SIEMENS

SINUMERIK

SINUMERIK 828D
PPU and components

Equipment Manual

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Appendix A

Valid for:
SINUMERIK 828D PPU 27x.4
SINUMERIK 828D PPU 290.4

06/2024
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Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

⚠ WARNING

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

Trademarks

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

Disclaimer of Liability

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

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Introduction

1

1.1 About SINUMERIK

From simple, standardized CNC machines to premium modular machine designs – the SINUMERIK CNCs offer the right solution for all machine concepts. Whether for individual parts or mass production, simple or complex workpieces – SINUMERIK is the highly dynamic automation solution, integrated for all areas of production. From prototype construction and tool design to mold making, all the way to large-scale series production.

Visit our website for more information SINUMERIK (https://www.siemens.com/sinumerik).

1.2 About this documentation

SINUMERIK documentation

The SINUMERIK documentation is organized into the following categories:

- General documentation/catalogs
- User documentation
- Manufacturer/service documentation.

Target group

This publication is intended for Project engineers, technologists (of machine manufacturers), commissioning engineers (of systems or machines), programmers.

Benefits

The Function Manual describes the functions so that the target group knows the functions and can select them. It enables the target group to put the functions into operation.

Standard scope

This documentation only describes the functionality of the standard version. This may differ from the scope of the functionality of the system that is actually supplied. Please refer to the ordering documentation only for the functionality of the supplied drive system.

It may be possible to execute other functions in the system which are not described in this documentation. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

For reasons of clarity, this documentation cannot include all of the detailed information on all product types. Further, this documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

The machine manufacturer must document any additions or modifications they make to the product themselves.

Websites of third-party companies

This document may contain hyperlinks to third-party websites. Siemens is not responsible for and shall not be liable for these websites and their content. Siemens has no control over the information which appears on these websites and is not responsible for the content and information provided there. The user bears the risk for their use.

1.3 Documentation on the internet

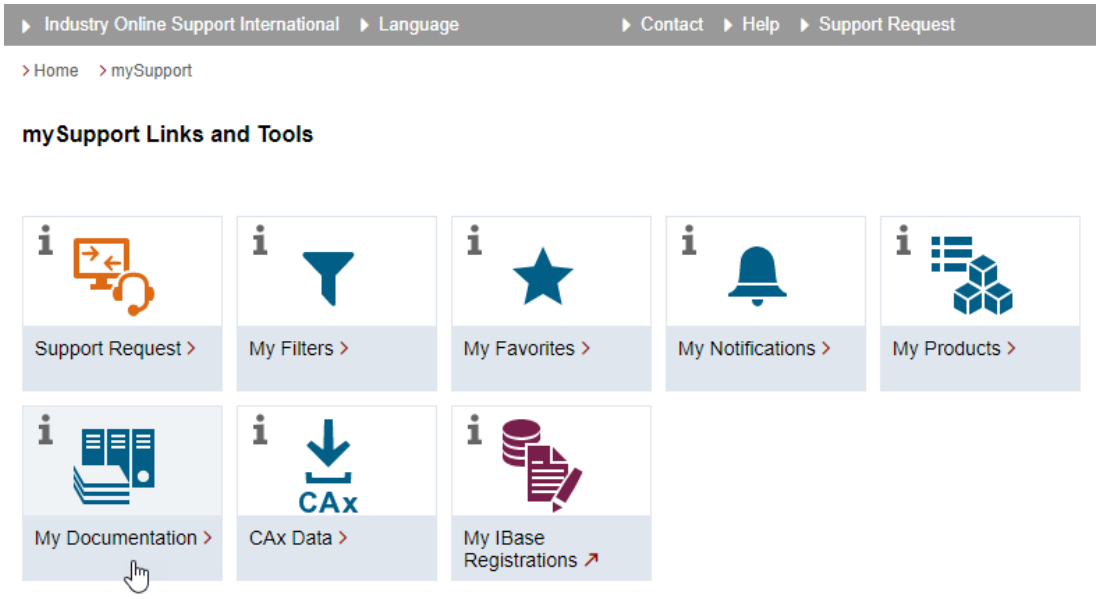
1.4 Feedback on the technical documentation

If you have any questions, suggestions or corrections regarding the technical documentation which is published in the Siemens Industry Online Support, use the link "Provide feedback" which appears at the end of the entry.

1.5 mySupport documentation

With the "mySupport documentation" web-based system you can compile your own individual documentation based on Siemens content, and adapt it for your own machine documentation.

To start the application, click on the "My Documentation" tile on the mySupport homepage (https://support.industry.siemens.com/cs/ww/en/my):



The configured manual can be exported in RTF, PDF or XML format.

Note

Siemens content that supports the mySupport documentation application can be identified by the presence of the "Configure" link.

1.6 Service and Support

Product support

You can find more information about products on the internet:

Product support (https://support.industry.siemens.com/cs/ww/en/)

The following is provided at this address:

- Up-to-date product information (product announcements)
- FAQs
- Manuals
- Downloads
- Newsletters with the latest information about your products
- Global forum for information and best practice sharing between users and specialists
- Local contact persons via our Contacts at Siemens database (→ "Contact")
- Information about field services, repairs, spare parts, and much more (→ "Field Service")

Technical support

Country-specific telephone numbers for technical support are provided on the internet at address (https://support.industry.siemens.com/cs/ww/en/sc/4868) in the "Contact" area.

If you have any technical questions, please use the online form in the "Support Request" area.

Training

You can find information on SITRAIN at the following address (https://www.siemens.com/sitrain).
SITRAIN offers training courses for automation and drives products, systems and solutions from Siemens.

Siemens support on the go





With the award-winning "Siemens Industry Online Support" app, you can access more than 300,000 documents for Siemens Industry products – any time and from anywhere. The app can support you in areas including:

- Resolving problems when implementing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Furthermore, you have access to the Technical Forum and other articles from our experts:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

The "Siemens Industry Online Support" app is available for Apple iOS and Android.

Data matrix code on the nameplate

The data matrix code on the nameplate contains the specific device data. This code can be read with a smartphone and technical information about the device displayed via the "Industry Online Support" mobile app.

1.7 Important product information

Using OpenSSL

This product can contain the following software:

- Software developed by the OpenSSL project for use in the OpenSSL toolkit
- Cryptographic software created by Eric Young.
- Software developed by Eric Young

You can find more information on the internet:

- OpenSSL (https://www.openssl.org)
- Cryptsoft (https://www.cryptsoft.com)

Compliance with the General Data Protection Regulation

Siemens observes standard data protection principles, in particular the data minimization rules (privacy by design).

For this product, this means:

The product does not process or store any personal data, only technical function data (e.g. time stamps). If the user links this data with other data (e.g. shift plans) or if he/she stores person-related data on the same data medium (e.g. hard disk), thus personalizing this data, he/she must ensure compliance with the applicable data protection stipulations.

Fundamental safety instructions 2

2.1 General safety instructions



⚠ WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

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

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

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



⚠ WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage. Contact with hazardous voltage can result in severe injury or death.

- 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

Electric shock due to equipment damage

Improper handling may cause damage to equipment. 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

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

Electric shock if there is no ground connection

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.

NOTICE

Damage to equipment due to unsuitable tightening tools.

Unsuitable tightening tools or fastening methods can damage the screws of the equipment.

- Only use screw inserts that exactly match the screw head.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.
- Adjust the tools used regularly.

⚠ CAUTION

Symptomatic respiratory and skin reaction to chemicals

A newly purchased product might contain traces of substances that are identified as sensitizers.

Sensitizers are substances which can cause sensitization in the lungs and skin after exposure to them.

Once sensitized, individuals can have severe reactions to further exposure, even in small amounts. In the most extreme cases, individuals might develop asthma or dermatitis respectively.

- If the product has a strong smell, keep it in a well-ventilated area for 14 days.

⚠ WARNING

Unexpected machine movement caused by radio devices or cellphones

Using radio devices, cellphones, or mobile WLAN devices in the immediate vicinity of the components can result in equipment malfunction or faults and damage to the devices. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- Avoid operating radio devices, cellphones and mobile WLAN devices in the direct vicinity of converters and operating units.
- Scan the machine readable code, e.g. a QR code, from a greater distance or switch off the converter power supply before scanning.
- Only operate built-in devices with the control cabinet doors closed.
- When control cabinet doors are open, only qualified electrical personnel are allowed to carry out service and maintenance work.

⚠ WARNING

Fire due to inadequate 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.

NOTICE

Overheating due to inadmissible mounting position

The device may overheat and therefore be damaged if mounted in an inadmissible position.

- Only operate the device in admissible mounting positions.

WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in 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 instructions for Safety Integrated

If you want to use Safety Integrated functions, you must observe the Safety instructions in the Safety Integrated documentation.

2.2 Equipment damage due to electric fields or electrostatic discharge

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



NOTICE

Equipment damage due to 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 of 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).

2.3 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment, or any eventuality which may arise. Application examples do not represent customer-specific solutions, but merely serve to provide assistance with typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

2.4 Cybersecurity information

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

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

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

For additional information on industrial cybersecurity measures that may be implemented, please visit
https://www.siemens.com/cybersecurity-industry.

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

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under
https://new.siemens.com/cert.

Further information is provided on the Internet:

Industrial Security Configuration Manual (https://support.industry.siemens.com/cs/ww/en/view/108862708)

⚠ WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a state-of-the-art, integrated industrial cybersecurity concept for the installation or machine.
- Make sure that you include all installed products in the integrated industrial cybersecurity concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- Carefully check all cybersecurity-related settings once commissioning has been completed.

2.5 Residual risks of power drive systems

When assessing the machine or system-related risk in accordance with the respective local regulations (e.g. EC Machinery Directive), the machine manufacturer or system integrator 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 or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware faults and/or software errors in the sensors, control system, actuators, 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 electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures inside and outside the components, including open flames, as well as emissions of light, noise, particles, gases, etc. due to fault conditions, e.g.:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
   - Short circuits or ground faults in the intermediate DC circuit of the converter
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

6. Influence of network-connected and wireless communications systems, e.g. ripple-control transmitters or data communication via the network or mobile radio, WLAN or Bluetooth.
7. Motors for use in potentially explosive areas:
   When moving components such as bearings become worn, this can cause enclosure components to exhibit unexpectedly high temperatures during operation, creating a hazard in areas with a potentially explosive atmosphere.

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

System description 3

3.1 Controller features

Control system versions

SINUMERIK 828D is available in the following hardware versions:

- PPU 270.4 (vertical operator panel)
- PPU 271.4 (horizontal operator panel)
- PPU 290.4 (vertical operator panel with touch screen)

Features

SINUMERIK 828 is a customized CNC solution for machine tools employing different technologies in the medium performance range.

SINUMERIK 828 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.

- Operator panel CNC with system software versions for turning, milling and grinding
- 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 port and Ethernet port at the front.
- Additional Ethernet interface at the rear for connecting to the company 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.
- Integrated PLC based on the SIMATIC S7-200 command set with ladder logic programming
- Up to 8 axes/spindles for milling and up to 10 axes/spindles for turning and grinding.
- 2 auxiliary axes via PROFINET with software 26x and 28x. Scaling variants are reduced from 14 to 12.
- 2 machining channels for turning, grinding and milling with software 28x.
- A total of 3 handwheels can be connected: 2 handwheels can be directly connected to the PPU, 1 handwheel via MCP PN
- Sentron PAC connection possible for Ctrl+E.
- GSM modem connection possible.

In addition for SINUMERIK 828 without touch screen:

- 2 operator panel versions for horizontal and vertical operator panel housings.
- Interface for CompactFlash card on the operator panel front.
- Standardized 3/8" threads are provided at the upper ends of the operator panel to attach commercially available additional components, for example, a holder for drawings.

Quantity structure for version 4.95

The following tables show the quantity structures for the different technologies:

Function	Software 24x			Software 26x		
	Grinding	Turning	Milling	Grinding	Turning	Milling
Non-volatile memory * (NVRAM): • For OEM data • For user data	512 kB 3 MB	512 kB 3 MB	512 kB 3 MB	512 kB 5 MB	512 kB 5 MB	512 kB 5 MB
Number of axes/spindles + PLC positioning axis	5	5	5	6+2	6+2	6+2
Maximum number of axes/spindles without Handling channel option	5	5	5	8	8	8
Maximum number of axes with drive-based Safety Integrated	5	5	5	6	6	6
Working - channel option	1	1	1	1	1	1
Handling - channel option	1	1	1	1	1	1
Maximum number of axes in Handling - channel	4	4	4	4	4	4
Total axes in system	8	8	8	9+2	9+2	9+2
Additional auxiliary axes via PROFINET	--	--	--	2	2	2
Axis expansion with NX10.3	1	1	1	1	1	1
Axis expansion with NX15.3	1	1	1	1	1	1
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

*) The data on the memory (NVRAM) depends on the software used.

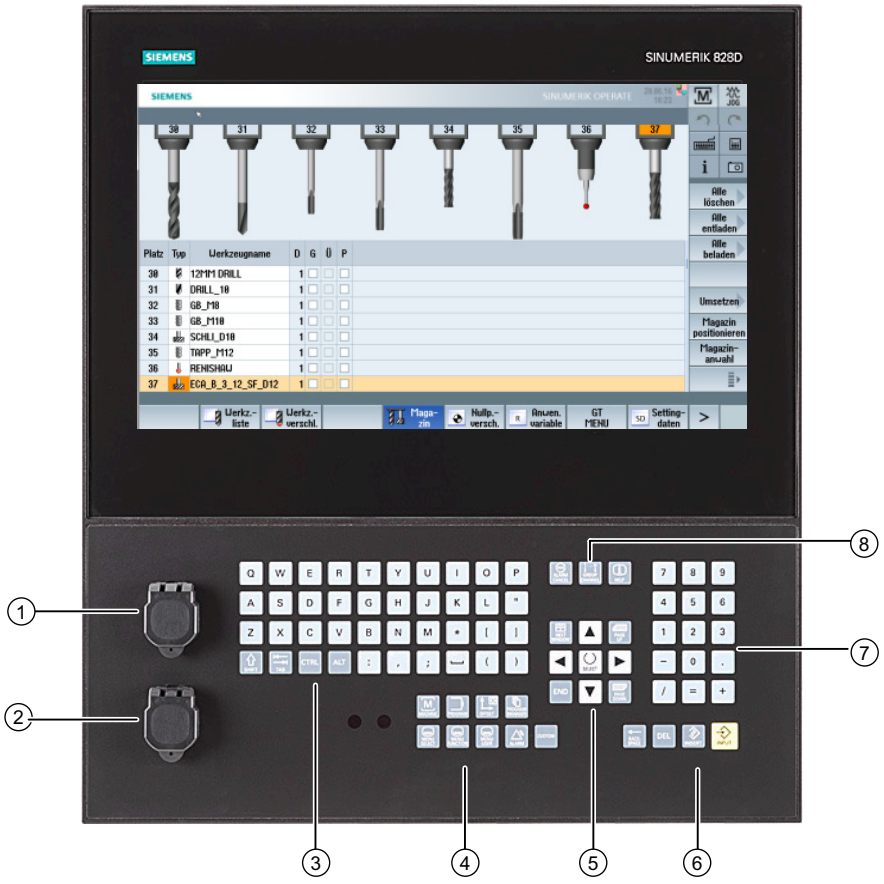
Function	Software 28x		
	Grinding	Turning	Milling
Non-volatile memory * (NVRAM): • For OEM data • For user data	512 kB 8 / 10 MB	512 KB 8/10 MB *)	512 KB 8/10 MB
Number of axes/spindles+ PLC positioning axis	10+2	10+2	8+2
Maximum number of axes/spindles without Handling channel option	12	12	10

Function	Software 28x		
	Grinding	Turning	Milling
Maximum number of axes with drive-based Safety Integrated	12	12	10
Working - channel option	2	2	2
Handling - channel option	2	2	2
Maximum number of axes in Handling - channel(s)	4+4	4+4	4+4
Total axes in system	16+2	16+2	14+2
Additional auxiliary axes via PROFINET	-- / 2	2 / 2	2 / 2
Axis expansion with NX10.3	1	1	1
Axis expansion with NX15.3	2	2	2
Number of DRIVE-CLiQ interfaces	3	3	3
Maximum number of I/O modules (digital/analog)	5	5	5

*) The data on the memory (NVRAM) depends on the software used.

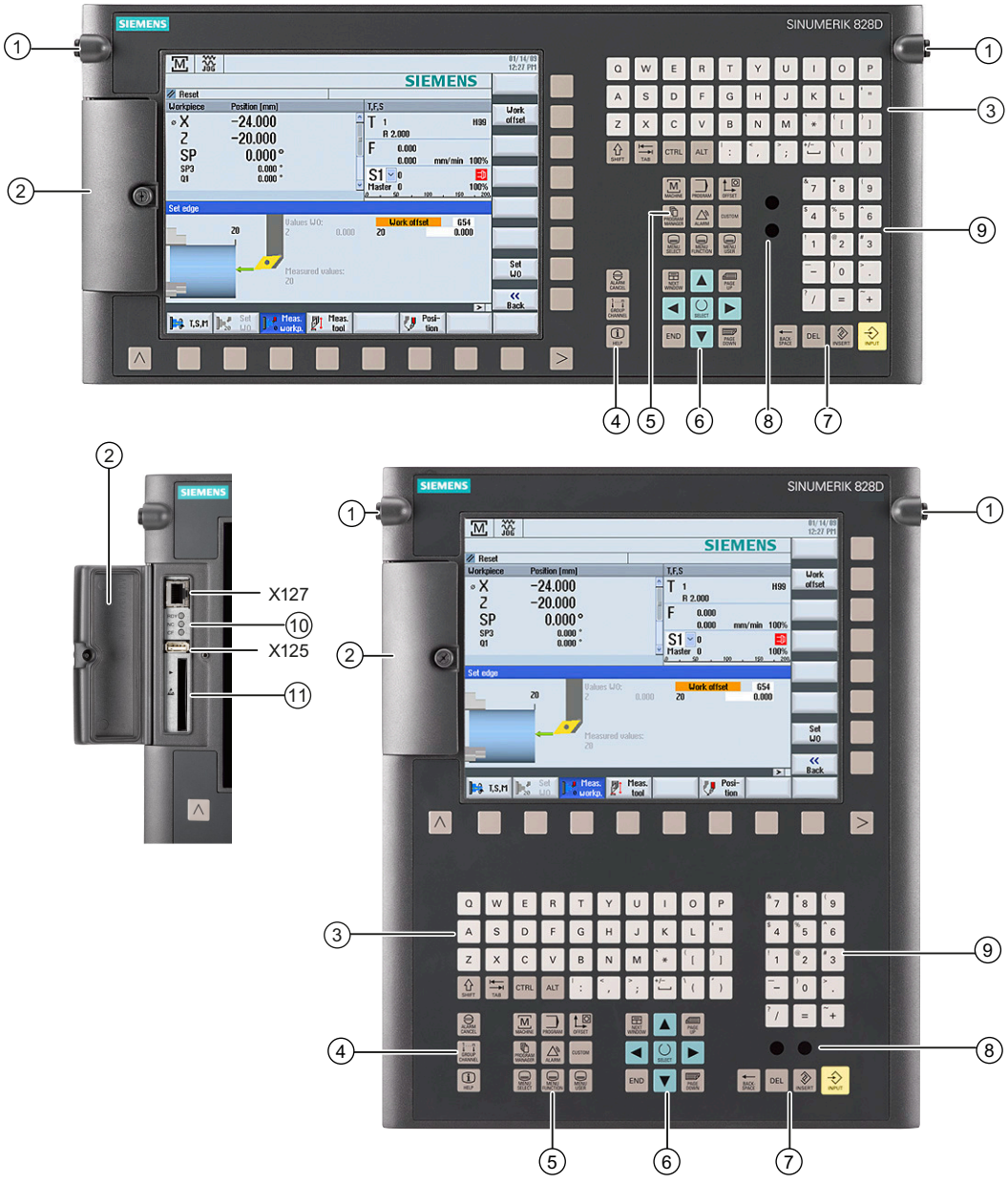
3.2 PPU versions

Front of the PPU 290.4



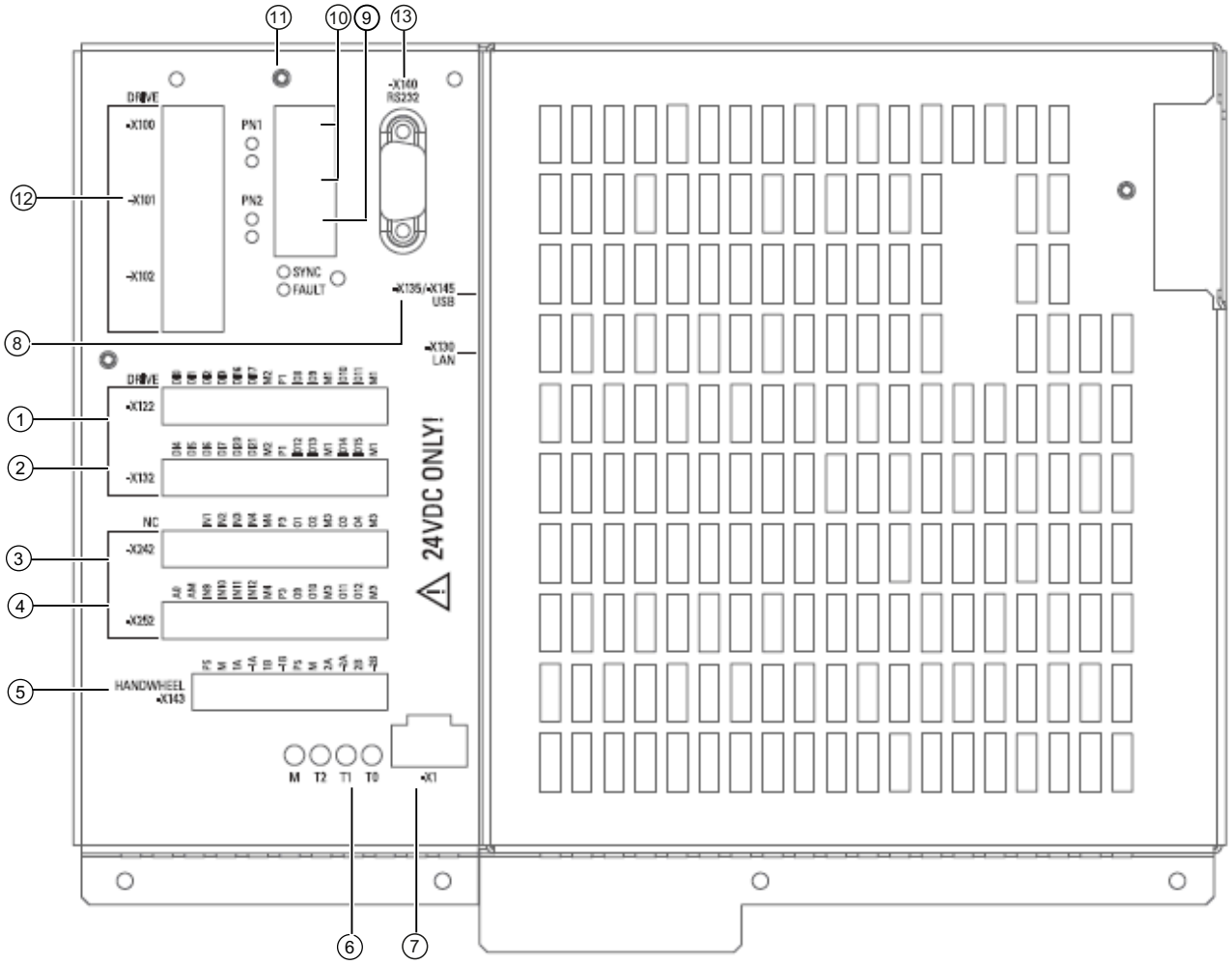
① USB interface
② X127 Ethernet interface (service connection)
③ Qwerty keyboard
④ Keys to quickly select the operating area
⑤ Cursor keypad
⑦ Numerical keys
⑥, ⑧ Control keys

Front of the PPU 27x.4



①	3/8" threads for additional components	⑧	Proximity sensor
②	Front cover	⑨	Numerical keys
③	QWERTY keyboard	⑩	Status LED: RDY, NC, CF
④, ⑦	Control keys	⑪	Slot for CompactFlash card
⑤	Keys to quickly select the operating area	X125	Front-USB
⑥	Cursor keypad	X127	Ethernet interface (service connection)

Rear of the PPU



①②	X122, X132	Digital inputs/outputs, drive
③④	X242, X252	Digital inputs/outputs for NC; control of the analog spindle (X252)
⑤	X143	Handwheels
⑥	M, T2, T1, T0	Measuring sockets
⑦	X1	Power supply
⑧	X135, X145	USB interface: for MCP 310 USB, MCP 483 USB, MCP 416 USB and for service
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 3-1 Interfaces at the rear of the PPU

Type plate

The PPU type plate is located on the rear. All the information required to clearly identify the PPU is available on the type plate.

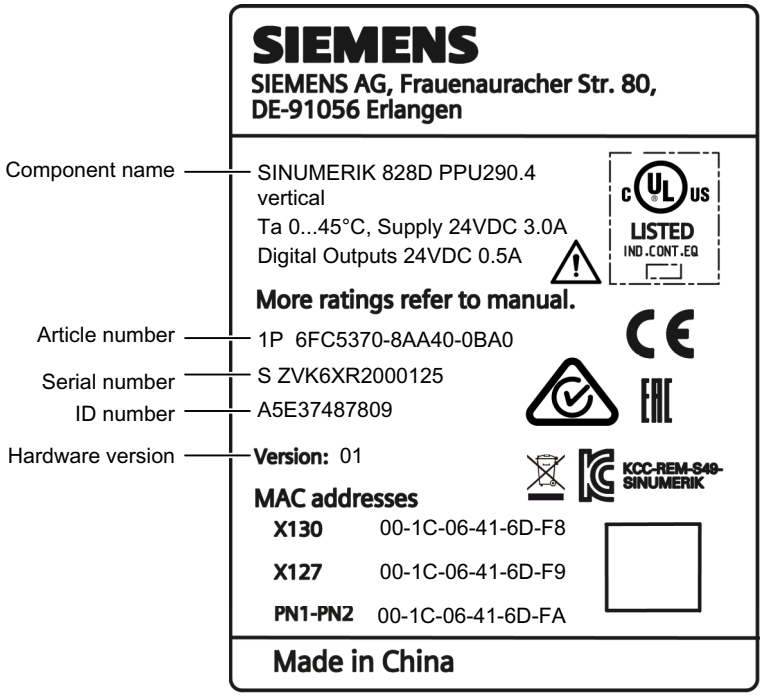


Figure 3-2 Example: Vertical PPU type plate

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

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.

3.3 Operator controls and display elements

3.3.1 Keyboard and monitor

Keys on the PPU

The following keys are located 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 control key group includes special functions.
- The area changeover displays the operating areas.
- The menu forward key changes to the expansion of the horizontal soft key bar in the same menu.
- The menu back key returns to the higher-level menu.
- The machine area key switches directly into the "Machine" operating area.
- The cursor key group is used to navigate on the screen.

Key combinations (shortcut keys) on an external keyboard

The keys on the operator panel front with the appropriate key combinations on an external keyboard are juxtaposed in the following overview:

Key	Key combination	Key	Key combination
	SHIFT		CTRL
	Tabulator key		ALT
	F9		SHIFT + F9
	Key ESC		"←" key
	F11		"Delete" key
	F12		"Insert" key
A ... Z	A ... Z		↲ ("Enter") key

Key	Key combination	Key	Key combination
	F10		SHIFT + F10
	F2		F5
	F3		CTRL + F10
	F4		SHIFT + CTRL + F10

Key	Key combination	Key	Key combination
	↑ key		"Home" key
	← key		"End" key
	<5> key on the number block		
	→ key		"Page up" key
	↓ key		"Page down" key

Softkeys

The softkeys are arranged in an 8 + 8 layout so that the CNC is easy to operate. The softkeys call up functions that are available at the screen via a menu bar.

Color display

The TFT color display has a diagonal width of 10.4" with a resolution of 800 x 600 pixels. The touch display has a diagonal width of 15.6" with a resolution of 1366 x 768 pixels.

For additional technical data, see: Technical data (Page 287)

3.3.2 Proximity sensor

Function of the proximity sensor

The proximity sensor comprises an infrared transmitter (send) diode and an infrared phototransistor. The proximity sensor responds when persons approach - and has the following sensing range:

- The identification range is 0.8 ... 1 m.
- The opening angle is approximately 45 degrees.

The time until the screen is dimmed or darkened only expires as long as no operator actions are performed or messages are output in the part program: The time is reset and the screen goes bright again as a result of the following events:

- An alarm or a message occurs
- Sensor signal for a PPU with a proximity switch
- Operation via the keys and softkeys on the PPU
- Operation via the machine control panel
- Operation with a mouse connected via USB
- Operation via the VNC viewer

General conditions for the optimum effect

The optimum effect of the sensor is guaranteed under the following supplementary conditions:

- The front must be kept clean because the sensor functions with infrared light.
- There must be no foreign bodies or objects in the detection area.
- A protective film on the front of the control influences the detection area of the sensor.

Dark-switching sequence

The default setting of interface signal DB1900.DBX5000.1 = 0 has the following function:

The screensaver function has two stages.

1. The first stage takes effect after three minutes. This interval cannot be changed and has a very positive effect on the service life of the screen. In the first stage, the screen is dimmed to 20% of the current brightness value. This tells the operator that the screen will soon go dark (screensaver).
2. The screen is darkened when the time set in the display machine data MD9006 $MM_DISPLAY_SWITCH_OFF_INTERVAL elapses. The default setting is 15 minutes.

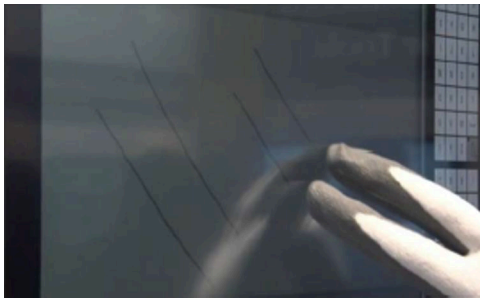
If the interface signal DB1900.DBX5000.1 = 1 is set, the MD9006 is not effective, and the screensaver is immediately effective without prior dimming (see: SINUMERIK 828D List Manual NC Variables and Interface Signals (https://support.industry.siemens.com/cs/de/en/view/109481493)).

3.3.3 Operation when wearing gloves

Recommended gloves

The following gloves are recommended when using the PPU 290.4:

- BM Polyco: Reusable gloves, white, cotton Article number: RS 562-952)
- Carex (leather) (Article number: 1505/k)
- Comasec PU900 (Article number: 4342)
- KCL Man at work (Article number: 301)
- KCL Camapur Comfort (Article number: 619)
- KCL Camapur Comfort antistatic (Article number: 625)
- KCL Camatril Velours (Article number: 730)
- KCL Dermatril L (Article number: 741)
- KCL Thermoplus (Article number: 955)
- UVEX profi ENB 20A ergo (Article number: 60148)



Do not wear thick gloves when operating the touch-sensitive glass user interface.

Wear thin gloves made of cotton or gloves for touch-sensitive glass user interfaces with capacitive touch function.

Note

Operating with thicker gloves

To operate the touch panel with thicker work gloves, apply somewhat more pressure.

3.3.4 Operating with gestures

Finger gestures to operate the touch display



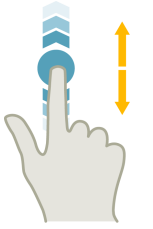
Tap

- Select window
- Select an object
- Activate entry field



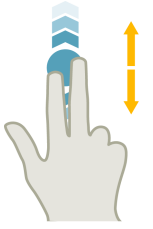
Tapping and holding

- Open object to be changed



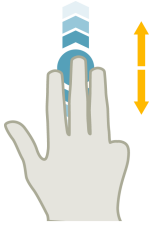
Vertical swipe with 1 finger (flick)

- Scrolling in lists
- Scrolling in files



Vertical swipe with 2 fingers (flick)

- Laterally scrolling in lists
- Laterally scrolling in files



Vertical swipe with 3 fingers (flick)

- Scrolling to the beginning or end of lists
- Scrolling to the beginning or end of files

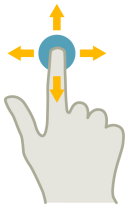
Note:

The distance between the fingers must be at least 10 mm so that the 3 fingers are reliably identified.



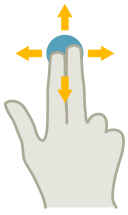
Horizontal swipe with 1 finger (flick)

- Scrolling in lists with lots of columns



Pan with 1 finger

- Moving content of graphics
- Moving content of lists



Pan with 2 fingers

- Rotating content of graphics



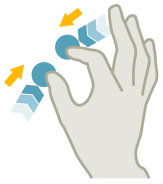
Tap with 2 fingers

- Calling a context menu



Spread

- Increasing the size of the content of graphics



Pinch

- Decreasing the size of the content of graphics

3.4 CompactFlash Cards

3.4.1 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 (not for PPU 290.4).
- 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 SINUMERIK, then it possibly involves a memory card that has not been formatted for this control system (e.g. Ext3 Linux file system), or a memory card with a defective file system or an incorrect memory card type.
- 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.

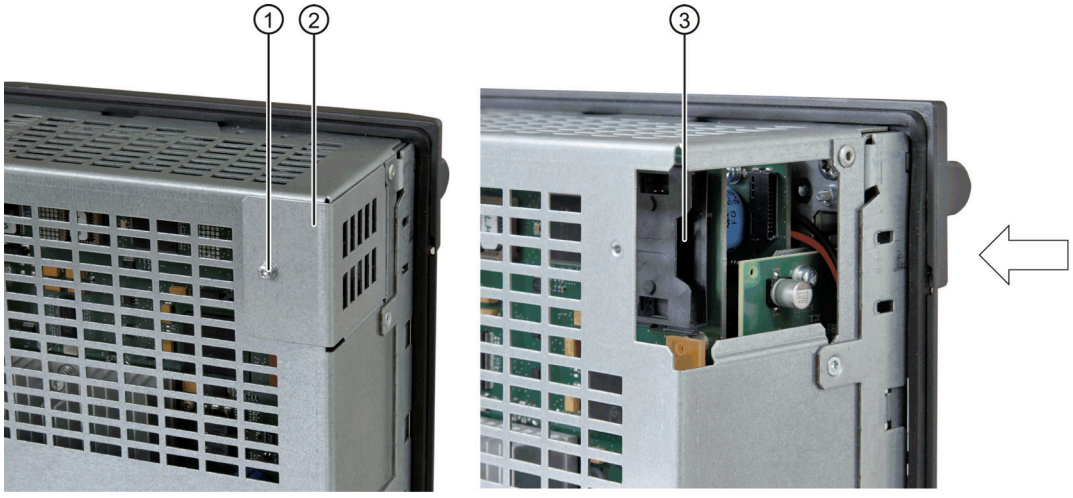
- Only use memory cards that have been approved by Siemens for use with SINUMERIK. Even though SINUMERIK follows general industry standards for memory cards, it is possible that memory cards from some manufacturers will not function perfectly in this device or are not completely compatible with it (you can obtain information on compatibility from the memory card manufacturer or supplier).
- For SINUMERIK 828D from software 4.95 version, the memory card (8 GB) with order number 6FC5313-6AG00-0AA0 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.

3.4.2 Replacing the system CompactFlash card

Replacing the system CompactFlash card

Slot and mounting position:



① M3 screw
② Metal cover
③ Slot

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:

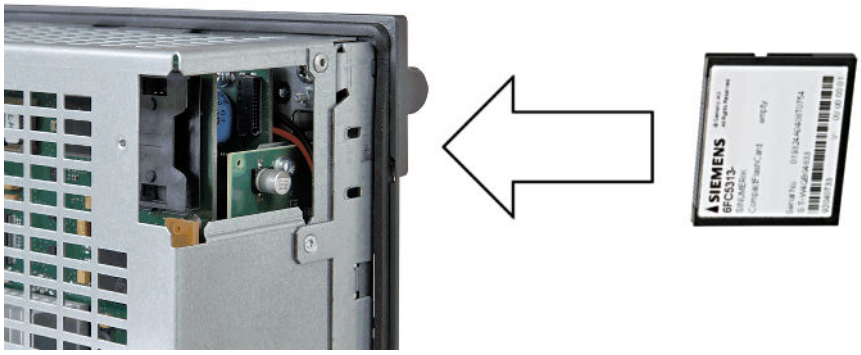
1. Switch off the power supply.
2. Loosen the screw ①.
3. Swing the metal cover ② to the side and remove.



4. Pull out the CompactFlash card sideways.



5. Gently insert the new CompactFlash card into slot ③ until it clicks into place. 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.



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.

3.4.3 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.

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.

Note

Memory size of the data storage medium that can be connected

The memory size of the data storage medium that can be connected is not restricted. It is only important that these are FAT, FAT16 or FAT32 types. Only the first partition is used.

With its own formatting tool, Windows can only format data storage medium up to 32 GB in FAT32. In these cases (> 32 GB), in order to achieve compatibility with SINUMERIK 828D, other tools or operating systems should be used to format data storage medium in the FAT32 file format.

ExFAT and NTFS are not supported.

Inserting the CompactFlash card

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



Figure 3-3 Direction to insert the user CompactFlash card

3.5 System overview

Configuration with four axes (basic configuration)

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

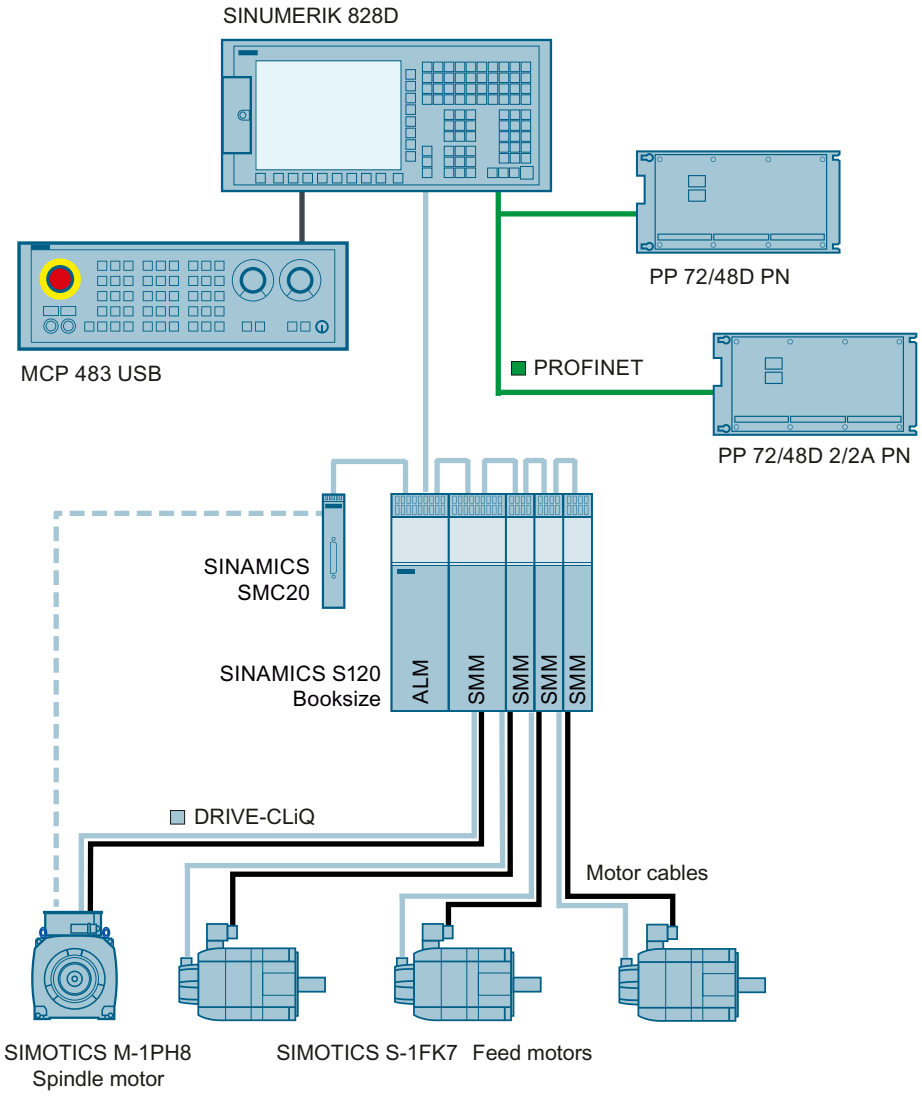


Figure 3-4 Configuration example 1: Basic configuration with four axes

Configuration with 4 axes and 2 auxiliary axes

The following configuration shows an example with 2 auxiliary axes:

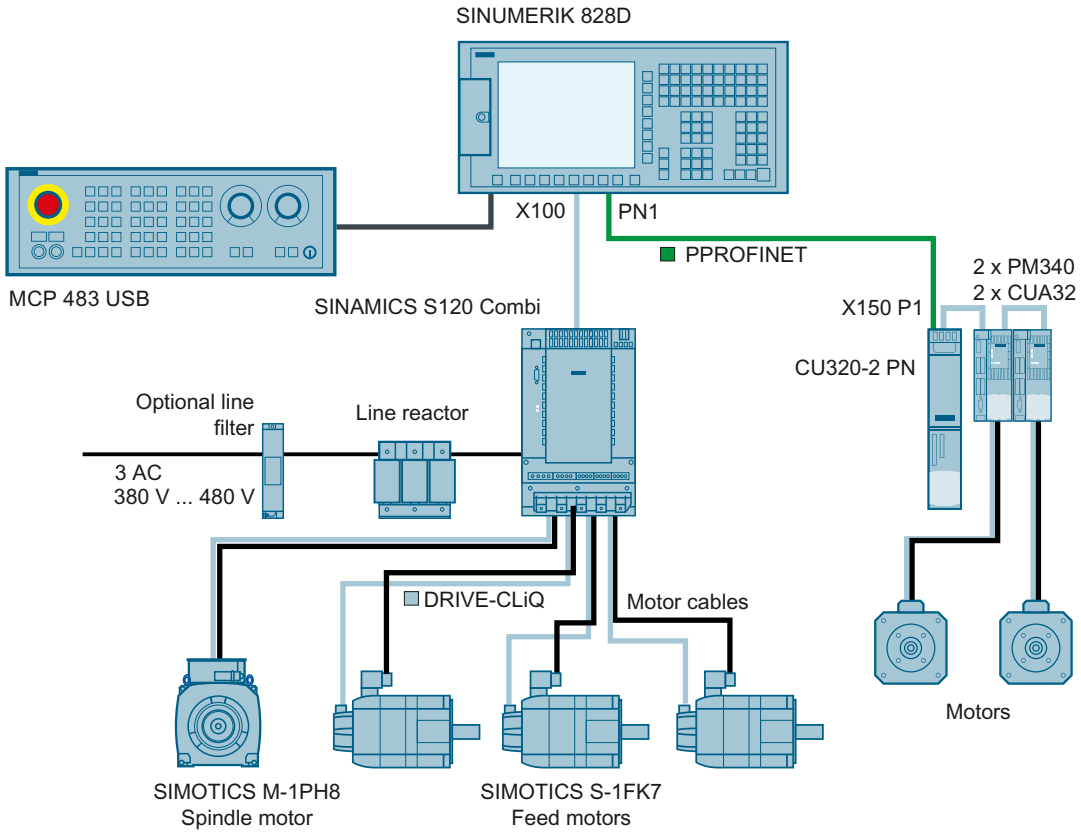


Figure 3-5 Configuration example 2: Basic expansion stage with 4 axes and 2 auxiliary axes

Configuration with 6 axes (maximum expansion stage) and Safety Integrated

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

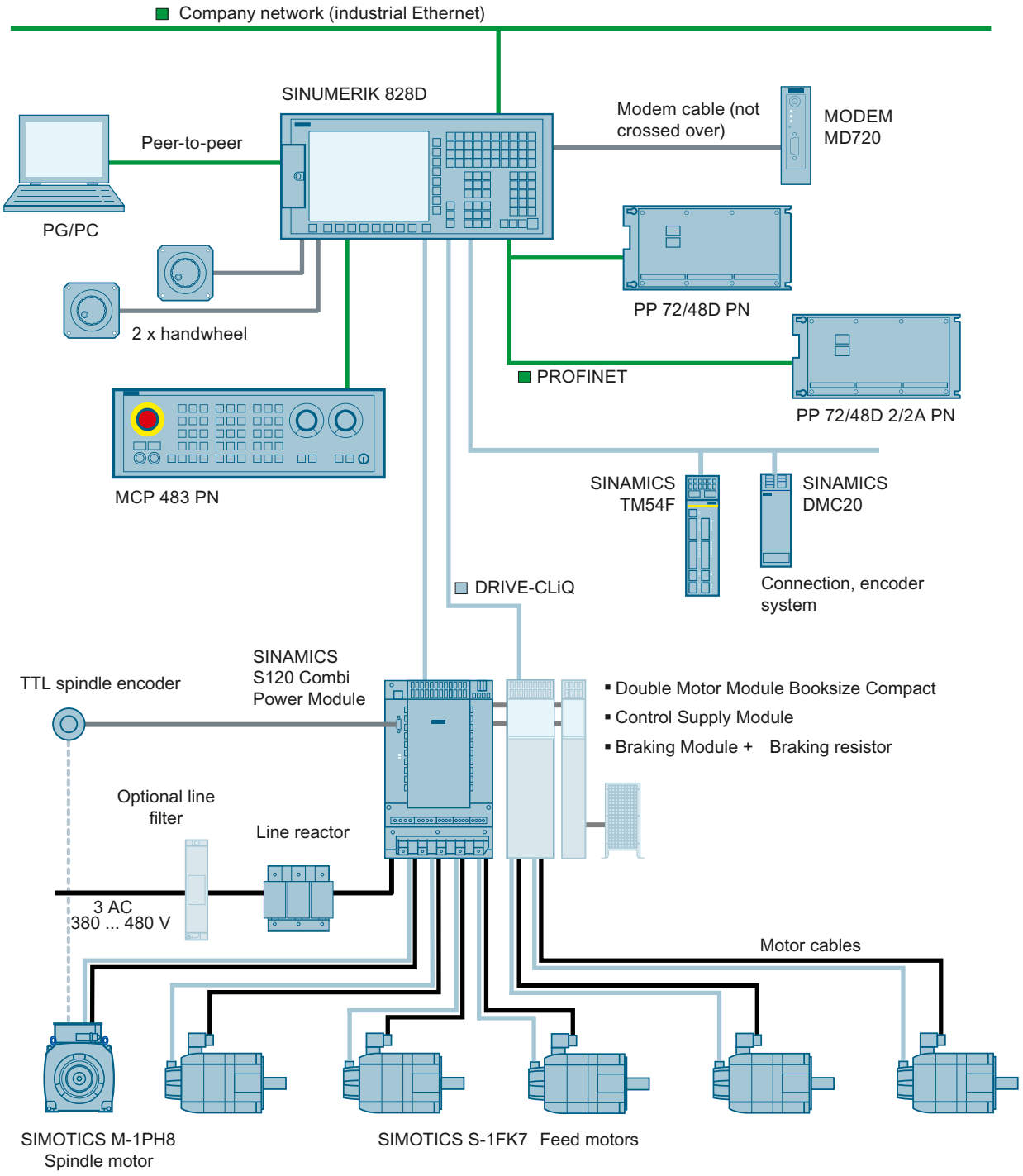


Figure 3-6 Configuration example 3: Maximum expansion stage with 6 axes and with Safety Integrated

3.6 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.
- **Increasing the number of axes**
  - NX10.3 / NX15.3
    You can increase the number of axes connected to the NC using NX modules. Each NX10.3 component can control up to 3 additional servo axes and each NX15.3 component can control up to 6 additional axes.
  - SINAMICS CU310-2 PN or SINAMICS CU320-2 PN (Page 44)
    In addition to the NC axes, you can connect up till 6 auxiliary axes via one SINAMICS CU320-2 PN.
- **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.
- **SENTRON PAC3200 / PAC4200**
  When connecting a SENTRON 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** astype 1FK7, 1FT7, and 1PH8feed and main spindle motors. Type 1FW6 **torque motors** can also be connected.

Application planning

4

4.1 Secondary electrical conditions

4.1.1 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 (PELV).

4.1.2 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:

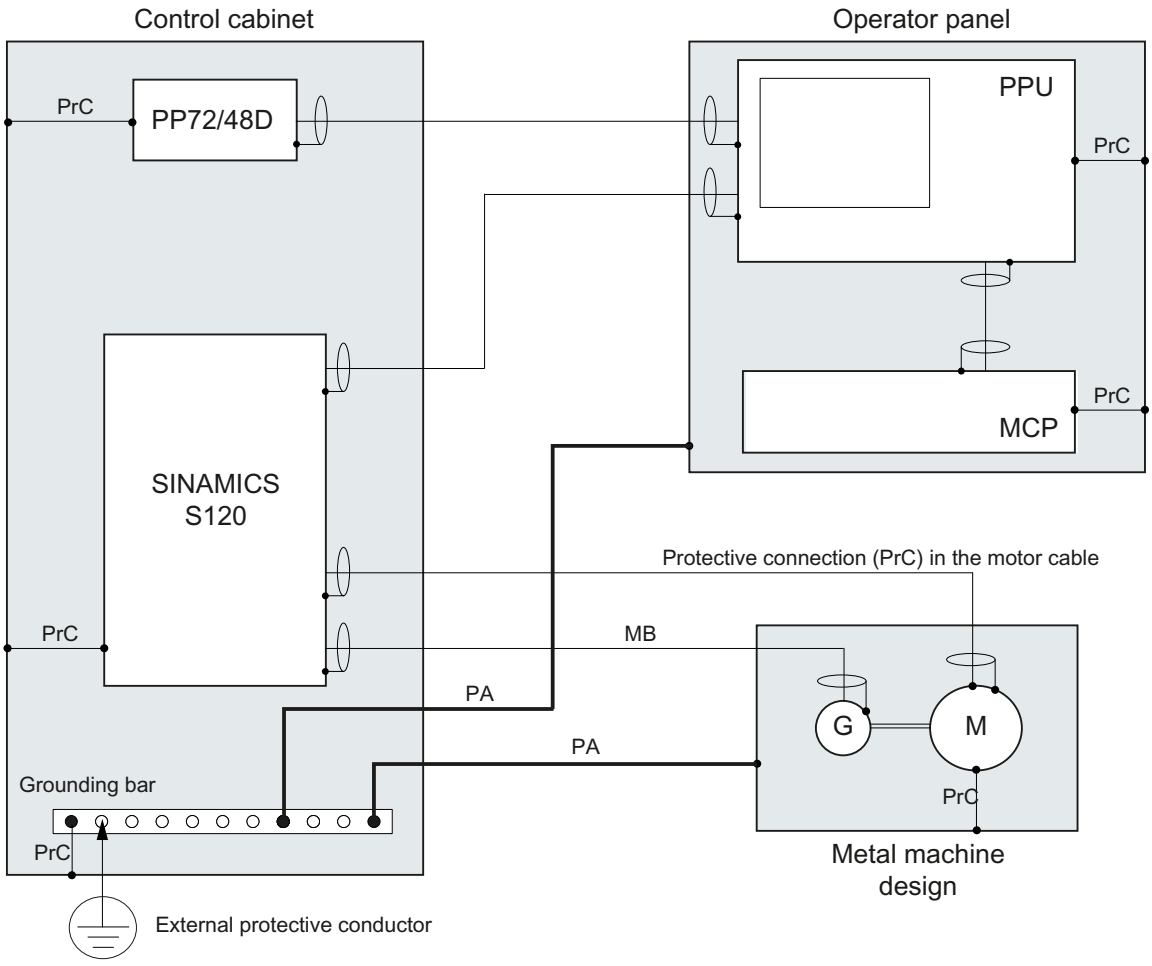
- Panel Processing Unit PPU
- Machine Control Panel
- PLC I/O modules
- SINAMICS S120 drive components

Grounding measures

The PPU and machine control panel are attached with tension jacks to a metal mounting 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 or the operator panel housing.

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

The SINAMICS S120 drive system is installed in the control cabinet. The electronic 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.



MB	Shielded signal cable with reference ground
M	Motor
G	Encoder
PA	Equipotential bonding conductor
PS	Protective connection (via metal design or green-yellow protective conductors)

Figure 4-1 Grounding concept

Requirements of the cable cross-section

The following rules apply for external cable cross-sections:

- PA cross-section ≥ 10 mm^2
- The cable cross-section of the external protective conductor is calculated from the cable cross-section of the line connection as follows:

Line connection S [mm^2]	External protective conductor min. [mm^2]
S ≤ 16	S
16 ≤ S ≤ 35	16
S ≥ 35	S/2

4.1.3 EMC compatibility

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 control 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 control 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 achieve the greatest possible EMC compatibility for the complete system (control, power unit, machine), the following EMC measures must be carefully 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.

- 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)

EMC-compatible installation of the components

The PPU and operator components must be installed in metallically enclosed EMC-compatible housings.

References

Additional specifications on interference suppression measures can be found in the following references:

- 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.

4.2 Climatic and mechanical environmental conditions

4.2.1 Ambient conditions

Observing the ambient conditions

Fault-free operation is only ensured if the following conditions are observed:

- The ambient conditions are maintained during storage, transportation and operation.
- Original components and replacement 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

The connection conditions must be maintained when installing the complete system. Please contact your sales representative for assistance and support.

4.2.2 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	EN 60721-3-1
Temperature range	-20 ... + 60 °C	-25 ... + 55 °C
Temperature change	-40 °C/+30 °C and +70 °C/+15 °C *)	< 0.5 K / min (≙ 30 K / h) averaged over 5 minutes
Relative humidity	5 ... 95 %	10 ... 100 %
Permissible change of the relative humidity	max. 0.1% / min (≙ 6% / h)	

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

Table 4-1 Transport values for PPU

Vibratory load: • **Operation (3M1)** • **Package (1M2)**	 9 - 29 Hz: 0.3 mm; 29 - 200 Hz: 1g 5 - 9 Hz: 3.5 mm, 9 - 200 Hz: 1 g
Shock load: • **Operation (3M1)**	 5 g, 30 ms

4.2.3 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 (≙ 30 K / h) averaged over 5 minutes		
Humidity	Relative: 5 ... 90 %		
Permissible change of the relative humidity	max. 0.1% / min (≙ 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^2h

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.

4.3 Recycling and disposal

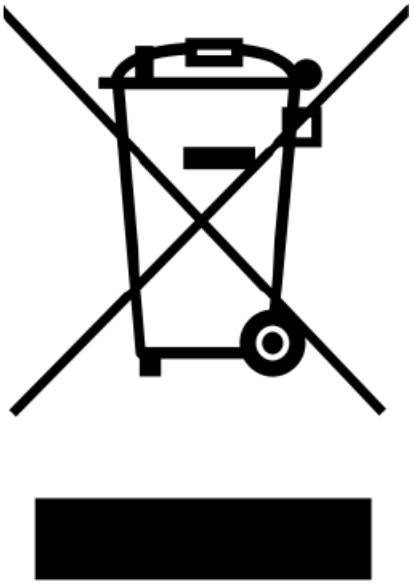


Figure 4-2 Recycle

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

5

Installation notes

The PPU modules and components may only be installed in housings, cabinets or in isolated electrical operating areas. Housings, cabinets, or isolated electrical operating areas 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.

Note

If the equipment is not used in a manner specified by the manufacturer, the protection provided by the equipment can be impaired.

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

5.1 Dimension drawings

PPU horizontal

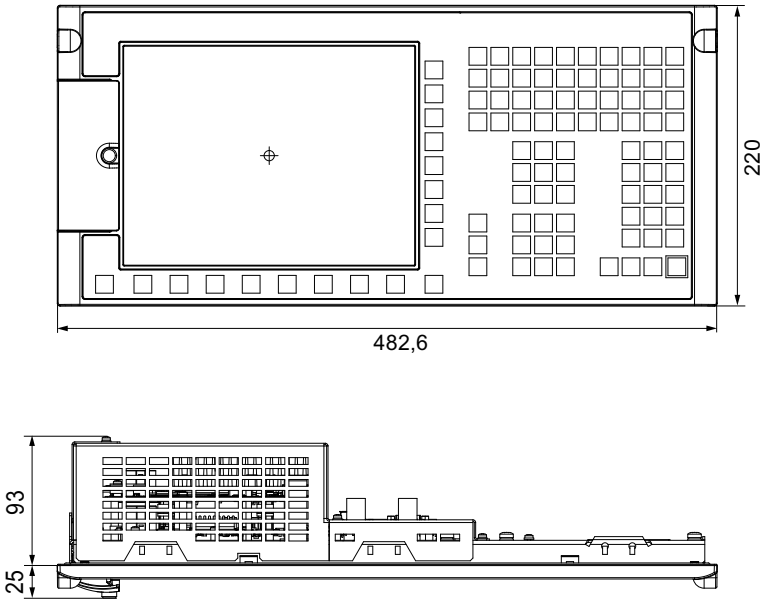


Figure 5-1 Horizontal PPU dimensions

PPU vertical

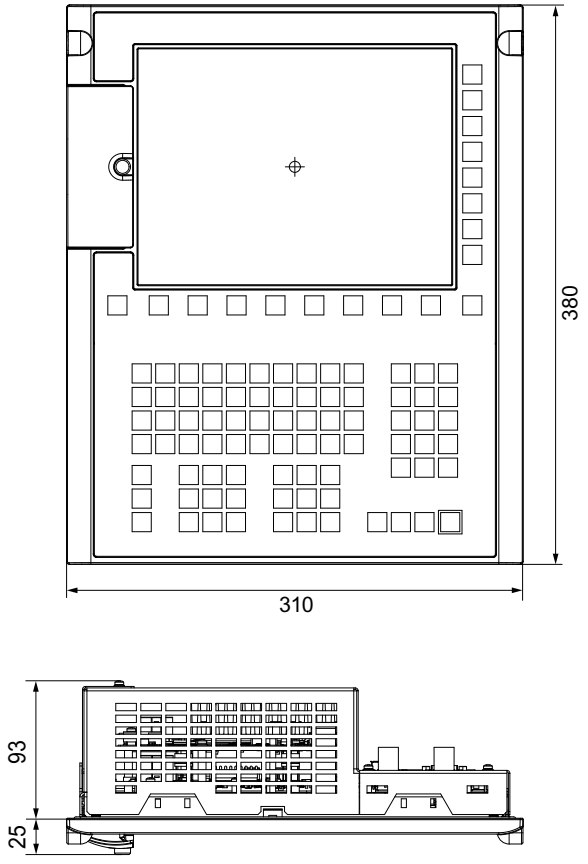
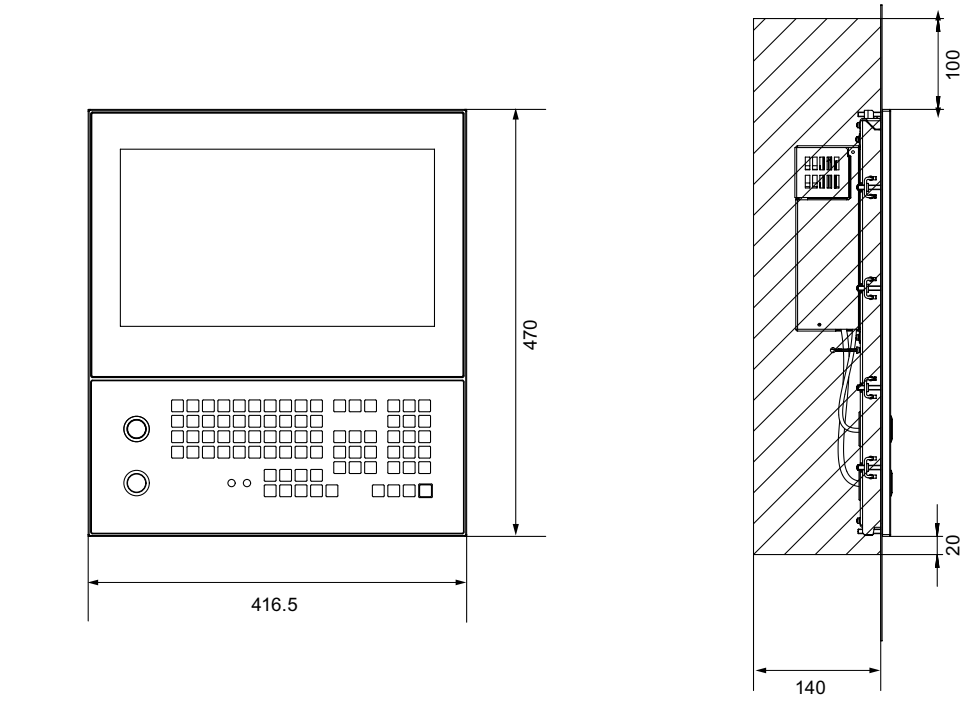
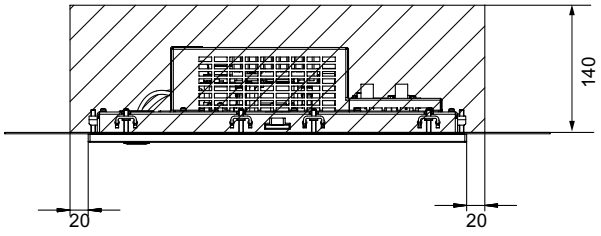


Figure 5-2 Vertical PPU dimensions

PPU touch variant





Dashed area: Clearance for cable and ventilation

Figure 5-3 PPU touch variant dimensions

5.2 Installing the PPU

Permitted mounting positions

The PPU is attached to the operator panel housing by means of special tensioning elements. The tensioners are included in the scope of delivery.

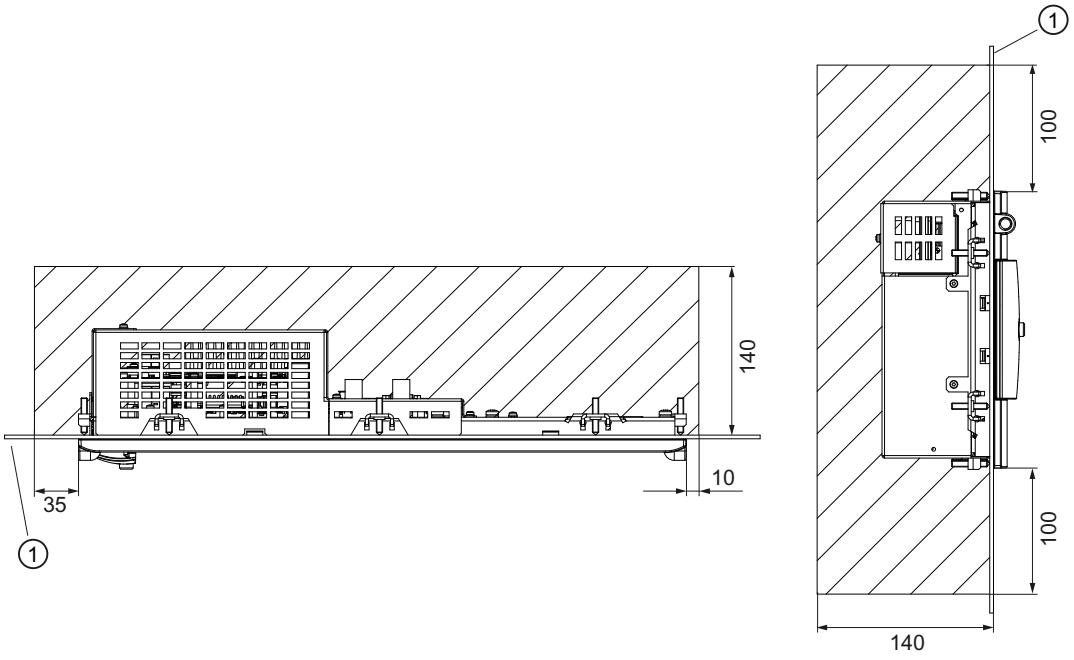
Note

Installing the PPU

The maximum permissible tightening torque for the tensioning screws is 0.5 Nm.

To avoid malfunctions, the PPU 270.4 and the PPU 290.4 must only be installed in the vertical mounting position.

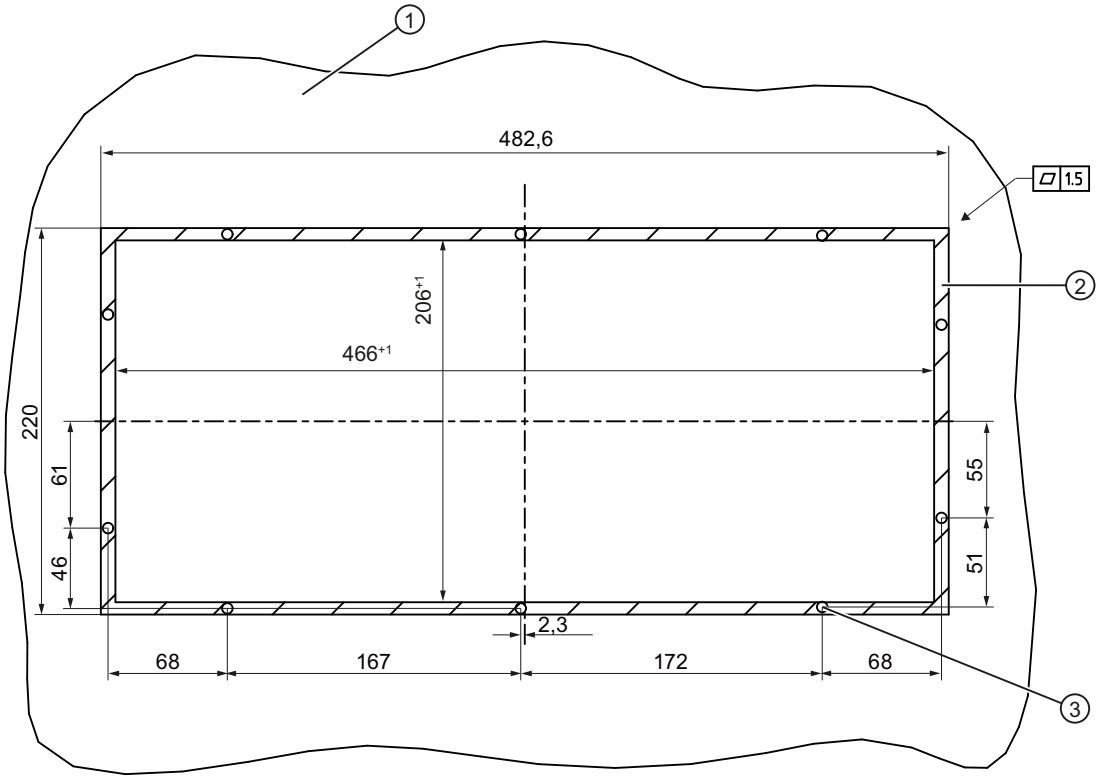
Installation of the horizontal PPU version



① Mounting frame

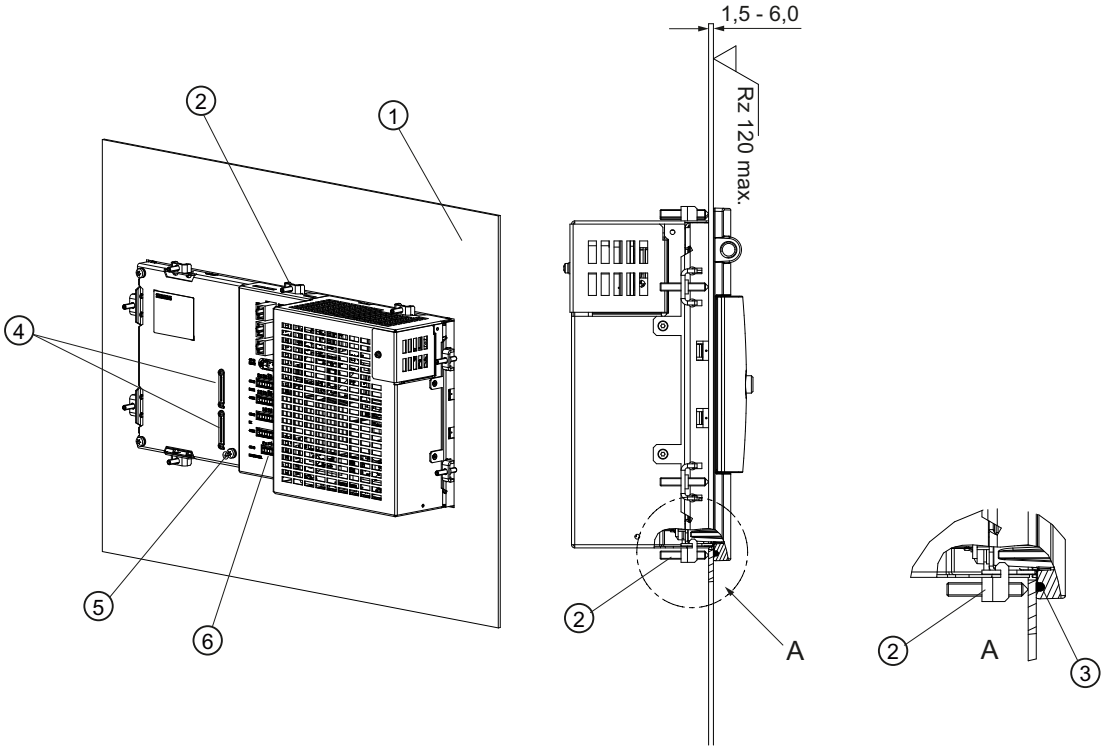
Figure 5-4 Clearance for ventilation and cables in the horizontal PPU

Panel cutout of the horizontal PPU version



① Mounting frame
② Seal area
③ Pressure point for tensioners

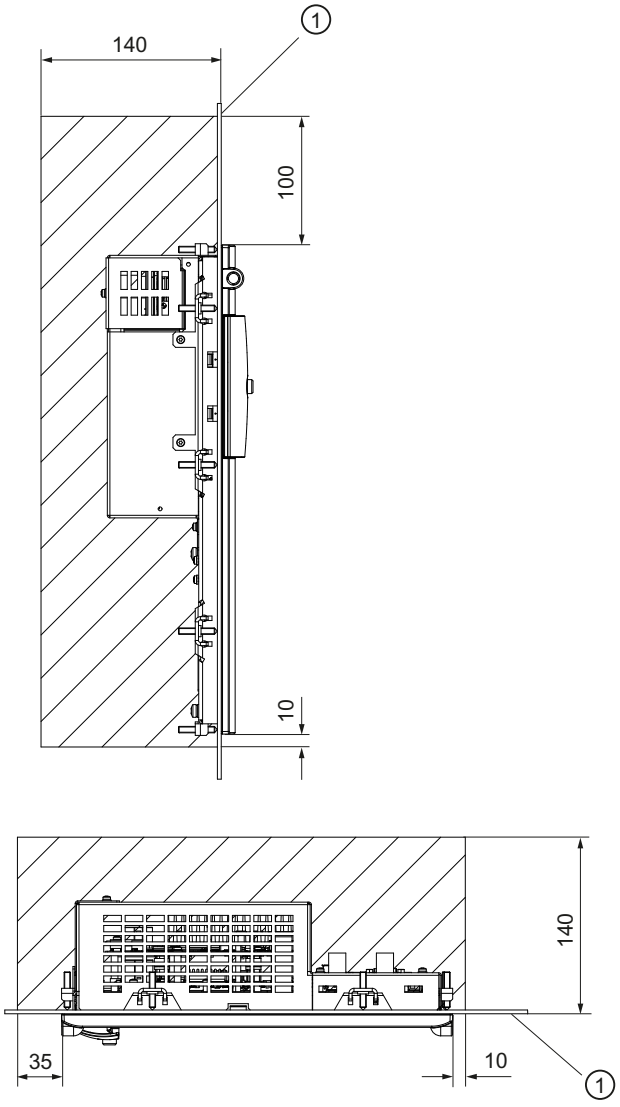
Figure 5-5 Horizontal PPU panel cutout



① Mounting frame
② Tension jacks (10x)
③ Seal
④ Shield contact
⑤ Grounding screw M5
⑥ Interfaces

Figure 5-6 Horizontal PPU mounting

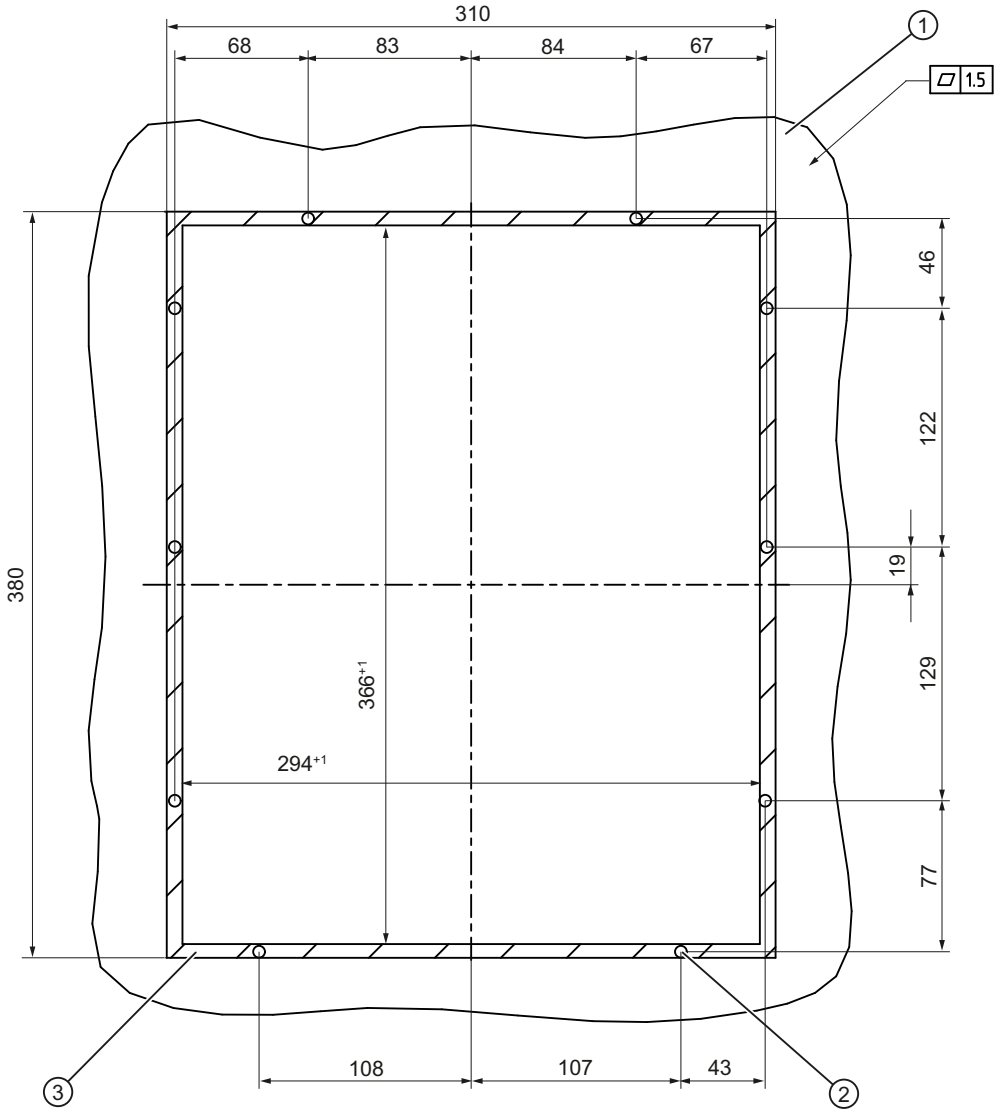
Installation of the vertical PPU versions



① Mounting frame

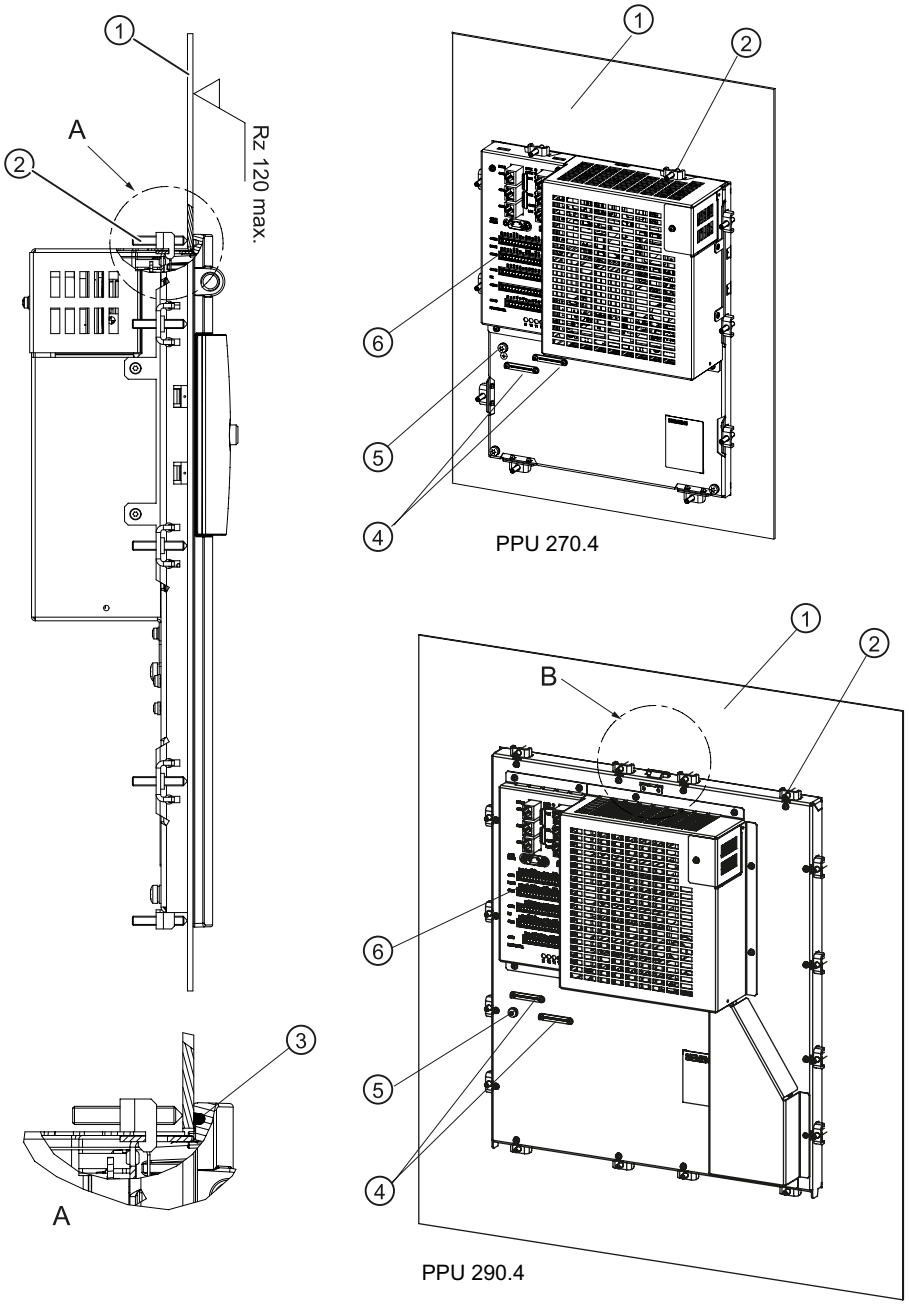
Figure 5-7 Clearance for ventilation and cables in the vertical PPU and touch PPU

Panel cutout of the vertical PPU versions



① Mounting frame
② Pressure point for tensioners
③ Seal area

Figure 5-8 Vertical PPU panel cutout



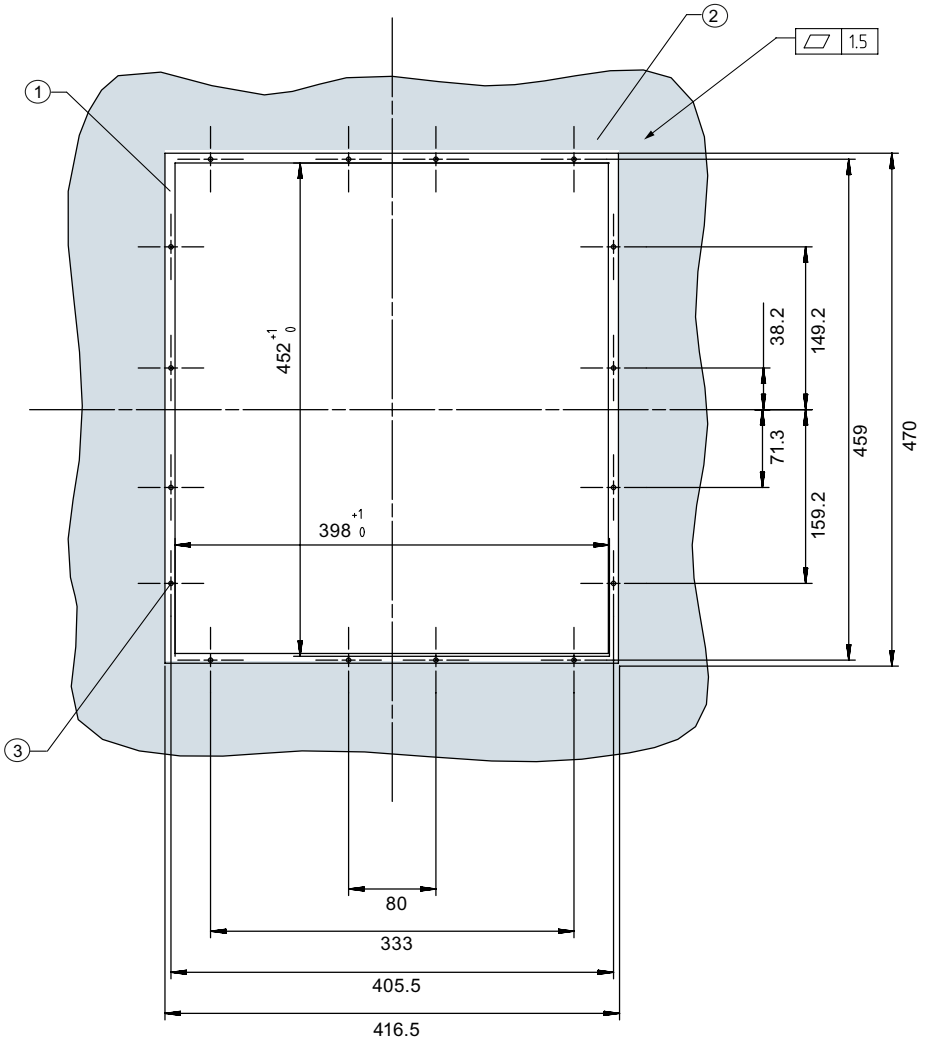
B Detailed view, see diagram (Page 65)
① Mounting frame
② 10 tensioners for PPU 270.4
16 tensioners for PPU 290.4
③ Seal
④ Shield contact
⑤ Grounding screw M5
⑥ Terminal blocks

Figure 5-9 Installation of the vertical PPU version

5.3 Installation of the PPU 290.4

Preparation for installing the PPU 290.4

Special clamping elements are used to fix the PPU in a housing with IP65 / IP66 degree of protection if the housing conforms to what is specified in the dimension sheet. When using the tension jacks, holes or threaded holes are not required. The PPU already has a PU foam seal. The tension jacks are included in the scope of delivery.



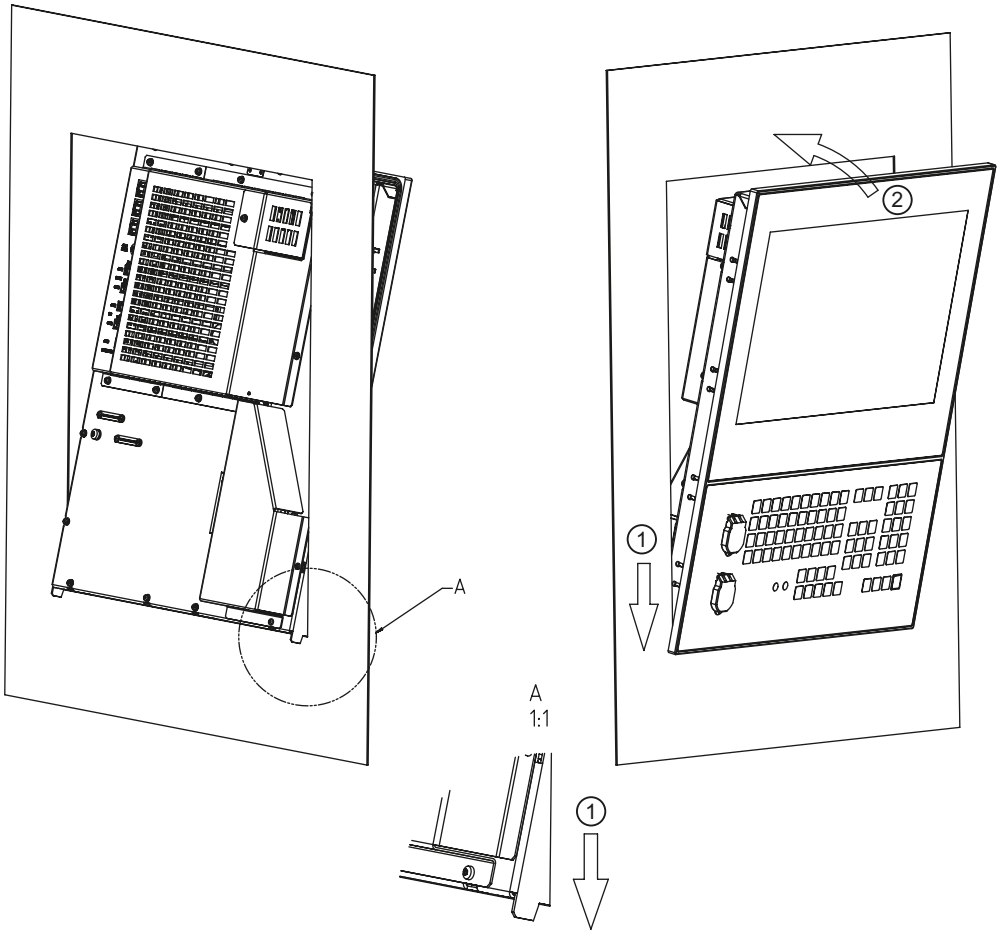
① Seal area
② Mounting frame
③ Pressure point for tension jacks (16 units)

Figure 5-10 Installation cutout

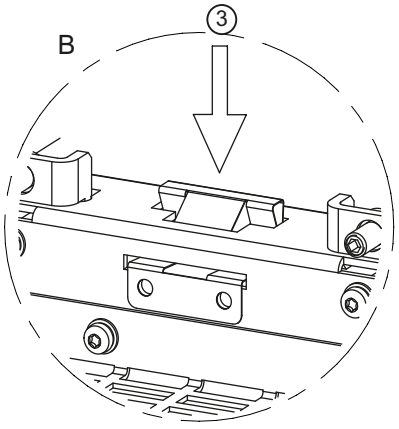
Installing the PPU 290.4

Procedure:

1. Insert the PPU into the installation cutout from the front ①.

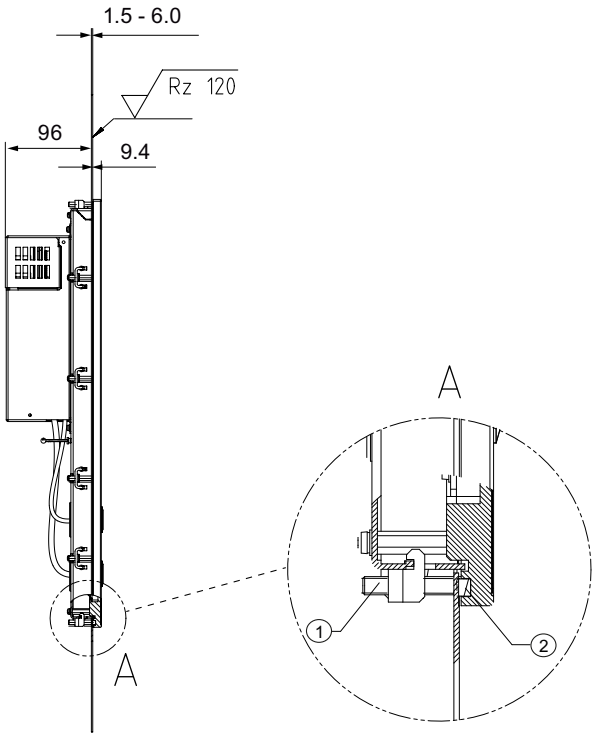


2. Tilt the PPU ② and press the snap mechanism ③ to fit the device into the cutout:



3. Fix the PPU in the installation cutout from the rear using the tension jacks by tightening the setscrews:

Ensure that the PPU sits firmly in the installation cutout and cannot fall out before you secure the PPU at the rear using the tension jacks.



A Detail view
① Tension jack with setscrew Tightening torque 0.5 Nm
② Seal

NOTICE

Installing the PPU

The following points must be carefully observed to correctly install the PPU:

- The maximum permissible tightening torque for the tension jack screws is 0.5 Nm, and this tightening torque must not be exceeded.
- Inadmissible installation positions can result in malfunctions: Please note that permissible installation position may only deviate up to max. 60° from the vertical.
- It is crucial that the seal is not damaged when installing the device so that the maximum achievable degree of protection can be fulfilled. Therefore, center the PPU in the installation cutout.
- Do not use suction grippers to lift the glass front to avoid damaging the glass front.

Rules for permitted topologies

6

6.1 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

Assignment of the DRIVE-CLiQ interfaces on the S120 Combi:

DRIVE-CLiQ interface	Connection to
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: 2nd 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

Assignment of the DRIVE-CLiQ interfaces on the SINUMERIK 828D (PPU)

DRIVE-CLiQ interface	Connection to
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 Module (DMx20) [1]

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

Assignment of the DRIVE-CLiQ interfaces of the expansion axes:

DRIVE-CLiQ interface	Connection to
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)
Second Single Motor Module:	
X200	X201 of the first Single Motor Module
X201	Remains empty

DRIVE-CLiQ interface	Connection to
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.

Assignment of the DRIVE-CLiQ interfaces on the DMx20 to assign a direct measuring system to the feed axes:

DRIVE-CLiQ interface	Connection to
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 on the S120 Combi (only for S120 Combi with four axes, remains empty for S120 Combi with three axes)
X504	Feedrate 1st expansion axis at the Motor Module
X505	Feedrate 2nd expansion axis at the Motor Module

Assignment of the DRIVE-CLiQ interfaces on the TM54F:

DRIVE-CLiQ interface	Connection to
X500	X102 of the control (PPU)
X501	X500 of the DMx20: Without a DMx20, this interface remains empty.

6.2 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.

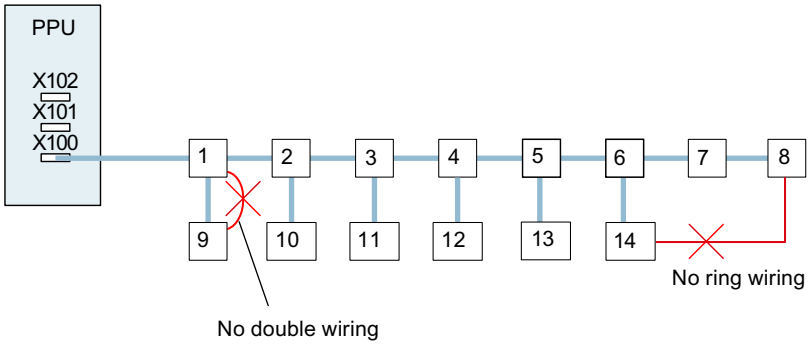


Figure 6-1 Example: DRIVE-CLiQ line at the X100 terminal (without Safety Integrated)

- 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.

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.

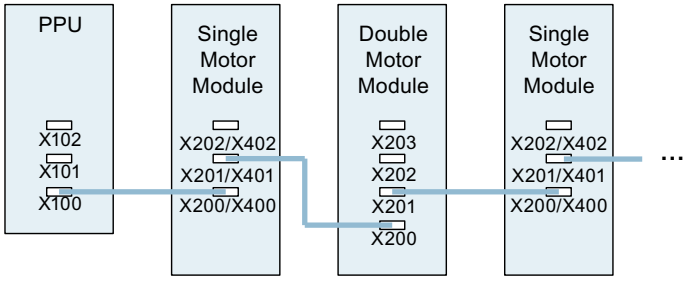


Figure 6-2 Example: DRIVE-CLiQ line

- 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.

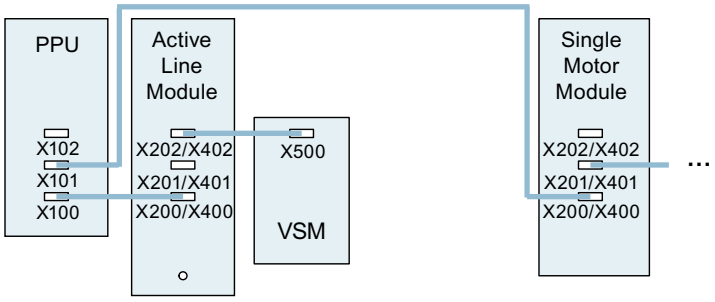


Figure 6-3 Example: Topology with VSM for booksize and chassis components

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

6.3 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:
SINAMICS S120 booksize				
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 83)
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 83)
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 83)
SINAMICS S120 Booksize with S120 Combi				
1	3 x Combi 1 x SMy at the Combi	not used	1 x TM54F 1 x hub DMx 2 x SMy at the hub DMx	---
2	3x Combi 1 x SMy at the Combi	1 x booksize compact	1 x TM54F 1 x hub DMx 3 x SMy at the hub DMx	---
3	4 x Combi 1 x SMy at the Combi	not used	1 x TM54F 1 x hub DMx 3 x SMy at the hub DMx	---
4	4 x Combi 1 x SMy at the Combi	1 x booksize compact	1 x TM54F 1 x hub DMx 4 x SMy at the hub DMx	---

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:
4	4 x Combi 1 x SMy at the Combi	2 x booksize compact	1 x TM54F 1 x hub DMx 5 x SMy at the hub DMx	---
6	1xCombi 3 x SMy at the Combi	2 x booksize compact 1 x TM54F 1 x hub DMx 5 x SMy at the hub DMx	1 x NX 15.3 1 x TM54F 1 x hub DMx 5 xSMy to hub DMx 1xCombi 2 x SMy at the Combi 2 x booksize compact	Topology with SINAMICS S120 Combi and booksize (Page 88)

Sinamics S120 with CU230

Number of axes	Port 1 at the PPU X100	Port 2 at the PPU X101	Port 3 at the PPU X102	Port 4 at the PPU PN1	Example in the figure
12+6	1 x LM 4 x MoMo 1 x SMy at the 1st MoMo 1 x SMy at the 2nd MoMo 3 x SMy at the 3rd MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMy at the hub DMx	1 x NX 15.3 1 xSMy to NX 15.3 6 x MoMo 1 x TM54F 1 x hub DMx 5 x SMy at the hub DMx	1 x CU320 6 x MoMo	Topology with SINAMICS S120 booksize and Nx15.3 12 axes and 6 axes with CU320 (Page 93)

6.4 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

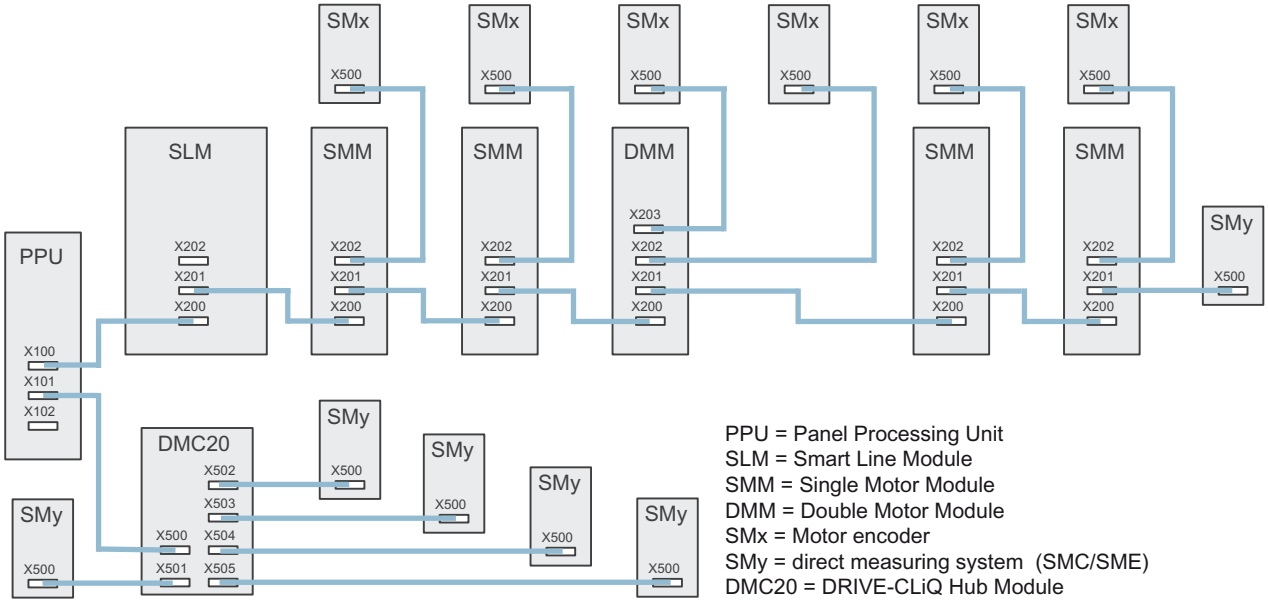


Figure 6-4 DRIVE-CLiQ wiring without NX

Topology for the maximum configuration with SINAMICS S120 booksize and 8 axes

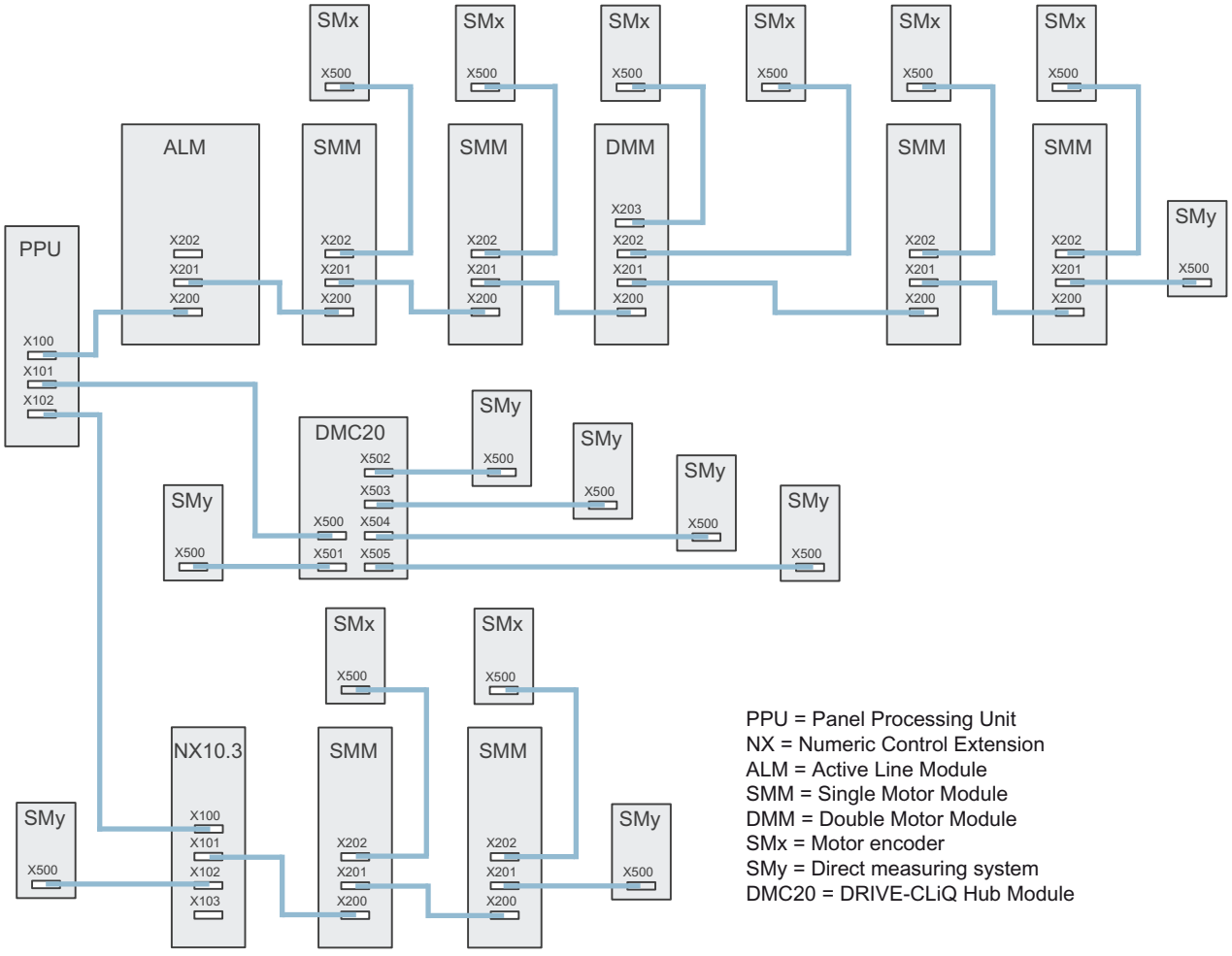


Figure 6-5 DRIVE-CLiQ wiring with NX10.3

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

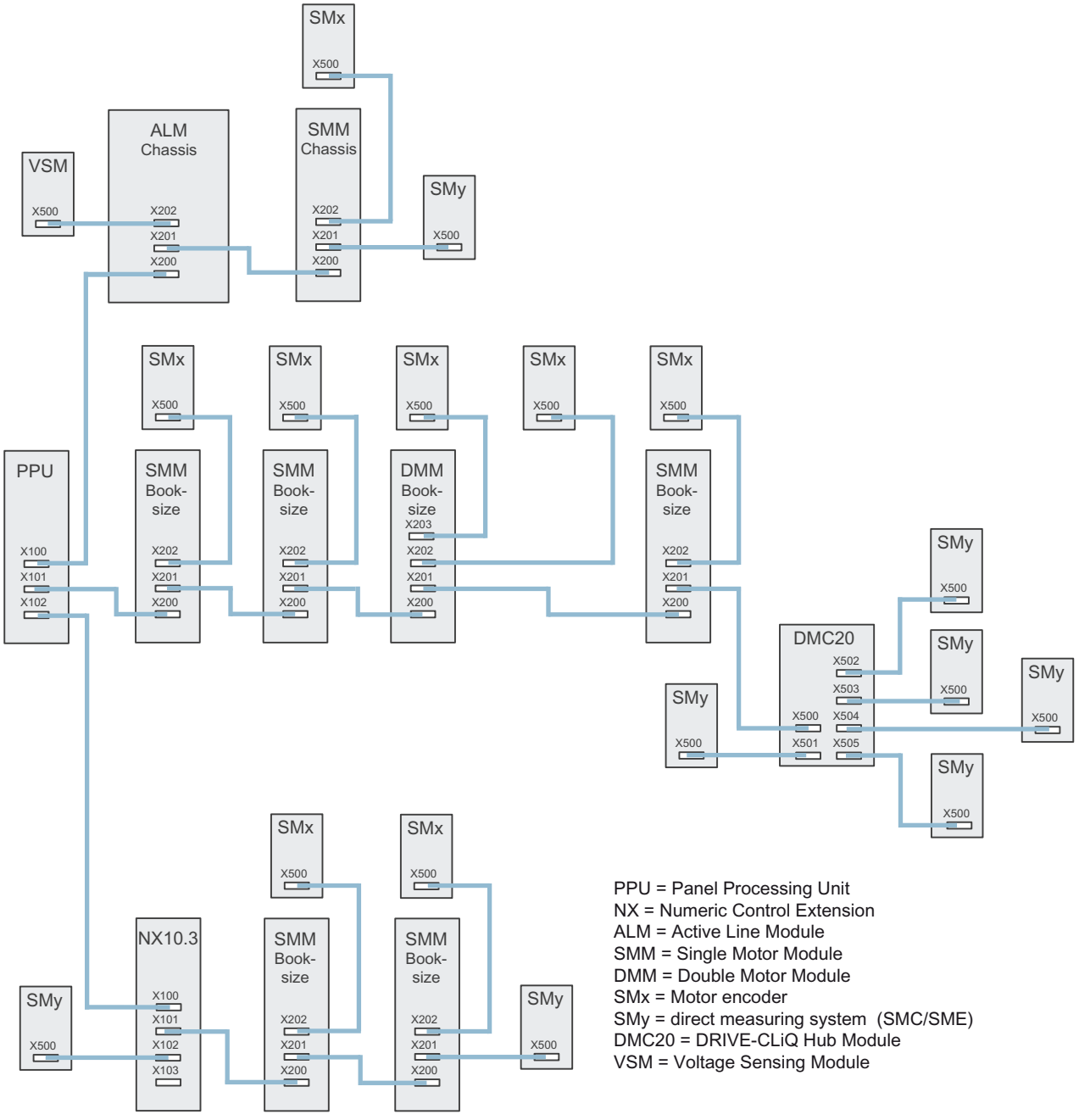
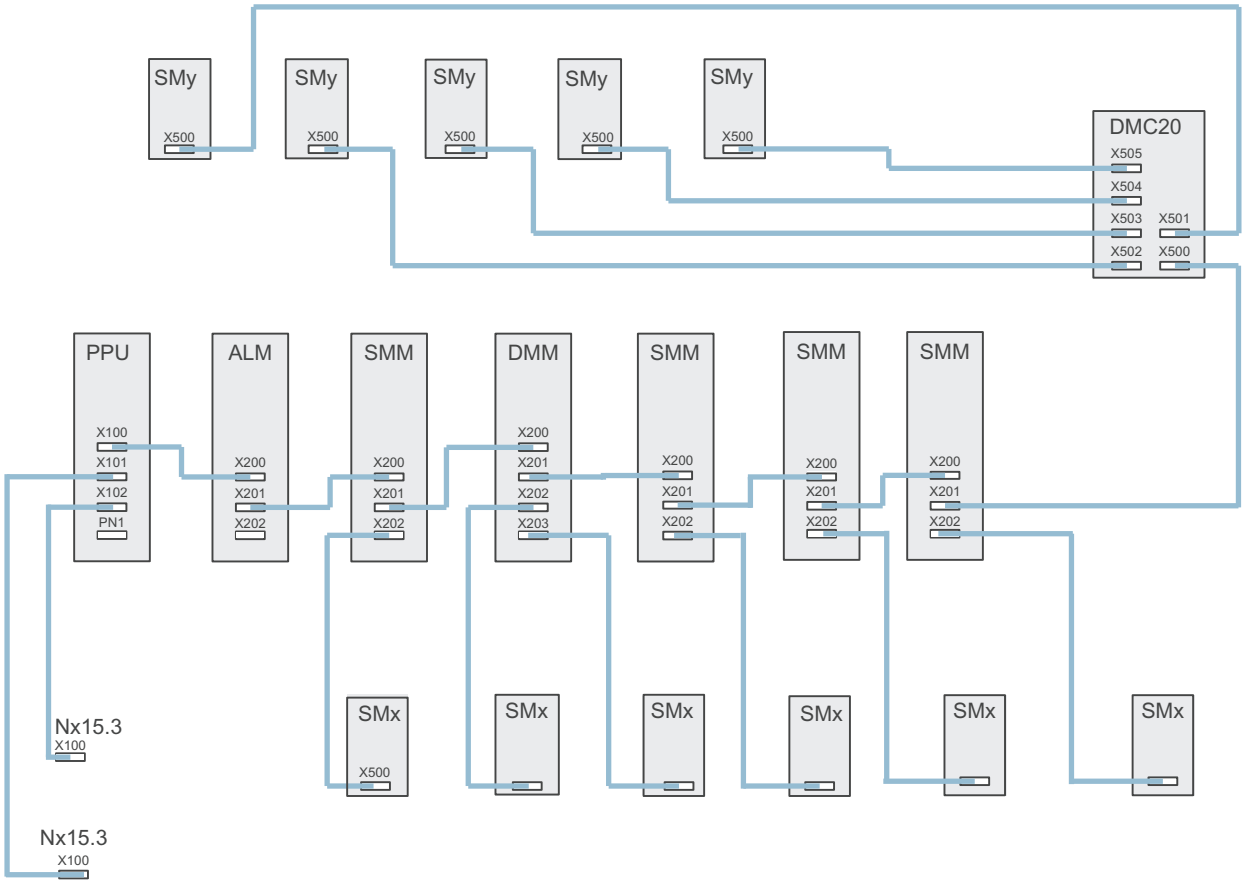
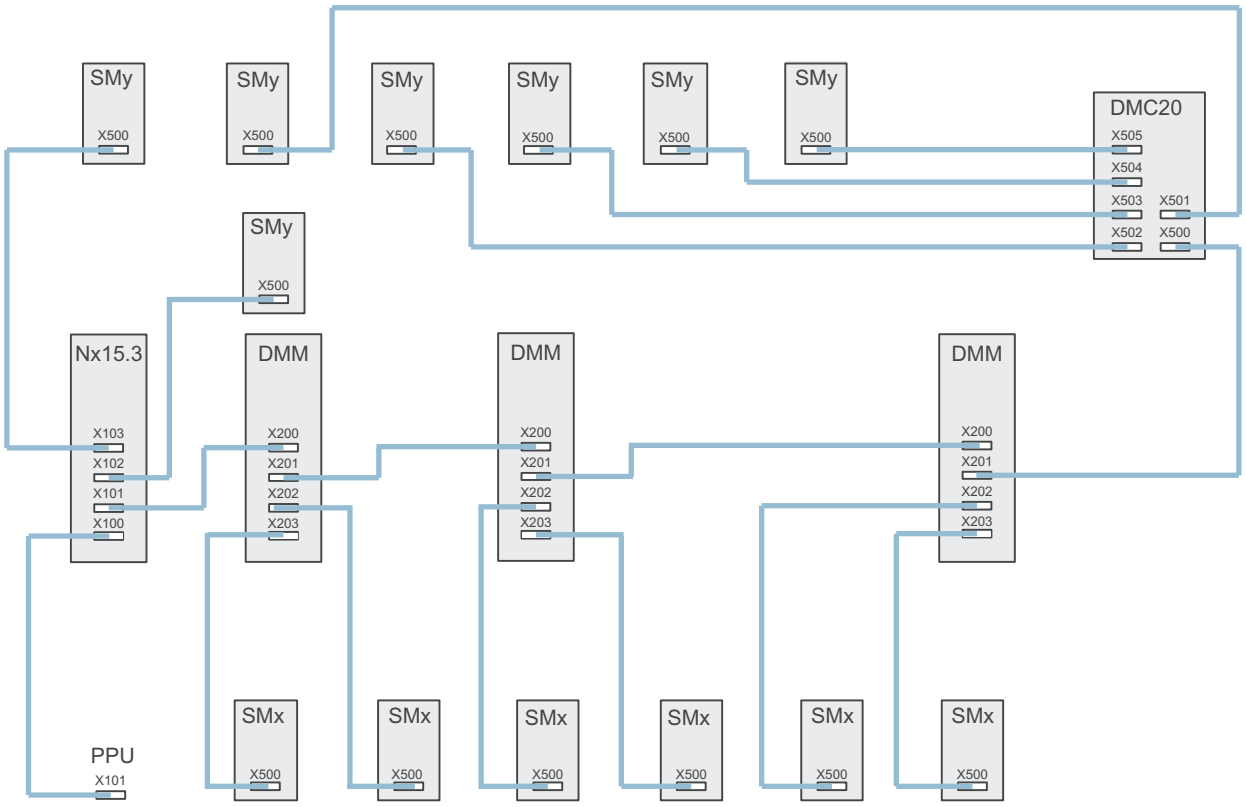


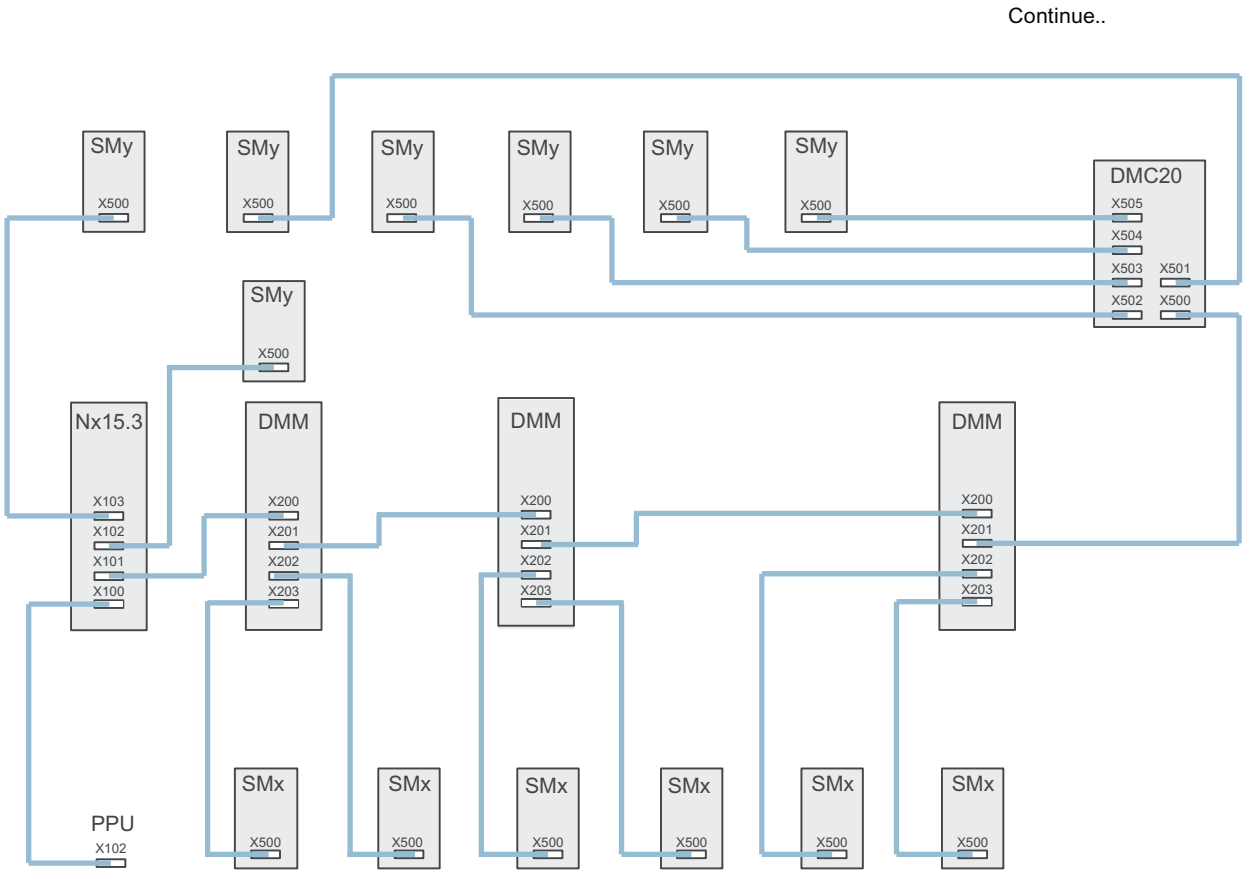
Figure 6-6 DRIVE-CLiQ wiring with NX10.3

Topology with 2 NX 15.3



Continue..


SMy
X500
SMy
X500
SMy
X500
SMy
X500
SMy
X500
SMy
X500
DMC20
X505
X504
X503
X501
X502
X500
SMy
X500
Nx15.3
X103
X102
X101
X100
DMM
X200
X201
X202
X203
DMM
X200
X201
X202
X203
DMM
X200
X201
X202
X203
PPU
X101
SMx
X500
SMx
X500
SMx
X500
SMx
X500
SMx
X500
SMx
X500



PPU = Panel Processing Unit
SMM = Single Motor Module
DMM = Double Motor Module
SMy = direct measuring system (SMC/SME)
DMC20 = DRIVE-CLiQ Hub Module
SMx = Motor encoder
NX = Numeric Control Extension
ALM = Active Line Module

Figure 6-7 DRIVE-CLiQ wiring with two NX15.3

6.5 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

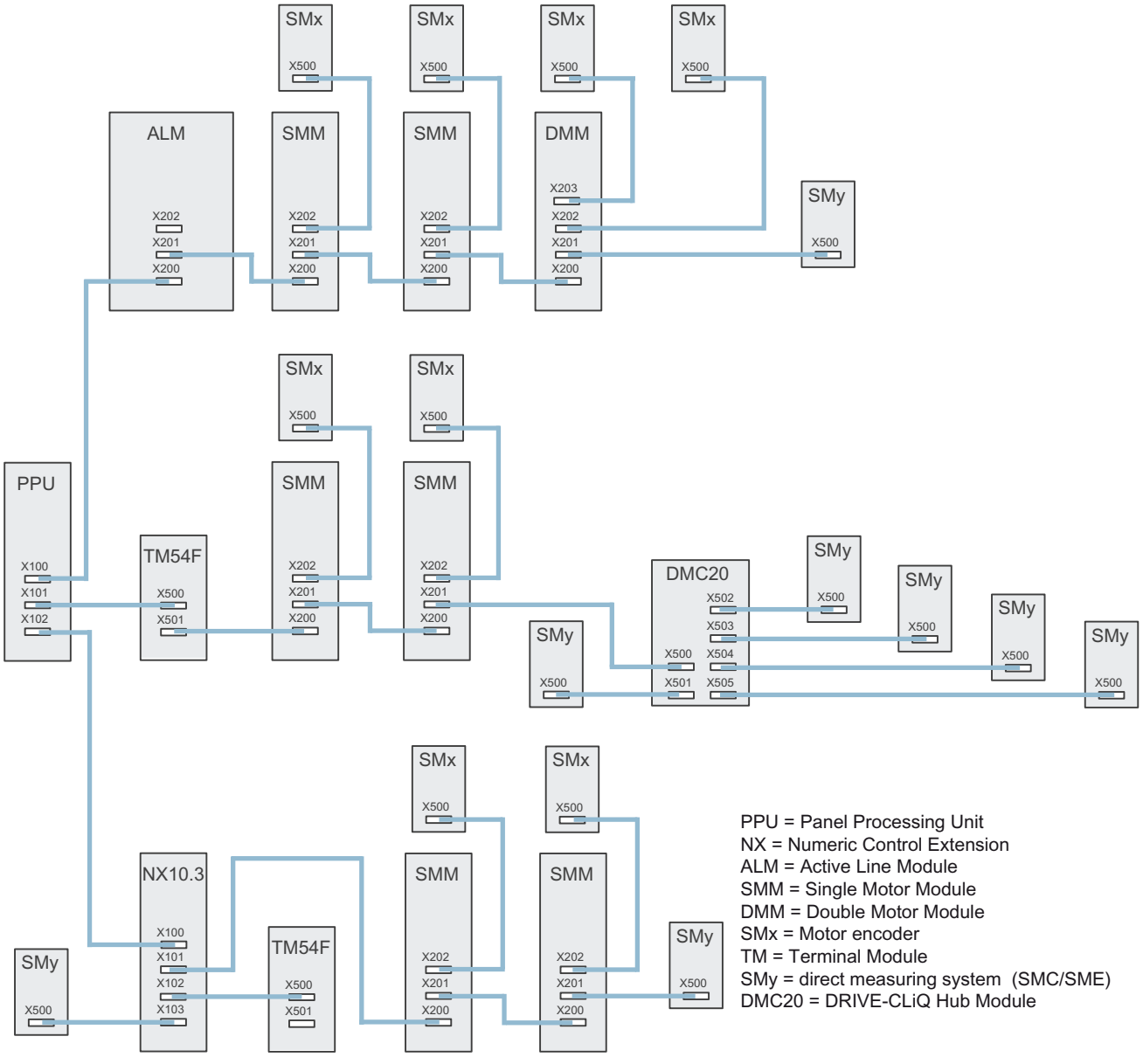


Figure 6-8 DRIVE-CLiQ wiring with Safety Integrated functions and NX10.3

Topology with SINAMICS S120 booksize and 5 plus 3 axes

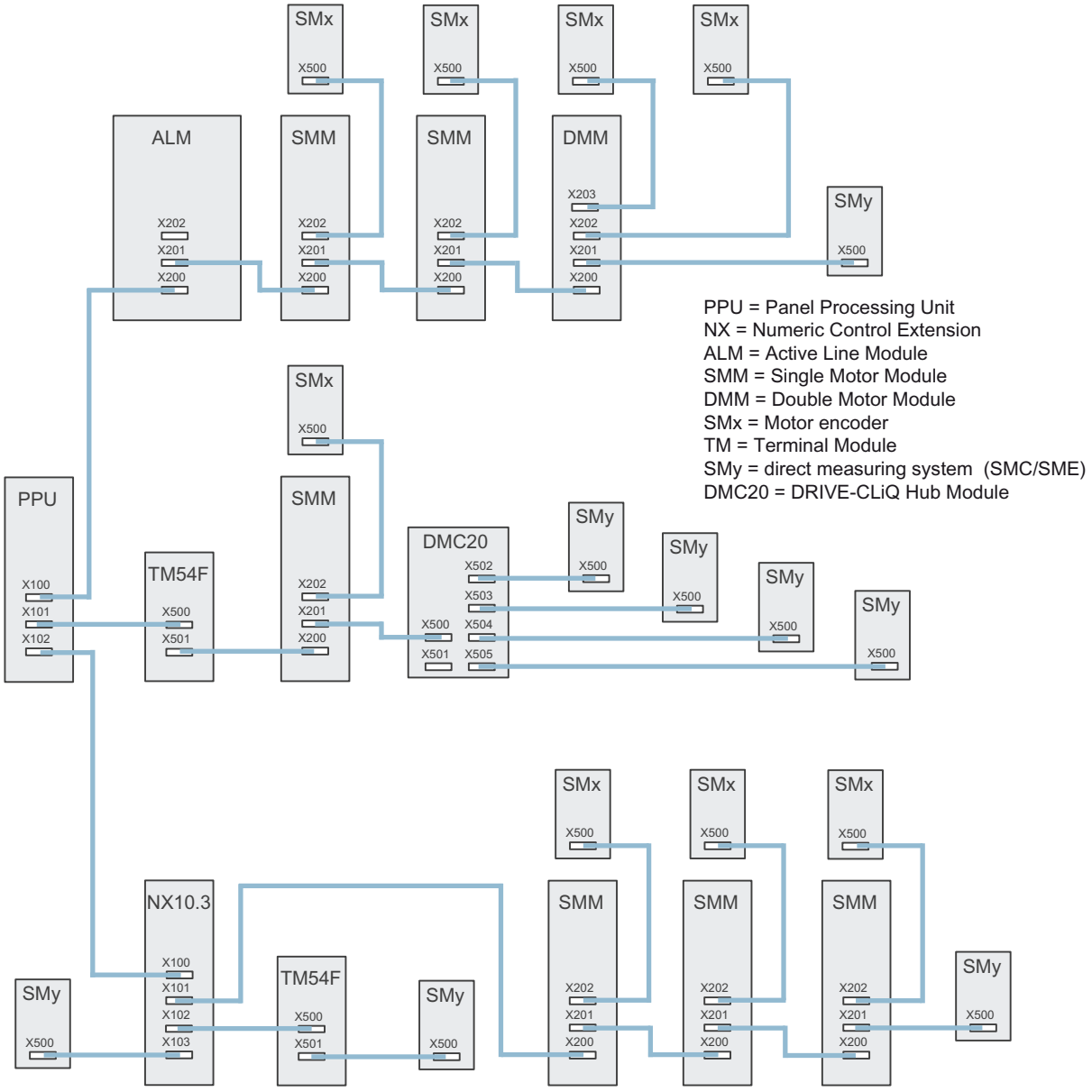


Figure 6-9 DRIVE-CLiQ wiring with Safety Integrated functions and NX10.3

Topology with SINAMICS S120 booksize and 6 plus 4 axes

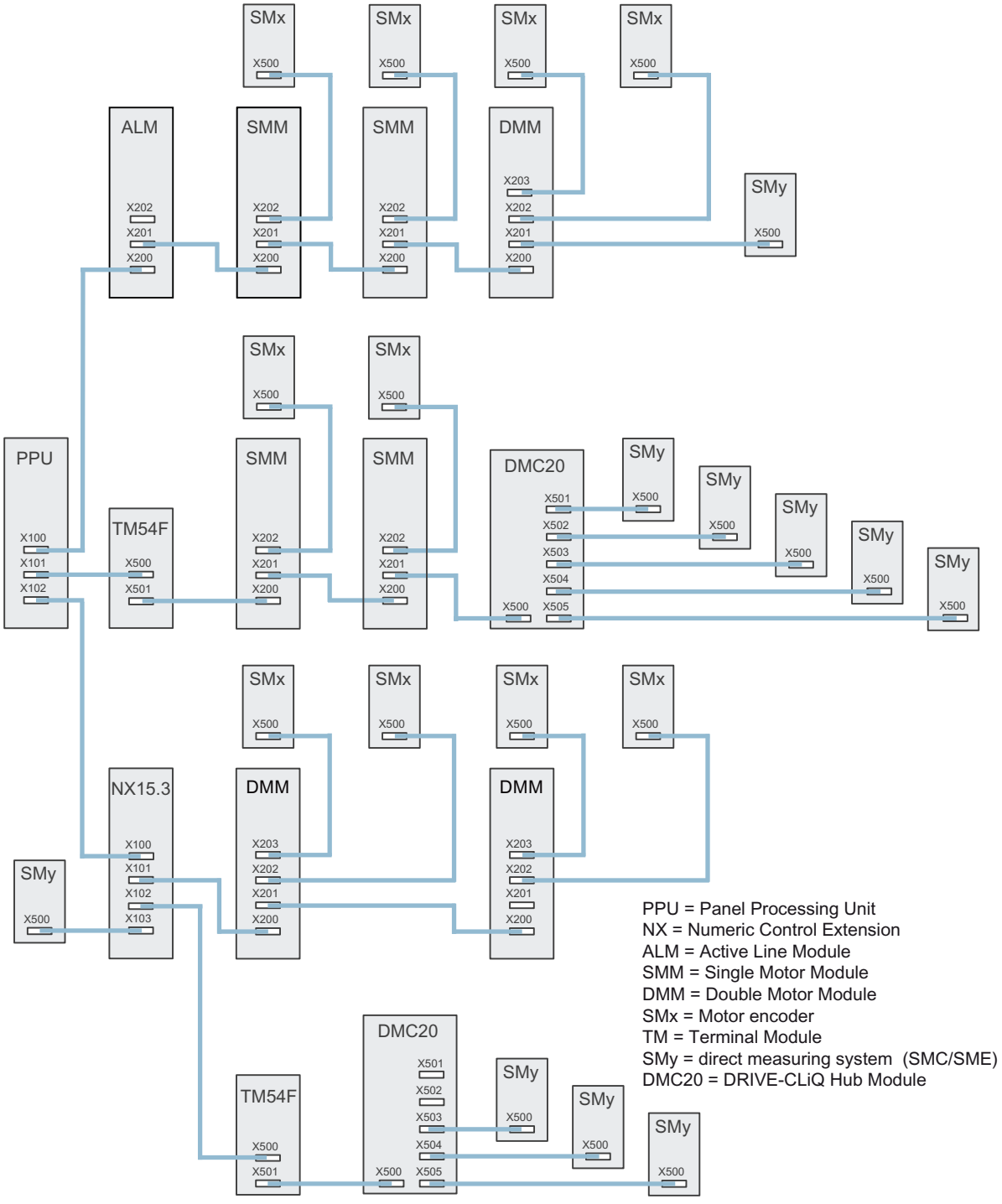


Figure 6-10 DRIVE-CLiQ wiring with Safety Integrated functions

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: Tireg/Tnreg = 125 µs, LM = 250 µs, monitoring cycle = 12 ms, Tdp = 1.5 ms

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

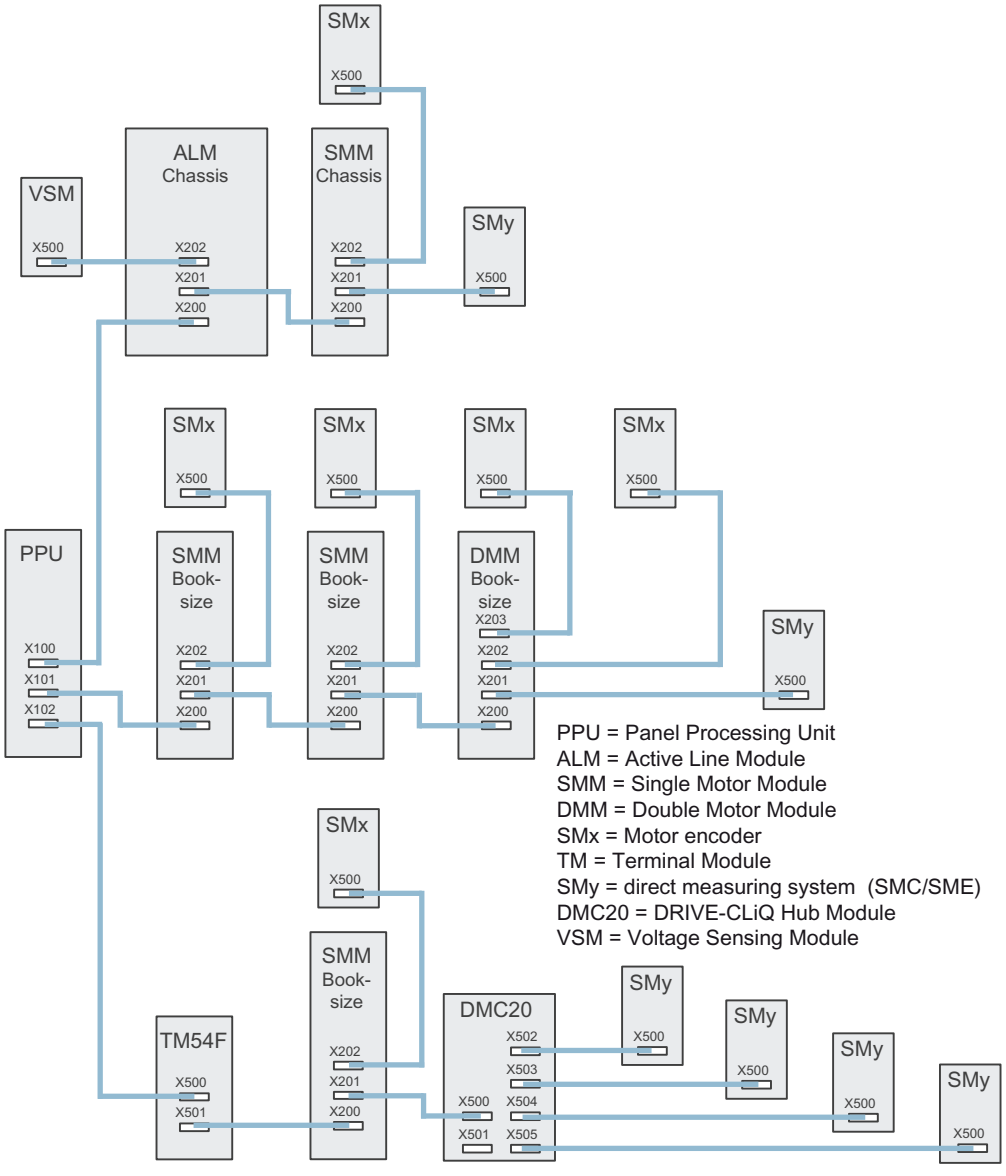


Figure 6-11 DRIVE-CLiQ wiring with Safety Integrated functions and without NX

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

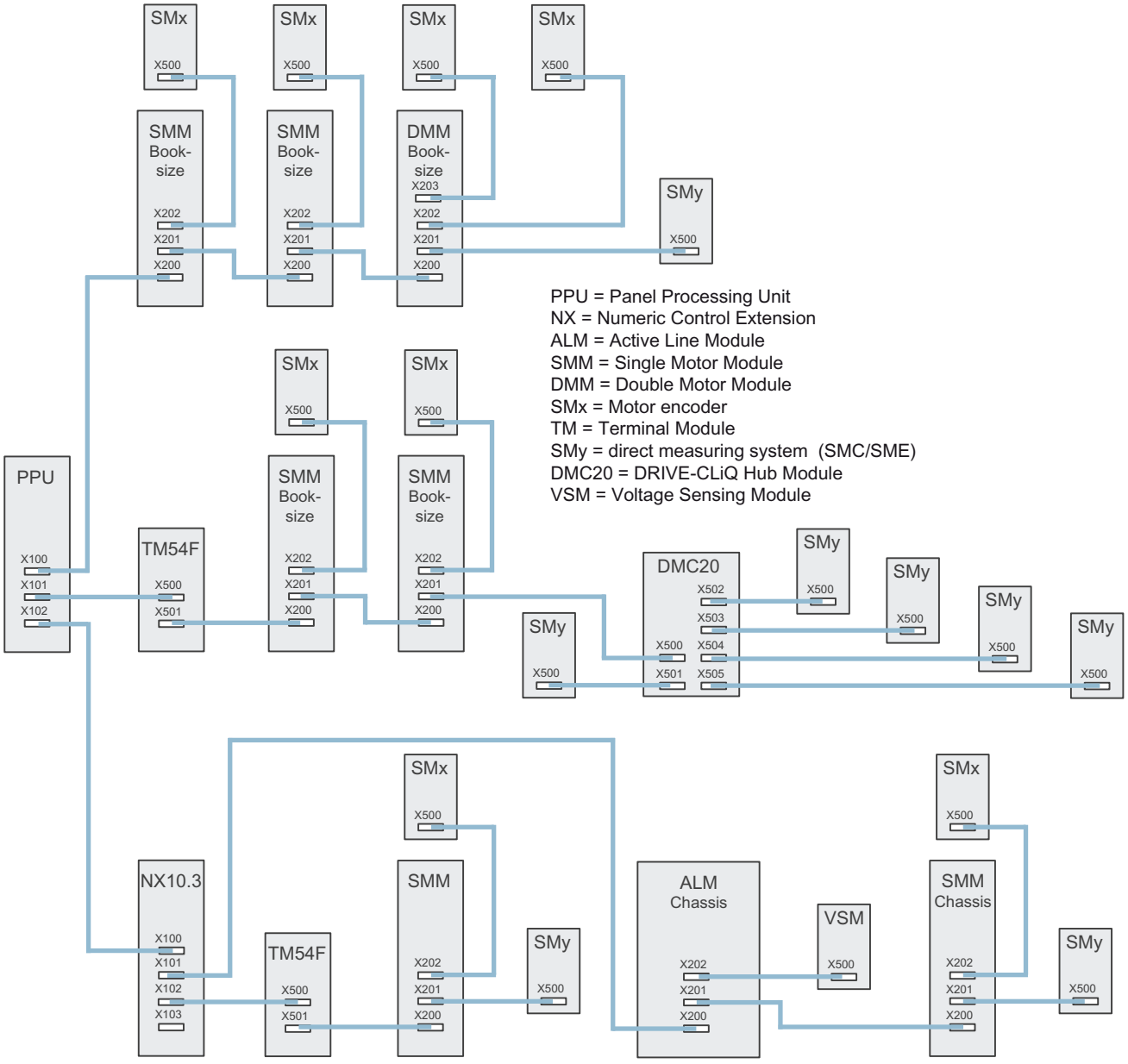


Figure 6-12 Example with Safety Integrated functions and with NX10.3

Note

You can find an example with SINAMICS S120 Combi and Safety Integrated functions under System overview (Page 43) or in the SINAMICS S120 Combi Manual.

Topology with SINAMICS S120 3-4 axis Combi and SINAMICS S120 compact modules

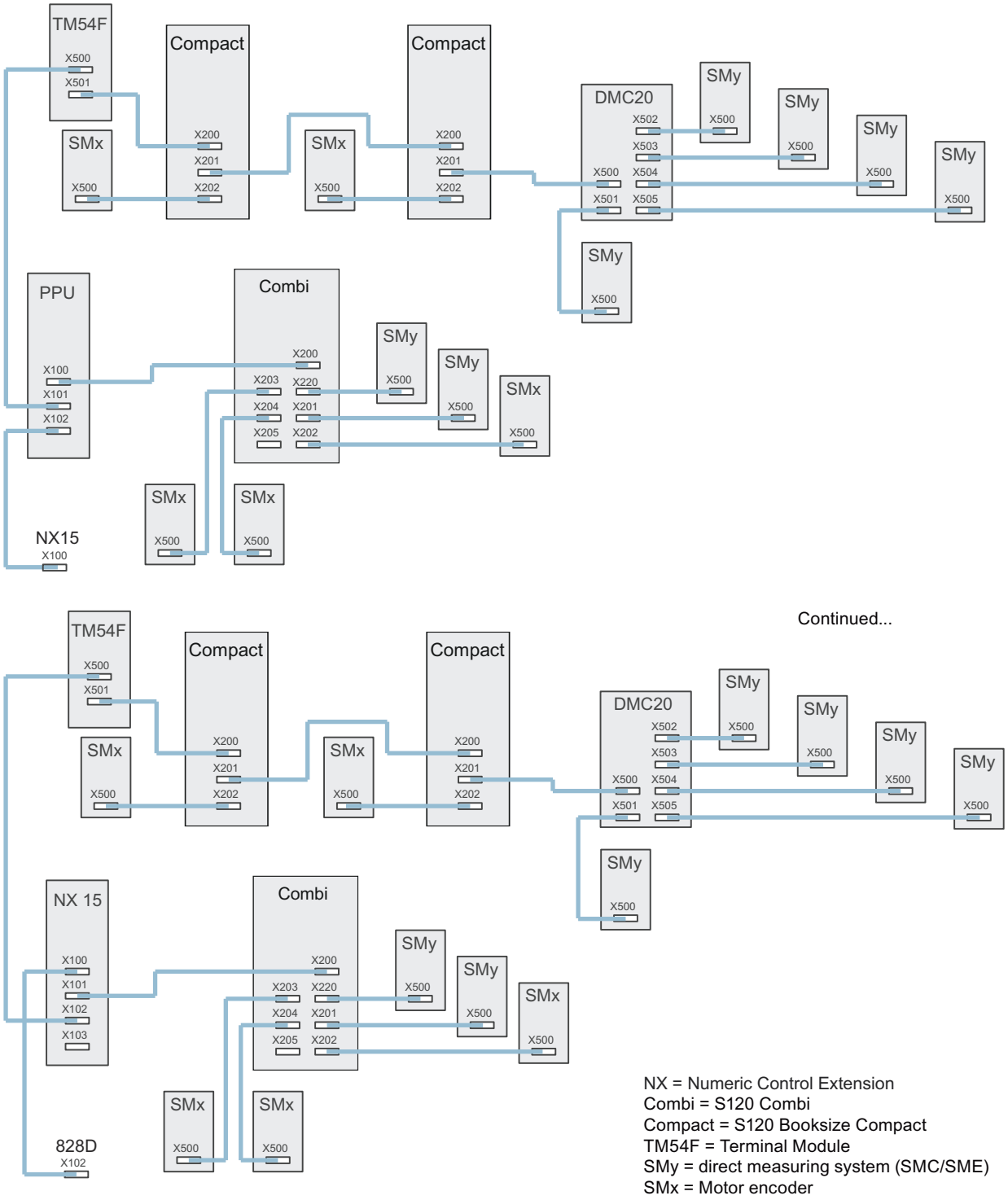
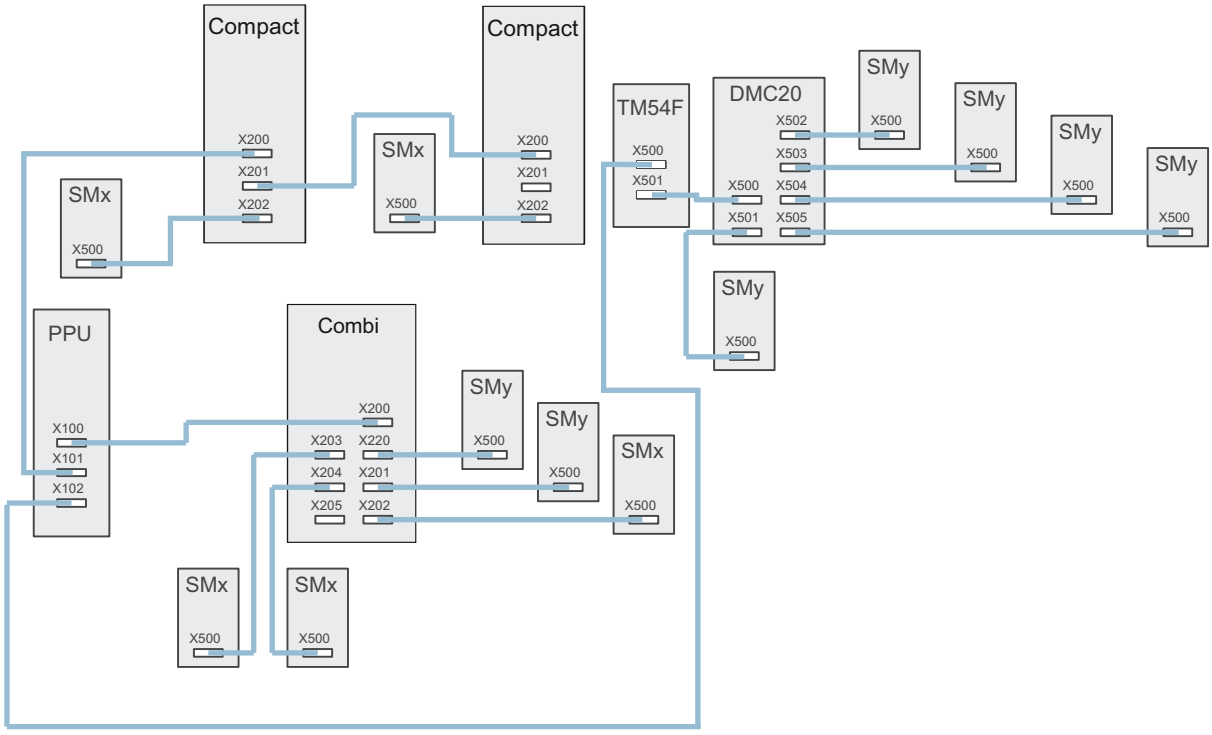


Figure 6-13 Example with Safety Integrated functions and with NX15.3

Topology with SINAMICS S120 booksize with 3 - 4 axis combi and 2 axis compact



NX = Numeric Control Extension
Combi = S120 Combi
Compact = S120 Booksize Compact
TM54F = Terminal Module
SMy = direct measuring system (SMC/SME)
SMx = Motor encoder

Figure 6-14 Topology with 3 -4 axis combi & 2 axis compact

Topology with SINAMICS S120 3-4 axis Combi and SINAMICS S120 booksize module

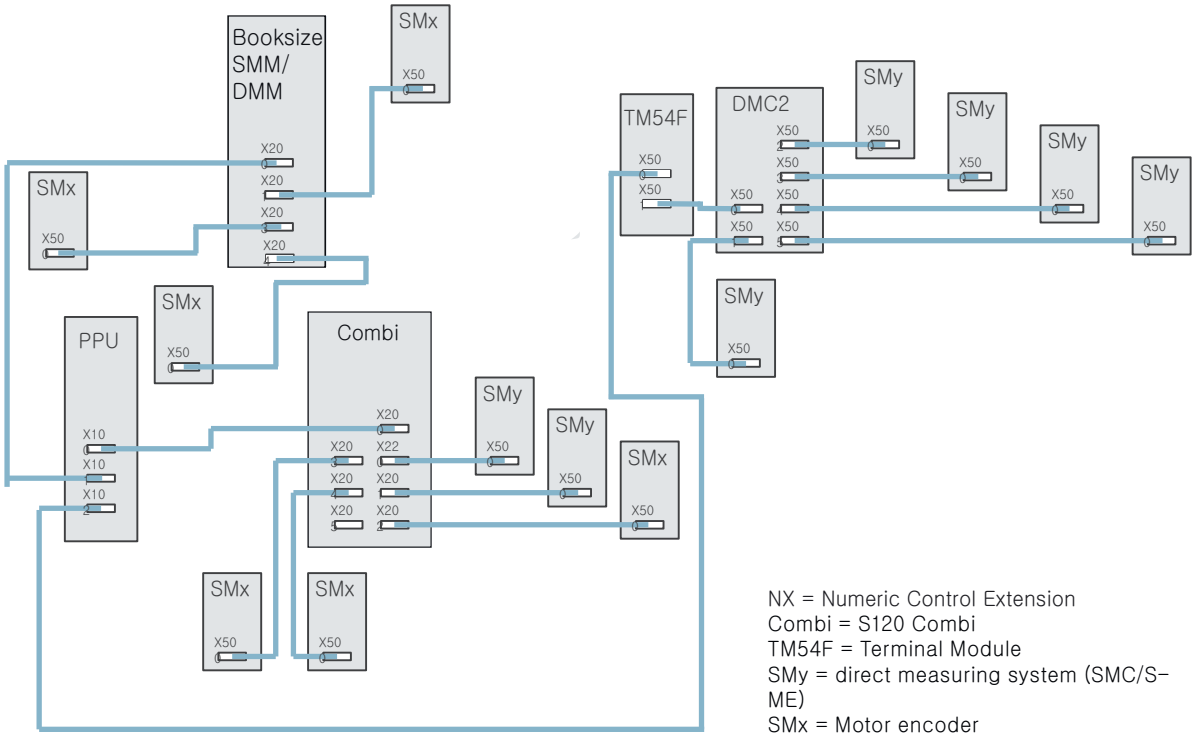
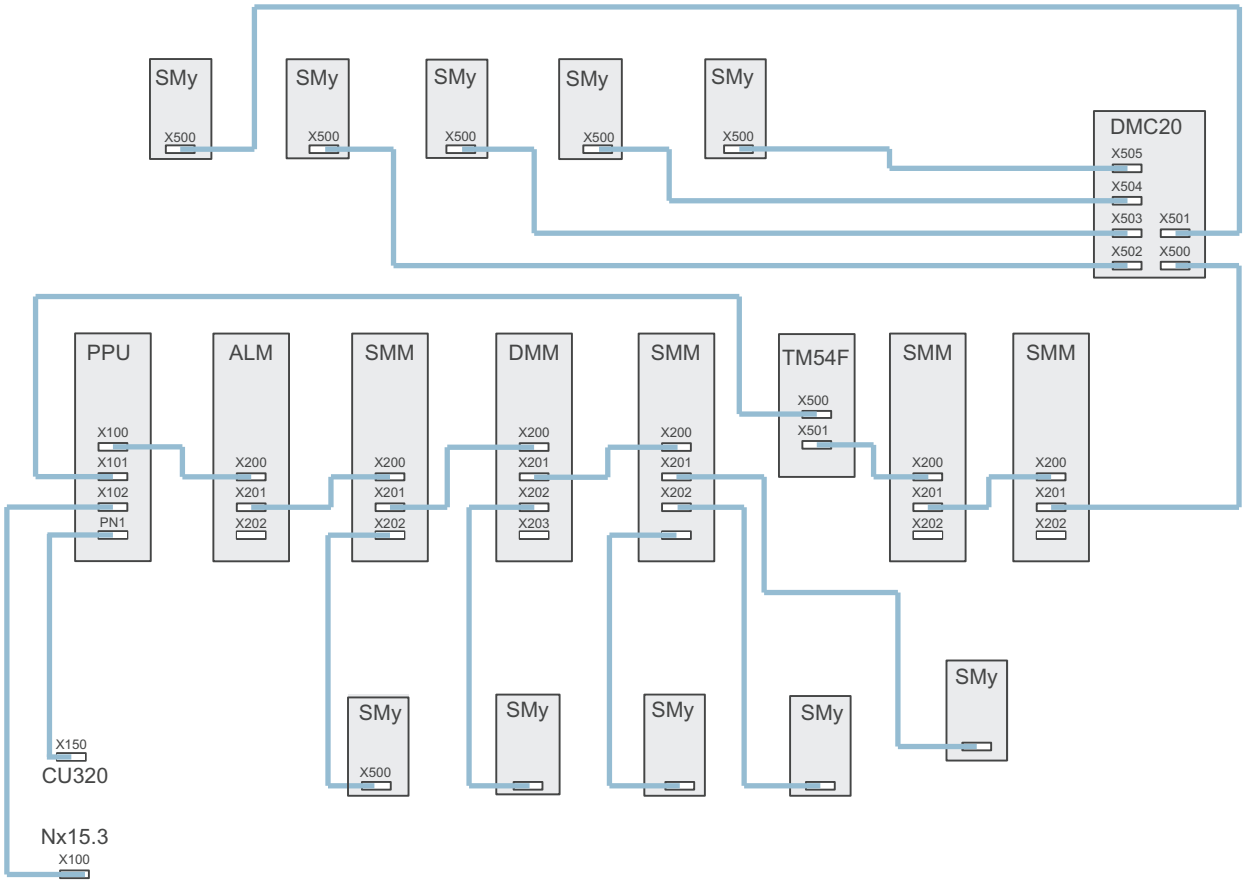
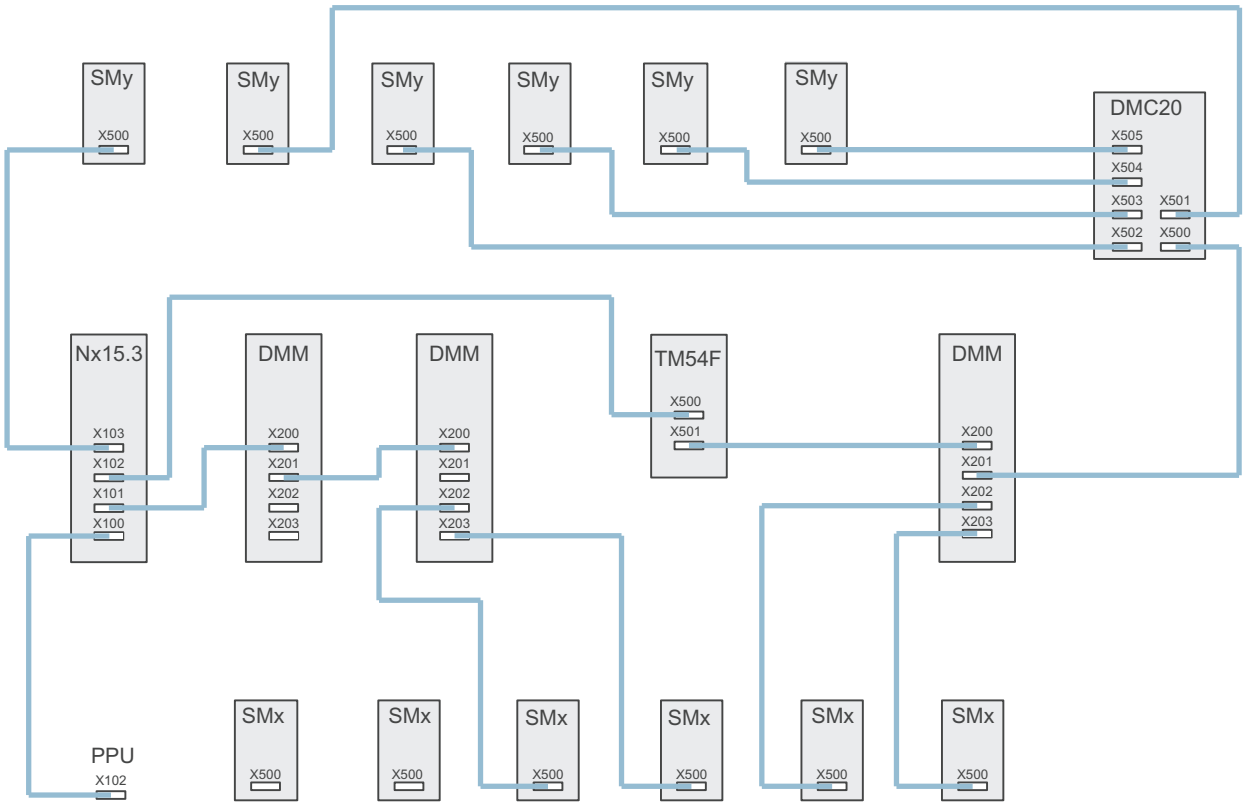


Figure 6-15 Topology with SINAMICS S120 3-4 axis Combi and SINAMICS S120 booksize module

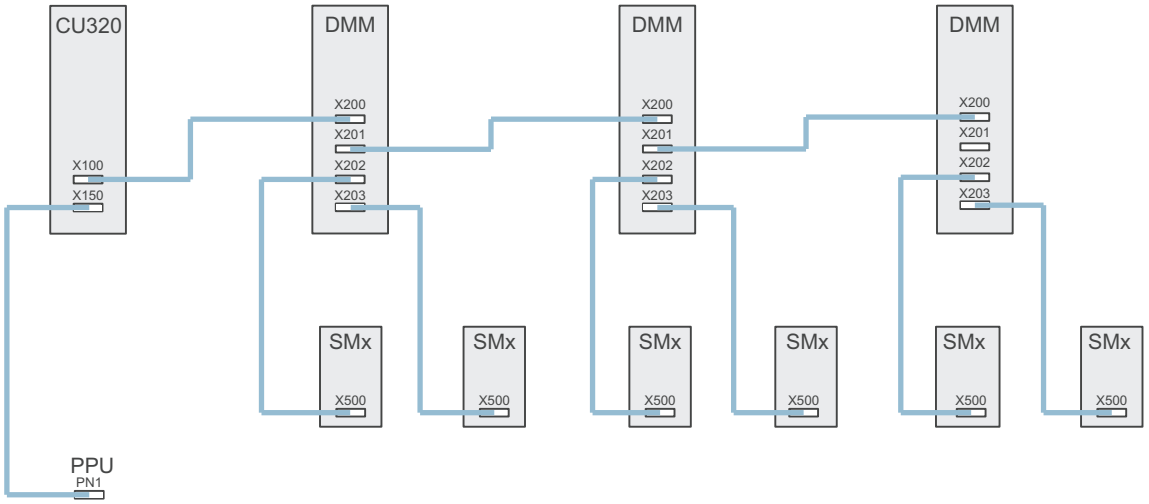
Topology with SINAMICS S120 booksize and Nx15.3 12 axes and 6 axes with CU320



Continue..


SMy
X500
SMy
X500
SMy
X500
SMy
X500
SMy
X500
SMy
X500
DMC20
X505
X504
X503
X501
X502
X500
Nx15.3
X103
X102
X101
X100
DMM
X200
X201
X202
X203
DMM
X200
X201
X202
X203
TM54F
X500
X501
DMM
X200
X201
X202
X203
PPU
X102
SMx
X500
SMx
X500
SMx
X500
SMx
X500
SMx
X500
SMx
X500

Continue...



PPU = Panel Processing Unit
NX = Numeric Control Extension
ALM = Active Line Module
SMM = Single Motor Module
DMM = Double Motor Module
TM = Terminal Module
SMy = direct measuring system (SMC/SME)
DMC20 = DRIVE-CLiQ Hub Module
SMx = Motor encoder

Figure 6-16 Example with Safety Integrated functions and with NX15.3, CU320

Interface description

7

7.1 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:

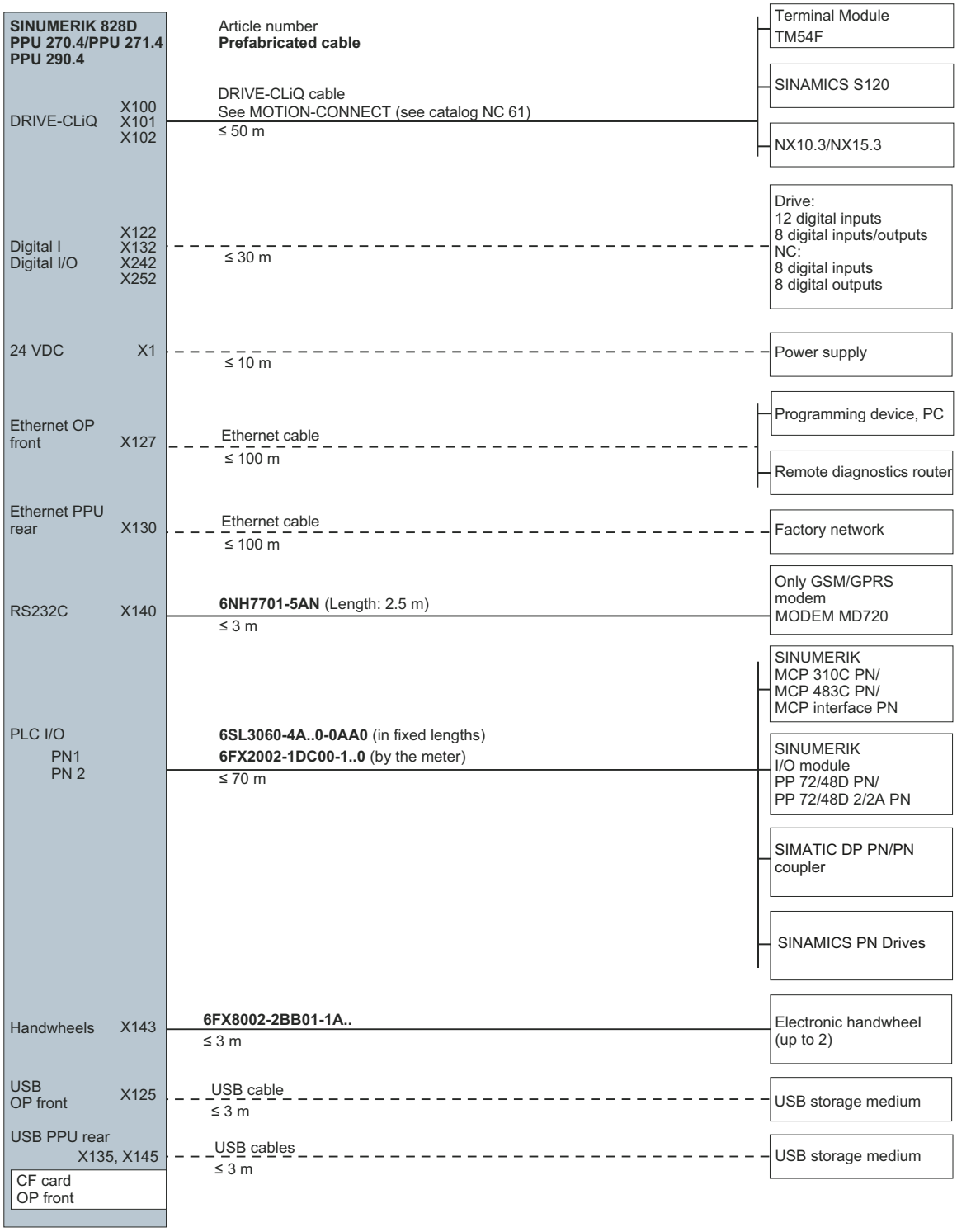
B	Bidirectional
GND	Grounding
I	Input
O	Output
VI	Voltage input (supply voltage)
VO	Voltage output (supply voltage)

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:



7.2 Power supply connection

7.2.1 Requirements for the power supply

Pin assignment at X1 screw-type terminal block

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.

Parameter	Values
Typical current consumption (PPU only: Processor, memory)	1.2 A
Max. current consumption (PPU with full load, e.g. USB, handwheels)	2.5 A
Maximum switch-on current	4.4 A

⚠ 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" (https://support.industry.siemens.com/cs/de/de/view/60612658/en) Configuration Manual.

Table 7-1 Technical data of the DC power supply

Rated voltage	According to EN 61131-2	24 VDC
	Voltage range (mean value)	20.4 VDC to 28.8 VDC
	Voltage range (dynamic)	18.5 VDC to 30.2 VDC
	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

7.2.2 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.

WARNING

Temperature specification

Use cables rated temperature as at least 80°C for power supply.

The supply for the 24 V DC load power supply is wired to screw terminal block X1:

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

If you only use one wire per connection, then an end sleeve is not required.

The following conductor end sleeves are permissible: Without an insulating collar in accordance with DIN 46228, Form A, long version

Use flexible cables with a cross-section of 0.25 to 2.5 mm^2 (or AWG 23 to AWG 13) for wiring the power supply according to the maximum current that flows.

7.3 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 1000 Mbit:

- X130 connects the PPU to the company network.
  - IP address can be freely selected
  - MAC address, see also: PPU versions (Page 28)
- X127 for a peer-to-peer connection with permanently set IP address 192.168.215.1, e.g. for access with Access MyMachine /P2P via PG/PC.

LED 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:

LEDs	Status	Meaning
Green	Lit	1000 Mbit link available
	Off	Missing or faulty link
Yellow	Lit	Receive or transmit activity
	Off	No activity

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.

7.4 PLC I/O Interface based on PROFINET

PN1, PN2 pin assignment

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 "PPU versions (Page 28)". The same applies for the MAC addresses of the operator components.

To connect IO devices (IO module, machine control panel) to the control system (IO controller), use the prefabricated SINAMICS S120 DRIVE-CLiQ signal cables that are also technically suitable for PLC I/O interfaces:

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

LED displays on the front

The three LEDs located behind the front flap (not for PPU290.4) 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 condition: • When powering up, if NC Ready is not yet available • Critical fault (power off/on necessary)
NC	Yellow	Cyclic flashing	NC operation
CF	Yellow	Lights up	Access to 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.

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	This state is not relevant for the diagnostics if I/O modules, machine control panels and PN/PN couplers are connected to the control.
		Red	Bus fault: • No physical connection to a subnet/switch • Incorrect transmission rate • Full duplex transmission is not activated
		Flashing red (2 Hz)	With the SINUMERIK 828D, this does not indicate an incorrect response.

Name	Color	Status	Meaning
Sync	Green	Off	The task system is not synchronized to the send cycle of PLC I/O interface. An internal substitute cycle of the same size as the send cycle will be generated.
		Green	The task system has been synchronized to the cycle for PLC I/O Interface, and data exchange is running.
		Flashing green (0.5 Hz)	The task system has been synchronized to the cycle for PLC I/O Interface. The cyclic data exchange is running.

7.5 Digital inputs/outputs

X122 pin assignment

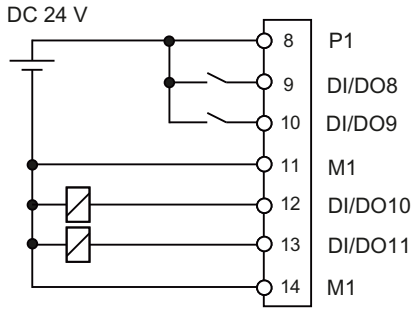
Pin		Signal name	Meaning
1	DI0	DI0	Digital input 0
2	DI1	DI1	Digital input 1
3	DI2	DI2	Digital input 2
4	DI3	DI3	Digital input 3
5	DI16	DI16	Digital input 16
6	DI17	DI17	Digital input 17
7	M2	MEXT2	Ground for pins 1...6
8	P1	P24EXT1	+24 V power supply
9	IO8	DI/DO8	Digital input/output 8
10	IO9	DI/DO9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

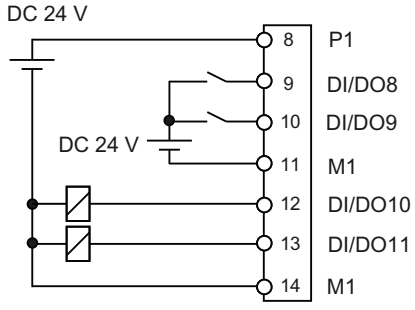
Pin		Signal name	Meaning
1	DI4	DI4	Digital input 4
2	DI5	DI5	Digital input 5
3	DI6	DI6	Digital input 6
4	DI7	DI7	Digital input 7
5	DI20	DI20	Digital input 20
6	DI21	DI21	Digital input 21
7	M2	MEXT2	Ground for pins 1...6
8	P1	P24EXT1	+24 V power supply
9	IO12	DI/DO12	Digital input/output 12
10	IO13	DI/DO13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

Connecting the inputs and outputs:

- **Recommended connection: Inputs and outputs connected to the same supply**
  If both inputs and outputs are operated with the same 24 V supply.



- Not recommended connection: Inputs and outputs on different supplies



NOTICE
Exceeding the permissible input current If the inputs and outputs are supplied separately with power, the input current can exceed the permissible value of 15 mA according to EN61131-2, and the signal source can be overloaded.

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
11	M3	MEXT3		Ground for pins 9, 10, 12, 13

Pin		Signal name	NC variable	Meaning
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 axis/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 axis/spindle: Digital NC output 11 • With analog axis/spindle: Controller enable in accordance with MD30134 $MA_IS_UNIPOLAR_OUTPUT
13	O12	DOUT12	--	• Without analog axis/spindle: Digital NC output 12 • With analog axis/spindle: Traversing direction in accordance with MD30134 $MA_IS_UNIPOLAR_OUTPUT
14	M3	MEXT3		Ground for pins 9, 10, 12, 13

NOTICE

Shielded signal cables for analog signals

To ensure safe, fault-free operation of the system, shielded cables with shield connection should be used for the wiring of the analog outputs.

(See also: EMC compatibility (Page 49))

Use

The following assignment applies to the terminals:

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

The following twelve inputs and eight inputs/outputs are used for drive control:

- At terminal X242, four inputs and four outputs are available for the NC.
- At terminal X252, four inputs and two outputs are available for the NC.

Note

Terminals MEXT1 ... MEXT4 must be connected for the digital inputs/outputs to function.

- Connect the incorporated ground reference of the digital inputs.
- Connect 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 connected to terminal P at X1. This removes the galvanic isolation for these digital inputs.

An open input is interpreted as "low".

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 mm^2
- 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 mm^2 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.

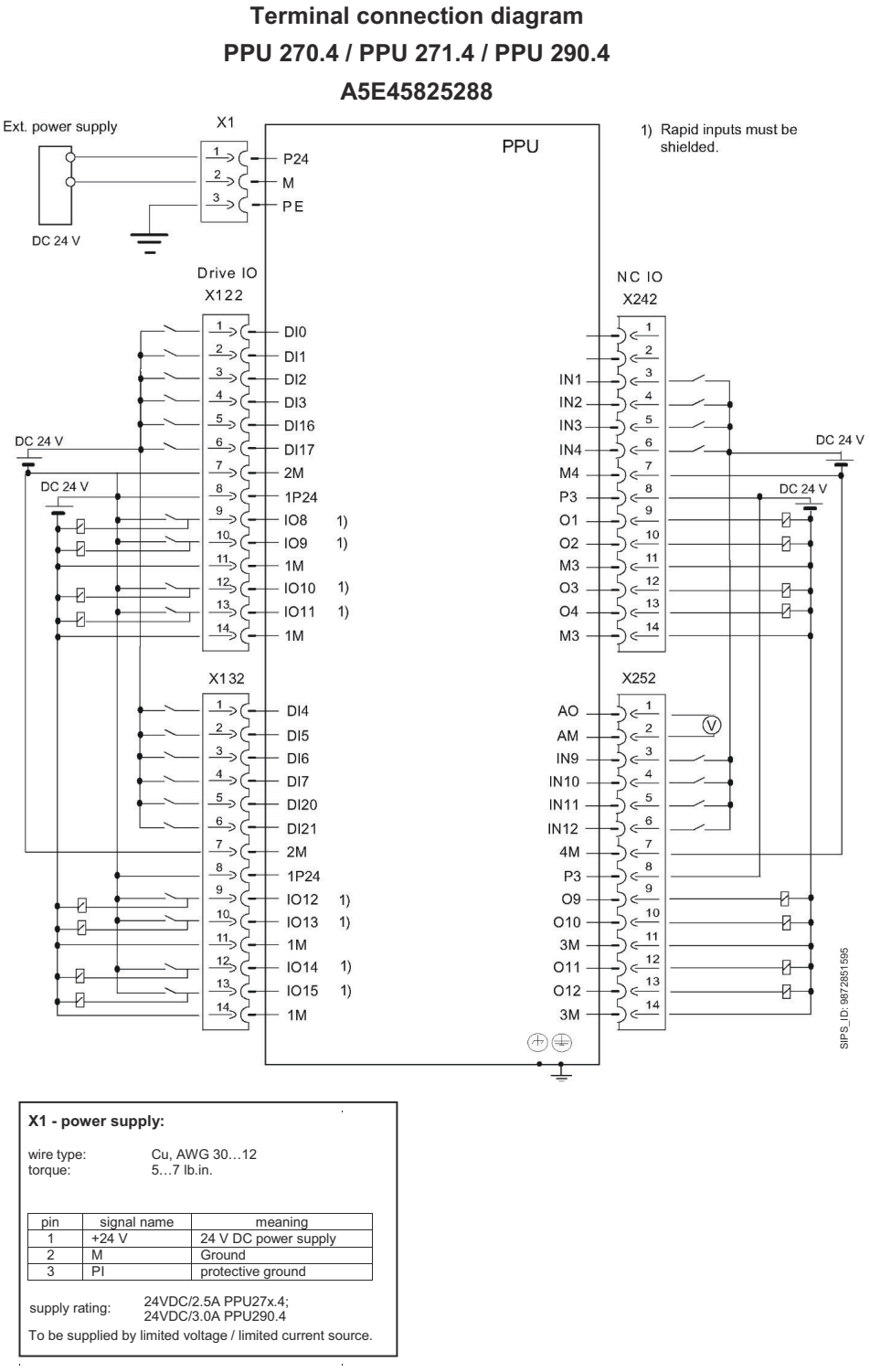
3. Wire the digital outputs of the interface for connection of the actuators.
4. Insert the cable into the corresponding screw terminal.

References

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

7.5.1 Terminal connection diagram

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



X1 - power supply:

wire type: Cu, AWG 30…12
torque: 5…7 lb.in.

pin	signal name	meaning
1	+24 V	24 V DC power supply
2	M	Ground
3	PI	protective ground

supply rating: 24VDC/2.5A PPU27x.4;
24VDC/3.0A PPU290.4

To be supplied by limited voltage / limited current source.

Figure 7-1 Terminal connection diagram for digital inputs/outputs

X122, X132 - digital inputs / outputs:

connector type: BCZ 3.81/14/180 SN by Weidmüller or equal / compatible
Interface wire type: Cu, AWG 14…30
torque: 2…4 lb.in.

pin	pin assignment:signal name	signal type	meaning
1	DI 0 / DI 4	I	digital input
2	DI 1 / DI 5	I	digital input
3	DI 2 / DI 6	I	digital input
4	DI 3 / DI 7	I	digital input
5	DI 16 / DI 20	I	digital input
6	DI 17 / DI 21	I	digital input
7	2M	GND	ground for pins 1…6
8	1P24EXT	VI	power supply for pins 9,10,12,13
9	DI O8 / O12 / NO4	B	digital input / output
10	DI O9 / O13 / NO5	B	digital input / output
11	1M	GND	ground for pins 9,10,12,13
12	DI O10 / O14 / NO6	B	digital input / output
13	DI O11 / O15 / NO7	B	digital input / output
14	1M	GND	ground for pins 9,10,12,13
I=input; B=bidirectional; GND=reference potential; VI= voltage input			

input rating: 24Vdc
output rating: 24Vdc / 0.5 A
To be supplied by limited voltage / limited current source.

X242, X252 - digital inputs / outputs:

connector type: BCZ 3.81/14/180 SN by Weidmüller or equal / compatible
Interface wire type: Cu, AWG 14…30
torque: 2…4 lb.in.

pin	pin assignment:signal name	signal type	meaning
1	AO (X242 only)	VO	analog out +/- 10V
2	AGND (X242 only)	GND	analog ground
3	IN 1 / IN 9	I	digital input
4	IN 2 / IN 10	I	digital input
5	IN 3 / IN 11	I	digital input
6	IN 4 / IN 12	I	digital input
7	4M	GND	ground for pins 1…4
8	3P24	VI	power supply for pins 9,10,12,13
9	OUT 1 / OUT 9	O	digital input / output
10	OUT 2 / OUT 10	O	digital input / output
11	3M	GND	ground for pins 9,10,12,13
12	OUT 3 / OUT 11	O	digital input / output
13	OUT 4 / OUT 12	O	digital input / output
14	3M	GND	ground for pins9,10,12,13
I=input; O=output; GND=reference potential; VI= voltage input; VO=voltage output			

input rating: 24Vdc
output rating: 24Vdc / 0.5 A
To be supplied by limited voltage / limited current source.

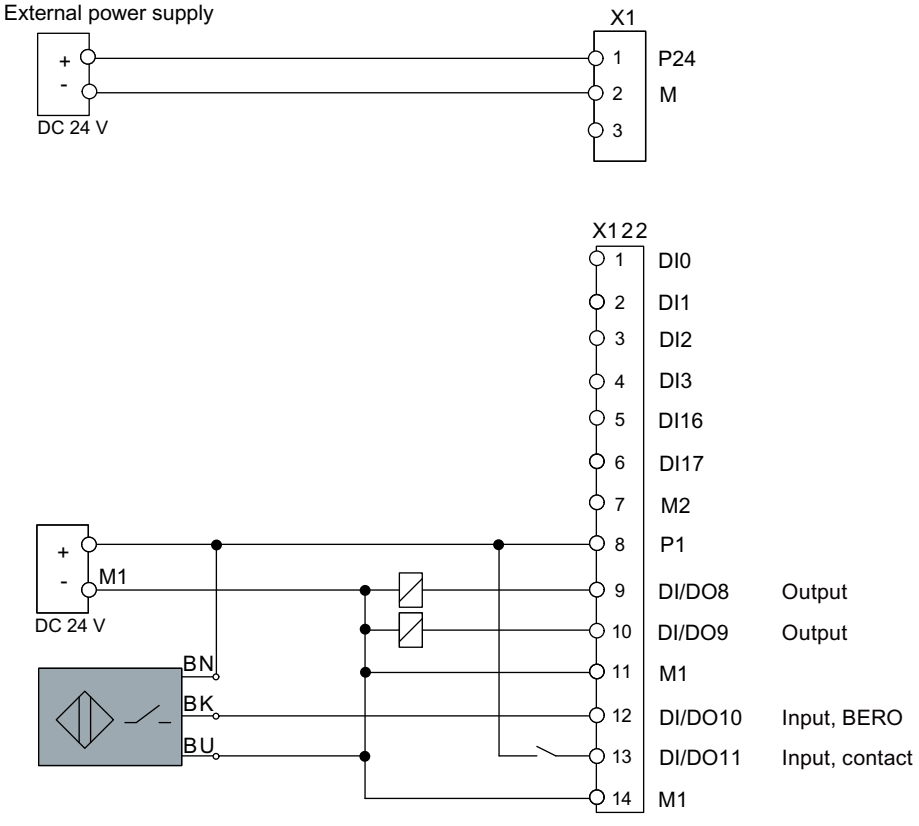
Maximum ambient temperature 45°C.
For use on a flat surface in a type 1 enclosure.
For use in pollution degree 2 environment only.

7.5.2 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.



BK	(black)	Signal
BU	(blue)	- supply
BN	(brown)	+ supply

Figure 7-2 Connection to X122

7.5.3 Technical data

Digital inputs

Parameter	Value
Voltage	-3 V to 30 V
Typical power consumption	2.5 mA at 24 VDC
Signal level (including ripple)	High: 15 V to 30 V Low: -3 V to 5 V
Maximum signal propagation times	L → H: maximum 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 outputs

Parameter	Value
Voltage	18 V to 30 V
Load current per output, maximum	0.5 A
Load current per connector, maximum	1 A
Maximum signal propagation times	L → H: 50 µs H → L: 300 µs for 10 kΩ load
Galvanic isolation	Yes: The reference potential is terminal 3M/3P24 (24 VDC)

Bidirectional digital inputs/outputs

Parameter	Value
As input:	
Voltage	-3 V to 30 V
Typical power consumption	2.5 mA at 24 VDC
Signal level (including ripple)	High: 15 V to 30 V Low: -3 V to 5 V
Maximum signal propagation times (fast inputs)	L → H: 10 µs H → L: 150 µs
Galvanic isolation	Yes: The reference potential is terminal 1M.
As output:	
Voltage	18 V to 30 V
Maximum output current for one load (resistive)	0.5 A
Maximum output current for one connector (resistive)	1 A

Parameter	Value
Maximum signal propagation times	L → H: 50 µs H → L: 300 µs for 10 kΩ load
Galvanic isolation	Yes: The reference potential is terminal 1M/1P24 (24 VDC)

7.6 DRIVE-CLiQ

7.6.1 DRIVE-CLiQ interface

X100 - X102 pin assignment

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 69)
- Topology rules for S120 Booksize (Page 71)
- Topology rules for Safety Integrated functions (Page 75)
- Topology example without Safety Integrated functions (Page 77)
- Topology example with Safety Integrated functions (Page 83)

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

7.6.2 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.

7.7 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. three handwheels. You can connect two handwheels to the PPU. You can connect an additional handwheel to the machine control panel, see X111, X222, X333 digital inputs/outputs (Page 252).

The signals can be transferred using the following technique:

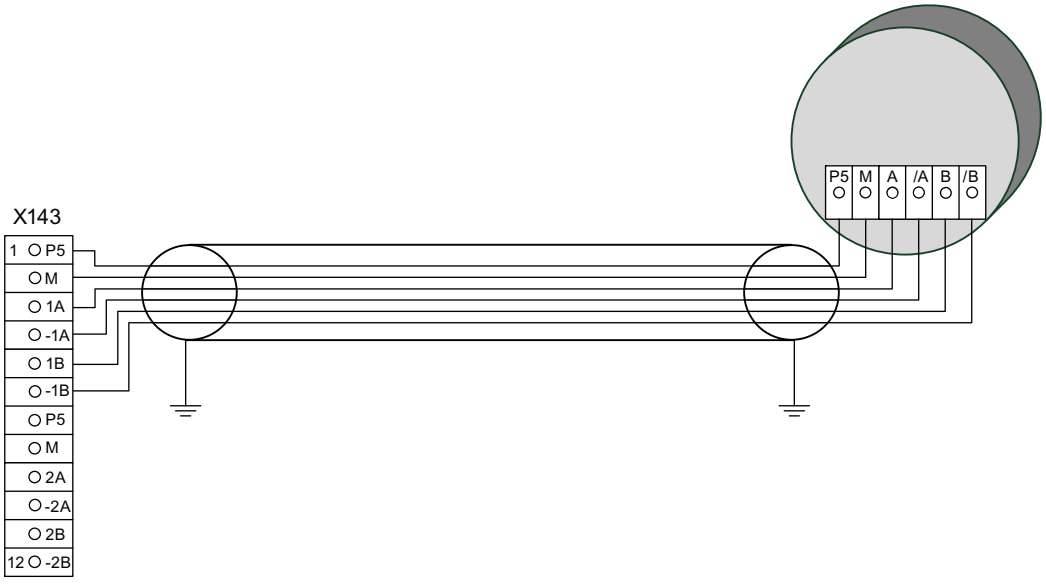
- Differential signal transfer (RS422): One signal and a negated signal for each track.
- Asymmetrical signal transfer: One 5 V TTL signal for each track.

The following applies to both techniques:

- Max. output frequency: 500 kHz
- Phase shift of Track A to Track B: 90° ±30°
- Supply: 5 V, max. 250 mA

The following diagrams indicate the different data transfer types:

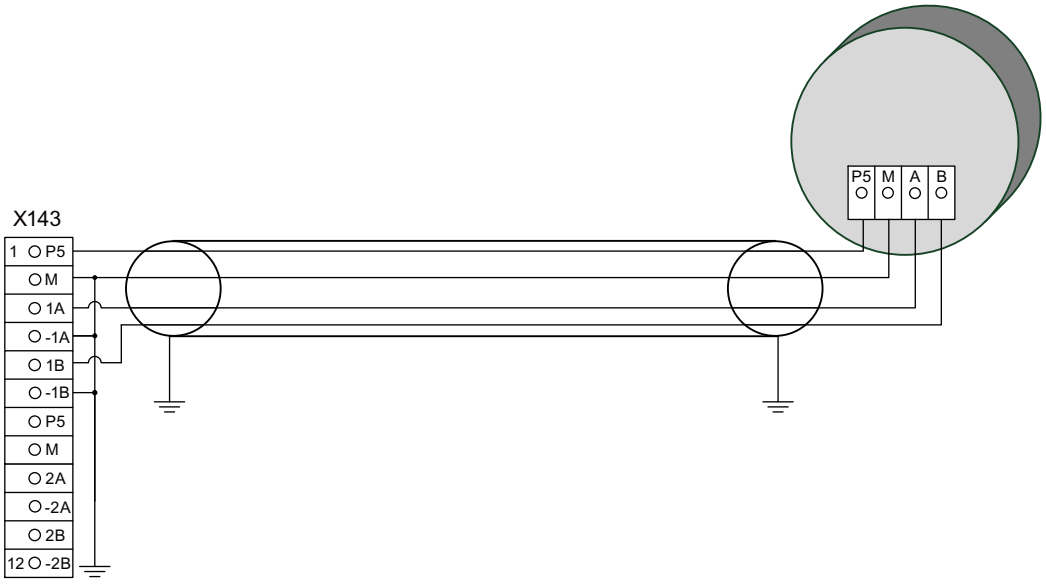
- **Differential signal transfer:**



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

7.8 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.
- **USB ports X135 and X145** (rear) is enabled for all MCP USBs and for service.

Note

Memory size of the data storage medium that can be connected

The memory size of the data storage medium that can be connected is not restricted. It is only important that these are FAT, FAT16 or FAT32 types. Only the first partition is used.

With its own formatting tool, Windows can only format data storage medium up to 32 GB in FAT32. In these cases (> 32 GB), in order to achieve compatibility with SINUMERIK 828D, other tools or operating systems should be used to format data storage medium in the FAT32 file format.

ExFAT and NTFS are not supported.

Cable specification

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

Features	Variants
Connector type	USB socket - type A
Version	USB 3.0
Current carrying capacity	0.5 A per connector
Maximum data transfer rate	12 Mbit/s
Maximum cable length	3 m

7.9 RS 232 serial interface

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.

X140 cable specification

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

8

8.1 MCP 483 USB

Description

The MCP 483 USB machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the horizontal version of SINUMERIK 828D: PPU 271.4.

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:
  - 50 keys with assigned LEDs
  - Predefined keys for common functions, e.g. reset key, program control.
  - Key group for operating as milling machine or lathe.
  - Keys for individual use.
  - Key type: Real keys with protective film
- Spindle control with override spindle (rotary switch with 15 positions)
- Feed control with feed override (rotary switch with 18 positions)
- Digital input

Interfaces:

A USB 3.0 interface for communication with the PPU with a transmission rate of 12 Mbit/s.

Expansion slots:

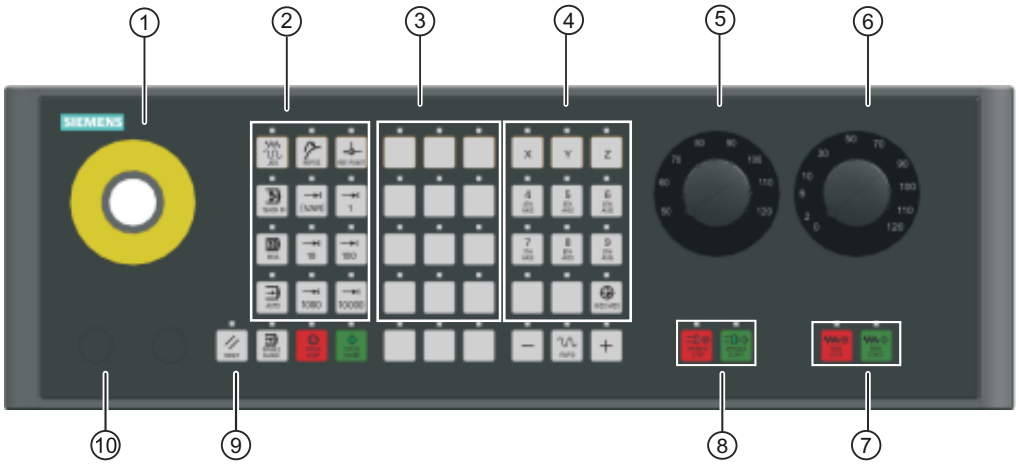
- 1 slot for Emergency Stop button (d = 22 mm)
- 2 slots for control devices (d = 16 mm)

8.1.1 Operator controls and displays

Operator controls (front)

The MCP module is delivered with a default slide-in labels. In addition, blank slide-in labels are included in the accessory pack. The following key blocks can be labeled for machine-specific labeling: ②③④; blank slide-in labels are included in the accessories pack (see Spare parts and accessories (Page 134)).

A manufacturer-specific logo can be attached above the Emergency Stop pushbutton.



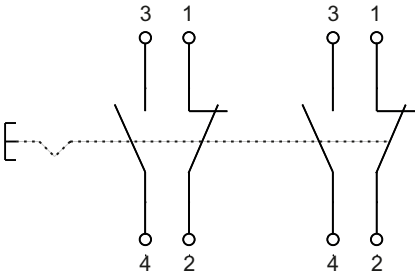
①	Slot for the Emergency Stop button
②+③+④	Keys for machine functions that can also be used as customer keys for labeling with slide-in labels.
⑤	Rotary spindle override switch
⑥	Rotary feedrate override switch
⑦	Keys for feedrate control
⑧	Keys for spindle control
⑨	Reset button
⑩	2 slots for control devices (d = 16 mm)

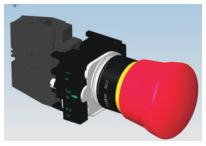
Figure 8-1 Position of operator controls

NOTICE
Several keys simultaneously pressed When keys are simultaneously pressed, a maximum of two keys are reliably evaluated. If there is no safety-relevant key evaluation, all key signals go to zero and none of the keys are effective.

NOTICE
Slots for control devices Do not break the openings when it is not used. Seal the opening by installing control devices. Recommend to use the Siemens options.

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.

For an Emergency Stop, all drives are brought to a standstill with the maximum possible braking torque.

The Emergency Stop pushbutton is released by rotating it to the left (counter-clockwise).

Note

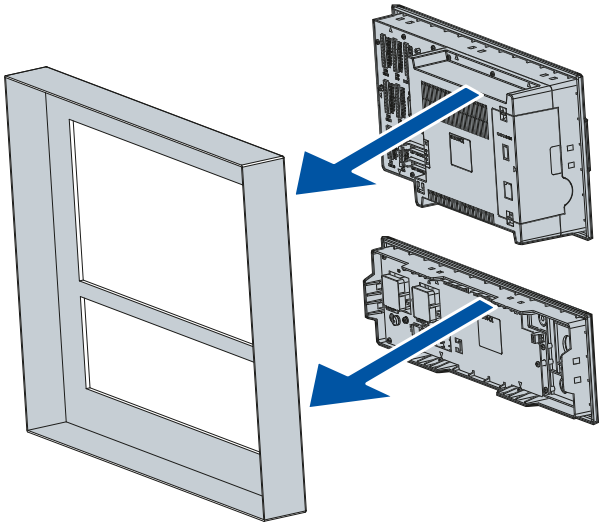
The emergency stop button should meet the requirement: UL certification category NISD, at least IP65, A600, R300.

If the specified emergency stop button by Siemens is not used then, the IP 65 protection of the front cover cannot be guaranteed.

8.1.2 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 accessories: Spare parts and accessories (Page 134).

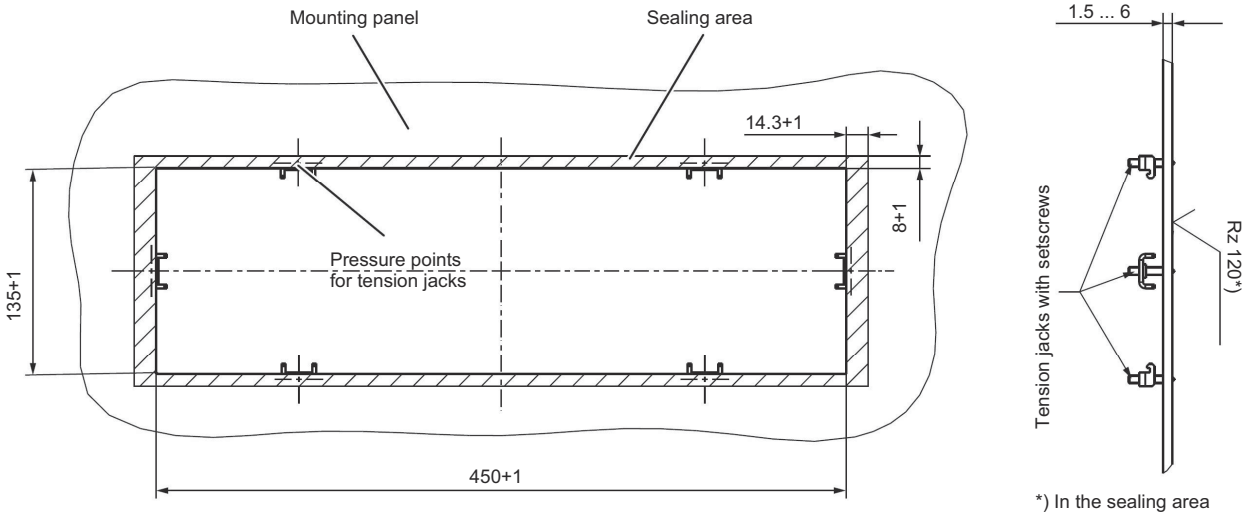


Figure 8-2 Mounting panel cutout

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).

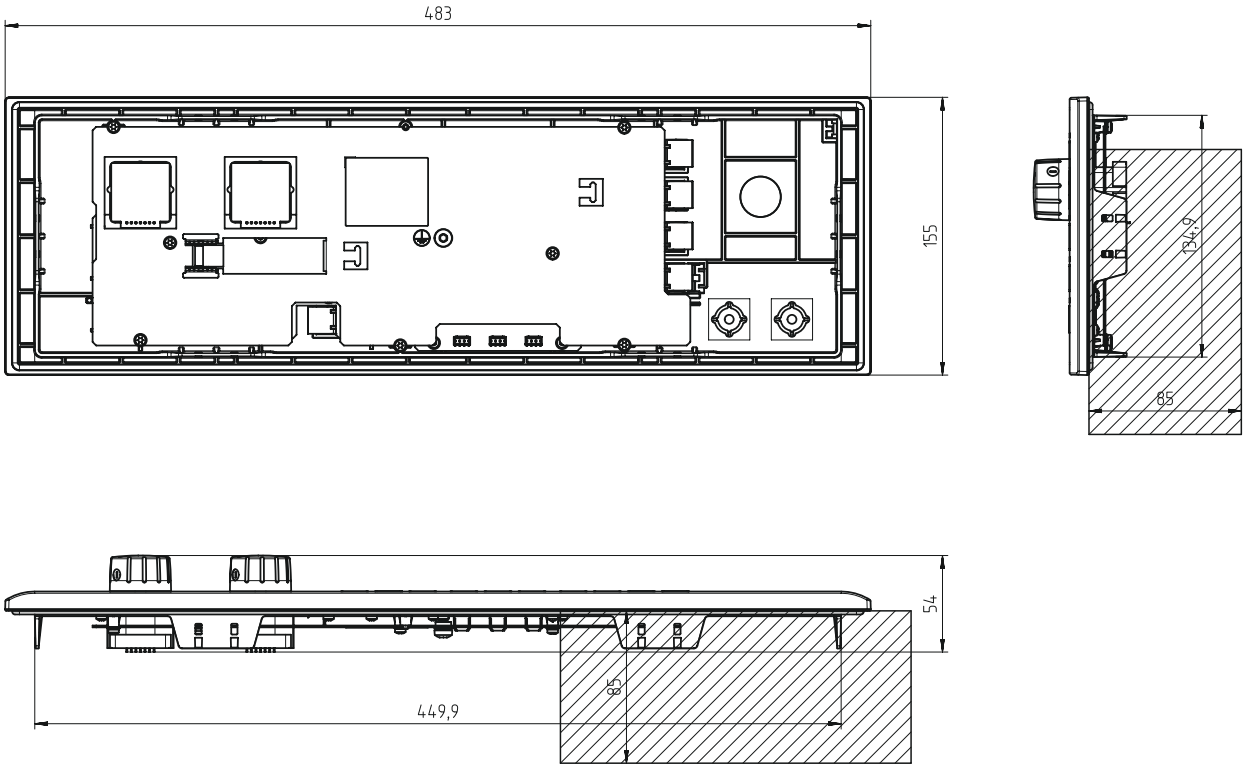


Figure 8-3 Dimensions and clearances

8.1.3 Connecting

Connections (rear)



① X1 NC: USB connection to the PPU
② Protective conductor connection M5 / 1.8 Nm
③ Slots for control devices (d = 16 mm)
④ Interface X51, X52, X55

Figure 8-4 Connections at the rear

USB 3.0 interface

The USB cable to connect the machine control panel to the PPU is included in the accessories pack. The machine control panel is also supplied with power via this USB connection. This USB cable must be routed separately away from other cables to avoid EMC disturbances (Page 49).

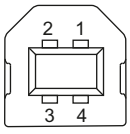
You can also connect the machine control panel to the PPU via an industrial USB hub.

Pin assignment USB port

Connection designation: **X1**

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

The switch positions for the feed override is assigned to the values in the input image below:

Spindle override	Value in the IBn+0
50 %	0x1
55 %	0x3
60 %	0x2
65 %	0x6
70 %	0x7
75 %	0x5
80 %	0x4
85 %	0xC
90 %	0xD
95 %	0xF
100 %	0xE
105 %	0xA
110 %	0xB
115 %	0x9
120 %	0x8

Feed override	Value in the IBn+3
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

Digital inputs X51, X52, X55

Only switches (passive inputs) can be connected via the X51, X52 and X55 connectors.

Note

Connection of miniature handheld unit

Alternatively, at the inputs X51, X52 and X55, one miniature handheld unit may be operated.

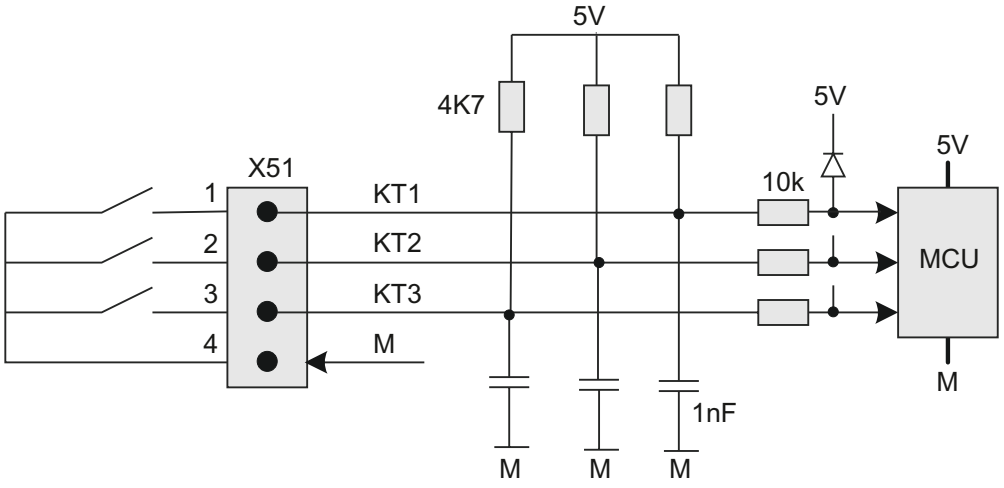


Figure 8-5 X51/X52/X55 Block Diagram

Connector Type:	4-pin plug connector
Reference Designator:	X51/X52/X55
Max. cable length:	0.6 m

Table 8-1 Assignment of connector X51

Pin	Signal name	Type	Meaning
1	KT1	I	Customer key 0
2	KT2		Customer key 1
3	KT3		Customer key 2
4	M	V	Ground

Table 8-2 Assignment of connector X52

Pin	Signal name	Type	Meaning
1	KT4	I	Customer key 3
2	KT5		Customer key 4
3	KT6		Customer key 5
4	M	V	Ground

Table 8-3 Assignment of connector X55

Pin	Signal name	Type	Meaning
1	KT7	I	Customer key 6
2	KT8		Customer key 7
3	KT9		Customer key 8
4	M	V	Ground

8.1.4 Parameterization

Input image

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. It is possible to connect one MCP USB and one MCP-PN at the same time - There are different ways to activate and use the MCP USB. Further information on settings in the machine data can be found in Section AUTOHOTSPOT.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IBn+0	Spindle override				Operation mode			
	D	C	B	A	JOG	Teach In	MDA	AUTOM.
IBn+1				Reserved				
	REPOS	REF.	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
IBn+2	Reserved	Reserved	Spindle Start	* Spindle Stop	Feed Start	* Feed Stop	Cycle-Start	* Cycle-Stop
IBn+3				Feed override				
	Reset	Reserved	Single block	E	D	C	B	A
IBn+4	Direction keys				Axis selection			
	+ R15	– R13	Rapid traverse R14	Reserved	X R1	4. Axis R4	7. Axis R7	Reserved R10
IBn+5	Axis selection							
	Y R2	Z R3	5. Axis R5	Toggle MCS/WCS	Reserved R11	9. Axis R9	8. Axis R8	6. Axis R6
IBn+6	Free customer use							
	T9	T10	T11	T12	T13	T14	T15	
IBn+7	Free customer use							
	T1	T2	T3	T4	T5	T6	T7	T8
IBn+8	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+9	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+10	Digit inputs							
	KT-IN8 X55.2	KT-IN7 X55.1	KT-IN6 X52.3	KT-IN5 X52.2	KT-IN4 X52.1	KT-IN3 X51.3	KT-IN2 X51.2	KT-IN1 X51.1

IBn+11	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	KT-IN9 X55.3
IBn+12	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+13	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
DB1000.dbb1000	Version information of the MCP USB - byte 0							
DB1000.dbb1001	Version information of the MCP USB - byte 1							
DB1000.dbb1002	Version information of the MCP USB - byte 2							
DB1000.dbb1003	Version information of the MCP USB - byte 3							

Output image

Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
QBn+0	Reserved				Operation mode			
	Reserved	Reserved	Reserved	Reserved	JOG	Teach In	MDA	AUTOM.
QBn+1					Machine functions			
	Feed Start	* Feed Stop	Cycle- Start	* Cycle- Stop	REPOS	REF.	var. INC	Reserved
QBn+2	Direction key	Axis selection						
	- R13	X R1	4. Achse R4	7. Achse R7	Reserved R10	Single block	Spindle start	* Spindle Stop
QBn+3	Axis selection							Direction key
	Z R3	5. Axis R5	Toggle MCS/WCS	Reserved R11	9. Axis R9	8. Axis R8	6. Axis R6	+ R15
QBn+4	Free customer use							
	T9	T10	T11	T12	T13	T14	T15	Y R2
QBn+5	Free customer use							
	T1	T2	T3	T4	T5	T6	T7	T8
QBn+6	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	RESET	Rapid R14
QBn+7	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Key assignment

Some of the keys are permanently pre-assigned, the remaining keys can be freely assigned. The labeling of the permanently assigned keys is shown in brackets in the table.

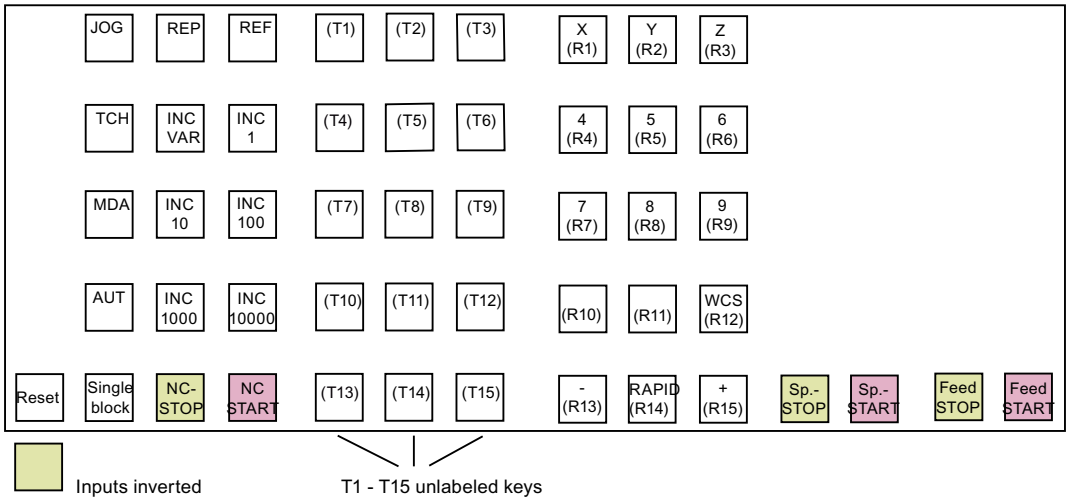


Figure 8-6 MCP483 default key assignment

8.1.5 Technical data

MCP 483 USB

Parameter	Value
Input voltage	5 V DC
Power consumption, max.	2.5 W
Vibratory load: • Operation • Transportation (in transportation packaging)	 9 – 29 Hz: 0.3 mm/29 - 200 Hz: 1 g (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 • Transportation (in transportation packaging)	 5 g, 30 ms, 3 shocks (acc. to EN 60721-3-3) 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) IP00 (rear)
Cooling	By natural convection

Parameter	Value
Temperature limits:	
• Storage	-40 °C ... +70 °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 ... 90 %
Condensation, spraying water, and icing	Not permissible
Supply air	Without aggressive gases, dusts, and oils
Approvals	CE, UL/CSA, KC, RCM, EAC
Dimensions:	
• Width	483 mm
• Height	155 mm
• Depth	54 mm
Weight:	1.26 kg

See also

Other values/standards: Application planning (Page 47)

8.1.6 Spare parts and accessories

Accessories pack when delivered from the factory

Qty.	Description
1	USB cable (length: 0.8 m) for the connection between the PPU and MCP USB
6	Mounting elements with screws to mount the MCP
1	Blank film for slide-in labels • Product announcement (https://support.industry.siemens.com/cs/de/de/view/107745917/en) • DOConCD in directory "Supplementary documentation_slide-in labels"

Spare parts and accessories

Qty.	Description	Article number
1	Feed/rapid traverse override rotary switch	6FC5347-0AF11-0AA0
1	Spindle/rapid traverse override rotary switch	6FC5347-0AF11-1AA0
1	SINUMERIK MCP 416/483 USB slide-in strips (3 pcs)	6FC5348-0AA04-0AA0
1	Cable set (60 cables for additional MCP control devices, 500 mm long)	6FC5247-0AA35-0AA0

Additional spare parts for these components can be found here: Spare parts (Spares on Web). (https://www.sow.siemens.com/?lang=en)

8.2 MCP 310 USB

Description

The MCP 310 USB machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the vertical versions of SINUMERIK 828D: PPU 270.4.

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:
  - 49 keys with assigned LED
  - Predefined keys for common functions, e.g. reset key, program control.
  - Key group for operating as milling machine or lathe.
  - Keys for individual use.
  - Key type: Real keys with protective film
- Feed control with feed override (rotary switch with 18 positions)
- Digital input

Interfaces:

A USB 3.0 interface for communication with the PPU with a transmission rate of 12 Mbit/s.

Expansion slots:

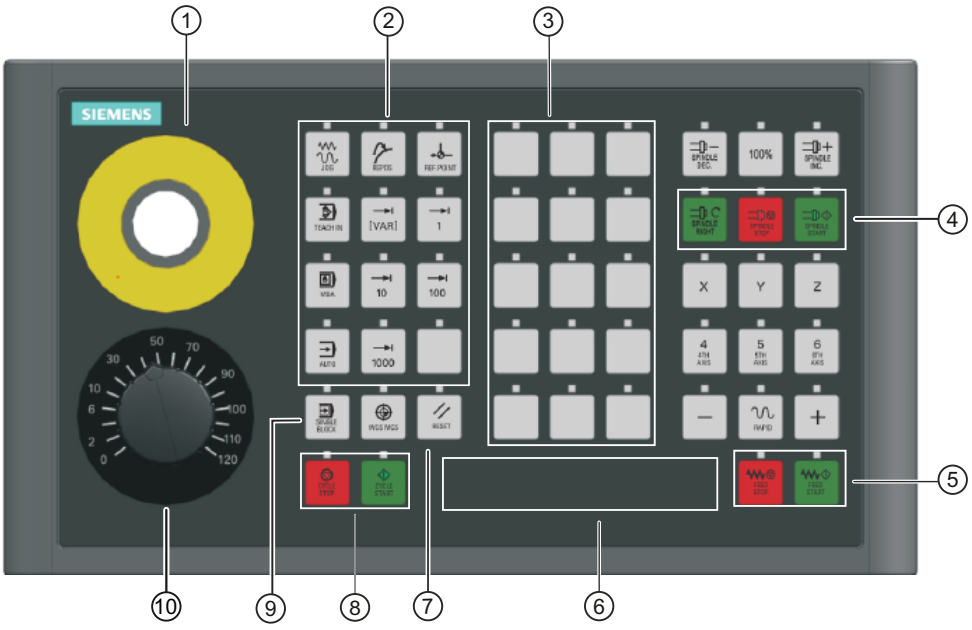
- 1 slot for Emergency Stop button (d = 22 mm)
- 4 slots for control devices (d = 16 mm)

8.2.1 Operator controls and displays

Operator controls (front)

The MCP module is delivered with a default slide-in labels. In addition, blank slide-in labels are included in the accessory pack. The following key blocks can be labeled for machine-specific labeling: ②③ ; blank slide-in labels are included in the accessories pack (see Spare parts and accessories (Page 147)).

A manufacturer-specific logo can be attached above the Emergency Stop pushbutton.



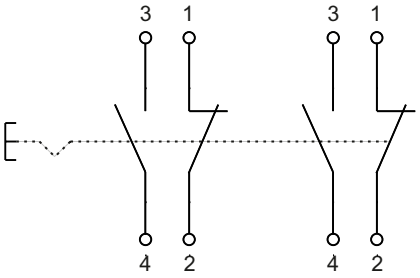
① Slot for the Emergency Stop button
②+③ Keys for machine functions and customer keys for labeling using slide-in labels
④ Keys for spindle control
⑤ Keys for feedrate control
⑥ 4 slots for control devices (d=16mm)
⑦ Reset button
⑧ NC START/ NC STOP keys
⑨ Keys for coolant and single block that can also be used as customer keys for labeling using slide-in labels
⑩ Rotary feedrate override switch

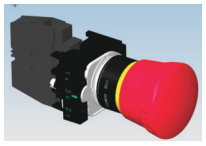
Figure 8-7 MCP 310 USB Front

NOTICE
Several keys simultaneously pressed When keys are simultaneously pressed, a maximum of two keys are reliably evaluated. If there is no safety-relevant key evaluation, all key signals go to zero and none of the keys are effective.

NOTICE
Slots for control devices Do not break the openings when it is not used. Seal the opening by installing control devices. Recommend to use the Siemens options.

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.

For an Emergency Stop, all drives are brought to a standstill with the maximum possible braking torque.

The Emergency Stop pushbutton is released by rotating it to the left (counter-clockwise).

Note

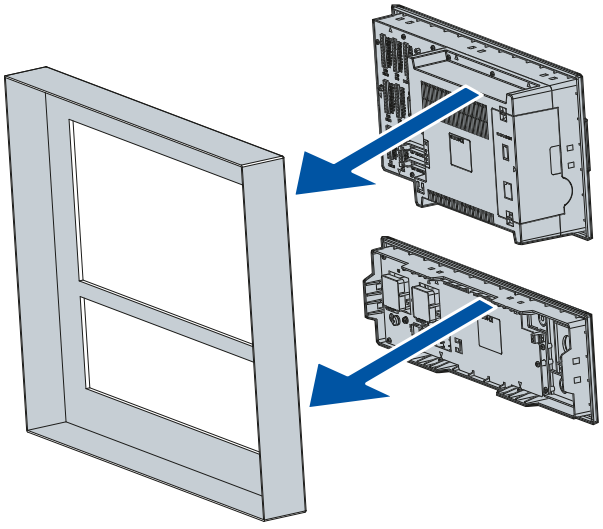
The emergency stop button should meet the requirement: UL certification category NISD, at least IP65, A600, R300.

If the specified emergency stop button by Siemens is not used then, the IP 65 protection of the front cover cannot be guaranteed.

8.2.2 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 accessories: Spare parts and accessories (Page 147).

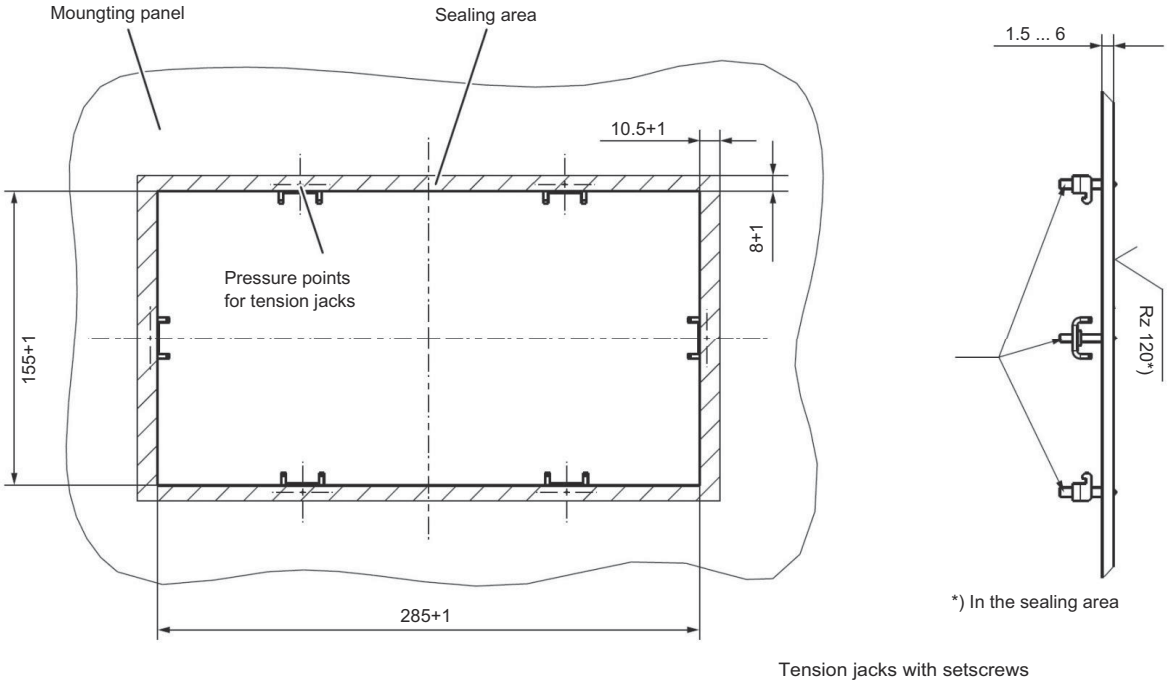


Figure 8-8 Mounting panel cutout

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).

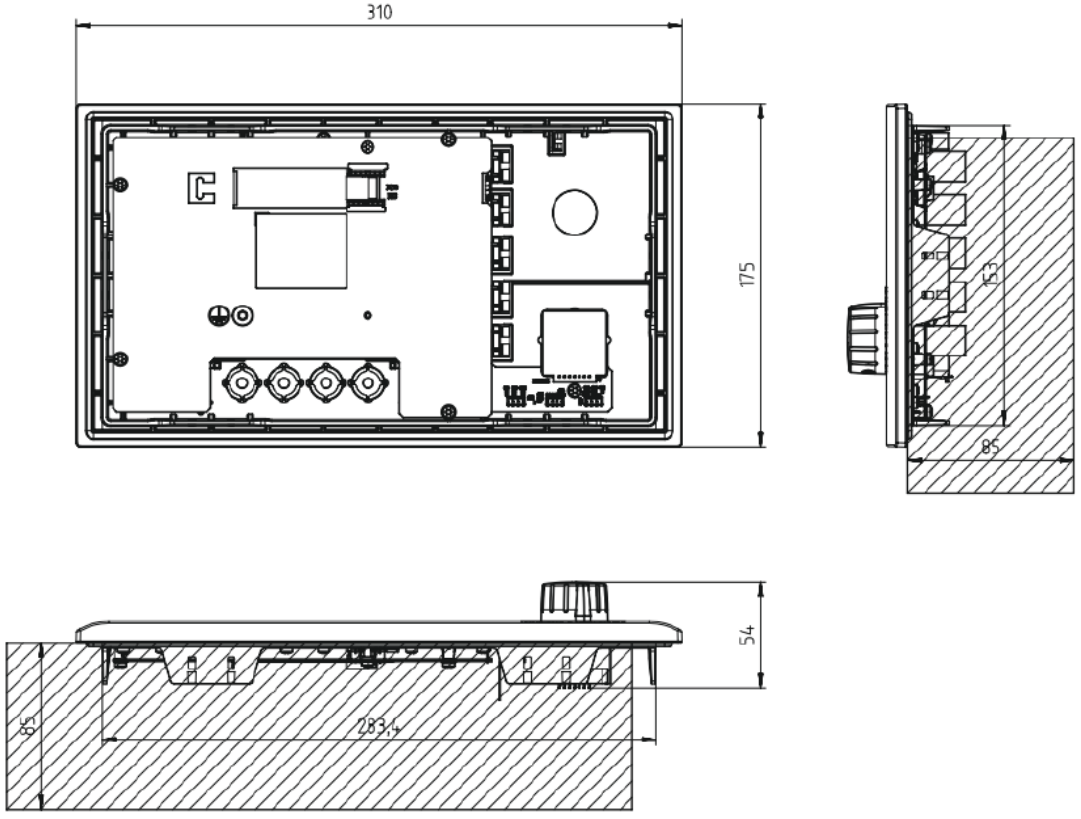
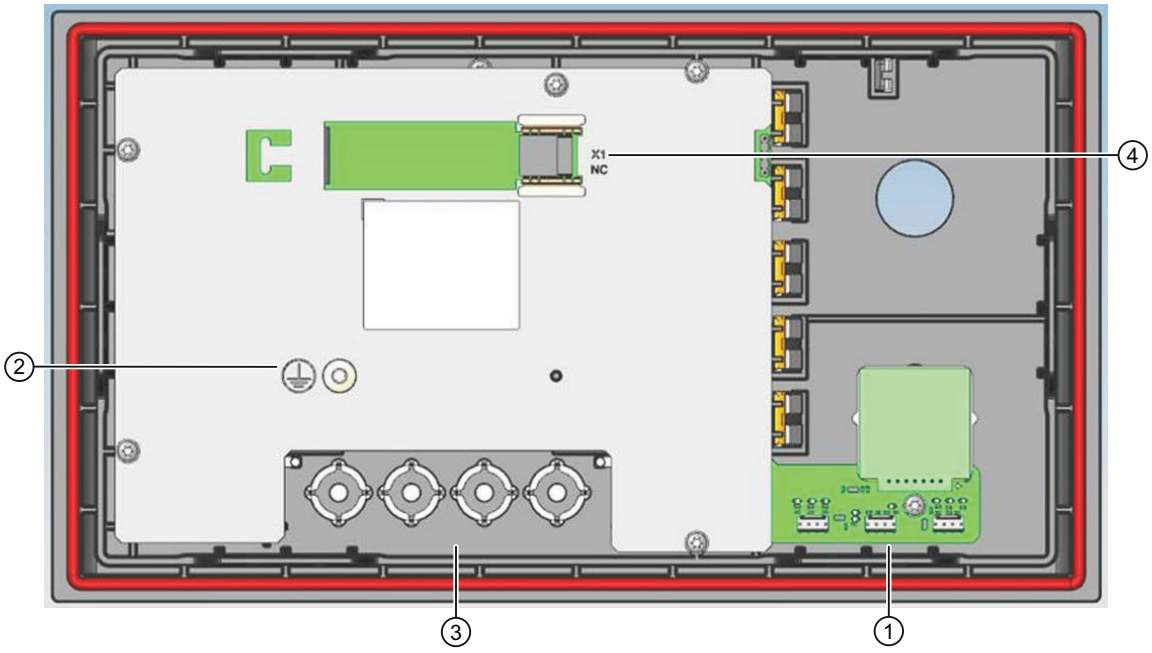


Figure 8-9 Dimensions and clearances

8.2.3 Connecting

Connections (rear)



① Interfaces X51, X52, X55
② Protective conductor connection M5 / 1.8 Nm
③ Slots for control devices (d = 16 mm)
④ X1 NC: USB connection to the PPU

Figure 8-10 Connections at the rear

8.2.3.1 Description

USB 3.0 interface

The USB cable to connect the machine control panel to the PPU is included in the accessories pack. The machine control panel is also supplied with power via this USB connection. This USB cable must be routed separately away from other cables to avoid EMC disturbances. (Page 49)

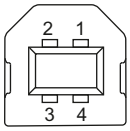
You can also connect the machine control panel to the PPU via an industrial USB hub.

Pin assignment USB port

Connection designation:**X1**

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: **BB**

Connector type: 7-pin COMBICON connector

The switch positions for the feed override is assigned to the values in the input image below:

Feed override	Value in the IBn+3
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

Digital inputs X51, X52, X55

Only switches (passive inputs) can be connected via the X51, X52 and X55 connectors.

Note

Connection of miniature handheld unit

Alternatively, at the inputs X51, X52 and X55, one miniature handheld unit may be operated.

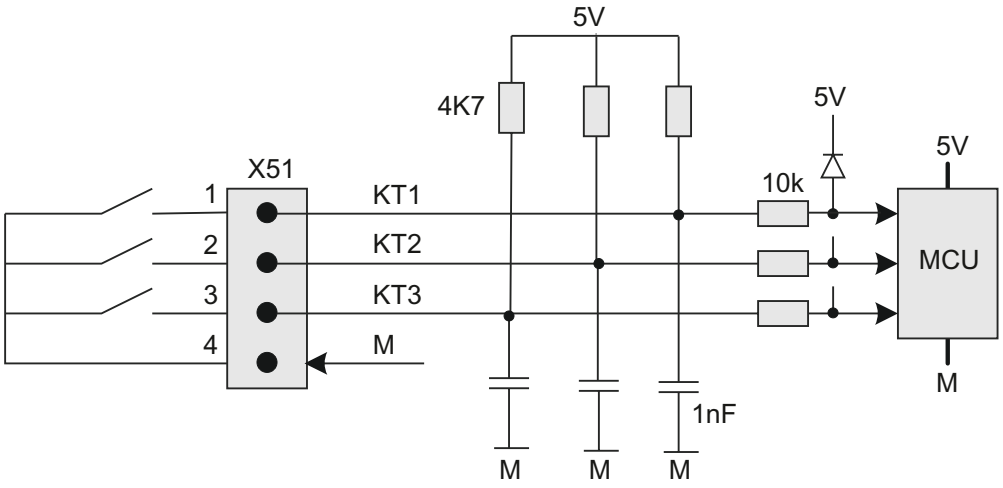


Figure 8-11 X51/X52/X55 Block Diagram

Connector Type:	4-pin plug connector
Reference Designator:	X51/X52/X55
Max. cable length:	0.6 m

Table 8-4 Assignment of connector X51

Pin	Signal name	Type	Meaning
1	KT1	I	Customer key 0
2	KT2		Customer key 1
3	KT3		Customer key 2
4	M	V	Ground

Table 8-5 Assignment of connector X52

Pin	Signal name	Type	Meaning
1	KT4	I	Customer key 3
2	KT5		Customer key 4
3	KT6		Customer key 5
4	M	V	Ground

Table 8-6 Assignment of connector X55

Pin	Signal name	Type	Meaning
1	KT7	I	Customer key 6
2	KT8		Customer key 7
3	KT9		Customer key 8
4	M	V	Ground

8.2.4 Parameterization

Input image

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. It is possible to connect one MCP USB and one MCP-PN at the same time - There are different ways to activate and use the MCP USB. Further information on settings in the machine data can be found in Section Activating and addressing components (Page 282).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IBn+0	* Cycle-Stop	Spindle -	Spindle 100%	Spindle +	Single block	JOG	MDA	AUTOM.
IBn+1	Cycle-Start	Spindle right	* Spindle Stop	Spindle left	Reserved	REF.	REPOS	Teach In
IBn+2	Feed Start	* Feed Stop	Var. INC	Reserved	1000 INC	100 INC	10 INC	1 INC
IBn+3				Feed override				
	Reset	Reserved	Reserved	E	D	C	B	A
IBn+4	Direction keys							
	+ R15	- R13	Rapid traverse R14	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+5	T16	Reserved	6	5	4	Z	Y	X
IBn+6	Free customer use							
	T9	T10	T11	T12	Toggle MCS/WCS	T13	T14	T15
IBn+7	Free customer use							
	T1	T2	T3	T4	T5	T6	T7	T8
IBn+8	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+9	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+10	Digit inputs							
	KT-IN8 X55.2	KT-IN7 X55.1	KT-IN6 X52.3	KT-IN5 X52.2	KT-IN4 X52.1	KT-IN3 X51.3	KT-IN2 X51.2	KT-IN1 X51.1
IBn+11	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	KT-IN9 X55.3
IBn+12	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+13	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
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							

Output image

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
QBn+0	* Cycle-Stop	Spindle -	Spindle 100%	Spindle +	Single block	JOG	MDA	AUTOM.
QBn+1	Cycle-Start	Spindle right	* Spindle Stop	Spindle left	Reset	REF.	REPOS	Teach In
QBn+2	Feed Start	* Feed Stop	Var. INC	Reserved	1000 INC	100 INC	10 INC	1 INC
QBn+3	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
QBn+4	+	-	Rapid traverse	Reserved	Reserved	Reserved	Reserved	Reserved
QBn+5	T16	Reserved	6	5	4	Z	Y	X
QBn+6	T9	T10	T11	T12	Toggle MCS/WCS	T13	T14	T15
QBn+7	T1	T2	T3	T4	T5	T6	T7	T8

Key assignment

Some of the keys are permanently pre-assigned, the remaining keys can be freely assigned. The labeling of the permanently assigned keys is shown in brackets in the table. Keys are designated with S1 to S39 in the following figure.

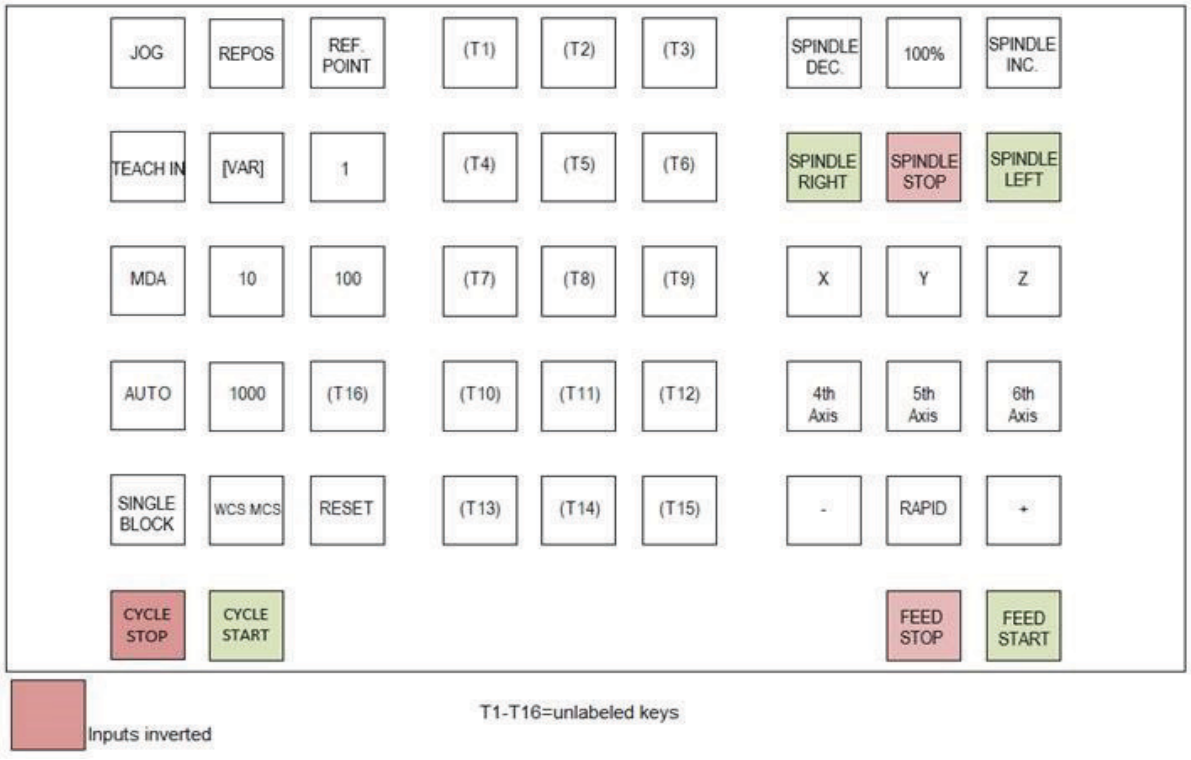


Figure 8-12 MCP 310 Key assignment

8.2.5 Technical data

MCP 310 USB

Parameter	Value
Input voltage	5 V DC
Power consumption, max.	2.5 W
Vibratory load:	
• Operation	9 – 29 Hz: 0.3 mm/29 - 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	5 g, 30 ms, 3 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) IP00 (rear)
Cooling	By natural convection
Temperature limits:	
• Storage	-40 °C ... +70 °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 ... 90 %
Condensation, spraying water, and icing	Not permissible
Supply air	Without aggressive gases, dusts, and oils
Approvals	CE, UL/CSA, KC, RCM, EAC
Dimensions:	
• Width	310 mm
• Height	175 mm
• Depth	54 mm
Weight:	0.93 kg

See also

Other values/standards: Application planning (Page 47)

8.2.6 Spare parts and accessories

Accessories pack when delivered from the factory

Qty.	Description
1	USB cable (length: 0.8 m) for the connection between the PPU and MCP USB
6	Mounting elements with screws to mount the MCP
1	Blank film for slide-in labels • Product announcement (https://support.industry.siemens.com/cs/de/de/view/107745917/en) • DOConCD in directory "Supplementary documentation_slide-in labels"

Spare parts and accessories

Qty.	Description	Article number
1	Feed/rapid traverse override rotary switch	6FC5347-0AF11-0AA0
1	SINUMERIK MCP 310 USBslide-in strips (3 pcs)	6FC5348-0AA04-1AA0
1	Cable set (60 cables for additional MCP control devices, 500 mm long)	6FC5247-0AA35-0AA0

Additional spare parts for these components can be found here: Spare parts (Spares on Web) (https://www.sow.siemens.com/?lang=en) .

8.3 MCP 416 USB

Description

The MCP 416 USB machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the SINUMERIK 828D PPU 290.4.

The machine-specific keys have replaceable slide-in labels so that they can be adapted. Further, there is space on the left-hand and right-hand sides to attach an OEM logo.

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:
  - 50 keys with LEDs; of which,
  - Predefined keys for common functions, e.g. reset key, program control.
  - Key group for operating as milling machine or lathe.
  - Keys for individual use.
  - Key type: Real keys with protective film
- Spindle control with override spindle (rotary switch with 15 positions)
- Feed control with feed override (rotary switch with 18 positions)
- Digital input

Interfaces:

A USB 3.0 interface for communication with the PPU with a transmission rate of 12 Mbit/s.

Expansion slots:

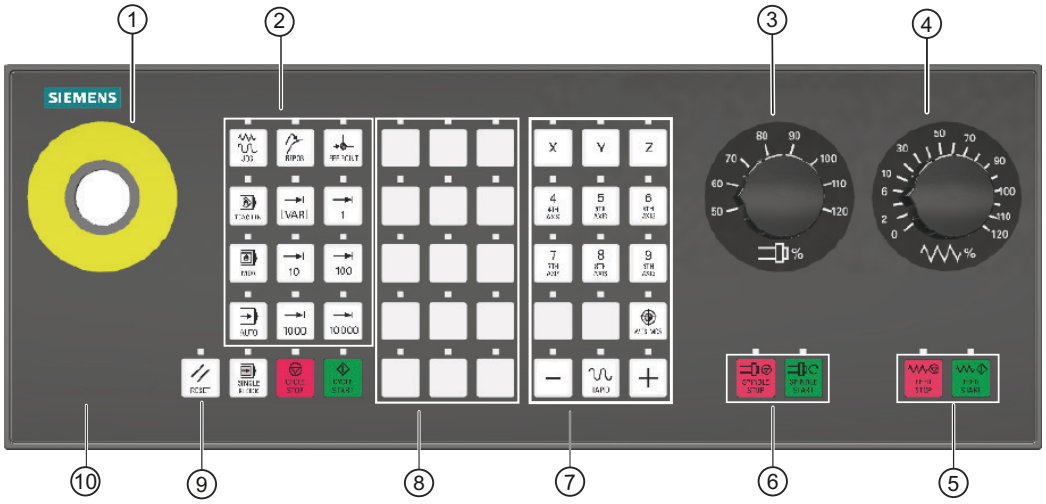
- 1 slot for Emergency Stop button (d = 22 mm)
- 2 slots for control devices (d = 16 mm)

8.3.1 Operating and display elements

Operator controls

Printed slide-in labels are included in the accessory pack. In addition, blank slide-in labels are included in the accessory pack. The following key blocks can be labeled for machine-specific labeling: ②⑦⑧; blank slide-in labels are included in the accessories pack (see: Spare parts and accessories (Page 291)).

A manufacturer-specific logo can be attached above the Emergency Stop pushbutton.



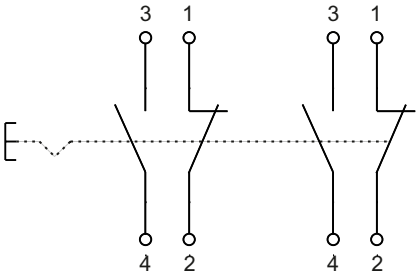
① Slot for the Emergency Stop button
② Keys for machine functions that can also be used as customer keys for labeling with slide-in labels.
③ Rotary spindle override switch
④ Rotary feedrate override switch
⑤ Keys for feedrate control
⑥ Keys for spindle control
⑦+⑧ Customer keys for labeling using slide-in labels
⑨ Reset button
⑩ 2 slots for control devices (d = 16 mm)

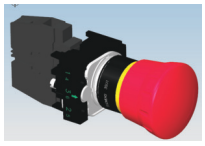
Figure 8-13 Position of operator controls

NOTICE
Several keys simultaneously pressed When keys are simultaneously pressed, a maximum of two keys are reliably evaluated. If there is no safety-relevant key evaluation, all key signals go to zero and none of the keys are effective.

NOTICE
Slots for control devices Do not break the openings when it is not used. Seal the opening by installing control devices. Recommend to use the Siemens options.

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.

For an Emergency Stop, all drives are brought to a standstill with the maximum possible braking torque.

The Emergency Stop pushbutton is released by rotating it to the left (counter-clockwise).

Note

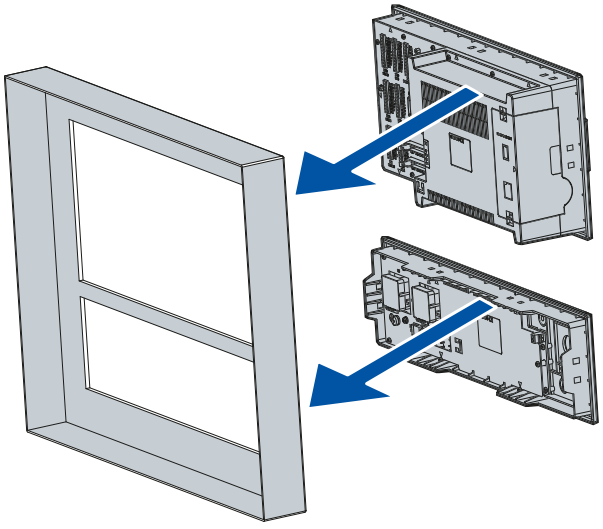
The emergency stop button should meet the requirement: UL certification category NISD, at least IP65, A600, R300.

If the specified emergency stop button by Siemens is not used then, the IP 65 protection of the front cover cannot be guaranteed.

8.3.2 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 accessories: Spare parts and accessories (Page 291).

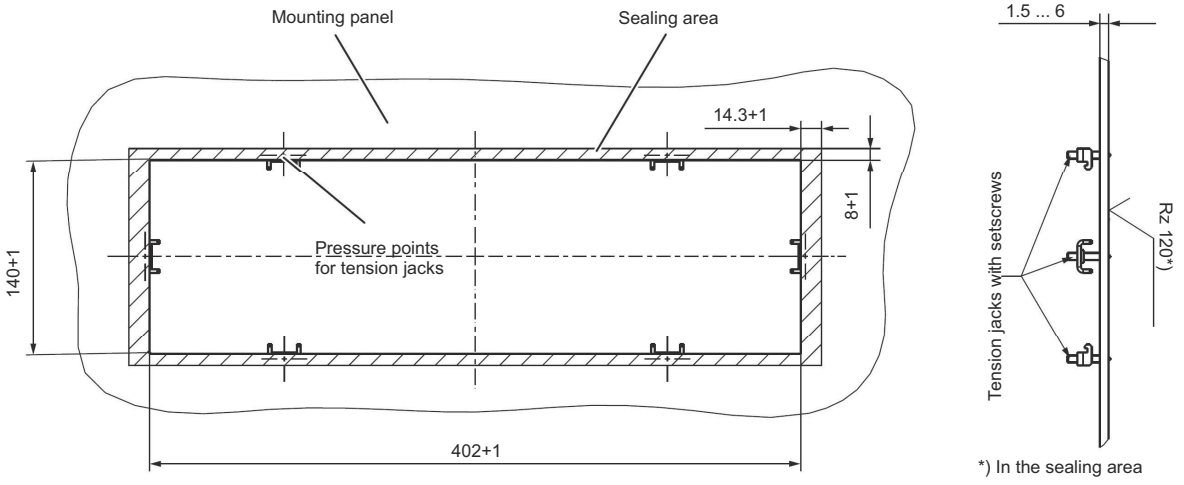


Figure 8-14 Mounting panel cutout

Dimension drawing

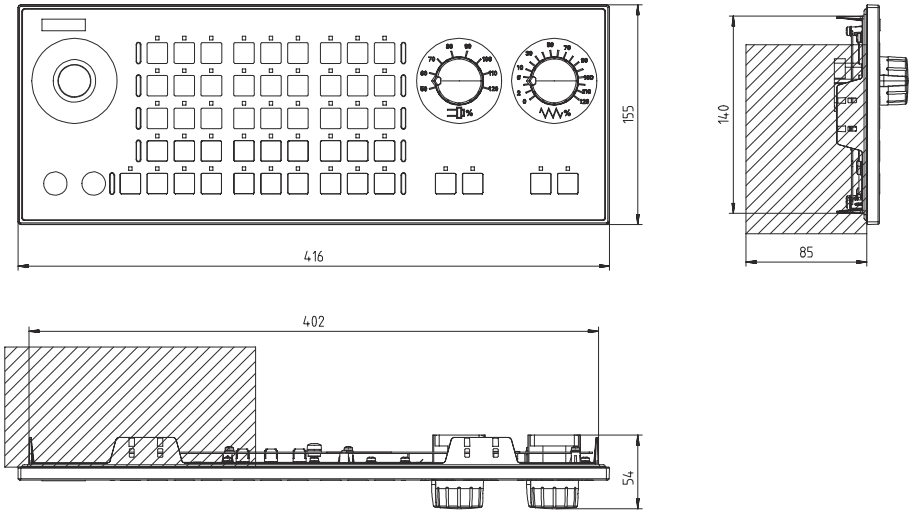
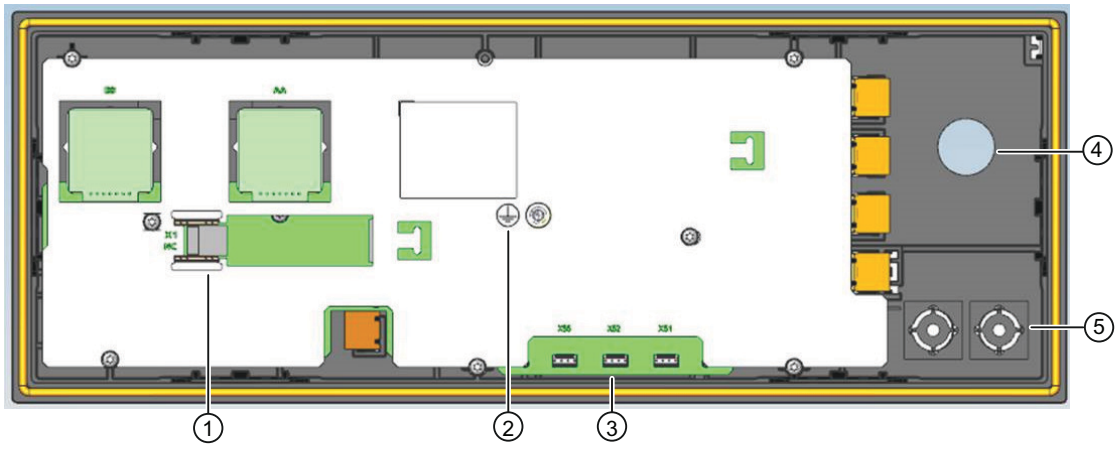


Figure 8-15 Dimensions and clearances

8.3.3 Connecting

Connections (rear)



① X1 NC: USB connection to the PPU
② Protective conductor connection M5 / 1.8 Nm
③ Interface: X51, X52, X55
④ Slot for the Emergency Stop button
⑤ Slots for control devices (d = 16 mm)

Figure 8-16 MCP 416 USB: Connections at the rear

USB 3.0 interface

The USB cable to connect the machine control panel to the PPU is included in the accessories pack. The machine control panel is also supplied with power via this USB connection. This USB cable must be routed separately away from other cables to avoid EMC disturbances (Page 49).

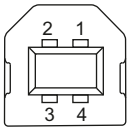
You can also connect the machine control panel to the PPU via an industrial USB hub.

Pin assignment USB port

Connection designation: **X1**

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

The switch positions for the feed override is assigned to the values in the input image below:

Spindle override	Value in the IBn+0
50 %	0x1
55 %	0x3
60 %	0x2
65 %	0x6
70 %	0x7
75 %	0x5
80 %	0x4
85 %	0xC
90 %	0xD
95 %	0xF
100 %	0xE
105 %	0xA
110 %	0xB
115 %	0x9
120 %	0x8

Feed override	Value in the IBn+3
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

Digital inputs X51, X52, X55

Only switches (passive inputs) can be connected via the X51, X52 and X55 connectors.

Note

Connection of miniature handheld unit

Alternatively, at the inputs X51, X52 and X55, one miniature handheld unit may be operated.

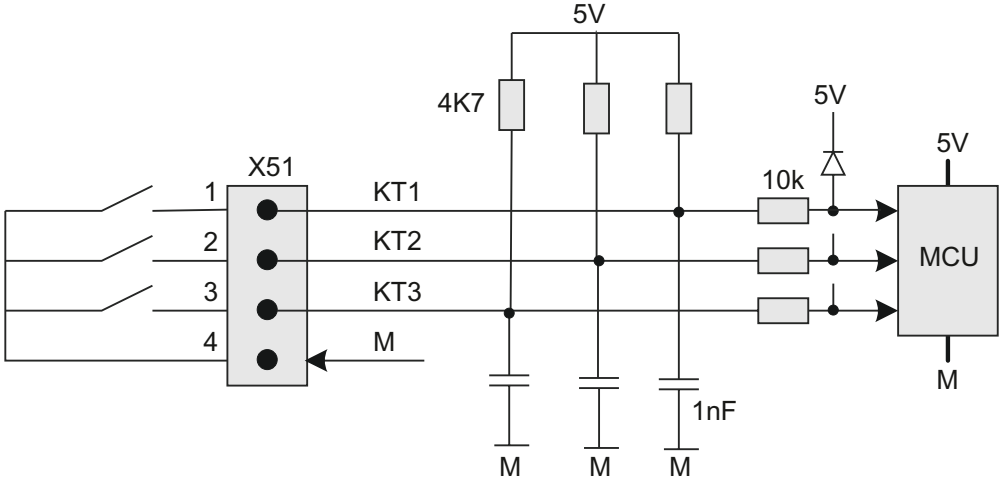


Figure 8-17 X51/X52/X55 Block Diagram

Connector Type: 4-pin plug connector
Reference Designator: X51/X52/X55
Max. cable length: 0.6 m

Table 8-7 Assignment of connector X51

Pin	Signal name	Type	Meaning
1	KT1	I	Customer key 0
2	KT2		Customer key 1
3	KT3		Customer key 2
4	M	V	Ground

Table 8-8 Assignment of connector X52

Pin	Signal name	Type	Meaning
1	KT4	I	Customer key 3
2	KT5		Customer key 4
3	KT6		Customer key 5
4	M	V	Ground

Table 8-9 Assignment of connector X55

Pin	Signal name	Type	Meaning
1	KT7	I	Customer key 6
2	KT8		Customer key 7
3	KT9		Customer key 8
4	M	V	Ground

8.3.4 Parameterization

Input image

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. It is possible to connect one MCP USB and one MCP-PN at the same time - There are different ways to activate and use the MCP USB. Further information on settings in the machine data can be found in Section Activating and addressing components (Page 282).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IBn+0	Spindle override				Operation mode			
	D	C	B	A	JOG	Teach In	MDA	AUTOM.

IBn+1				Reserved				
	REPOS	REF.	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
IBn+2	Reserved	Reserved	Spindle Start	* Spindle Stop	Feed Start	* Feed Stop	Cycle-Start	* Cycle-Stop
IBn+3				Feed override				
	Reset	Reserved	Single block	E	D	C	B	A
IBn+4	Direction keys				Axis selection			
	+ R15	– R13	Rapid traverse R14	Reserved	X R1	4. Axis R4	7. Axis R7	Reserved R10
IBn+5	Axis selection							
	Y R2	Z R3	5. Axis R5	Toggle MCS/WCS	Reserved R11	9. Axis R9	8. Axis R8	6. Axis R6
IBn+6	Free customer use							
	T9	T10	T11	T12	T13	T14	T15	T16
IBn+7	Free customer use							
	T1	T2	T3	T4	T5	T6	T7	T8
IBn+8	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+9	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+10	Digit inputs							
	KT-IN8 X55.2	KT-IN7 X55.1	KT-IN6 X52.3	KT-IN5 X52.2	KT-IN4 X52.1	KT-IN3 X51.3	KT-IN2 X51.2	KT-IN1 X51.1
IBn+11	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	KT-IN9 X55.3
IBn+12	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+13	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
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							

Output image

Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
QBn+0	Reserved				Operation mode			
	Reserved	Reserved	Reserved	Reserved	JOG	Teach In	MDA	AUTOM.
QBn+1					Machine functions			
	Feed Start	* Feed Stop	Cycle-Start	* Cycle-Stop	REPOS	REF.	var. INC	Reserved
QBn+2	Direction key	Axis selection						
	- R13	X R1	4. Achse R4	7. Achse R7	Reserved R10	Single block	Spindle start	* Spindle Stop

QBn+3	Axis selection							Direction key
	Z R3	5. Axis R5	Toggle MCS/WCS	Reserved R11	9. Axis R9	8. Axis R8	6. Axis R6	+ R15
QBn+4	Free customer use							
	T9	T10	T11	T12	T13	T14	T15	Y R2
QBn+5	Free customer use							
	T1	T2	T3	T4	T5	T6	T7	T8
QBn+6	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	RESET	Rapid R14
QBn+7	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Key assignment

Some of the keys are permanently pre-assigned, the remaining keys can be freely assigned. The labeling of the permanently assigned keys is shown in brackets in the table.

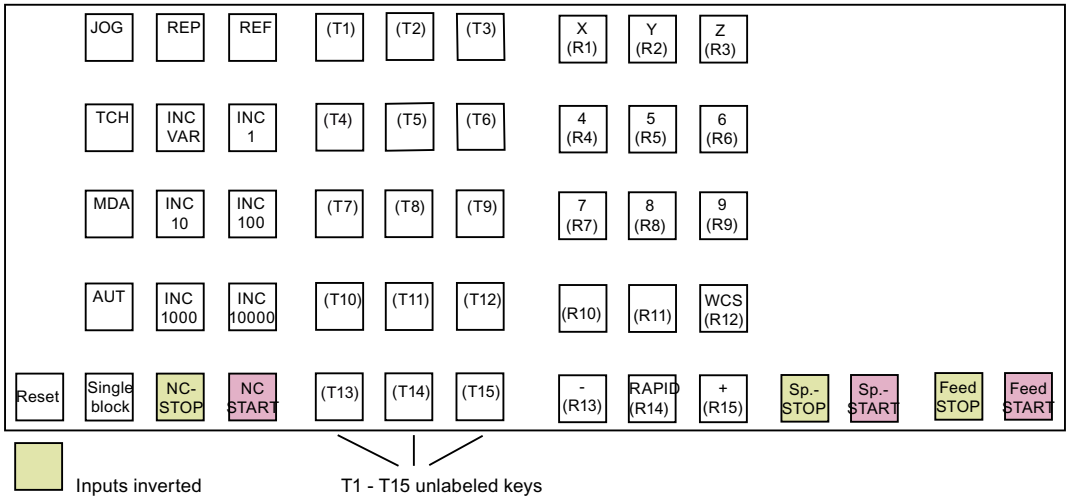


Figure 8-18 MCP416 default key assignment

8.3.5 Technical data

828D MCP 416 USB

Parameter	Value
Input voltage	5 V DC
Power consumption, max.	2.5 W

Parameter	Value
Vibratory load:	
• Operation	9 – 29 Hz: 0.3 mm/29 - 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	5 g, 30 ms, 3 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)
	IP00 (rear)
Cooling	By natural convection
Temperature limits:	
• Storage	-40 °C ... +70 °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 ... 90 %
Condensation, spraying water, and icing	Not permissible
Supply air	Without aggressive gases, dusts, and oils
Approvals	CE, UL/CSA, KC, RCM, EAC
Background color	RAL9017
Dimensions:	
• Width	416 mm
• Height	155 mm
• Depth	54 mm
Weight:	1.16 kg

See also

Other values/standards: Application planning (Page 47)

8.3.6 Spare parts and accessories

Accessories pack when delivered from the factory

Qty.	Description
1	USB cable (length: 0.8 m) for the connection between the PPU and MCP USB
6	Mounting elements with screws to mount the MCP
1	Blank film for slide-in labels • Product announcement (https://support.industry.siemens.com/cs/de/de/view/107745917/en) • DOConCD in directory "Supplementary documentation_slide-in labels"

Spare parts and accessories

Qty.	Description	Article number
1	Feed/rapid traverse override rotary switch	6FC5347-0AF11-0AA0
1	Spindle/rapid traverse override rotary switch	6FC5347-0AF11-1AA0
1	SINUMERIK MCP 416/483 USB slide-in strips (3 pcs)	6FC5348-0AA04-0AA0
1	Cable set (60 cables for additional MCP control devices, 500 mm long)	6FC5247-0AA35-0AA0

Additional spare parts for these components can be found here: Spare parts (Spares on Web). (https://www.sow.siemens.com/?lang=en)

8.4 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.

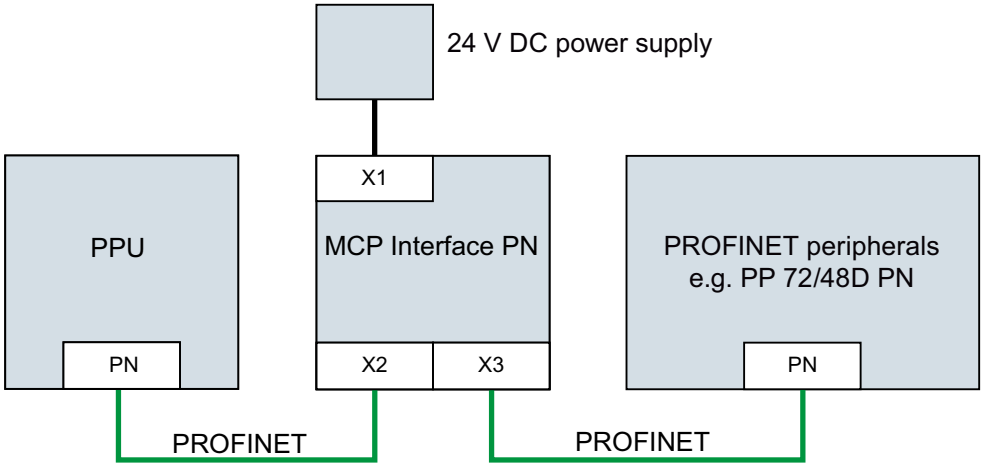
You can connect the following operator controls to the interface:

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

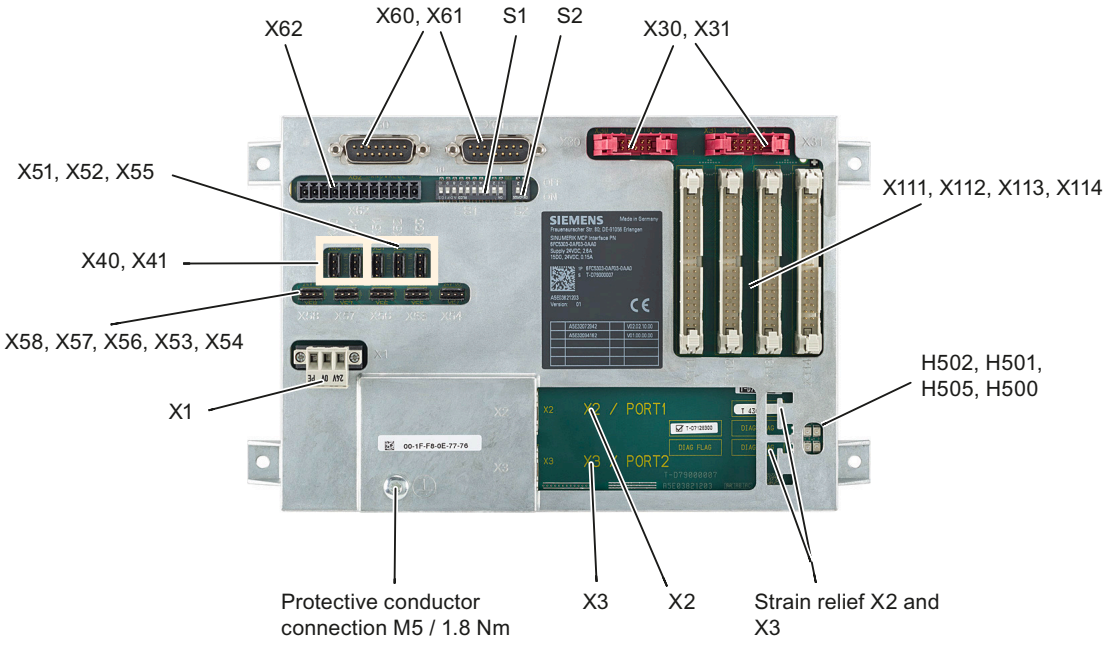
The following inputs/outputs are also available:

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

System configuration



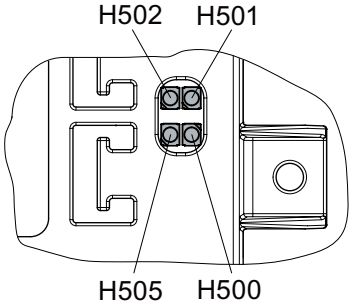
Display



X1	24 V DC power supply
X2 / X3	PROFINET interfaces
X30	Interface for rotary switch feedrate override
X31	Interface for rotary switch spindle override
X40 / X41	Digital inputs (24 V)
X51 / X52 / X55	Digital inputs (TTL)
X58 / X57 / X56 / X53 / X54	Digital outputs (24 V)
X60 / X62	Handwheel
X61	Reserved
X111 / X112 / X113 / X114	Key and LED interfaces
H500 / H501 / H502 / H505	LEDs for status display
S1	DIP switch for the IP-Address MCP

Figure 8-19 View of MCP Interface PN

LEDs for status display



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 fallen below its setpoint; a reset will be initiated.
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.

8.4.1 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

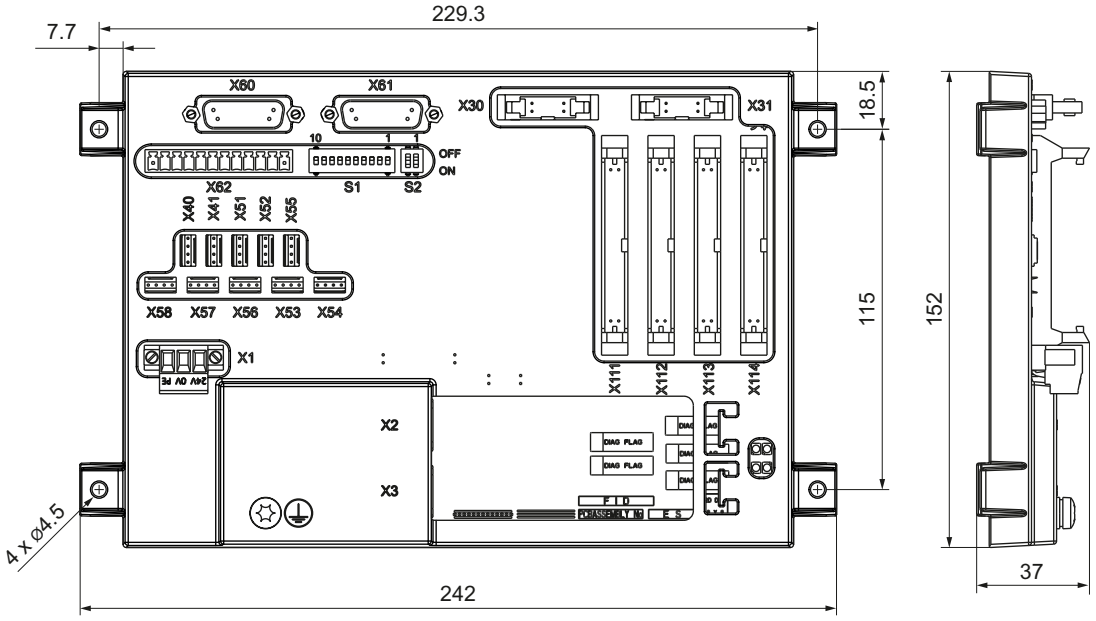
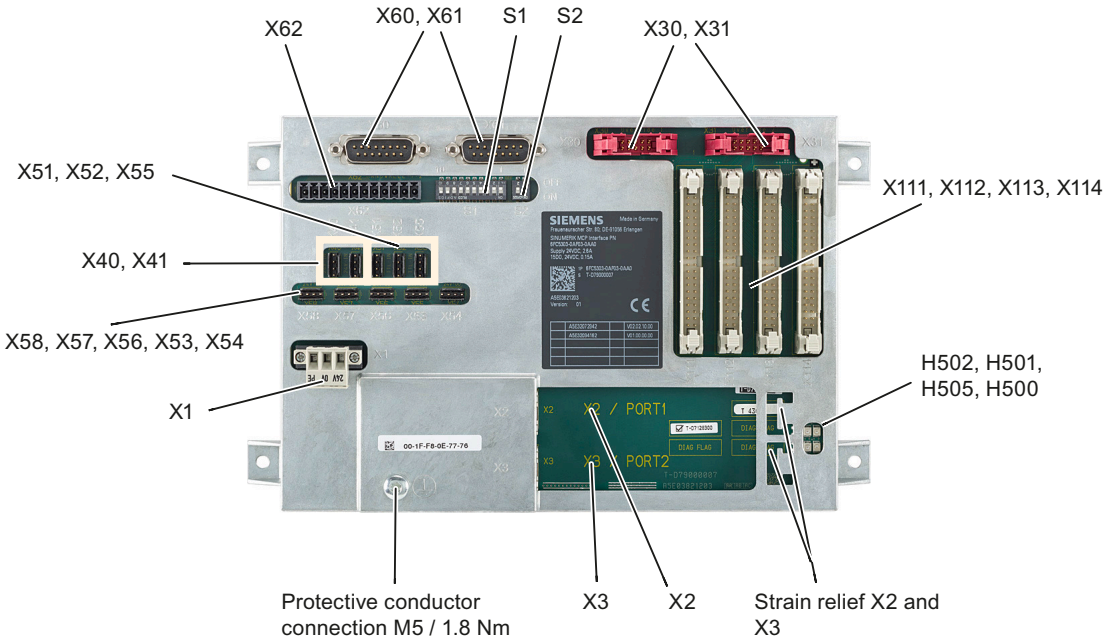


Figure 8-20 Dimensions

8.4.2 Connection

Position of the interfaces



X1	24 VDC power supply
X2 / X3	PROFINET interfaces
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)
X58 / X57 / X56 / X53 / X54	Digital outputs (24 V)
X60 / X62	Handwheel
X61	Reserved
X111/X112/X113/X114	Key and LED interfaces
H502 / H501 / H505 / H500	LEDs for status display
S1	DIP switch for setting the MCP address
S2	DIP switch for setting the signal transmission of the handwheel pulses

Figure 8-21 Interfaces, MCP interface PN

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 8-10 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.

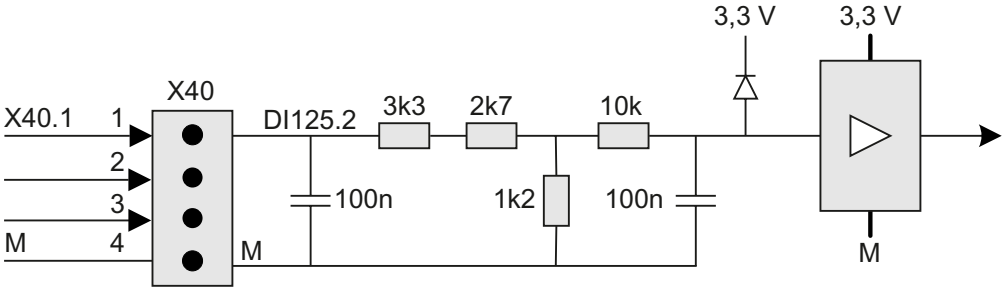


Figure 8-22 Schematic circuit diagram X40, X41

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 8-11 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 8-12 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 8-13 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 226).

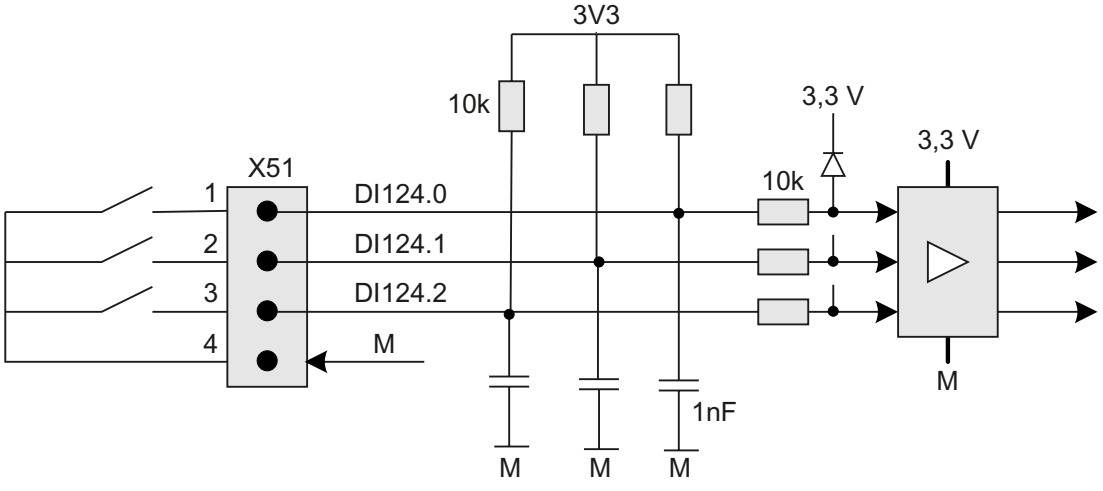


Figure 8-23 Block diagram X51, X52, X55

Connector designation: **X51, X52, X55**
Connector type: 4-pin plug connector

Special feature: No galvanic isolation
Max. cable length: 0.6 m

Table 8-14 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 8-15 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 8-16 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 8-17 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).

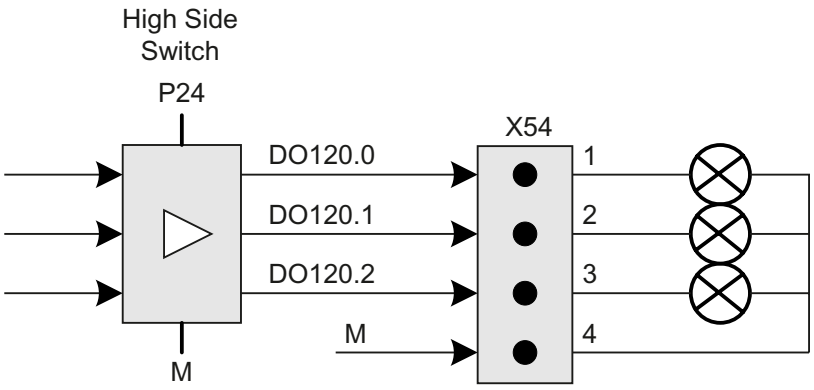


Figure 8-24 Block diagram X53, X54 and X56 to X58

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 8-18 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 8-19 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 8-20 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 8-21 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 8-22 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 8-23 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 8-24 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 8-25 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.

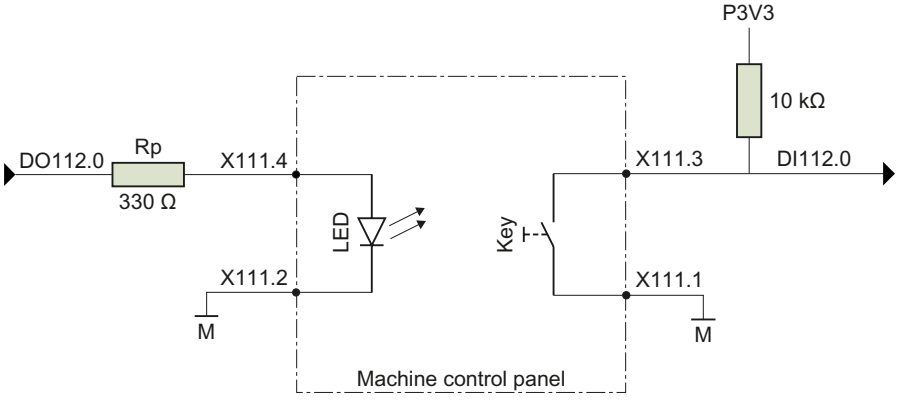


Figure 8-25 Schematic circuit diagram X111

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 8-26 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 8-27 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 8-28 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 8-29 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 8-30 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 8-31 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

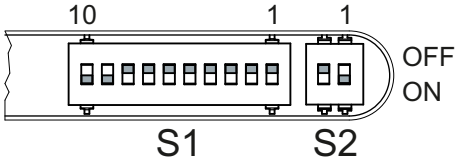


Table 8-32 Setting of switch S1 as delivered

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 8-33 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 284).

The handwheel signal type is set with switch S2-1.

Table 8-34 Switch S2 settings

1	Meaning
ON	differential interface
OFF	TTL interface

Note

Switch S2-2 is reserved for test purposes.

8.4.3 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 AUTOHOTSPOT.

Standard input image

Table 8-35 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 8-36 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 8-37 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 8-38 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.

8.4.4 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 47)

8.5 MCP 483C PN

Description

The MCP 483C PN machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the horizontal versions of SINUMERIK 828D: PPU 281.4 and PPU 241.4

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
  - Key type: Mechanical short-stroke keys
  - Direction keys for milling machines with rapid traverse override
    The key covers for the direction keys for lathes are provided in the scope of delivery.
- Spindle control with override spindle (rotary switch with 16 positions)
- Feed control with feed override (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)
- 9 customer-specific inputs (e.g. for illuminated pushbuttons)
- Six customer-specific outputs
- Handwheel connection

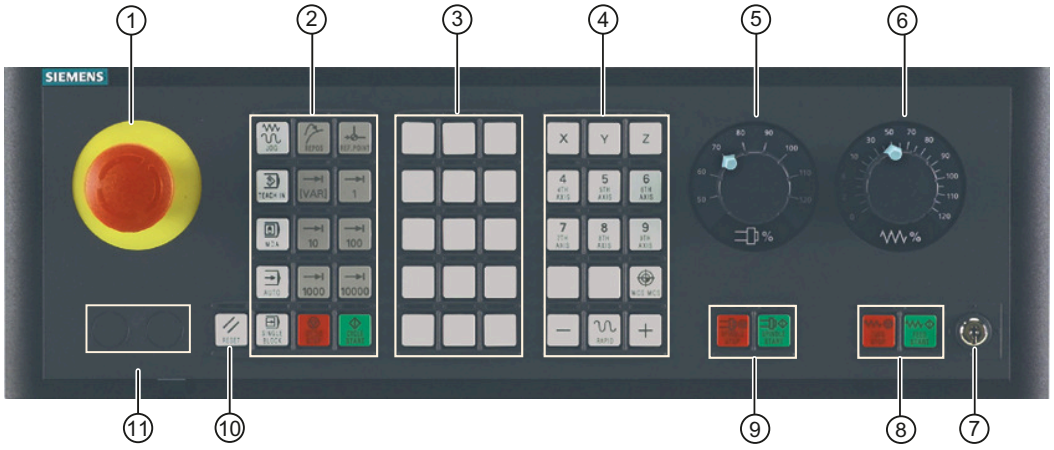
Expansion slots:

Two slots for control devices (d = 16 mm)

An additional cable set is required for control devices: Spare parts and accessories (Page 195)

8.5.1 Operator controls and display elements

Operator controls



① Emergency-Stop button
② Operating modes and machine functions
③ 17 customer keys
④ Direction keys with rapid traverse override
⑤ Rotary spindle override switch
⑥ Rotary feedrate override switch
⑦ Key-operated switch
⑧ Keys for feed control
⑨ Keys for spindle control
⑩ Reset button
⑪ 2 slots for control devices (d = 16 mm)

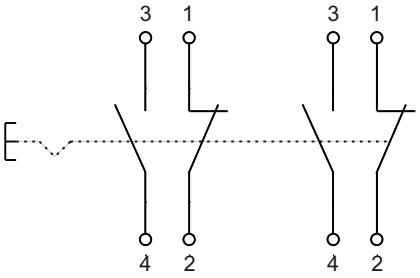
Figure 8-26 Position of control elements on MCP 483C PN

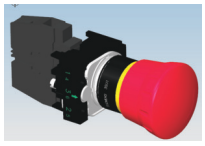
WARNING

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 the following situations:

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

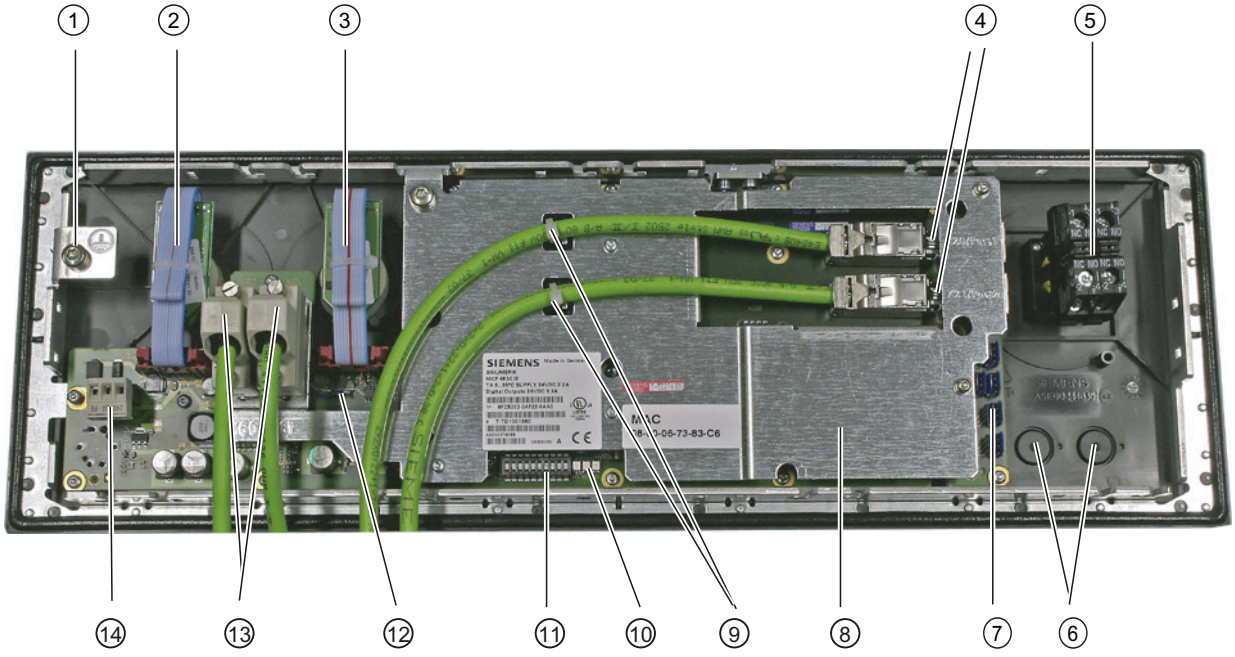
For an Emergency Stop, all drives are brought to a standstill with the maximum possible braking torque.

The Emergency Stop pushbutton is released by rotating it to the left (counter-clockwise).

Key caps

All keys of the MCP 483C PN come with changeable key caps. The additional key caps for turning machines are supplied in the accessories pack (Page 195):

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 8-27 Rear panel of MCP 483C PN

LEDs for status display

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

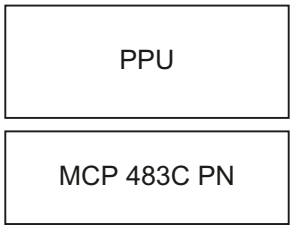
Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply OK
H2	PNSync	Green	Lit: System software running, STOP state
			Flashes 0.5 Hz: System software running, RUN state

Name	Designation	Color	Description
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

8.5.2 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 195)").

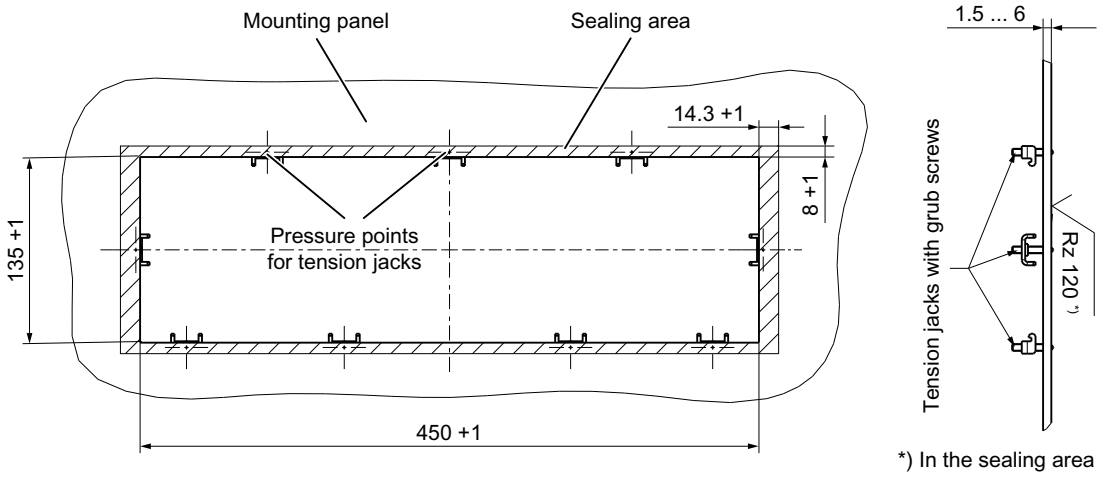


Figure 8-28 Panel cutout of MCP 483C PN

MCP 483C PN dimension drawing

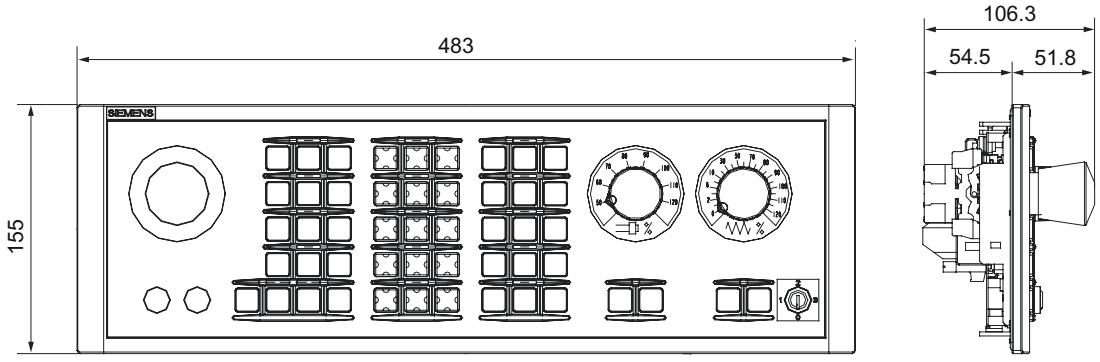


Figure 8-29 MCP 483C PN dimensions

8.5.3 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.

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

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

Pin	Signal name	Signal type	Meaning
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

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.

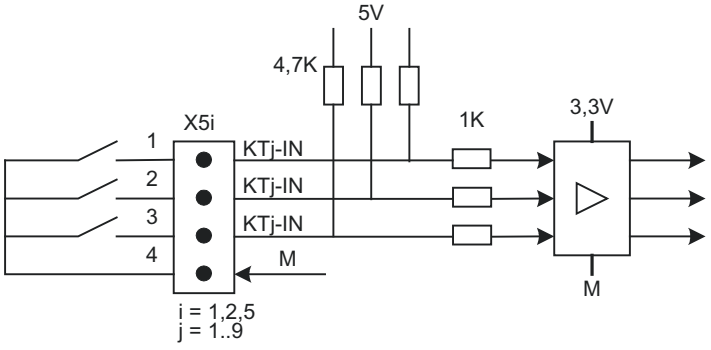


Figure 8-30 Circuit diagram of the input circuit for X51, X52 and X55

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

Connector type: 4-pin plug connector

Table 8-39 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 8-40 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 8-41 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.

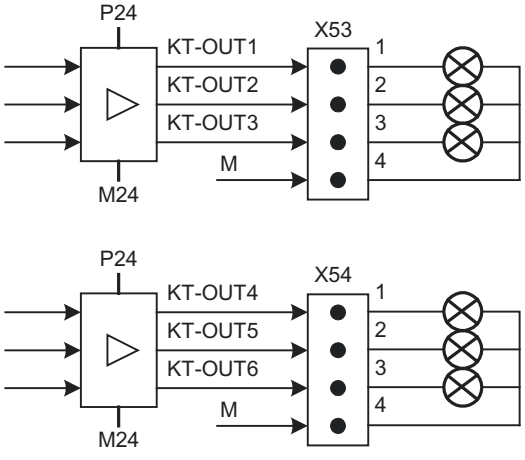


Figure 8-31 Circuit diagram of the output circuit for X53 and X54

⚠ CAUTION

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

Connector designation: **X53, X54**

Connector type: 4-pin plug connector

Table 8-42 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 8-43 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

You can connect a handwheel either with TTL or difference signals via X60. 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

Pin	Name	Type	Meaning
1	P5V	V	5 V power supply
2	M	V	Ground
3	HW1_A	I	Handwheel pulses track A

Pin	Name	Type	Meaning
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

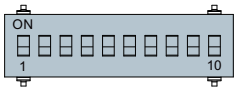
Switch S1

The handwheel signal type is set with switch S1.

Closed	Differential connection
Open	TTL interface

Switch S1 is closed when supplied ex works.

Switch S2



Switch position: "ON" is at the top.

Table 8-44 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 set to "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 8-45 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 284).

8.5.4 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 AUTOHOTSPOT.

Input image MCP 483C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
IB112	Spindle override				Operating mode			
	D (2^3)	C (2^2)	B (2^1)	A (2^0)	JOG	TEACH IN	MDI	AUTO
IB113	Machine function							
	REPOS	REF.	var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
IB114	Keyswitch position 0	Keyswitch position 2	Spindle start	*Spindle stop	Feed start	*Feed stop	NC start	*NC stop
IB115	RESET	Keyswitch position 1	Single block	Feed override				
				E (2^4)	D (2^3)	C (2^2)	B (2^1)	A (2^0)
IB116	Direction keys			Keyswitch position 3	Axis selection			
	+ R15	- R13	Rapid traverse R14		X R1	4. axis R4	7. axis R7	R10
IB117	Axis selection							
	Y R2	Z R3	5. axis R5	Drive command in MCS/WCS	R11	9. axis R9	8. axis R8	6. axis R6
IB118	Freely assignable customer keys							
	T9	T10	T11	T12	T13	T14	T15	-
	Freely assignable customer keys							
IB119	T1	T2	T3	T4	T5	T6	T7	T8
IB120	-	-	-	-	-	-	-	-
IB121	-	-	-	-	-	-	-	-
IB122	KT-IN8	KT-IN7	KT-IN6	KT-IN5	KT-IN4	KT-IN3	KT-IN2	KT-IN1
IB123	-	-	-	-	-	-	-	KT-IN9
IB124	-	-	-	-	-	-	-	-
IB125	-	-	-	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

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
IB m + 0	Handwheel 1 counter status (16-bit signed, low-order byte equals byte m + 0)							
IB m + 1								
IB m + 2	Handwheel 2 counter status (16-bit signed, low-order byte equals byte m + 2)							
IB 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 MCP 483C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
QB112	Machine function				Operating mode			
	1000 INC	100 INC	10 INC	1 INC	JOG	TEACH IN	MDI	AUTO
QB113	Feed start	*Feed stop	NC start	*NC stop	Machine function			
					REPOS	REF.	var. INC	10000 INC
QB114	Direction key - R13	Axis selection				Single block	Spindle start	*Spindle stop
		X R1	4. axis R4	7. axis R7	R10			
QB115	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	
QB116	Freely assignable customer keys							
	T9	T10	T11	T12	T13	T14	T15	Y R2
QB117	Freely assignable customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
QB118	-	-	-	-	-	-	RESET	R14
QB119	-	-	KT-OUT 6	KT-OUT 5	KT-OUT 4	KT-OUT 3	KT-OUT 2	KT-OUT 1
Signals marked with * are inverse signals								

Default key assignment

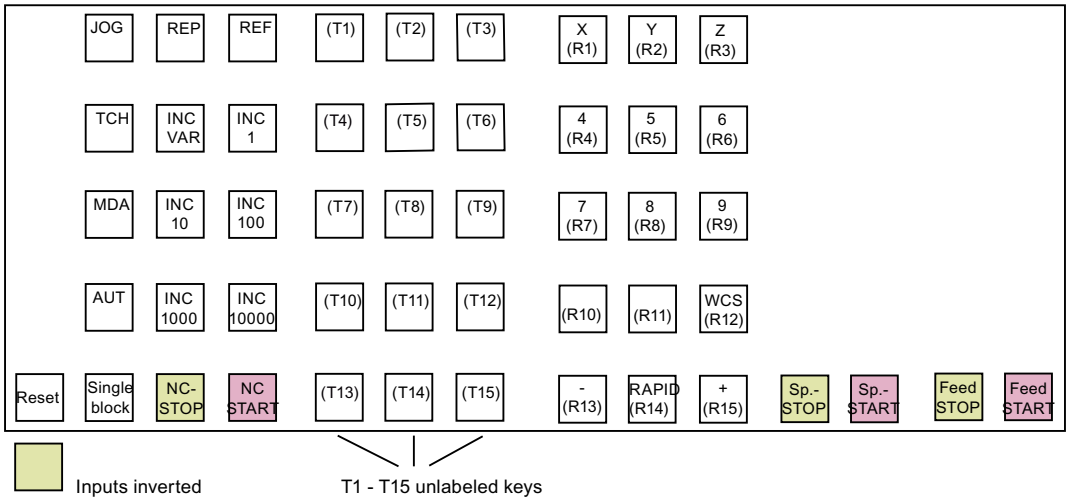


Figure 8-32 Default key assignment of MCP 483C PN

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

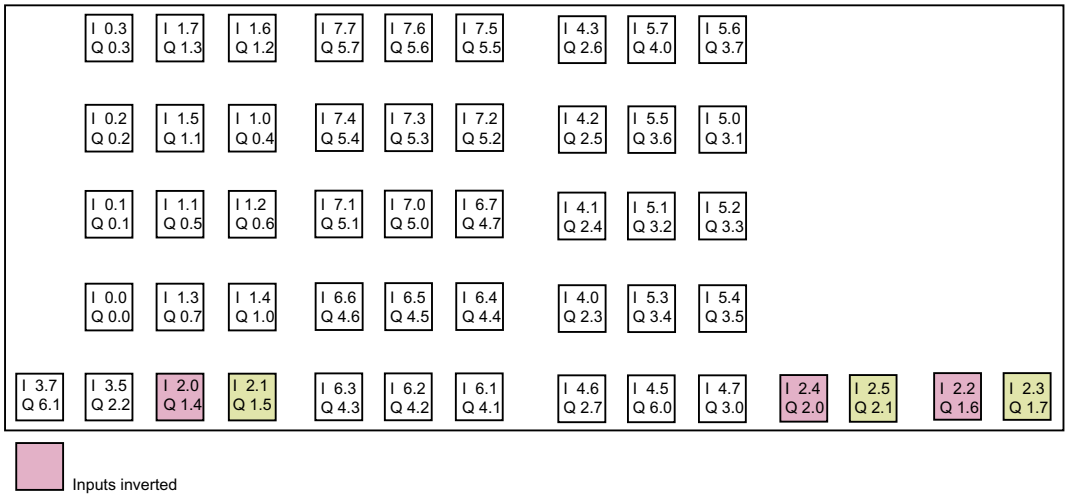


Figure 8-33 Inputs and outputs of the MCP 483C PN keyboard

8.5.5 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
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 47)

8.5.6 Spare parts and accessories

Accessories pack when delivered from the factory:

Qty.	Description
9	Key caps for turning (labeled)
30	Key caps, ergograu (for labeling) ergo gray
30	Key caps, transparent (for labeling)
1	Backing plate for Emergency Stop, yellow

Slide-in labels:

- Product announcement (https://support.industry.siemens.com/cs/de/de/view/107745917/en)
- DOConCD in directory "Supplementary documentation_slide-in labels"

Additional spare parts that can be ordered:

Qty.	Description	Article number
1 set	Square, can be labeled with laser, 1 set with 500, ergo-gray (light basic)	6FC5348-0AF00-0AA0
1 set	Square, can be labeled with laser, 1 set with 500, mid-gray (medium basic)	6FC5348-0AF01-0AA0
1 set	Square key caps, can be inscribed with a laser, 1 set of 90 caps ergo gray and 20 caps each in red/green/yellow/medium gray	6FC5248-0AF12-0AA0
1 set	Square key cap for inscription plates, 1 set of 90 caps clear	6FC5248-0AF21-0AA0
1 set	Set of keys (10 keys)	6FC5148-0AA03-0AA0
60	Cable set for additional control devices, 0.5 m long	6FC5247-0AA35-0AA0
1	Feedrate rotary switch: Override feedrate / rapid traverse electronic rotary switch 1x23G, T=32, cap, knob, pointer, feedrate and rapid traverse dials	6FC5247-0AF13-1AA0
1	Spindle rotary switch: Spindle/rapid traverse override, electronic rotary switch 1x16G, T=24, cap, knob, pointer, spindle and rapid traverse dials	6FC5248-0AF12-1AA0
1 set	Tensioner set (9 items) for supplementary components with 2.5 mm profile, length 20 mm	6FC5248-0AF14-0AA0
1 set	Rapid traverse dial for 16-stage rotary switch, 1 set of 20 units	6FC5248-0AF30-0AA0
1	Industrial USB hub 4	6AV6671-3AH00-0AX0

Qty.	Description	Article number
1	Emergency Stop pushbutton: Mushroom pushbutton with holder, 22 mm round, plastic, red, 40 mm, positive latching, rotate to unlatch	3SB3000-1HA20
1	Contact block with 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be additionally connected)	3SB3400-0A

8.6 MCP 310C PN

Description

The MCP 310C PN machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the vertical versions of SINUMERIK 828D: PPU 280.4 and PPU 240.4

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
  - Key type: mechanical short-stroke keys
  - Direction keys for milling machines with rapid traverse override
    The key covers for the direction keys for lathes are supplied.
- Spindle control with override spindle (rotary switch with 16 positions)
- Feed control with feed override (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)
- 9 customer-specific inputs (e.g. for illuminated pushbuttons)
- Six customer-specific outputs
- Handwheel connection

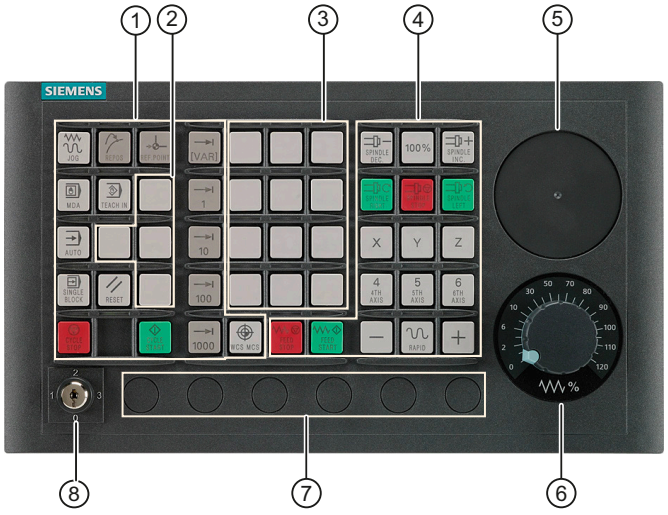
Expansion slots:

Six slots for control devices (d = 16 mm)

Additional cable set required for control devices: Spare parts and accessories (Page 213)

8.6.1 Operator controls and display elements

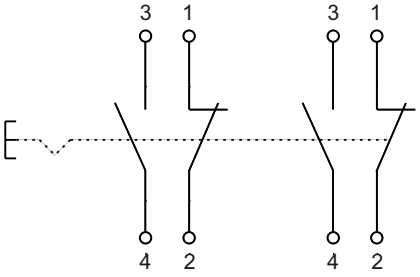
Operator controls

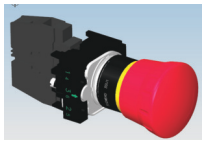


①	Operating modes and machine functions
② + ③	16 customer keys
④	Spindle control
⑤	Slot for Emergency-Stop button or rotary switch for spindle override
⑥	Rotary switch for feed override
⑦	6 slots for control devices (d = 16 mm)
⑧	Key-operated switch

Figure 8-34 Arrangement of the MCP 310C PN control elements

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.

For an Emergency Stop, all drives are brought to a standstill with the maximum possible braking torque.

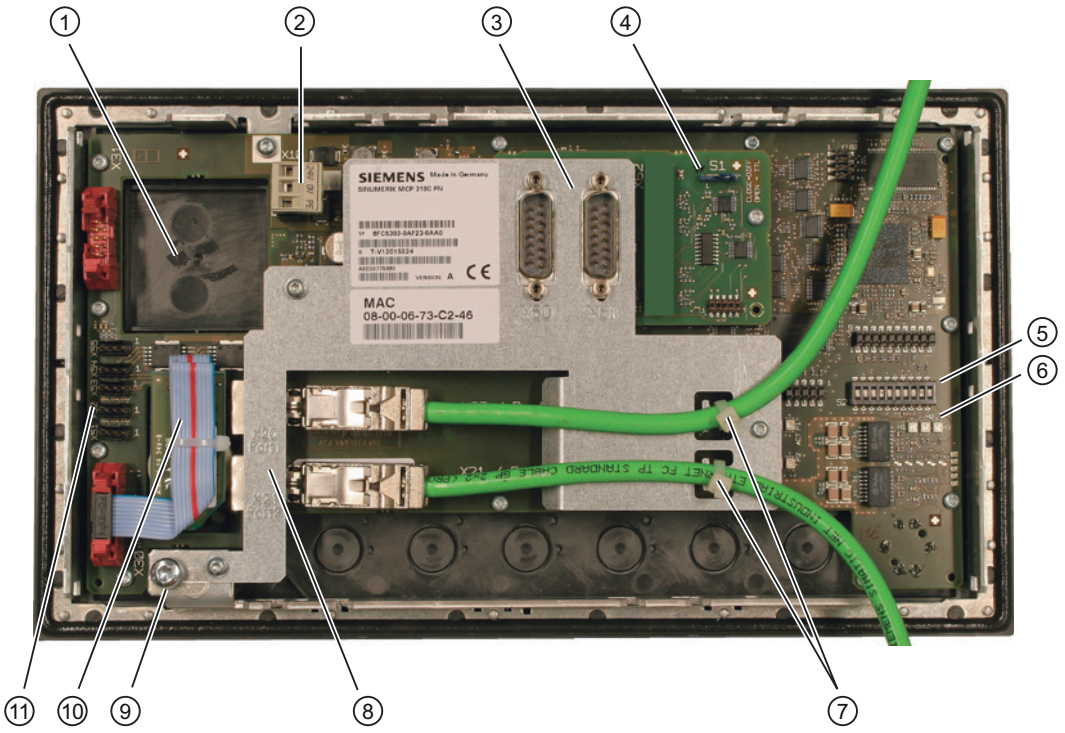
The Emergency Stop pushbutton is released by rotating it to the left (counter-clockwise).

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. The additional key caps for turning machines are supplied accessories pack (Page 213).



① Slot for Emergency-Stop button or spindle override
② Power supply interface X10
③ X60 connection for handwheel, X61 reserved
④ Switch for setting the handwheel signal type
⑤ Switch S2
⑥ LEDs
⑦ Ethernet cable strain relief
⑧ PLC I/O Interface connections X20 (port 1), X21 (port 2) behind cover plate
⑨ Equipotential bonding
⑩ Feed override
⑪ Customer-specific inputs and outputs

Figure 8-35 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 8-46 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

Name	Designation	Color	Description
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.

8.6.2 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).

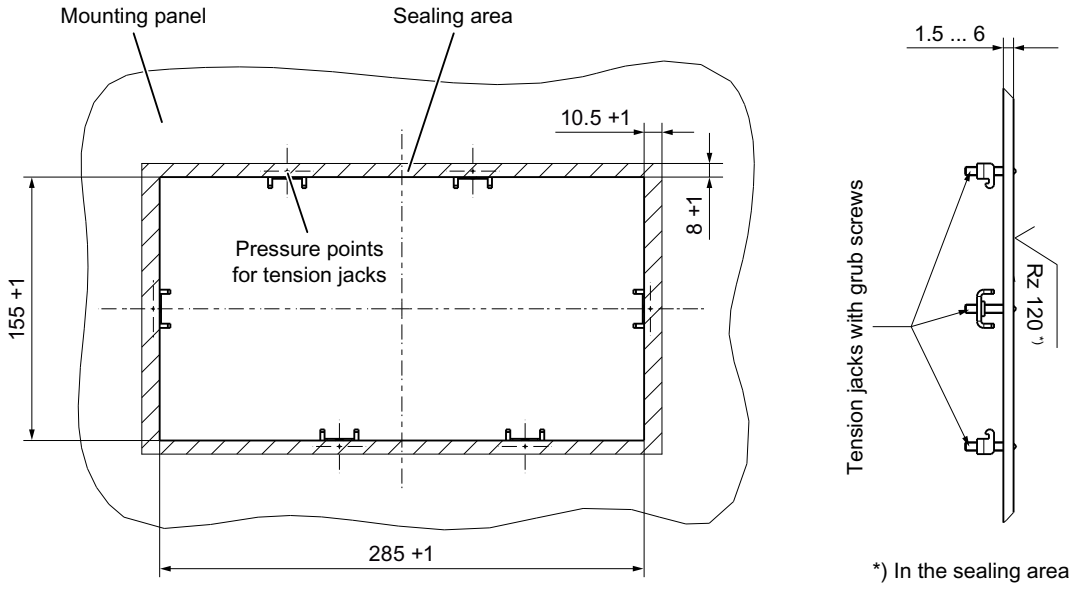
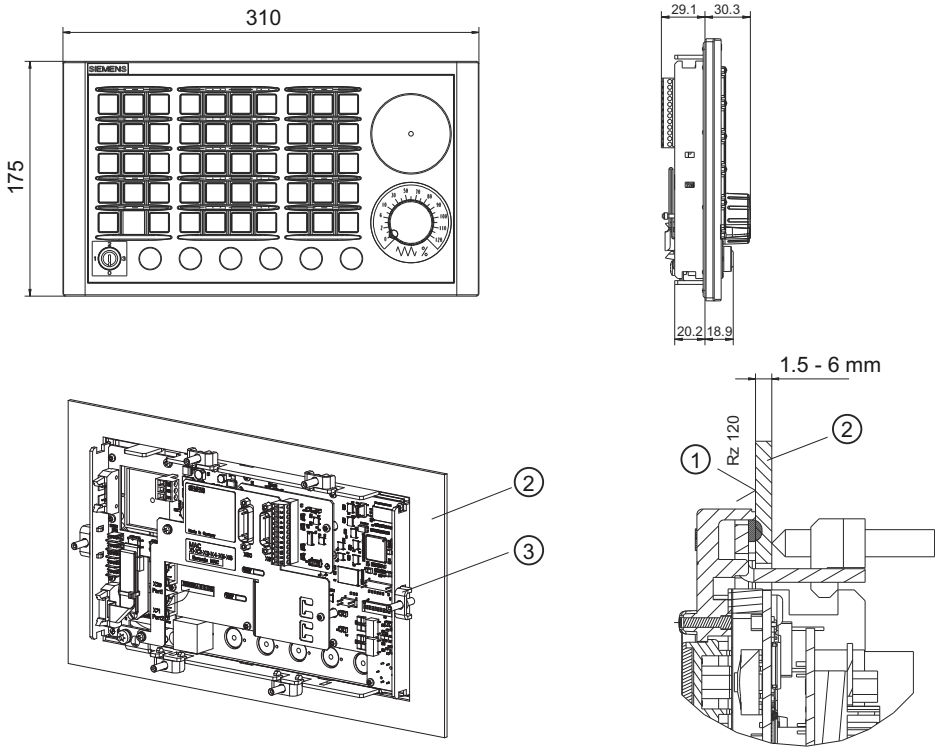


Figure 8-36 Panel cut-out for the machine control panel MCP 310C PN

Dimension drawing



① In the sealing area
② Mounting frame
③ Tension jack (6 parts) - tightening torque 0.5 Nm

Figure 8-37 MCP 310C PN dimensions

8.6.3 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.

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

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

Pin	Signal name	Signal type	Meaning
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

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.

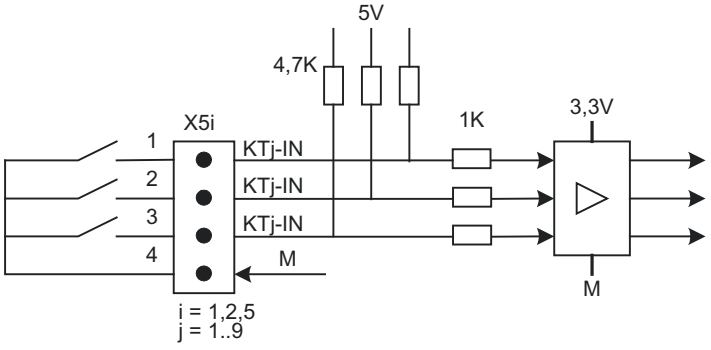


Figure 8-38 Circuit diagram of the input circuit for X51, X52 and X55

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

Connector type: 4-pin plug connector

Table 8-47 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 8-48 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 8-49 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.

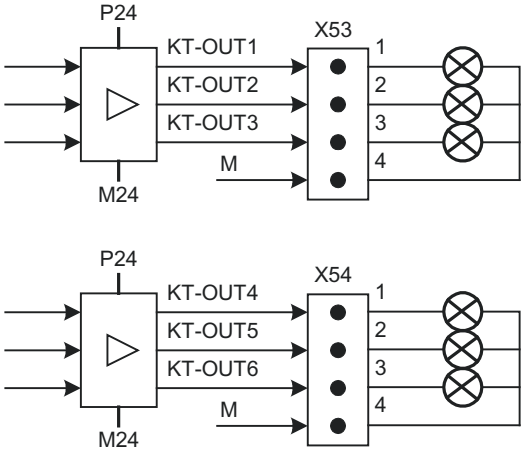


Figure 8-39 Circuit diagram of the output circuit for X53 and X54

⚠ CAUTION

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

Connector designation: **X53, X54**

Connector type: 4-pin plug connector

Table 8-50 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 8-51 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

You can connect a handwheel either with TTL or difference signals via X60. 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

Pin	Name	Type	Meaning
1	P5V	V	5 V power supply
2	M	V	Ground
3	HW1_A	I	Handwheel pulses track A

Pin	Name	Type	Meaning
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

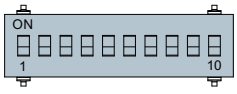
Switch S1

The handwheel signal type is set with switch S1.

Closed	Differential connection
Open	TTL interface

Switch S1 is closed when supplied ex works.

Switch S2



Switch position: "ON" is at the top.

Table 8-52 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 set to "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 8-53 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 284).

8.6.4 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 AUTOHOTSPOT.

Input image MCP 310C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
IB112	* NC stop	Spindle -	Spindle 100%	Spindle +	Single block	JOG	MDI	AUTO
IB113	NC start	Spindle right	* Spindle stop	Spindle left	Keyswitch position 3	REF	REP	Teach IN
IB114	Feed start	* Feed stop	INC VAR	Keyswitch position 0	INC 1000	INC 100	INC 10	INC 1
IB115		Keyswitch	Keyswitch	Feed override				
	RESET	position 2	position 1	E (2^4)	D (2^3)	C (2^2)	B (2^1)	A (2^0)
IB116	Direction keys			KT5	KT4	KT3	KT2	KT1
	+	-	Rapid traverse					
IB117	T16	KT6	6	5	4	Z	Y	X
IB118	Freely assignable customer keys					Freely assignable customer keys		
	T9	T10	T11	T12	WCS MCS	T13	T14	T15
IB119	Freely assignable customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
IB120	-	-	-	-	-	-	-	-
IB121	-	-	-	-	-	-	-	-
IB122	KT-IN8	KT-IN7	KT-IN6	KT-IN5	KT-IN4	KT-IN3	KT-IN2	KT-IN1
IB123	-	-	-	-	-	-	-	KT-IN9
IB124	-	-	-	-	-	-	-	-
IB125	-	-	-	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

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
IB m + 0	Handwheel 1 counter status (16-bit signed, low-order byte equals byte m + 0)							
IB m + 1								
IB m + 2	Handwheel 2 counter status (16-bit signed, low-order byte equals byte m + 2)							
IB 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 MCP 310C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
QB112	* NC stop	Spindle -	Spindle 100%	Spindle +	Single block	JOG	MDI	AUTO
QB113	NC start	Spindle right	* Spindle stop	Spindle left	RESET	REF	REP	Teach IN
QB114	Feed start	* Feed stop	INC VAR	-	INC 1000	INC 100	INC 10	INC 1
QB115	-	-	-	-	-	-	-	-
QB116	+	_	Rapid traverse	KT-OUT5	KT-OUT4	KT-OUT3	KT-OUT2	KT-OUT1
QB117	T16	KT-OUT6	6	5	4	Z	Y	X
QB118	Freely assignable customer keys							
	T9	T10	T11	T12	WCS MCS	T13	T14	T15
QB119	Freely assignable customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
Signals marked with * are inverse signals								

Default key assignment

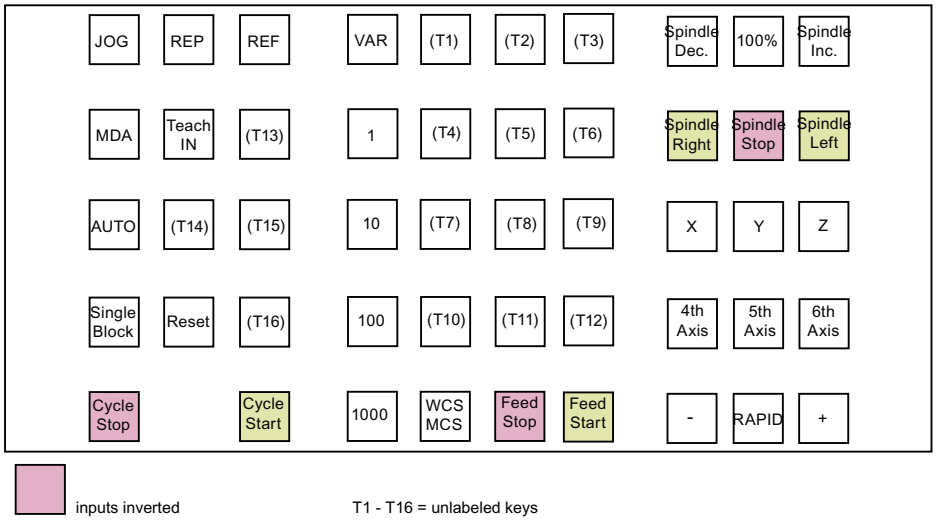


Figure 8-40 Default key assignment of MCP 310C PN

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



Figure 8-41 Inputs and outputs of the MCP 310C PN keyboard

8.6.5 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
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 47)"

8.6.6 Spare parts and accessories

Accessories pack when delivered from the factory:

Qty.	Description
9	Key caps for turning (labeled)
30	Key caps, ergograu (for labeling) ergo gray
30	Key caps, transparent (for labeling)
1	Backing plate for Emergency Stop, yellow

Slide-in labels:

- Product announcement (https://support.industry.siemens.com/cs/de/de/view/107745917/en)
- DOConCD in directory "Supplementary documentation_slide-in labels"

Additional spare parts that can be ordered:

Qty.	Description	Article number
1 set	Square, can be labeled with laser, 1 set with 500, ergo-gray (light basic)	6FC5348-0AF00-0AA0
1 set	Square, can be labeled with laser, 1 set with 500, mid-gray (medium basic)	6FC5348-0AF01-0AA0
1 set	Square key caps, can be inscribed with a laser, 1 set of 90 caps ergo gray and 20 caps each in red/green/yellow/medium gray	6FC5248-0AF12-0AA0
1 set	Square key cap for inscription plates, 1 set of 90 caps clear	6FC5248-0AF21-0AA0
1 set	Set of keys (10 keys)	6FC5148-0AA03-0AA0
60	Cable set for additional control devices, 0.5 m long	6FC5247-0AA35-0AA0
1	Feedrate rotary switch: Override feedrate / rapid traverse electronic rotary switch 1x23G, T=32, cap, knob, pointer, feedrate and rapid traverse dials	6FC5247-0AF13-1AA0
1	Spindle rotary switch: Spindle/rapid traverse override, electronic rotary switch 1x16G, T=24, cap, knob, pointer, spindle and rapid traverse dials	6FC5248-0AF12-1AA0
1 set	Tensioner set (9 items) for supplementary components with 2.5 mm profile, length 20 mm	6FC5248-0AF14-0AA0
1 set	Rapid traverse dial for 16-stage rotary switch, 1 set of 20 units	6FC5248-0AF30-0AA0
1	Industrial USB hub 4	6AV6671-3AH00-0AX0

Qty.	Description	Article number
1	Emergency Stop pushbutton: Mushroom pushbutton with holder, 22 mm round, plastic, red, 40 mm, positive latching, rotate to unlatch	3SB3000-1HA20
1	Contact block with 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be additionally connected)	3SB3400-0A

8.7 Electronic handwheel

Description

The portable electronic handwheel is intended for use directly at the machine. 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 enables increment-precise traversing. 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.

For safe storage on non-magnetic surfaces, a holder (Page 219) is available.



① Handwheel
② Spiral connection cable
③ 9-pin connector

Figure 8-42 View of portable electronic handwheel

8.7.1 Mounting

Dimensions of the electronic handheld handwheel

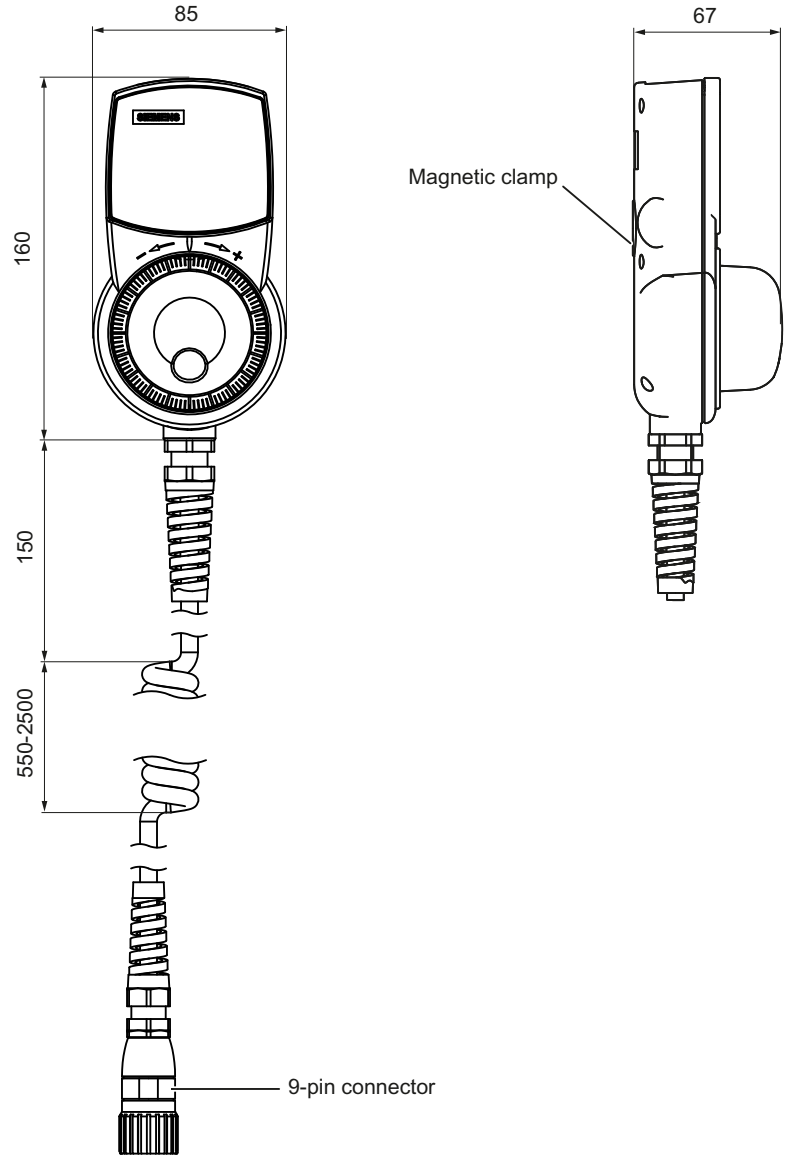


Figure 8-43 Front view and side view

Additional options

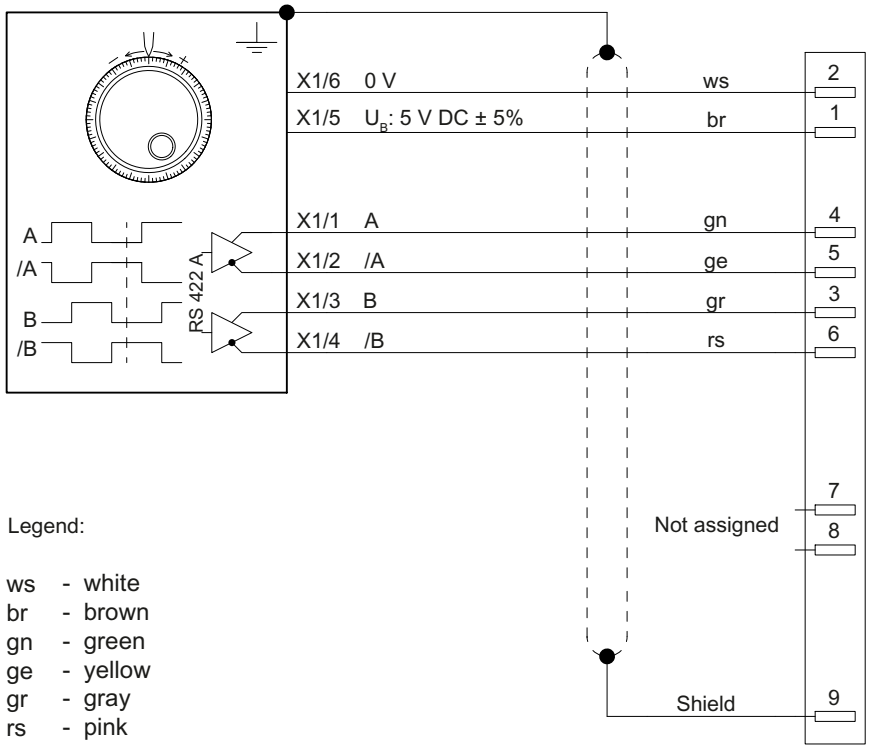
Optionally, the handheld electronic handwheel can be stored in a screw-on holder. The holder is mounted using three M4 screws (included in the scope of delivery).

See also: Mini handheld unit, Chapter "Mounting (Page 222)"

8.7.2 Connection

Electrical connection diagram

The portable handwheel is connected via a flange socket using the spiral connection cable. You will find article numbers for the recommended flange socket in Section Spare parts and accessories (Page 219).



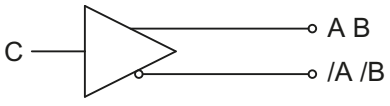
Note

If a connected handwheel triggers pulses from its neutral position or in the event of a slight touch, connect it opposite to its labeling.

- Exchange the wires of terminal A with those of terminal /A.
- Exchange the wires of terminal B with those of terminal /B.

Output circuitry

RS 422 A: Load current ≦ 20 mA



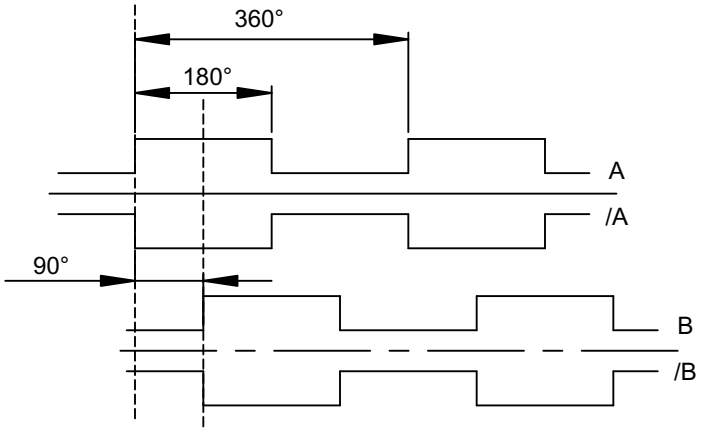


Figure 8-44 Pulse diagram

8.7.3 Technical specifications

Handheld electronic handwheel

Parameter	Value
Operating voltage	5 VDC ± 5%
Current consumption	Max. 80 mA
Output frequency	Max. 2 kHz
Number of pulses per revolution	Max. 100
Phase shift angle between signal A and signal B	90°
Interface	RS422 (TTL)
Cable length	Max. 25 m
Actuating force	0.04 Nm
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

Parameter	Value
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

8.7.4 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
Signal connector	9-pin connector	6FX2003-0SA01

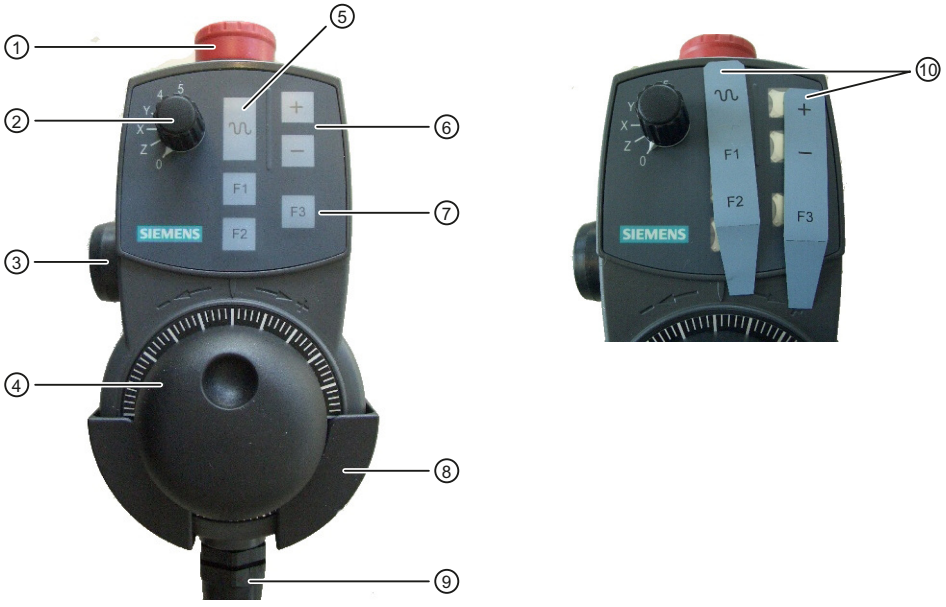
8.8 Mini handheld unit

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 operator controls.

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

- 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 8-45 Operator controls of the mini handheld unit

8.8.1 Operator controls

Operator controls 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.

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 key 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.

8.8.2 Mounting

Dimensions of the mini handheld unit

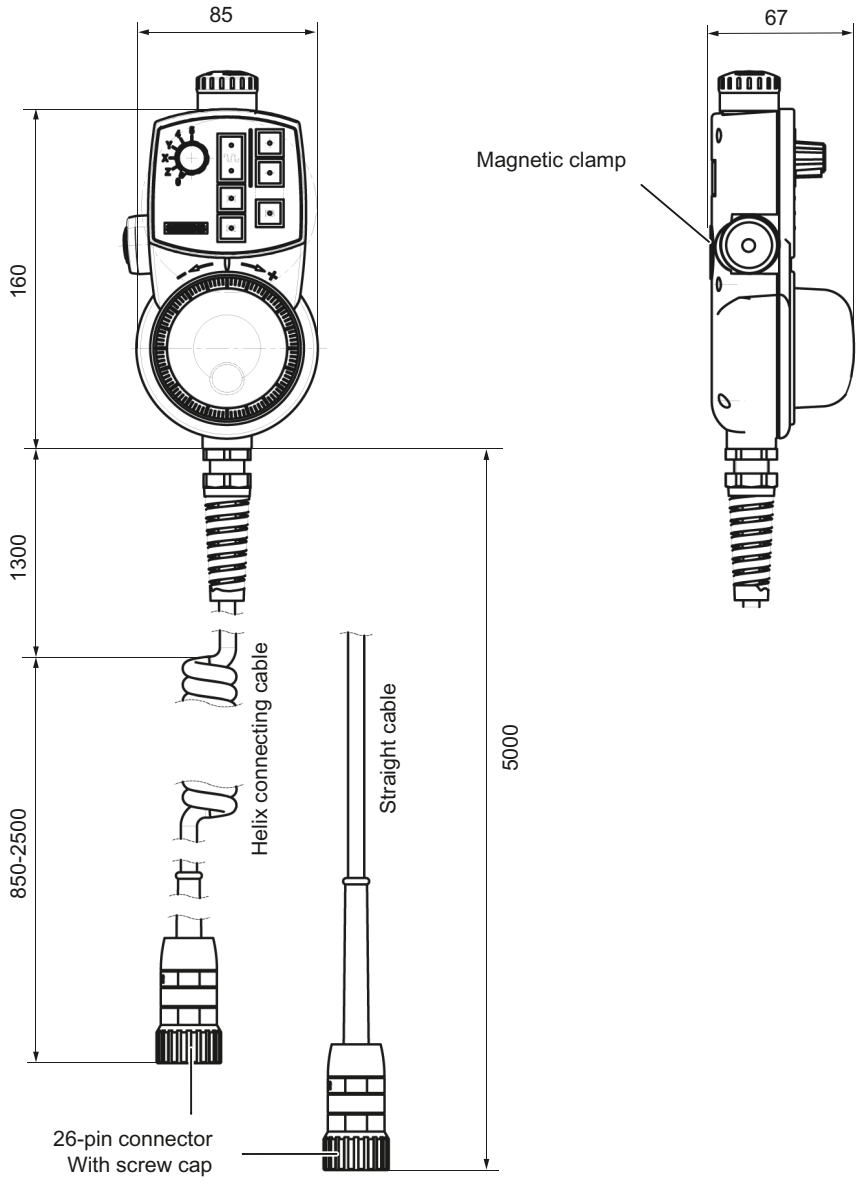


Figure 8-46 Dimension drawing of the mini HHU

Installing the connection kit

Procedure:

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

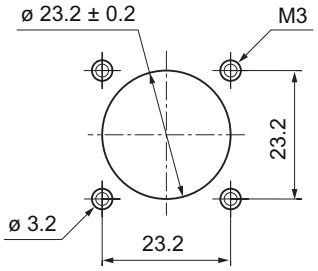


Figure 8-47 Hole pattern for mounting

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.

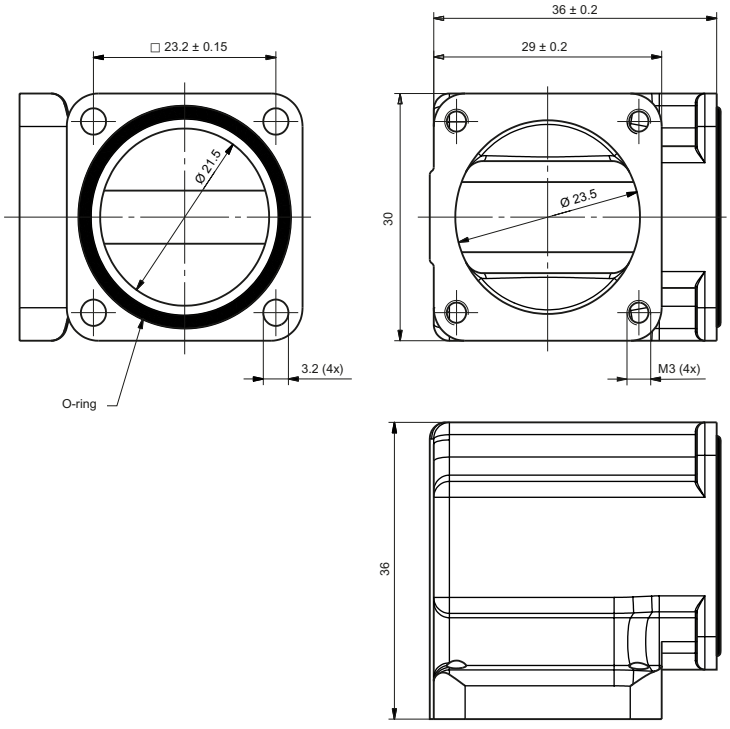


Figure 8-48 Dimension drawing of angled socket

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

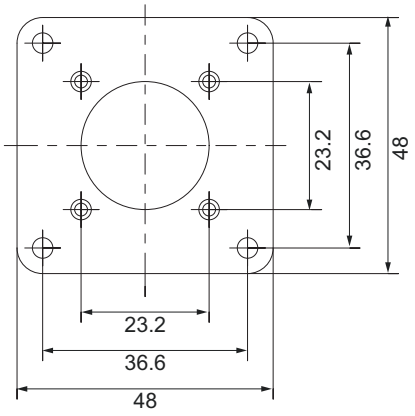


Figure 8-49 Dimension drawing of the adapter plate

- **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.

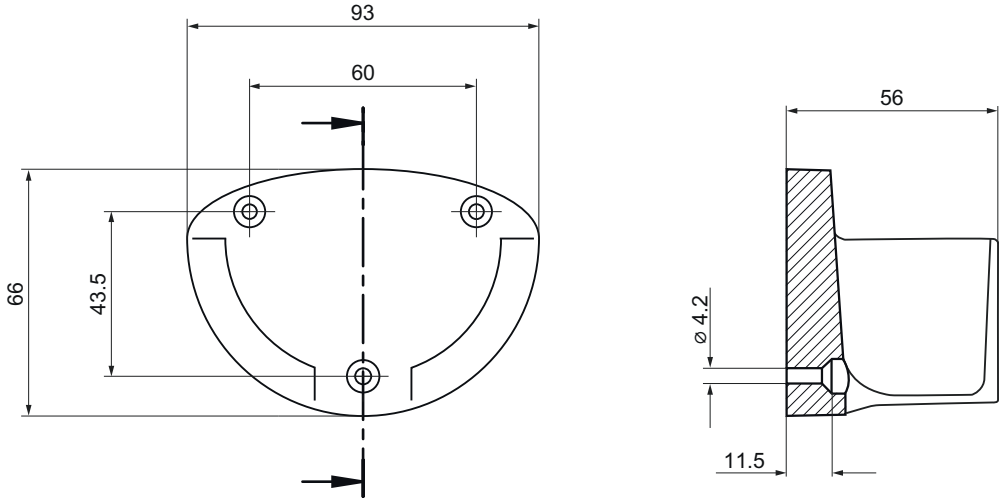


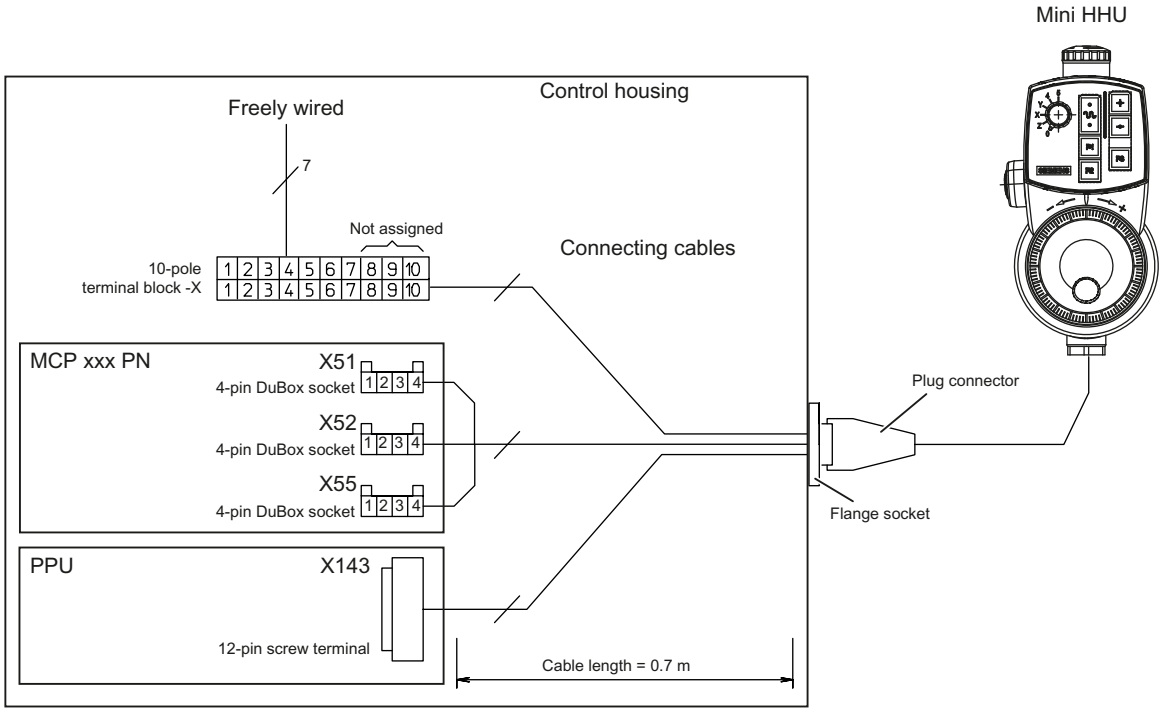
Figure 8-50 Dimension drawing of the holder

- **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.

8.8.3 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.



MCP xxx PN: MCP interface PN, MCP 483C PN, MCP 310C PN

Figure 8-51 Connection using a prefabricated connection kit

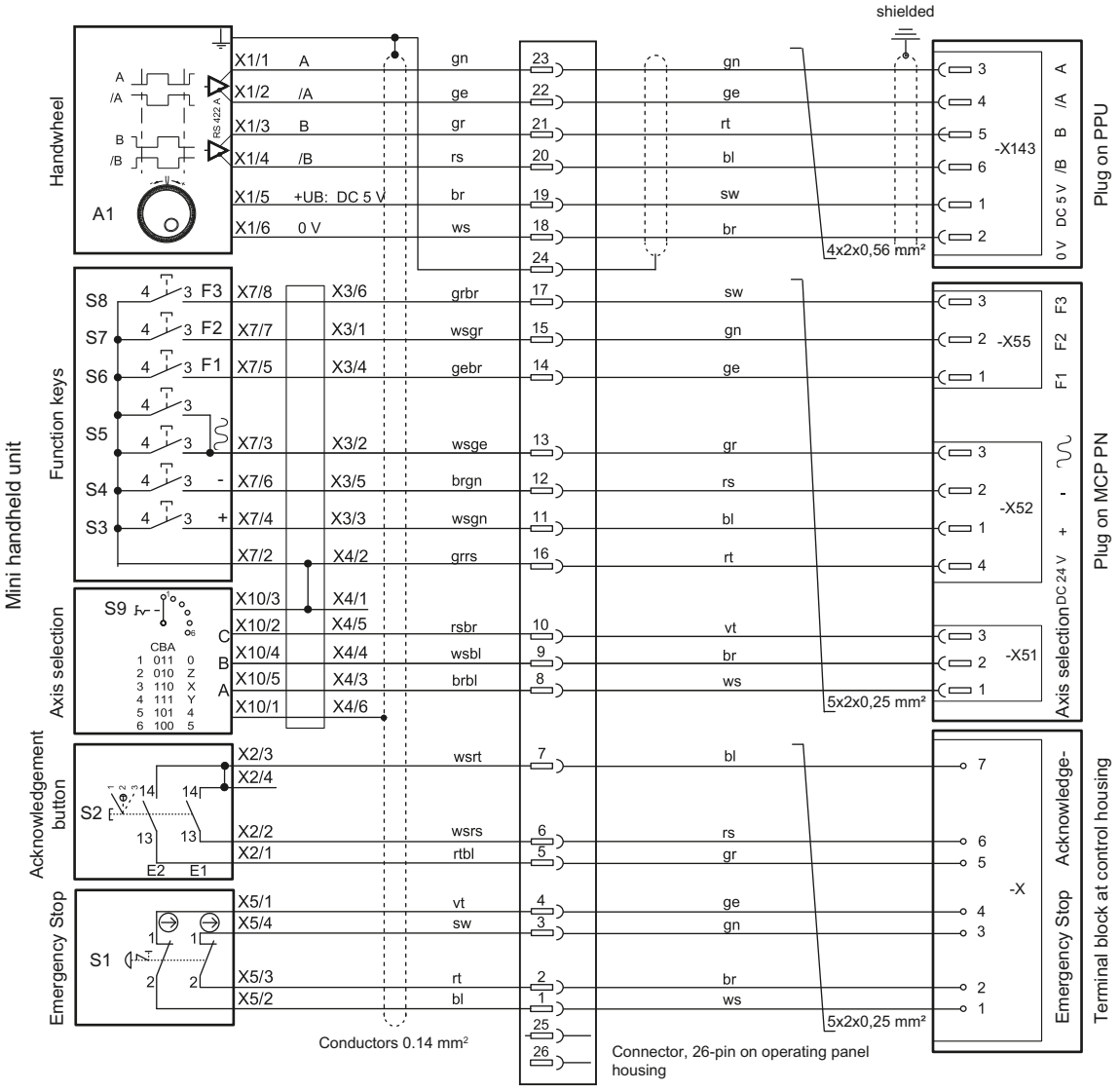
Note

Connecting the mini HHU to the MCP Interface PN and MCP 483 USB/MCP 310 USB/MCP 416 USB:

- Axis selection switch to X51
- Function keys to X52 and X55
- Handwheel to X60 or X62

Note that the SINUMERIK 828D software supports a maximum of three handwheels.

Circuit diagram



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

Figure 8-52 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.



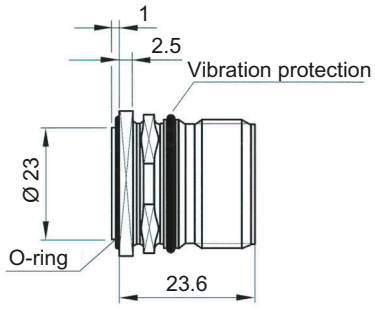


Figure 8-53 Flange socket

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!

8.8.4 Parameterization

If a mini HHU is connected, the functional assignment listed in the table below is valid for customer keys KT1 to KT9. When the mini HHU is connected, the customer keys (inputs) are not available for other applications.

On the **MCP Interface PN** module, the customer keys are assigned to input bytes **EB124 and EB125**:

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB124						Axis selector 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

On machine control panels **MCP 310C PN and MCP 483C PN**, the customer keys are assigned to input bytes **EB122 and EB123**.

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB122						Axis selector 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

Note

In the SINUMERIK 828D, handwheel data is processed directly by the NC and is not available in the PLC.

8.8.5 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	
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 %	

Parameter	Value
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	
	Jog key: rapid traverse	
	Jog key: positive traversing direction	
	Jog key: negative traversing direction	
Function keys F1, F2, F3 • Switching current • Contact rating	NO contact max. 0.1 A max. 1 W	

8.8.6 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

Component	Description	Article number
Holder	including three M4 screws	6FX2006-1BG70
Industrial Hub USB	4 USB 2.0 sockets, to access the USB interface of an installed device, mounting onto standard rail possible, suitable for Standard USB interfaces	6AV6671-3AH00-0AX0

8.9 PP 72/48D PN and PP 72/48D 2/2A PN

8.9.1 Description

Features

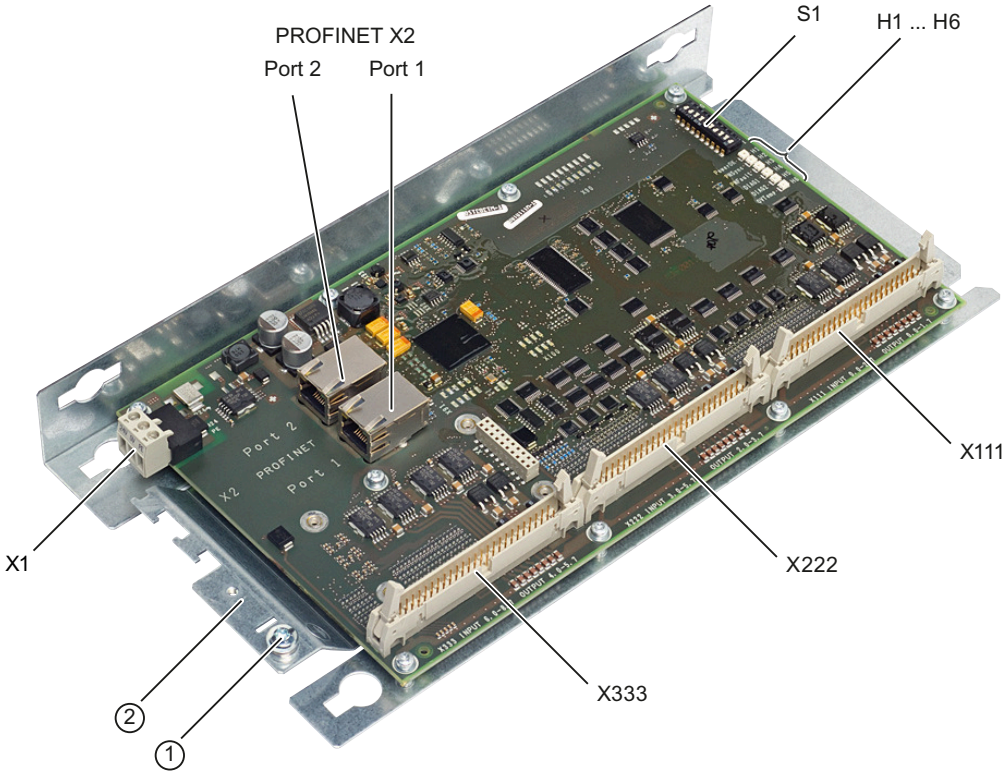
The PP 72/48D PN and PP 72/48D 2/2A PN I/O modules are simple modules (without a separate housing) for connecting digital and analog input/outputs as part of an automation system based on PROFINET IO.

The modules have the following features:

- 72 digital inputs and 48 digital outputs
- PROFINET IO connection (max. 100 MBaud)
- Onboard 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.
- The PP 72/48D 2/2A PN I/O module also has 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.
- Analog signal cables can be connected directly to terminal contacts on the module.

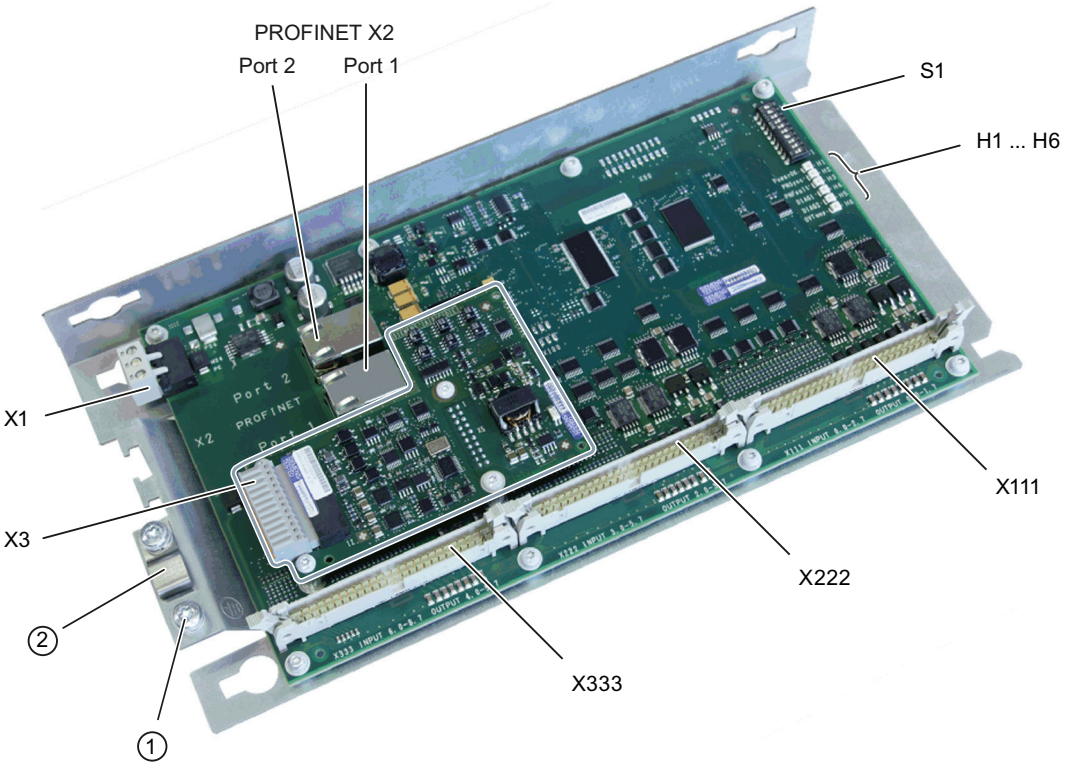
An external power source (24 VDC) is required for supplying power to the module and digital outputs.

Display



①	Grounding screw
S1	DIP switch for setting the IP address
H1 ... H6	LEDs for status display
X1	Screw-type terminal block to connect the power supply
X2	Port 1 and port 2 to connect the PROFINET-based PLC PLC I/O interface
X111, X222, X333	Flat ribbon cable connector for the digital inputs/outputs

Figure 8-54 PP 72/48D PN I/O module



①	Grounding screw
②	Shield connection
S1	DIP switch for setting the IP address
H1 ... H6	LEDs for status display
X1	Screw-type terminal block to connect the power supply
X2	Port 1 and port 2 to connect the PROFINET-based PLC PLC I/O interface
X3	Connector for the analog inputs/outputs
X111, X222, X333	Flat ribbon cable connector for the digital inputs/outputs

Figure 8-55 PP 72/48D 2/2A PN I/O module

Example: Type plate

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

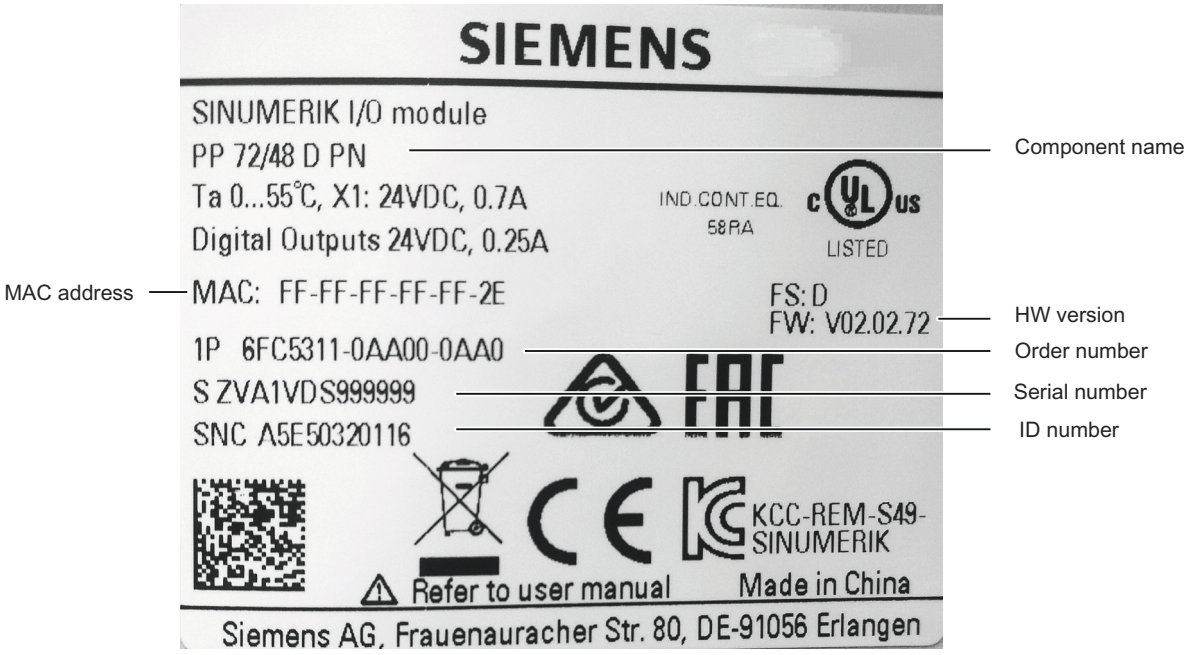


Figure 8-56 PP 72/48D PN type plate

LEDs for status display

The I/O module has the following status displays 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 has synchronized to the bus cycle clock.
			Not lit: Task system is not synchronized to the bus cycle clock.
			Flashes 0.5 Hz: Task system has synchronized to the bus cycle clock and the cyclic data exchange is running.
H3	PNFault	Red	Not lit: Module is operating without errors; the data exchange with all configured I/O modules is running.
			Lit: Severe bus error One of the following errors is present at port 1 / port 2: • 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 display

Note

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

8.9.2 Assembling

8.9.2.1 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.

Table 8-54 Mounting versions:

Portrait mounting at the lateral strap of the mounting plate	(2x M6 screws).
Flat mounting at the rear wall of the mounting plate	(4x M6 screws).
For grounding wire, use copper conductors only. Conducteurs de terre, utiliser uniquement du cuivre.	AWG10 (2.5mm2), the torque is 3Nm.

8.9.2.2 Dimension drawing

PP 72/48D PN dimension drawing

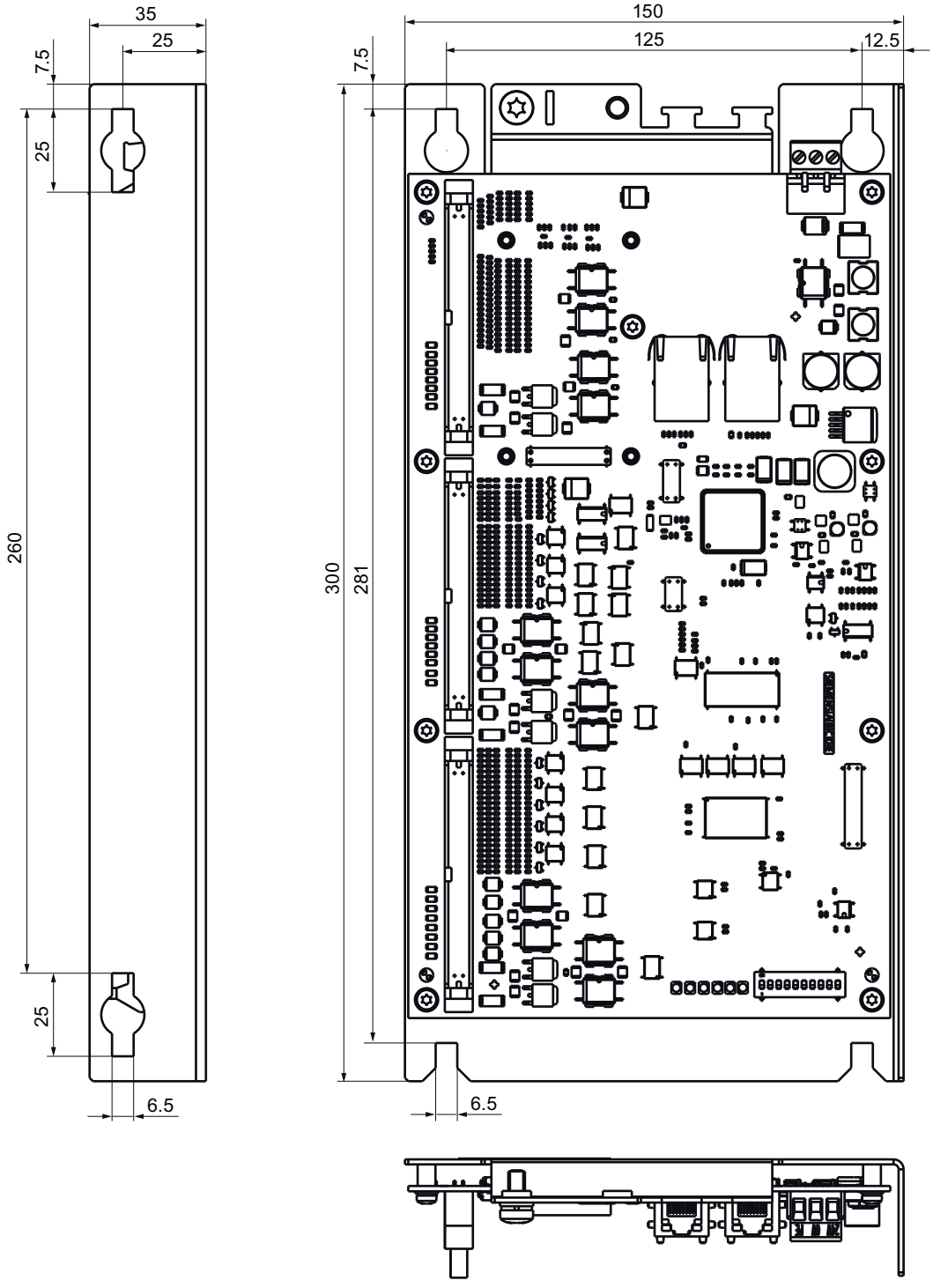


Figure 8-57 PP 72/48D PN dimensions

8.9.2.3 Dimension drawing

PP 72/48D 2/2A PN dimension drawing

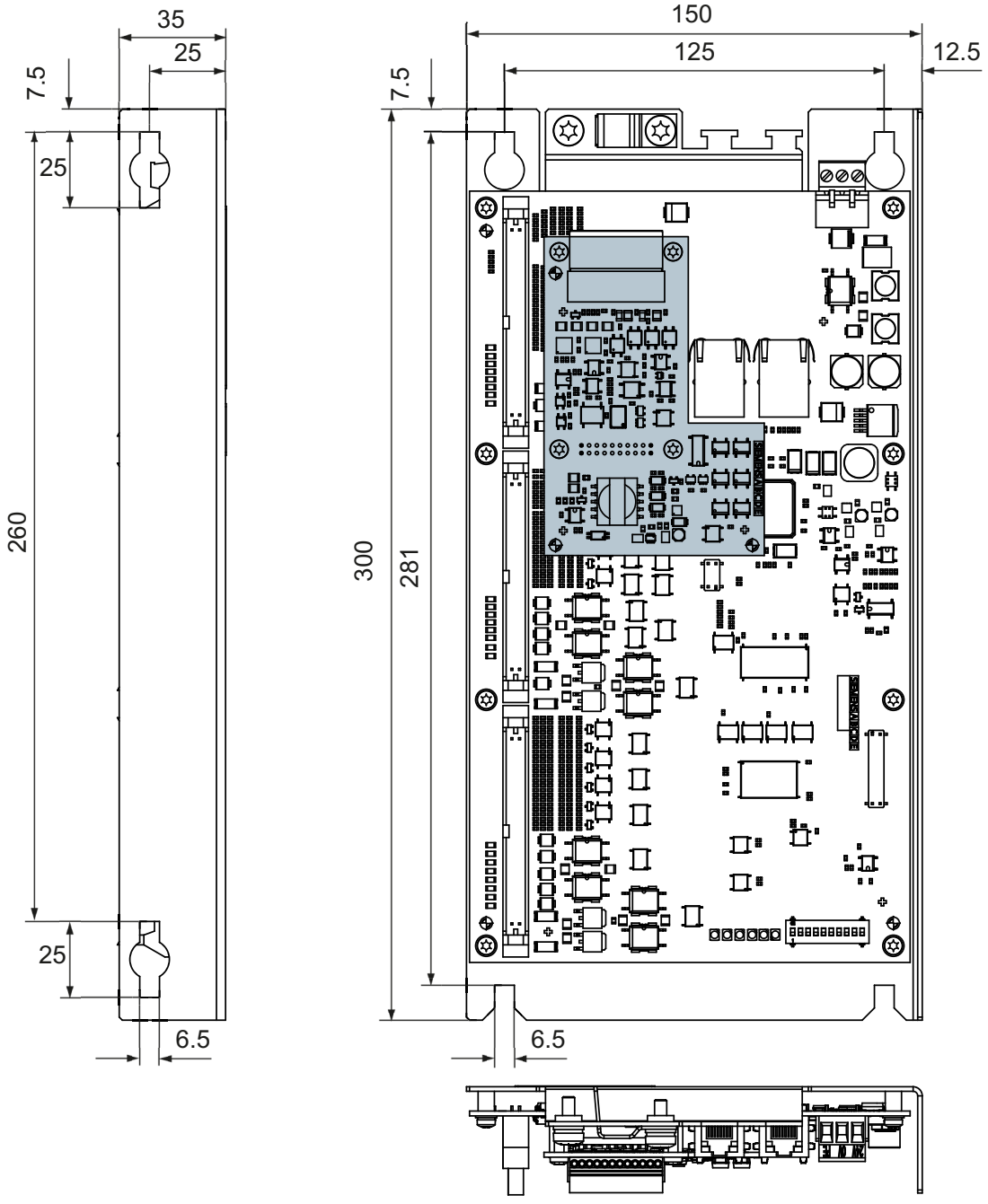
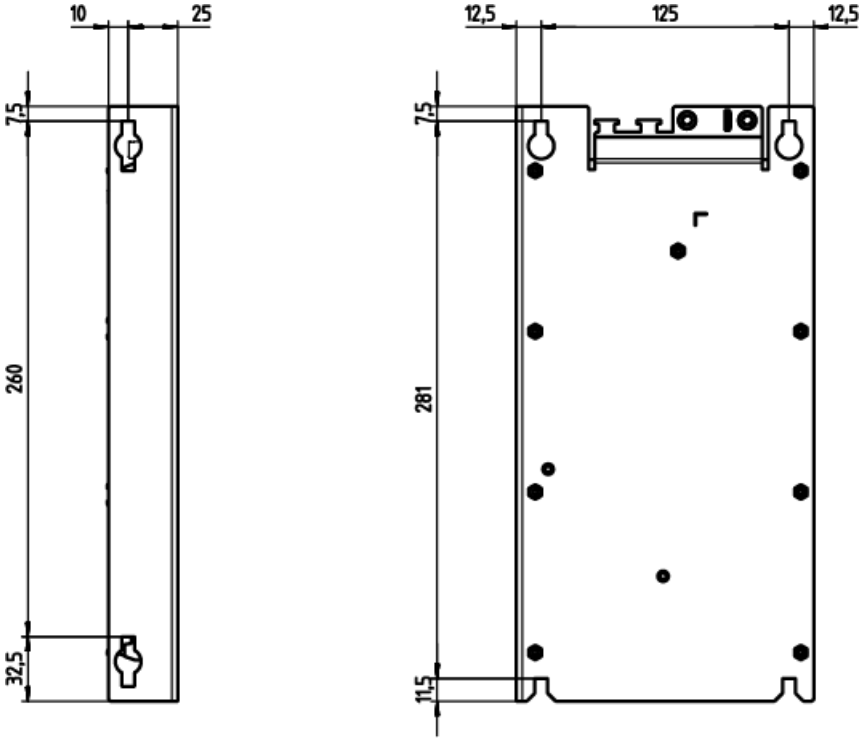


Figure 8-58 PP 72/48D 2/2A PN dimensions

8.9.2.4 Drilling

Drilling patterns

The drilling patterns differ by the number and direction of PP 72/48 module. Select the appropriate drilling pattern corresponding to the individual design.



Drilling pattern: Module number maximum 5 pcs

8.9.2.5 Installing

Dimension diagrams

Installing a large plane of sheet metal with 4 fastening elements, in vertical direction with grounding screws in upward direction.

Mounting: 4XM6(6 Nm)

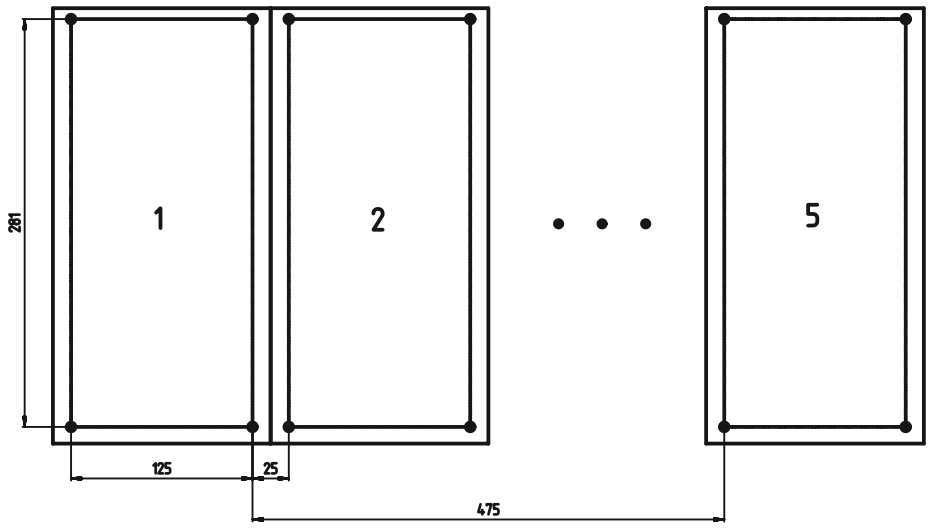


Figure 8-59 Installing the sheet metal vertically

Installing a large plane of sheet metal with 4 fastening elements, in horizontal direction with grounding screws in upward direction.

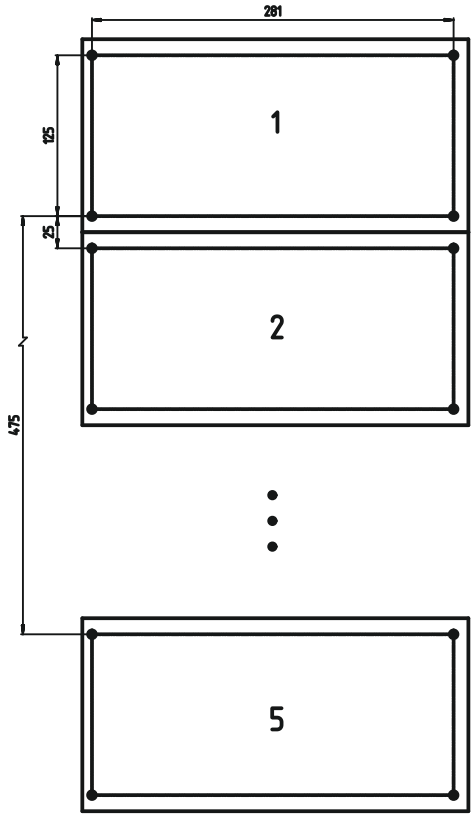


Figure 8-60 Installing the sheet metal horizontally

Dimension diagrams

Installing a small plane of sheet metal with 2 fastening elements, in vertical direction with grounding screws in upward direction.

Vertical direction: 150 mm distance

Mounting: 2XM6(6 Nm)

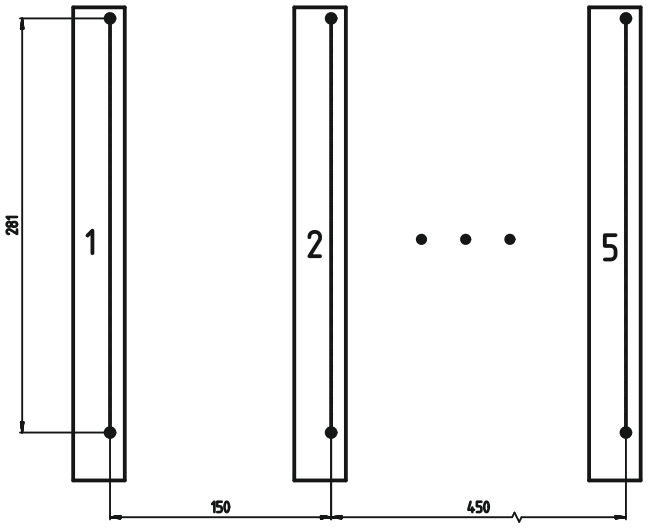


Figure 8-61 Installing small sheet metal vertically

Installing a small plane of sheet metal with 2 fastening elements, in horizontal direction with grounding screws in upward direction.

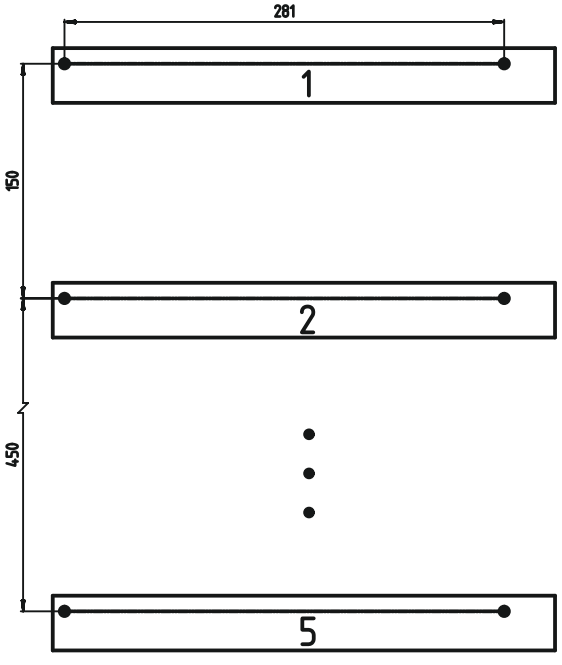
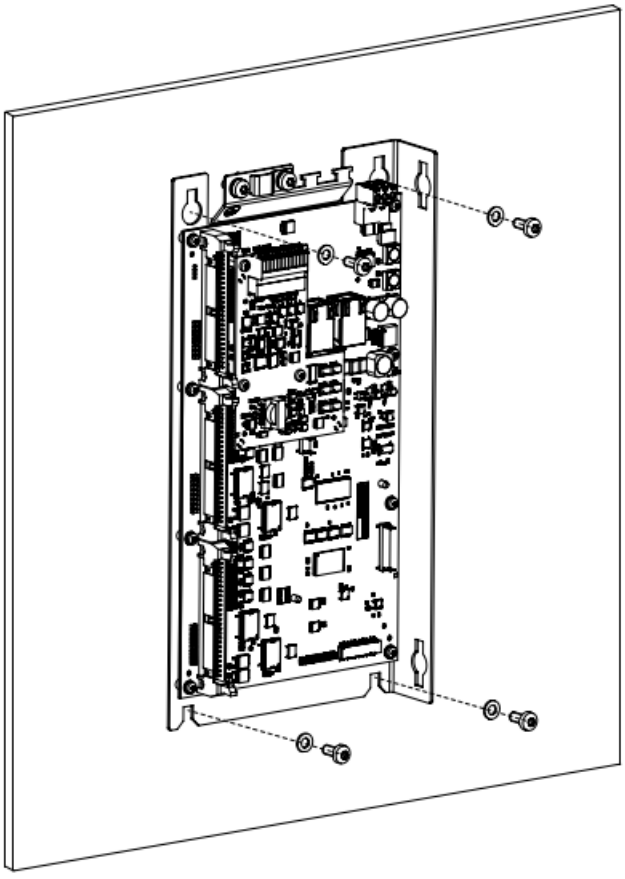


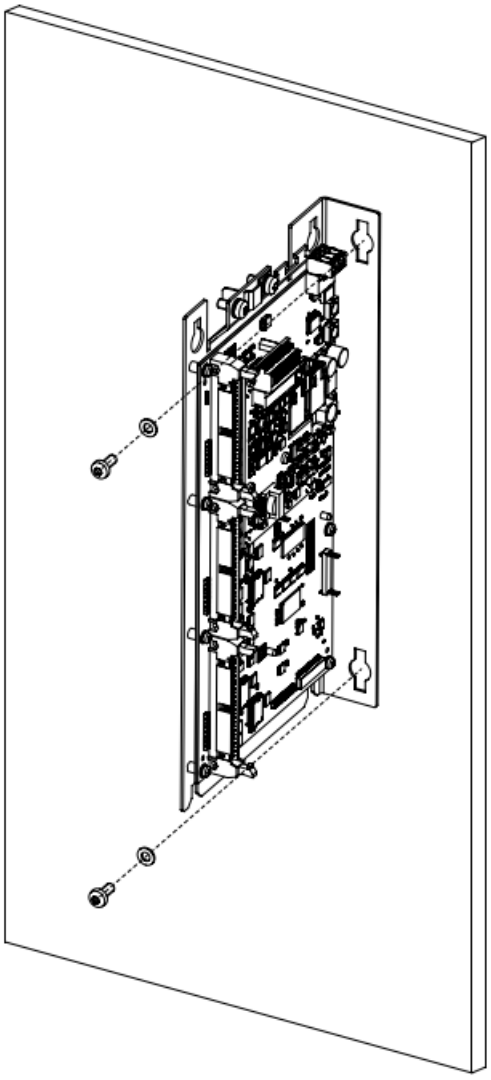
Figure 8-62 Installing small sheet metal horizontally

Installation procedure

1. Drill the holes corresponding to the drilling in the mounting panel.
2. Tighten the panel with 6 Nm screws and washers.

The below diagrams illustrate the installation procedure:





8.9.2.6 Dimensions

The following are the dimensions of the PP 72/48 modules.

PP 7248D PN I/O module

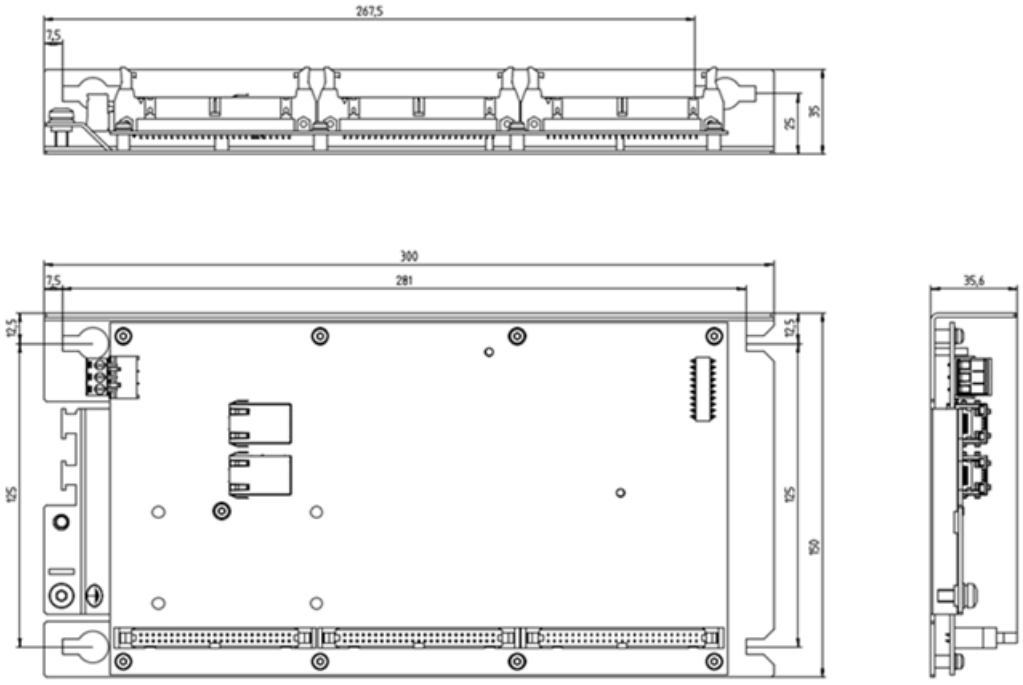


Figure 8-63 PP 72/48D PN I/O module dimensions

PP 7248D 2/2A PN I/O module

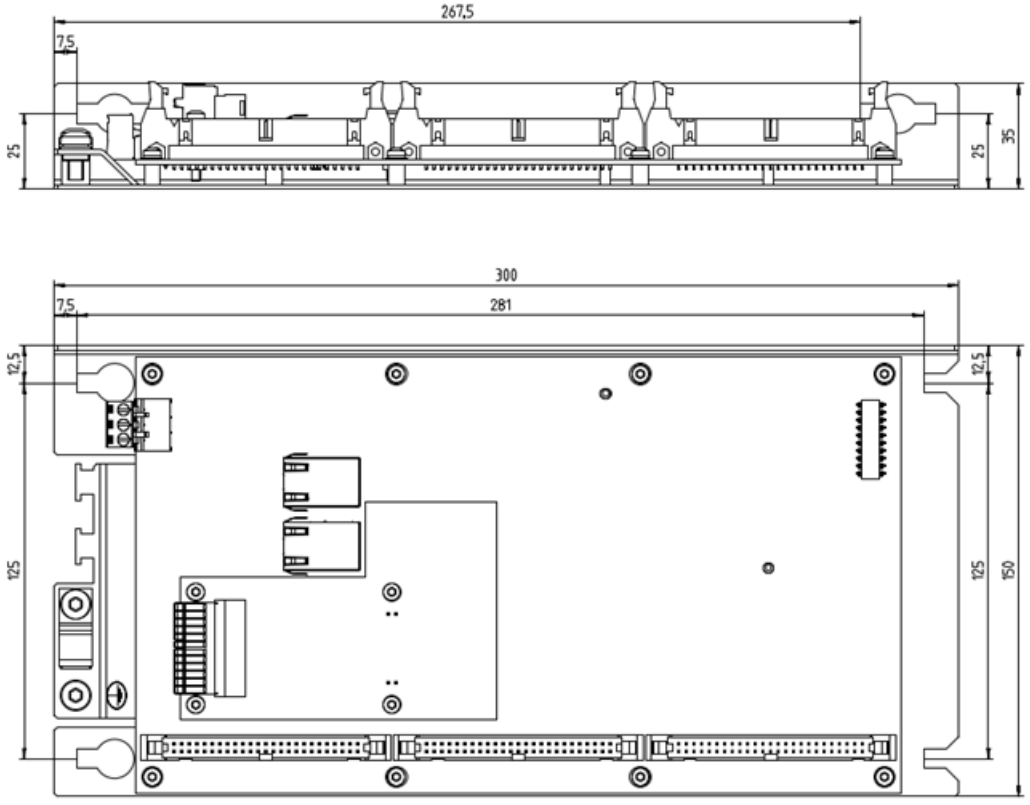
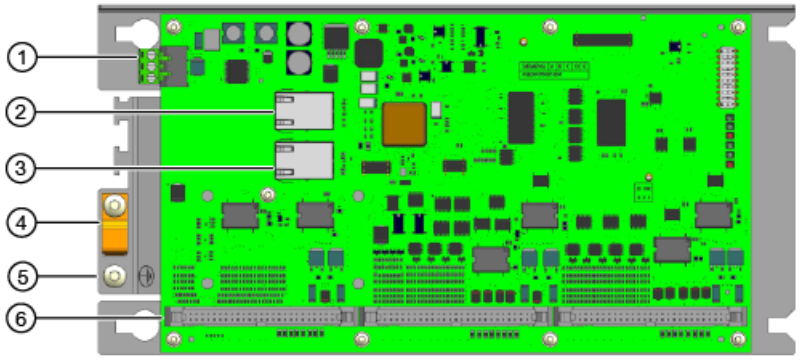


Figure 8-64 PP 72/48D 2/2A PN I/O module dimensions

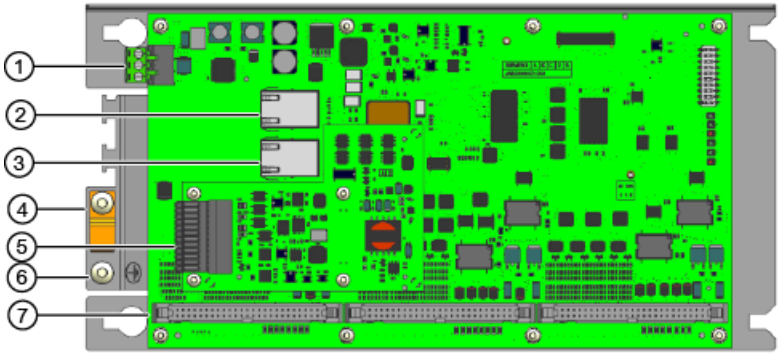
8.9.3 Connecting

PP 72/48D PN I/O module



1 Interface X1 Power supply
2 X2 Port 1
3 X2 Port 2
4 Cable strain relief screw M5 (3 Nm)
5 Grounding screw M5 (3 Nm)
6 X111 / X222 / X333 Digital I/O

PP 72/48D 2/2A PN I/O module



1 Interface X1 Power supply
2 X2 Port 1
3 X2 Port 2
4 Cable strain relief screw M5 (3 Nm)
5 X3 Analog I/O
6 Grounding screw M5 (3 Nm)
7 X111 / X222 / X333 Digital I/O

Connection options

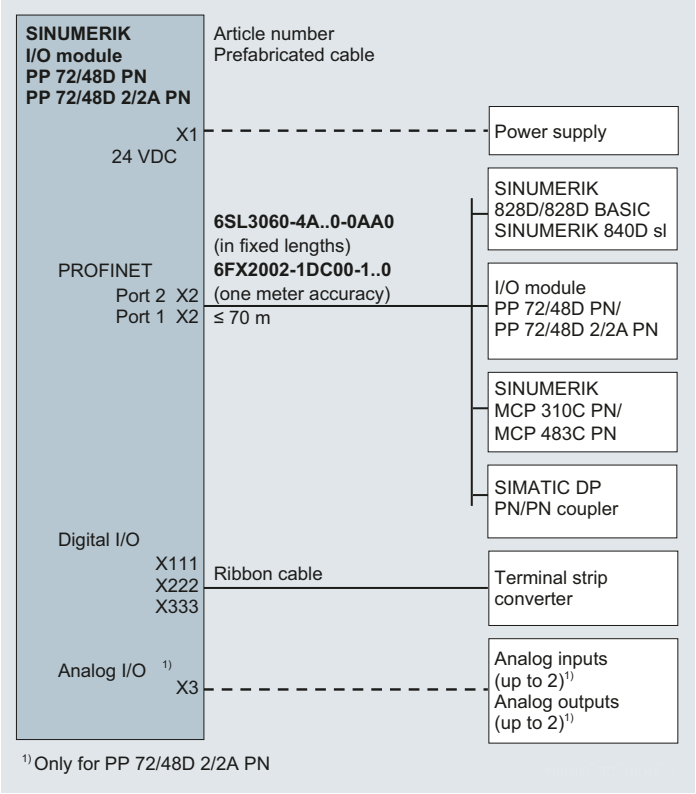


Figure 8-65 Interfaces

8.9.3.1 X1 power supply

Requirements of the DC 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.

Rated voltage	According to EN 61131-2	24 VDC
	Voltage range (mean value)	20.4 VDC to 28.8 VDC
	Voltage range (dynamic)	18.5 VDC to 30.2 VDC
	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
X1 terminal 	Wiring range	AWG 28 to AWG 12
	Torque	0.51 Nm
	Conductor material Matériau des conducteurs	Use copper conductors only Utiliser uniquement des conducteurs en cuivre

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.

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 mm^2 (or AWG 30 to AWG 12) for wiring the power supply according to the maximum occurring current.

Note

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

Table 8-55 Requirements for digital inputs

Features	Value
Connection option	Up to 2.5 mm2
Current carrying capacity	Max. 10 A
Maximum cable length	10 m

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

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 VDC) for the digital outputs must therefore be connected to all four pins per DOCOMx (X111, X222, X333: pins 47, 48, 49, 50).

Analog inputs/outputs

An additional external power supply is not required for the analog inputs and outputs.

X1 pin assignment

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

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

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

- Polarity reversal
- Short-circuit (electrical current limiting of outputs)
- Overload (self-restoring PTC fuse)

Wiring the screw terminal block

The required 24 VDC load current 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.

Use flexible cables with a cross-section of 0.25 to 2.5 mm^2 (or AWG 23 to AWG 13) for wiring the power supply according to the maximum current that flows. If you only use one wire per connection, a ferrule is not required. You can use ferrules without an insulating collar according to DIN 46228, Form A long version.

Cable specification:

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

8.9.3.2 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.

X2 pin assignment: 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

Data transmission

The interfaces are designed for operation in full-duplex mode, i.e. for sending and receiving data. 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 rate: 100 Mbps (fast Ethernet).
- The maximum length of the connections between the terminal device and network component or between two network components must not exceed 70 m.

LED status 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:

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

DIP switch S1

The correct logical IP address for communication (Page 284) with PLC I/O interface must be assigned to the I/O module with the 10-bit DIP switch S1. 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 a power OFF → ON.

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

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

8.9.3.3 X111, X222, X333 digital inputs/outputs

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. The maximum cable length is 30 m.

X111 pin assignment

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
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)					

X222 pin assignment

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

Pin	Signal name	Type	Pin	Signal name	Type
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
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)					

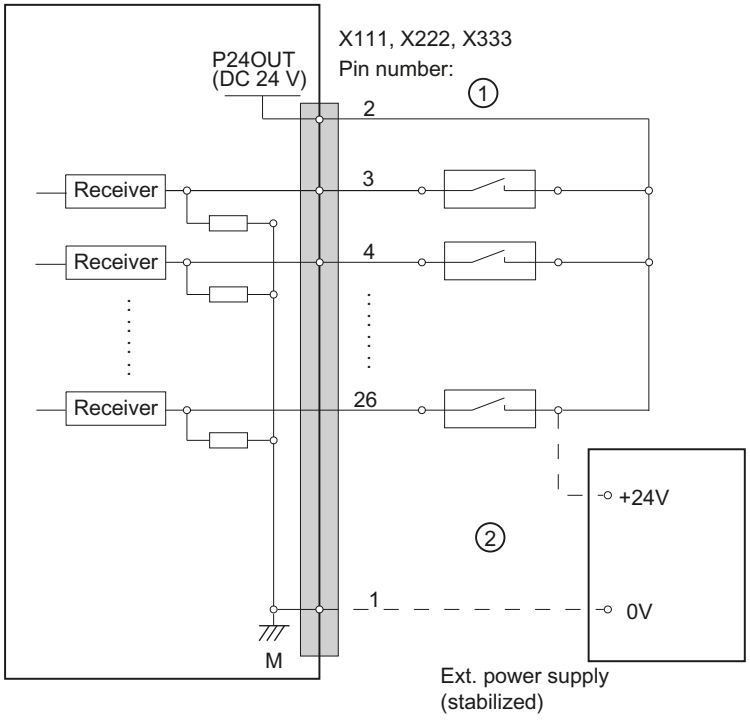
X333 pin assignment

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

Pin	Signal name	Type	Pin	Signal name	Type
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)					

Pin assignment of the digital inputs

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



① When using the internal power supply P24OUT

② When using the external power supply $P24OUT_{ext}$

Figure 8-66 X111 pin assignment

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.
- 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.

Electrical specification

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} at X222: DI 3.0 to 3.7	--	--	600 µs

Terminal assignment for the digital outputs

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

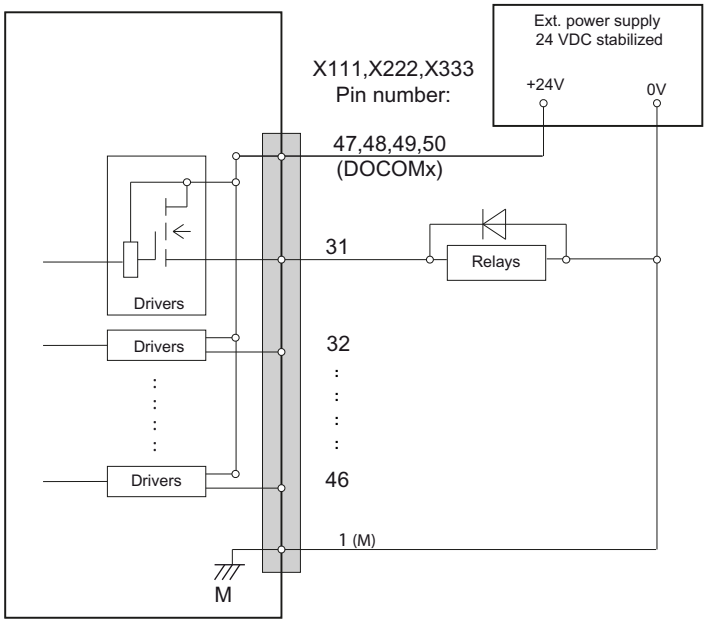


Figure 8-67 X111 pin assignment

Features:

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

NOTICE
Protection against short-circuit A max. current of I_{out} = 0.25 A at X111, X222, X333 where the simultaneity factor is 100%: Pin 2 must not be exceeded.

Electrical specification

Digital outputs	Min.	Typical	Max.	Nominal
Voltage at high level (U_H)	V_{CC} - 3 V	1)	V_{CC}	24 V
Output current I_{OUT}	--	--	250 mA 2)	--
Voltage at low level (U_L)	--	--	--	Output open
Leakage current at low level	--	50 µA	400 µA	--
Signal delay time T_{PHL}	--	0.5 ms	--	--
Internal resistance R_i	--	7 kΩ/kOhm	--	--
Maximum switching frequency				
Resistive load	--	--	100 Hz	--
Inductive load	--	--	2 Hz	--
Lamp	--	--	11 Hz	--

1) $U_{H_typical} = V_{CC} - I_{OUT} \times R_{ON}$

Actual operating voltage V_{CC}

I_{OUT}: Output current maximum short-circuit current: 4 A (max. 100 µs, V_{CC} = 24 V)

R_{ON}: Maximum internal resistance = 0.4 Ω

2) For a simultaneity factor of 100% (i.e. all outputs are active), a polarity reversal neither results in a high signal level nor does it destroy the outputs.

8.9.3.4 X3 analog inputs/outputs

X3 pin assignment

The analog signal to be measured is connected to terminals AI 1+/- and AI 2+/-. The CO and CI terminals supply the constant current for the 4-wire measurement of PT100 elements.

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 -

Pin	Signal name	Signal type	Meaning
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 -

AI: Analog input - AO: Analog output

CI: Current input - CO: Current output

Table 8-56 Cable specification:

Connector	12-pin socket/plug combination
Cable	Shielded
Max. cable length:	30 m
Max. connectable core cross-section:	0.5 mm2
Cable material Matériau des câbles ⚠	Use copper conductors only. AWG 28 ~ AWG 24（0.32 mm2 ~ 0.5 mm2). Utiliser uniquement des conducteurs en cuivre

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
Shielded signal cables for analog signals To ensure safe, fault-free operation of the system, shielded cables with shield connection should be used for the wiring of the analog outputs. See also: EMC compatibility (Page 49)

Analog inputs

The module has two analog inputs. These can optionally be assigned parameters as voltage, current or Pt100 input.

- "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-bit (incl. sign)
Accuracy	+/-0.5%
Internal resistance Ri	100 KOhm

- "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-bit (incl. sign)
Accuracy	+/-0.5%
Internal resistance Ri	133 ohm

- "Pt100" mode

Parameter	Value
Input range (rated value)	- 200° C to + 259° C
Standard	EN60751
Resolution	16-bit (incl. sign)
Accuracy	+/- 2° C
Internal resistance Ri	>> 10 kOhm

Cycle time of the analog value generation: 20 ms per channel

The analog inputs are only enabled after the parameter assignment.

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.

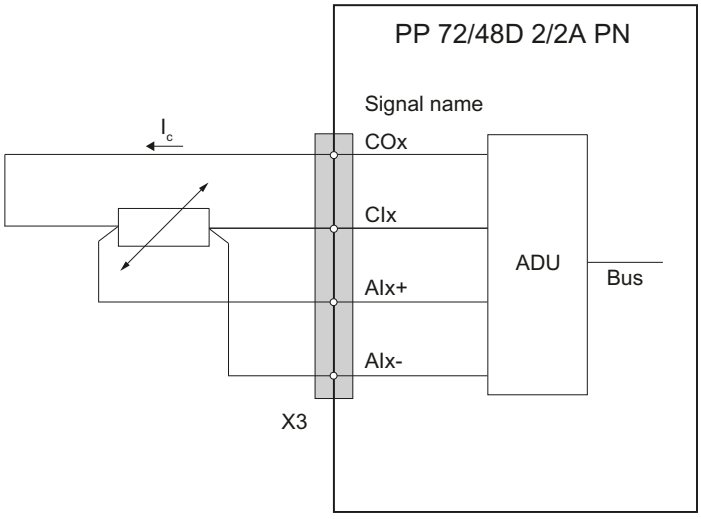
Measurement using a 4-wire connection system

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 measuring accuracy in comparison with 2-wire connections.



x 1, 2
ADU Analog Digital Unit
I_c Constant current

Figure 8-68 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.

- "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-bit (incl. sign)
Accuracy	+/-0.5%
Max. load current	-3 mA to +3 mA

- "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-bit (incl. sign)
Accuracy	+/-0.5%
Load impedance	≤ 600 ohm

The cycle time of the analog value generation is limited by the PLC cycle.

The analog outputs are only enabled after the parameter assignment.

Note

From the switch-on of the I/O module to when it is enabled, the analog outputs do not have 0 V, but rather -0.2 V. This is due to a voltage pulse. This value must be taken into consideration when specifying the setpoint.

Analog value display

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

Note

The analog values of the inputs and outputs are written and read in 16-bit data format, i.e. they must be accessed **word-by-word**.

Analog inputs - measured values

"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

"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

"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			

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 signalized in status word 0 (channel-specific) in the input image. In addition, a corresponding error code is output for the diagnostics at a counter value of "2" (Page 269).

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. Observe the "PNFault" LED and the status byte 1.

Analog output measured values

"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

"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

8.9.4 Equipotential bonding

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

8.9.5 Assigning parameters

8.9.5.1 Parameter assignment of the digital inputs/outputs

Input image of the digital inputs

The input image for the 1st I/O module (n=0) contains the following digital inputs (DI): n+0 ... n+8 (9 bytes)

X222.P3 ... X222.P10 are rapid inputs

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

Output image of the digital outputs

The output image for the 1st I/O module (n=0) contains the following digital outputs (DO): n+0 ... n+5 (6 bytes)

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

Terminal	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
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

See also

To activate and address an I/O module via machine data, see Section: AUTOHOTSPOT.

8.9.5.2 Assigning parameters to the analog inputs/outputs

Operating mode of the analog outputs

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 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 to 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
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

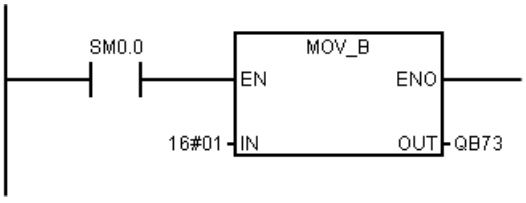
For further information on assigning parameters to analog inputs and outputs and addressing, refer Addressing components (Page 284).

Checkback signal of the operating modes

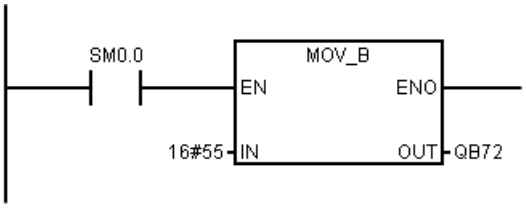
The set operating modes are saved in the input image in status byte 0. This value must be compared with Control Byte 0 in the output image. If these are different, an error has occurred, e.g. in the case of overvoltage in the "Temperature measurement" operating mode, see Diagnostics via input image (Page 269).

Example of programming

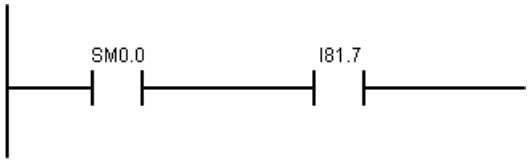
1. Determine control type:



2. Set the operating mode:



3. Query the error status bit in cyclic operation:



8.9.5.3 Examples of assigning parameters to the analog inputs/outputs

Measured values and responses

The following examples for assigning parameters to analog inputs/outputs are provided for the I/O module with the third PP module.

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

	Address	Voltage ±10 V			
		0 V	**2.5 V**	**10 V**	**12 V**
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
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	-	-

	Address	Pt100	
		Incorrect operating mode	**Resistor is not connected**
Diagnostics	IB50	16#2	16#2
	IB51	16#3	16#6
PNFault LED		ON	ON
Troubleshooting		Deactivating/activating	Deactivating/activating

8.9.5.4 Diagnostics via input image

Diagnostics via 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							

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

Messages in byte 1 ("alive and well" counter)

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 result in a communication failure, because the communication is performed with hardware support. The watchdog switches off the digital outputs, while the inputs retain their last values.

Overview of the messages in byte 1, depending on the "alive and well" counter:

"alive and well" counter	Value of byte 1	Meaning
0	0	Reserved
1		Temperature value

"alive and well" counter	Value of byte 1	Meaning
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

Correcting errors at counter value "2"

Value of 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 switched off. [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 switched off. [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 the 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 switched off. [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 the values in the user program.

[1)] The analog outputs retain their last output value.

8.9.6 Technical data

I/O module

Parameter	Value	
I/O module	**PP 72/48D PN**	**PP 72/48D 2/2A PN**
Power consumption at rated load (without digital outputs)	17 W	19 W
Rated current	0.7 A	0.8 A
Power loss	18 W	
Pollution degree	2	
Degree of protection	Open type/indoor use only	
Overvoltage degree	OVC II	
Input voltage	24 V DC + 20% / - 15%	
Rated tolerance	20.4 V DC to 28.8 V DC	
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, KCC, EAC	
Heat dissipation/ cooling	Open-circuit ventilation	
Condensation	Not permitted	
Limit to relative humidity at 25 °C	5 to 95% (without condensation) 5 to 90% (with condensation)	
Air pressure	106 to 92 kPa or 0 to 1000 m above sea level	
Derating	At altitudes over 1000 to 4000 m above sea level, the upper temperature limit must be reduced by 3.5°C / 500 m	
Ambient temperature:		
• Storage	-40 to 70° C	
• Transport	-40 to 70° C	
• Operation	0 to 55° C	
Dimensions:		
• Width	300 mm	
• Height	150 mm	
• Depth	35 mm	
Weight, approx.	0.9 kg	
Storage	1M2 (in product packaging); 1.5 mm; 0.5 g	

Parameter	Value
• Operation	3M1
• Vibration in operation	10 - (57）58 Hz; 0.075 mm (57）58 - 150 Hz; 1 g
• Shock in operation	5 g; 30 ms
Free fall	≤ 1 m (in transport packaging)
Output rating X111, X222, X333**:**	
• Resistance	24 VDC; 0.25 A/channel; 4 A/terminal
• Pilot duty	24 VDC; 0.25 A/channel; 4 A/terminal
• Tungsten	24 V; 5 W

8.10 NX10.3 / NX15.3

8.10.1 Description

Properties

Using the NX10.3 and 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:

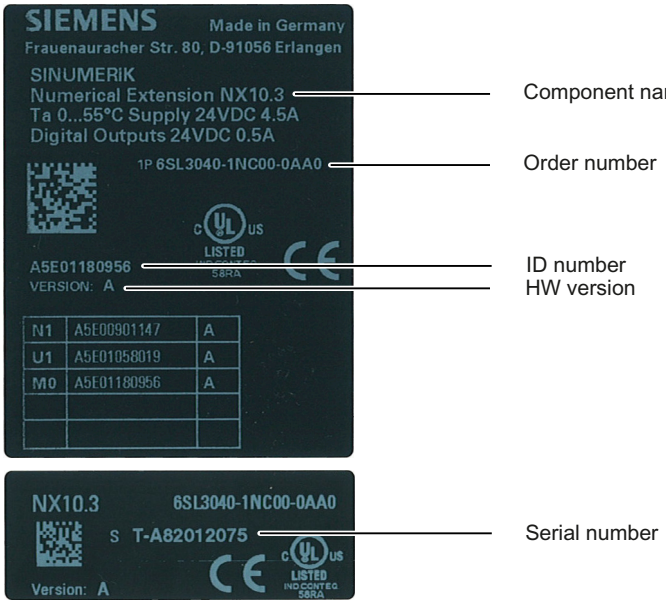


Figure 8-69 Type plate using the NX10.3 as example

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 NX module serial number prior to assembly.

Display

The NX module has the following interfaces:

- 4 DRIVE-CLiQ (X100 – X103)
- 6 digital inputs and 4 digital inputs/outputs (X122)
- Power supply (X124)

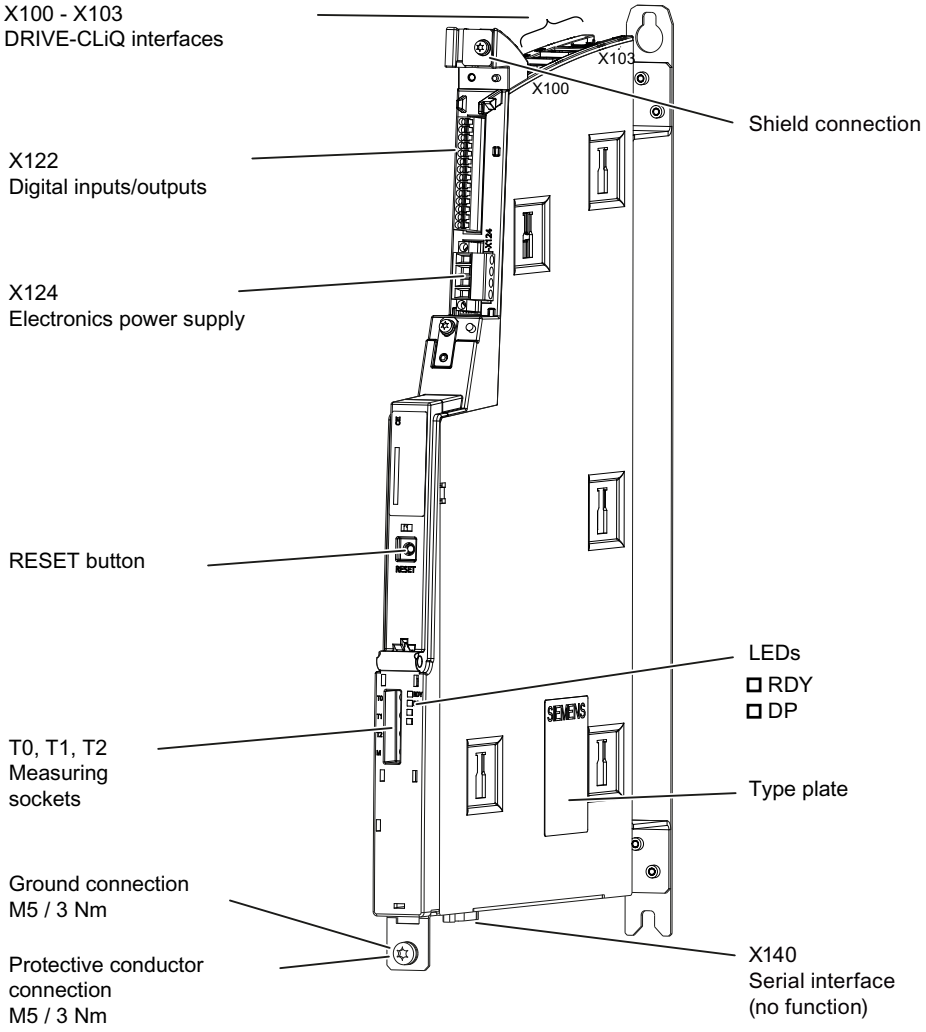


Figure 8-70 Display of the NX module (without cover)

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.

8.10.2 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

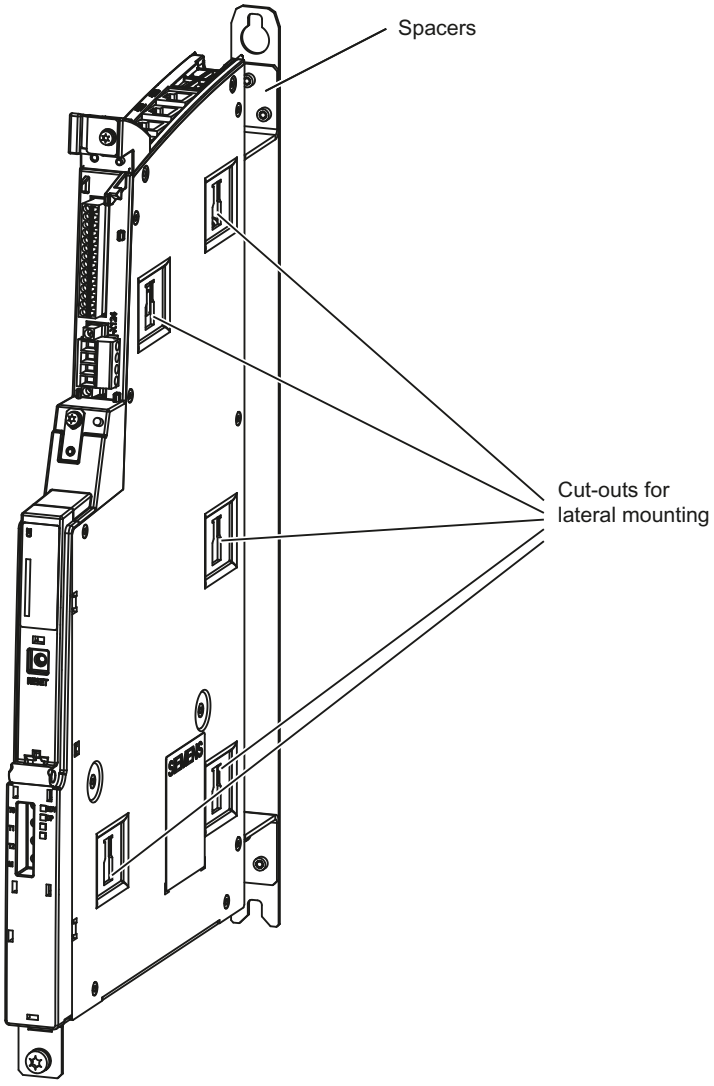


Figure 8-71 Mounting aids for the NX10.3 / NX15.3

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

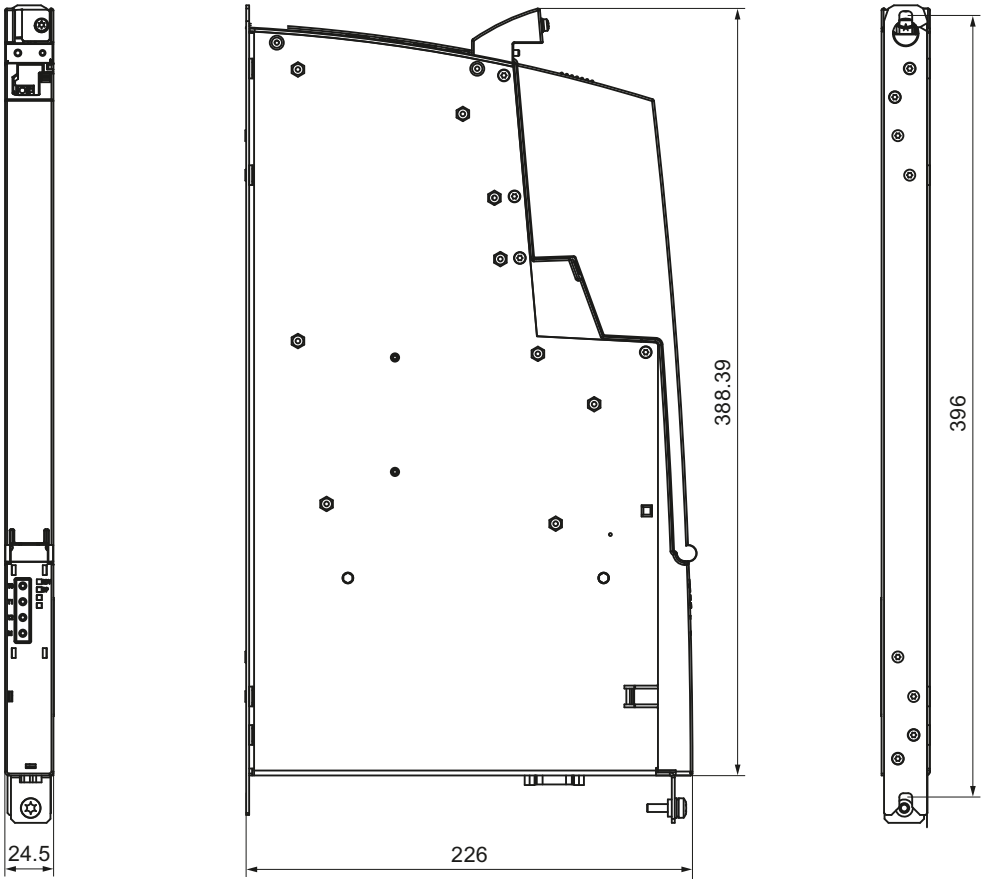


Figure 8-72 Dimensions NX10.3 / NX15.3

8.10.3 Connecting

X124 power supply pin assignment

Connector designation:	**X124**
Connector type:	Screw terminal 2
Max. connectable cross-section:	2.5 mm^2

Pin	Signal name		Meaning
1	+	(Voltage input)	Electronics power supply
2	+	(Voltage input)	Electronics power supply
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.

Parameter	Value
Voltage	24 VDC (20.4 V - 28.8 V)
Current consumption	Max. 0.8 A (without load)
Max. current via the jumper 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 pin assignment

Connector designation: **X122**
Connector type: Spring-loaded terminal 1
Max. connectable cross-section: 0.5 mm^2

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)
13	DI/DO11	Digital input/output 11 (rapid input)
14	M	Ground

An open input is interpreted as "low".

Note

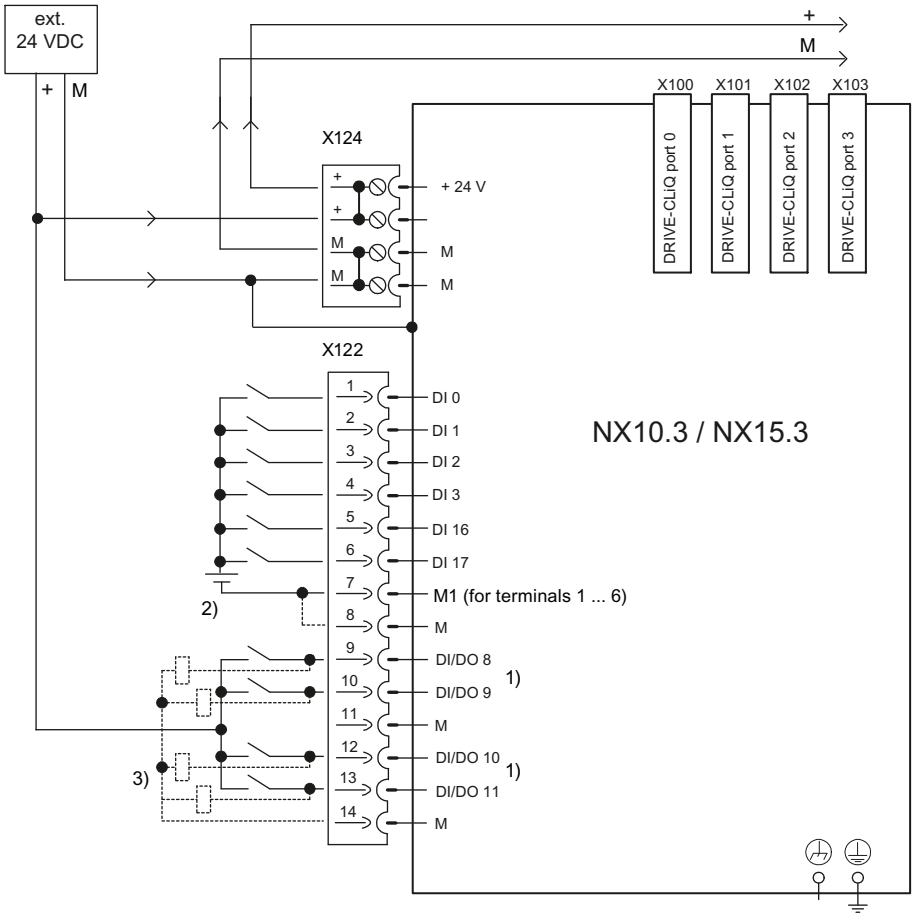
Terminal M1 must be connected for the digital inputs (DI) 0 to 3 and 16/17 to function. This can be done as follows:

- Connect the ground reference of the digital inputs.
- Jumper to terminal M: This removes the electrical isolation for these digital inputs.

Parameter	Value
Current consumption	Typical: 10 mA at 24 VDC
Galvanic isolation	The reference potential is terminal M1
As an input	
Voltage	-3 V to 30 V
Current consumption	Typical: 10 mA at 24 VDC
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

The digital inputs/outputs are connected appropriately during commissioning.



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 8-73 Connection example for the NX10.3 / NX15.3

See also

For the pin assignment of the DRIVE-CLiQ interfaces X100 - X103, please refer to Section "DRIVE-CLiQ (Page 114)".

For further information on DC voltage and standards, please refer to Section "Power supply connection (Page 97)".

8.10.4 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

8.11 Activating and addressing components

8.11.1 Activating components

Machine data for the PLC PN I/O

The following components are assigned fixed addresses for the input and output image of the PLC: PN 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 ≤ i ≤ 15	Input addresses
12987[i]	$MN_PLC_DEACT_IMAGE_LADDR_OUT	0 ≤ i ≤ 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 AUTOHOTSPOT. MD12987[i] is preset with the value -1 and must not be changed.

Machine data for the machine control panel

There are diffenent machine control panels available. It can be used in the I/O-Image of the PLC or by using DataBlocks.To activate the machine control panel, check the setting of the following machine data:

Machine data		One MCP type PN		One MCP type USB	
		Addressing via image	Address-ing via DB1000	Address-ing via DB1000	Addressing via image
MD12950 $MN_PLC_MCP_CONNECT	[0]	0	0	1	1
	[1]	-1	-1	-1	-1
MD12951 $MN_PLC_MCP_CONNECT	[0]	112	112	112	112
	[1]	0	0	0	0
MD12952 $MN_PLC_MCP_CONNECT	[0]	112	112	112	112
	[1]	0	0	0	0
MD12986 $MN_PLC_DEACT_IM-AGE_LADDR_IN	[6]	-1	-1	112	112
MD19720 $MN_PLC_FUNC-TION_MASK	Bit 0	0H	1H	0H	2H

Note

It is possible to connect two MCPs. But, one of each type of MCP must be used. To activate both the MCPs, use index [1] for the second MCP.

When the MCP USB is activated for I/O-Addressing, the DB-Addressing of the PN-MCP is not possible at the same time.

When the MCP USB is activated for I/O-Addressing, the PN-Devices in the address area of the MCP USB should be inactive using the correct settings in MD12986[..] & MD12987[..].

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**
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	SENTRON PAC4200
12986[9]	144	SENTRON PAC3200

Note

Monitoring the I/O

The use of an input/output address of a deactivated module in the PLC program does not trigger an alarm. The PLC 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.

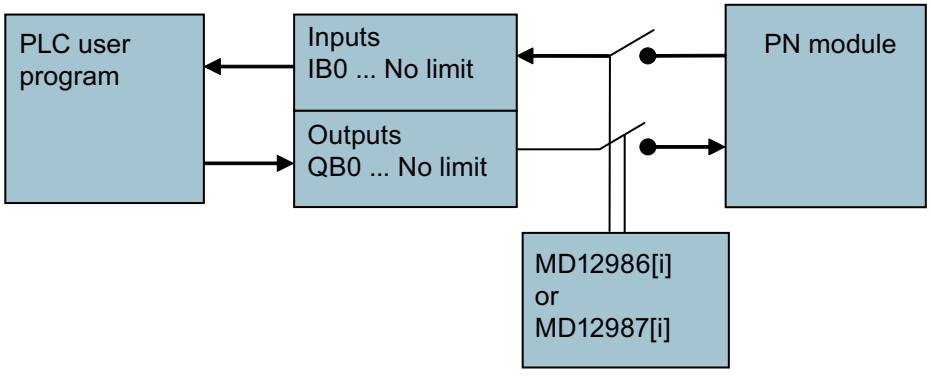


Figure 8-74 I/O switch

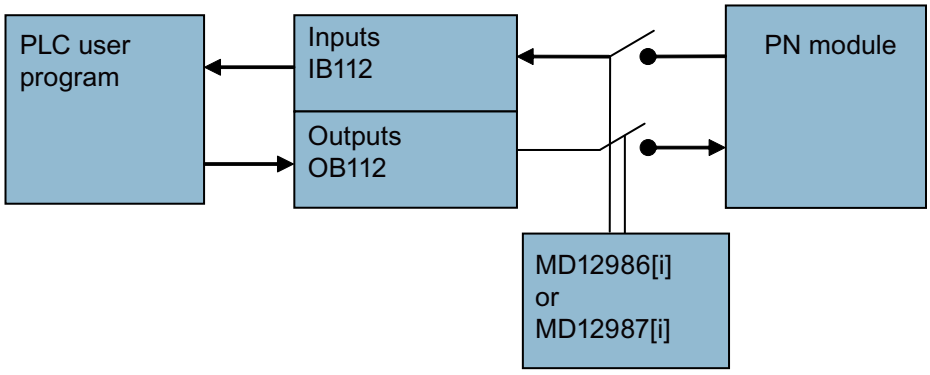


Figure 8-75 Example 2 - Activating an MCP USB using I/O-Addressing

8.11.2 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
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 component	Bus	Device name	IP address	Input addresses	Output addresses
PN/PN coupler *	PN	pn-pn-coupler20	20	96 ... 111	96 ... 111
PN/PN coupler * expansion	PN	pn-pn-coupler20	20	156 ... 251	156 ... 251
External machine control panel	PN	mcp-pn64	64	112 ... 125	112 ... 121
Reserved		--	--	126 ... 131	122 ... 123
SENTRON PAC4200 *	PN	pac4200-pn21	21	132 ... 143	132 ... 143
SENTRON 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

9

PPU 27x.4

Parameter	PPU vertical	PPU horizontal
Input voltage	24 VDC + 20% / - 15%	
Rated current	2.5 A	
Power consumption, max.	60 W	
Power loss	28 W	
Cooling	Open-circuit ventilation	
Degree of protection according to EN 60529	IP65 (front) IP20 (rear)	
Protection class according to EN 61800-5-1	III (DVC A, PELV)	
Degree of contamination according to EN 61800-5-1	2	
Climatic and mechanical environmental conditions (Page 51)	Storage according to EN 60721-3-1 Transport according to EN 60721-3-2 Operation according to EN 60721-3-3	
(Infrared) Proximity sensor:		
Wavelength	850 nm	
P_{max} @100 mm distance	0.00194 W	
P_{max} @100 mm distance	$3.14 \cdot 10^{-7}$ J	
Pulse duration	0.000162 s	
Pulse repetition rate	29 Hz	
Display:		
Size		10.4"
Resolution (pixel)		600 x 800
Pixel error	Error class II acc. to DIN EN ISO 9241-307	
Dimensions:		
• Width	310 mm	483 mm
• Height	380 mm	220 mm
• Depth	105 mm	105 mm
Weight, approx.	4.5 kg	4.5 kg
Basic color of the front	614 anthracite (similar to RAL 7021)	

Further technical specifications for the PPU can be found in chapter Interface description (Page 95).

PPU 290.4

Parameter	PPU vertical
Input voltage	24 VDC + 20% / - 15%
Rated current	3 A
Power consumption, max.	72 W
Power loss	28 W
Cooling	Open-circuit ventilation
Degree of protection according toEN 60529	IP65 (front) IP20 (rear)
Protection class according toEN 61800-5-1	III (DVC A, PELV)
Degree of contamination according toEN 61800-5-1	2
Climatic and mechanical environmental conditions (Page 51)	Storage according to EN 60721-3-1 Transport according to EN 60721-3-2 Operation according to EN 60721-3-3
(Infrared) Proximity sensor:	
Wavelength	850 nm
P_{max}@100 mm distance	0.00194 W
P_{max}@100 mm distance	$3.14 \cdot 10^{-7}$J
Pulse duration	0.000162 s
Pulse repetition rate	29 Hz
Display:	
Size	15.6"
Resolution (pixel)	1368 x 766
Pixel error	Error class II acc. to DIN EN ISO 9241-307
Dimensions:	
• Width	416 mm
• Height	470 mm
• Depth	105 mm
Weight, approx.	8.9 kg
Basic color of the front	Black (similar to RAL 9011)

Certificates

You can obtain an up-to-date list of currently certified components on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person. The certificates can be downloaded from the Internet: Certificates (https://support.industry.siemens.com/cs/ww/en/ps/14590/cert)

EC Declaration of Conformity

You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated") on the Internet at the following address (https://support.industry.siemens.com/cs/de/en/view/109747434).

Relevant directives and standards

The following directives and standards are relevant for SINUMERIK 828 devices:

- **European Machinery Directive**
  SINUMERIK 828 devices fulfil the requirements stipulated in the European Machinery Directive 2006/42/EU, insofar as they are covered by the application area of this directive. However, the use of the SINUMERIK 828 devices in a typical machine application has been fully assessed for compliance with the main regulations in this directive concerning health and safety.
- **Directive 2011/65/EU**
  SINUMERIK 828 devices comply with the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic devices (RoHS II).
- **European EMC Directive**
  SINUMERIK 828 devices comply with the EMC Directive 2014/30/EU.
- **EMC requirements for South Korea**

  SINUMERIK 828 devices with the KC marking on the type plate satisfy the EMC requirements for South Korea.
- **Eurasian conformity**

  SINUMERIK 828 comply with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).
- **North American market**

  SINUMERIK 828 devices provided with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications. You can find the relevant certificates on the Internet pages of the certifier (https://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html).

- **Australia and New Zealand (RCM formerly C-Tick)**

  SIUMERIK 828 devices showing the test symbols fulfill the EMC requirements for Australia and New Zealand.

- **Quality systems**
  Siemens AG employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.

- **Electric shock due to connection of an unsuitable power supply**

  When the equipment is connected to an unsuitable power supply (Page 47) and/or insufficiently grounded or rear cover, exposed components may carry a hazardous voltage that might result in serious injury or death. Only use power supplies that provide PELV (Protective Extra Low Voltage) output voltages acc. to UL 61010 for all connections and terminals of the electronics modules.

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 observed for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3 of category C2 or the limit value class A, Group 1 to KN11. By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are observed. Further, additional measures may be required, such as 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 EMC Installation Guideline Configuration Manual (https://support.industry.siemens.com/cs/de/en/view/60612658).

The final statement regarding compliance with the standard is given by the respective label attached to the individual unit.

Ground symbols

Icon	Meaning
	Ground (e.g. M 24 V)
	Connection for function potential bonding
	Connection for protective conductor

Spare parts and accessories 10

10.1 Ordering data

Ordering data

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 271.4 horizontal	6FC5370-5AA40-0AA0
• PPU 270.4 vertical	6FC5370-6AA40-0AA0
• PPU 290.4 vertical	6FC5370-8AA40-0BA0
CompactFlash card with system software and license	
• for SW 24x turning	6FC5835-1GY40- ☐ YA0
• for SW 24x milling	6FC5835-2GY40- ☐ YA0
• for SW 24x grinding	6FC5835-3GY40- ☐ YA0
• for SW 26x turning	6FC5834-1GY40- ☐ YA0
• for SW 26x milling	6FC5834-2GY40- ☐ YA0
• for SW 26x grinding	6FC5834-3GY40- ☐ YA0
• for SW 28x turning	6FC5836-1GY40- ☐ YA0
• for SW 28x milling	6FC5836-2GY40- ☐ YA0
• for SW 28x grinding	6FC5836-3GY40- ☐ YA0

Components

Designation	Article number
Machine control panels:	
• MCP 483 USB	6FC5303-0AF32-0AA1
• MCP 310 USB	6FC5303-0AF33-0AA1
• MCP 416 USB	6FC5303-0AF34-0AA1
• 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:	
• With spiral connection cable	6FX2007-1AD03
• With straight cable	6FX2007-1AD13
I/O modules:	

Designation	Article number
• PP 72/48D PN (only digital I/O)	6FC5311-0AA00-0AA0
• PP 72/48D 2/2A PN (digital and analog I/O)	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
USB-FlashDrive 32 GB, can be booted USB 3.0	6AV6881-0AS42-0AA1
CompactFlash Card 8 GB, empty as user memory	6FC5313-6AG00-0AA0
Front flap with fastening	6FC5348-2AA00-0AA0
Set of clamps (9x)	6FC5248-0AF14-0AA0
SENTRON PAC3200 Power Monitoring Device	7KM2112-0BA00-3AA0
SENTRON PAC4200 Power Monitoring Device	7KM4212-0BA00-3AA0
PROFINET Switched Ethernet expansion module	7KM9300-0AE00-0AA0
MODEM MD720	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: • 6 m ribbon cable, 50-pin • 8 insulation displacement connectors, 50-pin	6EP5306-5BG00
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 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

10.2 SITOP power supply

Description



Figure 10-1 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 SIOS_SITOP (http://support.automation.siemens.com/WW/view/en/10807212)

10.3 SENTRON PAC3200 and PAC4200

Description



Figure 10-2 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).

Details on the configuration of the communication between the PPU and the SENTRON PAC can be found at: Activating and addressing components (Page 282)

Technical specifications

Parameter	SENTRON PAC3200	SENTRON PAC4200
Article number	7KM2112-0BA00-3AA0	7KM4212-0BA00-3AA0
Switched Ethernet PROFINET module	7KM9300-0AE00-0AA0	
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 VAC 50/60 Hz ±10% 110 to 340 VDC ±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 VDC; ±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 further information about SENTRON PAC in the context of SINUMERIK in the Ctrl-Energy System Manual as well as on the Internet at:

- SIOS_SENTRON PAC3200 (https://support.industry.siemens.com/cs/de/en/view/26504261)
- SIOS_SENTRON PAC4200 (https://support.industry.siemens.com/cs/de/en/view/34261817)

10.4 PN/PN coupler

10.4.1 Principle of operation

Application

The PN/PN coupler links two Ethernet subnets with one another and exchanges data. The maximum size of the data that can be transferred is 16-byte input data and 16-byte output data. In order to expand the address width of the PN/PN coupler from 16 bytes 112 bytes, an additional SDB needs to be installed on the controller (for more information see product announcement (https://support.industry.siemens.com/cs/de/en/view/109746200/en)).

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 the 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 figure, these are the device names "Subnet 1" in network 1 and "Subnet 2" in network 2.

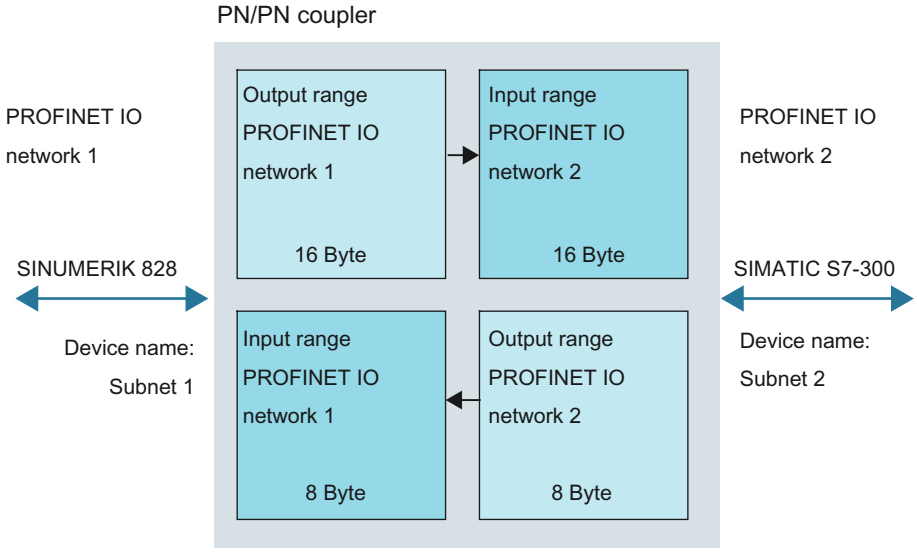


Figure 10-3 Principal mode of operation of the PN/PN coupler

References

Installation and Operating Manual: SIMATIC Bus Links, PN/PN Coupler (https://support.industry.siemens.com/cs/de/en/view/44319532/en)

10.4.2 Configuration

Configuring PROFINET components

To configure and analyze PROFINET components, Siemens Industry Online Support provides the following tools free-of-charge:

- **Primary Setup Tool (PST)** on the Internet at the following address: (http://support.automation.siemens.com/WW/view/en/19440762)
  Using the Primary Setup Tool (PST), you can configure PROFINET components, e.g. you can allocate the PN/PN coupler a device name.
- **PRONETA** on the Internet at the following address: (http://support.automation.siemens.com/WW/view/en/67460624)
  PRONETA (PROFINET network analysis) is a PC tool to analyze PROFINET networks.

Requirements for the configuration (Page 284):

- For the SINUMERIK 828D, the "PN-PN-Coupler20" name is permanently defined; therefore, the name must be exactly the same in the connected subnet.
- The following IP address is permanently set for the PN/PN coupler: 192.168.214.20
- The PN/PN coupler must be connected to the PROFINET interface X1 of the PPU.
- The PC must be connected with a crossover cable, e.g. via interface X2 on the PN/PN coupler.

The device name must be configured in the following cases:

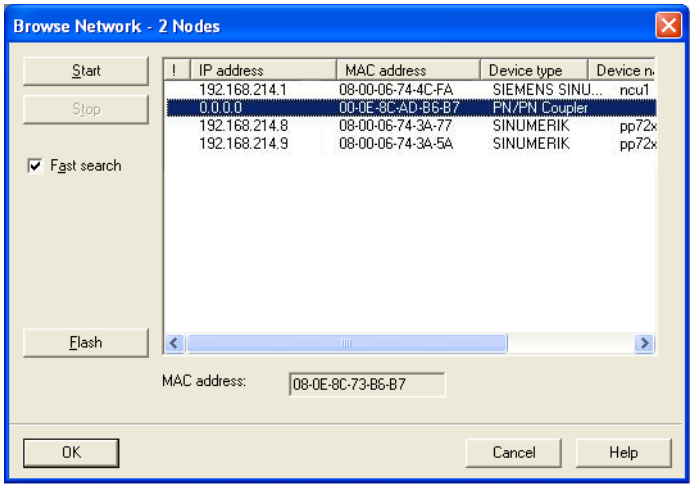
- When commissioning for the first time
- When a device is replaced

Example: Configuration with SIMATIC STEP 7

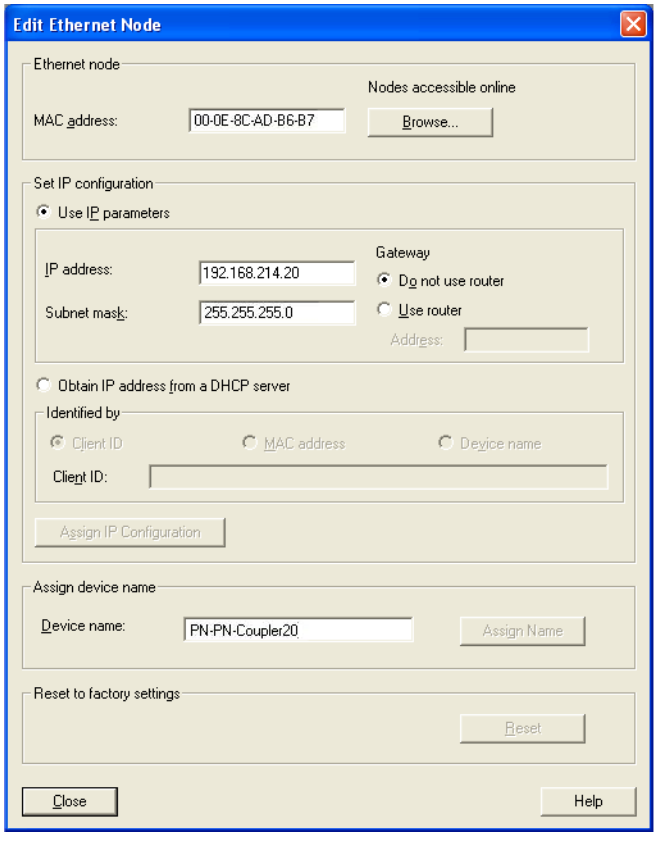
Procedure:

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 "Edit Ethernet Nodes" dialog box, press the "Browse..." button under "Nodes that can be accessed online".

4. In the "Search Network" dialog box, 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.



10.5 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

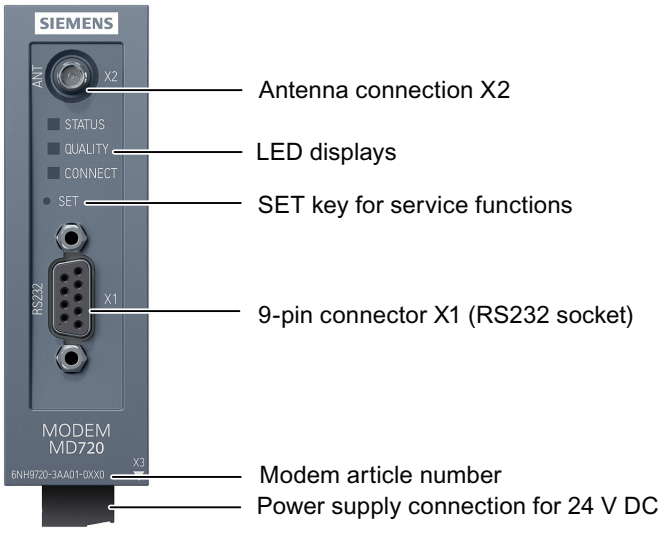


Figure 10-4 InterfacesMODEM MD720

The following diagram shows the standard way in which the modem is connected to a PPU.

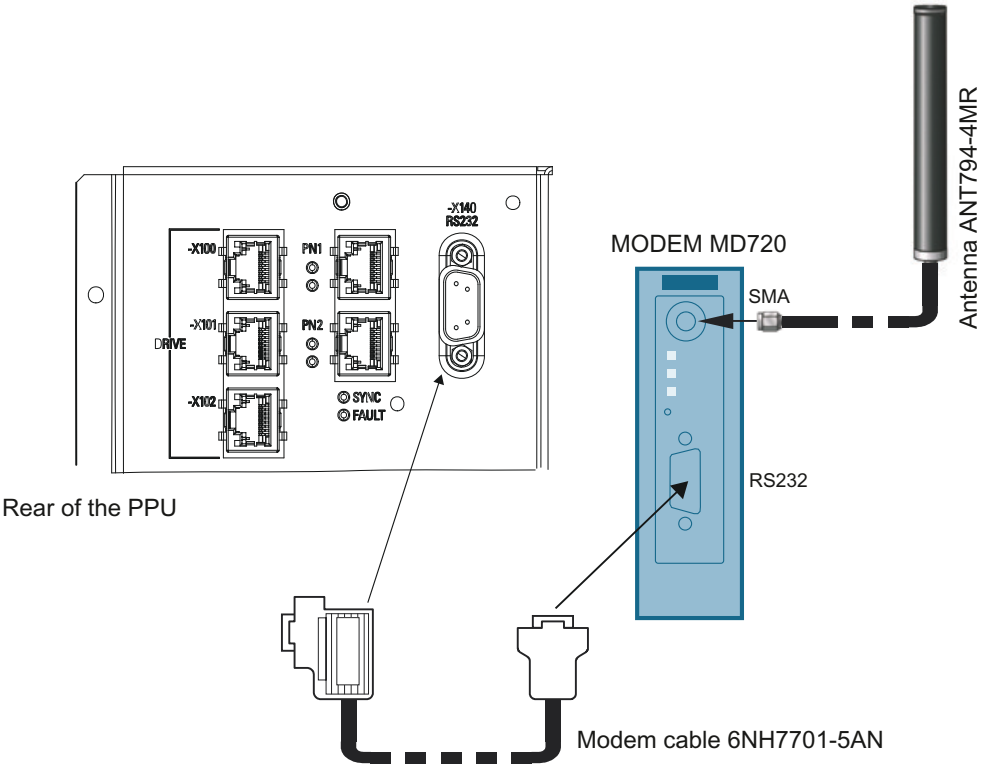


Figure 10-5 Connection of MODEM MD720 to the PPU

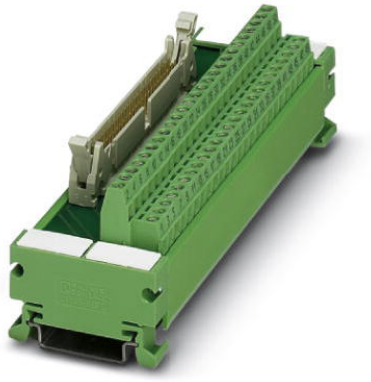
Further information

You can find further information on the MODEM MD720 on the Internet at:

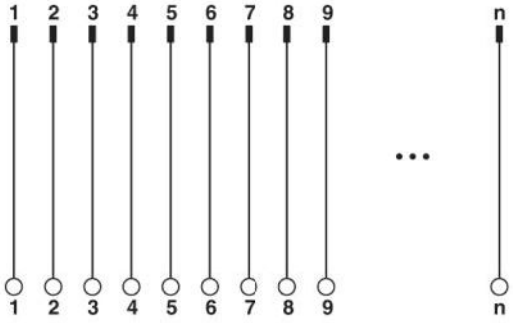
- MODEM MD720 (http://support.automation.siemens.com/WW/view/en/73513752)
- SIOS_ANT794-4MR (http://support.automation.siemens.com/WW/view/en/23119005)

10.6 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

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)

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