281.3	Article number		Terminal Module
	Prefabricated cable		TM54F
	DRIVE-CLiQ cable		SINAMICS S120
DRIVE-CLiQ	X100 X101 X102	See MOTION-CONNECT (see catalog NC 61) ≤ 50 m	NX10.3/NX15.3 ¹⁾
Digital I Digital I/O	X122 X132 X242 X252	≤ 30 m	Drive: 12 digital inputs 8 digital inputs/outputs NC: 8 digital inputs 8 digital outputs
24 VDC	X1	≤ 10 m	Power supply
Ethernet OP front	X127	Ethernet cable ≤ 100 m	Programming device, PC
			Remote diagnostics router
Ethernet PPU rear	X130	Ethernet cable ≤ 100 m	Factory network
RS232C	X140	6NH7701-5AN (Length: 2.5 m) ≤ 3 m	Only GSM/GPRS modem MODEM MD720
PLC I/O Port 1 Port 2 ²⁾	X120 X120	6SL3060-4A..0-0AA0 (in fixed lengths) 6FX2002-1DC00-1..0 (by the meter) ≤ 70 m	SINUMERIK MCP 310C PN/ MCP 483C PN/ MCP interface PN
			SINUMERIK I/O module PP 72/48D PN/ PP 72/48D 2/2A PN
Handwheels	X143	6FX8002-2BB01-1A.. ≤ 3 m	SIMATIC DP PN/PN coupler
			Electronic handwheel (up to 2)
USB OP front	X125	USB cable ≤ 3 m	USB storage medium
USB PPU rear	X135	USB cable ≤ 3 m	USB storage medium
CF card OP front			

¹⁾ NX10.3 only for PPU 26x.3 and PPU 28x.3; NX15.3 only for PPU 28x.3

²⁾ Not for PPU 240.3/PPU 241.3

6.2 Power supply connection

6.2.1 Requirements for the power supply

Pin assignment at X1 screw-type terminal block

Table 6-1 Pin assignment

Pin	Signal name	Signal type	Meaning
1	P24	VI	24 VDC power supply
2	M	VO	Ground
3	PE	GND	Protective ground

Requirements of DC power supplies

Interface X1 is intended exclusively for the connection of the external 24 V power supply, e.g.

- SITOP (stabilized 24 V power supplies)
- CSM (Control Supply Module)

The following power consumption values for the PPU provide a configuration basis for calculating the 24 VDC power supply.

Table 6-2 Input voltage specification

Parameter	Values
Typ. power consumption ¹⁾	1.2 A
Max. power consumption ²⁾	2.5 A
Max. starting current	4.4 A

¹⁾ PPU only (processor, memory, etc.)

²⁾ PPU with full load (USB, handwheels)

 DANGER
Risk of lightning strike In the case of supply lines > 10 m, protectors must be installed at the device input in order to protect against lightning (surge). The DC power supply must be connected to the ground/shield of the control unit for EMC and/or functional reasons. For EMC reasons, this connection should only be made at one point. As a rule, the connection is provided as standard in the PLC I/Os. If this is not the case in exceptional circumstances, the ground connection should be made on the grounding rail of the control cabinet. See also: "EMC Installation Guideline" Configuration Manual

6.2 Power supply connection

Table 6-3 Technical data of the DC power supply

Rated voltage	According to EN 61131-2	24 V DC
	Voltage range (mean value)	20.4 VDC to 28.8 V DC
	Voltage range (dynamic)	18.5 to 30.2 V DC
	Voltage ripple peak-to-peak	5% (unfiltered 6-pulse rectification)
	Booting time at POWER ON	Any
Non-periodic overvoltages		≤ 35 V
	Duration of overvoltage	≤ 500 ms
	Recovery time	≥ 50 s
	Events per hour	≤ 10
Transient voltage interruptions	Idle time	≤ 3 ms
	Recovery time	≥ 10 s
	Events per hour	≤ 10

6.2.2 Connecting the power supply

Cable specification

 DANGER
Protective separation
The 24 V direct voltage must be configured as an extra-low-voltage with protective separation - DVC A or PELV.

The required 24 VDC load power supply is wired to the screw-type terminal block (X1).

Use flexible cables with a cross-section of 0.25 to 2.5 mm² (or AWG 23 to AWG 13) for wiring the power supply according to the maximum occurring current.

If you only use one wire per connection, a ferrule is not required. The following wire-end ferrules are permissible: Without an insulating collar in accordance with DIN 46228, Form A, long version

Table 6-4 Cable specification for X1

Features	Version
Connection option	Up to 2.5 mm ²
Current carrying capacity	max. 10 A
Max. cable length	10 m

6.3 Ethernet

X130, X127 pin assignment

Pin	Signal name	Signal type	Meaning
1	TX+	O	Transmit data +
2	TX-	O	Transmit data -
3	RX+	I	Receive data +
4	NC	-	
5	NC	-	
6	RX-	I	Receive data -
7	NC	-	
8	NC	-	

Use

The interfaces are designed for operation in full-duplex mode; in other words, the ports can be used for the sending as well as for the receiving of data packets. The ports are connected as an Ethernet terminal with 10/100 Mbit:

- X130 connects the PPU to the plant network.
 - The IP address can be freely selected.
 - MAC address, see also: Type plate (Page 26).
- X127 is used to connect the following components:
 - PG/PC via peer-to-peer with permanently assigned IP address 192,168,215 .1, for example, for the commissioning software, RCS Commander
 - Modem for remote diagnostics

LED status displays

For diagnostic purposes, the RJ45 sockets are each equipped with a green and a yellow LED. This allows the following status information about the respective Ethernet port to be displayed:

Table 6-5 LED status displays

LEDs	Status	Meaning
Green	Lit	10 or 100 Mbit link available
	Off	Missing or faulty link
Yellow	Lit	Receive or transmit activity
	Off	No activity

6.3 Ethernet

Cable specification for X130 and X127

Feature	Version
Connector type	RJ45 socket with 180° cable outlet
Cable type	Industrial Ethernet cable (CAT5)
Max. cable length	100 m

Note

The X127 interface does not support auto crossing. If the Ethernet port of the connected PC or modem does not support auto-crossing, a crossed Ethernet cable must be used.

6.4 PLC I/O Interface based on PROFINET

Pin assignment PN1, PN2

Pin	Signal name	Signal type	Meaning
1	TX+	O	Transmit data +
2	TX-	O	Transmit data -
3	RX+	I	Receive data +
4	N.C.	-	Not assigned
5	N.C.	-	Not assigned
6	RX-	I	Receive data -
7	N.C.	-	Not assigned
8	N.C.	-	Not assigned

The interfaces have the following properties:

- The interfaces are designed for full-duplex mode; in other words, the ports can both transmit and receive.
- The two 100 Mbit Ethernet ports and the internal Ethernet controller are connected to an integrated 3-port switch. The MAC address of the Ethernet controller is stamped on the type plate.

Wiring the PLC I/O Interface

Interfaces PN1 and PN2 can be used to establish the PLC I/O Interface communication network, which is based on PROFINET IO:

- To connect a machine control panel (MCP 310C PN, MCP 483C PN or MCP Interface PN)
- To connect to the PLC I/Os

Note

The PPU has one MAC address for both PLC I/O Interface ports that is the printed on the type plate of the PPU, see section "Type plate (Page 26)". The same applies for the MAC addresses of the operator components.

When connecting I/O devices (I/O modules, machine control panel) to the I/O Controller (PPU), please use the pre-assembled SINAMICS S120 DRIVE-CLiQ signal cables; from a technical point of view, these are also suitable for use with PLC I/O Interface.

- Article number: 6FX2002-1DC00-1□□0
- Max. cable length: 70 m

LED displays on the rear

For diagnostic purposes, the RJ45 sockets are each equipped with a green and a yellow LED. This allows the following information on the respective port to be displayed:

Name	Color	Status	Meaning
Link	Green	Lit	100 Mbit link available
		Off	Missing or faulty link
Activity	Yellow	Lit	Sending or receiving
		Off	No activity

Next to the PN1 port there are two status LEDs (Fault, Sync) that apply to both ports:

Name	Color	Status	Meaning
Fault	Red	Off	For the 828D, all possible I/O modules, machine control panels and PN/PN couplers are connected. This is the reason why this status is not relevant for diagnostics.
		Red	Bus fault: • No physical connection to a subnet/switch • Incorrect transmission rate • Full duplex transmission is not activated
		Flashing red (2 Hz)	For the 828D, this is a normal state and does not represent incorrect behavior.
Sync	Green	Off	The SINUMERIK 828D task system is not synchronized to the send cycle of PLC I/O Interface. An internal substitute clock of the same size as the send clock is generated.
		Green	The SINUMERIK 828D task system has been synchronized to the cycle for PLC I/O Interface, and data exchange is running.
		Flashing green (0.5 Hz)	The SINUMERIK 828D task system has been synchronized to the cycle for PLC I/O Interface, and cyclic data exchange is running.

LED displays on the front

The three LEDs located behind the front flap at the front of the PPU have the following significance:

Name	Color	Status	Meaning
RDY	Green	Lights up	NC Ready and PLC in run mode.
	Yellow	Lights up	PLC in stop mode
		Flashing	Power-up
	Red	Lights up	NC in stop mode: • When booting, if NC Ready is not yet available • Critical fault (power off/on necessary)

Name	Color	Status	Meaning
NC	Yellow	Cyclic flashing	NC operation
CF	Yellow	Lights up	Accessing the CompactFlash card.

NOTICE**CompactFlash card**

If the LED is lit, the CompactFlash card must not be removed!

Non-compliance can result in damage to the CompactFlash card.

6.5 Digital inputs/outputs

Pin assignment for X122

Pin		Signal name	Meaning
1	DI0	DI0	Digital input 0
2	DI1	DI1	Digital input 1
3	DI2	DI2	Digital input 2
4	DI3	DI3	Digital input 3
5	DI16	DI16	Digital input 16
6	DI17	DI17	Digital input 17
7	M2	MEXT2	Ground for pins 1...6
8	P1	P24EXT1	+24 V power supply
9	IO8	DI/DO8	Digital input/output 8
10	IO9	DI/DO9	Digital input/output 9
11	M1	MEXT1	Ground for pins 9, 10, 12, 13
12	IO10	DI/DO10	Digital input/output 10
13	IO11	DI/DO11	Digital input/output 11
14	M1	MEXT1	Ground for pins 9, 10, 12, 13

X132 pin assignment

Pin		Signal name	Meaning
1	DI4	DI4	Digital input 4
2	DI5	DI5	Digital input 5
3	DI6	DI6	Digital input 6
4	DI7	DI7	Digital input 7
5	DI20	DI20	Digital input 20
6	DI21	DI21	Digital input 21
7	M2	MEXT2	Ground for pins 1...6
8	P1	P24EXT1	+24 V power supply
9	IO12	DI/DO12	Digital input/output 12
10	IO13	DI/DO13	Digital input/output 13
11	M1	MEXT1	Ground for pins 9, 10, 12, 13
12	IO14	DI/DO14	Digital input/output 14
13	IO15	DI/DO15	Digital input/output 15
14	M1	MEXT1	Ground for pins 9, 10, 12, 13

Connection notes

1. Recommended connection:

If both inputs and outputs are operated on a digital inputs/outputs group, it is recommended that both the inputs and the outputs are fed with the same 24 VDC supply:

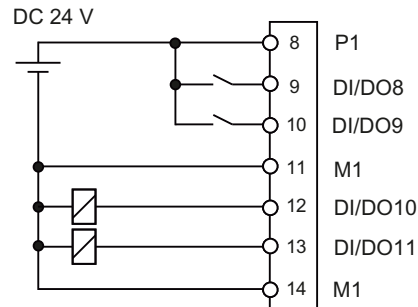


Figure 6-1 Inputs and outputs on the same supply

2. Not recommended connection:

If the inputs and outputs supplied separately with power, the input current can exceed the permissible value of 15 mA according to EN61131-2. This may possibly cause the signal source to be overloaded:

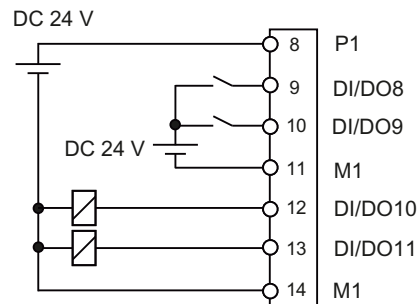


Figure 6-2 Inputs and outputs on different supplies

X242 pin assignment

Pin		Signal name	NC variable	Meaning
1	Not connected			
2	Not connected			
3	IN1	DIN1	\$A_IN[1]	Digital NC input 1
4	IN2	DIN2	\$A_IN[2]	Digital NC input 2
5	IN3	DIN3	\$A_IN[3]	Digital NC input 3
6	IN4	DIN4	\$A_IN[4]	Digital NC input 4
7	M4	MEXT4		Ground for pins 3...6
8	P3	P24EXT3		+24 V power supply
9	O1	DOUT1	\$A_OUT[1]	Digital NC output 1
10	O2	DOUT2	\$A_OUT[2]	Digital NC output 2

Pin		Signal name	NC variable	Meaning
11	M3	MEXT3		Ground for pins 9, 10, 12, 13
12	O3	DOUT3	\$A_OUT[3]	Digital NC output 3
13	O4	DOUT4	\$A_OUT[4]	Digital NC output 4
14	M3	MEXT3		Ground for pins 9, 10, 12, 13

X252 pin assignment

Pin		Signal name	NC variable	Meaning
1	AO	AOUT		Analog output (voltage for analog spindle)
2	AM	AGND		Analog ground
3	IN9	DIN9	\$A_IN[9]	Digital NC input 9
4	IN10	DIN10	\$A_IN[10]	Digital NC input 10
5	IN11	DIN11	\$A_IN[11]	Digital NC input 11
6	IN12	DIN12	\$A_IN[12]	Digital NC input 12
7	M4	MEXT4		Ground for pins 3...6
8	P3	P24EXT3		+24 V power supply
9	O9	DOUT9	\$A_OUT[9]	Digital NC output 9
10	O10	DOUT10	\$A_OUT[10]	Digital NC output 10
11	M3	MEXT3		Ground for pins 9, 10, 12, 13
12	O11	DOUT11	--	- Without analog spindle: Digital NC output 11 - With analog spindle: Controller release for analog spindle (in accordance with MD30134 \$MA_IS_UNIPOLAR_OUT PUT)
13	O12	DOUT12	--	- Without analog spindle: Digital NC output 12 - With analog spindle: Travel direction of the analog spindle (in accordance with MD30134 \$MA_IS_UNIPOLAR_OUT PUT)
14	M3	MEXT3		Ground for pins 9, 10, 12, 13

Use

The following assignment applies to the terminals:

- Ten signals can each be assigned to connectors X122 and X132:
 - Six digital inputs
 - Four bidirectional digital inputs/outputs

These twelve inputs and eight inputs/outputs are used for drive control.

- For the X242 connector, four inputs and four outputs are available for the NC.
- For the X252 connector, four inputs and two outputs are available for the NC.

Cable specification at X122, X132, X242 and X252

Please note the following:

- Use flexible cables with a cable cross-section of at least 0.25 mm²
- Ferrules are not required.
- You can use ferrules without an insulating collar in accordance with DIN 46228, Form A long version.
- You can connect two cables each with a cross section of 0.25 mm² in one ferrule.

Features	Version
Connection option	Up to 0.5 mm ²
Current carrying capacity	4 A max. 4 A
Max. cable length	30 m

Wiring the digital inputs/outputs

Tools required: 3.5-mm screwdriver or power screwdriver

Procedure:

1. Strip off 6 mm of cable insulation and, if necessary, press on a ferrule.
2. Wire the digital inputs of the interface for connection of the sensors.
3. Wire the digital outputs of the interface for connection of the actuators.
4. Insert the cable into the corresponding screw terminal.

References

More information about digital inputs/outputs can be found in:
Basic Functions Function Manual, "PLC for SINUMERIK 828D" (P4)

6.5.1 Terminal connection diagram

The following figure shows the terminal connection diagram for the digital inputs/outputs of a PPU.

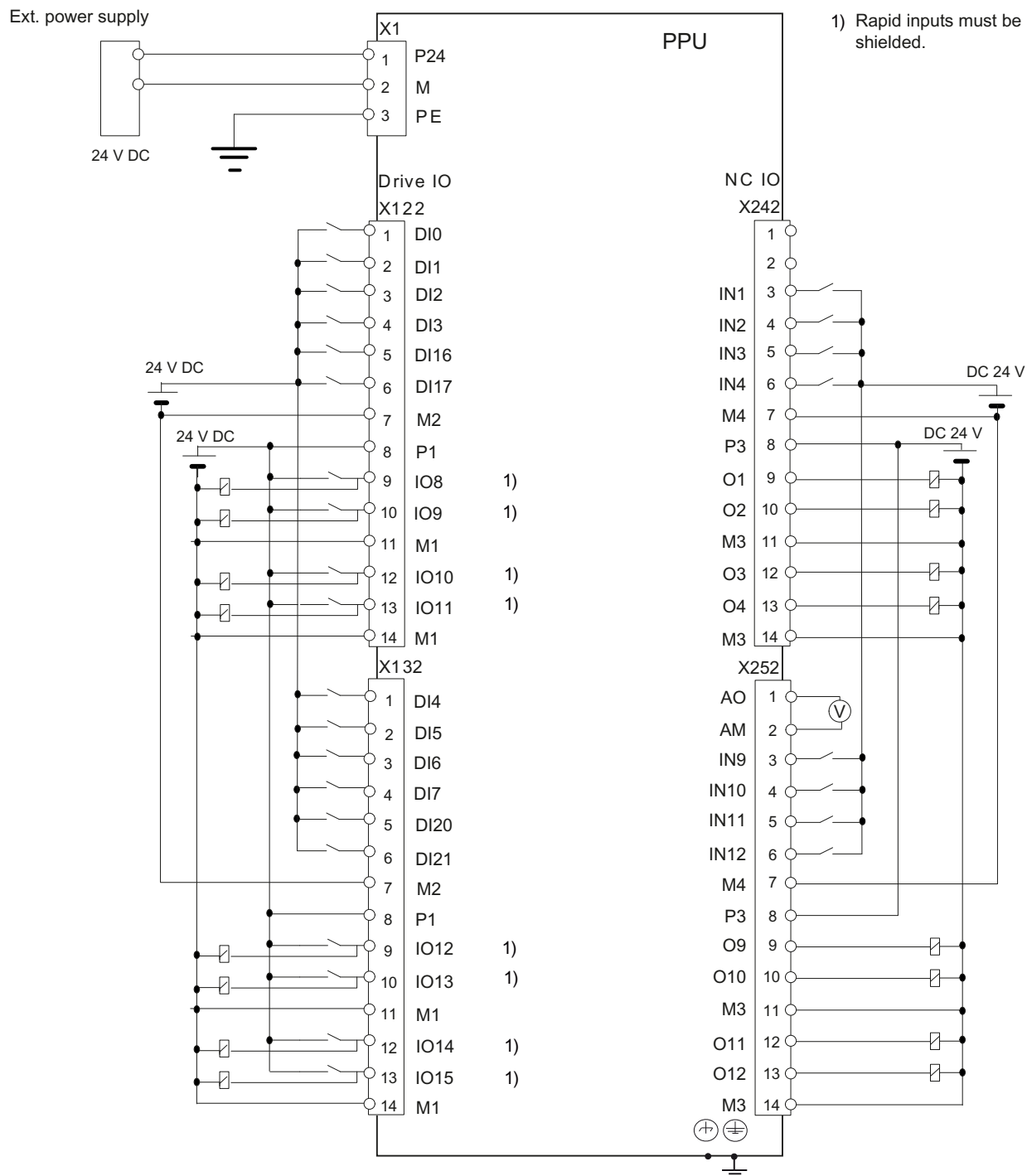


Figure 6-3 Terminal connection diagram for digital inputs/outputs

6.5.2 Example: Connecting a BERO inductive proximity switch

Supplementary conditions

The following rules must be observed when connecting a proximity switch:

- In principle, proximity switches can be connected to any input.
- Because both the DI input terminals and the parameterizable DI/DO terminals are isolated, the ground of the supply must be connected to the associated M terminal.
- When a connection is made to one of the parameterizable terminals, the positive pole of the power supply must also be connected to the associated P connection terminal.
- Each group can be supplied with its own supply that is independent of the device supply. In the simplest case, everything can be fed from a single supply. Nevertheless, all M and P terminals must be connected.

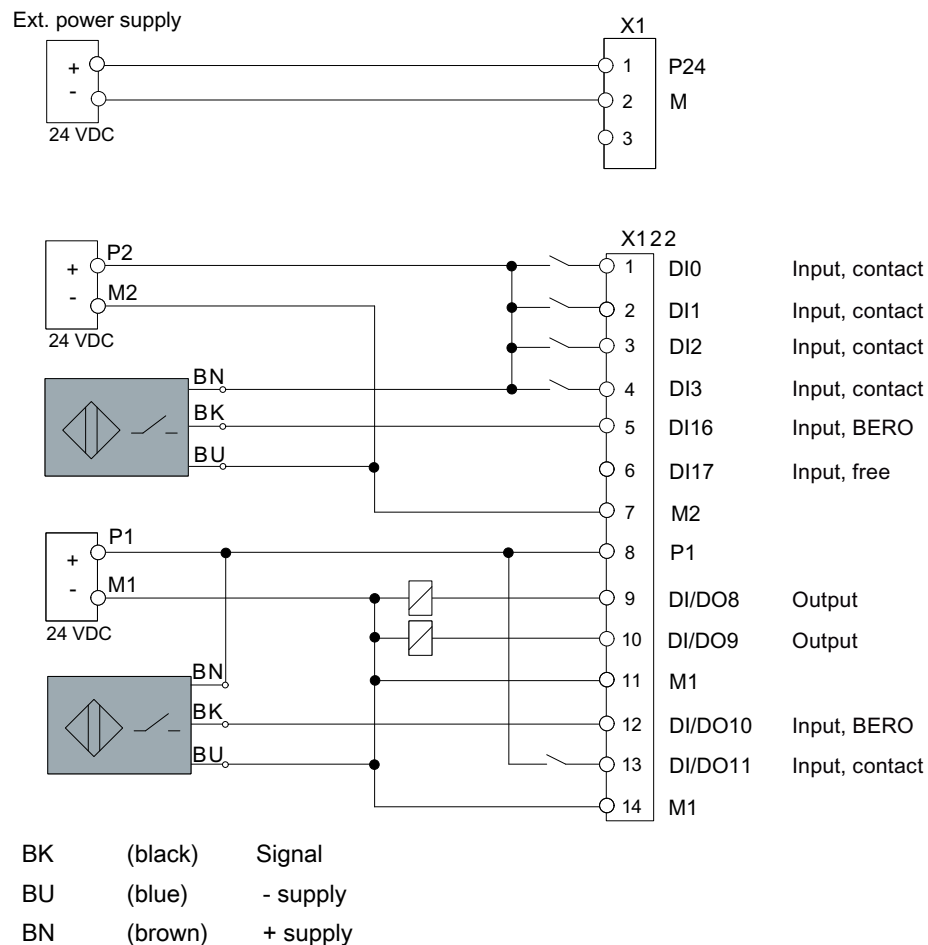


Figure 6-4 Connection to X122

6.5.3 Technical data

Note

An open input is interpreted as "low".

Note

Terminals MEXT1 ... MEXT4 must be connected for the digital inputs/outputs to function. This can be done as follows:

- Connect the ground reference of the digital inputs.
- A jumper to terminal M on plug connector X1.

P24EXT (P1, P3) must also be connected so that the outputs function. An external supply can also be connected here, or a jumper can be inserted to terminal P at X1.

This removes the galvanic isolation for these digital inputs.

Digital inputs

Table 6-6 Technical data of the digital inputs at X122/X132 and X242/X252

Parameter	Value
Voltage	-3 V to 30 V
Typical power consumption	10 mA at 24 V DC
Signal level (including ripple)	High: 15 V to 30 V Low: -3 V to 5 V
Signal propagation times	L → H: 50 µs H → L: 150 µs
Galvanic isolation	Yes: The reference potential is terminal 2M at X122/X132. The reference potential is terminal 4M at X242/X252.

Digital inputs/outputs

Table 6-7 Technical data of the digital inputs/outputs at X122/X132

Parameter	Value
As input:	
Voltage	-3 V to 30 V
Typical power consumption	10 mA at 24 V DC
Signal level (including ripple)	High: 15 V to 30 V Low: -3 V to 5 V
Signal propagation (rapid inputs)	L → H: 10 µs H → L: 150 µs
Galvanic isolation	Yes: The reference potential is terminal 1M.
As output:	

Parameter	Value
Voltage	18 V to 30 V
Load current per output, maximum	0.5 A
Load current per connector, maximum	1 A
Signal propagation times	L → H: 50 µs H → L: 200 µs
Galvanic isolation	Yes: The reference potential is terminal 1M/1P24 (24 V DC)

Digital outputs

Table 6-8 Technical data of the digital outputs at X242/X252

Parameter	Value
Voltage	18 V to 30 V
Load current per output, maximum	0.5 A
Load current per connector, maximum	1 A
Signal propagation times	L → H: 50 µs H → L: 200 µs
Galvanic isolation	Yes: The reference potential is terminal 3M/3P24 (24 V DC).

6.6 DRIVE-CLiQ

6.6.1 DRIVE-CLiQ interface

Pin assignment at X100 - X102

PIN	Signal name	Signal type	Meaning
1	TXP	O	Transmit data +
2	TXN	O	Transmit data -
3	RXP	I	Receive data +
4	--	--	Reserved
5	--	--	Reserved
6	RXN	I	Receive data -
7	--	--	Reserved
8	--	--	Reserved
A	--	--	Reserved
B	--	--	Reserved

Use

DRIVE-CLiQ interfaces are used to connect SINAMICS S120 components to the PPU.

The following rules apply:

- Topology rules for S120 Combi (Page 55)
- Topology rules for S120 Booksize (Page 57)
- Topology rules for Safety Integrated functions (Page 61)
- Topology example without Safety Integrated functions (Page 62)
- Topology example with Safety Integrated functions (Page 65)

DRIVE-CLiQ has the following properties:

- Components can be independently expanded
- Automatic detection of components by the PPU
- Standardized interfaces to all components
- Uniform diagnostics down to the components
- Complete service down to the components

Cable specification for X100 - X102

Feature	Version
Connector type	RJ45 socket with 180° cable outlet
Cable type	MOTION-CONNECT
Article number	6FX2002-1DC00-1□□0
Max. cable length	70 m

Blanking cover for DRIVE-CLiQ interface: Tyco company, article number: 969556-5

Note

Interfaces X100 to X102

The interfaces X100 to X102 of the PPU do not provide any 24 V supply voltage. Consequently, no components, such as SME, can be connected here that must be supplied with 24 V via DRIVE-CLiQ.

Additional references

Further information on the components in this section:

- SINAMICS S120 Control Units and Additional System Components Manual
- SINAMICS S120 Booksize Power Units Manual
- SINAMICS S120 Booksize Power Units with Cold Plate Manual
- SINAMICS S120 Combi Manual

6.6.2 SINAMICS components

Components with DRIVE-CLiQ

As a rule, all SINAMICS components approved for SINUMERIK 828D can be connected using DRIVE-CLiQ.

Component	Description
NX10.3 / NX15.3	Axis expansion module
Active / Basic / Smart Line Modules Booksize / Chassis	Line Modules provide the central power supply to the DC link.
Single / Double Motor Modules Booksize / Chassis	Motor Modules draw their power from the DC link to supply the connected motors.
SINAMICS S120 Combi	The S120 Combi is a compact unit in the Booksize format with integrated infeed.
Single/Double Motor Modules Booksize Compact	The Booksize Compact format is the expansion module for the S120 Combi.
SMC10 / 20 / 30	Cabinet-mounted sensor modules are used when a motor with a DRIVE-CLiQ interface is not available and when external encoders are required in addition to the motor encoder.

Component	Description
SMC40	This Sensor Module is used to convert encoder signals from absolute encoders with EnDat 2.2 to DRIVE-CLiQ.
DMC20 / DME20	DRIVE-CLiQ Hub Modules are used to implement the star-shaped distribution of a DRIVE-CLiQ line.
TM54F	The TM54F Terminal Module is a terminal expansion module for Safety Integrated functions.
TM120	The Terminal Module TM120 is a DRIVE-CLiQ component for safe electrically isolated temperature evaluation.

Note**Connection of Sensor Modules**

In principle, SMx encoder modules can be connected to Line Modules provided standard cycles are used for current and speed controllers in the related Motor Module.

If the standard cycle is reduced, it is then **not** possible to connect an SMx to a Line Module.

NOTICE**Connection of the SMC40**

The SMC40 can only be integrated in the actual topology if the DRIVE-CLiQ X500/x interfaces and the corresponding X520/x encoder interfaces are assigned.

Without a connected encoder, it is also not possible to subsequently integrate the SMC40 in the topology.

6.7 Handwheel

X143 pin assignment

Pin		Signal name	Meaning
1	P5	P5	5 VDC power supply
2	M	M	Ground
3	1A	1A	Handwheel pulses track A, channel 1
4	-1A	1/A	Handwheel pulses track A (negated), channel 1
5	1B	1B	Handwheel pulses track B, channel 1
6	-1B	1/B	Handwheel pulses track B (negated), channel 1
7	P5	P5	5 VDC power supply
8	M	M	Ground
9	2A	2A	Handwheel pulses track A, channel 2
10	-2A	2/A	Handwheel pulses track A (negated), channel 2
11	2B	2B	Handwheel pulses track B, channel 2
12	-2B	2/B	Handwheel pulses track B (negated), channel 2

Signal transfer

Max. two electronic handwheels can be connected to connector X143 on the rear of the PPU.

Note

The SINUMERIK 828D software can process up to max. 3 handwheels. You can connect 2 handwheels to the PPU. You can connect an additional handwheel to the machine control panel, see Connectable components (Page 97).

The signals can be transferred using the following technique:

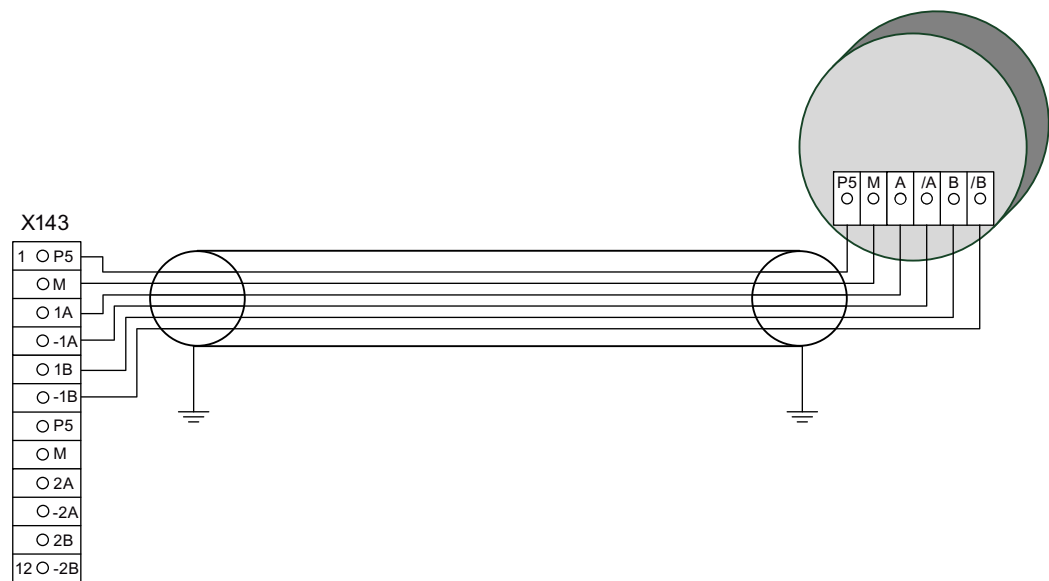
- Differential signal transfer (RS422): One signal and a negated signal for each track.
- Asymmetrical signal transfer: One 5 V TTL signal for each track.

The following applies to both techniques:

- Max. output frequency: 500 kHz
- Phase shift of Track A to Track B: $90^\circ \pm 30^\circ$
- Supply: 5 V, max. 250 mA

The following diagrams indicate the different data transfer types:

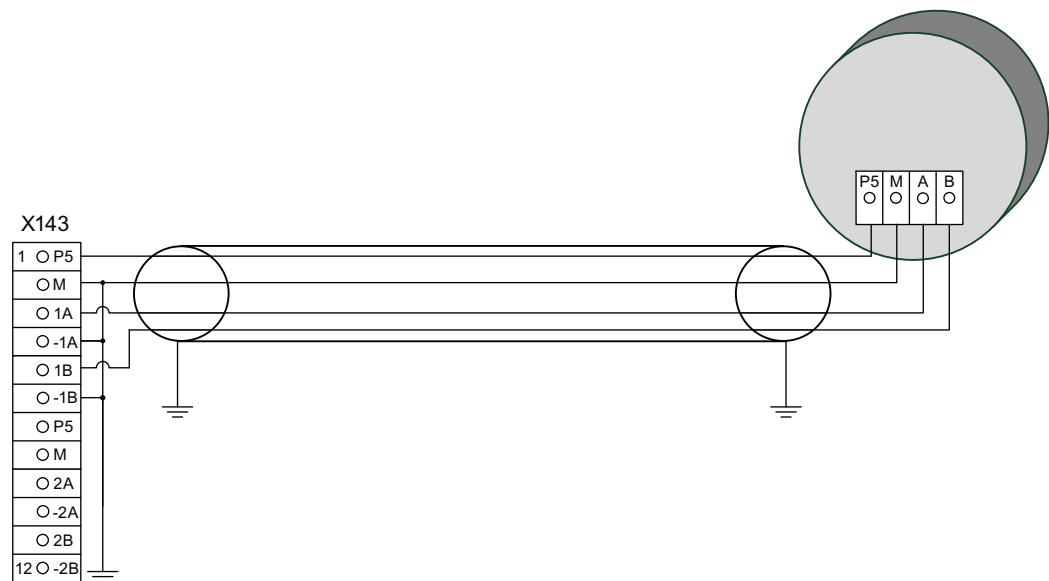
- **Differential signal transfer:**



Note

Differential signal transfer is the preferred technique, as it is insensitive to electromagnetic disturbances.

- **Asymmetrical signal transfer:**



Cable specification

Feature	Version
Connector type:	12-pin screw terminal
Cable type:	Twisted pair, shielded
Article number	6FX8002-2BB01-1A□□
Max. cable length	3 m

6.8 USB

Use

The USB interfaces correspond to the norm and are, therefore, not described in detail here.

- The **X125 USB interface** (at the front behind a flap) can be used to connect a USB-FlashDrive for transferring user and commissioning data.
- The X135 USB interface (at the rear) is available only for service purposes.

Cable specification

Features	Variants
Connector type:	USB socket - type A
Version:	USB 2.0
Current carrying capacity:	0.5 A per connector
Max. data transmission rate	12 Mbit/s
Max. cable length	3 m

Note

The 5 V power supply is designed to be short-circuit proof.

6.9 RS 232 serial interface

Pin assignment

Table 6-9 X140 pin assignment

Pin	Signal name	Signal type	Meaning
1	Not connected		
2	RxD	I	Serial receive data
3	TxD	O	Serial transmit data
4	DTR	O	Data terminal ready
5	M	-	Ground (reference potential)
6	DSR	I	Ready for operation
7	RTS	O	Switch-on transmit section
8	CTS	I	Clear to send
9	Reserved		

Use

For connecting the MODEM MD720 GSM modem.

Cable specification

Table 6-10 Cable specification for X140

Feature	Version
Connector type	9-pin SUB-D connector
Cable type	RS232
Article number	6FX8002-1AA11-1□□0
Max. cable length	3 m

Connectable components

7.1 MCP 483 USB

Description

The MCP 483 USB machine control panel allows machine functions to be operated in a user-friendly way. It can be used with a SINUMERIK 828D control for machine-related operation of machine tools.

The machine-specific keys have replaceable slide-in labels so that they can be adapted.

The machine control panel is mounted from the rear with special tension jacks supplied with the panel.

Operator controls / display elements:

- Operating mode and function keys:
 - 40 keys with assigned LED for the MCP 483 USB
 - Predefined keys for common functions, e.g. reset key, program control.
 - Key group for operating as milling machine or lathe. The slide-in labels for the keys are included in the accessories pack.
 - Keys for individual use.
 - Key type: Membrane keys with protective film
- Spindle control with override spindle (rotary switch with 15 positions)
- Feed control with override feed / rapid traverse (rotary switch with 18 positions)
- 2-digit 7-segment display for the tool number

Interfaces:

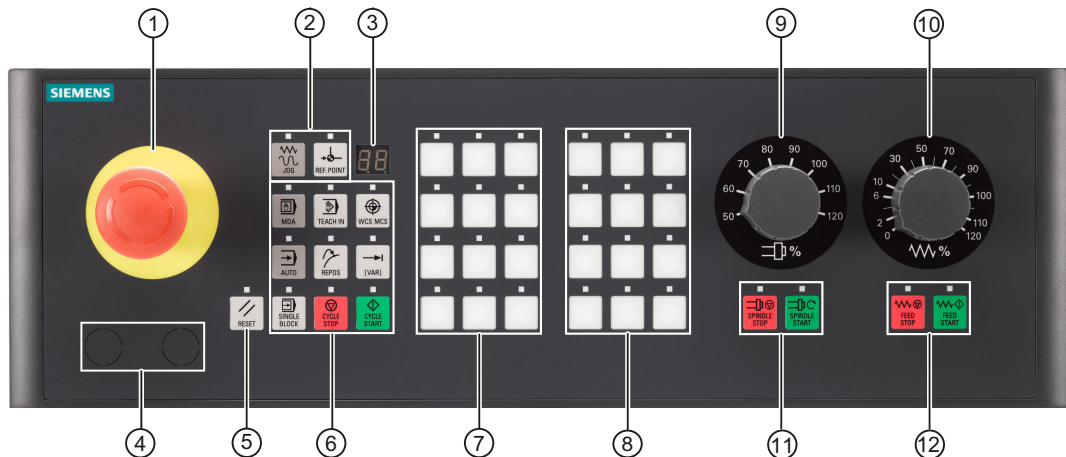
A USB 2.0 interface for communication with the PPU with a transmission rate of 12 Mbit/s.

Expansion slots:

- 1 slot for Emergency Stop button (d = 22 mm)
- 2 slots for control devices (d = 16 mm, e.g. switches)

7.1.1 Operator controls and displays

Operator controls (front)



- ① Slot for the Emergency Stop button
- ② JOG and reference point keys
- ③ Display for the tool number
- ④ Slots for control devices (d = 16 mm, e.g. switch)
Drill mounting holes to install control devices.
- ⑤ Reset button
- ⑥ Keys for operating modes, machine functions and program control
- ⑦ Customer keys
- ⑧ Direction keys with rapid traverse override for lathes and milling machines
- ⑨ Override switch for the spindle
- ⑩ Override switch for the feed control
- ⑪ Keys for spindle control
- ⑫ Keys for feed control

Figure 7-1 Position of operator controls

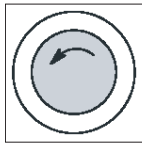
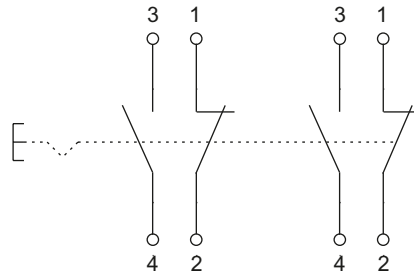
NOTICE

Slots for control devices

Do not break out the openings for mounting control devices (risk of damage), rather drill them to the required width.

Printed slide-in labels are included in the accessory pack for labeling key groups for operation in milling machines and lathes. You can individually label the customer keys, see Section Spare parts and accessories (Page 108). Blank slide-in labels are included in the accessory pack.

Emergency Stop circuit



EMERGENCY STOP

Press the Emergency Stop button in the following situations:

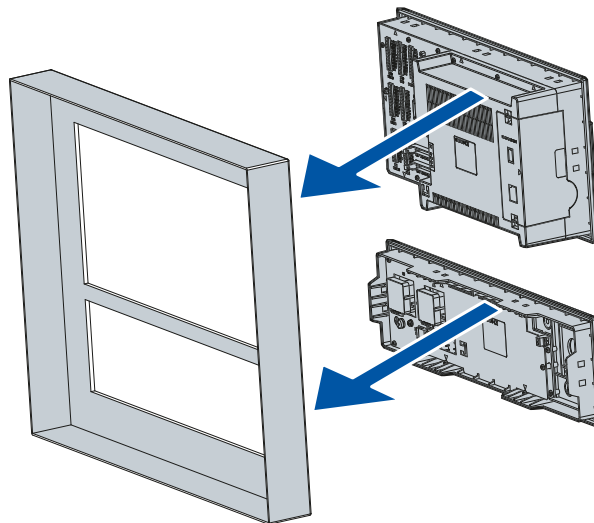
- When persons are at risk.
- When there is a risk of the machine or workpiece being damaged.

As a rule, when operating the Emergency Stop button, all drives are brought to a standstill with max. braking torque. Turn the Emergency Stop button counter-clockwise to release it.

7.1.2 Mounting

Installation and mounting

The recommended machine control panel mounting is shown in the following diagram:



The machine control panel is mounted from the front in a rectangular cut-out and attached using tension jacks (0.5 Nm tightening torque). The tension jacks are included in the scope of delivery. Tension jacks are also available as a spare part, see Section Spare parts and accessories (Page 108).

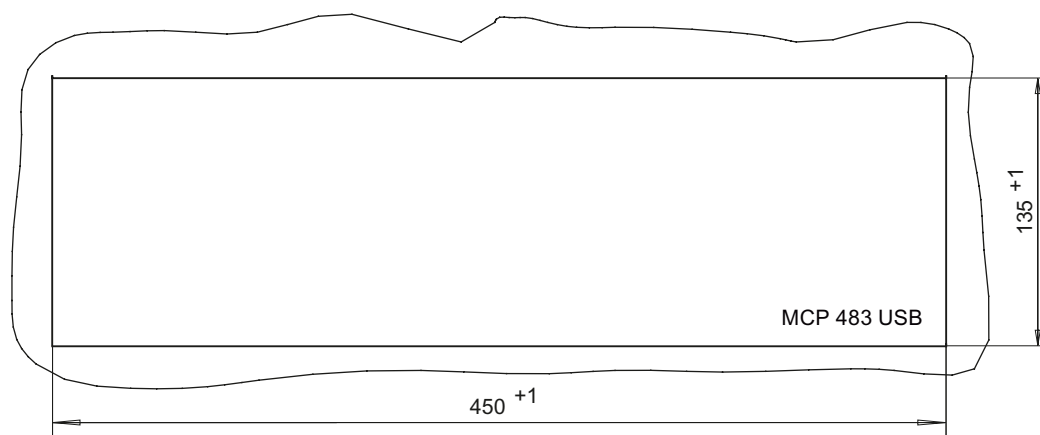


Figure 7-2 Mounting panel cutout

Dimension drawing

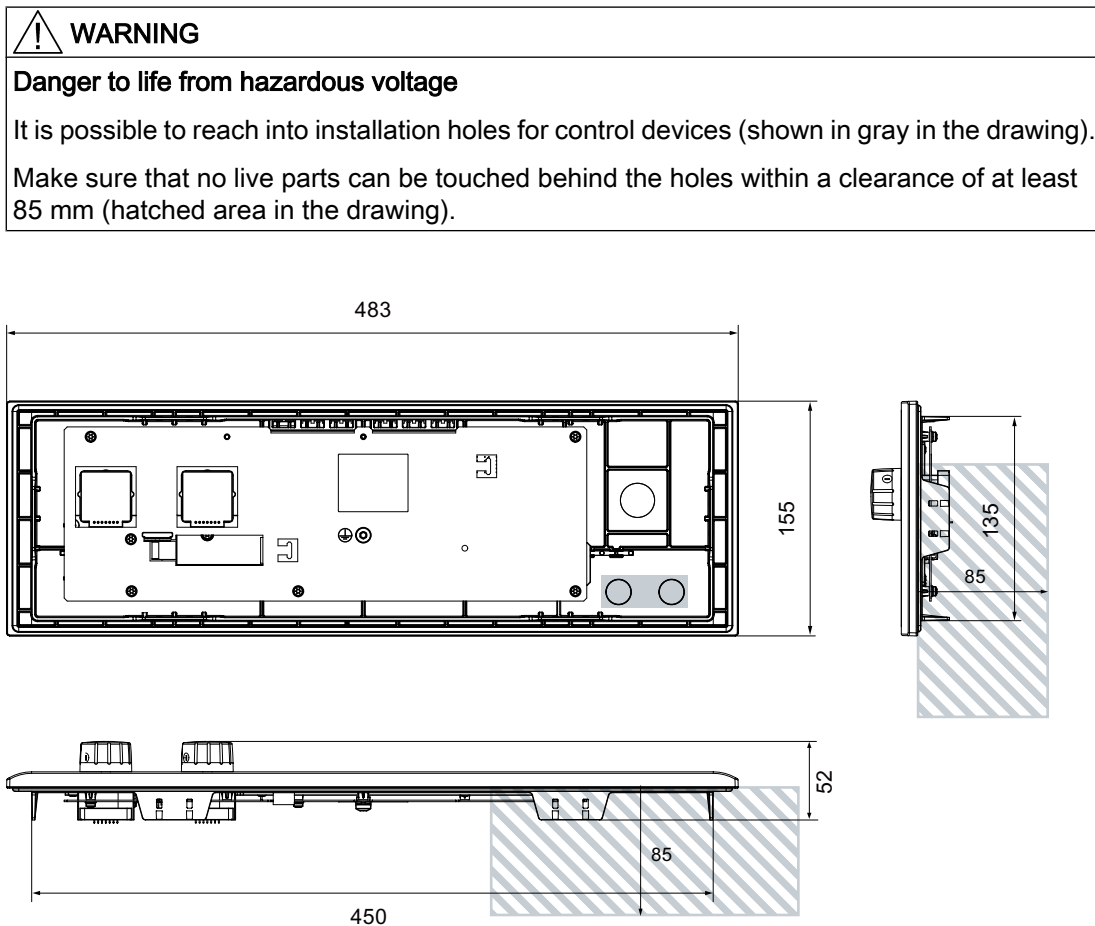
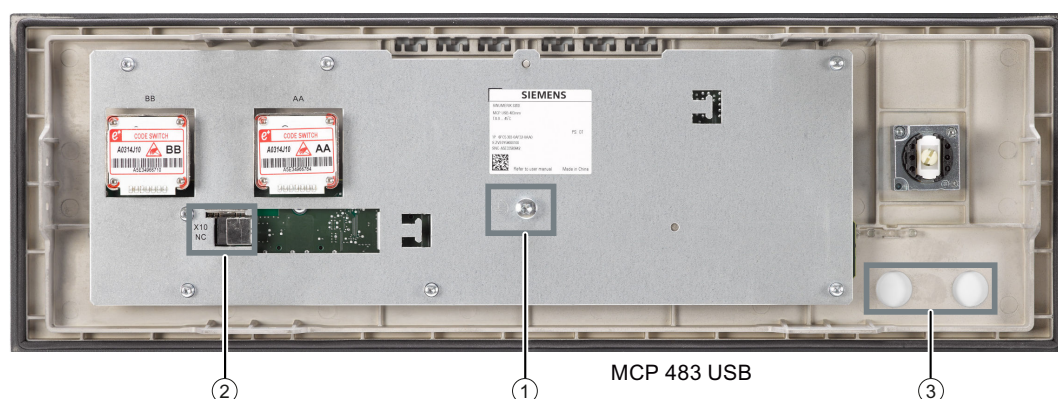


Figure 7-3 Dimensions and clearances

7.1.3 Connecting

Connections (rear)



- ① Ground terminal
- ② USB connection for communication with the PPU, X10 NC
- ③ Slots for control devices (d = 16 mm)

Figure 7-4 Connections at the rear

USB 2.0 interface

The machine control panel is connected to the PPU using a USB cable. The machine control panel is also supplied with power via this USB connection. The USB cable is included in the accessory pack of the machine control panel.

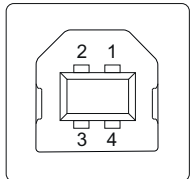
You can also connect the machine control panel via an industrial USB hub (6AV6671-3AH00-0AX0).

Pin assignment of the USB connection

Connection designation: **X10 NC**

Connection type: USB socket, type B

Maximum cable length: 0.8 m

Type B socket	Pin	Signal name	Signal type	Meaning
	1	P5V	V	+ 5 V
	2	Data-	B	Data -
	3	Data+		Data +
	4	GND	V	Ground

Connections and switch settings of the override switch

Connection designation: **AA, BB**

Connector type: 7-pin COMBICON connector

Encoding: Gray code

The machine control panel has two override switches for the feedrate and for the spindle. The switch positions with the associated values are listed in the following tables:

- You can read out the value for the feedrate override in the input image DB1000.DBB3.0...4.

Position	Value
0 %	0x01
2 %	0x02
4 %	0x06
6 %	0x07
10 %	0x04
20 %	0x0C
30 %	0x0D
40 %	0x0F
50 %	0x0E
60 %	0x0A
70 %	0x0B
80 %	0x08
90 %	0x19
100 %	0x1A
105 %	0x1E
110 %	0x1F
120 %	0x1C

- You can read out the value for the spindle override in the input image DB1000.DBB0.4...7.

Position	Value
50 %	0x10
55 %	0x30
60 %	0x20
65 %	0x60
70 %	0x70
75 %	0x50
80 %	0x40
85 %	0xC0
90 %	0xD0
95 %	0xF0
100 %	0xE0
105 %	0xA0
110 %	0xB0
115 %	0x90
120 %	0x80

7.1.4 Parameterization

Input image

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. Either one MCP USB or one MCP PN can be connected to the PPU, and therefore only DB1000 and DB1100 are described. To activate the MCP USB set MD12950[0] = 1. Further information on settings in the machine data can be found in Section Activating components (Page 258).

DB1000								
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DBB0	Spindle override				Operating mode			
	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)	JOG	TEACH IN	MDI	AUTO
DBB1	Machine function							
	REPOS	REF.	Var. INC	-	-	-	-	-
DBB2	-	-	Spindle start	Spindle stop ^{*)}	Feedrate start	Feedrate stop ^{*)}	NC start	NC stop ^{*)}
DBB3	RESET	-	Single block	Feedrate override				
				E (2 ⁴)	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)
DBB4	S24	S22	S23	-	S31	S34	S37	-
DBB5	S32	S33	S35	Travel command in MCS/WCS	-	S39	S38	S36
DBB6	Freely assignable customer keys				Reserved			
	S18	S40	S7	S21	-	-	-	-
DBB7	Freely assignable customer keys							
	S10	S11	S12	S13	S14	S15	S16	S17
DBB1000	Version information of the MCP USB - byte 0							
DBB1001	Version information of the MCP USB - byte 1							
DBB1002	Version information of the MCP USB - byte 2							
DBB1003	Version information of the MCP USB - byte 3							

*) These signals are inverse.

Output image

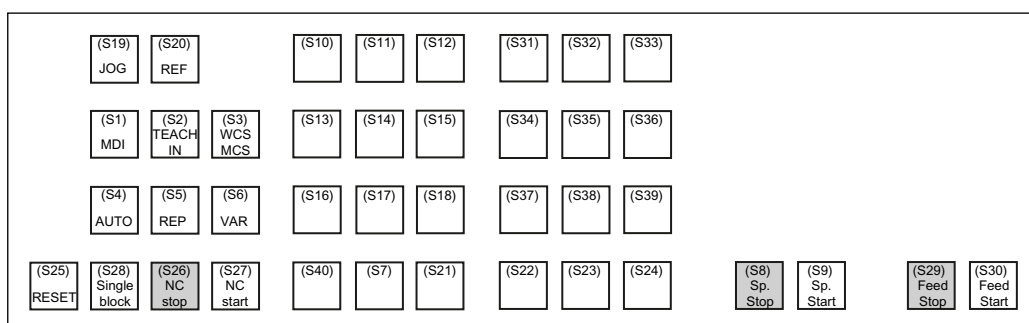
DB1100								
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DBB0	-	-	-	-	Operating mode			
					JOG	TEACH IN	MDI	AUTO
DBB1	Feedrate start	Feedrate stop ^{*)}	NC start	NC stop ^{*)}	Machine function			-
					REPOS	REF.	Var. INC	
DBB2	S22	S31	S34	S37	-	Single block	Spindle start	Spindle stop ^{*)}

DB1100								
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DBB3	S33	S35	Travel com- mand in MCS/WCS	-	S39	S38	S36	S24
DBB4	Freely assignable customer keys				-	-	-	S32
	S18	S40	S7	S21				
DBB5	Freely assignable customer keys							
	S10	S11	S12	S13	S14	S15	S16	S17
DBB6	-	-	-	-	-	-	RESET	S23
DBB7	-	-	-	-	-	-	-	-
DBB8	7-segment display LED 1							
DBB9	7-segment display LED 2							
DBB10	-	-	-	-	-	-	-	-
DBB11	-	-	-	-	-	-	-	-
DBB12	-	-	-	-	-	-	DP2	DP1

*) These signals are inverse.

Key assignment

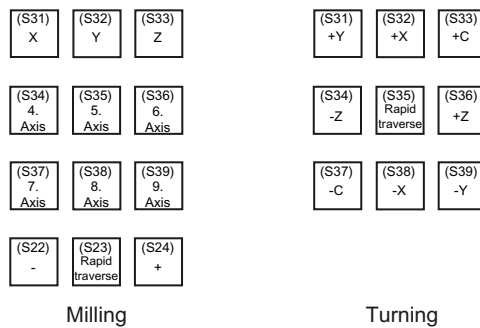
The keypad with keys S22 up to S24 and S31 up to S39 is only differently assigned for milling and turning applications. Keys S22 up to S24 are only preassigned for milling applications. You can freely assign keys S22 up to S24 for turning applications.



 Inputs inverted

Technology-specific key assignment:

7.1 MCP 483 USB



Some of the keys are permanently preassigned, the remaining keys can be freely assigned. The labeling of the permanently assigned keys are shown in brackets in the table. The keys are designated with S1 up to S40 in the following tables and diagrams.

Port 0.0	Port 0.1	Port 0.2	Port 0.3	Port 0.4
S1 (MDI)	S2 (TEACH IN)	S3 (WCS MCS)	S4 (AUTO)	S5 (REPOS)
S6 (VAR)	S7	S8 (Spindle stop)	S9 (Spindle start)	S10
S11	S12	S13	S14	S15
S16	S17	S18	S19 (JOG)	S20 (REF. POINT)
S21	S22	S23	S24	S25 (RESET)
S26 (NC stop)	S27 NC start)	S28 (Single block)	S29 (Feed stop)	S30 (Feed start)
S31	S32	S33	S34	S35
S36	S37	S38	S39	S40

Control 7-segment display

The MCP USB has a 2-position 7-segment display. To output a character, write the ASCII code as hexadecimal value of the character to the output image.

Example: To display the number 2, you must write hexadecimal value 32 to the output image.

Table 7-1 ASCII character table

Code	...0	...1	...2	...3	...4	...5	...6	...7	...8	...9	...A	...B	...C	...D	...E	...F
0...	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1...	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2...	SP	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
3...	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4...	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5...	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6...	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7...	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL

7.1.5 Technical data

MCP 483 USB

Parameter	Value
Input voltage	5 V DC
Power consumption, max.	2.5 W
Vibratory load:	
• Operation	10 – 58 Hz: 0.35 mm/58 - 200 Hz: 1 g
• Transportation (in transportation packaging)	(3M6 acc. to EN 60721-3-3) 5 – 9 Hz: 3.5 mm/9 - 200 Hz: 1 g (2M3 acc. to EN 60721-3-2)
Shock load:	
• Operation	10 g, 6 ms, 6 shocks (acc. to EN 60721-3-3)
• Transportation (in transportation packaging)	10 g, 6 ms, 100 shocks (acc. to EN 60721-3-2)
Protection class acc. to EN 61800-5-1	III (DVC A, PELV)
Degree of protection acc. to DIN IEC 529	IP65 (front) IP20 (rear)
Cooling	By natural convection
Temperature limits:	
• Storage	-25 °C ... +55 °C
• Transportation (in transportation packaging)	-40 °C ... +70 °C
• Operation:	
– Front	0 ... +45 °C
– Rear	0 ... +55 °C
Relative humidity:	
• Storage	5 ... 95 %
• Transportation	5 ... 95 %
• Operation	5 ... 85 %
Condensation, spraying water, and icing	Not permissible
Supply air	Without aggressive gases, dusts, and oils
Approvals	CE, cULus, KCC, EAC, C-Tick
Dimensions:	
• Width	483 mm
• Height	155 mm
• Depth	49 mm
Weight:	1.22 kg

See also

Other values/standards: Application planning (Page 37)

7.1.6 Spare parts and accessories

Accessories pack (for delivery ex works)

Component	Description	Amount
USB cable, 0.8 m	For the connection between MCP USB and PPU	1
Mounting element with screws	For mounting the MCP USB	6
Slide-in labels	Labeled slide-in labels for keys when using the MCP USB in a milling machine/lathe	1
Blank film for slide-in labels	For customers to produce their own slide-in labels	1
Product Information	Product information for the MCP USB	1

Spare parts and accessories

Component	Description	Quantity	Article number
Emergency Stop button	22 mm actuating element, 40 mm mushroom pushbutton, snap action with tamper protection, latching, red, with holder, non-illuminated	1	3SB3000-1HA20
Contact block	With 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be additionally connected)	1	3SB3400-0A
Set of tension jacks	Set of tension jacks for supplementary operator components with 2.5 mm profile, 20mm length	9	6FC5248-0AF14-0AA0

All spare parts currently available for a product can be found online at (www.siemens.com/sow).

Inserting slide-in labels

Labels for keys for milling machines and lathes are included in the accessories pack as slide-in labels. Proceed as described below to insert or replace the slide-in labels for the MCP USB. The slide-in labels are designated with E1 to E3 in the diagram below.

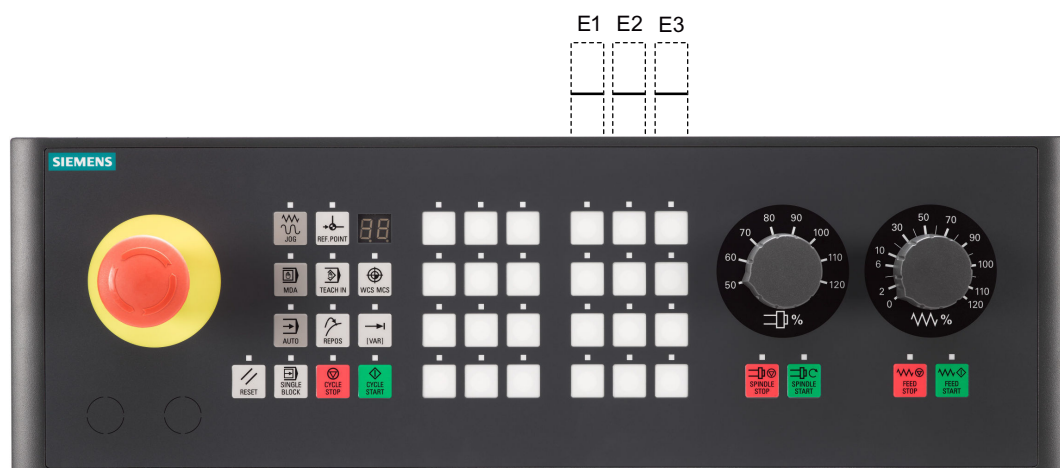


Figure 7-5 Slide-in labels, example of MCP 483 USB

Printing customized slide-in labels

Siemens provides a symbol library with key symbols. Customers can print their own slide-in labels using the A4 blank films included in the accessory pack.

Siemens also provides a template file to print customized key labels. Copy the symbols from the symbol library to the required key position in the template.

Cutting slide-in labels

The blank films contained in the accessory pack are precut to the correct length. After printing, you just have to separate the print-in labels.

7.2 MCP 310 USB

Description

The MCP 310 USB machine control panel allows machine functions to be operated in a very user-friendly way. They can be used with a SINUMERIK 828D control for machine-level operation of machine tools. The machine-specific keys have replaceable slide-in labels so that they can be adapted.

The machine control panel is mounted from the rear with special tension jacks supplied with the panel.

Operator controls / display elements:

- Operating mode and function keys:
 - 39 keys with assigned LED
 - Predefined keys for common functions, e.g. reset key, program control.
 - Key group for operating as milling machine or lathe. The slide-in labels for the keys are included in the accessories pack.
 - Keys for individual use.
 - Key type: Membrane keys with protective film
- Spindle control with override spindle (rotary switch with 15 positions)
- Feed control with override feed / rapid traverse (rotary switch with 18 positions)
- 2-digit 7-segment display for the tool number

Interfaces:

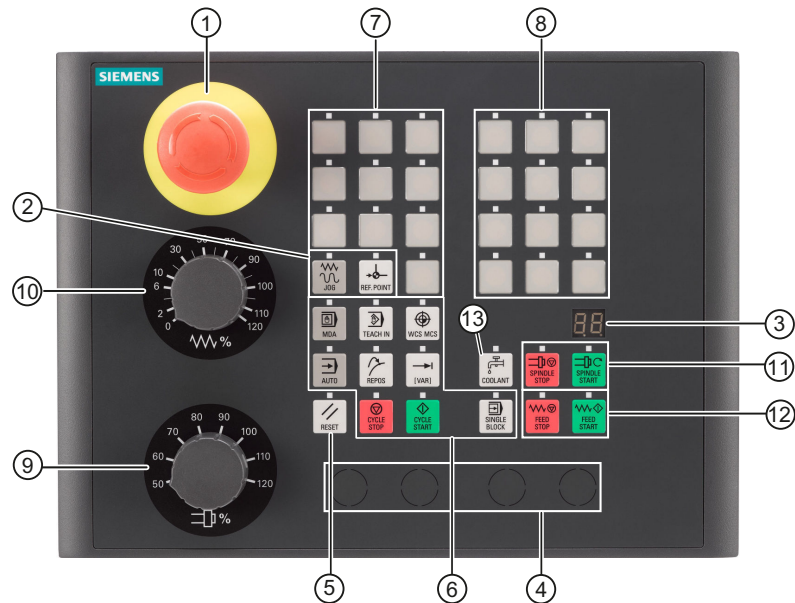
A USB 2.0 interface for communication with the PPU with a transmission rate of 12 Mbit/s.

Expansion slots:

- 1 slot for Emergency Stop button (d = 22 mm)
- 4 slots for control devices (d = 16 mm, e.g. switch)

7.2.1 Operator controls and displays

Operator controls (front)



- ① Slot for the Emergency Stop button
- ② JOG and reference point keys
- ③ Display for the tool number
- ④ Slots for control devices (d = 16 mm, e.g. switch)
Drill mounting holes to install control devices.
- ⑤ Reset button
- ⑥ Keys for operating modes, machine functions and program control
- ⑦ Customer keys
- ⑧ Direction keys with rapid traverse override for lathes and milling machines
- ⑨ Override switch for the spindle
- ⑩ Override switch for the feed control
- ⑪ Keys for spindle control
- ⑫ Keys for feed control
- ⑬ Key for the coolant

Figure 7-6 Position of operator controls

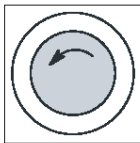
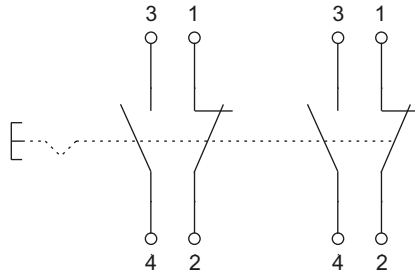
NOTICE

Slots for control devices

Do not break out the openings for mounting control devices (risk of damage), rather drill them to the required width.

Printed slide-in labels are included in the accessory pack for labeling key groups for operation in milling machines and lathes. You can individually label the customer keys, see Section Spare parts and accessories (Page 122). Blank slide-in labels are included in the accessory pack.

Emergency Stop circuit



EMERGENCY STOP

Press the Emergency Stop button in the following situations:

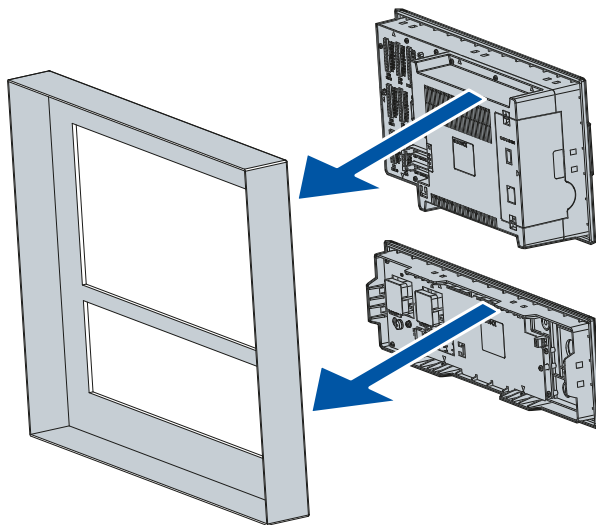
- When persons are at risk.
- When there is a risk of the machine or workpiece being damaged.

As a rule, when operating the Emergency Stop button, all drives are brought to a standstill with max. braking torque. Turn the Emergency Stop button counter-clockwise to release it.

7.2.2 Mounting

Installation and mounting

The recommended machine control panel mounting is shown in the following diagram:



The machine control panel is mounted from the front in a rectangular cut-out and attached using tension jacks (0.5 Nm tightening torque). The tension jacks are included in the scope of delivery. Tension jacks are also available as a spare part, see Section Spare parts and accessories (Page 122).

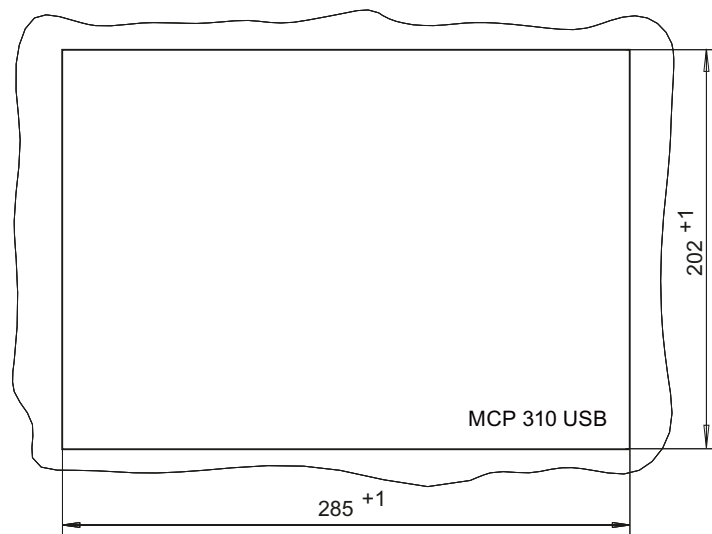


Figure 7-7 Mounting panel cutout

Dimension drawing

 WARNING
Danger to life from hazardous voltage
It is possible to reach into installation holes for control devices (shown in gray in the drawing). Make sure that no live parts can be touched behind the holes within a clearance of at least 85 mm (hatched area in the drawing).

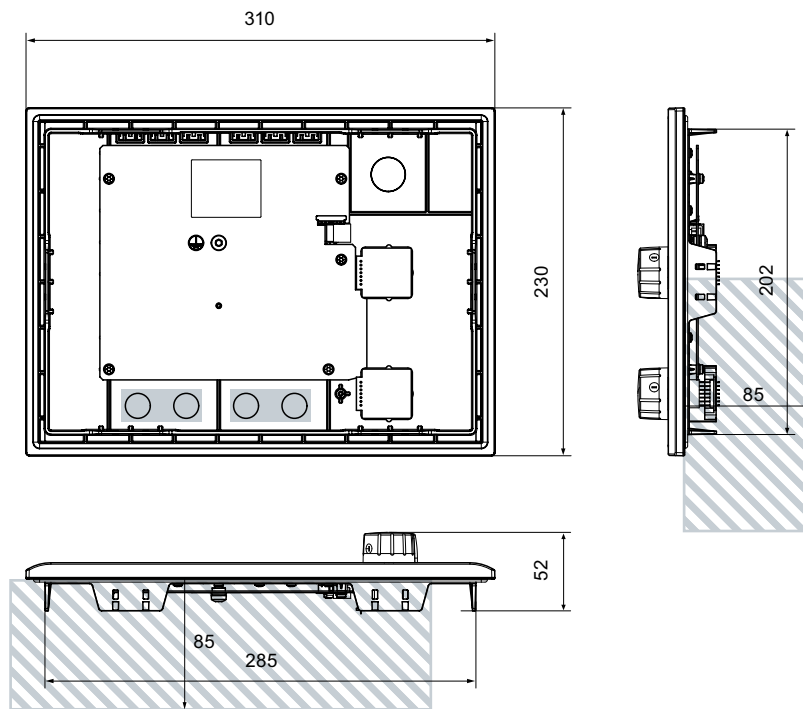
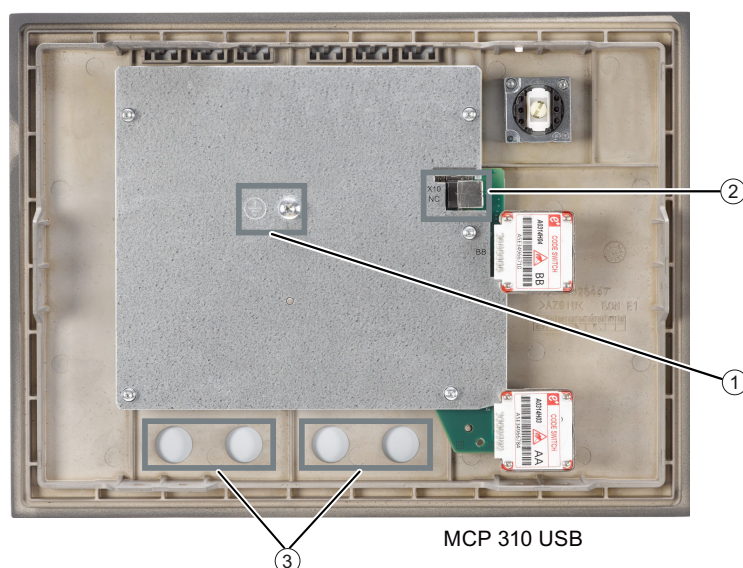


Figure 7-8 Dimensions and clearances

7.2.3 Connecting

Connections (rear)



- ① Ground terminal
- ② USB connection for communication with the PPU, X10 NC
- ③ Slots for control devices (d = 16 mm)

Figure 7-9 Connections at the rear

USB 2.0 interface

The machine control panel is connected to the PPU using a USB cable. The machine control panel is also supplied with power via this USB connection. The USB cable is included in the accessory pack of the machine control panel.

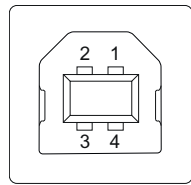
You can also connect the machine control panel via an industrial USB hub (6AV6671-3AH00-0AX0).

Pin assignment of the USB connection

Connection designation: **X10 NC**

Connection type: USB socket, type B

Maximum cable length: 0.8 m

Type B socket	Pin	Signal name	Signal type	Meaning
	1	P5V	V	+ 5 V
	2	Data-	B	Data -
	3	Data+		Data +
	4	GND	V	Ground

Connections and switch settings of the override switch

Connection designation: **AA, BB**

Connector type: 7-pin COMBICON connector

Encoding: Gray code

The machine control panel has two override switches for the feedrate and for the spindle. The switch positions with the associated values are listed in the following tables:

- You can read out the value for the feedrate override in the input image DB1000.DBB3.0...4.

Position	Value
0 %	0x01
2 %	0x02
4 %	0x06
6 %	0x07
10 %	0x04
20 %	0x0C
30 %	0x0D
40 %	0x0F
50 %	0x0E
60 %	0x0A
70 %	0x0B
80 %	0x08
90 %	0x19
100 %	0x1A
105 %	0x1E
110 %	0x1F
120 %	0x1C

- You can read out the value for the spindle override in the input image DB1000.DBB0.4...7.

Position	Value
50 %	0x10
55 %	0x30
60 %	0x20
65 %	0x60
70 %	0x70
75 %	0x50
80 %	0x40
85 %	0xC0
90 %	0xD0
95 %	0xF0
100 %	0xE0
105 %	0xA0
110 %	0xB0
115 %	0x90
120 %	0x80

7.2.4 Parameterization

Input image

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. Either one MCP USB or one MCP PN can be connected to the PPU, and therefore only DB1000 and DB1100 are described. To activate the MCP USB set MD12950[0] = 1. Further information on settings in the machine data can be found in Section Activating and addressing components (Page 258).

DB1000								
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DBB0	Spindle override				Operating mode			
	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)	JOG	TEACH IN	MDI	AUTO
DBB1	Machine function							
	REPOS	REF.	Var. INC	-	-	-	-	-
DBB2	-	-	Spindle start	Spindle stop ^{*)}	Feedrate start	Feedrate stop ^{*)}	NC start	NC stop ^{*)}
DBB3	RESET	-	Single block	Feed override				
				E (2 ⁴)	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)
DBB4	S24	S22	S23	-	S31	S34	S37	-
DBB5	S32	S33	S35	Travel command in MCS/WCS	-	S39	S38	S36
DBB6	Freely assignable customer keys				Reserved			
	S18	-	S7 (coolant)	S21	-	-	-	-
DBB7	Freely assignable customer keys							
	S10	S11	S12	S13	S14	S15	S16	S17
DBB1000	Version information of the MCP USB - byte 0							
DBB1001	Version information of the MCP USB - byte 1							
DBB1002	Version information of the MCP USB - byte 2							
DBB1003	Version information of the MCP USB - byte 3							

*) These signals are inverse.

Output image

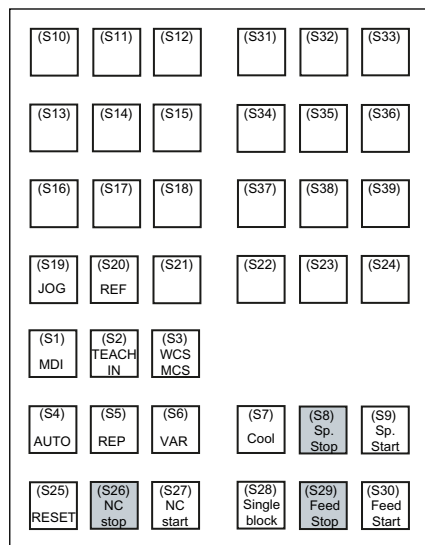
DB1100								
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DBB0	-	-	-	-	Operating mode			
					JOG	TEACH IN	MDI	AUTO
DBB1	Feedrate start	Feedrate stop ^{*)}	NC start	NC stop ^{*)}	Machine function			-
					REPOS	REF.	Var. INC	
DBB2	S22	S31	S34	S37	-	Single block	Spindle start	Spindle stop ^{*)}

DB1100								
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DBB3	S33	S35	Travel com- mand in MCS/WCS	-	S39	S38	S36	S24
DBB4	Freely assignable customer keys				-	-	-	S32
	S18	-	S7 (coolant)	S21				
DBB5	Freely assignable customer keys							
	S10	S11	S12	S13	S14	S15	S16	S17
DBB6	-	-	-	-	-	-	RESET	S23
DBB7	-	-	-	-	-	-	-	-
DBB8	7-segment display LED 1							
DBB9	7-segment display LED 2							
DBB10	-	-	-	-	-	-	-	-
DBB11	-	-	-	-	-	-	-	-
DBB12	-	-	-	-	-	-	DP2	DP1

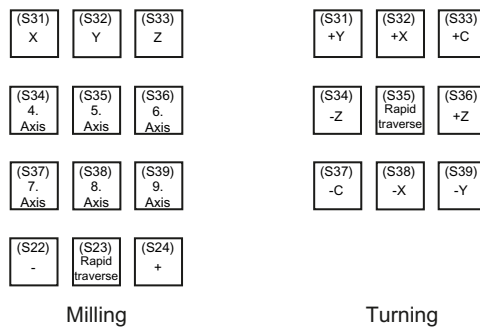
*) These signals are inverse.

Key assignment

The keypad with keys S22 up to S24 and S31 up to S39 is only differently assigned for milling and turning applications. Keys S22 up to S24 are only preassigned for milling applications. You can freely assign keys S22 up to S24 for turning applications.



Technology-specific key assignment:



Some of the keys are permanently preassigned, the remaining keys can be freely assigned. The labeling of the permanently assigned keys are shown in brackets in the table. Keys are designated with S1 to S39 in the following table and diagrams.

Port 0.0	Port 0.1	Port 0.2	Port 0.3	Port 0.4
S1 (MDI)	S2 (TEACH IN)	S3 (WCS MCS)	S4 (AUTO)	S5 (REPOS)
S6 (VAR)	S7 (coolant)	S8 (Spindle stop)	S9 (Spindle start)	S10
S11	S12	S13	S14	S15
S16	S17	S18	S19 (JOG)	S20 (REF. POINT)
S21	S22	S23	S24	S25 (RESET)
S26 (NC stop)	S27 NC start)	S28 (Single block)	S29 (Feed stop)	S30 (Feed start)
S31	S32	S33	S34	S35
S36	S37	S38	S39	--

Control 7-segment display

The MCP USB has a 2-position 7-segment display. To output a character, write the ASCII code as hexadecimal value of the character to the output image.

Example: To display the number 2, you must write hexadecimal value 32 to the output image.

Table 7-2 ASCII character table

Code	...0	...1	...2	...3	...4	...5	...6	...7	...8	...9	...A	...B	...C	...D	...E	...F
0...	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1...	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2...	SP	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
3...	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4...	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5...	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6...	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7...	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL

7.2.5 Technical data

MCP 310 USB

Parameter	Value
Input voltage	5 V DC
Power consumption, max.	2.5 W
Vibratory load:	
• Operation	10 – 58 Hz: 0.35 mm/58 - 200 Hz: 1 g
• Transportation (in transportation packaging)	(3M6 acc. to EN 60721-3-3) 5 – 9 Hz: 3.5 mm/9 - 200 Hz: 1 g (2M3 acc. to EN 60721-3-2)
Shock load:	
• Operation	10 g, 6 ms, 6 shocks (acc. to EN 60721-3-3)
• Transportation (in transportation packaging)	10 g, 6 ms, 100 shocks (acc. to EN 60721-3-2)
Protection class acc. to EN 61800-5-1	III (DVC A, PELV)
Degree of protection acc. to DIN IEC 529	IP65 (front) IP20 (rear)
Cooling	By natural convection
Temperature limits:	
• Storage	-25 °C ... +55 °C
• Transportation (in transportation packaging)	-40 °C ... +70 °C
• Operation:	
– Front	0 ... +45 °C
– Rear	0 ... +55 °C
Relative humidity:	
• Storage	5 ... 95 %
• Transportation	5 ... 95 %
• Operation	5 ... 85 %
Condensation, spraying water, and icing	Not permissible
Supply air	Without aggressive gases, dusts, and oils
Approvals	CE, cULus, KCC, EAC, C-Tick
Dimensions:	
• Width	310 mm
• Height	230 mm
• Depth	49 mm
Weight:	1.10 kg

See also

Other values/standards: Application planning (Page 37)

7.2.6 Spare parts and accessories

Accessories pack (for delivery ex works)

Component	Description	Amount
USB cable, 0.8 m	For the connection between MCP USB and PPU	1
Mounting element with screws	For mounting the MCP USB	6
Slide-in labels	Labeled slide-in labels for keys when using the MCP USB in a milling machine/lathe	1
Blank film for slide-in labels	For customers to produce their own slide-in labels	1
Product Information	Product information for the MCP USB	1

Spare parts and accessories

Component	Description	Quantity	Article number
Emergency Stop button	22 mm actuating element, 40 mm mushroom pushbutton, snap action with tamper protection, latching, red, with holder, non-illuminated	1	3SB3000-1HA20
Contact block	With 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be additionally connected)	1	3SB3400-0A
Set of tension jacks	Set of tension jacks for supplementary operator components with 2.5 mm profile, 20mm length	9	6FC5248-0AF14-0AA0

All spare parts currently available for a product can be found online at (www.siemens.com/sow).

Inserting slide-in labels

Labels for keys for milling machines and lathes are included in the accessories pack as slide-in labels. Proceed as described below to insert or replace the slide-in labels for the MCP USB. The slide-in labels are designated with E1 to E3 in the diagram below.

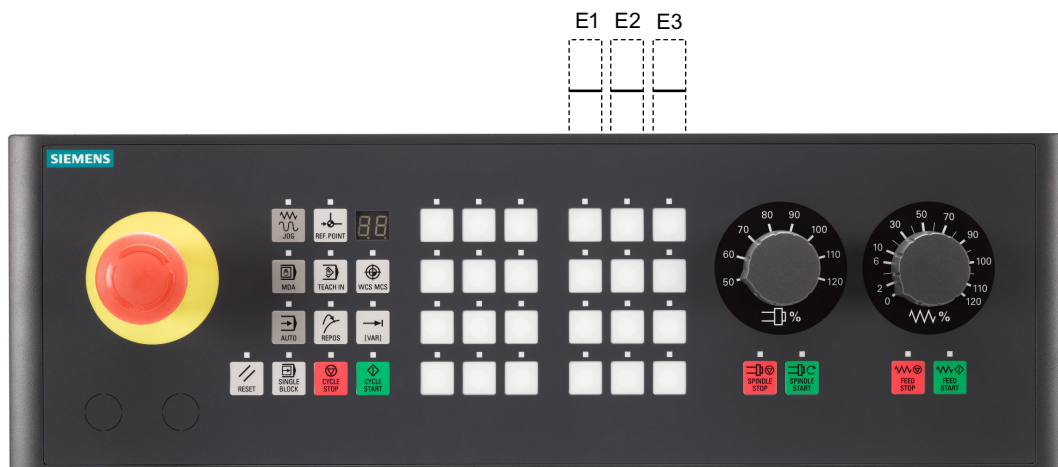


Figure 7-10 Slide-in labels, example of MCP 483 USB

Printing customized slide-in labels

Siemens provides a symbol library with key symbols. Customers can print their own slide-in labels using the A4 blank films included in the accessory pack.

Siemens also provides a template file to print customized key labels. Copy the symbols from the symbol library to the required key position in the template.

Cutting slide-in labels

The blank films contained in the accessory pack are precut to the correct length. After printing, you just have to separate the print-in labels.

7.3 MCP 483C PN

Description

The MCP 483C PN machine control panel enables user-friendly operation of the machine functions. It can be used with a SINUMERIK 828D control for machine-related operation of machine tools.

All keys are designed with replaceable caps for machine-specific adaptations. The key caps can be freely inscribed using laser. Clear key caps can be used as an alternative.

The machine control panel is mounted from the rear with special tension jacks supplied with the panel.

Operator controls

- Operating mode and function keys:
 - 50 keys with assigned LEDs
 - Direction keys for milling machines with rapid traverse override (The key covers for the direction keys for lathes are supplied.)
 - Key type: Mechanical short-stroke keys
- Spindle control with override spindle (rotary switch with 16 positions)
- Feed control with override feed/rapid traverse (rotary switch with 23 positions)
- Key-operated switch (four positions and three different keys)
- Emergency-Stop button, two contact pairs (1 NO + 1 NC)

Interfaces

- PLC I/O Interface (data transmission rate: 100 Mbit/s)
- Nine customer-specific inputs (e.g. for illuminated pushbuttons)
- Six customer-specific outputs
- Handwheel connection

Expansion slots

Two slots for control devices (d = 16 mm)

An additional cable set is required for control devices: Spare parts and accessories (Page 139)

7.3.1 Operator controls and display elements

Operator controls (front)

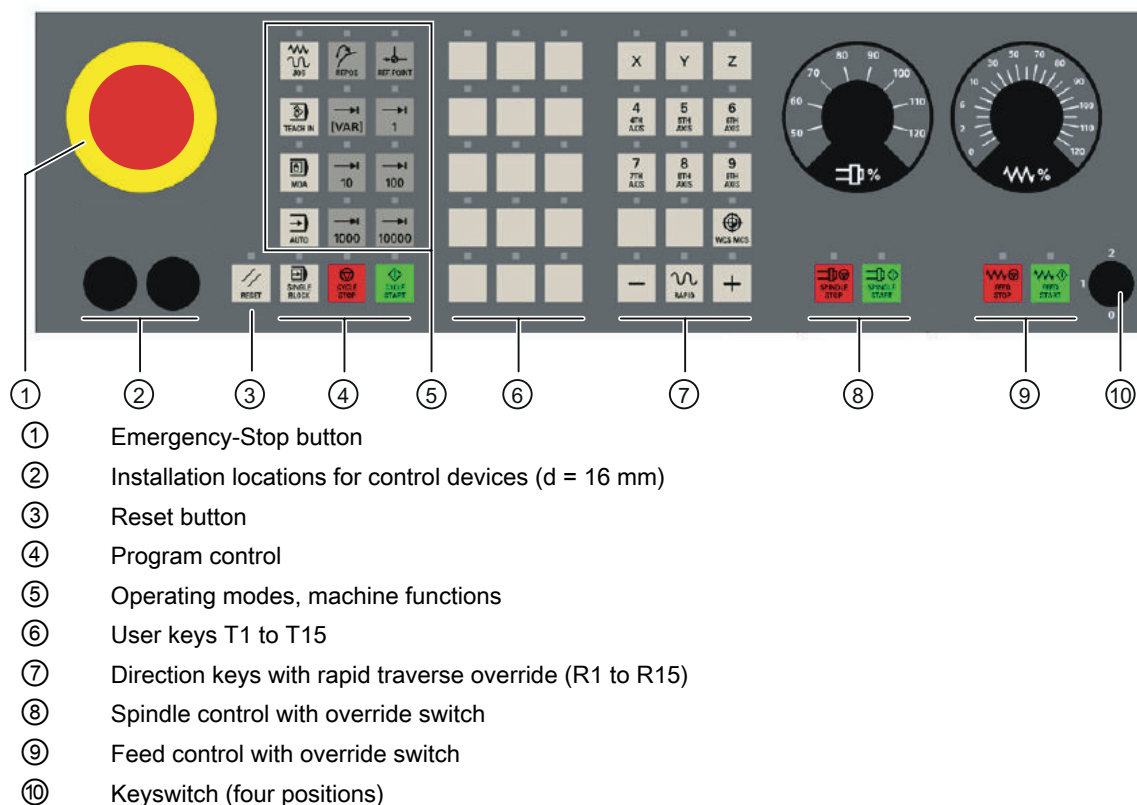


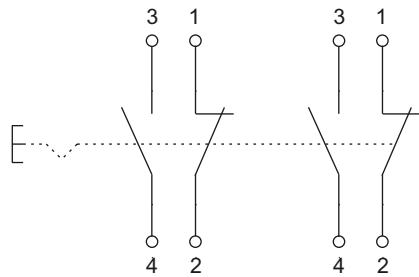
Figure 7-11 Position of control elements on MCP 483C PN

WARNING

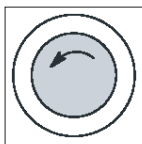
Mounting slots for control devices

The openings for installing control devices ② in "Position of control elements of MCP483C PN" Fig. must not be broken out (risk of damage) but carefully drilled to the required width.

Emergency Stop circuit



EMERGENCY STOP



- Press the Emergency Stop button in emergency situations:
- When persons are at risk.
 - When there is a risk of the machine or workpiece being damaged.

As a rule, when operating the Emergency-Stop button, all drives are brought to a standstill with max. braking torque. Turn the emergency-stop counterclockwise to unlatch it.

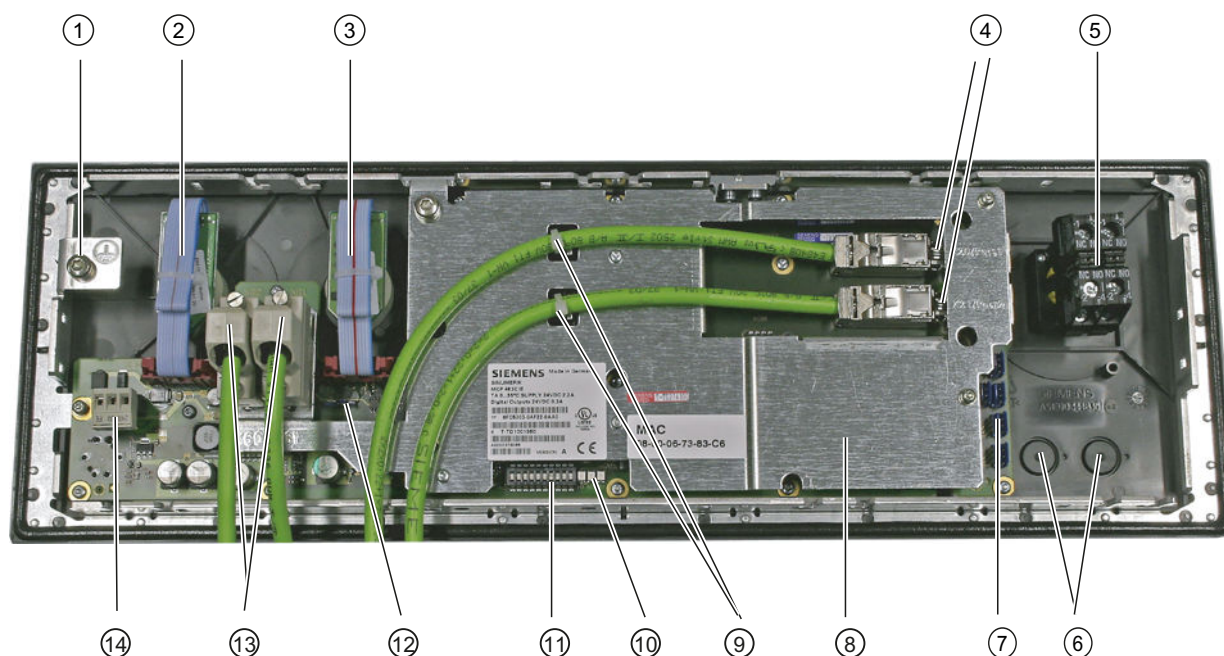
Key caps

All keys of the MCP 483C PN come with changeable key caps. Refer to the following table for the additional replacement key caps provided for lathes in the accessories pack:

Key cap	Symbol number	Key cap	Symbol number
	7027		7129
	7125		7130
	7126		7131
	7127		7132
	7128		

You will find article numbers for the key caps in Chapter Spare parts and accessories (Page 139).

Display elements (rear)



- ① Ground terminal
- ② Feed override X30
- ③ Spindle override X31
- ④ PLC I/O Interface X20/X21 connections
- ⑤ Slot for emergency stop
- ⑥ Installation locations for additional control devices (d = 16 mm)
- ⑦ Customer-specific inputs and outputs
- ⑧ Cover plate
- ⑨ Ethernet cable strain relief
- ⑩ LEDs
- ⑪ Switch for setting the MCP address
- ⑫ Switch for setting the handwheel signal type
- ⑬ X60 connection for handwheel, X61 reserved
- ⑭ Power supply interface X10

Figure 7-12 Rear panel of MCP 483C PN

LEDs for status display

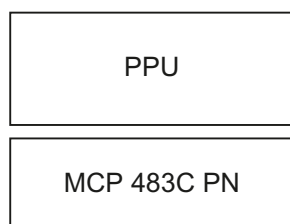
When the system is booting, all three LEDs are lit.

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply OK
H2	PNSync	Green	Lit: System software running, STOP state
			Flashes 0.5 Hz: System software running, RUN state
H3	PNFault	Red	Not lit: Module is operating without errors; data exchange with all configured I/O devices is running.
			Lit: Serious bus fault; only output when one of the following errors is detected for the ports: - No physical connection to a subnet/switch - Incorrect transmission rate - Full duplex transmission is not activated

7.3.2 Mounting

Mounting sequence

The recommended installation of the MCP 483C PN machine control panel is shown in the following figure:



Mounting positions

The permitted mounting position is max. 60° to the vertical.

Note

For mounting positions greater than 60°, a fan must also be installed to keep the ambient temperature of the machine control panel constantly below 55° C.

Tension jacks

The machine control panel is mounted from the front in a rectangular cut-out and attached by means of nine supplied tension jacks (0.5 Nm tightening torque).

Tension jacks are also available as a spare part (see Section: "Spare parts and accessories (Page 139)").

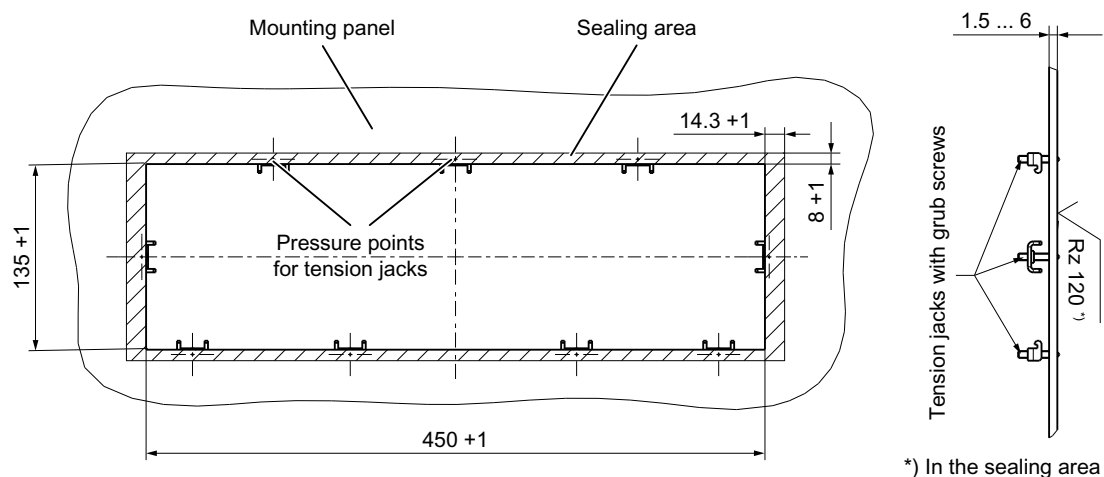


Figure 7-13 Panel cutout of MCP 483C PN

MCP 483C PN dimension drawing

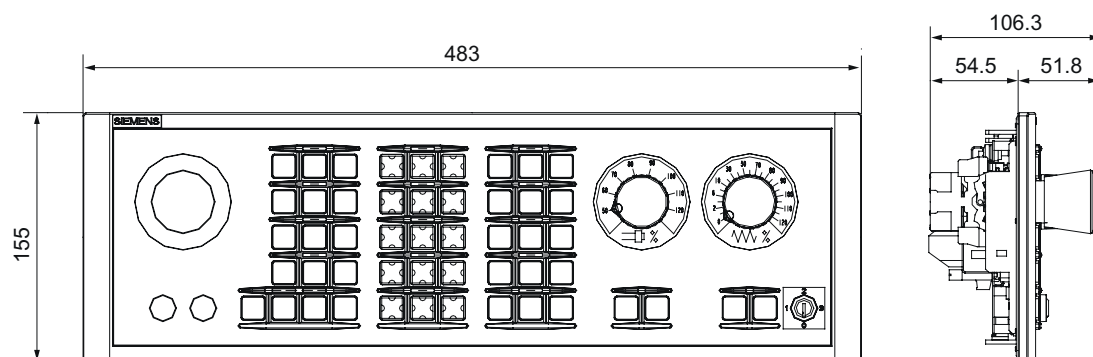


Figure 7-14 MCP 483C PN dimensions

7.3.3 Connecting

Securing the cables

Two equivalent connections (Fast Ethernet) are available for establishing the PLC I/O Interface communication network based on PROFINET.

Two cable ties are included in the scope of delivery. You use these to secure the Ethernet cables on the cover plate at the rear of the machine control panel.

The Ethernet cables are not included in the scope of delivery. When connecting the machine control panel to the SINUMERIK 828D, please use the preassembled SINAMICS DRIVE-CLiQ signal cables; from a technical point of view, these are also suitable for use with PROFINET.

NOTICE**Damage to cables**

Make sure that all cables are routed so that they do not come into contact with chafing edges.

See also

Auto-Hotspot

Interface overview

X10	Power supply interface
X20	PLC I/O Interface port 1
X21	PLC I/O Interface port 2
X30	Interface for rotary switch feed override
X31	Interface for rotary switch spindle override/EMERGENCY STOP (optional)
X51 / X52 / X55	Interfaces for customer-specific inputs
X53 / X54	Interfaces for customer-specific outputs
X60	Interface for handwheel
X61	Reserved
S1	Switch for setting the handwheel signal type
S2	Switch for setting the MCP address

X10 power supply pin assignment

Connector designation: **X10**

Connector type: Terminal block, 3-pin plug connector

Pin	Signal name	Signal type	Meaning
1	P24	V	24 V potential
2	M24	V	24 V ground
3	SHIELD	V	Shield connection

PLC I/O Interface pin assignment

Connector designation: **X20, X21**

Connector type: RJ45 socket

Table 7-3 Assignment of connectors X20, X21

Pin	Signal name	Signal type	Meaning
1	TX+	I	Transmit +
2	TX-	I	Transmit -
3	RX+	O	Receive +
4	N.C.	-	Not assigned
5	N.C.	-	Not assigned
6	RX-	O	Receive -
7	N.C.	-	Not assigned
8	N.C.	-	Not assigned

Rotary switch: Feed override X30 / spindle override X31

Connector designation: **X30/X31**

Connector type: 2 x 5-pin plug connector, according to EN 60603-13 with coding

Table 7-4 Assignment of connector X30

Pin	Signal name	Signal type	Meaning
1	N.C.	-	Not assigned
2	N.C.	-	Not assigned
3	M	V	Ground
4	N.C.	-	Not assigned
5	P5	V	5 V supply
6	OV16	I	Rotary override switch, position/value 16
7	OV8		Rotary override switch, position/value 8
8	OV4		Rotary override switch, position/value 4
9	OV2		Rotary override switch, position/value 2
10	OV1		Rotary override switch, position/value 1

Optional customer buttons IN (X51 / X52 / X55)

Only switches (passive inputs) may be connected via the X51, X52 and X55 connectors. X51 and X52 are typically used for connecting illuminated pushbuttons. The lamps in the buttons are activated via X53 and X54. X55 has no corresponding outputs.

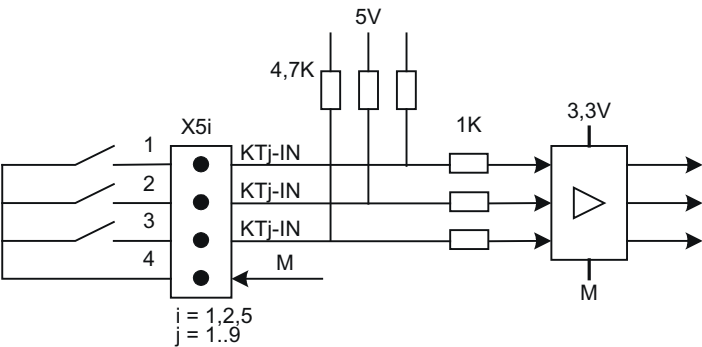


Figure 7-15 Main circuit diagram for input circuit for X51, X52 and X55

Connector designation: **X51, X52, X55**

Connector type: 4-pin plug connector

Table 7-5 Assignment of connector X51

Pin	Signal name	Signal type	Meaning
1	KT-IN1	I	Customer key 1
2	KT-IN2		Customer key 2
3	KT-IN3		Customer key 3
4	M	V	Ground

Table 7-6 Assignment of connector X52

Pin	Signal name	Signal type	Meaning
1	KT-IN4	I	Customer key 4
2	KT-IN5		Customer key 5
3	KT-IN6		Customer key 6
4	M	V	Ground

Table 7-7 Assignment of connector X55

Pin	Signal name	Signal type	Meaning
1	KT-IN7	I	Customer key 7
2	KT-IN8		Customer key 8
3	KT-IN9		Customer key 9
4	M	V	Ground

Optional customer buttons OUT (X53 / X54)

The short-circuit-proof outputs X53/X54 are provided to control lamps in the buttons. Lamps with 24 V and 1.2 W per output are recommended.

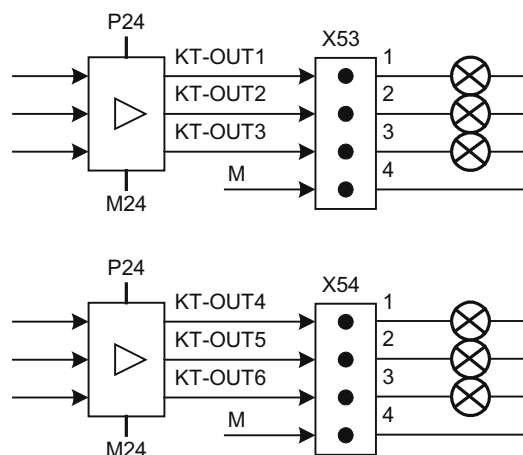


Figure 7-16 Main circuit diagram for input circuit for X53 and X54



CAUTION

Do not connect any relays, valves or other inductive loads.

Connector designation: **X53, X54**

Connector type: 4-pin plug connector

Table 7-8 Assignment of connector X53

Pin	Signal name	Signal type	Meaning
1	KT-OUT1	O	Output 1 lamp
2	KT- OUT2		Output 2 lamp
3	KT- OUT3		Output 3 lamp
4	M	V	Ground

Table 7-9 Assignment of connector X54

Pin	Signal name	Signal type	Meaning
1	KT-OUT4	O	Output 4 lamp
2	KT- OUT5		Output 5 lamp
3	KT- OUT6		Output 6 lamp
4	M	V	Ground

X60 handwheel

Via X60, you can connect one handwheel either with TTL or difference signals.

Note

The handwheel is supplied by the MCP module with 5 V / 100 mA. An external power supply is not permitted.

NOTICE

Handwheel connections

The SINUMERIK 828D software can process up to three handwheels. You can connect two handwheels to the PPU. You can connect an additional handwheel to the machine control panel.

Connector designation: **X60**

Connector type: 15-pin Sub-D socket

Table 7-10 Assignment of connector X60

Pin	Name	Type	Meaning
1	P5V	V	5 V power supply
2	M	V	Ground
3	HW1_A	I	Handwheel pulses track A
4	HW1_XA	I	Handwheel pulses track A (negated)
5	N.C.	-	Not assigned
6	HW1_B	I	Handwheel pulses track B
7	HW1_XB	I	Handwheel pulses track B (negated)
8	N.C.	-	Not assigned
9	P5V	V	5 V power supply
10	N.C.	-	Handwheel 2 pulses track A (negated)
11	M	V	Ground
12	N.C.	-	Not assigned
13	N.C.	-	Not assigned
14	N.C.	-	Not assigned
15	N.C.	-	Not assigned

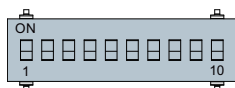
Switch S1

The handwheel signal type is set with switch S1.

Closed	differential interface
Open	TTL interface

Switch S1 is closed when supplied ex works.

Switch S2



Switch position: "ON" is at the top.

Table 7-11 Switch S2 is set as delivered

1	2	3	4	5	6	7	8	9	10	Meaning
								ON	ON	PLC I/O Interface
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF			PROFINET address "0"

The two switches S2-9 and S2-10 must remain "ON".

The switches S2-1 to S2-8 define the PROFINET address. For a SINUMERIK 828D, the address "64" must always be assigned to the MCP.

Table 7-12 Settings of switch S2

1	2	3	4	5	6	7	8	9	10	Meaning
						ON		ON	ON	
OFF	OFF	OFF	OFF	OFF	OFF		OFF			PROFINET address "64"

Further information on the addressing can be found in Section Addressing components (Page 259).

7.3.4 Parameterization

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. Information on settings in the machine data can be found in Section Activating components (Page 258).

Standard input image

Table 7-13 Input image MCP 483C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB112	Spindle override				Operating mode			
	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)	JOG	TEACH IN	MDI	AUTO
EB113	Machine function							
	REPOS	REF.	var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
EB114	Keyswitch position 0	Keyswitch position 2	Spindle start	*Spindle stop	Feed start	*Feed stop	NC start	*NC stop

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB115	RESET	Keyswitch position 1	Single block	Feed override				
				E (2 ⁴)	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)
EB116	Direction keys			Keyswitch position 3	Axis selection			
	+ R15	- R13	Rapid tra- verse R14		X R1	4. axis R4	7. axis R7	R10
EB117	Axis selection							
	Y R2	Z R3	5. axis R5	Drive com- mand in MCS/WCS	R11	9. axis R9	8. axis R8	6. axis R6
EB118	Freely assignable customer keys							
	T9	T10	T11	T12	T13	T14	T15	-
EB119	Freely assignable customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
EB120	-	-	-	-	-	-	-	-
EB121	-	-	-	-	-	-	-	-
EB122	KT-IN8	KT-IN7	KT-IN6	KT-IN5	KT-IN4	KT-IN3	KT-IN2	KT-IN1
EB123	-	-	-	-	-	-	-	KT-IN9
EB124	-	-	-	-	-	-	-	-
EB125	-	-	-	X31 pin 6 ¹⁾	X31 pin 7 ¹⁾	X31 pin 8 ¹⁾	X31 pin 9 ¹⁾	X31 pin 10 ¹⁾
Signals marked with * are inverse signals.								

1) If the 4-stage spindle override rotary switch on X31 is replaced by a 5-stage rotary switch, the information here can be measured in 5 stages.

Input image of the handwheel

Table 7-14 Input image for handwheel data

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB m + 0	Handwheel 1 counter status (16-bit signed, low-order byte equals byte m + 0)							
EB m + 1								
EB m + 2	Handwheel 2 counter status (16-bit signed, low-order byte equals byte m + 2)							
EB m + 3								

Note

Within the SINUMERIK control, the handwheel data is processed directly by the NC and is not available to the PLC.

Output image

Table 7-15 Output image MCP 483C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
AB112	Machine function				Operating mode			
	1000 INC	100 INC	10 INC	1 INC	JOG	TEACH IN	MDI	AUTO
AB113	Feed start	*Feed stop	NC start	*NC stop	Machine function			
					REPOS	REF.	var. INC	10000 INC
AB114	Direction key - R13	Axis selection			R10	Single block	Spindle start	*Spindle stop
		X R1	4. axis R4	7. axis R7				
AB115	Axis selection							Direction key + R15
	Z R3	5. axis R5	Drive command in MCS/WCS	R11	9. axis R9	8. axis R8	6. axis R6	
AB116	Freely assignable customer keys							
	T9	T10	T11	T12	T13	T14	T15	Y R2
AB117	Freely assignable customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
AB118	-	-	-	-	-	-	RESET	R14
AB119	-	-	KT-OUT 6	KT-OUT 5	KT-OUT 4	KT-OUT 3	KT-OUT 2	KT-OUT 1

Signals marked with * are inverse signals

Signals marked with * are inverse signals

Default key assignment

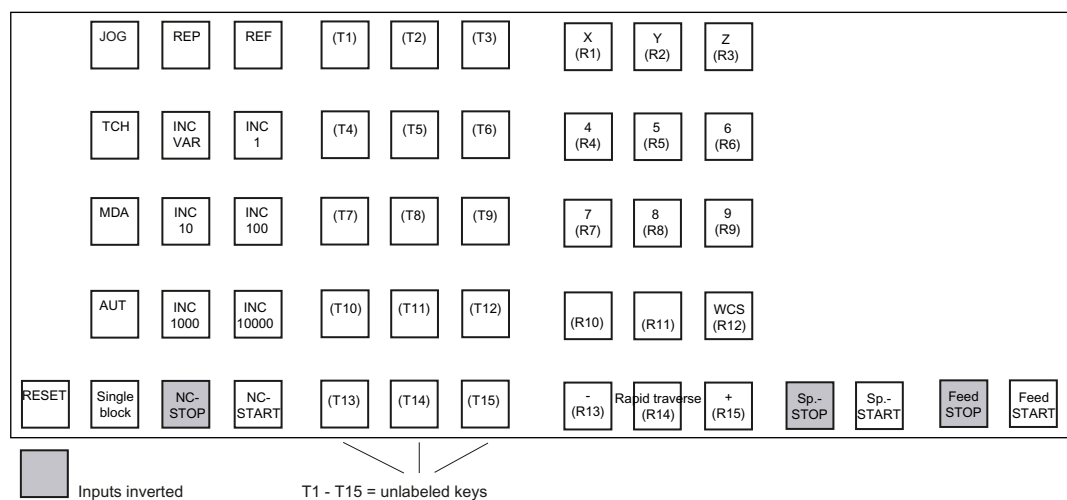


Figure 7-17 Default key assignment of MCP 483C PN

Assignment of the inputs (I) and outputs (O) to the keys and LEDs

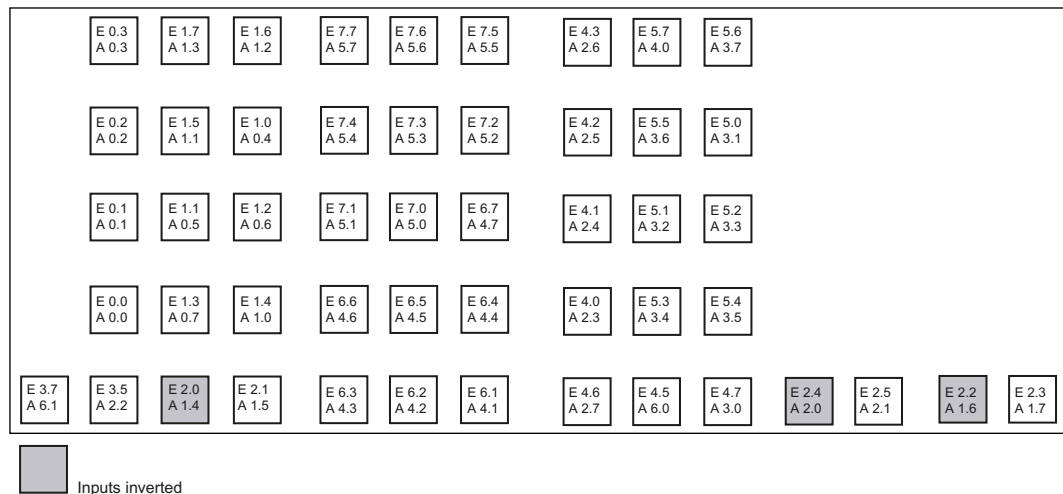


Figure 7-18 Inputs and outputs of the MCP 483C PN keyboard

7.3.5 Technical data

MCP 483C PN

Parameter	Value
Input voltage	24 V DC
Power consumption, max.	
• Board	5 W
• Illumination	43.2 W (6 x 7.2 W) *)
• Handwheels	2 x 0.9 W
• Total	50 W
Vibratory load:	
• Operation	10 – 58 Hz: 0.15 mm
• Transport (in transport packaging)	58 – 200 Hz: 2 g (acc. to EN 60721-3-3)
	5 – 9 Hz: 6.2 mm
	9 – 200 Hz: 2 g (acc. to EN 60721-3-2)
Shock load:	
• Operation	15 g, 11 ms, 18 shocks (acc. to EN 60721-3-3)
• Transport (in transport packaging)	15 g, 6 ms, 18 shocks (acc. to EN 60721-3-2)
Protection class acc. to EN 61800-5-1	III (DVC A, PELV)
Degree of protection acc. to DIN IEC 529	IP54 (front)
	IP00 (rear)
Condensation, splash water and icing	Not permissible

Parameter	Value
Relative humidity:	
• Storage	5 ... 95 %
• Transport	5 ... 95 %
• Operation	5 ... 95 %
Supply air	Without aggressive gases, dusts and oils
Cooling	By natural convection
Ambient temperature:	
• Storage	-25 °C ... 55 °C
• Transport (in transport packaging)	-40 °C ... 70 °C
• Operation	
– Front	0 ... 45 °C
– Rear	0 ... 55 °C
Dimensions:	
• Width	483 mm
• Height	155 mm
• Depth	55 mm
Weight, approx.	1.8 kg
Approvals	CE, cULus

*) If the outputs for the illuminated pushbuttons (X53/X54) are loaded with the max. permissible current of 0.3 A, this results in additional power consumption of 36 W. The total power consumption is then 50 W.

See also

Other values/standards: Application planning (Page 37)

7.3.6 Spare parts and accessories

Table 7-16 Spare part kits for machine control panel MCP 483C PN

Name	Description	Quantity	Article number
Emergency Stop button	22 mm actuating element, 40 mm mushroom pushbutton, snap action with tamper protection, latching, red, with holder, non-illuminated	1	3SB3000-1HA20
Contact block	with 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be additionally connected)	1	3SB3400-0A
Set of keys	Set of keys for machine control panel	10	6FC5148-0AA03-0AA0
Rapid traverse dial	for 16-stage rotary switch	20	6FC5248-0AF30-0AA0

Name	Description	Quantity	Article number
Rotary switch for spindle	Spindle/rapid traverse override, electronic rotary switch 1x16G, T=24, cap, knob, pointer, spindle and rapid-traverse dials	1	6FC5247-0AF12-1AA0
Rotary switch for feed	Override feedrate / rapid traverse electronic rotary switch 1x23G, T=32, cap, knob, pointer, feedrate and rapid-traverse dials	1	6FC5247-0AF13-1AA0
Set of tensioners	Set of tensioners for supplementary operator components with 2.5 mm profile, 20mm length	9	6FC5248-0AF14-0AA0

Table 7-17 Accessories pack (for delivery ex works)

Component	Description	Amount
Keyset	Key caps for turning (labeled)	9
	Ergo gray key caps (can be labeled)	30
	Clear key caps (can be labeled)	30
Yellow backing plate	for emergency stop	1

Table 7-18 Accessories available for order

Component	Description	Amount	Article number
Square key cap, can be laser-labeled	1 set of 90, ergo-gray and 20 each of red / green / yellow / medium gray	1	6FC5248-0AF12-0AA0
Square key cap, for inscription plates	1 set of 90, clear	1	6FC5248-0AF21-0AA0
Cable set	For additional MCP control devices, length 500 mm	60	6FC5247-0AA35-0AA0

7.4 MCP 310C PN

Description

The 310C PN machine control panel enables user-friendly operation of the machine functions. It can be used in the SINUMERIK 828D for machine-related operation of machine tools.

All keys are designed with replaceable caps for machine-specific adaptations. The key caps can be freely inscribed using laser. Clear key caps can be used as an alternative.

The machine control panel is mounted from the rear with special tension jacks supplied with the panel.

Operator controls

- Operating mode and function keys:
 - 49 keys with assigned LEDs
 - Direction keys for milling machines with rapid traverse override (key covers for direction keys for turning machines are supplied)
 - Key type: mechanical short-stroke keys
- Feed control with override feed/rapid traverse (rotary switch with 23 positions)
- Key-operated switch (four positions and three different keys)

Interfaces

- PLC I/O Interface (data transmission rate: 100 Mbit/s)
- Nine customer-specific inputs (e.g. for illuminated pushbuttons)
- Six customer-specific outputs
- Handwheel connection

Expansion slots

Six slots for control devices (d = 16 mm)

Additional cable set required for control devices: Spare parts and accessories (Page 157)

7.4.1 Operator controls and display elements

Operator controls

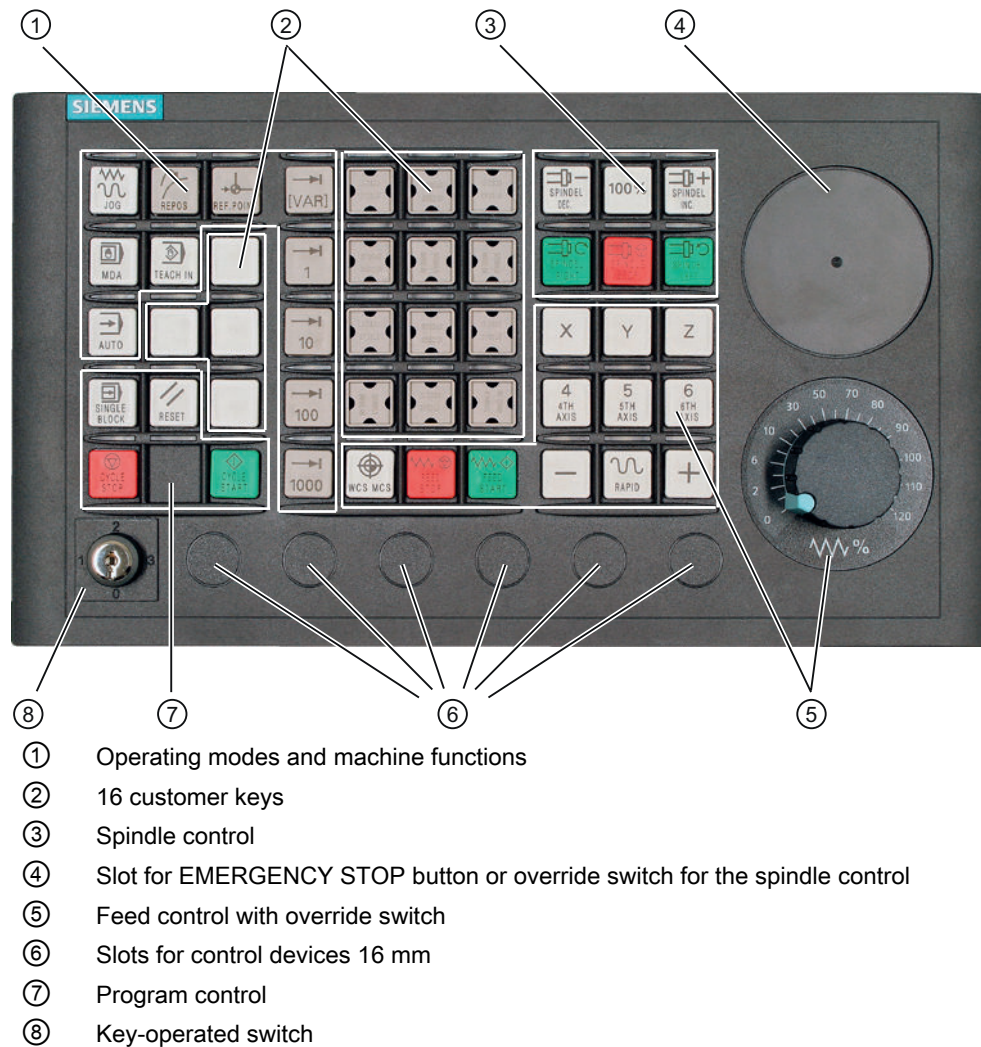


Figure 7-19 Arrangement of the MCP 310C PN control elements

Emergency Stop button

If an EMERGENCY STOP button is to be retrofitted, refer to Chapter Operator controls and display elements (Page 125) of the MCP 483C PN.

Mounting slots for control devices

 WARNING
Warning of damage
Do not chip out the openings for mounting control devices ⑥; drill them to the required width.

Key caps

All keys of the MCP 310C PN come with changeable key caps. Refer to the following table for the additional replacement key caps provided for lathes in the accessories pack:

Key cap	Symbol number	Key cap	Symbol number
 RAPID	7027	–X	7129
+C	7125	–Y	7130
+X	7126	–Z	7131
+Y	7127	–C	7132
+Z	7128		

You will find article numbers for the key caps in Chapter Spare parts and accessories (Page 157).

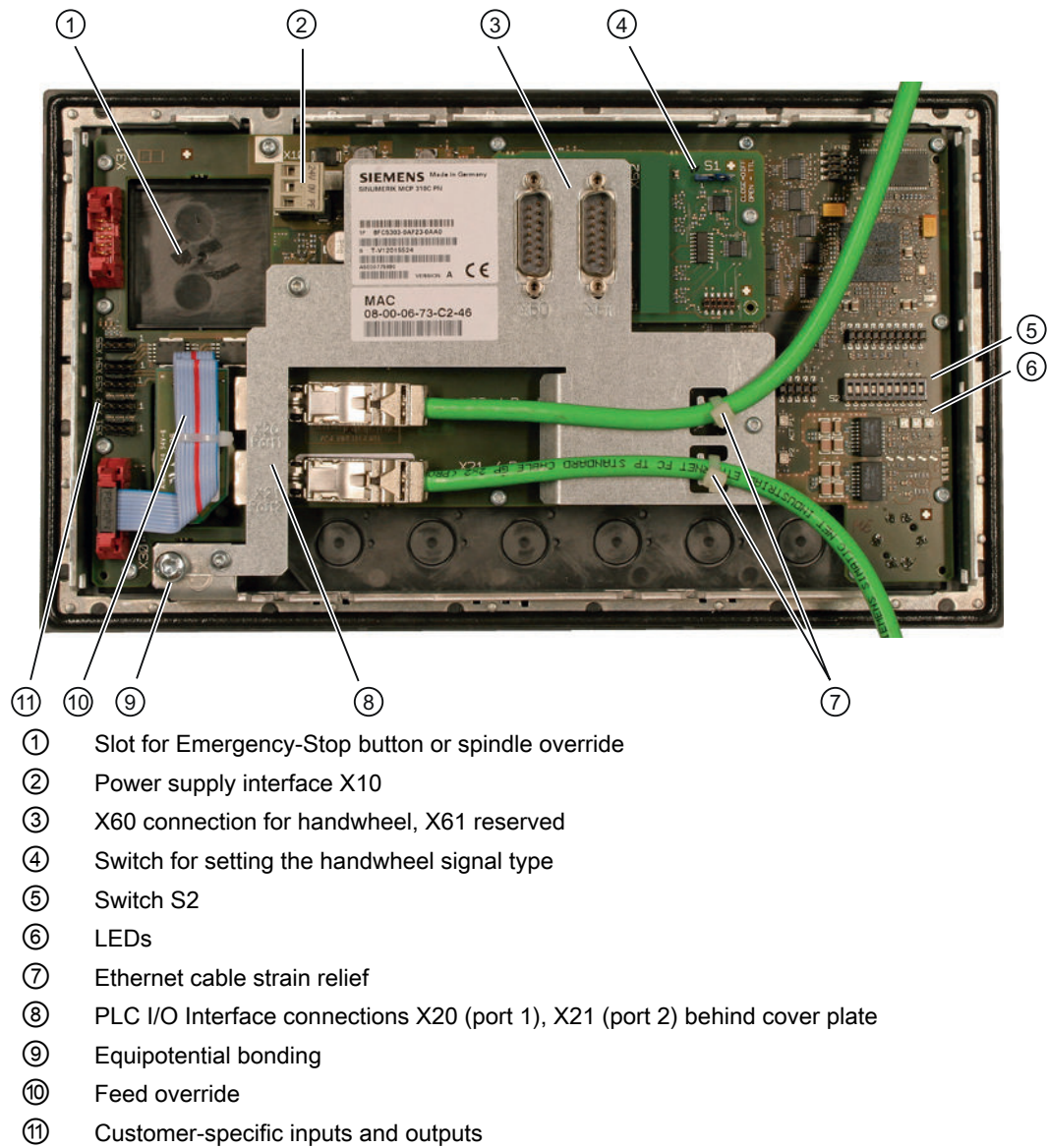


Figure 7-20 Rear of the MCP 310C PN with Ethernet connecting cables

Equipotential bonding

The equipotential bonding conductor is attached by means of an M5 screw.

LEDs for status display

Table 7-19 LEDs

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply ok
H2	PNSync	Green	Lit: System software running, STOP state Flashes 0.5 Hz: System software running, RUN state
H3	PNFault	Red	Not lit: Module is operating without errors; data exchange with all configured I/O devices is running. Lit: Serious bus fault; only output when one of the following errors is detected for the ports: • No physical connection to a subnet/switch • Incorrect transmission rate • Full duplex transmission is not activated

Note

When the system is booting, all three LEDs are lit.

7.4.2 Mounting

Mounting position

The permitted mounting position is max. 60° to the vertical.

Note

For mounting position greater than 60°, a fan must also be installed to keep the ambient temperature of the machine control panel constantly below 55° C.

Tension jacks

The machine control panel is attached using six tension jacks (tightening torque, 0.5 Nm).

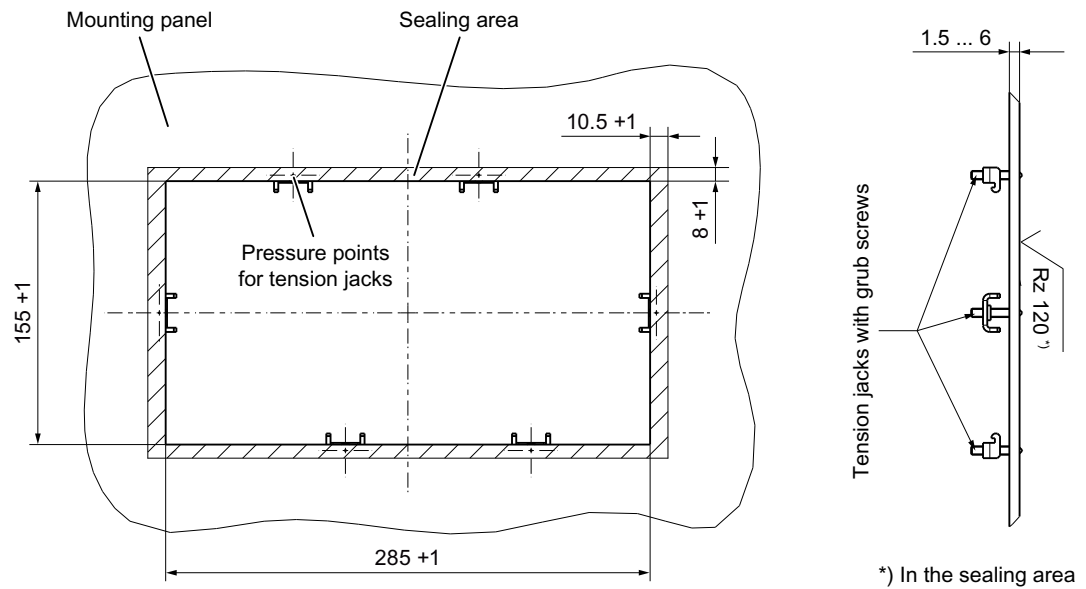


Figure 7-21 Panel cut-out for the machine control panel MCP 310C PN

Dimension drawing

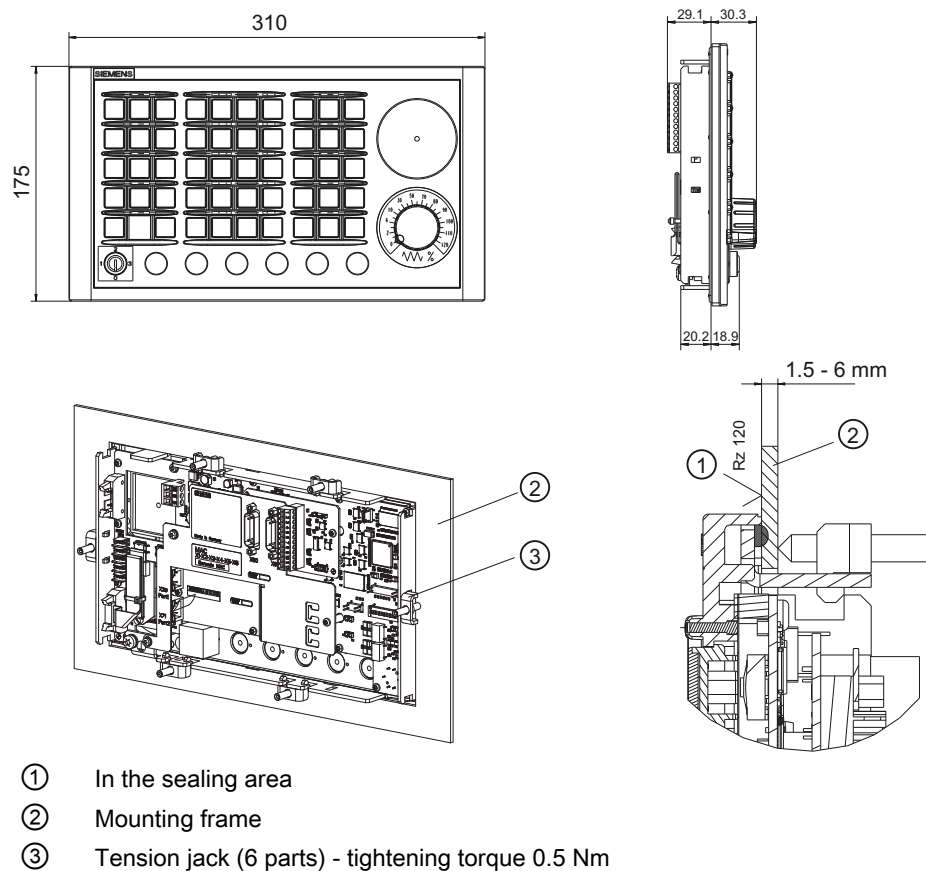


Figure 7-22 MCP 310C PN dimensions

7.4.3 Connecting

Securing the cables

Two equivalent connections (Fast Ethernet) are available for establishing the PLC I/O Interface communication network based on PROFINET.

Two cable ties are included in the scope of delivery. You use these to secure the Ethernet cables on the cover plate at the rear of the machine control panel.

The Ethernet cables are not included in the scope of delivery. When connecting the machine control panel to the SINUMERIK 828D, please use the preassembled SINAMICS DRIVE-CLiQ signal cables; from a technical point of view, these are also suitable for use with PROFINET.

NOTICE**Damage to cables**

Make sure that all cables are routed so that they do not come into contact with chafing edges.

See also

Ordering data (Page 263)

Interface overview

X10	Power supply interface
X20	PLC I/O Interface port 1
X21	PLC I/O Interface port 2
X30	Interface for rotary switch feed override
X31	Interface for rotary switch spindle override/EMERGENCY STOP (optional)
X51 / X52 / X55	Interfaces for customer-specific inputs
X53 / X54	Interfaces for customer-specific outputs
X60	Interface for handwheel
X61	Reserved
S1	Switch for setting the handwheel signal type
S2	Switch for setting the MCP address

X10 power supply pin assignment

Connector designation: **X10**

Connector type: Terminal block, 3-pin plug connector

Pin	Signal name	Signal type	Meaning
1	P24	V	24 V potential
2	M24	V	24 V ground
3	SHIELD	V	Shield connection

PLC I/O Interface pin assignment

Connector designation: **X20, X21**

Connector type: RJ45 socket

Table 7-20 Assignment of connectors X20, X21

Pin	Signal name	Signal type	Meaning
1	TX+	I	Transmit +
2	TX-	I	Transmit -
3	RX+	O	Receive +
4	N.C.	-	Not assigned
5	N.C.	-	Not assigned
6	RX-	O	Receive -
7	N.C.	-	Not assigned
8	N.C.	-	Not assigned

Rotary switch: Feed override X30 / spindle override X31

Connector designation: **X30/X31**

Connector type: 2 x 5-pin plug connector, according to EN 60603-13 with coding

Table 7-21 Assignment of connector X30

Pin	Signal name	Signal type	Meaning
1	N.C.	-	Not assigned
2	N.C.	-	Not assigned
3	M	V	Ground
4	N.C.	-	Not assigned
5	P5	V	5 V supply
6	OV16	I	Rotary override switch, position/value 16
7	OV8		Rotary override switch, position/value 8
8	OV4		Rotary override switch, position/value 4
9	OV2		Rotary override switch, position/value 2
10	OV1		Rotary override switch, position/value 1

Optional customer buttons IN (X51 / X52 / X55)

Only switches (passive inputs) may be connected via the X51, X52 and X55 connectors. X51 and X52 are typically used for connecting illuminated pushbuttons. The lamps in the buttons are activated via X53 and X54. X55 has no corresponding outputs.

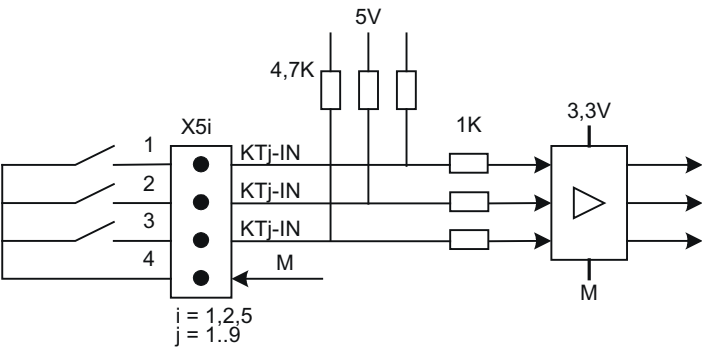


Figure 7-23 Main circuit diagram for input circuit for X51, X52 and X55

Connector designation: **X51, X52, X55**

Connector type: 4-pin plug connector

Table 7-22 Assignment of connector X51

Pin	Signal name	Signal type	Meaning
1	KT-IN1	I	Customer key 1
2	KT-IN2		Customer key 2
3	KT-IN3		Customer key 3
4	M	V	Ground

Table 7-23 Assignment of connector X52

Pin	Signal name	Signal type	Meaning
1	KT-IN4	I	Customer key 4
2	KT-IN5		Customer key 5
3	KT-IN6		Customer key 6
4	M	V	Ground

Table 7-24 Assignment of connector X55

Pin	Signal name	Signal type	Meaning
1	KT-IN7	I	Customer key 7
2	KT-IN8		Customer key 8
3	KT-IN9		Customer key 9
4	M	V	Ground

Optional customer buttons OUT (X53 / X54)

The short-circuit-proof outputs X53/X54 are provided to control lamps in the buttons. Lamps with 24 V and 1.2 W per output are recommended.

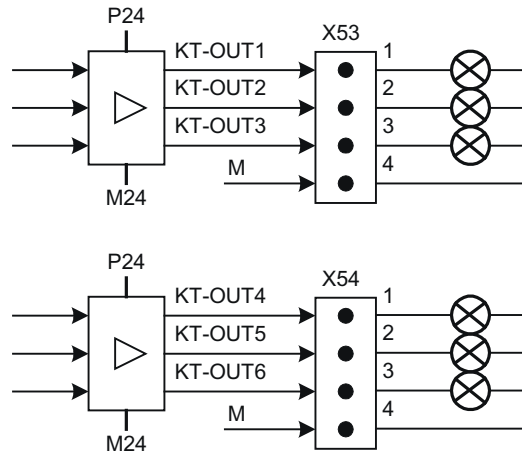


Figure 7-24 Main circuit diagram for input circuit for X53 and X54

CAUTION

Do not connect any relays, valves or other inductive loads.

Connector designation: **X53, X54**

Connector type: 4-pin plug connector

Table 7-25 Assignment of connector X53

Pin	Signal name	Signal type	Meaning
1	KT-OUT1	O	Output 1 lamp
2	KT- OUT2		Output 2 lamp
3	KT- OUT3		Output 3 lamp
4	M	V	Ground

Table 7-26 Assignment of connector X54

Pin	Signal name	Signal type	Meaning
1	KT-OUT4	O	Output 4 lamp
2	KT- OUT5		Output 5 lamp
3	KT- OUT6		Output 6 lamp
4	M	V	Ground

X60 handwheel

Via X60, you can connect one handwheel either with TTL or difference signals.

Note

The handwheel is supplied by the MCP module with 5 V / 100 mA. An external power supply is not permitted.

NOTICE

Handwheel connections

The SINUMERIK 828D software can process up to three handwheels. You can connect two handwheels to the PPU. You can connect an additional handwheel to the machine control panel.

Connector designation: **X60**

Connector type: 15-pin Sub-D socket

Table 7-27 Assignment of connector X60

Pin	Name	Type	Meaning
1	P5V	V	5 V power supply
2	M	V	Ground
3	HW1_A	I	Handwheel pulses track A
4	HW1_XA	I	Handwheel pulses track A (negated)
5	N.C.	-	Not assigned
6	HW1_B	I	Handwheel pulses track B
7	HW1_XB	I	Handwheel pulses track B (negated)
8	N.C.	-	Not assigned
9	P5V	V	5 V power supply
10	N.C.	-	Handwheel 2 pulses track A (negated)
11	M	V	Ground
12	N.C.	-	Not assigned
13	N.C.	-	Not assigned
14	N.C.	-	Not assigned
15	N.C.	-	Not assigned

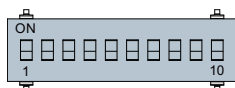
Switch S1

The handwheel signal type is set with switch S1.

Closed	differential interface
Open	TTL interface

Switch S1 is closed when supplied ex works.

Switch S2



Switch position: "ON" is at the top.

Table 7-28 Switch S2 is set as delivered

1	2	3	4	5	6	7	8	9	10	Meaning
								ON	ON	PLC I/O Interface
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF			PROFINET address "0"

The two switches S2-9 and S2-10 must remain "ON".

The switches S2-1 to S2-8 define the PROFINET address. For a SINUMERIK 828D, the address "64" must always be assigned to the MCP.

Table 7-29 Settings of switch S2

1	2	3	4	5	6	7	8	9	10	Meaning
						ON		ON	ON	
OFF	OFF	OFF	OFF	OFF	OFF		OFF			PROFINET address "64"

Further information on the addressing can be found in Section Addressing components (Page 259).

7.4.4 Parameterization

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. Information on settings in the machine data can be found in Section Activating components (Page 258).

Standard input image

Table 7-30 Input image MCP 310C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB112	* NC stop	Spindle -	Spindle 100%	Spindle +	Single block	JOG	MDI	AUTO
EB113	NC start	Spindle right	* Spindle stop	Spindle left	Keyswitch position 3	REF	REP	Teach IN
EB114	Feed start	* Feed stop	INC VAR	Keyswitch position 0	INC 1000	INC 100	INC 10	INC 1

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB115	RESET	Keyswitch position 2	Keyswitch position 1	Feed override				
		E (2 ⁴)	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)		
EB116	Direction keys			KT5	KT4	KT3	KT2	KT1
	+	-	Rapid tra- verse					
EB117	T16	KT6	6	5	4	Z	Y	X
EB118	Freely assignable customer keys				WCS MCS	Freely assignable customer keys		
	T9	T10	T11	T12		T13	T14	T15
EB119	Freely assignable customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
EB120	-	-	-	-	-	-	-	-
EB121	-	-	-	-	-	-	-	-
EB122	KT-IN8	KT-IN7	KT-IN6	KT-IN5	KT-IN4	KT-IN3	KT-IN2	KT-IN1
EB123	-	-	-	-	-	-	-	KT-IN9
EB124	-	-	-	-	-	-	-	-
EB125	-	-	-	X31 pin 6 ¹⁾	X31 pin 7 ¹⁾	X31 pin 8 ¹⁾	X31 pin 9 ¹⁾	X31 pin 10 ¹⁾

Signals marked with * are inverse signals.

1) If the 4-stage rotary spindle override switch on X31 is replaced by a 5-stage rotary switch, the input information here can be measured in 5 stages.

Input image of the handwheel

Table 7-31 Input image for handwheel data

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB m + 0	Handwheel 1 counter status (16-bit signed, low-order byte equals byte m + 0)							
EB m + 1								
EB m + 2	Handwheel 2 counter status (16-bit signed, low-order byte equals byte m + 2)							
EB m + 3								

Note

Within the SINUMERIK control, the handwheel data is processed directly by the NC and is not available to the PLC.

Output image

Table 7-32 Output image MCP 310C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
AB112	* NC stop	Spindle -	Spindle 100%	Spindle +	Single block	JOG	MDI	AUTO
AB113	NC start	Spindle right	* Spindle stop	Spindle left	RESET	REF	REP	Teach IN
AB114	Feed start	* Feed stop	INC VAR	-	INC 1000	INC 100	INC 10	INC 1
AB115	-	-	-	-	-	-	-	-
AB116	+	-	Rapid traverse	KT-OUT5	KT-OUT4	KT-OUT3	KT-OUT2	KT-OUT1
AB117	T16	KT-OUT6	6	5	4	Z	Y	X
AB118	Freely assignable customer keys							
	T9	T10	T11	T12	WCS MCS	T13	T14	T15
AB119	Freely assignable customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8

Signals marked with * are inverse signals

Default key assignment

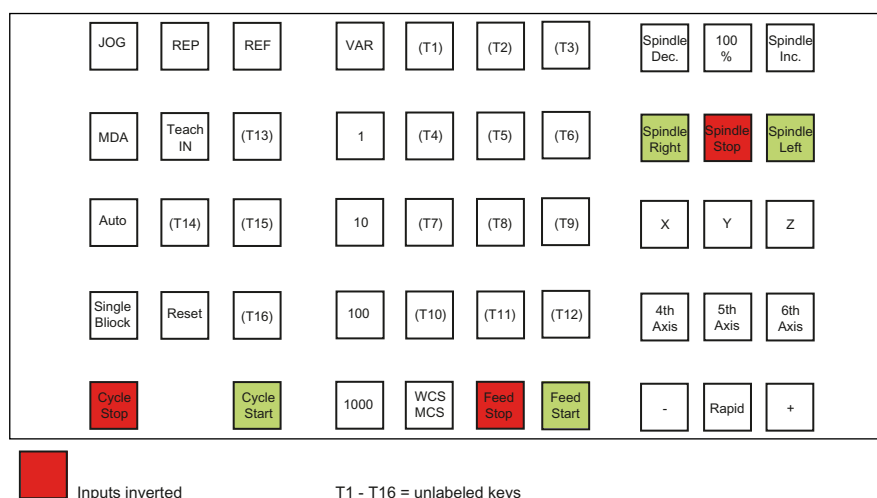


Figure 7-25 Default key assignment of MCP 310C PN

Assignment of the inputs (I) and outputs (O) to the keys and LEDs



Figure 7-26 Inputs and outputs of the MCP 310C PN keyboard

7.4.5 Technical data

MCP 310C PN

Parameter	Value
Input voltage	24 V DC
Power consumption, max.	
• Board	5 W
• Illumination	43.2 W (6 x 7.2 W) *)
• Handwheels	2 x 0.9 W
• Total	50 W
Vibratory load:	
• Operation	10 – 58 Hz: 0.15 mm
• Transport (in transport packaging)	58 – 200 Hz: 2 g (acc. to EN 60068-2-6 test Fc) 5 – 9 Hz: 3.5 mm 9 – 200 Hz: 1 g (acc. to EN 60068-2-6)
Shock load:	
• Operation	15 g, 11 ms, 18 shocks according to EN 60068-1
• Transport (in transport packaging)	15 g, 11 ms, 18 shocks according to EN 60068-2-27
Protection class acc. to EN 61800-5-1	III (DVC A, PELV)
Degree of protection acc. to DIN IEC 529	IP54 (front) IP00 (rear)
Condensation, spraying water, and icing	Not permitted

Parameter	Value
Relative humidity:	
• Storage	5 ... 95 %
• Transport	5 ... 95 %
• Operation	5 ... 95 %
Supply air	Without aggressive gases, dusts, and oils
Cooling	By natural convection
Ambient temperature:	
• Storage	-25 °C ... 55 °C
• Transport (in transport packaging)	-40 °C ... 70 °C
• Operation	
– Front	0 ... 45 °C
– Rear	0 ... 55 °C
Dimensions:	
• Width	310 mm
• Height	175 mm
• Depth	55 mm
Weight, approx.	1.2 kg
Approvals	CE, cULus

*) If the outputs for the illuminated pushbuttons (X53/X54) are loaded with the max. permissible current of 0.3 A, this results in additional power consumption of 36 W. The total power consumption is then 50 W.

See also

Other values/standards: Chapter "Application planning (Page 37)"

7.4.6 Spare parts and accessories

Table 7-33 Accessories and spare parts for MCP 310C PN

Name	Description	Amount	Article number
Emergency-Stop button	22 mm actuating element, 40 mm mushroom pushbutton, snap action with tamper protection, latching, red, with holder, non-illuminated	1	3SB3000-1HA20
Contact block	with 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be additionally connected)	1	3SB3400-0A
Sets of keys	Set of keys (10 sets) for machine control panel	1 set	6FC5148-0AA03-0AA0

Name	Description	Amount	Article number
Set of tensioners	Tensioner set (9 items) for supplementary components with 2.5 mm profile, length 20 mm	1 set	6FC5248-0AF14-0AA0
Override Spindle rotary switch	Spindle/rapid traverse override, electronic rotary switch 1x16G, T=24, cap, knob, pointer, spindle and rapid-traverse dials	1	6FC5247-0AF12-1AA0
Override Feed rotary switch	Override feedrate / rapid traverse electronic rotary switch 1x23G, T=32, cap, knob, pointer, feedrate and rapid-traverse dials	1	6FC5247-0AF13-1AA0
Key cap	Square, can be labeled by laser, 1 set of 90, ergo-gray and 20 each of red / green / yellow / medium gray	1	6FC5248-0AF12-0AA0
Key cap	Square, for inscription plates, 1 set of 90, clear	1	6FC5248-0AF21-0AA0
Cable set	For additional MCP control devices, length 500 mm	60	6FC5247-0AA35-0AA0

Accessories pack (for delivery ex works):

Component	Description	Amount
Keyset	Key caps for turning (labeled)	9
	Ergo gray key caps (can be labeled)	30
	Clear key caps (can be labeled)	30
Yellow backing plate	for emergency stop	1

7.5 MCP Interface PN

Description

In the SINUMERIK solution line control family, communication with the operator panels is via PROFINET (Industrial Ethernet).

The MCP Interface PN module enables customer-specific machine control panels to be connected to a machine tool. Communication is handled via PROFINET RT or Industrial Ethernet.

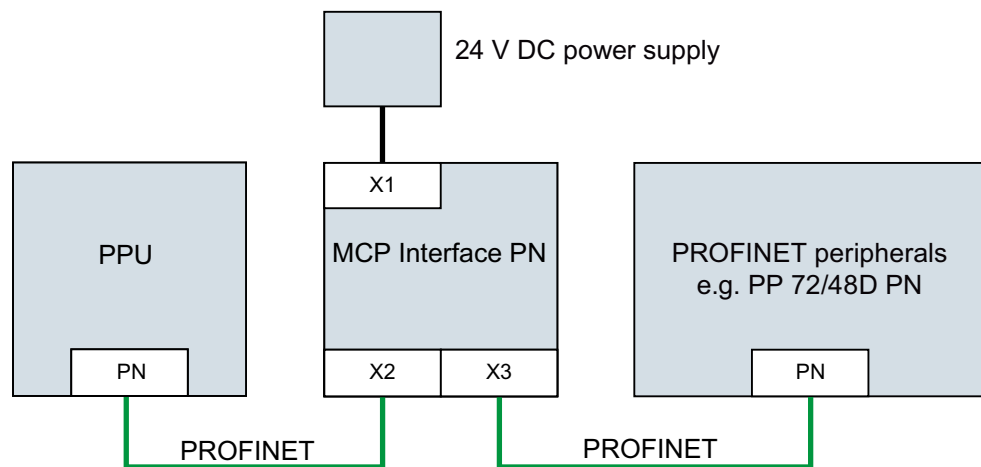
You can connect the following operator controls to the interface:

- 80 single keys
- 64 LEDs
- Handwheel
- 2 override switches

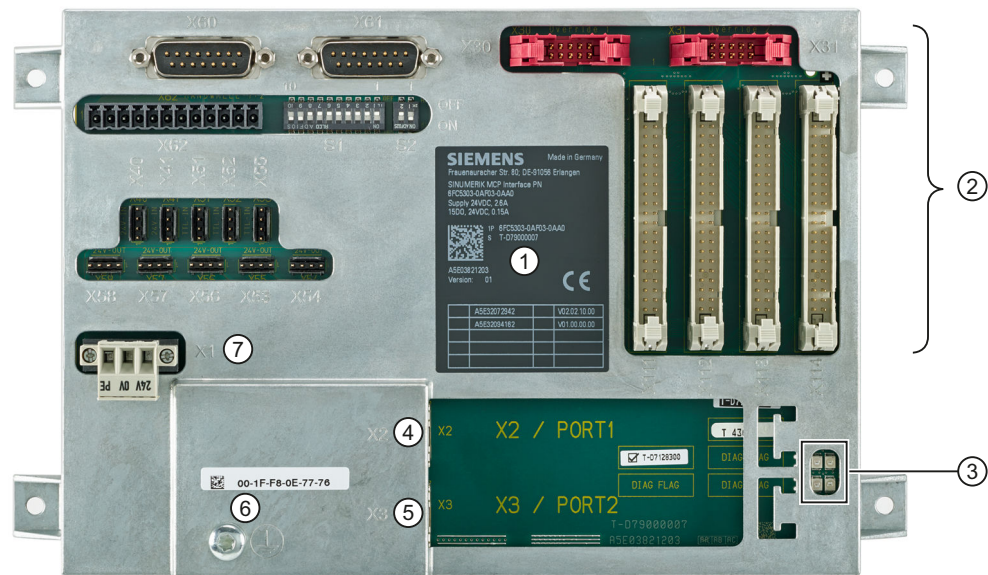
The following inputs/outputs are also available:

- 9 digital inputs (5 V)
- 6 digital inputs (24 V)
- 15 digital inputs (24 V / each 0.15 A)

System configuration



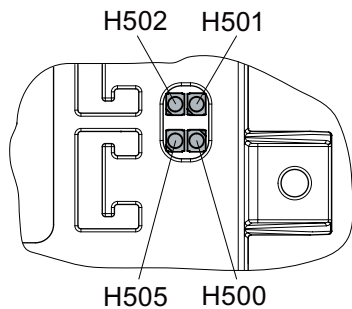
Illustration



- ① Type plate
- ② Terminal strips / connectors for operator controls
- ③ Diagnostics LED
- ④ PROFINET interface X2 (Industrial Ethernet 100 Mbit/s)
- ⑤ PROFINET interface X3 (Industrial Ethernet 100 Mbit/s)
- ⑥ Grounding screw M5 for potential equalization connection
- ⑦ 24 V DC power supply X1 (with screw connection)

Figure 7-27 View of MCP Interface PN

LED displays



Name	Function	Status	Meaning
H500	POWER OK (green)	Lit	All internal voltages are in the setpoint range.
		Not lit	At least one of the generated voltages has exceeded its setpoint; a reset will be initiated.

Name	Function	Status	Meaning
H501	BUS_SYNC	Not lit	No PROFINET communication.
		Lit	PROFINET is synchronized (STOP state).
		Flashes (0.5 Hz)	PROFINET is synchronized (RUN state).
H502	BUS_FAULT	Lit	PROFINET group fault.
H505	Temperature alarm (red)	Lit	At least one temperature limit is being exceeded.

7.5.1 Mounting

Installation

The module can be attached at a suitable position via the four mounting holes (e.g. behind the machine control panel or in the control cabinet). The selection of the appropriate mounting position depends on the interfaces used and the associated maximum cable lengths.

Four standard torx-slotted screws T20/M4 are used to attach the module.

MCP Interface PN dimension drawing

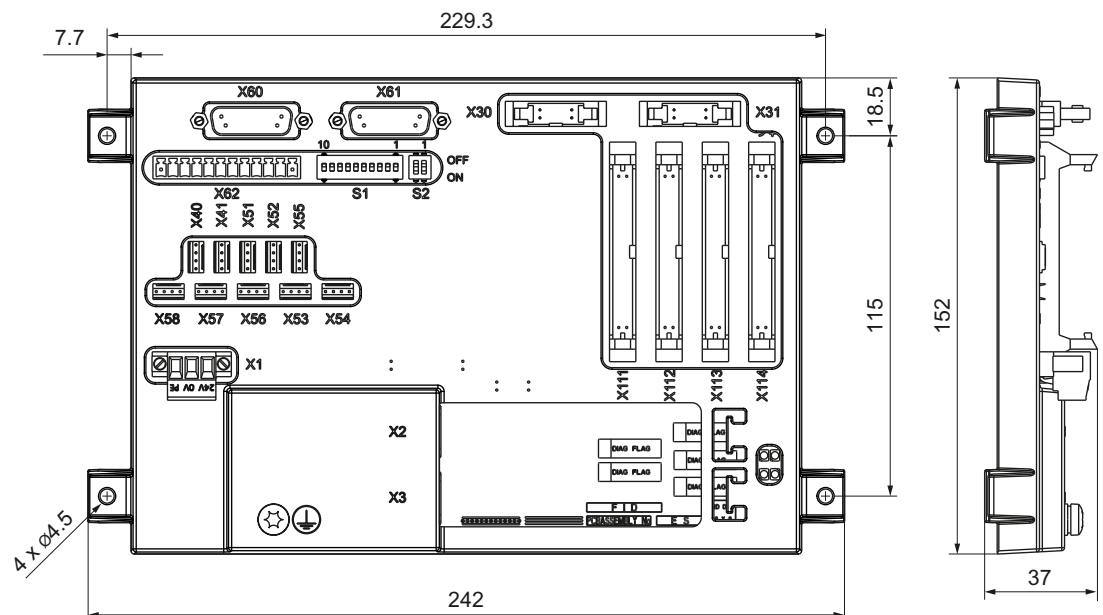


Figure 7-28 MCP Interface PN dimension drawing

7.5.2 Connection

Position of the interfaces

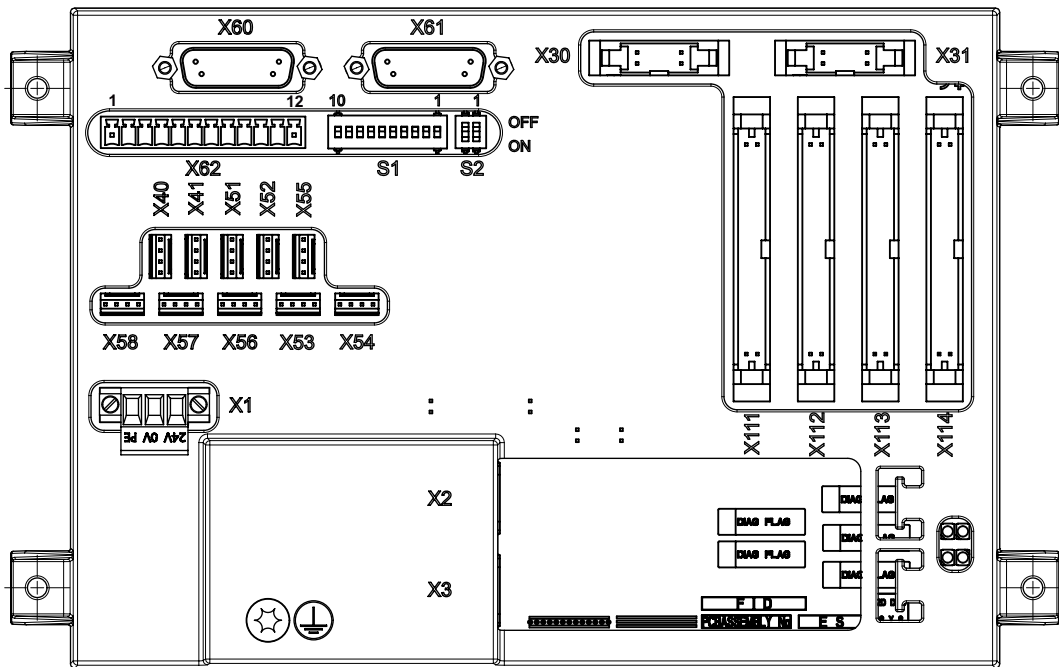


Figure 7-29 MCP Interface PN interfaces

Interface overview

X1	24 VDC power supply
X2	PROFINET interface
X3	PROFINET interface
X30	Interface for rotary switch feed override
X31	Interface for rotary switch spindle override
X40/X41	Digital inputs (24 V)
X51 / X52 / X55	Digital inputs (TTL)
X53 / X54 / X56 / X57 / X58	Digital outputs (24 V)
X60 / X62	Handwheel
X61	Reserved
X111/X112/X113/X114	Keys and LED interface
S1	DIP switch for setting the MCP address
S2	DIP switch for setting the handwheel signal type

Rotary switch: Feed override X30 / spindle override X31

Connector designation: **X30/X31**

Connector type: 2 x 5-pin plug connector, acc. to EN 60603-13 with coding

Table 7-34 Assignment of connector X30 / X31

Pin	Signal name	Signal type	Meaning
1	N.C.	-	Not assigned
2	N.C.	-	Not assigned
3	M	V	Ground
4	N.C.	-	Not assigned
5	P5	V	5 V supply
6	DI122.4 / DI123.4	I	Rotary override switch, position/value 16
7	DI122.3 / DI123.3		Rotary override switch, position/value 8
8	DI122.2 / DI123.2		Rotary override switch, position/value 4
9	DI122.1 / DI123.1		Rotary override switch, position/value 2
10	DI122.0 / DI123.0		Rotary override switch, position/value 1

Digital inputs X40, X41

A total of six 24 V signals can be evaluated via the X40 and X41 connectors.

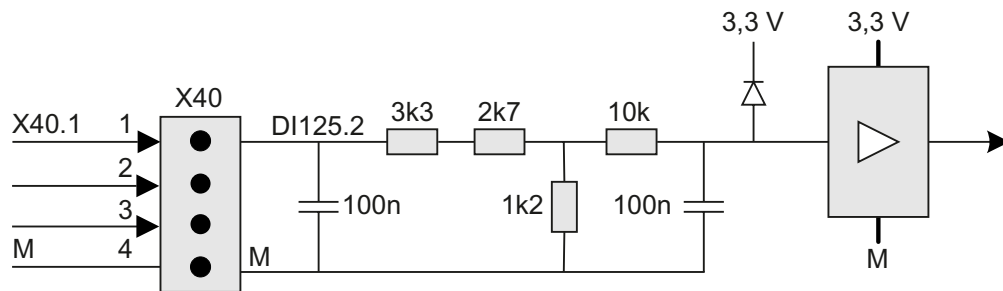


Figure 7-30 Schematic circuit diagram X40, X41

Connector designation: **X40, X41**
 Connector type: 4-pin plug connector
 Special feature: No galvanic isolation, short-circuit proof
 Max. cable length: 0.6 m

Table 7-35 X40 pin assignments

Pin	Signal name	Type	Meaning
1	DI125.2	I	24 V input 0
2	DI125.3		24 V input 1
3	DI125.4		24 V input 2
4	M	V	Ground

Table 7-36 X41 pin assignments

Pin	Signal name	Type	Meaning
1	DI125.5	I	24 V input 3
2	DI125.6		24 V input 4
3	DI125.7		24 V input 5
4	M	V	Ground

Table 7-37 Technical data for X40, X41

Parameter	Value
Voltage:	-3 V to 30 V
Typical current consumption:	6 mA at 24 VDC
Signal level (including ripple):	High signal level: 15 V to 30 V
	Low signal level: -3 V to 5 V

Digital inputs X51, X52, X55

Only switches (passive inputs) may be connected via the X51, X52 and X55 connectors. Typically, illuminated pushbuttons are connected here. The lamps in the buttons are activated via X53, X54 and X56 to X58.

Note

Connection miniature handheld unit

Alternatively, at the inputs X51, X52 and X55, one miniature handheld unit may be operated. For details, please refer to Section Mini handheld unit, Connecting (Page 190).

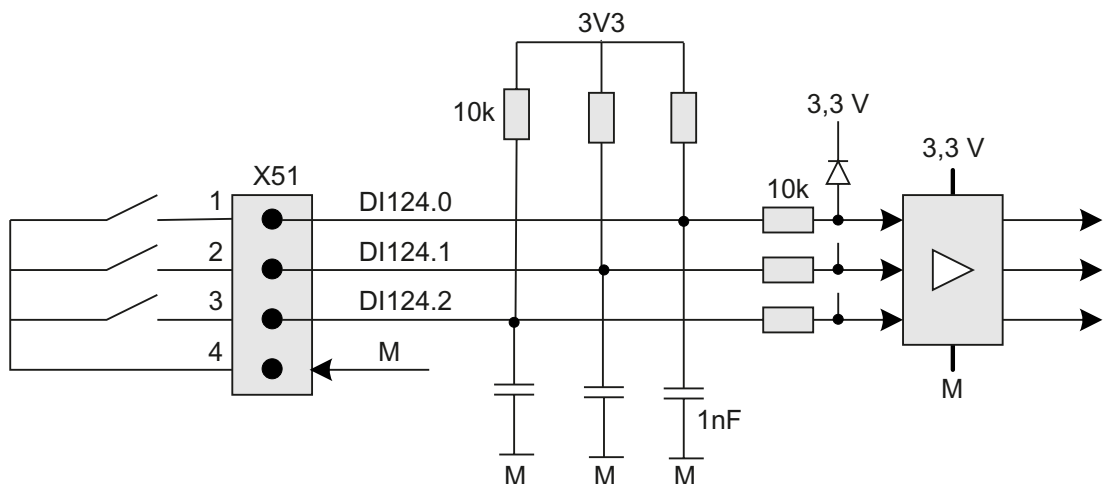


Figure 7-31 Block diagram X51, X52, X55

Connector designation: **X51, X52, X55**
 Connector type: 4-pin plug connector
 Special feature: No galvanic isolation
 Max. cable length: 0.6 m

Table 7-38 Assignment of connector X51

Pin	Signal name	Type	Meaning
1	DI124.0	I	Customer key 0
2	DI124.1		Customer key 1
3	DI124.2		Customer key 2
4	M	V	Ground

Table 7-39 Assignment of connector X52

Pin	Signal name	Type	Meaning
1	DI124.3	I	Customer key 3
2	DI124.4		Customer key 4
3	DI124.5		Customer key 5
4	M	V	Ground

Table 7-40 Assignment of connector X55

Pin	Signal name	Type	Meaning
1	DI124.6	I	Customer key 6
2	DI124.7		Customer key 7
3	DI125.0		Customer key 8
4	M	V	Ground

Table 7-41 Technical data for X51, X52, X55

Parameter	Value
Voltage:	Nominal: 0 V to 5 V
	Permissible: -3 V to 30 V
Typical current consumption:	0.2 mA at 5 VDC
	-0.3 mA at 0 VDC
Signal level (including ripple):	High signal level: 2.3 V to 5 V
	Low signal level: 0 V to 1 V

Digital outputs X53, X54, X56, X57, X58

The 15 outputs are provided to control lamps in the illuminated pushbuttons. Recommended are lamps with 1.2 W (50 mA).

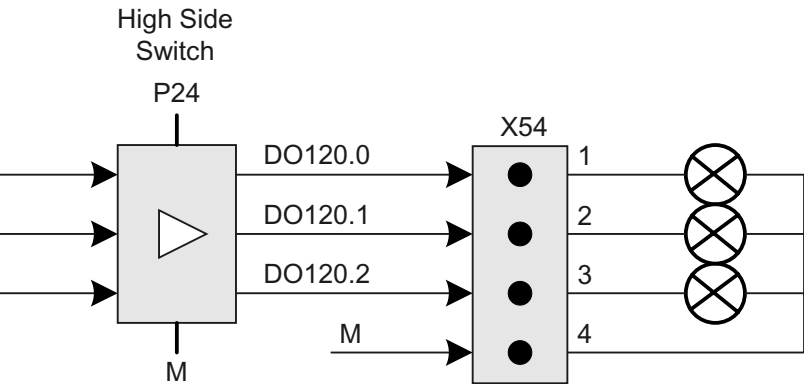


Figure 7-32 Block diagram X53, X54 and X56 to X58

Note

Observe the utilization of the power supply

The fifteen 24 V outputs are divided into 2 groups with 8 or 7 outputs each.

- Group 1 comprises the output signals DO120.x
- Group 2 comprises the output signals DO121.x

For each group, the 24 V supply may be loaded with max. 1.2 A.

Connector designation:	X53, X54, X56, X57, X58
Connector type:	4-pin plug connector
Special feature:	No galvanic isolation, short-circuit proof
Max. cable length:	0.6 m

Table 7-42 Assignment of connector X53

Pin	Signal name	Type	Meaning
1	DO120.3	O	24 V output 3 (group 1)
2	DO120.4		24 V output 4 (group 1)
3	DO120.5		24 V output 5 (group 1)
4	M	V	Ground

Table 7-43 Assignment of connector X54

Pin	Signal name	Type	Meaning
1	DO120.0	O	24 V output 0 (group 1)
2	DO120.1		24 V output 1 (group 1)
3	DO120.2		24 V output 2 (group 1)
4	M	V	Ground

Table 7-44 Assignment of connector X56

Pin	Signal name	Type	Meaning
1	DO120.6	O	24 V output 6 (group 1)
2	DO120.7		24 V output 7 (group 1)
3	DO121.0		24 V output 8 (group 2)
4	M	V	Ground

Table 7-45 Assignment of connector X57

Pin	Signal name	Type	Meaning
1	DO121.1	O	24 V output 9 (group 2)
2	DO121.2		24 V output 10 (group 2)
3	DO121.3		24 V output 11 (group 2)
4	M	V	Ground

Table 7-46 Assignment of connector X58

Pin	Signal name	Type	Meaning
1	DO121.4	O	24 V output 12 (group 2)
2	DO121.5		24 V output 13 (group 2)
3	DO121.6		24 V output 14 (group 2)
4	M	V	Ground

Table 7-47 Technical data for X53, X54 and X56 to X58

Parameter	Value
Voltage:	Nominal: 24 V
	Permissible: 18 V to 30 V
Max. load current:	Per output: 0.7 A
	Per connector: 1 A
	Per output at 100% simultaneity of all 15 outputs: 0.15 A
UL certified rating	Each output: 24 V / 0.15 A general, resistive load 24 V / 3.6 W lamp load 24 V / 0.15 A coil load

Handwheel X60 / X62

Via X60, you can connect one handwheel either with TTL or difference signals. Alternatively, you can connect the handwheel via X62. You can connect only one handwheel to the module because the signals from X60 are fed parallel to X62.

Use switch S2 to switch between TTL and difference signals.

Note

The handwheel is supplied by the MCP module with 5 V / 100 mA. An external power supply is not permitted.

NOTICE

Handwheel connections

The SINUMERIK 828D software can process up to three handwheels. You can connect two handwheels to the PPU. You can connect an additional handwheel to the machine control panel.

Connector designation: **X60**
 Connector type: 15-pin Sub-D socket

Table 7-48 Assignment of connector X60

Pin	Signal name	Type	Meaning
1	P5V	V	5 V power supply
2	M	V	Ground
3	HW1_A	I	Handwheel pulses track A
4	HW1_XA	I	Handwheel pulses track A (negated)
5	N.C.	-	Not assigned
6	HW1_B	I	Handwheel pulses track B
7	HW1_XB	I	Handwheel pulses track B (negated)
8	N.C.	-	Not assigned
9	P5V	V	5 V power supply
10	N.C.	-	Handwheel 2 pulses track A (negated)
11	M	V	Ground
12	N.C.	-	Not assigned
13	N.C.	-	Not assigned
14	N.C.	-	Not assigned
15	N.C.	-	Not assigned

Connector designation: **X62**
 Connector type: 12-pin plug connector
 Special feature: No galvanic isolation
 Max. cable length: 5 m

Table 7-49 Assignment of connector X62

Pin	Signal name	Type	Meaning
1	P5HW	V	5 V power supply
2	M	V	Ground
3	HW1_A	I	Handwheel 1 pulses track A
4	HW1_XA	I	Handwheel 1 pulses track A (negated)
5	HW1_B	I	Handwheel 1 pulses track B
6	HW1_XB	I	Handwheel 1 pulses track B (negated)
7	P5HW	V	5 V power supply
8	M	V	Ground
9	HW2_A	I	Handwheel 2 pulses track A
10	HW2_XA	I	Handwheel 2 pulses track A (negated)
11	HW2_B	I	Handwheel 2 pulses track B
12	HW2_XB	I	Handwheel 2 pulses track B (negated)

Digital inputs and outputs X111, X112, X113, X114

You can connect up to 80 keys and 64 LEDs. The connectors are connected to the machine control panel with ribbon cables.

All keys signal "high" in the idle state (= open). When actuated, the state changes to "low". Short-stroke keyboards and membrane keyboards can be connected. 5 V signals can also be applied to the inputs. The inputs are TTL-compatible, but not 24 V-tolerant.

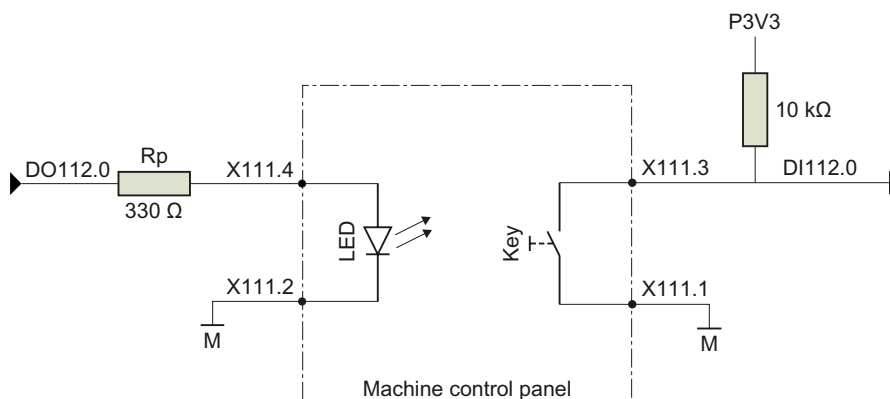


Figure 7-33 Schematic circuit diagram X111

Note

LED brightness

The setting of the LED brightness can be implemented by an additional external resistor connected in series.

Connector designation: **X111, X112, X113, X114**
 Connector type: 40-pin plug connector
 Special feature: No galvanic isolation, with interlock
 Max. cable length: 2 m

Table 7-50 Assignment of connector X111

Pin	Signal name	Type	Pin	Signal name	Type
1	Ground	V	2	Ground	V
3	DI112.0	I	4	DO112.0	O
5	DI112.1		6	DO112.1	
7	DI112.2		8	DO112.2	
9	DI112.3		10	DO112.3	
11	DI112.4		12	DO112.4	
13	DI112.5		14	DO112.5	
15	DI112.6		16	DO112.6	
17	DI112.7		18	DO112.7	
19	DI113.0		20	DO113.0	
21	DI113.1		22	DO113.1	
23	DI113.2		24	DO113.2	
25	DI113.3		26	DO113.3	
27	DI113.4		28	DO113.4	
29	DI113.5		30	DO113.5	
31	DI113.6		32	DO113.6	
33	DI113.7		34	DO113.7	
35	DI120.0		36	DI120.1	I
37	DI120.2		38	DI120.3	I
39	Reserved		40	Reserved	

Table 7-51 Assignment of connector X112

Pin	Signal name	Type	Pin	Signal name	Type
1	Ground	V	2	Ground	V
3	DI114.0	I	4	DO114.0	O
5	DI114.1		6	DO114.1	
7	DI114.2		8	DO114.2	
9	DI114.3		10	DO114.3	
11	DI114.4		12	DO114.4	
13	DI114.5		14	DO114.5	
15	DI114.6		16	DO114.6	
17	DI114.7		18	DO114.7	
19	DI115.0		20	DO115.0	
21	DI115.1		22	DO115.1	
23	DI115.2		24	DO115.2	
25	DI115.3		26	DO115.3	
27	DI115.4		28	DO115.4	
29	DI115.5		30	DO115.5	
31	DI115.6		32	DO115.6	
33	DI115.7		34	DO115.7	
35	DI120.4		36	DI120.5	I
37	DI120.6		38	DI120.7	I
39	Reserved		40	Reserved	

Table 7-52 Assignment of connector X113

Pin	Signal name	Type	Pin	Signal name	Type
1	Ground	V	2	Ground	V
3	DI116.0	I	4	DO116.0	O
5	DI116.1		6	DO116.1	
7	DI116.2		8	DO116.2	
9	DI116.3		10	DO116.3	
11	DI116.4		12	DO116.4	
13	DI116.5		14	DO116.5	
15	DI116.6		16	DO116.6	
17	DI116.7		18	DO116.7	
19	DI117.0		20	DO117.0	
21	DI117.1		22	DO117.1	
23	DI117.2		24	DO117.2	
25	DI117.3		26	DO117.3	
27	DI117.4		28	DO117.4	
29	DI117.5		30	DO117.5	
31	DI117.6		32	DO117.6	
33	DI117.7		34	DO117.7	
35	DI121.0		36	DI121.1	I
37	DI121.2		38	DI121.3	I
39	Reserved		40	Reserved	

Table 7-53 Assignment of connector X114

Pin	Signal name	Type	Pin	Signal name	Type
1	Ground	V	2	Ground	V
3	DI118.0	I	4	DO118.0	O
5	DI118.1		6	DO118.1	
7	DI118.2		8	DO118.2	
9	DI118.3		10	DO118.3	
11	DI118.4		12	DO118.4	
13	DI118.5		14	DO118.5	
15	DI118.6		16	DO118.6	
17	DI118.7		18	DO118.7	
19	DI119.0		20	DO119.0	
21	DI119.1		22	DO119.1	
23	DI119.2		24	DO119.2	
25	DI119.3		26	DO119.3	
27	DI119.4		28	DO119.4	
29	DI119.5		30	DO119.5	
31	DI119.6		32	DO119.6	
33	DI119.7		34	DO119.7	
35	DI121.4		36	DI121.5	I
37	DI121.6		38	DI121.7	I
39	Reserved		40	Reserved	

Table 7-54 Technical data of the inputs of X111 to X114

Parameter	Value
Voltage:	0 V to 5 V
Typical current consumption:	0.2 mA at 5 VDC
	-0.3 mA at 0 VDC
Signal level (including ripple):	High signal level: 2.3 V to 5 V
	Low signal level: 0 V to 1 V

Table 7-55 Technical data of the outputs of X111 to X114

Parameter	Value
Voltage:	0 V to 5 V (depending on the load)
Typical load current (without external series resistor):	8 mA at LED flow voltage = 2.3 V
	15 mA at short-circuit

Switch S1, S2

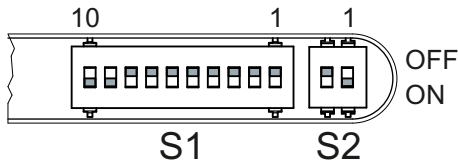


Table 7-56 Setting of switch S1 as delivered

1	2	3	4	5	6	7	8	9	10	Meaning
								ON	ON	PLC I/O Interface
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF			PROFINET address "0"

The two switches S1-9 and S1-10 must remain set to "ON".
The switches S1-1 to S1-8 define the PROFINET address. For a SINUMERIK 828D, the address "64" must always be assigned to the MCP.

Table 7-57 Switch S1 settings

1	2	3	4	5	6	7	8	9	10	Meaning
						ON		ON	ON	
OFF	OFF	OFF	OFF	OFF	OFF		OFF			PROFINET address "64"

Further information on the addressing can be found in Section Addressing components (Page 259).
The handwheel signal type is set with switch S2-1.

Table 7-58 Switch S2 settings

1	Meaning
ON	differential interface
OFF	TTL interface

Note
Switch S2-2 is reserved for test purposes.

7.5.3 Parameter assignment

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. Information on settings in the machine data can be found in Section Activating components (Page 258).

Standard input image

Table 7-59 MCP Interface PN input image

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB112	X111.17	X111.15	X111.13	X111.11	X111.9	X111.7	X111.5	X111.3
EB113	X111.33	X111.31	X111.29	X111.27	X111.25	X111.23	X111.21	X111.19
EB114	X112.17	X112.15	X112.13	X112.11	X112.9	X112.7	X112.5	X112.3
EB115	X112.33	X112.31	X112.29	X112.27	X112.25	X112.23	X112.21	X112.19
EB116	X113.17	X113.15	X113.13	X113.11	X113.9	X113.7	X113.5	X113.3
EB117	X113.33	X113.31	X113.29	X113.27	X113.25	X113.23	X113.21	X113.19
EB118	X114.17	X114.15	X114.13	X114.11	X114.9	X114.7	X114.5	X114.3
EB119	X114.33	X114.31	X114.29	X114.27	X114.25	X114.23	X114.21	X114.19
EB120	X112.38	X112.37	X112.36	X112.35	X111.38	X111.37	X111.36	X111.35
EB121	X114.38	X114.37	X114.36	X114.35	X113.38	X113.37	X113.36	X113.35
EB122	T_Critical ^{*)}	T_High ^{*)}	T_Low ^{*)}	X30.6	X30.7	X30.8	X30.9	X30.10
EB123	-	-	-	X31.6	X31.7	X31.8	X31.9	X31.10
EB124	X55.2	X55.1	X52.3	X52.2	X52.1	X51.3	X51.2	X51.1
EB125	X41.3	X41.2	X41.1	X40.3	X40.2	X40.1	-	X55.3
EB126	The current temperature value of the LM77 temperature sensor in degrees Celsius, further information see below							
EB127	Identifier for the 'MCP Interface PN' module is 0x8D							

^{*)} A logical 1 in the appropriate bit means that the associated temperature alarm is present.

Note

Bytes EB126 and EB127

The EB126 and EB127 bytes have significance only when the MCP Interface PN module is configured as universal component.

The LM77 temperature sensor measures the temperature on the MCP Interface PN module. The temperature is represented as integer value.

Range of values: -25° C to 100° C

Table 7-60 Temperature representation examples

Temperature in °C	Representation in byte EB126
65	0x41
36	0x20
0	0x00
-1	0xFF
-5	0xFB

Input image of the handwheels

Table 7-61 Input image for handwheel data

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB m + 0	Handwheel 1 counter status (16-bit signed, low-order byte equals byte m + 0)							
EB m + 1								
EB m + 2	Handwheel 2 counter status (16-bit signed, low-order byte equals byte m + 2)							
EB m + 3								

Note

Within the SINUMERIK control, the handwheel data is processed directly by the NC and is not available to the PLC.

Output image

Table 7-62 MCP Interface PN output image

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
AB112	X111.18	X111.16	X111.14	X111.12	X111.10	X111.8	X111.6	X111.4
AB113	X111.34	X111.32	X111.30	X111.28	X111.26	X111.24	X111.22	X111.20
AB114	X112.18	X112.16	X112.14	X112.12	X112.10	X112.8	X112.6	X112.4
AB115	X112.34	X112.32	X112.30	X112.28	X112.26	X112.24	X112.22	X112.20
AB116	X113.18	X113.16	X113.14	X113.12	X113.10	X113.8	X113.6	X113.4
AB117	X113.34	X113.32	X113.30	X113.28	X113.26	X113.24	X113.22	X113.20
AB118	X114.18	X114.16	X114.14	X114.12	X114.10	X114.8	X114.6	X114.4
AB119	X114.34	X114.32	X114.30	X114.28	X114.26	X114.24	X114.22	X114.20
AB120	X56.2	X56.1	X53.3	X53.2	X53.1	X54.3	X54.2	X54.1
AB121	-	X58.3	X58.2	X58.1	X57.3	X57.2	X57.1	X56.3

Note

An appropriate bit set to "High" switches the associated output to "High" or the corresponding LED on. This means that inversion by the operating software is not required.

7.5.4 Technical data

MCP Interface PN

Parameter	Value
Input voltage	24 V DC
Power consumption, max.	
• Board	2.4 W
• Handwheels	2 x 0.9 W
• Lamps	54 W (15 x 3.6 W)
• LEDs	4 W (80 x 0.05 W)
• Total	62.4 W
Protection class acc. to EN 60204-1	III
Degree of protection acc. to EN 60529	IP00
Relative humidity:	
• Storage	5 ... 95 %
• Transport	5 ... 95 %
• Operation	5 ... 95 %
Ambient temperature:	
• Storage	-25 ... +55 °C
• Transport	-40 ... +70 °C
• Operation	
– Front	0 ... +55 °C
– Rear	0 ... +45 °C
Dimensions:	
• Width	242 mm
• Height	152 mm
• Depth	36 mm
Weight	0.6 kg
Approvals	CE, cULus

See also

Other values/standards: Application planning (Page 37)

7.6 Electronic handwheel

Description

The portable electronic handwheel is intended for use in conjunction with machines. A magnetic bracket and spiral connection cable can be found on its enclosure. The magnetic bracket (retaining magnet) enables the handwheel to be attached to metallic surfaces.

The portable electronic handwheel is an incremental encoder that generates signals according to how the manually operated wheel is rotated. The handwheel's magnetic latching facility makes for an extremely precise incremental process. The axis selected via the control can be positioned so that the axes are parallel. The portable handwheel offers a PPR count of 100 S/R.

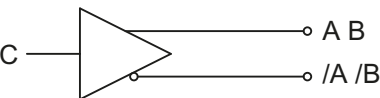


Figure 7-34 View of electronic portable handwheel

For safe storage on non-magnetic surfaces, a holder (Page 183) is available.

Output circuitry

RS 422 A: Load current $\leq 20\text{ mA}$



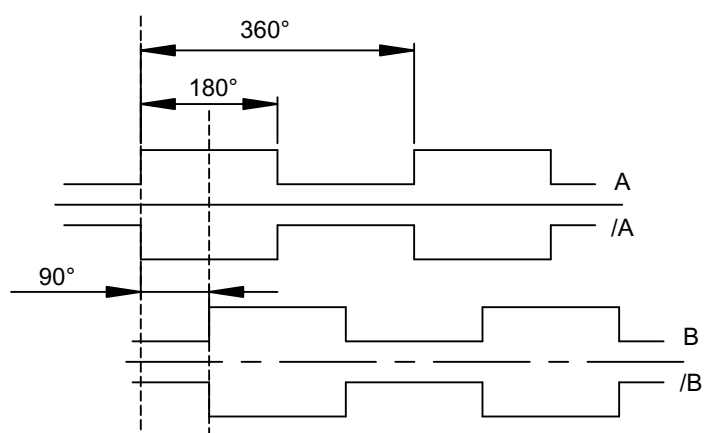


Figure 7-35 Pulse diagram

7.6.1 Mounting

Dimensions of the electronic handheld handwheel

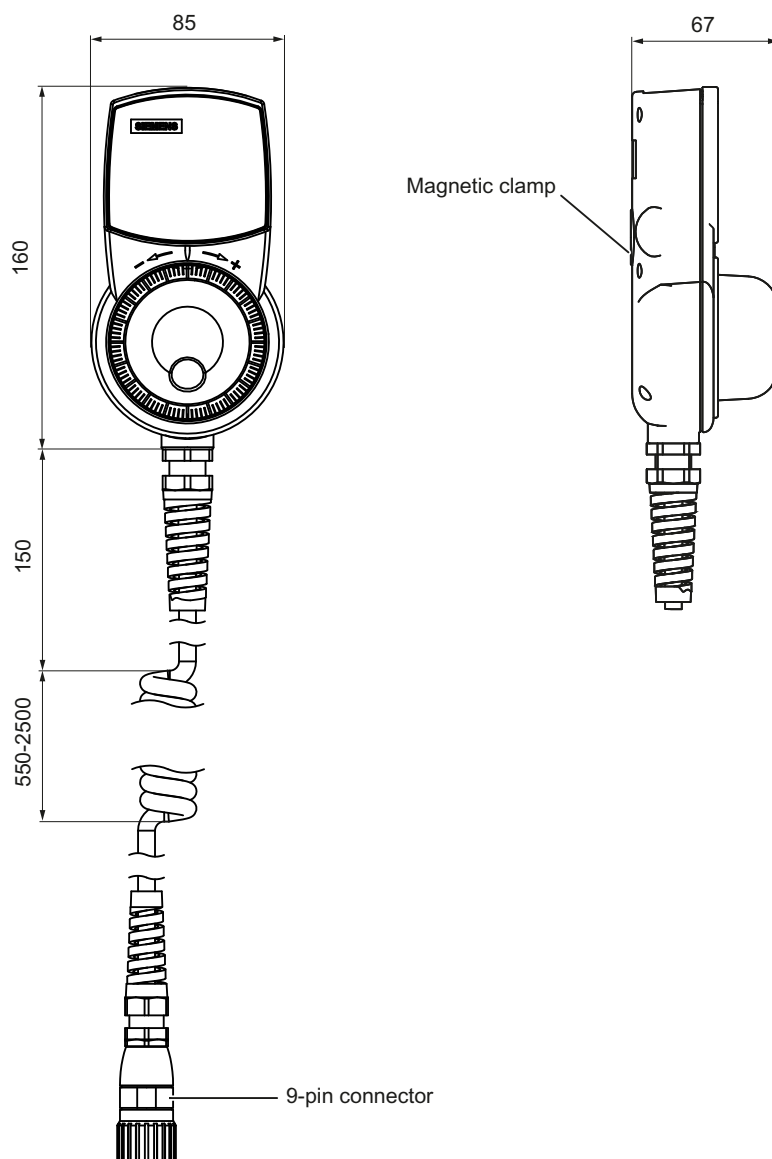


Figure 7-36 Front view and side view

Additional options

Optionally, the handheld electronic handwheel can be stored in a screw-on holder. The holder is mounted using three M4 screws (included in the scope of delivery).

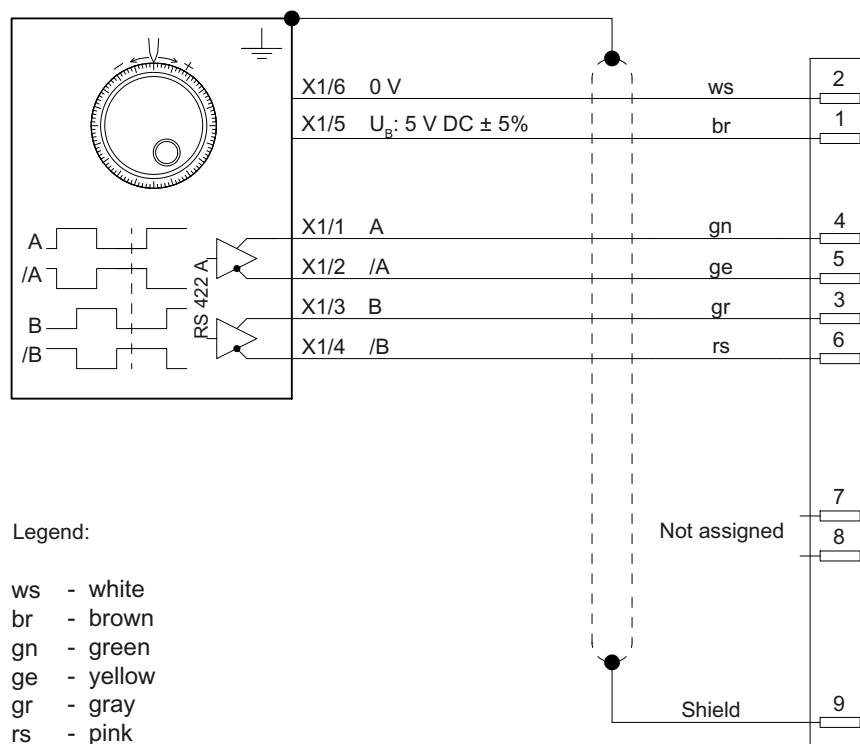
See also: Mini handheld unit, Chapter "Mounting (Page 186)"

7.6.2 Connection

Electrical connection diagram

The handheld handwheel is connected via a flange socket using the spiral connection cable.

You will find article numbers for the recommended flange socket in Chapter Spare parts and accessories (Page 183).



7.6.3 Technical specifications

Handheld electronic handwheel

Parameter	Value
Operating voltage	5 V DC $\pm$ 5%
Current consumption	Max. 80 mA
Limit frequency	10 kHz
Number of pulses	100 S/R
Displacement of phase A to B, typical	90° electrical
Interface	RS422
Cable length	Max. 25 m
Actuating force	4 Ncm
Speed	Max. 1,000 rpm
Protection class	I
Degree of protection in acc. with DIN EN 60529/ IEC 60529	IP65
Housing material	Thermoplastic
Vibratory load	
• Operation	58 – 200 Hz: 10 m/s ²
• Transport (in transport packaging)	9 - 200 Hz: 20 m/s ²
Shock load in acc. with IEC 68-2-27	
• Operation	100 m/s ² , 11 ms, 6 shocks
• Transport (in transport packaging)	300 m/s ² , 6 ms, 6 shocks
Condensation, splash water, and icing	Not permitted
Supply air	Without aggressive gases, dusts, and oils
Relative humidity:	
• Storage	5 ... 95 %
• Transport	5 ... 95 %
• Operation	5 ... 95 %
Ambient temperature:	
• Storage	-25 ... 55 °C
• Transport	-40 ... 70 °C
• Operation	0 ... 55 °C
Dimensions:	
• Width	160 mm
• Height	85 mm
• Depth	67 mm
Weight	0.3 kg (without connecting cable)
Approvals	CE, cULus

7.6.4 Spare parts and accessories

Accessories

The following components are available as accessories for the handheld electronic handwheel:

Component	Description	Article number
Flange socket	9-pin flange socket	6FC9341-1AQ
Holder	including three M4 screws	6FX2006-1BG70

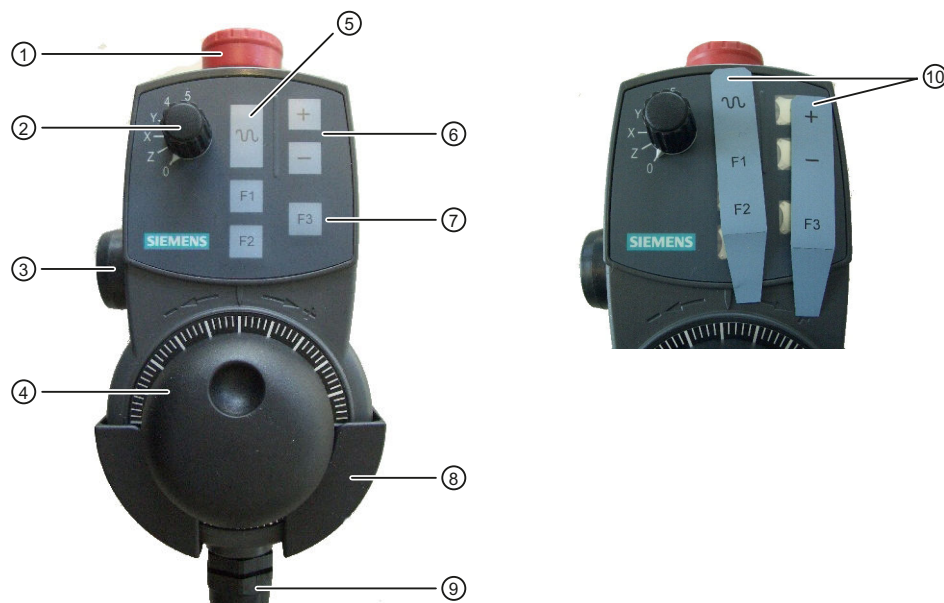
7.7 Mini handheld unit

Description

The mini handheld unit (Mini HHU) is a small easy-to-handle unit for setting up and operating simple machines in the JobShop area or similar applications. Special attention has been paid in the design to ergonomics and logical layout of the control elements.

Since coarse, medium and fine infeed can easily be graduated, the operator control concept offers fast, increment-precise positioning. The signals are sent in parallel to the CNC control.

- The mini HHU is connected to the control with a connection kit.
- The mini HHU can be fixed on metal surfaces by means of the integrated magnetic clamp. A holder is available as an option.
- Key labeling can be customized using slide-in labels.



- ① Emergency Stop button, 2-channel
- ② Axis selector switch for 5 axes and neutral position
- ③ Enabling button, 2-channel, 3-stage
- ④ Handwheel
- ⑤ Rapid traverse key for high-speed travel with traversing keys or handwheel
- ⑥ Traversing key direction + / direction -
- ⑦ F1, F2, F3 function keys for customer-specific applications (freely assignable)
- ⑧ Holder (optional)
- ⑨ Connecting cable
- ⑩ Slide-in labels

Figure 7-37 Control elements of the mini handheld unit

7.7.1 Operator controls

Control elements of the mini handheld unit

Features of the operator controls:

- **Emergency Stop button**
The EMERGENCY STOP button must be pressed in the following emergency situations:
 - When a person is at risk.
 - When there is a danger of the machine or workpiece being damaged.
- **Axis selection switch**
The axis selection switch can be used to select up to five axes. The coding is carried out in Gray Code.

Table 7-63 Coding of axis selection switch

Connector X1			Switch position	Function
Pin 8	Pin 9	Pin 10		
0	0	0	-	Mini HHU not connected
1	1	0	0	No axis selected
0	1	0	Z	Z axis selected
0	1	1	X	X axis selected
1	1	1	Y	Y axis selected
1	0	1	4	Axis 4 selected
0	0	1	5	Axis 5 selected

- **Enabling button**
The enabling button is designed as a 3-way switch. This must be held in its central position for movements to be triggered.
- **Handwheel**
The handwheel can be used to initiate movements at the selected axis using the axis selection switch. The handwheel supplies two track signals with 100 increments/revolution.
- **Rapid traverse key**
The rapid traverse key increases the traversing speed of the selected axis with the axis selection switch. The rapid traverse button is active both for traversing commands issued via the +/- keys and for handwheel signals.
- **Traversing keys**
The + and - traversing keys can be used to trigger traversing movements on the axis selected via the axis selection switch.
- **Function keys**
The function keys can be used to trigger machine-specific functions.

7.7.2 Mounting

Dimensions of the mini handheld unit

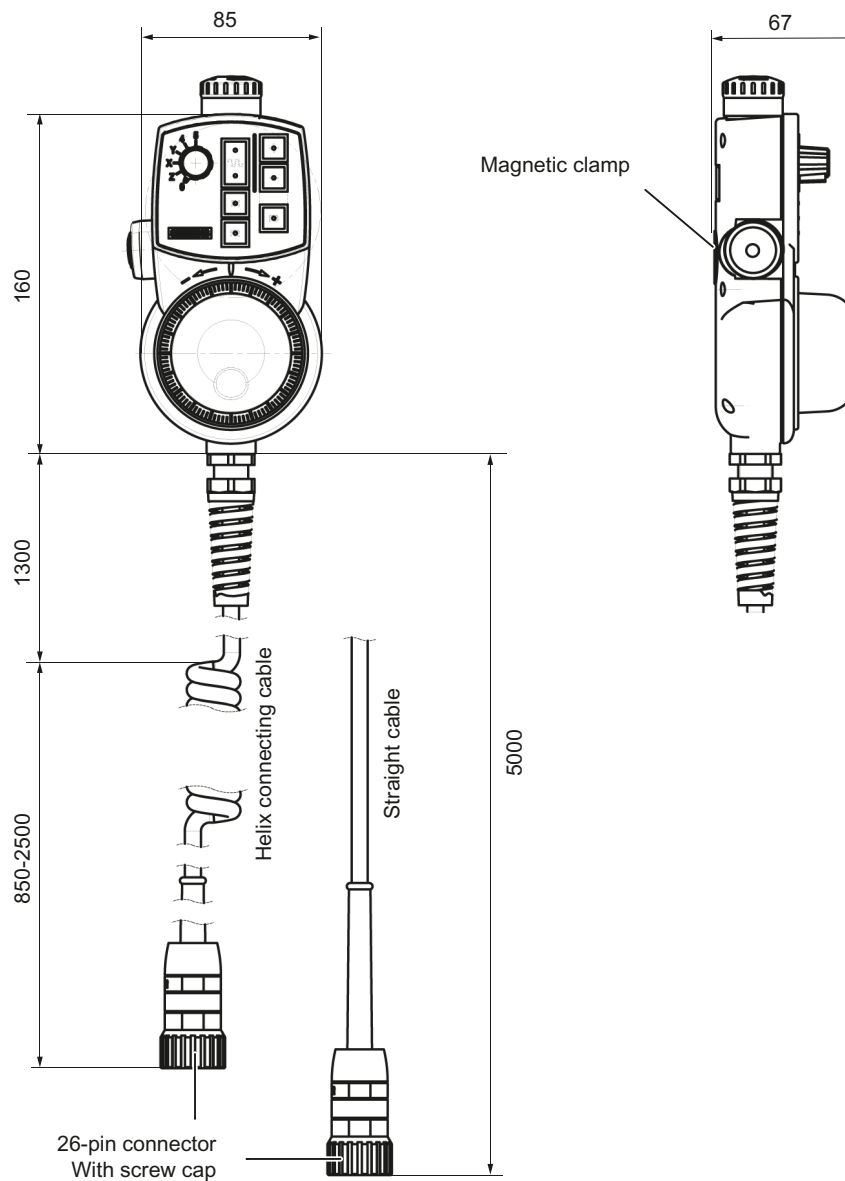


Figure 7-38 Dimension drawing of the mini HHU

Installing the connection kit

Procedure:

1. Transfer the hole pattern to the wall of the controller housing.

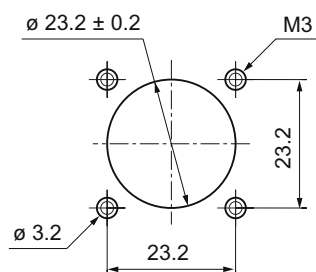


Figure 7-39 Hole pattern for mounting

2. Insert the connection wires through the large drill hole into the controller housing.
3. Mount the flange socket (with seal) onto the controller housing.
4. Connect the connecting cables according to the circuit diagram.

Additional options

For the mini HHU, the following accessories can optionally be used:

- **Angled socket**

An angled socket is available as an option, which permits the cable outlet direction to be rotated through 90°.

Note

The angled socket can only be used in conjunction with the non-assembled connection kit.

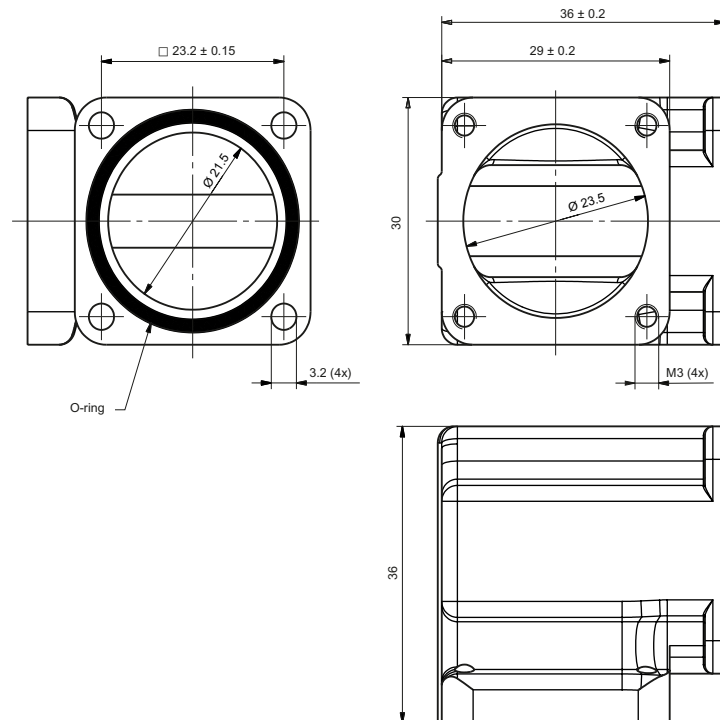


Figure 7-40 Dimension drawing of angled socket

- **Adapter plate**

To install the metal flange socket in the location for plastic flange sockets, an adapter plate is available.

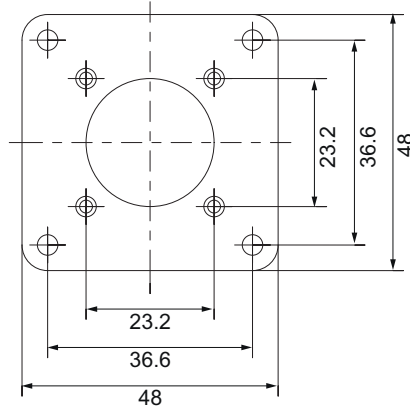


Figure 7-41 Dimension drawing of the adapter plate

- **Holder**

The mini HHU can be stored in a screw-on holder; this enables safe storage even on non-magnetic surfaces. The holder is secured with three M4 screws.

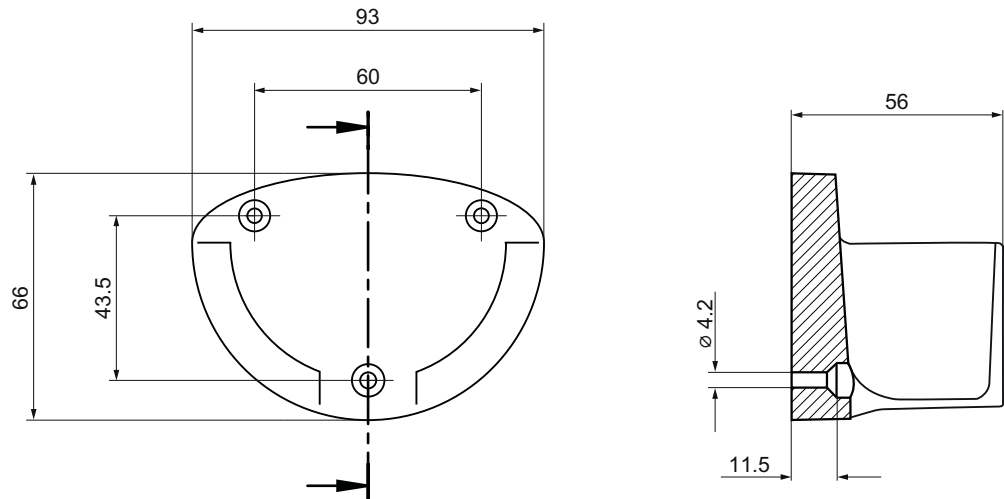


Figure 7-42 Dimension drawing of the holder

- **Slide-in labels**

You can replace the slide-in labels. To do this, you must release the six Torx screws at the rear of the housing. The housing can now be taken apart. You can now withdraw the slide-in labels out of the guide on the front panel and replace them.

Make sure that no connecting cables are pinched or crushed when reassembling.

7.7.3 Connecting

Connection diagram overview

A connection kit that must be ordered separately is required for connection of the mini HHU. This connection kit contains a metal flange socket made for installation in the control housing on the machine and a terminating connector for overriding the Emergency Stop circuit when the mini HHU is not connected.

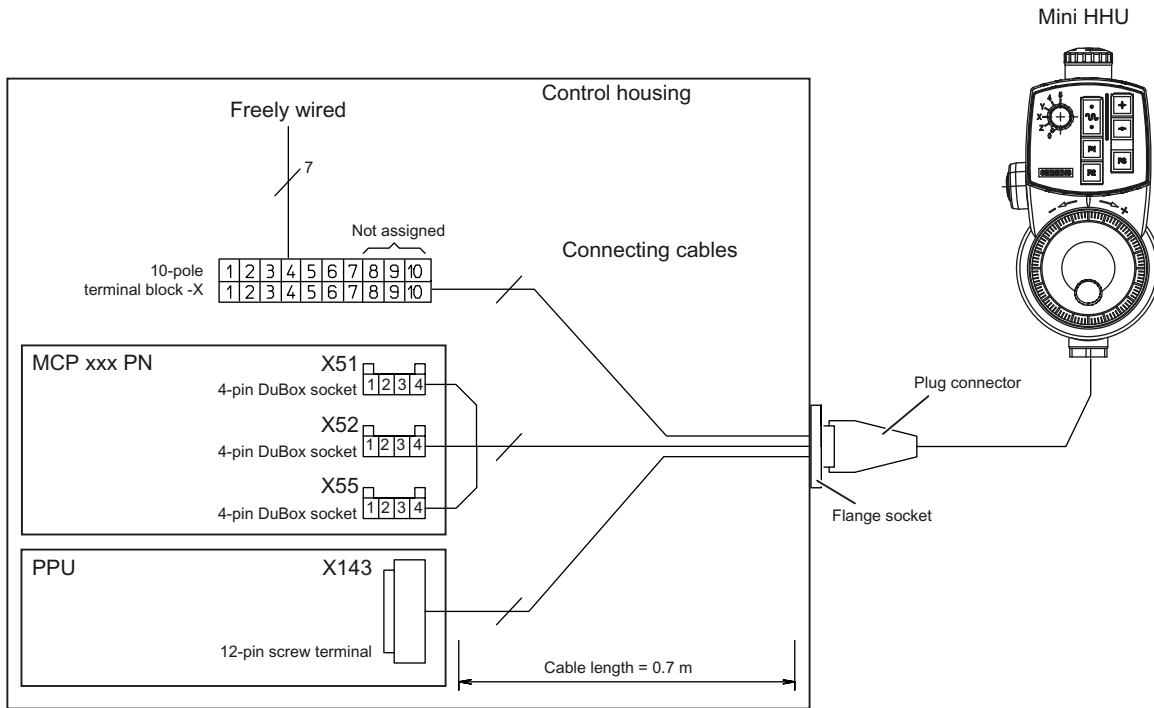


Figure 7-43 Connection using a prefabricated connection kit

Note

Mini HHU on the MCP Interface PN

You can also connect the mini HHU to the MCP Interface PN module:

- The selection switch at X51
- The function keys at X52 and X55
- The handwheel at X60 / X62

Note that the SINUMERIK 828D software can process up to three handwheels.

Mini handheld unit

Handwheel

Function keys

Axis selection

Enabling button

Emergency Stop

Terminal block in the control housing

Connector on the MCP xxx PN

Connector on the PPU

Conductors, 0.14 mm²

26-pin connector on the operator panel housing

Color Code Table:

Color	Code
Blue	bl
Brown	br
Yellow	ge
Green	gn
Gray	gr
Pink	rs
Red	rt
Black	sw
Violet	vt
White	ws
Brown blue	brbl
Yellow brown	gebr
Gray brown	grbr
Gray pink	grrs
Pink brown	rsbr
Red blue	rtbl
White blue	wsbl
White yellow	wsge
White gray	wsgr
White pink	wsrs
White red	wsrt

Figure 7-44 Circuit diagram of the mini HHU with prefabricated connection kit

Connection of the flange socket

Procedure:

1. Use the flange-mounted socket to connect the mini HHU to the PLC via the handwheel interface. The signals are sent to the NC in parallel. There is no need for an additional distributor.

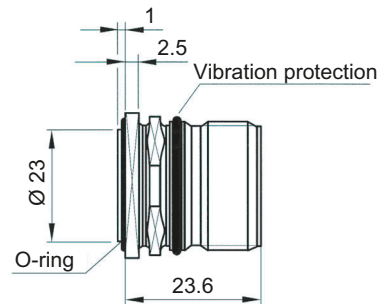


Figure 7-45 Flange socket

2. Insert the connector for the mini HHU connection cable in the detent lugs / guideways of the flange socket.
3. Tighten the screw cap.

Note

If the connector is connected incorrectly, the pins may be damaged!

7.7.4 Parameterization

Note

The mini HHU can only be operated with a Siemens machine control panel of the PN type.

If a mini HHU is connected, the functional assignment listed in the table below is valid for customer keys KT1 to KT9. On machine control panels MCP 310C PN and MCP 483C PN, the customer keys are assigned to input bytes IB122 and IB123. On the MC Interface PN module, the customer keys are assigned to input bytes IB124 and IB125.

When the mini HHU is connected, the customer keys (inputs) are not available for other applications.

Table 7-64 Input image for MCP 310C PN and MCP 483C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB122						Axis selection switch		
	KT8	KT7	KT6	KT5	KT4	KT3	KT2	KT1
	F2	F1				2 ³	2 ²	2 ¹
	X55.2	X55.1	X52.3	X52.2	X52.1	X51.3	X51.2	X51.1
EB123	-	-	-	-	-	-	-	KT9 F3 X55.3

Table 7-65 Input image for MCP Interface PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB124						Axis selection switch		
	KT8	KT7	KT6	KT5	KT4	KT3	KT2	KT1
	F2	F1				2 ³	2 ²	2 ¹
	X55.2	X55.1	X52.3	X52.2	X52.1	X51.3	X51.2	X51.1
EB125	-	-	-	-	-	-	-	KT9 F3 X55.3

Note

Within the SINUMERIK control, the handwheel data is processed directly by the NC and is not available to the PLC.

7.7.5 Technical data

Mini handheld unit

Parameter	Value
Input voltage for switching signals	24 V DC
Power supply for the handwheel	5 V DC
Current drawn at 5 V DC	Approx. 90 mA

Parameter	Value
Handwheel	100 pulses/rev
Handwheel signals	RS422
Emergency Stop button	24 V DC, 2 A 2 x NC contact
Enabling buttons	24 V DC 2 x NO contacts
Axis selector switch	24 V DC: 0.2 W Gray code
Degree of protection without shaft input according to EN 60529	IP65
Reliability, Emergency Stop button and enabling buttons	$B_{10d} = 100\,000$
Relative humidity:	Condensation not permissible
• Storage	5 ... 95 %
• Transport	5 ... 95 %
• Operation	5 ... 95 %
Ambient temperature:	
• Storage	-20 ... 60 °C
• Transport	-20 ... 60 °C
• Operation	0 ... 55 °C
Dimensions:	
• Height	180 mm
• Width	90 mm
• Depth	67 mm
Weight	Approx. 0.5 kg without connecting cable Approx. 1.3 kg with connecting cable
Max. cable length	25 m
Approvals	CE, cULus

Note

The quantitative assessment of the Emergency Stop and enabling safety functions must be based on the B_{10d} value corresponding to the used standards (e.g. ISO 13849-1) under consideration of the respective application (frequency of the actuation, service life, diagnostics by the evaluation unit, etc.). The B_{10d} value only applies when the technical properties of the emergency stop and enabling buttons are taken into account.

Operator controls

Element	Specification
Acknowledgment button	Isolated, 2-channel NO contact, 3-pole
Emergency Stop button according to EN ISO 13850	Isolated, 2-channel NC contact, released by twisting
Axis selector switch	5 axes: X, Y, Z, 4. Axis, 5 Axis and neutral position

Element	Specification
	Jog key: positive traversing direction
	Jog key: negative traversing direction
	Jog key: rapid traverse for jog keys and handwheel
Function keys F1, F2, F3	NO contact
• Switching current	max. 0.1 A
• Contact rating	max. 1 W

7.7.6 Spare parts and accessories

List of the spare parts

The following spare parts are available:

Item name	Article number	Can be used with 6FX2007-	
		-1AD03	-1AD13
6-pos. selector switch with accessories	104899	X	X
Emergency Stop button	104900	X	X
ZXE-104833 (3-position enabling button)	104901	X	X
Protective cover and nut for ZXE	104902	X	X
3.5 m spiral connecting cable	104903	X	----
5 m straight connecting cable	104904	---	X
5 m straight extension cable	103832	X	X
10 m straight extension cable	103833	X	X
15 m straight extension cable	103834	X	X
Connecting adapter (0.5 m adapter cable; metal coupling on mini HHU side to T+B plastic coupling on panel side)	103835	X	X
Dismantling tool for plug connector	105037	X	X

Ordering address:

Euchner GmbH + Co
Vertrieb Technik
Kohlhammerstr. 16
70771 Leinfelden-Echterdingen
Germany

Phone +49 (0) 711 7597-0
Fax +49 (0) 711 7597-303

Accessories

The following components are available as accessories for the mini handheld unit:

Component	Description	Article number
Connection kit	Assembled, metal version, with terminating connector	6FX2006-1BG20
Connection kit	Assembled, metal version, without dummy plug	6FX2006-1BG25
Connection kit	Non-assembled, metal version, with terminating connector	6FX2006-1BG03
Angled socket	Metal design, for non-assembled connection kit	6FX2006-1BG56
Adapter plate	Non-assembled, plastic on metal version	6FX2006-1BG45
Holder	including three M4 screws	6FX2006-1BG70

7.8 PP 72/48D PN

7.8.1 Description

Features

The I/O module is a simple module (without a separate enclosure) for connecting digital and analog input/outputs as part of an automation system based on PROFINET IO.

The module has the following important features:

- 72 digital inputs and 48 digital outputs
- PLC I/O Interface connection (max. 100 MBaud)
- Onboard status display via 2 diagnostic LEDs
- The three plug-in connectors for the digital inputs and outputs are 50-pin terminal posts for connecting ribbon cables.
- The use of terminal strip converters or the direct connection of distribution boards is possible.
- Analog signal cables can be connected directly to screw contacts on the module.

An external power supply unit (24 VDC) is required to supply the module and the digital outputs.

Illustration

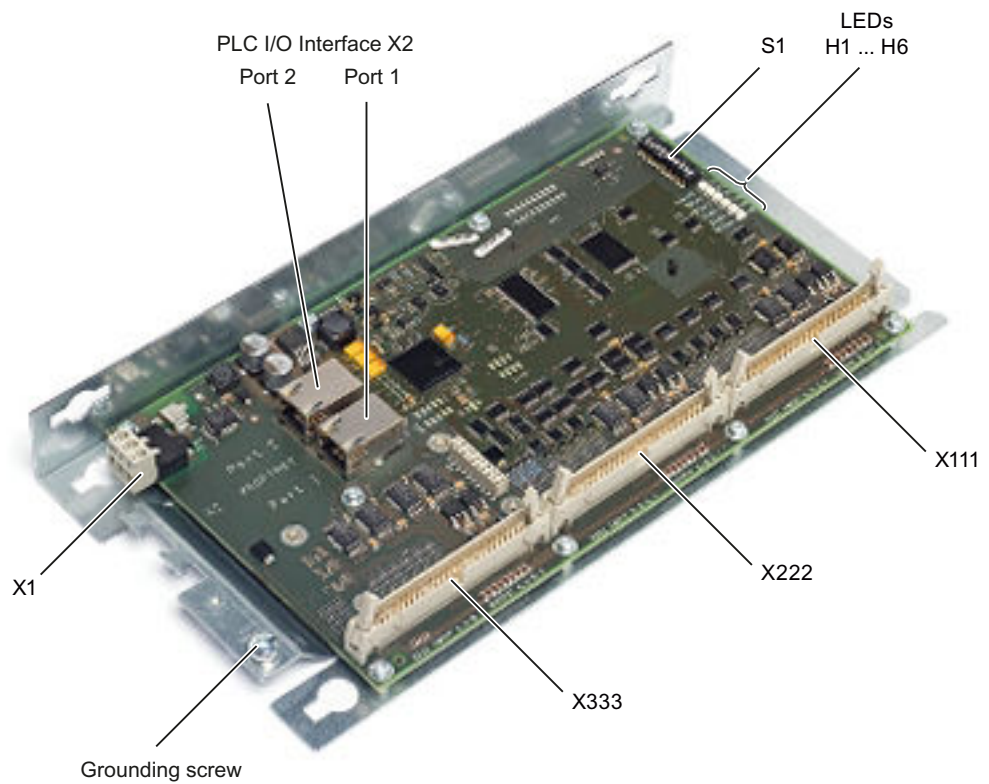


Figure 7-46 PP 72/48D PN I/O module

Type plate

The type plate and the MAC address label are on the rear side of the mounting plate. It is advisable to make a note of relevant data as it is no longer visible after installation.

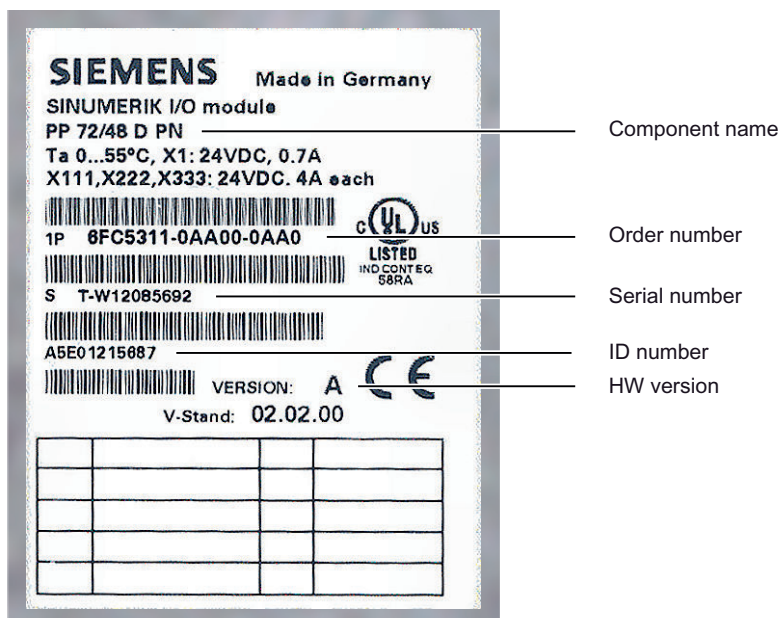


Figure 7-47 PP 72/48D PN type plate

LED for status displays

The PP 72/48 D PN has the following additional LEDs that provide information on the module status:

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply ok
			Not lit: As soon as one of the generated logic voltages falls below its setpoint, a reset is triggered and the PowerOK LED goes out.
H2	PNSync	Green	Lit: Task system is synchronized to the bus cycle clock.
			Not lit: Task system is not synchronized to bus cycle clock.
			Flashes 0.5 Hz: Task system is synchronized to the bus cycle clock and cyclic data exchange is running.
H3	PNFault	Red	Not lit: Module is operating without errors; data exchange with all configured I/O devices is running.
			Lit: Serious bus fault; only output when one of the following errors is detected for the ports: • No physical connection to a subnet/switch • Incorrect transmission rate • Full duplex transmission is not activated
H4	DIAG1	Green	Reserved
H5	DIAG2	Green	Reserved
H6	OVTemp	Red	Overtemperature indication

Note

When the system is booting, LEDs H1, H2 and H3 are lit.

7.8.2 Mounting

Mounting

The I/O module is screwed with a mounting plate to the control cabinet wall in the control cabinet. The module must be installed according to EN 60204.



WARNING

Protection against electric shock

A protective conductor must be connected using the grounding screw.

Mounting versions:

- Portrait mounting at the lateral strap of the mounting plate (2x M5 or M6 screws).
- Flat mounting at the rear wall of the mounting plate (4x M5 or M6 screws).

Dimension drawing

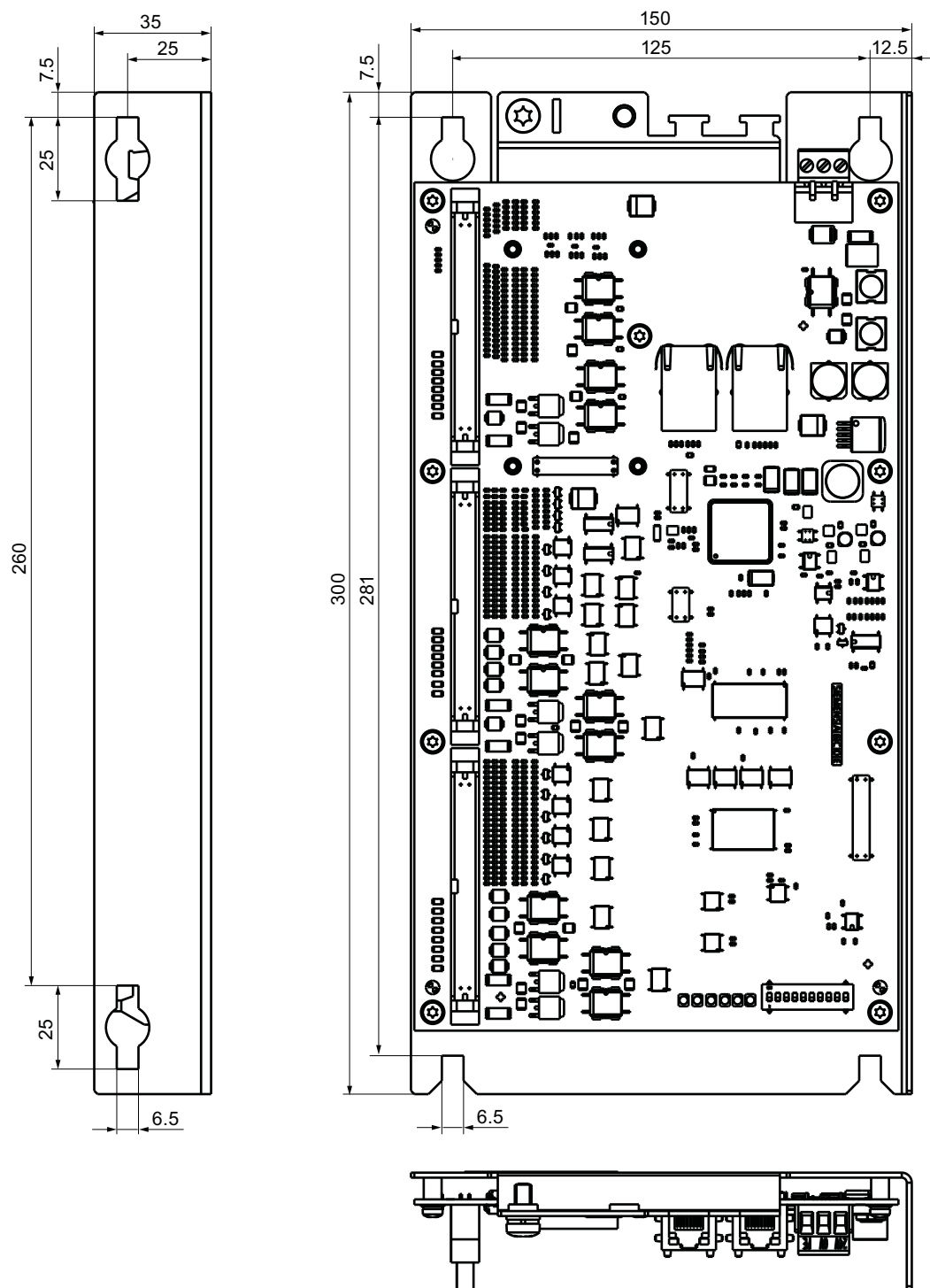


Figure 7-48 PP 72/48D PN dimensions

7.8.3 Connecting

Connection options

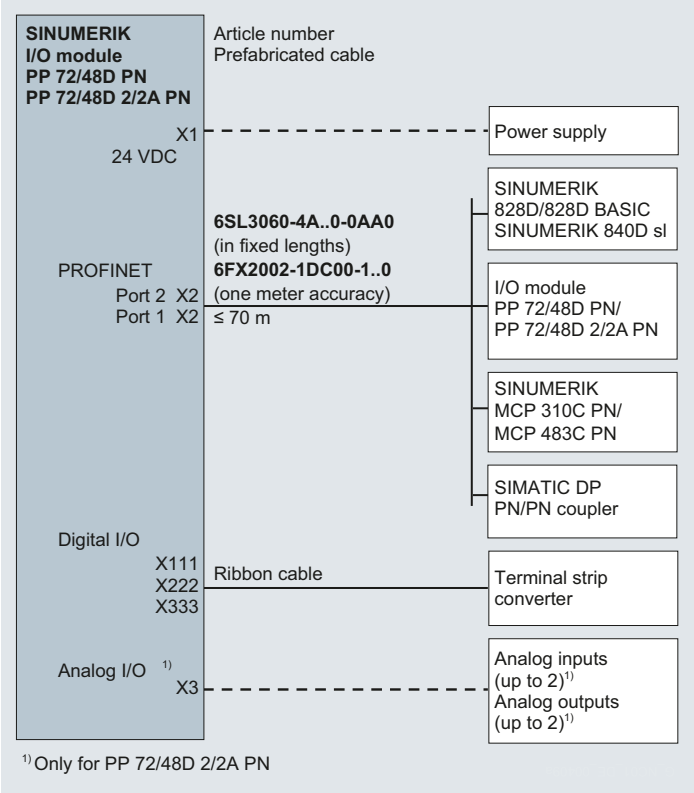


Figure 7-49 Connections of the PP 72/48D PN

Interfaces

Table 7-66 PP 72/48D PN I/O module interfaces

Interface	Designation	Type
Power supply connection	X1	Screw-terminal block
PLC I/O Interface	X2 (ports 1 and 2)	Socket
PLC I/O Interface address	S1	DIP switch
Digital input/outputs 1	X111	Ribbon cable connector
Digital input/outputs 2	X222	Ribbon cable connector
Digital input/outputs 3	X333	Ribbon cable connector

See also

Addressing components (Page 259)

7.8.3.1 X1 power supply

Features and use

A description of the interfaces for the external power supply X1 can be found in Chapter "Power supply connection (Page 73)" of the PPU description.

On the module side, the power supplies are protected against:

- Polarity reversal
- Short-circuit (elec. current limitation of the outputs)
- Overload (self-restoring PTC fuse - Multifuse)

Power requirement

0.7 A (at 24 VDC) for PP 72/48D PN and digital inputs plus 3 x 4 A at X111, X222 and X333 for supplying digital outputs.

Digital inputs

The 24 V supplied at X1 are used to supply the 72 digital inputs.

If the internal supply voltage is not used to supply the digital inputs, this can optionally be replaced by an external power supply (24 VDC). The reference ground of the power supply source must each be connected with X111, X222, X333, pin 1 (GND). X111, X222, X333, pin 2 (P24OUT) then remains open.

Digital outputs

To supply (24 VDC) the digital outputs, an additional external power supply source is required. The power supply is connected to terminals X111, X222 and X333 via pins 47, 48, 49 and 50 (DOCOMx). Ground pins must be connected to a common chassis ground.

Maximum current consumption: 3 x 4 A if all outputs are used simultaneously.

NOTICE
It is the user's responsibility to ensure that the max. current consumption per DOCOMx pin (X111, X222, X333: Pins 47, 48, 49, 50) does not exceed 1 A. The power supply (+24 VDC) for the digital outputs must therefore be connected to all four pins per DOCOMx (X111, X222, X333: pins 47, 48, 49, 50).

7.8.3.2 X2 PROFINET

Requirement

The I/O module has certified PROFINET interfaces, however their functionality cannot be fully utilized within the scope of the SINUMERIK 828D control system. Networking within SINUMERIK 828D is performed via a PLC I/O interface, which is based on PROFINET.

Data transmission rate and cables

The interfaces are designed for full-duplex mode; in other words, the ports can both transmit and receive. When connecting I/O modules to the SINUMERIK 828D, please use the preassembled SINAMICS DRIVE-CLiQ signal cables; from a technical point of view, these are also suitable for use with PROFINET:

- Article number: 6FX2002-1DC00-...
- The transmission characteristics of these cables meet the requirements of CAT5.
- Data transmission speed: 100 Mbps (fast Ethernet).
- The maximum length of the connections between the end device and network component or between two network components (e.g. switch ports) must not exceed 70 m.

Pin assignment

Table 7-67 Pin assignment - PROFINET X2, Port 1 and Port 2

Pin	Signal name	Signal type	Meaning
1	TX+	O	Transmit data +
2	TX-	O	Transmit data -
3	RX+	I	Receive data +
4	N.C.	-	Not assigned
5	N.C.	-	Not assigned
6	RX-	I	Receive data -
7	N.C.	-	Not assigned
8	N.C.	-	Not assigned

LED displays

For diagnostic purposes, the RJ45 sockets are each equipped with a green and a yellow LED. This allows the following information on the respective PROFINET port to be displayed:

Table 7-68 PROFINET ports LED displays

Name	Color	Status	Meaning
Link	Green	Lit	100 Mbit link available
		Off	Missing or faulty link

Name	Color	Status	Meaning
Activity	Yellow	Lit	Sending or receiving
		Off	No activity

PROFINET address (S1)

The right logical address must be assigned to the I/O module for communication with PLC I/O interface using the 10 bit DIP switch S1.

Table 7-69 Switch S1 settings

1	2	3	4	5	6	7	8	9	10	Device name	Meaning
								ON	ON		
ON	OFF	OFF	ON	OFF	OFF	OFF	OFF			pp72x48pn9	1st PP module
OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF			pp72x48pn8	2nd PP module
ON	ON	ON	OFF	OFF	OFF	OFF	OFF			pp72x48pn7	3rd PP module
OFF	ON	ON	OFF	OFF	OFF	OFF	OFF			pp72x48pn6	4th PP module
ON	OFF	ON	OFF	OFF	OFF	OFF	OFF			pp72x48pn5	5th PP module

The device name consists of the PROFINET name and the device number: in the case of I/O modules, the 1st module is device number 9.

Note

A newly set PROFINET address will only come into effect after power OFF/ON.

The switch positions 9 and 10 guarantee the PROFINET functionality of the module and must always be switched "ON".

Further information on the addressing can be found in Section Addressing components (Page 259).

7.8.3.3 X111, X222 and X333 pin assignment

Pin assignment

Table 7-70 Pin assignment X111

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	DI 0.0	I	4	DI 0.1	I
5	DI 0.2	I	6	DI 0.3	I
7	DI 0.4	I	8	DI 0.5	I
9	DI 0.6	I	10	DI 0.7	I
11	DI 1.0	I	12	DI 1.1	I
13	DI 1.2	I	14	DI 1.3	I
15	DI 1.4	I	16	DI 1.5	I

Pin	Signal name	Type	Pin	Signal name	Type
17	DI 1.6	I	18	DI 1.7	I
19	DI 2.0	I	20	DI 2.1	I
21	DI 2.2	I	22	DI 2.3	I
23	DI 2.4	I	24	DI 2.5	I
25	DI 2.6	I	26	DI 2.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	DO 0.0	O	32	DO 0.1	O
33	DO 0.2	O	34	DO 0.3	O
35	DO 0.4	O	36	DO 0.5	O
37	DO 0.6	O	38	DO 0.7	O
39	DO 1.0	O	40	DO 1.1	O
41	DO 1.2	O	42	DO 1.3	O
43	DO 1.4	O	44	DO 1.5	O
45	DO 1.6	O	46	DO 1.7	O
47	DOCOM1	VI	48	DOCOM1	VI
49	DOCOM1	VI	50	DOCOM1	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Table 7-71 Pin assignment for X222

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	DI 3.0	I	4	DI 3.1	I
5	DI 3.2	I	6	DI 3.3	I
7	DI 3.4	I	8	DI 3.5	I
9	DI 3.6	I	10	DI 3.7	I
11	DI 4.0	I	12	DI 4.1	I
13	DI 4.2	I	14	DI 4.3	I
15	DI 4.4	I	16	DI 4.5	I
17	DI 4.6	I	18	DI 4.7	I
19	DI 5.0	I	20	DI 5.1	I
21	DI 5.2	I	22	DI 5.3	I
23	DI 5.4	I	24	DI 5.5	I
25	DI 5.6	I	26	DI 5.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	DO 2.0	O	32	DO 2.1	O
33	DO 2.2	O	34	DO 2.3	O
35	DO 2.4	O	36	DO 2.5	O
37	DO 2.6	O	38	DO 2.7	O

Pin	Signal name	Type	Pin	Signal name	Type
39	DO 3.0	O	40	DO 3.1	O
41	DO 3.2	O	42	DO 3.3	O
43	DO 3.4	O	44	DO 3.5	O
45	DO 3.6	O	46	DO 3.7	O
47	DOCOM2	VI	48	DOCOM2	VI
49	DOCOM2	VI	50	DOCOM2	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Table 7-72 Pin assignment for X333

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	DI 6.0	I	4	DI 6.1	I
5	DI 6.2	I	6	DI 6.3	I
7	DI 6.4	I	8	DI 6.5	I
9	DI 6.6	I	10	DI 6.7	I
11	DI 7.0	I	12	DI 7.1	I
13	DI 7.2	I	14	DI 7.3	I
15	DI 7.4	I	16	DI 7.5	I
17	DI 7.6	I	18	DI 7.7	I
19	DI 8.0	I	20	DI 8.1	I
21	DI 8.2	I	22	DI 8.3	I
23	DI 8.4	I	24	DI 8.5	I
25	DI 8.6	I	26	DI 8.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	DO 4.0	O	32	DO 4.1	O
33	DO 4.2	O	34	DO 4.3	O
35	DO 4.4	O	36	DO 4.5	O
37	DO 4.6	O	38	DO 4.7	O
39	DO 5.0	O	40	DO 5.1	O
41	DO 5.2	O	42	DO 5.3	O
43	DO 5.4	O	44	DO 5.5	O
45	DO 5.6	O	46	DO 5.7	O
47	DOCOM3	VI	48	DOCOM3	VI
49	DOCOM3	VI	50	DOCOM3	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Cable specification:

- 50-pin ribbon cable connector: 50-pin insulation piercing connecting device with strain relief, ribbon cables and terminal converter are required to connect the digital inputs and outputs.
- The required connecting cables (ribbon cables) must be provided by the user. Maximum cable length: 30 m

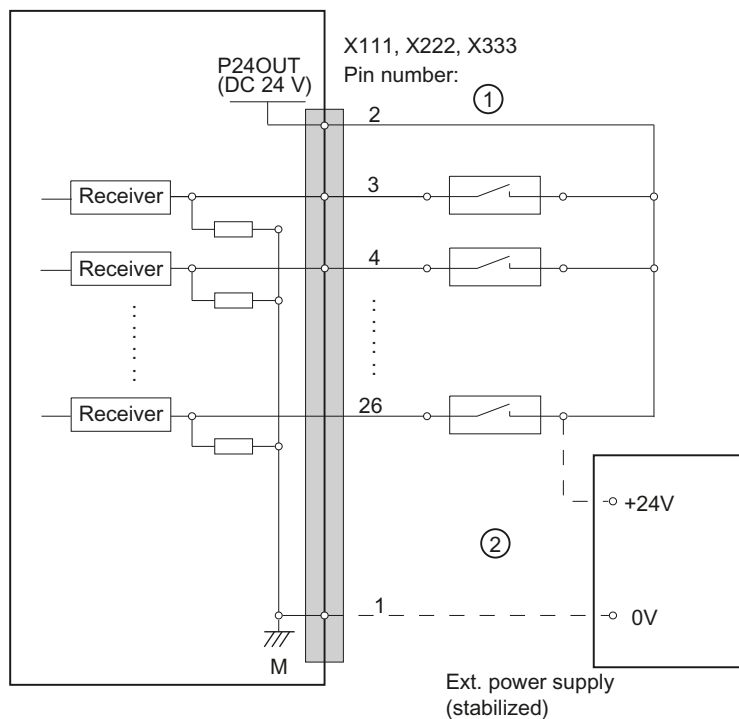
7.8.3.4 Specification of the digital inputs

Terminal assignment for the digital inputs

Features:

- X222: DI 3.0 to 3.7 are connected as rapid inputs.
- The inputs have no signaling (status LEDs).
- The inputs are not isolated.
- It is not possible to connect a 2-wire BERO.

The following figure shows an example of the terminal assignment for the digital inputs on connector X111. Connectors X222 and X333 are assigned analogously.



- ① When using the internal power supply P24OUT
 ② When using the external power supply P24OUT_{ext}

Figure 7-50 Terminal assignment for the digital inputs

Power supply for digital inputs (X111, X222, X333: Pin 2):

The internal power supply (P24OUT) is taken from the general power supply of module X1, pin 2 (P24). Alternatively, an external power supply can be connected if the load at the digital outputs becomes too high.

Technical data

Electrical specification of the digital inputs:

Digital inputs	Min.	Max.	Nominal
High-level voltage (U_H)	15 V	30 V	24 V
Input current I_{IN} at V_H	2 mA	15 mA	--
Low-level voltage (U_L)	-3 V	+5 V	0 V
Signal delay time T_{PHL}	0.5 ms	3 ms	--
Signal delay time T_{PHL} for X222: DI 3.0 to 3.7	--	--	600 μ s

7.8.3.5 Specification of the digital outputs

Terminal assignment for the digital outputs

The following figure shows an example of the terminal assignment for the digital outputs on connector X111. Connectors X222 and X333 are assigned analogously.

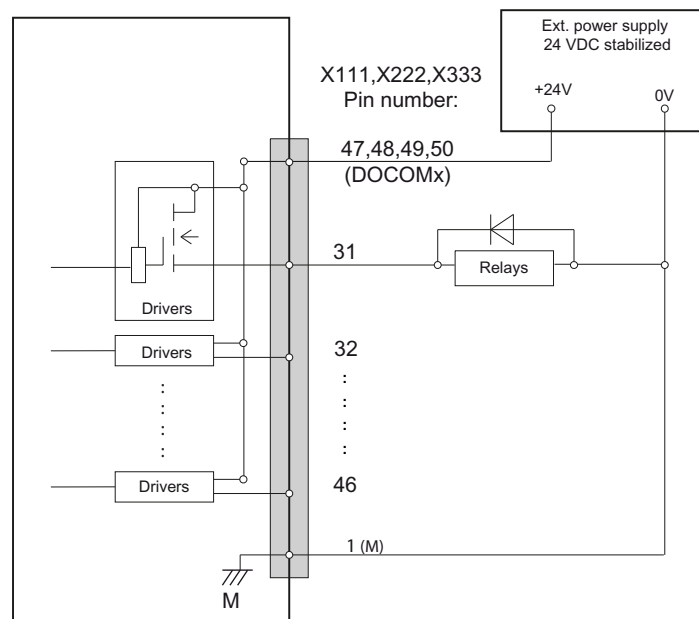


Figure 7-51 Terminal assignment for the digital outputs

NOTICE**Protection against short circuit**

A max. current of $I_{out} = 0.25 \text{ A}$ at X111, X222, X333 where the demand factor is 100%: Pin 2 must not be exceeded.

Characteristics:

- No galvanic isolation.
- Protection against: Short-circuit, overtemperature, and loss of ground.
- Automatic disconnection in case of undervoltage.

Technical data:

Table 7-73 Electrical specification of the digital outputs

Digital outputs	min.	Typical	max.	Nominal
High-level voltage (U_H)	$V_{CC} - 3 \text{ V}$	¹⁾	V_{CC}	24 V
Output current I_{OUT}	--	--	250 mA ²⁾	--
Voltage with low level (U_L)	--	--	--	Output open
Leakage current at low level	--	50 μA	400 μA	--
Signal delay time T_{PHL}	--	0.5 ms	--	--
Maximum switching frequency				
Resistive load	--	--	100 Hz	--
Inductive load	--	--	2 Hz	--
Lamp	--	--	11 Hz	--
¹⁾ $U_{H_typical} = V_{CC} - I_{OUT} \times R_{ON}$ V_{CC} : Current operating voltage I_{OUT} : Output current Maximum short-circuit current: 4 A (max. 100 μs , $V_{CC} = 24 \text{ V}$) R_{ON} : Maximum internal resistance = 0.4 Ω ²⁾ Where demand factor is 100% (all outputs active) Incorrect connection causes neither high level nor destruction of the outputs.				

7.8.4 Parameter assignment

7.8.4.1 Input / output images

Input image

The image comprises 3 slots (n, m, d $\triangleq$ start address, see Addressing components (Page 259)):

- Slot 1: Digital inputs (DI)
 - n+0 ... n+8 (9 byte)
 - X222.P3 - .P10 are rapid inputs
- Slot 2: 2 analog inputs (AI): m+0 ... m+7 (8 byte)
- Slot 3: Diagnostics: d+0 .. d+1

Table 7-74 Input image of digital inputs for the 1st I/O module (n=0)

Terminal	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
X111	n+0	Pin10 DI 0.7	Pin9 DI 0.6	Pin8 DI 0.5	Pin7 DI 0.4	Pin6 DI 0.3	Pin5 DI 0.2	Pin4 DI 0.1	Pin3 DI 0.0
	n+1	Pin18 DI 1.7	Pin17 DI 1.6	Pin16 DI 1.5	Pin15 DI 1.4	Pin14 DI 1.3	Pin13 DI 1.2	Pin12 DI 1.1	Pin11 DI 1.0
	n+2	Pin26 DI 2.7	Pin25 DI 2.6	Pin24 DI 2.5	Pin23 DI 2.4	Pin22 DI 2.3	Pin21 DI 2.2	Pin20 DI 2.1	Pin19 DI 2.0
X222	n+3	Pin10 DI 3.7	Pin9 DI 3.6	Pin8 DI 3.5	Pin7 DI 3.4	Pin6 DI 3.3	Pin5 DI 3.2	Pin4 DI 3.1	Pin3 DI 3.0
	n+4	Pin18 DI 4.7	Pin17 DI 4.6	Pin16 DI 4.5	Pin15 DI 4.4	Pin14 DI 4.3	Pin13 DI 4.2	Pin12 DI 4.1	Pin11 DI 4.0
	n+5	Pin26 DI 5.7	Pin25 DI 5.6	Pin24 DI 5.5	Pin23 DI 5.4	Pin22 DI 5.3	Pin21 DI 5.2	Pin20 DI 5.1	Pin19 DI 5.0
X333	n+6	Pin10 DI 6.7	Pin9 DI 6.6	Pin8 DI 6.5	Pin7 DI 6.4	Pin6 DI 6.3	Pin5 DI 6.2	Pin4 DI 6.1	Pin3 DI 6.0
	n+7	Pin18 DI 7.7	Pin17 DI 7.6	Pin16 DI 7.5	Pin15 DI 7.4	Pin14 DI 7.3	Pin13 DI 7.2	Pin12 DI 7.1	Pin11 DI 7.0
	n+8	Pin26 DI 8.7	Pin25 DI 8.6	Pin24 DI 8.5	Pin23 DI 8.4	Pin22 DI 8.3	Pin21 DI 8.2	Pin20 DI 8.1	Pin19 DI 8.0

Table 7-75 Input image of analog inputs for the 1st I/O module (m=56)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	Analog Status Byte 0							
m+1	Analog Status Byte 1							
m+2	Analog Status Byte 2							
m+3	Analog Status Byte 3							
m+4	AI 0.15	AI 0.14	AI 0.13	AI 0.12	AI 0.11	AI 0.10	AI 0.9	AI 0.8

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+5	AI 0.7	AI 0.6	AI 0.5	AI 0.4	AI 0.3	AI 0.2	AI 0.1	AI 0.0
m+6	AI 1.15	AI 1.14	AI 1.13	AI 1.12	AI 1.11	AI 1.10	AI 1.9	AI 1.8
m+7	AI 1.7	AI 1.6	AI 1.5	AI 1.4	AI 1.3	AI 1.2	AI 1.1	AI 1.0

Output image

The image comprises 2 slots (n, m, Δ start address):

- Slot 1: Digital outputs (DO): n+0 ... n+5 (6 byte)
- Slot 2: 2 analog outputs (AO): m+0 ... m+7 (8 byte)

Table 7-76 Output image of digital outputs for the 1st I/O module (n=0)

Terminal	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
X111	n+0	Pin38 DO 0.7	Pin37 DO 0.6	Pin36 DO 0.5	Pin35 DO 0.4	Pin34 DO 0.3	Pin33 DO 0.2	Pin32 DO 0.1	Pin31 DO 0.0
	n+1	Pin46 DO 1.7	Pin45 DO 1.6	Pin44 DO 1.5	Pin43 DO 1.4	Pin42 DO 1.3	Pin41 DO 1.2	Pin40 DO 1.1	Pin39 DO 1.0
X222	n+2	Pin38 DO 2.7	Pin37 DO 2.6	Pin36 DO 2.5	Pin35 DO 2.4	Pin34 DO 2.3	Pin33 DO 2.2	Pin32 DO 2.1	Pin31 DO 2.0
	n+3	Pin46 DO 3.7	Pin45 DO 3.6	Pin44 DO 3.5	Pin43 DO 3.4	Pin42 DO 3.3	Pin41 DO 3.2	Pin40 DO 3.1	Pin39 DO 3.0
X333	n+4	Pin38 DO 4.7	Pin37 DO 4.6	Pin36 DO 4.5	Pin35 DO 4.4	Pin34 DO 4.3	Pin33 DO 4.2	Pin32 DO 4.1	Pin31 DO 4.0
	n+5	Pin46 DO 5.7	Pin45 DO 5.6	Pin44 DO 5.5	Pin43 DO 5.4	Pin42 DO 5.3	Pin41 DO 5.2	Pin40 DO 5.1	Pin39 DO 5.0

Table 7-77 Output image of analog outputs for the 1st I/O module (m=56)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	Analog Control Byte 0							
m+1	Analog Control Byte 1							
m+2	Analog Control Byte 2							
m+3	Analog Control Byte 3							
m+4	AO 0.15	AO 0.14	AO 0.13	AO 0.12	AO 0.11	AO 0.10	AO 0.9	AO 0.8
m+5	AO 0.7	AO 0.6	AO 0.5	AO 0.4	AO 0.3	AO 0.2	AO 0.1	AO 0.0
m+6	AO 1.15	AO 1.14	AO 1.13	AO 1.12	AO 1.11	AO 1.10	AO 1.9	AO 1.8
m+7	AO 1.7	AO 1.6	AO 1.5	AO 1.4	AO 1.3	AO 1.2	AO 1.1	AO 1.0

See also

Information on settings in the machine data can be found in Section Activating components (Page 258).

7.8.4.2 Diagnostics via input image

Table 7-78 Diagnostics input image

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
d+0	count_2	count_1	count_0	T_Alarm_2	T_Alarm_1	Diag_2	Diag_1	Diag_0
d+1	Status_1							

Table 7-79 Messages in byte 0

Bit	Signal name	Message
7	count_2	alive and well 2
6	count_1	alive and well 1
5	count_0	alive and well 0
4	T_Alarm_2	Temperature not within the operating temperature range defined for the module
3	T_Alarm_1	Critical temperature exceeded
2	Diag_2	Overload DO byte 5/4
1	Diag_1	Overload DO byte 3/2
0	Diag_0	Overload DO byte 1/0

Note

The "alive and well" counter is a 3 bit modulo counter on a PP application level. The PP application can be monitored using this counter. Failure of the application software does not generally result in a communication failure, as this is developed in a hardware-supported manner. The watch dog switches off the digital outputs, while the inputs remain at their last set values.

Table 7-80 Overview of messages as a function of the "alive and well" counter

"alive and well" counter	Value byte 1	Message
0	0	Reserved
1		Temperature value
2	0	No error
	1	Impermissible input voltage in temperature measurement mode
	2	Reserved
	3	Overload at the outputs
	4	Incorrect operating mode selection
	5	Internal error, system error
	6	Overrange at the inputs
	7	Overrange at the outputs
3 ... 7	0	Reserved

Table 7-81 Elimination of error at "alive and well" counter status "2"

Value byte 1	Cause	Effect	Remedy
1	In the temperature measurement operating mode, an input voltage is too high. The hardware may become damaged/destroyed as a result.	The "PNFault" LED is activated. The outputs are disabled. ¹⁾ The value 0x80 is stored in Status Byte 1.	It is essential that a Pt100 element is connected to terminals 3-4 or 7-8. The module must be restarted with Power ON following elimination of the error.
2	Reserved	-	-
3	Overload at the outputs	The "PNFault" LED is activated. The outputs are disabled. ¹⁾ The value 0x80 is stored in Status Byte 1.	Check the loads at the analog output. The module must be restarted with Power ON following elimination of the error.
4	Incorrect operating mode selection, e.g. temperature measurement at the analog outputs.	Selection of operating mode is rejected,	If selected correctly, the module switches to cyclic operation.
5	Internal error, system error	The "PNFault" LED is activated. The outputs are disabled. ¹⁾ The value 0x80 is stored in Status Byte 1.	The firmware has detected a system error, this status can only be exited by means of a switch-on / switch-off.
6	Overrange at the inputs		Check input circuit and adjust, if required.
7	Overrange at the outputs		Correct values in the user program.

¹⁾ The analog outputs retain their last specified value.

Diagnostics via Status Bytes 0/1

In Status Byte 0, the set operating modes are reflected e.g. "0x55" if Control Byte 0 = 0x55 has been specified.

In the event of an error, the error bit is set in Status Byte 1 (bit 7). In the event of an error in one channel, **all** channels are disabled.

Table 7-82 Input image of analog inputs (excerpt)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	0	0	0	0	0	0	0	0
m+1	Error bit	0	0	0	0	0	0	0

7.8.5 Technical data

PP 72/48D PN I/O module

Parameter	Value
Input voltage	24 V DC + 20% / - 15%
Power consumption at rated load (without digital outputs)	17 W
Degree of protection in acc. with EN 60529	IP00
Protection class in acc. with EN 61800-5-1	III; DVC A (PELV)
Shock load during transport (in transport packaging)	Free-fall ≤ 1 m
Approvals	CE, cULus
Cooling	Open-circuit ventilation
Condensation	Not permitted
Relative humidity:	
• Storage	5 ... 95 % no condensation
• Transport	5 ... 95 % no condensation
• Operation	5 ... 90 % no condensation
Ambient temperature:	
• Storage	-40 ... 70 °C
• Transport	-40 ... 70 °C
• Operation	0 ... 55 °C
Dimensions:	
• Width	300 mm
• Height	150 mm
• Depth	35 mm
Weight, approx.	0.9 kg

7.9 PP 72/48D 2/2A PN

7.9.1 Description

Features

The I/O module is a simple module (without a separate enclosure) for connecting digital and analog input/outputs as part of an automation system based on PROFINET IO.

The module has the following important features:

- 72 digital inputs and 48 digital outputs
- Two analog inputs and two analog outputs
Analog process signals such as for detecting temperatures or controlling hydraulic workholders can be implemented via analog inputs/outputs.
- PROFINET IO connection (max. 100 MBaud)
- On-board status display via six LEDs
- The three plug-in connectors for the digital inputs and outputs are 50-pin terminal posts for connecting ribbon cables.
- The use of terminal strip converters or the direct connection of distribution boards is possible.
- Analog signal cables can be connected directly to terminal contacts on the module.

An external power supply unit (24 VDC) is required to supply the module and the digital outputs.

Illustration

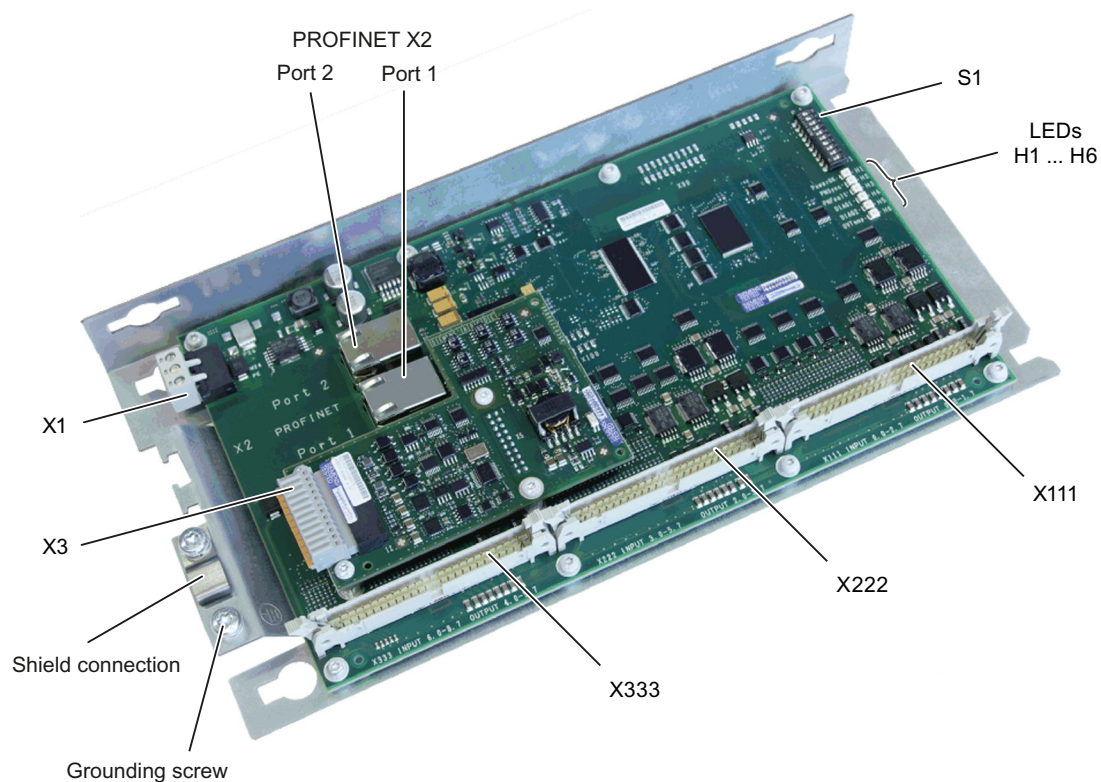


Figure 7-52 PP 72/48D 2/2A PN I/O module

Type plate

The type plate and the MAC address label are on the rear side of the mounting plate. It is advisable to make a note of relevant data as it is no longer visible after installation.

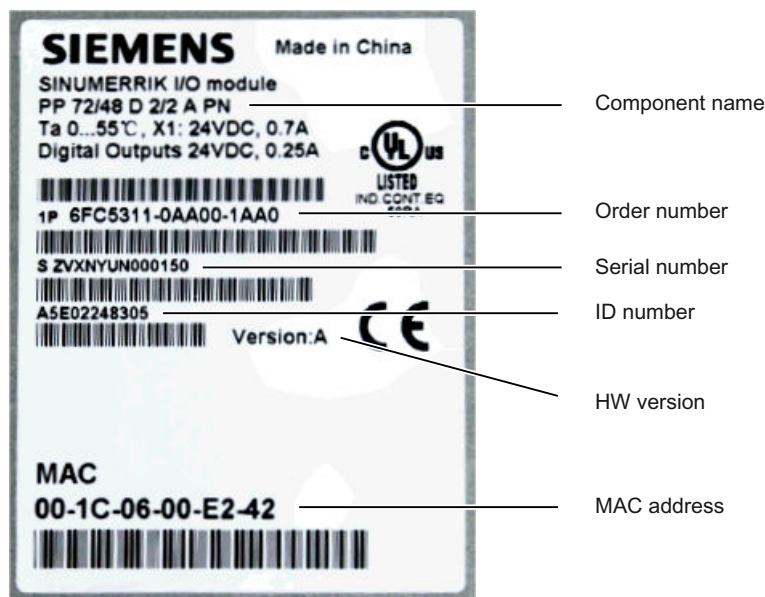


Figure 7-53 PP 72/48D 2/2A PN type plate

LEDs for status display

The PP 72/48D 2/2A PN has the following status displays that provide information on the module status:

Table 7-83 LEDs

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply ok
			Not lit: As soon as one of the generated logic voltages falls below its setpoint, a reset is triggered and the PowerOK LED goes out.
H2	PNSync	Green	Lit: Task system is synchronized to the bus cycle clock.
			Not lit: Task system is not synchronized to bus cycle clock.
			Flashes 0.5 Hz: Task system is synchronized to the bus cycle clock and cyclic data exchange is running.
H3	PNFault	Red	Not lit: Module is operating without errors; data exchange with all configured I/O devices is running.
			Lit: Serious bus fault; only output when one of the following errors is detected for the ports: - No physical connection to a subnet/switch - Incorrect transmission rate - Full duplex transmission is not activated
H4	DIAG1	Green	Reserved

Name	Designation	Color	Description
H5	DIAG2	Green	Reserved
H6	OVTemp	Red	Overtemperature indication

Note

When the system is booting, LEDs H1, H2 and H3 are lit.

7.9.2 Assembling

Mounting

The I/O module is screwed with a mounting plate to the control cabinet wall in the control cabinet. The module must be installed according to EN 60204.

**WARNING****Protection against electric shock**

A protective conductor must be connected using the grounding screw.

Mounting versions:

- Portrait mounting at the lateral strap of the mounting plate (2x M5 or M6 screws).
- Flat mounting at the rear wall of the mounting plate (4x M5 or M6 screws).

Dimension drawing

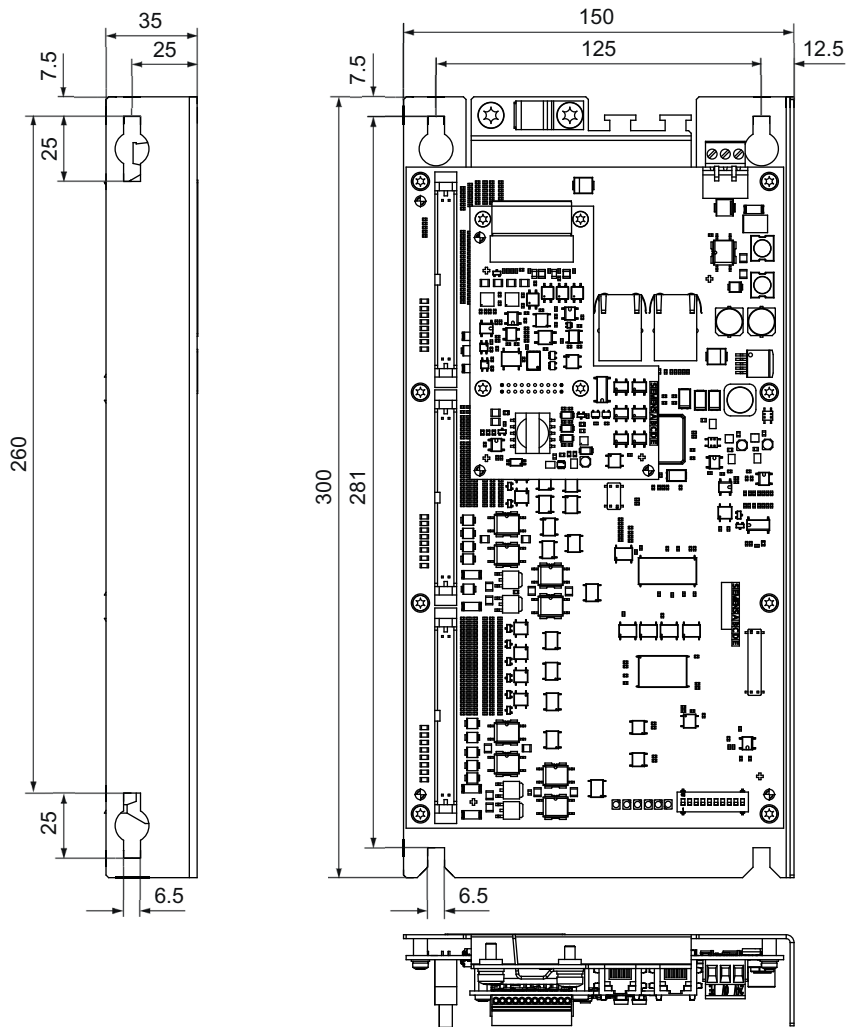


Figure 7-54 PP 72/48D 2/2A PN dimension drawing

7.9.3 Connection

Connection options

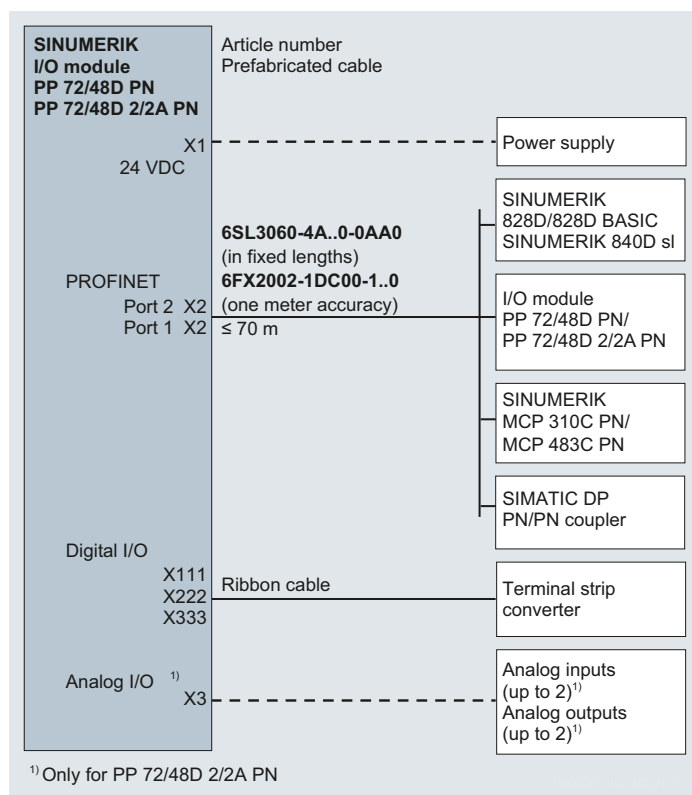


Figure 7-55 PP 72/48D 2/2A PN connections

Interface overview

Table 7-84 Interfaces of the PP 72/48D 2/2A PN I/O module

Interface	Designation	Type
Power supply connection	X1	Screw-terminal block
PROFINET IO	X2 (ports 1 and 2)	Socket
Analog inputs/outputs	X3	Terminal block
PROFINET address	S1	DIP switch
Digital input/outputs 1	X111	Ribbon cable connector
Digital input/outputs 2	X222	Ribbon cable connector
Digital input/outputs 3	X333	Ribbon cable connector

Note

Digital and analog signals must not be laid together within a cable.

See also

Addressing components (Page 259)

7.9.3.1 X1 power supply**Requirements for the power supply****DANGER****Risk of lightning strike**

In the case of supply lines > 10 m, protectors must be installed at the device input in order to protect against lightning (surge).

The DC power supply must be connected to the ground/shield of the control unit for EMC or functional reasons. For EMC reasons, this connection should only be made at one point. As a rule, the connection is provided as standard in the PLC I/Os. If this is not the case in exceptional circumstances, the ground connection should be made on the grounding rail of the control cabinet.

See also: "EMC Installation Guideline" Configuration Manual.

Table 7-85 Requirements of the DC power supply

Rated voltage	According to EN 61131-2	24 V DC
	Voltage range (mean value)	20.4 V DC to 28.8 V DC
	Voltage range (dynamic)	18.5 to 30.2 V DC
	Voltage ripple peak-to-peak	5% (unfiltered 6-pulse rectification)
	Booting time at POWER ON	Any
Non-periodic overvoltages		≤ 35 V
	Duration of overvoltage	≤ 500 ms
	Recovery time	≥ 50 s
	Events per hour	≤ 10
Transient voltage interruptions	Idle time	≤ 3 ms
	Recovery time	≥ 10 s
	Events per hour	≤ 10

Digital inputs

The 24 V supplied at X1 are used to supply the 72 digital inputs.

If the internal supply voltage is not used to supply the digital inputs, this can optionally be replaced by an external power supply (24 V DC). The reference ground of the power supply source must each be connected with X111, X222, X333, pin 1 (GND). X111, X222, X333, pin 2 (P24OUT) then remains open.

Digital outputs

To supply (24 V DC) the digital outputs, an additional external power supply source is required. The power supply is connected to terminals X111, X222 and X333 via pins 47, 48, 49 and 50 (DOCOMx). Ground pins must be connected to a common chassis ground.

Maximum current consumption: 3 x 4 A if all outputs are used simultaneously.

NOTICE

Protection against short circuit

It is the user's responsibility to ensure that the max. current consumption per DOCOMx pin (X111, X222, X333: Pins 47, 48, 49, 50) does not exceed 1 A. The power supply (+24 V DC) for the digital outputs must therefore be connected to all 4 pins per DOCOMx (X111, X222, X333: pins 47, 48, 49, 50).

Analog inputs/outputs

The inputs and outputs are supplied with power on-board, i.e. no further external power supply units are required.

Wiring the power supply

Properties

This interface is intended exclusively for the connection of the external 24 V power supply.

On the module side, the power supplies are protected against:

- Polarity reversal
- Short-circuit (elec. current limitation of the outputs)
- Overload (self-restoring PTC fuse - Multifuse)

Pin assignment

Table 7-86 Pin assignment at X1 screw-type terminal block

Pin	Signal name	Signal type	Meaning
1	P24	VI	24 VDC power supply
2	M	GND	Ground
3	PE	GND	Protective ground

Power requirement

0.7 A (at 24 V DC) for PP 72/48D 2/2A PN and digital inputs plus 3 x 4 A at X111, X222 and X333 for supplying digital outputs.

Wiring the screw terminal block

The required 24 VDC load power supply is wired to the screw-type terminal block (X1).

 DANGER
Protective separation
The 24 V direct voltage must be configured as an extra-low-voltage with protective separation - DVC A or PELV.

Power cables

Table 7-87 Cable specification for X1

Features	Version
Connection option	Up to 2.5 mm ²
Current carrying capacity	max. 10 A
Max. cable length	10 m

Use flexible cables with a cross-section of 0.25 to 2.5 mm² (or AWG 23 to AWG 13) for wiring the power supply according to the maximum occurring current.

If you only use one wire per connection, a ferrule is not required.

You can use ferrules without an insulating collar in accordance with DIN 46228, Form A long version.

7.9.3.2 X2 PROFINET

Requirement

The I/O module has certified PROFINET interfaces, however their functionality cannot be fully utilized within the scope of the SINUMERIK 828D control system. Networking within SINUMERIK 828D is performed via a PLC I/O interface, which is based on PROFINET.

Data transmission rate and cables

The interfaces are designed for full-duplex mode; in other words, the ports can both transmit and receive. When connecting I/O modules to the SINUMERIK 828D, please use the preassembled SINAMICS DRIVE-CLiQ signal cables; from a technical point of view, these are also suitable for use with PROFINET:

- Article number: 6FX2002-1DC00-...
- The transmission characteristics of these cables meet the requirements of CAT5.
- Data transmission speed: 100 Mbps (fast Ethernet).
- The maximum length of the connections between the end device and network component or between two network components (e.g. switch ports) must not exceed 70 m.

Pin assignment

Table 7-88 Pin assignment - PROFINET X2, Port 1 and Port 2

Pin	Signal name	Signal type	Meaning
1	TX+	O	Transmit data +
2	TX-	O	Transmit data -
3	RX+	I	Receive data +
4	N.C.	-	Not assigned
5	N.C.	-	Not assigned
6	RX-	I	Receive data -
7	N.C.	-	Not assigned
8	N.C.	-	Not assigned

LED displays

For diagnostic purposes, the RJ45 sockets are each equipped with a green and a yellow LED. This allows the following information on the respective PROFINET port to be displayed:

Table 7-89 PROFINET ports LED displays

Name	Color	Status	Meaning
Link	Green	Lit	100 Mbit link available
		Off	Missing or faulty link

Name	Color	Status	Meaning
Activity	Yellow	Lit	Sending or receiving
		Off	No activity

PROFINET address (S1)

The right logical address must be assigned to the I/O module for communication with PLC I/O interface using the 10 bit DIP switch S1.

Table 7-90 Switch S1 settings

1	2	3	4	5	6	7	8	9	10	Device name	Meaning
								ON	ON		
ON	OFF	OFF	ON	OFF	OFF	OFF	OFF			pp72x48pn9	1st PP module
OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF			pp72x48pn8	2nd PP module
ON	ON	ON	OFF	OFF	OFF	OFF	OFF			pp72x48pn7	3rd PP module
OFF	ON	ON	OFF	OFF	OFF	OFF	OFF			pp72x48pn6	4th PP module
ON	OFF	ON	OFF	OFF	OFF	OFF	OFF			pp72x48pn5	5th PP module

The device name consists of the PROFINET name and the device number: in the case of I/O modules, the 1st module is device number 9.

Note

A newly set PROFINET address will only come into effect after power OFF/ON.

The switch positions 9 and 10 guarantee the PROFINET functionality of the module and must always be switched "ON".

Further information on the addressing can be found in Section Addressing components (Page 259).

7.9.3.3 X111, X222 and X333 pin assignment

Pin assignment

Table 7-91 Pin assignment X111

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	DI 0.0	I	4	DI 0.1	I
5	DI 0.2	I	6	DI 0.3	I
7	DI 0.4	I	8	DI 0.5	I
9	DI 0.6	I	10	DI 0.7	I
11	DI 1.0	I	12	DI 1.1	I
13	DI 1.2	I	14	DI 1.3	I
15	DI 1.4	I	16	DI 1.5	I

Pin	Signal name	Type	Pin	Signal name	Type
17	DI 1.6	I	18	DI 1.7	I
19	DI 2.0	I	20	DI 2.1	I
21	DI 2.2	I	22	DI 2.3	I
23	DI 2.4	I	24	DI 2.5	I
25	DI 2.6	I	26	DI 2.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	DO 0.0	O	32	DO 0.1	O
33	DO 0.2	O	34	DO 0.3	O
35	DO 0.4	O	36	DO 0.5	O
37	DO 0.6	O	38	DO 0.7	O
39	DO 1.0	O	40	DO 1.1	O
41	DO 1.2	O	42	DO 1.3	O
43	DO 1.4	O	44	DO 1.5	O
45	DO 1.6	O	46	DO 1.7	O
47	DOCOM1	VI	48	DOCOM1	VI
49	DOCOM1	VI	50	DOCOM1	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Table 7-92 Pin assignment for X222

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	DI 3.0	I	4	DI 3.1	I
5	DI 3.2	I	6	DI 3.3	I
7	DI 3.4	I	8	DI 3.5	I
9	DI 3.6	I	10	DI 3.7	I
11	DI 4.0	I	12	DI 4.1	I
13	DI 4.2	I	14	DI 4.3	I
15	DI 4.4	I	16	DI 4.5	I
17	DI 4.6	I	18	DI 4.7	I
19	DI 5.0	I	20	DI 5.1	I
21	DI 5.2	I	22	DI 5.3	I
23	DI 5.4	I	24	DI 5.5	I
25	DI 5.6	I	26	DI 5.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	DO 2.0	O	32	DO 2.1	O
33	DO 2.2	O	34	DO 2.3	O
35	DO 2.4	O	36	DO 2.5	O
37	DO 2.6	O	38	DO 2.7	O

Pin	Signal name	Type	Pin	Signal name	Type
39	DO 3.0	O	40	DO 3.1	O
41	DO 3.2	O	42	DO 3.3	O
43	DO 3.4	O	44	DO 3.5	O
45	DO 3.6	O	46	DO 3.7	O
47	DOCOM2	VI	48	DOCOM2	VI
49	DOCOM2	VI	50	DOCOM2	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Table 7-93 Pin assignment for X333

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	DI 6.0	I	4	DI 6.1	I
5	DI 6.2	I	6	DI 6.3	I
7	DI 6.4	I	8	DI 6.5	I
9	DI 6.6	I	10	DI 6.7	I
11	DI 7.0	I	12	DI 7.1	I
13	DI 7.2	I	14	DI 7.3	I
15	DI 7.4	I	16	DI 7.5	I
17	DI 7.6	I	18	DI 7.7	I
19	DI 8.0	I	20	DI 8.1	I
21	DI 8.2	I	22	DI 8.3	I
23	DI 8.4	I	24	DI 8.5	I
25	DI 8.6	I	26	DI 8.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	DO 4.0	O	32	DO 4.1	O
33	DO 4.2	O	34	DO 4.3	O
35	DO 4.4	O	36	DO 4.5	O
37	DO 4.6	O	38	DO 4.7	O
39	DO 5.0	O	40	DO 5.1	O
41	DO 5.2	O	42	DO 5.3	O
43	DO 5.4	O	44	DO 5.5	O
45	DO 5.6	O	46	DO 5.7	O
47	DOCOM3	VI	48	DOCOM3	VI
49	DOCOM3	VI	50	DOCOM3	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Cable specification:

- 50-pin ribbon cable connector: 50-pin insulation piercing connecting device with strain relief, ribbon cables and terminal converter are required to connect the digital inputs and outputs.
- The required connecting cables (ribbon cables) must be provided by the user. Maximum cable length: 30 m

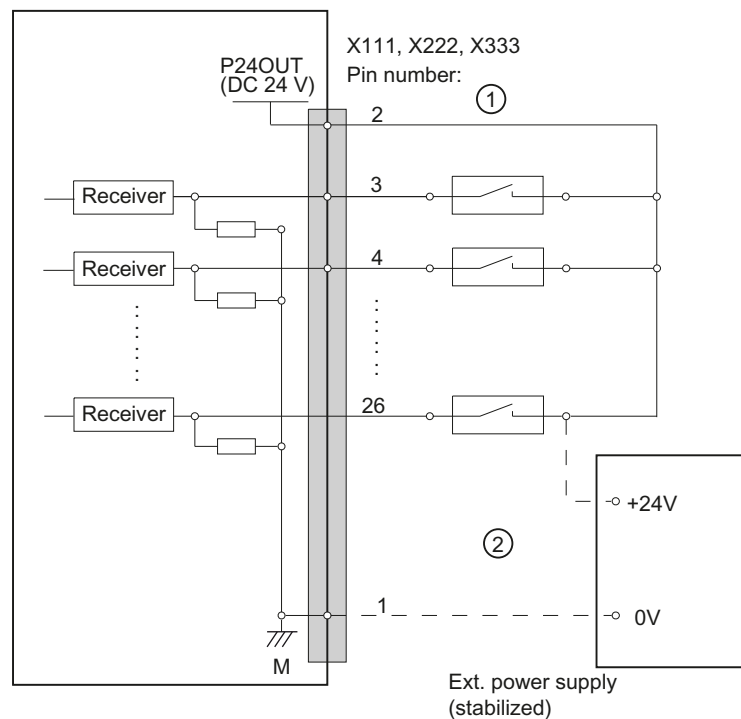
7.9.3.4 Specification of the digital inputs

Terminal assignment for the digital inputs

Features:

- X222: DI 3.0 to 3.7 are connected as rapid inputs.
- The inputs have no signaling (status LEDs).
- The inputs are not isolated.
- It is not possible to connect a 2-wire BERO.

The following figure shows an example of the terminal assignment for the digital inputs on connector X111. Connectors X222 and X333 are assigned analogously.



- ① When using the internal power supply P24OUT
 ② When using the external power supply P24OUT_{ext}

Figure 7-56 Terminal assignment for the digital inputs

Power supply for digital inputs (X111, X222, X333: Pin 2):

The internal power supply (P24OUT) is taken from the general power supply of module X1, pin 2 (P24). Alternatively, an external power supply can be connected if the load at the digital outputs becomes too high.

Technical data

Electrical specification of the digital inputs:

Digital inputs	Min.	Max.	Nominal
High-level voltage (U_H)	15 V	30 V	24 V
Input current I_{IN} at V_H	2 mA	15 mA	--
Low-level voltage (U_L)	-3 V	+5 V	0 V
Signal delay time T_{PHL}	0.5 ms	3 ms	--
Signal delay time T_{PHL} for X222: DI 3.0 to 3.7	--	--	600 μ s

7.9.3.5 Specification of the digital outputs

Terminal assignment for the digital outputs

The following figure shows an example of the terminal assignment for the digital outputs on connector X111. Connectors X222 and X333 are assigned analogously.

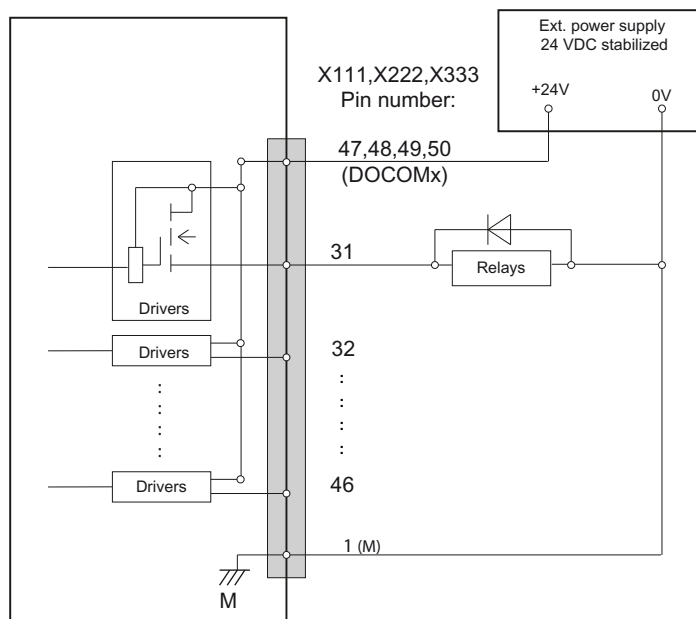


Figure 7-57 Terminal assignment for the digital outputs

NOTICE**Protection against short circuit**

A max. current of $I_{out} = 0.25 \text{ A}$ at X111, X222, X333 where the demand factor is 100%: Pin 2 must not be exceeded.

Characteristics:

- No galvanic isolation.
- Protection against: Short-circuit, overtemperature, and loss of ground.
- Automatic disconnection in case of undervoltage.

Technical data:

Table 7-94 Electrical specification of the digital outputs

Digital outputs	min.	Typical	max.	Nominal
High-level voltage (U_H)	$V_{CC} - 3 \text{ V}$	¹⁾	V_{CC}	24 V
Output current I_{OUT}	--	--	250 mA ²⁾	--
Voltage with low level (U_L)	--	--	--	Output open
Leakage current at low level	--	50 μA	400 μA	--
Signal delay time T_{PHL}	--	0.5 ms	--	--
Maximum switching frequency				
Resistive load	--	--	100 Hz	--
Inductive load	--	--	2 Hz	--
Lamp	--	--	11 Hz	--
¹⁾ $U_{H_typical} = V_{CC} - I_{OUT} \times R_{ON}$ V_{CC} : Current operating voltage I_{OUT} : Output current Maximum short-circuit current: 4 A (max. 100 μs , $V_{CC} = 24 \text{ V}$) R_{ON} : Maximum internal resistance = 0.4 Ω ²⁾ Where demand factor is 100% (all outputs active) Incorrect connection causes neither high level nor destruction of the outputs.				

7.9.3.6 Analog X3 inputs/outputs

Cable specification

- Connectors: 12-pin socket/plug combination
- Cable: shielded
 - max. cable length: 30 m
 - max. connectable core cross-section: 0.5 mm²

Wiring analog inputs/outputs

Procedure:

1. Strip cable for analog signals.
2. Secure the stripped connection piece of the cable with the shield connection clamp.

NOTICE

Shield contact

If the analog inputs/outputs are wired, a shielded lead must be used. The shield must be supported.

X3 pin assignment

Table 7-95 Pin assignment (standard)

Pin	Signal name	Signal type	Meaning
1	CO1	O	Channel 1 current output for PT100
2	CI1	I	Channel 1 current input for PT100
3	AI1+	I	Channel 1 analog input +
4	AI1-	I	Channel 1 analog input -
5	CO2	O	Channel 2 current output for PT100
6	CI2	I	Channel 2 current input for PT100
7	AI2+	I	Channel 2 analog input +
8	AI2-	I	Channel 2 analog input -
9	AO3+	O	Channel 3 current and voltage output +
10	AO3-	O	Channel 3 current and voltage output -
11	AO4+	O	Channel 4 current and voltage output +
12	AO4-	O	Channel 4 current and voltage output -

The analog signal to be measured is connected to the terminals AI 1+/- and AI 2+/- . AI stands for "Analog Input". The CO "Current Output" and CI "Current Input" terminals supply the constant current for the 4-wire measurement of PT100 elements.

Analog inputs

The module has two analog inputs. These can optionally be assigned parameters as voltage, current or PT100 input.

Note

The analog inputs are only enabled following the parameter assignment.

Cycle time of the analog value accumulation: 20 ms per channel

Table 7-96 Technical specifications in the "voltage input" operating mode

Parameter	Value
Input range (rated value)	- 10 V to + 10 V
permitted overrange	- 11.75 V to + 11.75 V
Resolution	16 bits (including sign)
Accuracy	+/- 0.5%
Internal resistance Ri	100 KOhm

Table 7-97 Technical specifications in the "current input" operating mode

Parameter	Value
Input range (rated value)	- 20 mA to + 20 mA
Permitted overrange	- 23.5 mA to + 23.5 mA
Resolution	16 bits (including sign)
Accuracy	+/- 0.5%
Internal resistance Ri	133 ohm

Table 7-98 Technical data in the "PT100" operating mode

Parameter	Value
Input range (rated value)	- 200 °C to + 259 °C
Standard	EN60751
Resolution	16 bits (including sign)
Accuracy	+/- 2 °C
Internal resistance Ri	>> 10 kOhm

NOTICE

Protection from overvoltage

If the PT100 operating mode is selected, the hardware is protected against overvoltage. The following mechanisms are triggered in the event of an error:

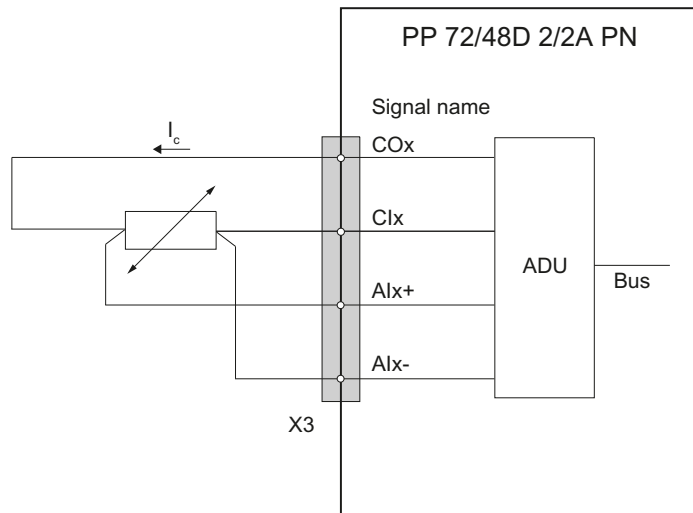
1. An error bit is set which is then communicated to the PLC.
2. The module is shut down.

Measurement using a 4-wire connection system

Notes regarding the connection and operation of PT100 resistors:

This enables the module to supply X3 with a constant current via the CO1, CI1, CO2 and CI2 terminals. The constant current is fed to the resistor to be measured where it is then measured as the voltage drop. It is imperative to wire the connected constant current cables directly to the resistor.

Measurements with 4-wire connections compensate for line resistances and return a considerably higher degree of precision in comparison with 2-wire connections.



x 1, 2

ADU Analog Digital Unit

I_c Constant current

Figure 7-58 PT100 pin assignment

Measurement using a 3-wire connection system

The following pins must be jumpered at connector X3 in order to perform the measurement in the PT100 using a 3-wire connection system:

- Temperature measurement with channel 1:
Short-circuit pin 2 (CI 1) and pin 4 (AI 1-) and connect the jumper at connector X3
- Temperature measurement with channel 2:
Short-circuit pin 6 (CI 2) and pin 8 (AI 2-) and connect the jumper at connector X3.

Note

Measuring accuracy

The accuracy of the temperature input becomes poorer: The resistance of the connecting cable of the jumpered connecting cable falsifies the measurement.

Analog outputs

The module has two analog outputs. These can optionally be assigned parameters as voltage or current output.

Note

The analog outputs are only enabled following the parameter assignment.

From the switch-on of the I/O module to its enabling, the analog outputs do not read 0 V, but are defined by a voltage pulse at -0.2 V. This value must be taken into consideration when specifying the setpoint value.

The cycle time of the analog value accumulation is limited by the PLC cycle.

Table 7-99 Technical specifications in the "voltage output" operating mode

Parameter	Value
Output range (rated value)	- 10 V to + 10 V
Permitted overrange	- 10.5 V to + 10.5 V
Resolution	16 bits (including sign)
Accuracy	+/- 0.5%
Max. load current	-3 mA to +3 mA

Table 7-100 Technical specifications in the "current output" operating mode

Parameter	Value
Output range (rated value)	- 20 mA to + 20 mA
Permitted overrange	- 20.2 mA to + 20.2 mA
Resolution	16 bits (including sign)
Accuracy	+/- 0.5%
Load impedance	≤ 600 ohm

7.9.4 Assigning parameters

7.9.4.1 Input / output images

Input image

The image comprises 3 slots (n, m, d $\triangleq$ start address, see Addressing components (Page 259)):

- Slot 1: Digital inputs (DI)
 - n+0 ... n+8 (9 byte)
 - X222.P3 - .P10 are rapid inputs
- Slot 2: 2 analog inputs (AI): m+0 ... m+7 (8 byte)
- Slot 3: Diagnostics: d+0 .. d+1

Table 7-101 Input image of digital inputs for the 1st I/O module (n=0)

Terminal	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
X111	n+0	Pin10 DI 0.7	Pin9 DI 0.6	Pin8 DI 0.5	Pin7 DI 0.4	Pin6 DI 0.3	Pin5 DI 0.2	Pin4 DI 0.1	Pin3 DI 0.0
	n+1	Pin18 DI 1.7	Pin17 DI 1.6	Pin16 DI 1.5	Pin15 DI 1.4	Pin14 DI 1.3	Pin13 DI 1.2	Pin12 DI 1.1	Pin11 DI 1.0
	n+2	Pin26 DI 2.7	Pin25 DI 2.6	Pin24 DI 2.5	Pin23 DI 2.4	Pin22 DI 2.3	Pin21 DI 2.2	Pin20 DI 2.1	Pin19 DI 2.0
X222	n+3	Pin10 DI 3.7	Pin9 DI 3.6	Pin8 DI 3.5	Pin7 DI 3.4	Pin6 DI 3.3	Pin5 DI 3.2	Pin4 DI 3.1	Pin3 DI 3.0
	n+4	Pin18 DI 4.7	Pin17 DI 4.6	Pin16 DI 4.5	Pin15 DI 4.4	Pin14 DI 4.3	Pin13 DI 4.2	Pin12 DI 4.1	Pin11 DI 4.0
	n+5	Pin26 DI 5.7	Pin25 DI 5.6	Pin24 DI 5.5	Pin23 DI 5.4	Pin22 DI 5.3	Pin21 DI 5.2	Pin20 DI 5.1	Pin19 DI 5.0
X333	n+6	Pin10 DI 6.7	Pin9 DI 6.6	Pin8 DI 6.5	Pin7 DI 6.4	Pin6 DI 6.3	Pin5 DI 6.2	Pin4 DI 6.1	Pin3 DI 6.0
	n+7	Pin18 DI 7.7	Pin17 DI 7.6	Pin16 DI 7.5	Pin15 DI 7.4	Pin14 DI 7.3	Pin13 DI 7.2	Pin12 DI 7.1	Pin11 DI 7.0
	n+8	Pin26 DI 8.7	Pin25 DI 8.6	Pin24 DI 8.5	Pin23 DI 8.4	Pin22 DI 8.3	Pin21 DI 8.2	Pin20 DI 8.1	Pin19 DI 8.0

Table 7-102 Input image of analog inputs for the 1st I/O module (m=56)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	Analog Status Byte 0							
m+1	Analog Status Byte 1							
m+2	Analog Status Byte 2							
m+3	Analog Status Byte 3							
m+4	AI 0.15	AI 0.14	AI 0.13	AI 0.12	AI 0.11	AI 0.10	AI 0.9	AI 0.8

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+5	AI 0.7	AI 0.6	AI 0.5	AI 0.4	AI 0.3	AI 0.2	AI 0.1	AI 0.0
m+6	AI 1.15	AI 1.14	AI 1.13	AI 1.12	AI 1.11	AI 1.10	AI 1.9	AI 1.8
m+7	AI 1.7	AI 1.6	AI 1.5	AI 1.4	AI 1.3	AI 1.2	AI 1.1	AI 1.0

Output image

The image comprises 2 slots (n, m, Δ start address):

- Slot 1: Digital outputs (DO): n+0 ... n+5 (6 byte)
- Slot 2: 2 analog outputs (AO): m+0 ... m+7 (8 byte)

Table 7-103 Output image of digital outputs for the 1st I/O module (n=0)

Terminal	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
X111	n+0	Pin38 DO 0.7	Pin37 DO 0.6	Pin36 DO 0.5	Pin35 DO 0.4	Pin34 DO 0.3	Pin33 DO 0.2	Pin32 DO 0.1	Pin31 DO 0.0
	n+1	Pin46 DO 1.7	Pin45 DO 1.6	Pin44 DO 1.5	Pin43 DO 1.4	Pin42 DO 1.3	Pin41 DO 1.2	Pin40 DO 1.1	Pin39 DO 1.0
X222	n+2	Pin38 DO 2.7	Pin37 DO 2.6	Pin36 DO 2.5	Pin35 DO 2.4	Pin34 DO 2.3	Pin33 DO 2.2	Pin32 DO 2.1	Pin31 DO 2.0
	n+3	Pin46 DO 3.7	Pin45 DO 3.6	Pin44 DO 3.5	Pin43 DO 3.4	Pin42 DO 3.3	Pin41 DO 3.2	Pin40 DO 3.1	Pin39 DO 3.0
X333	n+4	Pin38 DO 4.7	Pin37 DO 4.6	Pin36 DO 4.5	Pin35 DO 4.4	Pin34 DO 4.3	Pin33 DO 4.2	Pin32 DO 4.1	Pin31 DO 4.0
	n+5	Pin46 DO 5.7	Pin45 DO 5.6	Pin44 DO 5.5	Pin43 DO 5.4	Pin42 DO 5.3	Pin41 DO 5.2	Pin40 DO 5.1	Pin39 DO 5.0

Table 7-104 Output image of analog outputs for the 1st I/O module (m=56)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	Analog Control Byte 0							
m+1	Analog Control Byte 1							
m+2	Analog Control Byte 2							
m+3	Analog Control Byte 3							
m+4	AO 0.15	AO 0.14	AO 0.13	AO 0.12	AO 0.11	AO 0.10	AO 0.9	AO 0.8
m+5	AO 0.7	AO 0.6	AO 0.5	AO 0.4	AO 0.3	AO 0.2	AO 0.1	AO 0.0
m+6	AO 1.15	AO 1.14	AO 1.13	AO 1.12	AO 1.11	AO 1.10	AO 1.9	AO 1.8
m+7	AO 1.7	AO 1.6	AO 1.5	AO 1.4	AO 1.3	AO 1.2	AO 1.1	AO 1.0

See also

Information on settings in the machine data can be found in Section Activating components (Page 258).

7.9.4.2 Diagnostics via input image

Table 7-105 Diagnostics input image

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
d+0	count_2	count_1	count_0	T_Alarm_2	T_Alarm_1	Diag_2	Diag_1	Diag_0
d+1	Status_1							

Table 7-106 Messages in byte 0

Bit	Signal name	Message
7	count_2	alive and well 2
6	count_1	alive and well 1
5	count_0	alive and well 0
4	T_Alarm_2	Temperature not within the operating temperature range defined for the module
3	T_Alarm_1	Critical temperature exceeded
2	Diag_2	Overload DO byte 5/4
1	Diag_1	Overload DO byte 3/2
0	Diag_0	Overload DO byte 1/0

Note

The "alive and well" counter is a 3 bit modulo counter on a PP application level. The PP application can be monitored using this counter. Failure of the application software does not generally result in a communication failure, as this is developed in a hardware-supported manner. The watch dog switches off the digital outputs, while the inputs remain at their last set values.

Table 7-107 Overview of messages as a function of the "alive and well" counter

"alive and well" counter	Value byte 1	Message
0	0	Reserved
1		Temperature value
2	0	No error
	1	Impermissible input voltage in temperature measurement mode
	2	Reserved
	3	Overload at the outputs
	4	Incorrect operating mode selection
	5	Internal error, system error
	6	Overrange at the inputs
	7	Overrange at the outputs
3 ... 7	0	Reserved

Table 7-108 Elimination of error at "alive and well" counter status "2"

Value byte 1	Cause	Effect	Remedy
1	In the temperature measurement operating mode, an input voltage is too high. The hardware may become damaged/destroyed as a result.	The "PNFault" LED is activated. The outputs are disabled. ¹⁾ The value 0x80 is stored in Status Byte 1.	It is essential that a Pt100 element is connected to terminals 3-4 or 7-8. The module must be restarted with Power ON following elimination of the error.
2	Reserved	-	-
3	Overload at the outputs	The "PNFault" LED is activated. The outputs are disabled. ¹⁾ The value 0x80 is stored in Status Byte 1.	Check the loads at the analog output. The module must be restarted with Power ON following elimination of the error.
4	Incorrect operating mode selection, e.g. temperature measurement at the analog outputs.	Selection of operating mode is rejected,	If selected correctly, the module switches to cyclic operation.
5	Internal error, system error	The "PNFault" LED is activated. The outputs are disabled. ¹⁾ The value 0x80 is stored in Status Byte 1.	The firmware has detected a system error, this status can only be exited by means of a switch-on / switch-off.
6	Overrange at the inputs		Check input circuit and adjust, if required.
7	Overrange at the outputs		Correct values in the user program.

¹⁾ The analog outputs retain their last specified value.

Diagnostics via Status Bytes 0/1

In Status Byte 0, the set operating modes are reflected e.g. "0x55" if Control Byte 0 = 0x55 has been specified.

In the event of an error, the error bit is set in Status Byte 1 (bit 7). In the event of an error in one channel, **all** channels are disabled.

Table 7-109 Input image of analog inputs (excerpt)

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	0	0	0	0	0	0	0	0
m+1	Error bit	0	0	0	0	0	0	0

7.9.4.3 Assigning parameters to the analog inputs / outputs

Operating mode

Parameters are assigned to the operating mode via the m+0 byte (Analog Control Byte 0) of the output image of the analog outputs:

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	AO (channel 4)	AO (channel 4)	AO (channel 3)	AO (channel 3)	AI (channel 2)	AI (channel 2)	AI (channel 1)	AI (channel 1)
m+1	Reserved							Data format
m+2	Reserved							
m+3	Reserved							

The reserved bits must be preassigned with the value "0".

The operating mode is set to "no operating mode" during power-up, as soon as a valid setting is made this will be applied and will subsequently no longer be reset. If a reset is initiated by the user, this is interpreted as an error.

Type of control

The control type must be specified in the Analog Control Byte m+1 (bit 0), so that the 16 bit input and output values from and for the analog module are correctly interpreted by the control. In the SINUMERIK 828D control, the value "1" must be entered.

Note

The control type must be set prior to the operating mode so that the first set of user data is not misinterpreted. In addition to this, the Analog Control Byte m+0 / m+1 must only be accessed byte by byte.

Assigning parameters to the analog inputs

The analog inputs (AI) can be operated in the following operating modes:

Operating mode 1st channel	Bit 1	Bit 0
No operating mode	0	0
Voltage measurement	0	1
Current measurement	1	0
Temperature measurement (Pt100)	1	1

Operating mode 2nd channel	Bit 3	Bit 2
No operating mode	0	0
Voltage measurement	0	1

Operating mode 2nd channel	Bit 3	Bit 2
Current measurement	1	0
Temperature measurement (Pt100)	1	1

Assigning parameters to the analog outputs

The analog outputs (AO) can be operated in the following operating modes:

Operating mode 3rd channel	Bit 5	Bit 4
No operating mode	0	0
Voltage output	0	1
Current output	1	0
Impermissible operating mode	1	1

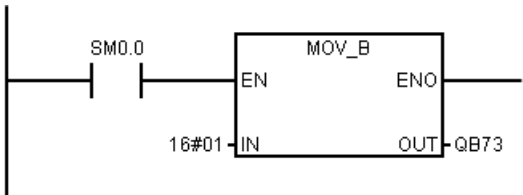
Operating mode 4th channel	Bit 7	Bit 6
No operating mode	0	0
Voltage output	0	1
Current output	1	0
Impermissible operating mode	1	1

Checkback signal of the operating modes

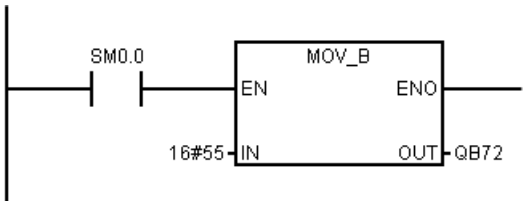
The set operating modes are saved in the input image in Status Byte 0. This value must be compared with Control Byte 0 in the output image. If these are different, an error has occurred, e. g. in the case of overvoltage in the "Temperature measurement" operating mode, see Diagnostics via input image (Page 238).

Examples of programming

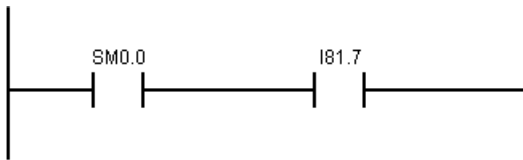
1. Determine control type:



2. Set the operating mode:



3. Query the error status bit in cyclic operation:



7.9.4.4 Analog value representation

Note

The analog values of the inputs and outputs are written or read in 16 bit data format i.e. they must be accessed word by word.

The analog values are provided as 16 bit integer values. Depending on the operating mode, the measured values must be converted using the following factors in order to achieve the corresponding physical value.

	Voltage [V]	Current [mA]	Temperature [°C]
Factor (AI):	0.00151947	0.003051758	0.1
Factor (AO):	0.000381469	0.0007629	-

Calculation: 16 bit value (hex. or dec.) * factor = measured value

Analog inputs

Table 7-110 Measured values in the voltage measurement operating mode

16 bit value (hex.)	16 bit value (dec.)	Factor	Voltage value [V]
Overflow		-	Deactivation
Overrange		-	Up to 11.75 V
0x19B5	6581	0.00151947	10 V
0x0CDA	3291		5 V
0x066D	1645		2.5 V
0x0000	0		0 V
0xF993	-1645		-2.5 V
0xF326	-3291		-5 V
0xE64B	-6581		-10 V
Underrange		-	Up to -11.75 V
Underflow		-	Deactivation

Table 7-111 Measured values in the current measurement operating mode

16 bit value (hex.)	16 bit value (dec.)	Factor	Current value [V]
Overflow		-	Deactivation
Overrange		-	Up to 23.5 mA
0x1999	6553	0.003051758	20 mA
0x0CCC	3277		10 mA
0x0000	0		0 mA
0xF333	-3277		-10 mA
0xE666	-6553		-20 mA
Underrange		-	Up to -23.5 mA
Underflow		-	Deactivation

Table 7-112 Measured values in the "temperature measurement" operating mode

16 bit value (hex.)	16 bit value (dec.)	Factor	Temperature value [V]
Overflow			
0x0A28	2590	0.1	259 °C
0x03E8	1000		100 °C
0x01F4	500		50 °C
0x0000	0.0		0 °C
0xFE0C	-500		-50 °C
0xFC18	-1000		-100 °C
0xF830	-2000		-200 °C
Underflow			

Note

If a Pt100 element is accidentally not connected in this operating mode and an input voltage higher than 0.25 V is output, the analog module automatically switches to the "no operating mode" operating mode and resets the gain factor to "1". This is signaled in Status Word 0 (channel-specific) in the input image. In addition, a corresponding error code is output in the diagnostics slot at a counter value of "2".

In the case of operation without a Pt100 element, a slightly negative voltage may be applied, which results in an error status for the module. Here, the "PNFault" LED and the status byte 1 are to be observed.

Analog outputs

Table 7-113 Measured values in the "voltage output" operating mode

16 bit value (hex.)	16 bit value (dec.)	Factor	Voltage value [V]
Overflow		-	Deactivation
Overrange		-	Up to 10.5 V
0x6666	26214	0.000381469	10 V
0x4CD1	19665		7.5 V
0x199B	6555		2.5 V
0x0000	0		0 V
0xE665	-6555		-2.5 V
0xB32F	-19665		-7.5 V
0x999A	-26214		-10 V
Underrange		-	Up to -10.5 V
Underflow		-	Deactivation

Table 7-114 Measured values in the "current output" operating mode

16 bit value (hex.)	16 bit value (dec.)	Factor	Current value [V]
Overflow		-	Deactivation
Overrange		-	20.2 mA
0x6666	26214	0.0007629	20 mA
0x4CD1	19665		15 mA
0x199B	6555		5 mA
0x0000	0		0 mA
0xE665	-6555		-5 mA
0xB32F	-19665		-15 mA
0x999A	-26214		-20 mA
Underrange		-	-20.2 mA
Underflow		-	Deactivation

7.9.4.5 Examples

Measured values and responses

The following examples for assigning parameters to analog inputs/outputs are provided for the I/O module with device number "7".

Example for operating mode voltage measurement

	Address	Voltage ± 10 V			
		0 V	2.5 V	10 V	12 V
Operating mode	QB72	16#55	16#55	16#55	16#55
Format	QB73	16#1	16#1	16#1	16#1
Value	QW76	16#0	16#199B	16#6666	16#7AE1
Value	QW78	16#0	16#199B	16#6666	16#7AE1
Operating mode	IB72	16#55	16#55	16#55	16#55
Format	IB73	16#1	16#1	16#1	16#1
Value	IW76	16#0	16#66D	16#19B5	16#0
Value	IW78	16#0	16#66D	16#19B5	16#0
Diagnostics	IB50	-	-	-	16#2
	IB51	16#0	16#0	16#0	16#7
PNFault LED		OFF	OFF	OFF	ON
Troubleshooting					Deactivating/ activating

Example for operating mode current measurement

	Address	Current 20 mA			
		0 mA	5 mA	20 mA	22 mA
Operating mode	QB72	16#AA	16#AA	16#AA	16#AA
Format	QB73	16#1	16#1	16#1	16#1
Value	QW76	16#0	16#199B	16#6666	16#70A5
Value	QW78	16#0	16#199B	16#6666	16#70A5
Operating mode	IB72	16#AA	16#AA	16#AA	16#AA
Format	IB73	16#1	16#1	16#1	16#1
Value	IW76	16#0	16#665	16#1996	16#0
Value	IW78	16#0	16#665	16#1996	16#0
Diagnostics	IB50	-	-	-	16#2
	IB51	16#0	16#0	16#0	16#7

	Address	Current 20 mA			
		0 mA	5 mA	20 mA	22 mA
PNFault LED		OFF	OFF	OFF	ON
Troubleshooting					Deactivating/ activating

Example for operating mode temperature measurement

	Address	Pt100	
		Incorrect operating mode	Resistor is not connected
Operating mode	QB72	16#AA	16#0F
Format	QB73	16#1	16#1
Value	QW76	-	-
Value	QW78	-	-
Operating mode	IB72	16#AA	16#0F
Format	IB73	16#81	16#81
Value	IW76	-	-
Value	IW78	-	-
Diagnostics	IB50	16#2	16#2
	IB51	16#3	16#6
PNFault LED		ON	ON
Troubleshooting		Deactivating/activating	Deactivating/activating

7.9.5 Technical data

PP 72/48D 2/2A PN I/O module

Parameter	Value
Input voltage	24 V DC + 20% / - 15%
Power consumption at rated load (without digital outputs)	19 W
Power loss	18 W
Rated current	0.7 A
Shock load during transport (in transport packaging)	Free-fall ≤ 1 m
Degree of protection in acc. with EN 60529	IP00
Protection class in acc. with EN 61800-5-1	III; DVC A (PELV)
Approvals	CE, cULus
Heat dissipation	Open-circuit ventilation

Parameter	Value
Condensation	Not permitted
Relative humidity:	
• Storage	5 ... 95 % no condensation
• Transport	5 ... 95 % no condensation
• Operation	5 ... 90 % no condensation
Ambient temperature:	
• Storage	-40 ... 70 °C
• Transport	-40 ... 70 °C
• Operation	0 ... 55 °C
Dimensions:	
• Width	300 mm
• Height	150 mm
• Depth	35 mm
Weight, approx.	0.9 kg

7.10 NX10.3 / NX15.3

7.10.1 Description

Properties

Using the NX10.3 und NX15.3 modules, you can expand the performance of an axis group of a SINUMERIK 828D CNC automation system. Each NX10.3 can control up to 3 additional axes and each NX15.3 can control up to 6 additional axes.

Type plate

The NX module type plate contains the following information:

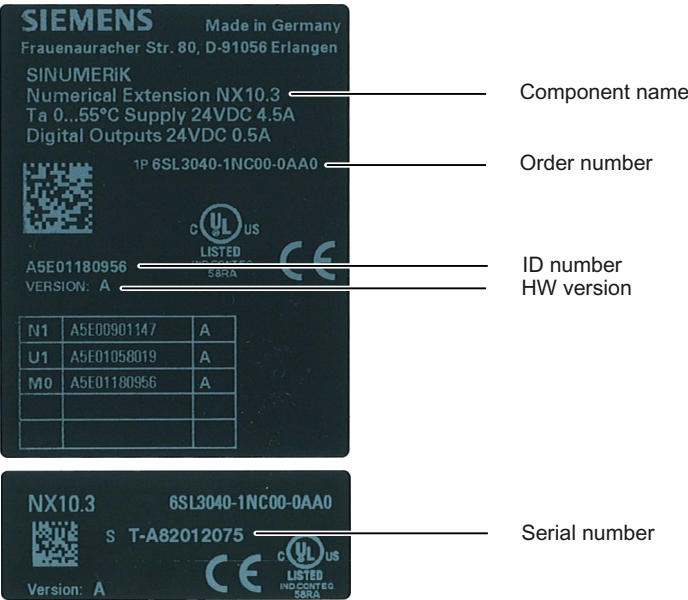


Figure 7-59 Type plate using the NX10.3 as example

Note

You might need to access the information provided on the side-mounted type plate after the equipment has been mounted. Since the type plate is located on the right-hand side of the housing, which is the side typically used to connect to the SINAMICS S120 module, we recommend that you make a note of the serial number of the NX prior to assembly.

Illustration

The NX module has the following interfaces:

- 4 DRIVE-CLiQ (X100 – X103)
- 6 digital inputs and 4 digital inputs/outputs (X122)
- Power supply (X124)

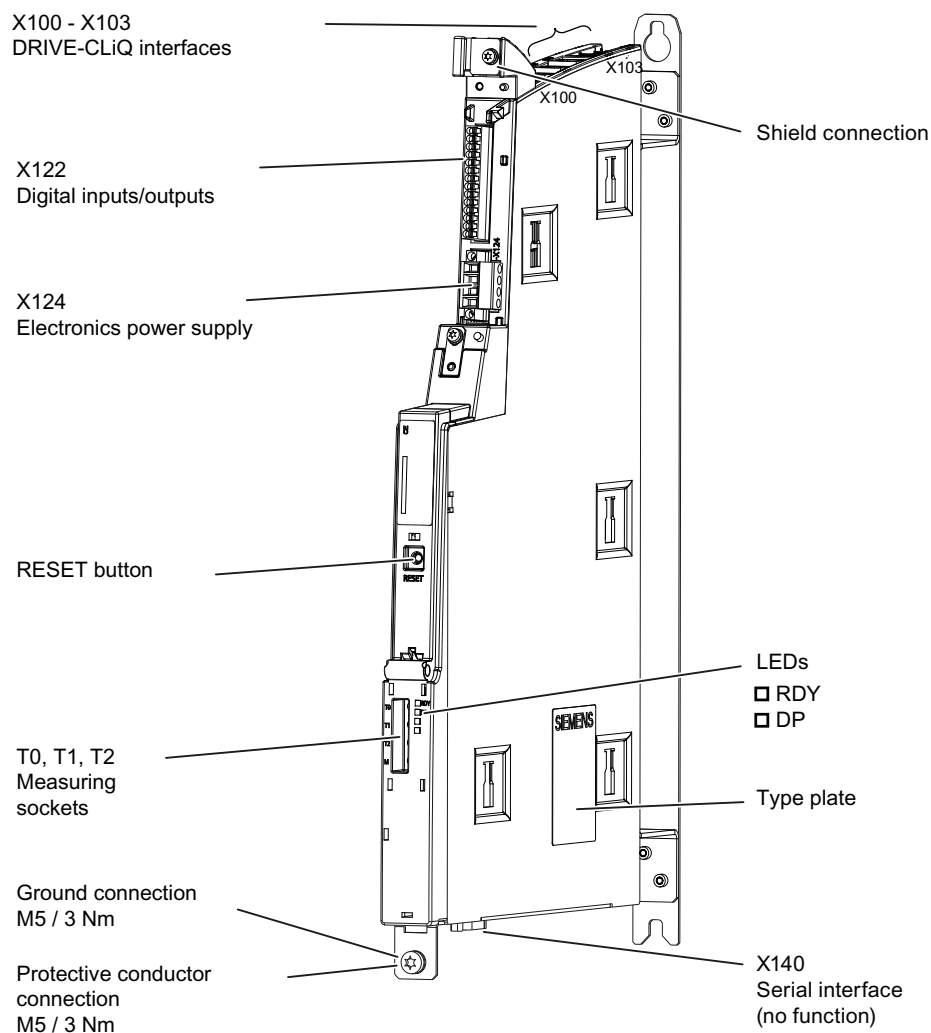


Figure 7-60 Illustration of the NX module (without cover)

LEDs for status display

The following status displays on the NX modules provide information about its state:

LEDs	Color	Status	Description
RDY	Off		Electronic power supply outside permissible tolerance range
	Green	Continuous light	The NX10.3 / NX15.3 is ready.
		Flashing 2 Hz	Writing to CompactFlash card
	Red	Continuous light	The NX10.3 / NX15.3 is presently powering up and at least one fault is active (e.g. RESET, watchdog monitoring, basic system fault).
		Flashing 0.5 Hz	Boot error (e.g. firmware cannot be loaded into the RAM)
	Yellow	Continuous light	Firmware is being loaded into the RAM.
		Flashing 0.5 Hz	Firmware cannot be loaded into the RAM.
		Flashing 2 Hz	Firmware CRC fault
DP	Off		Electronics power supply outside permissible tolerance range: The NX10.3 / NX15.3 is not ready.
	Green	Continuous light	CU_LINK is ready for communication and cyclic communication is running.
		Flashing 0.5 Hz	CU_LINK is ready for communication and cyclic communication is not running.
	Red	Continuous light	At least one CU_LINK fault is present. CU_LINK is not ready for operation (e.g. after switching on).

RESET button

The RESET button is on the front of the module under the cover.

Note

When the pushbutton is actuated, the locally connected drive systems are brought to a standstill with no feedback to the control. In other words, the drive and control run asynchronously once the drive has been successfully powered up.

7.10.2 Mounting

Designs

The NX10.3 / NX15.3 is integrated into the SINAMICS drive line-up. For the preferred installation sequence, the NX module should be mounted at the side of the Line Module.

NOTICE
Protection against overheating
The 80 mm ventilation spaces above and below the components must be observed.

Mounting aids

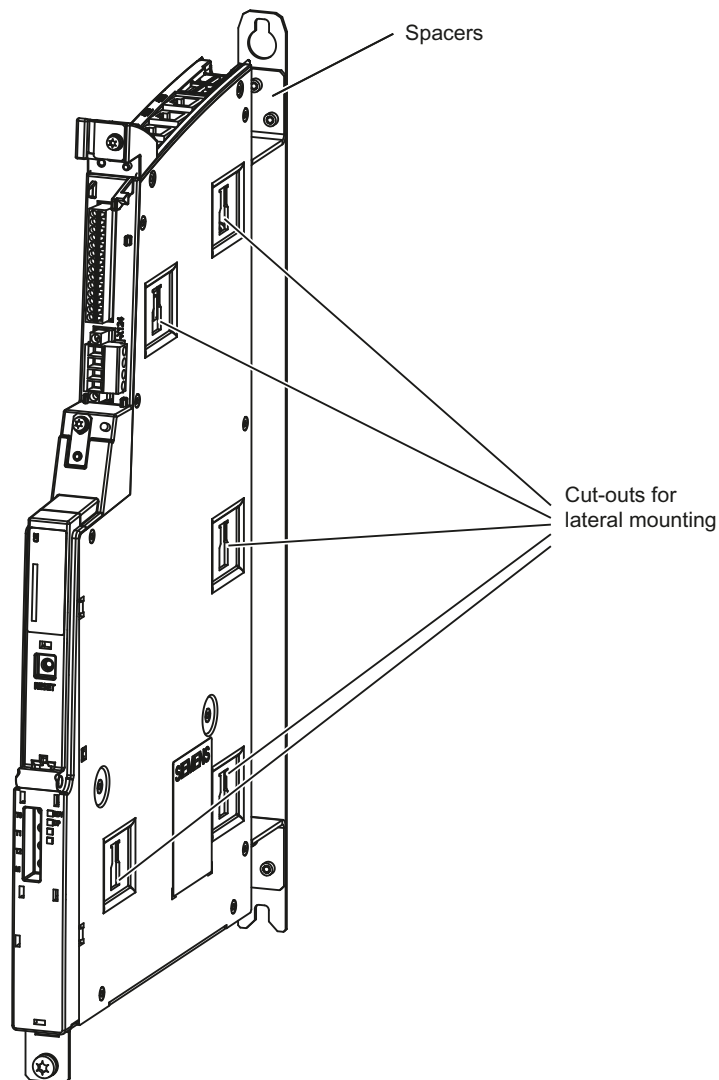


Figure 7-61 Mounting aids for the NX10.3 / NX15.3

Mounting an NX10.3 / NX15.3 onto an Active Line Module

Procedure:

1. Remove the spacers from the NX.
2. Position the NX on the left-hand side of the Line Module. The mounting fixtures fit exactly in the five cutouts on the NX.
3. Push the two units together.
4. Press down on the NX until it engages and is securely connected to the Line Module.

Dimension drawing

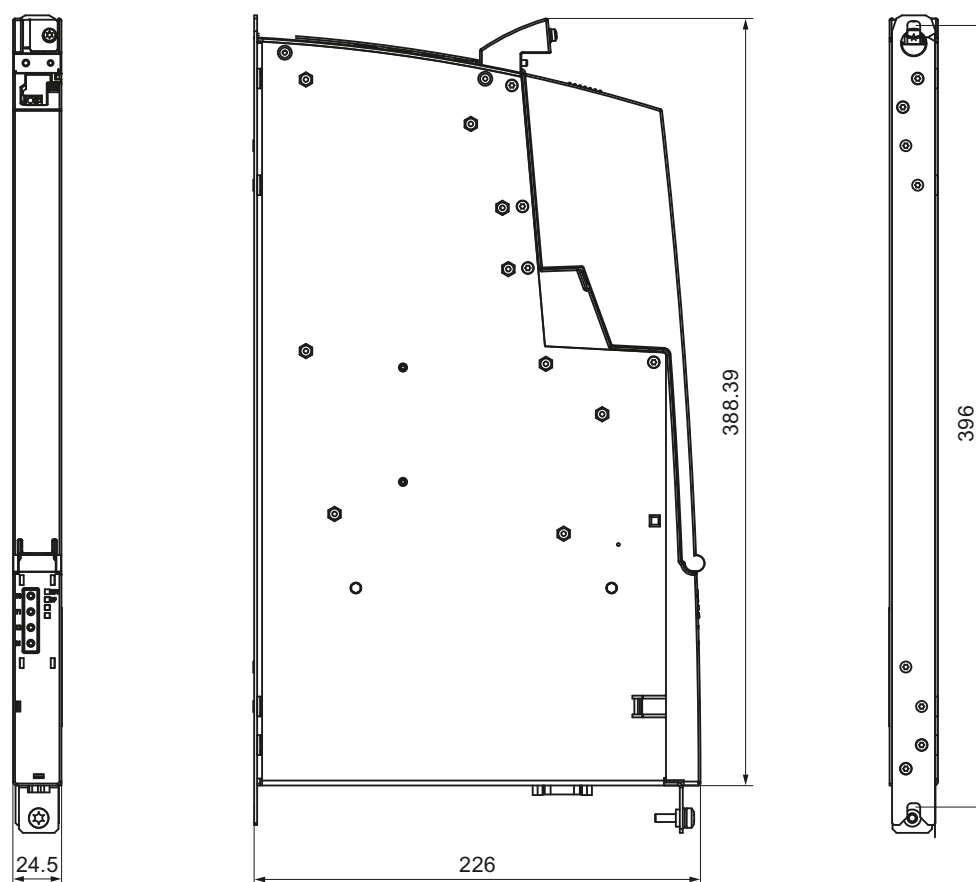


Figure 7-62 Dimensions NX10.3 / NX15.3

7.10.3 Connecting

Power supply X124

Connector designation:	X124
Connector type:	Screw terminal 2
Max. connectable cross-section:	2.5 mm ²

Table 7-115 Pin assignment for X124

Pin	Signal name	Meaning
1	+	(Voltage input) Electronics power supply
2	+	(Voltage input) Electronics power supply

Pin	Signal name		Meaning
3	M	(Voltage output)	Ground
4	M	(Voltage output)	Ground

Note

The two terminals "+" and "M" are jumpered in the connector and not in the device. This ensures that the supply voltage is looped through.

Table 7-116 Technical data for X124

Parameter	Value
Voltage	24 V DC (20.4 V - 28.8 V)
Current consumption	max. 0.8 A (without load)
Max. current via the bridges in the connector	20 A at 55 °C

Note**Current consumption**

The current consumption increases by the current consumption of DRIVE-CLiQ and the digital outputs.

X122 digital inputs/outputs

Connector designation: **X122**
 Connector type: Spring-loaded terminal 1
 Max. connectable cross-section: 0.5 mm²

Table 7-117 Pin assignment for X122

Pin	Signal name	Meaning
1	DI0	Digital input 0
2	DI1	Digital input 1
3	DI2	Digital input 2
4	DI3	Digital input 3
5	DI16	Digital input 16
6	DI17	Digital input 17
7	M1	Reference potential for terminals 1 to 6
8	M	Ground
9	DI/DO8	Digital input/output 8 (rapid input)
10	DI/DO9	Digital input/output 9 (rapid input)
11	M	Ground
12	DI/DO10	Digital input/output 10 (rapid input)

Pin	Signal name	Meaning
13	DI/DO11	Digital input/output 11 (rapid input)
14	M	Ground

An open input is interpreted as "low".

Note

Terminal M1 must be connected for the digital inputs (DI) 0 to 3 and 16/17 to function. This can be done as follows:

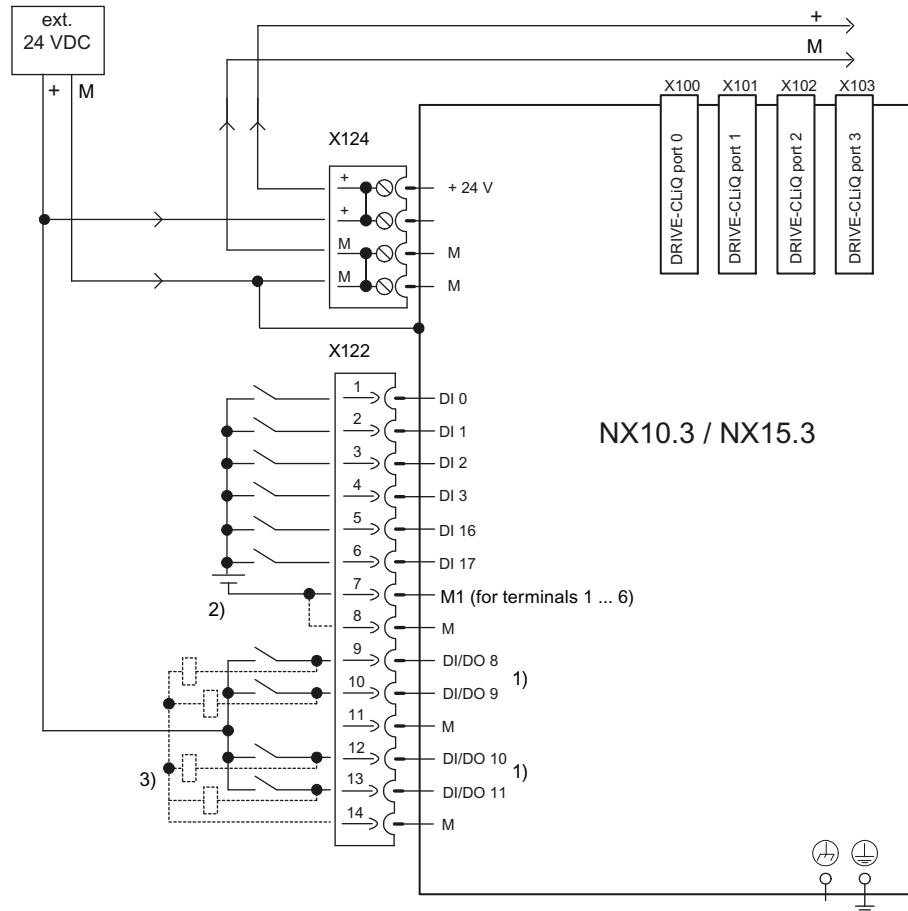
- Connect the ground reference of the digital inputs.
- Jumper to terminal M: This removes the electrical isolation for these digital inputs.

Table 7-118 Technical data for X122

Parameter	Value
Current consumption	Typical: 10 mA at 24 V DC
Galvanic isolation	The reference potential is terminal M1
As an input	
Voltage	-3 V to 30 V
Current consumption	Typical: 10 mA at 24 V DC
Signal level (including ripple)	High signal level: 15 V to 30 V Low signal level: -3 V to 5 V
Signal propagation times	Inputs / "fast inputs": L → H: approx. 50 µs/5 µs H → L: approx. 100 µs/50 µs
As an output	
Voltage	24 VDC
Max. load current	Per output: 500 mA continuous short circuit-proof

Connection example

When commissioning the system for the first time, the digital inputs/outputs are correspondingly preassigned.



- 1) Rapid inputs must be shielded.
- 2) Jumper open, electrical isolation for digital inputs (DI)
- 3) can be parameterized as either input or output

Figure 7-63 Connection example for the NX10.3 / NX15.3

See also

For the pin assignment of the DRIVE-CLiQ interfaces X100 - X103, please refer to Chapter "DRIVE-CLiQ (Page 88)".

For further information on DC voltage and standards, please see Chapter "Power supply connection (Page 73)".

7.10.4 Technical Data

Technical data of the NX10.3 / NX15.3

Parameter	Value
Input voltage	24 V DC
Permissible range	20.4 V - 28.8 V DC
Current (without DRIVE-CLiQ and digital outputs)	0.8 A
Inrush current	1.6 A
PE/ground connection	At the housing with screw M5/3 Nm
Number of axes, maximum	
• NX10.3:	3
• NX15.3:	6
Digital inputs	6
Digital inputs/outputs parameterizable	4
Cooling	Open-circuit ventilation
Pollution degree in acc. with EN 61800-5-1	2
Protection class in acc. with EN 61800-5-1	III (DVC A, PELV)
Degree of protection in acc. with EN 60529	IP20
Approvals	CE, cULus
Relative humidity:	
• Storage	5 ... 95 %
• Transport	5 ... 95 %
• Operation	5 ... 95 %
Ambient temperature:	
• Storage	-25 ... +55 °C
• Transport	-40 ... +70 °C
• Operation	0 ... +55 °C
Dimensions:	
• Width	25 mm
• Height	414 mm
• Depth	272 mm
Weight, approx.	2.58 kg

7.11 Activating and addressing components

7.11.1 Activating components

Machine data for the PLC I/O

The following components are assigned fixed addresses for the input and output image of the PLC: I/O modules, machine control panel, SENTRON PAC and PN/PN coupler.

To deactivate the update of the input and output images of the PLC, set the following machine data:

Machine data		Value range	
12986[i]	\$MN_PLC_DEACT_IMAGE_LADDR_IN	$0 \leq i \leq 15$	Input addresses
12987[i]	\$MN_PLC_DEACT_IMAGE_LADDR_OUT	$0 \leq i \leq 15$	Output addresses

The SINUMERIK 828D works with a fixed maximum configuration of the I/O modules. As delivered, the data transfer to the input and output image of the PLC is deactivated for all I/O modules.

To activate a PN component, you must enter the value -1 ("empty") in MD12986[i], see the table in Section Addressing components (Page 259). MD12987[i] is preset with the value -1 and must not be changed.

Machine control panel

To activate the machine control panel, check the setting of the following machine data:

Machine data		MCP type PN		MCP type USB
		Addressing via image	Addressing via DB1000	Addressing via DB1000
MD12950 \$MN_PLC_MCP_CONNECT	[0]	0	0	1
	[1]	-1	-1	-1
MD12951 \$MN_PLC_MCP_CONNECT	[0]	112	112	112
	[1]	0	0	0
MD12952 \$MN_PLC_MCP_CONNECT	[0]	112	112	112
	[1]	0	0	0
MD12986 \$MN_PLC_DEACT_IMAGE_LADDR_IN	[6]	-1	-1	112
MD19720 \$MN_PLC_FUNCTION_MASK	Bit 0	0	1	0

Example

In this example, two I/O modules and a machine control panel of the PN type are activated:

MD	Logical input address	Data transfer to the PLC deactivated
12986[0]	-1	1st PP module active
12986[1]	-1	2nd PP module active

MD	Logical input address	Data transfer to the PLC deactivated
12986[2]	18	3rd PP module inactive
12986[3]	27	4th PP module inactive
12986[4]	36	5th PP module inactive
12986[5]	96	PN/PN coupler inactive
12986[6]	-1	Machine control panel of the PN type active
12986[8]	132	SETRON PAC4200
12986[9]	144	SETRON PAC3200

Note**Monitoring the I/O**

The use of an input/output address of a deactivated module in the PLC user program does not trigger an alarm. The PLC user program always works with the image memory. Whether there is a connection to the physical inputs/outputs is configured via MD12986[i] and MD12987[i]. Active modules are then monitored cyclically for failure.

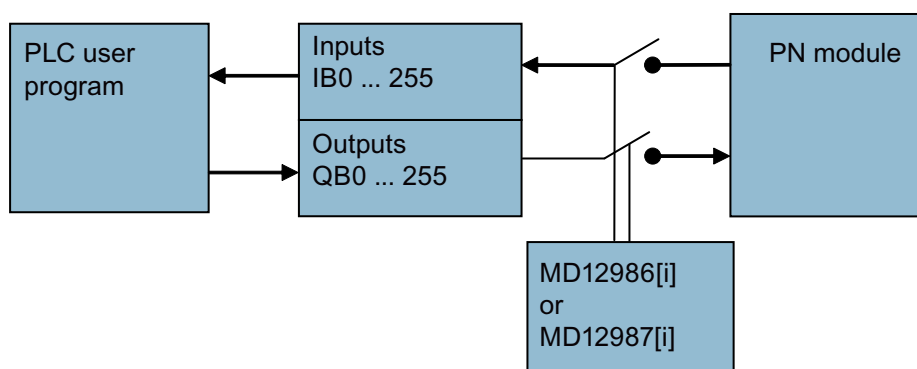


Figure 7-64 I/O switch

7.11.2 Addressing components

IP addresses of the PN components

The following table contains the IP address of the respective PN component. It is set on the PN component with a DIP switch. In this case, the maximum configuration with I/O modules, bus coupler and machine control panel via the PLC I/O Interface based on PROFINET is taken into consideration.

PN component	Bus	Device name	IP address	Input addresses	Output addresses
			192.168.214.	(active with MD12986[x] = -1)	
				Index n:	
1st PP module digital	PN	pp72x48pn9	9	0 ... 8	0 ... 5
2nd PP module digital	PN	pp72x48pn8	8	9 ... 17	6 ... 11

PN component	Bus	Device name	IP address	Input addresses	Output addresses
3rd PP module digital	PN	pp72x48pn7	7	18 ... 26	12 ... 17
4th PP module digital	PN	pp72x48pn6	6	27 ... 35	18 ... 23
5th PP module digital	PN	pp72x48pn5	5	36 ... 44	24 ... 29
Unassigned				45	30 ... 55
				Index d:	
1st PP module diagnostics	PN	pp72x48pn9	9	46 ... 47	--
2nd PP module diagnostics	PN	pp72x48pn8	8	48 ... 49	--
3rd PP module diagnostics	PN	pp72x48pn7	7	50 ... 51	--
4th PP module diagnostics	PN	pp72x48pn6	6	52 ... 53	--
5th PP module diagnostics	PN	pp72x48pn5	5	54 ... 55	--
				Index m:	
1st PP module analog	PN	pp72x48pn9	9	56 ... 63	56 ... 63
2nd PP module analog	PN	pp72x48pn8	8	64 ... 71	64 ... 71
3rd PP module analog	PN	pp72x48pn7	7	72 ... 79	72 ... 79
4th PP module analog	PN	pp72x48pn6	6	80 ... 87	80 ... 87
5th PP module analog	PN	pp72x48pn5	5	88 ... 95	88 ... 95
PN/PN coupler *	PN	pn-pn-coupler20	20	96 ... 111	96 ... 111
External machine control panel	PN	mcp-pn64	64	112 ... 125	112 ... 121
Reserved		--	--	126 ... 131	122 ... 123
SETRON PAC4200 *	PN	pac4200-pn21	21	132 ... 143	132 ... 143
SETRON PAC3200 *	PN	pac3200-pn22	22	144 ... 155	144 ... 155

The Index n, m, d is always the start address of the address range.

*) The IP address of these components is not set using a switch but rather configured appropriately.

Technical data

PPU

Parameter	Value	
Input voltage	24 V DC + 20% / - 15%	
Power consumption, max.	60 W	
Power loss	28 W	
Cooling	Open-circuit ventilation	
Degree of protection acc. to EN 60529	IP65 (with closed front cover) IP20 (rear)	
Protection class acc. to EN 61800-5-1	III (DVC A, PELV)	
Pollution degree acc. to EN 61800-5-1	2	
Climate classification:		
• Storage (in transport packaging)	1M2 acc. to EN 60721-3-1	
• Transport (in transport packaging)	2M3 acc. to EN 60721-3-2	
• Operation	3M1 acc. to EN 60721-3-3	
Mounting position	Vertical	
Dimensions:	PPU vertical:	PPU horizontal:
• Width	• 310 mm	• 483 mm
• Height	• 380 mm	• 220 mm
• Depth	• 105 mm	• 105 mm
Weight, approx.	4.5 kg	
Approvals	CE, cULus	
Basic color of the front	614 Anthracite (similar to RAL 7021)	

See also

Further technical data for the PPU can be found in the following sections:

- Transport and Storage Conditions (Page 41)
- Operating Conditions (Page 42)
- Requirements for the power supply (Page 73)

Digital inputs/outputs:

- Technical data (Page 86)

Spare parts and accessories

9.1 Ordering data

Ordering data of the components

SINUMERIK 828D is generally marketed in sales packages with drives, motors and accessories. For orders, please contact your local Siemens sales representative.

Designation	Article number
Panel Processing Unit without system software	
• PPU 241.3 BASIC horizontal	6FC5370-3AA30-0AA0
• PPU 240.3 BASIC vertical	6FC5370-4AA30-0AA0
• PPU 261.3 horizontal	6FC5370-5AA30-0AA0
• PPU 260.3 vertical	6FC5370-6AA30-0AA0
• PPU 281.3 horizontal	6FC5370-7AA30-0AA0
• PPU 280.3 vertical	6FC5370-8AA30-0AA0
CompactFlash card with system software and license	
• For PPU 241.3 / PPU 240.3: Turning	6FC5835-1GY40- □ YA0
• For PPU 241.3 / PPU 240.3: Milling	6FC5835-2GY40- □ YA0
• For PPU 241.3 / PPU 240.3: Grinding	6FC5835-3GY40- □ YA0
• For PPU 261.3 / PPU 260.3: Turning	6FC5834-1GY40- □ YA0
• For PPU 261.3 / PPU 260.3: Milling	6FC5834-2GY40- □ YA0
• For PPU 261.3 / PPU 260.3: Grinding	6FC5834-3GY40- □ YA0
• For PPU 281.3 / PPU 280.3: Turning	6FC5833-1GY40- □ YA0
• For PPU 281.3 / PPU 280.3: Milling	6FC5833-2GY40- □ YA0
• For PPU 281.3 / PPU 280.3: Turning, Advanced Software	6FC5836-1GY40- □ YA0
• For PPU 281.3 / PPU 280.3: Milling, Advanced Software	6FC5836-2GY40- □ YA0
• For PPU 281.3 / PPU 280.3: Grinding, Advanced Software	6FC5836-3GY40- □ YA0

Designation	Article number
Machine control panels:	
• MCP 483 USB	6FC5303-0AF32-0AA0
• MCP 310 USB	6FC5303-0AF33-0AA0
• MCP 483C PN	6FC5303-0AF22-0AA1
• MCP 310C PN	6FC5303-0AF23-0AA1
Interface module MCP Interface PN	6FC5303-0AF03-0AA0
Handheld electronic handwheel	6FC9320-5DE02
Mini handheld unit:	

9.1 Ordering data

Designation	Article number
• With spiral connection cable	6FX2007-1AD03
• With straight cable	6FX2007-1AD13
I/O modules:	
• PP 72/48D PN (digital)	6FC5311-0AA00-0AA0
• PP 72/48D 2/2A PN (analog)	6FC5311-0AA00-1AA0
Increased number of axes:	
• Numeric Control Extension NX10.3	6SL3040-1NC00-0AA0
• Numeric Control Extension NX15.3	6SL3040-1NB00-0AA0

Accessories

Designation	Article number
CompactFlash card (empty), 2 GB	6FC5313-5AG00-0AA2
CompactFlash card (empty as user memory), 8 GB	6FC5313-6AG00-0AA0
Front flap with fastening	6FC5348-2AA00-0AA0
Set of clamps (9x)	6FC5248-0AF14-0AA0
USB flash drive, 8 GB	6ES7648-0DC50-0AA0
SETRON PAC3200 Power Monitoring Device	7KM2112-0BA00-3AA0
SETRON PAC4200 Power Monitoring Device	7KM4212-0BA00-3AA0
PROFINET Switched Ethernet expansion module	7KM9300-0AE00-0AA0
MODEM MD720 GSM/GPRS modem	6NH9720-3AA01-0XX0
ANT794-4MR antenna	6NH9860-1AA00
RS232 modem cable	6NH7701-5AN
SIMATIC DP PN/PN coupler	6ES7158-3AD01-0XA0
Terminal strip converter, 50-pin	6EP5406-5AA00
Cable set comprising:	6EP5306-5BG00
• 6 m ribbon cable, 50-pin	
• 8 insulation displacement connectors, 50-pin	
IP20 PLC I/O interface connecting cable (corresponds to DRIVE-CLiQ signal cable)	6FX2002-1DC00-...
Blanking plates for the DRIVE-CLiQ interface	6SL3066-4CA00-0AA0
Stabilized power supply SITOP lite 10 A 24 V DC, 1-phase	6EP1334-1LB00
Stabilized power supply SITOP smart 10 A 24 V DC, 1-phase	6EP1334-2BA01
Stabilized power supply PSU100S 20 A 24 V DC, 1-phase	6EP1336-2BA10
Stabilized power supply PSU300S 10 A 24 V DC, 3-phase	6EP1434-2BA10
Stabilized power supply PSU300S 20 A 24 V DC, 3-phase	6EP1436-2BA10

9.2 MODEM MD720

Description

The SINUMERIK 828D can be optionally equipped with the MD720 GPRS/GSM modem. This optional hardware module makes it possible to exchange SMS messages with a cell phone on the basis of the GSM standard.

In addition to error messages, it is also possible to transmit operating states such as the machining status, tool wear limits or measuring process results. Using operating screens, it is very easy to assign specific information to specific cell phones.

Please ensure that the antenna required for data transmission (supplied by the manufacturer) is suitably located on the machine to achieve the best transmission/receiving conditions. Connection to the SINUMERIK 828D uses an RS232 modem cable. Please note that optimum transmission quality can only be guaranteed if the cable is no more than 3 m long.

A SIM card is not included in the modem scope of delivery. The users have to choose their own cell phone contract.

Note

Operating mode

The MODEM MD720 can either be operated in the terminal mode or the OPC mode. The terminal mode is always used for the SINUMERIK 828D.

Mounting

The MODEM MD720 is intended for mounting on DIN rails according to DIN EN 60715. There is a suitable fastener on the rear of the device.

Interfaces

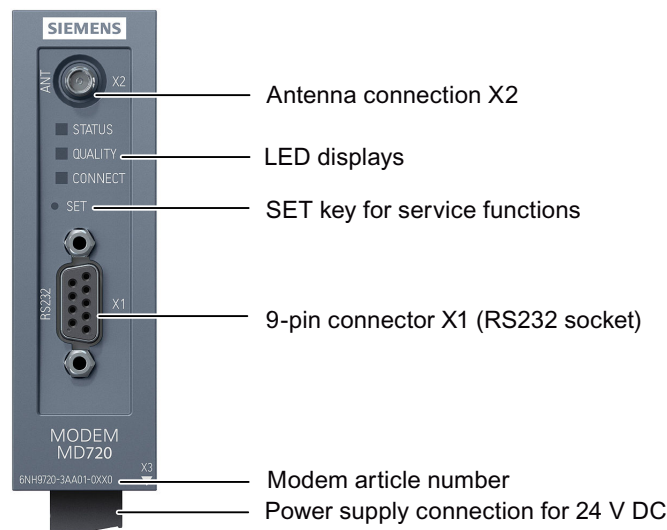


Figure 9-1 InterfacesMODEM MD720

The following diagram shows the standard way in which the modem is connected to a PPU.

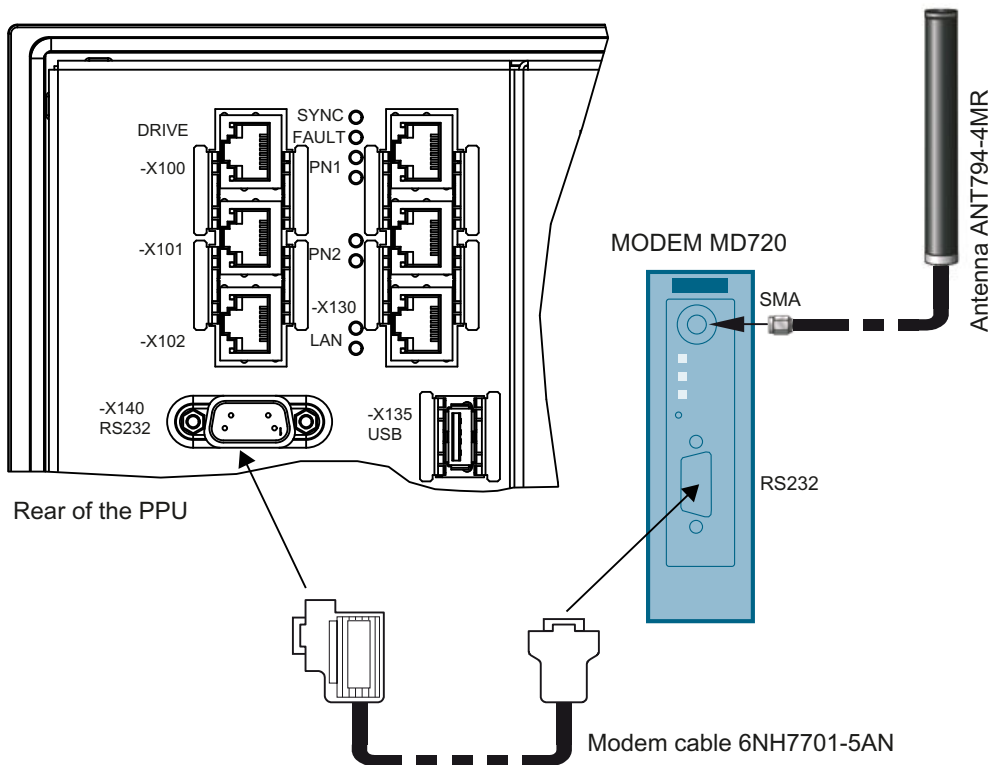


Figure 9-2 Connection of MODEM MD720 to the PPU

Further information

You can find further information on the MODEM MD720 on the Internet at:

- MODEM MD720 (<https://support.industry.siemens.com/cs/mdm/102401328?c=70936043019&pnid=15923&lc=en-WW>)
- Antenna ANT794-4MR (<http://support.automation.siemens.com/WW/view/en/22726648>)

9.3 PN/PN coupler

9.3.1 Principle of operation

Application

The PN/PN coupler is used to link two Ethernet subnets with one another and to exchange data. The maximum size of the data that can be transferred is 16-byte input data and 16-byte output data.

As a device, the PN/PN coupler has two PROFINET interfaces, each of which is linked to a subnet. During configuring, two I/O devices are made from this one PN/PN coupler; this means that there is one I/O device for each station with its own subnet. The other part of PN/PN coupler is called the coupling partner. Once configuring has been completed, the two parts are merged.

Example

The following example shows that the two networks are independent of one another. This means that for each PROFINET IO network you assign dedicated device names.

In the following diagram, these are the device names "Subnet1" in network 1 and "Subnet2" in network 2.

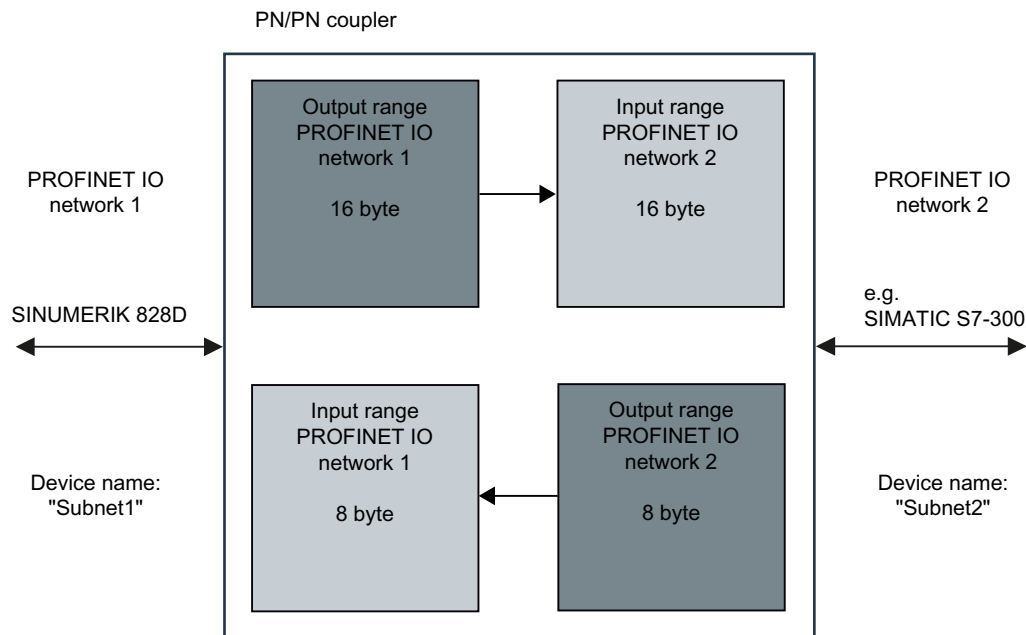


Figure 9-3 Principal mode of operation of the PN/PN coupler (example)

References

SIMATIC bus couplings PN/PN coupler Hardware Installation and Operating Manual

9.3.2 Configuration

Requirements

Please observe the following preconditions when configuring:

- For SINUMERIK 828D, the "PN-PN-Coupler20" name is already permanently defined; as a consequence, the name must be exactly the same in the connected subnet.
- The PN/PN coupler has the IP address 192.168.214.20 (permanently set).
- The I/O address area is 16 bytes from 96 ...111 (index m).
- SINUMERIK 828D must be connected to the PROFINET interface X1.

Note

Tools for configuring and analyzing PROFINET components

To configure and analyze PROFINET components, Siemens Automation and Drives Service & Support provides the following tools at no cost:

- Primary Setup Tool (PST)
Using the Primary Setup Tool (PST), you can configure PROFINET components, e.g. you can allocate the PN/PN coupler a device name.
You can find this tool in the Internet at the following address: (<http://support.automation.siemens.com/WW/view/en/19440762>)
 - PRONETA
PRONETA (PROFINET network analysis) is a PC tool to analyze PROFINET networks.
You can find this tool in the Internet under the following address: (<http://support.automation.siemens.com/WW/view/en/67460624>)
-

Configuration

The device name must be defined in the following cases:

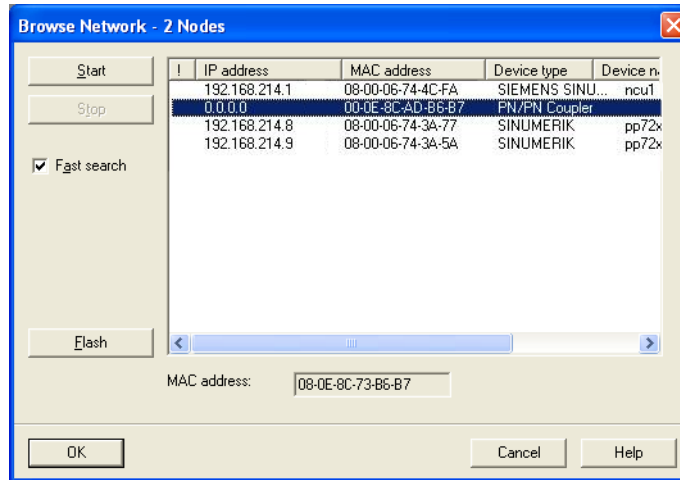
- When commissioning for the first time
- When a device is replaced

The PC must be connected using a crossover cable with, e.g. X2 at the PN/PN coupler.

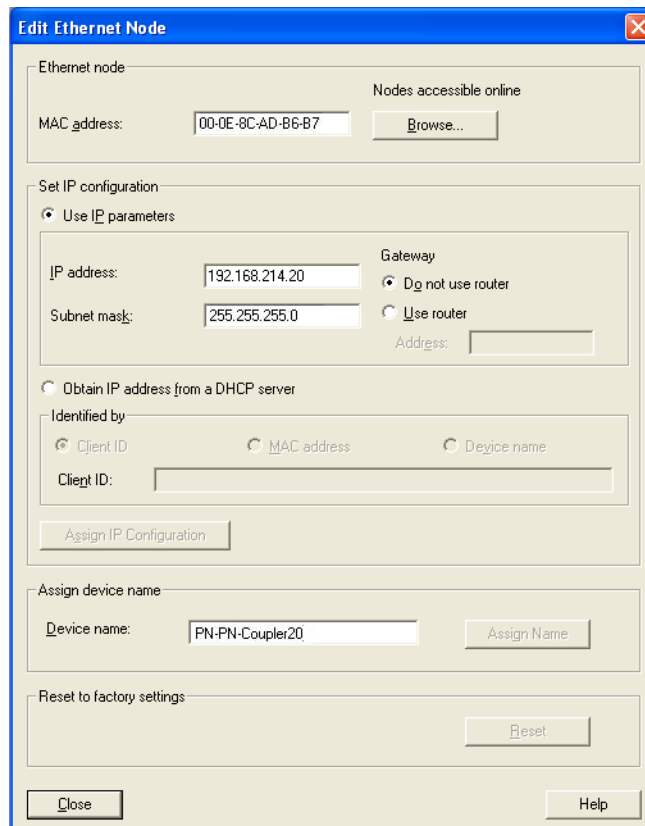
Procedure with STEP 7:

1. Under "Tools" select → "Set PG/PC interface" → "TCP/IP" → "Intel(R) PRO/100 VM".
2. Under "Target system" select → "Edit Ethernet nodes ...".
3. In the dialog window "Edit Ethernet Nodes", press the "Search..." button under "Nodes that can be accessed online".

4. In the dialog window "Search Network" select the coupler and press "OK".



5. Enter the IP address in the "Edit Ethernet Node" dialog.
6. Enter "PN-PN Coupler20" as a device name: This designation is mandatory so that the device will be detected.



See also

Addressing components (Page 259)

9.4 SENTRON PAC3200/PAC4200

Description



Figure 9-4 SENTRON PAC3200

The SENTRON PAC measuring devices ensure precise, reproducible and reliable measurement of energy values for infeed, outgoing feeders or individual loads. They not only supply comprehensive information about your electrical installation and power distribution system, but also provide important measured values to help you assess the status of your system and the power quality. For further processing of the measurement data, the devices are equipped with a wide range of communication options for easy integration into higher-level automation and power management systems. They can be used for both single-phase and multi-phase measurements in 3- and 4-conductor power supply systems (TN, TT, IT).

For communication between the PPU and the SENTRON PAC you require the switched Ethernet PROFINET module, article number: 7KM9300-0AE00-0AA0.

Technical data

Parameter	SENTRON PAC3200	SENTRON PAC4200
Article number	7KM2112-0BA00-3AA0	7KM4212-0BA00-3AA0
Suitable for TN, TT and IT systems	✓	✓
Continuous signal acquisition	✓	✓
Measuring inputs for voltage 3 AC; UL-L/UL-N; CAT III	Max. 690 V / 400 V	
• Wide-range power supply	95 to 240 V AC 50/60 Hz $\pm 10\%$ 110 to 340 V DC $\pm 10\%$	
Measuring inputs for voltage 3 AC; UL-L/UL-N; CAT III	Max. 500 V / 289 V	
• Low-voltage power supply	22 to 65 V DC; $\pm 10\%$	
Measurement at voltage transformers for voltages > 500 V / 690 V	✓	✓

Parameter	SENTRON PAC3200	SENTRON PAC4200
Measuring inputs for current 3 AC; CAT III	x/1 A or x/5 A	
Current direction, programmable	✓	✓ per phase
Measurement using current transformers	✓	✓
Dimensions (W x H x D)	96 x 96 x 56 mm	96 x 96 x 82 mm
Overall depth		
• Without module	51 mm	77 mm
• With module	73 mm	99 mm
Protection class	II	
Degree of protection at front	IP65	
Slots for expansion modules	1	2
Operating temperature	-10 to +55° C	
Relative humidity in operation no condensation	95%	
Degree of contamination	2	
Approvals	CE, cULus, C-Tick, GOST	CE, cULus, GOST

Further information

You can find additional information about SENTRON PAC in the context of SINUMERIK in the Ctrl-Energy System Manual as well as in the Internet at:

- SENTRON PAC3200 (<http://support.automation.siemens.com/WW/view/de/25240652>)
- SENTRON PAC4200 (<http://support.automation.siemens.com/WW/view/de/31675630>)

9.5 SITOP power supply

Description



Figure 9-5 SITOP PSU100S

The 24 V power supply units from the SITOP range are optimized for industrial use and operate on the switched-mode principle. Due to the precisely regulated output voltage, the devices are even suitable for the connection of sensitive sensors. Different versions are available depending on the output current and field of application. Some versions are listed in the table below.

SITOP lite/smart does not require much space on the standard mounting rail. With its tolerant overload response, even loads with a high inrush current can be smoothly switched on. If required, 50% extra power is made available for 5 seconds.

Selection and ordering data

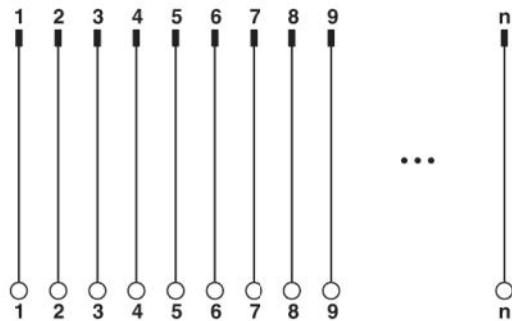
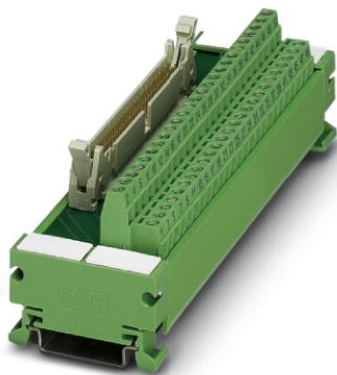
Description	Article number
Stabilized power supply SITOP lite 10 A 24 VDC, 1-phase	6EP1334-1LB00
Stabilized power supply SITOP smart 10 A 24 VDC, 1-phase	6EP1334-2BA01
Stabilized power supply PSU100S 20 A 24 VDC, 1-phase	6EP1336-2BA10
Stabilized power supply PSU300S 10 A 24 VDC, 3-phase	6EP1434-2BA10
Stabilized power supply PSU300S 20 A 24 VDC, 3-phase	6EP1436-2BA10

Further information

You can find additional information on the Internet at SITOP power supply (<http://support.automation.siemens.com/WW/view/de/10807212>)

9.6 Terminal strip converter

Terminal strip converter



Article number: 6EP5406-5AA00

1: 1 interconnection

Technical data

Parameter	Values
Rated voltage V_N	24 V AC 60 V DC
Max. current carrying capacity per branch	1 A
Number of poles	50
Pollution degree in acc. with EN 61800-5-1	2
Protection class in acc. with EN 61800-5-1	II
Applicable standards	IEC 60664 DIN VDE 0110
Ambient temperature:	
• Operation	-20 ... 55°C
• Storage/transport	-40 ... 70°C
Mounting position	Any
Dimensions:	
• Width	151 mm
• Height	50 mm
• Depth	40 mm
Weight, approx.	0.15 kg

Appendix

A.1 Abbreviations

ALM	Active Line Module
ASIC	Application Specific Integrated Circuit
AWG	American Wire Gauge
BERO	Proximity limit switch
CAT5	Quality class (category) for shielded twisted pair network cables. Class 5 states that these cables have a particularly low damping factor, making them suitable for 100 Mbit/s-FastEthernet networks.
CE	The CE marking (Conformité Européenne, which means "compliance with EU directives") for products is a marking according to EU law in relation to product safety.
CNC	Computerized Numerical Control Computerized numerical control
CRC	Cyclic redundancy check: Checksummenprüfung
cULus	Approval (see CE) for Canada and USA (UL = Underwriters Laboratories)
DIN	Deutsche Industrie Norm (German Industry Standard)
DIP	Dual In-Line Package: Dual in-line arrangement
DMC	DRIVE-CLiQ Hub Module
DP	Distributed I/O
DRAM	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electro-Static Discharge: elektrostatische Entladung
GSM	Global System for Mobile Communications: Worldwide standard for wireless transmission of voice, data, fax and text messages (SMS).
LEDs	Light-emitting diode light-emitting-diode display
MAC	Media Access Control
MCP	Machine control panel: Machine control panel
MLFB	Machine-Readable Product Code
MPI	Multi-Point Interface Multi-point interface
N.C.	Not connected: Connection unassigned
NCK	Numerical Control Kernel: NC kernel with block preparation, traversing range, etc.
NX	Numerical eXtension (axis extension module)
OLP	Optical Link Plug: Fiber-optic bus connector
OP	Operator Panel : Operator panel front
PCU	PC Unit: Computer unit
PG	Programming device
PLC	Programmable Logic Control: Programmable logic control (component of the CNC controller)
PN	PROFINET
QWERTY	keyboard assignment: American keyboard layout, the first six letters in the top row of letters, read from left to right.

RAM	Random Access Memory: Program memory which can be read and written into
SI	Safety Integrated
SLM	Smart Line Module
SMC	Cabinet-mounted sensor modules
SME	Sensor Module External
S/R	Steps per revolution: Pulses per revolution
SRAM	Static Random Access Memory: Static memory (battery-backed)
NV SRAM	Non-Volatile Static Random Access Memory: Non-volatile memory
USB	Universal Serial Bus: Bus system for connecting additional devices to a computer
VDE	Association of Electrical Engineering, Electronics and Information Technology (Germany)

A.2 Documentation overview SINUMERIK 828D

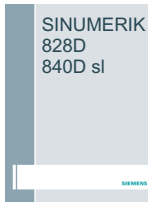
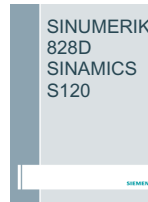
General Documentation



Catalog NC 82

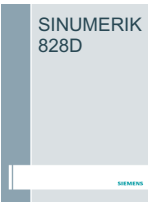
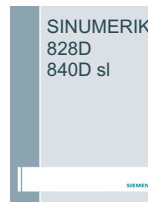
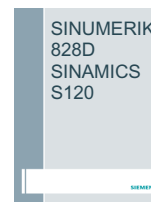
Sales Brochure
SINUMERIK 828DSales Brochure
SINUMERIK 828D BASIC T
SINUMERIK 828D BASIC MSales Brochure
SINUMERIK 828D

User documentation

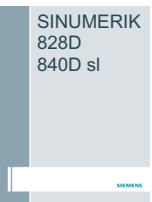
Operating Manual
Technology-specificProgramming Manual
- Fundamentals
- Job planning
- Measuring cycles
- ISO Rotate
- ISO Milling

Diagnostics Manual

Manufacturer/service documentation

Manual
Commissioning Manual
Service ManualFunction Manual
- Safety IntegratedFunction Manual
- Basic functions
- Expansion functions
- Special functions
- Synchronized actions
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Manufacturer/service documentation

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- EMC Installation Guideline

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