

SIEMENS

SINUMERIK

SINUMERIK 828D PPU

Manual

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Valid for




SINUMERIK 828D control system

06/2009
6FC5397-2DP10-0BA0

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
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.


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 device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

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 adhered to. The information in the relevant documentation must be observed.

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Disclaimer of Liability

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

Preface

SINUMERIK documentation

The SINUMERIK documentation is organized in three parts:

- General documentation
- User documentation
- Manufacturer/service documentation

Information on the following topics is available at <http://www.siemens.com/motioncontrol/docu>:

- Ordering documentation
Here you can find an up-to-date overview of publications.
- Downloading documentation
Links to more information for downloading files from Service & Support.
- Researching documentation online
Information on DOConCD and direct access to the publications in DOConWEB.
- Compiling individual documentation on the basis of Siemens contents with the My Documentation Manager (MDM), refer to <http://www.siemens.com/mdm>.
My Documentation Manager provides you with a range of features for generating your own machine documentation.
- Training and FAQs
Information on the range of training courses and FAQs (frequently asked questions) are available via the page navigation.

Target group

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

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

Benefits

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

Standard version

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

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

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

Technical Support

If you have any technical questions, please contact our hotline:

	Europe / Africa
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€0.14/min. from German landlines, mobile phone prices may differ.	
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E-mail	mailto:support.asia.automation@siemens.com

Note

National telephone numbers for technical support are provided under the following Internet address:

<http://www.automation.siemens.com/partner>

Questions about this documentation

If you have any queries (suggestions, corrections) in relation to this documentation, please send a fax or e-mail to the following address:

Fax	+49 9131 98 2176
E-mail	mailto:docu.motioncontrol@siemens.com

A fax form is available in the appendix of this document.

SINUMERIK Internet address

<http://www.siemens.com/sinumerik>

CompactFlash cards for users:

- The 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 result in damage to the memory card and the SINUMERIK as well as the data on the memory card.
- If you cannot use a memory card with the SINUMERIK, it is probably because the memory card is not formatted for the control system (e.g. Ext3 Linux file system), the memory card file system is faulty or it is the wrong type of memory card.
- Insert the memory card carefully and the right way round into the memory card slot (observe indicators such as arrow or similar). This way you avoid mechanical damage to the memory card or the device.
- Only use memory cards that have been approved by Siemens for use with SINUMERIK. Even though the SINUMERIK complies with the 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).
- The "CompactFlash® 5000 Industrial Grade" CompactFlash card from SanDisk has been approved for SINUMERIK (Order Number 6FC5313-5AG00-0AA0).

EC Declaration of Conformity

The EC Declaration of Conformity for the EMC Directive can be viewed/downloaded from the Internet at:

<http://support.automation.siemens.com>

under the Product Order No. 15257461, or at the relevant branch office of I DT MC Division of Siemens AG.

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System overview

1.1 System overview

Features

SINUMERIK 828D is a tailor-made CNC solution for milling and turning machines in the medium performance range.

SINUMERIK 828D is a panel-based CNC (panel processing unit). A CNC, PLC, operator panel and axis control for 6 drives (standard) are combined in one 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, the SINUMERIK 828D does not have any wearing parts such as fans or back-up batteries.

- CNC operator panel with tailor-made system software versions for turning and milling technologies.
- 2 operator panel versions for horizontal and vertical operator panel housings.
- Integrated full QWERTY CNC keyboard with mechanical short-stroke keys.
- USB, CompactFlash card and Ethernet interface on operator panel front.
- Additional Ethernet interface on rear of CNC for fixed factory network.
- PLC I/O Interface based on PROFINET for the connection of PLC I/O devices and a machine control panel.
- PP 72/48D PN as a PLC I/O module.
- 2 connectable handwheels.
- Optional GSM modem connection possible.
- 2 performance variants: PPU 260/261 and PPU 280/281.
- Up to 6 axes/spindles for milling applications and up to 8 axes/spindles for turning applications.
- 1 machining channel/mode group.
- Integrated PLC based on the SIMATIC S7-200 command set with Ladder Steps programming

System configuration

The SINUMERIK 828D PPU (Panel Processing Unit) combines CNC, PLC, HMI, drive control and communication tasks in a single component.

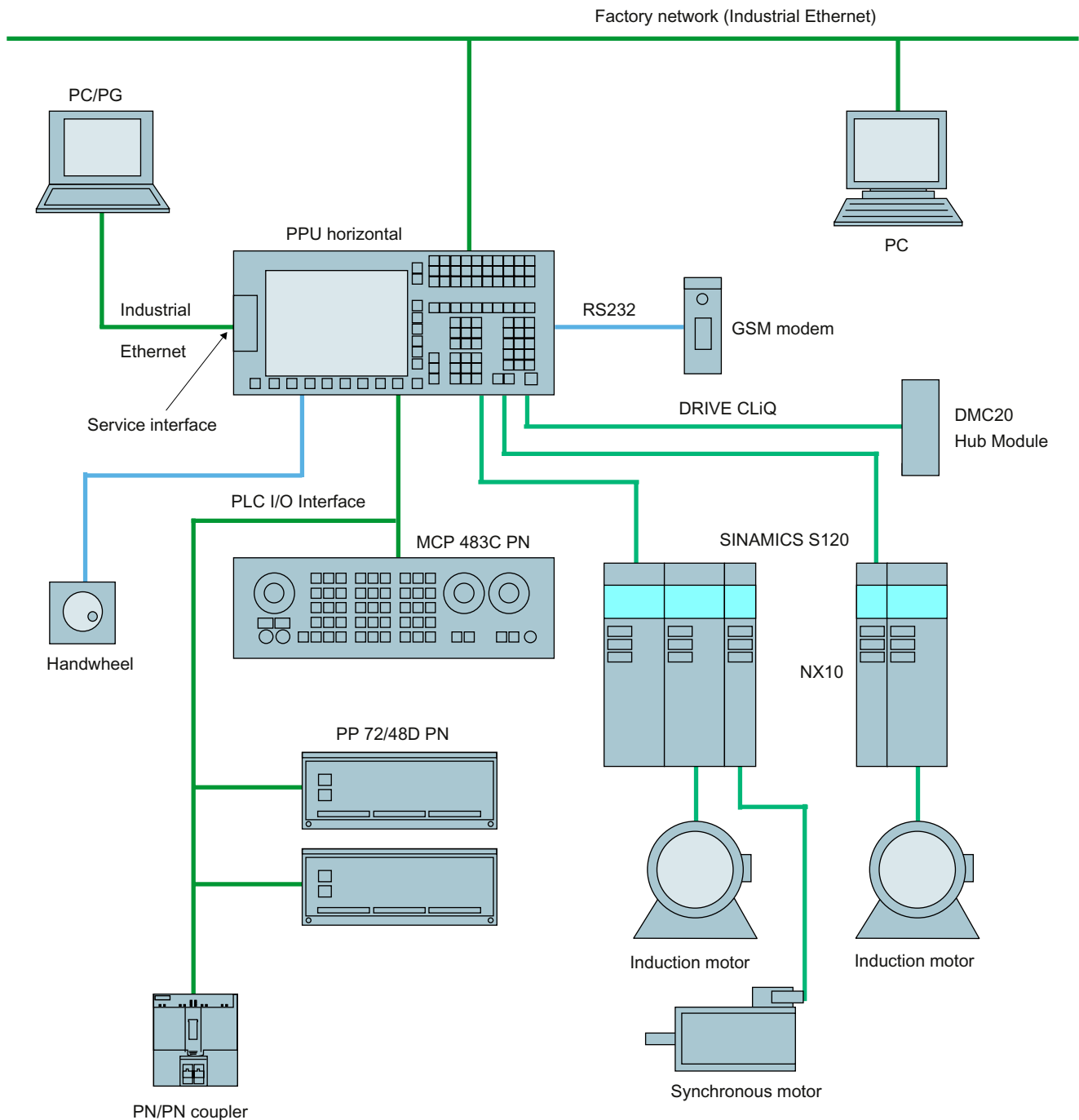


Figure 1-1 SINUMERIK 828D system overview

Components

The following components can be connected to the PPU:

- **MCP 310C PN, MCP 483C PN Machine Control Panels**

Contains the keys and switches required for the operation of a machine (turning or milling machine).

- **PLC I/O devices PP 72/48D PN**

The PP 72/48D PN module is used to connect digital inputs/outputs and has the following key features:

- Max. transfer rate 100 MBit/s
- 72 digital inputs and 48 digital outputs
- Onboard status display on 6 LEDs

To supply the module and the outputs, an external power supply unit (24 V DC) is required, which provides safety isolation from dangerous voltages.

- **SINAMICS S120 Booksize drive system**

Only the SINAMICS S120 Booksize Line and Motor Modules are used for drive control. The following **feed and main spindle motors** can be connected via the Motor Modules:

- 1FT7/1FK7/1FE1/2SP1 synchronous motors
- 1PH/1PM asynchronous motors

- **GSM modem**

Optional connection of a SINAUT MD720-3 GSM modem for sending and receiving SMS messages (Easy Message).

- **Handwheels**

A maximum of 2 handwheels can be connected.

- **Mini handheld unit**

A mini HHU can be integrated into the SINUMERIK 828D system using a connection kit.

- **PN/PN coupler**

A PN/PN bus coupler can be connected in order to link a SINUMERIK 828D to PROFINET networks. For a description, see

PN/PN Coupler SIMATIC Hardware Installation and Operating Manual

Communication

The following interfaces can be used for communication between the SINUMERIK 828D system components:

- **X100, X101, X102:** DRIVE-CLiQ
- **PN1, PN2:** PLC I/O Interface
- **X127, X130:** Industrial Ethernet
- **X140:** RS232

Note

MAC addresses

The MAC addresses required for establishing the PLC I/O Interface and Industrial Ethernet communication networks are printed on the type plate of the PPU. This is located on the rear side of the PPU.

This is similar for the MCP and PP components.

1.2 Variants

SINUMERIK 828D is available with two different panel variants (horizontal and vertical) and two performance variants. The following SINUMERIK 828D versions are a result of combining panel and performance variants:

Smaller performance variant:

- PPU 260.1 (vertical operator panel)
- PPU 261.1 (horizontal operator panel)

Larger performance variant:

- PPU 280.1 (vertical operator panel)
- PPU 281.1 (horizontal operator panel)

Performance

The following table shows the difference between the performance variants based on characteristic technical data/features:

Table 1- 1 Variants

Function	PPU 260.1 / 261.1		PPU 280.1 / 281.1	
	Turning	Milling	Turning	Milling
DRIVE-CLiQ ports	3	3	3	3
Basic quantity of axes/spindles	3	4	3	4
Maximum number of axes/spindles	6	6	6 / 8 *)	6
IPO cycle for max. configuration	6 ms	6 ms	6 ms	3 ms
Position-control cycle	3 ms	3 ms	1.5 ms	1.5 ms
Speed/current regulation cycle	125 µs	125 µs	125 µs	125 µs
Battery-backed work memory:				
- for OEM cycles	512 kB	512 kB	512 kB	512 kB
- for user data	3 MB	3 MB	5 MB	5 MB
Numeric Control Extension NX10	1	1	1	1
PP 72/48D PN I/O module	4	4	5	5
*) With the aid of an NX10, the max. number of axes can be increased to 8, with 5 axes being connected to the PPU and 3 axes to NX10.				

1.3 Ordering data

Table 1- 2 Components

Designation	Order number (MLFB)
Panel Processing Unit without system software	
PPU 261.1 horizontal	6FC5370-5AA00-0AA0
PPU 260.1 vertical	6FC5370-6AA00-0AA0
PPU 281.1 horizontal	6FC5370-7AA00-0AA0
PPU 280.1 vertical	6FC5370-8AA00-0AA0
CompactFlash Card with system software and license	
for PPU 261.1 / PPU 260.1: Turning	6FC5831-1GY00-0YA0
for PPU 261.1 / PPU 260.1: Milling	6FC5831-2GY00-0YA0
for PPU 281.1 / PPU 280.1: Turning	6FC5830-1GY00-0YA0
for PPU 281.1 / PPU 280.1: Milling	6FC5830-2GY00-0YA0
Axis expansion	
Numeric Control Extension NX10	6SL3040-0NC00-0AA0
Machine control panel	
MCP 483C PN	6FC5303-0AF22-0AA1
MCP 310C PN	6FC5303-0AF23-0AA1

Designation	Order number (MLFB)
Mini handheld unit	
with spiral connection cable	6FX2007-1AD03
with straight cable	6FX2007-1AD13
I/O module	
PP 72/48D PN	6FC5311-0AA00-0AA0
Machine Messenger	
SINAUT MD720-3 GSM/GPRS MODEM	6NH9720-3AA00
SINAUT ANT 794-4MR ANTENNA	6NH9860-1AA00
RS232 modem cable	6NH7701-5AN
Accessories	
SIMATIC PC USB FlashDrive, 2 GB	6ES7648-0DC40-0AA0
SIMATIC DP PN/PN coupler	6ES7158-3AD00-0XA0
Terminal strip converter, 50-pin	6EP5406-5AA00
Cable set comprising: <ul style="list-style-type: none"> • 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-...

Table 1- 3 Spare parts

Designation	Order number (MLFB)
Set of tensioners (9 units)	6FC5248-0AF14-0AA0
CompactFlash card, 1 GB, empty	6FC5313-5AG00-0AA0

Ordering

SINUMERIK 828D is generally marketed in sales packages with drives, motors and accessories. For orders, please contact your local Siemens sales representative.

Application planning

2.1 Secondary electrical conditions

2.1.1 Protective Separation as per EN 61800-5-1

Prerequisite

The complete system includes user interfaces (UIs) and interfaces for servicing, startup and maintenance.

User interfaces (UIs)

UIs are all the interfaces that are freely accessible to the machine operator without the need for tools or aids. These user interfaces provide safe isolation up to 230 V AC according to EN 61800-5-1.

Interfaces for servicing, startup and maintenance

 DANGER

The interfaces for servicing/installation and start-up/maintenance purposes are provided without protective separation.
--

If necessary, these interfaces can be isolated safely using a supplementary adapter (insulation voltage 230 V AC). Although these adapters are not included in the Siemens scope of delivery, you can buy these parts from your local dealer, who will be happy to advise you.

 DANGER

Safe isolation can only be ensured if the system configuration specified below is strictly adhered to. When installing additional components with EUIs, please make sure that the EUIs have safe isolation for at least 230 V AC.

Note

The components of the drive control comply with EN 61800-5-1 and contain only circuits and customer terminals with class DVC A voltages and safety isolation from circuits with dangerous voltages (PELV circuits).

2.1.2 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:

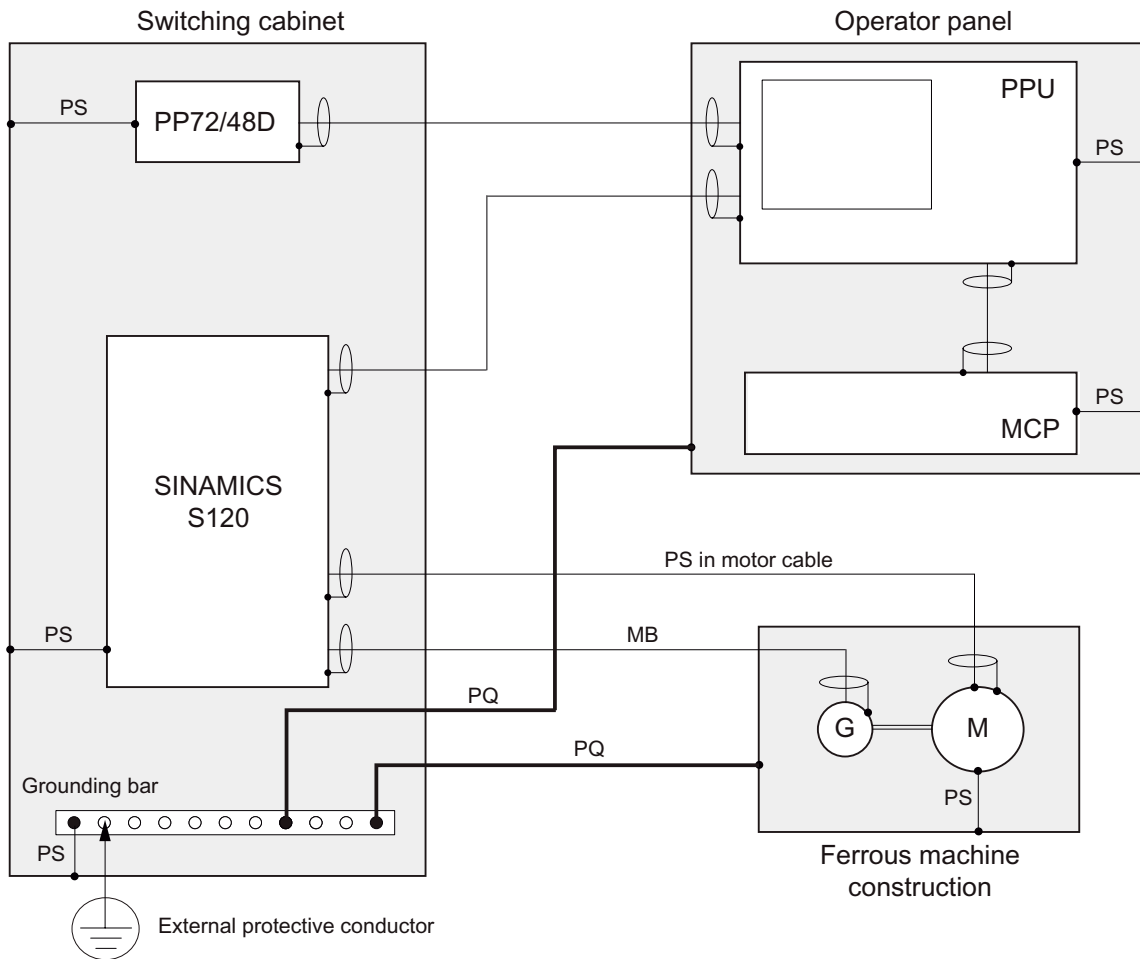
- Panel Processing Unit PPU
- Machine Control Panel
- PLC I/O devices PP 72/48D PN

Grounding measures

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

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

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



- 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 2-1 Grounding concept

The following rules apply for external cable cross sections:

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

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

Additional references

/EMC/EMC Installation Guide

2.1.3 RI suppression measures

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.

Shielded signal lines

- For the safe and smooth operation of the system, the specified cables must be used. Please refer to the chapter titled Connection.
- For digital signal transmission, the shield must have a conductive connection at both sides of the housing.

Exception:

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

Cable definitions

- Signal cables (example)
 - Data cables (Ethernet, PROFINET, DRIVE-CLiQ, sensor cables, etc.)
 - Ribbon cables for digital inputs/outputs
 - EMERGENCY OFF lines
- Power cables (example)
 - Low-voltage supply cables (230 V AC, 24 V DC, etc.)
 - Supply cables to contactors (primary and secondary circuit)

Rules for routing cables

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

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

- 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)

Note

For more information about interference suppression measures and connection of shielded cables, see

References

/EMC/EMC Installation Guide

2.2 Climatic and mechanical environmental conditions

2.2.1 Ambient conditions

Observing the ambient conditions

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

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



The equipment may not be commissioned until it has been clearly identified that the machine in which the controller is installed complies fully with the specifications in EC Directive 98/37/EC.

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 carefully maintained while setting up the complete system. Please contact your sales representative for assistance and support.

2.2.2 Transport and Storage Conditions

Components in original packaging

The following specifications apply to components in transport packaging:

Table 2- 1 Climatic environmental conditions

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

*) averaged over 5 min

**) assuming a direct change in the specified air temperatures

Table 2- 2 Test limit values for mechanical environmental conditions during transport/storage

Vibration to EN 60068-2-6	Frequency range	5 ... 9 Hz
	Constant deflection	7.5 mm
	Acceleration amplitude	9 ... 200 Hz: 2 g

$g \approx 9.81 \text{ m/s}^2$ (acceleration due to gravity)

2.2.3 Operating Conditions

Climatic environmental conditions

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

Table 2- 3 Climatic environmental conditions to EN 60721-3-3, Class 3K5

Temperature range	Front side: 0 ... 45 °C	Rear side: 0 ... 55 °C	
Temperature change	< 0.5 K / min (\pm 30 K / h) averaged over 5 min		
Humidity	Relative: 5 ... 90% at 25 °C	Absolute: \leq 25 g / m ³	
Permissible change in relative humidity	max. 0.1 % / min (\pm 6 % / h)		
Moisture condensation and ice formation	Not permissible		
Dripping water, spray, splash water, water jets	Permissible		
Supply air	Without aggressive gases, dusts and oils		
Air pressure	106 to 92 kPa or 0 to 1000 m above sea level		
Derating	At altitudes over 1,000 to 4,000 m above sea level, the upper temperature limit must be reduced by 3.5°C / 500 m.		
Active environmental conditions	Chemical: Class 3C2	Mechanical: Class 3S2	Biological: Class 3B1

Table 2- 4 Test limit values for mechanical environmental conditions during operation

Vibration to EN 60068-2-6	Frequency range	10 ... 58 Hz
	Constant deflection	0.075 mm
	Acceleration amplitude	58 ... 200 Hz: 1 <i>g</i>
Shock resistance to EN 60068-2-27	Acceleration	5 <i>g</i>
	Duration of nominal shock	30 ms
	Number of nominal shocks	18 shocks
	Shock form	Half-sine

$g \approx 9.81 \text{ m/s}^2$ (acceleration due to gravity)

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.

Table 2- 5 Maximum permissible dust content in the air

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

Note

Dust deposits must be removed at regular intervals.

Radio interference

Applicable standards: EN 61800-3

Table 2- 6 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.


NOTICE


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

Safety notes

3.1 Danger notices

The following notices are intended firstly for your personal safety and secondly to prevent damage occurring to the product described or any connected devices and machines. Non-observance of the warnings can result in severe personal injury or property damage.

 DANGER
<p>Only appropriately qualified personnel may commission/start-up SINUMERIK equipment.</p> <p>The personnel must take into account the information provided in the technical customer documentation for the product, and be familiar with and observe the specified danger and warning notices.</p> <p>When electrical equipment and motors are operated, the electrical circuits automatically conduct a dangerous voltage.</p> <p>When the system is operating, dangerous axis movements may occur throughout the entire work area.</p> <p>A potential fire hazard exists due to the energy being transferred in the equipment and the work materials used.</p> <p>All work on the electrical system must be performed after the system has been switched off and disconnected from the power supply.</p>

 DANGER
<p>Proper transportation, expert storage, installation and mounting, as well as careful operation and maintenance are essential for this SINUMERIK device to operate correctly and reliably.</p> <p>The details in the catalogs and proposals also apply to the design of special equipment versions.</p> <p>In addition to the danger and warning information provided in the technical customer documentation, the applicable national, local, and system-specific regulations and requirements must be taken into account.</p> <p>Only class DVC A protective extra-low voltages (PELVs) may be connected to connections and terminals up to 60 V in accordance with EN 61800-5-1.</p> <p>Should it be necessary to test or take measurements on live equipment, then the specifications and procedural instructions defined in Accident Prevention Regulation VBG A2 must be adhered to, in particular § 8 "Permissible deviations when working on live components". Suitable electric tools should be used.</p>

 **WARNING**

Operating the equipment in the immediate vicinity (< 1.5 m) of mobile telephones with a transmitting power of > 1 W may lead to incorrect functioning of the devices.

Connecting cables and signal lines should be installed so that inductive and capacitive interference does not in any way impair the automation and safety functions.

SINAMICS equipment with three-phase motors conforms to EMC Directive 2004/108/EC in the configurations specified in the associated EC Certificate of Conformity, provided that the configuration guidelines and actions are consistently applied.

 **DANGER**

Repairs to devices that have been supplied by our company may only be carried out by SIEMENS customer service or by repair centers authorized by SIEMENS.

When replacing parts or components, only use those parts that are included in the spare parts list.

EMERGENCY STOP/EMERGENCY OFF devices according to EN 60204-1 (VDE 0113 Part 1) must remain active in all modes of the automation equipment. Resetting the EMERGENCY STOP/EMERGENCY OFF device must not cause an uncontrolled or undefined restart.

Anywhere in the automation equipment where faults might cause physical injury or major material damage, in other words, where faults could be dangerous, additional external precautions must be taken, or facilities must be provided, that guarantee or enforce a safe operational state, even when there is a fault (e.g. using an independent limit value switch, mechanical locking mechanisms, EMERGENCY STOP/EMERGENCY OFF devices).

 **DANGER**

External power supply units for supplying components of the drive control must have safety isolation from circuits with dangerous voltages (DVC A according to EN 61800-5-1; SELV/PELV). In addition only power units with control circuits that have safety isolation from circuits with dangerous voltages may be connected.

3.2 ESD notices

CAUTION

The modules contain electrostatically sensitive devices. Discharge yourself of electrostatic energy before touching the components. The easiest way to do this is to touch a conductive, grounded object immediately beforehand (for example, bare metal parts of control cabinet or the protective ground contact of a socket outlet).

NOTICE

Handling ESD modules:

- When handling electrostatically sensitive devices, make sure that operator, workplace and packing material are properly grounded.
- Generally, electronic modules must not be touched unless work has to be carried out on them. When handling PC boards make absolutely sure that you do not touch component pins or printed conductors.
- Touch components only if:
 - you are constantly grounded via an ESD arm band,
 - ESD shoes or ESD shoe grounding strips if there is an ESD floor.
- Boards/modules must only be placed on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).
- Keep modules away from visual display units, monitors or TV sets (minimum distance from screen 10 cm).
- Do not bring ESD-sensitive modules into contact with chargeable and highly-insulating materials, such as plastic, insulating table tops or clothing made of synthetic materials.
- Measurements on modules are allowed only if:
 - The measuring instrument is properly earthed (e.g., protective conductor) or
 - Before measuring with a floating measuring instrument, the probe is briefly discharged (e.g., touch the bare metal parts of the control housing).

Description

4.1 Features

The following PPU versions are available:

Component	Description
PPU 260.1	PPU with vertical keyboard
PPU 261.1	PPU with horizontal keyboard
PPU 280.1	PPU with vertical keyboard and enhanced performance
PPU 281.1	PPU with horizontal keyboard and enhanced performance

In principle, hardware remains the same for all the software versions. The only difference in terms of the external appearance of the PPU is the operator panel layout, which is arranged either vertically or horizontally.

Operator components

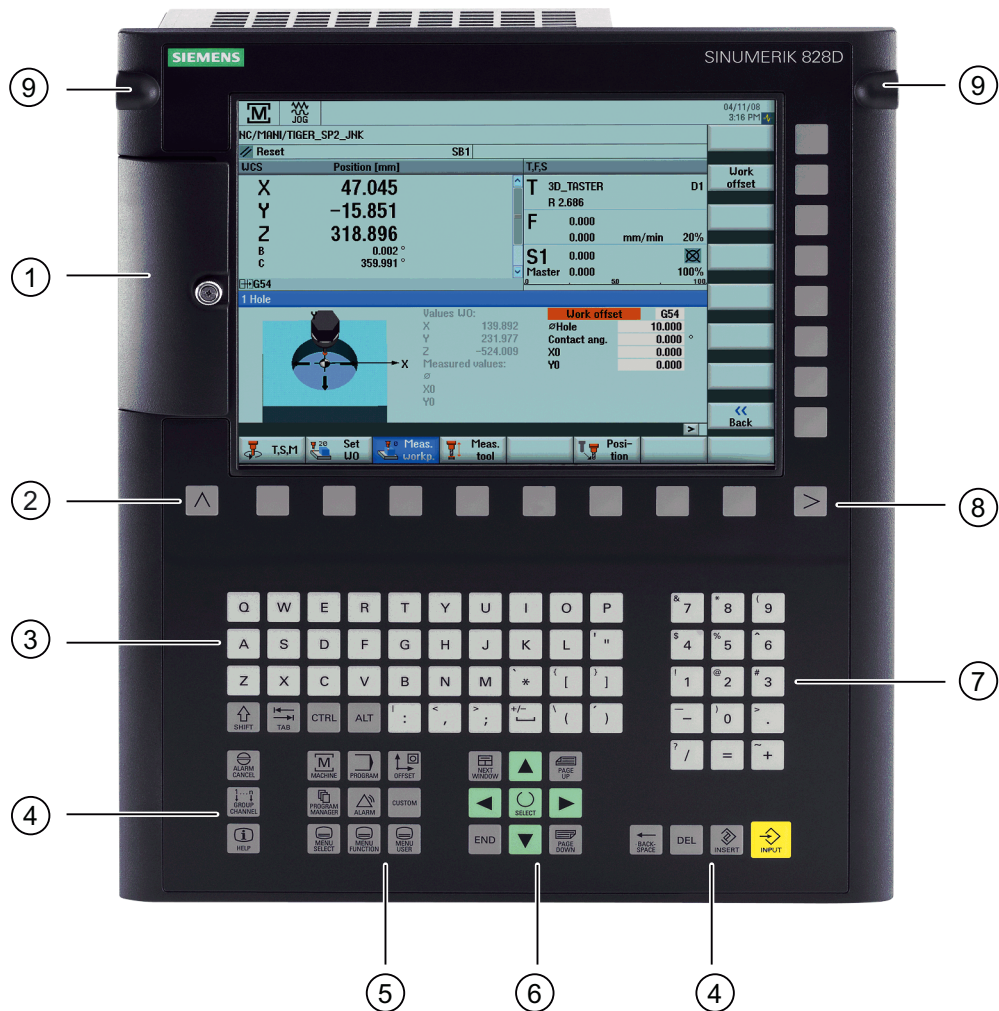
The TFT color display has a diagonal width of 10.4". The resolution is 640 x 480 pixels. The softkeys are arranged in an 8 + 8 layout; this makes the CNC easy to operate using only a very small number of menu levels.

The SINUMERIK 828D keyboard is based on a full QWERTY-type design. This enables the user to enter text for part-program names or tool identifiers and plain-text language commands directly without using the keys in the second input level (Shift key). The keys involved are mechanical short-stroke keys. The short-stroke keys are behind a molded protective foil; this ensures accordance with IP65 protection.

Standardized 3/8" threads are embedded in the upper edges of the operator panel. These threads can be used for attaching commercially available additional components such as holders for diagrams or similar.

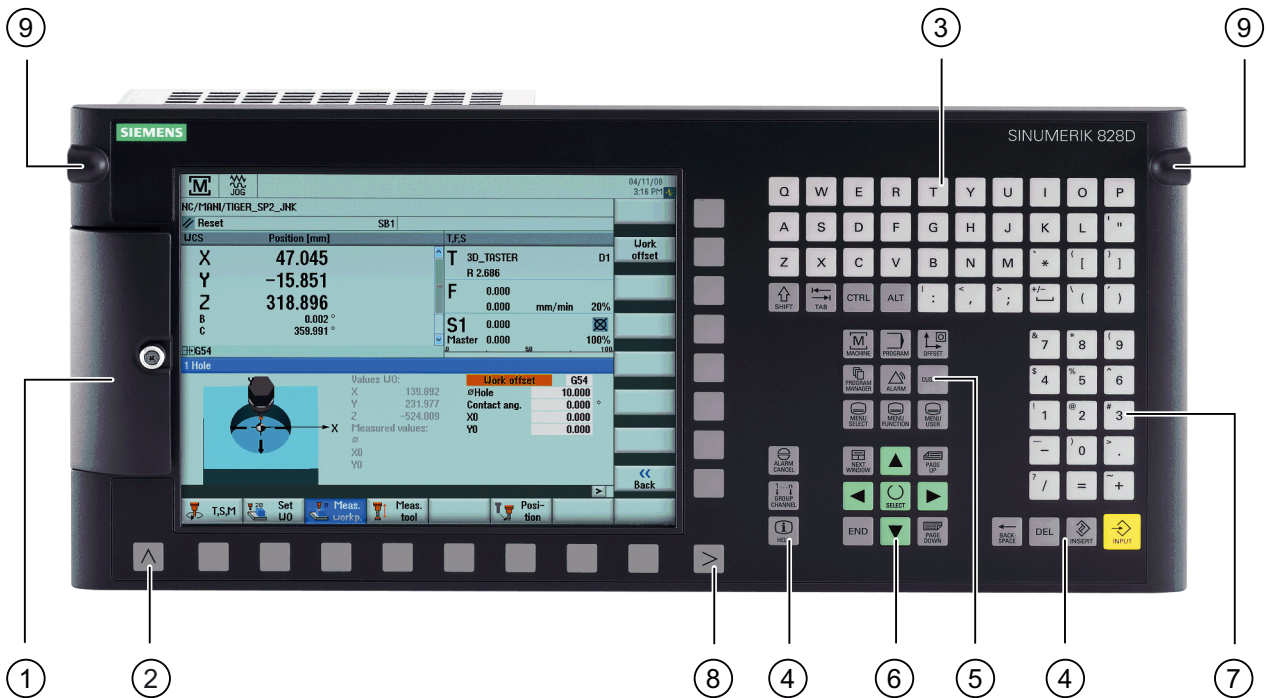
4.2 Layout

Front



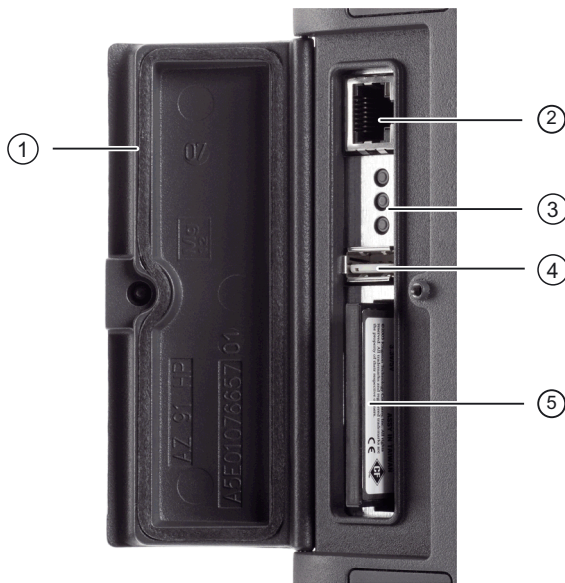
- ① Protective flap for user interfaces
- ② Menu back key
- ③ Alphabetic key group
- ④ Control key group
- ⑤ Hotkey group
- ⑥ Cursor key group
- ⑦ Numeric key group
- ⑧ Menu forward key
- ⑨ 3/8" threads for additional components

Figure 4-1 Layout of a vertical PPU



- ① Protective flap for user interfaces
- ② Menu back key
- ③ Alphabetic key group
- ④ Control key group
- ⑤ Hotkey group
- ⑥ Cursor key group
- ⑦ Numeric key group
- ⑧ Menu forward key
- ⑨ 3/8" threads for additional components

Figure 4-2 Layout of a horizontal PPU



- ① Protective flap for user interfaces
- ② X127 Ethernet (service socket)
- ③ RDY, NC, CF status LEDs
- ④ X125 USB socket
- ⑤ Slot for CompactFlash (CF) Card

Figure 4-3 Interfaces behind protective flap

Rear

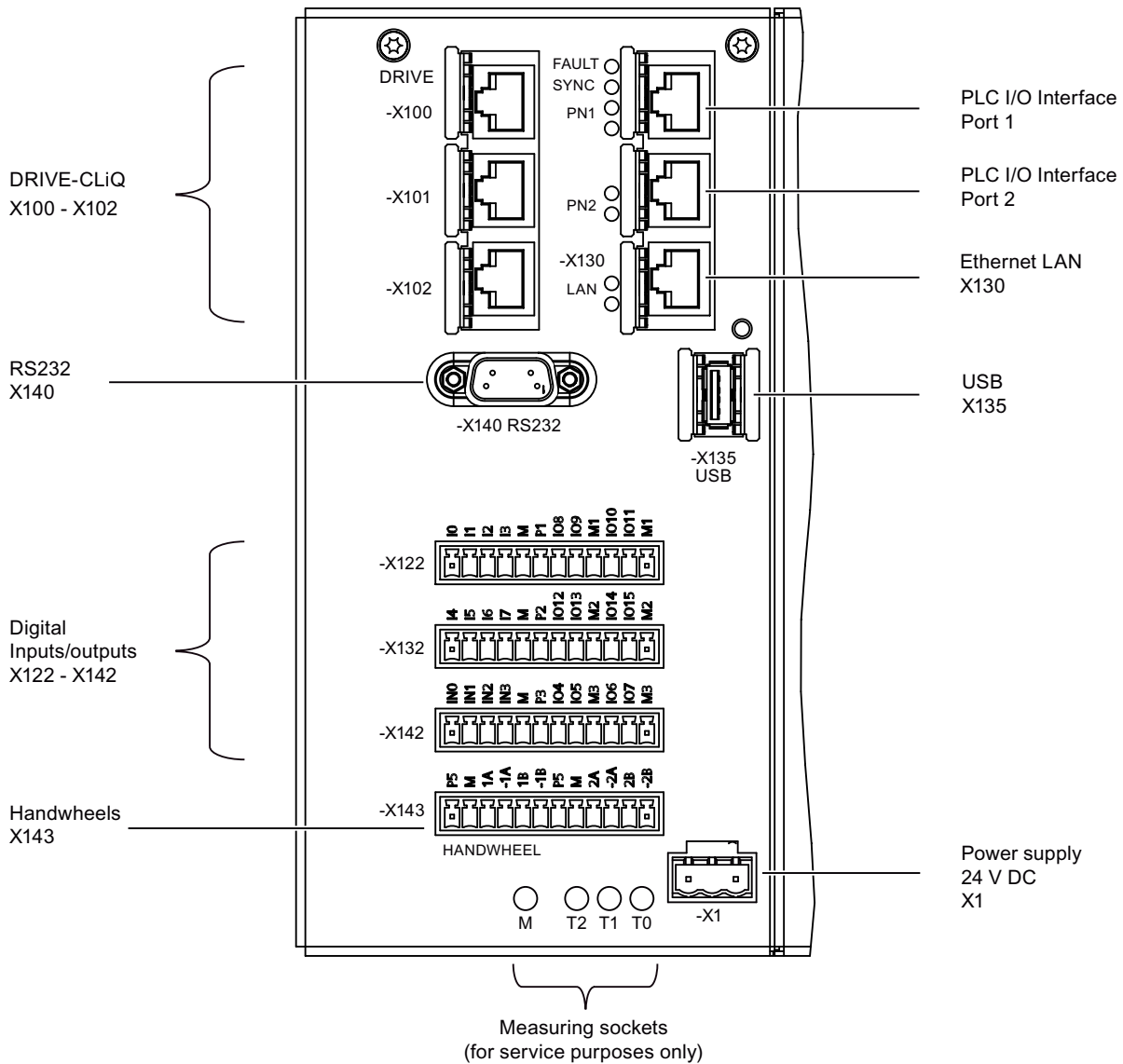


Figure 4-4 Interfaces on the rear side of the PPU

4.3 Type plate

The PPU type plate is located on the rear side.

Note

The information contained in each field of the type plate on the current control unit may differ from the information presented in this manual (for example, a later product version, approvals and marks that have not yet been issued, etc., may be shown).

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

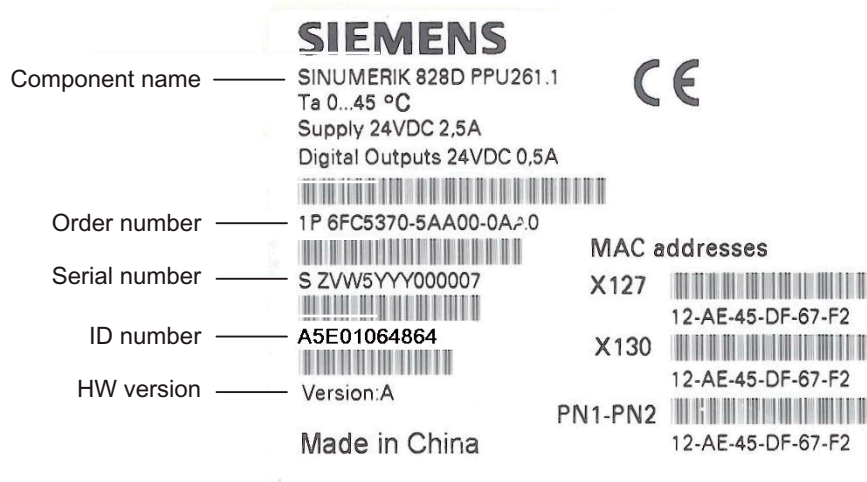


Figure 4-5 Horizontal PPU type plate

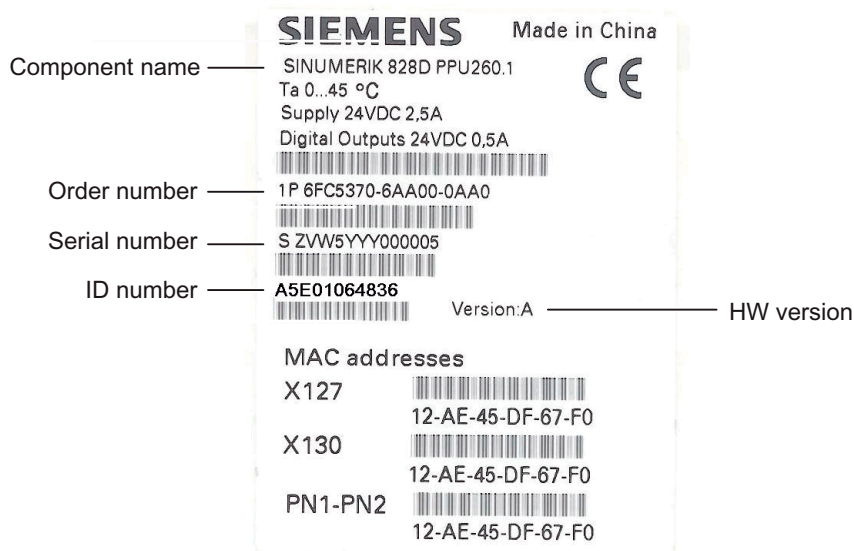


Figure 4-6 Vertical PPU type plate























4.4 Keyboard and display

Keyboard

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




- The alphabetic key group contains the letters A ... Z and blank characters for entering text.
- The numeric key group contains the digits 0 - 9, numerical/special characters and the decimal point for entering numeric characters and operators.
- The cursor key group is used to navigate on the screen.
- The control key group includes special functions.
- The area switchover shows the main menu.
- The menu forward key enables an expansion of the horizontal softkey bar in the same menu.
- The softkeys call up functions that are available on screen via a menu bar.
- The machine area key switches directly into the "Machine" operating area.
- The menu back key returns to the superordinate menu, one window is closed.

The key symbols used on the operator panel front appear below along with the corresponding function keys on the PC keyboard.

Key	Function corresponds to PC key function	Key	Function corresponds to PC key function
	Esc		End
	F11		Backspace
	F12		Tab
	Space		(only intended for internal keyboard changeover)
	Home		Ctrl key
	Page up		Alt key
	Page down		Delete
	Cursor up		Insert
	Cursor left		Enter
	Cursor right		F9
	Cursor down		F10

Description

4.4 Keyboard and display

Key		Function corresponds to PC key function	Key	Function corresponds to PC key function
	SELECT	5 (in numeric key group)	A ... Z	A ... Z
		<Shift> F9		<Shift> F10

Display

Note

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

Operator controls and display elements

5.1 CompactFlash Cards

5.1.1 Properties

There are two slots for CompactFlash Cards on the PPU:

- The "CF" slot for optional user data cards is located on the front side behind the protective flap.
- The slot for the system software card is located on the rear side.

CompactFlash Card for system software

The system software card is delivered bootable. It is not supplied with the PPU and must be ordered as a separate component.

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

As well as the technology-specific basic software for SINUMERIK 828D and the firmware for SINAMICS, the system software card also contains:

- Version info (serial number, version, type designation)
- License key This means that the CompactFlash Card can be inserted into another PPU without requiring a license change.

CAUTION

In the event of a defect, the system software card must be replaced. For information about restoring your system using an empty CompactFlash Card, please refer to the Service Manual.

CompactFlash Card for user data

This interface performs the following tasks:

- Transfer of user and commissioning data.
- 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

A user data card with FAT16/32 formatting can be loaded with files at the PC in the card reader.

5.1.2 Inserting the CompactFlash card

CAUTION

Damage to the CompactFlash Card

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

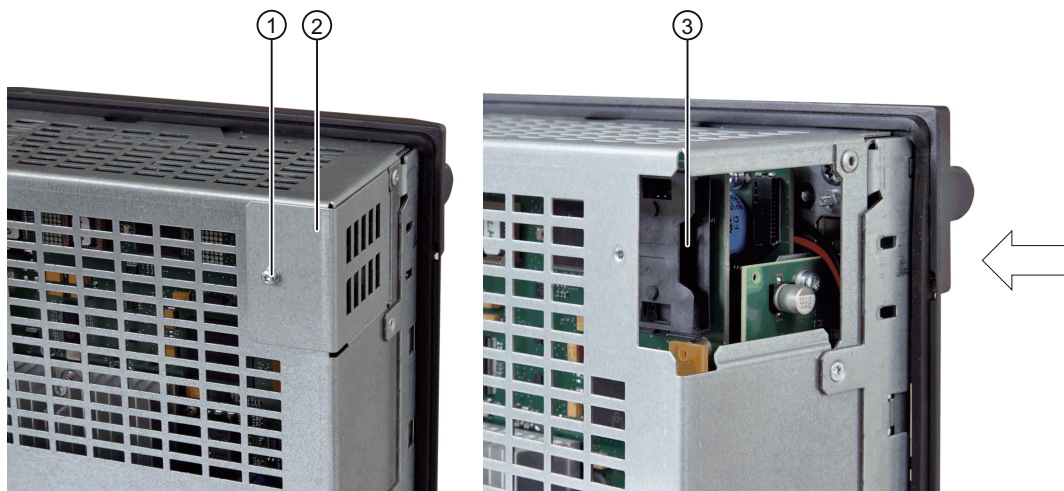
Help with insertion

The CompactFlash Card has a notch on the opposite side to the pins. This must always be on the right when inserting the card.



Only changing the system software card is detailed, as this is secured by a screwed down metal cover.

Location of the system software card slot



- ① M3 screw
- ② Metal cover
- ③ Slot

Procedure

NOTICE

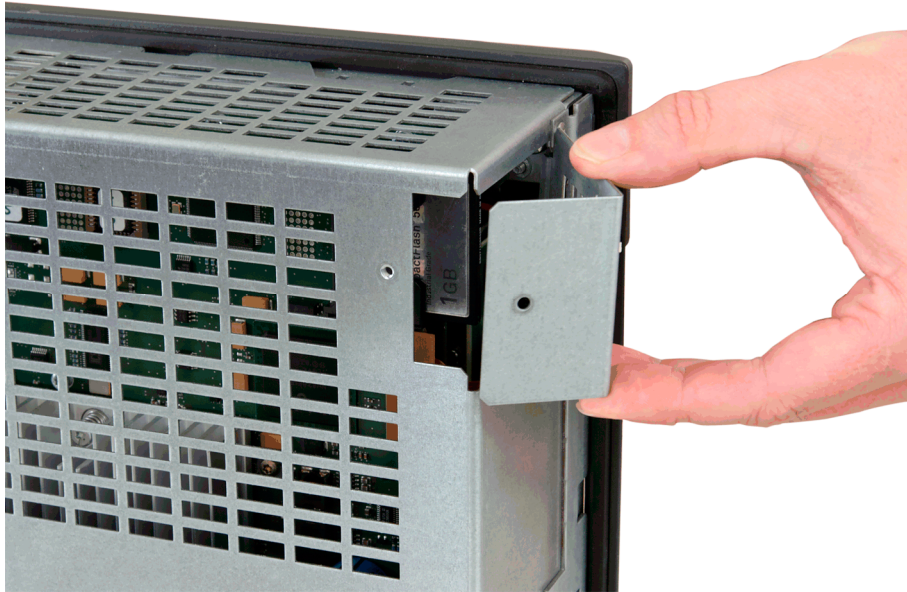
ESD: you must discharge yourself at the cabinet or ground terminal before touching a CompactFlash Card.

 **CAUTION**

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

Please proceed as follows:

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



4. Pull out the CompactFlash Card sideways.



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

6. Re-attach the metal cover ② by first guiding it in backward, then tilting into the end position and finally screwing in the screw ①.
7. Switch the power supply on again.

5.1.3 Writing to a CompactFlash Card

Writing to a CompactFlash Card

The CompactFlash Card for user data can be written to as follows:

- The CompactFlash Card is inserted in the PPU.
- You can write to the CompactFlash Card directly via a PG/PC using a suitable memory card adapter.

Note the following when handling a CompactFlash Card.

Note

The CompactFlash card always comes formatted. **You must not reformat it under any circumstances.**

To ensure that the CompactFlash Card functions properly, the card must not be repartitioned.

5.2 LED front displays

The three LEDs located behind the protective flap on the front side of the PPU mean the following:

Table 5- 1 NC status LED displays

Name	Color	Status	Meaning
RDY	Green	On	NC Ready and PLC in run mode.
	Yellow	On	PLC in stop mode
		Flashing	Power-up
	Red	On	NC in stop mode: <ul style="list-style-type: none"> • in power-up, if NC Ready is not yet available • Critical error (power off/on necessary)
NC	Yellow	Cyclic flashing	NC operation

Table 5- 2 LED display for CompactFlash Card X145 user data

Name	Color	Status	Meaning
CF	Yellow	On	Accessing the CompactFlash Card.

CAUTION

If the LED is on, the CompactFlash Card must not be removed. Non-compliance can result in damage to the CompactFlash Card.

Interfaces

6.1 Overview

Interface overview

Table 6- 1 Overview of the interfaces

Interface	Designation	Connector type
Front		
Ethernet (PC connection)	X127	RJ45 socket
USB	X125	USB socket
CompactFlash Card for user data	X145	50-pin socket
Rear		
DRIVE-CLiQ	X100, X101, X102	DRIVE-CLiQ socket
Ethernet (factory) IE2/NET	X130	RJ45 socket
PLC I/O Interface	PN1, PN2	RJ45 socket
Digital inputs/outputs	X122, X132, X142	12-pin screw terminal
Handwheel	X143	12-pin screw terminal
24 V power supply	X1	3-pin screw terminal
USB interface *)	X135	USB socket
RS232 interface *)	X140	9-pin SUB D connector
*) X135 and X140 are standard interfaces, which are not covered in any more detail in this chapter.		

Note

For specifications regarding the cables to be connected and the use of interfaces, see the chapter titled "Connection".

Definition

In the tables showing the pin assignment of the interfaces, the letters in the "Signal type" column have the following meaning:

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

6.2 X1 power supply

This interface is intended exclusively for the connection of the external 24 V power supply. See Requirements for the power supply (Page 63)

Pin assignment

Table 6- 2 Pin assignment at X1 screw-type terminal block

Pin	Signal name	Signal type	Meaning
1	P24	VI	24 V DC power supply
2	M	VO	Ground
3	PI	GND	Protective ground

6.3 DRIVE-CLiQ interfaces X100 - X102

Properties

DRIVE-CLiQ has the following properties:

- Independent expansion of components possible
- Automatic detection of components by the PPU
- Standardized interfaces to all components
- Uniform diagnostics down to the components
- Complete service down to the components

Pin assignment

Table 6- 3 Pin assignment at X100 - X102

PIN	Signal name	Signal type	Meaning
1	TXP	O	Transmit data +
2	TXN	O	Transmit data -
3	RXP	I	Receive data +
4			Reserved, do not use
5			Reserved, do not use
6	RXN	I	Receive data -
7			Reserved, do not use
8			Reserved, do not use
A			Reserved, do not use
B			Reserved, do not use

Additional references

For information about the components indicated above, refer to the

- SINAMICS S120 Control Units and Additional System Components Manual
- SINAMICS S120 Booksize Power Units Manual
- SINAMICS S120 Commissioning Manual

6.4 PLC I/O Interface PN1, PN2

Properties

- The interfaces are designed for full-duplex mode; in other words, the ports can both transmit and receive.
- 100 Mbit Ethernet ports with an integrated 2-port switch and a TCP/IP address for the 2 ports, which can be read out from the HW Info block

Pin assignment

Table 6- 4 Pin assignment PN1, PN2

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

LED displays

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

Table 6- 5 Ports PN1, PN2 LED displays

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

There are two status LEDs (fault and sync) next to port PN1, which apply to both ports.

Table 6- 6 LED display PLC I/O Interface status

Name	Color	Status	Meaning
Fault	Red	Off	The data exchange to all configured IO devices runs without errors.
		Red	Bus fault: <ul style="list-style-type: none"> No physical connection to a subnet/switch Incorrect transmission rate Full duplex transmission is not activated.
		Flashing red (2 Hz)	<ul style="list-style-type: none"> Failure of a connected I/O device. At least one of the assigned IO devices cannot be addressed Incorrect or no configuration
Sync	Green	Off	The SINUMERIK 828D 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 SINUMERIK 828D task system has been synchronized to the cycle for PLC I/O Interface, and data exchange is running.
		Flashing green (0.5 Hz)	The SINUMERIK 828D task system has been synchronized to the cycle for PLC I/O Interface, and cyclic data exchange is running.

6.5 X130, X127 Ethernet interfaces

Properties

- The interfaces are designed for full-duplex mode; in other words, the ports can both transmit and receive.
- 10/100 Mbit Ethernet ports. Both ports are connected as an Ethernet terminal.

Pin assignment

Table 6- 7 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	-	

LEDs

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

Table 6- 8 Ethernet port LED displays

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

6.6 X122, X132 and X142 digital inputs/outputs

6.6.1 Pin assignment

Pin assignment

Table 6- 9 X122 digital inputs/outputs

Pin	Signal name	Signal type	Meaning
1	DI0	I	Digital input 0
2	DI1	I	Digital input 1
3	DI2	I	Digital input 2
4	DI3	I	Digital input 3
5	MEXT4	GND	Ground for DI0 - DI3
6	P24EXT1	VI	Power supply for DIO8 - DIO11
7	DIO8	B	Digital input/output 0 (rapid input)
8	DIO9	B	Digital input/output 1 (rapid input)
9	MEXT1	GND	Ground for DIO8 - DIO11
10	DIO10	B	Digital input/output 2 (rapid input)
11	DIO11	B	Digital input/output 3 (rapid input)
12	MEXT1	GND	Ground for DIO8 - DIO11

Table 6- 10 X132 digital inputs/outputs

Pin	Signal name	Signal type	Meaning
1	DI4	I	Digital input 4
2	DI5	I	Digital input 5
3	DI6	I	Digital input 6
4	DI7	I	Digital input 7
5	MEXT5	GND	Ground for DI4 - DI7
6	P24EXT2	VI	Power supply for DIO12 - DIO15
7	DIO12	B	Digital input/output 4 (rapid input)
8	DIO13	B	Digital input/output 5 (rapid input)
9	MEXT2	GND	Ground for DIO12 - DIO15
10	DIO14	B	Digital input/output 6 (rapid input)
11	DIO15	B	Digital input/output 7 (rapid input)
12	MEXT2	GND	Ground for DIO12 - DIO15

Table 6- 11 X142 digital inputs/outputs

Pin	Signal name	Signal type	Meaning
1	DIN0	I	Digital NCK input 0
2	DIN1	I	Digital NCK input 1
3	DIN2	I	Digital NCK input 2
4	DIN3	I	Digital NCK input 3
5	MEXT6	GND	Ground for DIN0 – DIN3
6	P24EXT3	VI	Power supply for DINO4 - DINO7
7	DINO4	B	Digital NCK input/output 4 (rapid input)
8	DINO5	B	Digital NCK input/output 5 (rapid input)
9	MEXT3	GND	Ground for DINO4 - DINO7
10	DINO6	B	Digital NCK input/output 6 (rapid input)
11	DINO7	B	Digital NCK input/output 7 (rapid input)
12	MEXT3	GND	Ground for DINO4 - DINO7

6.6.2 Technical data

Digital inputs

Table 6- 12 Technical data for digital inputs X122/X132/X142

Parameter	Values
Voltage	-3 V to 30 V
Typical power consumption	10 mA at 24 V DC
Galvanic isolation	Reference potential is terminal MEXT4, MEXT5, MEXT6
Signal level (including ripple)	High signal level: 15 V to 30 V Low signal level: -3 V to 5 V
Signal propagation delays	L → H: 50 μs H → L: 100 μs

Digital inputs/outputs


Table 6- 13 Technical data for the digital inputs/outputs of X122/X132/X142

Parameter	Values
	As an input
Voltage	-3 V to 30 V
Typical power consumption	10 mA at 24 V DC
Signal level (including ripple)	High signal level: 15 V to 30 V Low signal level: -3 V to 5 V
Pins 7, 8, 10 and 11 are "rapid inputs"	
Signal propagation delays for "rapid inputs"	L → H: 10 μs H → L: 100 μs
Galvanic isolation	Reference potential is terminal MEXT1, MEXT2, MEXT3
	As an output
Voltage	24 V DC
Maximum load current per output	500 mA
Maximum load current per connector	1 A

Note

An open input is interpreted as "low".

Only "rapid inputs" can be used as inputs for BEROs.

 DANGER
<p>Terminals MEXT1 ... MEXT6 must be connected for the digital inputs/outputs to work. This can be done as follows:</p> <ul style="list-style-type: none"> • Connect the ground reference of the digital inputs. • A bridge to terminal M on plug connection X1. Notice: This removes the galvanic isolation for these digital inputs.

6.7 X143 handwheel interface

Pin assignment

Table 6- 14 X143 pin assignment

Pin	Signal name	Signal type	Meaning
1	3P5	V	5 VDC power supply
2	M	-	Ground
3	1A	I	Handwheel pulses track A, channel 1
4	X1A	I	Handwheel pulses track A (negated), channel 1
5	1B	I	Handwheel pulses track B, channel 1
6	X1B	I	Handwheel pulses track B (negated), channel 1
7	3P5	V	5 VDC power supply
8	M	-	Ground
9	2A	I	Handwheel pulses track A, channel 2
10	X2A	I	Handwheel pulses track A (negated), channel 2
11	2B	I	Handwheel pulses track B, channel 2
12	X2B	I	Handwheel pulses track B (negated), channel 2

6.8 RS232 interface X140

Pin assignment

Table 6- 15 X140 pin assignment

Pin	Signal name	Signal type	Meaning
1	DCD	I	Receive signal level (carrier)
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	Data Set Ready
7	RTS	O	Request To Send
8	CTS	I	Clear To Send
9	RI	I	Incoming call

Dimension drawings

PPU horizontal

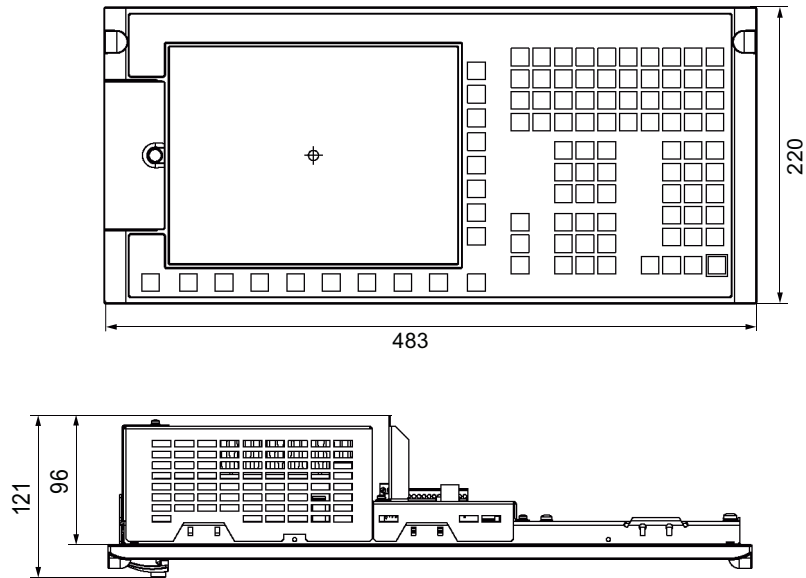


Figure 7-1 Horizontal PPU dimensioning

PPU vertical

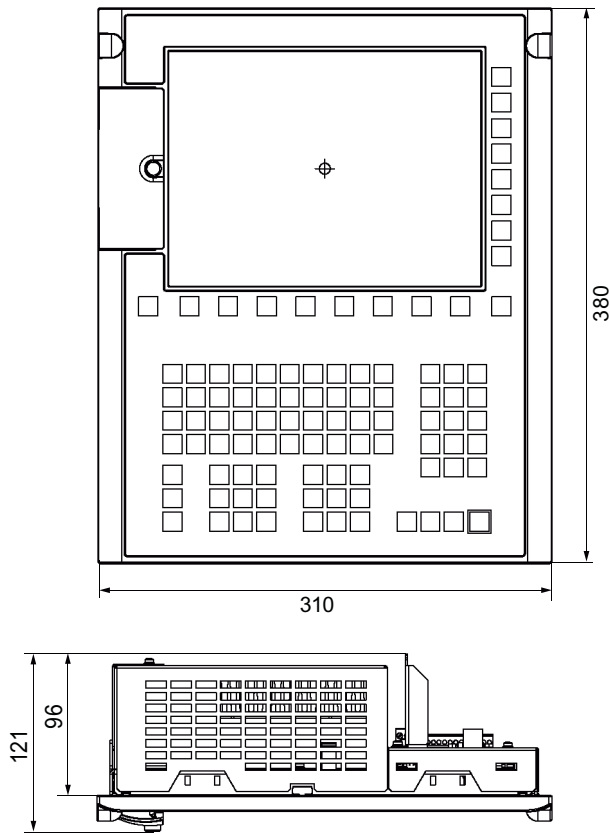


Figure 7-2 Vertical PPU dimensioning

Installation

8.1 Safety notes

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



Control cabinet manufacture

You can find out more about this subject in the system manual on "Control Cabinet Integration for SINAMICS S120 Booksize / SIMODRIVE".

8.2 Designs

Basic design

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

NOTICE
Mounting the PPU
The maximum permissible tightening torque for the tensioning screws is 0.8 Nm and this value must not be exceeded.

The SINAMICS components and PLC I/O modules are installed in a control cabinet.

Note

Notes for mounting components from the SINAMICS S120 Booksize product family can be found in the following SINAMICS documentation:

SINAMICS S120 Booksize Power Units Manual

PPU horizontal

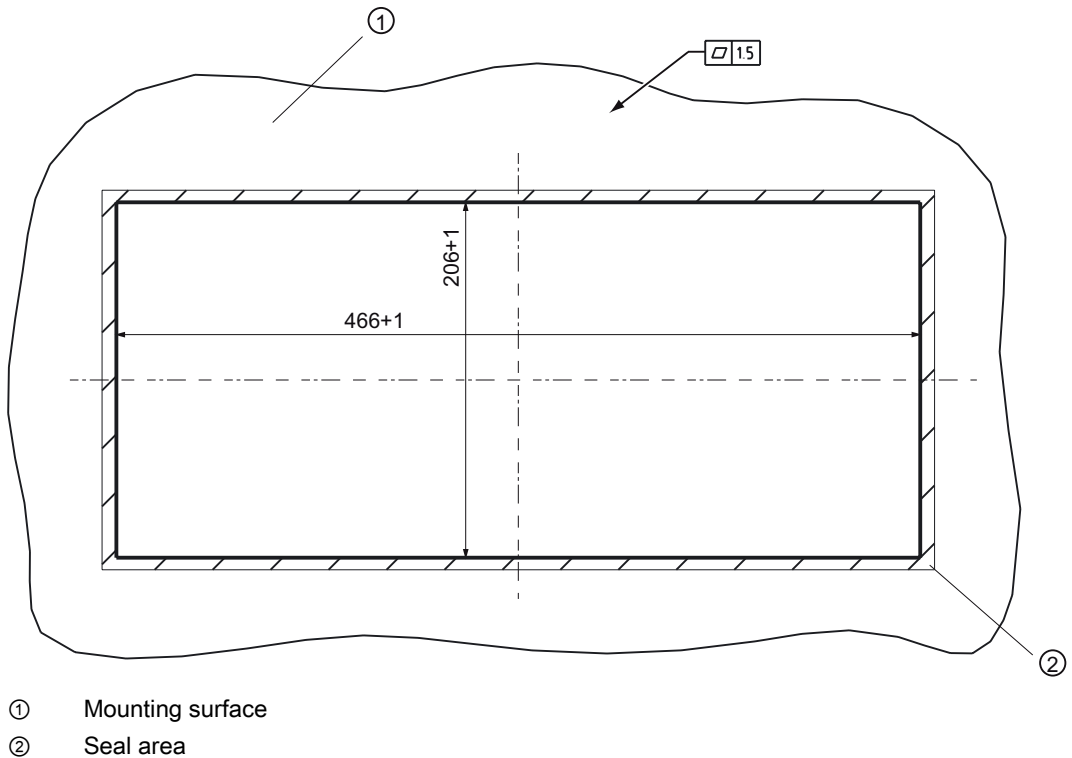


Figure 8-1 Horizontal PPU panel cutout

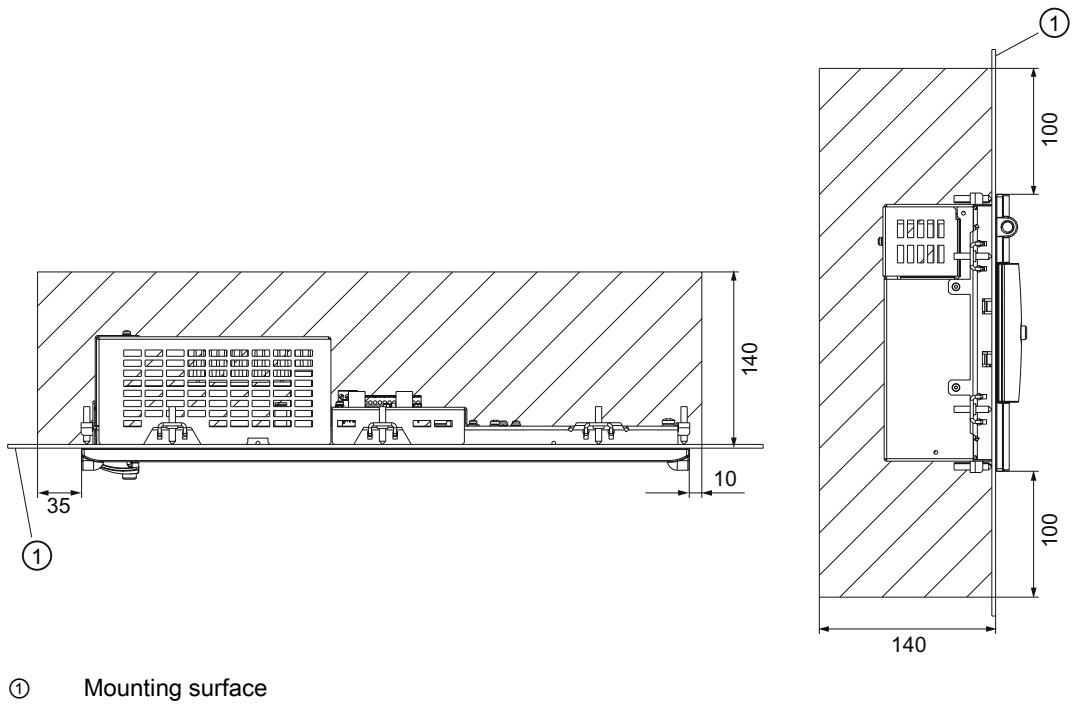
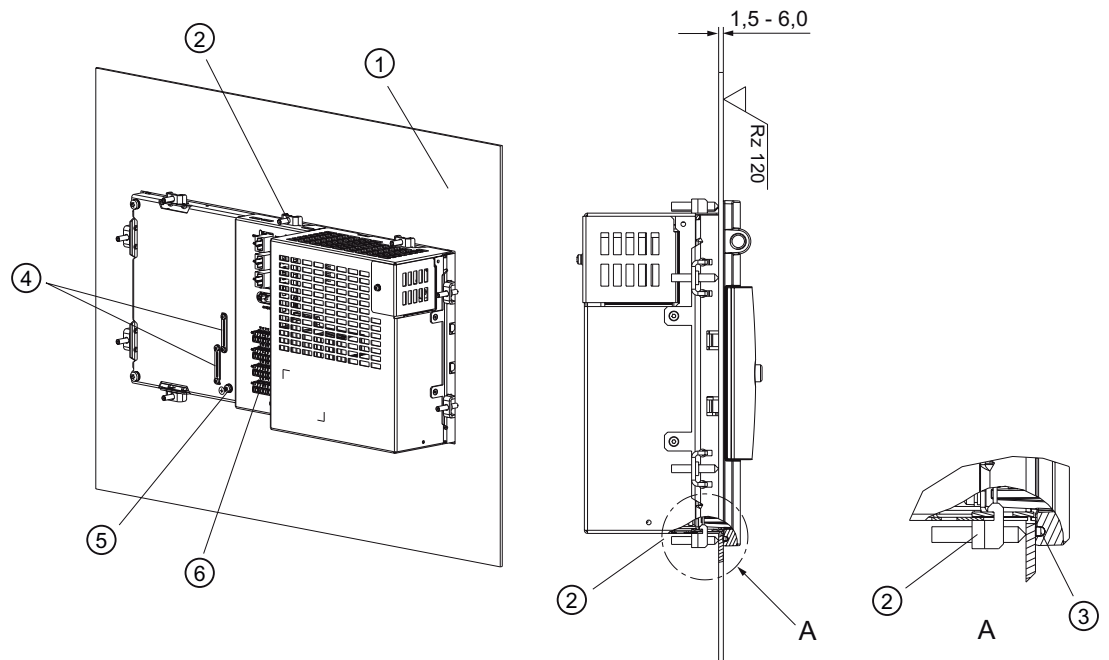


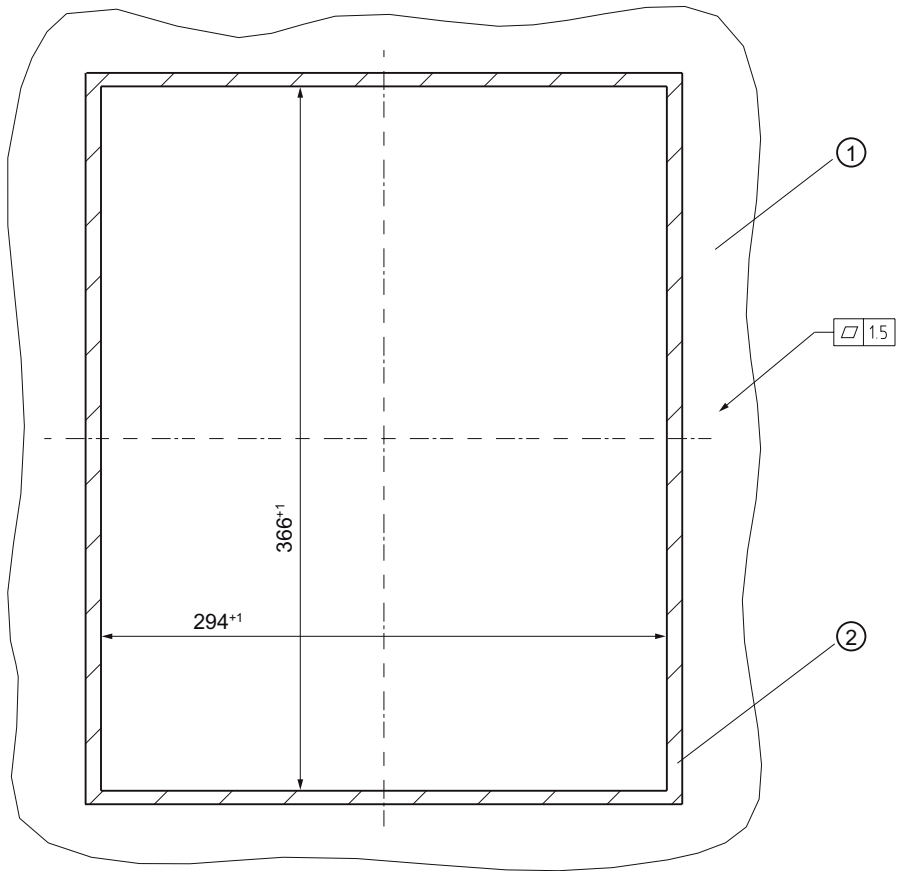
Figure 8-2 Clearance for ventilation and cables in the horizontal PPU



- ① Mounting surface
- ② Tensioner (10 parts)
- ③ Seal area
- ④ Shield contact
- ⑤ M4 grounding screw
- ⑥ Interfaces

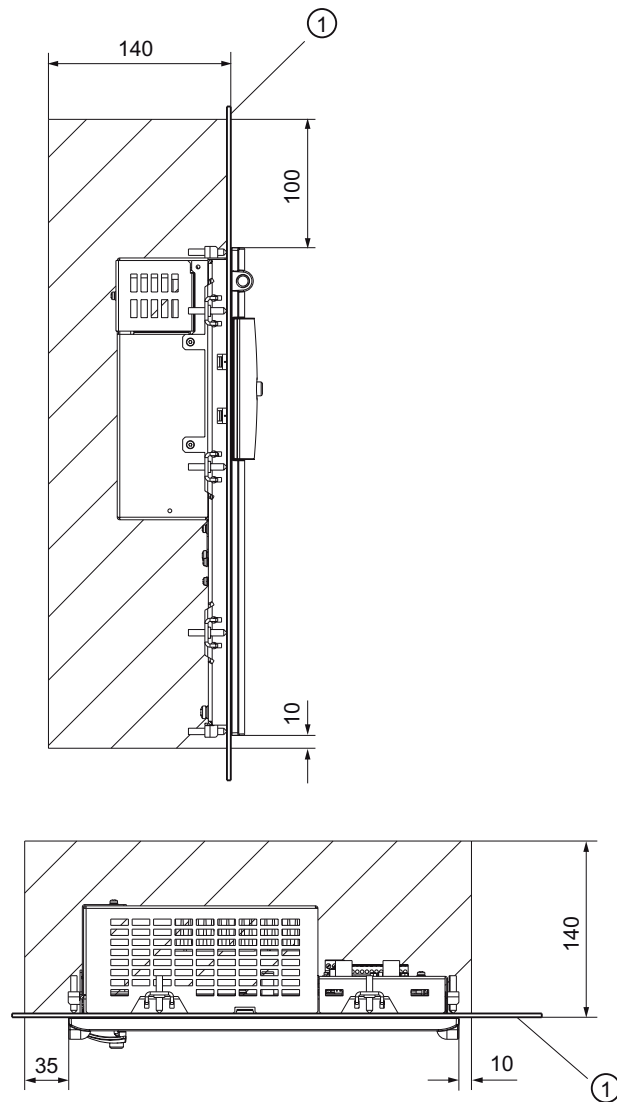
Figure 8-3 Horizontal PPU mounting

PPU vertical



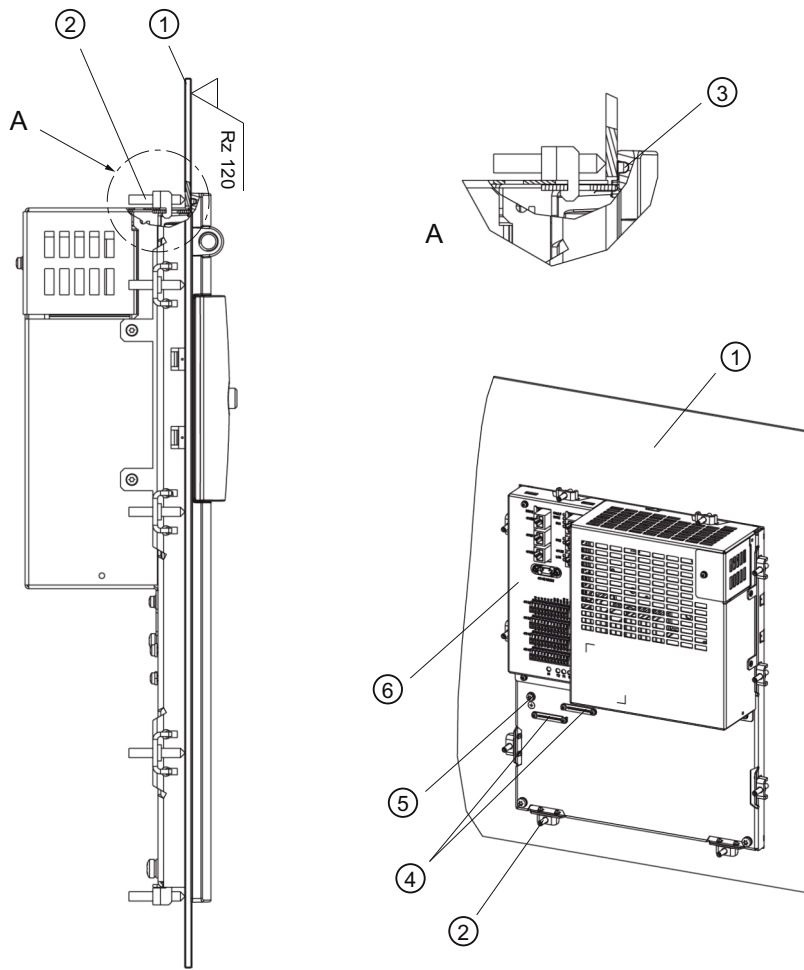
- ① Mounting surface
- ② Seal area

Figure 8-4 Vertical PPU panel cutout



① Mounting surface

Figure 8-5 Clearance for ventilation and cables in the vertical PPU



- ① Mounting surface
- ② Tensioner (10 parts)
- ③ Seal area
- ④ Shield contact
- ⑤ M4 grounding screw
- ⑥ Interfaces

Figure 8-6 Vertical PPU mounting

Connection

9.1 Overview

Connection options

The following can be connected to a PPU:

- Up to 2 electronic handwheels, including the handwheel signals of a mini handheld unit.
- Up to 4 (PPU 260/261) or 5 (PPU 280/281) PP 72/48D PN I/O modules.
- One MCP 310C PN or MCP 483C PN Machine Control Panel
- A SINAUT MD720-3 GSM modem.
- SINAMICS S120 drive system via DRIVE-CLiQ.
- A SIMATIC DP PN/PN coupler.

 DANGER
--

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

NOTICE

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 digital input X122.1 on the PPU.
--

The following overview shows an example of the various interfaces and their connection options.

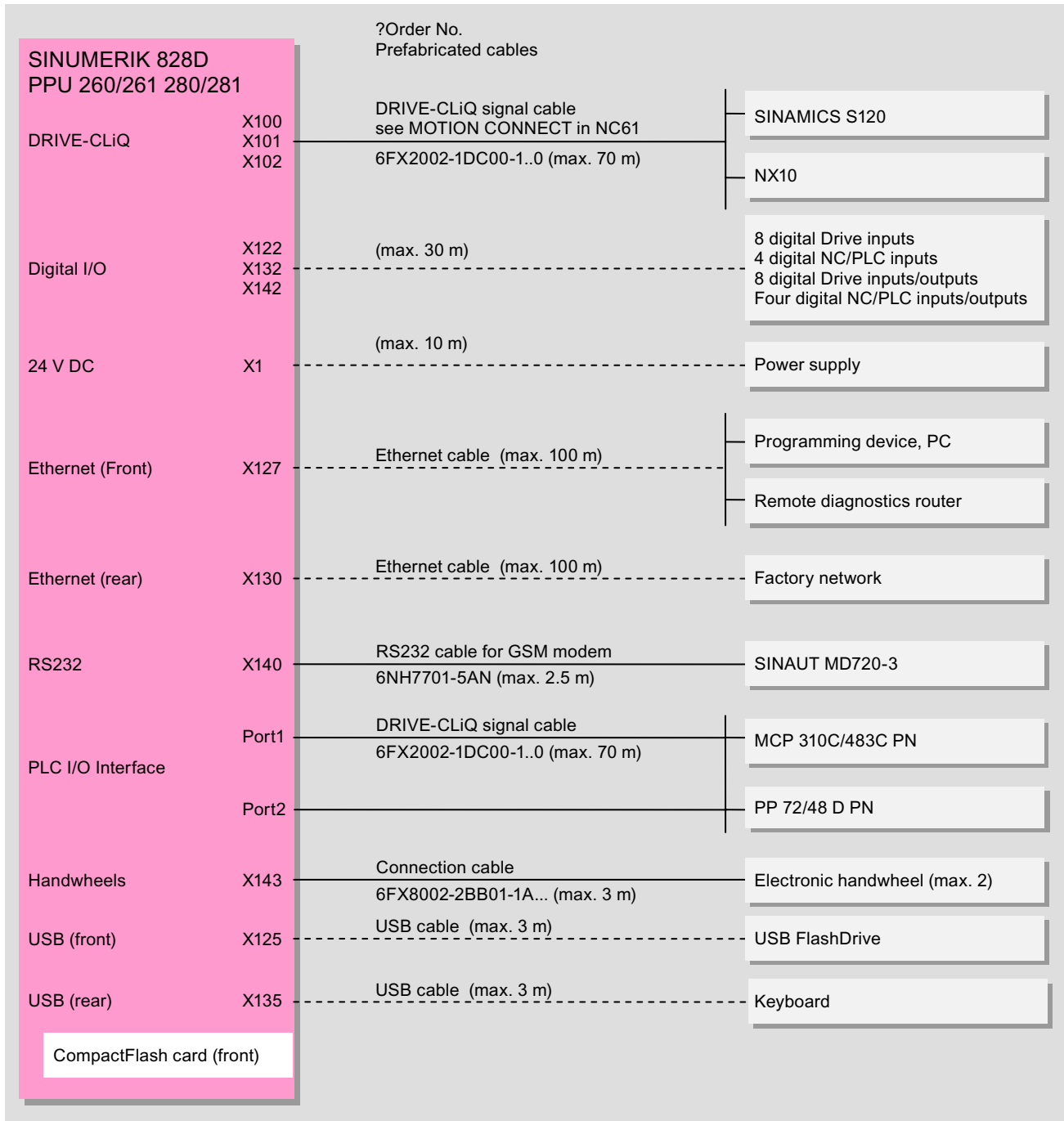


Figure 9-1 PPU connection options

9.2 Power supply connection

9.2.1 Requirements for the power supply

External 24 V power supply

Power is supplied to the PPU by an external 24 V power supply (e.g.: SITOP). The following power consumption values for the PPU provide a configuration basis for calculating the 24 VDC power supply.

Table 9- 1 Input voltage specification

Parameter	Values
Typ. power consumption ¹⁾	1.2 A
Max. power consumption ²⁾	2.5 A
Max. starting current	4.4 A
¹⁾ PPU only (processor, memory, etc.)	
²⁾ PPU with full load (USB, handwheels)	

Requirements of DC power supplies


 DANGER
<p>The DC power supply is always referenced to ground and may not be generated by an autotransformer.</p> <p>User interfaces must be powered via a DC power supply with safe isolation to EN 61800-5-1.</p> <p>In the case of supply lines > 10 m, protectors must be installed at the device input in order to protect against lightning (surge).</p> <p>The DC power supply must be connected to the ground/shield of the control unit for EMC and/or functional reasons. For EMC reasons, this connection should only be made at one point. As a rule, the connection is provided as standard in the S7-300 I/Os. In exceptional circumstances when this is not the case, the ground connection should be made on the grounding rail of the control cabinet; please also refer to /EMC/EMC Installation Guide.</p>


Table 9- 2 Requirements of the DC power supply

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

9.2.2 Connecting the power supply

Wiring the screw terminal block

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

 DANGER
The 24 V direct voltage is to be configured as an extra-low voltage with safe isolation - DVC A or PELV.

Power cables

Table 9- 3 Cable specification for X1

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

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

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

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

9.3 DRIVE-CLiQ

9.3.1 Use

Use

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

- X100 for connecting to the Line Module in the SINAMICS S120 drive line-up.
- X101 for connecting to a hub (DMC20) or a direct measuring system (SMC).
- X102 for connecting to an NX10 axis expansion module.

Cable specification

Table 9- 4 Cable specification for X100 - X102

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

Blanking cover for DRIVE-CLiQ interface: Tyco, order no.: 969556-5

9.3.2 Rules

Introduction

The components of the SINAMICS S120 Booksize drive family and the PPU are interconnected using DRIVE-CLiQ. When connecting all the necessary components (drive units), please note the following rules.

General rules for DRIVE-CLiQ wiring

The following rules must be followed for DRIVE-CLiQ wiring:

- Ring wiring is not permitted.
- Drive units must not be double-wired.
- A maximum of 7 drive units can be operated in series on a PPU, where a Double Motor Module takes the place of 2 drive units. If an NX is connected, only 6 other drive units can be operated on the PPU.
- A maximum of 3 servo type drive units can be connected to the NX in series.

- A maximum of 9 encoders (measuring systems) can be connected to a PPU/NX.
- Sensor Modules:
 - SMC/SME modules can be connected to the final Motor Module.
 - SMC modules can also be connected to the PPU.
 - Connect additional measuring systems via DMC20.

Note

Connecting a direct measuring system to a free DRIVE-CLiQ socket from SLM/ALM is not advised as differing cycle rates can lead to differing dynamic behavior from the interpolating machine axes.

Only the encoders connected to the same DRIVE-CLiQ line as the relevant servo drive can be evaluated.

Rules for DRIVE-CLiQ wiring using a DMC20 without NX

- If 6 drive units are operated on one DRIVE-CLiQ line, DMC20 must be operated on a separate DRIVE-CLiQ socket (X101) on the PPU.
- If 5 drive units are operated on one DRIVE-CLiQ line, DMC20 can be operated on the last Motor Module in this line.

Rules for DRIVE-CLiQ sockets

The following rules must be observed when using DRIVE-CLiQ sockets:

- The DRIVE-CLiQ cable between the PPU and the Line Module must be connected to X200 of the Line Module.
- The DRIVE-CLiQ cables between the power units should be connected from interface X201 to X200 on the next component.
- The power line to the motor and the associated motor encoder must be connected to a Motor Module. Please note:
 - Motor connection X1: Encoder at X202
 - Motor connection X2: Encoder at X203

Note

If an additional encoder is connected to X201 of a Double Motor Module, it is automatically assigned to the second motor as encoder 2.

Examples

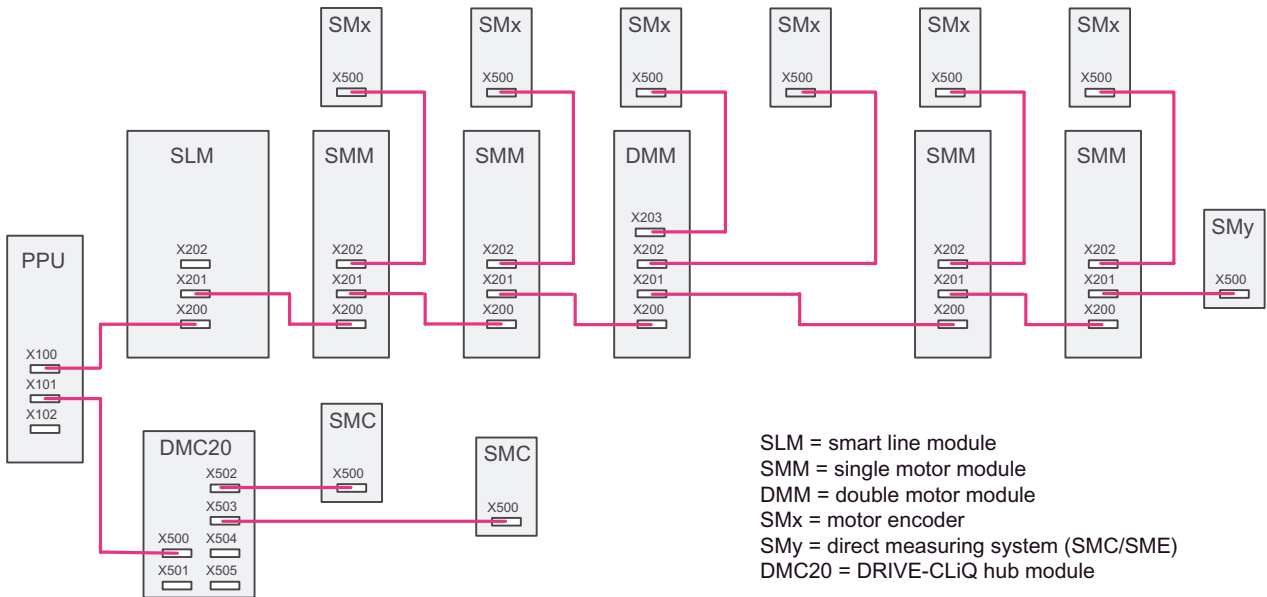


Figure 9-2 DRIVE-CLiQ wiring without NX

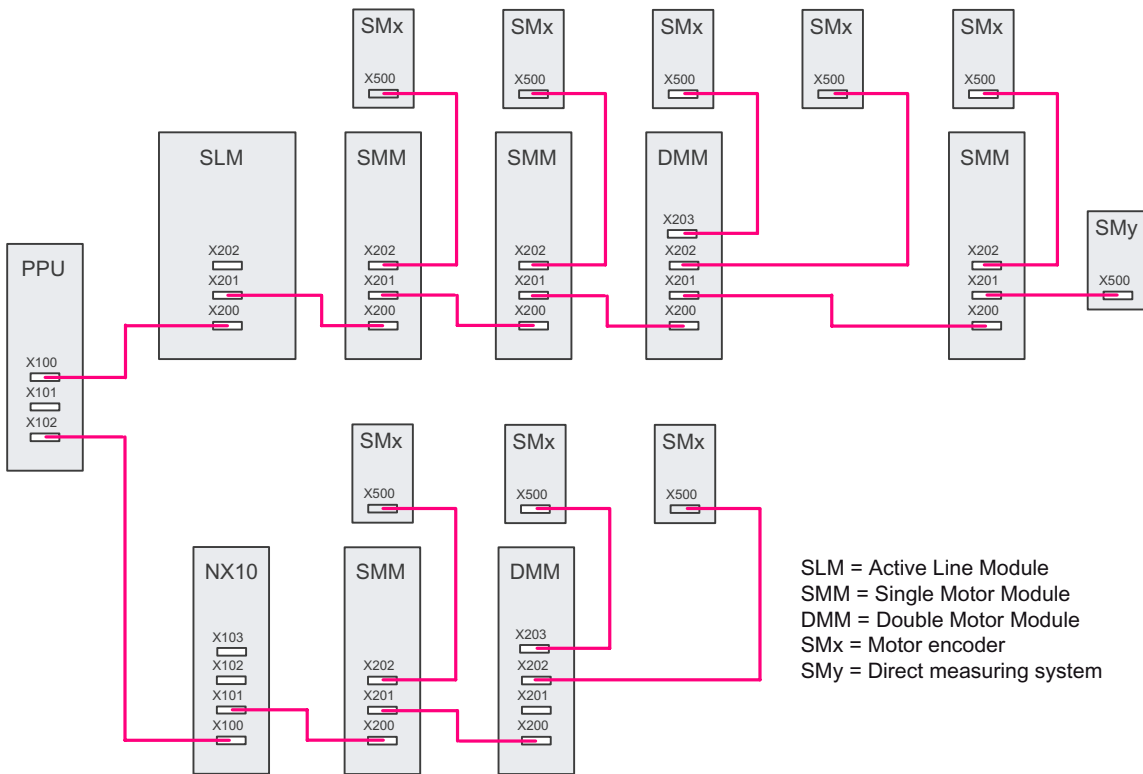


Figure 9-3 DRIVE-CLiQ wiring with NX

9.3.3 Connectable components

Components

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

Table 9- 5 Components with DRIVE-CLiQ

Component	Description
Active / Basic / Smart Line Module Booksize *)	Line Modules provide the central power supply to the DC link.
Single / Double Motor Module Booksize *)	Motor Modules draw their power from the DC link to supply the connected motors.
NX10	Axis expansion module
SMC10 / 20 / 30	Cabinet-mounted Sensor Modules are needed when a motor with a DRIVE-CLiQ interface is not available and when external encoders are required in addition to the motor encoder.
SME20 / 25 / 120 / 125	Measuring systems outside the cabinet can be connected directly to the Sensor Module External.
DMC20	DRIVE-CLiQ Hub Modules are used to implement star-shaped distribution of a DRIVE-CLiQ line.

*) Please be aware that the modules in the compact series are not released for SINUMERIK and therefore cannot be used with SINUMERIK 828D.

Additional references

- You can find information about Line Modules and Motor Modules in the SINAMICS S120 "Booksize Power Units" and "Booksize Cold Plate Power Units" manuals.
- You can find information on the sensors and hub in the SINAMICS S120 "Control Units and Additional System Components" manual.

9.4 PLC I/O Interface

Use

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

- For connecting a machine control panel (MCP 310C PN or MCP 483C PN)
- For connecting to PLC I/O devices (PP 72/48D PN)

Note

The PPU has one MAC address for both PLC I/O Interface ports. It is printed on the type plate of the PPU. Refer to the chapter titled "Description". The same procedure applies for the MAC addresses of the operator components.

Wiring PLC I/O Interface

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

- Order no.: 6FX2002-1DC00-1□□0
- Max. cable length: 70 m

9.5 Ethernet

Use

- X130 connects the PPU to the plant network.
Company address can be freely assigned, for MAC address refer to type plate.
- X127 is used to connect the following components:
 - PC (e.g. commissioning tool, RCS commander)
 - Modem for remote diagnosticsPeer-to-Peer with permanent IP address (192.168.215.1).

Note

The MAC addresses are printed on the type plate. Refer to the chapter titled "Description".

Cable specification

Table 9- 6 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 supports both a crossover and standard Ethernet cable.

9.6 Digital inputs/outputs

9.6.1 Use

Use

- 8 signals can be assigned to each connector:
 - 4 digital inputs
 - 4 bidirectional digital inputs/outputs
- 8 inputs and 8 inputs/outputs are used for drive control.
- 4 inputs and 4 inputs/outputs are available for the NCK. As an option, connector X142 can also be assigned to the servo-synchronous PLC task.

Cable specification

Table 9- 7 Cable specification for X122, X132 and X142

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

Please note the following:

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

Tools required

3.5-mm screwdriver or power screwdriver

Wire digital inputs/outputs

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.

9.6.2 Terminal connection diagram

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

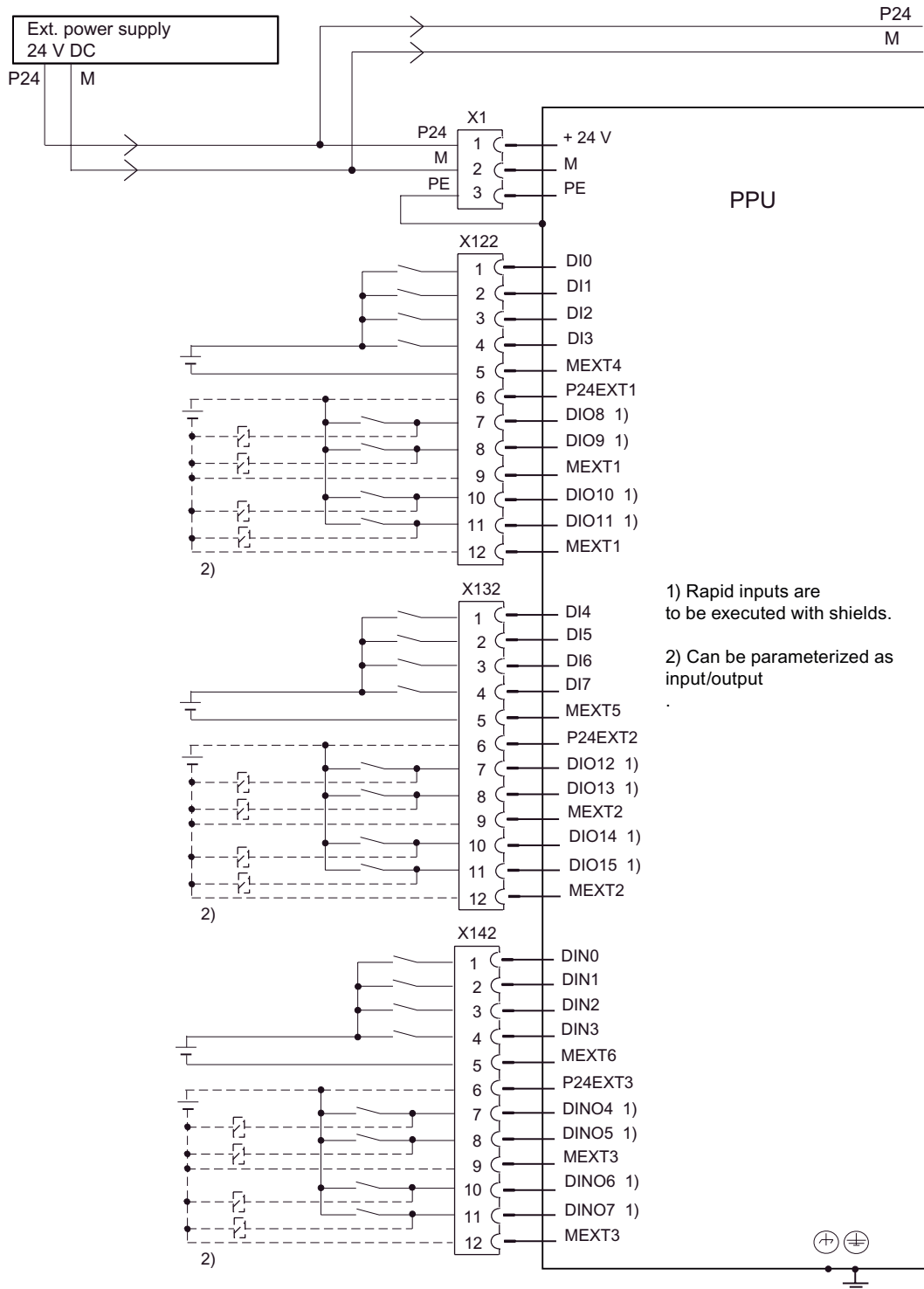


Figure 9-4 Terminal connection diagram for digital inputs/outputs

Additional references

Notes for configuring digital inputs/outputs at X122/X132 can be found in the "Turning and Milling Commissioning Manual", in the chapter titled "Commissioning the Drive".

9.7 USB

Use

A USB-FlashDrive for transferring user and commissioning data can be connected using the USB interfaces X125 (front, behind protective flap) and X135 (rear side).

Properties

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

Table 9- 8 Cable specification for X125 and X135

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

Note

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

9.8 Handwheel

Use

Max. 2 electronic handwheels can be connected to connector X143 on the rear of the PPU.

The handwheel must meet the following requirements:

- Transmission procedure: 5 V TTL or differential signal
- Signals:
 - Track A as a true and inverted signal
 - Track B as a true and inverted signal
- Max. output frequency: 500 kHz
- Phase shift of Track A to Track B: $90^\circ \pm 30^\circ$
- Supply: 5 V, max. 250 mA

Cable specification

Table 9- 9 Cable specification for X143

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

9.9 RS232

Use

For connecting the SINAUT MD720-3 GSM modem.

Cable specification

Table 9- 10 Cable specification for X140

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

Technical data

Table 10- 1 General technical specifications for PPUs

Safety	
Protection class	III (DVC A, PELV) acc. to EN 61800-5-1
Degree of protection according to EN 60529	IP65 (front) ^{*)} , IP20 (rear)
Approvals	CE / cULus
Degree of contamination	2 to according to 61800-5-1
Cooling	Open-circuit ventilation
Mounting position	Vertical
Mechanical stress	
Operation	3M1 according to EN 60721-3-3
Transportation (in transportation packaging)	2M3 according to EN 60721-3-2
Storage (in transport packaging)	1M2 according to EN 60721-3-1

^{*)} with closed protective flap

Table 10- 2 Electrical and mechanical data

	PPU 260.1 / PPU 280.1	PPU 261.1 / PPU 281.1
Input voltage	24 V DC	24 V DC
Power consumption, max.	60 W	60 W
Power loss	28 W	28 W
Dimensions (WxHxD)	(310 x 380 x 121) mm	(483 x 220 x 121) mm
Weight, approx.	4.5 kg	4.5 kg

Note

Further technical specifications with regard to the PPU can be found in the following chapters:

Transport and Storage Conditions (Page 22)

Operating Conditions (Page 23)

Requirements for the power supply (Page 63)

Digital inputs/outputs:

Technical data (Page 50)

Spare parts/accessories

11.1 MCP 483C PN

11.1.1 Description

The MCP 483C PN machine control panel enables user-friendly operation of the machine functions. It can be used in the SINUMERIK 828D system for machine-level operation of milling and turning machines.

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

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

Operator controls

- Operating mode and function keys:
 - 50 keys with assigned LEDs
 - Direction keys for milling machines with rapid traverse override (key caps for direction keys for turning machines are supplied.)
For information, refer to section: "Control and display elements" → "Front side").
- Spindle control with override spindle (rotary switch with 16 positions)
- Feed control with override feed/rapid traverse (rotary switch with 23 positions)
- Key-operated switch (4 positions and 3 different keys)
- Emergency stop latching pushbutton, 2 contact pairs (1 NO + 1 NC)

Interfaces

- PLC I/O Interface (transfer rate: 100 MBit/s)
- 9 customer-specific inputs (e.g. for illuminated pushbuttons)
- 6 customer-specific outputs

NOTICE

Handwheel connections

A maximum of 2 handwheels can be connected to the SINUMERIK 828D. They must be wired directly with terminal X143 of the PPU.

Expansion slots

2 slots for control devices (d = 16 mm).
 (additional cable set required for control devices, see section: "Accessories")

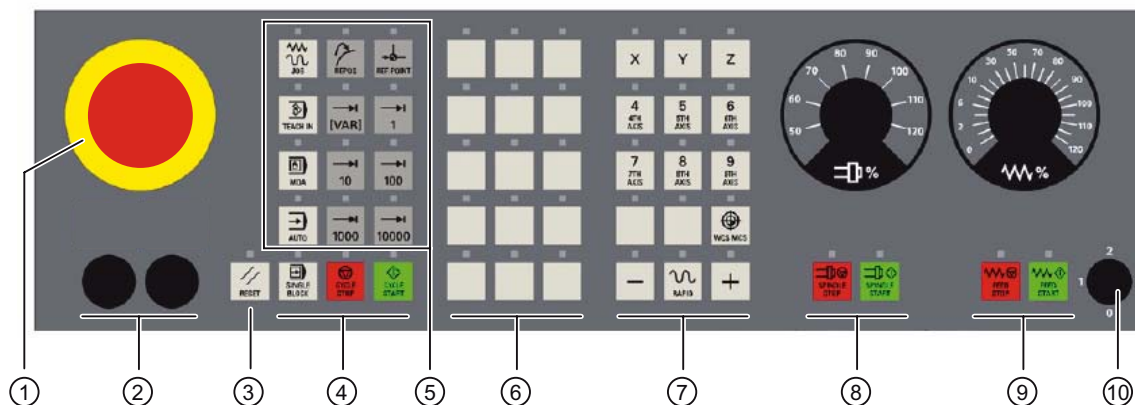
Key type

Mechanical short-stroke keys.

11.1.2 Operator controls and display elements

11.1.2.1 Front side

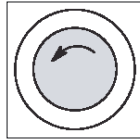
Overview



- ① Emergency stop latching pushbutton
- ② Installation locations for control devices (d = 16 mm)
- ③ Reset button
- ④ Program control
- ⑤ Operating modes, machine functions
- ⑥ User keys T1 to T15
- ⑦ Direction keys with rapid traverse override (R1 to R15)
- ⑧ Spindle control with override switch
- ⑨ Feed control with override switch
- ⑩ Keyswitch (four positions)

Figure 11-1 Position of control elements on MCP 483C PN

Emergency stop



Press the red pushbutton in an emergency if

- people are at risk,
- there is the danger of machines or the workpiece being damaged.

As a rule, when operating the Emergency Stop button, all drives are brought to a standstill with max. braking torque.

Turn the emergency stop counterclockwise to unlatch it.



Machine manufacturer

For other reactions to the emergency stop:
refer to the machine tool manufacturer's instructions

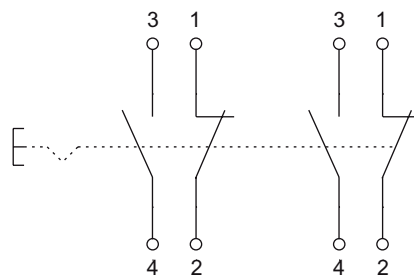


Figure 11-2 Emergency stop circuit

Mounting slots for control devices

	WARNING
<p>The openings for installing control devices (2) in "Position of control elements of MCP483C PN" Fig. must not be chipped out (risk of damage) but drilled to the required width.</p>	

Key caps

All keys of the MCP 483C PN come with changeable key caps.

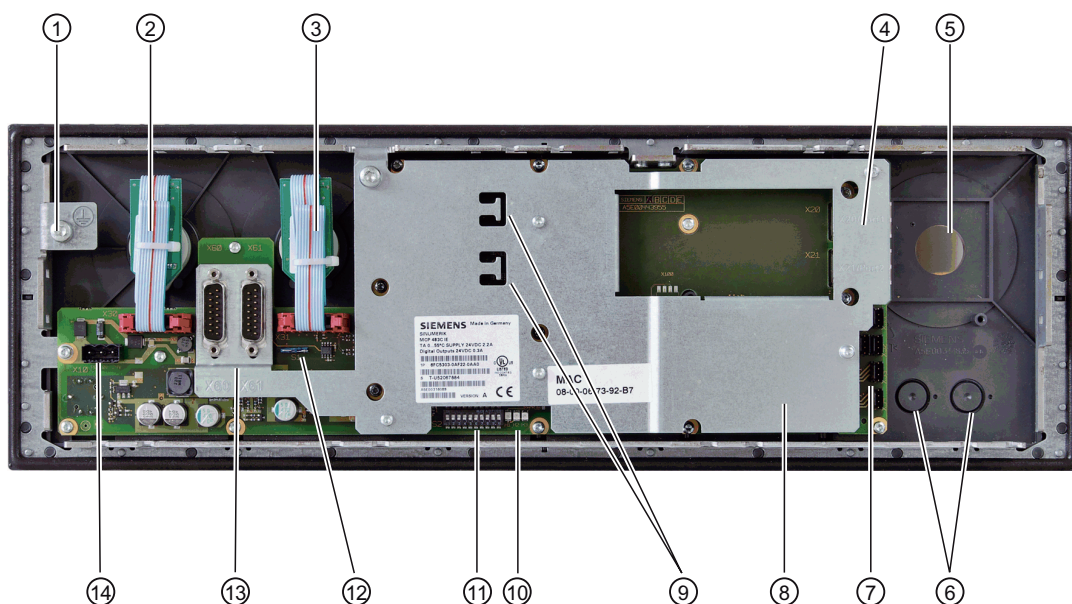
Refer to the following table for the additional replacement key caps provided for turning machines in the accessories pack.

Key cap	Symbol number	Key cap	Symbol number
	7027	-X	7129
+C	7125	+Y	7130
+X	7126	-Z	7131

-Y	7127	-C	7132
+Z	7128		

You will find the order numbers for the key caps in section: "Accessories".

11.1.2.2 Rear side



- ① Ground terminal
- ② Feed override X30
- ③ Spindle override X31
- ④ X20/X21 PLC I/O Interface connections (see in detail)
- 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 S2
- ⑫ Reserved
- ⑬ Reserved
- ⑭ Power supply interface X10

In detail:

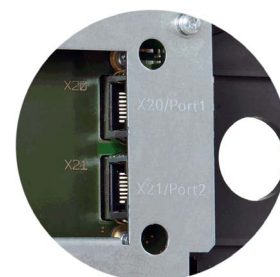


Figure 11-3 Rear panel of MCP 483C PN

LEDs

Table 11- 1 LEDs: Status display

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply ok
H2	PNSync	Green	Lit: System software running, STOP state
			Flashes 0.5 Hz: System software running, RUN state
H3	PNFault	Red	Not lit: Module is operating without errors; data exchange with all configured IO Devices is running.
			Lit: Serious bus fault; only output when one of the following errors is detected for the ports: <ul style="list-style-type: none"> • 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.

11.1.3 Interfaces

11.1.3.1 Overview

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
X51 / X52 / X55	Interfaces for customer-specific inputs
X53 / X54	Interfaces for customer-specific outputs
X60 / X61	Reserved
S1	Reserved
S2	Switch for setting the MCP address

11.1.3.2 Description

Signal type

- V Voltage (supply voltage)
- I Input
- O Output
- B Bidirectional

Power supply interface

Connector designation: **X10**
 Connector type: Terminal block, 3-pin plug connector

Table 11- 2 X10 pin assignments

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

PLC I/O Interface pin assignment

Connector designation: **X20, X21**
 Connector type: RJ45 socket

Table 11- 3 Assignment of connectors X20, X21

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

Rotary switch: Feed override X30 / spindle override X31

Connector designation: **X30 / X31**
Connector type: 2 x 5-pin plug connector, acc. to IEC603-13 with coding

Table 11- 4 Assignment of connector X30

Pin	Signal name	Signal type	Meaning
1	N.C.	-	Not assigned
2	N.C.	-	Not assigned
3	M	V	Ground
4	N.C.	-	Not assigned
5	P5	V	5 V supply
6	OV_VS16	I	Rotary override switch, position/value 16
7	OV_VS8		Rotary override switch, position/value 8
8	OV_VS4		Rotary override switch, position/value 4
9	OV_VS2		Rotary override switch, position/value 2
10	OV_VS1		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 usually intended for connecting illuminated pushbuttons.

The lamps in the buttons are activated via X53 and X54. X55 has no corresponding outputs.

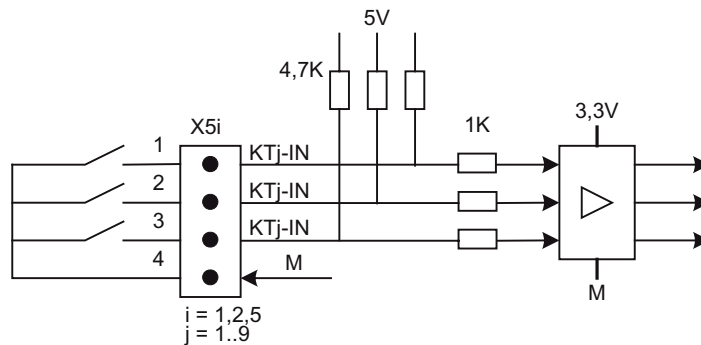


Figure 11-4 Main circuit diagram for input circuit for X51, X52 and X55

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

Table 11- 5 Assignment of connector X51

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

Table 11- 6 Assignment of connector X52

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

Table 11- 7 Assignment of connector X55

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

Optional customer buttons OUT (X53 / X54)

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

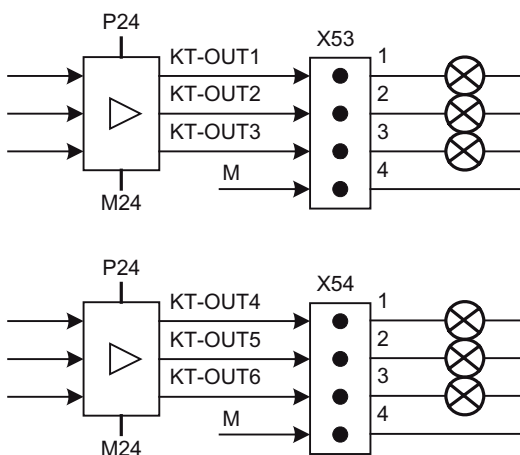



Figure 11-5 Main circuit diagram for input circuit for X53 and X54

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

Connector designation: **X53, X54**
Connector type: 4-pin plug connector

Table 11- 8 Assignment of connector X53

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

Table 11- 9 Assignment of connector X54

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

Switch S2



Schalter S2

Switch position: "ON" is at the top.

Table 11- 10 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			Address "0"

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

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

11.1 MCP 483C PN

Table 11- 11 Settings of switch S2

1	2	3	4	5	6	7	8	9	10	Meaning
								ON	ON	
ON	ON	ON	ON	ON	ON	ON	ON			DCP mode
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF			Address "64"

11.1.3.3 Input / output images

Input image

The specifications for assigning input and output bytes listed in the tables are set as standard addresses in the PLC by setting the following machine data:
 MD12986 PLC_DEACT_IMAGE_LADDR_IN[6] = -1

Table 11- 12 Input image MCP 483C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Spindle override				Mode			
EB112	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)	JOG	TEACH IN	MDA	AUTO
	Machine function							
EB113	REPOS	REF.	var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
EB114	Keyswitch position 0	Keyswitch position 2	Spindle Start	*Spindle Stop	Feed Start	*Feed Stop	NC start	*NC Stop
EB115	RESET	Keyswitch position 1	Single block	Feedrate override				
				E (2 ⁴)	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)
EB116	Direction keys			Keyswitch	Axis selection			
	+ R15	- R13	Rapid traverse R14	position 3	X R1	4th axis R4	7th axis R7	R10
EB117	Axis selection							
	Y R2	Z R3	5th axis R5	Motion command in MCS/WCS	R11	9th axis R9	8th axis R8	6th axis R6
EB118	Unassigned customer keys							
	T9	T10	T11	T12	T13	T14	T15	-
EB119	Unassigned customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
EB120	-	-	-	-	-	-	-	-
EB121	-	-	-	-	-	-	-	-
EB122	KT-IN8	KT-IN7	KT-IN6	KT-IN5	KT-IN4	KT-IN3	KT-IN2	KT-IN1
EB123	-	-	-	-	-	-	-	KT-IN9
EB124	-	-	-	-	-	-	-	-

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB125	-	-	-	X31 pin 6 ¹⁾	X31 pin 7 ¹⁾	X31 pin 8 ¹⁾	X31 pin 9 ¹⁾	X31 pin 10 ¹⁾
Signals marked with * are inverse signals.								

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

Output image

Table 11- 13 Output image MCP 483C PN

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

Default key assignment

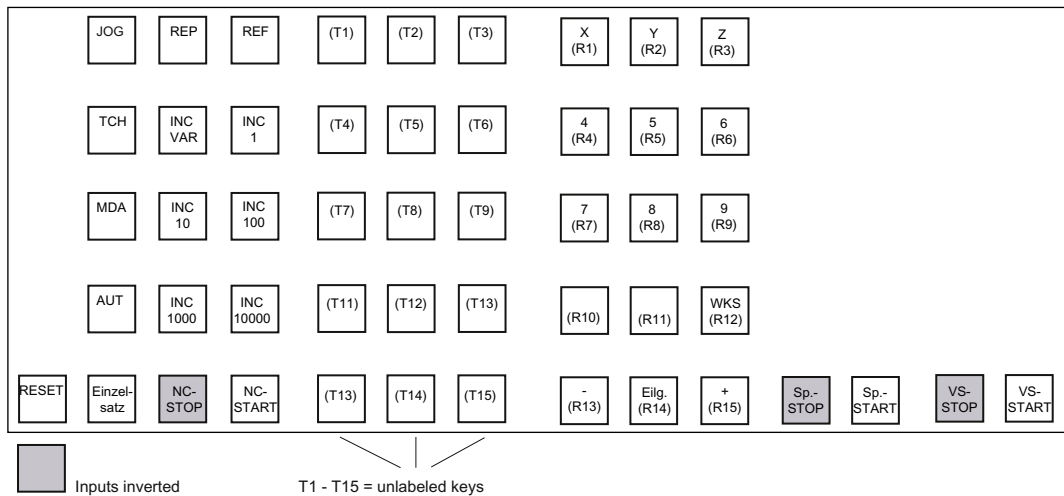


Figure 11-6 Default key assignment of MCP 483C PN

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

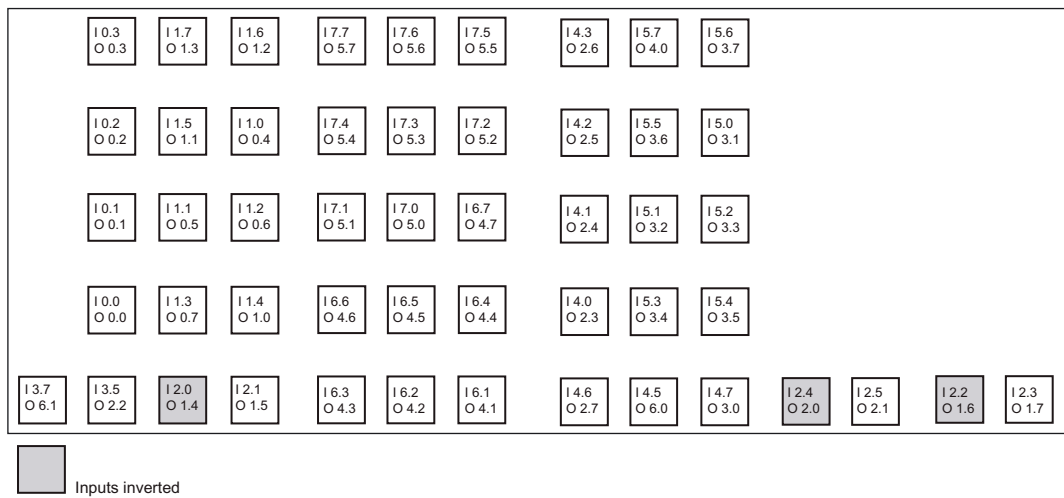
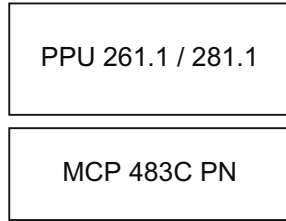


Figure 11-7 Inputs and outputs of the MCP 483C PN keyboard

11.1.4 Mounting

The 483C PN machine control panel is ideally combined with a horizontal PPU. The recommended combination sequence is shown in the figure:



MCP 483C PN dimension drawing

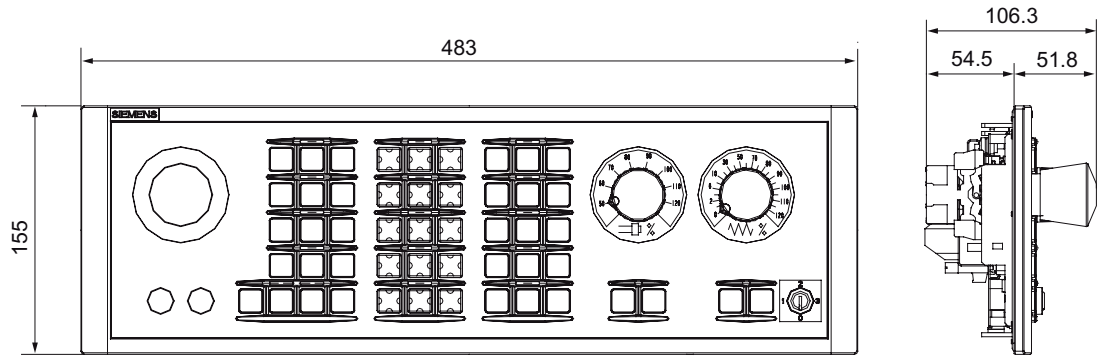


Figure 11-8 Front and side view of MCP 483C PN

Tension jacks

The machine control panel is mounted from the front in a rectangular cutout. It is secured with nine clamping fixtures (tightening torque 0.5 Nm, see dimension drawing), which are included in delivery. Clamping fixtures can also be obtained as spare parts (see section: "Spare parts" → "Overview").

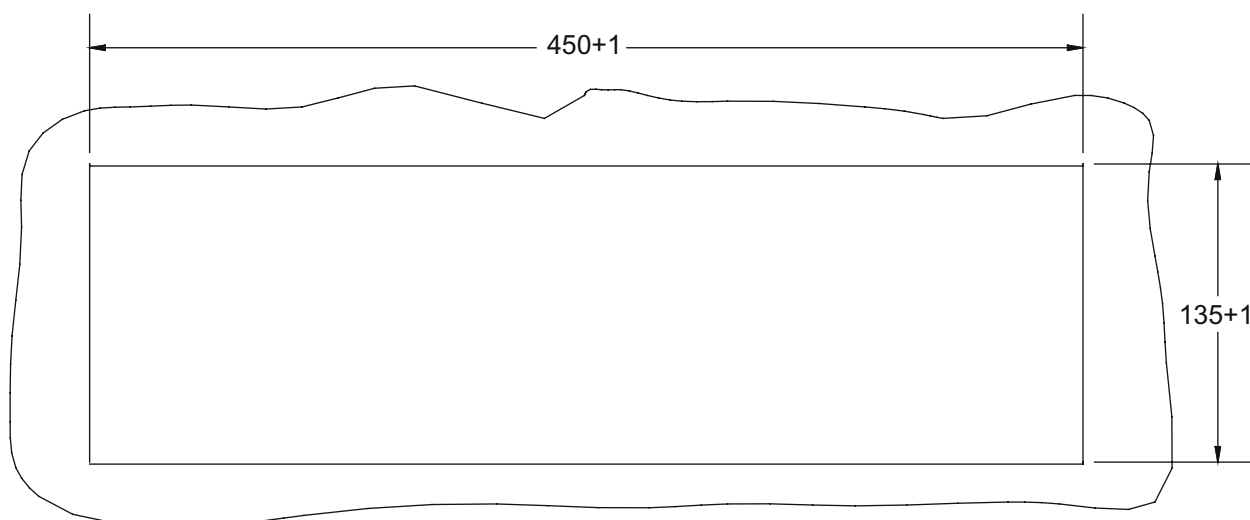


Figure 11-9 Panel cutout of MCP 483C PN

Mounting position

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

11.1.5 Connection

Two equivalent connections (Fast Ethernet) are available for establishing the PLC I/O Interface communication network based on PROFINET (see System overview (Page 11)).

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. They must be ordered separately, see Ordering data (Page 15).

Securing Ethernet cables

Two cable ties are included in the scope of delivery. These are used to secure the Ethernet cables on the cover plate on the rear of the machine control panel (see figure in section: "Operator controls and display elements" → "rear side").

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

11.1.6 Technical data

Safety				
Protection class	III (DVC A, PELV) acc. to EN 61800-5-1			
Degree of protection according to EN 60529	Front: IP54	Mounting frame: IP65	Rear side: IP00	
Approvals	CE / cULus			
Electrical data				
Input voltage	24 V DC			
Power consumption, max.	Board 5 W	Handwheels 2 x 0.9 W	Lamps 43.2 W (6x 7.2 W *)	Total 50 W
Mechanical data				
Dimensions	Width: 483 mm Height: 155 mm		Depth: 106 mm Mounting depth: 54.5 mm	
Weight	Approx. 2 kg			
Mechanical environmental conditions	Operation		Transport (in transport packaging)	
Vibratory load	10 –58 Hz: 0.15 mm 58 –200 Hz: 2g3M6 according to EN 60721-3-3		5 -9 Hz: 6.2 mm 9 –200 Hz: 2g2M3 according to EN 60721-3-2	
Shock stressing	15 g, 11 ms 18 shocks 3M4 per EN 60721-3-3		15 g, 6 ms 18 shocks 2M2 according to EN 60721-3-2	
Climatic environmental conditions				
Cooling	By natural convection			
Condensation, splashwater and icing	Not permissible			
Supply air	Without aggressive gases, dusts and oils			
	Operation		Storage / shipping (in transport packaging)	
Applicable standards	EN 60721-3-3		EN 60721-3-1 / -3-2	
Climate class	3K5		1K3 / 2K4	
Temperature limits	0 ... 45° C (at front) 0 ... 55° C (at rear)		-25 ... 55 °C	
*) 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.				

For other values / standards see the chapter "Application planning".

11.1.7 Spare parts

11.1.7.1 Overview

Table 11- 14 Spare part kits for machine control panel MCP 483C PN

Name	Description	Quantity	Order number
EMERGENCY STOP latching pushbutton	22 mm actuating element, 40mm mushroom pushbutton, snap action with tamper protection, latching, red, with holder, unlit	1	3SB3000-1HA20
Contact block	with 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be connected additionally)	1	3SB3400-0A
Set of keys	Set of keys for machine control panel	10	6FC5148-0AA03-0AA0
Rapid traverse dial	for 16-stage rotary switch	20	6FC5248-0AF30-0AA0
Rotary switch for spindle	Spindle/rapid traverse override, electronic rotary switch 1x16G, T=24, cap, knob, pointer, spindle and rapid-traverse dials	1	6FC5247-0AF12-1AA0
Rotary switch for feed	Feed / rapid traverse override, electronic rotary switch 1x23G, T=32, cap, knob, pointer, feed and rapid-traverse dials	1	6FC5247-0AF13-1AA0
Set of tension jacks	Set of tensioners for supplementary operator components with 2.5 mm profile, 20mm length	9	6FC5248-0AF14-0AA0

11.1.7.2 Replacing the rotary switch

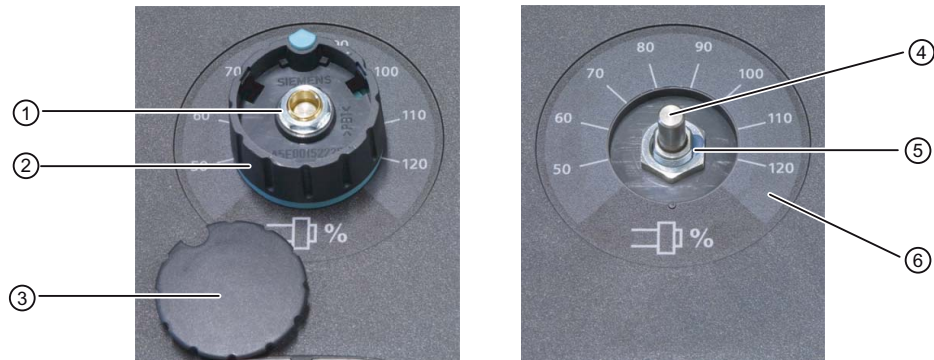
Note

For the MCP 483C PN, use only electronic rotary switches.

Removing the rotary switch

1. Lever the cover ③ off the rotary knob ② (snap-on connection).
2. Remove the nut of collet ① with a wrench (width 10).
3. Remove the entire rotary knob ②.
4. Remove the lock nut ⑤ on the axis of the rotary switch ④ with a wrench (width 14).

5. Remove the connector on the end of the rotary switch cable from the socket.
6. Remove the rotary switch



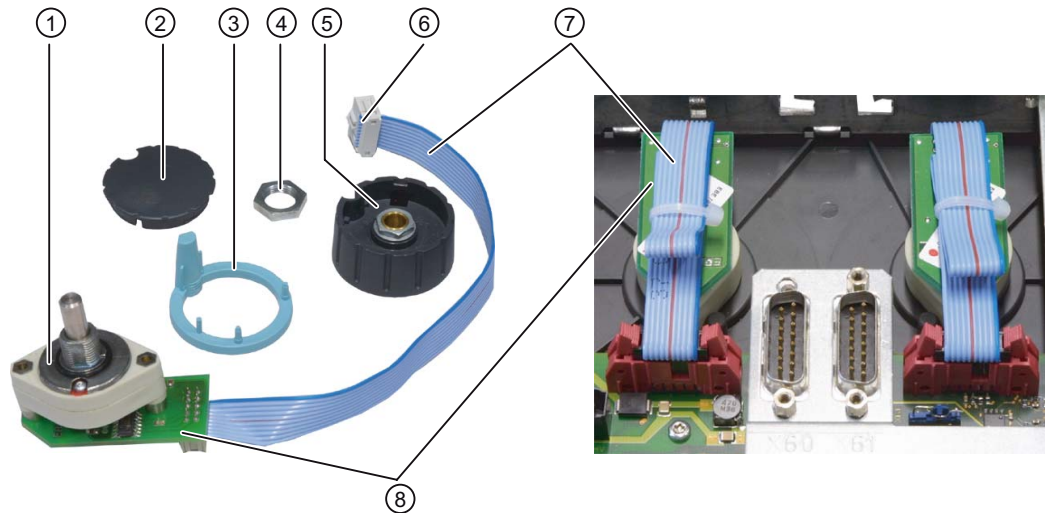
- ① Nut of the collet
- ② Rotary knob
- ③ Cap
- ④ Rotary switch shaft
- ⑤ Lock nut
- ⑥ Scale

Figure 11-10 Removal of rotary switch

Installing the rotary switch

1. Push the O-ring ① onto the axis of the new rotary switch as a seal.
2. Insert the rotary switch into the front cutout so that pressure is applied to the O-ring.
3. Screw the lock nut ④ on the axis of the rotary switch from the front with a wrench (width 14) (tightening torque: 3 Nm).
4. Connect the arrow ring ③ and rotary knob ⑤.
5. Slide both parts onto the shaft of the rotary switch.
6. Align the arrow point on the ring with position "0" on the scale.
7. Tighten the collet nut of the rotary knob by hand and using a torque spanner with 2 Nm torque.

8. Place the cover ② on the rotary knob and snap it into position.
9. Fold and fasten the connecting cable ⑦ as shown in the figure on the right.



- ① O-ring
- ② Cap
- ③ Arrow ring
- ④ Lock nut
- ⑤ Rotary knob
- ⑥ Connector (see detail diagram)
- ⑦ Connecting cable
- ⑧ Terminal board

Detail diagram of the connector

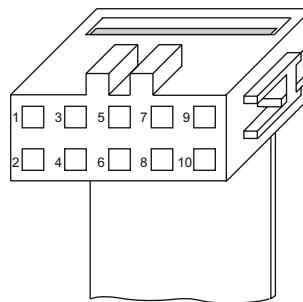


Figure 11-11 Installation of rotary switch

Proceed in the same way to install the second rotary switch.

NOTICE
It is essential to use the correct tightening torques.

11.1.8 Accessories

Table 11- 15 Accessories pack (for delivery ex works)

Component	Description	Number
Keypad	Key caps for turning (labeled)	9
	Ergo grey key caps (for labeling)	30
	Clear key caps (for labeling)	30
Yellow backing plate	for EMERGENCY STOP	1

Table 11- 16 Accessories available for order

Component	Description	Number	Order number
Quadratic key cap (for labeling)	1 set of 90, ergo-gray and 20 each of red / green / yellow / medium gray	1	6FC5248-0AF12-0AA0
Quadratic key cap (for labeling)	1 set of 90, clear	1	6FC5248-0AF21-0AA0
Cable set	For additional MCP control devices, length 500 mm	60	6FC5247-0AA35-0AA0

11.2 MCP 310C PN

11.2.1 Description

The 310C PN machine control panel enables user-friendly operation of the machine functions. It can be used in the SINUMERIK 828D system for machine-level operation of milling and turning machines.

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

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

Operator controls

- Operating mode and function keys:
 - 49 keys with assigned LEDs
 - Direction keys for milling machines with rapid traverse override (key caps for direction keys for turning machines are supplied.)
For information, refer to section: "Control and display elements" → "Front side").
- Feed control with override feed/rapid traverse (rotary switch with 23 positions)
- Key-operated switch (4 positions and 3 different keys)

Interfaces

- PLC I/O Interface (transfer rate: 100 MBit/s)
- 9 customer-specific inputs (e.g. for illuminated pushbuttons)
- 6 customer-specific outputs

NOTICE
Handwheel connections A maximum of 2 handwheels can be connected to the SINUMERIK 828D. They must be wired directly with terminal X143 of the PPU.

Expansion slots

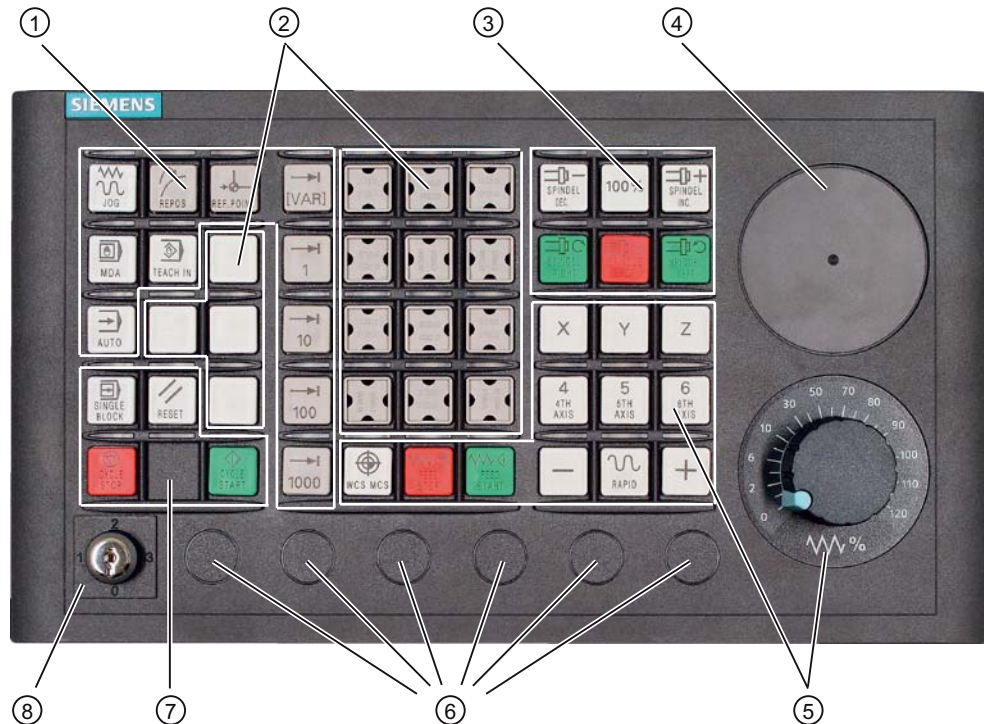
6 slots for control devices (d = 16 mm).
(additional cable set required for control devices, see section: "Accessories")

Key type:

Mechanical short-stroke keys.

11.2.2 Operator controls and display elements

11.2.2.1 Front




- ① Operating modes and machine functions
- ② 16 customer keys
- ③ Spindle control
- ④ Slot for EMERGENCY STOP button or spindle override switch
- ⑤ Feed control with override switch
- ⑥ Slots for control devices 16 mm
- ⑦ Program control
- ⑧ Key-operated switch

Figure 11-12 Arrangement of the MCP 310C PN control elements

EMERGENCY STOP button

If an EMERGENCY STOP button is added: see section: "Machine control panel: MCP 483 PN", section: "Operator control and display elements" → "Front side").


Mounting slots for control devices

 WARNING
Do not chip out the openings for mounting control devices © (risk of damage), but drill them to the required width.

Key caps

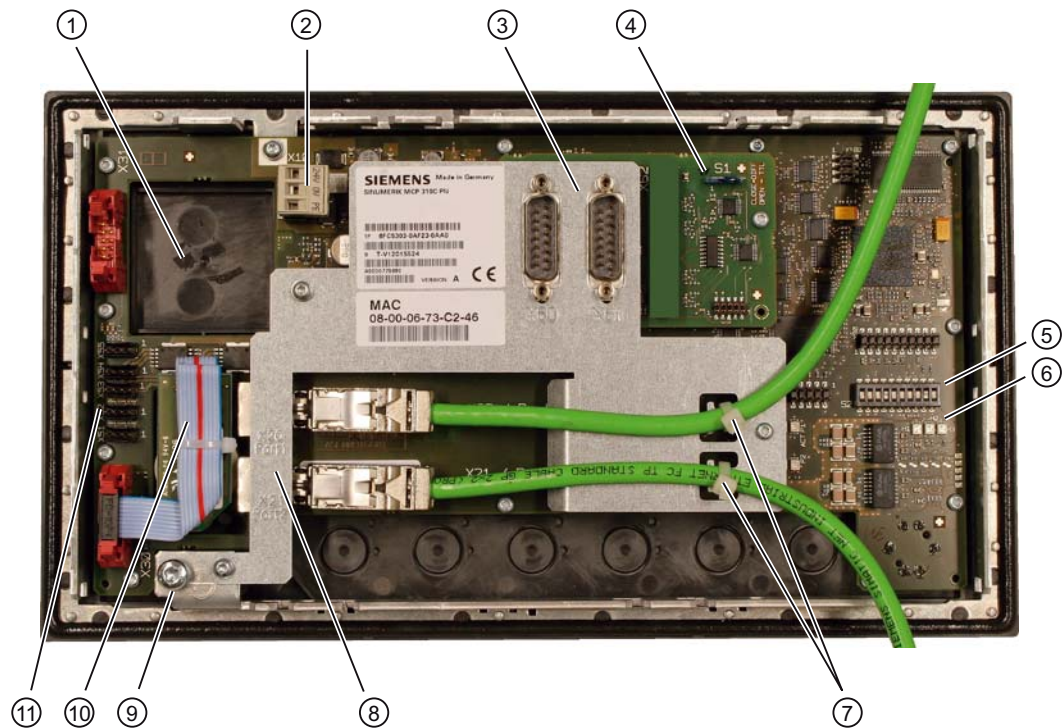
All keys of the MCP 310C PN come with changeable key caps.

Refer to the following table for the additional replacement key caps provided for turning machines in the accessories pack.

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

You will find the order numbers for the key caps in section: "Accessories".

11.2.2.2 Rear side



- ① Slot for EMERGENCY STOP button or spindle override
- ② Power supply interface X10
- ③ Reserved
- ④ Reserved
- 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 11-13 Rear of the MCP 310C PN with Ethernet connecting cables

LEDs

Table 11- 17 LEDs: Status display

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply ok
H2	PNSync	Green	Lit: System software running, STOP state
			Flashes 0.5 Hz: System software running, RUN state
H3	PNFault	Red	Not lit: Module is operating without errors; data exchange with all configured IO Devices is running.
			Lit: Serious bus fault; only output when one of the following errors is detected for the ports: <ul style="list-style-type: none"> • 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.

Equipotential bonding

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

11.2.3 Interfaces

11.2.3.1 Overview

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 / X61	Reserved
S1	Reserved
S2	Switch for setting the MCP address

11.2.3.2 Description

Signal type

- V Voltage (supply voltage)
- I Input
- O Output
- B Bidirectional

Power supply interface X10

Connector designation: **X10**
 Connector type: Terminal block, 3-pin plug connector

Table 11- 18 X10 pin assignments

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

PLC I/O Interface X20/X21 pin assignment

Connector designation: **X20, X21**
 Connector type: RJ45 socket

Table 11- 19 Assignment of connectors X20, X21

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

Rotary switch: Feed override X30Connector designation: **X30**

Connector type: 2 x 5-pin plug connector, acc. to IEC603-13 with coding

Table 11- 20 Assignment of connector X30

Pin	Signal name	Signal type	Meaning
1	N.C.	-	Not assigned
2	N.C.	-	Not assigned
3	M	V	Ground
4	N.C.	-	Not assigned
5	P5	V	5 V supply
6	OV_VS16	I	Rotary override switch, position/value 16
7	OV_VS8		Rotary override switch, position/value 8
8	OV_VS4		Rotary override switch, position/value 4
9	OV_VS2		Rotary override switch, position/value 2
10	OV_VS1		Rotary override switch, position/value 1

Rotary switch: Spindle override X31Connector designation: **X31**

Connector type: 2 x 5-pin plug connector, acc. to IEC603-13 with coding

Table 11- 21 Assignment of connector X30

Pin	Signal name	Signal type	Meaning
1	N.C.	-	Not assigned
2	N.C.	-	Not assigned
3	M	V	Ground
4	N.C.	-	Not assigned
5	P5	V	5 V supply
6	OV_SP16	I	Rotary override switch, position/value 16
7	OV_SP8		Rotary override switch, position/value 8
8	OV_SP4		Rotary override switch, position/value 4
9	OV_SP2		Rotary override switch, position/value 2
10	OV_SP1		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. Connector X55 is used to connect the mini HHU.

X51 and X52 are usually intended for connecting illuminated pushbuttons. The lamps in the buttons are activated via X53 and X54. X55 has no corresponding outputs.

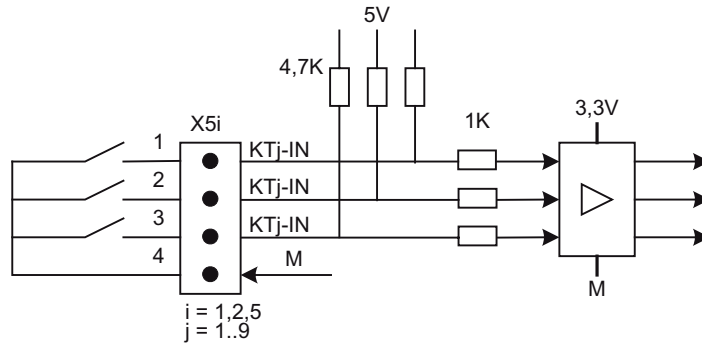


Figure 11-14 Main circuit diagram for input circuit for X51, X52 and X55

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

Table 11- 22 Assignment of connector X51

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

Table 11- 23 Assignment of connector X52

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

Table 11- 24 Assignment of connector X55

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

Optional customer buttons OUT (X53 / X54)

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

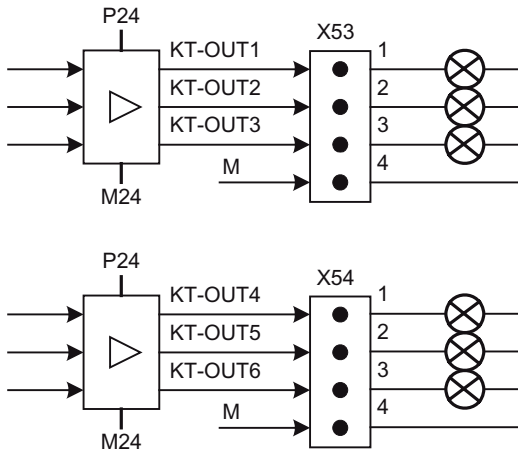


Figure 11-15 Main circuit diagram for input circuit for X53 and X54

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

Connector designation: **X53, X54**
Connector type: 4-pin plug connector

Table 11- 25 Assignment of connector X53

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

Table 11- 26 Assignment of connector X54

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

Switch S2

Switch position: "ON" is at the top (as with MCP 483C PN).

Table 11- 27 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			Address "0"

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

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

Table 11- 28 Settings of switch S2

1	2	3	4	5	6	7	8	9	10	Meaning
								ON	ON	
ON	ON	ON	ON	ON	ON	ON	ON			DCP mode
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF			Address "64"

11.2.3.3 Input / output images

Input image

The specifications for assigning input and output bytes listed in the tables are set as standard addresses in the PLC by setting the following machine data:
MD12986 PLC_DEACT_IMAGE_LADDR_IN[6] = -1

Table 11- 29 Input image MCP 310C PN

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
EB112	* NC Stop	Spindle -	Spindle 100%	Spindle +	Single block	JOG	MDA	AUTO	
EB113	NC Start	Spindle right	* Spindle stop	Spindle left	Keyswitch position 3	REF	REP	Teach IN	
EB114	Feed Start	* Feed Stop	INC VAR	Keyswitch position 0	INC 1000	INC 100	INC 10	INC 1	
EB115	RESET	Keyswitch position 2	Keyswitch position 1	Feedrate override					
				E (2 ⁴)	D (2 ³)	C (2 ²)	B (2 ¹)	A (2 ⁰)	
EB116	Direction keys			KT5	KT4	KT3	KT2	KT1	
	+	-	Rapid traverse						
EB117	T16	KT6	6	5	4	Z	Y	X	
EB118	Unassigned customer keys					Unassigned customer keys			
	T9	T10	T11	T12	WCS MCS	T13	T14	T15	

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
EB119	Unassigned customer keys							
	T1	T2	T3	T4	T5	T6	T7	T8
EB120	-	-	-	-	-	-	-	-
EB121	-	-	-	-	-	-	-	-
EB122	KT-IN8	KT-IN7	KT-IN6	KT-IN5	KT-IN4	KT-IN3	KT-IN2	KT-IN1
EB123	-	-	-	-	-	-	-	KT-IN9
EB124	-	-	-	-	-	-	-	-
EB125	-	-	-	X31 pin 6 ¹⁾	X31 pin 7 ¹⁾	X31 pin 8 ¹⁾	X31 pin 9 ¹⁾	X31 pin 10 ¹⁾
Signals marked with * are inverse signals.								
1)	If the 4-stage rotary spindle override switch on X31 is replaced by a 5-stage rotary switch, the input information here can be measured in 5 stages.							

Output image

Table 11- 30 Output image MCP 310C PN

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

Default key assignment

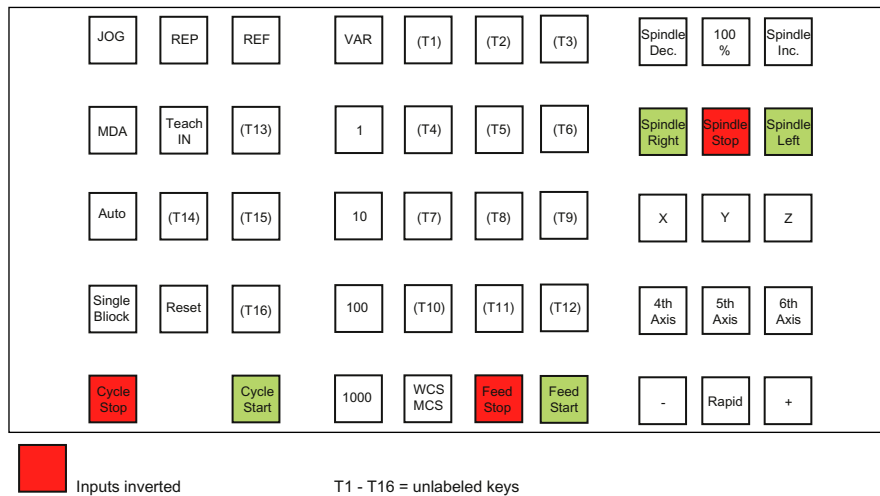


Figure 11-16 Default key assignment of MCP 310C PN

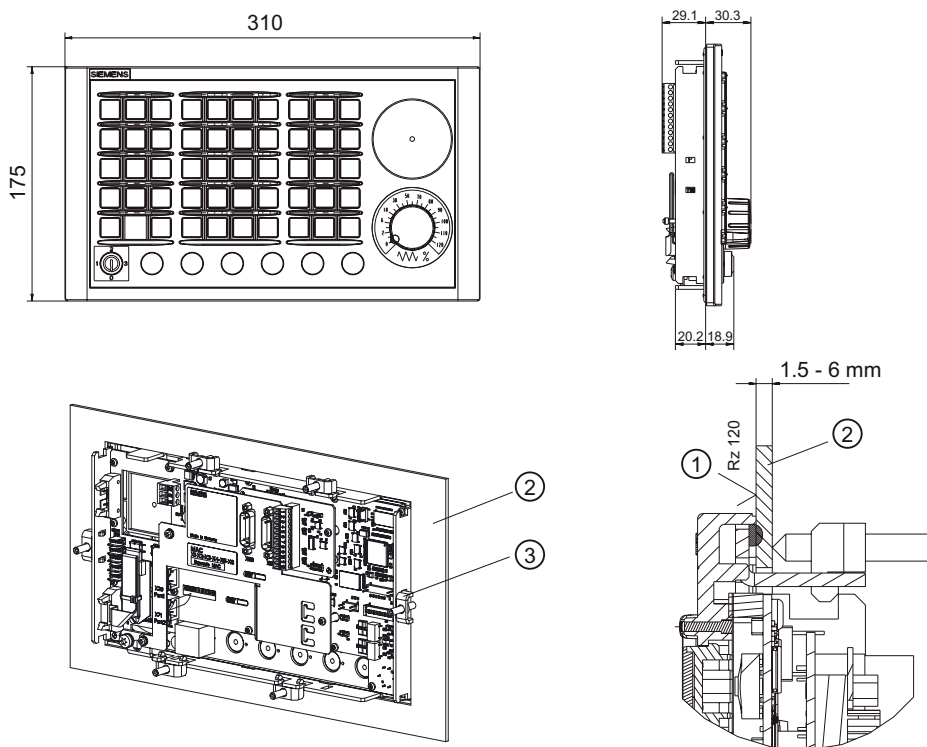
Assignment of the inputs (I) and outputs (O) to the keys and LEDs



Figure 11-17 Inputs and outputs of the MCP 310C PN keyboard

11.2.4 Mounting

Dimension drawing



- ① In the sealing area
- ② Mounting frame
- ③ Tension jack (6 parts) - tightening torque 0,5 Nm

Figure 11-18 MCP 310C PN dimension drawing

Tension jacks

The machine control panel is attached using 6 tension jacks (tightening torque, 0.5 Nm).

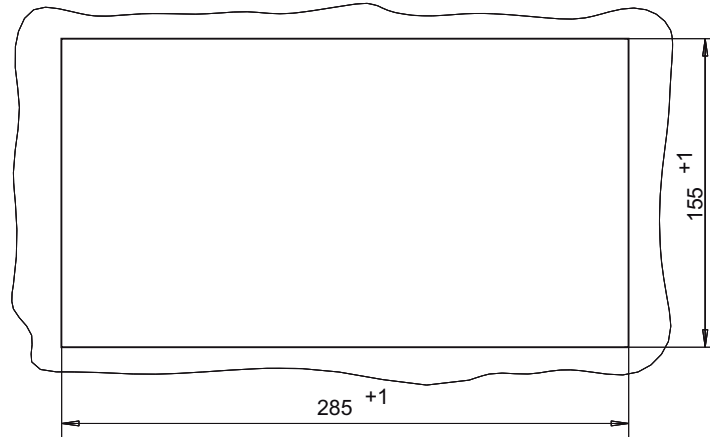


Figure 11-19 Panel cut-out for the machine control panel MCP 310C PN

Mounting position

Max. 60° to the vertical.

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.

11.2.5 Connection

Two equivalent connections (Fast Ethernet) are available for establishing the PLC I/O Interface communication network based on PROFINET (see System overview (Page 11)).

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. They must be ordered separately, see Ordering data (Page 15).

Securing the cables

Two cable ties are included in the scope of delivery. These are used to secure the Ethernet cables on the cover plate on the rear of the machine control panel (see figure in section: "Operator controls and display elements" --> "rear side").

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

11.2.6 Technical data

Safety				
Protection class	III (DVC A, PELV) acc. to EN 61800-5-1			
Degree of protection acc. to DIN IEC 529	Front: IP54		Rear side: IP00	
Approvals	CE / cULus			
Electrical data				
Input voltage	24 V DC			
Power consumption, max.	Board 5 W	Lamps 43.2 W (6 x 7.2 W) *)	Handwheels 2 x 0.9 W	Total 50 W
Mechanical data				
Dimensions	Width: 310 mm Height: 175 mm		Depth: 85.2 mm Mounting depth (with cables): 53.9 mm Mounting depth (without cables): 29.1 mm	
Weight	Approx. 1.2 kg			
Mechanical environmental conditions		Operation		Transport (in product packaging)
Vibratory load		10 – 58 Hz: 0.15 mm 58 – 200 Hz: 2g acc. to EN 60068-2-6 (test Fc)		5 – 9 Hz: 3,5 mm 9 - 200 Hz: 1 g according to EN 60068-2-6
Shock stressing		15g, 11 ms 18 shocks (3 in each direction) acc. to EN 60068-1		15g, 11 ms 18 shocks (3 in each direction) acc. to EN 60068-2-27
Climatic environmental conditions				
Cooling	By natural convection			
Condensation, splashwater and icing	Not permissible			
Supply air	Without aggressive gases, dusts and oils			
		Operation	Storage	Transport (in transport packing)
Applicable standards		DIN EN 60721-3-3	DIN EN 60721-3-1	DIN EN 60721-3-1 / -3-2
Climate class		3K3		
Temperature limits		0 ... 45 °C (at the front) 0 ... 55 °C (at the rear)	-25 °C ... 55 °C	-40 ... 70 °C
*) 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.				

For other values / standards see the chapter "Application planning".

11.2.7 Spare parts

11.2.7.1 Overview

Table 11- 31 Spare parts for machine control panel 310C PN

Name	Description	Quantity	Order number
EMERGENCY STOP latching pushbutton	22 mm actuating element, 40mm mushroom pushbutton, snap action with tamper protection, latching, red, with holder, unlit	1	3SB3000-1HA20
Contact block	with 2 contact pairs (1 NO + 1 NC), 2-pin, screw terminal (3rd contact pair can be connected additionally)	1	3SB3400-0A
Sets of keys	Set of keys (10 sets) for machine control panel	1 set	6FC5148-0AA03-0AA0
Set of tension jacks	Tension jack set (9 items) for supplementary components with 2.5 mm profile, length 20 mm	1 set	6FC5248-0AF14-0AA0
Override for rotary spindle switch	Spindle/rapid traverse override, solid-state rotary switch 1x16G, T=24, cap, button, pointer, spindle and rapid-traverse dials	1	6FC5247-0AF12-1AA0
Rotary feed override switch	Feed rate/rapid traverse, override solid-state rotary switch 1x23G, T=32, cap, button, pointer, feed and rapid-traverse dials	1	6FC5247-0AF13-1AA0

11.2.7.2 Replacement

Replacement of the rotary switch is described in chapter: "Machine control panel: MCP 483 PN" → "Spare parts" → "Replacement".

11.2.8 Accessories

Table 11- 32 Accessories pack (for delivery ex works)

Component	Description	Number
Keyset	Key caps for turning (labeled)	9
	Ergo grey key caps (for labeling)	30
	Clear key caps (for labeling)	30
Yellow backing plate	for EMERGENCY STOP	1

Table 11- 33 Accessories available for order

Component	Description	Number	Order number
Quadratic key cap (for labeling)	1 set of 90, ergo-gray and 20 each of red / green / yellow / medium gray	1	6FC5248-0AF12-0AA0
Quadratic key cap (for labeling)	1 set of 90, clear	1	6FC5248-0AF21-0AA0
Cable set	For additional MCP control devices, length 500 mm	60	6FC5247-0AA35-0AA0

11.3 Mini handheld unit

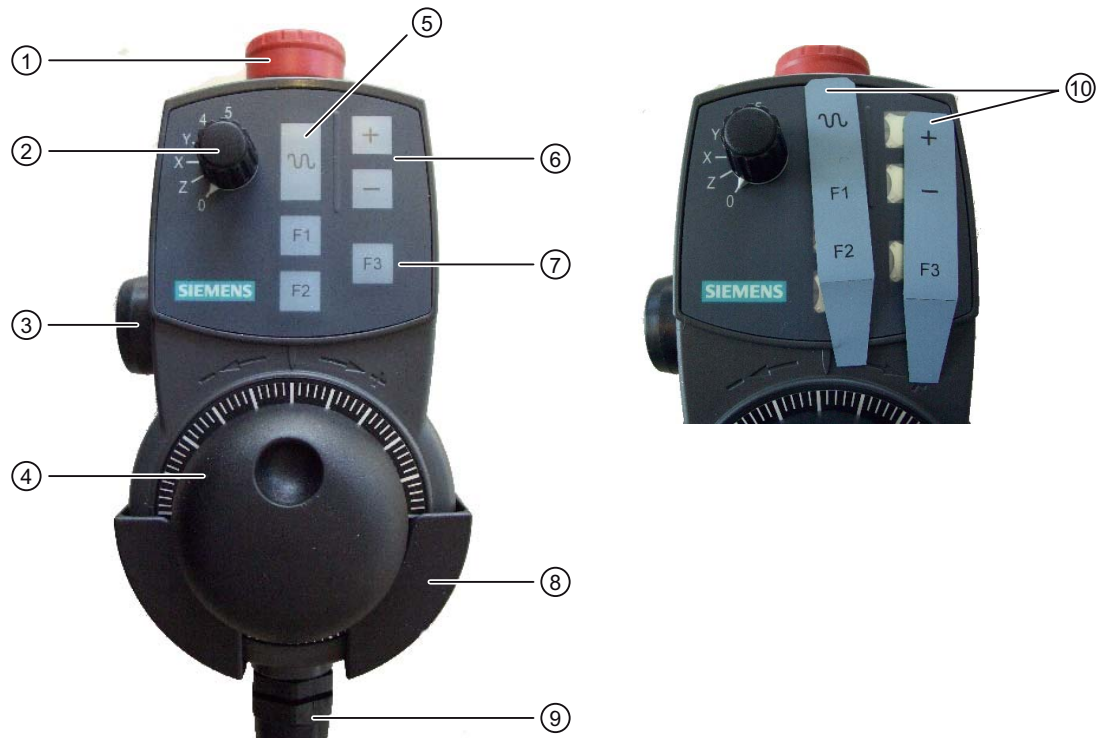
11.3.1 Description

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

Features

- The mini HHU can be connected to the SINUMERIK 828D control system using a connection kit.
- Key labeling can be customized using slide-in labels.
- The mini handheld unit can be fixed on metal surfaces by means of the integrated magnetic clamp.

11.3.2 Operator controls



- ① EMERGENCY OFF pushbutton
- ② Selection switch for 5 axes and neutral position
- ③ Enabling button, two channels, 3 positions
- ④ Handwheel
- ⑤ Rapid traverse key for high-speed travel with traversing keys or handwheel
- ⑥ Traversing key direction + / direction -
- ⑦ Function keys F1, F2, F3
- ⑧ Cover bracket (optional)
- ⑨ Connecting cable
- ⑩ Slide-in labels

Figure 11-20 Control elements of the mini handheld unit

EMERGENCY OFF pushbutton

The EMERGENCY OFF pushbutton must be pressed in an emergency

1. when a person is at risk,
2. When there is a danger of the machine or workpiece being damaged.

Axis selection switch

The axis selection switch can be used to select up to five axes. The coding is carried out in Gray Code.

Table 11- 34 Coding of axis selection switch

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

Enabling button

The enabling button is designed as a 3-way switch. This must be held in its central position for movements to be triggered.

Handwheel

The handwheel can be used to initiate movements at the selected axis using the axis selection switch.

Rapid traverse key

The rapid traverse key increases the traversing speed of the selected axis with the axis selector switch. The rapid traverse button is active both for traversing commands issued via the +/- keys and for handwheel signals.

Traversing keys

The + and - traversing keys can be used to trigger traversing movements on the axis selected via the axis selection switch.

Function keys

The function keys can be used to trigger machine-specific functions.

11.3.3 Dimension drawing

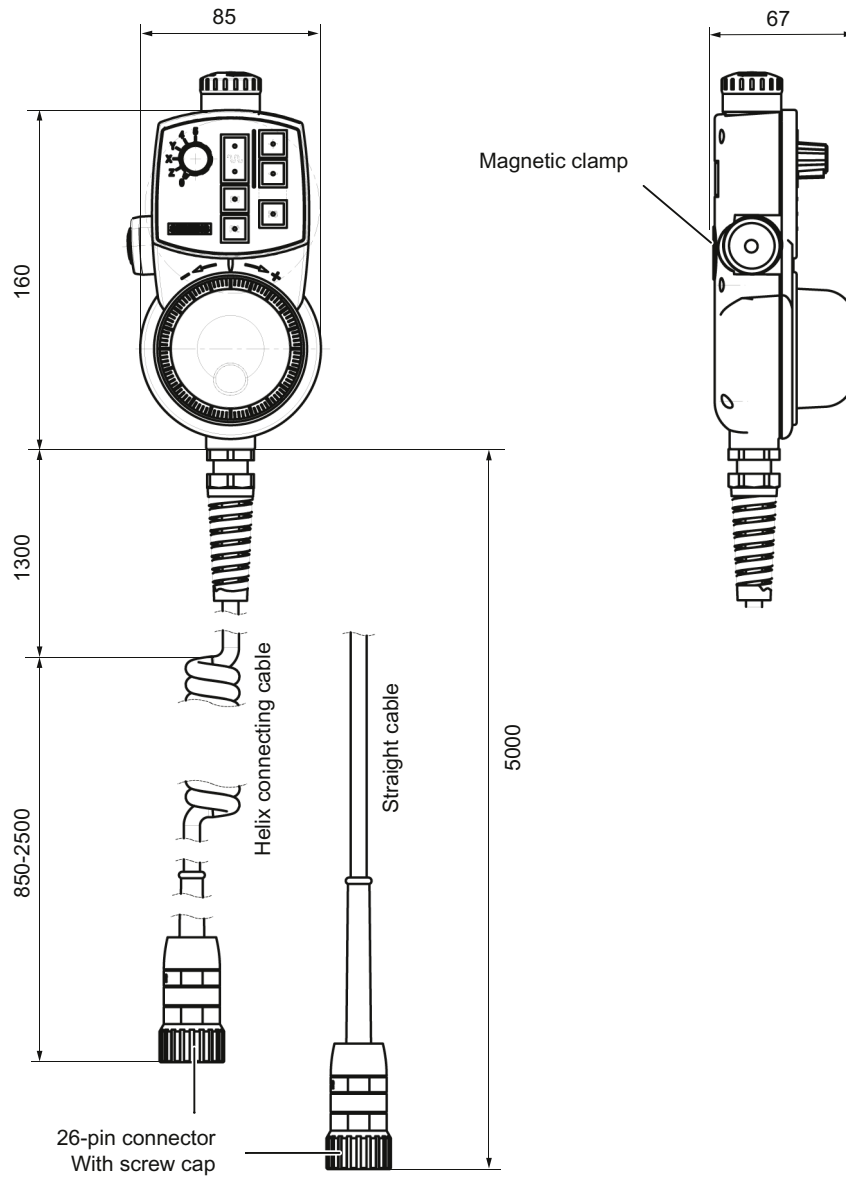


Figure 11-21 Dimensions of the mini handheld unit

11.3.4 Connection

Basic procedure

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

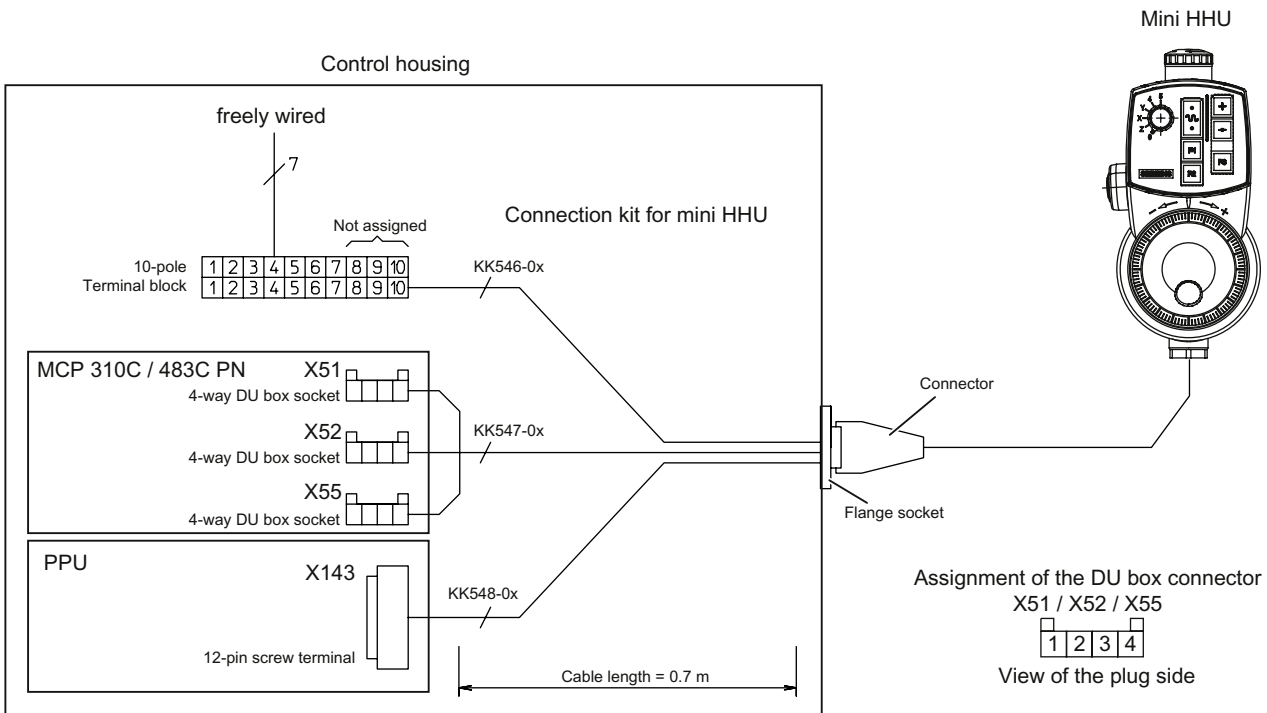


Figure 11-22 Connection diagram

1. Use the hole pattern for the wall of the control housing.
2. Insert the connection kit through the large drill hole into the control housing.
3. Mount the flange socket (with seal) onto the control housing.
4. Connect the connecting cables according to the circuit diagram.

Hole pattern for mounting the flange socket

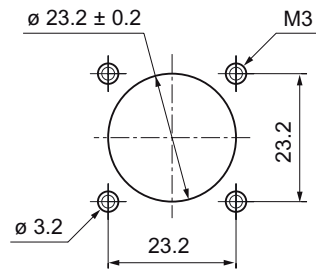


Figure 11-23 Hole pattern for mounting

Flange socket

The mini HHU is connected to the PLC or the connector for handwheels via a flange socket. The flange socket is part of the connection kit. The signals are sent to the NC in parallel. There is no need for an additional distributor.

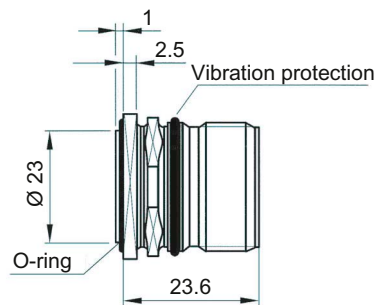


Figure 11-24 Flange socket

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

Note

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

Angle box

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

Note

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

Adapter plate

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

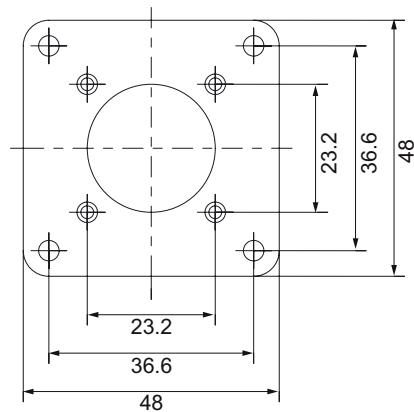


Figure 11-25 Dimension drawing of the adapter plate

Retaining plate

As an option, the mini HHU can be stored in a screw-on retaining plate, to enable safe storage even on non-magnetic surfaces. The retaining plate is secured with three M4 screws.

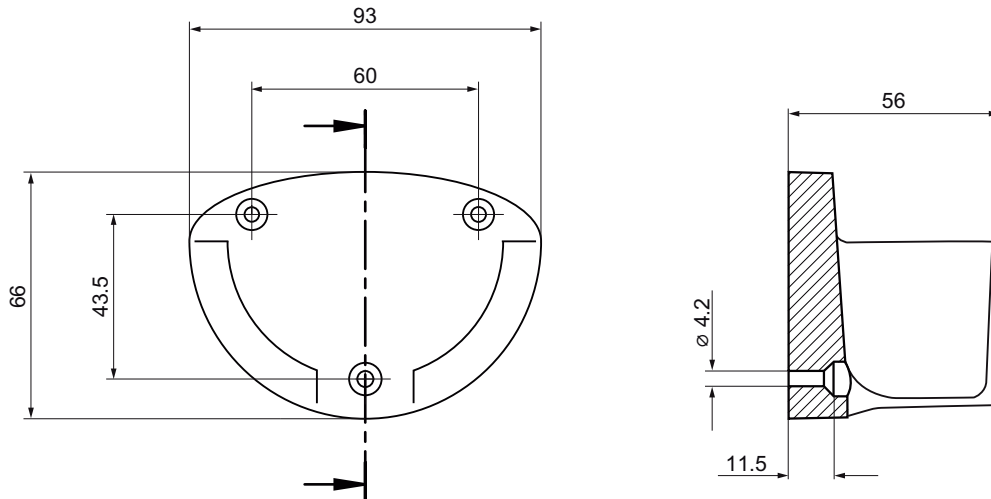



Figure 11-26 Dimension drawing of the retaining plate

11.3.5 Configuring

To address the mini HHU using standard addresses, set the following machine data:
 MD12986 PLC_DEACT_IMAGE_LADDR_IN[6] = -1

If a mini HHU is connected, the functional assignment listed in the table below is valid for customer keys KT1 to KT9 (byte 122 and byte 123). The customer keys (inputs) are then not available for other applications.

Table 11- 35 Input image for MCP with standard addresses


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

Note

Within the SINUMERIK controller, the handwheel data are processed directly by the NCK and are not available to the PLC.

11.3.6 Technical data

Table 11- 36 Technical specifications of the mini HHU

Operator controls			
Enabling button	floating	2 channels	NO contact, 3-positions
EMERGENCY OFF pushbutton	floating	2 channels	NC contact, locked by twisting
Selection switch	5 axes: X, Y, Z. 4. 5 and neutral position		
Jog key +	Positive traverse direction		
Jog key -	Negative traverse direction		
Jog key 	Rapid traverse for jog keys and handwheel		
Function keys	3 x: F1, F2, F3		
Handwheel	100 S/R		
Electrical data			
Rated voltage for switching signals	24 V		
Rated voltage for handwheel	5 V		
5 V current consumption	Approx. 90 mA		
Handwheel signals	RS 422		
EMERGENCY OFF pushbutton	24 V	2 A	NC contact
Enabling buttons	24 V	2 A	NO contact
Safety			
Protection class	IP65 (to EN 60529)		
Approvals	CE		
Mechanical data			
Dimensions approx.	Height: 180 mm	Width: 90 mm	Depth: 67 mm
Approx. weight	0.5 kg without connecting cable		
Max. cable length	25 m		
Ambient conditions			
	Application/operation		Storage/transport
Temperature ranges	0 ... 55 °C		-20 ... 60° C
Temperature change	Within 1 minute max. 0.2 K		
Permissible change in relative humidity EN 60721-3-3, Class 3K5			
Within 1 minute	Max. 0.1%		

11.3.7 Spare parts

The following spare parts are available:

Item name	Order number	Can be used with 6FX2007-	
		-1AD03	-1AD13
6-pos. load-tap-changer with accessories	104899	X	X
EMERGENCY OFF pushbutton	104900	X	X
ZXE-104833 (3-position enabling button)	104901	X	X
Protective cover and nut for ZXE	104902	X	X
Spiral cable 3.5 m	104903	X	
Cable 5 m	104904		X
Extension cable 5 m	103832	X	X
Extension cable 10 m	103833	X	X
Extension cable 15 m	103834	X	X
Connection adapter	103835	X	X
Dismantling tool for plug connector	105037	X	X

Order address

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

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

11.3.8 Accessories

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

Component	Order number	Remarks
Connection kit	6FX2006-1BG20	with terminating connector
Connection kit	6FX2006-1BG25	without terminating connector
Angle box	6FX2006-1BG56	Non-assembled, metal version
Adapter plate	6FX2006-1BG45	Non-assembled, plastic on metal version
Retaining plate	6FX2006-1BG70	Including three M4 screws

11.4 PP 72/48D PN

11.4.1 Description

Features

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

Note

Communication network for the SINUMERIK 828D automation system:

PLC I/O Interface based on PROFINET IO, see System overview (Page 11).

The module has the following important features:

- 72 digital inputs and 48 digital outputs
- PLC I/O Interface connection (max. 100 MBaud)
- On-board status display via 2 diagnostic LEDs
- The 3 plug-in connectors for the digital inputs and outputs are 50-pin terminal posts for connecting ribbon cables.
- Terminal strip converters can be used, or the direct connection of distribution boards, for example, is possible.
- Analog signal cables can be connected directly to screw contacts on the module.

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

Illustration

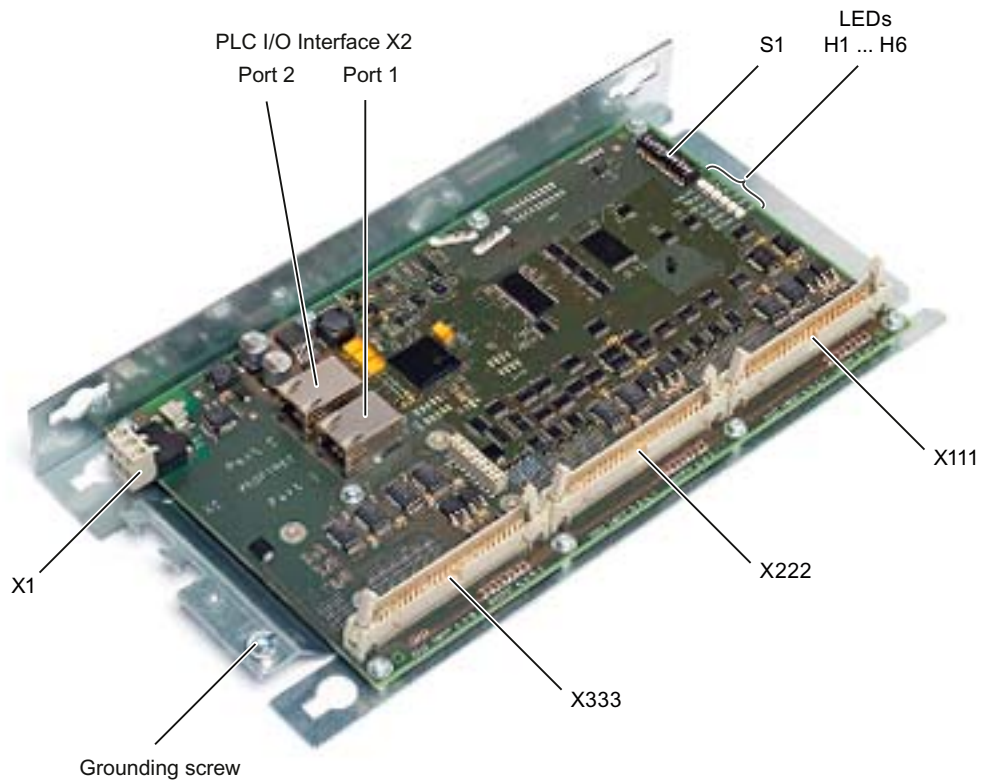


Figure 11-27 PP 72/48D PN I/O module

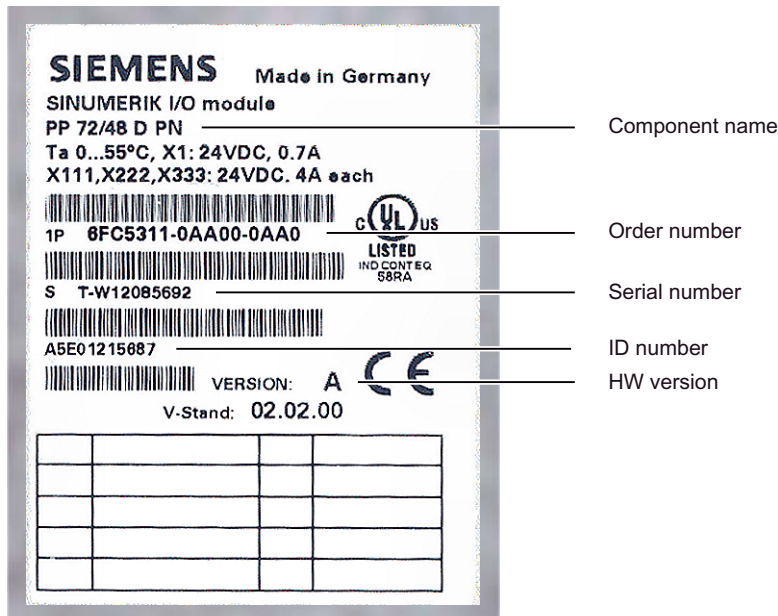


Figure 11-28 PP 72/48D PN type plate

Note

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

11.4.2 Interfaces**11.4.2.1 Overview****Interface overview**

PP 72/48D PN I/O module interfaces

Table 11- 37 PP 72/48D PN I/O module interfaces

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

11.4.2.2 X1 power supply**Features and use**

A description of the interfaces for the external power supply X1 can be found in the chapters titled "Interfaces" and "Connection" in the PPU description.

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

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

Power requirement

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

Digital inputs

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

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

Digital outputs

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

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

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

11.4.2.3 PLC I/O Interface X2

PLC I/O Interface X2 interfaces, port 1 and 2

A description of the interfaces can be found in the chapters titled "Interfaces" and "Connection" in the PPU description.

PLC I/O Interface address (S1)

A logical address can be assigned to the PP 72/48D PN for communication with PLC I/O Interface using a 10-bit DIP switch S1. The correct addresses must be assigned to up to five I/O modules.

Table 11- 38 Switch S1 settings

1	2	3	4	5	6	7	8	9	10	Meaning/device name
								on	on	
on	off	off	on	off	off	off	off			pp1-p9
off	off	off	on	off	off	off	off			pp2-p8
on	on	on	off	off	off	off	off			pp3-p7
off	on	on	off	off	off	off	off			pp4-p6
on	off	on	off	off	off	off	off			pp5-p5

NOTICE

A newly set PLC I/O Interface address will only come into effect after power OFF/ON.
--

The switch positions 9 and 10 guarantee the PLC I/O Interface functionality of the module and must always be switched "on".

11.4.2.4 X111, X222 and X333 digital inputs/outputs

Cable specification

- Connectors: 50-pin ribbon cable connectors
50-pin insulation displacement connectors with cable grip, ribbon cables and terminal converters
are required for connecting digital inputs and outputs.
- The required connecting cables (ribbon cables) must be provided by the user
- Max. cable length: 30 m

Pin assignment

Table 11- 39 Pin assignment X111

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	Input 0.0	I	4	Input 0.1	I
5	Input 0.2	I	6	Input 0.3	I
7	Input 0.4	I	8	Input 0.5	I
9	Input 0.6	I	10	Input 0.7	I
11	Input 1.0	I	12	Input 1.1	I
13	Input 1.2	I	14	Input 1.3	I
15	Input 1.4	I	16	Input 1.5	I
17	Input 1.6	I	18	Input 1.7	I
19	Input 2.0	I	20	Input 2.1	I
21	Input 2.2	I	22	Input 2.3	I
23	Input 2.4	I	24	Input 2.5	I
25	Input 2.6	I	26	Input 2.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	Output 0.0	O	32	Output 0.1	O
33	Output 0.2	O	34	Output 0.3	O
35	Output 0.4	O	36	Output 0.5	O
37	Output 0.6	O	38	Output 0.7	O
39	Output 1.0	O	40	Output 1.1	O
41	Output 1.2	O	42	Output 1.3	O
43	Output 1.4	O	44	Output 1.5	O
45	Output 1.6	O	46	Output 1.7	O
47	DOCOM1	VI	48	DOCOM1	VI
49	DOCOM1	VI	50	DOCOM1	VI
VI: Voltage input/VO: Voltage output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Table 11- 40 Pin assignment for X222

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	Input 3.0	I	4	Input 3.1	I
5	Input 3.2	I	6	Input 3.3	I
7	Input 3.4	I	8	Input 3.5	I
9	Input 3.6	I	10	Input 3.7	I
11	Input 4.0	I	12	Input 4.1	I
13	Input 4.2	I	14	Input 4.3	I
15	Input 4.4	I	16	Input 4.5	I
17	Input 4.6	I	18	Input 4.7	I
19	Input 5.0	I	20	Input 5.1	I
21	Input 5.2	I	22	Input 5.3	I
23	Input 5.4	I	24	Input 5.5	I
25	Input 5.6	I	26	Input 5.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	Output 2.0	O	32	Output 2.1	O
33	Output 2.2	O	34	Output 2.3	O
35	Output 2.4	O	36	Output 2.5	O
37	Output 2.6	O	38	Output 2.7	O
39	Output 3.0	O	40	Output 3.1	O
41	Output 3.2	O	42	Output 3.3	O
43	Output 3.4	O	44	Output 3.5	O
45	Output 3.6	O	46	Output 3.7	O
47	DOCOM2	VI	48	DOCOM2	VI
49	DOCOM2	VI	50	DOCOM2	VI
VI: Voltage input/VO: Voltage output					
I: Signal input/O: Signal output/GND: Reference potential (ground)					

Table 11- 41 Pin assignment for X333

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

Digital inputs

- Features:
 - X222: Inputs 3.0 to 3.7 are connected as rapid inputs; this means the input filter has a max. delay time of 600 μ s.
 - The inputs have no signaling (status LEDs).
 - The inputs are not isolated.
 - It is not possible to connect 2-wire BEROs.
- Terminal assignment for the digital inputs:

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

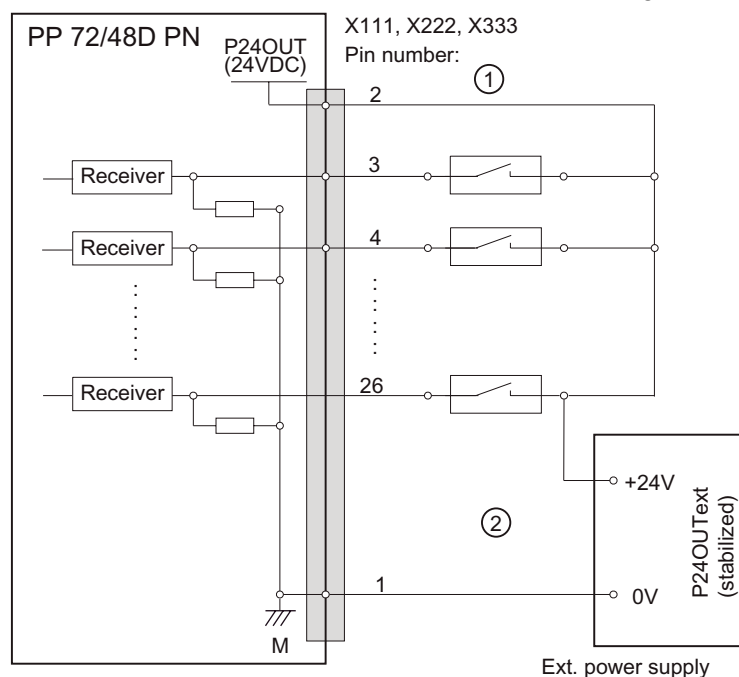


Figure 11-29 Terminal assignment for the digital inputs

- ① If you are using the internal power supply P24OUT
- ② If you are using an external power supply P24OUT_{ext}

- Internal power supply (P24OUT):

The internal power supply for the digital inputs (X111, X222, X333: Pin 2) is derived from the general power supply of module X1, pin 2 (P24).

- Technical specifications:

Table 11- 42 Electrical specification of the digital inputs:

Digital inputs	min.	max.	Nominal
High-level voltage (U _H)	15 V	30 V	24 V
Input current I _{IN} at V _H	2 mA	15 mA	-
Low-level voltage (U _L)	-30 V	+5 V	0 V
Signal delay time T _{PHL}	0.5 ms	3 ms	-

Digital outputs

- Features
 - No galvanic isolation.
 - Protection against: Short-circuit, overtemperature, and loss of ground.
 - Automatic disconnection in case of undervoltage.
- Terminal assignment for the digital outputs:

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

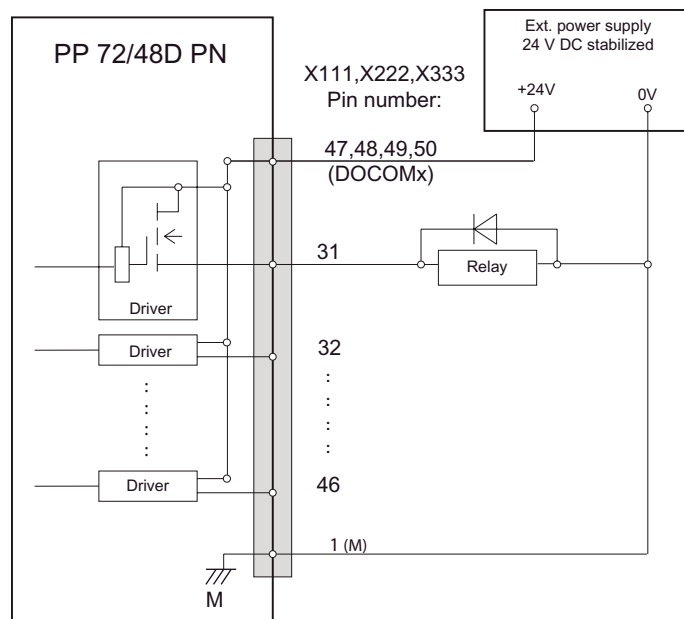


Figure 11-30 Terminal assignment for the digital outputs

CAUTION

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

- Technical specifications:

Table 11- 43 Electrical specification of the digital outputs

Digital outputs	min.	Standard	max.	Nominal
High-level voltage (U _H)	V _{CC} - 3 V	¹⁾	V _{CC}	24 V
Output current I _{OUT}	-	-	250 mA ²⁾	-
Voltage with low level (U _L)	-	-	-	Output open
Leakage current at low level	-	50 µA	400 µA	-
Signal delay time T _{PHL}	-	0.5 ms	-	-
Maximum switching frequency				
Resistive load	-	-	100 Hz	-
Inductive load	-	-	2 Hz	-
Lamp	-	-	11 Hz	-
<ul style="list-style-type: none"> • ¹⁾ U_{H,typical} = V_{CC} - I_{OUT} × R_{ON} V_{CC}: Current operating voltage 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⁾ Where demand factor is 100% (all outputs active) • Incorrect connection causes neither high level nor destruction of the outputs. 				

11.4.3 LED displays

Display elements

Each PLC I/O Interface port has two integrated LEDs displaying the link status (green) and activity (yellow); see the chapter titled PLC I/O Interface PN1, PN2 (Page 46).

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

Table 11- 44 LEDs: Status indicator

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply ok
			Not lit: As soon as one of the generated logic voltages falls below its setpoint, a reset is triggered and the PowerOK LED goes out.
H2	PNSync	Green	Lit: Task system is synchronized to the bus cycle clock.
			Not lit: Task system is not synchronized to bus cycle clock.
			Flashes 0.5 Hz: Task system is synchronized to the bus cycle clock and cyclic data exchange is running.
H3	PNFault	Red	Not lit: Module is operating without errors; data exchange with all configured IO Devices is running.
			Lit: Serious bus fault; only output when one of the following errors is detected for the ports: <ul style="list-style-type: none"> No physical connection to a subnet/switch Incorrect transmission rate Full duplex transmission is not activated.
H4	DIAG1	Green	Reserved
H5	DIAG2	Green	Reserved
H6	OVTemp	Red	Overtemperature indication

Note

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

11.4.4 Dimension drawing

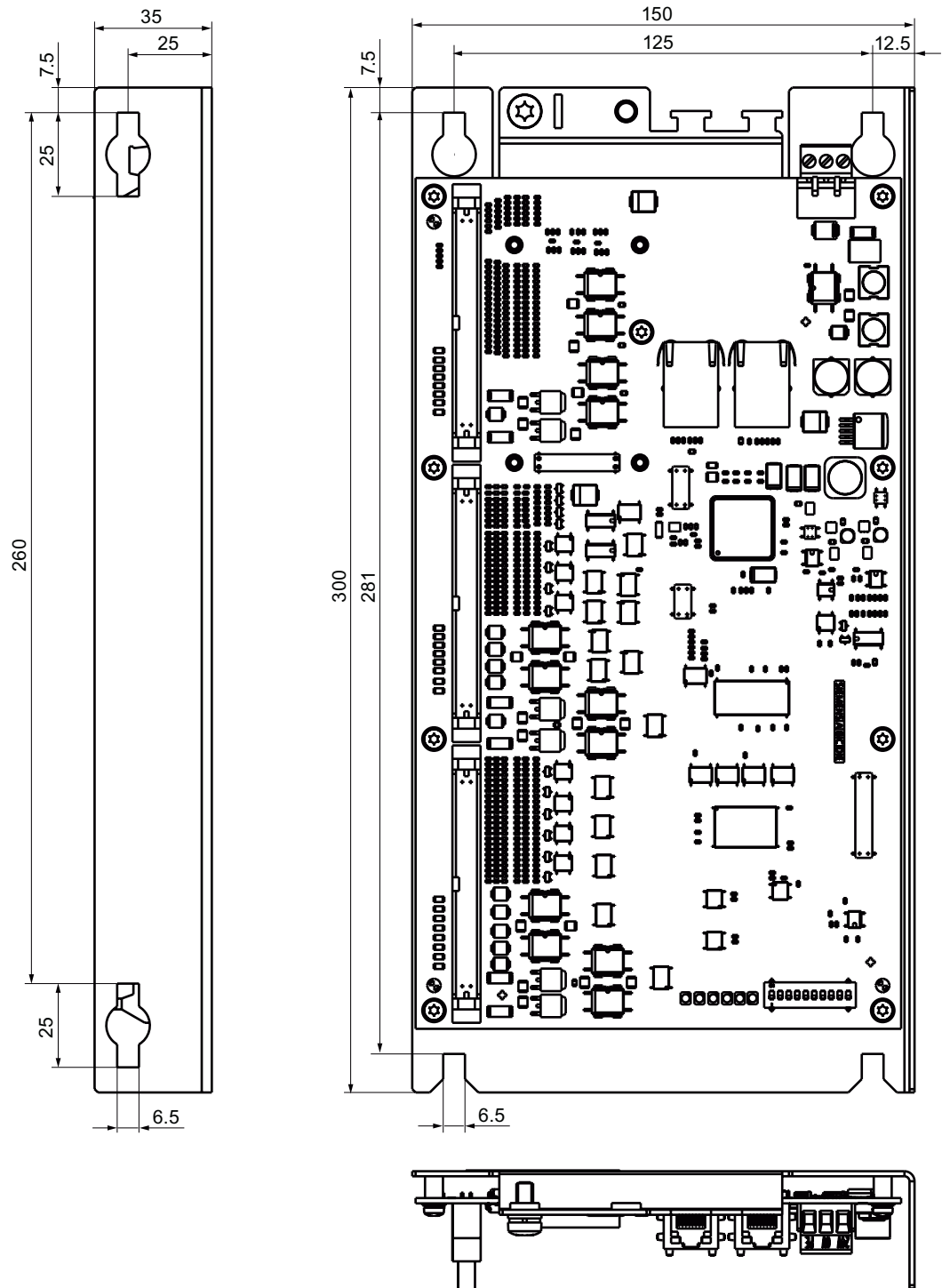


Figure 11-31 PP 72/48D PN dimension drawing

11.4.5 Connection/Installation

Connection

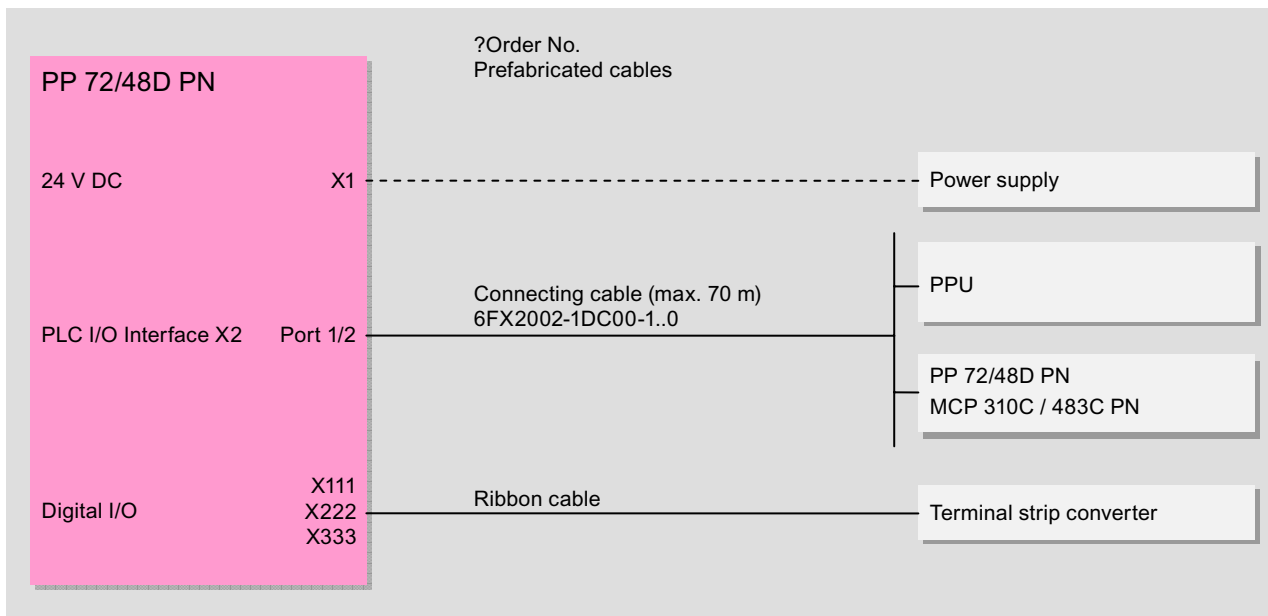


Figure 11-32 I/O module connection options

Mounting

The I/O module can be fastened to the wall of the control cabinet using a mounting plate and M6 screws. The module must be installed according to EN 60204.

! WARNING

A protective conductor must be connected using the grounding screw.

11.4.6 Technical data

Table 11- 45 Technical data of the I/O module

Safety		
Degree of protection	IP 00 according to EN 60529	
Protection class	III; DVC A, (PELV) acc. to EN 61800-5-1	
Approvals	cULus, CE	
Power consumption at rated load (without digital outputs)		
PP 72/48D PN	17 W	
Mechanical data		
Dimensions (WxHxD)	(150 x 300 x 35) mm	
Weight, approx.	0.9 kg	
Climatic environmental conditions		
Cooling	Open-circuit ventilation	
	Operation	Storage/transport
Temperature limits	0 ... 55 °C	-40 ... 70 °C
Limits for relative humidity At 25 °C	5 ... 90 % Without condensation	5 ... 95 % Without condensation
Condensation	Not permissible	
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.	
Shock stress during transportation		
Free fall	≤ 1 m (in transport packaging)	

11.5 NX10

11.5.1 Description

Properties

Using this module, you can expand the performance of an axis grouping of the SINUMERIK 828D CNC automation system. With an NX10 Numeric Control Extension, the PPU is able to control up to 8 axes.

The NX10 has the following interfaces:

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

Illustration

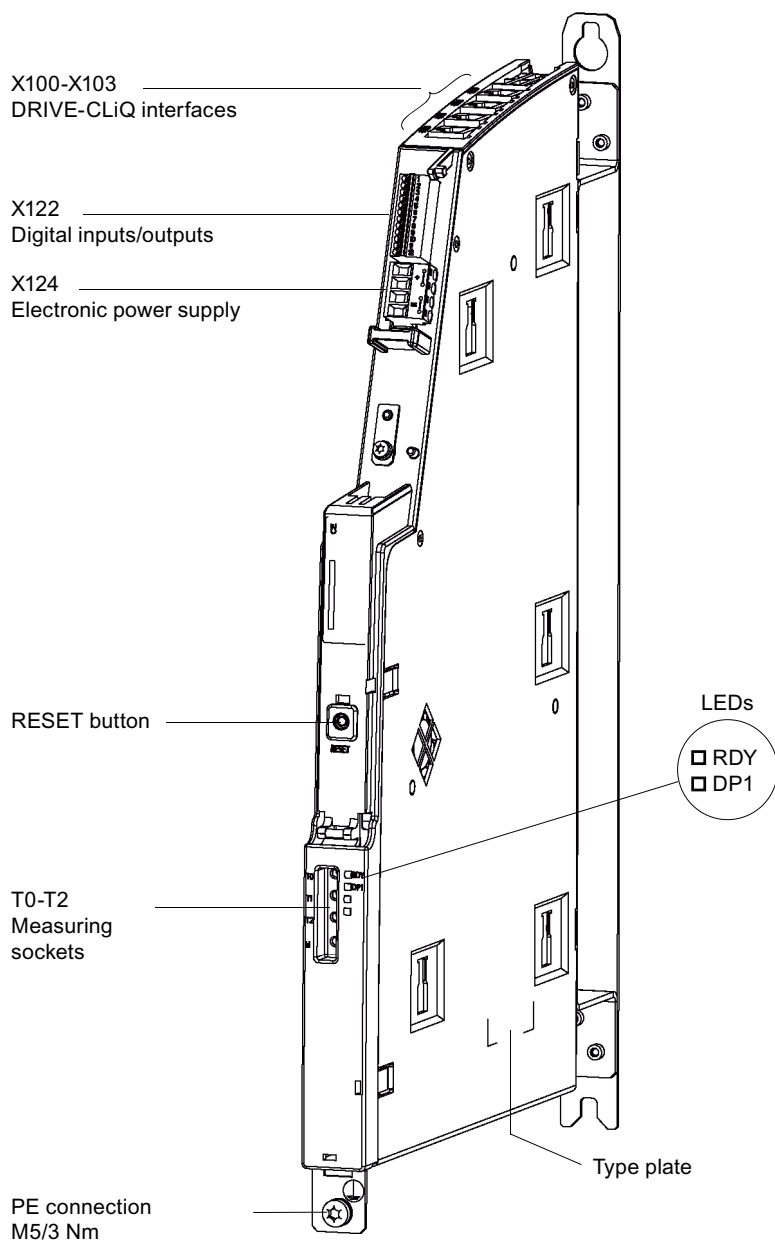


Figure 11-33 Illustration of NX10 (without cover)

Type plate

The NX10 module type plate contains the following basic information:

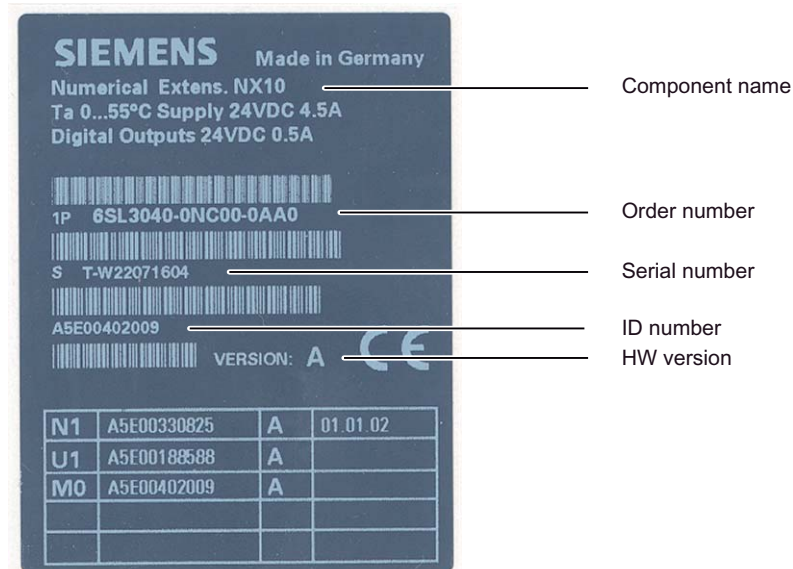


Figure 11-34 NX10 type plate

Note

You might need to access the information provided on the side-mounted type plate after the equipment has been mounted. Since the type plate is located on the right-hand side of the housing, which is the side typically used to connect to the SINAMICS S120 module, we recommend that you make a note of the serial number of the NX10 prior to assembly.

11.5.2 Operating and display elements

LED displays

Table 11- 46 Description of the LEDs on the NX10

LEDs	Color	Status	Description
RDY, READY H1	Off		Electronic power supply outside permissible tolerance range
	Green	Steady-light signal	NX10 is ready for operation
		Blinklight 2 Hz	Writing to CompactFlash Card
	Red	Steady light	At least one fault is pending (e.g., RESET, watchdog monitoring, basic system fault). NX10 is booting up.
		Blinklight 0.5 Hz	Boot fault (e.g., firmware cannot be loaded into the RAM)
	Yellow	Steady light	Firmware loading into RAM
		Flashing, 0.5 Hz	Unable to load firmware into RAM
Flashing, 2 Hz		Firmware CRC fault	
DP1, CU_LINK H2	Off		Electronic power supply outside the permissible tolerance range, NX10 is not ready for operation.
	Green	Steady light	CU_LINK is ready for communication and cyclic communication is running
		Flashing, 0.5 Hz	CU_LINK is ready for communication and no cyclic communication is running
Red	Steady light	At least one CU_LINK fault is present. CU_LINK not ready for operation (e.g., after POWER ON)	

RESET button

The RESET button is on the front of the module under the cover.

NOTICE
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 successfully booted up.

11.5.3 Interfaces

Connection example

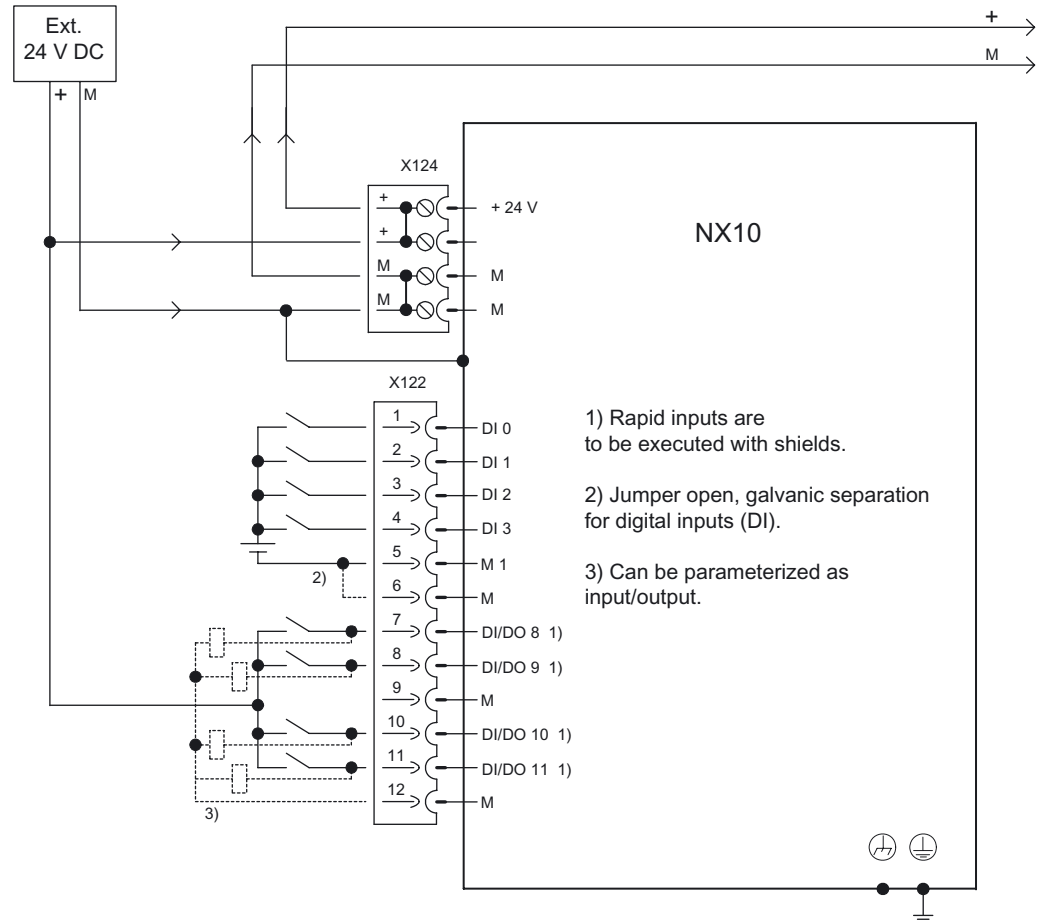


Figure 11-35 Connection example for NX10

Note

The digital inputs/outputs are reserved by the system (pin assignment).

Definition

In the tables showing the pin assignment of the interfaces, the letters in the "Signal type" column have the following meaning:

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

DRIVE-CLiQ interfaces X100 - X103

A description of the interfaces can be found in the chapters titled "Interfaces" and "Connection" in the PPU description.

Digital inputs/outputs

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

Table 11- 47 Pin assignment for X122

Pin	Signal name	Signal type	Meaning
1	DI0	I	Digital input 0
2	DI1	I	Digital input 1
3	DI2	I	Digital input 2
4	DI3	I	Digital input 3
5	M1	GND	Ground for DI0 - DI3 (functionally-separated relative to M)
6	M	GND	Ground
7	DI/DO8	B	Digital input/output 0 (rapid input)
8	DI/DO9	B	Digital input/output 1 (rapid input)
9	M	GND	Ground
10	DI/DO10	B	Digital input/output 2 (rapid input)
11	DI/DO11	B	Digital input/output 3 (rapid input)
12	M	GND	Ground

Note

An open input is interpreted as "low".

The "rapid inputs" can be used for positioning measurement.


 DANGER
To enable digital inputs (DI) 0 to 3 to function, terminal M1 must be connected. This can be done as follows:
<ul style="list-style-type: none"> • Connect the ground reference of the digital inputs. • A bridge to terminal M.
Notice: This will cancel the galvanic isolation for these digital inputs.

Table 11- 48 Technical specifications for X122

Parameter	Value
Current consumption	Typical: 10 mA at 24 V DC
Galvanic isolation	The reference potential is terminal M1
As an input	
Voltage	-3 V to 30 V
Current consumption	Typical: 10 mA at 24 V DC
Signal level (including ripple)	High signal level: 15 V to 30 V Low signal level: -3 V to 5 V
Signal propagation delays	Inputs / "fast inputs": L → H: approx. 50 µs/5 µs H → L: approx. 100 µs/50 µs
As an output	
Voltage	24 V DC
Max. load current	Per output: 500 mA continuous short circuit-proof

Power supply

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

Table 11- 49 Pin assignment for X124

Pin	Signal name	Signal type	Meaning
1	+	VI	Electronic power supply
2	+	VI	Electronic power supply
3	M	VO	Ground
4	M	VO	Ground

Note

The two "+" and "M" terminals are jumpered in the connector and not in the device. This ensures that the supply voltage is looped through.

Table 11- 50 Technical specifications for X124

Parameter	Value
Voltage	24 V DC (20.4 V - 28.8 V)
Current consumption	max. 0.8 A (without load)
Max. current via the bridges in the connector	20 A at 55 °C

Note

The current consumption increases by the current consumption of DRIVE-CLiQ and the digital outputs.

Further information (direct voltage requirements, standards) can be found in the chapter titled "Connection" in the PPU description.

11.5.4 Dimension drawing

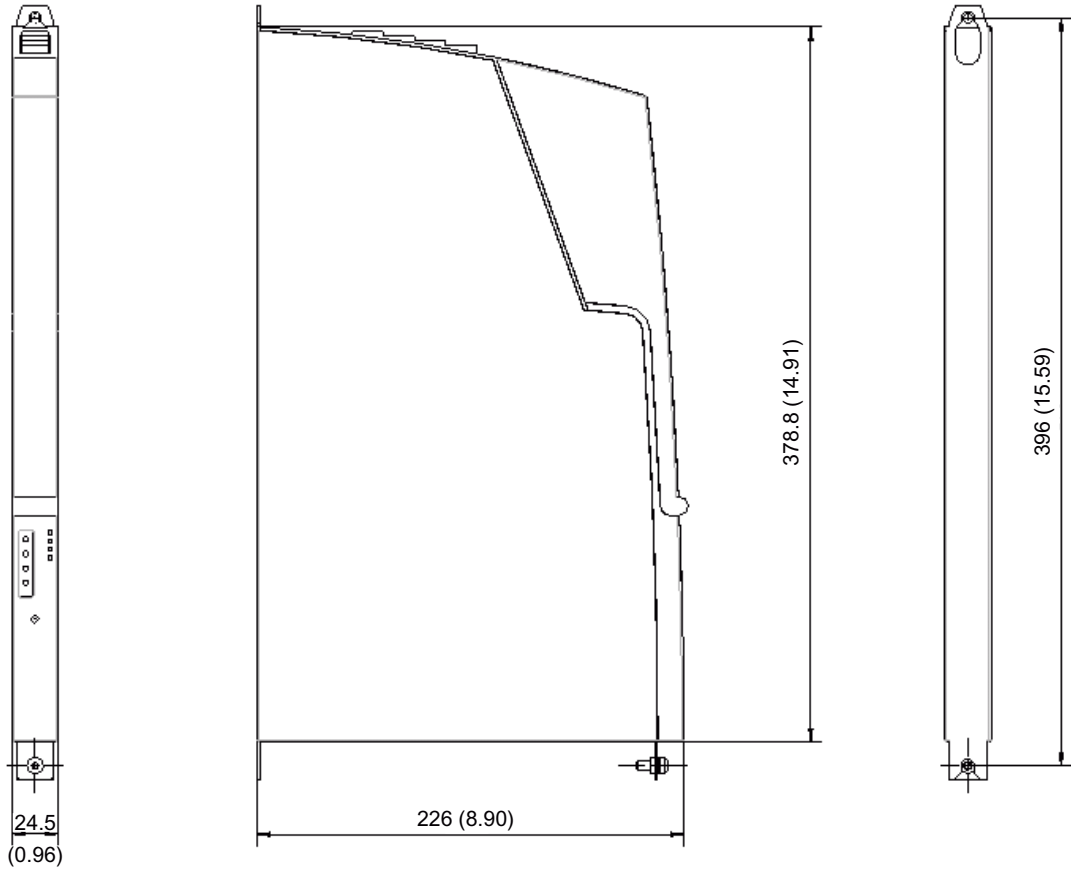


Figure 11-36 NX10 dimension drawing

11.5.5 Mounting

Mounting aids

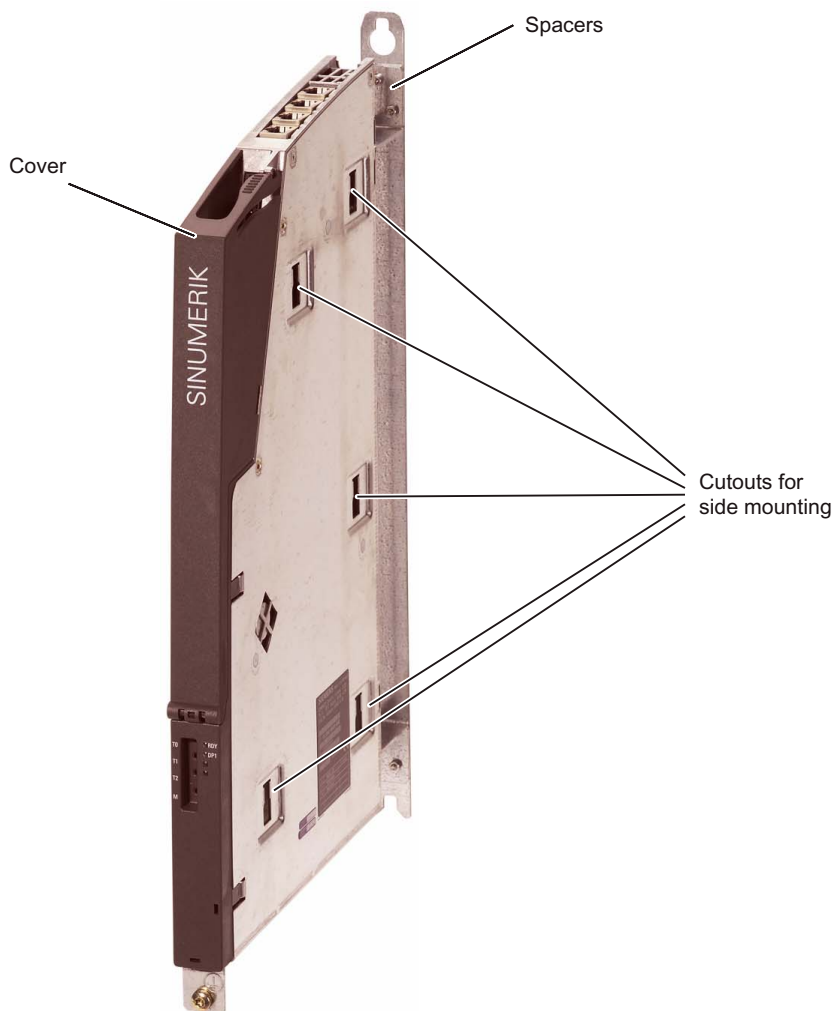


Figure 11-37 NX10 mounting aids

Designs

The NX10 is integrated into the SINAMICS drive line-up.

Preferred call sequence: The NX module should be attached to the side of the Line Module.

CAUTION

The 80 mm ventilation spaces above and below the components must be observed.

Procedure

Mounting an NX10 on an Active Line Module:

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.

11.5.6 Technical Data

Table 11- 51 Technical specifications

Parameters	Values
Input voltage	24 V DC (20.4 V - 28.8 V)
Current (without DRIVE-CLiQ or digital outputs)	0.8 A
PE/ground connection	On housing with M5/3 Nm screw
Dimensions (WxHxD)	(24.5 x 396 x 226) mm
Weight, approx.	1.5 kg
Mounting position	Vertical

11.6 GSM modem

Function

The SINUMERIK 828D can be equipped with a SINAUT MD720-3 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 statuses such as the machining processing level, 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 GSM modem scope of delivery. The user has to choose their own cell phone contract.

Note

The SINAUT MD720-3 has two different operating modes. Only the terminal mode is used with the SINUMERIK 828D.

Illustration

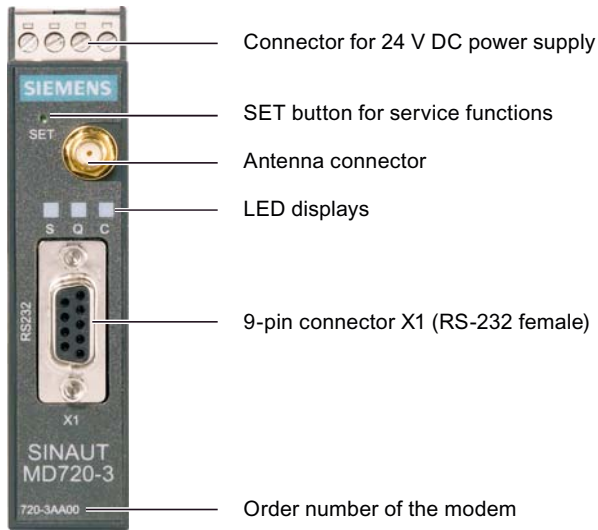


Figure 11-38 Illustration of the SINAUT MD720-3

Mounting

The SINAUT MD720-3 is intended for installation on DIN rails complying with DIN EN 50022. There is a suitable fastener on the rear of the device.

Connection

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

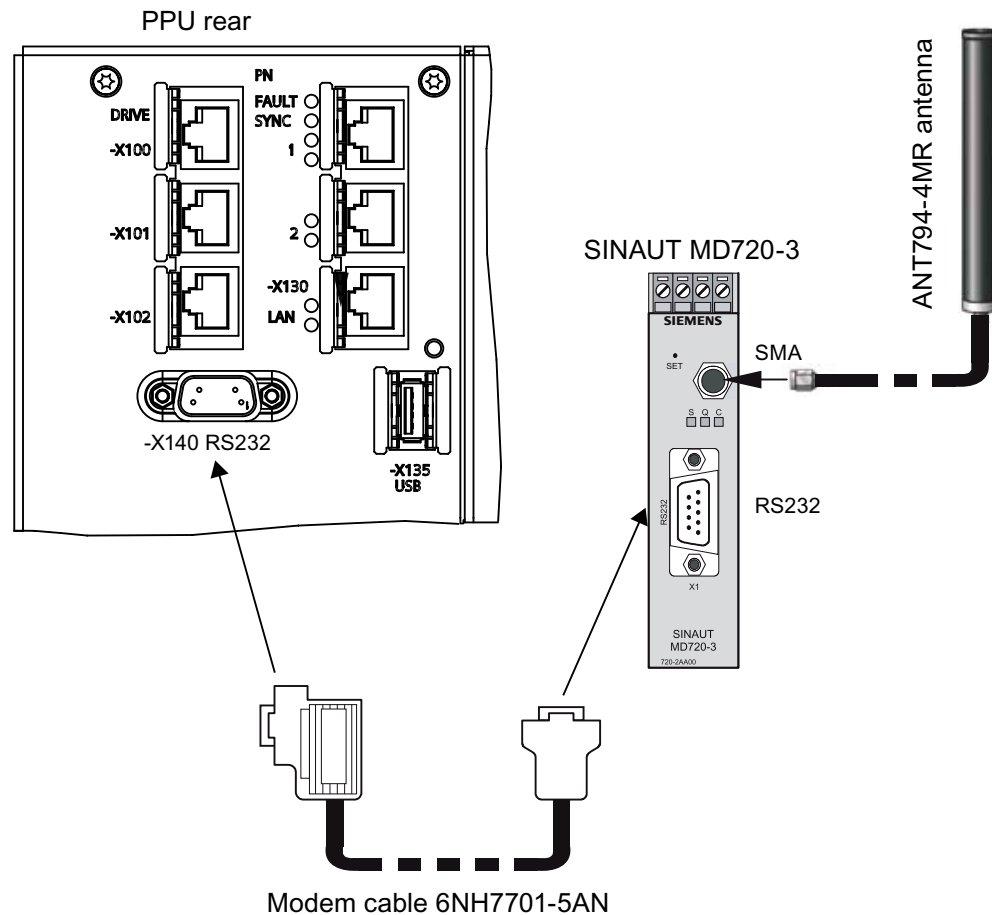


Figure 11-39 Connecting SINAUT MD720-3 to the PPU

Additional references

Further information on the GSM modem can be found in the following books included on the enclosed product CD:

- "SIMATIC NET GPRS/GSM modem SINAUT MD720-3" system manual:
 - Inserting the SIM card
 - Connecting the device and starting up
 - Service functions
- "SIMATIC NET Quad-Band GSM Antenna SINAUT 794-4MR" Operating Instructions:
 - Mounting the antenna

Appendix

A.1 Spring-Loaded Terminals/Screw Terminals

Connectable conductor cross-sections of spring-loaded terminals

Table A- 1 Spring-loaded terminals

Spring-loaded terminal type			
1	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.14 mm ² to 1.5 mm ² 0.25 mm ² to 1.5 mm ² 0.25 mm ² to 0.5 mm ²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
2	Connectable conductor cross-sections	Flexible	0.08 mm ² to 2.5 mm ²
	Insulation stripping length	8 to 9 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	

Connectable conductor cross-sections of screw terminals

Table A- 2 Screw terminals

Screw terminal type			
1	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm ² to 1.5 mm ² 0.25 mm ² to 1.5 mm ² 0.25 mm ² to 0.5 mm ²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
	Tightening torque	0.22 to 0.25 Nm	
2	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm ² to 2.5 mm ² 0.5 mm ² to 2.5 mm ² 0.5 mm ² to 1.5 mm ²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
3	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm ² to 2.5 mm ² 0.25 mm ² to 1 mm ² 0.25 mm ² to 1 mm ²
	Insulation stripping length	9 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	

Screw terminal type			
4	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm ² to 4 mm ² 0.25 mm ² to 4 mm ² 0.25 mm ² to 4 mm ²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
5	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm ² to 6 mm ² 0.5 mm ² to 6 mm ² 0.5 mm ² to 6 mm ²
	Insulation stripping length	12 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.2 to 1.5 Nm	
6	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm ² to 10 mm ² 0.5 mm ² to 10 mm ² 0.5 mm ² to 10 mm ²
	Insulation stripping length	11 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.5 to 1.8 Nm	
7	Connectable conductor cross-sections	0.5 mm ² to 16 mm ²	
	Insulation stripping length	14 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.5 to 1.7 Nm	

A.2 Abbreviations

ALM	Active Line Module
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
EUI	User Interface

EGB	Electrostatic Sensitive Devices
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic discharge: elektrostatische Entladung
GSM	Global System for Mobile Communications: Worldwide standard for wireless transmission of voice, data, fax and text messages (SMS).
HMI	Human Machine Interface: SINUMERIK operator interface for operating, programming and simulation
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
S/R	Steps per rotation
SLM	Smart Line Module
SMC	Cabinet-mounted sensor modules
SME	Sensor Module External
SRAM	Static RAM: Static memory (battery-backed)
USB	Universal Serial Bus: Bus system for connecting additional devices to a computer
VDE	Association of Electrical Engineering, Electronics and Information Technology (Germany)

A.3 Publication-specific information

A.3.1 Feedback on the documentation

This document will be continuously improved with regard to its quality and ease of use. Please help us with this task by sending your comments and suggestions for improvement via e-mail or fax to:

E-mail: <mailto:docu.motioncontrol@siemens.com>

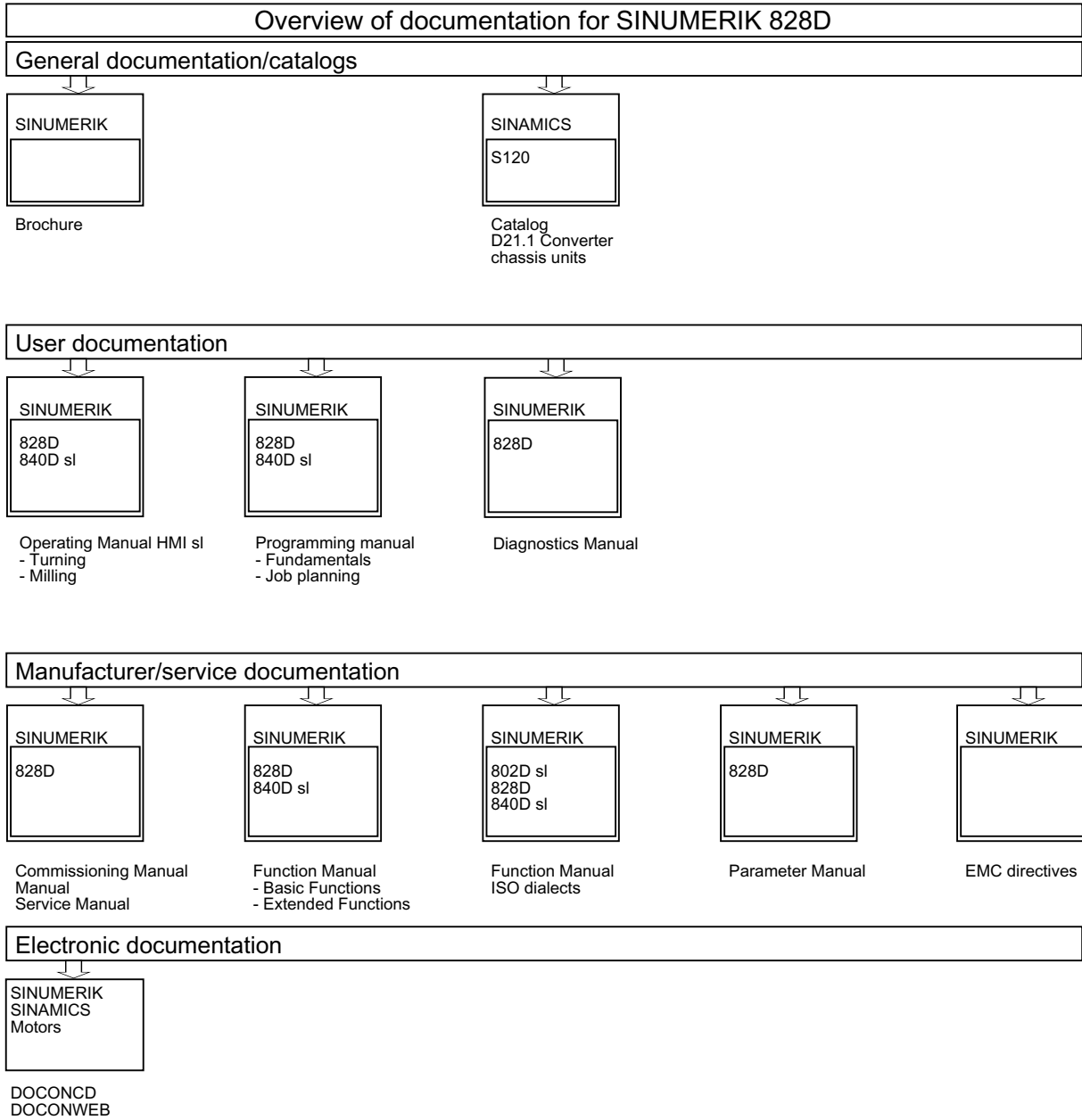
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Suggestions and/or corrections

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