SIEMENS

SINUMERIK

SINUMERIK 828D
PPU and components

Equipment Manual

Introduction 1

Fundamental safety instructions 2

System description 3

Application planning 4

Installing 5

Service and maintenance 6

Rules for permitted topologies 7

Interface description 8

Diagnosis 9

Connectable components 10

Technical data 11

Recommended connectors 12

Spare part and accessories 13

Appendix A

Valid for:
SINUMERIK 828D Smart PPU26x.5
SINUMERIK 828D PU 272.5
SINUMERIK 828D PPU 27x.5
SINUMERIK 828D PPU 290.5

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Legal information

Warning notice system

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

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

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

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

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified persons are those who, because of their training and experience, are familiar with the installation, assembly, commissioning, operation, decommissioning and disassembly of the product and can recognize risks and avoid possible hazards.

Proper use of Siemens products

Note the following:

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

Trademarks

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

Disclaimer of Liability

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

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GERMANY

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Table of contents

1 Introduction 9

1.1 About SINUMERIK 9

1.2 About this documentation 10
1.2.1 Structure, content, target group, ... 10

1.3 Documentation on the internet 11

1.4 Feedback on the technical documentation 13

1.5 mySupport documentation 14

1.6 Service and Support 15

1.7 Digital product information as QR code 17

1.8 OpenSSL 18

1.9 Compliance with the General Data Protection Regulation 19

2 Fundamental safety instructions 21

2.1 General safety instructions 21

2.2 Product damage due to electric fields or electrostatic discharge 25

2.3 Warranty and liability for application examples 26

2.4 Cybersecurity information 27

2.5 Residual risks of power drive systems 28

3 System description 31

3.1 Controller features 31

3.2 PU and PPU variants 34
3.2.1 PU Variant 34
3.2.2 PPU variants 36

3.3 Type plates 41
3.3.1 Type plates for PU 41
3.3.2 Type plate for PPU 43

3.4 SD card 44
3.4.1 SD card system 44
3.4.2 Replacing the System SD card 45
3.4.2.1 PU 45
3.4.2.2 PPU 46

3.5 Operator controls and display elements 47
3.5.1 Keyboard and monitor 47
3.5.2 Operation when wearing gloves 49
3.5.3 Operating with gestures 50

3.6 System overview 52

3.6.1 System overview for PU ... 52
3.6.2 System overview for PPU ... 56
3.7 Connectable components ... 61
4 Application planning ... 65
4.1 Secondary electrical conditions ... 65
4.1.1 Protective Separation ... 65
4.1.2 Grounding concept ... 65
4.1.2.1 Grounding concept for PU ... 65
4.1.2.2 Grounding concept for PPU ... 67
4.1.3 EMC compatibility ... 69
4.2 Climatic and mechanical environmental conditions ... 71
4.2.1 PU ... 71
4.2.1.1 Ambient conditions ... 71
4.2.1.2 Transport and Storage Conditions ... 71
4.2.1.3 Operating Conditions ... 72
4.2.2 PPU ... 73
4.2.2.1 Ambient conditions ... 73
4.2.2.2 Transport and Storage Conditions ... 74
4.2.2.3 Operating Conditions ... 74
4.3 Recycling and disposal ... 77
4.4 Cable fixing ... 78
4.4.1 Cable fixing for PU ... 78
4.4.2 Cable fixing for PPU ... 79
5 Installing ... 83
5.1 Safety notes ... 83
5.2 Installing instruction for PU ... 84
5.2.1 Dimension drawings ... 84
5.2.2 Installing the PU ... 86
5.2.3 Installation of the PU ... 89
5.2.3.1 Vertical mounting for PU ... 89
5.2.3.2 DIN-rail mounting for PU ... 91
5.3 Installing instructions for PPU ... 94
5.3.1 Dimension drawings ... 94
5.3.2 Installing the PPU ... 99
5.3.3 Installation of the PPU ... 107
6 Service and maintenance ... 111
6.1 Service position for PPU ... 111
6.2 Service and maintenance ... 116
7 Rules for permitted topologies ... 119
7.1 Topology rules for S120 Combi ... 120
7.2 Topology rules for S120 Booksize ... 122
7.3 Topology rules for Safety Integrated functions ... 126
7.4 Topology example without Safety Integrated functions ... 128

7.5 Topology example with Safety Integrated functions ... 134
7.6 Topology rules for PN drives and IOs ... 145
8 Interface description ... 147
8.1 Interface overview ... 147
8.2 Power supply ... 150
8.2.1 Requirements for the 24 V power supply ... 150
8.2.2 Connecting the power supply ... 151
8.3 Ethernet ... 153
8.4 PLC I/O Interface based on PROFINET ... 155
8.5 Digital inputs/outputs ... 157
8.5.1 Distributed I/O - X301, X302 ... 160
8.5.2 DI/DO description ... 164
8.5.3 Terminal connection diagram ... 167
8.5.4 Example: Connecting a BERO inductive proximity switch ... 171
8.5.5 Technical data ... 172
8.6 Spindle encoder interface - X60 ... 174
8.7 DRIVE-CLiQ ... 175
8.7.1 DRIVE-CLiQ interface ... 175
8.7.2 SINAMICS components ... 176
8.8 Handwheel ... 178
8.9 USB ... 180
9 Diagnosis ... 183
9.1 LED display ... 183
9.2 7-segment display (for PU) ... 185
9.3 DIAG/RESET button (for PU) ... 188
9.4 NCK rotary switch (for PU) ... 189
9.5 Error messages (for PPU) ... 190
10 Connectable components ... 193
10.1 MCP 398C ... 193
10.1.1 Description ... 193
10.1.1.1 Overview ... 193
10.1.2 DImension drawings ... 195
10.1.2.1 Dimensions for MCP 398C ... 195
10.1.3 Technical data ... 196
10.1.3.1 MCP 398C ... 196
10.2 Machine Control Panel: SINUMERIK MCP 1200U-H ... 199
10.2.1 Description ... 199
10.2.1.1 Rating plate ... 200
10.2.2 Operator controls and displays ... 201
10.2.3 Installation and mounting ... 203
10.2.3.1 Dimension drawing ... 205
10.2.4 Connecting ... 206

10.2.4.1 Rear side ... 206
10.2.4.2 Description ... 206
10.2.5 Parameter assignment ... 209
10.2.5.1 Parameterization ... 209
10.2.6 Service and maintenance ... 211
10.2.7 Technical data ... 213
10.2.7.1 MCP 1200U-H ... 213
10.2.7.2 Supplementry electrical conditions ... 215
10.2.7.3 Relevant directives and standards ... 217
10.2.7.4 Recycling and disposal ... 219
10.2.8 Safety and security ... 219
10.2.8.1 General security guidelines ... 219
10.2.8.2 Enhancing MCP safety with PLC program ... 220
10.2.9 Spare parts and accessories ... 223

10.3 Machine Control Panel: SINUMERIK MCP 1200U-V ... 225
10.3.1 Description ... 225
10.3.1.1 Rating plate ... 226
10.3.2 Operator controls and displays ... 227
10.3.2.1 Front side ... 227
10.3.3 Installation and mounting ... 229
10.3.4 Connecting ... 231
10.3.4.1 Description ... 232
10.3.5 Parameterization ... 234
10.3.6 Service and maintenance ... 236
10.3.7 Technical data ... 238
10.3.7.1 MCP 1200U-V ... 238
10.3.7.2 Supplementry electrical conditions ... 240
10.3.7.3 Relevant directives and standards ... 241
10.3.7.4 Recycling and disposal ... 244
10.3.8 Safety and security ... 244
10.3.8.1 General security guidelines ... 244
10.3.8.2 Enhancing MCP safety with PLC program ... 245
10.3.9 Spare parts and accessories ... 249
10.3.9.1 Spare parts and accessories ... 249

10.4 Machine Control Panel: SINUMERIK MCP 1500U ... 250
10.4.1 Rating plate ... 251
10.4.2 Operator controls and displays ... 252
10.4.3 Installation and mounting ... 254
10.4.4 Connecting ... 257
10.4.5 Parameterization ... 260
10.4.6 Technical data ... 262
10.4.6.1 MCP 1500U ... 262
10.4.6.2 Supplementry electrical conditions ... 265
10.4.6.3 Relevant directives and standards ... 266
10.4.6.4 Recycling and disposal ... 268
10.4.7 Safety and security ... 269
10.4.7.1 General security guidelines ... 269
10.4.7.2 Enhancing MCP safety with PLC program ... 270
10.4.8 Spare parts and accessories ... 273
10.4.8.1 Spare parts and accessories ... 273

10.5 MCP Interface PN ... 274

10.5.1 Mounting 275
10.5.2 Connection 277
10.5.3 Parameter assignment 289
10.5.4 Technical data 292

10.6 Industrial PC 293
10.6.1 SIMATIC display 293
10.6.2 Third party panel / PC 294

10.7 Electronic handwheel 295
10.7.1 Mounting 296
10.7.2 Connection 297
10.7.3 Technical specifications 298
10.7.4 Spare parts and accessories 299

10.8 PN IO devices 300
10.8.1 PP 72/48D PN and PP 72/48D 2/2A PN 300
10.8.1.1 Description 300
10.8.1.2 Assembling 304
10.8.1.3 Connecting 314
10.8.1.4 Equipotential bonding 330
10.8.1.5 Assigning parameters 331
10.8.1.6 Technical data 338
10.8.1.7 Terminal strip converter 339
10.8.2 SENTRON PAC2200 340
10.8.2.1 Technical data 340
10.8.3 PN/PN coupler 342
10.8.3.1 Principle of operation 342
10.8.3.2 Configuration 343
10.8.4 Activating and addressing components 344
10.8.4.1 Activating components 344
10.8.4.2 Addressing components 348
10.8.5 PN-IO device availability matrix 349

10.9 SITOP power supply 350

10.10 NX10.3 / NX15.3 351
10.10.1 Description 351
10.10.2 Mounting 353
10.10.3 Connecting 355
10.10.4 Technical Data 359

10.11 Mini handheld unit 360
10.11.1 Operator controls 361
10.11.2 Mounting 362
10.11.3 Connecting 366
10.11.4 Parameterization 368
10.11.5 Technical data 369
10.11.6 Spare parts and accessories 371

11 Technical data 373

11.1 Technical Data 373

12 Recommended connectors 379
13 Spare part and accessories 381
13.1 Ordering data 381
A Appendix 383
A.1 Abbreviations 383
Index 385

1 Introduction

1.1 About SINUMERIK

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

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

1.2 About this documentation

1.2.1 Structure, content, target group, ...

About SINUMERIK

From basic standard machines to modular premium machines, SINUMERIK CNC controls offer the optimum solution for every machine concept. SINUMERIK is the highly productive automation solution for all production areas:

- Production of individual parts or mass production
- Simple or complex workpieces
- Prototype production
- Tool and mold making
- Large series production

More information is available on the SINUMERIK (https://www.siemens.com/sinumerik) website.

Target group

This documentation addresses qualified persons in the areas of planning, engineering and commissioning, and enables the target group to professionally commission the system: Drive commissioning, tuning of the machine and archiving.

Standard scope

This documentation only describes the functionality of the standard version. The standard scope may deviate from the functionality of the system supplied. Please refer to the ordering documentation only for the functionality of the supplied drive system.

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

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

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

Web pages of third-party companies

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

1.3 Documentation on the internet

Industry Online Support Siemens (SiePortal)

The complete documentation is available under the documentation overview SINUMERIK 828D (https://support.industry.siemens.com/cs/document/109766724).



SINUMERIK 828D

Function Manual	Basic functions (https://support.industry.siemens.com/cs/ww/en/view/109803078)
Function Manual	Monitoring and compensating (https://support.industry.siemens.com/cs/ww/en/view/109803079)
Function Manual	Axes and spindles (https://support.industry.siemens.com/cs/ww/en/view/109803125)
Function Manual	PLC (https://support.industry.siemens.com/cs/ww/en/view/109803073)
Function Manual	Technologies (https://support.industry.siemens.com/cs/ww/en/view/109766724)
Function Manual	Transformations (https://support.industry.siemens.com/cs/ww/en/view/109803075)
Function Manual	Tools (https://support.industry.siemens.com/cs/ww/en/view/109803037)
Function Manual	Tool management (https://support.industry.siemens.com/cs/ww/en/view/109803122)
Function Manual	Synchronized actions (https://support.industry.siemens.com/cs/ww/en/view/109803076)
Function Manual	Safety Integrated (https://support.industry.siemens.com/cs/ww/en/view/109823268)
Function Manual	ISO dialects (https://support.industry.siemens.com/cs/ww/en/view/109801254)
List Manual	Machine data (https://support.industry.siemens.com/cs/ww/en/view/109803036)
List Manual	Parameter description (https://support.industry.siemens.com/cs/ww/en/view/109803042) SINAMICS S120 for SINUMERIK 828D
Programming Manual	Easy XML (https://support.industry.siemens.com/cs/ww/en/view/109803119)
Commissioning Manual	SINUMERIK Operate /PCU Modular (https://support.industry.siemens.com/cs/ww/en/view/109974255/en)

Commissioning Manual	PCU Base Software /IPC (https://support.industry.siemens.com/cs/ww/en/view/109974252/en) (PCU Base for IPC Version 15 or higher)
Commissioning Manual	SINUMERIK 828D CNC commissioning (https://support.industry.siemens.com/cs/document/109820804/)
SINAMICS S120	
Function Manual	Drive functions (https://support.industry.siemens.com/cs/ww/en/view/109781535)
Equipment Manual	Combi (https://support.industry.siemens.com/cs/ww/en/view/109800046)
Equipment Manual	Booksize power units (https://support.industry.siemens.com/cs/ww/en/view/109781351)

See also

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

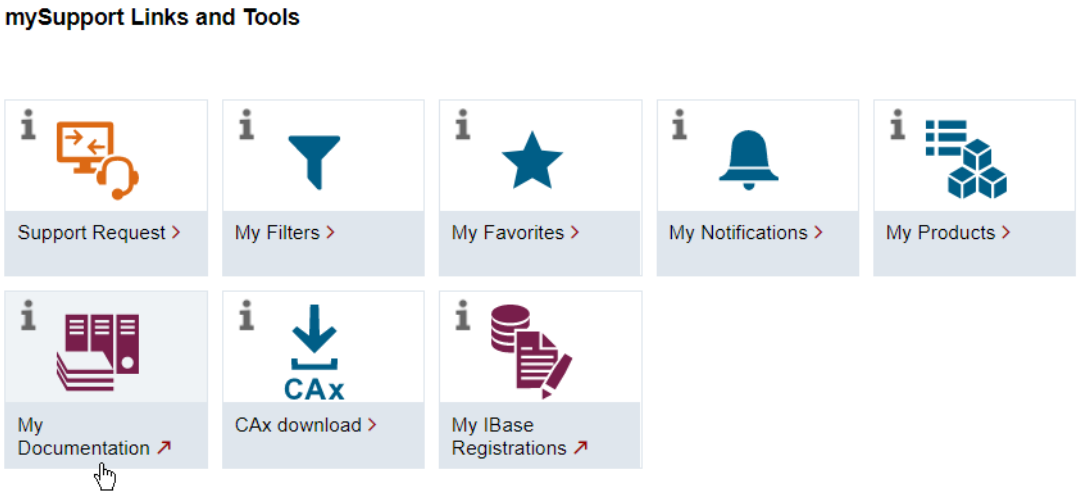
1.4 Feedback on the technical documentation

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

1.5 mySupport documentation

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

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



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

Note

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

1.6 Service and Support

Product support

You can find more information about products on the internet:

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

The following is provided at this address:

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

Technical support

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

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

Training

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

Siemens support on the go



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

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

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

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

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

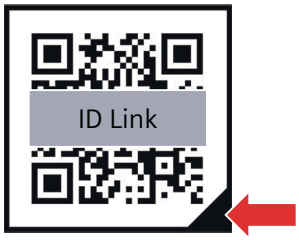
1.7 Digital product information as QR code

Digital product information as QR code

The ID link according to IEC 61406 provides you with digital information about your product.

The ID link is a globally unique identifier and is located as a QR code on the product and the product packaging.

You can recognize the ID link by the frame with a black corner at the bottom right.



In addition to the digital nameplate you will find the following product information:

- Technical specifications
- FAQs
- Manuals
- Certificates
- Product announcements
- Application examples

1.8 OpenSSL

Using OpenSSL

This product can contain the following software:

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

You can find more information on the internet:

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

1.9 Compliance with the General Data Protection Regulation

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

For this product, this means:

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

Fundamental safety instructions

2

2.1 General safety instructions



⚠ WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

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

Generally, the following steps apply when establishing safety:

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

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



⚠ WARNING

Electric shock due to connection to an unsuitable power supply

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

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



⚠ WARNING

Electric shock from a damaged product

Improper handling can damage the product. If a product is damaged, hazardous voltages may be present on the housing or exposed components, which can result in serious injury or death if touched.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Never use a damaged product.



⚠ WARNING

Electric shock due to unconnected cable shields

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

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



⚠ WARNING

Electric shock in the absence of grounding

For products with protection class I, a faulty protective conductor connection means that the product is not grounded in conformance with the applicable regulations. In the absence of grounding, high voltages may be present in open, exposed parts, which can result in serious injury or death if touched.

- Ground the product in conformance with the applicable regulations.

NOTICE

Product damage caused by an unsuitable screw-tightening tool

Unsuitable screw-tightening tools or tightening methods can damage the product screws.

- Use a screw-tightening tool that fits the screw head exactly.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.
- Regularly calibrate the screw-tightening tool used.

⚠ CAUTION

Symptomatic respiratory and skin reaction to chemicals

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

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

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

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

⚠ WARNING

Unexpected machine motion caused by radio devices or cell phones

Radio devices, cell phones, or mobile WLAN devices in the immediate vicinity of the product can cause the product to malfunction or damage the product. The malfunction may impair the functional safety of machines and can therefore endanger persons or result in material damage.

- Avoid operating radio devices, cell phones, and mobile WLAN devices in the direct vicinity of converters and operating units.
- Scan the machine readable code, e.g. a QR code at least 0.4 m away from the converter, or switch off the converter power supply before scanning.
- Only operate built-in devices with the control cabinet doors closed.
- When the control cabinet doors are open, only qualified personnel may perform service and maintenance work.

⚠ WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause the product to overheat and result in fire and smoke. A fire with smoke development can result in serious injury or death. Overheating increases the probability of failure and shortens product service life.

- Observe the minimum distances specified for the product as ventilation clearances.

NOTICE

Overheating due to inadmissible mounting position

The product can overheat and therefore be damaged if mounted in an incorrect position.

- Only operate the product in approved mounting positions.

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

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

2.2 Product damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESDs) are electronic devices, modules, or individual components with freely accessible contacts, e.g. products with signal and communication interfaces or modules without an enclosed housing, which can be damaged by electrostatic fields or electrostatic discharges.



NOTICE

Product damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can damage individual electronic components, integrated circuits, and modules. A pre-damaged or damaged product causes malfunctions, which in turn increase the probability of failure and a shortened service life.

- Only pack, store, transport, and ship individual electronic components, modules, or products in their original packaging or in other suitable materials, e.g. conductive ESD foam or aluminum foil.
- When you open the product, e.g. to replace a component or a module, or if you touch electrical contacts, then ground yourself using one of the following measures:
  - Wear an ESD armband
  - Wear ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic modules or individual components on a conductive surface, e.g. on an ESD surface, on ESD foam, on an ESD packaging bag, or an ESD transport container.

2.3 Warranty and liability for application examples

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

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

2.4 Cybersecurity information

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

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

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

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

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

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

Further information is provided on the Internet:

Configuration Manual Industrial Cybersecurity (https://support.industry.siemens.com/cs/ww/en/view/109975311)

⚠ WARNING

Unsafe operating states resulting from software manipulation

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

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

2.5 Residual risks of power drive systems

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

1. Unintentional movements of driven machine or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware faults and/or software errors in the sensors, control system, actuators, and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures inside and outside the components, including open flames, as well as emissions of light, noise, particles, gases, etc. due to fault conditions, e.g.:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
   - Short circuits or ground faults in the intermediate DC circuit of the converter
3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly

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

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

System description

3

3.1 Controller features

Control variants

SINUMERIK 828D is available in the following hardware variants:

- PPU 260.5 (processing unit with vertical operator panel)
- PPU 261.5 (processing unit with horizontal operator panel)
- PU 272.5 (standalone processing unit)
- PPU 270.5 (processing unit with vertical operator panel)
- PPU 271.5 (processing unit with horizontal operator panel)
- PPU 290.5 (processing unit with vertical operator panel and touch screen)

Validity

The following description applies to the following components:

Designation	Article number
SINUMERIK 828D Smart PPU 260.5	6FC5370-3AA50-0AA0
SINUMERIK 828D Smart PPU 261.5	6FC5370-2AA50-0AA0
SINUMERIK 828D PU 272.5	6FC5370-7AA50-0AA0
SINUMERIK 828D PPU 270.5	6FC5370-6AA50-0AA0
SINUMERIK 828D PPU 271.5	6FC5370-5AA50-0AA0
SINUMERIK 828D PPU 290.5	6FC5370-8AA50-0BA0

Features

SINUMERIK 828 is a customized CNC solution for machine positioning system with mold employing different technologies in the medium performance range.

SINUMERIK 828 PPU is a CNC (processing unit). A CNC, PLC, and axis control (PPU 27x.5 and PPU 290.5) for six drives (standard) in a single unit. This design provides a high degree of robustness by eliminating the need for hardware interfaces between the CNC electronics module and the operator panel. In order to guarantee that operation is as low-maintenance as possible, the SINUMERIK 828 PPU has no wearing parts such as fans or back-up batteries.

- Operator panel CNC with system software versions for turning, milling and grinding
- Integrated full QWERTY CNC keyboard with mechanical short-stroke keys for PPU 260.5, PPU 270.5 and PPU 290.5. This enables the user to enter text for part-program names or tool identifiers and plain-text language commands directly, without using the keys of the second input level (shift key).

- ONG keyboard with mechanical short-stroke keys for PPU261.5 and PPU 271.5.
- The keys have IP65 degree of protection
- Two external USB 3.1 and two external USB 2.0 ports for PPU27x.5 and PPU290.5. Three external USB 2.0 ports for PPU26x.5
- Ethernet interfaces for connecting to the company network
  - Ethernet port for Service (X127) and factory network (X130)
  - Ethernet port for machine network (X120) available for PPU27x.5 and PPU290.5
- PLC I/O interface based on PROFINET for the connection of PLC I/O devices and an MCP
- PP 72/48D PN and PP 72/48D 2/2A PN as PLC I/O module
- Integrated PLC based on the SIMATIC S7-200 command set with ladder logic programming
- Support for up to 8 axes or spindles for milling and up to 10 axes or spindles for turning and grinding with the PPU 27x.5, and PPU 290.5.
- Two auxiliary axes via PROFINET with software 26x and 28x.
- A total of 2 handwheels can be connected: Two handwheels can be directly connected to the PPU.
- Sentron PAC connection possible for energy management (Ctrl+E).
- 4 operator panel variants for horizontal and vertical operator panel housings

Quantity structure for CNC-Software version 5.25

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

Function	Software 24x						Software 26x			Software 28x		
	PPU26x.5			PPU.5/PU.5			PPU.5/PU.5			PPU.5/PU.5		
	Grinding	Turning	Milling	Grind-ing	Turning	Mill-ing	Grinding	Turning	Mill-ing	Grinding	Turning	Milling
Non-volatile memory * (NVRAM): For OEM data	512 kB			512 kB			512 kB			512 kB		
Non-volatile memory * (NVRAM): For user data	3 MB			3 MB			5 MB			10 MB		
Maximum number of channels	1			2			2			4		
Maximum number of working - channels	1			1			1			2		
Maximum number of handling - channels	--			1			1			2		

Function	Software 24x						Software 26x			Software 28x		
	PPU26x.5			PPU.5/PU.5			PPU.5/PU.5			PPU.5/PU.5		
	Grinding	Turning	Milling	Grinding	Turning	Milling	Grinding	Turning	Milling	Grinding	Turning	Milling
Maximum axes in system (including axes/spindles in machining channel + axes in handling axes + PLC positioning axes)	5 (S200 drive + 1FL2 motor)			8			11			18		16
Maximum number of axes with drive-based Safety Integrated	5			5			6			12		10
Maximum number of axes/spindles + PLC positioning axis	5			5			6+2			10+2		8+2
Maximum number of axes in handling channel(s)	--			4			4			4+4		
Additional auxiliary axes via PROFINET	--			--			2			2		
Number of Numeric Control Extensions with NX10.3	--			1			2			2		
Number of Numeric Control Extensions with NX15.3	--			1			1			2		
Number of DRIVE-CLiQ interfaces	--			3			3			3		
Maximum number of I/O modules (PP 72/48D PN or PP 72/48D 2/2 A PN)	1			3			5	4		5		

*) The data on the memory (NVRAM) depends on the software use

NOTICE

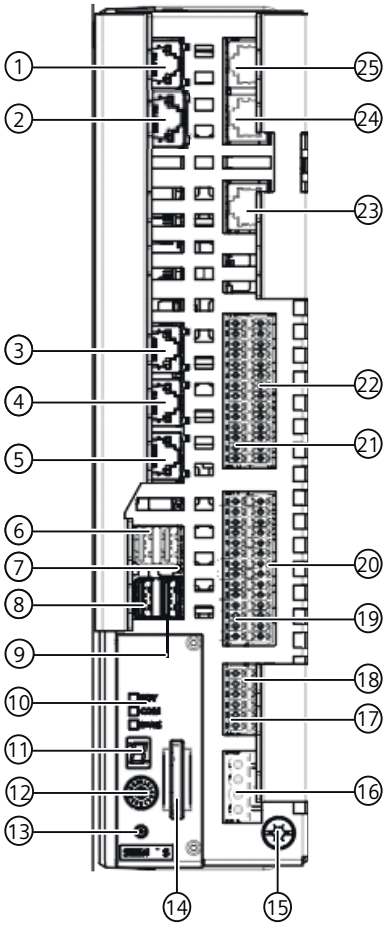
Compatibility for PPU 26x.5

Only Software Version 24.x is supported on PPU26x.5.

3.2 PU and PPU variants

3.2.1 PU Variant

Front of the PU



1	X150P1	PLC I/O interface
2	X150P2	PLC I/O interface
3	X120	LAN interface
4	X130	LAN interface
5	X127	LAN interface
6	X145	USB 2.0
7	X155	USB 2.0
8	X125	USB 3.1
9	X135	USB 3.1
10		LED display
11		7-segment display

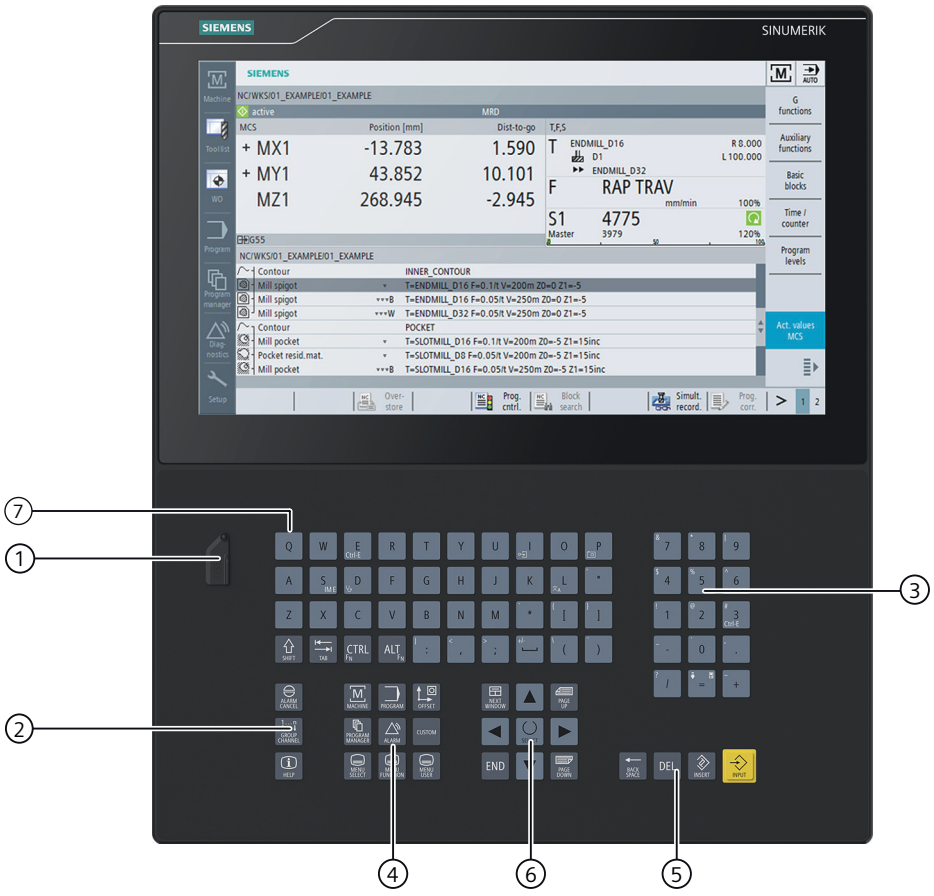
12		NCK switch
13		DIAG/RESET button
14	X110	SD card slot
15		PE screw M5 x 12 screws, Torx25/Slot, tighting torque 3 Nm
16	X1	Power supply 4 pin
17	X143.1	Handwheel interface
18	X143.2	Handwheel interface
19	X242	NC I/O
20	X252	NC I/O
21	X122	Drive I/O
22	X132	Drive I/O
23	X102	Drive-CLiQ interface
24	X101	Drive-CLiQ interface
25	X100	Drive-CLiQ interface

Figure 3-1 Interfaces at the front of PU

3.2.2 PPU variants

Front of the PPU 290.5

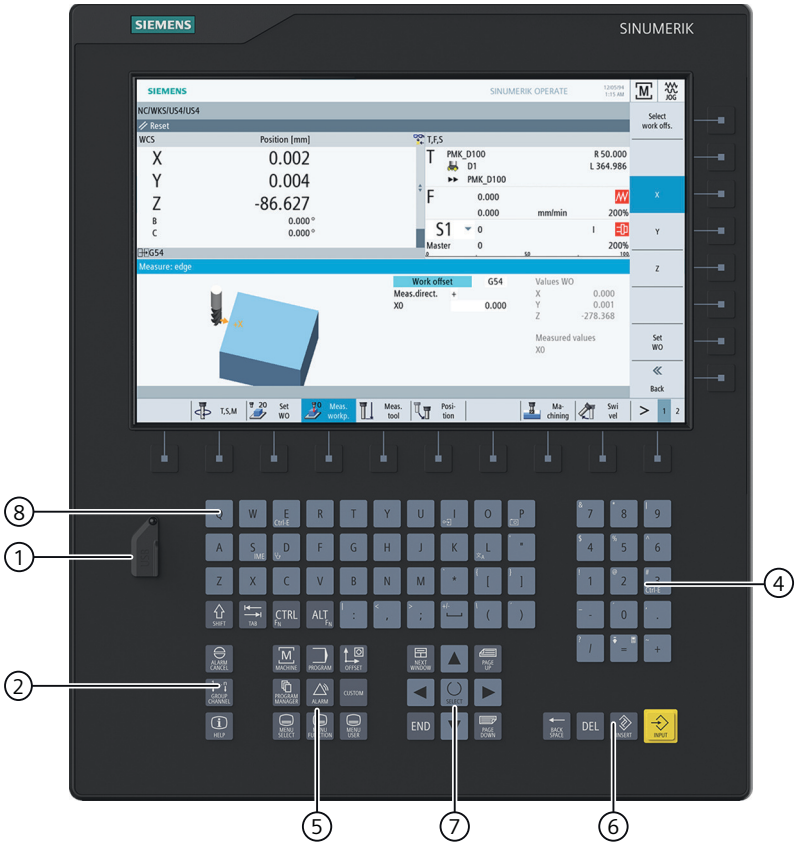
PPU 290.5 (processing unit with vertical operator panel and touch screen)



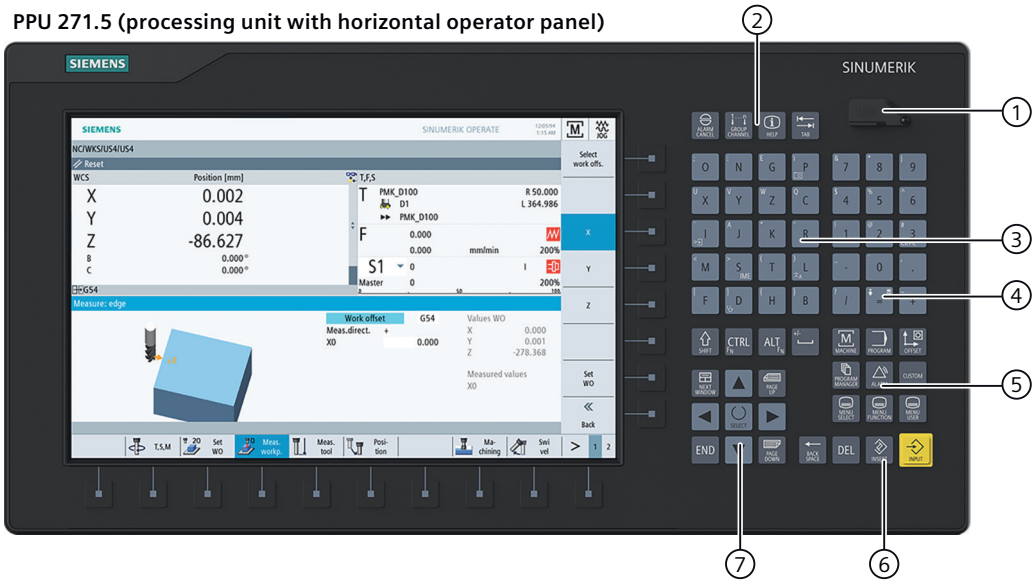
1 USB Interface - X125
2 & 5 Control keys
3 Numerical keys
4 Keys to quickly select the operating area
6 Cursor keypad
7 QWERTY keyboard

Front of the PPU 27x.5

PPU 270.5 (processing unit with vertical operator panel)



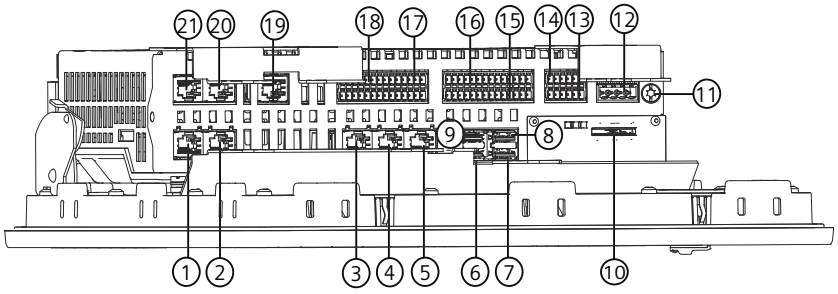
PPU 271.5 (processing unit with horizontal operator panel)



1	USB Interface - X125
2 & 6	Control keys

3	ONG keyboard
4	Numerical keys
5	Keys to quickly select the operating area
7	Cursor keypad
8	QWERTY keyboard

Rear of the PPU 27x.5 and PPU 290.5

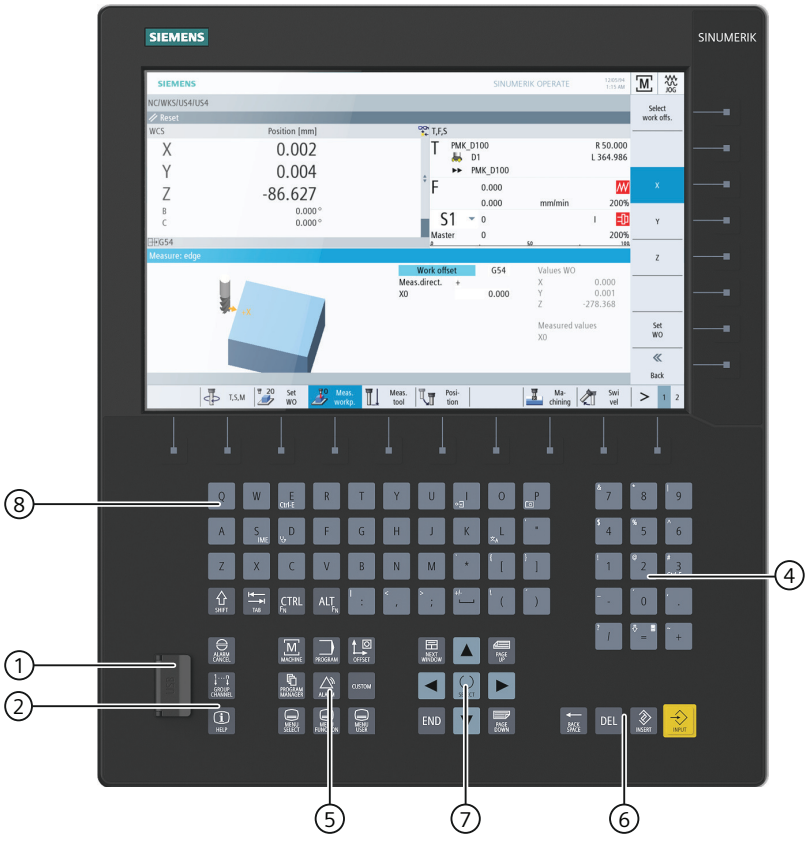


1	X150P1	PLC I/O interface
2	X150P2	PLC I/O interface
3	X120	LAN interface
4	X130	LAN interface
5	X127	LAN interface
6	X145	USB 2.0
7	X125	USB 3.1
8	X135	USB 3.1
9	X155	USB 2.0
10	X110	SD card slot (push)
11		PE screw M5 x 12, Torx25/Slot, tightening torque 3 Nm
12	X1	Power supply 4 pin
13	X143.1	Handwheel interface
14	X143.2	Handwheel interface
15	X242	NC I/O
16	X252	NC I/O
17	X122	Drive I/O
18	X132	Drive I/O
19	X102	Drive-CLiQ interface
20	X101	Drive-CLiQ interface
21	X100	Drive-CLiQ interface

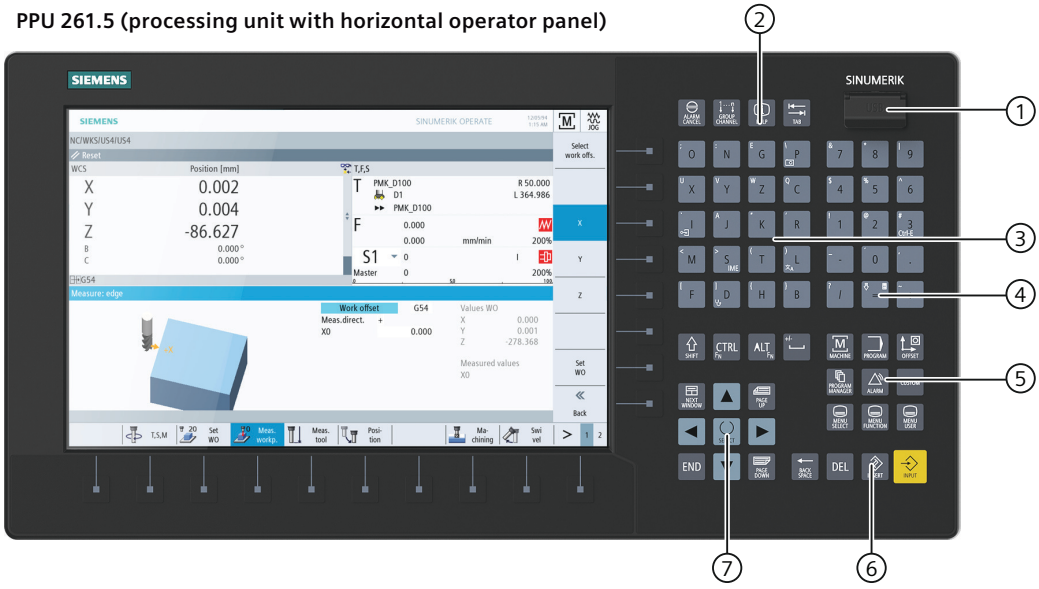
Figure 3-2 Interfaces at the rear of the PPU 27x.5 and PPU 290.5

Front of the PPU 26x.5

PPU 260.5 (processing unit with vertical operator panel)



PPU 261.5 (processing unit with horizontal operator panel)

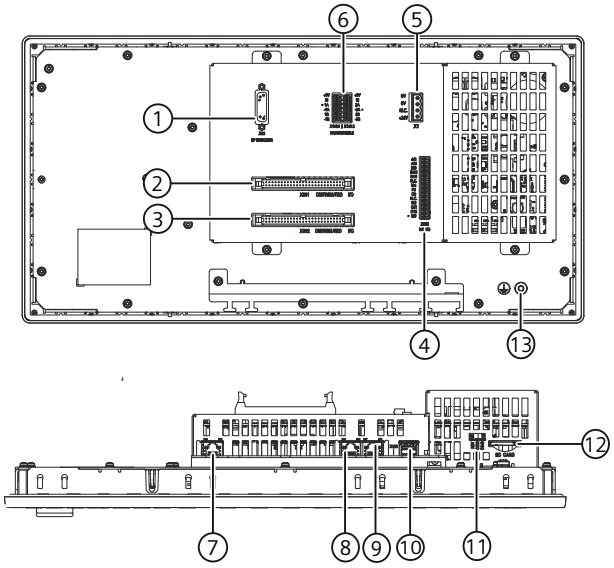


1 USB Interface - X125

2 & 6 Control keys

3	ONG keyboard
4	Numerical keys
5	Keys to quickly select the operating area
7	Cursor keypad
8	QWERTY keyboard

Rear of the PPU 26x.5



1	X60	Encoder
2	X301	Distributed I/O
3	X302	Distributed I/O
4	X252	NC I/O
5	X1	Power supply 4 pin
6	X143.1 / X143.2	Handwheel interfaces
7	X150	PLC I/O interface
8	X130	LAN interface
9	X127	LAN interface
10	X145/X155	USB 2.0
11		SD card slot
12		LED display
13		PE screw M5 x 12, Torx25/Slot, tightening torque 3 Nm

Figure 3-3 Interfaces at the rear of the PPU 26x.5

3.3 Type plates

3.3.1 Type plates for PU

Type plates

You can locate the PU type plate on the side of the electronic box. All the information required to clearly identify the PU is available on the type plate.

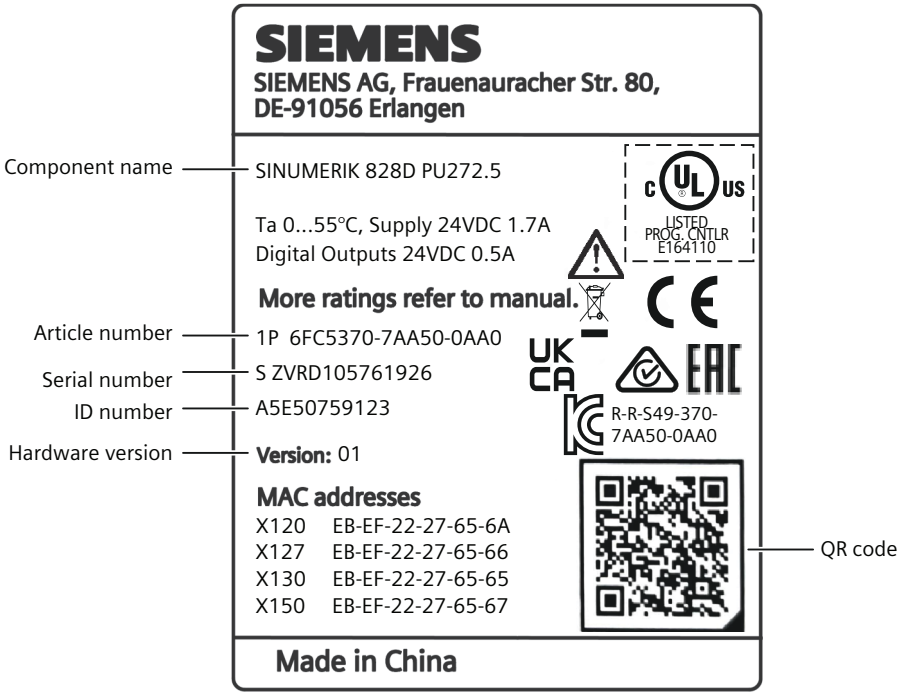


Figure 3-4 PU type plate

The contents of the individual type plate sections on the current control might differ from those described in this manual, for example, updated product status, approvals, and identifications not yet issued.

Note

MAC addresses

The MAC addresses printed on the type plate of the PU are required for configuring the PLC I/O interface communications networks based on PROFINET and Industrial ethernet. There is a similar situation for the MCP and the I/O modules.

Type plate at the front

You can find this type plate at the front of the electronic box.



Figure 3-5 Type plate at the front

The QR code contains information about the MLFB, FID, FS, product name and the MAC addresses of X150, X120, X130 and X127.

3.3.2 Type plate for PPU

Type plate

You can locate the PPU type plate on the backside of the electronic box. All the information required to clearly identify the PPU is available on the type plate.

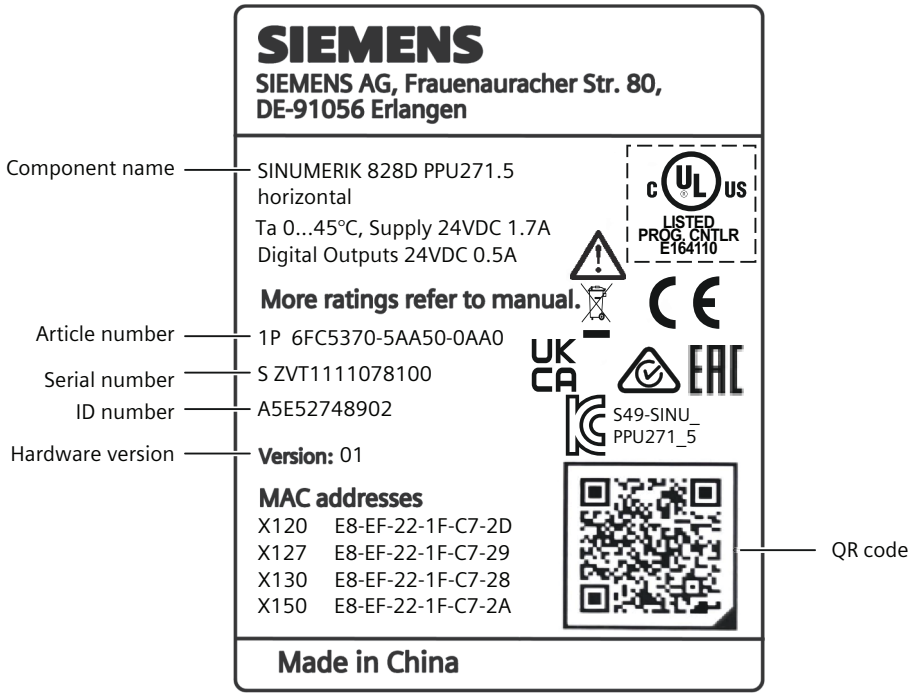


Figure 3-6 Example: Horizontal PPU type plate

The contents of the individual type plate sections on the current control might differ from those described in this manual, for example, updated product status, approvals, and identifications not yet issued.

Note

MAC addresses

The MAC addresses printed on the type plate of the PPU are required for configuring the PLC I/O interface communications networks based on PROFINET and Industrial ethernet. There is a similar situation for the MCP and the I/O modules.

The QR code contains information about the MLFB, FID, FS, product name and the MAC addresses of X150, X120, X130 and X127.

3.4 SD card

3.4.1 SD card system

Overview

The PU/PPU has one slot for SD card:

- You can locate the slot for the SD card at the connector area of the electronic box.

SD card with system software

The system SD card is essential for the operation of the PU/PPU.

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

- Version information (serial number, version, type designation)
- License key: Allows moving the SD card to another PU/PPU without changing the licenses.

Note the following when you use a system SD card:

- Do not remove the memory card during operation. Removing the memory card while accessing can lead to damage of the memory card and the SINUMERIK as well as the data on the 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.

Note

- When you're updating the technology or performance class license, if the read in SD card is for a license with a changed performance class or technology, the PU/PPU displays an unchanged license.
- To show the right license, restart the HMI manually.
- When you replace the SD card and the WinHMI restarts for relicensing (which only occurs when the SD card is replaced) should not result in changes to the software.

NOTICE
SD card system • The SD card always comes formatted. **You must not reformat it under any circumstances.** • To ensure that the system SD card functions properly, you must not re-partition the card. • In the event of a defect, replace the system software card. For information about restoring your system, use an empty SD card, refer to the Commisioning Manual.

3.4.2 Replacing the System SD card

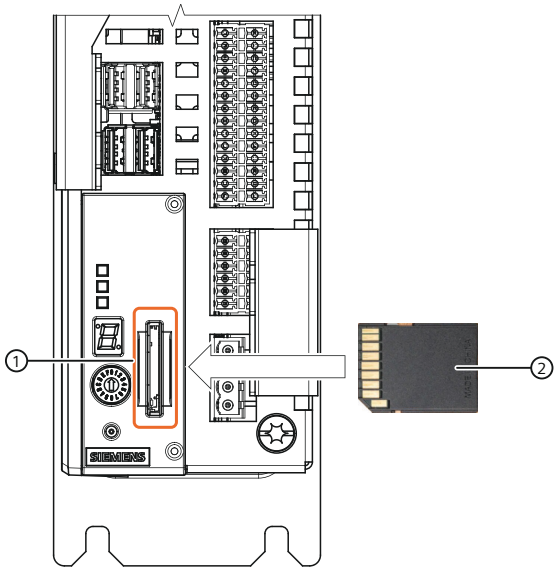
3.4.2.1 PU

Replacing the system SD card

⚠ CAUTION
Electrostatic Device (ESD) Before you touch SD card, discharge yourself at the cabinet or at the ground terminal. The SD card may only be inserted or removed when the control unit is disconnected from the power supply.

Procedure:

1. Switch off the power supply.
2. Pull out the SD card sideways
3. Gently insert the new SD card into slot until it clicks into place. The SD card has an edge on the opposite side to the pins. This edge must always be on the top when inserting the card.



1 SD card slot on PU
2 SD card

4. Switch the power supply on again.

NOTICE
Plugging in the SD card Please ensure that the SD card is inserted with care. Otherwise, the card may be damaged.

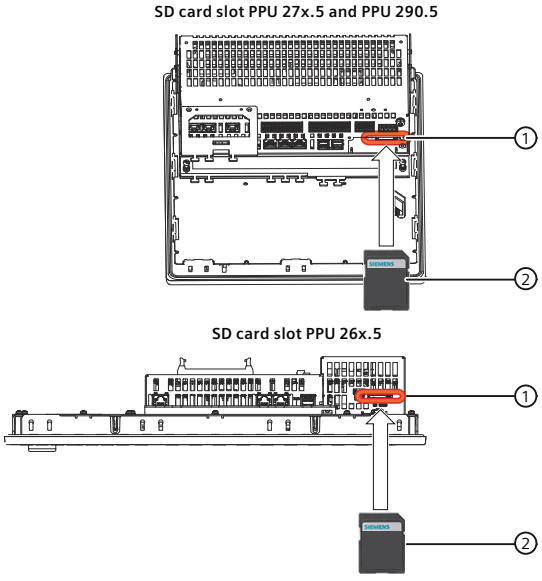
3.4.2.2 PPU

Replacing the system SD card

⚠ CAUTION
Electrostatic Device (ESD) Before you touch SD card, discharge yourself at the cabinet or at the ground terminal. The SD card may only be inserted or removed when the control unit is disconnected from the power supply.

Procedure:

1. Switch off the power supply.
2. Gently push the SD card to remove it.
3. Gently insert the new SD card into slot and push until it clicks into the place. See orientation of the card in the figure below.



1 SD card slot on PPU (push)
2 SD card

4. Switch the power supply on again.

NOTICE
Plugging in the SD card Please ensure that the SD card is inserted with care. Otherwise, the card may be damaged.

3.5 Operator controls and display elements

3.5.1 Keyboard and monitor

Keys on the PPU

The following keys are located on the operator panel front:

- The alphabetic key group contains the letters A ... Z and the space character for entering text.
- The numeric key group contains the digits 0 - 9, arithmetic/special characters and the decimal point for entering numeric characters and operators.
- The control key group includes special functions.
- The area changeover displays the operating areas.
- The menu forward key changes to the expansion of the horizontal soft key bar in the same menu.
- The menu back key returns to the higher-level menu.
- The machine area key switches directly into the "Machine" operating area.
- The cursor key group is used to navigate on the screen.

Key combinations (shortcut keys) on an external keyboard

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

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

Key	Key combination	Key	Key combination
	F10		SHIFT + F10
	F2		F5
	F3		CTRL + F10
	F4		SHIFT + CTRL + F10
Caps Lock function on panel processing unit	Use the keyboard shortcut <SHIFT> + <=> to switch between lowercase and uppercase letters.		

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

Softkeys

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

Color display

The TFT color display has a diagonal width of 12.1" with a resolution of 1280 x 800 pixels. The touch display has a diagonal width of 15.6" with a resolution of 1920 x 1080 pixels

For additional technical data, see: AUTOHOTSPOT

3.5.2 Operation when wearing gloves

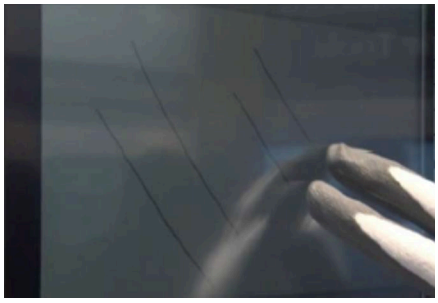
Recommended gloves

The following gloves are recommended when using the PPU 290.5

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

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

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



Note

Operating with thicker gloves

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

3.5.3 Operating with gestures

Finger gestures to operate the touch display



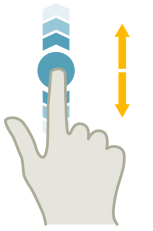
Tap

- Select window
- Select an object
- Activate entry field



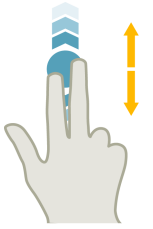
Tapping and holding

- Open object to be changed



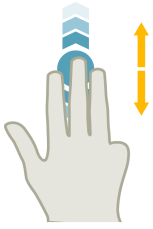
Vertical swipe with 1 finger (flick)

- Scrolling in lists
- Scrolling in files



Vertical swipe with 2 fingers (flick)

- Laterally scrolling in lists
- Laterally scrolling in files



Vertical swipe with 3 fingers (flick)

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

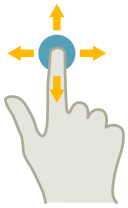
Note:

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



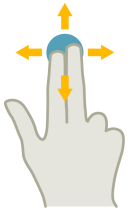
Horizontal swipe with 1 finger (flick)

- Scrolling in lists with lots of columns



Pan with 1 finger

- Moving content of graphics
- Moving content of lists



Pan with 2 fingers

- Rotating content of graphics



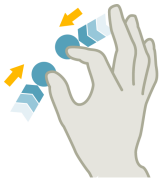
Tap with 2 fingers

- Calling a context menu



Spread

- Increasing the size of the content of graphics



Pinch

- Decreasing the size of the content of graphics

3.6 System overview

3.6.1 System overview for PU

Configuration with IPC, HT10 option, and optional Edge box

The following configuration shows a typical example with IPC, HT10 option, and optional Edge box:

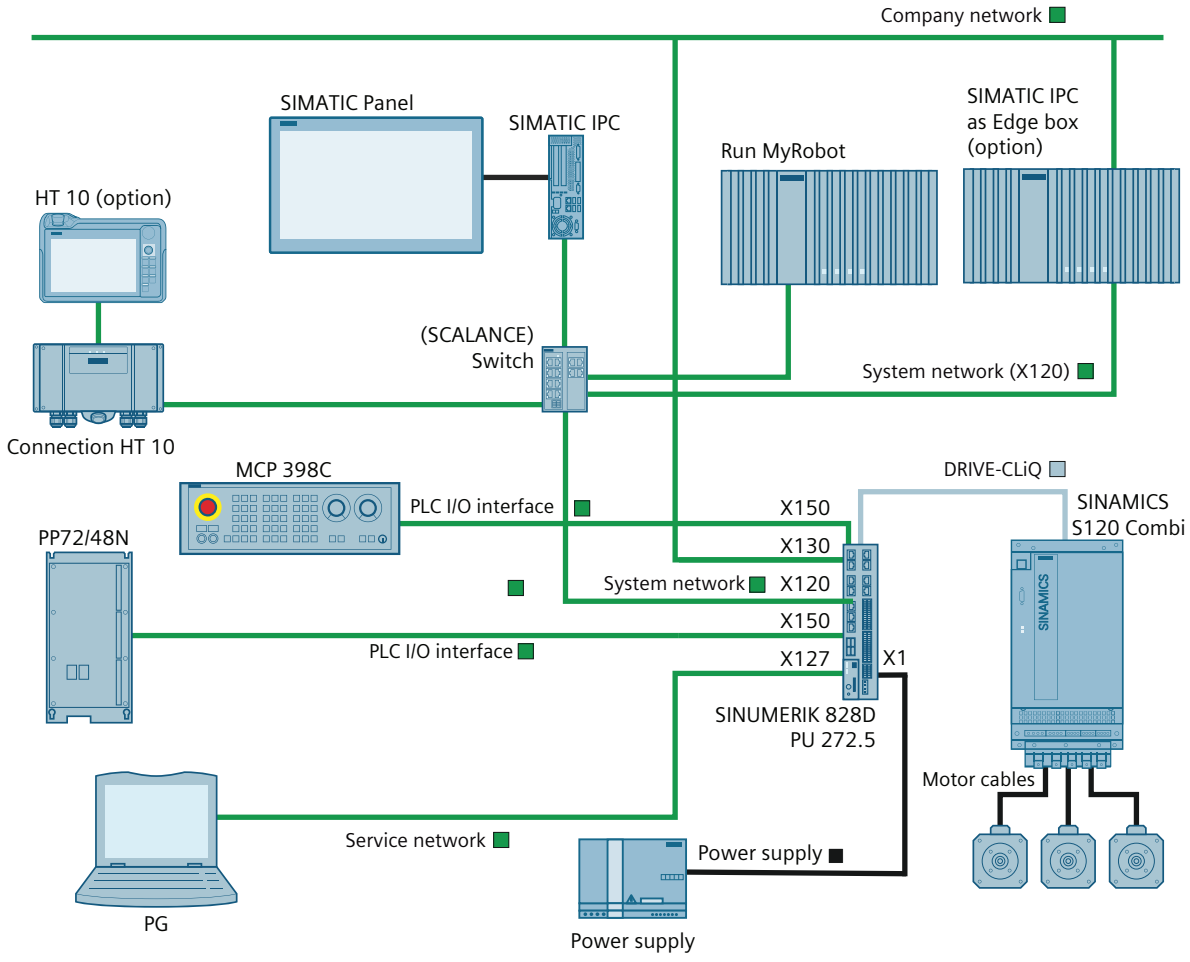


Figure 3-7 Configuration with IPC, HT10 option, and optional edge box

Configuration with three axes (basic configuration)

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

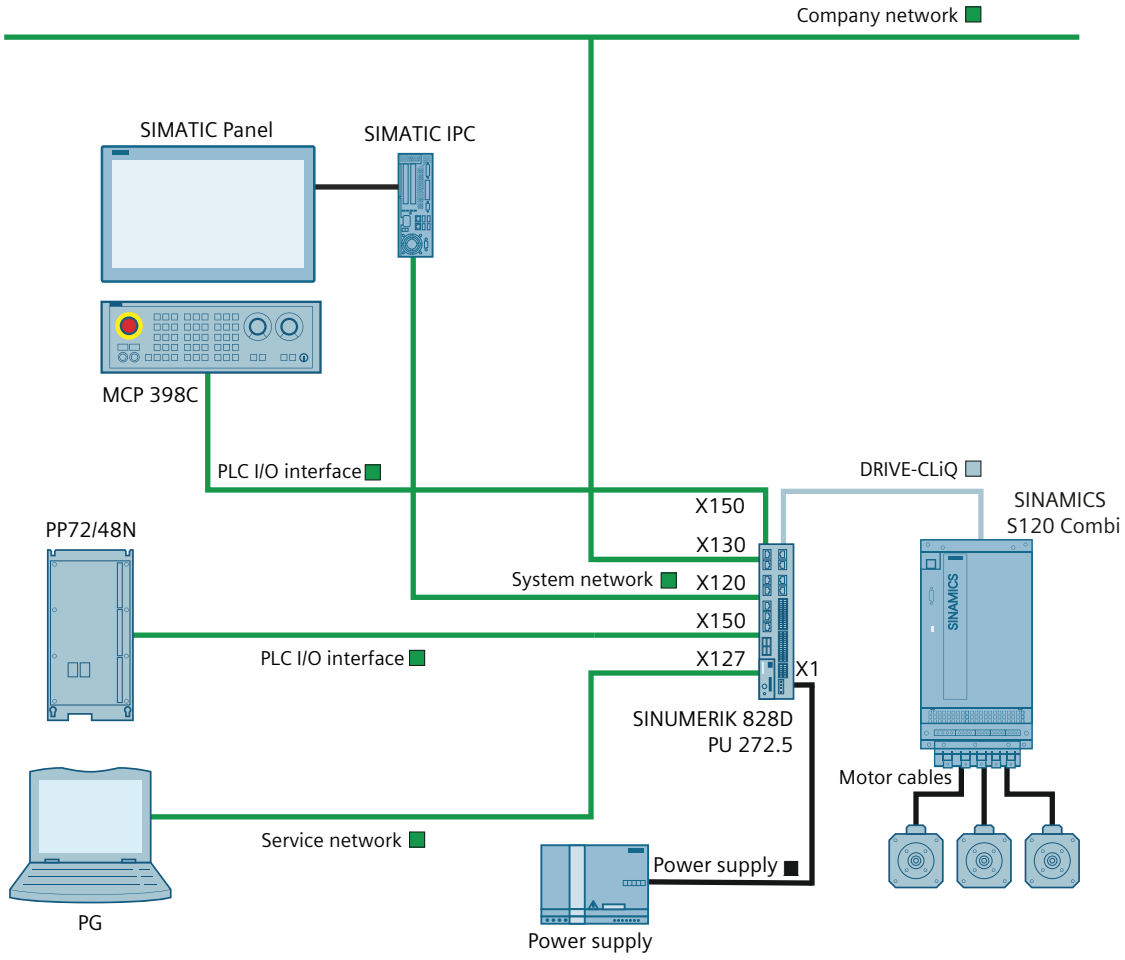


Figure 3-8 Configuration example 1: Basic configuration with three axes

Configuration with 4 axes and 2 auxiliary axes

The following configuration shows an example with 2 auxiliary axes:

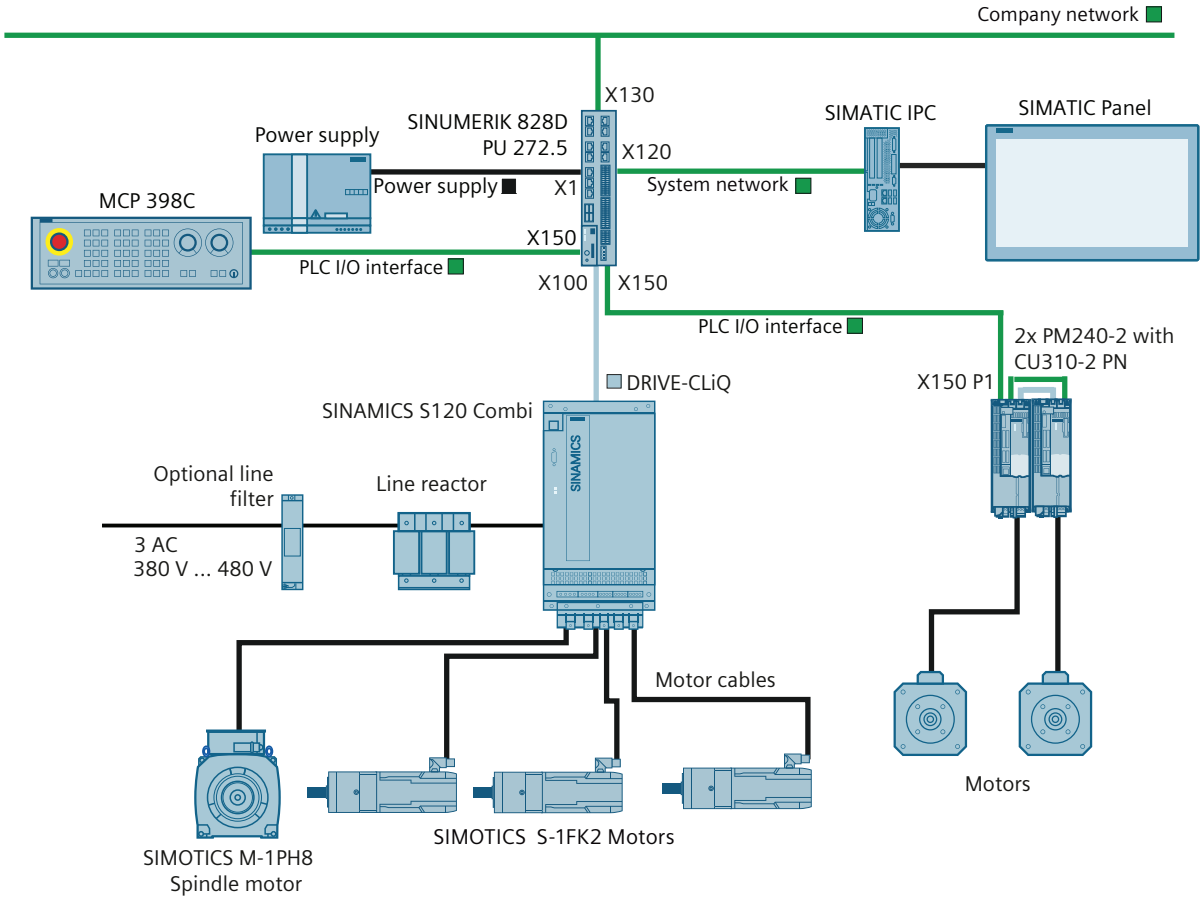


Figure 3-9 Configuration example 2: Basic expansion stage with 4 axes and 2 auxiliary axes

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

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

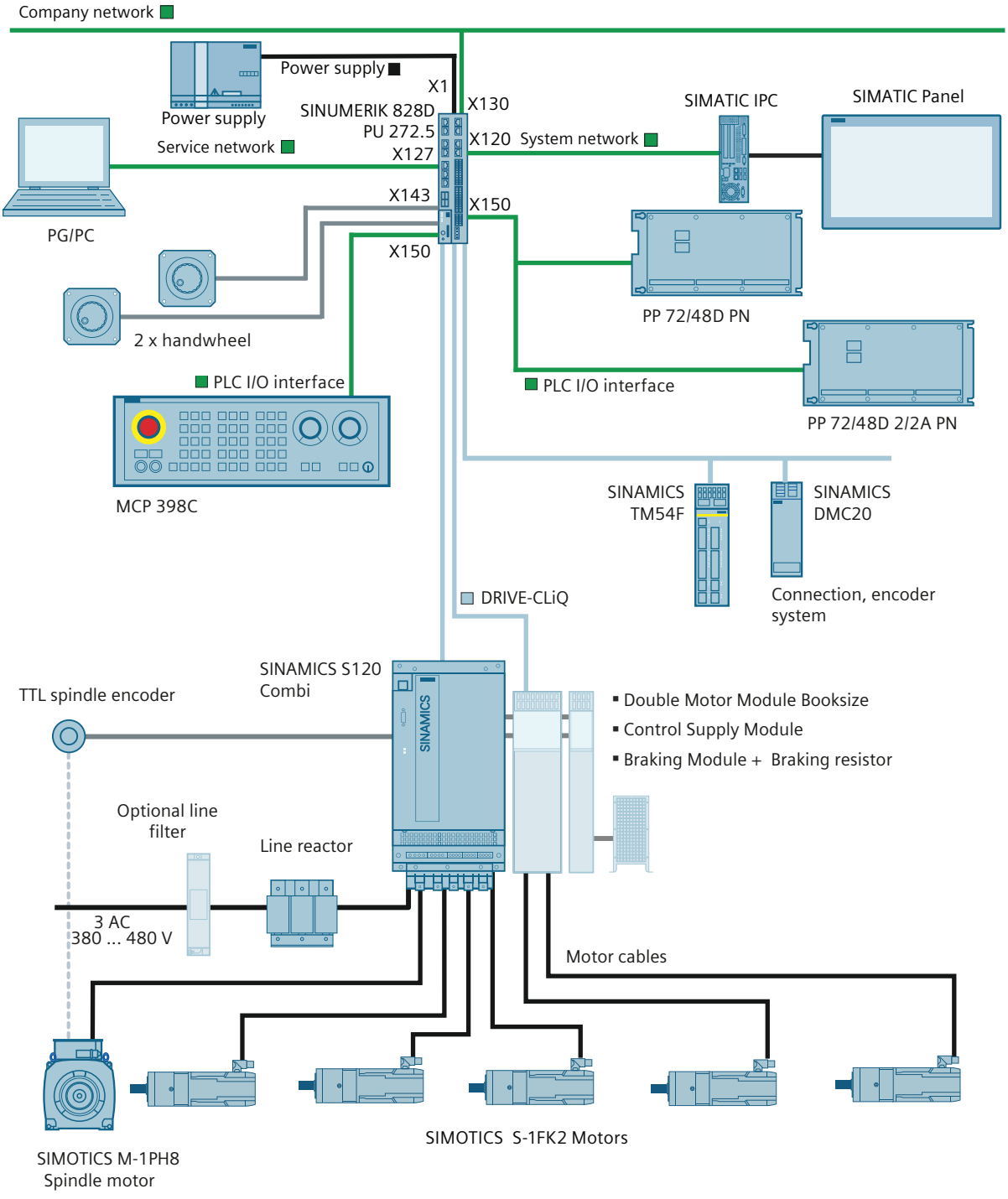


Figure 3-10 Configuration example 3: Maximum expansion stage with 6 axes and with Safety Integrated

3.6.2 System overview for PPU

Configuration with IPC, HT10 option, and optional Edge box

The following configuration shows a typical example with IPC, HT10 option, and optional Edge box:

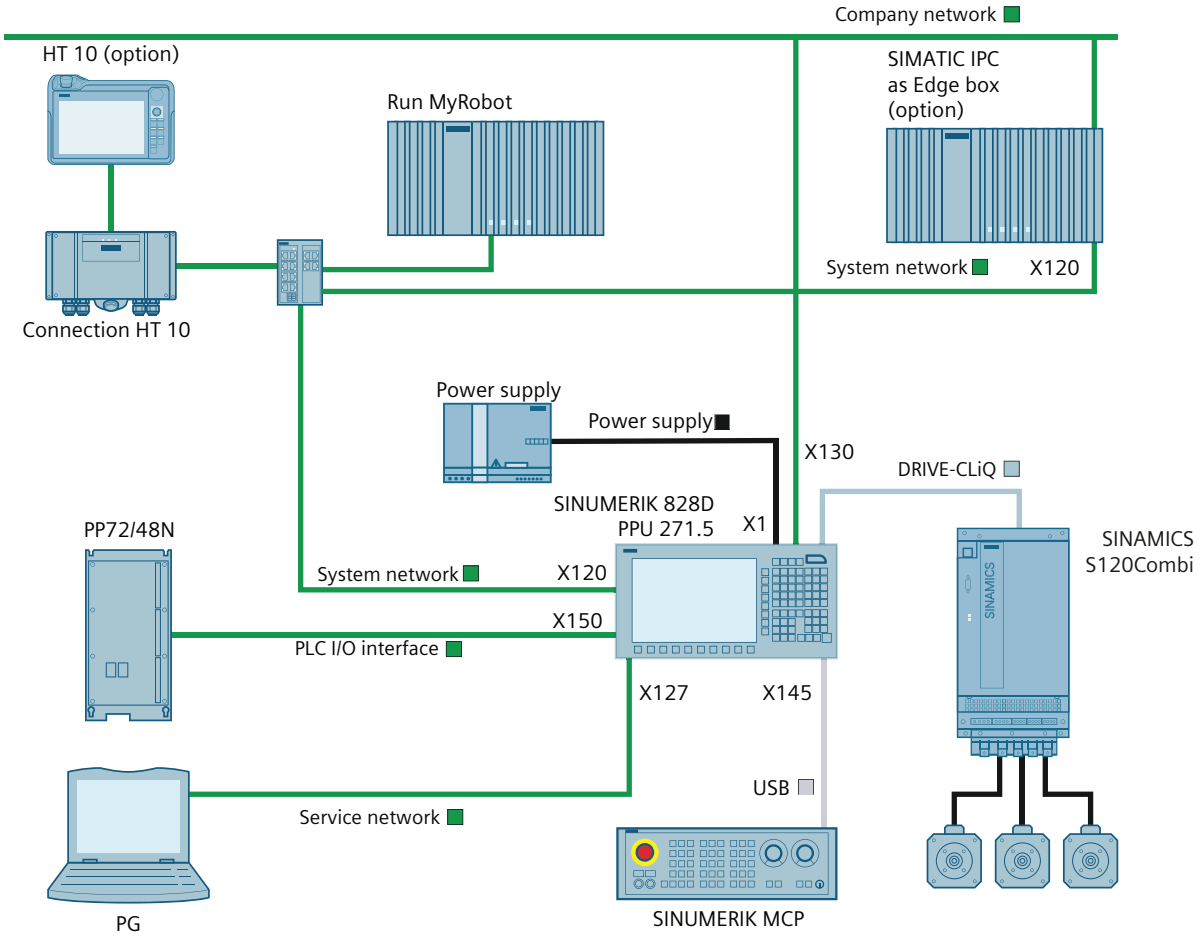


Figure 3-11 Configuration with IPC, HT10 option, and optional Edge box

Configuration with three axes (basic configuration)

The following configuration shows a typical example with SINAMICS S120:

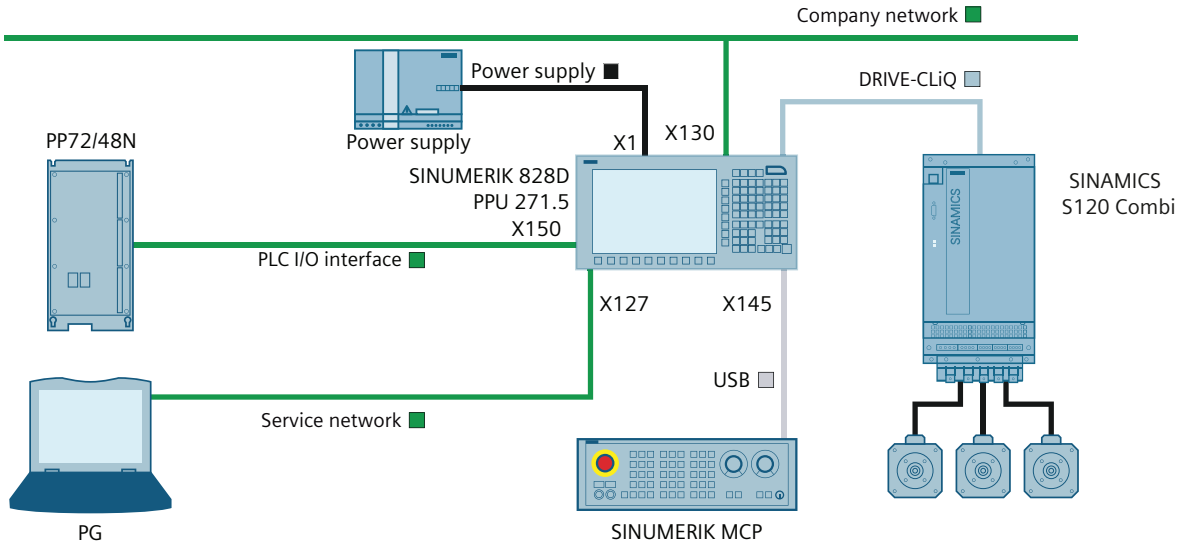


Figure 3-12 Configuration example 1: Basic configuration with three axes

Configuration with 4 axes and 2 auxiliary axes

The following configuration shows an example with 2 auxiliary axes:

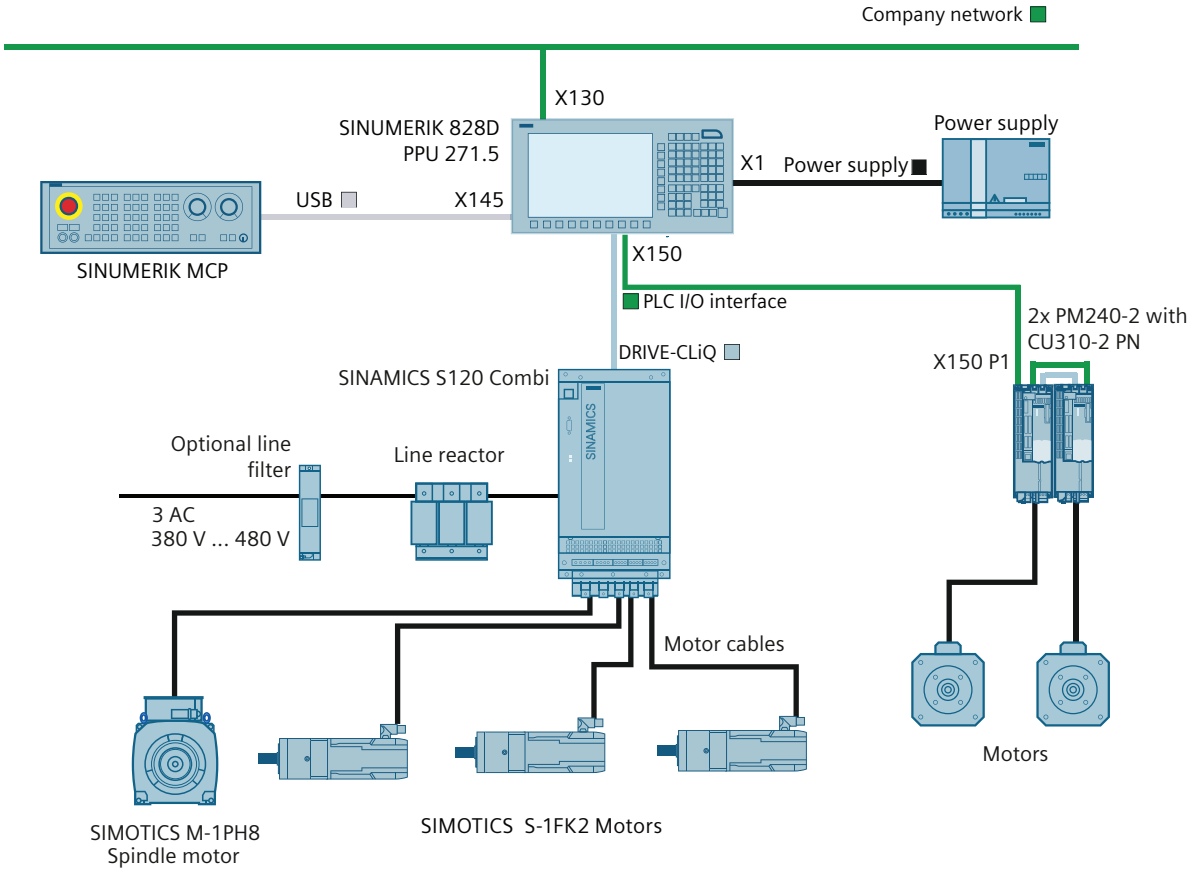


Figure 3-13 Configuration example 2: Basic expansion stage with 4 axes and 2 auxiliary axes

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

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

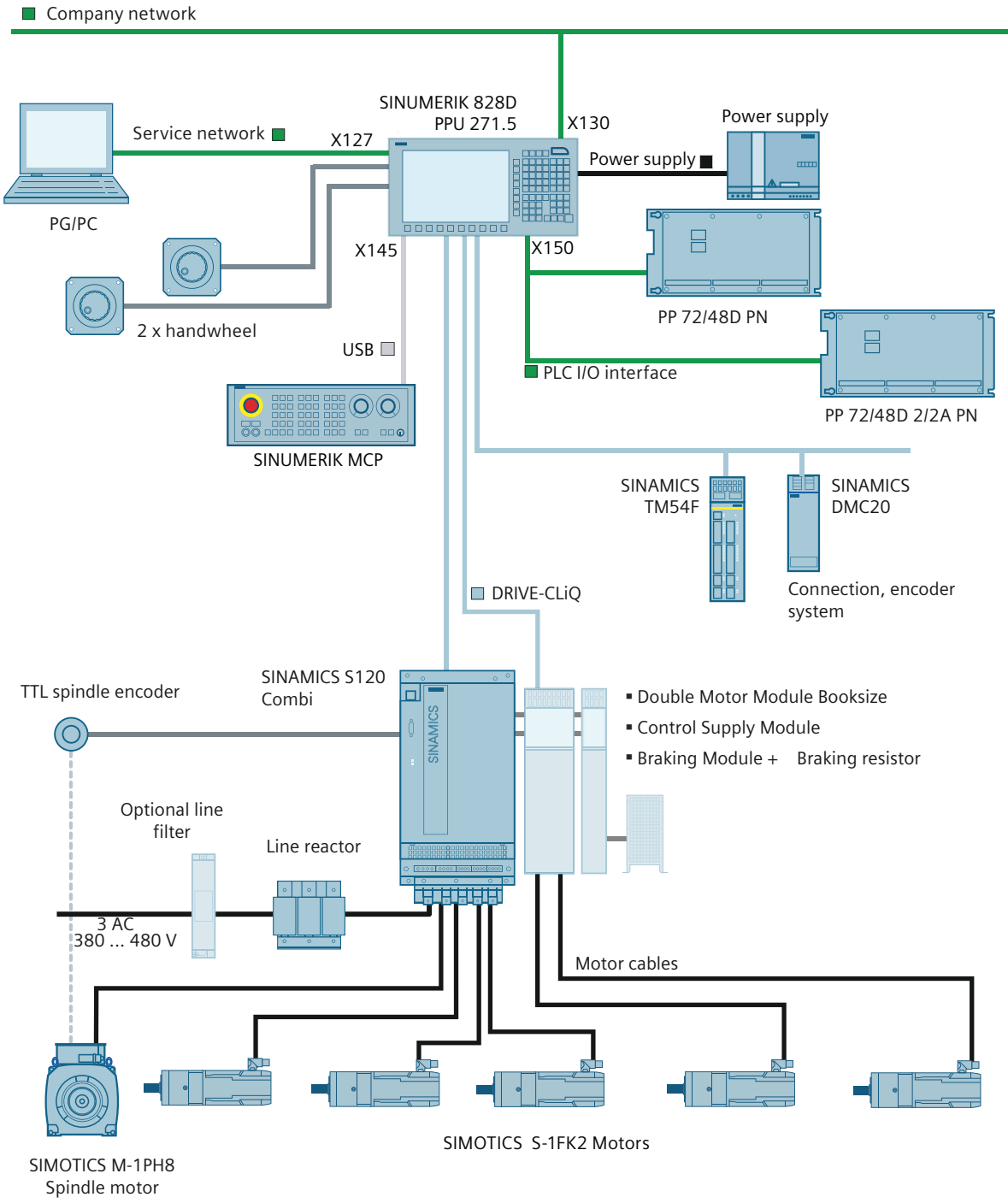


Figure 3-14 Configuration example 3: Maximum expansion stage with 6 axes and with Safety Integrated

Maximum cofiguration overview for PPU 26x.5

The following configuration shows the maximum expansion stage for PPU 26x,5

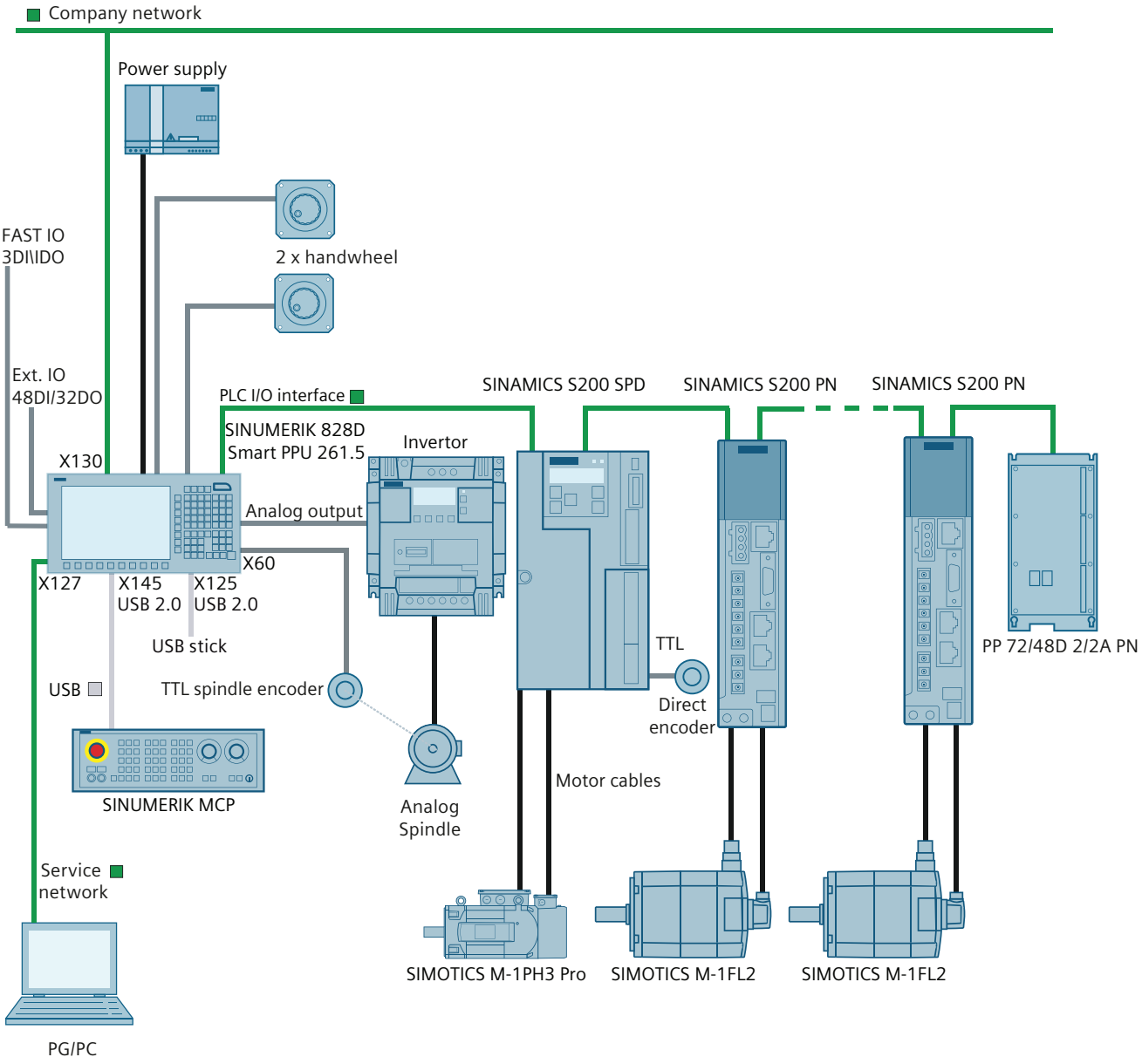


Figure 3-15 Configuration example 4: Maximum expansion stage for PPU 26x.5

3.7 Connectable components

Component overview

The following components can be connected to the PU/PPU:

- **MCP in a horizontal or vertical version**
  Includes the buttons and switches required to operate a machine tool, that is connected via PROFINET or USB.
- **Handwheels**
  A maximum of two handwheels can be connected.
- **Mini handheld unit**
  You can integrate a mini handheld unit into the SINUMERIK 828D system with the use of a connection kit.
- **PP 72/48D PN / PP 72/48D 2/2A PN I/O modules**
  The modules are used to connect digital as well as analog inputs and the outputs. To supply the module and the outputs, an external power supply unit (24 VDC) is required, which provides safety isolation from dangerous voltages.
- **Increasing the number of axes**
  - NX10.3/NX15.3
    You can increase the number of axes connected to the NC using NX modules. Each NX10.3 component can control up to 3 additional servo axes. Each NX15.3 component can control up to 6 additional axes.
  - SINAMICS CU310-2 PN or SINAMICS CU320-2 PN (Page 56)
    In addition to the NC axes, you can connect up to 6 auxiliary axes via one SINAMICS CU320-2 PN, you can use a maximum of 2 auxiliary axis with PU/PPU.
- **PN/PN coupler**
  A PN/PN coupler can be connected in order to link a SINUMERIK 828D to PROFINET networks.
- **Industrial PC (Connection possible only with PU)**
  - SIMATIC IPC: The device provides industrial PC systems for high-performance and space-saving applications in particular in the field of machine, systems and switchgear cabinet engineering. OEMs / end users will be able to develop machines with SIMATIC IPC.
  - Third-party panel / PC: OEMs / end users will be able to develop machines with third party IPC or third-party panel + SIMATIC IPC with HMI OA applications based on Windows.
- **HT 10 mobile handheld terminal**
  The HT 10 mobile handheld terminal combines the functions of an operator panel and a machine control panel in one device, permitting complete operator control and monitoring of machines. It can be used according to the principle of a Thin Client (see also the Equipment Manual: "TCU 30.3") as a supplementary main operator panel or as a secondary control panel.
- **SENTRON PAC2200**
  When connecting a SENTRON PAC2200, functions are available to increase the energy efficiency of a machine tool.

SINAMICS S120 drive system

Only the SINAMICS S120 Line Modules and Motor Modules are used for drive control. You can use the Motor Modules to connect **servomotors** as type 1FK2,1FT2, and1PH3feed and main spindle motors. Type1FW6 **torque motors** can also be connected.

- **SINAMICS S120 Combi drive system**
  The S120 Combi Power Modules are optimized as a drive for processing machines with 3 to 6 axes. Motor Modules in booksize formats are used as expansion axes.
- **SIMOTICS S-1FK2 feed motors**
  Compact and highly dynamic synchronous motors for a wide range of uses in an industrial environment. They are characterized by high power density, degree of protection and overload capability.
- **SIMOTICS M-1PH3 spindle motors**
  1PH3 motors are asynchronous variant motors that can be used for the freely selectable performance of both vector control and servo control with SINAMICS S120 converter components.
- **SIMOTICS S-1FK7 feed motors**
  The performance and accuracy of the CNC and drive can only be utilized if they can be transferred to the machine axes.Thanks to their unique dynamic response and accuracy, SIMOTICS S-1FK7 feed motors are exactly suited for this purpose.
- **SIMOTICS M-1PH8 spindle motors**
  With the SIMOTICS M-1PH8 spindle motors we offer very fast acceleration times and a wide speed range with high output guarantee, maximum productivity of the machine – with speeds of up to 24000 rpm.
- **SIMOTICS T-1FW6 torque motors**
  The torque motors satisfy the most exacting demands in precision, performance and dynamic response. Permanent magnet synchronous motors with a high number of poles are fully integrated in the machine, and mechanical transmission elements such as gear units are omitted, so you benefit from greater flexibility with regard to installation, easier servicing, higher availability and minimal space requirements.
- **SIMOTICS L-1FN3 linear motors**
  SIMOTICS L-1FN3 motors are linear drives in compact design with a high power/force density. They are characterized by wearfree force transmission. The SIMOTICS L-1FN3 motors comply with the highest requirements on dynamics, contour precision and accuracy and are optimized for operation on high-performance machine tools.
- **SIMOTICS M-1FE1/1FE2 built-in motors**
  SIMOTICS M-1FE built-in motors are suitable for the highest demands on machining quality, accuracy and smooth running. Depending on the application, built-in motors are available in a high-torque or high-speed version. Built-in motors are high-performance motor spindles that are used in machine tools with applications for short acceleration times and high speeds.

Reference

Additional specifications on SINAMICS S120 drive system and SIMOTICS motors can be found in the following reference:

- Catalog NC 82: SINUMERIK 828 Equipment for Machine Tools (https://support.industry.siemens.com/cs/document/109746977/)

See also

System overview for PPU (Page 56)

System overview for PU (Page 52)

Application planning

4

4.1 Secondary electrical conditions

4.1.1 Protective Separation

Protective separation of the interfaces

By using an extra-low voltage, all interfaces provide protective separation in accordance with Class DVC As and are implemented as PELV (Protective Extra-Low Voltage) circuits.

4.1.2 Grounding concept

4.1.2.1 Grounding concept for PU

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 PU can be located in the control cabinet or in the operator cabinet.

The individual system components are:

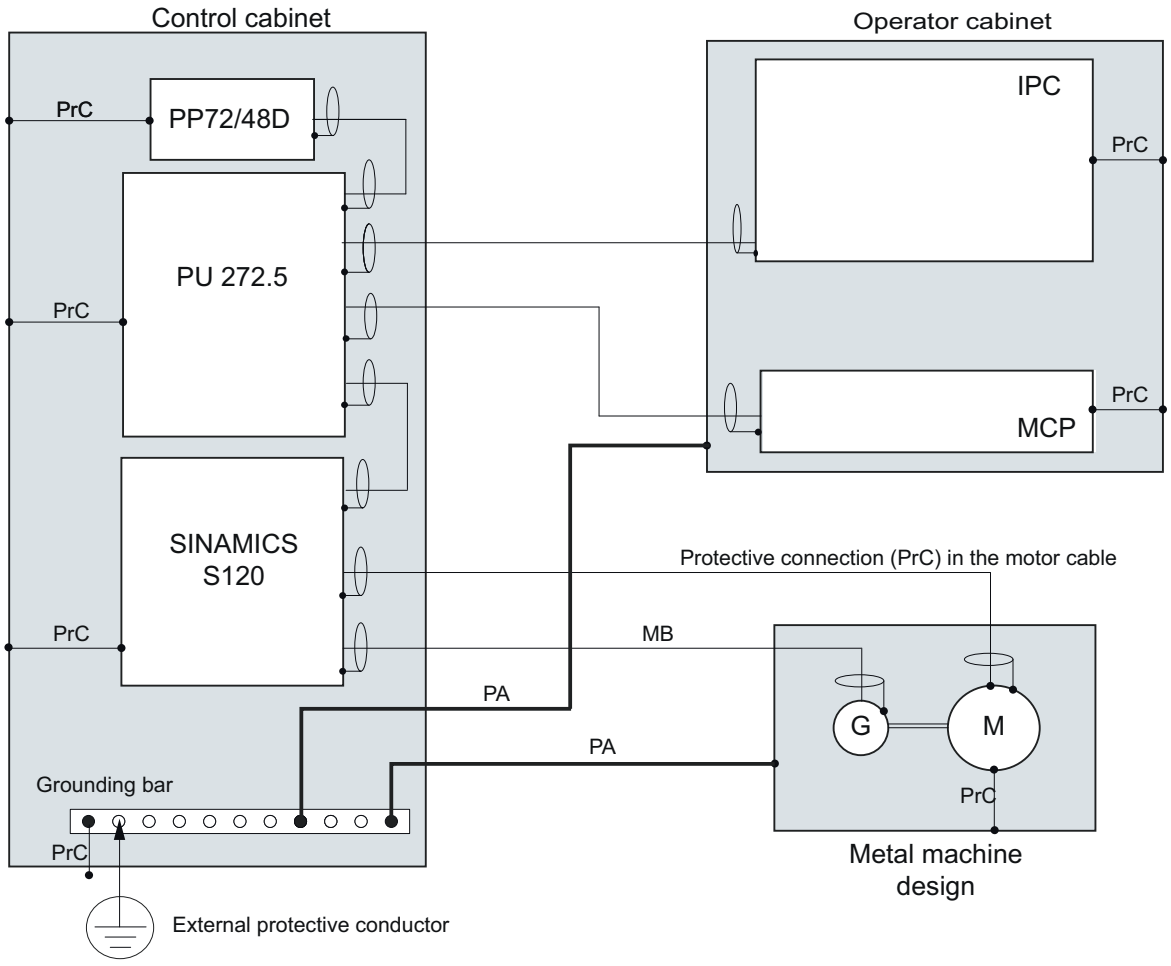
- Processing Unit PU
- Machine Control Panel
- IPC (Industrial PC)
- PLC I/O modules
- SINAMICS S120 drive components

Grounding measures

The individual modules are attached to a metal cabinet panel. Insulating paints on the mounting points must be removed. Modules have a protective conductor connection for grounding (grounding screw) at the rear of the device, which must be connected to the grounding bar of the control cabinet or the operator panel housing.

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

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



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

Figure 4-1 Grounding concept

Requirements of the cable cross-section

The following rules apply for external cable cross-sections:

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

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

4.1.2.2 Grounding concept for PPU

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 PPU can be located in the operator cabinet.

The individual system components are:

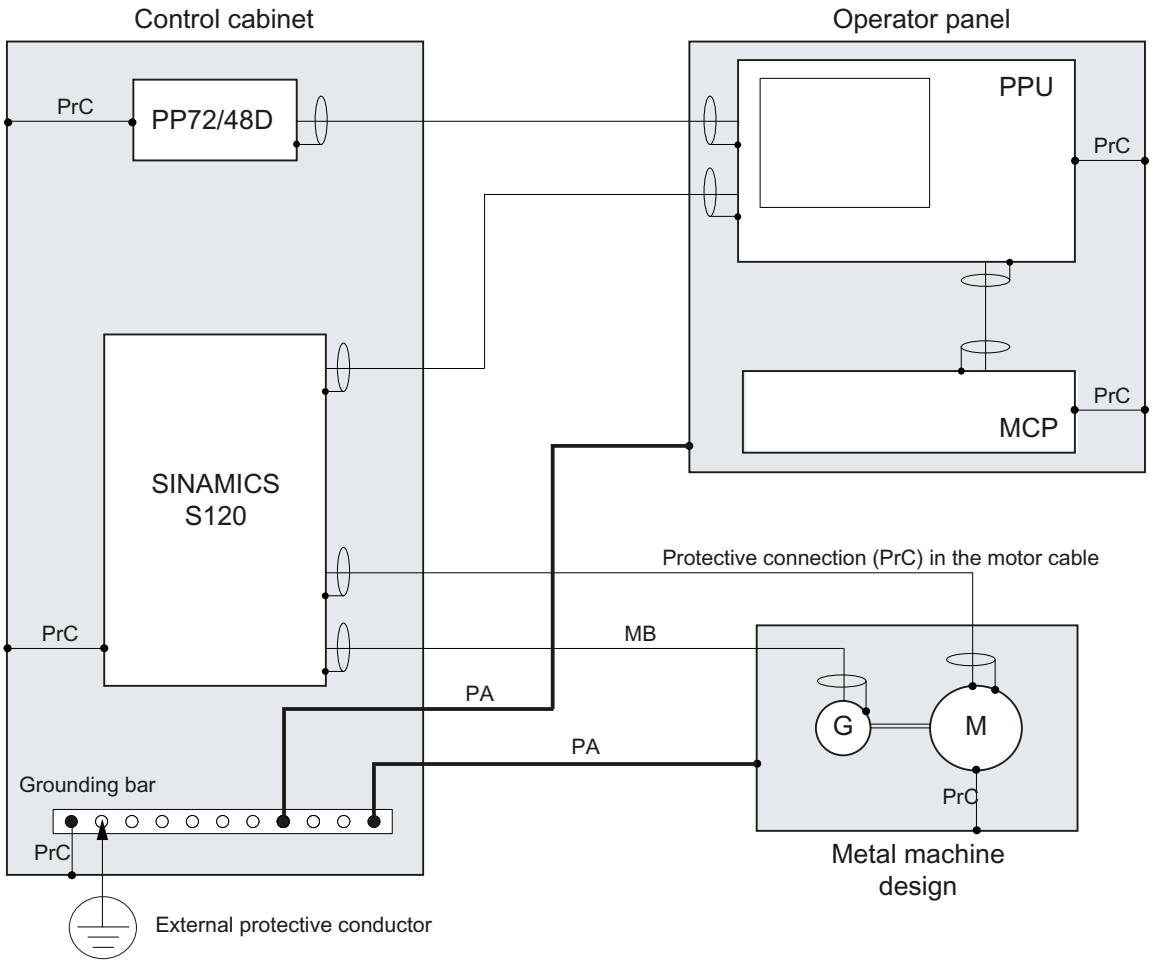
- Panel Processing Unit PPU
- Machine Control Panel
- PLC I/O modules
- SINAMICS S120 drive components

Grounding measures

The individual modules are attached to a metal cabinet panel. Insulating paint on the mounting points must be removed. Modules have a protective conductor connection for grounding (grounding screw) at the rear of the device, which must be connected to the grounding bar of the control cabinet or the operator panel housing.

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

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



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

Figure 4-2 Grounding concept

Requirements of the cable cross-section

The following rules apply for external cable cross-sections:

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

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

4.1.3 EMC compatibility

Shielded signal cables

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

- For safe and fault-free operation of the system, the specified cables must be used.
- For digital signal transmission, the shield must have a conductive connection at both sides of the housing.
  Exception:
  Standard shielded cables grounded on only one side can be used for devices from other manufacturers (printers, programming devices, etc.). However, these devices must not be connected to the control during normal operation. However, if the system cannot operate without them, then the cable shields must be connected at both ends. Furthermore, the non-Siemens device must be connected to the control via an equipotential bonding cable.

Cable definitions

The following cables are permissible:

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

Rules for routing cables

In order to achieve the greatest possible EMC compatibility for the complete system (control, power unit, machine), the following EMC measures must be carefully observed:

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

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

EMC-compatible installation of the components

Install the PPU and operator components in metallically enclosed EMC-compatible housings.

References

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

- EMC Installation Guideline Configuration Manual/Basic system requirements (https://support.industry.siemens.com/cs/mdm/60612658)
- SINAMICS S120 Combi Manual (https://support.industry.siemens.com/cs/document/109800046)

EMF assessments for 24 V components

The 24 V components, e.g. control systems PU/PPU, handheld units and machine control panels do not generate any appreciable electromagnetic fields.

No minimum clearance has to be maintained for 24 V components.

EMC limit values in South Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

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

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

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

4.2 Climatic and mechanical environmental conditions

4.2.1 PU

4.2.1.1 Ambient conditions

Observing the ambient conditions

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

- The ambient conditions are maintained during storage, transportation and operation.
- Original components and replacement parts are used. This applies in particular to the use of specified cables and connectors.
- The equipment is correctly installed and commissioned.

Standard requirements

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

Long-term storage	EN 60721-3-1 (2002)
Transport	EN 60721-3-2 (1997)
Stationary operation	EN 60721-3-3 (2002)

Assistance and support

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

4.2.1.2 Transport and Storage Conditions

Components in original packaging

The following specifications apply to components in transport packaging:

	Transport	**Storage**
Standard / class	EN 60721-3-2 (1997)	EN 60721-3-1 (2002)
Temperature range	-40...+ 70°C	-25 ... + 55°C
Temperature change	-40 °C/+30°C	< 0.5 K / min (≙ 30 K / h) averaged over 5 minutes
Relative humidity	5 ... 95 %	5 ... 95 %
Permissible change of the relative humidity	max. 0.1% / min (≙ 6% / h)	

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

Table 4-1 Transport values for PU

Vibratory load: Package (1M2)	5 - 9 Hz: 3.5 mm, 9 - 200 Hz: 1 g

4.2.1.3 Operating Conditions

Note

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

Climatic environmental conditions

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

Temperature range	0 ... 55°C		
Temperature change	< 0.5 K / min (≙ 30 K / h) averaged over 5 minutes		
Humidity	Relative: 5 ... 90 %		
Permissible change of the relative humidity	max. 0.1% / min (≙ 6% / h)		
Moisture condensation and ice formation	Not permissible		
Dripping water, spray, splash water, water jets	Not 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 0-4000m, under 1000m without any derating, on 1000-4000m, the upper temperature limit must be reduced by 3.5°C/500m.		
Active environmental conditions	Chemical: Class 3C2(H2S,SO2)	Mechanical: Class 3S1	Biological: Class 3B1

Vibratory and shock load values

These are the vibratory and shock load values for PU in operating conditions

Vibratory load (3M1)	9 - 29 Hz: 0.3 mm; 29 - 200 Hz: 1g
Shock load (3M1)	5 g, 30 ms

Function-impairing dust

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

Maximum permissible amount of dust in the ambient air:

Suspended component	0.2 mg/m^3
Deposits	1.5 mg/m^{2}h

Limit values for radio interference suppression in industrial environments

	Limit class according to EN 61800-3
Conducted radio interference	C2
Radio interference	C2

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.
- The device is designed for operation in the second environement (industrial areas) and must not be used in the first environment (residential areas) without appropriate interference suppress measures.

Literature:

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

4.2.2 PPU

4.2.2.1 Ambient conditions

Observing the ambient conditions

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

- The ambient conditions are maintained during storage, transportation and operation.
- Original components and replacement parts are used. This applies in particular to the use of specified cables and connectors.
- The equipment is correctly installed and commissioned.

Standard requirements

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

Long-term storage	EN 60721-3-1 (2002)
Transport	EN 60721-3-2 (1997)
Stationary operation	EN 60721-3-3 (2002)

Assistance and support

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

4.2.2.2 Transport and Storage Conditions

Components in original packaging

The following specifications apply to components in transport packaging:

	Transport	**Storage**
Standard / class	EN 60721-3-2 (1997)	EN 60721-3-1 (2002)
Temperature range	-20...+ 60°C	-20 ... + 60°C
Temperature change	-40 °C/+30°C	< 0.5 K / min (≙ 30 K / h) averaged over 5 minutes
Relative humidity	5 ... 95 %	5 ... 95 %
Permissible change of the relative humidity	max. 0.1% / min (≙ 6% / h)	

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

Table 4-2 Transport values for PPU

Vibratory load: Package (1M2)	5 - 9 Hz: 3.5 mm, 9 - 200 Hz: 1 g

4.2.2.3 Operating Conditions

Note

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

Climatic environmental conditions

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

Temperature range	Front: 0 ... 45°C Back: 0 ... 55°C
Temperature change	< 0.5 K / min (≙ 30 K / h) averaged over 5 minutes
Humidity	Relative: 5 ... 90 %
Permissible change of the relative humidity	max. 0.1% / min (≙ 6% / h)

Moisture condensation and ice formation	Not permissible		
Dripping water, spray, splash water, water jets	Not 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 0-4000m, under 1000m without any derating, on 1000-4000m, the upper temperature limit must be reduced by 3.5°C/500m.		
Active environmental conditions	Chemical: Class 3C2 (H2S, SO2)	Mechanical: Class 3S1	Biological: Class 3B1

Vibration and shock load values

These are the vibratory and shock load values for PPU in operating conditions

Vibration load (3M1)	9 - 29 Hz: 0.3 mm; 29 - 200 Hz: 1g
Shock load (3M1)	5 g, 30 ms

Function-impairing dust

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

Maximum permissible amount of dust in the ambient air:

Suspended component	0.2 mg/m^3
Deposits	1.5 mg/m^{2}h

Limit values for radio interference suppression in industrial environments

	Limit class according to EN 61800-3
Conducted radio interference	C2
Radio interference	C2

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.
- The device is designed for operation in the second environement (industrial areas) and must not be used in the first environment (residential areas) without appropriate interference suppress measures.

Literature:

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

4.3 Recycling and disposal

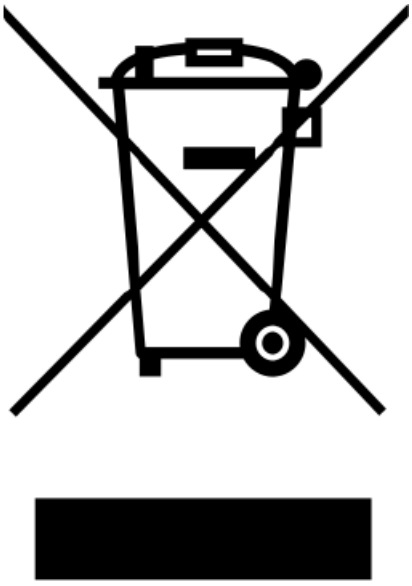


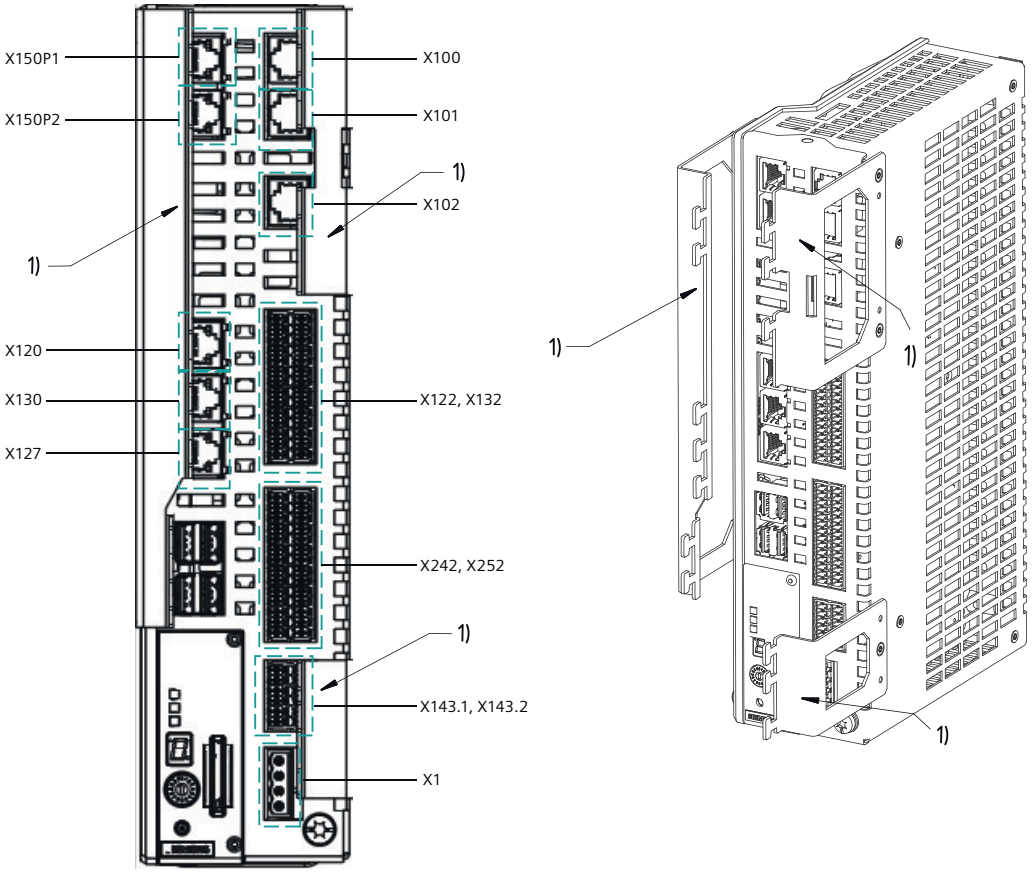
Figure 4-3 Recycle

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

4.4 Cable fixing

4.4.1 Cable fixing for PU

How to fix cables for PU



1) Cable pull relief for PU

Procedure

1. Insert the PROFINET cables at X150P1 and X150P2 interfaces.
2. Insert the Ethernet cable at LAN interfaces X130, X120, and X127.
3. Insert the DRIVE-CLiQ cable at X100 – X102.
4. Insert the handwheel terminal at X143.1 and 143.2.
5. Insert the digital input/output terminals at X122, X132.
6. Insert the input/output terminals at X242, X252.
7. Insert the power supply terminal at X1.

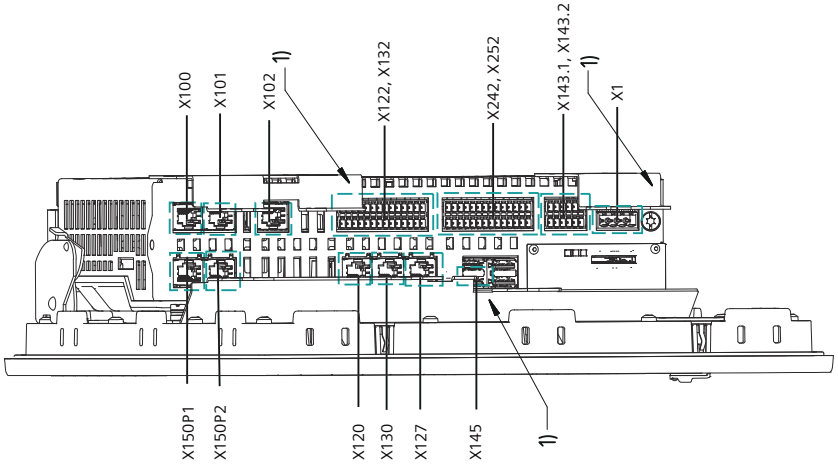
8. Connect the cable shield of analog spindle cable at X252 at the cable pull relief.
9. Fix cables at X150P1, X150P2, X120, X130, X127, X100-X102, X143.1/X143.2, X122, X132, X242, X252, and X1 at the cable pull relief.

Note

Use non conductive cable ties (plastic) for fixation. If the cable ties are to make contact use metallic cable ties.

4.4.2 Cable fixing for PPU

How to fix cables for PPU 27x.5 and PPU 290.5



1) Cable pull relief

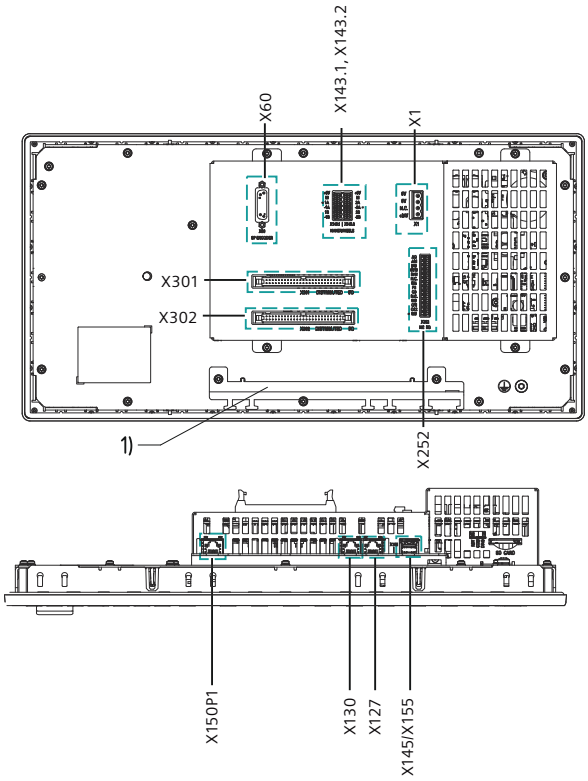
Procedure

1. Insert the PROFINET cables at X150P1 and X150P2 interfaces.
2. Insert the Ethernet cables at LAN interfaces X130, X120.
3. Insert the USB cable to SINUMERIK 828D MCP at X145.
4. Insert the DRIVE-CLiQ cable at X100 – X102.
5. Insert the handwheel terminals at X143.1 and 143.2.
6. Insert the digital input/output terminals at X122, X132.
7. Insert the input/output terminals at X242, X252.
8. Insert power supply terminal at X1.
9. Connect the cable shield of analog spindle cable at X252 at the cable pull relief.
10. Fix cables at X150P1, X150P2, X120, X130, X127, X100-X102, X143.1/X143.2, X122, X132, X242, X252, and X1 at the cable pull relief.

Note

Use non conductive cable ties (plastic) for fixation. If the cable ties are to make contact use metallic cable ties.

How to fix cables for PPU 26x.5



1) Cable pull relief

Procedure

1. Insert the PLC I/O interface cables at X150 interface.
2. Insert the Ethernet cables at LAN interfaces X130, X127.
3. Insert the USB cable to SINUMERIK 828D MCP at X145.
4. Insert the handwheel terminals at X143.1 and 143.2.
5. Insert the digital input/output terminals at X301, X302.
6. Insert the input/output terminals at X252.
7. Insert the analog spindle cable at X60.
8. Insert power supply terminal at X1.

9. Connect the cable shield of analog spindle cable at X252 at the cable pull relief.
10. Fix cables at X150P1, X130, X127, X143.1/X143.2, X301, X302, X242, X252, and X1 at the cable pull relief.

Note

Use non conductive cable ties (plastic) for fixation. If the cable ties are to make contact use metallic cable ties.

Installing

5

5.1 Safety notes

Installation notes

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

⚠ DANGER
Risk of electric shock
The entire system must be voltage-free when mounting or wiring the SINUMERIK 828D.

Note

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

Components in the control cabinet

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

References

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

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

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

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

5.2 Installing instruction for PU

5.2.1 Dimension drawings

PU

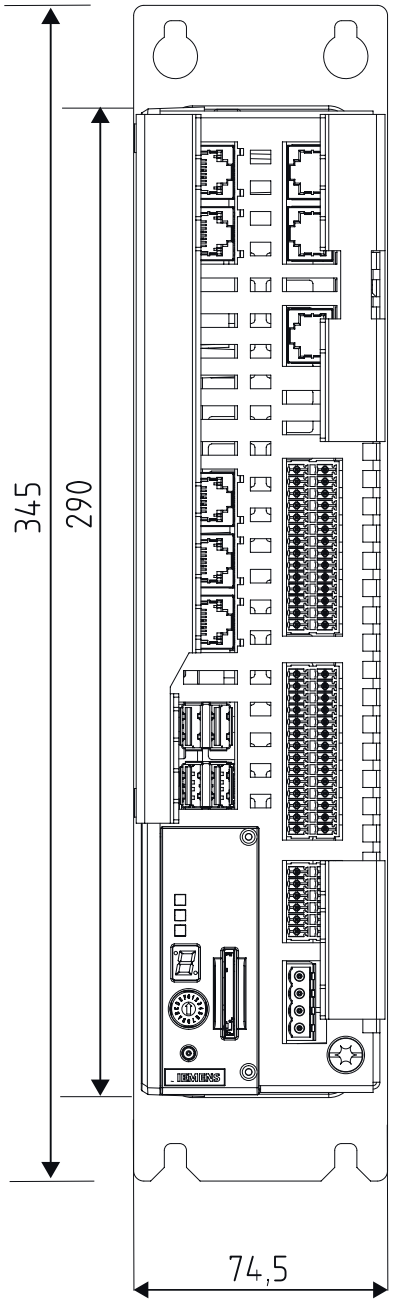


Figure 5-1 Dimension drawing of PU, all data in mm

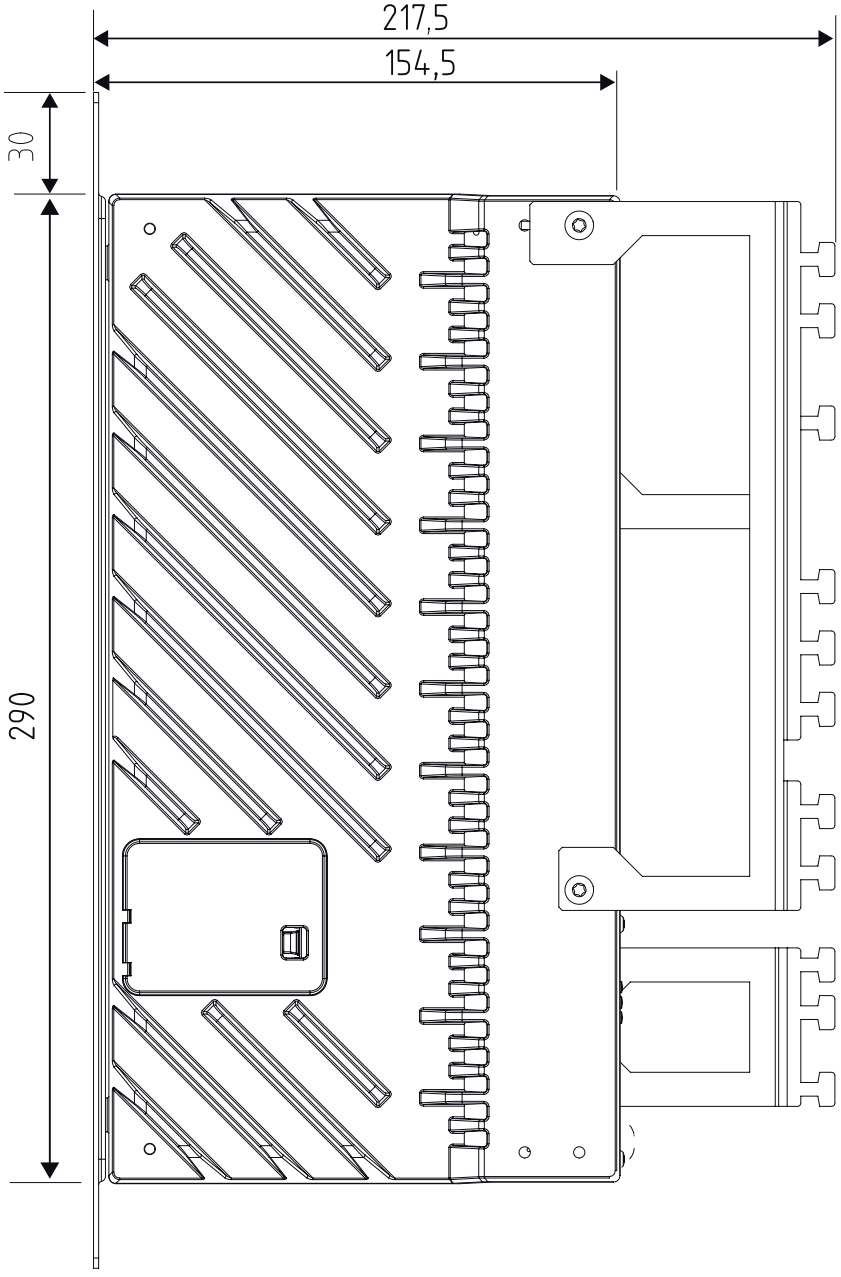


Figure 5-2 Dimension drawing of PU, all data in mm

5.2.2 Installing the PU

Permitted mounting positions

The PU comes attached with the device rear panel mount adapter. The PU can be mounted in the following permitted positions:

- Vertical mounting
- DIN-rail mounting (optional mounting position)

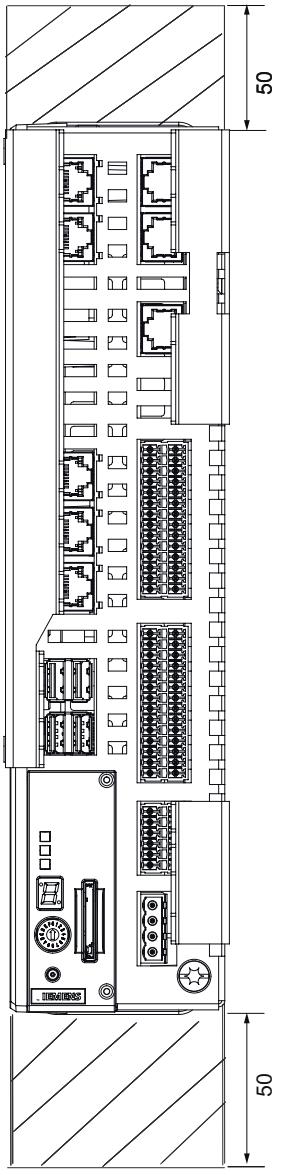
You can mount the PU vertically close to the control cabinet or the drive system. There is an option to mount the PU horizontally through DIN-rail support where DIN rail mounting is available.

Note

1. For DIN rail mounting, you need a PU Mounting Kit for DIN Rail 6FC5348-1AA00-0AA0.
2. To install the PU in DIN-rail mounting position you need to convert the PU into DIN-rail mounting position, so that you can snap the PU to a DIN-rail present in the operator or control cabinet.

Prerequisites for installing the PU

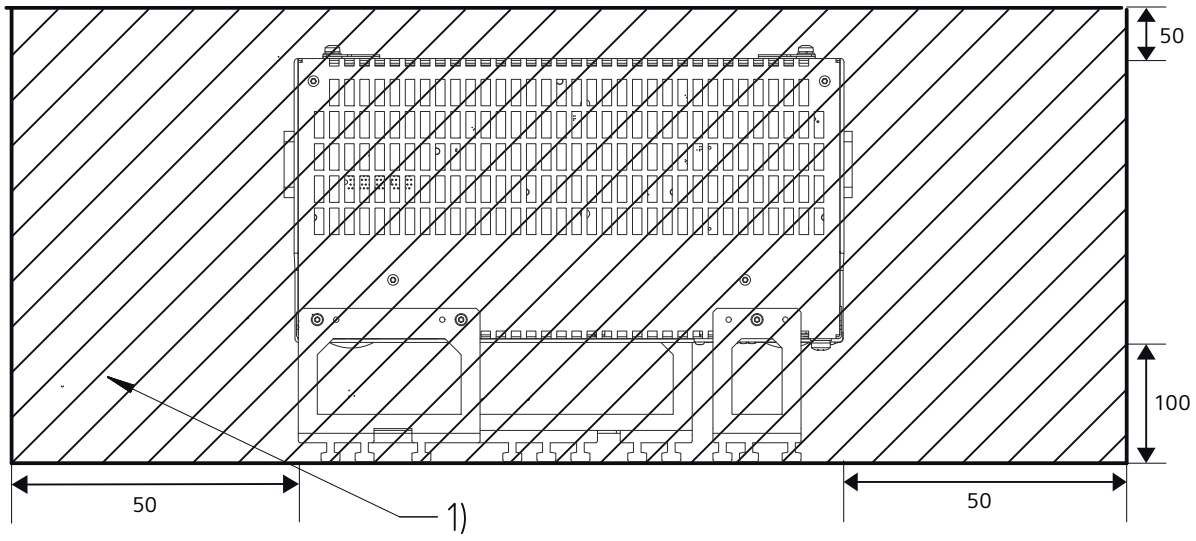
Installing the PU in vertical mounting position



Dashed area: Clearance for cables and ventilation

Figure 5-3 Clearance for ventilation and cables in vertical mounting

Installing the PU in DIN rail mounting position



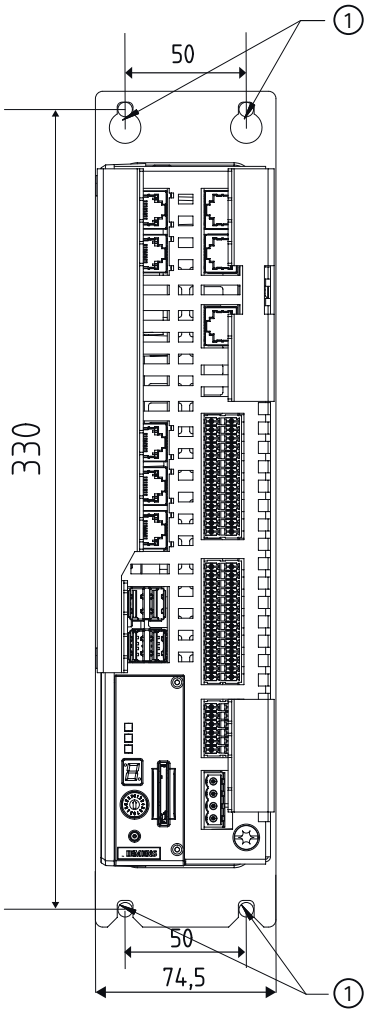
1) Free space for cables and ventilation

Figure 5-4 Clearance for ventilation and cables in DIN-rail mounting

5.2.3 Installation of the PU

5.2.3.1 Vertical mounting for PU

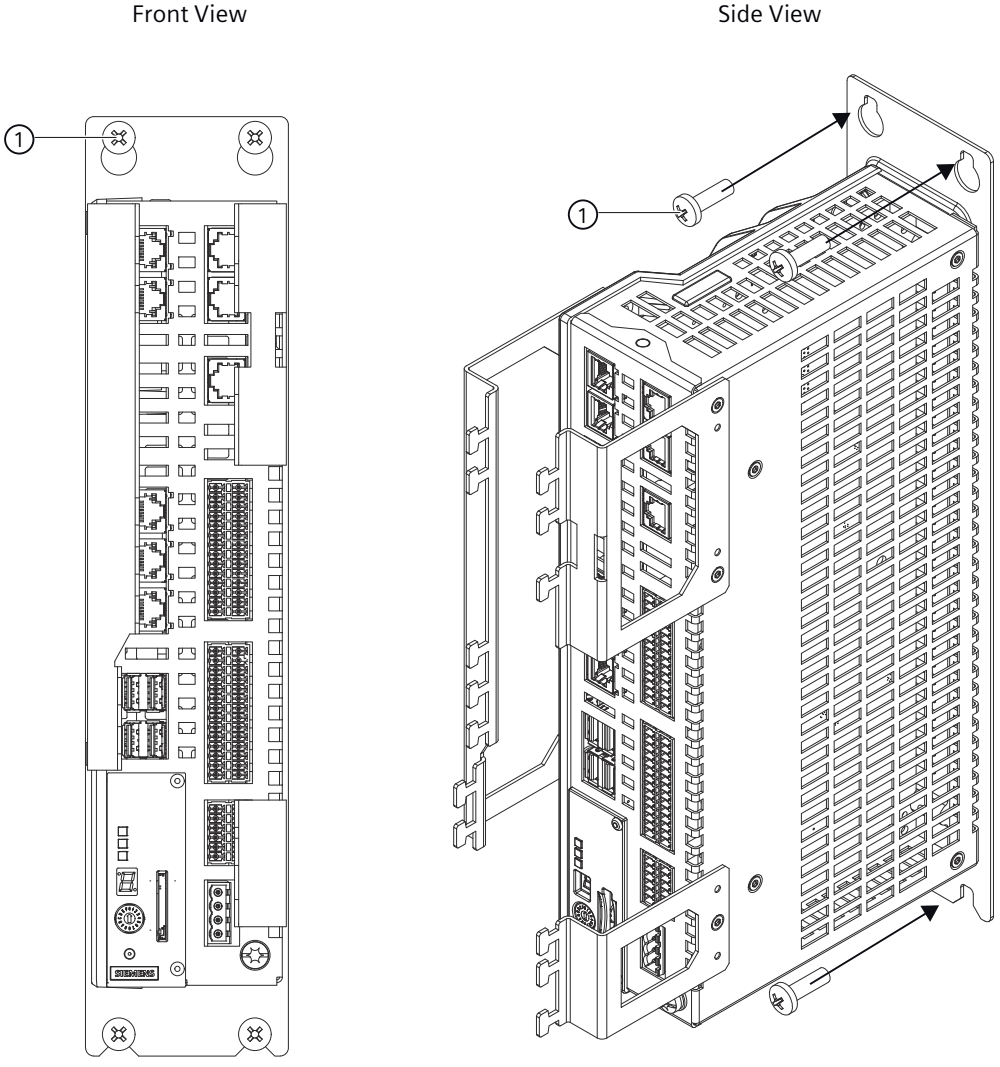
1. The PU comes attached with the device rear panel mount adapter.
2. Drill the PU onto the wall using 4 X M6 screws, tightening torque, 6 Nm.



① screw positions - M6, tightening torque 6 Nm

Figure 5-5 Drill mounting position for PU

3. To hold the mounting frame in place, use M6 screws at the upper and lower side of the mounting frame.



① 4 X M6 screws, Tighting torque, 6 Nm

Figure 5-6 PU mounting with screws for wall mount

4. Fasten the screws at wall mount, torque 6 Nm.

Note

Installing the PU

Carefully observed the following points to correctly install the PU:

- Inadmissible installation position can result in malfunctions.

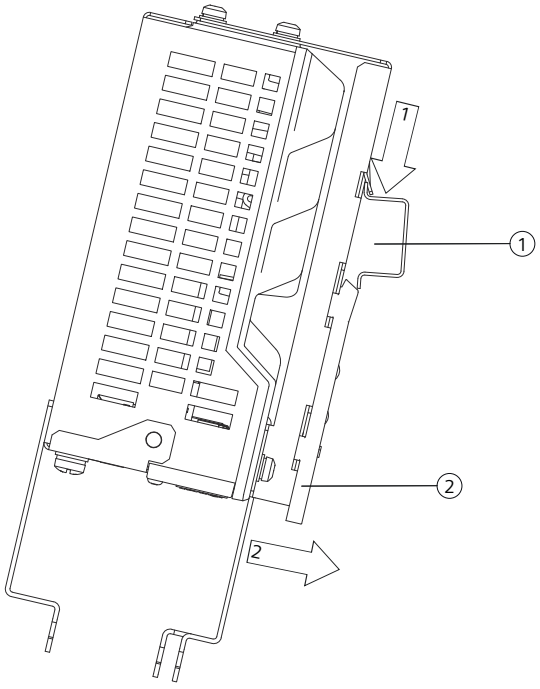
5.2.3.2 DIN-rail mounting for PU

Note

1. For DIN rail mounting, you need a PU Mounting Kit for DIN Rail 6FC5348-1AA00-0AA0.
2. Convert the PU into DIN-rail mounting position, so that you can snap the PU to a DIN-rail present in the operator or control cabinet.
3. You can mount the PU in DIN-rail mounting with other components or wall mounting where DIN-rail mounting is available.

Installation

1. Tilt the component backwards slightly and attach it to the DIN rail using the hooks.
2. Swivel the component onto the DIN rail until you hear the mounting slides at the rear latch.

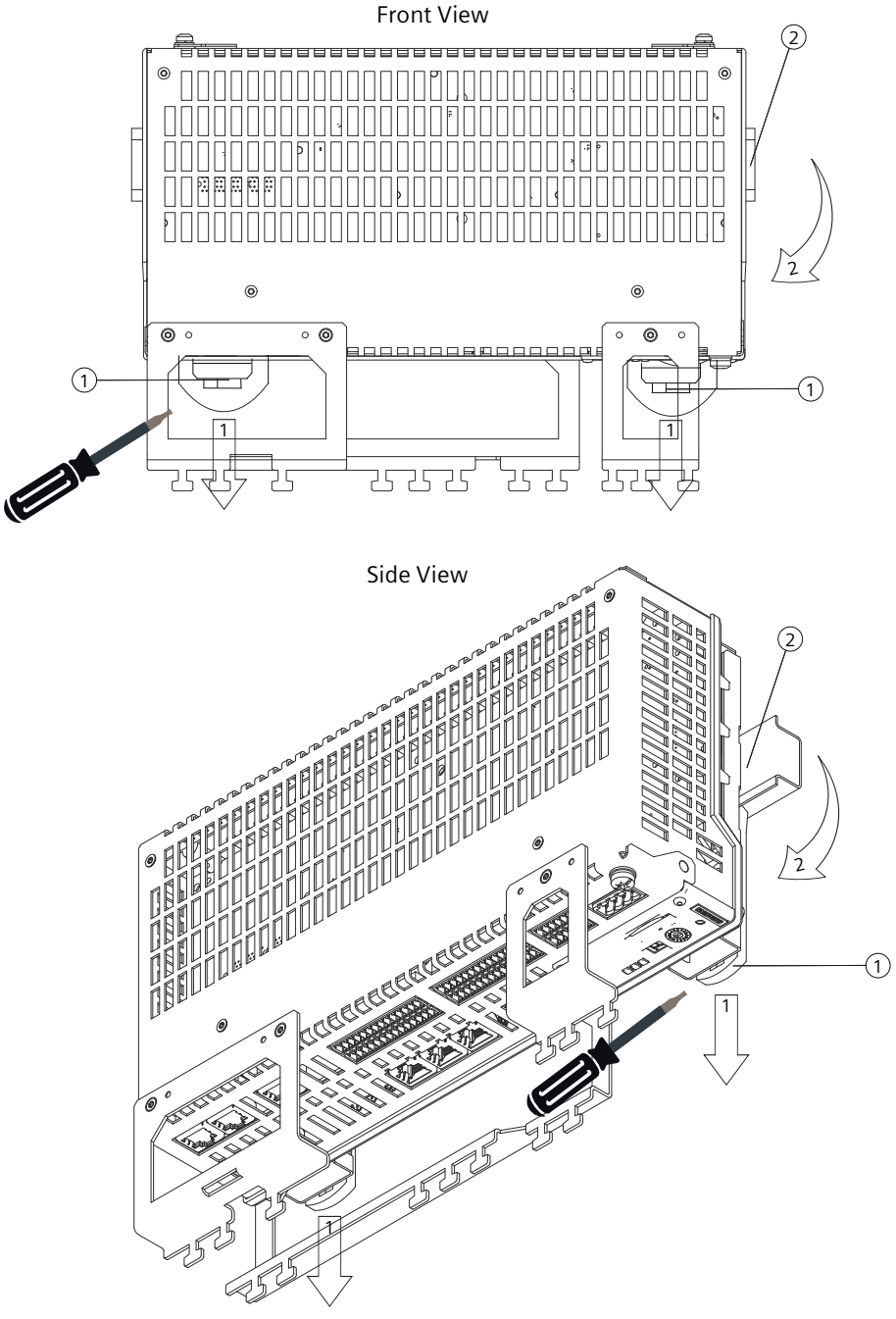


① Mounting rail
② Mounting slides

Figure 5-7 Installing for a DIN-rail mounting

Removal

1. First shift the mounting slides downwards at the lug to release the interlocking with the mounting rail.
2. Swivel the component to the front and withdraw it upwards from the DIN rail.



① Mounting slides
② Mounting rail

Figure 5-8 Removing for a DIN rail mounting

Note

Installing the PU

Carefully observed the following points to correctly install the PU:

- Inadmissible installation position can result in malfunctions.

5.3 Installing instructions for PPU

5.3.1 Dimension drawings

PPU 271.5 (horizontal variant)

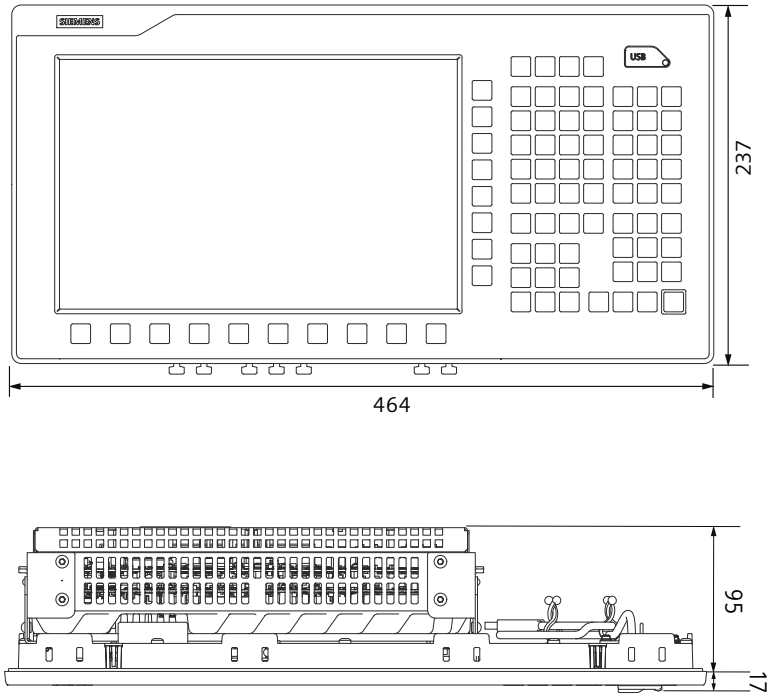


Figure 5-9 Dimensions of PPU 271.5

PPU270.5 (vertical variant)

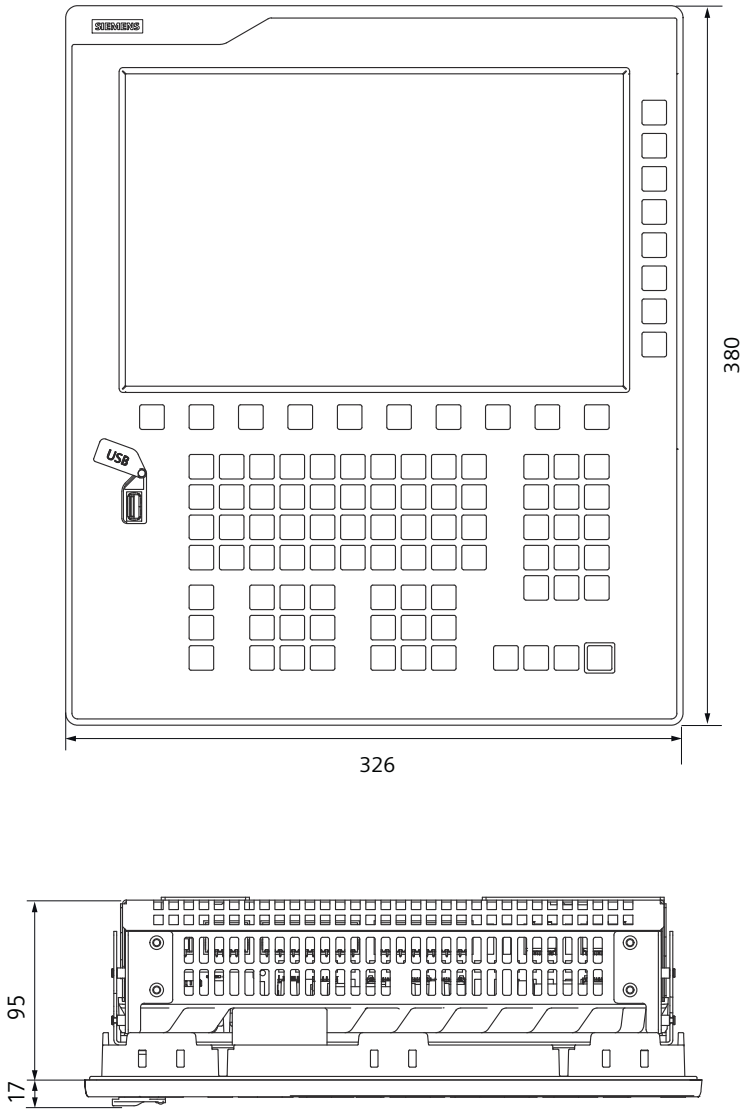


Figure 5-10 Dimensions of PPU270.5

PPU 261.5 (horizontal variant)

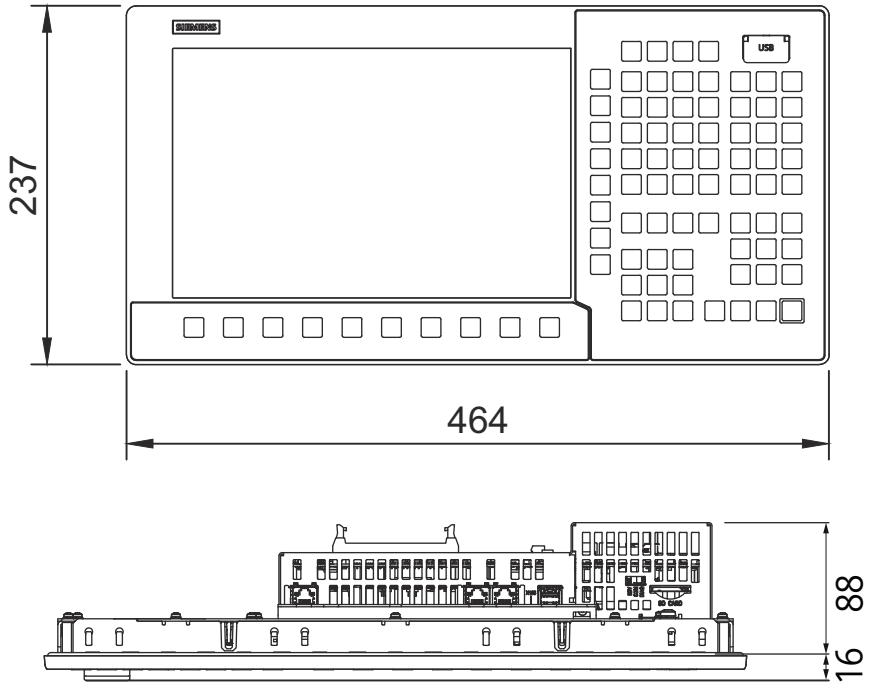


Figure 5-11 Dimensions of PPU 261.5

PPU 260.5 (vertical variant)

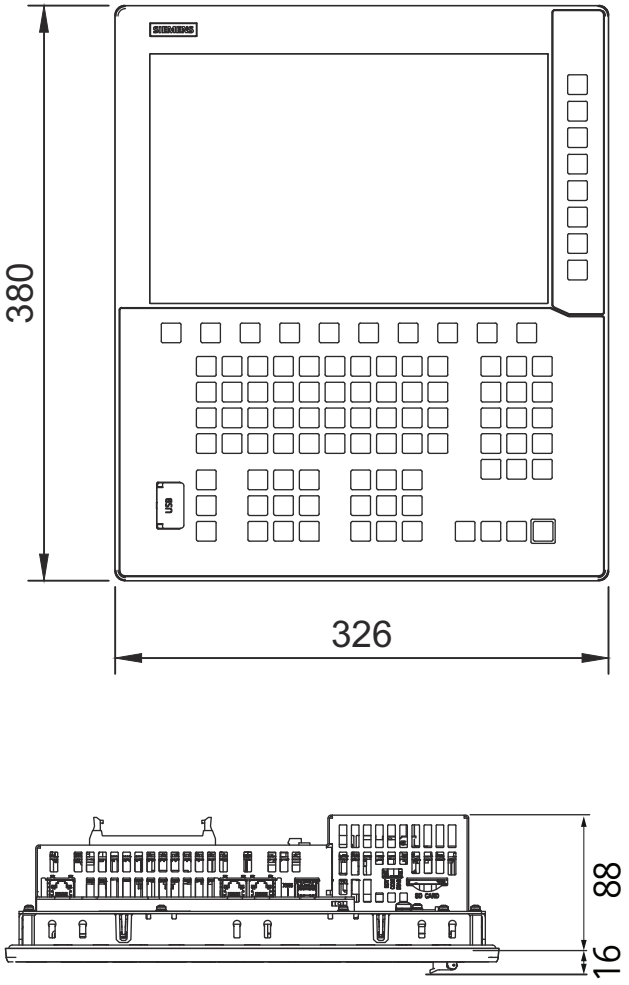
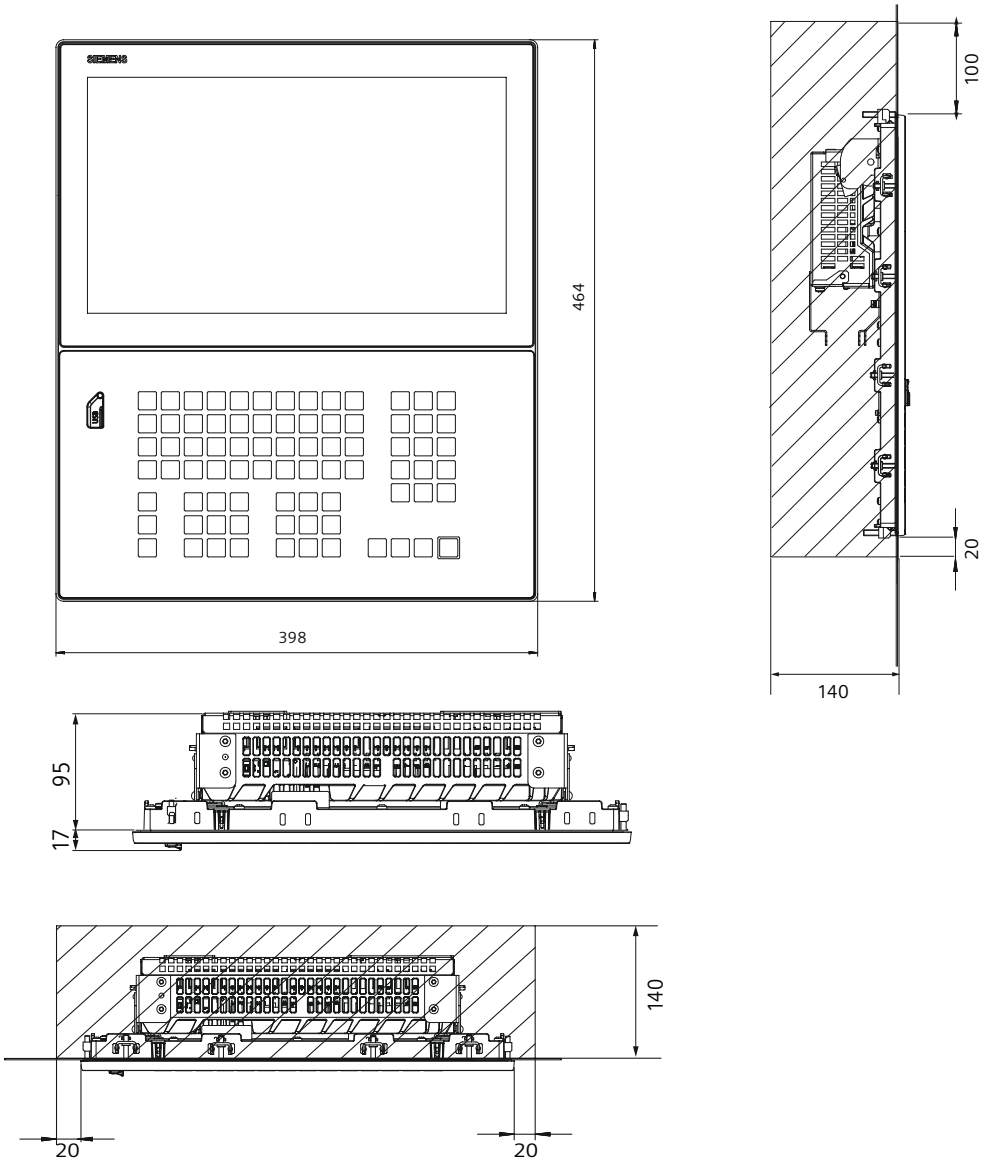


Figure 5-12 DImensions of PPU 260.5 vertical variant

PPU 290.5 (touch variant)



Dashed area: Clearance for cable and ventilation

Figure 5-13 DImensions of PPU 290.5 touch variant

5.3.2 Installing the PPU

Permitted mounting positions

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

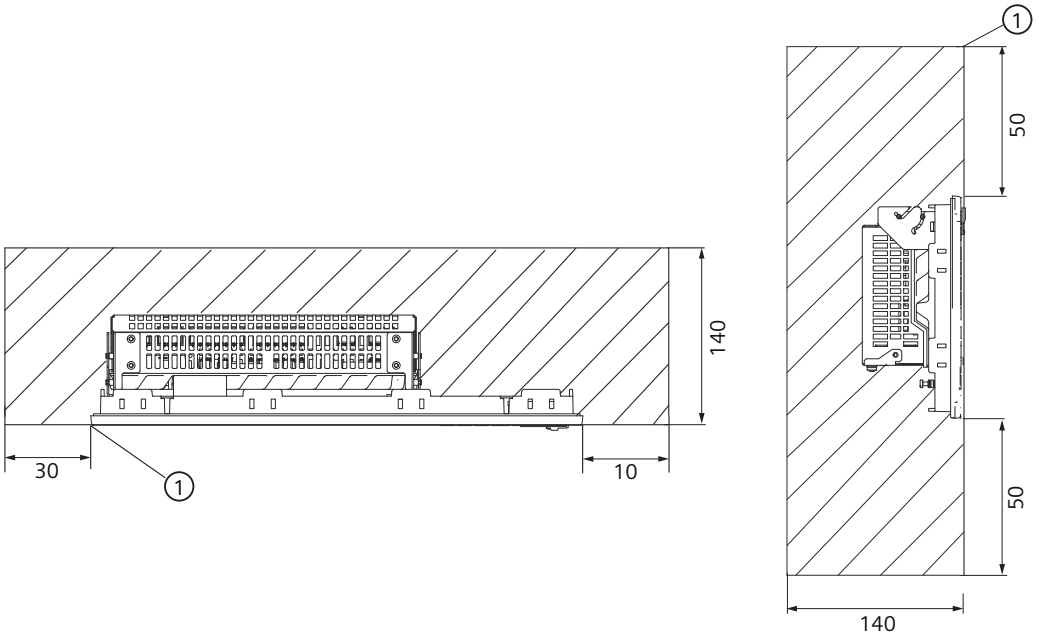
Note

Installing the PPU

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

To avoid malfunctions, the PPU 270.5 must only be installed in the vertical mounting position.

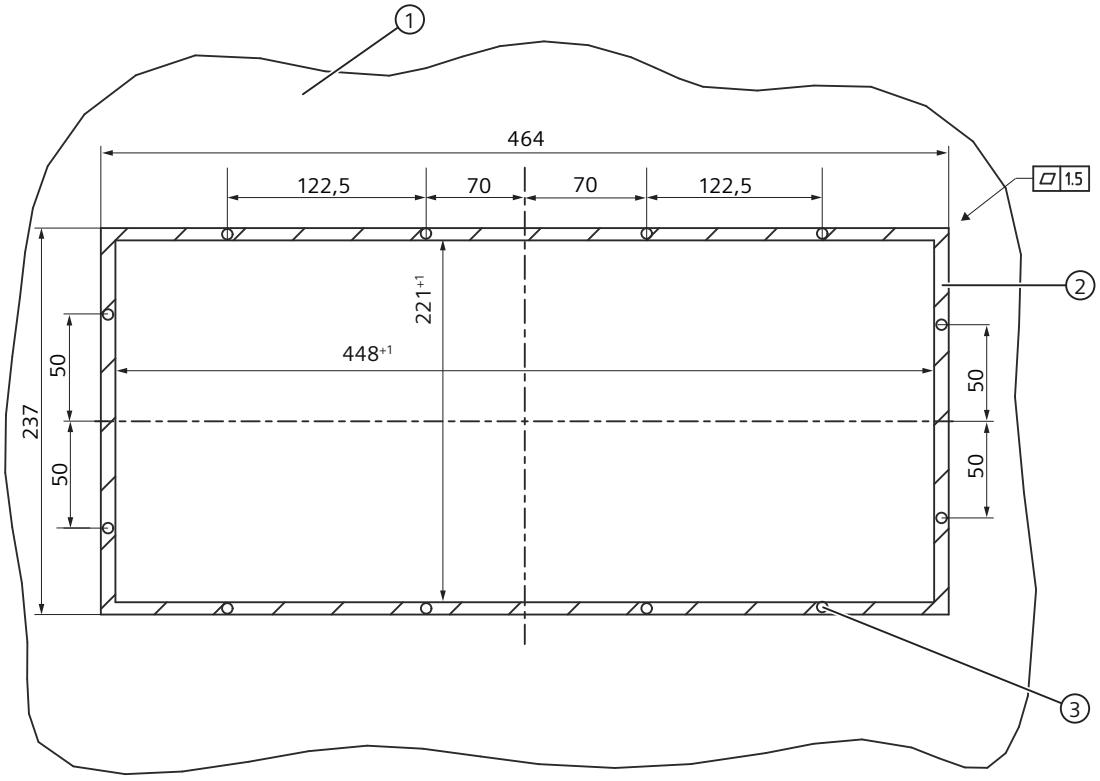
Installation of the horizontal PPU variant



① Mounting frame

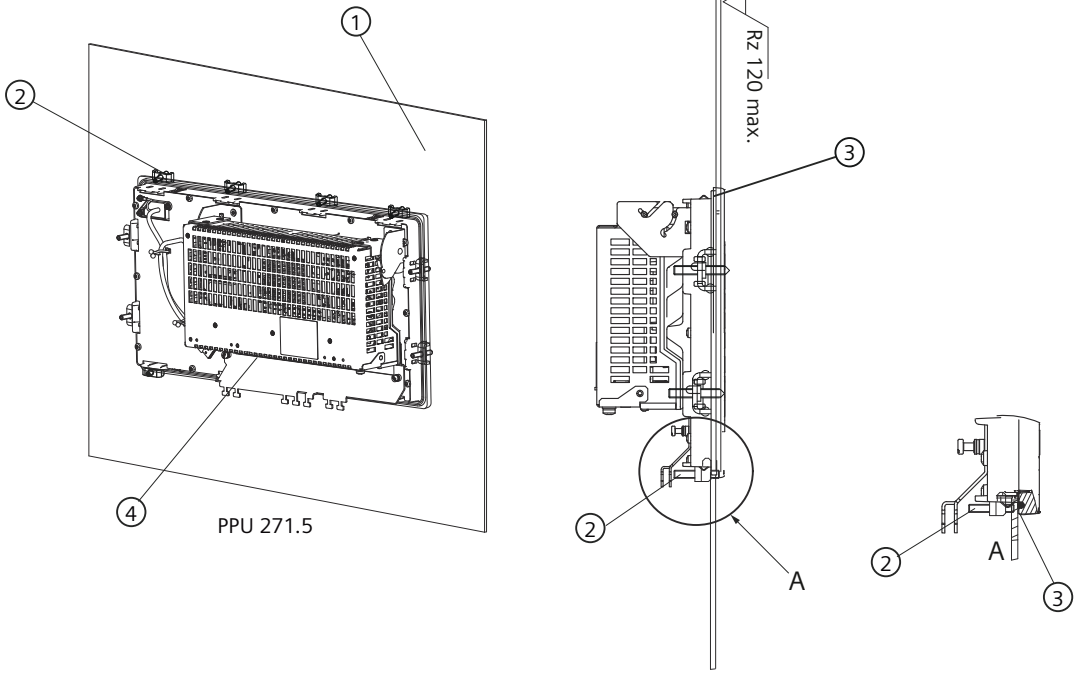
Figure 5-14 Clearance for ventilation and cables in the horizontal PPU

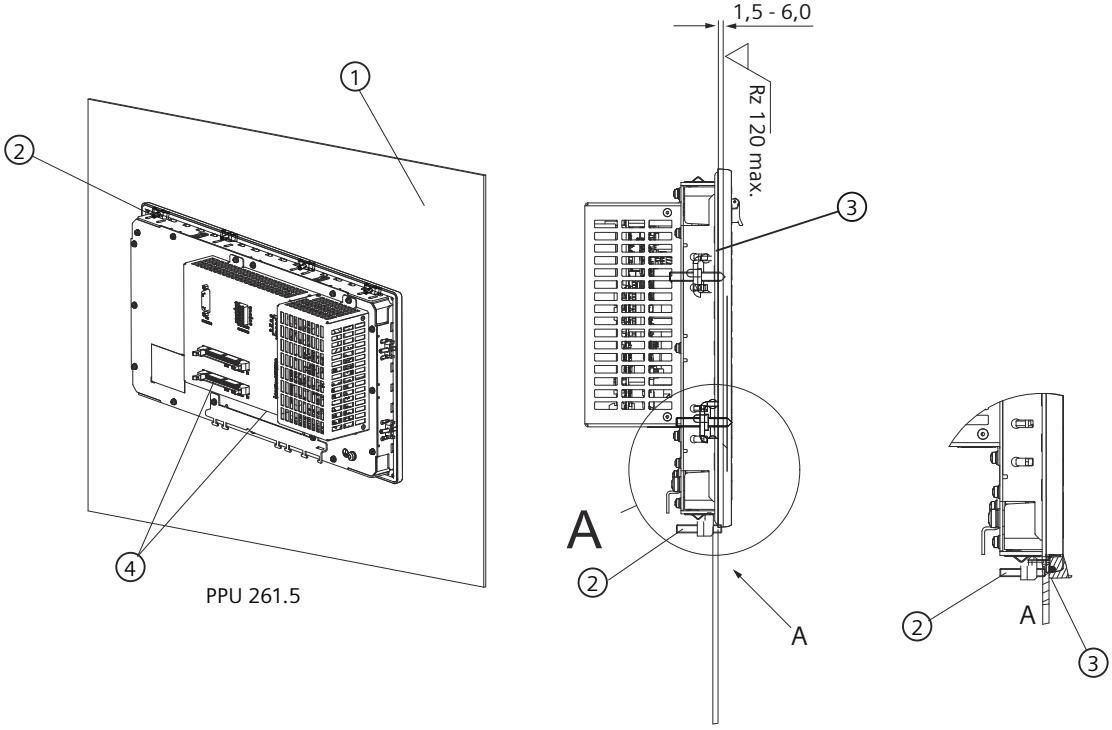
Panel cutout of the horizontal PPU variant



① Mounting frame
② Seal area
③ Pressure point for tensioners

Figure 5-15 Horizontal PPU panel cutout

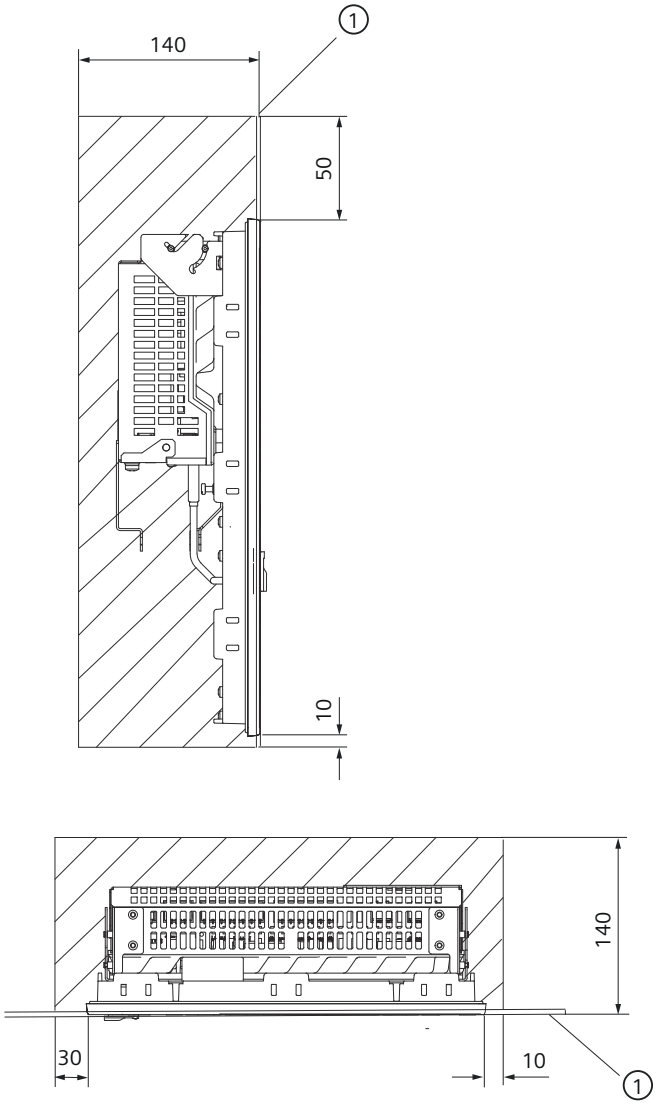




① Mounting frame
② 12 tensioners for PPU 261.5
12 tensioners for PPU 271.5
③ Seal

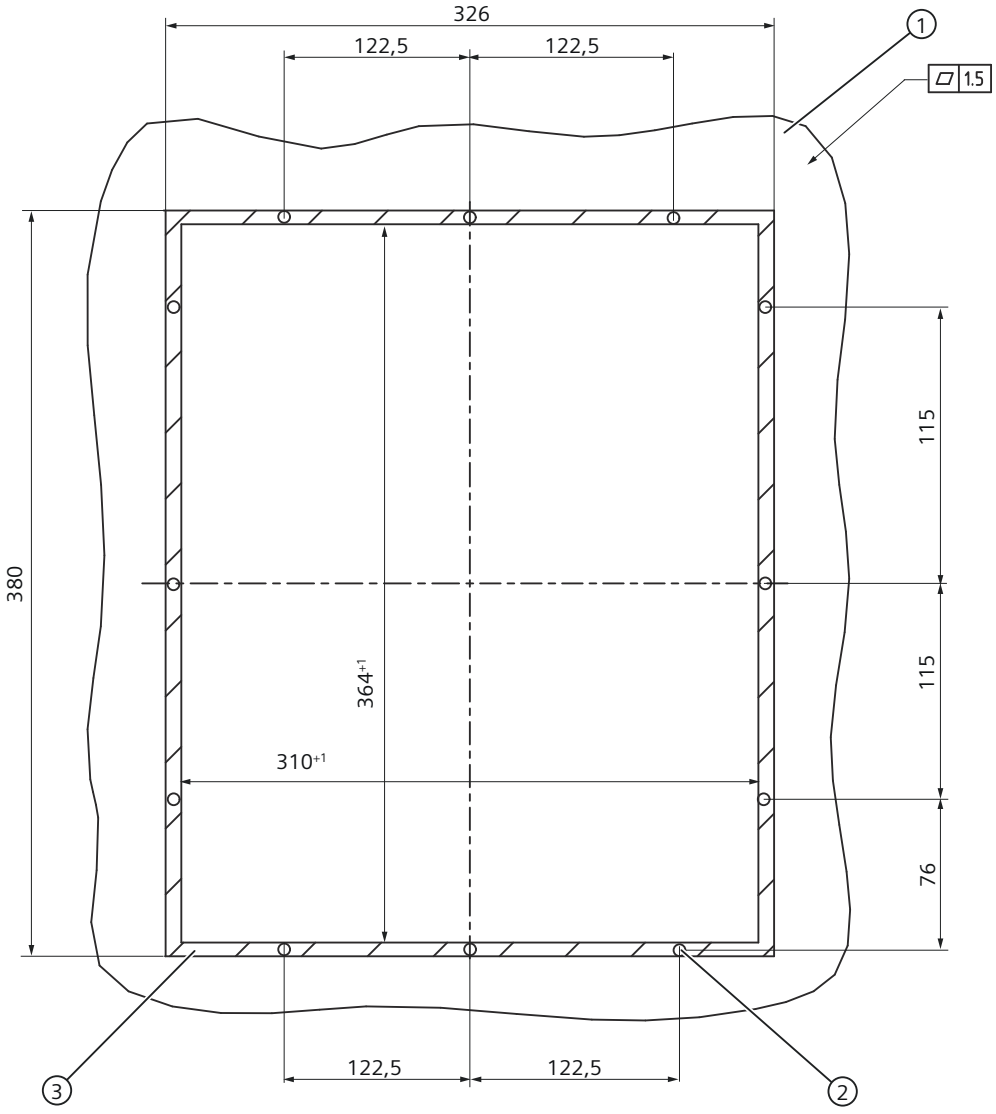
④ Interfaces
Figure 5-16 Horizontal PPU mounting

Installation of the vertical PPU varaint



① Mounting frame
Figure 5-17 Clearance for ventilation and cables in the vertical PPU

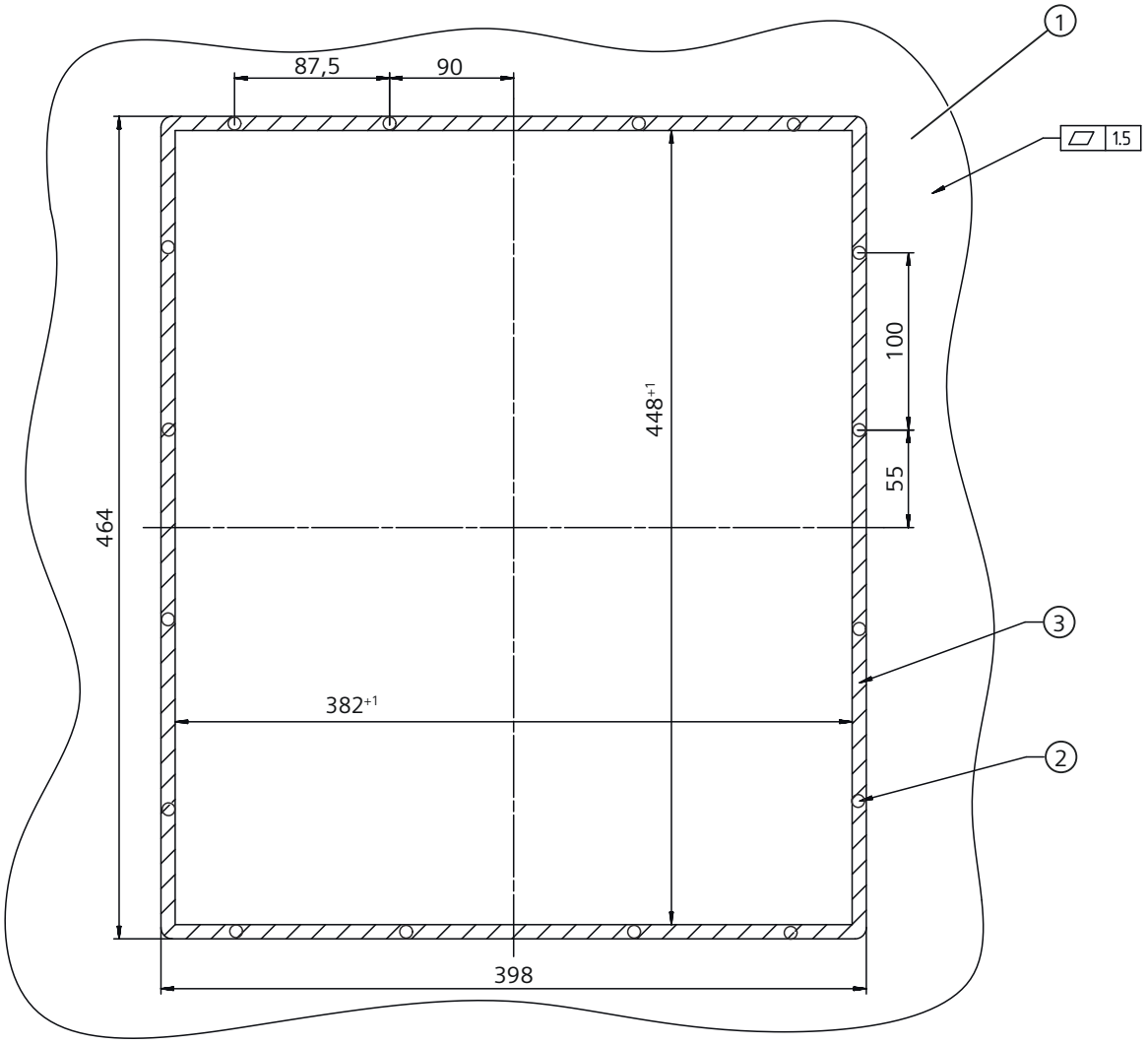
Panel cutout of the vertical PPU variant



① Mounting frame
② Pressure point for tensioners
③ Seal area

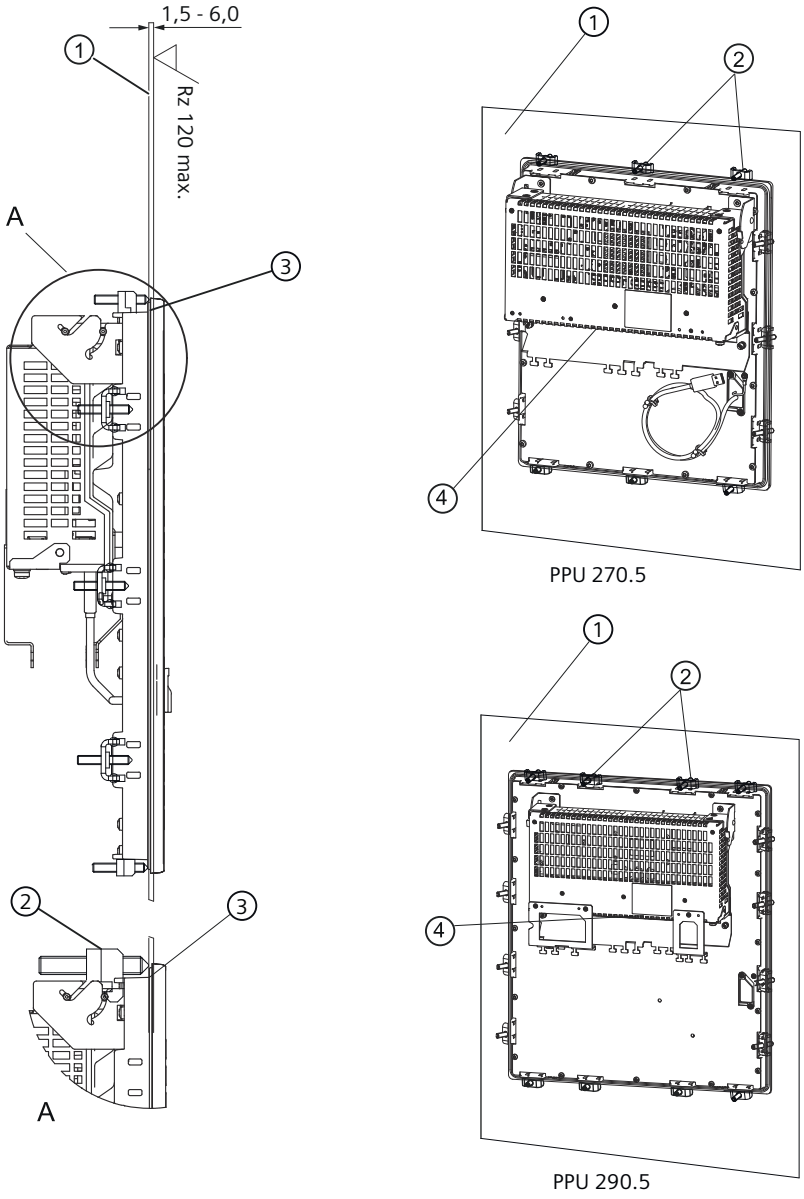
Figure 5-18 Vertical PPU panel cutout

Panel cutout of the vertical PPU with touch screen variant



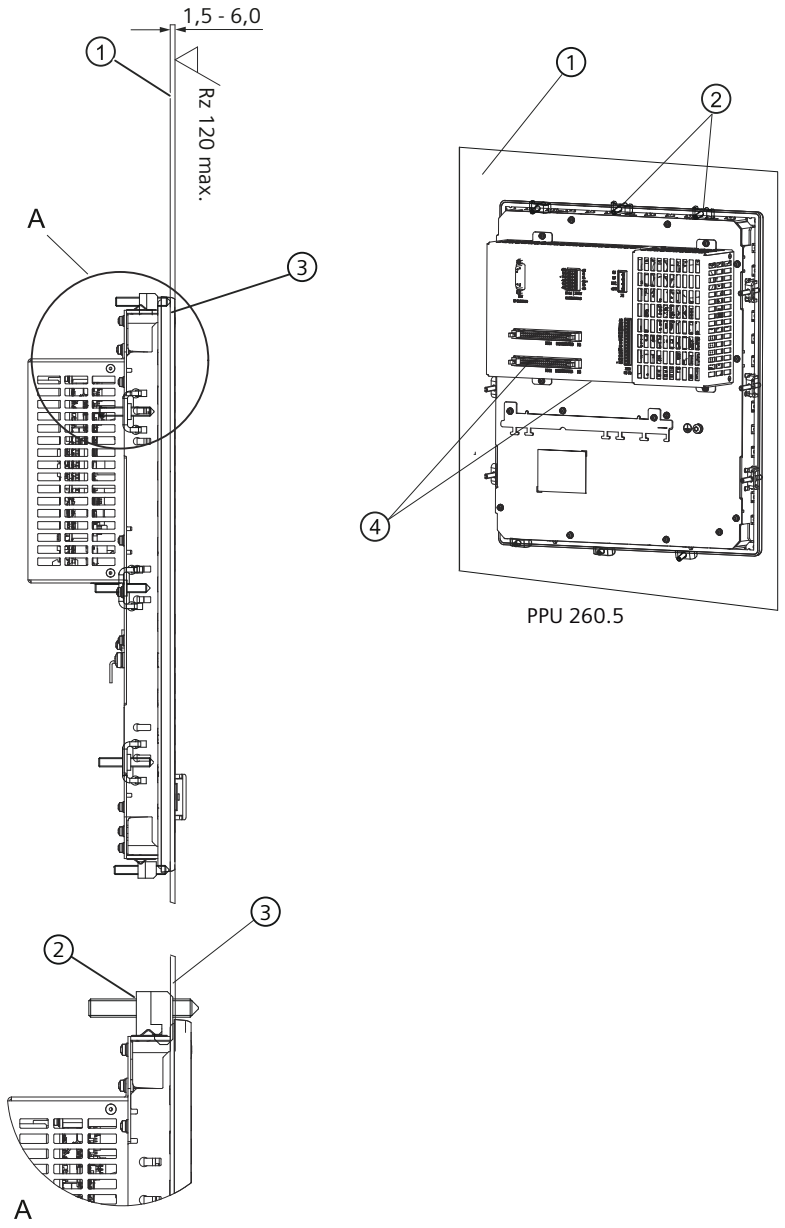
① Mounting frame
② Pressure point for tensioners
③ Seal area

Figure 5-19 Vertical PPU with touch screen panel cutout



A Detailed view
① Mounting frame
② 12 tensioners for PPU 270.5
16 tensioners for PPU 290.5
③ Seal
④ Interfaces

Figure 5-20 Installation of the vertical PPU 270.5 and PPU 290.5 variants



A Detailed view
① Mounting frame
② 12 tensioners for PPU 260.5
③ Seal
④ Interfaces

Figure 5-21 Installation of the vertical PPU 260.5 variant

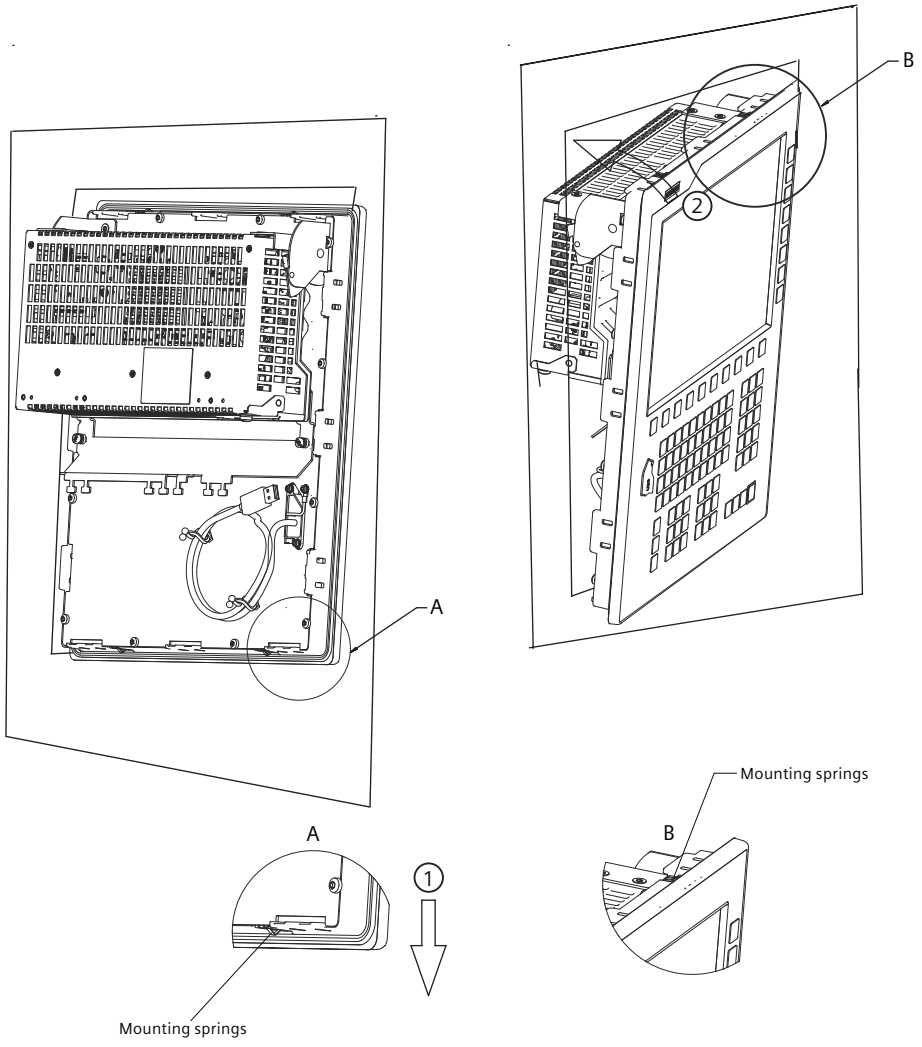
5.3.3 Installation of the PPU

Preparation for installing the PPU

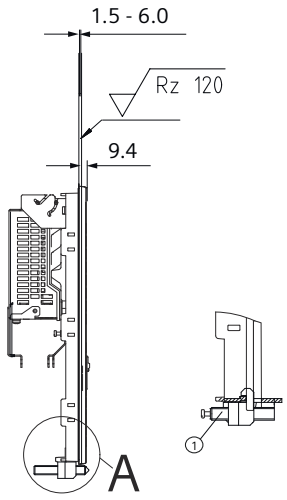
Special clamping elements are used to fix the PPU in a housing with IP65 / IP66 degree of protection if the housing conforms to what is specified in the dimension sheet. When using the tension jacks, holes or threaded holes are not required. The PPU already has a PU foam seal. The tension jacks are included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

Installing the PPU

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



2. Tilt the PPU ② and fit the device into the cutout. The mounting springs prevent the PPU from falling out.
3. Fix the PPU in the installation cutout from the rear using the tension jacks by tightening the setscrews:
   Ensure that the PPU sits firmly in the installation cutout and cannot fall out before you secure the PPU at the rear using the tension jacks.



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

Note

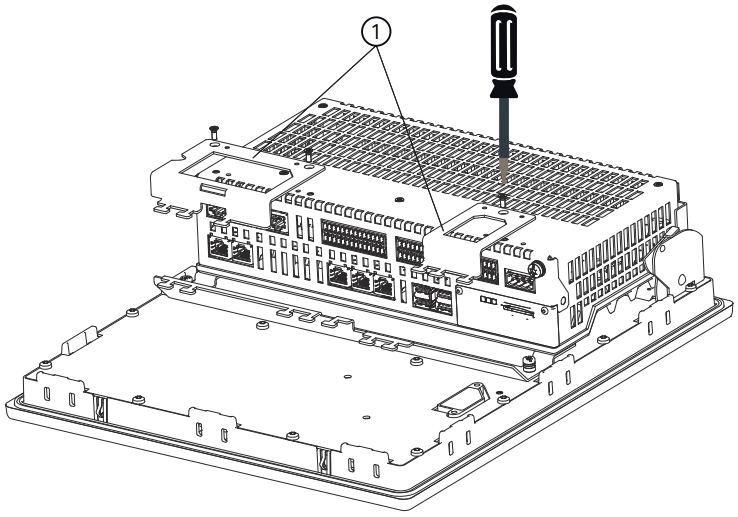
Installing the PPU

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

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

Installing the upper cable pull relief for PPU 27x.5 and PPU 290.5

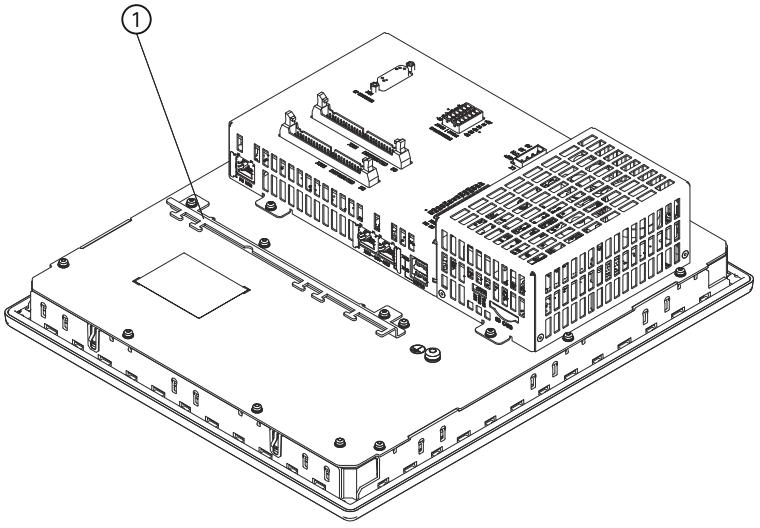
The upper cable pull relief and their screws are availalble in an extra bag included in the scope of delivery. You need to assemble them (ideally after plugging in all the cables). Tool used is Torx10, tightening torque 0.8 Nm.



① Upper cable pull relief

Cable pull relief for PPU 26x.5

The cable pull relief is already assembled on the module.



① Cable pull relief

Service and maintenance

6

6.1 Service position for PPU

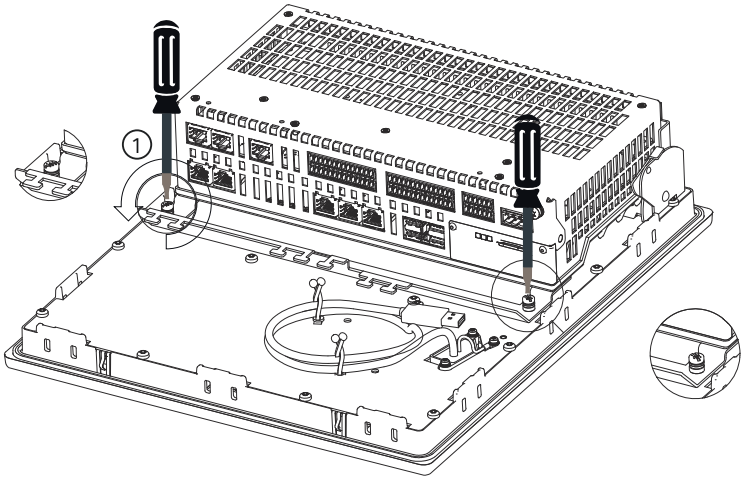
The panel variants of SINUMERIK 828D: PPU 270.5, PPU 271.5, and PPU 290.5 support service position for the electronic box (processing unit) and panel.

Note

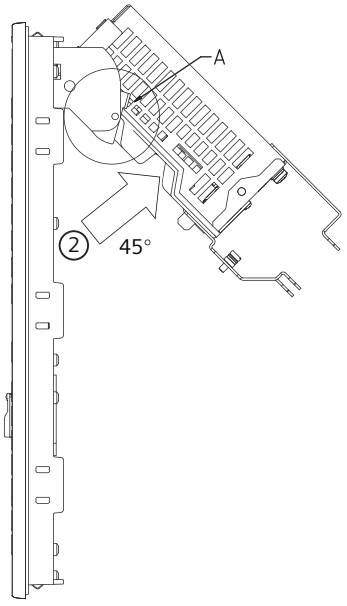
The service position should be allowed only to service people or trained professional for easy access to the interfaces.

Instructions: Service position for PPU 270.5 (Vertical variant) and PPU 290.5 (Touch variant)

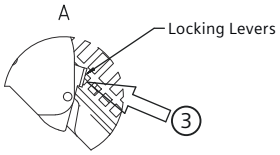
1. To bring the box into the service position, loosen the screws ① using the Torx20 or a flat screwdriver.



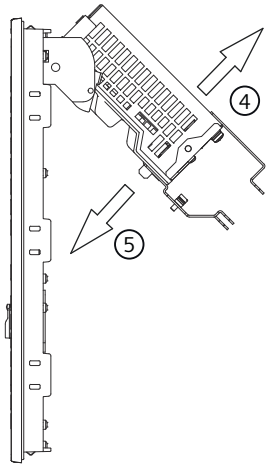
2. Swivel the box ② by 45 °



3. Press the locking levers located at the hinge ③ from both sides to lock the box in service position.

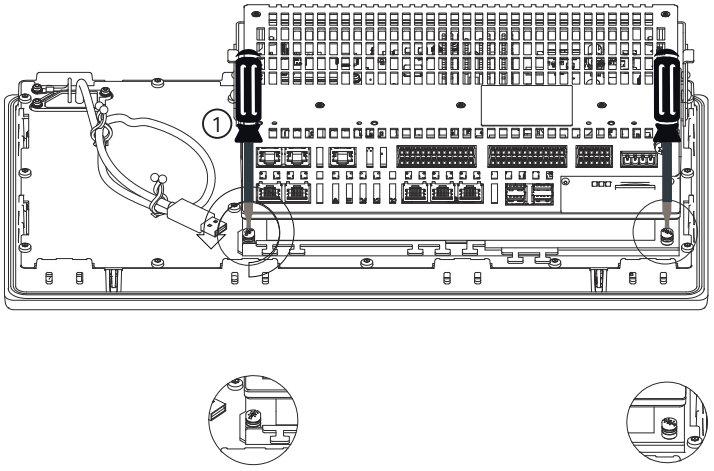


4. To return the box to its normal position, simply lift it ④ and move the box slightly further. As you do, the locking levers will release, allowing you to lower the box again ⑤. Finally, secure it in place by tightening the screws, Torx20 or a flat screwdriver, tightening torque 1.3Nm.

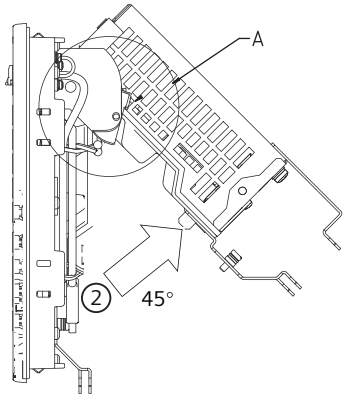


Instructions: Service position for PPU 271.5 (Horizontal variant)

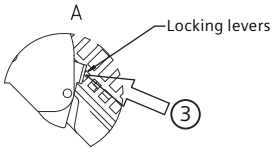
1. To bring the box into the service position, loosen the screws ① using the Torx20 or a flat screwdriver.



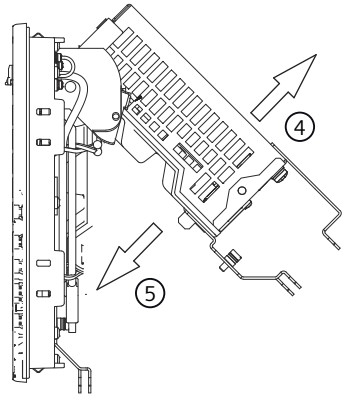
2. Swivel the box ② by 45 °



3. Press the locking levers located at the hinge ③ from both sides to lock the box in service position.



4. To return the box to its normal position, simply lift it ④ and move the box slightly further. As you do, the locking levers will release, allowing you to lower the box again ⑤. Finally, secure it in place by tightening the screws, Torx20 or a flat screwdriver, tightening torque 1.3Nm.



6.2 Service and maintenance

Cleaning the device

Use a soft cloth moistened either with water or a mild cleaning agent to clean the housing and operator controls of the device.

Note

Switch the device off for cleaning

Clean the device only when it is switched off. This way, you ensure that you cannot unintentionally trigger any functions by touching the keys.

Procedure

Spray the cleaning agent on to a cleaning cloth. Never use caustic solvents or abrasive cleaners.

Note

Avoid damage

Do not clean the device using compressed air or steam jets because they can damage it.

Checking the device

In order to prevent foreign bodies or liquids entering the device, regularly check the device for the following:

- Ensure that all the housing screws are in place and tight
- For damage to the housing
- For damage to the cable cover or cable entry

Protect the device from environmental effects

Protect the device against the following environmental factors:

- Direct sunshine and heat sources
- Mechanical vibration and shock
- Dust
- Humidity
- Strong magnetic fields

Suspected malfunction

If you suspect a malfunction due to unusual product reactions, isolate the device from power. Immediately inform qualified personnel to check the function and ensure that the product functions correctly.

The following signs can indicate a malfunction:

- Unusual or no functioning
- Unusual heat generation
- Smoke development

Repair

Send the device back to the manufacturer for repair. The device must only be repaired there.

Rules for permitted topologies

7

The Sinumerik 828D (P)PUs offer two different IO systems:

1. DRIVE-CliQ for the controls with integrated drive control PU272.5, PPU27x.5, PPU290.5
2. PLC IO Interface for all (P)PUs

7.1 Topology rules for S120 Combi

Topology rules for DRIVE-CLiQ

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

Assigning the DRIVE-CLiQ interfaces

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

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

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

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

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

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

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

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

DRIVE-CLiQ interface	Connection to
X202	Motor encoder for feedrate 1st expansion axis
X203	Motor encoder for feedrate 2nd expansion axis

[1] Remains empty if only one Single Motor Module is used.

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

DRIVE-CLiQ interface	Connection to
X500	X501 of the TM54F X102 of the PU (if a TM54F is not being used)
X501	Direct encoder, feedrate 1 at the S120 Combi
X502	Direct encoder, feedrate 2 at the S120 Combi
X503	Direct encoder, feedrate 3 on the S120 Combi (only for S120 Combi with four axes, remains empty for S120 Combi with three axes)
X504	Feedrate 1st expansion axis at the Motor Module
X505	Feedrate 2nd expansion axis at the Motor Module

Assignment of the DRIVE-CLiQ interfaces on the TM54F:

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

7.2 Topology rules for S120 Booksize

Introduction

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

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

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

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

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

Note

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

DRIVE-CLiQ rules

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

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

- A maximum of eight DRIVE-CLiQ nodes can be connected in one row. A row is always seen from the perspective of the Control Unit.
  This number reduces to a maximum of four DRIVE-CLiQ nodes in one row when the extended functions of drive-based Safety Integrated are configured.
- A maximum of 14 nodes can be connected to one DRIVE-CLiQ line on a Control Unit.
- Ring wiring is not permitted.

- Components must not be double-wired.

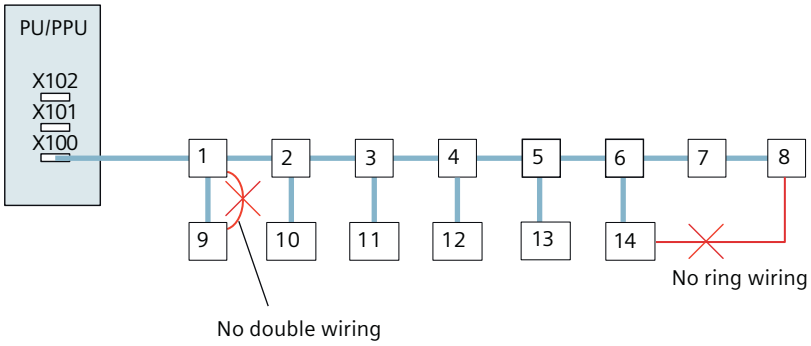


Figure 7-1 Example: DRIVE-CLiQ line at the X100 terminal (without Safety Integrated)

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

- To allow the following modules to be assigned automatically during the commissioning (device identification), they should be connected to a free DRIVE-CLiQ port on the associated Active Line Module / Motor Module:
  - Voltage Sensing Module (VSM)
  - Terminal Module TM120

  Note

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

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

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

Recommended rules:

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

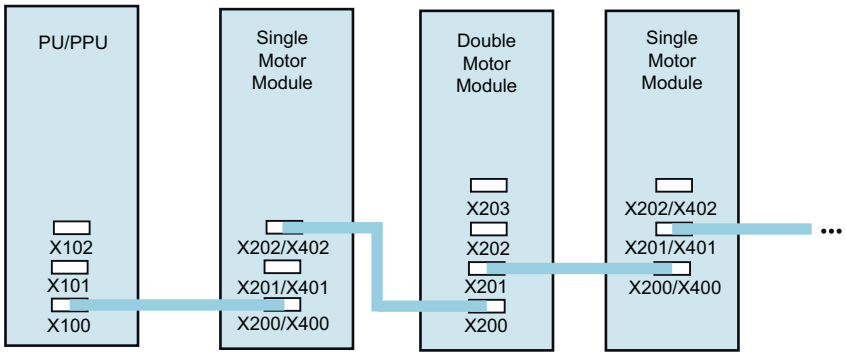


Figure 7-2 Example: DRIVE-CLiQ line

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

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

Component	Connecting the motor encoder via DRIVE-CLiQ
Single Motor Module chassis	X402
Power Module chassis	X402

Note

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

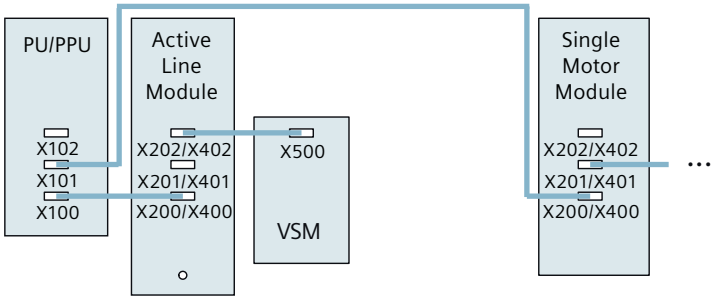


Figure 7-3 Example: Topology with VSM for booksize and chassis components

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

7.3 Topology rules for Safety Integrated functions

Number of axes	Port 1 at the PPU X100	Port 2 at the PPU X101	Port 3 at the PPU X102	Example in the figure:
SINAMICS S120 booksize				
5	1 x LM 4 x MoMo 1 x SMy at the 4th MoMo	1 x TM54F 1 x MoMo 1 x hub DMx 4 x SMy at the hub DMx	not used	---
6	1 x LM 4 x MoMo 1 x SMy at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMy at the hub DMx	not used	---
7	1 x LM 4 x MoMo 1 x SMy at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMy at the hub DMx	1 x NX10.3 1 x TM54F 1 x MoMo 1 x SMy at the MoMo	---
8	1 x LM 4 x MoMo 1 x SMy at the 4th MoMo	1 x TM54F 1 x MoMo 1 x hub DMx 4 x SMy at the hub DMx	1 x NX10.3 1 x TM54F 3 x MoMo 1 x SMy at NX10.3 1 x SMy at TM54F 1 x SMy at the 3rd MoMo	Topology with SINAMICS S120 Booksize 5+3 axes (Page 134)
8	1 x LM 4 x MoMo 1 x SMy at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMy at the hub DMx	1 x NX10.3 1 x TM54F 2 x MoMo 1 x SMy at NX10.3 1 x SMy at the 2nd MoMo	Topology with SINAMICS S120 Booksize and 6+2 axes (Page 134)
10	1 x LM 4 x MoMo 1 x SMy at the 4th MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMy at the hub DMx	1 x NX15.3 1 x TM54F 4 x MoMo 1 x SMy at the NX15.3 3 x SMy at the hub DMx	Topology with SINAMICS S120 Booksize and 6+4 axes (Page 134)
SINAMICS S120 Booksize with S120 Combi				
1	3 x Combi 1 x SMy at the Combi	not used	1 x TM54F 1 x hub DMx 2 x SMy at the hub DMx	---
2	3x Combi 1 x SMy at the Combi	1 x booksize compact	1 x TM54F 1 x hub DMx 3 x SMy at the hub DMx	---
3	4 x Combi 1 x SMy at the Combi	not used	1 x TM54F 1 x hub DMx 3 x SMy at the hub DMx	---
4	4 x Combi 1 x SMy at the Combi	1 x booksize compact	1 x TM54F 1 x hub DMx 4 x SMy at the hub DMx	---

Number of axes	Port 1 at the PPU X100	Port 2 at the PPU X101	Port 3 at the PPU X102	Example in the figure:
4	4 x Combi 1 x SMy at the Combi	2 x booksize compact	1 x TM54F 1 x hub DMx 5 x SMy at the hub DMx	---
6	1xCombi 3 x SMy at the Combi	2 x booksize compact 1 x TM54F 1 x hub DMx 5 x SMy at the hub DMx	1 x NX 15.3 1 x TM54F 1 x hub DMx 5 xSMy to hub DMx 1xCombi 2 x SMy at the Combi 2 x booksize compact	Topology with SINAMICS S120 Combi and booksize (Page 139)

Sinamics S120 with CU320

Number of axes	Port 1 at the PPU X100	Port 2 at the PPU X101	Port 3 at the PPU X102	Port 4 at the PPU PN1	Example in the figure
12+6	1 x LM 4 x MoMo 1 x SMy at the 1st MoMo 1 x SMy at the 2nd MoMo 3 x SMy at the 3rd MoMo	1 x TM54F 2 x MoMo 1 x hub DMx 5 x SMy at the hub DMx	1 x NX 15.3 1 xSMy to NX 15.3 6 x MoMo 1 x TM54F 1 x hub DMx 5 x SMy at the hub DMx	1 x CU320 6 x MoMo	Topology with SINAMICS S120 booksize and Nx15.3 12 axes and 6 axes with CU320 (Page 134)

7.4 Topology example without Safety Integrated functions

Note

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

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

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

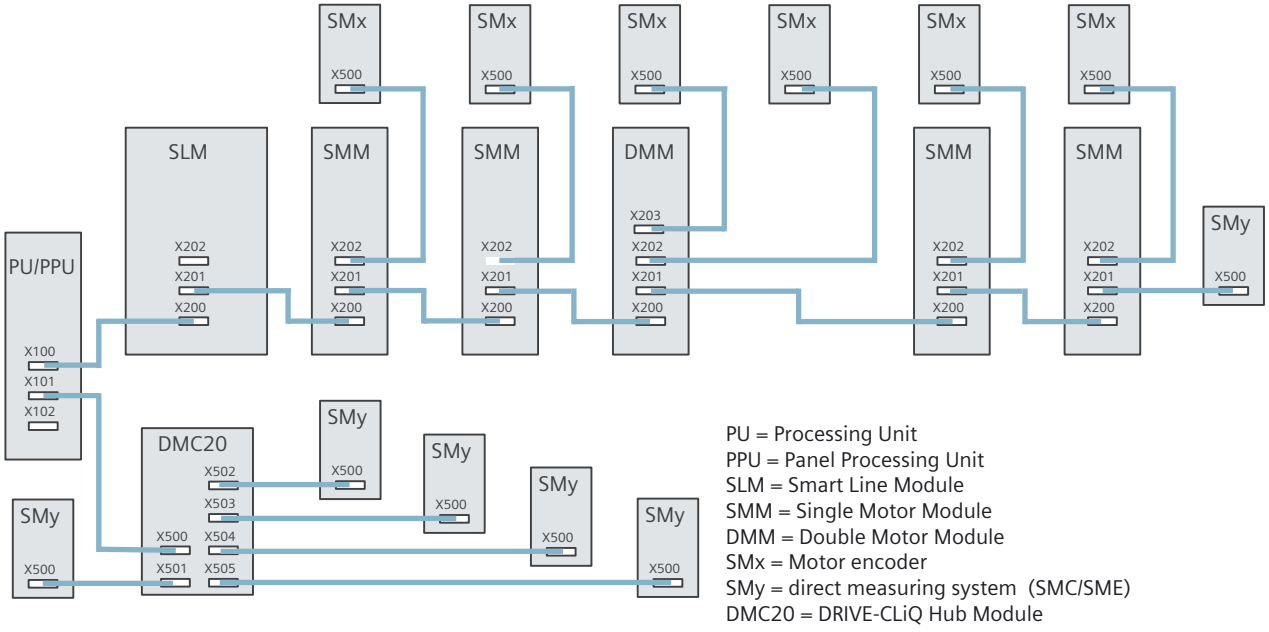


Figure 7-4 DRIVE-CLiQ wiring without NX

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

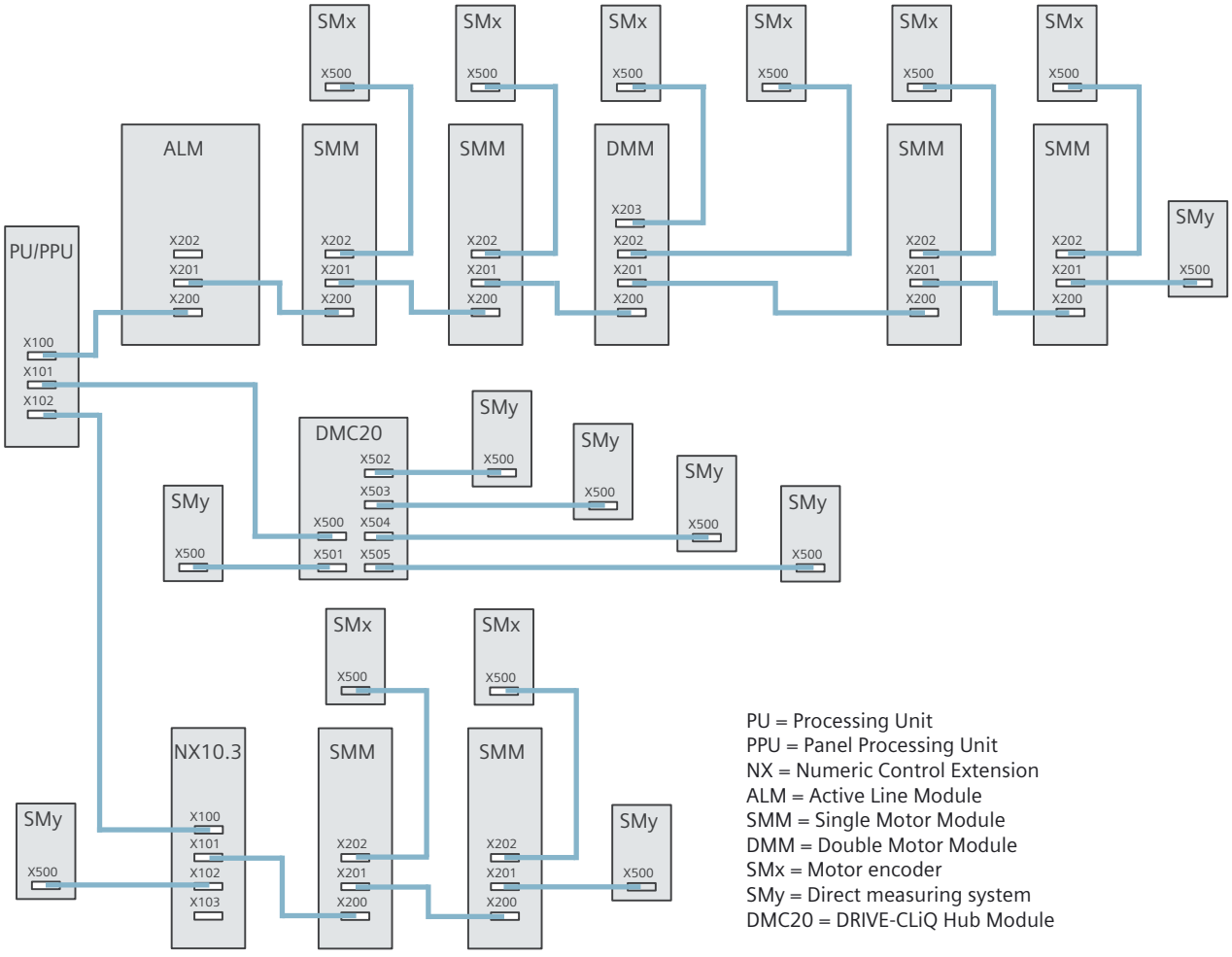


Figure 7-5 DRIVE-CLiQ wiring with NX10.3

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

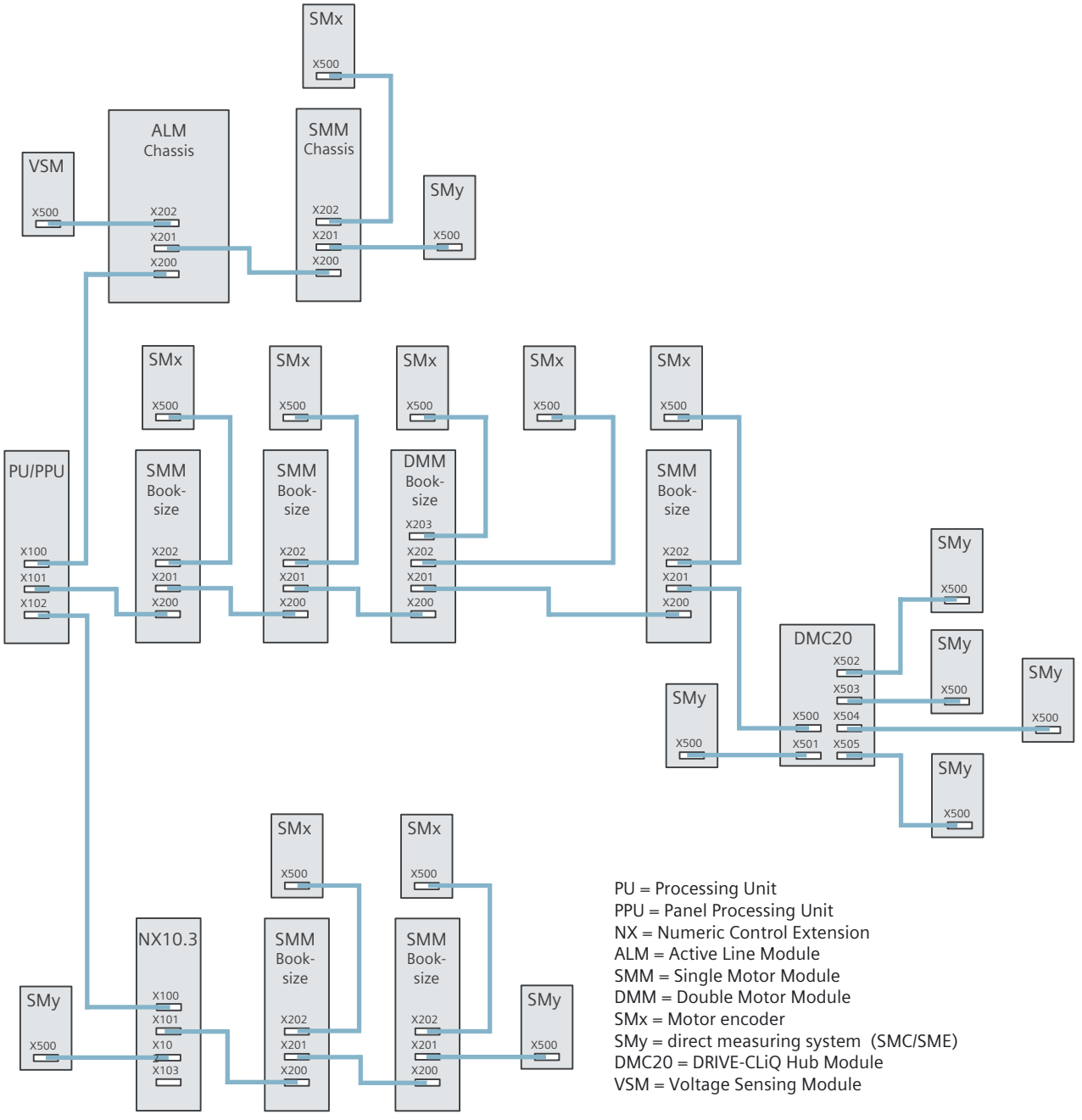
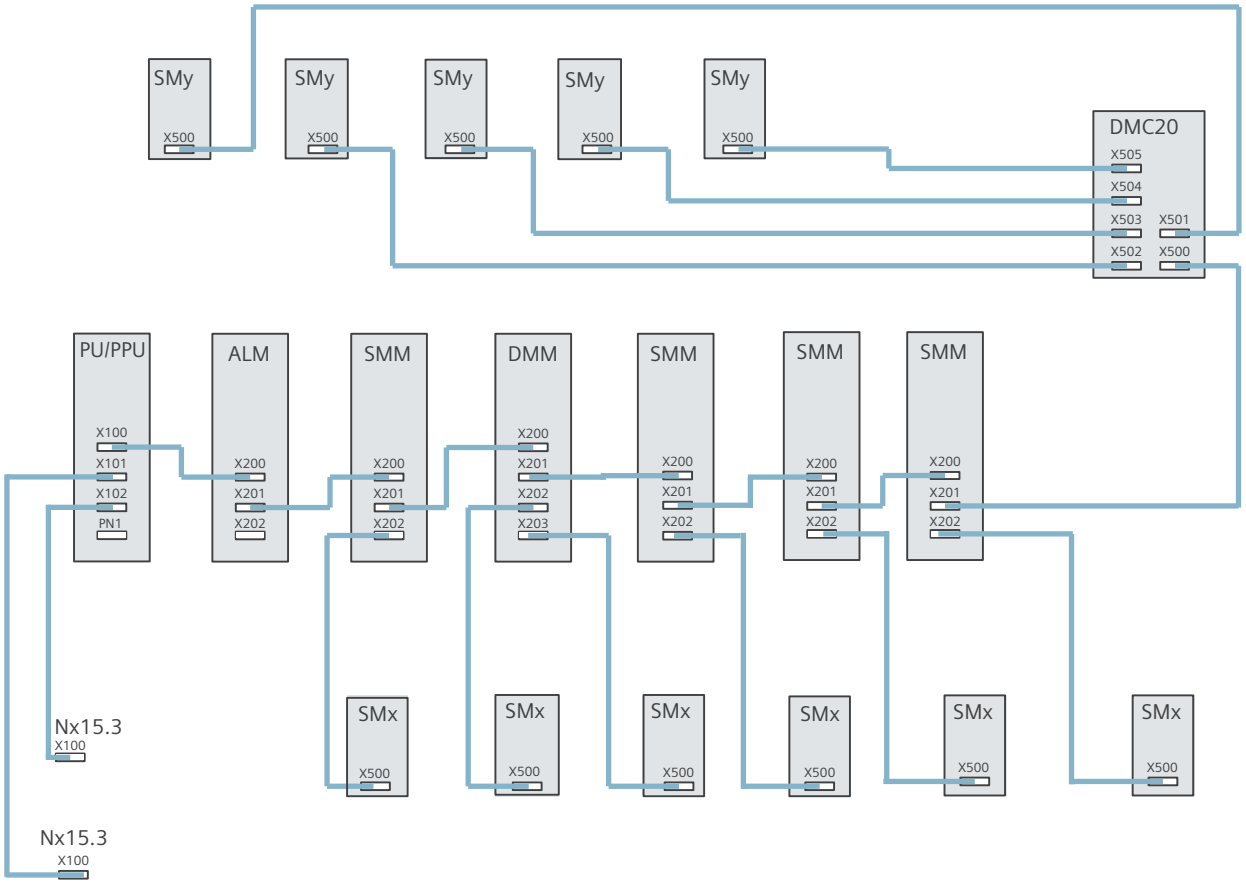
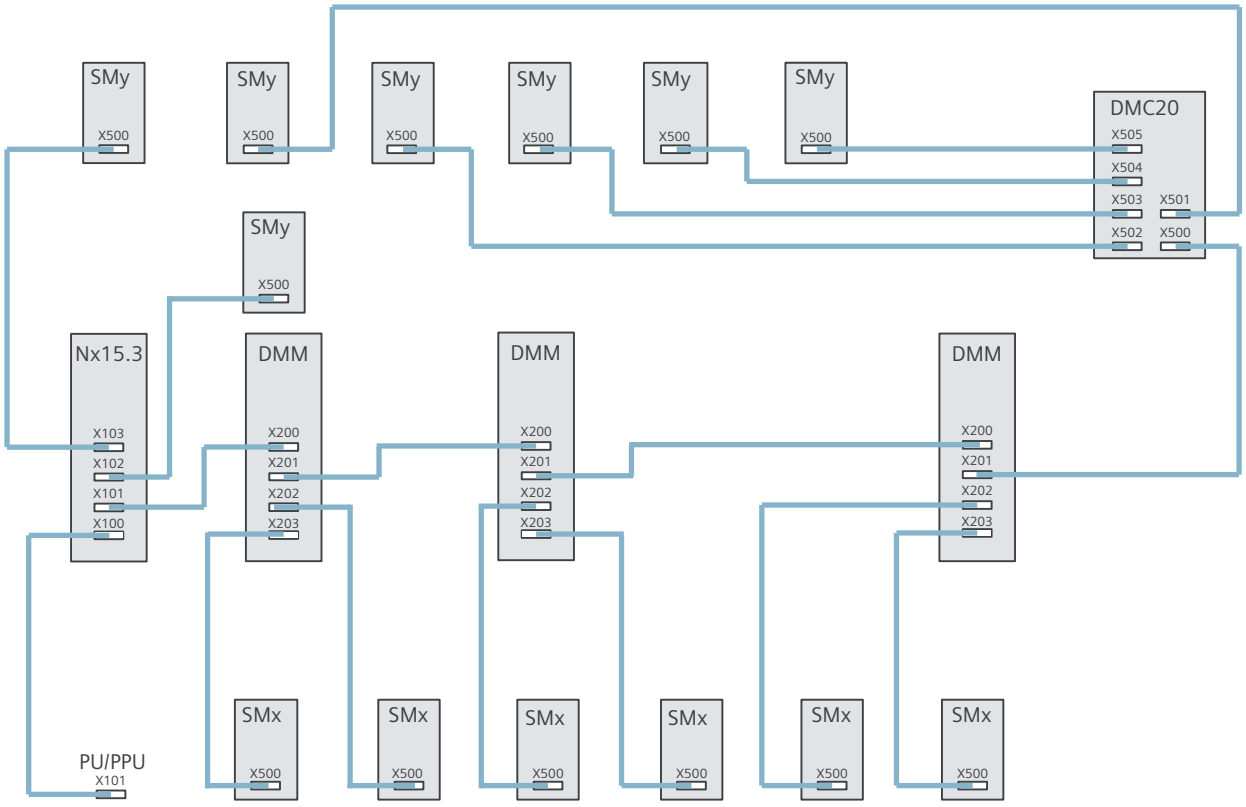


Figure 7-6 DRIVE-CLiQ wiring with NX10.3

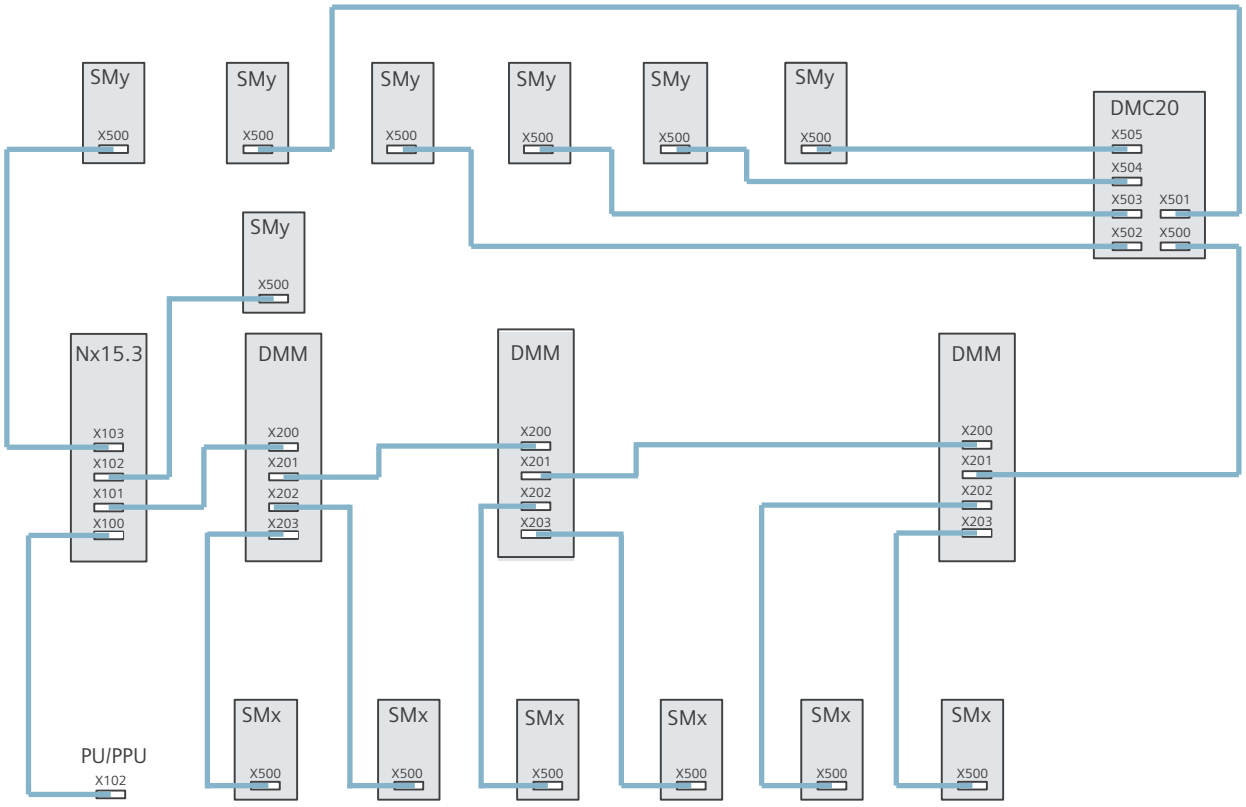
Topology with 2 NX 15.3



Continue..


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

Continue..



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

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

7.5 Topology example with Safety Integrated functions

Note

Additional notes on Safety Integrated functions are available under:

SINAMICS S120 Safety Integrated Function Manual.

Topology with SINAMICS S120 booksize and 6 plus 2 axes

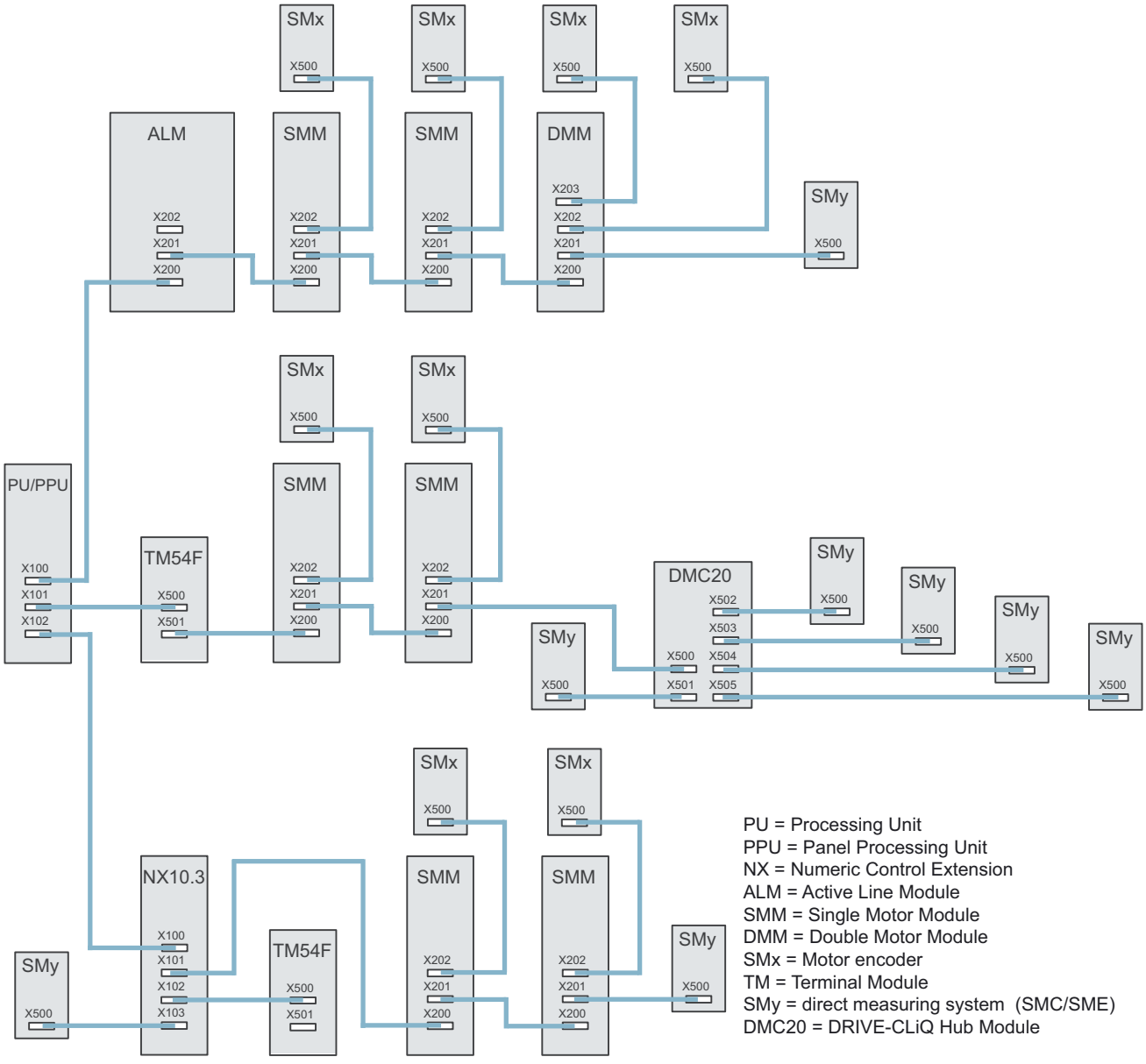


Figure 7-8 DRIVE-CLiQ wiring with Safety Integrated functions and NX10.3

Topology with SINAMICS S120 booksize and 5 plus 3 axes

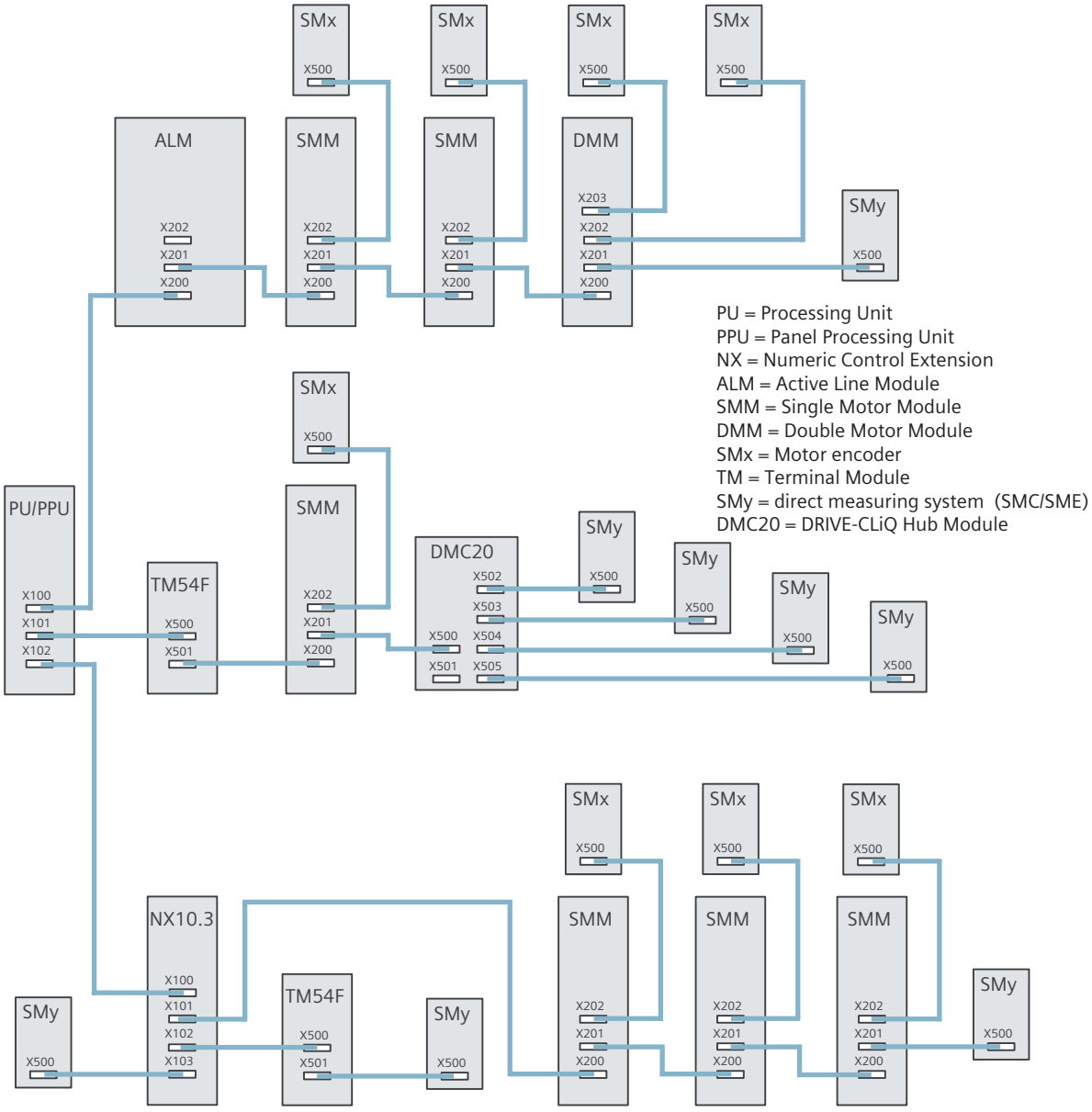


Figure 7-9 DRIVE-CLiQ wiring with Safety Integrated functions and NX10.3

Topology with SINAMICS S120 booksize and 6 plus 4 axes

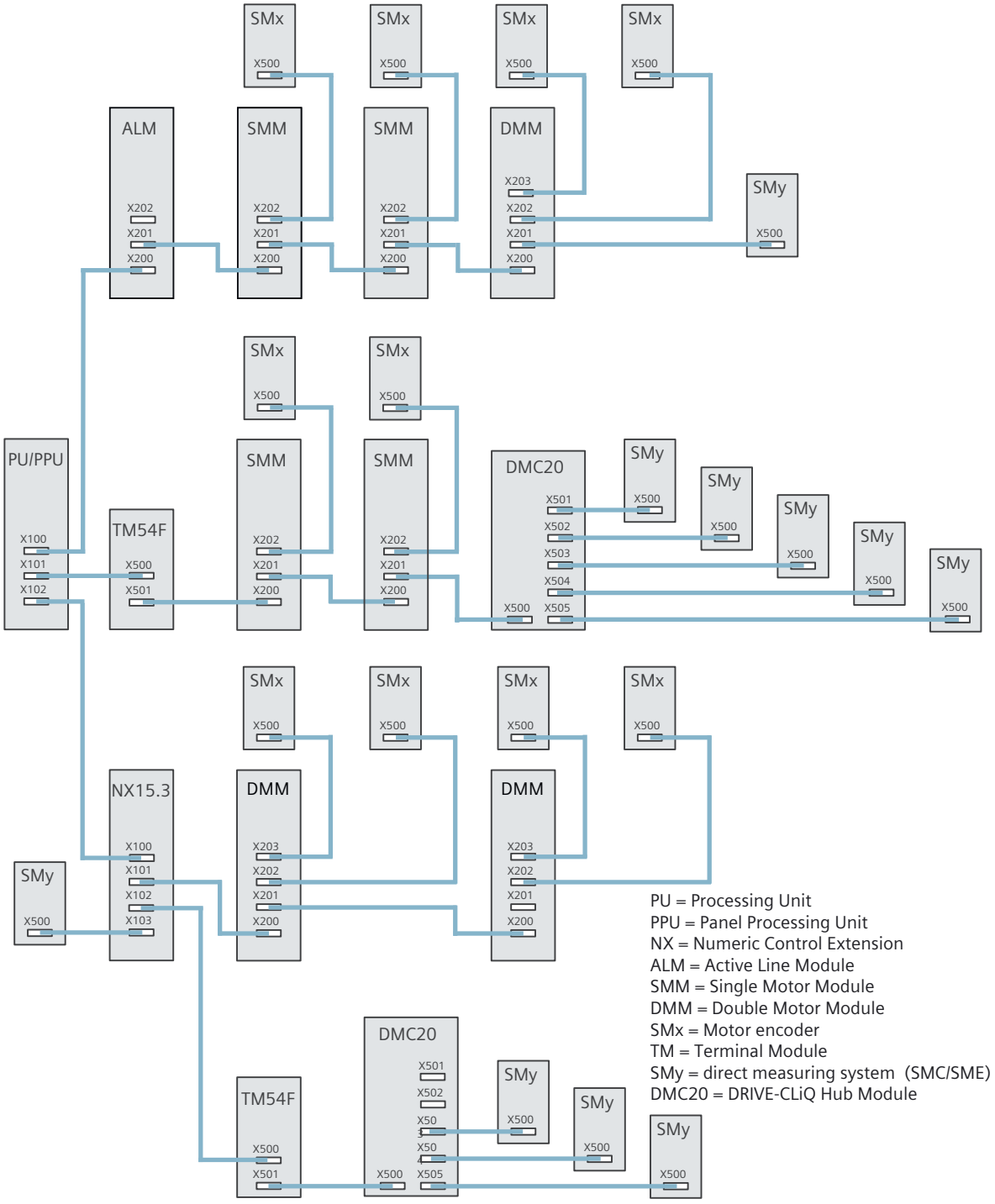


Figure 7-10 DRIVE-CLiQ wiring with Safety Integrated functions

Note

Please note the following conditions for the examples below:

1. Chassis Line Modules must be based on a DAC-ASIC
2. With Safety Integrated functions
3. Standard cycles: Tireg/Tnreg = 125 µs, LM = 250 µs, monitoring cycle = 12 ms, Tdp = 1.5 ms

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

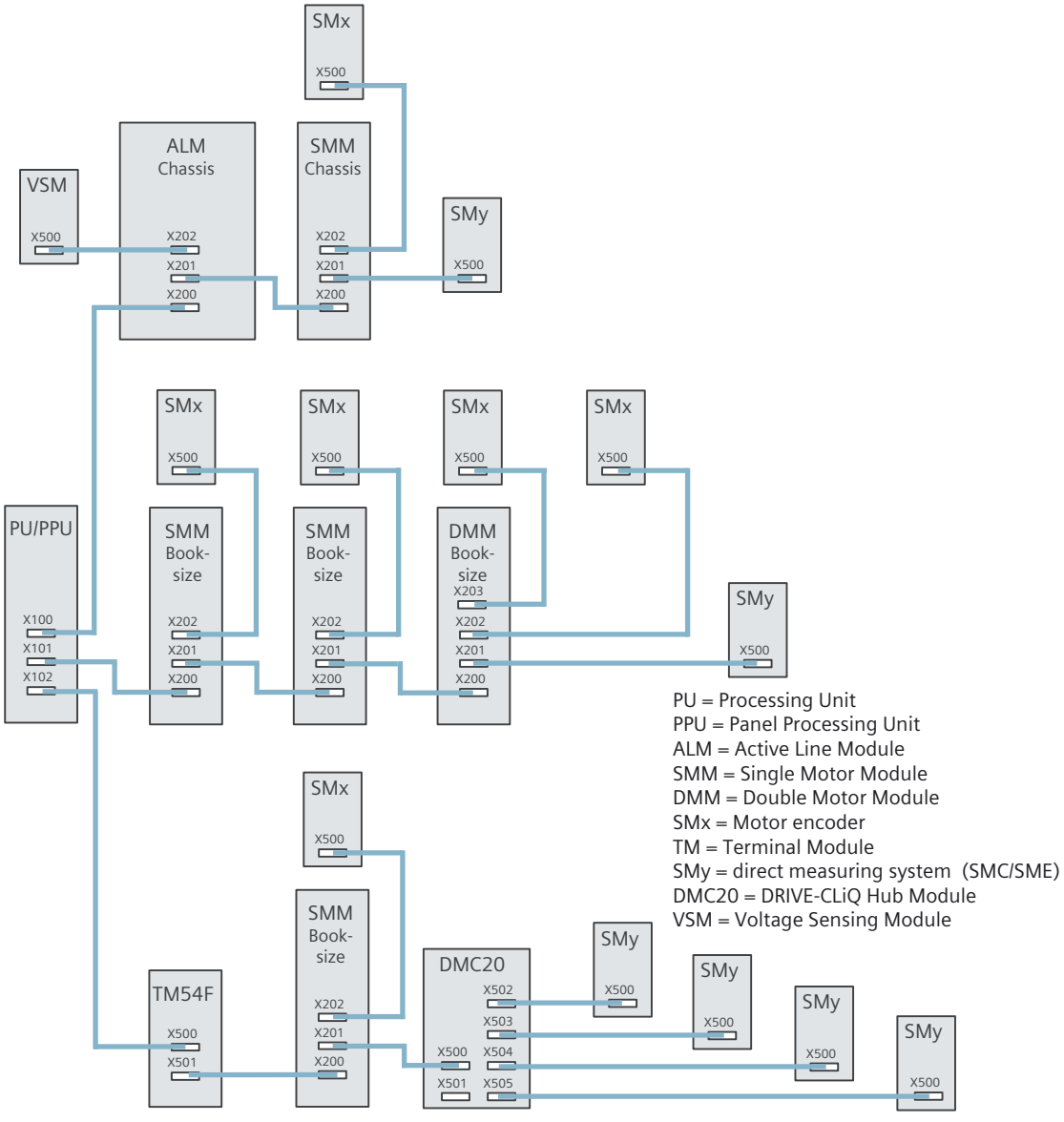


Figure 7-11 DRIVE-CLiQ wiring with Safety Integrated functions and without NX

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

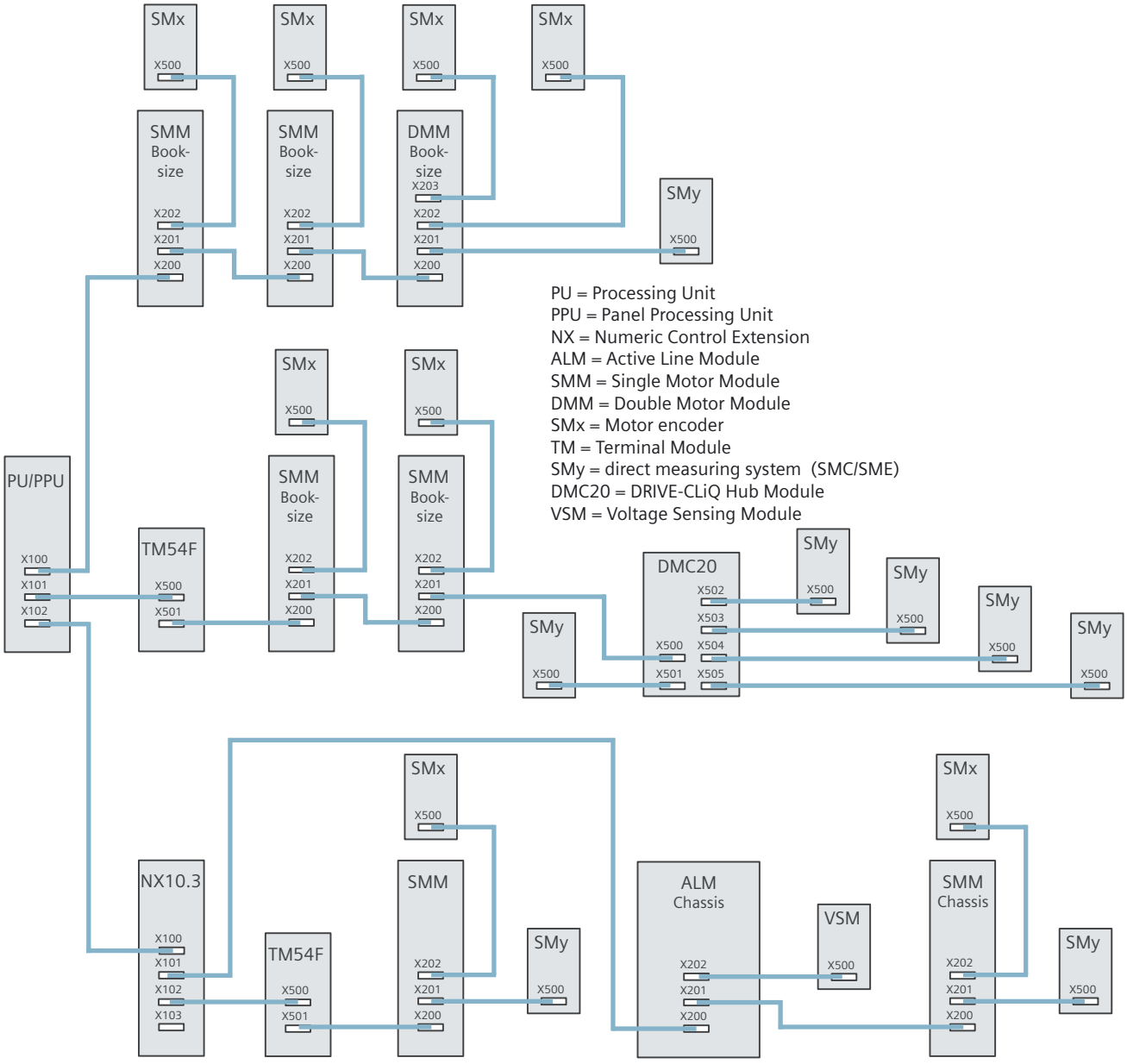


Figure 7-12 Example with Safety Integrated functions and with NX10.3

Note

You can find an example with SINAMICS S120 Combi and Safety Integrated functions under System overview for PPU (Page 56) or in the SINAMICS S120 Combi Manual.

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

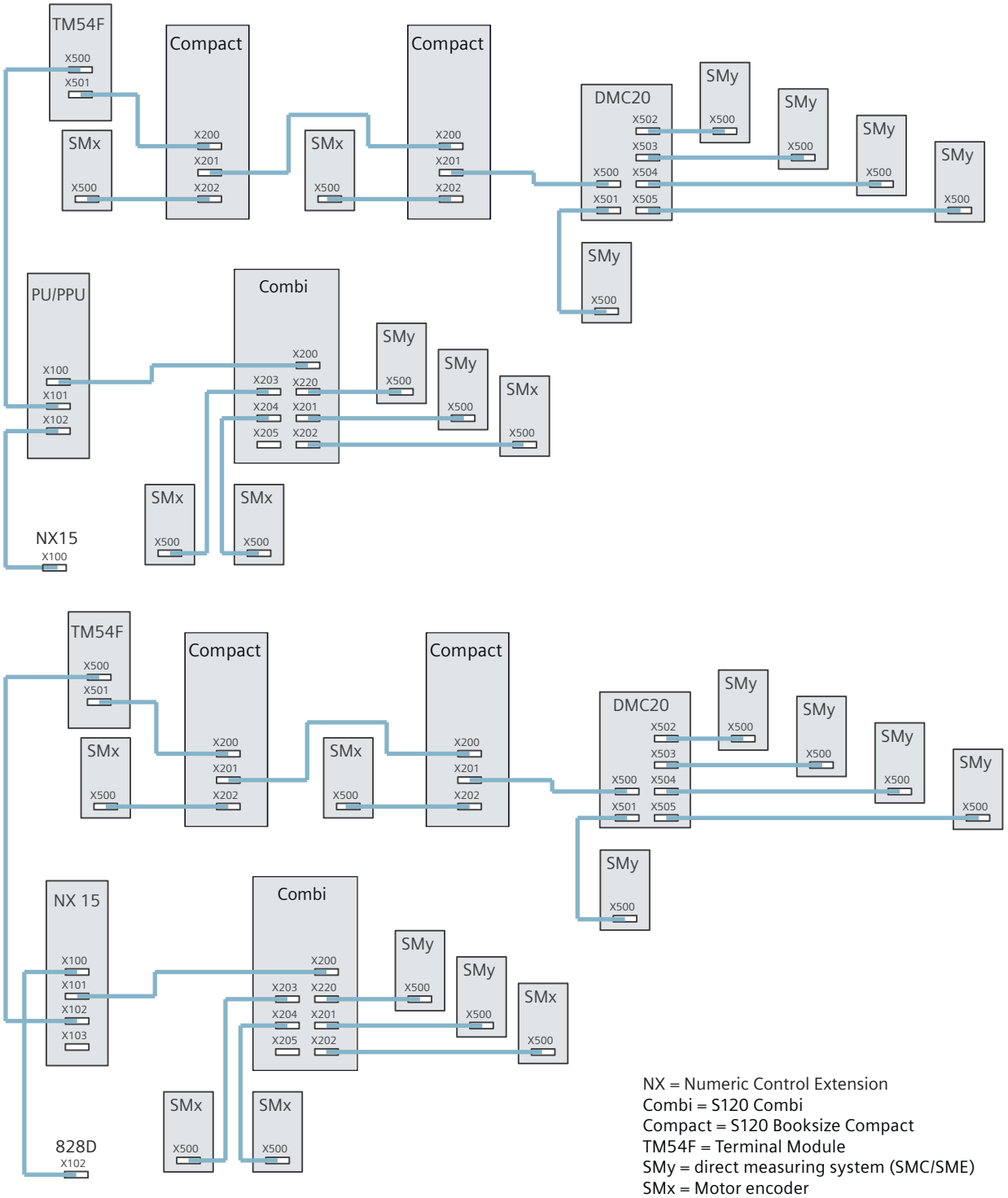


Figure 7-13 Example with Safety Integrated functions and with NX15.3

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

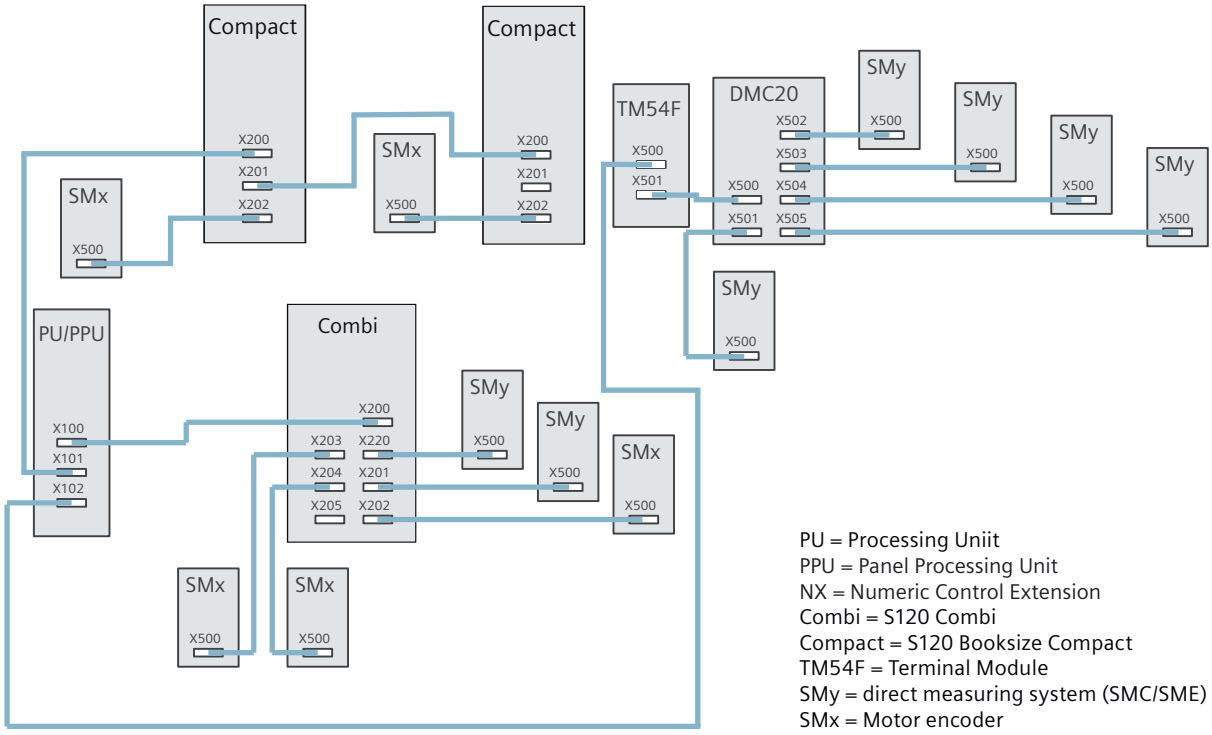


Figure 7-14 Topology with 3-4 axis combi & 2 axis compact

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

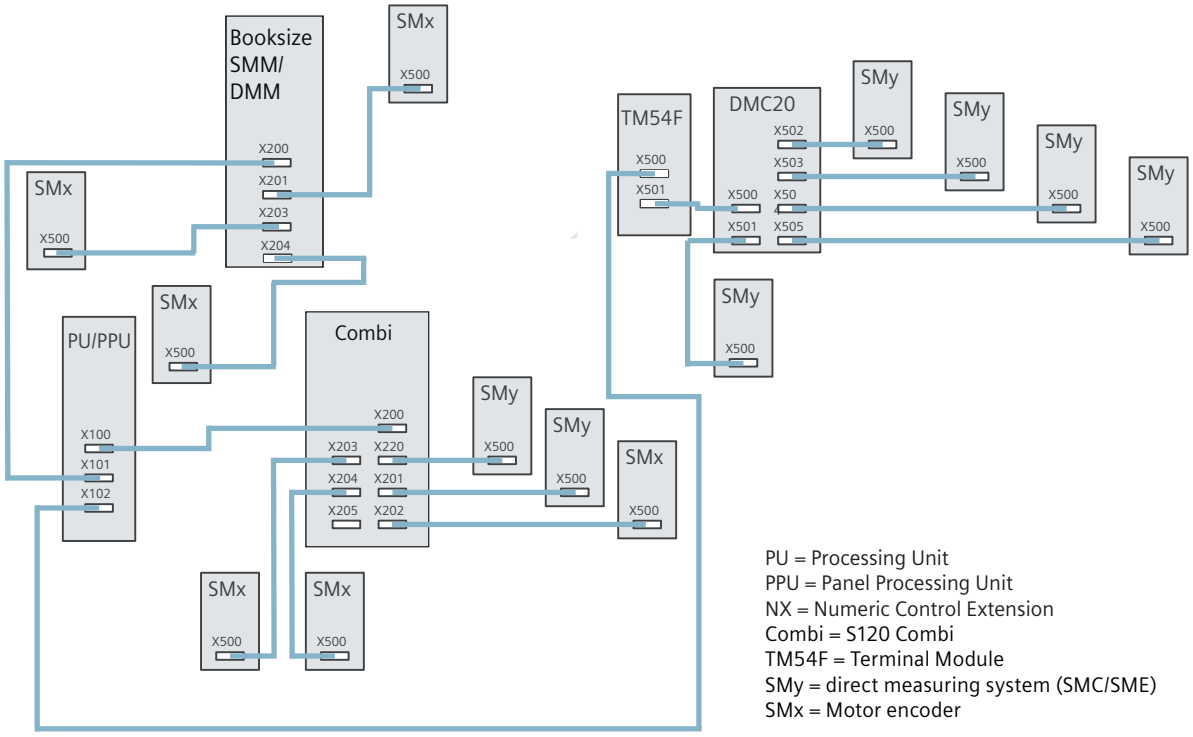
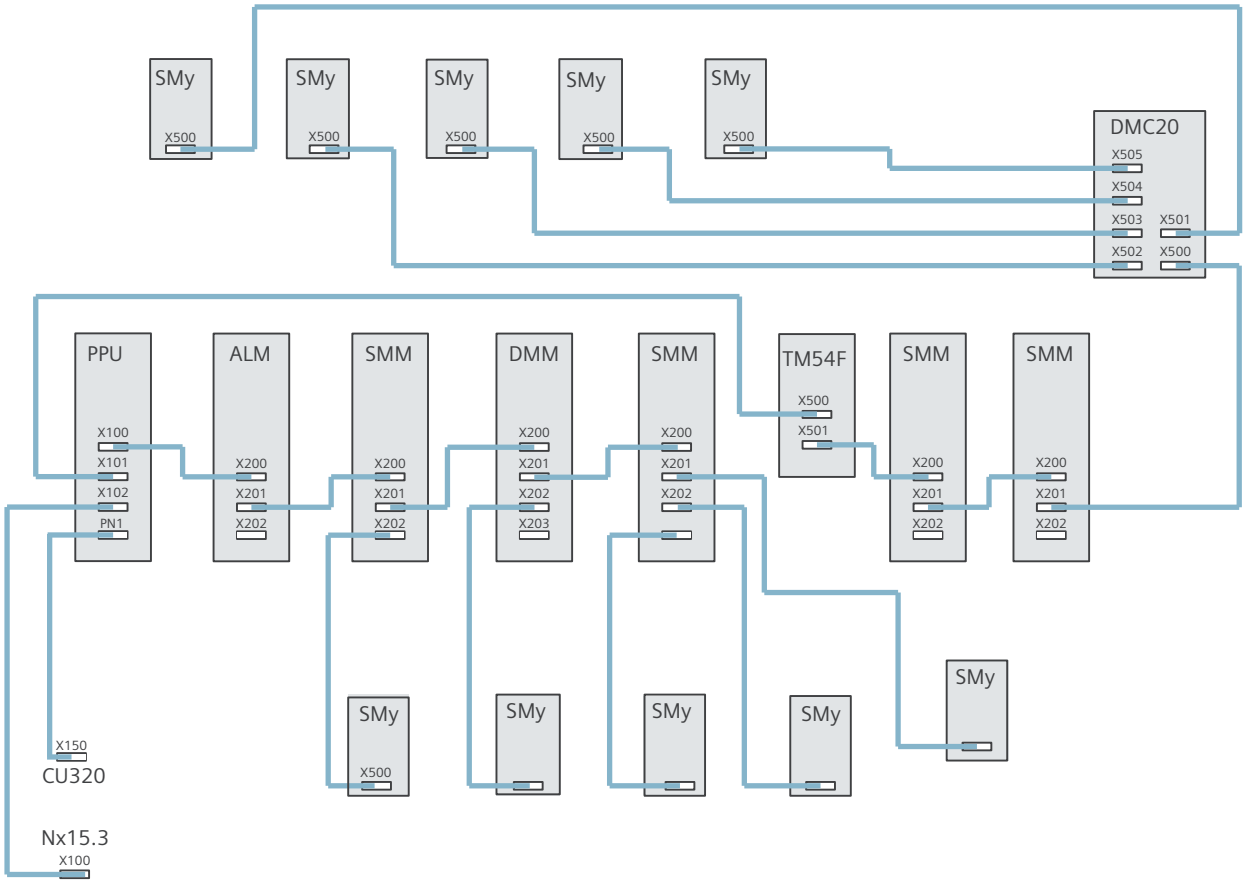
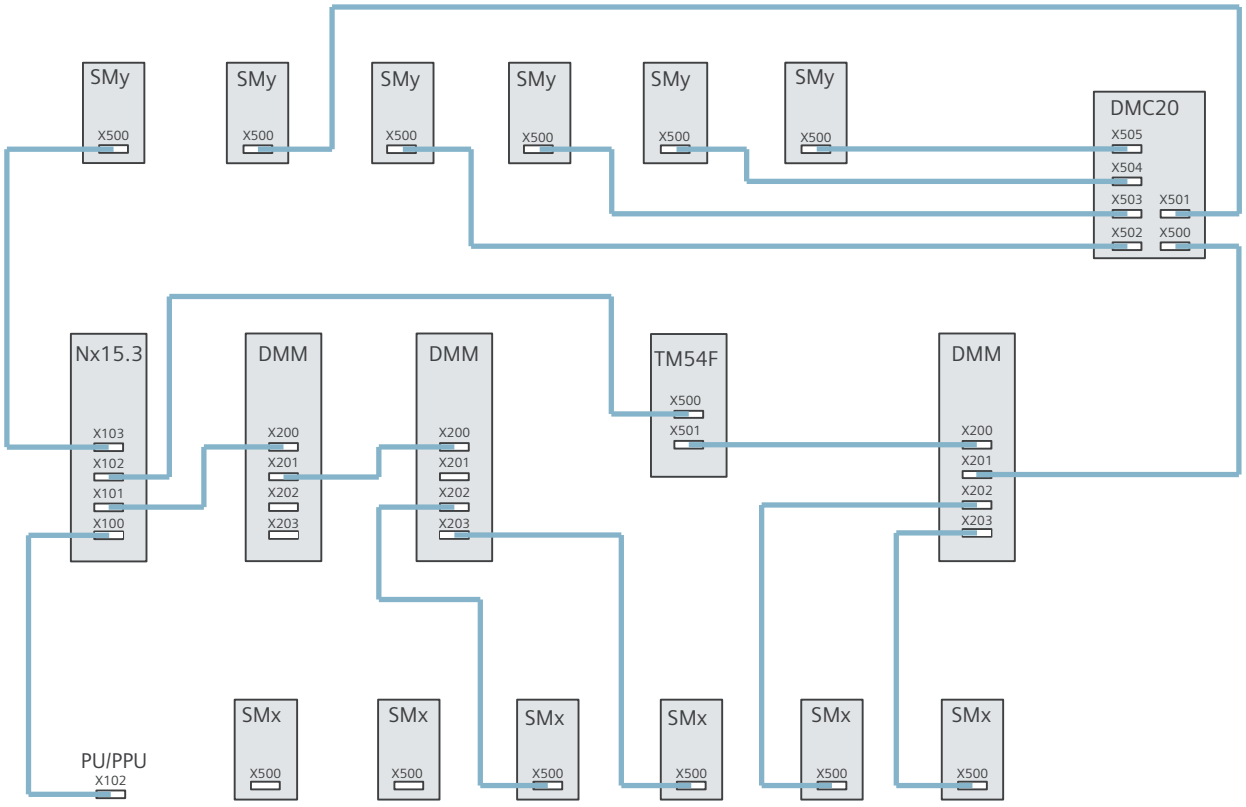


Figure 7-15 Topology with SINAMICS S120 3-4 axis Combi and SINAMICS S120 booksize module

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



Continue..


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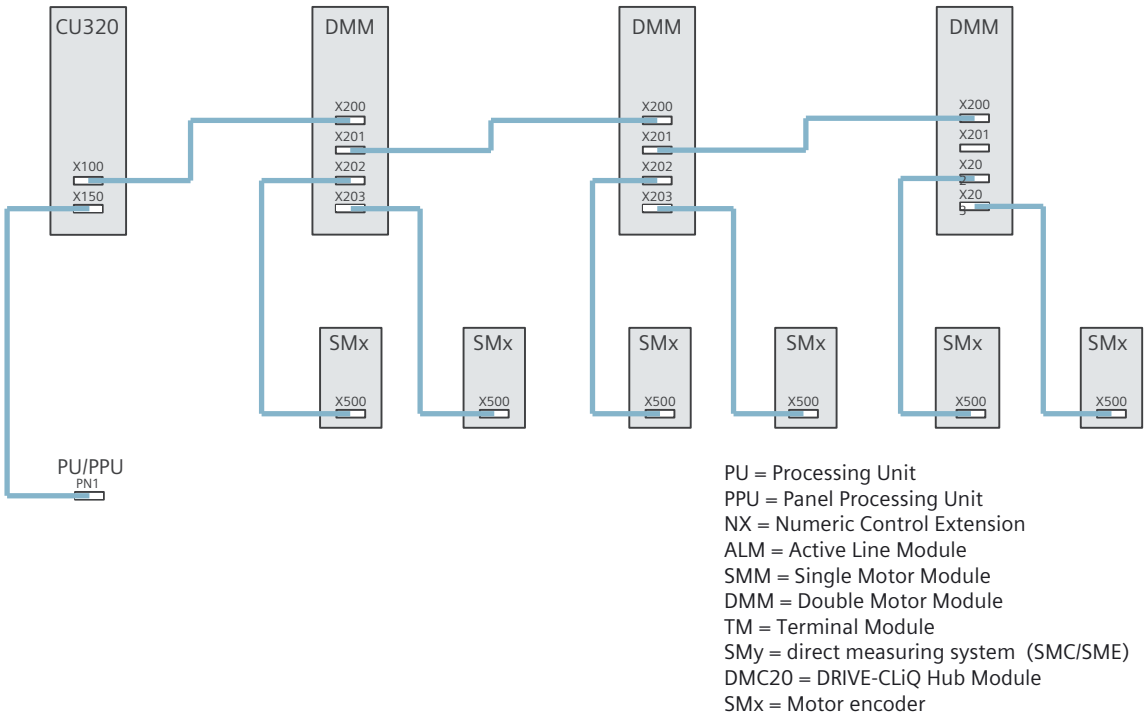


Figure 7-16 Example with Safety Integrated functions and with NX15.3, CU320

7.6 Topology rules for PN drives and IOs

There are PN topology rules for the PN drives and IOs in PPU26x.5 system. These rules must be observed. If these rules are violated, a corresponding alarm will be displayed.

Assigning the PN interfaces

Assignment of the PN interface on SINUMERIK 828D PPU26x.5:

PN interface	Connection to
X150	X150 P1 of S200 PN, or X150 P1 of S200 SPD if it is integrated into system as digital spindle drive.

Assignment of the PN interfaces on SINAMICS S200 SPD:

PN interface	Connection to
X150 P1	X150 P1 of PPU26x.5
X150 P2	X150 P1 of next S200 PN servo drive first, or X1 P1 of PP72/48 D 2/2A PN if it is integrated into system for distributed IO extension

Assignment of the PN interfaces on SINAMICS S200 PN:

PN interface	Connection to
X150 P1	X150 P1 of PPU26x.5 if no S200 SPD, or X150 P2 of S200 SPD if it is integrated into system as digital spindle drive.
X150 P2	X150 P1 of next S200 PN servo drive, or X1 P1 of PP72/48 D 2/2A PN if it is integrated into system for distributed IO extension

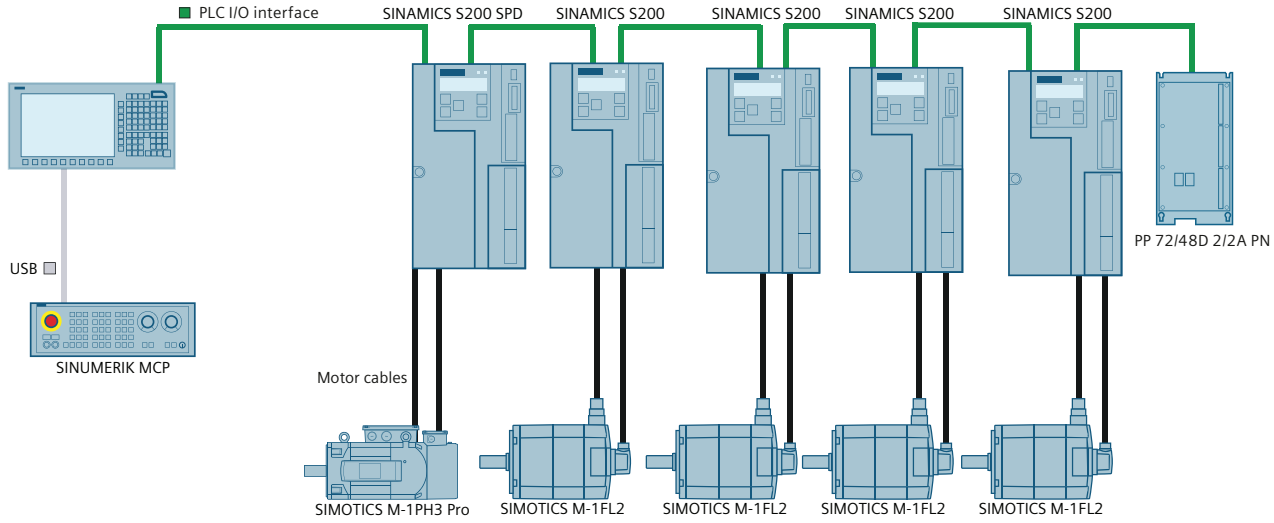
Note

If S200 SPD drive and PP72/48 PN IO module are integrated into PPU26x.5 system configuration, PPU26x.5 should connect S200 SPD first, then S200 PN servo drives, finally PP72/48 PN IO module as the far end of PN bus nodes.

Topology examples for PPU 26x.5 with PLC IO interface

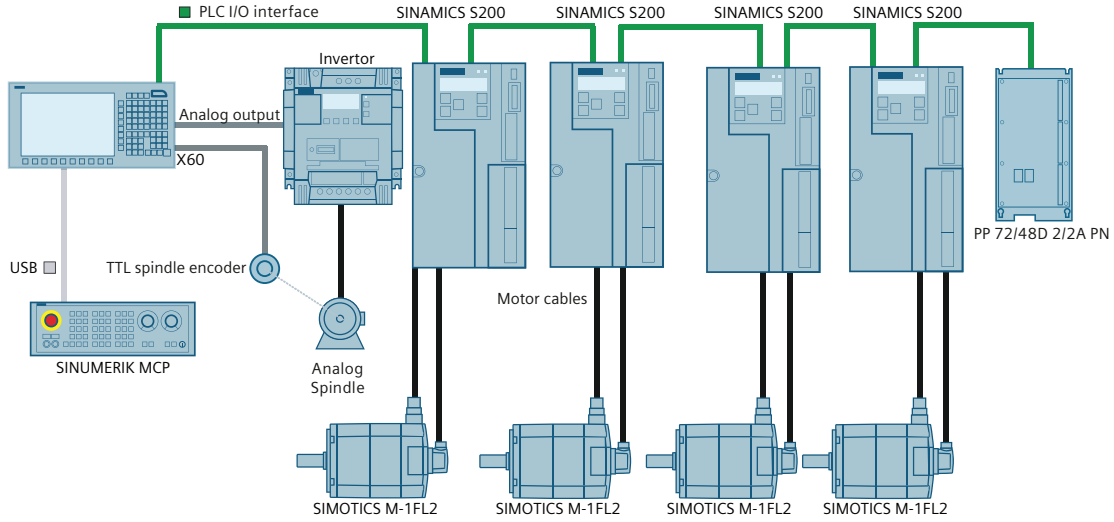
The PLC IO interface rules differ between drives e.g. additional servo drives and other IO devices. The given topology for drives must be followed correctly. These topologies are predefined in the controls.

Usage of S200 servo drives and S200 spindle drive



The S200 spindle drive must be connected first to PPU26x.5 and afterwards all the S200 servo axes. Otherwise, it is just a line topology one drive after another. All other IO devices e.g. PP72/48 module must be connected after the drives.

Usage of only S200 servo drives (e.g. together with an analog spindle)



Inside the CNC, a total of five axes and spindles can be used. If an analog spindle is used, only four S200 drives can be assigned to axes. All other I/O devices, for example the PP72/48 module, must be connected after the drives.

Interface description

8

8.1 Interface overview

Requirement

⚠ DANGER

Risk of electric shock

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

Definition

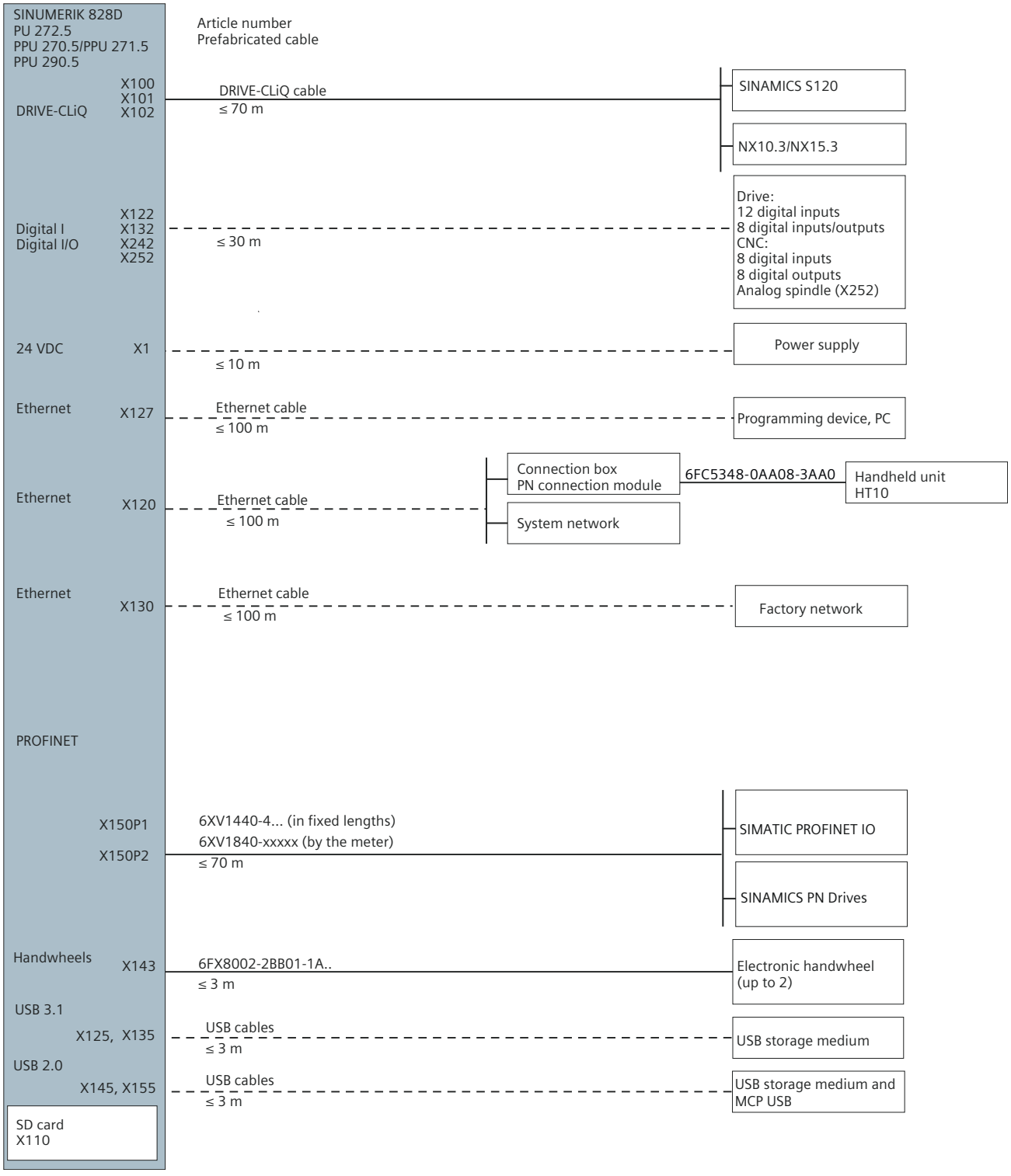
The abbreviations used in "Signal type" column in the tables showing the pin assignment have the following meaning:

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

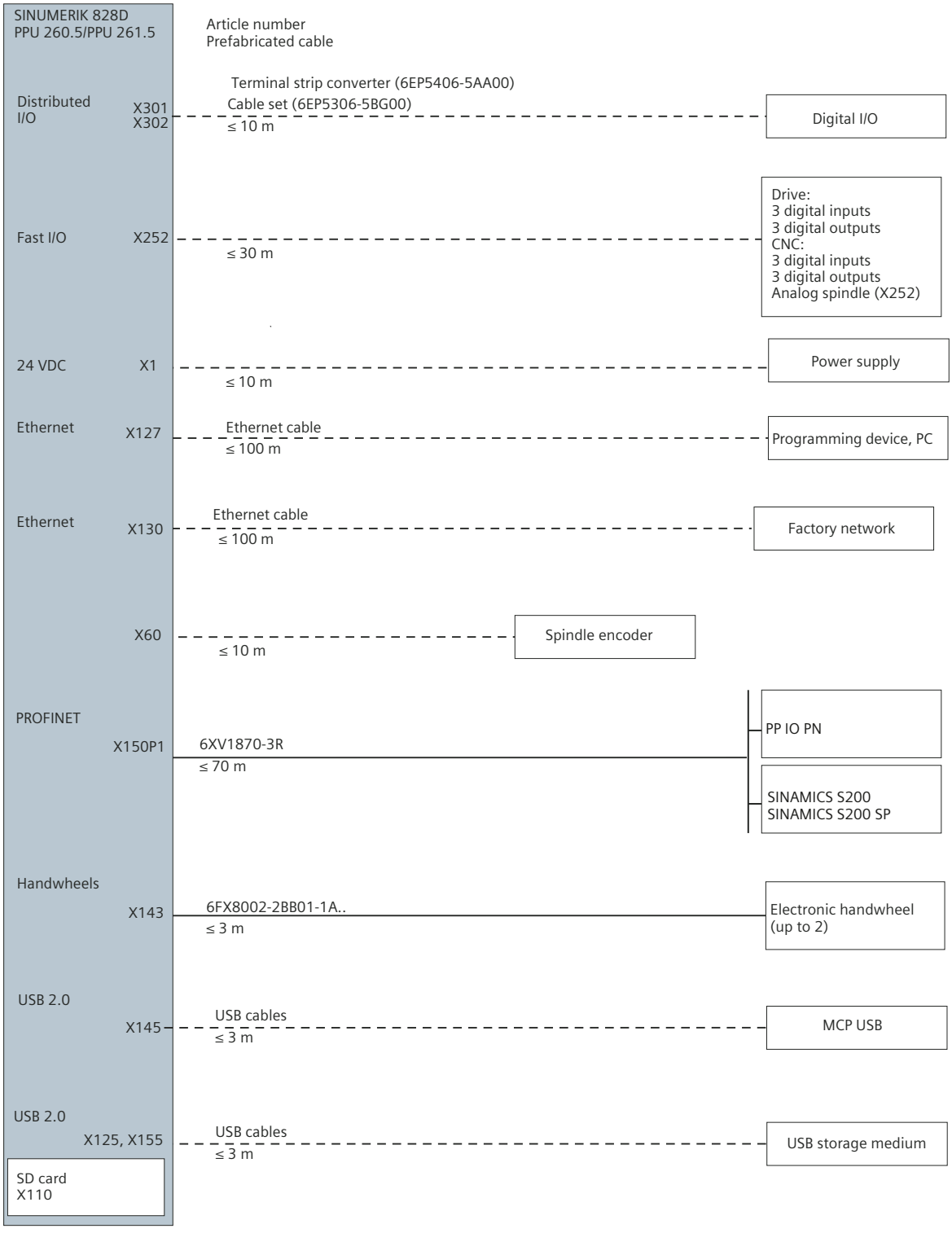
Note

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

Connection options for PPU 27x.5 and PPU290.5



Connection options for PPU 26x.5



8.2 Power supply

8.2.1 Requirements for the 24 V power supply

Interface X1 is intended exclusively for the connection of the external 24 V power supply, for example:

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

Table 8-1 Technical data of the DC power supply

Rated voltage	According to IEC 61131-2	24 VDC
	Voltage range (mean value)	20.4 VDC to 28.8 VDC
	Voltage range (dynamic)	19.2 VDC to 30 VDC
	Voltage ripple peak-to-peak	≤2.5% (switch mode power supply, >20kHz)
	Ramp-up time at POWER ON	Any
Mains buffering	Mains/voltage failure stored energy time	≤ 3 ms
	Repeat rate, min. 1 event every 10 s	

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

Table 8-2 PU/PPU current consumption

Operating condition	Current
PU only: Processor, memory	1.1 A
PPU only: Processor, memory	1.5 A
PU with full load, e.g. USB, handwheels	1.7 A
PPU with full load, e.g. USB, handwheels	2.1 A
Maximum switch-on current	6.0 A

⚠ DANGER

Protective separation

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

⚠ DANGER

Risk of lightning strike

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

Note

- When using external power supplies, for example SITOP, the ground potential of the power supply must be connected with the protective ground connection of the system (PELV).
- Ground potential and housing (PE) are connected internally with low impedance.

Note

If the 24V will be converted from a primary supply voltage, then the primary voltage must not exceed 600V / OVC III.

8.2.2 Connecting the power supply

Pin assignment at X1

Pin	Signal name	Signal type	Meaning
red	P24	VI	24 VDC power supply
red	-		
blue	M	VI	Ground
blue	M		

Representation

1. Spring-loaded terminals - "red" and "blue" marking
2. "red" represents "P24" and "blue" reperesents "M"

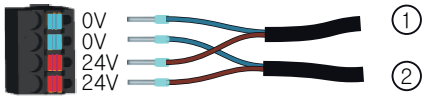
Note

The two red terminals such as the two blue terminals are shorted in the plug (see Chapter 12 " Recommended connectors (Page 379)").

This ensures that the 24 V voltage is looped through.

At socket X1 of the electronic box, only pin1 is internally connected for 24 V. Pin2 is internally unconnected

Maximum current for looping through the internal jumper (blue-blue, red-red) is 15 A



① 24 V external
② Loop-through for additional components

Cable specification

The supply for the 24 V DC power supply is wired to spring-loaded terminal block X1:

Table 8-3 Cable specification

Features		**Version**
Connection type		Spring-loaded terminals
Connectable cable types and conductor cross-sections [1]		
1.	Solid	0.5 to 2.5 mm^2
2.	Stranded	0.5 to 2.5 mm^2
3.	Flexible, with ferrule without plastic sleeve	0.5 to 2.5 mm^2
4.	Flexible, with ferrule with plastic sleeve	0.5 to 2.5 mm^2
5.	Flexible, with ferrule with plastic sleeve for double wire	0.5 to 1 mm^2
6.	Solid, AWG	AWG 20 to AWG 12
7.	Stranded, AWG	AWG 20 to AWG 12
Conductor material		Use copper conductors only
Max. cable length		10 m
Stripping length		10 - 11 mm
Tool		screwdriver, 0.6 X 3.5 mm

[1] Select the permitted conductor cross-section in accordance with national regulations (NEC, VDE, UL ...). The basis for this can be the output current of the 24 V DC power supply or the overcurrent protection device used in the 24 V circuit.

8.3 Ethernet

Pin assignment

Table 8-4 Assignment of the Ethernet interfaces X120, X130 and X127 in 10/100 Mbit/s mode

Pin	Name	Type	Remark
1	TxD+	O	Transmit data
2	TxD-		
3	RxD+	I	Receive data
4/5	GND	-	(not used in 10/100 Mbit/s mode for data transmission)
6	RD-	I	Receive data
7/8	GND	-	(not used in 10/100 Mbit/s mode for data transmission)

Signal type: O = Output; I = Input

Table 8-5 Assignment of the Ethernet interfaces X120, X130 and X127 in 1 Gbit/s mode

Pin	Name	Type	Remark
1	DA+	B	Bidirectional pair A+
2	DA-		Bidirectional pair A-
3	DB+		Bidirectional pair B+
4	DC+		Bidirectional pair C+
5	DC-		Bidirectional pair C-
6	DB-		Bidirectional pair B-
7	DD+		Bidirectional pair D+
8	DD-		Bidirectional pair D-

Signal type: B = Bidirectional

Use

The interfaces are designed for operation in full-duplex mode; in other words, the ports can be used for the sending as well as for the receiving of data packets. The ports are connected as an Ethernet terminal with 1000 Mbit:

- X130 connects the PPU to the factory network.
  - IP address can be freely selected
  - MAC address, see also: Type plates (Page 41)
- X127 for service network, a peer-to-peer connection with permanently set IP address 192.168.215.1, e.g. for access with Access MyMachine/P2P via PG/PC.
- X120 for machine network and handheld units.

LED displays

For diagnostic purposes, the RJ45 sockets of LAN ports are each equipped with yellow LEDs. This allows the following status information about the respective Ethernet port to be displayed:

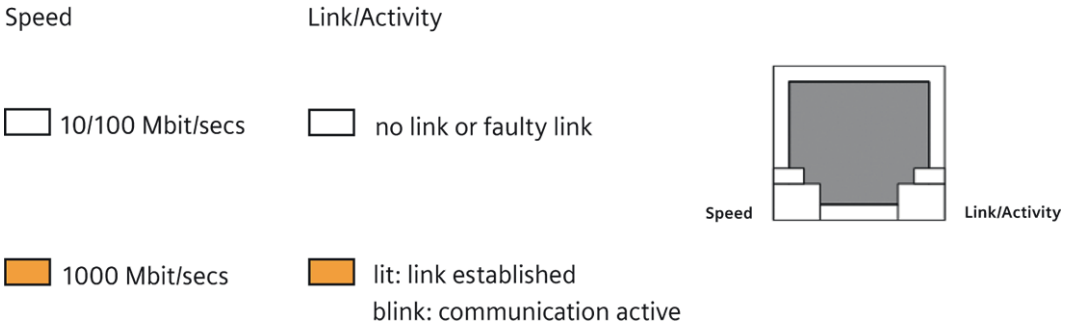


Figure 8-1 Ethernet LED meanings

LEDs	Status	Meaning
Speed	Off	10/100 Mbit link available
	Lit	1000 Mbit link available
Link/Activity	Off	Missing or faulty link
	Lit	link established
	Blink	communication active
	Off	No activity

Cable specification

Table 8-6 Cable specification for X120, X130, and X127

Feature	Version
Connector type	RJ45 socket
Cable type	Industrial Ethernet cable (CAT5e)
Max. data transmission rate:	10/100/1000 Mbit/s
Max. cable length	100 m

See also

Type plate for PPU (Page 43)

Type plates for PU (Page 41)

8.4 PLC I/O Interface based on PROFINET

For PPU 27x.5, PU272.5, and PPU 290.5

Wiring the PLC I/O Interface

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

- To connect a machine control panel (MCP PN)
- To connect to the PLC I/Os
- To connect CU320 or CU310 to PN for auxiliary axes

Note

- The PPU has one MAC address for both PLC I/O Interface ports that is the printed on the type plate of the PPU, see section "Type plates (Page 41)". The same applies for the MAC addresses of the operator components.
- X150 supports RT and IRT

Properties

The PLC I/O interface X150 is equipped with an integrated 2-port switch and a TCP/IP address for the 2 ports.

For PPU 26x.5

Wiring the PLC I/O Interface

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

- To connect servo drives (S200 PN, S200 SPD)
- To connect to the PLC I/O (PP72/48D 2/2A PN)
- To connect other PN devices (PN/PN coupler, PN proxy SPP for PAC2200)

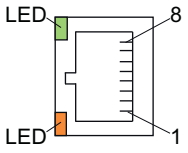
Note

- The PPU has one MAC address for both PLC I/O Interface ports that is the printed on the type plate of the PPU, see section "Type plates (Page 41)". The same applies for the MAC addresses of the operator components.
- X150 supports RT and IRT
- The maximum data size of PN/PN coupler can be transferred is 16-byte input data and 16-byte output data. In order to expand the address width of PN/PN coupler from 16 bytes to 112 bytes, an additional SDB needs to be installed on the controller.

Pin assignment

For diagnostic purposes, the RJ45 sockets are each equipped with a green and an orange LED. This allows the following status information about the respective PLC I/O interface port to be displayed:

Table 8-7 Assignment of PLC I/O interfaces X150, ports 1, 2 in the 10/100 MBit/s mode

Connector	Pin	Name	Type	Remark
	1	TxD+	O	Transmit data
	2	TxD-		
	3	RxD+	I	Receive data
	4/5	GND	-	(not used in 10/100 Mbit/s mode for data transmission)
	6	RD-	I	Receive data
	7/8	GND	-	(not used in 10/100 Mbit/s mode for data transmission)
	Shield	-	-	On connector housing
	-	LED green (Link)	-	Lit: 10 or 100 Mbit/s Off: No or faulty connection
	-	LED orange (Activity)	-	Flashes: Data exchange Off: No data exchange

Signal type: O = Output; I = Input

Note

The PLC I/O interface has what is known as autocrossing functionality, i.e. when required, transmit and receive lines are switched over. Thus, no crossover cables are necessary.

Cable specification

For PLC I/O interface port, you always require a data transmission rate of 100 Mbit/s (Fast Ethernet) in full duplex mode. For data transfer purposes, you can use twisted-pair copper cables (4-wire, 100Base-T).

Table 8-8 Cable specification for X150 ports 1, 2

Characteristic	Version
Connector type	RJ45 socket
Cable type	Industrial Ethernet cable (as of CAT5)
Max. cable length	70 m

8.5 Digital inputs/outputs

X122 pin assignment

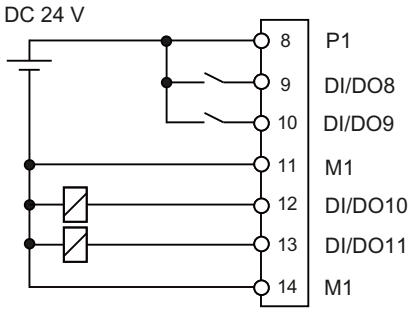
Pin		Signal name	Meaning
1	DI0	DI0	Digital drive input 0
2	DI1	DI1	Digital drive input 1
3	DI2	DI2	Digital drive input 2
4	DI3	DI3	Digital drive input 3
5	DI16	DI16	Digital drive input 16
6	DI17	DI17	Digital drive input 17
7	M2	MEXT2	Ground for pins 1...6
8	P1	P24EXT1	+24 V power supply
9	IO8	DI/DO8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

X132 pin assignment

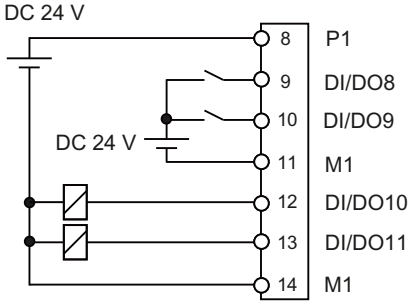
Pin		Signal name	Meaning
1	DI4	DI4	Digital drive input 4
2	DI5	DI5	Digital drive input 5
3	DI6	DI6	Digital drive input 6
4	DI7	DI7	Digital drive input 7
5	DI20	DI20	Digital drive input 20
6	DI21	DI21	Digital drive input 21
7	M2	MEXT2	Ground for pins 1...6
8	P1	P24EXT1	+24 V power supply
9	IO12	DI/DO12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

Connecting the inputs and outputs:

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



- Not recommended connection: Inputs and outputs on different supplies



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

Note

When using external power supplies (e.g. SITOP), the ground potential of the power supply must be connected with the protective ground connection of the system (PELV).

X242 pin assignment

Pin		Signal name	NC variable	Meaning
1	Not connected			
2	Not connected			
3	IN1	DIN1	$A_IN[1]	Digital NC input 1
4	IN2	DIN2	$A_IN[2]	Digital NC input 2
5	IN3	DIN3	$A_IN[3]	Digital NC input 3
6	IN4	DIN4	$A_IN[4]	Digital NC input 4
7	M4	MEXT4		Ground for pins 3...6

Pin		Signal name	NC variable	Meaning
8	P3	P24EXT3		+24 V power supply
9	O1	DOUT1	$A_OUT[1]	Digital NC output 1
10	O2	DOUT2	$A_OUT[2]	Digital NC output 2
11	M3	MEXT3		Ground for pins 9, 10, 12, 13
12	O3	DOUT3	$A_OUT[3]	Digital NC output 3
13	O4	DOUT4	$A_OUT[4]	Digital NC output 4
14	M3	MEXT3		Ground for pins 9, 10, 12, 13

Note

X242 is not available with PPU26x.5

X252 pin assignment

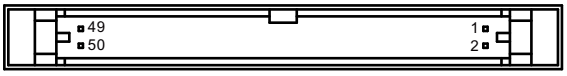
Pin		Signal name	NC variable	Meaning
1	AO	AOUT		Analog output (voltage for analog axis/spindle)
2	AM	AGND		Analog ground
3	IN9	DIN9	$A_IN[9]	Digital NC input 9
4	IN10	DIN10	$A_IN[10]	Digital NC input 10
5	IN11	DIN11	$A_IN[11]	Digital NC input 11
6	IN12	DIN12	$A_IN[12]	Digital NC input 12
7	M4	MEXT4	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

NOTICE
Shielded signal cables for analog signals To ensure safe, fault-free operation of the system, shielded cables with shield connection should be used for the wiring of the analog outputs. (See also: EMC compatibility (Page 69))

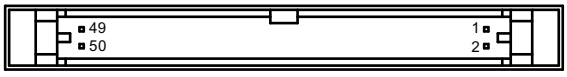
8.5.1 Distributed I/O - X301, X302

Pin assignment

Type	50-pin socket
Inputs	Permissible level (including ripple)
	High level: 20.4 V to 28.8 V
	Low level: -3 V to +5 V
Outputs	Rated digital output current: 250 mA

Pin	Signal	Comment	Pin	Signal	Comment
 X301 DISTRIBUTED I/O 1					
1	M	External ground	26	I2.7	Digital input
2	+24 V	+24 V output [1)]	27	M	External ground
3	I0.0	Digital input	28	M	External ground
4	I0.1	Digital input	29	M	External ground
5	I0.2	Digital input	30	M	External ground
6	I0.3	Digital input	31	Q0.0	Digital output
7	I0.4	Digital input	32	Q0.1	Digital output
8	I0.5	Digital input	33	Q0.2	Digital output
9	I0.6	Digital input	34	Q0.3	Digital output
10	I0.7	Digital input	35	Q0.4	Digital output
11	I1.0	Digital input	36	Q0.5	Digital output
12	I1.1	Digital input	37	Q0.6	Digital output
13	I1.2	Digital input	38	Q0.7	Digital output
14	I1.3	Digital input	39	Q1.0	Digital output
15	I1.4	Digital input	40	Q1.1	Digital output
16	I1.5	Digital input	41	Q1.2	Digital output
17	I1.6	Digital input	42	Q1.3	Digital output
18	I1.7	Digital input	43	Q1.4	Digital output

Pin	Signal	Comment	Pin	Signal	Comment
19	I2.0	Digital input	44	Q1.5	Digital output
20	I2.1	Digital input	45	Q1.6	Digital output
21	I2.2	Digital input	46	Q1.7	Digital output
22	I2.3	Digital input	47	+24 V	+24 V input
23	I2.4	Digital input	48	+24 V	+24 V input
24	I2.5	Digital input	49	+24 V	+24 V input
25	I2.6	Digital input	50	+24 V	+24 V input

Pin	Signal	Comment	Pin	Signal	Comment
 X302 DISTRIBUTED I/O 2					
1	M	External ground	26	I5.7	Digital input
2	+24 V	+24 V output [1]	27	M	External ground
3	I3.0	Digital input	28	M	External ground
4	I3.1	Digital input	29	M	External ground
5	I3.2	Digital input	30	M	External ground
6	I3.3	Digital input	31	Q2.0	Digital output
7	I3.4	Digital input	32	Q2.1	Digital output
8	I3.5	Digital input	33	Q2.2	Digital output
9	I3.6	Digital input	34	Q2.3	Digital output
10	I3.7	Digital input	35	Q2.4	Digital output
11	I4.0	Digital input	36	Q2.5	Digital output
12	I4.1	Digital input	37	Q2.6	Digital output
13	I4.2	Digital input	38	Q2.7	Digital output
14	I4.3	Digital input	39	Q3.0	Digital output
15	I4.4	Digital input	40	Q3.1	Digital output
16	I4.5	Digital input	41	Q3.2	Digital output
17	I4.6	Digital input	42	Q3.3	Digital output
18	I4.7	Digital input	43	Q3.4	Digital output
19	I5.0	Digital input	44	Q3.5	Digital output
20	I5.1	Digital input	45	Q3.6	Digital output
21	I5.2	Digital input	46	Q3.7	Digital output
22	I5.3	Digital input	47	+24 V	+24 V input
23	I5.4	Digital input	48	+24 V	+24 V input
24	I5.5	Digital input	49	+24 V	+24 V input
25	I5.6	Digital input	50	+24 V	+24 V input

[1] Make sure that the current at pin 2 of X301 or X302 does not exceed the maximum current I_{out} = 0.25 A; otherwise, the controller could be damaged.

Connecting

⚠ WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage that might result in serious injury or death.

- The 24 V power supply must be protective extra-low voltage in accordance with EN60204-1, Section 6.4, PELV (with M ground).

⚠ CAUTION

Damage to power supply due to incorrect grounding

Be sure not to connect pin 2 of X301/302 to ground; otherwise, the power supply of the control system could be damaged.

Note

The 24 V output of X301/302 pin 2 comes from pins 47 to 50.

Note

Addressing ranges

X301: IB3, IB4, IB5, QB2, QB3

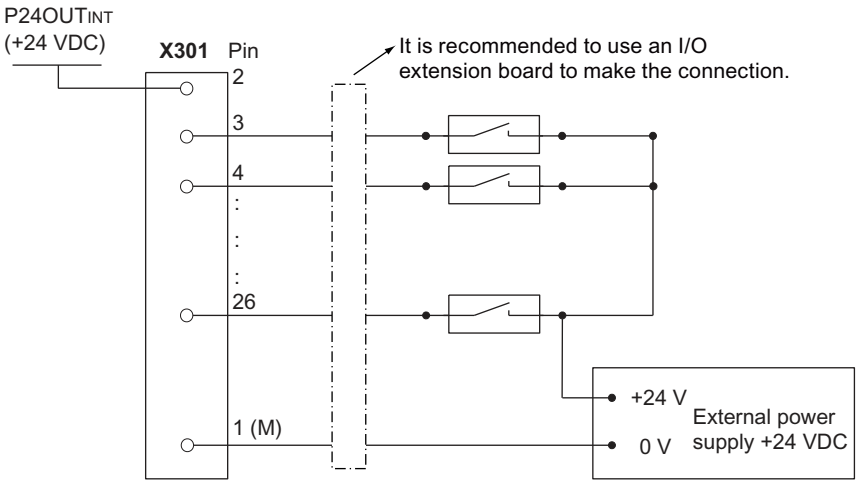
X302: IB6, IB7, IB8, QB4, QB5

Note

The connecting cable between the power source, load current supply connection, and associated reference potential M must **not** exceed the maximum permissible length of 10 m.

Digital inputs

The diagram below shows you how to connect the connector pins of the digital inputs at interface X301 (example). You can connect connector X302 in the same way.

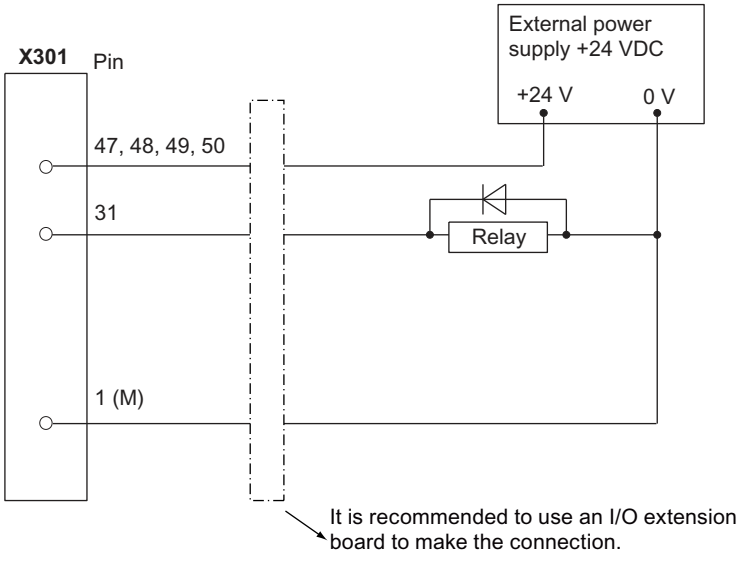


Note

When using an external power supply, you must connect the 24 V (permissible range: 20.4 V to 28.8 V) power supply for the digital outputs to **all the four power input pins** (X301, X302: **pins 47, 48, 49, 50**).

Digital outputs

The diagram below shows you how to connect the connector pins of the digital outputs at interface X301 (example). You can connect connector X302 in the same way.



To supply the digital outputs, you must connect an external 24 VDC power supply (X301, X302: pins 47, 48, 49, 50).

You must also connect the reference ground of the external power supply to X301, X302: Pin 1 (M).

Note

You must ensure that the maximum current consumption at pin 47, pin 48, pin 49 or pin 50 does **not** exceed 1 A.

Note

You must connect the 24 V power supply for the digital outputs to **all the four power input pins** (X301, X302: **pins 47, 48, 49, 50**).

External power supply

When using an external power supply for the digital inputs, you must connect the reference ground to X301, X302: Pin 1 (M).

8.5.2 DI/DO description

Use

The following assignment applies to the terminals:

- Ten signals, related to drive, can each be assigned to X122 and X132:
  - Six digital inputs
  - Four bidirectional digital inputs/outputs
- 8 digital signals, related to NC, can each be assigned to X242 and X252:
  - Four digital inputs
  - Four digital outputs

Note

- MEXT1 (M1) must always be connected at both X122:11/:14 and X132:11/:14 to the related ground reference so that the Drive digital inputs/outputs are working.
- MEXT3 (M3) must always be connected at both X242:11/:14 and X252:11/:14 to the related ground reference so that the NC digital outputs are working.
- MEXT2 (M2) must always be connected at both X122:7 and X132:7 to the related ground reference so that the Drive digital inputs are working.
- MEXT4 (M4) must always be connected at both X242:7 and X252:7 to the related ground reference so that the NC digital inputs are working.
- Connect the incorporated ground reference of the digital inputs.
- Connect a jumper to terminal M on plug connector X1.
- P24EXT1 (P1) must always be connected at both X122:8 and X132:8 so that the Drive outputs are working.
- P24EXT3 (P3) must always be connected at both X242:8 and X252:8 so that the NC outputs are working.
- For digital IOs external power supply can be used to have a galvanic isolation.

Alternatively they can also be connected to the same power supply as used for terminal X1. This removes the galvanic isolation for the digital inputs/outputs.

Cable specification at X122, X132, X242 and X252

	Features	Version
Connector type		14-pin spring-loaded terminals
Current carrying capacity per connector pin		8 A max
Connectable cable types and conductor cross-sections[1)]		
1.	Solid	0.2 to 1.5 mm^2
2.	Stranded	0.2 to 1.5 mm^2
3.	Flexible, with ferrule without plastic sleeve	0.25 to 1.0 mm^2
4.	Flexible, with ferrule with plastic sleeve	0.25 to 0.75 mm^2
5.	Solid, AWG	AWG 24 to AWG 16
6.	Stranded, AWG	AWG 24 to AWG 16
Max. cable length		30 m
Stripping length		8 - 10 mm
Tool		screwdriver, 0.4 x 2.0 mm

[1)] Select the permitted conductor cross-section in accordance with national regulations (NEC, VDE, UL ...).

The basis for this can be the output current of the 24 V DC power supply or the overcurrent protection device used in the 24 V circuit.

Wiring the digital inputs/outputs

Tools required: 0.4 x 2.0 mm screwdriver or power screwdriver

Procedure:

1. Strip off 10 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 spring-loaded terminal.

Using shielded cables

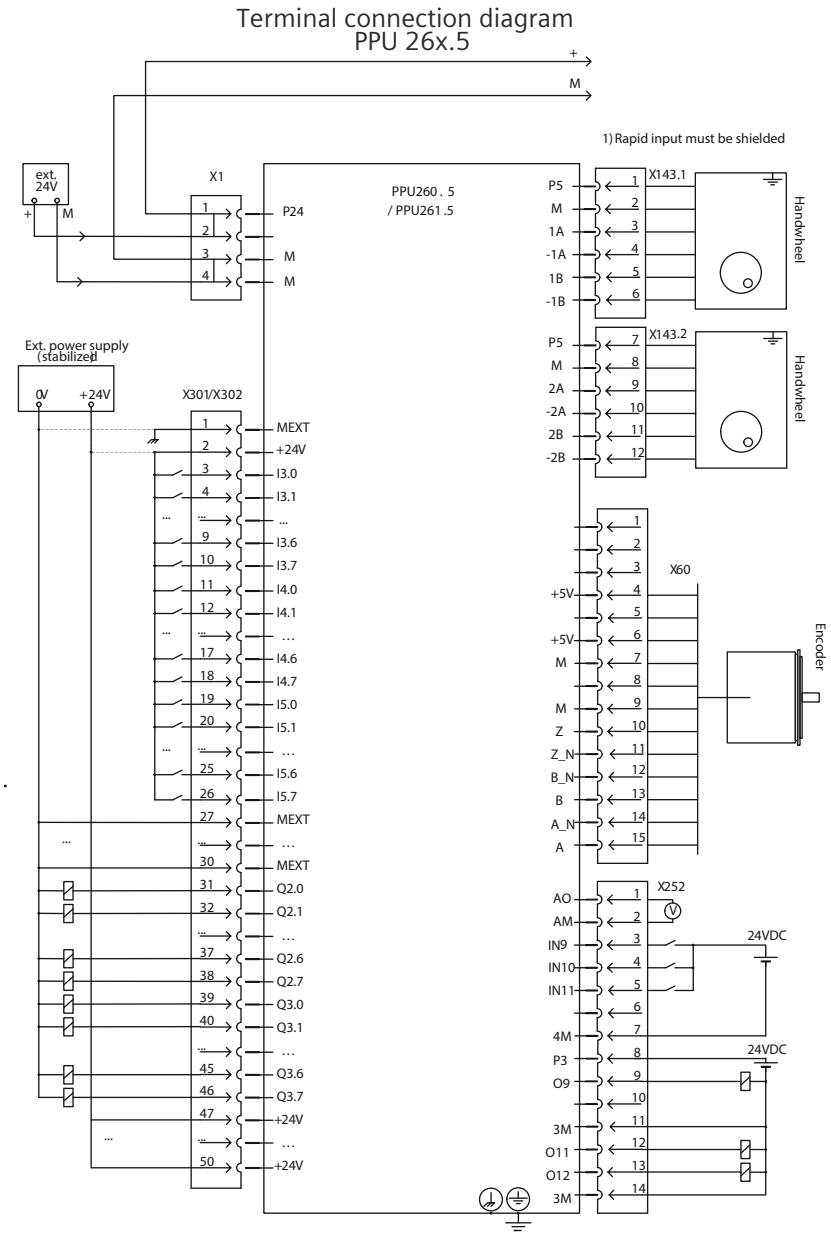
When using a shielded cable for the bidirectional inputs/outputs and analog output, the following options are available for the shield connection:

1. Attach the cable shield to a grounded shielding bus immediately after the cable entry point in the cabinet (strip the insulation off the cable for this purpose).
2. Continue routing the shielded cable to the module but do not make a connection to the shield there.
3. Connect the cable shield (strip the insulation off the cable for this purpose) to the cable pull relief at the module.

References

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

8.5.3 Terminal connection diagram



X1 - power supply:

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

pin	signal name	meaning
1	P24	24 V DC power supply
2	-	
3	M	protective ground
4	M	

supply rating: 24VDC/3.5A

To be supplied by limited voltage / limited current source.

X252 - digital inputs / outputs:

connector type: 0021-20-H021-14-xx by Dinkle or equal / compatible
Interface wire type: Cu, AWG 24…16

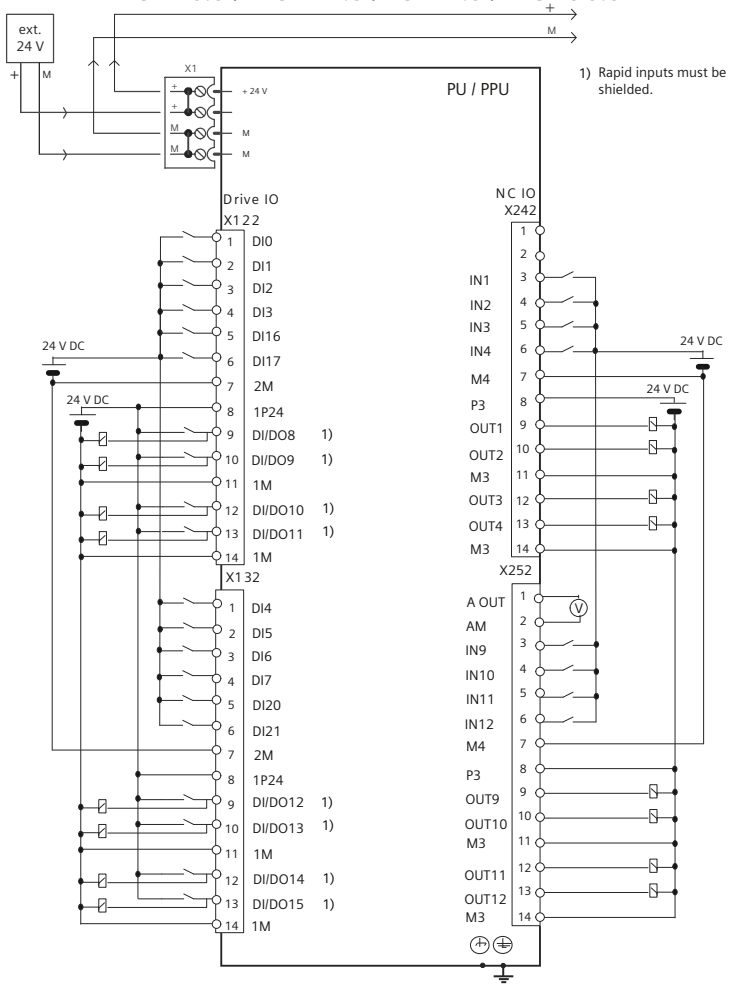
pin	pin assignment:signal name	signal type	meaning
1	AO (X252 only)	VO	analog out +/- 10V
2	AGND (X252 only)	GND	analog ground
3	IN 9 / MVI1	I	Fast input 9 / MVI1
4	IN 10 / MVI2	I	Fast input 10 / MVI2
5	IN 11 / BERO	I	Fast input 11 / BERO
6	IN 4 / IN 12	I	digital input
7	4M	GND	ground for pins 1…4
8	3P24	VI	power supply for pins 9,10,12,13
9	OUT 1 / OUT 9	O	digital input / output
10	OUT 2 / OUT 10	O	digital input / output
11	3M	GND	ground for pins 9,10,12,13
12	OUT 11 / CW	O	Fast output 11 / Clockwise for AO
13	OUT 12 / CCW	O	Fast output 12 / Counter-clockwise for AO
14	3M	GND	ground for pins9,10,12,13

I=input; O=output; GND=reference potential; VI= voltage input; VO=voltage output

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

Maximum ambient temperature 55°C.
For use on a flat surface in a type 1 enclosure.
For use in pollution degree 2 environment only.

Terminal connection diagram
PPU 270.5 / PPU 271.5 / PU272.5 / PPU 290.5



X1 - power supply:

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

pin	signal name	meaning
1	P24	24 V DC power supply
2	-	
3	M	protective ground
4	M	

supply rating: 24VDC/3.5A

To be supplied by limited voltage / limited current source.

X122, X132 - digital inputs / outputs:

connector type: 0021-20-H021-14-xx by Dinkle or equal / compatible
Interface wire type: Cu, AWG 24…16

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

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

X242, X252 - digital inputs / outputs:

connector type: 0021-20-H021-14-xx by Dinkle or equal / compatible
Interface wire type: Cu, AWG 24…16

pin	pin assignment:signal name	signal type	meaning
1	AO (X252 only)	VO	analog out +/- 10V
2	AGND (X252 only)	GND	analog ground
3	IN 1 / IN 9	I	digital input
4	IN 2 / IN 10	I	digital input
5	IN 3 / IN 11	I	digital input
6	IN 4 / IN 12	I	digital input
7	4M	GND	ground for pins 1…4
8	3P24	VI	power supply for pins 9,10,12,13
9	OUT 1 / OUT 9	O	digital input / output
10	OUT 2 / OUT 10	O	digital input / output
11	3M	GND	ground for pins 9,10,12,13
12	OUT 3 / OUT 11	O	digital input / output
13	OUT 4 / OUT 12	O	digital input / output
14	3M	GND	ground for pins9,10,12,13
I=input; O=output; GND=reference potential; VI= voltage input; VO=voltage output			

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

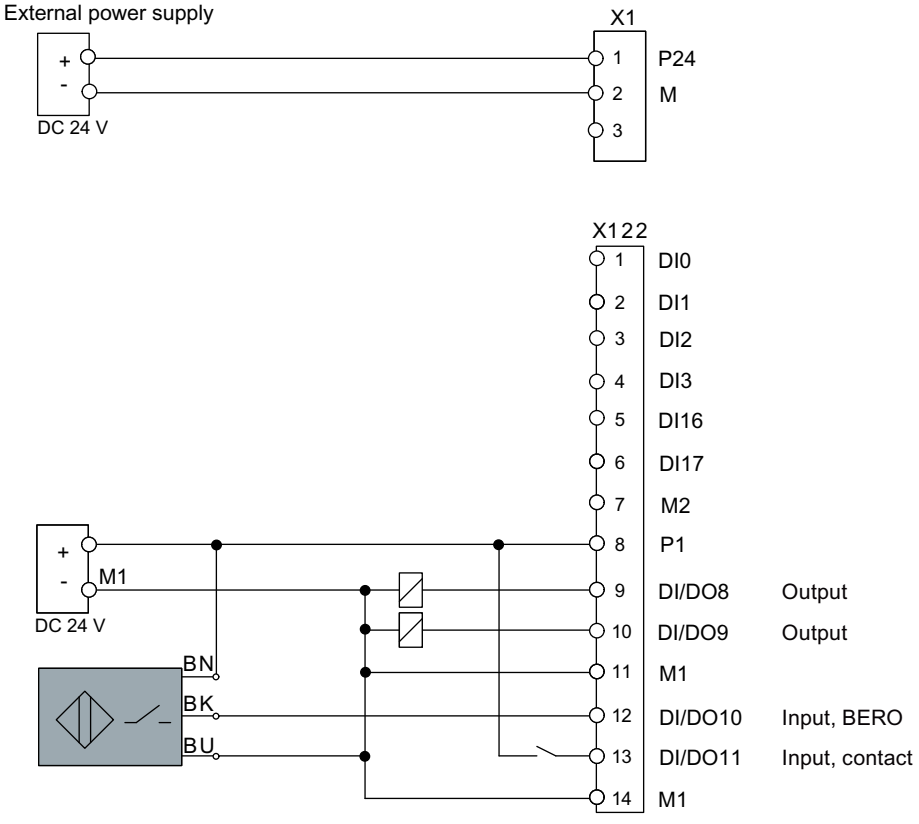
Maximum ambient temperature 55°C.
For use on a flat surface in a type 1 enclosure.
For use in pollution degree 2 environment only.

8.5.4 Example: Connecting a BERO inductive proximity switch

Supplementary conditions

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

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



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

Figure 8-2 Connection to X122

8.5.5 Technical data

Digital inputs

Parameter	Value
Voltage	-3 V to 30 V
Typical power consumption	3.6 mA at 24 VDC
Signal level (including ripple)	High: 15 V to 30 V Low: -3 V to 5 V
Maximum signal propagation times	L → H: maximum 50 µs H → L: 150 µs
Galvanic isolation	Yes: The reference potential is terminal 2M at X122/X132. The reference potential is terminal 4M at X242/X252.

Digital outputs

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

Bidirectional digital inputs/outputs

Parameter	Value
As input:	
Voltage	-3 V to 30 V
Typical power consumption	3.6 mA at 24 VDC
Signal level (including ripple)	High: 15 V to 30 V Low: -3 V to 5 V
Maximum signal propagation times (fast inputs)	L → H: 10 µs H → L: 150 µs
Galvanic isolation	Yes: The reference potential is terminal 1M.
As output:	
Voltage	24 VDC
Maximum output current for one load (resistive)	0.5 A continuously short-circuit proof
Maximum output current for one connector (resistive)	1 A

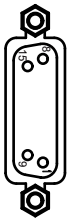
Parameter	Value
Maximum signal propagation times	L → H: 50 µs H → L: 300 µs for 10 kΩ load
Galvanic isolation	Yes: The reference potential is terminal 1M/1P24 (24 VDC)

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

8.6 Spindle encoder interface - X60

Pin assignment

Type	Sub-D, 15-pin, female
Cable	Type: encoder cable
	Max. length: 10m

Illustration	Pin	Signal	Comment
 X60 SP ENCODER	1	-	Not assigned
	2	-	Not assigned
	3	-	Not assigned
	4	+5 V	+5 V power supply
	5	-	Not assigned
	6	+5 V	+5 V power supply
	7	M	Ground
	8	-	Not assigned
	9	M	Ground
	10	Z	Zero mark
	11	Z_N	Zero mark, negative
	12	B_N	Track B, negative
	13	B	Track B
	14	A_N	Track A, negative
	15	A	Track A

8.7 DRIVE-CLiQ

8.7.1 DRIVE-CLiQ interface

X100 - X102 pin assignment

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

Use

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

The following rules apply:

- Topology rules for S120 Combi (Page 120)
- Topology rules for S120 Booksize (Page 122)
- Topology rules for Safety Integrated functions (Page 126)
- Topology example without Safety Integrated functions (Page 128)
- Topology example with Safety Integrated functions (Page 134)

DRIVE-CLiQ has the following properties:

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

Cable specification for X100 - X102

Feature	Version
Connector type	RJ45
Cable type	MOTION-CONNECT

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

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

Note

Interfaces X100 to X102

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

Additional references

Further information on the components in this section:

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

8.7.2 SINAMICS components

Components with DRIVE-CLiQ

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

Component	Description
NX10.3 / NX15.3	Axis expansion module
Active / Basic / Smart Line Modules Booksize / Chassis	Line Modules provide the central power supply to the DC link.
Single / Double Motor Modules Booksize / Chassis	Motor Modules draw their power from the DC link to supply the connected motors.
SINAMICS S120 Combi	The S120 Combi is a compact unit in the Booksize format with integrated infeed.
Single/Double Motor Modules Booksize Compact	The Booksize Compact format is the expansion module for the S120 Combi.
SMC10 / 20 / 30	Cabinet-mounted sensor modules are used when a motor with a DRIVE-CLiQ interface is not available and when external encoders are required in addition to the motor encoder.
SMC40	This Sensor Module is used to convert encoder signals from absolute encoders with EnDat 2.2 to DRIVE-CLiQ.
DMC20 / DME20	DRIVE-CLiQ Hub Modules are used to implement the star-shaped distribution of a DRIVE-CLiQ line.

Component	Description
TM54F	The TM54F Terminal Module is a terminal expansion module for Safety Integrated functions.
TM120	The Terminal Module TM120 is a DRIVE-CLiQ component for safe electrically isolated temperature evaluation.

Note

Connection of Sensor Modules

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

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

NOTICE

Connection of the SMC40

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

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

8.8 Handwheel

X143 pin assignment

No.	Pin		Signal name	Meaning
X143.1	1	P5	P5	5 VDC power supply output
	2	M	M	Ground
	3	1A	1A	Handwheel pulses track A, channel 1
	4	-1A	1/A	Handwheel pulses track A (negated), channel 1
	5	1B	1B	Handwheel pulses track B, channel 1
	6	-1B	1/B	Handwheel pulses track B (negated), channel 1
X143.2	1	P5	P5	5 VDC power supply output
	2	M	M	Ground
	3	2A	2A	Handwheel pulses track A, channel 2
	4	-2A	2/A	Handwheel pulses track A (negated), channel 2
	5	2B	2B	Handwheel pulses track B, channel 2
	6	-2B	2/B	Handwheel pulses track B (negated), channel 2

Signal transfer

Max. two electronic handwheels can be connected to connectors X143.1 and X143.2 on the rear of the PPU.

The signals can be transferred using the following technique:

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

The following applies to both techniques:

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

The following diagrams indicate the different data transfer types:

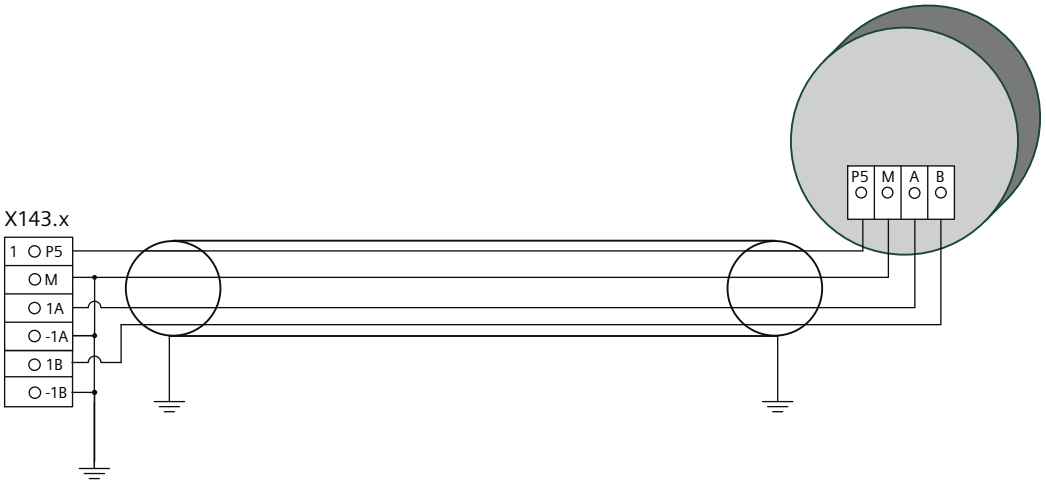
- **Differential signal transfer:s**



Note

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

- **Asymmetrical signal transfer:**



Cable specification

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

8.9 USB

Use

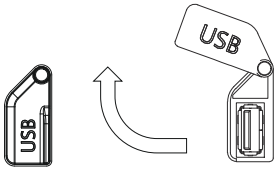
The USB interfaces correspond to the norm and are, therefore, not described in detail here.

- To connect a USB-FlashDrive use the **X125 and X135 USB interface**s for transferring the system and commissioning data.
- You can use **USB ports X145 and X155** for all SINUMERIK 828D MCPs and for service.

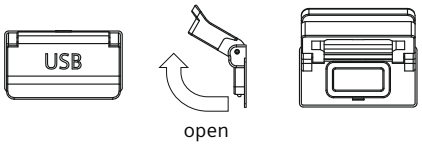
Note

- Use the USB interfaces of the PC/IPC system for data exchange with external storage media. (with PU 272.5 only)
- The PPU 26x.5 provides X125 (USB 2.0) at the front, and X145 and X155 (USB 2.0) at the rear side.
- The USB interfaces of the PPU are only permitted for hardware configuration or service purposes.

- Rotate the USB cap clockwise to open the USB interface - X125 for PPU27x.5 and PPU 290.5 variants.



- Open the USB cap to open the USB interface - X125 for PPU26x.5 variants.



Cable specification

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

Features	Variants
Connector type	Double USB socket - type A
Version	USB 3.1 Gen1
Current carrying capacity	0.9 A per connector
Maximum data transfer rate	5 Gbit/s
Maximum cable length	3 m

Features	Variants
Connector type	Double USB socket - type A
Version	USB 2.0
Current carrying capacity	Total 0.6 A per connector
Maximum data transfer rate	480 Mbit/s
Maximum cable length	3 m

Diagnosis

9

9.1 LED display

Meaning of the RDY, PLC, and DIAG LEDs

Name	Function	Status	Meaning
RDY	Ready	LED lights up red	There is at least one fault (e.g. RESET, watchdog monitoring etc.) or the PPU is ramping up.
		 LED flashes red (2 Hz)	Not assigned (SINAMICS boot error).
		LED lights up yellow	Ramping up the PPU.
		LED flashes yellow (0.5 Hz)	Firmware update of the connected DRIVE-CLiQ components
		LED flashes yellow (2 Hz)	Firmware update is complete for components. Wait for POWER ON for the components in question.
		LED lights up green	NC ramped up and everything in cyclic mode
		 LED flashes green/orange or red/orange (1 Hz)	LED-supported detection of connected DRIVE-CLiQ component is activated: (p0124[0] = 1).

Name	Function	Status	Meaning
PLC	PLC status	LED off	CP not ramped up / started
		LED lights up green	PLC is in RUN operation state
		LED flashes green	No configuration
		LED lights up yellow	The PLC is in the STOP operation state.
		LED flashes yellow	The PLC-project could not be loaded and translated during start up.
		LED flashes red	The execution of the PLC-project caused a CPU exception (e.g. Division by 0 or an invalid floating point number)
		LED lights up red	Error status (FATAL error)
DIAG	Diagnostics	LED lights up green	Everything OK.
		LED lights up yellow	Software-related fault is pending. Contact the Hotline.
		LED flashes yellow (0.5 Hz)	The data backup operation initiated with the Ctrl + Alt + D shortcut is running.
		LED lights up red	HW-related tests fail, e.g. memory test during switch on. If no change occurs after multiple switch off/on, replace the device.

Important LED states

While the PPU is ramping up, all LEDs briefly light up orange. You can carry out a detailed diagnosis using a PG/PC and the operating software.

Additional reference

- For information on drive faults and alarms, see also:
  SINAMICS S120/S150 List Manual (LH1) (https://support.industry.siemens.com/cs/document/109827046/)

9.2 7-segment display (for PU)



Figure 9-1 7-segment display

The continuously running ticker "three lines" as shown depicts that the start up menu is in active state. To access the startup menu, follow the steps described in the SINUMERIK 828D Commissioning Manual or the AccessMyMachine p2p help.



Figure 9-2 Start up menu - active state

Error messages

These error messages are shown on the 7-segment display as continuously running text ("ticker").

Note

When submitting a query to SIEMENS Technical Support: In addition to the message shown on the 7-segment display, additional information regarding the status LEDs and the operating state (continuous operation, switch-on phase, restart, etc.) can provide important information on resolving your problem.

7-segment display	Meaning	Troubleshooting
C	"Crash" or kernel panic: The Linux system no longer responds	1. Restart the PU. 2. Execute the "DIDAC" diagnostics option. This function saves all the diagnostic data to a ZIP file. 3. Contact SIEMENS Technical Support and transfer the zipped diagnostics data.
Copy FAIL	Firmware installation failed.	
F	"Failure"	
F.	The point is lit continuously and no longer flashes: NCK crash	
Lxx=yyy	Internal error when starting NCK, "xx" is the line number in the mcsystem.ini, "yyy" is a unique error code for the code position.	

7-segment display	Meaning	Troubleshooting
Merr	"System Restore Error": A System Restore Point installation failed.	• Check the log file under "/var/log/initpu.log". • Contact SIEMENS Technical Support.
NO ARC	The CNC software package is missing or cannot be found on the SD card.	Boot the PU using the SINUMERIK service system, and check the partition using the "Check storage integrity" diagnostics option. • Replace the SD card if it is shown to be defective. • Contact SIEMENS Technical Support if the SD card is not defective.
NO SD	The operating system cannot detect an SD card.	• Insert the SD card. • Check that the SD card is correctly inserted. • Check whether the SD card is defective.
NO SSD	The internal storage medium was not detected.	Contact SIEMENS Technical Support.
PART FAIL	Error when re-partitioning	Boot the PU using the SINUMERIK service system, and check the partition using the "Check storage integrity" diagnostics option.
SD Error <n>	<n> = single-digit code: • SD Error 2: Card reader not responding; HW problem • SD Error 3: SD card missing, or does not contain an ext4 partition • SD Error 4: fsck (file system check) failed with incorrigible errors • SD Error 5: File system linking failed, a write or read error has occurred on the SD card.	• Check whether the mechanical write protection (lock) of the SD card has been activated. • It is possible that the SD card is defective and must be replaced. • Check the SD card using the "Check storage integrity" diagnostics option.

7-segment display	Meaning	Troubleshooting
SIGErr=<nn>	<nn> = double-digit code:	
	SIGErr=07: Error while reading a signed file While reading a signed software an error occurred.	Check whether the original software package is installed and has not been modified. • Install the original CNC software package.
	SIGErr=08: signature file error No SIEMENS signature was found for a software component.	Check whether the original CNC software package is installed and has not been modified. • Install the original CNC software package.
	SIGErr=09: Device certificate period of validity error The system time has not been correctly set.	Occurs the first time the device is turned on if the system time has not yet been set. Check the settings if the error is permanent.
	SIGErr=11: signature file invalid Software was installed with an unassociated signature file.	Check whether the original CNC software package is installed and has not been modified. • Install the original CNC software package.
	All others SIGErr	The hardware is possibly defective. • Contact SIEMENS Technical Support.
unPAC FAIL	A problem has occurred when reading, unzipping or writing the data.	Boot the PU using the SINUMERIK service system, and check the partition using the "Check storage integrity" diagnostics option. • Contact SIEMENS Technical Support if the diagnostics check is unsuccessful.
	The archive with the CNC software is possibly corrupt or unreadable.	Reinstall the CNC software if the SD card is OK.
6	point not flashing: Operating system has crashed where the NCK is no longer clocking	Restart the PU.

Please contact SIEMENS Technical Support (https://support.industry.siemens.com/cs/sc/4868) if it was not possible to resolve the error.

Note

SD Error 1

For SD Error 1: System card reader is not present in HW info, please contact SIEMENS Technical Support (https://support.industry.siemens.com/cs/sc/4868)

9.3 DIAG/RESET button (for PU)

Arrangement

The DIAG/RESET button is situated on the front of the PU below the NCK commissioning switch.

Performing the operation

DIAG/RESET button has two functions:

- RESET: To restart the PU, press the button for more than 10 seconds.
- DIAG: To start the Didac function, press the button for less than 8 seconds. This function collects all the available log files of the operating software and stores them in the following directory: /card/user/sinumerik/didac/out_<Date-Time>.7z.

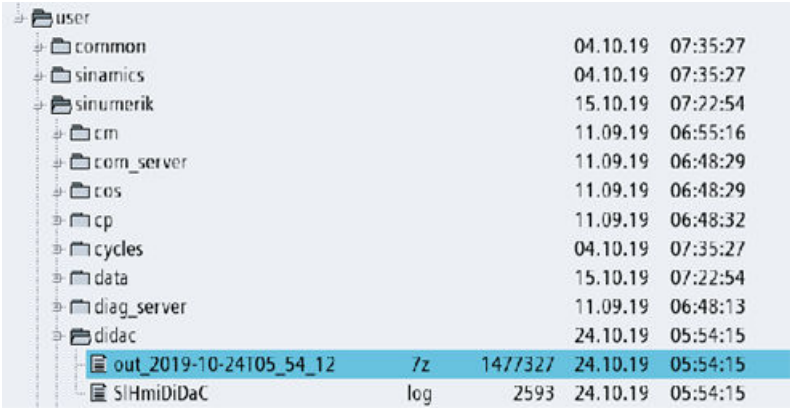


Figure 9-3 DIAG functionality

This function is available with CNC software version 6.13.

Note

In case you get in touch with the Siemens Technical Support, please copy those log files to your computer (for example, via USB memory stick) and make sure that your support request includes them.

9.4 NCK rotary switch (for PU)

The PU provides an NCK rotary coding switch. The NCK rotary switch is used for commissioning or to perform service work, e.g. to use the SINUMERIK service system or the Startup menu.

- The NCK rotary switch: Setting during normal operation: "0"



Figure 9-4 NCK rotary switch

Precondition

Flat-bladed screwdriver for the NCK rotary switch.

NCK rotary switch

Switch position	NC operating mode
0	Normal runup of the PU
1	General reset (NCK runup with default values)
7	Debug mode (NCK is not started); the SSH port tcp/22 is open at X130
8	Starts the Startup menu; the IP address for X130 of the PU is output on a 7-segment display
9	Normal runup of the PU; SSH port tcp/22 is open on X130
10	If available, saved user data are reloaded
11	The PLC is stopped
All others	Not relevant

Note

Switch position when booting the SINUMERIK service system

When booting the SINUMERIK service system, it is not permissible that the NCK rotary switch is set to position 0 as the PU in position 0 always boots from the integrated memory and from the SD card.

Note

Booting the Startup menu

When booting, the Startup menu in position 8, no service USB memory must be inserted at the PU. Otherwise, the PU does not boot the Startup menu, but instead, the SINUMERIK service system on the USB memory.

9.5 Error messages (for PPU)

Error messages

These error messages are shown on the top left corner of the panel. The error meesages occur in yellow font with red background.

Note

When submitting a query to SIEMENS Technical Support: In addition to the message shown on the top left corner of the panel, additional information regarding the status LEDs and the operating state (continuous operation, switch-on phase, restart, etc.) can provide important information on resolving your problem.

Top left corner - panel	Meaning	Troubleshooting
beiboot	onboard flash device did not initialize properly (HW problem or HWINFO wrong)"	Contact SIEMENS Technical Support.
SD Error <n>	<n> = single-digit code: • SD Error 2: Card reader not responding; HW problem • SD Error 3: SD card missing, or does not contain an ext4 partition • SD Error 4: fsck (file system check) failed with incorrigible errors • SD Error 5: File system linking failed A write or read error has occurred on the SD card.	• Check whether the mechanical write protection (lock) of the SD card has been activated. • It is possible that the SD card is defective and must be replaced. • Check the SD card using the "Check storage integrity" diagnostics option.

Top left corner - panel	Meaning	Troubleshooting
SIGErr=<nn>	<nn> = double-digit code:	
	SIGErr=07: Error while reading a signed file While reading a signed software an error occurred.	Check whether the original software package is installed and has not been modified. • Install the original software package.
	SIGErr=08: signature file error No SIEMENS signature was found for a software component.	Check whether the original CNC software package is installed and has not been modified. • Install the original CNC software package.
	SIGErr=09: Device certificate period of validity error The system time has not been correctly set.	Occurs the first time the device is turned on if the system time has not yet been set. Check the settings if the error is permanent.
	SIGErr=11: signature file invalid Software was installed with an unassociated signature file.	Check whether the original CNC software package is installed and has not been modified. • Install the original CNC software package.
	All others SIGErr	The hardware is possibly defective. • Contact SIEMENS Technical Support.

Please contact SIEMENS Technical Support if it was not possible to resolve the error.

Note

SD Error 1

For SD Error 1: System card reader is not present in HW info, please contact SIEMENS Technical Support

Connectable components 10

10.1 MCP 398C

10.1.1 Description

10.1.1.1 Overview

The MCP 398C enables user-friendly operation of the machine functions on complex machining stations. It is suitable for machine-level operation of milling, turning, grinding and special machines.

Note

The IE functionality (IE = **I**ndustrial **E**thernet) is still included and preset.
Observe switch position S2 in this regard.

In addition to the standard elements for machine control, freely assignable slots can be integrated with the EM 66, EM 131 and EM 187 for connecting further control devices, e.g. for pushbuttons, USB interface, Ethernet interface. The EM 131 and EM 187 also have space for a third override switch, a handwheel, or other operator controls.

The function of the MCP 398C can be extended considerably by installing additional keys.

All keys are designed with replaceable caps for machine-specific adaptations. The key caps can be freely inscribed using a laser. Alternatively, you can use clear key covers.

The machine control panel is easy to mount on the rear using special tension jacks.

The MCP 398C is available as a standard version and with expansion modules.

Validity

The following description applies to the following machine control panels and expansion modules:

Table 10-1 Standard version

Designation	Features	Article number
MCP 398C		6FC5303-0AF25-0AA0

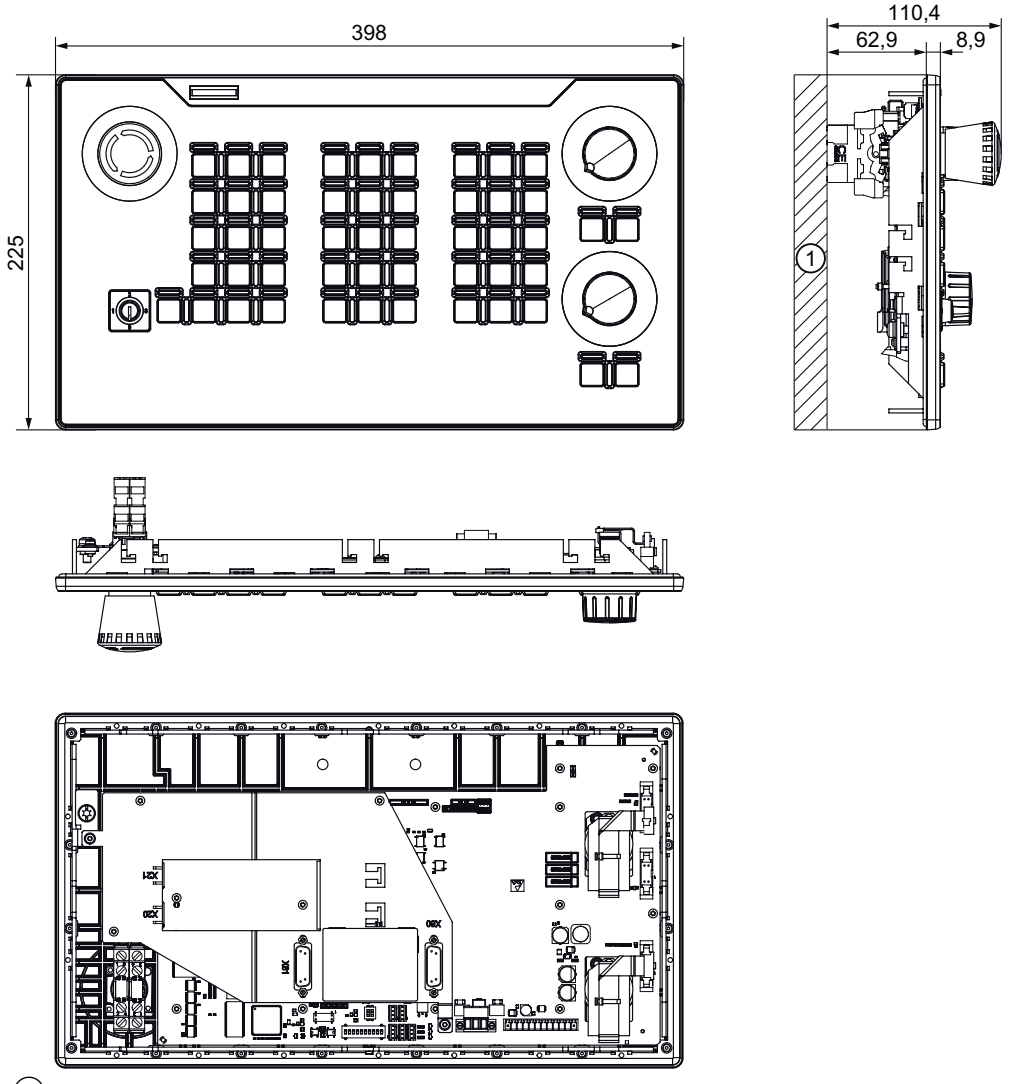
Table 10-2 Expansion modules

Designation	Features	Article number
EM 66	Space for 4 slots (d = 16 mm) or for three slots (d = 22 mm)	6FC5303-0AF30-0AA0
EM 131	Space for 6 slots (depending on the size of the switching elements) as well as space for a third override switch, a handwheel, or other operator controls.	6FC5303-0AF31-0AA0
EM 187	Space for 8 slots (depending on the size of the switching elements) as well as space for a third override switch, a handwheel, or other operator controls.	6FC5303-0AF28-0AA0

The safety-related accessories / spare parts are marked in Section "Accessories and spare parts" with an *).

10.1.2 DImension drawings

10.1.2.1 Dimensions for MCP 398C



① 10 mm ventilation clearance

Figure 10-1 Front and side view of MCP 398C with connection cable

For non-dimensioned/undefined areas, a minimum clearance of "0" is permitted.

10.1.3 Technical data

10.1.3.1 MCP 398C

	MCP 398C		EM 66	EM 131	EM 187
Safety					
Safety class according to EN 50178	III; PELV				
Degree of protection according to EN 60529 [1]	Front: IP54 Rear: IP00 [2]		Front: IP65 (without built-in elements) Rear: IP00 [2]		
Approvals	CE / UL / RCM / EAC / KC		EAC		
Flame resistance	UL 94 V-1 [3]				
Electrical data					
Overvoltage category	Secondary circuit supplied from primary circuits up to Cat. III, 300 VAC[4]				
Power supply [5]	24 VDC (20.4 V ... 28.8 V)				
Power consumption, max.	MCP 398C only	5 W	-	-	-
	+ two handwheels	2 x 0.9 W			
	+ third override	0.9 W			
	+ 24 V load on X53/X54	6 x 3.6 W			
	Total	29.3 W			
Current consumption, max.	1.25 A		-	-	-
Mechanical data					
Dimensions W x H x D (mm)	398 x 225 x 110.4		66 x 225 x 28	131 x 225 x 33	187 x 225 x 33
Weight (kg)	1.7		0.3	0.5	0.6
Max. vertical mounting position	≤ 45°				
Tightening torques, max.	Tension jacks: 0.5 Nm				
	M3: 0.8 Nm standard				
	M4: 1.8 Nm				
	M5: 3 Nm standard				
Mechan. stability	According to UL 61010 [3]				
Climatic environmental conditions					
Classification of the climatic environment	3K3 according to EN 60721-3-3				
Heat dissipation	By natural convection				
Condensation and ice formation	Not permitted				
Supply air	Without corrosive gases, dusts and oils				

	MCP 398C	EM 66	EM 131	EM 187
	Use and operation			
Max. installation altitude	Up to 1000 m without derating From 1000 m to 4000 m with linear ambient temperature derating, -0.5 K per 100 m			
Temperature limit values (storage)	-20 ... 55° C (cyclic)			
Temperature limit values (operation)	0 ... 45° C (front) 0 ... 55° C (rear)			
Temperature change	Max. 30 K/h			
Relative humidity	5 ... 90% (without condensation)			
Permissible change in the relative humidity	Max. 6%/h			
Pollution degree	2 (only use indoors)			
Mechanical environmental conditions				
Classification of the mechanical environment	Class 3M1 according to EN 60721-3-3			
Vibration load during operation	Frequency range: 10 – 200 Hz Deflection at 10 – 58 Hz: 0.15 mm Acceleration at 58 – 200 Hz: 2 g			
Shock load during operation with shock-sensitive components	Acceleration: 5 g Shock duration: 30 ms Load: 3 x in each direction			

1) The system installer ensures the system is sealed properly according to IP65, IP classification has not been checked by UL, UL TYPE 1.

2) Open equipment according to UL 61010.

3) The customer must ensure that the product, with the rear cover to be attached by the customer, meets the requirements for flame resistance of the material according to UL 94 V-1 and the mechanical stability / fire protection requirements / touch protection according to UL 61010.

4) If power supply units with primary-side supplies up to 600 VAC (line-to-neutral voltage) have to be deployed, the transient voltages on the primary side of the power supply unit must be limited to 4000 V.

5) Connect the device only to a 24 VDC power supply that is compliant with protective extra-low voltage (PELV) requirements according to UL 61010.

Note

The 24 VDC power source must be adapted to the input data of the device (see "Electrical data").

Note

Damage to components by coolants and lubricants

The SINUMERIK operator components have been designed for industrial use, particularly on machine tools and production machines. This also takes into account the use of commercially available coolants and lubricants. The use of aggressive compounds and additives can damage components and result in their failure.

Avoid contact between the operator components with coolants and lubricants, as resistance to all coolants and lubricants cannot be guaranteed

Emergency stop button

Rated voltage	24 VDC
Current rating, max.	3 A
Current rating, min.	1 mA
Switching capacity	DC 13 according to EN 60947-5-1
Conditional rated short-circuit current	10 A gL/gG according to EN 60947-5-1
B_{10d}	500000

Note

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

10.2 Machine Control Panel: SINUMERIK MCP 1200U-H

10.2.1 Description

The MCP 1200U-H machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the SINUMERIK 828D: PPU 271.5 and PPU 261.5

The machine-specific keys have replacable button cover so that they can be adapted. The machine control panel is mounted from the rear with special tension jacks supplied with the panel.

Validity

The following description applies to the following component:

Designation	Article number
SINUMERIK MCP 1200U-H	6FC5303-0AF32-1AA1

Operator controls / display elements:

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

Interfaces

A USB 2.0 interface for communication with the PPU with a transmission rate of 12 Mbps.

Expansion slots

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

10.2.1.1 Rating plate

Rating plate of the MCP 1200U-H

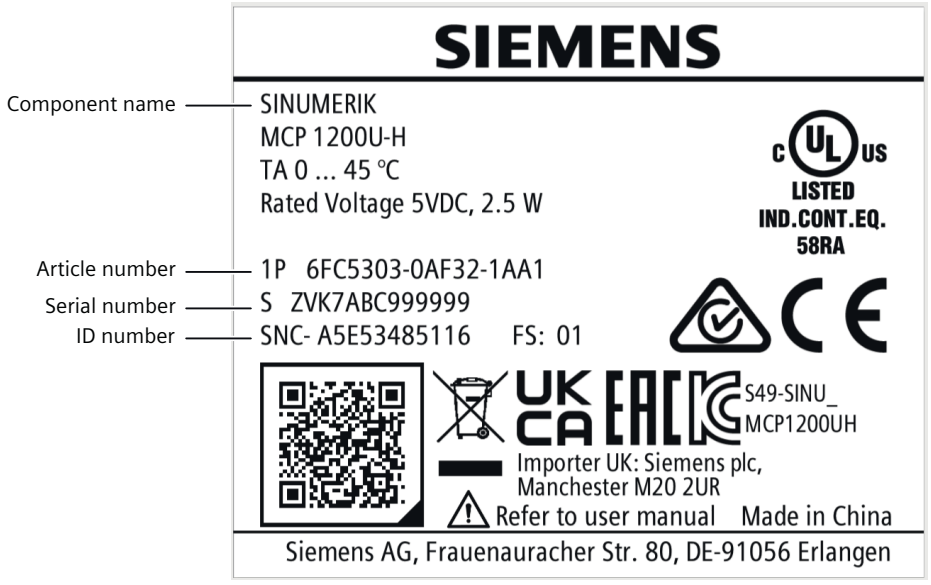


Figure 10-2 Example graphic of the MCP 1200U-H rating plate

Note

Different contents of the rating plates

The contents of the individual rating plate fields on the device may differ from those described in this manual (e.g. new product version, approvals and markings not yet issued, etc.).

Note

Product code scanning

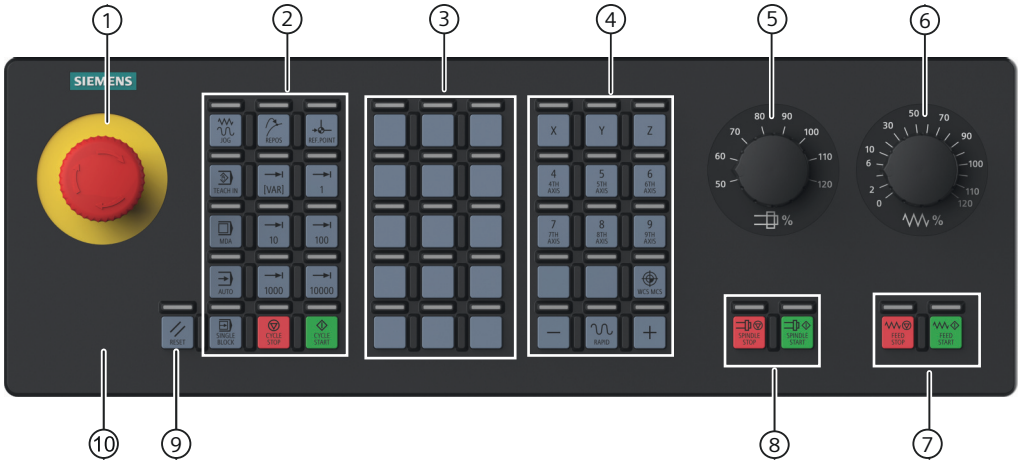
The product code contains the article number of the device. Scan the product code with the aid of the Siemens Industry Online Support App to be taken directly to the Internet Webpage for the product, including all of the technical information and graphical data.

The app is available for iPhone, iPad, Android and Windows Phone

10.2.2 Operator controls and displays

Operator controls (front)

The MCP module is delivered with a default laser marking caps. The following key blocks for machine-specific labeling: ②③④.



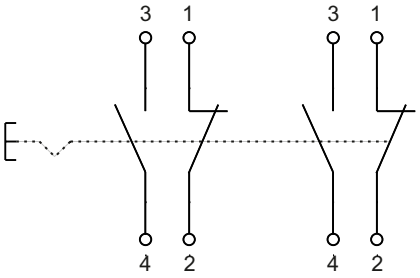
①	Slot for the Emergency Stop button
②+③+④	Keys for machine functions
⑤	Rotary spindle override switch
⑥	Rotary feedrate override switch
⑦	Keys for feedrate control
⑧	Keys for spindle control
⑨	Reset button
⑩	2 slots for control devices (d = 16 mm)

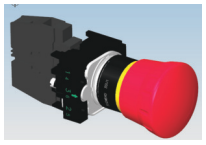
Figure 10-3 Position of operator controls

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

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

Emergency Stop circuit





Emergency Stop

Press the Emergency Stop button in the following situations:

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

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

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

Note

The emergency stop button should meet the requirement: UL certification category NISD, at least IP54, A600, R300.

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

Key covers

All keys of the MCP 1200U-H come with changeable key caps.

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

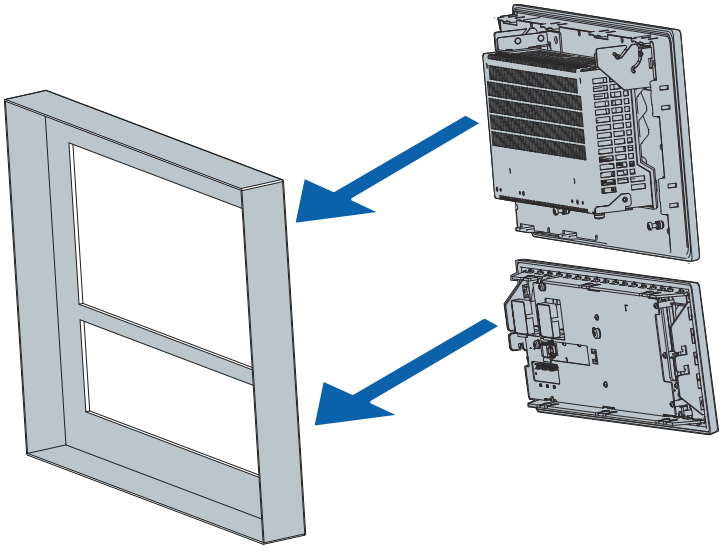
Key cover	Symbol cover	Key cover	Symbol cover
RAPID	7027	−X	7129
+C	7125	+Y	7130
+X	7126	−Z	7131
−Y	7027	−C	7132
+Z	7128		

See also

Spare parts and accessories (Page 223)

10.2.3 Installation and mounting

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



The machine control panel is mounted from the front in a rectangular cut-out and attached using eight tension jacks (0.5 Nm tightening torque). The tension jacks are included in the scope of delivery. Tension jacks are also available as accessories: Spare part and accessories (Page 223)

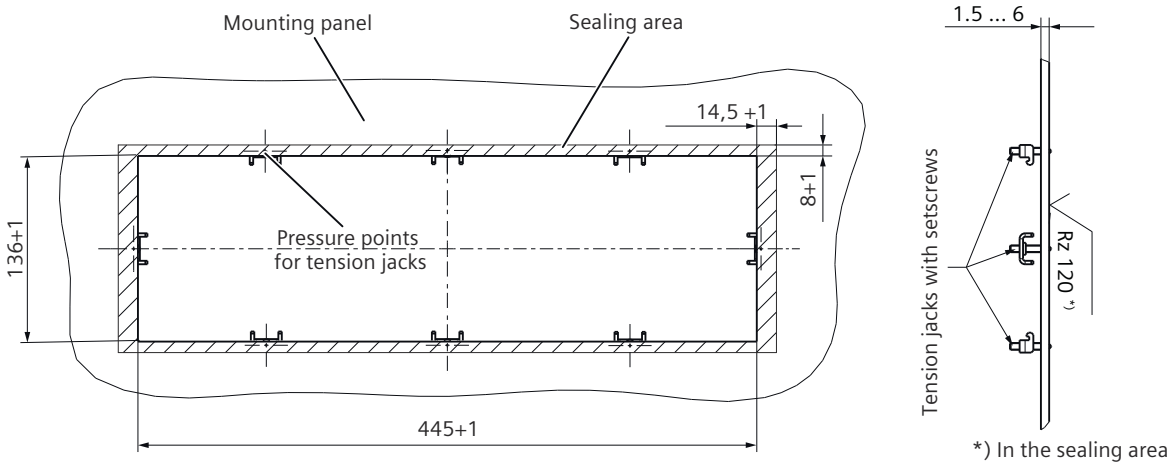
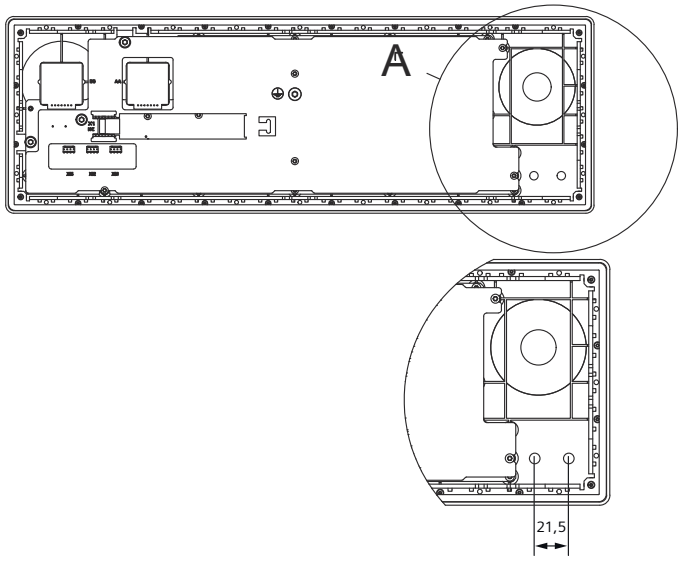


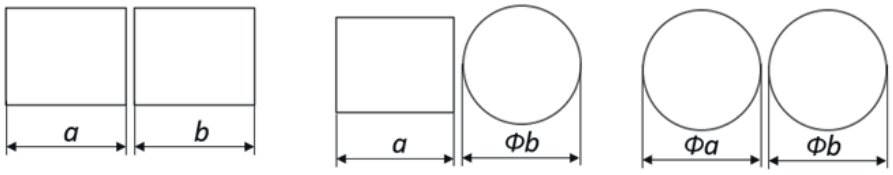
Figure 10-4 Mounting panel cutout

Two designated slots are provided for mounting control devices, with a theoretical center-to-center spacing of 21.5 mm between adjacent slots.



two slots position (horizontal)

The recommended horizontal distance between two buttons or keys should not exceed 20 mm, considering the potential deviations in the machining of panel slots that is a/2 +b/2≤20



1) 2) 3)

Figure 10-5 Control device

Note

The specified value is based on the horizontal center of the button being aligned with the theoretical center of the slot.

10.2.3.1 Dimension drawing

⚠ WARNING

Danger to life from hazardous voltage

It is possible to reach into installation holes for control devices (shown in gray in the drawing).

Make sure that no live parts can be touched behind the holes within a clearance of at least 85 mm (hatched area in the drawing).

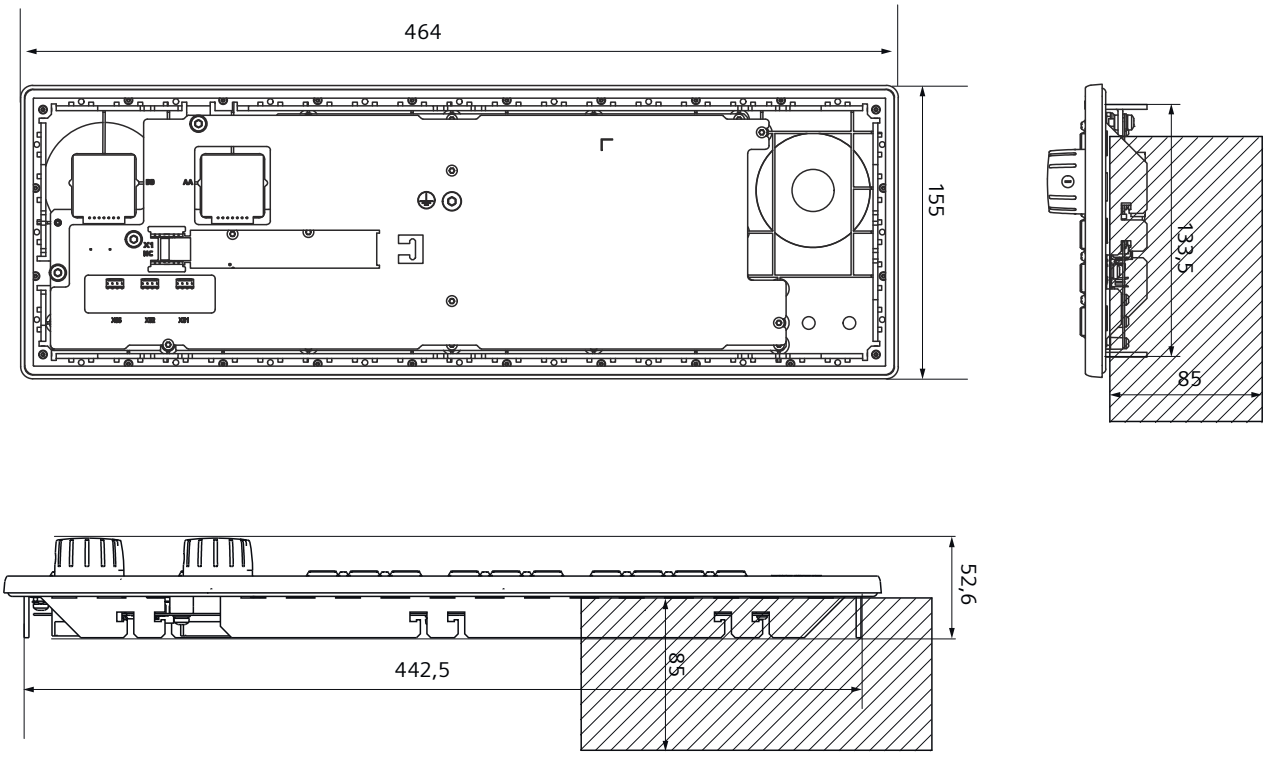


Figure 10-6 Dimensions and clearances

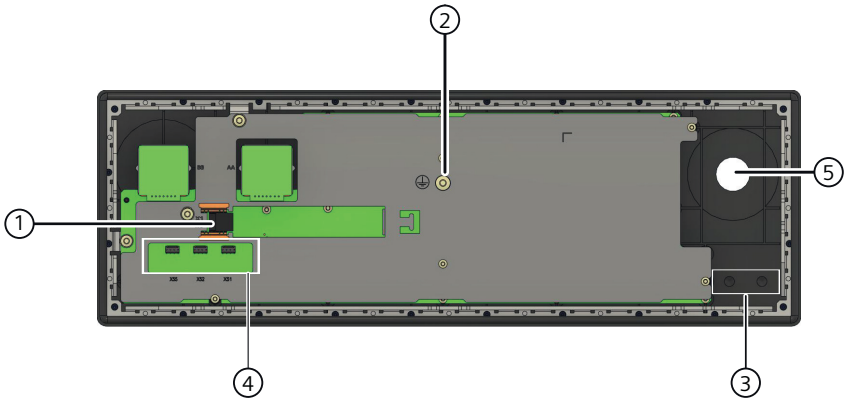
See also

Spare parts and accessories (Page 223)

10.2.4 Connecting

10.2.4.1 Rear side

Connections (rear)



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

Figure 10-7 MCP1200U-H: Connections at the rear

10.2.4.2 Description

USB 2.0 interface

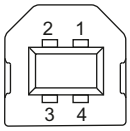
The USB cable to connect the machine control panel to the PPU is included in the accessories pack. The machine control panel is also supplied with power via this USB connection. This USB cable must be routed separately away from other cables to avoid EMC disturbances (Page 69).

Pin assignment USB port

Connection designation: **X1**

Connection type: USB socket, type B

Maximum cable length: 0.8 m

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

Connections and switch settings of the override switch

Connection designation: **AA, BB**

Connector type: 7-pin COMBICON connector

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

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

Feed override	Value in the IBn+3
0 %	0x01
2 %	0x02
4 %	0x06
6 %	0x07
10 %	0x04
20 %	0x0C
30 %	0x0D
40 %	0x0F
50 %	0x0E
60 %	0x0A
70 %	0x0B
80 %	0x08
90 %	0x19
100 %	0x1A
105 %	0x1E
110 %	0x1F
120 %	0x1C

Digital inputs X51, X52, X55

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

Note

Connection of miniature handheld unit

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

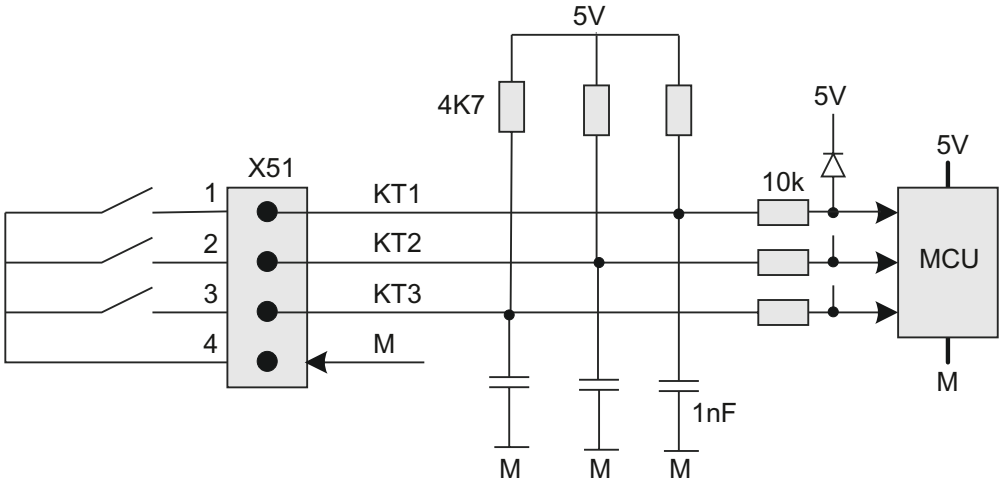


Figure 10-8 X51/X52/X55 Block Diagram

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

Table 10-3 Assignment of connector X51

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

Table 10-4 Assignment of connector X52

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

Table 10-5 Assignment of connector X55

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

10.2.5 Parameter assignment

10.2.5.1 Parameterization

Input image

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC.

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

IBn+10	Digit inputs							
	KT-IN8 X55.2	KT-IN7 X55.1	KT-IN6 X52.3	KT-IN5 X52.2	KT-IN4 X52.1	KT-IN3 X51.3	KT-IN2 X51.2	KT-IN1 X51.1
IBn+11	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	KT-IN9 X55.3
IBn+12	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+13	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
DB1000. dbb1000	Version information of the 828D MCP - byte 0							
DB1000. dbb1001	Version information of the 828D MCP - byte 1							
DB1000. dbb1002	Version information of the 828D MCP - byte 2							
DB1000. dbb1003	Version information of the 828D MCP - byte 3							

Output image

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

Key assignment

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

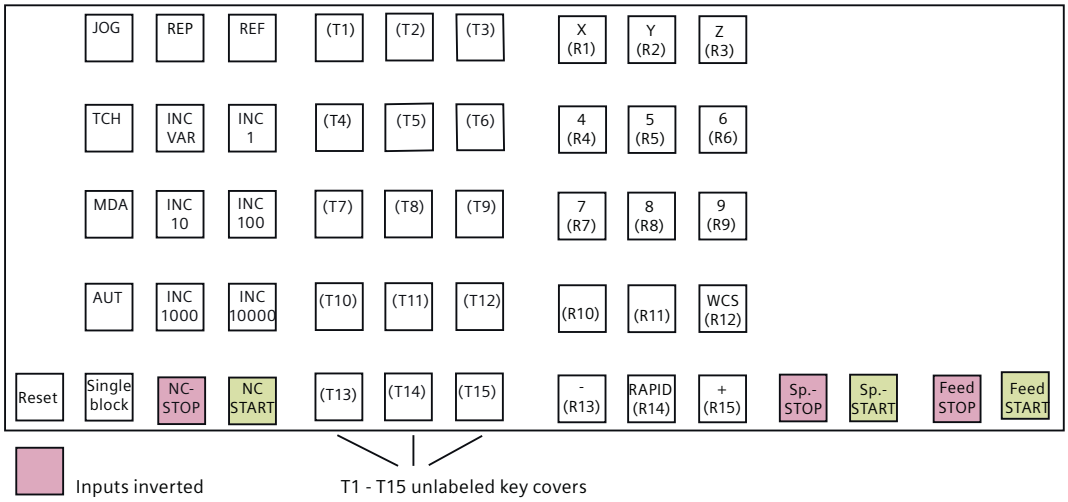


Figure 10-9 MCP 1200U-H default key assignment

See also

Activating components (Page 344)

10.2.6 Service and maintenance

Cleaning the device

Use a soft cloth moistened either with water or a mild cleaning agent to clean the housing and operator controls of the device.

Note

Switch the device off for cleaning

Clean the device only when it is switched off. This way, you ensure that you cannot unintentionally trigger any functions by touching the keys.

Procedure

Spray the cleaning agent on to a cleaning cloth. Never use caustic solvents or abrasive cleaners.

Note

Avoid damage

Do not clean the device using compressed air or steam jets because they can damage it.

Checking the device

In order to prevent foreign bodies or liquids entering the device, regularly check the device for the following:

- Ensure that all the housing screws are in place and tight
- For damage to the housing
- For damage to the cable cover or cable entry

Protect the device from environmental effects

Protect the device against the following environmental factors:

- Direct sunshine and heat sources
- Mechanical vibration and shock
- Dust
- Humidity
- Strong magnetic fields

Checking the emergency stop button

Check the emergency stop button regularly to ensure that it functions correctly.

Suspected malfunction

If you suspect a malfunction due to unusual product reactions, isolate the device from power. Immediately inform qualified personnel to check the function and ensure that the product functions correctly.

The following signs can indicate a malfunction:

- Unusual or no functioning
- Unusual heat generation
- Smoke development

Repair

Send the device back to the manufacturer for repair. The device must only be repaired there.

10.2.7 Technical data

10.2.7.1 MCP 1200U-H

	MCP 1200U-H
Safety	
Safety class according to EN 50178	III; PELV
Degree of protection according to EN 60529 [1]	Front: IP54 Rear: IP00 [2]
Approvals	CE / UL / RCM / EAC / KC / UKCA
Flame resistance	UL 94 V-1 [3]
Electrical data	
Overvoltage category	Secondary circuit supplied from primary circuits up to Cat. III, 300 VAC
Power supply	5 VDC
Power consumption, max.	2.5 W
Current consumption, max.	0.5 A
Mechanical data	
Dimensions W x H x D (mm)	464 x 155 x 52.6
Weight (kg)	1.79
Tightening torques, max.	Tension jacks: 0.5 Nm
	M3: 0.6 Nm standard
	M4: 1 Nm
	M5: 3 Nm standard
Mechan. stability	According to UL 61010 [3]
Climatic environmental conditions	
Classification of the climatic environment	3K3 according to EN 60721-3-3
Heat dissipation	By natural convection
Condensation and ice formation	Not permitted
Supply air	Without corrosive gases, dusts and oils
	Use and operation
Max. installation altitude	Up to 1000 m without derating From 1000 m to 4000 m with linear ambient temperature derating, -0.5 K per 100 m
Temperature limit values (storage)	-40 °C ... +70 °C
Temperature limit values (transportation)	-40 °C ... +70 °C

	MCP 1200U-H		
Temperature limit values (operation)	0 ... 45° C (front) 0 ... 55° C (rear)		
Temperature change	Max. 30 K/h		
Relative humidity (storage)	5 ... 95% (without condensation)		
Relative humidity (transportation)	5 ... 95% (without condensation)		
Relative humidity (operation)	5 ... 85% (without condensation)		
Permissible change in the relative humidity	Max. 6%/h		
Pollution degree of contamination according to EN 61800-5-1	2 (only use indoors)		
Mechanical environmental conditions			
Classification of the mechanical environment	Class 3M1 according to EN 60721-3-3		
Vibratory load during operation	Frequency range: 10 – 200 Hz Deflection at 10 – 58 Hz: 0.15 mm Acceleration at 58 – 200 Hz: 2 g		
Vibratory load during package (1M2)	Frequency range: 5 – 9 Hz Deflection at 10 – 58 Hz: 3.15 mm Acceleration at 9 – 200 Hz: 1 g		
Shock load during operation with shock-sensitive components	Acceleration: 5 g Shock duration: 30 ms Load: 3 x in each direction		
Active environmental conditions	Chemical: Class 3C2 (H2S,SO2)	Mechanical: Class 3S1	Biological: Class 3B1

1) The system installer ensures the system is sealed properly according to IP65.

2) Open equipment according to UL 61010.

3) The customer must ensure that the product, with the rear cover to be attached by the customer, meets the requirements for flame resistance of the material according to UL 94 V-1 and the mechanical stability / fire protection requirements / touch protection according to UL 61010.

Function-impairing dust

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

Maximum permissible amount of dust in the ambient air:

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

Note

Damage to components by coolants and lubricants

The SINUMERIK operator components have been designed for industrial use, particularly on machine tools and production machines. This also takes into account the use of commercially available coolants and lubricants. The use of aggressive compounds and additives can damage components and result in their failure.

Avoid contact between the operator components with coolants and lubricants, as resistance to all coolants and lubricants cannot be guaranteed.

Emergency stop button

Rated voltage	24 VDC
Current rating, max.	3 A
Current rating, min.	1 mA
Switching capacity	DC 13 according to EN 60947-5-1
Conditional rated short-circuit current	10 A gL/gG according to EN 60947-5-1
B_{10d}	500000

Note

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

10.2.7.2 Supplementry electrical conditions

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
- Machine Control Panel (MCP)
- PLC I/O modules
- SINAMICS S120 drive components

Grounding measures

The individual modules are attached to a metal cabinet panel. Insulating paints on the mounting points (e.g. tension jacks) must be removed.

It is permissible to have a cluster of operator components for ground connection/ equipotential bonding.
Example: The control panel on the swivel arm.
It is sufficient in this instance to connect the ground connections of, for example, the operator panel front using a cable and to route a shared grounding conductor to the central ground connection in the control cabinet.

Please note that interruption of the grounding during maintenance work is not permissible.

Reference

More information about the EMC installation guideline can be found under:

- Configuration Manual (https://support.industry.siemens.com/cs/document/109800046), EMC installation guideline (https://support.industry.siemens.com/cs/mdm/60612658)

EMF assessments for 24 V components

The 24 V components, e.g. control systems PPU, handheld units and machine control panels do not generate any appreciable electromagnetic fields.

No minimum clearance has to be maintained for 24 V components.

EMC limiting values in South Korea

EMC limit values in South Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

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

10.2.7.3 Relevant directives and standards

Certificates

You can obtain an up-to-date list of currently certified components on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person. The certificates can be downloaded from the Internet: Certificates

EC Declaration of Conformity



You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated") on the Internet at the following address.

Relevant directives and standards

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

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

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

  SINUMERIK MCP comply with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).

- **North American market**

  SINUMERIK MCP devices provided with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications. You can find the relevant certificates on the Internet pages of the certifier.

- **UK Conformity Assessed marking**

  The SINUMERIK MCP devices comply with the designated British standards (BS) for programmable logic controllers published in the official consolidated list of the British Government. The SINUMERIK MCP devices meet the requirements and protection targets of the following regulations and related amendments:

  – Electrical Equipment (Safety) Regulations 2016 (Low-Voltage)
  – Electromagnetic Compatibility Regulations 2016 (EMC)
  – Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016 (Explosion Protection)
  – Regulations on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2012 (RoHS)

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

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

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

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

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

10.2.7.4 Recycling and disposal

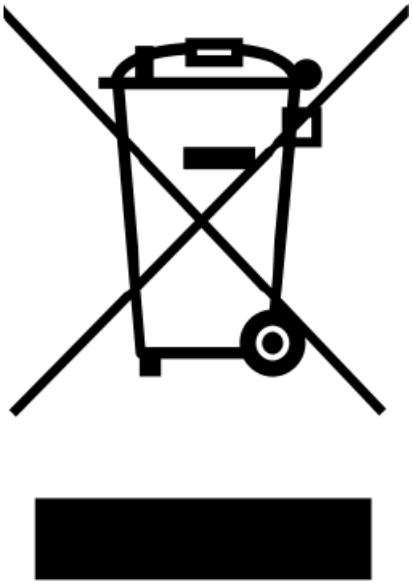


Figure 10-10 Recycle

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

10.2.8 Safety and security

10.2.8.1 General security guidelines

Safety symbols

Icon	Explanation
	The equipment is only suitable for direct current. Used for marking corresponding terminals.
	For marking the connection for an external protective conductor for protecting against electrical shock in the event of an error or for a connecting terminal of the external protective conductor.

	For marking the ground connection.
 General warning symbol	The documentation must be consulted in any scenario where the symbol is affixed in order to find out the type of potential hazard and the actions required to avoid the risk.

Plant security

Unauthorized persons may be able to enter the production site/building and damage or alter production equipment as a result of gaps in a company's physical security.

To prevent attackers from standing in front of the MCP and pressing keys with malicious intent follow these guidelines:

1. Incorporate a shield with a lock, which users can engage when leaving to prevent unauthorized access and manipulation of the MCP keys.
2. Regularly monitor MCP access and maintain logs to detect any unauthorized activity.

NOTICE
Protection of interfaces against unauthorized access Machine control panels must be integrated and operated in a housing/console/control cabinet so that interfaces can be protected against unauthorized access, as described in the "Connecting" section.

Company security

The company's physical security must be ensured by taking the following measures:

- Closed off and monitored company premises
- Entry control, keys / card readers and/or security personnel

Protection for machine specific labelling

To prevent attackers replacing the labels on the key blocks, take the following measures:

- Label every component clearly, ensuring the labels are visible.
- Schematics Alignment: Ensure that the labels on the control panel match those on the schematics.

10.2.8.2 Enhancing MCP safety with PLC program

To prevent unauthorized personnel from operating the MCP, you can set up a PLC special program that locks MCP functions using a specific combination of keys. This means that once the MCP is locked, no one can use the control panel unless they know the unlock sequence.

Note the following recommendations for PLC program implementation:

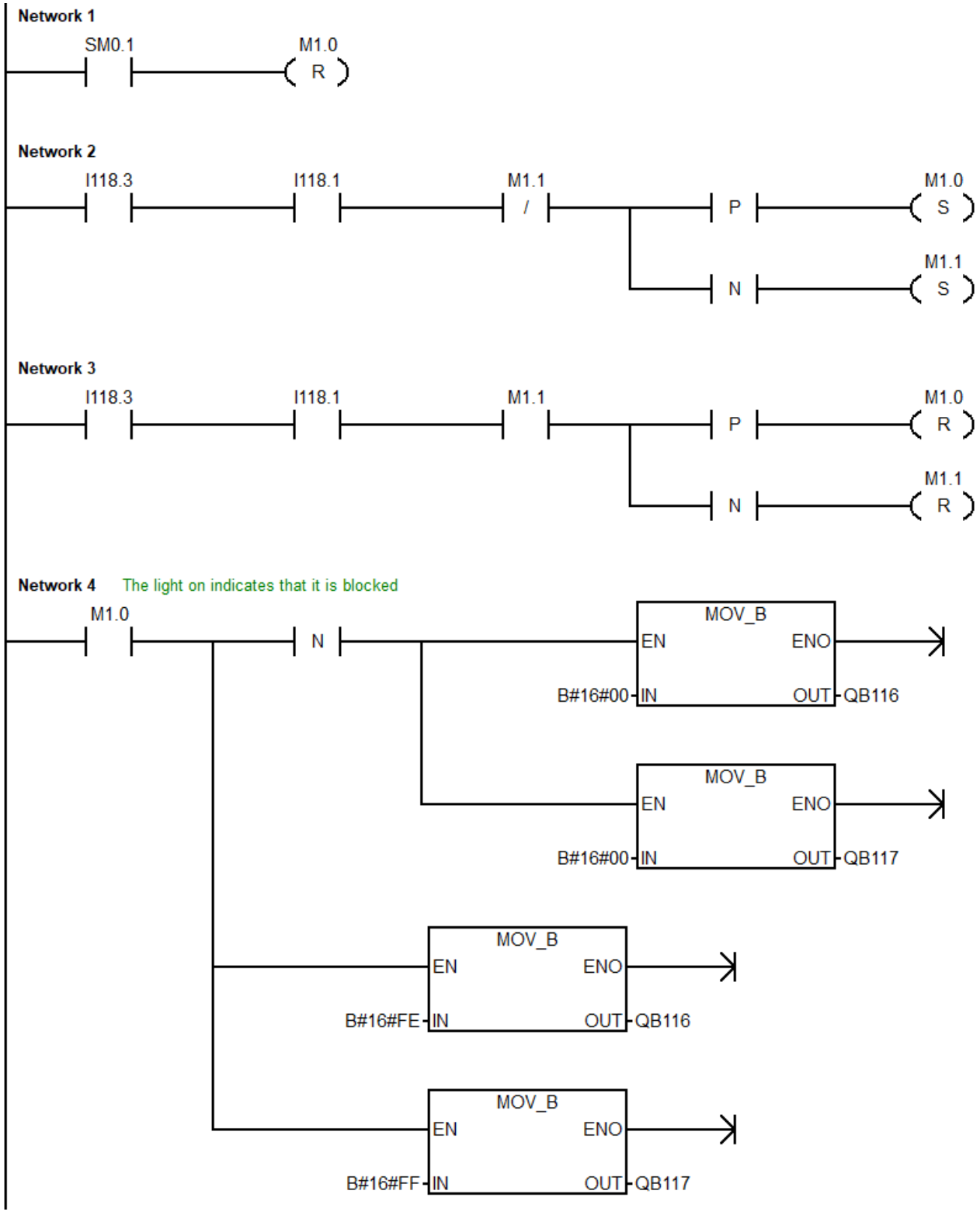
Cut Off Input Signals:

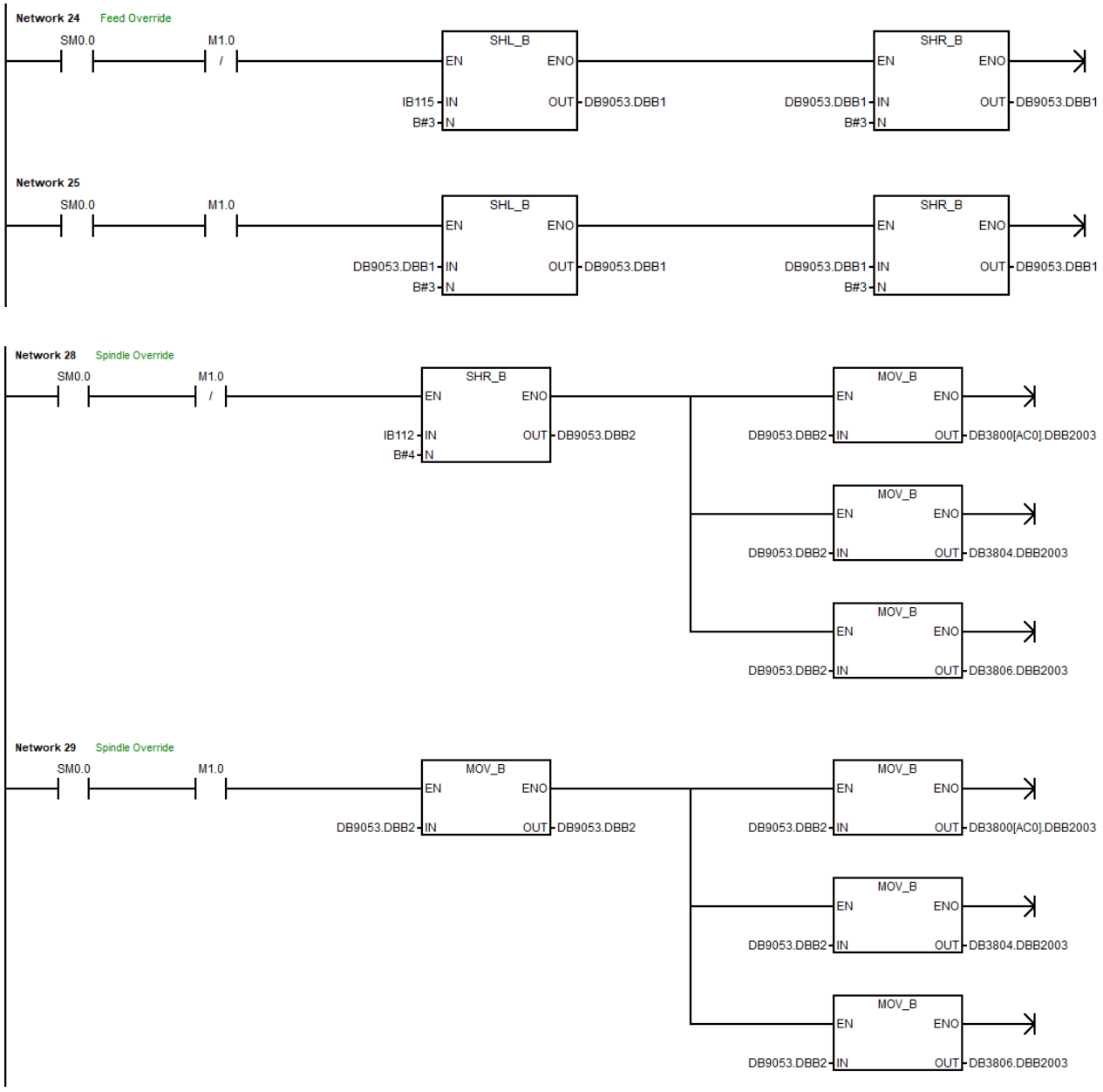
- Add a normally closed signal before each individual input signal.
- When the key combination is pressed, this immediately opens the signal to cut off the inputs.
- When the key combination is pressed again, this immediately restores the normally closed state to resume normal reading of inputs.

Maintain Override Switch Code Point Information:

- After pressing the key combination, read the code point information of the override switch.
- Store this information in a register; this information will be used in place of the override switch data.
- When the key combination is pressed again, restore the actual value from the override switch code point

PLC program exmaple:





10.2.9 Spare parts and accessories

Accessories pack when delivered from the factory

Qty.	Description
1	USB cable (length: 0.8 m) for the connection between the PPU and MCP
1	8pcs clamps to mount the MCP

Qty.	Description
1	Button cover kit-30 pcs Fe-gray blank button covers
1	Button cover kit-9 pcs Fe-gray marked button covers

Spare parts

Qty.	Description	Article number
1	500 × Fe-GRAY,QUADRATE KEY CAPS USED FOR SINUMERIK 828D MCPs.	6FC5348-0AF02-0AA0

Optional parts

Qty.	Description	Article number
1	500 × Fe-GRAY,QUADRATE KEY CAPS USED FOR SINUMERIK 828D MCPs.	6FC5348-0AF02-0AA0
1	Emegency stop mushroom pushbutton 22mm (0.87 in) without holder	3SU1000-1HB20-0AA0
1	Holder For mushroom pushbutton	3SU1500-0AA10-0AA0
1	Contact block with 2 contacts Screw ternimnals for front panel mounting 1 NO contact + 1 NC contact	3SU1400-1AA10-1FA0
1	Cable set (1 set = 60 units) For additional macheine control panel control devices Length 500 mm(19.69 in)	6FC5247-0AA35-0AA0

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

10.3 Machine Control Panel: SINUMERIK MCP 1200U-V

10.3.1 Description

The MCP 1200U-V machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the vertical SINUMERIK 828D: PPU 270.5 and PPU 260.5

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

Validity

The following description applies to the following component:

Designation	Article number
SINUMERIK MCP 1200U-V	6FC5303-0AF33-1AA1

Operator controls / display elements:

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

Interfaces

A USB 2.0 interface for communication with the PPU with a transmission rate of 12 Mbps.

Expansion slots

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

10.3.1.1 Rating plate

Rating plate of the MCP 1200U-V

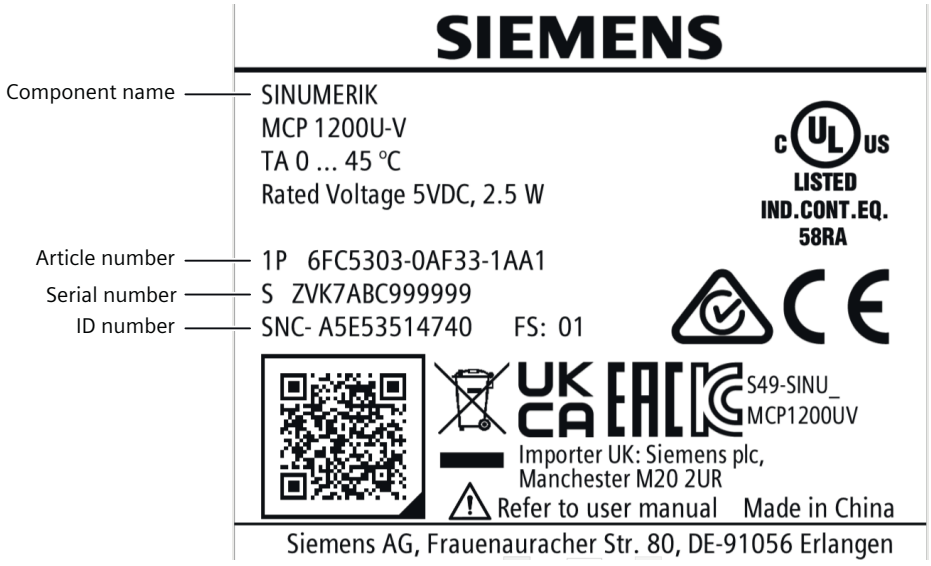


Figure 10-11 Example graphic of the MCP 1200U-V rating plate

Note

Different contents of the rating plates

The contents of the individual rating plate fields on the device may differ from those described in this manual (e.g. new product version, approvals and markings not yet issued, etc.).

Note

Product code scanning

The product code contains the article number of the device. Scan the product code with the aid of the Siemens Industry Online Support App to be taken directly to the Internet Webpage for the product, including all of the technical information and graphical data.

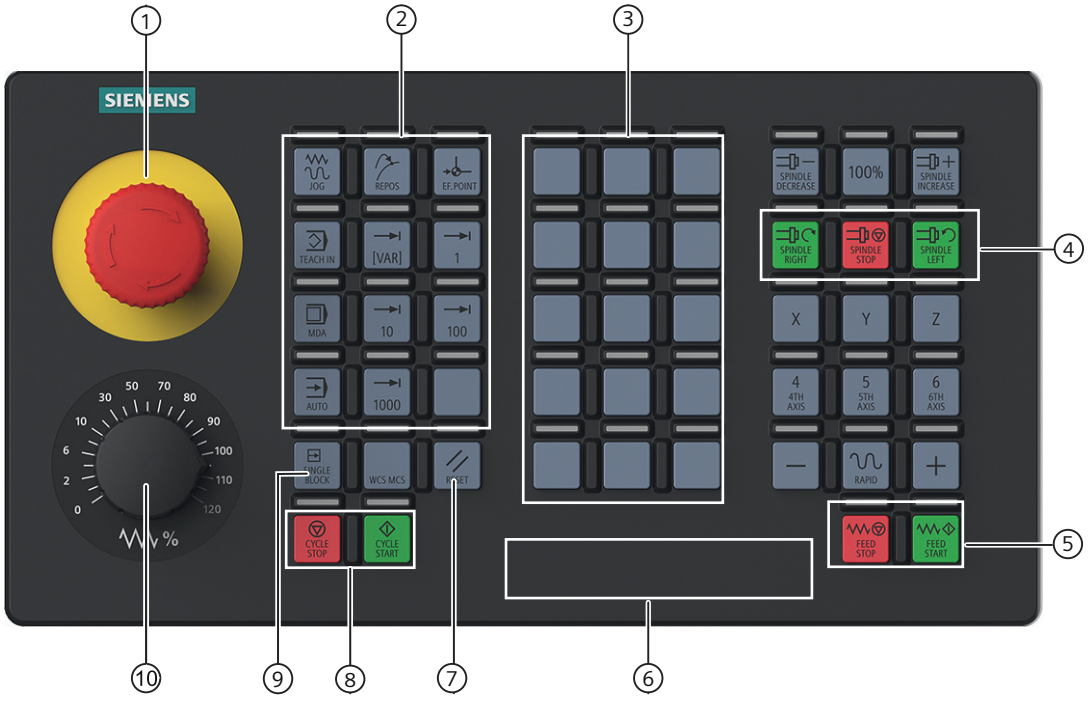
The app is available for iPhone, iPad, Android and Windows Phone

10.3.2 Operator controls and displays

10.3.2.1 Front side

Operator controls (front)

The MCP module is delivered with a default laser marking caps. The following key blocks can be labeled for machine-specific labeling: ②③



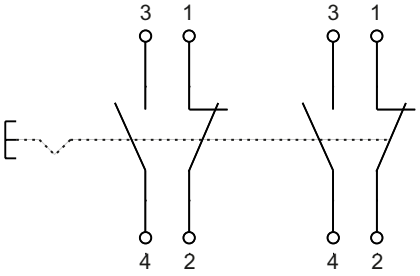
① Slot for the Emergency Stop button
②+③ Keys for machine functions
④ Keys for spindle control
⑤ Keys for feedrate control
⑥ 4 slots for control devices (d=16mm)
⑦ Reset button
⑧ NC START/ NC STOP keys
⑨ Keys for coolant and single block that can also be used as customer keys for labeling
⑩ Rotary feedrate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

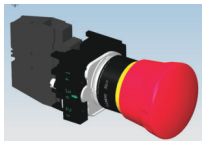
Figure 10-12 Position of operator controls

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

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

Emergency Stop circuit





Emergency Stop

Press the Emergency Stop button in the following situations:

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

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

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

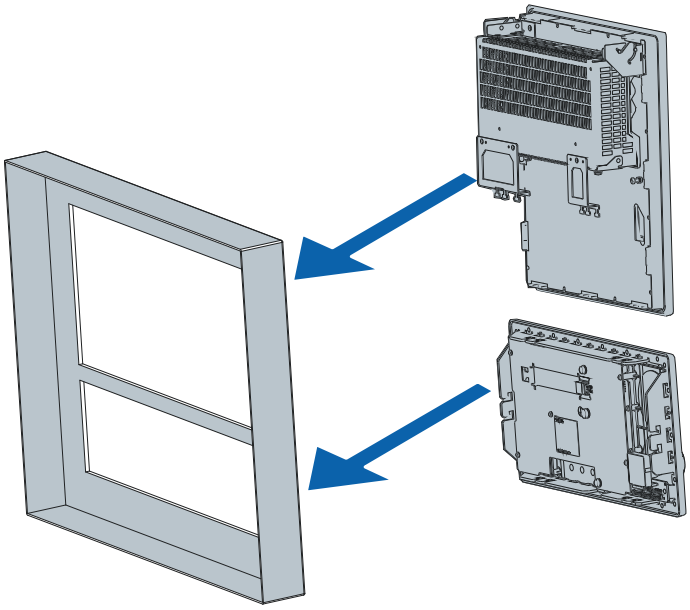
Note

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

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

10.3.3 Installation and mounting

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



The machine control panel is mounted from the front in a rectangular cut-out and attached using six tension jacks (0.5 Nm tightening torque). The tension jacks are included in the scope of delivery. Tension jacks are also available as accessories: Spare part and accessories (Page 249)

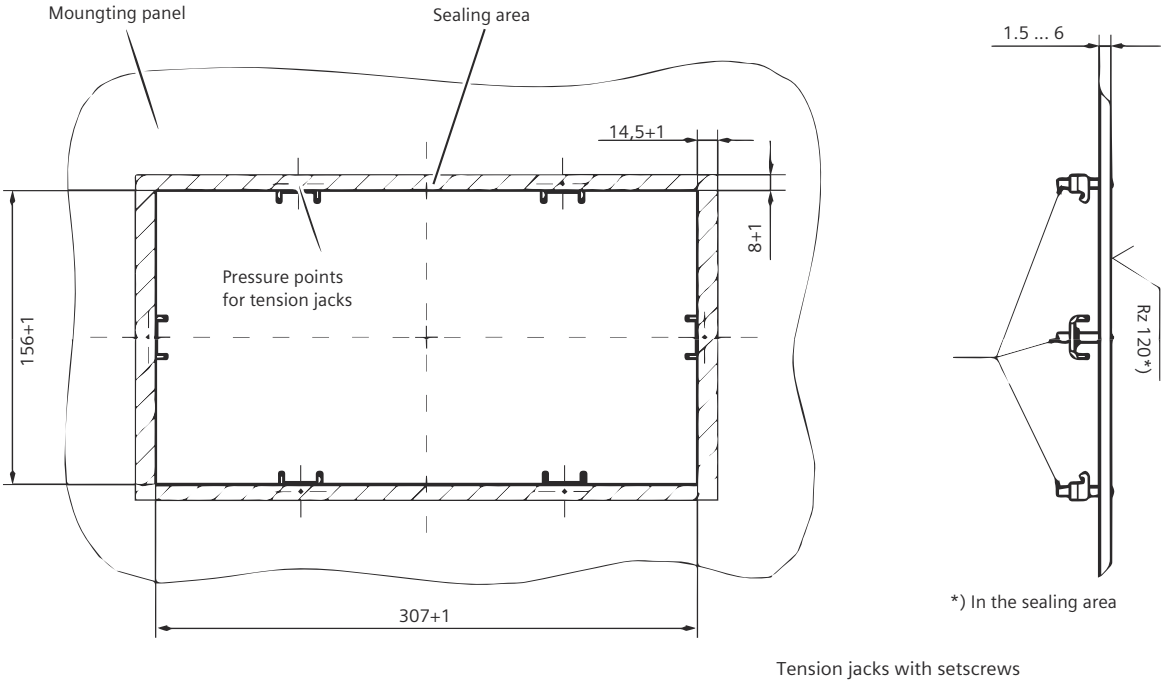
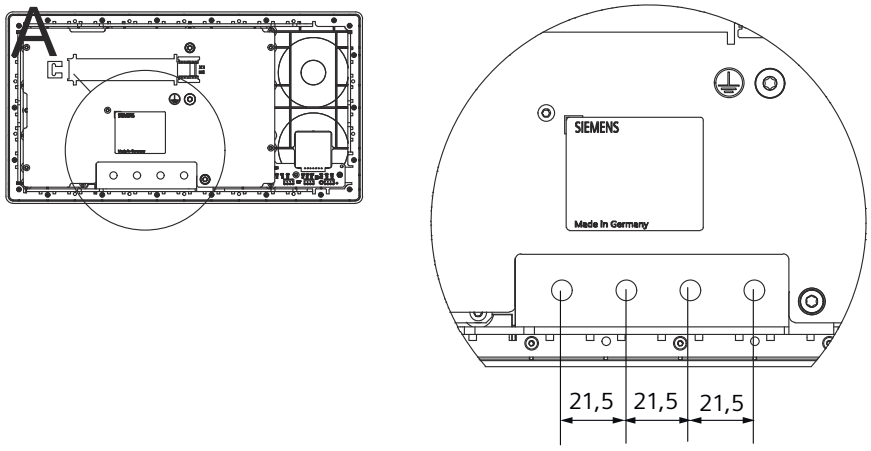


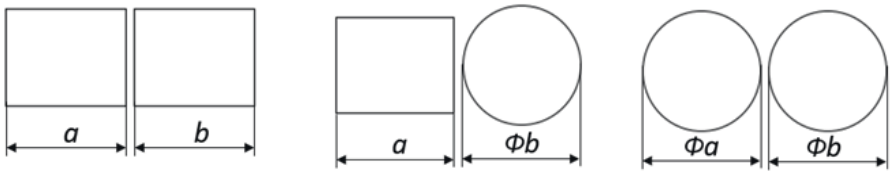
Figure 10-13 Mounting panel cutout

Four designated slots are provided for mounting control devices, with a theoretical center-to-center spacing of 21.5 mm between adjacent slots.



four slots position (horizontal)

The recommended horizontal distance between two buttons or keys should not exceed 20 mm, considering the potential deviations in the machining of panel slots that is a/2 +b/2≤20



1) 2) 3)

Figure 10-14 Control device

Note

The specified value is based on the horizontal center of the button being aligned with the theoretical center of the slot.

Dimension drawing

⚠ WARNING

Danger to life from hazardous voltage

It is possible to reach into installation holes for control devices (shown in gray in the drawing).

Make sure that no live parts can be touched behind the holes within a clearance of at least 85 mm (hatched area in the drawing).

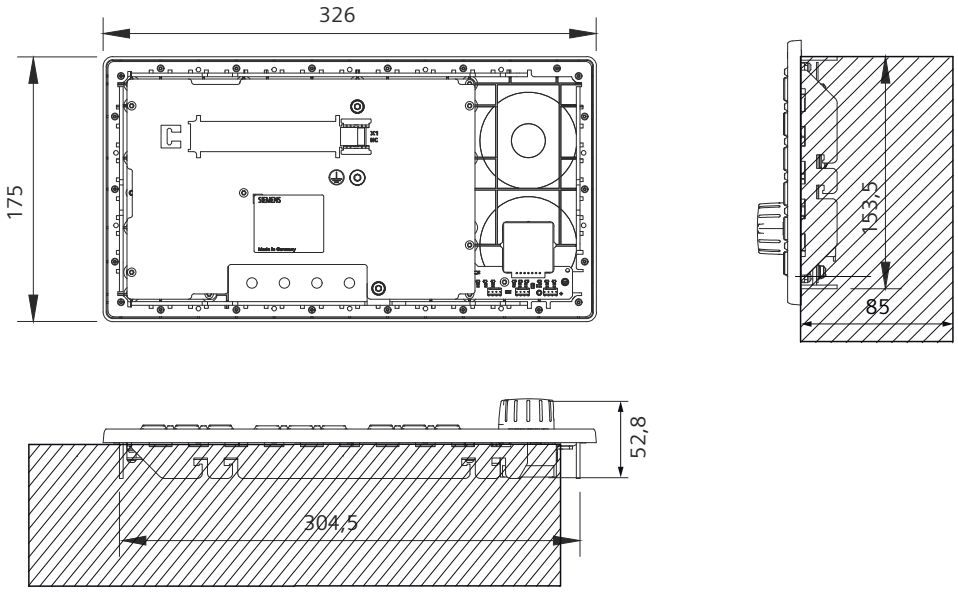
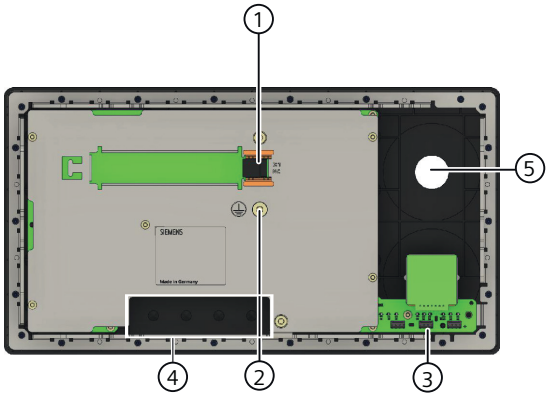


Figure 10-15 Dimensions and clearances

10.3.4 Connecting



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

Figure 10-16 MCP 1200U-V: Connections at the rear

10.3.4.1 Description

USB 2.0 interface

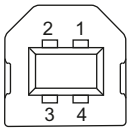
The USB cable to connect the machine control panel to the PPU is included in the accessories pack. The machine control panel is also supplied with power via this USB connection. This USB cable must be routed separately away from other cables to avoid EMC disturbances.

Pin assignment USB port

Connection designation: **X1**

Connection type: USB socket, type B

Maximum cable length: 0.8 m

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

Connections and switch settings of the override switch

Connection designation: **BB**

Connector type: 7-pin COMBICON connector

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

Feed override	Value in the IBn+3
0 %	0x01
2 %	0x02
4 %	0x06
6 %	0x07
10 %	0x04
20 %	0x0C
30 %	0x0D
40 %	0x0F
50 %	0x0E
60 %	0x0A
70 %	0x0B
80 %	0x08
90 %	0x19
100 %	0x1A
105 %	0x1E
110 %	0x1F
120 %	0x1C

Digital inputs X51, X52, X55

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

Note

Connection of miniature handheld unit

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

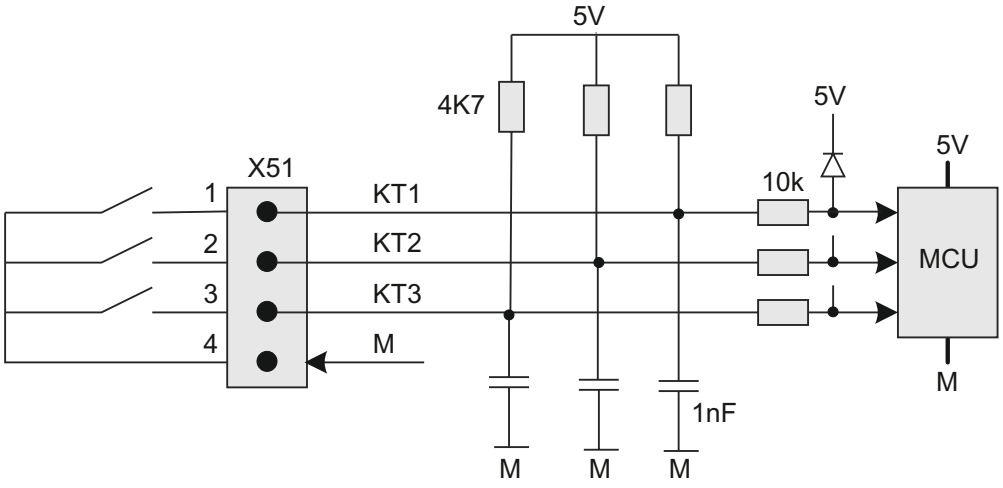


Figure 10-17 X51/X52/X55 Block Diagram

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

Table 10-6 Assignment of connector X51

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

Table 10-7 Assignment of connector X52

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

Table 10-8 Assignment of connector X55

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

10.3.5 Parameterization

Input image

The specifications for assigning input and output bytes listed in the tables are defined as standard addresses in the PLC. There are different ways to activate and use the MCP USB. Further information on settings in the machine data can be found in Section Activating and addressing components (Page 344).

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

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IBn+12	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Re-served	Reserved
IBn+13	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Re-served	Reserved
DBB1000	Version information of the MCP USB - byte 0							
DBB1001	Version information of the MCP USB - byte 1							
DBB1002	Version information of the MCP USB - byte 2							
DBB1003	Version information of the MCP USB - byte 3							

Output image

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

Key assignment

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

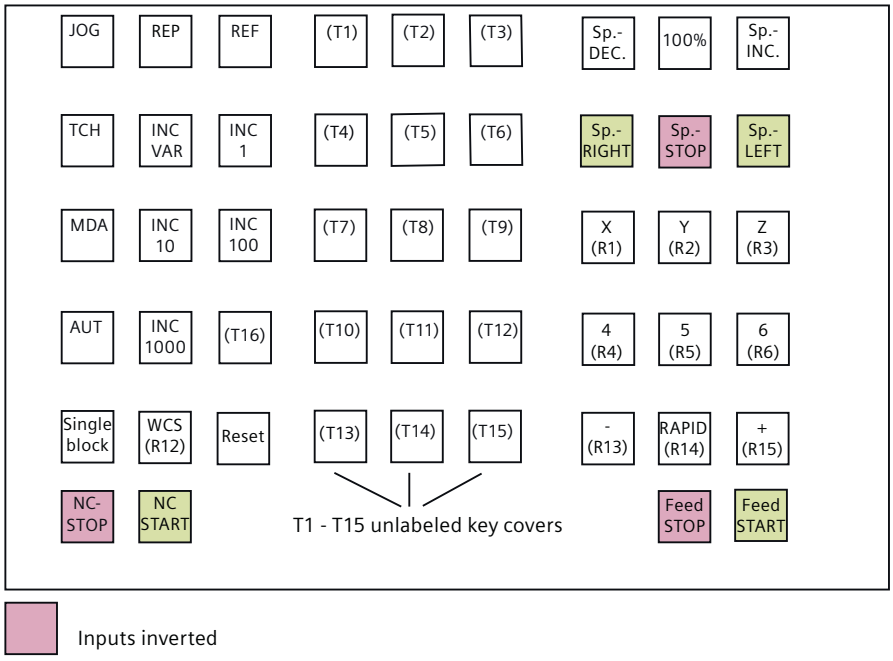


Figure 10-18 MCP 1200U-V default key assignment

10.3.6 Service and maintenance

Cleaning the device

Use a soft cloth moistened either with water or a mild cleaning agent to clean the housing and operator controls of the device.

Note

Switch the device off for cleaning

Clean the device only when it is switched off. This way, you ensure that you cannot unintentionally trigger any functions by touching the keys.

Procedure

Spray the cleaning agent on to a cleaning cloth. Never use caustic solvents or abrasive cleaners.

Note

Avoid damage

Do not clean the device using compressed air or steam jets because they can damage it.

Checking the device

In order to prevent foreign bodies or liquids entering the device, regularly check the device for the following:

- Ensure that all the housing screws are in place and tight
- For damage to the housing
- For damage to the cable cover or cable entry

Protect the device from environmental effects

Protect the device against the following environmental factors:

- Direct sunshine and heat sources
- Mechanical vibration and shock
- Dust
- Humidity
- Strong magnetic fields

Checking the emergency stop button

Check the emergency stop button regularly to ensure that it functions correctly.

Suspected malfunction

If you suspect a malfunction due to unusual product reactions, isolate the device from power. Immediately inform qualified personnel to check the function and ensure that the product functions correctly.

The following signs can indicate a malfunction:

- Unusual or no functioning
- Unusual heat generation
- Smoke development

Repair

Send the device back to the manufacturer for repair. The device must only be repaired there.

10.3.7 Technical data

10.3.7.1 MCP 1200U-V

	MCP 1200U-V
Safety	
Safety class according to EN 50178	III; PELV
Degree of protection according to EN 60529 [1]	Front: IP54 Rear: IP00 [2]
Approvals	CE / UL / RCM / EAC / KC
Flame resistance	UL 94 V-1 [3]
Electrical data	
Overvoltage category	Secondary circuit supplied from primary circuits up to Cat. III, 300 VAC
Power supply [5]	5 VDC
Power consumption, max.	2.5 W
Current consumption, max.	0.5 A
Mechanical data	
Dimensions W x H x D (mm)	326 x 175 x 52.8
Weight (kg)	1.36
Tightening torques, max.	Tension jacks: 0.5 Nm
	M3: 0.6 Nm standard
	M4: 1 Nm
	M5: 3 Nm standard
Mechan. stability	According to UL 61010 [3]
Climatic environmental conditions	
Classification of the climatic environment	3K3 according to EN 60721-3-3
Heat dissipation	By natural convection
Condensation and ice formation	Not permitted
Supply air	Without corrosive gases, dusts and oils
	Use and operation
Max. installation altitude	Up to 1000 m without derating From 1000 m to 4000 m with linear ambient temperature derating, -0.5 K per 100 m
Temperature limit values (storage)	-40 °C ... +70 °C (cyclic)
Temperature limit values (transportation)	-40 °C ... +70 °C (cyclic)
Temperature limit values (operation)	0 ... 45° C (front) 0 ... 55° C (rear)
Temperature change	Max. 30 K/h

	MCP 1200U-V
Relative humidity (storage)	5 ... 95% (without condensation)
Relative humidity (transportation)	5 ... 95% (without condensation)
Relative humidity (operation)	5 ... 85% (without condensation)
Permissible change in the relative humidity	Max. 6%/h
Pollution degree	2 (only use indoors)
Mechanical environmental conditions	
Classification of the mechanical environment	Class 3M1 according to EN 60721-3-3
Vibration load during operation	Frequency range: 10 – 200 Hz Deflection at 10 – 58 Hz: 0.15 mm Acceleration at 58 – 200 Hz: 2 g
Shock load during operation with shock-sensitive components	Acceleration: 5 g Shock duration: 30 ms Load: 3 x in each direction

1) The system installer ensures the system is sealed properly according to IP65.

2) Open equipment according to UL 61010.

3) The customer must ensure that the product, with the rear cover to be attached by the customer, meets the requirements for flame resistance of the material according to UL 94 V-1 and the mechanical stability / fire protection requirements / touch protection according to UL 61010.

Note

The 24 VDC power source must be adapted to the input data of the device (see "Electrical data").

Note

Damage to components by coolants and lubricants

The SINUMERIK operator components have been designed for industrial use, particularly on machine tools and production machines. This also takes into account the use of commercially available coolants and lubricants. The use of aggressive compounds and additives can damage components and result in their failure.

Avoid contact between the operator components with coolants and lubricants, as resistance to all coolants and lubricants cannot be guaranteed.

Emergency stop button

Rated voltage	24 VDC
Current rating, max.	3 A
Current rating, min.	1 mA
Switching capacity	DC 13 according to EN 60947-5-1
Conditional rated short-circuit current	10 A gL/gG according to EN 60947-5-1
B_{10d}	500000

Note

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

10.3.7.2 Supplementry electrical conditions

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
- Machine Control Panel (MCP)
- PLC I/O modules
- SINAMICS S120 drive components

Grounding measures

The individual modules are attached to a metal cabinet panel. Insulating paints on the mounting points (e.g. tension jacks) must be removed.

It is permissible to have a cluster of operator components for ground connection/ equipotential bonding.
Example: The control panel on the swivel arm.
It is sufficient in this instance to connect the ground connections of, for example, the operator panel front using a cable and to route a shared grounding conductor to the central ground connection in the control cabinet.

Please note that interruption of the grounding during maintenance work is not permissible.

Reference

More information about the EMC installation guideline can be found under:

- Configuration Manual (https://support.industry.siemens.com/cs/document/109800046), EMC installation guideline (https://support.industry.siemens.com/cs/mdm/60612658)

EMF assessments for 24 V components

The 24 V components, e.g. control systems PPU, handheld units and machine control panels do not generate any appreciable electromagnetic fields.

No minimum clearance has to be maintained for 24 V components.

EMC limiting values in South Korea

EMC limit values in South Korea

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

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

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

10.3.7.3 Relevant directives and standards

Certificates

You can obtain an up-to-date list of currently certified components on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person. The certificates can be downloaded from the Internet: Certificates

EC Declaration of Conformity



You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated") on the Internet at the following address.

Relevant directives and standards

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

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

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

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

  SINUMERIK MCP devices provided with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications. You can find the relevant certificates on the Internet pages of the certifier.

- **UK Conformity Assessed marking**

  UK
  CA

  The SINUMERIK MCP devices comply with the designated British standards (BS) for programmable logic controllers published in the official consolidated list of the British Government. The SINUMERIK MCP devices meet the requirements and protection targets of the following regulations and related amendments:

  – Electrical Equipment (Safety) Regulations 2016 (Low-Voltage)
  – Electromagnetic Compatibility Regulations 2016 (EMC)
  – Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016 (Explosion Protection)
  – Regulations on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2012 (RoHS)

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

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

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

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

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

10.3.7.4 Recycling and disposal

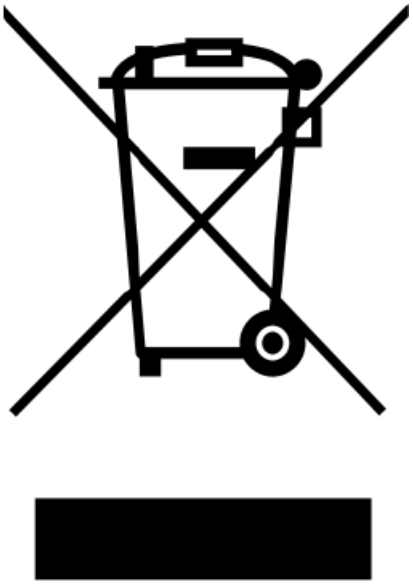


Figure 10-19 Recycle

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

10.3.8 Safety and security

10.3.8.1 General security guidelines

Safety symbols

Icon	Explanation
⎓	The equipment is only suitable for direct current. Used for marking corresponding terminals.
⏚	For marking the connection for an external protective conductor for protecting against electrical shock in the event of an error or for a connecting terminal of the external protective conductor.

	For marking the ground connection.
 General warning symbol	The documentation must be consulted in any scenario where the symbol is affixed in order to find out the type of potential hazard and the actions required to avoid the risk.

Plant security

Unauthorized persons may be able to enter the production site/building and damage or alter production equipment as a result of gaps in a company's physical security.

To prevent attackers from standing in front of the MCP and pressing keys with malicious intent follow these guidelines:

1. Incorporate a shield with a lock, which users can engage when leaving to prevent unauthorized access and manipulation of the MCP keys.
2. Regularly monitor MCP access and maintain logs to detect any unauthorized activity.

NOTICE
Protection of interfaces against unauthorized access Machine control panels must be integrated and operated in a housing/console/control cabinet so that interfaces can be protected against unauthorized access, as described in the "Connecting" section.

Company security

The company's physical security must be ensured by taking the following measures:

- Closed off and monitored company premises
- Entry control, keys / card readers and/or security personnel

Protection for machine specific labelling

To prevent attackers replacing the labels on the key blocks, take the following measures:

- Label every component clearly, ensuring the labels are visible.
- Schematics Alignment: Ensure that the labels on the control panel match those on the schematics.

10.3.8.2 Enhancing MCP safety with PLC program

To prevent unauthorized personnel from operating the MCP, you can set up a PLC special program that locks MCP functions using a specific combination of keys. This means that once the MCP is locked, no one can use the control panel unless they know the unlock sequence.

Note the following recommendations for PLC program implementation:

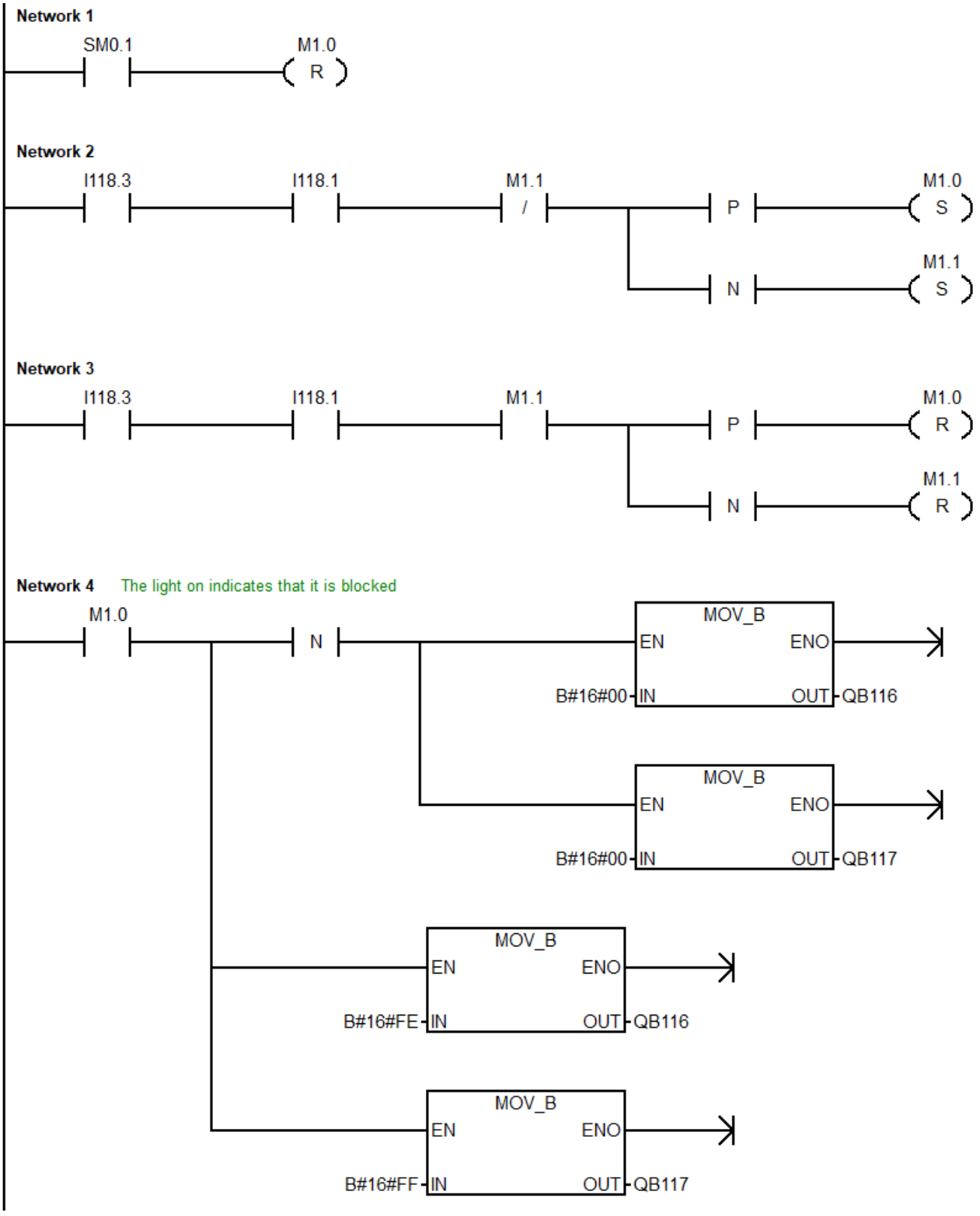
Cut Off Input Signals:

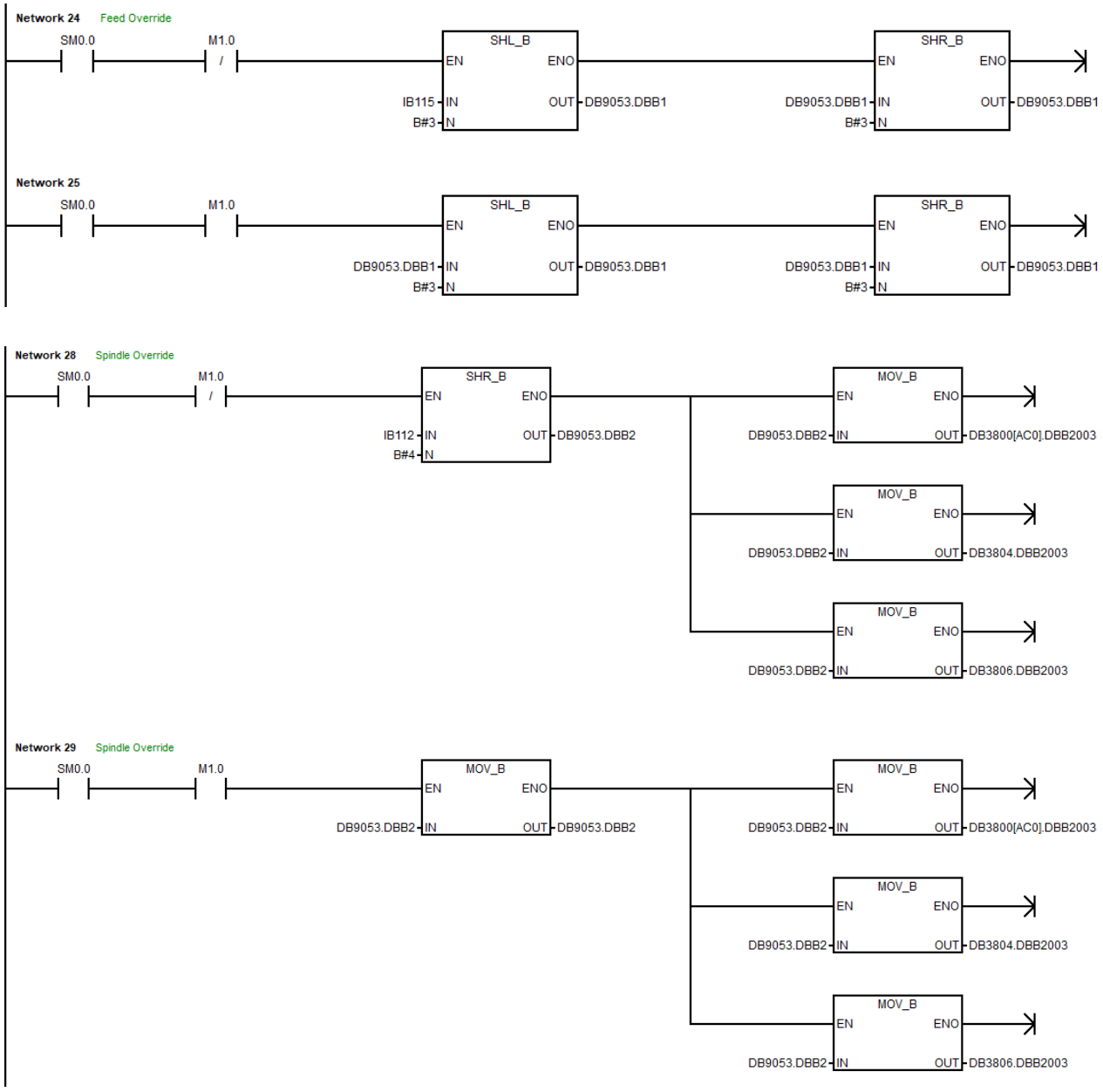
- Add a normally closed signal before each individual input signal.
- When the key combination is pressed, this immediately opens the signal to cut off the inputs.
- When the key combination is pressed again, this immediately restores the normally closed state to resume normal reading of inputs.

Maintain Override Switch Code Point Information:

- After pressing the key combination, read the code point information of the override switch.
- Store this information in a register; this information will be used in place of the override switch data.
- When the key combination is pressed again, restore the actual value from the override switch code point

PLC program exmaple:




Network 24 Feed Override
SM0.0
M1.0
/
SHL_B
EN
ENO
IB115
IN
OUT
DB9053.DBB1
B#3
N
SHR_B
EN
ENO
DB9053.DBB1
IN
OUT
DB9053.DBB1
B#3
N
Network 25
SM0.0
M1.0
SHL_B
EN
ENO
DB9053.DBB1
IN
OUT
DB9053.DBB1
B#3
N
SHR_B
EN
ENO
DB9053.DBB1
IN
OUT
DB9053.DBB1
B#3
N
Network 28 Spindle Override
SM0.0
M1.0
/
SHR_B
EN
ENO
IB112
IN
OUT
DB9053.DBB2
B#4
N
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3800[AC0].DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3804.DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3806.DBB2003
Network 29 Spindle Override
SM0.0
M1.0
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB9053.DBB2
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3800[AC0].DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3804.DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3806.DBB2003

10.3.9 Spare parts and accessories

10.3.9.1 Spare parts and accessories

Accessories pack when delivered from the factory

Qty.	Description
1	USB cable (length: 0.8 m) for the connection between the PPU and MCP
1	6pcs clamps to mount the MCP
1	Button cover kit-30 pcs Fe-gray blank button covers
1	Button cover kit-9 pcs Fe-gray marked button covers

Spare parts

Qty.	Description	Article number
1	500 × Fe-GRAY,QUADRATE KEY CAPS USED FOR SINUMERIK 828D MCPs.	6FC5348-0AF02-0AA0

Optional parts

Qty.	Description	Article number
1	500 × Fe-GRAY,QUADRATE KEY CAPS USED FOR SINUMERIK 828D MCPs.	6FC5348-0AF02-0AA0
1	Emegency stop mushroom pushbutton 22mm (0.87 in) without holder	3SU1000-1HB20-0AA0
1	Holder For mushroom pushbutton	3SU1500-0AA10-0AA0
1	Contact block with 2 contacts Screw ternimnals for front panel mounting 1 NO contact + 1 NC contact	3SU1400-1AA10-1FA0
1	Cable set (1 set = 60 units) For additional macheine control panel control devices Length 500 mm(19.69 in)	6FC5247-0AA35-0AA0

Additional spare parts for these components can be found here: Spare parts (Spares on Web).

10.4 Machine Control Panel: SINUMERIK MCP 1500U

The MCP 1500U machine control panel allows machine functions to be operated in a user-friendly way, and is used to control machine tools locally. It is a perfect fit for the SINUMERIK 828D PPU 290.5.

The machine-specific keys have replacable button cover so that they can be adapted. The machine control panel is mounted from the rear with special tension jacks supplied with the panel.

Validity

The following description applies to the following component:

Designation	Article number
SINUMERIK MCP 1500U	6FC5303-0AF34-1AA1

Operator controls / display elements:

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

Interfaces

A USB 2.0 interface for communication with the PPU with a transmission rate of 12 Mbps.

Expansion slots

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

10.4.1 Rating plate

Rating plate of the MCP 1500U

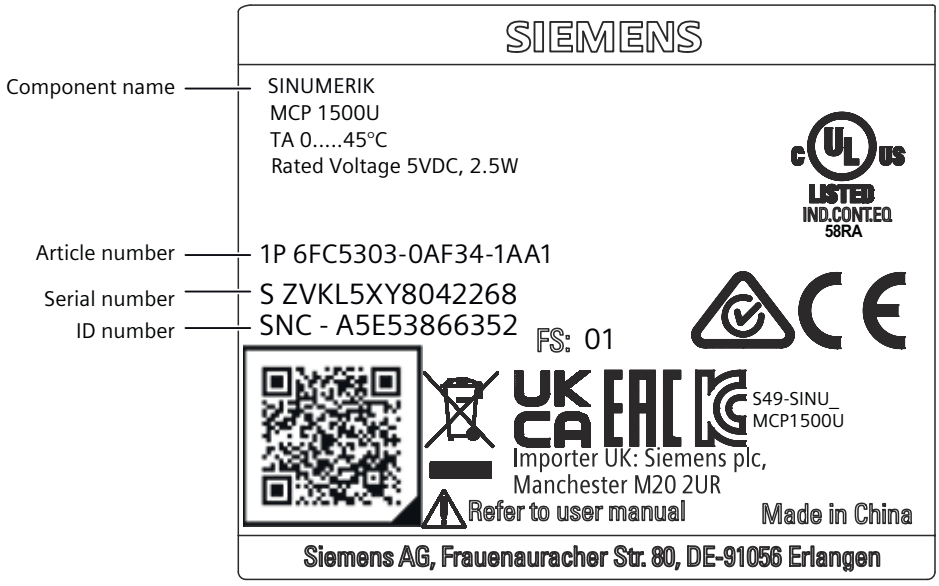


Figure 10-20 Example graphic of the MCP 1500U rating plate

Note

Different contents of the rating plates

The contents of the individual rating plate fields on the device may differ from those described in this manual (e.g. new product version, approvals and markings not yet issued, etc.).

Note

Product code scanning

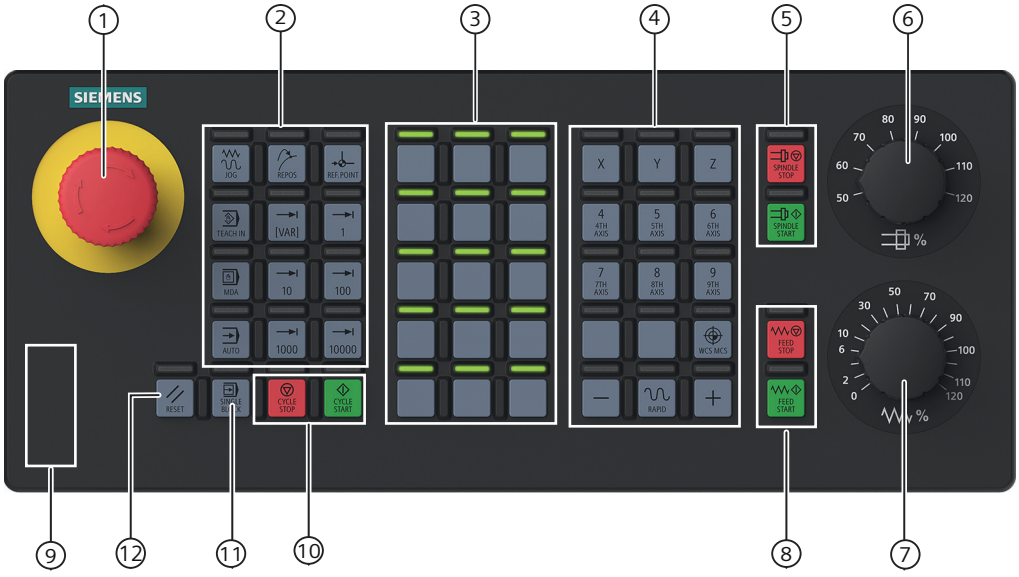
The product code contains the article number of the device. Scan the product code with the aid of the Siemens Industry Online Support App to be taken directly to the Internet Webpage for the product, including all of the technical information and graphical data.

The app is available for iPhone, iPad, Android and Windows Phone

10.4.2 Operator controls and displays

Operator controls

The MCP module is delivered with a default laser marking caps. The following key blocks for machine-specific labeling: ②③④.

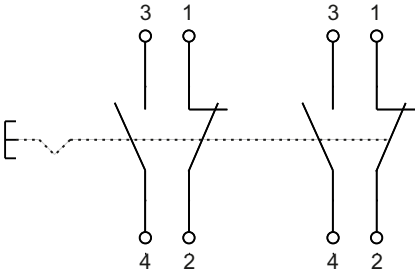


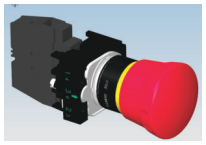
① Slot for the Emergency Stop button
②+ Keys for machine functions
③+
④
⑤ Keys for spindle control
⑥ Rotary spindle override switch
⑦ Rotary feedrate override switch
⑧ Keys for feedrate control
⑨ 2 slots for control devices (d = 16 mm)
⑩ NC START/ NC STOP keys
⑪ Keys for coolant and single block that can also be used as customer keys for labeling
⑫ Reset button

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

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

Emergency Stop circuit





Emergency Stop

Press the Emergency Stop button in the following situations:

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

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

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

Note

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

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

Key covers

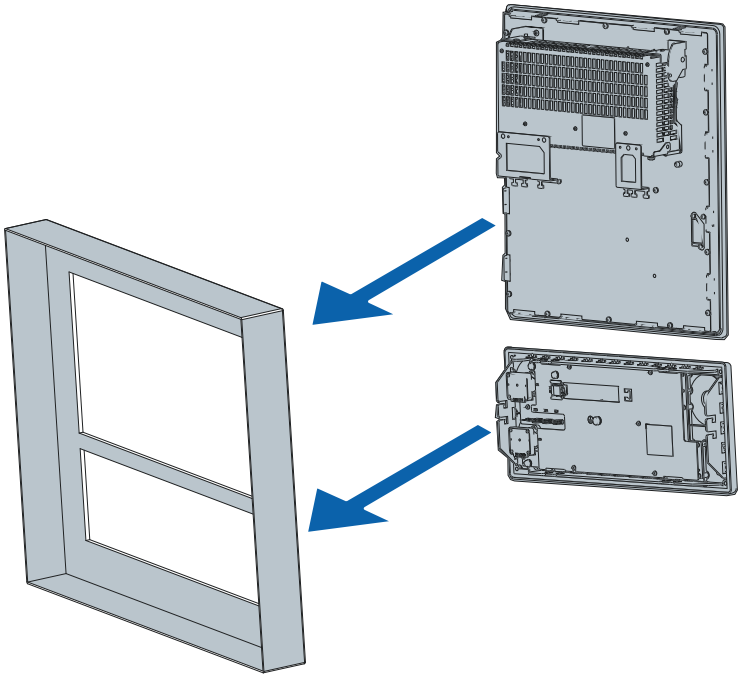
All keys of the MCP 1500U come with changeable key caps.

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

Key cover	Symbol cover	Key cover	Symbol cover
RAPID	7027	−X	7129
+C	7125	+Y	7130
+X	7126	−Z	7131
−Y	7027	−C	7132
+Z	7128		

10.4.3 Installation and mounting

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



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

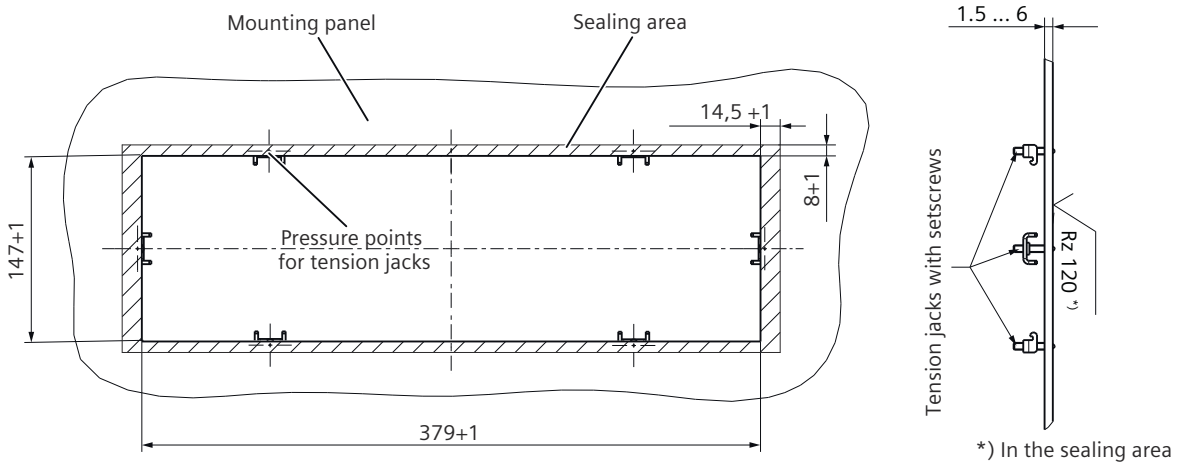
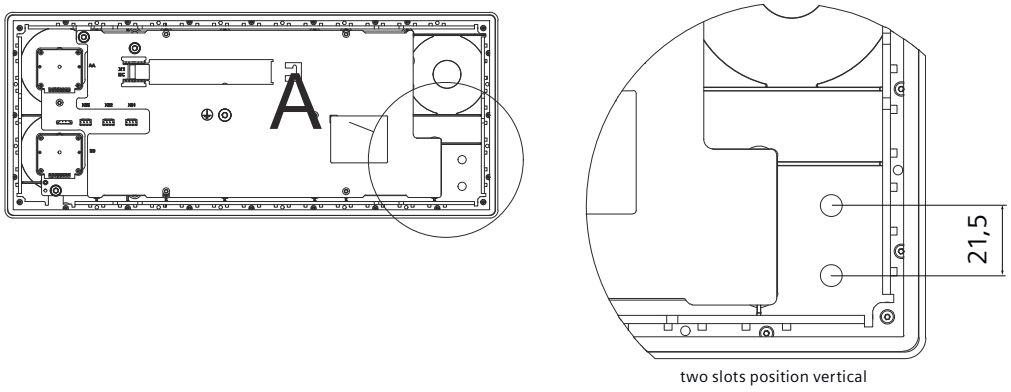


Figure 10-21 Mounting panel cutout

Two designated slots are provided for mounting control devices, with a theoretical center-to-center spacing of 21.5 mm between adjacent slots.



The recommended vertical distance between two buttons or keys should not exceed 20 mm, considering the potential deviations in the machining of panel slots that is a/2 +b/2≤20

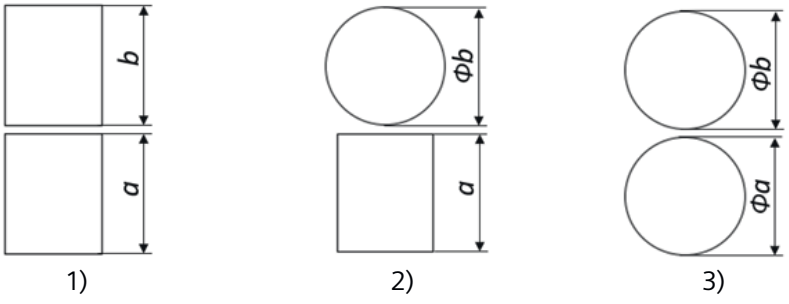


Figure 10-22 Control device

Note

The specified value is based on the horizontal center of the button being aligned with the theoretical center of the slot.

Dimension drawing

⚠ WARNING

Danger to life from hazardous voltage

It is possible to reach into installation holes for control devices (shown in gray in the drawing).

Make sure that no live parts can be touched behind the holes within a clearance of at least 85 mm (hatched area in the drawing).

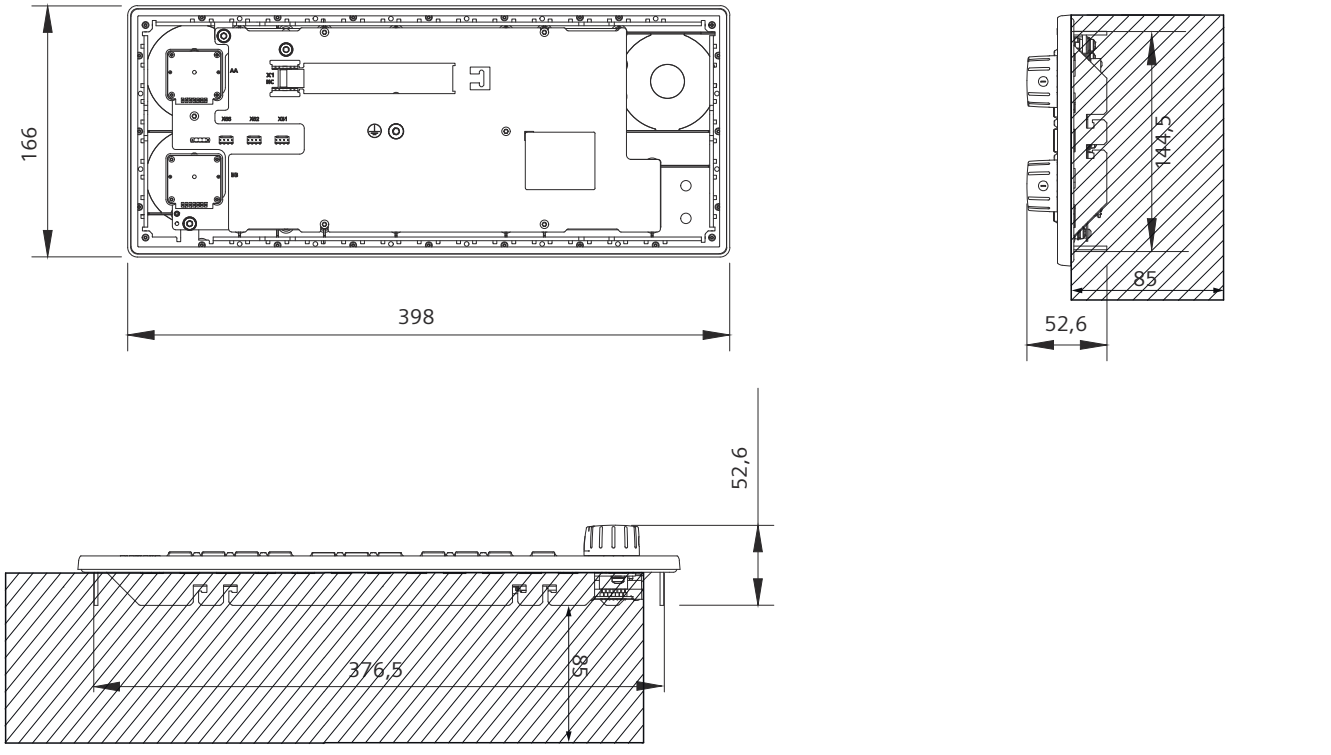
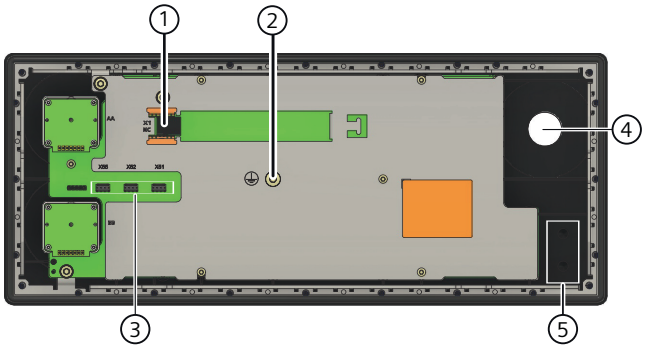


Figure 10-23 Dimensions and clearances

10.4.4 Connecting

Connections (rear)



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

Figure 10-24 MCP 1500U: Connections at the rear

USB 2.0 interface

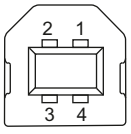
The USB cable to connect the machine control panel to the PPU is included in the accessories pack. The machine control panel is also supplied with power via this USB connection. This USB cable must be routed separately away from other cables to avoid EMC disturbances.

Pin assignment USB port

Connection designation: **X1**

Connection type: USB socket, type B

Maximum cable length: 0.8 m

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

Connections and switch settings of the override switch

Connection designation: **AA, BB**

Connector type: 7-pin COMBICON connector

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

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

Feed override	**Value in the IBn+3**
0 %	0x01
2 %	0x02
4 %	0x06
6 %	0x07
10 %	0x04
20 %	0x0C
30 %	0x0D
40 %	0x0F
50 %	0x0E
60 %	0x0A
70 %	0x0B
80 %	0x08
90 %	0x19
100 %	0x1A
105 %	0x1E
110 %	0x1F
120 %	0x1C

Digital inputs X51, X52, X55

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

Note

Connection of miniature handheld unit

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

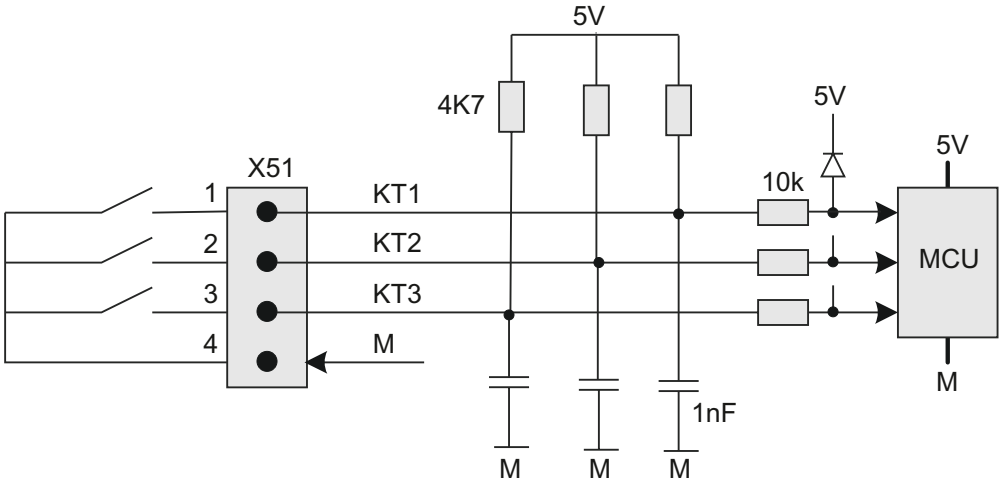


Figure 10-25 X51/X52/X55 Block Diagram

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

Table 10-9 Assignment of connector X51

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

Table 10-10 Assignment of connector X52

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

Table 10-11 Assignment of connector X55

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

10.4.5 Parameterization

Input image

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

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IBn+0	Spindle override				Operation mode			
	D	C	B	A	JOG	Teach In	MDA	AUTOM.
IBn+1				Reserved				
	REPOS	REF.	Var. INC	10000 INC	1000 INC	100 INC	10 INC	1 INC
IBn+2	Reserved	Reserved	Spindle Start	* Spindle Stop	Feed Start	* Feed Stop	Cycle-Start	* Cycle-Stop
IBn+3				Feed override				
	Reset	Reserved	Single block	E	D	C	B	A
IBn+4	Direction keys				Axis selection			
	+ R15	– R13	Rapid traverse R14	Reserved	X R1	4. Axis R4	7. Axis R7	Reserved R10
IBn+5	Axis selection							
	Y R2	Z R3	5. Axis R5	Toggle MCS/WCS	Reserved R11	9. Axis R9	8. Axis R8	6. Axis R6
IBn+6	Free customer use							
	T9	T10	T11	T12	T13	T14	T15	T16
IBn+7	Free customer use							
	T1	T2	T3	T4	T5	T6	T7	T8
IBn+8	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+9	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+10	Digit inputs							
	KT-IN8 X55.2	KT-IN7 X55.1	KT-IN6 X52.3	KT-IN5 X52.2	KT-IN4 X52.1	KT-IN3 X51.3	KT-IN2 X51.2	KT-IN1 X51.1

IBn+11	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	KT-IN9 X55.3
IBn+12	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
IBn+13	Reserved	Reserved	Reserved	Reserved	Re- served	Reserved	Reserved	Reserved
DBB1000	Version information of the MCP USB - byte 0							
DBB1001	Version information of the MCP USB - byte 1							
DBB1002	Version information of the MCP USB - byte 2							
DBB1003	Version information of the MCP USB - byte 3							

Output image

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

Key assignment

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

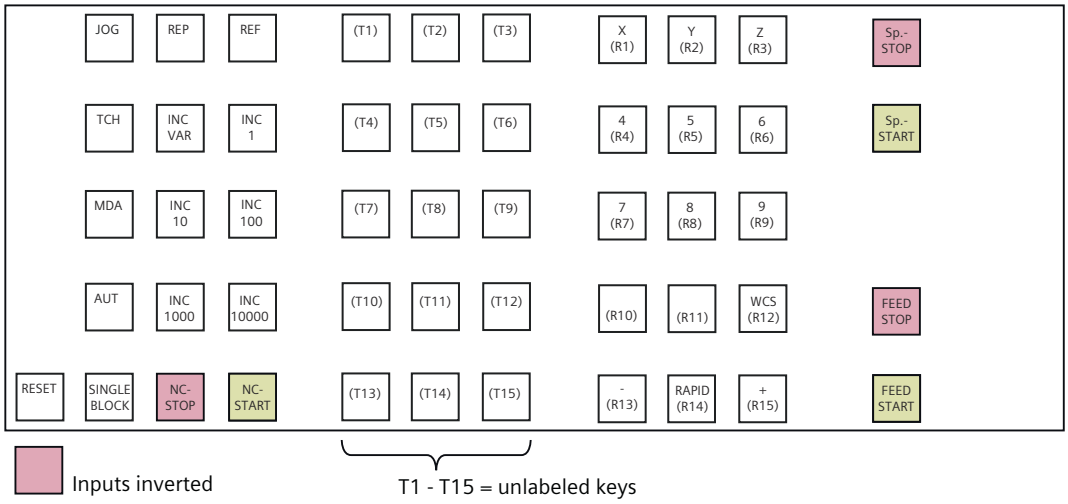


Figure 10-26 MCP 1500U default key assignment

10.4.6 Technical data

10.4.6.1 MCP 1500U

	MCP 1500U
Safety	
Safety class according to EN 50178	III; PELV
Degree of protection according to EN 60529 [1)]	Front: IP54 Rear: IP00 [2)]
Approvals	CE / UL / RCM / EAC / KC / UKCA
Flame resistance	UL 94 V-1 [3)]
Electrical data	
Overvoltage category	Secondary circuit supplied from primary circuits up to Cat. III, 300 VAC
Power supply	5 VDC
Power consumption, max.	2.5 W
Current consumption, max.	0.5 A
Mechanical data	
Dimensions W x H x D (mm)	398 x 166 x 52.6
Weight (kg)	1.64

	MCP 1500U		
Tightening torques, max.	Tension jacks: 0.5 Nm		
	M3: 0.6 Nm standard		
	M4: 1 Nm		
	M5: 3 Nm standard		
Mechan. stability	According to UL 61010 [3)]		
Climatic environmental conditions			
Classification of the climatic environment	3K3 according to EN 60721-3-3		
Heat dissipation	By natural convection		
Condensation and ice formation	Not permitted		
Supply air	Without corrosive gases, dusts and oils		
	Use and operation		
Max. installation altitude	Up to 1000 m without derating From 1000 m to 4000 m with linear ambient temperature derating, -0.5 K per 100 m		
Temperature limit values (storage)	-40 °C ... +70 °C		
Temperature limit values (transportation)	-40 °C ... +70 °C		
Temperature limit values (operation)	0 ... 45° C (front) 0 ... 55° C (rear)		
Temperature change	Max. 30 K/h		
Relative humidity (storage)	5 ... 95% (without condensation)		
Relative humidity (transportation)	5 ... 95% (without condensation)		
Relative humidity (operation)	5 ... 85% (without condensation)		
Permissible change in the relative humidity	Max. 6%/h		
Pollution degree of contamination according to EN 61800-5-1	2 (only use indoors)		
Mechanical environmental conditions			
Classification of the mechanical environment	Class 3M1 according to EN 60721-3-3		
Vibratory load during operation	Frequency range: 10 – 200 Hz Deflection at 10 – 58 Hz: 0.15 mm Acceleration at 58 – 200 Hz: 2 g		
Vibratory load during package (1M2)	Frequency range: 5 – 9 Hz Deflection at 10 – 58 Hz: 3.5 mm Acceleration at 9 – 200 Hz: 1 g		
Shock load during operation with shock-sensitive components	Acceleration: 5 g Shock duration: 30 ms Load: 3 x in each direction		
Active environmental conditions	Chemical: Class 3C2 (H2S,SO2)	Mechanical: Class 3S1	Biological: Class 3B1

1) The system installer ensures the system is sealed properly according to IP65.

2) Open equipment according to UL 61010.

3) The customer must ensure that the product, with the rear cover to be attached by the customer, meets the requirements for flame resistance of the material according to UL 94 V-1 and the mechanical stability / fire protection requirements / touch protection according to UL 61010.

Function-impairing dust

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

Maximum permissible amount of dust in the ambient air:

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

Note

Damage to components by coolants and lubricants

The SINUMERIK operator components have been designed for industrial use, particularly on machine tools and production machines. This also takes into account the use of commercially available coolants and lubricants. The use of aggressive compounds and additives can damage components and result in their failure.

Avoid contact between the operator components with coolants and lubricants, as resistance to all coolants and lubricants cannot be guaranteed.

Emergency stop button

Rated voltage	24 VDC
Current rating, max.	3 A
Current rating, min.	1 mA
Switching capacity	DC 13 according to EN 60947-5-1
Conditional rated short-circuit current	10 A gL/gG according to EN 60947-5-1
B_{10d}	500000

Note

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

10.4.6.2 Supplementry electrical conditions

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
- Machine Control Panel (MCP)
- PLC I/O modules
- SINAMICS S120 drive components

Grounding measures

The individual modules are attached to a metal cabinet panel. Insulating paints on the mounting points (e.g. tension jacks) must be removed.

It is permissible to have a cluster of operator components for ground connection/ equipotential bonding.
Example: The control panel on the swivel arm.
It is sufficient in this instance to connect the ground connections of, for example, the operator panel front using a cable and to route a shared grounding conductor to the central ground connection in the control cabinet.

Please note that interruption of the grounding during maintenance work is not permissible.

Reference

More information about the EMC installation guideline can be found under:

- Configuration Manual (https://support.industry.siemens.com/cs/document/109800046), EMC installation guideline (https://support.industry.siemens.com/cs/mdm/60612658)

EMF assessments for 24 V components

The 24 V components, e.g. control systems PPU, handheld units and machine control panels do not generate any appreciable electromagnetic fields.

No minimum clearance has to be maintained for 24 V components.

EMC limiting values in South Korea

EMC limit values in South Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

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

10.4.6.3 Relevant directives and standards

Certificates

You can obtain an up-to-date list of currently certified components on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person. The certificates can be downloaded from the Internet: Certificates

EC Declaration of Conformity

CE

You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated") on the Internet at the following address.

Relevant directives and standards

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

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

- **EMC requirements for South Korea**

  SINUMERIK MCP devices with the KC marking on the type plate satisfy the EMC requirements for South Korea.

- **Eurasian conformity**

  SINUMERIK MCP comply with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).

- **North American market**

  SINUMERIK MCP devices provided with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications. You can find the relevant certificates on the Internet pages of the certifier.

- **UK Conformity Assessed marking**

  The SINUMERIK MCP devices comply with the designated British standards (BS) for programmable logic controllers published in the official consolidated list of the British Government. The SINUMERIK MCP devices meet the requirements and protection targets of the following regulations and related amendments:

  – Electrical Equipment (Safety) Regulations 2016 (Low-Voltage)
  – Electromagnetic Compatibility Regulations 2016 (EMC)
  – Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016 (Explosion Protection)
  – Regulations on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2012 (RoHS)

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

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

- **Quality systems**
  Siemens AG employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.
- **Electric shock due to connection of an unsuitable power supply**

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

10.4.6.4 Recycling and disposal

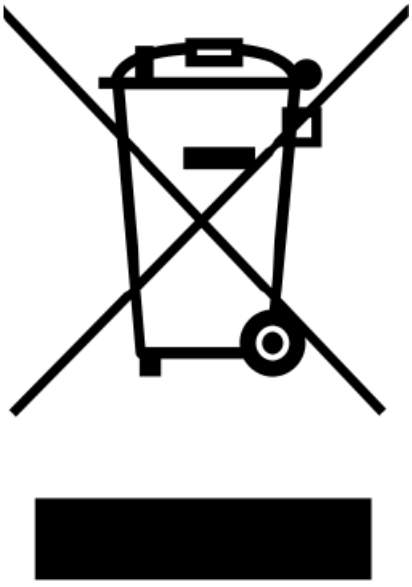


Figure 10-27 Recycle

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

10.4.7 Safety and security

10.4.7.1 General security guidelines

Safety symbols

Icon	Explanation
	The equipment is only suitable for direct current. Used for marking corresponding terminals.
	For marking the connection for an external protective conductor for protecting against electrical shock in the event of an error or for a connecting terminal of the external protective conductor.
	For marking the ground connection.
 General warning symbol	The documentation must be consulted in any scenario where the symbol is affixed in order to find out the type of potential hazard and the actions required to avoid the risk.

Plant security

Unauthorized persons may be able to enter the production site/building and damage or alter production equipment as a result of gaps in a company's physical security.

To prevent attackers from standing in front of the MCP and pressing keys with malicious intent follow these guidelines:

1. Incorporate a shield with a lock, which users can engage when leaving to prevent unauthorized access and manipulation of the MCP keys.
2. Regularly monitor MCP access and maintain logs to detect any unauthorized activity.

NOTICE
Protection of interfaces against unauthorized access Machine control panels must be integrated and operated in a housing/console/control cabinet so that interfaces can be protected against unauthorized access, as described in the "Connecting" section.

Company security

The company's physical security must be ensured by taking the following measures:

- Closed off and monitored company premises
- Entry control, keys / card readers and/or security personnel

Protection for machine specific labelling

To prevent attackers replacing the labels on the key blocks, take the following measures:

- Label every component clearly, ensuring the labels are visible.
- Schematics Alignment: Ensure that the labels on the control panel match those on the schematics.

10.4.7.2 Enhancing MCP safety with PLC program

To prevent unauthorized personnel from operating the MCP, you can set up a PLC special program that locks MCP functions using a specific combination of keys. This means that once the MCP is locked, no one can use the control panel unless they know the unlock sequence.

Note the following recommendations for PLC program implementation:

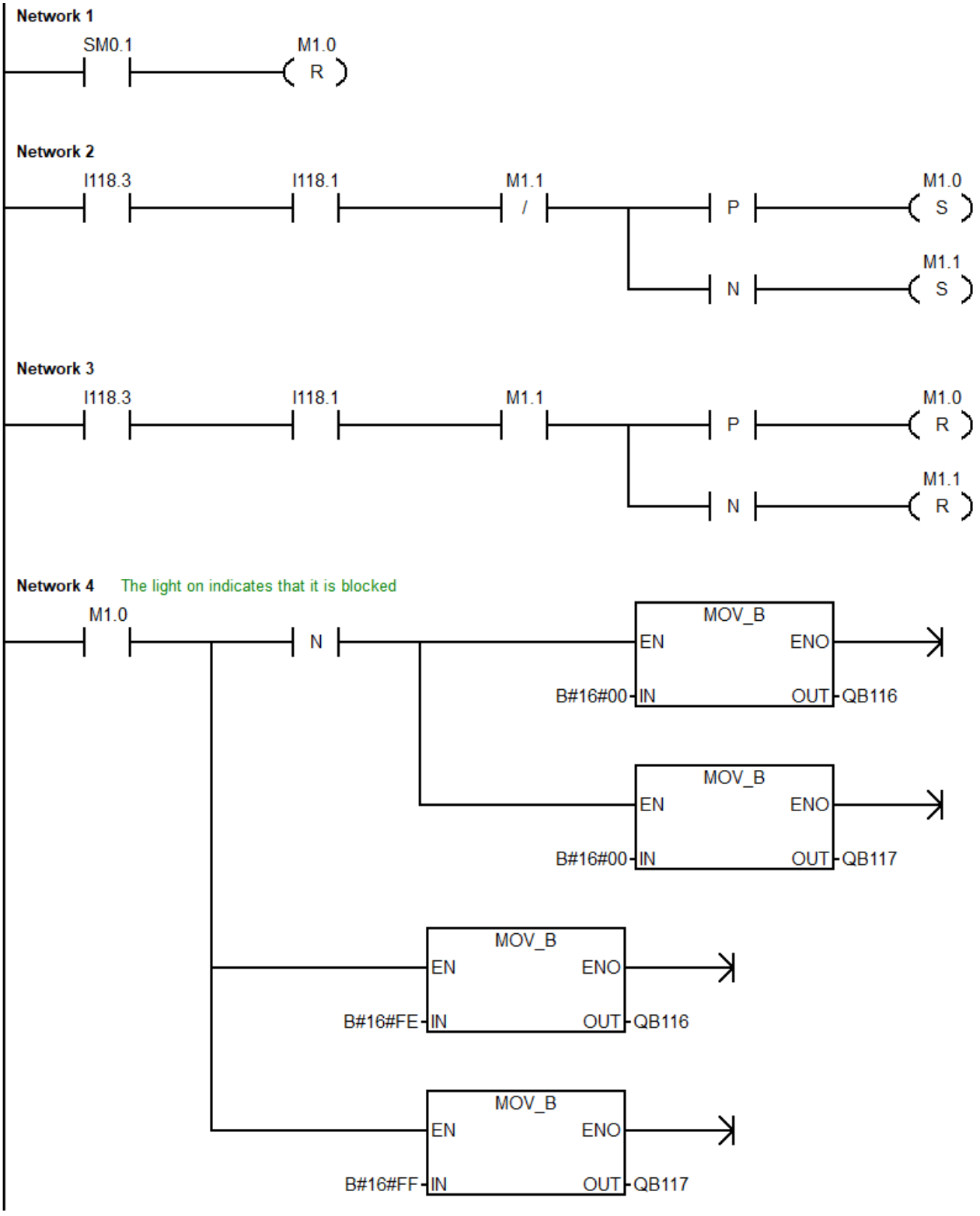
Cut Off Input Signals:

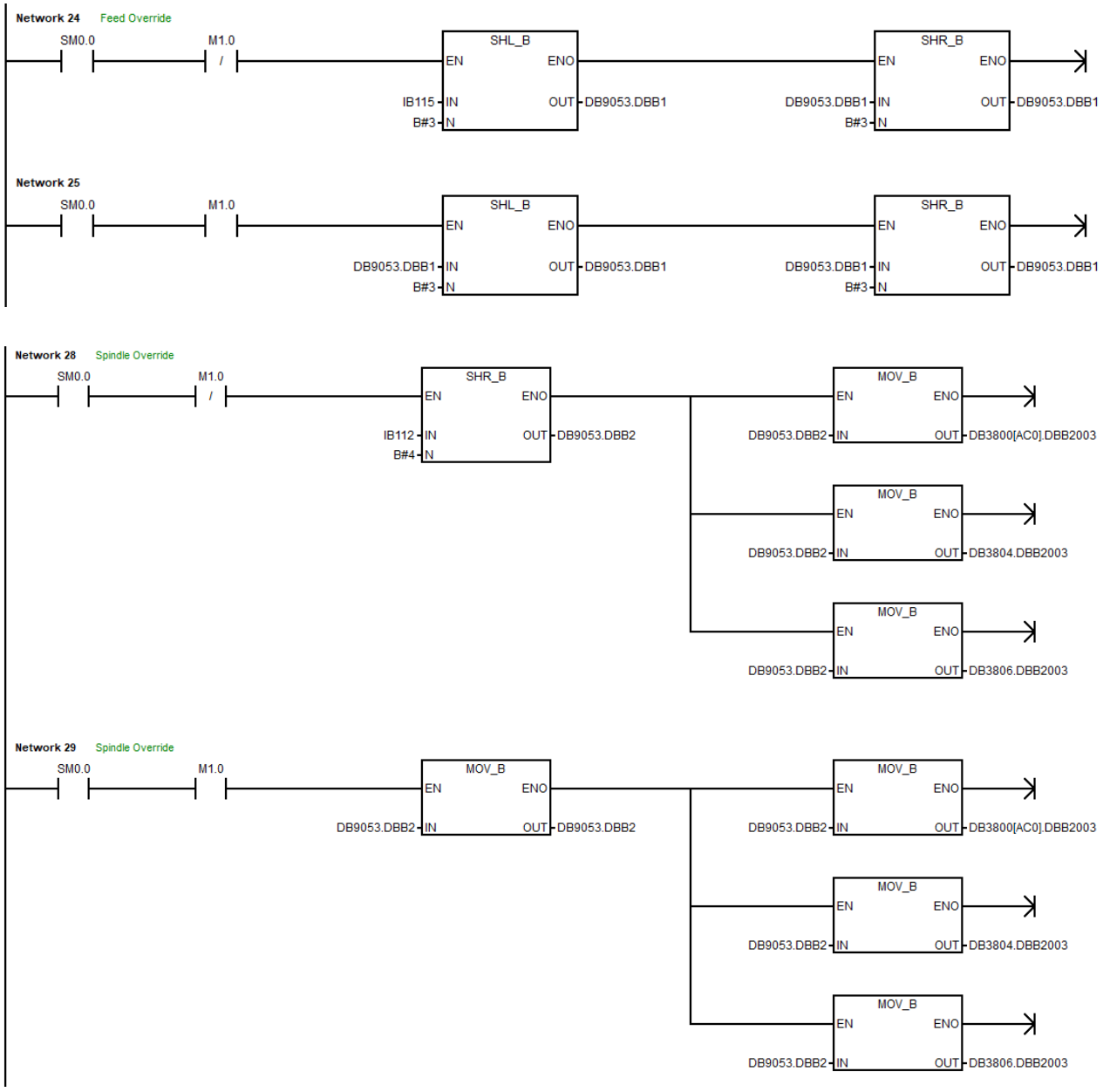
- Add a normally closed signal before each individual input signal.
- When the key combination is pressed, this immediately opens the signal to cut off the inputs.
- When the key combination is pressed again, this immediately restores the normally closed state to resume normal reading of inputs.

Maintain Override Switch Code Point Information:

- After pressing the key combination, read the code point information of the override switch.
- Store this information in a register; this information will be used in place of the override switch data.
- When the key combination is pressed again, restore the actual value from the override switch code point

PLC program exmaple:




Network 24 Feed Override
SM0.0
M1.0
/
SHL_B
EN
ENO
IB115
IN
OUT
DB9053.DBB1
B#3
N
SHR_B
EN
ENO
DB9053.DBB1
IN
OUT
DB9053.DBB1
B#3
N
Network 25
SM0.0
M1.0
SHL_B
EN
ENO
DB9053.DBB1
IN
OUT
DB9053.DBB1
B#3
N
SHR_B
EN
ENO
DB9053.DBB1
IN
OUT
DB9053.DBB1
B#3
N
Network 28 Spindle Override
SM0.0
M1.0
/
SHR_B
EN
ENO
IB112
IN
OUT
DB9053.DBB2
B#4
N
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3800[AC0].DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3804.DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3806.DBB2003
Network 29 Spindle Override
SM0.0
M1.0
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB9053.DBB2
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3800[AC0].DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3804.DBB2003
MOV_B
EN
ENO
DB9053.DBB2
IN
OUT
DB3806.DBB2003

10.4.8 Spare parts and accessories

10.4.8.1 Spare parts and accessories

Accessories pack when delivered from the factory

Qty.	Description
1	USB cable (length: 0.8 m) for the connection between the PPU and MCP
1	6pcs clamps to mount the MCP
1	Button cover kit-30 pcs Fe-gray blank button covers
1	Button cover kit-9 pcs Fe-gray marked button covers

Spare parts

Qty.	Description	Article number
1	500 × Fe-GRAY,QUADRATE KEY CAPS USED FOR SINUMERIK 828D MCPs.	6FC5348-0AF02-0AA0

Optional parts

Qty.	Description	Article number
1	500 × Fe-GRAY,QUADRATE KEY CAPS USED FOR SINUMERIK 828D MCPs.	6FC5348-0AF02-0AA0
1	Emegency stop mushroom pushbutton 22mm (0.87 in) without holder	3SU1000-1HB20-0AA0
1	Holder For mushroom pushbutton	3SU1500-0AA10-0AA0
1	Contact block with 2 contacts Screw ternimnals for front panel mounting 1 NO contact + 1 NC contact	3SU1400-1AA10-1FA0
1	Cable set (1 set = 60 units) For additional macheine control panel control devices Length 500 mm(19.69 in)	6FC5247-0AA35-0AA0

Additional spare parts for these components can be found here: Spare parts (Spares on Web).

10.5 MCP Interface PN

Description

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

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

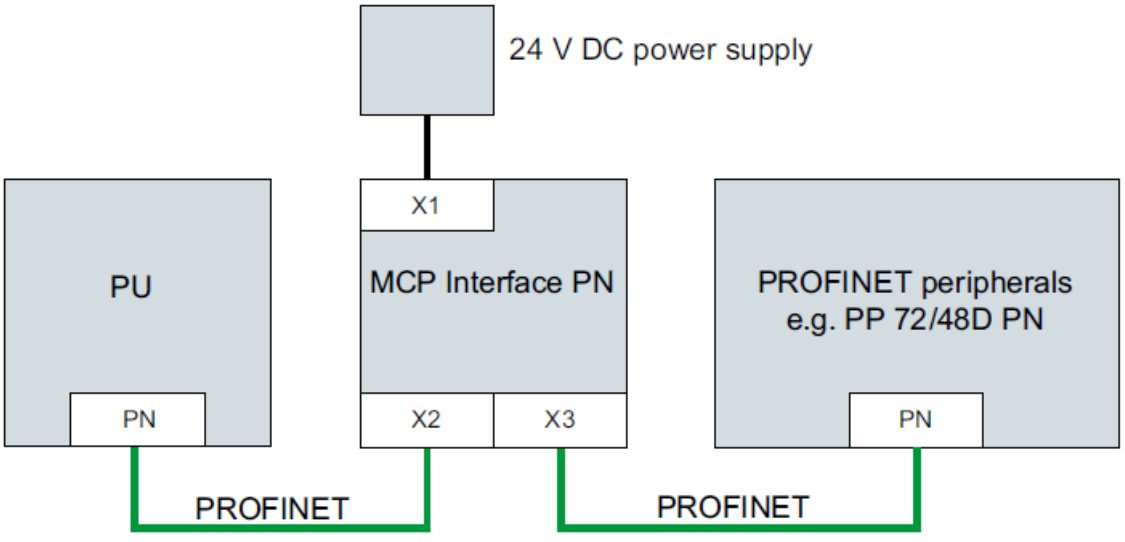
You can connect the following operator controls to the interface:

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

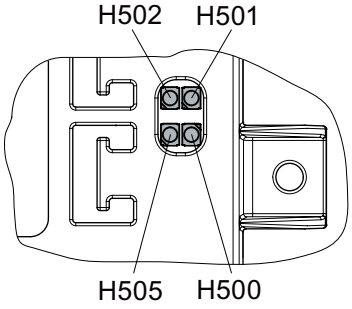
The following inputs/outputs are also available:

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

System configuration



LEDs for status display



Name	Function	Status	Meaning
H500	POWER OK (green)	Lit	All internal voltages are in the setpoint range.
		Not lit	At least one of the generated voltages has fallen below its setpoint; a reset will be initiated.
H501	BUS_SYNC	Not lit	No PROFINET communication.
		Lit	PROFINET is synchronized (STOP state).
		Flashes (0.5 Hz)	PROFINET is synchronized (RUN state).
H502	BUS_FAULT	Lit	PROFINET group fault.
H505	Temperature alarm (red)	Lit	At least one temperature limit is being exceeded.

10.5.1 Mounting

Installation

The module can be attached at a suitable position via the four mounting holes (e.g. behind the machine control panel or in the control cabinet). The selection of the appropriate mounting position depends on the interfaces used and the associated maximum cable lengths. Four standard torx-slotted screws T20/M4 are used to attach the module.

MCP Interface PN dimension drawing

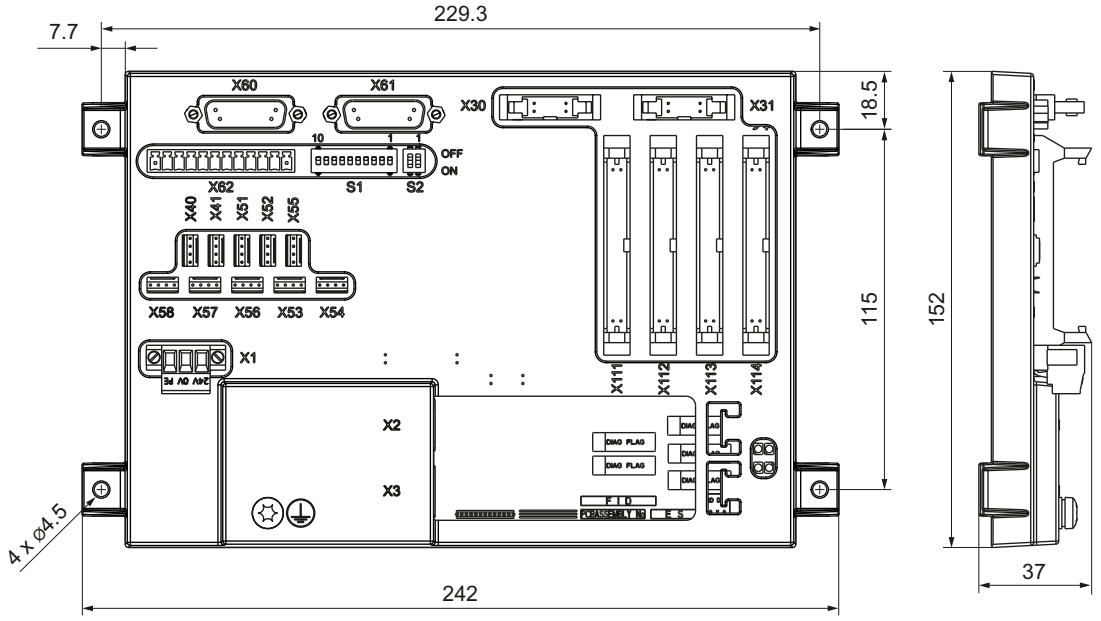
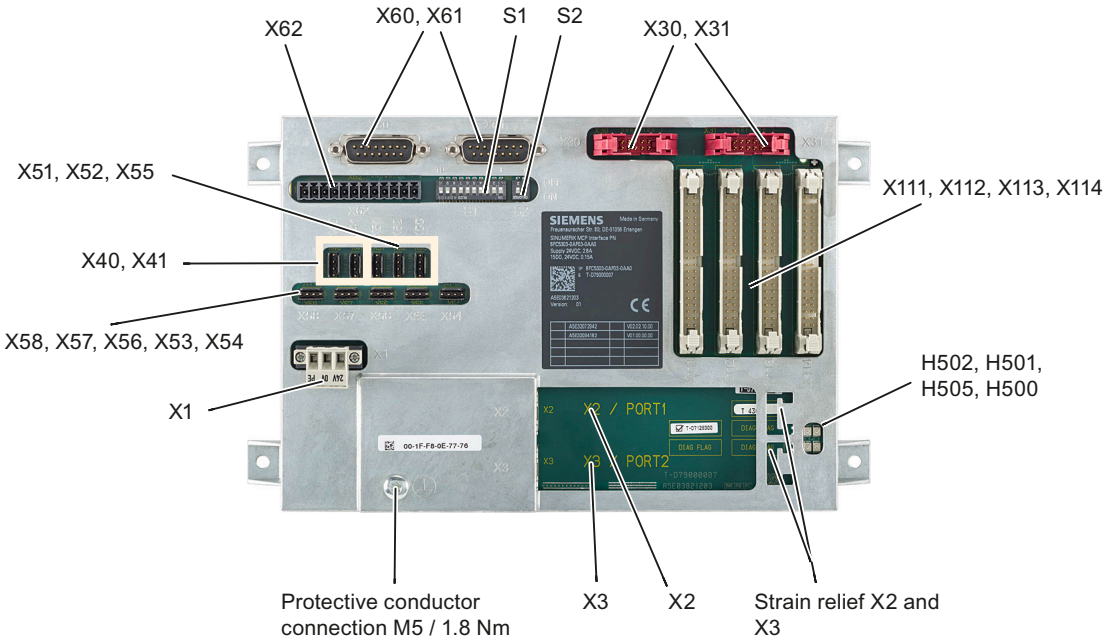


Figure 10-28 Dimensions

10.5.2 Connection

Position of the interfaces



X1	24 VDC power supply
X2 / X3	PROFINET interfaces
X30	Interface for rotary switch feed override
X31	Interface for rotary switch spindle override
X40/X41	Digital inputs (24 V)
X51 / X52 / X55	Digital inputs (TTL)
X58 / X57 / X56 / X53 / X54	Digital outputs (24 V)
X60 / X62	Handwheel
X61	Reserved
X111/X112/X113/X114	Key and LED interfaces
H502 / H501 / H505 / H500	LEDs for status display
S1	DIP switch for setting the MCP address
S2	DIP switch for setting the signal transmission of the handwheel pulses

Figure 10-29 Interfaces, MCP interface PN

Rotary switch: Feed override X30 / spindle override X31

Connector designation: **X30/X31**

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

Table 10-12 Assignment of connector X30 / X31

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

Digital inputs X40, X41

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

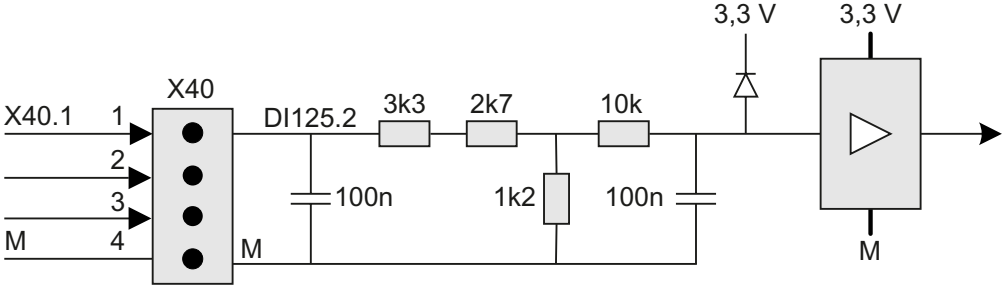


Figure 10-30 Schematic circuit diagram X40, X41

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

Table 10-13 X40 pin assignments

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

Table 10-14 X41 pin assignments

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

Table 10-15 Technical data for X40, X41

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

Digital inputs X51, X52, X55

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

Note

Connection miniature handheld unit

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

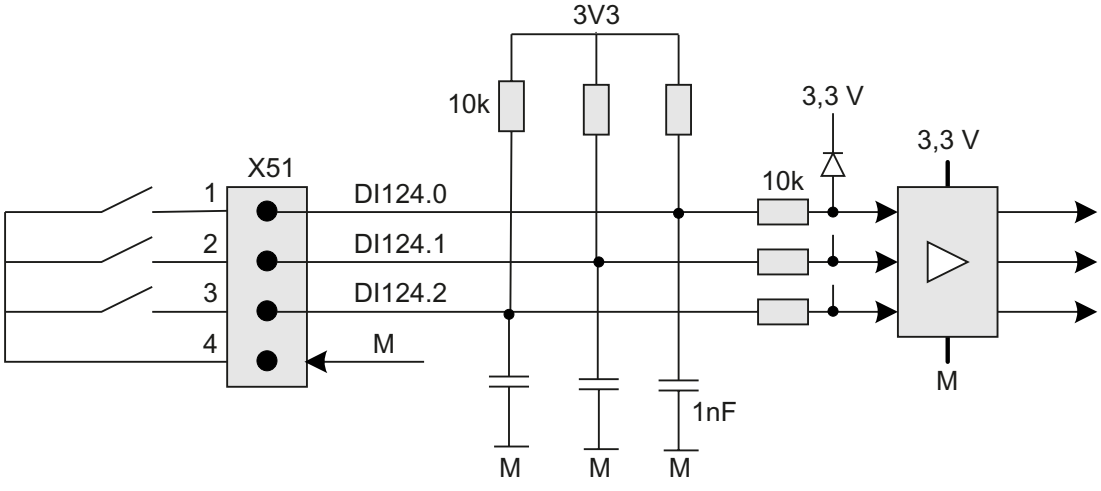


Figure 10-31 Block diagram X51, X52, X55

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

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

Table 10-16 Assignment of connector X51

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

Table 10-17 Assignment of connector X52

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

Table 10-18 Assignment of connector X55

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

Table 10-19 Technical data for X51, X52, X55

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

Digital outputs X53, X54, X56, X57, X58

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

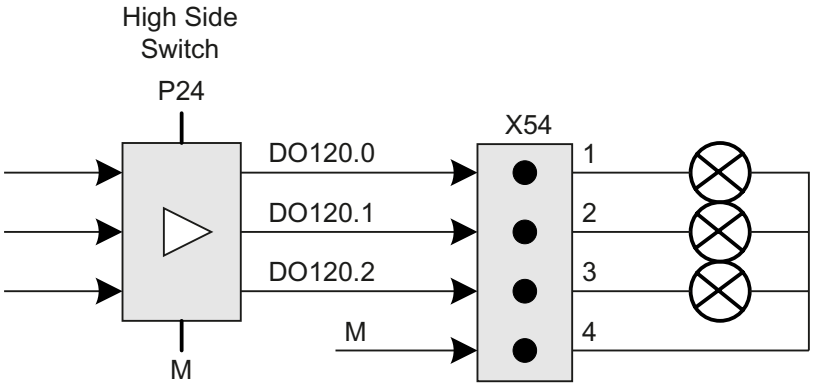


Figure 10-32 Block diagram X53, X54 and X56 to X58

Note

Observe the utilization of the power supply

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

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

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

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

Table 10-20 Assignment of connector X53

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

Table 10-21 Assignment of connector X54

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

Table 10-22 Assignment of connector X56

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

Table 10-23 Assignment of connector X57

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

Table 10-24 Assignment of connector X58

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

Table 10-25 Technical data for X53, X54 and X56 to X58

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

Handwheel X60 / X62

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

Use switch S2 to switch between TTL and difference signals.

Note

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

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

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

Table 10-26 Assignment of connector X60

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

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

Table 10-27 Assignment of connector X62

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

Digital inputs and outputs X111, X112, X113, X114

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

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

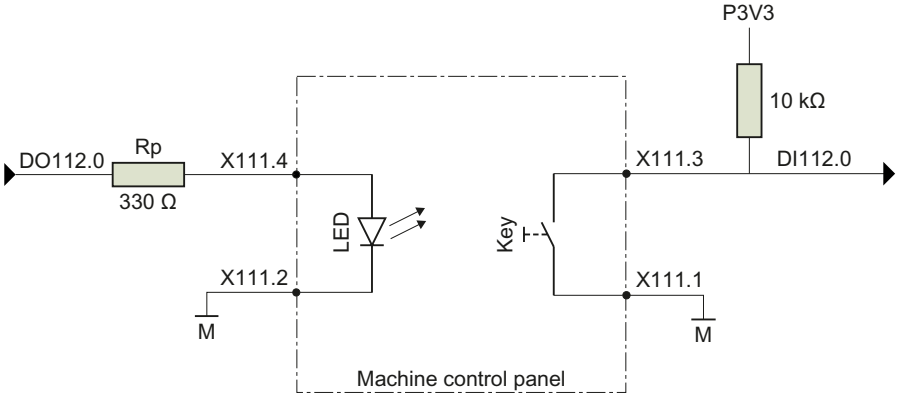


Figure 10-33 Schematic circuit diagram X111

Note

LED brightness

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

Connector designation: **X111, X112, X113, X114**
Connector type: 40-pin plug connector

Special feature: No galvanic isolation, with interlock
Max. cable length: 2 m

Table 10-28 Assignment of connector X111

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

Table 10-29 Assignment of connector X112

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

Table 10-30 Assignment of connector X113

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

Table 10-31 Assignment of connector X114

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

Table 10-32 Technical data of the inputs of X111 to X114

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

Table 10-33 Technical data of the outputs of X111 to X114

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

Switch S1, S2

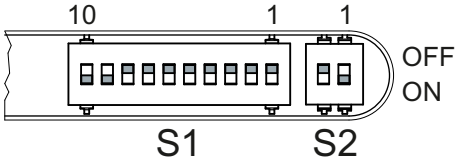


Table 10-34 Setting of switch S1 as delivered

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

The two switches S1-9 and S1-10 must remain set to "ON".

The switches S1-1 to S1-8 define the PROFINET address. For a SINUMERIK 828D, the address "64" must always be assigned to the MCP.

Table 10-35 Switch S1 settings

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

Further information on the addressing can be found in Section AUTOHOTSPOT.

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

Table 10-36 Switch S2 settings

1	Meaning
ON	differential interface
OFF	TTL interface

Note

Switch S2-2 is reserved for test purposes.

10.5.3 Parameter assignment

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

Standard input image

Table 10-37 MCP Interface PN input image

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

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

Note

Bytes EB126 and EB127

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

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

Range of values: -25° C to 100° C

Table 10-38 Temperature representation examples

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

Input image of the handwheels

Table 10-39 Input image for handwheel data

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

Note

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

Output image

Table 10-40 MCP Interface PN output image

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

Note

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

10.5.4 Technical data

MCP Interface PN

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

See also

Other values/standards: AUTOHOTSPOT

10.6 Industrial PC

10.6.1 SIMATIC display

Description

The device provides industrial PC systems for high-performance and space-saving applications in particular in the field of machine, systems and switchgear cabinet engineering:

- Measuring and controlling process and machine data, for example, automated washing systems, assembling machines and packaging machines.
- Operating and visualization tasks with separate monitors or displays, for example, information terminals and large-scale displays in automotive production.
- Data logging and processing, for example, system data logging and distributed process control.

SIMATIC IPC display interfacing

The following are the display connection possibilities within the SINUMERIK PU 272.5:

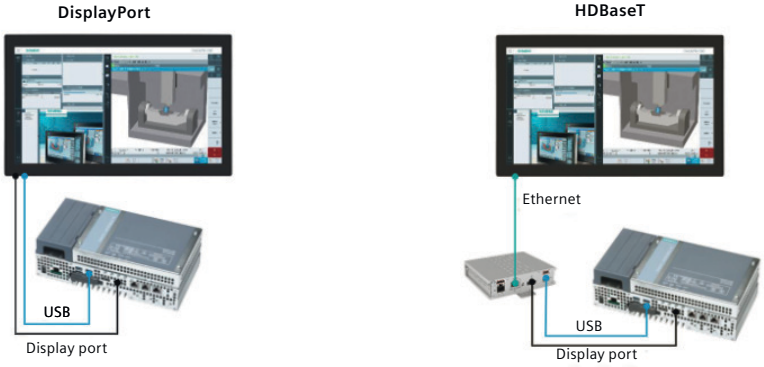


Figure 10-34 IPC display interfacing

References

Additional specifications on SIMATIC IPC can be found in the following references:

- Industrial PC SIMATIC (https://support.industry.siemens.com/cs/mdm/109746599)
- For updated information on PCU Base for IPC refer: "PCU Base for IPC" (https://support.industry.siemens.com/cs/document/109801206/)

10.6.2 Third party panel / PC

Third party panel / PC display interfacing

OEMs / end users will be able to develop machines with third party IPC or third-party panel + SIMATIC IPC with HMI OA applications based on Windows.

Note

For the use case involving third-party IPC or SIMATIC IPC combined with a third-party panel, SIEMENS will solely ensure the functionality of the interface from SIEMENS component to the third-party component.

Prerequisites for third party panel / PC display interfacing

- Software
  - SINUMERIK 828 D Operate 6.20 has only been released for the operation on SINUMERIK 828D Version 5.21.
  - "Microsoft .NET Framework 3.5 SP1" must be installed and activated for a correct installation of SINUMERIK Operate
- Hardware
  - A PC with German or English Windows, Windows 10 (64-bit), network card, min. 4 GB RAM and 10 GB free hard disk memory space is required to install this software.
- Operate tested with following Windows versions:

Operate version	Windows version
6.21	• Windows 10 Enterprise 2019 LTSC Version OS build version – 17763.3887 (with latest updated Microsoft patches)

10.7 Electronic handwheel

Description

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

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

For safe storage on non-magnetic surfaces, a holder (Page 299) is available.



① Handwheel
② Spiral connection cable
③ 9-pin connector

Figure 10-35 View of portable electronic handwheel

10.7.1 Mounting

Dimensions of the electronic handheld handwheel

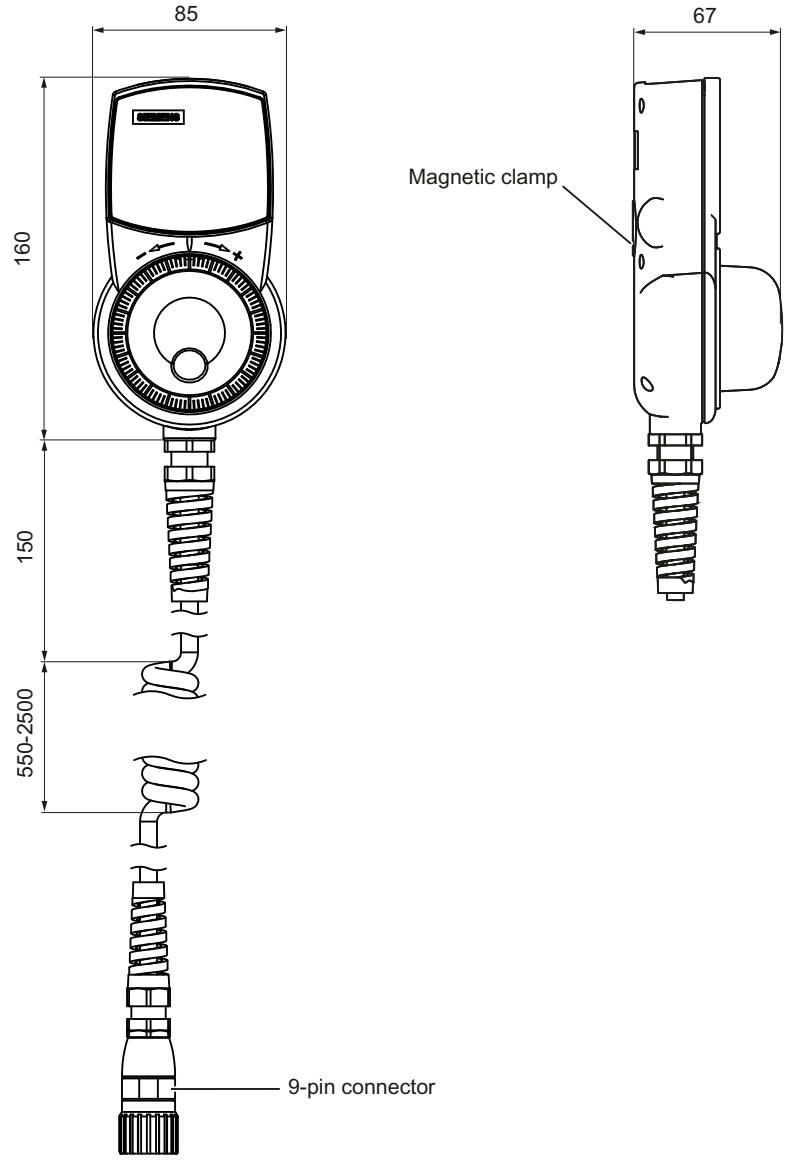


Figure 10-36 Front view and side view

Additional options

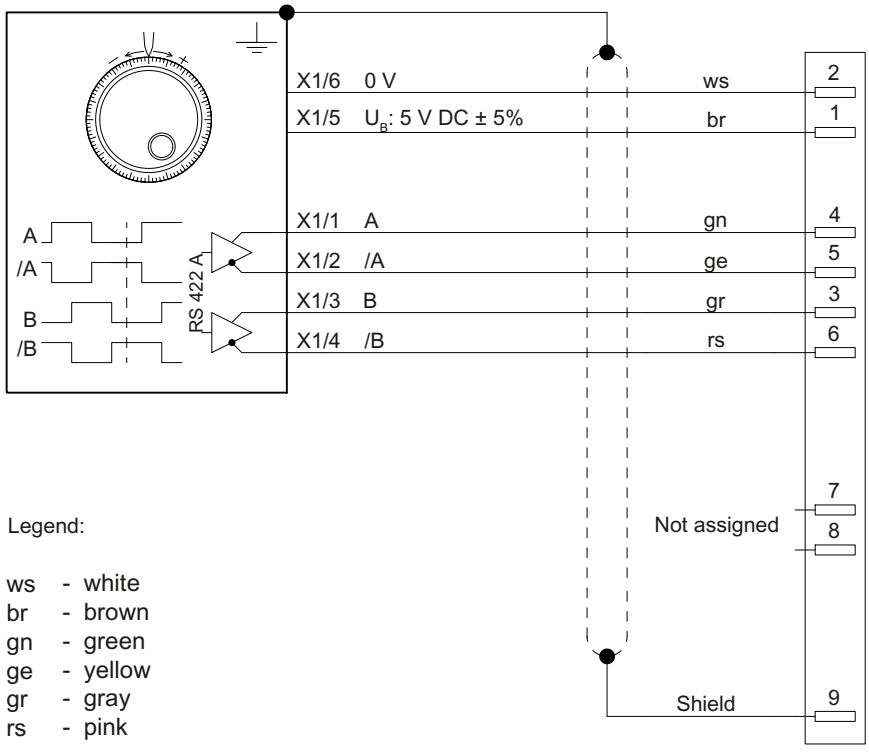
Optionally, the handheld electronic handwheel can be stored in a screw-on holder. The holder is mounted using three M4 screws (included in the scope of delivery).

See also: Mini handheld unit, Chapter "Mounting (Page 362)"

10.7.2 Connection

Electrical connection diagram

The portable handwheel is connected via a flange socket using the spiral connection cable. You will find article numbers for the recommended flange socket in Section Spare parts and accessories (Page 299).



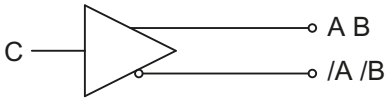
Note

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

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

Output circuitry

RS 422 A: Load current ≦ 20 mA



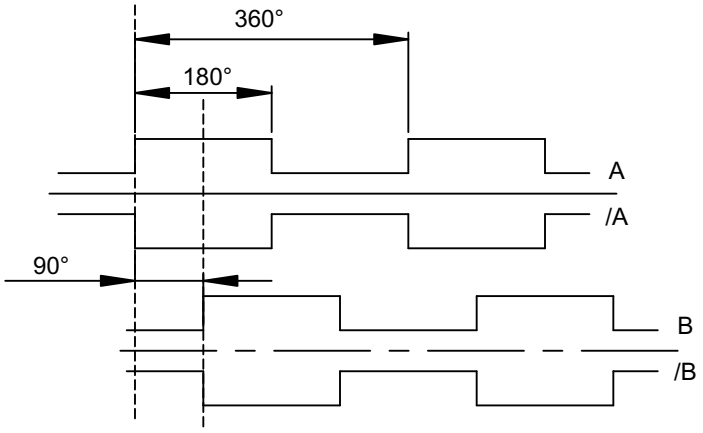


Figure 10-37 Pulse diagram

10.7.3 Technical specifications

Handheld electronic handwheel

Parameter	Value
Operating voltage	5 VDC ± 5%
Current consumption	Max. 80 mA
Output frequency	Max. 2 kHz
Number of pulses per revolution	Max. 100
Phase shift angle between signal A and signal B	90°
Interface	RS422 (TTL)
Cable length	Max. 25 m
Actuating force	0.04 Nm
Protection class	I
Degree of protection in acc. with DIN EN 60529/ IEC 60529	IP65
Housing material	Thermoplastic
Vibratory load	
• Operation	58 – 200 Hz: 10 m/s^2
• Transport (in transport packaging)	9 - 200 Hz: 20 m/s^2
Shock load in acc. with IEC 68-2-27	
• Operation	100 m/s^2, 11 ms, 6 shocks
• Transport (in transport packaging)	300 m/s^2, 6 ms, 6 shocks
Condensation, splash water, and icing	Not permitted
Supply air	Without aggressive gases, dusts, and oils

Parameter	Value
Relative humidity:	
• Storage	5 ... 95%
• Transport	5 ... 95%
• Operation	5 ... 95%
Ambient temperature:	
• Storage	-25 ... 55° C
• Transport	-40 ... 70° C
• Operation	0 ... 55° C
Dimensions:	
• Width	160 mm
• Height	85 mm
• Depth	67 mm
Weight	0.3 kg (without connecting cable)
Approvals	CE, cULus

10.7.4 Spare parts and accessories

Accessories

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

Component	Description	Article number
Flange socket	9-pin flange socket	6FC9341-1AQ
Holder	including three M4 screws	6FX2006-1BG70
Signal connector	9-pin connector	6FX2003-0SA01

10.8 PN IO devices

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

10.8.1.1 Description

Features

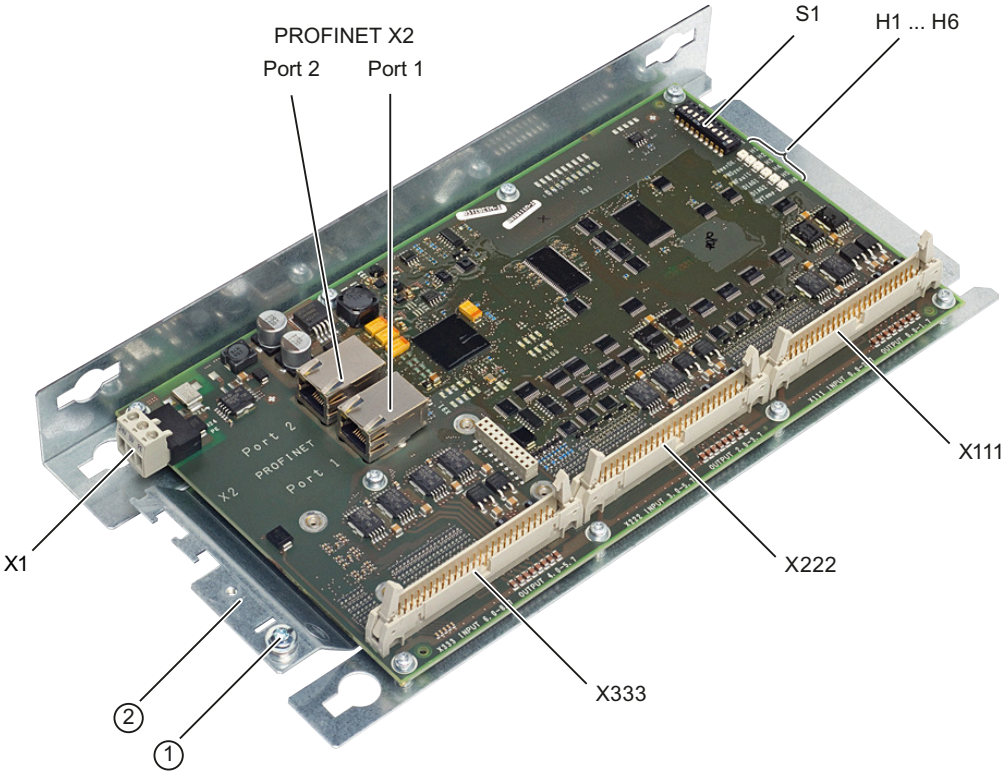
The PP 72/48D PN and PP 72/48D 2/2A PN I/O modules are simple modules (without a separate housing) for connecting digital and analog input/outputs as part of an automation system based on PROFINET IO.

The modules have the following features:

- 72 digital inputs and 48 digital outputs
- PROFINET IO connection (max. 100 MBaud)
- Onboard status display via six LEDs
- The three plug-in connectors for the digital inputs and outputs are 50-pin terminal posts for connecting ribbon cables.
- The use of terminal strip converters or the direct connection of distribution boards is possible.
- The PP 72/48D 2/2A PN I/O module also has two analog inputs and two analog outputs. Analog process signals such as for detecting temperatures or controlling hydraulic workholders can be implemented via analog inputs/outputs.
- Analog signal cables can be connected directly to terminal contacts on the module.

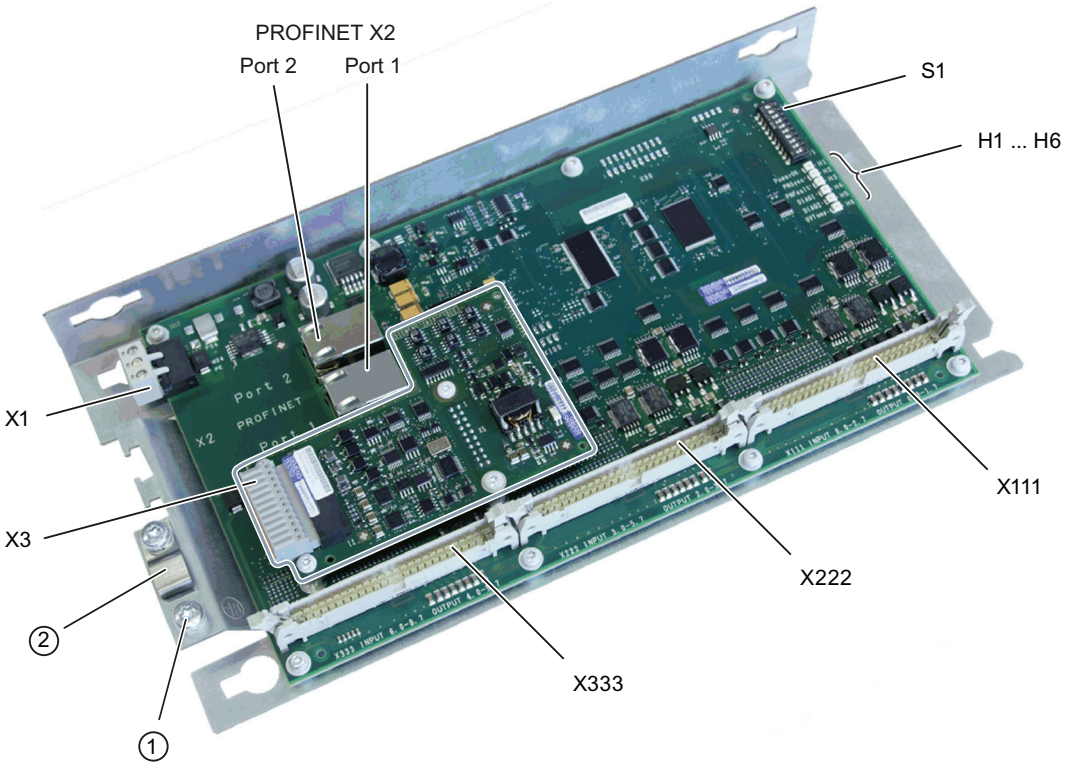
An external power source (24 VDC) is required for supplying power to the module and digital outputs.

Display



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

Figure 10-38 PP 72/48D PN I/O module



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

Figure 10-39 PP 72/48D 2/2A PN I/O module

Example: Type plate

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

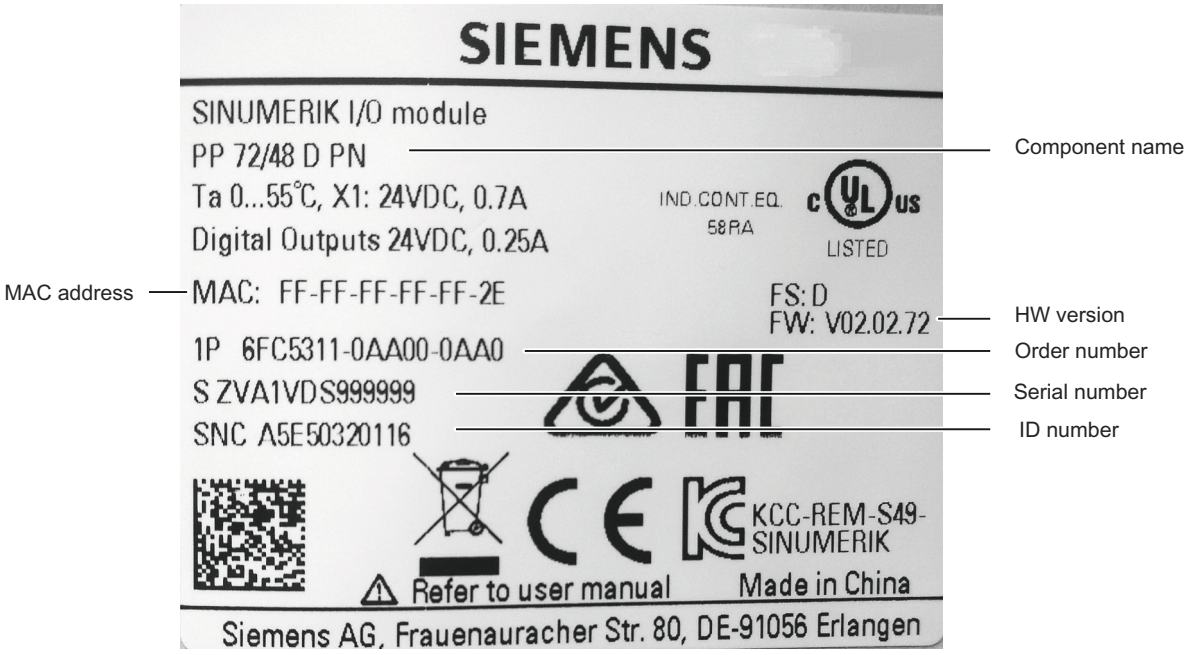


Figure 10-40 PP 72/48D PN type plate

LEDs for status display

The I/O module has the following status displays that provide information on the module status:

Name	Designation	Color	Description
H1	PowerOK	Green	Lit: Power supply OK
			Not lit: As soon as one of the generated logic voltages falls below its setpoint, a reset is triggered and the PowerOK LED goes out.
H2	PNSync	Green	Lit: Task system has synchronized to the bus cycle clock.
			Not lit: Task system is not synchronized to the bus cycle clock.
			Flashes 0.5 Hz: Task system has synchronized to the bus cycle clock and the cyclic data exchange is running.
H3	PNFault	Red	Not lit: Module is operating without errors; the data exchange with all configured I/O modules is running.
			Lit: Severe bus error One of the following errors is present at port 1 / port 2: • No physical connection to a subnet/switch • Incorrect transmission rate • Full duplex transmission is not activated
H4	DIAG1	Green	Reserved
H5	DIAG2	Green	Reserved
H6	OVTemp	Red	Overtemperature display

Note

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

10.8.1.2 Assembling

Mounting

Mounting

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

⚠ **WARNING**
Protection against electric shock A protective conductor must be connected using the grounding screw.

Table 10-41 Mounting versions:

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

Dimension drawing

PP 72/48D PN dimension drawing

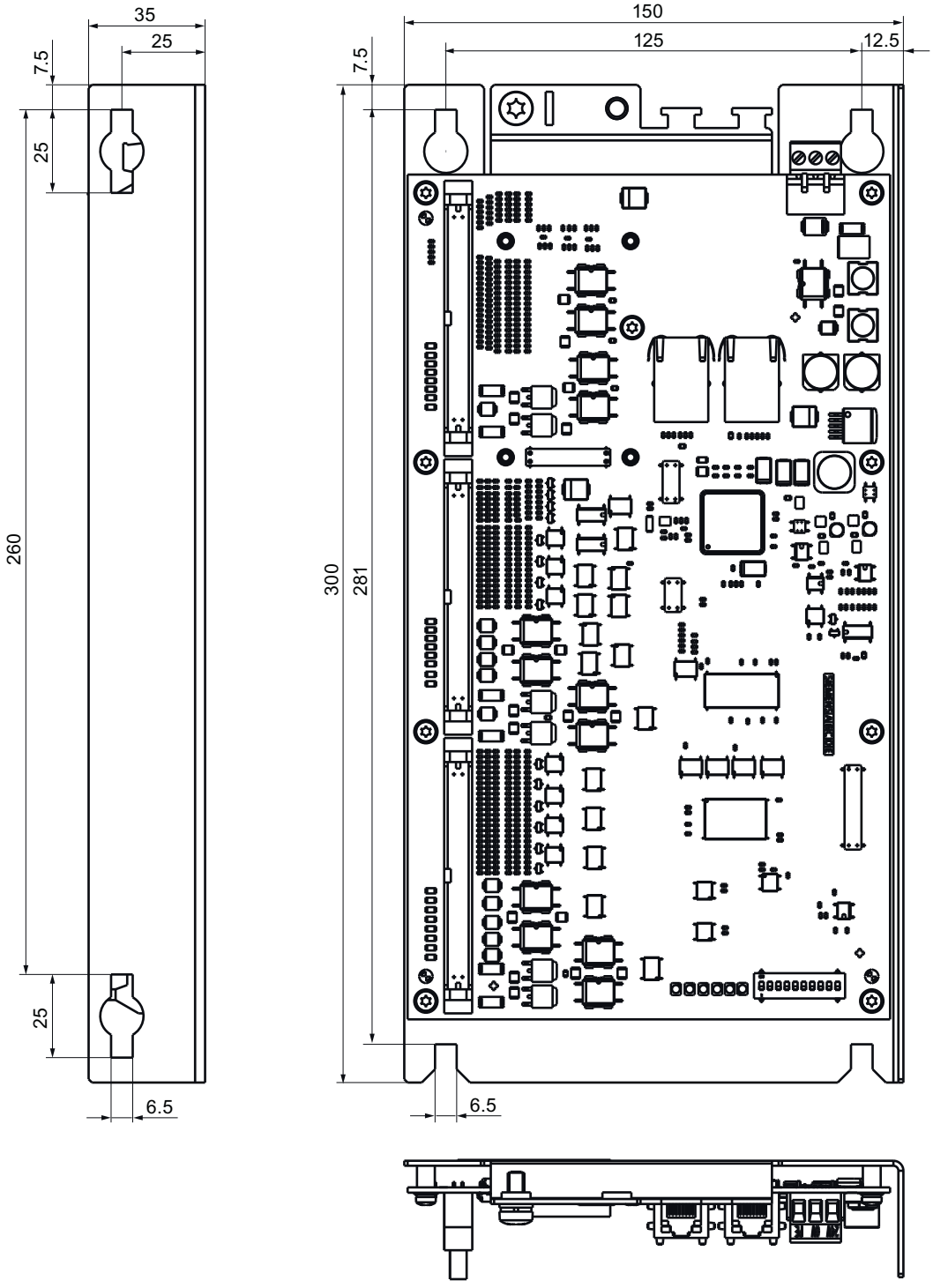


Figure 10-41 PP 72/48D PN dimensions

Dimension drawing

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

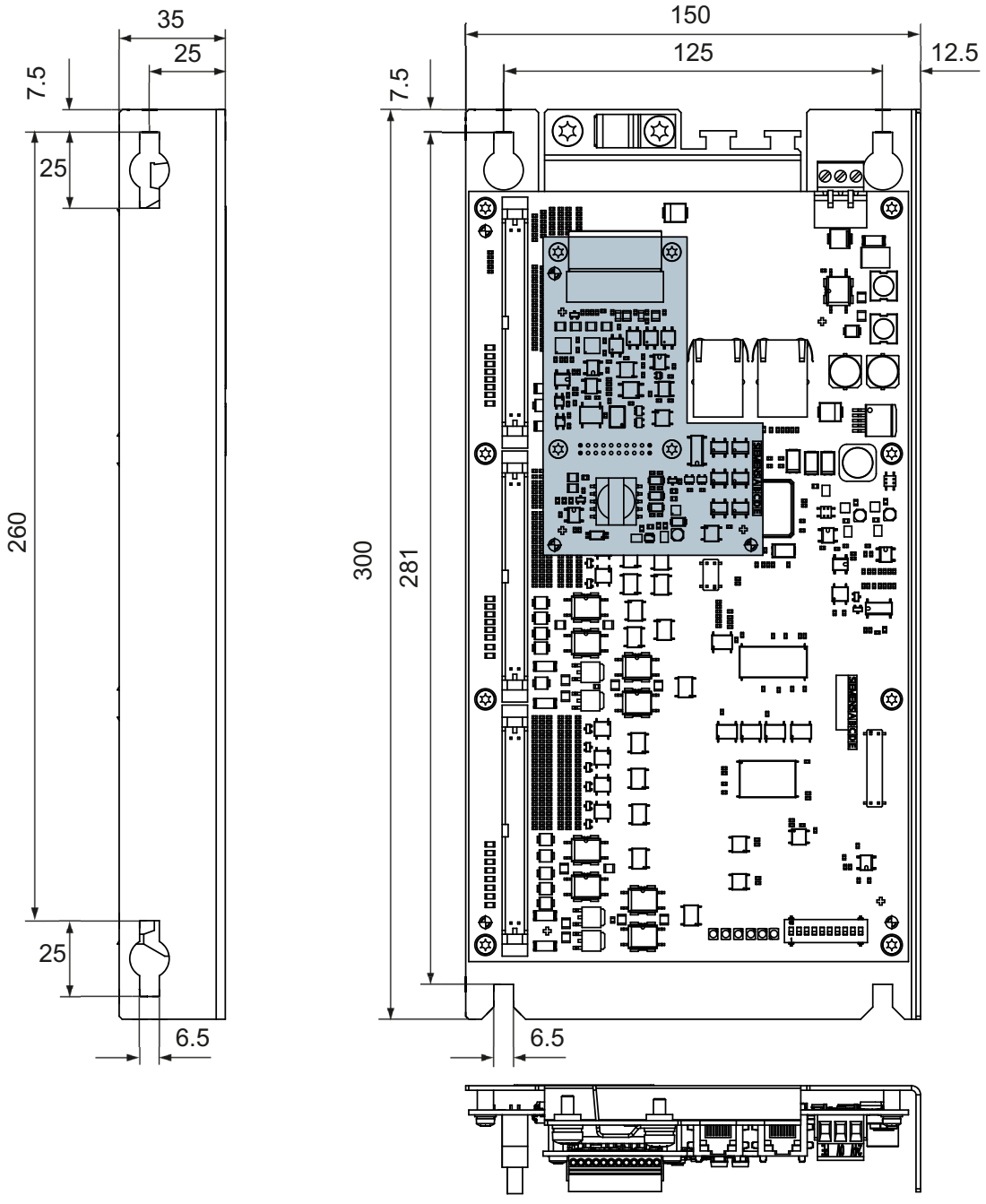
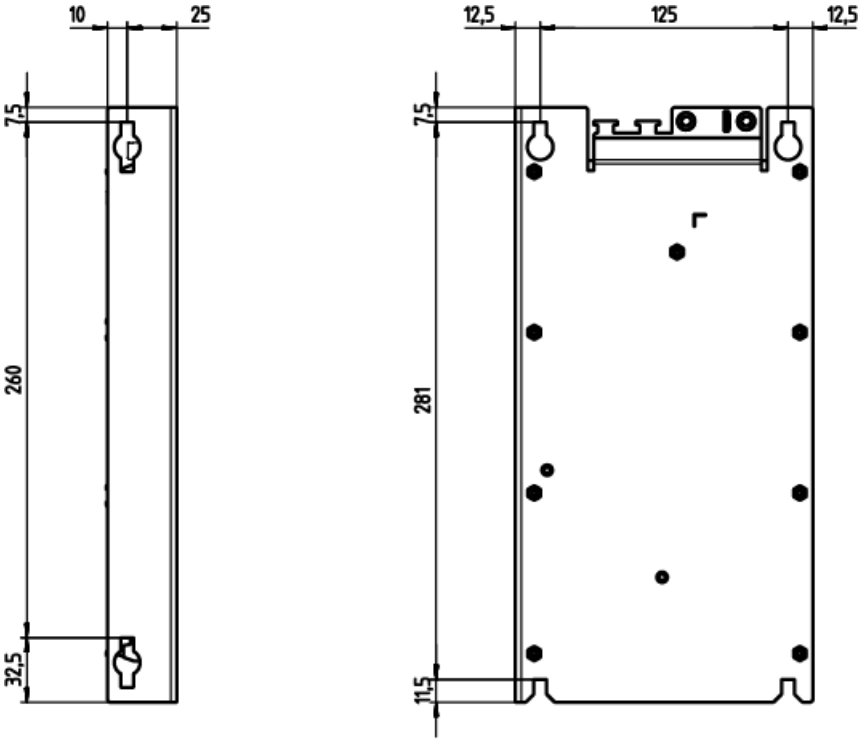


Figure 10-42 PP 72/48D 2/2A PN dimensions

Drilling

Drilling patterns

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



Drilling pattern: Module number maximum 5 pcs

Installing

Dimension diagrams

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

Mounting: 4XM6(6 Nm)

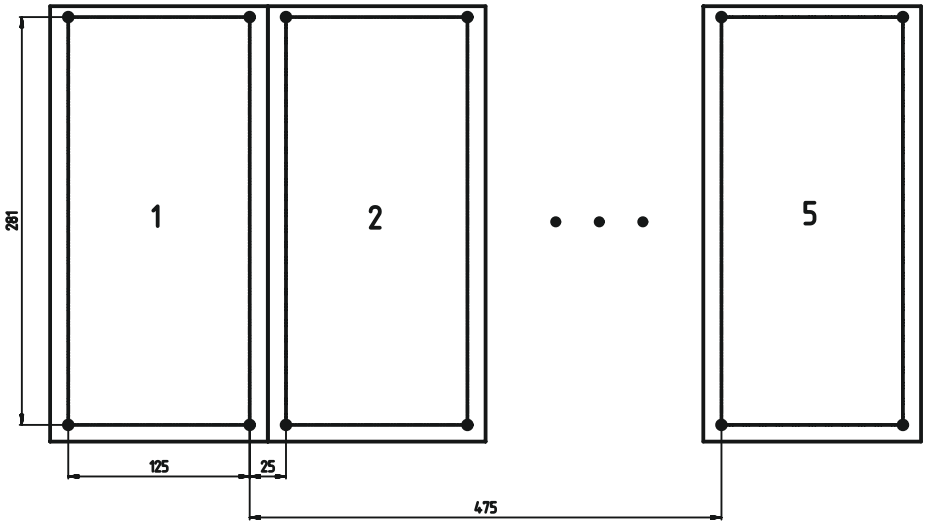


Figure 10-43 Installing the sheet metal vertically

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

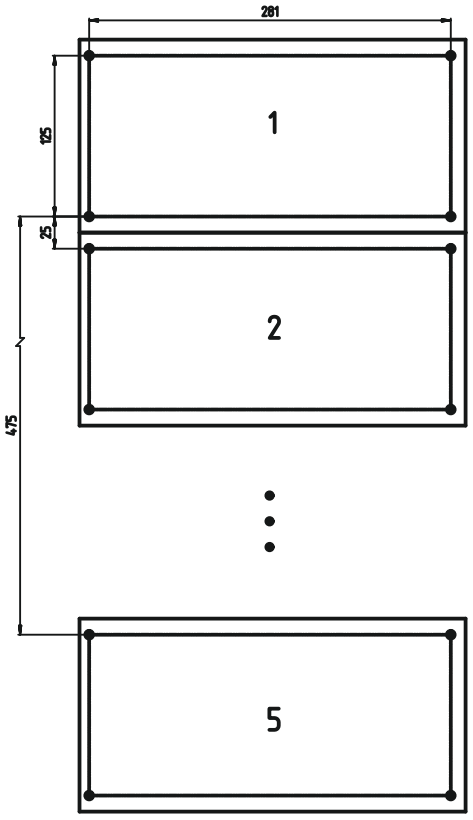


Figure 10-44 Installing the sheet metal horizontally

Dimension diagrams

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

Vertical direction: 150 mm distance

Mounting: 2XM6(6 Nm)

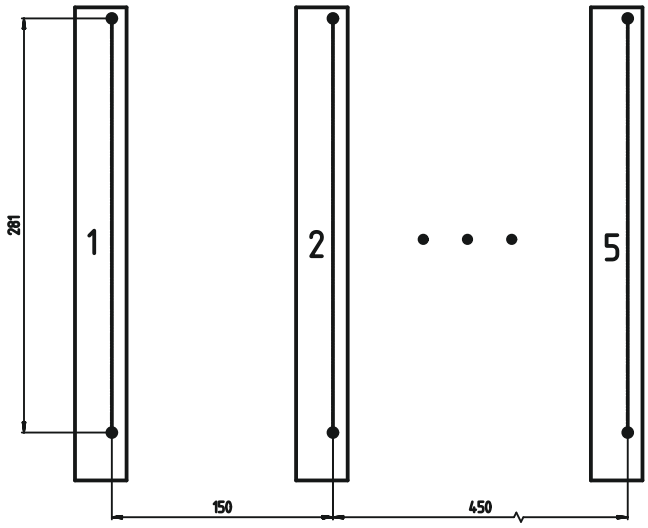


Figure 10-45 Installing small sheet metal vertically

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

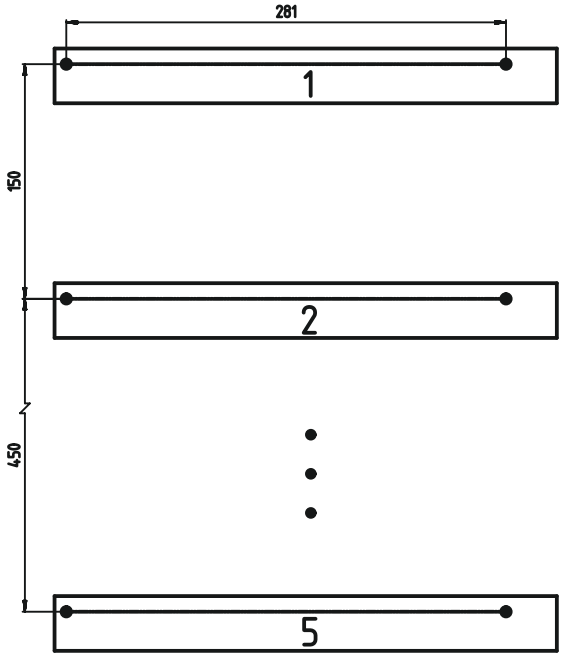
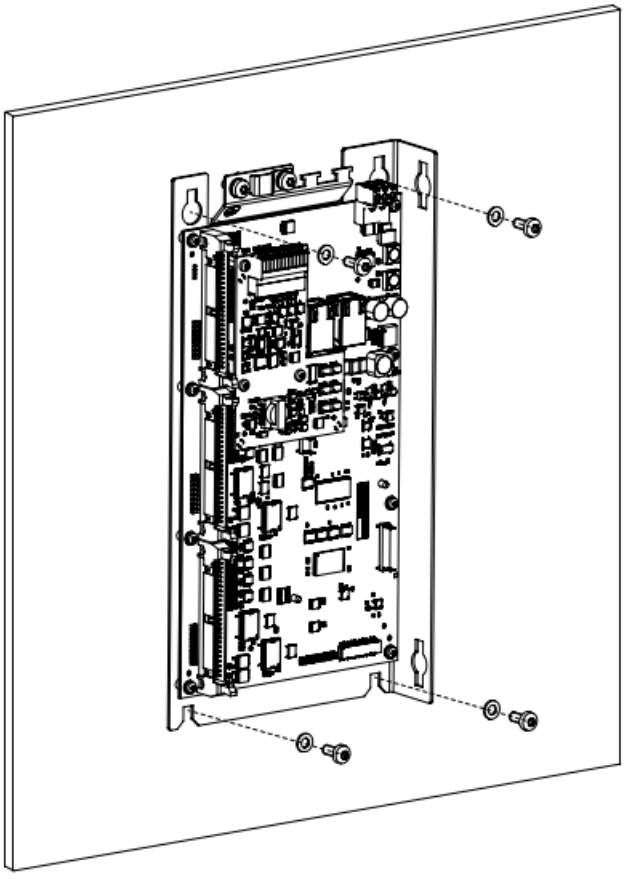


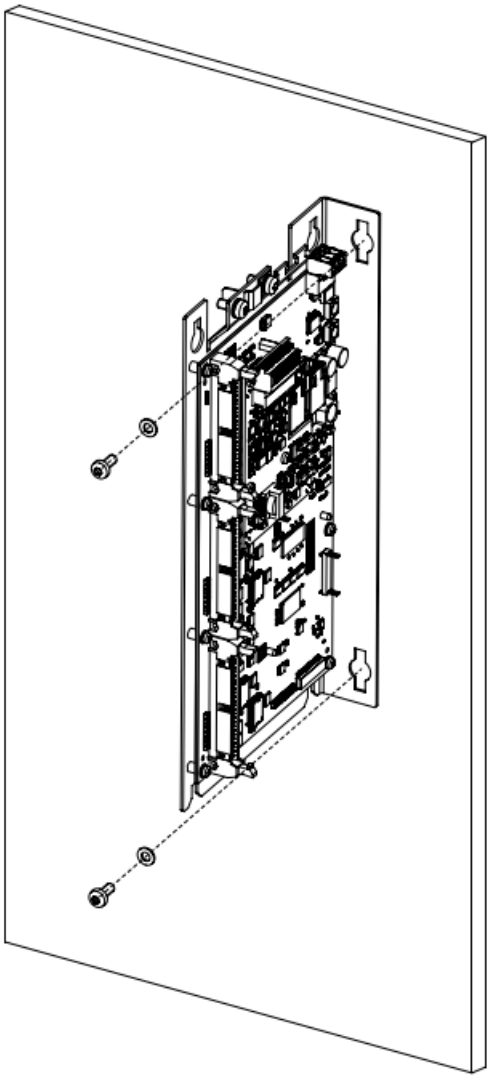
Figure 10-46 Installing small sheet metal horizontally

Installation procedure

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

The below diagrams illustrate the installation procedure:





Dimensions

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

PP 7248D PN I/O module

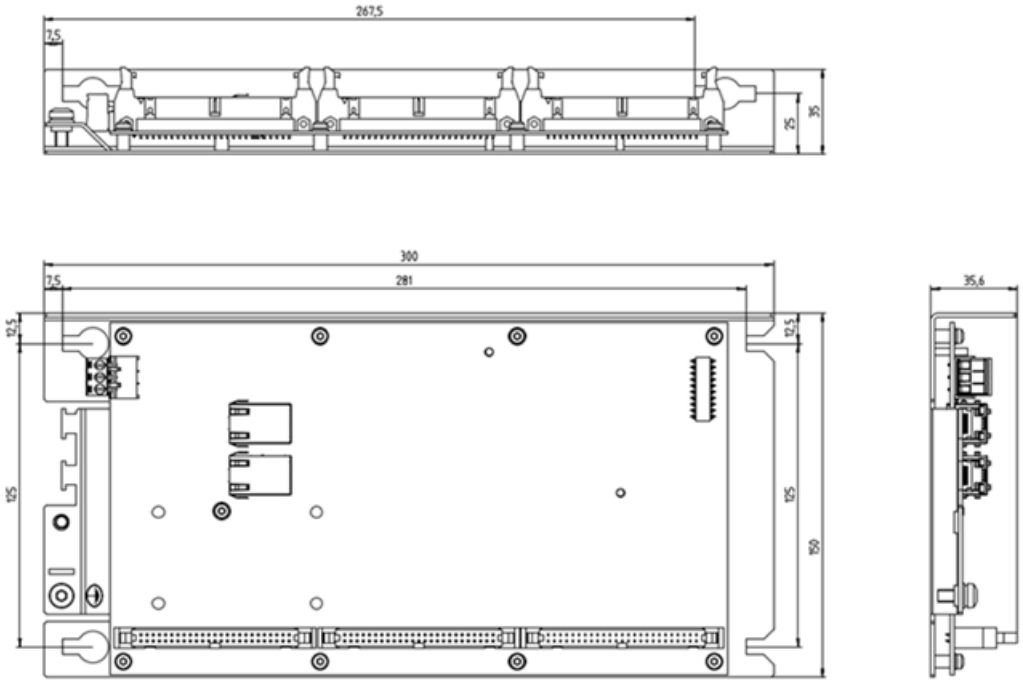


Figure 10-47 PP 72/48D PN I/O module dimensions

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

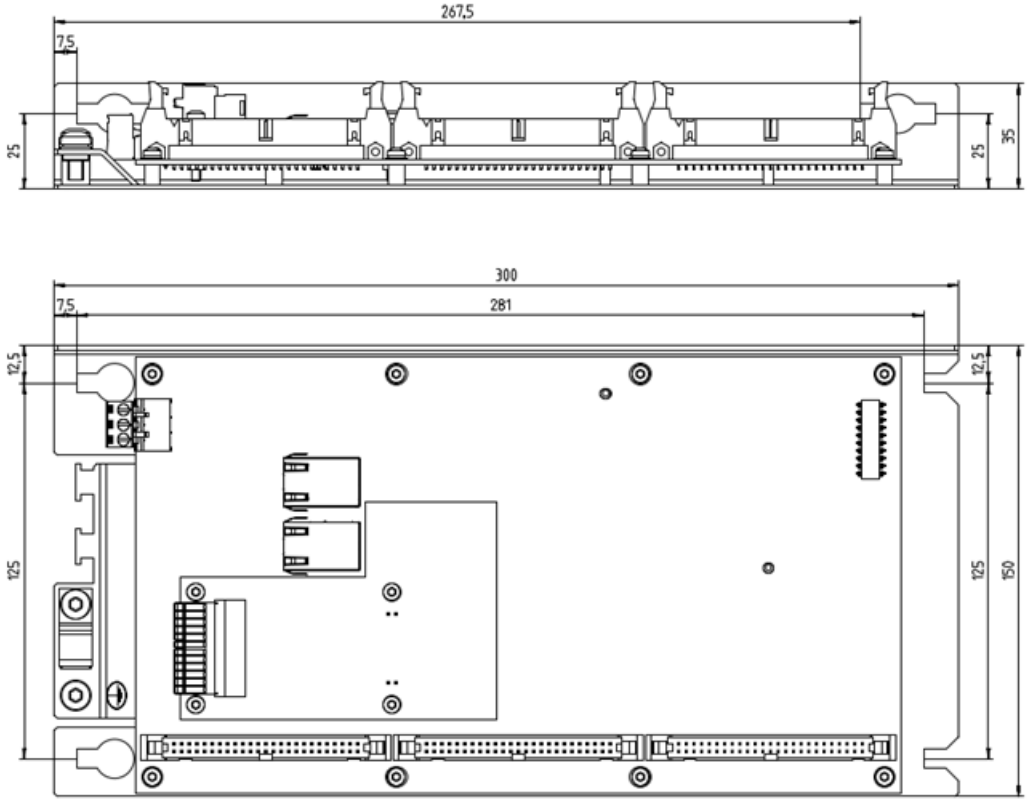
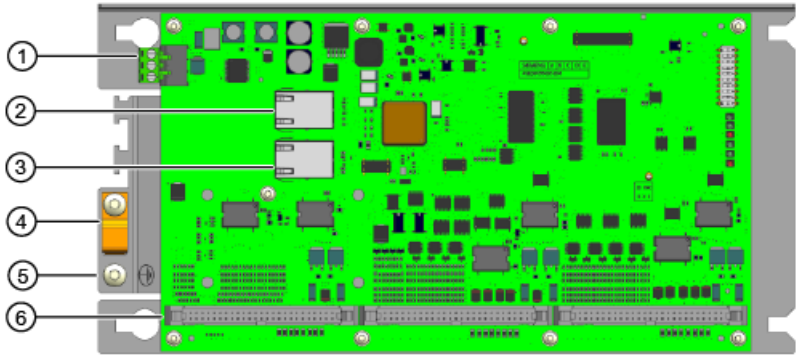


Figure 10-48 PP 72/48D 2/2A PN I/O module dimensions

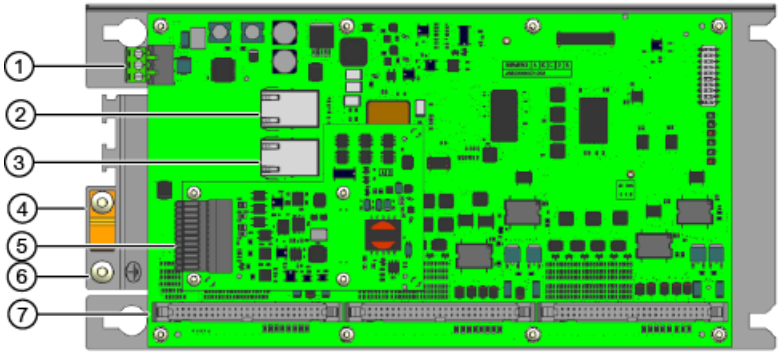
10.8.1.3 Connecting

PP 72/48D PN I/O module



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

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



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

Connection options

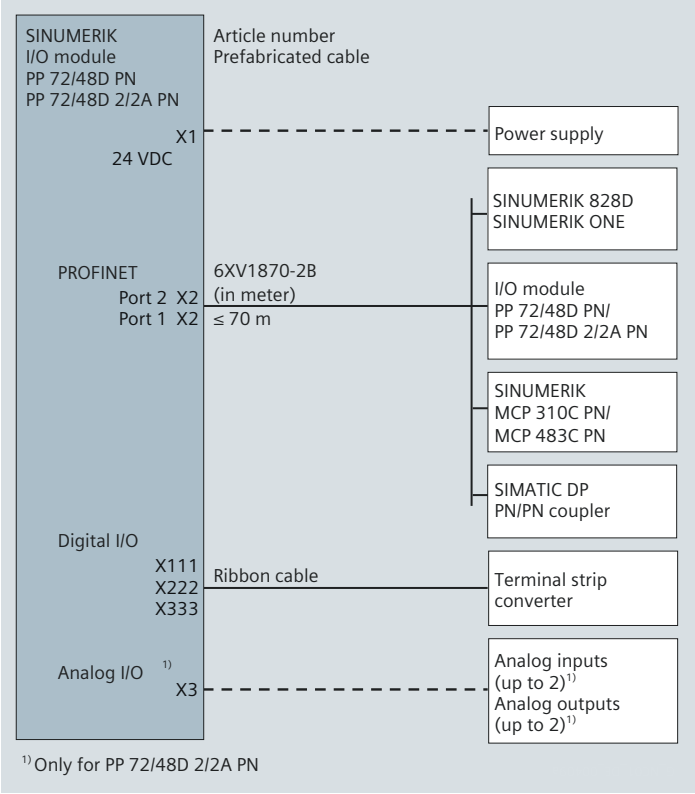


Figure 10-49 Interfaces

X1 power supply

Requirements of the DC power supply

⚠ DANGER

Risk of lightning strike

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

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

See also: "EMC Installation Guideline" Configuration Manual.

Rated voltage	According to IEC 61131-2	24 VDC
	Voltage range (mean value)	20.4 VDC to 28.8 VDC
	Voltage range (dynamic)	19.2 VDC to 30 VDC
	Voltage ripple peak-to-peak	5% (unfiltered 6-pulse rectification)
	Booting time at POWER ON	Any
Mains buffering	Mains/voltage failure stored energy time	≤ 3 ms
	Repeat rate, min. 1 event every 10 s	
X1 terminal 	Wiring range	AWG 28 to AWG 12
	Torque	0.51 Nm

Digital inputs

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

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

The required 24 VDC load power supply is wired to the screw-type terminal block (X1). Use flexible cables with a cross-section of 0.25 to 2.5 mm^2 (or AWG 30 to AWG 12) for wiring the power supply according to the maximum occurring current.

Note

If you only use one wire per connection, a ferrule is not required. You can use ferrules without an insulating collar in accordance with DIN 46228, Form A long version

Table 10-42 Requirements for digital inputs

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

Digital outputs

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

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

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

Analog inputs/outputs

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

X1 pin assignment

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

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

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

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

Wiring the screw terminal block

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

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

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

Cable specification:

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

Note

X1 terminal conductor material

Use copper conducors only

X2 PROFINET

Requirement

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

X2 pin assignment: Port 1 and port 2

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

Data transmission

The interfaces are designed for operation in full-duplex mode, i.e. for sending and receiving data. When connecting I/O modules to the SINUMERIK 828D, please use the preassembled SINAMICS DRIVE-CLiQ signal cables; from a technical point of view, these are also suitable for use with PROFINET:

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

LED status displays

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

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

DIP switch S1

The correct logical IP address for communication (Page 348) with PLC I/O interface must be assigned to the I/O module with the 10-bit DIP switch S1. The device name consists of the PROFINET name and the device number: In the case of I/O modules, the 1st module is device number 9.

Note

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

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

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

X111, X222, X333 digital inputs/outputs

Cable specification

50-pin ribbon cable connector:

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

X111 pin assignment

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

X222 pin assignment

Pin	Signal name	Type	Pin	Signal name	Type
1	M	GND	2	P24OUT	VO
3	DI 3.0	I	4	DI 3.1	I
5	DI 3.2	I	6	DI 3.3	I
7	DI 3.4	I	8	DI 3.5	I
9	DI 3.6	I	10	DI 3.7	I
11	DI 4.0	I	12	DI 4.1	I
13	DI 4.2	I	14	DI 4.3	I
15	DI 4.4	I	16	DI 4.5	I
17	DI 4.6	I	18	DI 4.7	I
19	DI 5.0	I	20	DI 5.1	I

Pin	Signal name	Type	Pin	Signal name	Type
21	DI 5.2	I	22	DI 5.3	I
23	DI 5.4	I	24	DI 5.5	I
25	DI 5.6	I	26	DI 5.7	I
27	Not assigned	-	28	Not assigned	-
29	Not assigned	-	30	Not assigned	-
31	DO 2.0	O	32	DO 2.1	O
33	DO 2.2	O	34	DO 2.3	O
35	DO 2.4	O	36	DO 2.5	O
37	DO 2.6	O	38	DO 2.7	O
39	DO 3.0	O	40	DO 3.1	O
41	DO 3.2	O	42	DO 3.3	O
43	DO 3.4	O	44	DO 3.5	O
45	DO 3.6	O	46	DO 3.7	O
47	DOCOM2	VI	48	DOCOM2	VI
49	DOCOM2	VI	50	DOCOM2	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

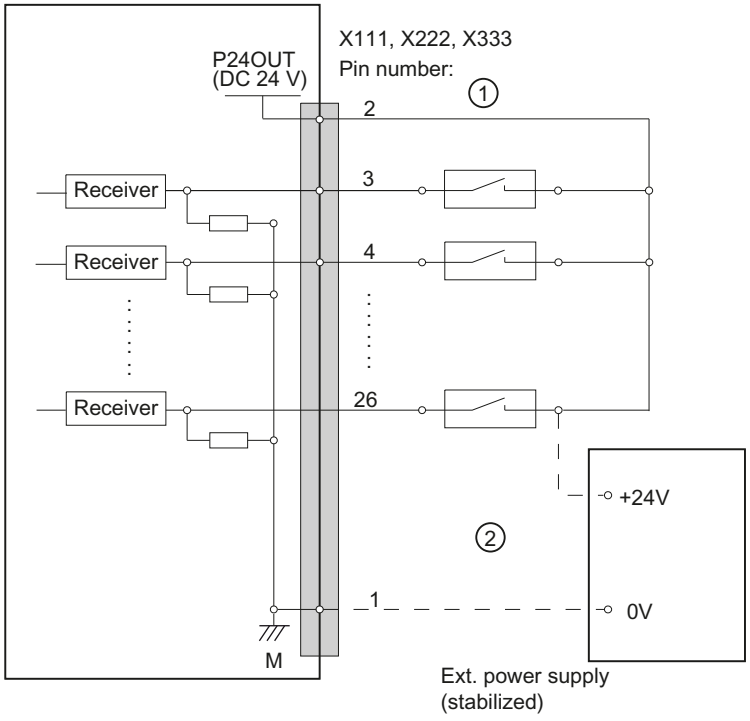
X333 pin assignment

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

Pin	Signal name	Type	Pin	Signal name	Type
43	DO 5.4	O	44	DO 5.5	O
45	DO 5.6	O	46	DO 5.7	O
47	DOCOM3	VI	48	DOCOM3	VI
49	DOCOM3	VI	50	DOCOM3	VI
VI: Voltage input/VO: Voltage Output I: Signal input/O: Signal output/GND: Reference potential (ground)					

Pin assignment of the digital inputs

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



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

Figure 10-50 X111 pin assignment

Features:

- X222: DI 3.0 to 3.7 are connected as rapid inputs.
- The inputs have no signaling (status LEDs).
- The inputs are not isolated.

- It is not possible to connect a 2-wire BERO.
- Power supply for digital inputs (X111, X222, X333: Pin 2):
  The internal power supply (P24OUT) is taken from the general power supply of module X1, pin 2 (P24). Alternatively, an external power supply can be connected if the load at the digital outputs becomes too high.

Electrical specification

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

Terminal assignment for the digital outputs

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

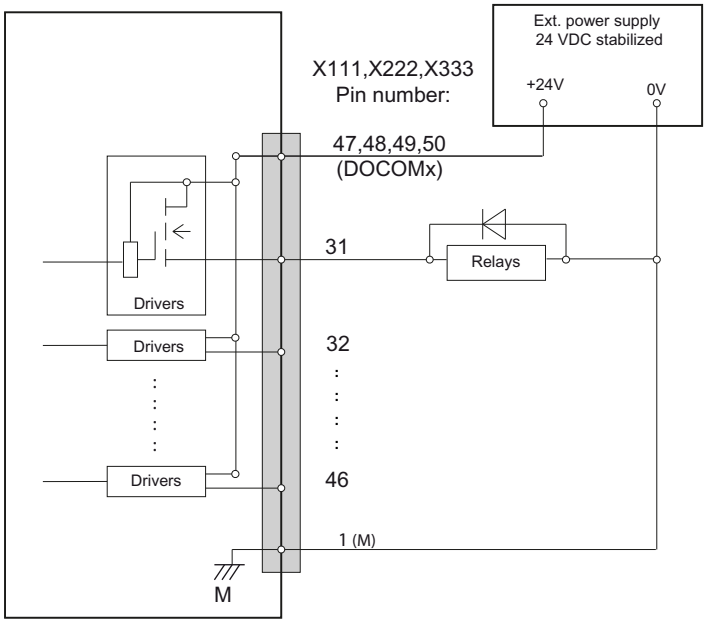


Figure 10-51 X111 pin assignment

Features:

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

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

Electrical specification

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

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

Actual operating voltage V_{CC}

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

R_{ON}: Maximum internal resistance = 0.4 Ω

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

X3 analog inputs/outputs

X3 pin assignment

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

Pin	Signal name	Signal type	Meaning
1	CO1	O	Channel 1 current output for Pt100
2	CI1	I	Channel 1 current input for Pt100
3	AI1+	I	Channel 1 analog input +
4	AI1-	I	Channel 1 analog input -
5	CO2	O	Channel 2 current output for Pt100
6	CI2	I	Channel 2 current input for Pt100
7	AI2+	I	Channel 2 analog input +
8	AI2-	I	Channel 2 analog input -

Pin	Signal name	Signal type	Meaning
9	AO3+	O	Channel 3 current and voltage output +
10	AO3-	O	Channel 3 current and voltage output -
11	AO4+	O	Channel 4 current and voltage output +
12	AO4-	O	Channel 4 current and voltage output -

AI: Analog input - AO: Analog output

CI: Current input - CO: Current output

Table 10-43 Cable specification:

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

Wiring analog inputs/outputs

Procedure:

1. Strip cable for analog signals.
2. Secure the stripped connection piece of the cable with the shield connection clamp.

NOTICE
Shielded signal cables for analog signals To ensure safe, fault-free operation of the system, shielded cables with shield connection should be used for the wiring of the analog outputs. See also: EMC compatibility (Page 69)

Analog inputs

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

- "Voltage input" operating mode:

Parameter	Value
Input range (rated value)	- 10 V to + 10 V
Permitted overrange	- 11.75 V to + 11.75 V
Resolution	16-bit (incl. sign)
Accuracy	+/-0.5% of full range
Internal resistance Ri	100 KOhm

- "Current input" operating mode:

Parameter	Value
Input range (rated value)	- 20 mA to + 20 mA
Permitted overrange	- 23.5 mA to + 23.5 mA
Resolution	16-bit (incl. sign)
Accuracy	+/-0.5% of full range
Internal resistance Ri	133 ohm

- "Pt100" mode

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

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

The analog inputs are only enabled after the parameter assignment.

NOTICE
Protection from overvoltage If the Pt100 operating mode is selected, the hardware is protected against overvoltage. The following mechanisms are triggered in the event of an error: 1. An error bit is set which is then communicated to the PLC. 2. The module is shut down.

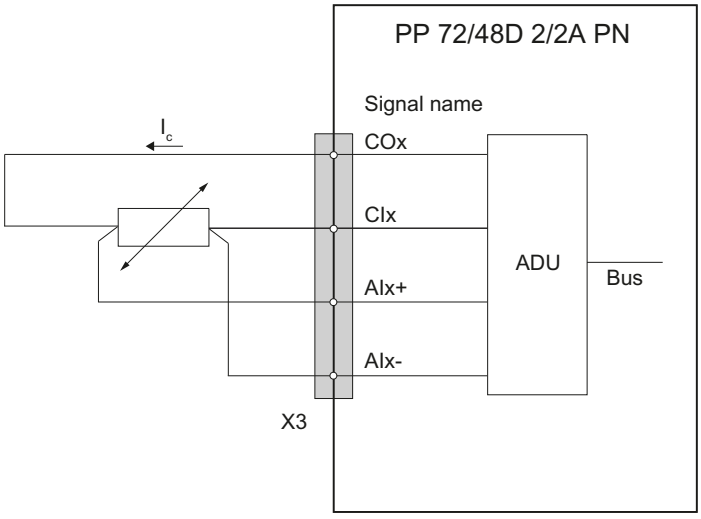
Measurement using a 4-wire connection system

Notes regarding the connection and operation of Pt100 resistors:

This enables the module to supply X3 with a constant current via the CO1, CI1, CO2 and CI2 terminals. The constant current is fed to the resistor to be measured where it is then

measured as the voltage drop. It is imperative to wire the connected constant current cables directly to the resistor.

Measurements with 4-wire connections compensate for line resistances and return a considerably higher degree of measuring accuracy in comparison with 2-wire connections.



x 1, 2
ADU Analog Digital Unit
I_c Constant current

Figure 10-52 Pt100 pin assignment

Measurement using a 3-wire connection system

The following pins must be jumpered at connector X3 in order to perform the measurement in the Pt100 using a 3-wire connection system:

- Temperature measurement with channel 1:
  Short-circuit pin 2 (CI 1) and pin 4 (AI 1-) and connect the jumper at connector X3
- Temperature measurement with channel 2:
  Short-circuit pin 6 (CI 2) and pin 8 (AI 2-) and connect the jumper at connector X3.

Note

Measuring accuracy

The accuracy of the temperature input becomes poorer: The resistance of the connecting cable of the jumpered connecting cable falsifies the measurement.

Analog outputs

The module has two analog outputs. These can optionally be assigned parameters as voltage or current output.

- "Voltage output" operating mode:

Parameter	Value
Output range (rated value)	- 10 V to + 10 V
Permitted overrange	- 10.5 V to + 10.5 V
Resolution	16-bit (incl. sign)
Accuracy	+/-0.5% of full range
Max. load current	-3 mA to +3 mA

- "Current output" operating mode:

Parameter	Value
Output range (rated value)	-20 mA to +20 mA
Permitted overrange	-20.2 mA to +20.2 mA
Resolution	16-bit (incl. sign)
Accuracy	+/-0.5% of full range
Load impedance	≤ 600 ohm

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

The analog outputs are only enabled after the parameter assignment.

Note

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

Analog value display

The analog values are provided as 16-bit integer values. Depending on the operating mode, the measured values must be converted using the following factors in order to achieve the corresponding physical value.

	Voltage [V]	Current [mA]	Temperature [° C]
Factor (AI):	0.00151947	0.003051758	0.1
Factor (AO):	0.000381469	0.0007629	-

Calculation: 16-bit value (hex. or dec.) * factor = measured value

Note

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

Analog inputs - measured values

"Voltage measurement" operating mode:

16-bit value (hex.)	16-bit value (dec.)	Factor	Voltage value [V]
Overflow		-	Deactivation
Overrange		-	Up to 11.75 V
0x19B5	6581	0.00151947	10 V
0x0CDA	3291		5 V
0x066D	1645		2.5 V
0x0000	0		0 V
0xF993	-1645		-2.5 V
0xF326	-3291		-5 V
0xE64B	-6581		-10 V
Underrange		-	Up to -11.75 V
Underflow		-	Deactivation

"Current measurement" operating mode:

16-bit value (hex.)	16-bit value (dec.)	Factor	Current value [V]
Overflow		-	Deactivation
Overrange		-	Up to 23.5 mA
0x1999	6553	0.003051758	20 mA
0x0CCC	3277		10 mA
0x0000	0		0 mA
0xF333	-3277		-10 mA
0xE666	-6553		-20 mA
Underrange		-	Up to -23.5 mA
Underflow		-	Deactivation

"Temperature measurement" operating mode:

16-bit value (hex.)	16-bit value (dec.)	Factor	Temperature value [V]
Overflow			
0x0A28	2590	0.1	259° C
0x03E8	1000		100° C
0x01F4	500		50° C
0x0000	0.0		0° C
0xFE0C	-500		-50° C
0xFC18	-1000		-100° C
0xF830	-2000		-200° C
Underflow			

If a Pt100 element is accidentally not connected in this operating mode and an input voltage higher than 0.25 V is output, the analog module automatically switches to the "No operating mode" operating mode and resets the gain factor to "1". This is signalized in status word 0 (channel-specific) in the input image. In addition, a corresponding error code is output for the diagnostics at a counter value of "2" (Page 336).

In the case of operation without a Pt100 element, a slightly negative voltage may be applied, which results in an error status for the module. Observe the "PNFault" LED and the status byte 1.

Analog output measured values

"Voltage output" operating mode:

16-bit value (hex.)	16-bit value (dec.)	Factor	Voltage value [V]
Overflow		-	Deactivation
Overrange		-	Up to 10.5 V
0x6666	26214	0.000381469	10 V
0x4CD1	19665		7.5 V
0x199B	6555		2.5 V
0x0000	0		0 V
0xE665	-6555		-2.5 V
0xB32F	-19665		-7.5 V
0x999A	-26214		-10 V
Underrange		-	Up to -10.5 V
Underflow		-	Deactivation

"Current output" operating mode:

16-bit value (hex.)	16-bit value (dec.)	Factor	Current value [V]
Overflow		-	Deactivation
Overrange		-	20.2 mA
0x6666	26214	0.0007629	20 mA
0x4CD1	19665		15 mA
0x199B	6555		5 mA
0x0000	0		0 mA
0xE665	-6555		-5 mA
0xB32F	-19665		-15 mA
0x999A	-26214		-20 mA
Underrange		-	-20.2 mA
Underflow		-	Deactivation

10.8.1.4 Equipotential bonding

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

10.8.1.5 Assigning parameters

Parameter assignment of the digital inputs/outputs

Input image of the digital inputs

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

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

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

Output image of the digital outputs

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

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

See also

To activate and address an I/O module via machine data, see Section: Activating components (Page 344).

Assigning parameters to the analog inputs/outputs

Operating mode of the analog outputs

Parameters are assigned to the operating mode via the m+0 byte (Analog Control Byte 0) of the output image of the analog outputs:

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit3	Bit1	Bit0
m+0	AO (channel 4)	AO (channel 4)	AO (channel 3)	AO (channel 3)	AI (channel 2)	AI (channel 2)	AI (channel 1)	AI (channel 1)
m+1	Reserved							Data format
m+2	Reserved							
m+3	Reserved							

The operating mode is set to "no operating mode" during power-up. As soon as a valid setting is made this will be applied and will subsequently no longer be reset. If a reset is initiated by the user, this is interpreted as an error.

Type of control

The control type must be specified in the Analog Control Byte m+1 (bit 0), so that the 16-bit input and output values from and to the analog module are correctly interpreted by the control. In the SINUMERIK 828D control, the value "1" must be entered.

Note

The control type must be set prior to the operating mode so that the first set of user data is not misinterpreted. In addition to this, the Analog Control Byte m+0 / m+1 must only be accessed byte-by-byte.

Assigning parameters to the analog inputs

The analog inputs (AI) can be operated in the following operating modes:

Operating mode 1st channel	Bit 1	Bit 0
No operating mode	0	0
Voltage measurement	0	1
Current measurement	1	0
Temperature measurement (Pt100)	1	1

Operating mode 2nd channel	Bit 3	Bit 2
No operating mode	0	0
Voltage measurement	0	1
Current measurement	1	0
Temperature measurement (Pt100)	1	1

Assigning parameters to the analog outputs

The analog outputs (AO) can be operated in the following operating modes:

Operating mode 3rd channel	Bit 5	Bit 4
No operating mode	0	0
Voltage output	0	1
Current output	1	0
Impermissible operating mode	1	1

Operating mode 4th channel	Bit 7	Bit 6
No operating mode	0	0
Voltage output	0	1
Current output	1	0
Impermissible operating mode	1	1

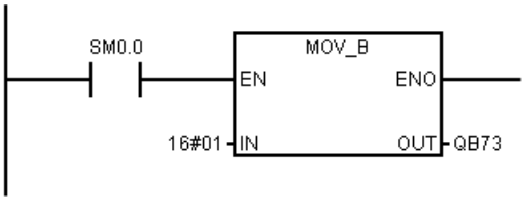
For further information on assigning parameters to analog inputs and outputs and addressing, refer Addressing components (Page 348).

Checkback signal of the operating modes

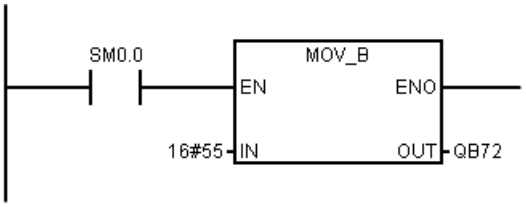
The set operating modes are saved in the input image in status byte 0. This value must be compared with Control Byte 0 in the output image. If these are different, an error has occurred, e.g. in the case of overvoltage in the "Temperature measurement" operating mode, see Diagnostics via input image (Page 336).

Example of programming

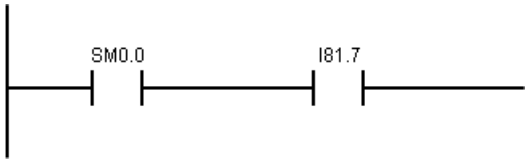
1. Determine control type:



2. Set the operating mode:



3. Query the error status bit in cyclic operation:



Examples of assigning parameters to the analog inputs/outputs

Measured values and responses

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

Example for operating mode voltage measurement

	Address	Voltage ±10 V			
		0 V	**2.5 V**	**10 V**	**12 V**
Operating mode	QB72	16#55	16#55	16#55	16#55
Format	QB73	16#1	16#1	16#1	16#1
Value	QW76	16#0	16#199B	16#6666	16#7AE1
Value	QW78	16#0	16#199B	16#6666	16#7AE1
Operating mode	IB72	16#55	16#55	16#55	16#55
Format	IB73	16#1	16#1	16#1	16#1
Value	IW76	16#0	16#66D	16#19B5	16#0
Value	IW78	16#0	16#66D	16#19B5	16#0

	Address	Voltage ±10 V			
		0 V	**2.5 V**	**10 V**	**12 V**
Diagnostics	IB50	-	-	-	16#2
	IB51	16#0	16#0	16#0	16#7
PNFault LED		OFF	OFF	OFF	ON
Troubleshooting					Deactivating/ activating

Example for operating mode current measurement

	Address	Current 20 mA			
		0 mA	**5 mA**	**20 mA**	**22 mA**
Operating mode	QB72	16#AA	16#AA	16#AA	16#AA
Format	QB73	16#1	16#1	16#1	16#1
Value	QW76	16#0	16#199B	16#6666	16#70A5
Value	QW78	16#0	16#199B	16#6666	16#70A5
Operating mode	IB72	16#AA	16#AA	16#AA	16#AA
Format	IB73	16#1	16#1	16#1	16#1
Value	IW76	16#0	16#665	16#1996	16#0
Value	IW78	16#0	16#665	16#1996	16#0
Diagnostics	IB50	-	-	-	16#2
	IB51	16#0	16#0	16#0	16#7
PNFault LED		OFF	OFF	OFF	ON
Troubleshooting					Deactivating/ activating

Example for operating mode temperature measurement

	Address	Pt100	
		Incorrect operating mode	**Resistor is not connected**
Operating mode	QB72	16#AA	16#0F
Format	QB73	16#1	16#1
Value	QW76	-	-
Value	QW78	-	-
Operating mode	IB72	16#AA	16#0F
Format	IB73	16#81	16#81
Value	IW76	-	-
Value	IW78	-	-

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

Diagnostics via input image

Diagnostics via input image

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

Messages in byte 0

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

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

Note

The "alive and well" counter is a 3-bit modulo counter on a PP application level. The PP application can be monitored using this counter. Failure of the application software does not result in a communication failure, because the communication is performed with hardware support. The watchdog switches off the digital outputs, while the inputs retain their last values.

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

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

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

Correcting errors at counter value "2"

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

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

10.8.1.6 Technical data

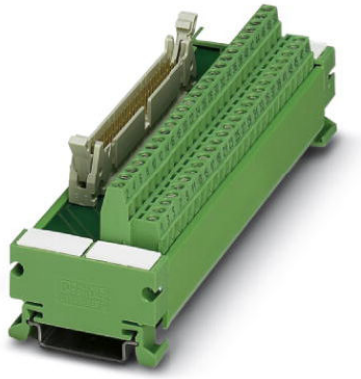
I/O module

Parameter	Value	
I/O module	**PP 72/48D PN**	**PP 72/48D 2/2A PN**
Power consumption at rated load (without digital outputs)	17 W	19 W
Rated current	0.7 A	0.8 A
Power loss	18 W	
Pollution degree	2	
Degree of protection	Open type/indoor use only	
Overvoltage degree	OVC II	
Input voltage	24 V DC + 20% / - 15%	
Rated tolerance	20.4 V DC to 28.8 V DC	
Shock load during transport (in transport packaging)	Free-fall ≤ 1 m	
Degree of protection in acc. with EN 60529	IP00	
Protection class in acc. with EN 61800-5-1	III; DVC A (PELV)	
Approvals	CE, cULus, KCC, EAC	
Heat dissipation/ cooling	Open-circuit ventilation	
Condensation	Not permitted	
Limit to relative humidity at 25 ℃	5 to 95% (without condensation) 5 to 90% (with condensation)	
Air pressure	106 to 92 kPa or 0 to 1000 m above sea level	
Derating	At altitudes over 1000 to 4000 m above sea level, the upper temperature limit must be reduced by 3.5°C / 500 m	
Ambient temperature:		
• Storage	-40 to 70° C	
• Transport	-40 to 70° C	
• Operation	0 to 55° C	
Dimensions:		
• Width	300 mm	
• Height	150 mm	
• Depth	35 mm	
Weight, approx.	0.9 kg	
Storage	1M2 (in product packaging); 1.5 mm; 0.5 g	

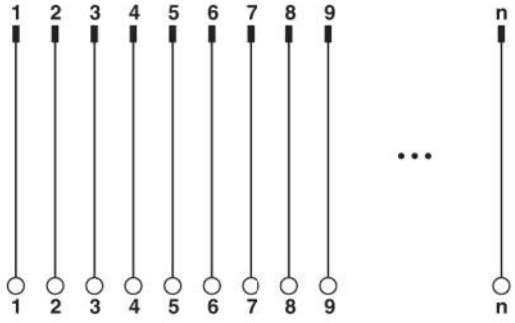
Parameter	Value
• Operation	3M1
• Vibration in operation	10 - (57） 58 Hz; 0.075 mm (57） 58 - 150 Hz; 1 g
• Shock in operation	5 g; 30 ms
Free fall	≤ 1 m (in transport packaging)
Output rating X111, X222, X333**:**	
• Resistance	24 VDC; 0.25 A/channel; 4 A/terminal
• Pilot duty	24 VDC; 0.25 A/channel;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

10.8.1.7 Terminal strip converter

Terminal strip converter



Article number: 6EP5406-5AA00



1: 1 interconnection

Technical data

Parameter	Values
Rated voltage V_N	24 V AC 60 V DC
Max. current carrying capacity per branch	1 A
Number of poles	50
Pollution degree in acc. with EN 61800-5-1	2
Protection class in acc. with EN 61800-5-1	II
Applicable standards	IEC 60664 DIN VDE 0110

Parameter	Values
Ambient temperature:	
• Operation	-20 ... 55°C
• Storage/transport	-40 ... 70°C
Mounting position	Any
Dimensions:	
• Width	151 mm
• Height	50 mm
• Depth	40 mm
Weight, approx.	0.15 kg

10.8.2 SENTRON PAC2200

10.8.2.1 Technical data

Description

The PAC2200 is a measuring device for measuring the basic electrical variables in low-voltage power distribution. All measured variables are shown on the display of the PAC2200. The device is capable of single-phase, two-phase or three-phase measurement and can be used in TN, TT and IT systems.



Figure 10-53 SENTRON PAC2200

Details on the configuration of the communication between the PU and the SENTRON PAC can be found at: Activating and addressing components (Page 344)

Technical specifications

Model	
product brand name	SENTRON
product designation	Energy counter

Model	
type of signal	S0
design of the energy counter	Solid-state
design of the pulse output	Electrical

General technical data	
type of the power supply network	three-wire/four-wire

Supply voltage	
Operating voltage	
● between L and L minimum	3 V
● between L and L maximum	480 V
● between N and L minimum	3 V
● between N and L minimum	476 V

Protection class	
protection class IP	IP40

Main circuit	
operating frequency rated value	
● minimum	45 Hz
● maximum	65 Hz
operational current rated value	65A

suitability	
suitability for use	Import/export

Product function	
backstop	Yes
blocking code	Yes

Display and operation	
display version	digital

Numbers	
number of characters that can be displayed	12

Mechanical design	
number of modular width units	6
Type of fixing	DIN-rail mounting TH35 to EN 60715
Housing dimensions W x H x D	108 mm x 97 mm x 71 mm [4.2 in x 3.8 in x 2.8 in]
net weight	528 g
Approvals	CE, C-Tick, EAC, UKCA

Further information

You can find further information about SENTRON PAC in the context of SINUMERIK in the Ctrl-Energy System Manual as well as on the Internet at:

- SIOS_SENTRON PAC2200 (https://support.industry.siemens.com/cs/document/109746835/)

10.8.3 PN/PN coupler

10.8.3.1 Principle of operation

Application

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

As a device, the PN/PN coupler has two PROFINET interfaces, each of which is linked to a subnet. During configuring, two I/O devices are made from this one PN/PN coupler; this means that there is one I/O device for each station with its own subnet. The other part of the PN/PN coupler is called the coupling partner. Once configuring has been completed, the two parts are merged.

Example

The following example shows that the two networks are independent of one another. This means that for each PROFINET IO network you assign dedicated device names. In the following figure, these are the device names "Subnet 1" in network 1 and "Subnet 2" in network 2.

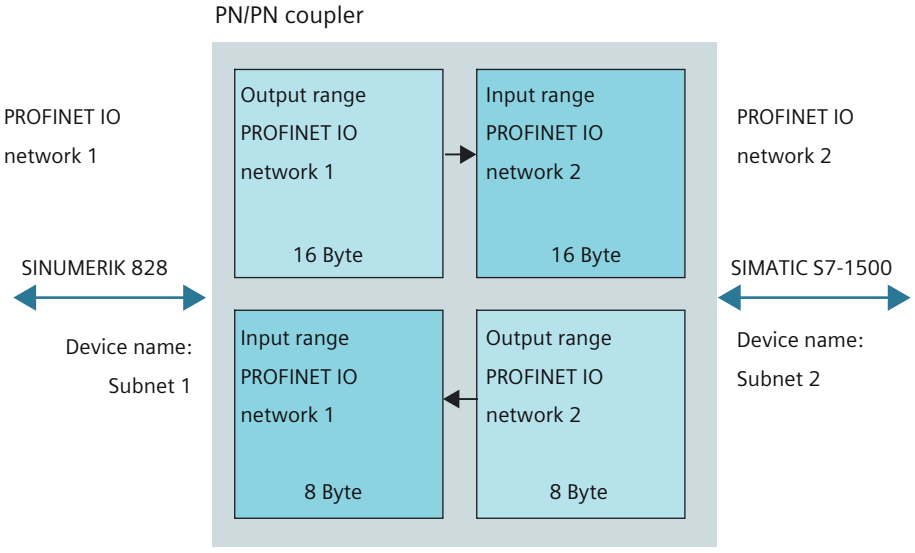


Figure 10-54 Principal mode of operation of the PN/PN coupler

References

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

10.8.3.2 Configuration

Configuring PROFINET components

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

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

Requirements for the configuration (Page 348):

- For the SINUMERIK 828D, the "PN-PN-Coupler20" name is permanently defined; therefore, the name must be exactly the same in the connected subnet.
- The following IP address is permanently set for the PN/PN coupler: 192.168.216.20

- The PN/PN coupler must be connected to the PROFINET interface X150P1 or X150P2 of the PPU.
- The PC must be connected with a crossover cable, e.g. via interface X2 on the PN/PN coupler.

The device name must be configured in the following cases:

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

Example

Procedure:

1. Under "Tools" select → "Set PG/PC interface" →"TCP/IP" → "Intel(R) PRO/100 VM".
2. Under "Target system" select → "Edit Ethernet nodes ...".
3. In the "Edit Ethernet Nodes" dialog box, press the "Browse..." button under "Nodes that can be accessed online".
4. In the "Search Network" dialog box, select the coupler and press "OK".
5. Enter the IP address in the "Edit Ethernet Node" dialog.
6. Enter "PN-PN Coupler20" as a device name: This designation is mandatory so that the device will be detected.

10.8.4 Activating and addressing components

10.8.4.1 Activating components

Machine data for the PLC PN I/O

The following components are assigned fixed addresses for the input and output image of the PLC: PN I/O modules, machine control panel, SENTRON PAC and PN/PN coupler.

To deactivate the update of the input and output images of the PLC, set the following machine data:

Machine data		Value range	
12986[i]	$MN_PLC_DEACT_IMAGE_LADDR_IN	0 ≤ i ≤ 15	Input addresses
12987[i]	$MN_PLC_DEACT_IMAGE_LADDR_OUT	0 ≤ i ≤ 15	Output addresses

The SINUMERIK 828D works with a fixed maximum configuration of the I/O modules. As delivered, the data transfer to the input and output image of the PLC is deactivated for all I/O modules.

To activate a PN component, you must enter the value -1 ("empty") in MD12986[i], see the table in Section Addressing components (Page 348). MD12987[i] is preset with the value -1 and must not be changed.

Machine data for the machine control panel

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

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

Note

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

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

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

Example

In this example, two I/O modules and a machine control panel of the PN type are activated:

MD	Logical input address	Data transfer to the PLC deactivated
12986[0]	**-1**	**1st PP module active**
12986[1]	**-1**	**2nd PP module active**
12986[2]	18	3rd PP module inactive
12986[3]	27	4th PP module inactive
12986[4]	36	5th PP module inactive
12986[5]	96	PN/PN coupler inactive
12986[6]	**-1**	**Machine control panel of the PN type active**
12986[8]	132	SENTRON PAC2200

Note

Monitoring the I/O

The use of an input/output address of a deactivated module in the PLC program does not trigger an alarm. The PLC program always works with the image memory. Whether there is a connection to the physical inputs/outputs is configured via MD12986[i] and MD12987[i]. Active modules are then monitored cyclically for failure.

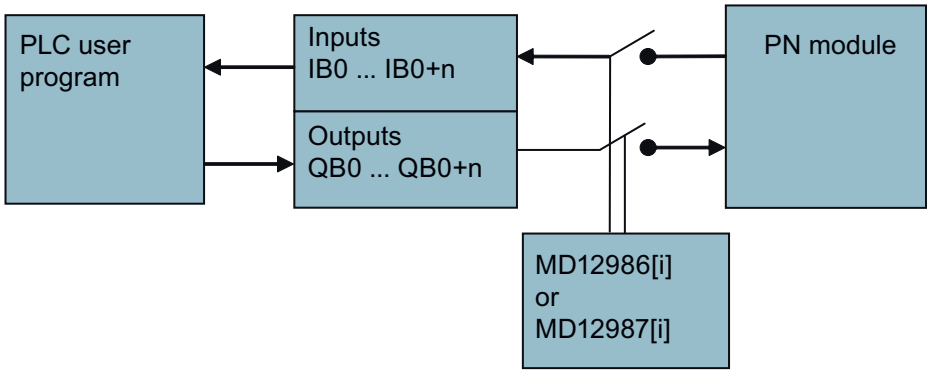


Figure 10-55 I/O switch

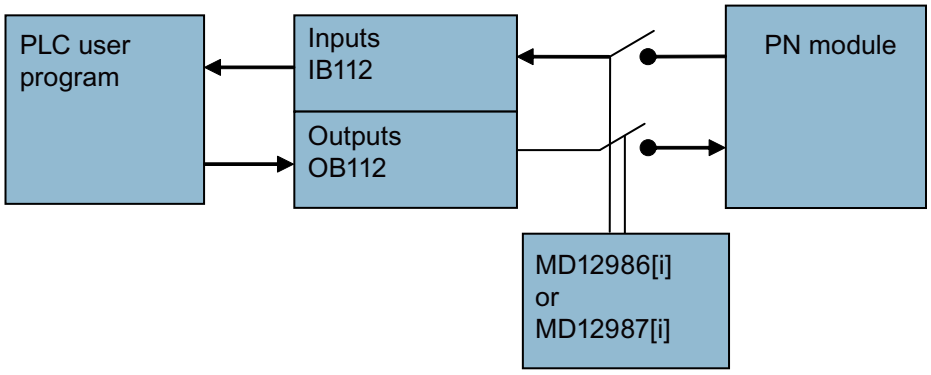


Figure 10-56 Example 2 - Activating an MCP USB using I/O-Addressing

Handheld Terminal HT 10

The HT 10 mobile handheld terminal combines the functions of an operator panel and a machine control panel in one device. It therefore provides the option of being able to completely operate and monitor a machine.



① Emergency stop button
② Display / touch screen
③ Handwheel (optional)
④ Rotary override switch
⑤ LED function keys

More information

- More information on commissioning the handheld terminal can be found in the Equipment Manual Operating components HT 10 handheld terminals (https://support.industry.siemens.com/cs/document/109783841/technical-documentation-for-sinumerik-operator-components?dti=0&lc=en-WW).
- More information about the interface signals is provided in the Function Manual PLC (https://support.industry.siemens.com/cs/document/109803073/sinumerik-828d-plc?dti=0&lc=en-WW).

More information on calibration and operation of the handheld terminal is provided in the online help under
Operate Universal/Turning/Milling/Grinding.

10.8.4.2 Addressing components

IP addresses of the PN components

The following table contains the IP address of the respective PN component. It is set on the PN component with a DIP switch. In this case, the maximum configuration with I/O modules, bus coupler and machine control panel via the PLC I/O Interface based on PROFINET is taken into consideration.

PN component	Bus	Device name	IP address	Input addresses	Output addresses
			192.168.216.	(active with MD12986[x] = -1)	
				Index n:	
1st PP module digital	PN	pp72x48pn9	9	0 ... 8	0 ... 5
2nd PP module digital	PN	pp72x48pn8	8	9 ... 17	6 ... 11
3rd PP module digital	PN	pp72x48pn7	7	18 ... 26	12 ... 17
4th PP module digital	PN	pp72x48pn6	6	27... 35	18 ... 23
5th PP module digital	PN	pp72x48pn5	5	36 ... 44	24 ... 29
Unassigned				**45**	**30 ... 55**
				Index d:	
1st PP module diagnostics	PN	pp72x48pn9	9	46 ... 47	--
2nd PP module diagnostics	PN	pp72x48pn8	8	48 ... 49	--
3rd PP module diagnostics	PN	pp72x48pn7	7	50 ... 51	--
4th PP module diagnostics	PN	pp72x48pn6	6	52 ... 53	--
5th PP module diagnostics	PN	pp72x48pn5	5	54 ... 55	--
				Index m:	
1st PP module analog	PN	pp72x48pn9	9	56 ... 63	56 ... 63
2nd PP module analog	PN	pp72x48pn8	8	64 ... 71	64 ... 71
3rd PP module analog	PN	pp72x48pn7	7	72 ... 79	72 ... 79
4th PP module analog	PN	pp72x48pn6	6	80 ... 87	80 ... 87
5th PP module analog	PN	pp72x48pn5	5	88 ... 95	88 ... 95
PN/PN coupler *	PN	pn-pn-coupler20	20	96 ... 111	96 ... 111
PN/PN coupler * expansion	PN	pn-pn-coupler20	20	156 ... 251	156 ... 251
External machine control panel	PN	mcp-pn64	64	112 ... 125	112 ... 121
Reserved		--	--	126 ... 131	122 ... 123
SENTRON PAC4200 *	PN	pac2200-pn21	21	132 ... 143	--

The Index n, m, d is always the start address of the address range.

*) The IP address of these components is not set using a switch but rather configured appropriately.

10.8.5 PN-IO device availability matrix

Shows availability of PN-IO devices for software and hardware combinations.

Hardware	Software	pp72x48pn9	pp72x48pn8	pp72x48pn7	pp72x48pn6	pp72x48pn5	pn-pn coupler20	spc-pac2200	mcp-pn64
(P)PU2[7,9]x.5	SW280	X	X	X	X	X	X	X	X
(P)PU2[7,9]x.5	SW260	X	X	X	X	-	X	X	X
(P)PU2[7,9]x.5	SW240	X	X	X	-	-	X	X	X
PPU26x.5	SW240	-	X	-	-	-	X	X	-

X indicates available

- indicates unavailable

Note

The PN-IO devices must be connected either to X150PN2 (available only for (P)PU2[7,9]x.5) or at the end of the PN topology, following PN-connected drive modules such as S200 or CU320.

10.9 SITOP power supply

Description



Figure 10-57 SITOP PSU100S

The 24 V power supply units from the SITOP range are optimized for industrial use and operate on the switched-mode principle. Due to the precisely regulated output voltage, the devices are even suitable for the connection of sensitive sensors. Different versions are available depending on the output current and field of application. Some versions are listed in the table below.

SITOP lite/smart does not require much space on the standard mounting rail. With its tolerant overload response, even loads with a high inrush current can be smoothly switched on. If required, 50% extra power is made available for 5 seconds.

Selection and ordering data

Description	Article number
Stabilized power supply SITOP lite 10 A 24 VDC, 1-phase	6EP1334-1LB00
Stabilized power supply SITOP smart 10 A 24 VDC, 1-phase	6EP1334-2AA01-0AB0
Stabilized power supply PSU100S 20 A 24 VDC, 1-phase	6EP1336-2BA10
Stabilized power supply PSU300S 10 A 24 VDC, 3-phase	6EP1434-2BA10
Stabilized power supply PSU300S 20 A 24 VDC, 3-phase	6EP1436-2BA10

Further information

You can find additional information on the Internet at SIOS_SITOP (http://support.automation.siemens.com/WW/view/en/10807212)

10.10 NX10.3 / NX15.3

10.10.1 Description

Properties

Using the NX10.3 and NX15.3 modules, you can expand the performance of an axis group of a SINUMERIK 828D CNC automation system. Each NX10.3 can control up to 3 additional axes and each NX15.3 can control up to 6 additional axes.

Type plate

The NX module type plate contains the following information:

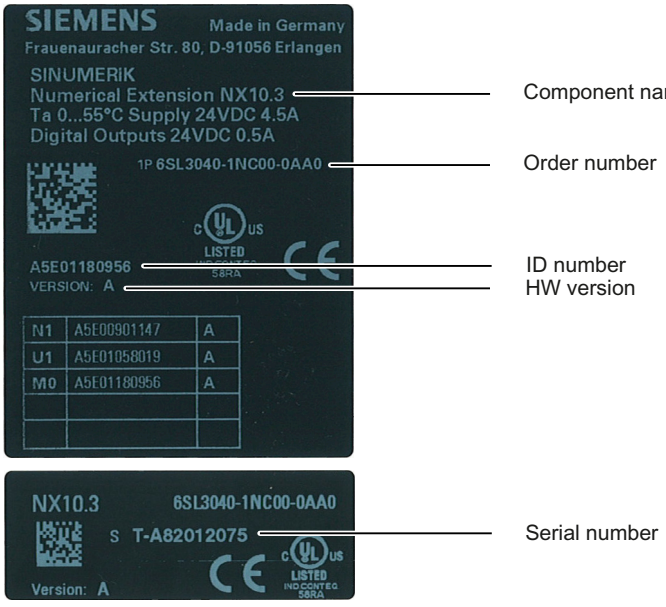


Figure 10-58 Type plate using the NX10.3 as example

Note

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

Display

The NX module has the following interfaces:

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

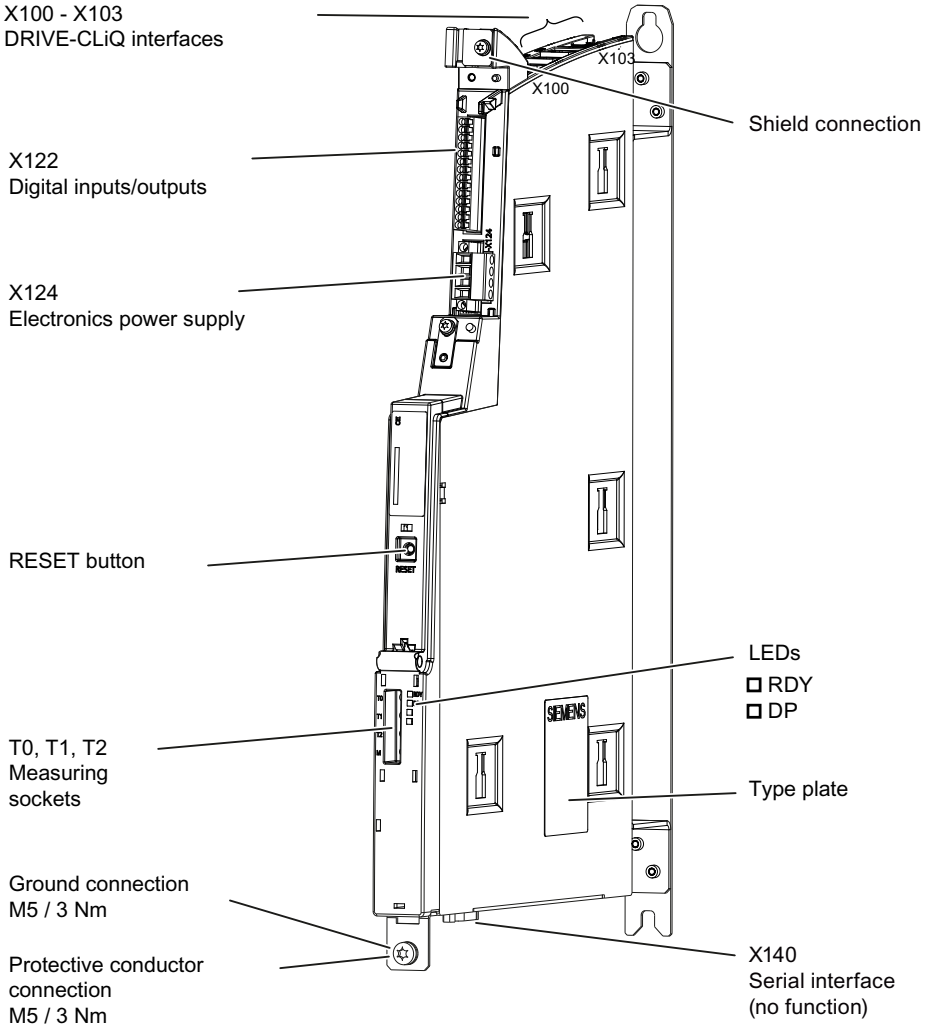


Figure 10-59 Display of the NX module (without cover)

LEDs for status display

The following status displays on the NX modules provide information about its state:

LEDs	Color	Status	Description
RDY	Off		Electronic power supply outside permissible tolerance range
	Green	Continuous light	The NX10.3 / NX15.3 is ready.
		Flashing 2 Hz	Writing to CompactFlash card
	Red	Continuous light	The NX10.3 / NX15.3 is presently powering up and at least one fault is active (e.g. RESET, watchdog monitoring, basic system fault).
		Flashing 0.5 Hz	Boot error (e.g. firmware cannot be loaded into the RAM)
	Yellow	Continuous light	Firmware is being loaded into the RAM.
		Flashing 0.5 Hz	Firmware cannot be loaded into the RAM.
		Flashing 2 Hz	Firmware CRC fault
DP	Off		Electronics power supply outside permissible tolerance range: The NX10.3 / NX15.3 is not ready.
	Green	Continuous light	CU_LINK is ready for communication and cyclic communication is running.
		Flashing 0.5 Hz	CU_LINK is ready for communication and cyclic communication is not running.
	Red	Continuous light	At least one CU_LINK fault is present. CU_LINK is not ready for operation (e.g. after switching on).

RESET button

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

Note

When the pushbutton is actuated, the locally connected drive systems are brought to a standstill with no feedback to the control. In other words, the drive and control run asynchronously once the drive has been successfully powered up.

10.10.2 Mounting

Designs

The NX10.3 / NX15.3 is integrated into the SINAMICS drive line-up. For the preferred installation sequence, the NX module should be mounted at the side of the Line Module.

NOTICE
Protection against overheating
The 80 mm ventilation spaces above and below the components must be observed.

Mounting aids

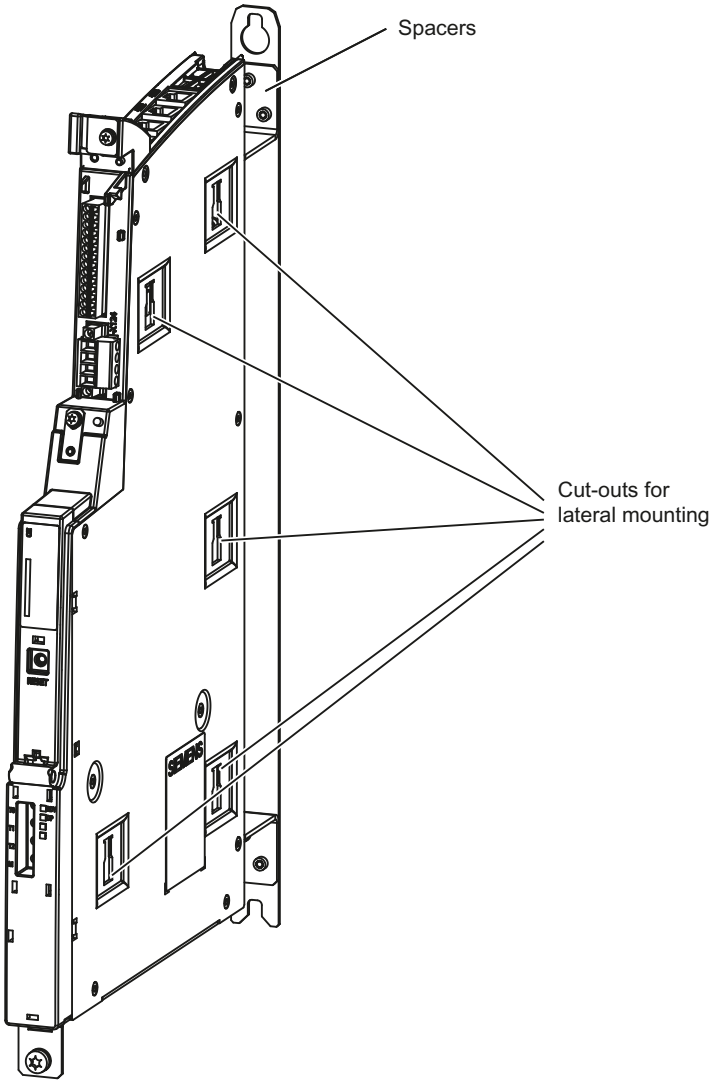


Figure 10-60 Mounting aids for the NX10.3 / NX15.3

Mounting an NX10.3 / NX15.3 onto an Active Line Module

Procedure:

1. Remove the spacers from the NX.
2. Position the NX on the left-hand side of the Line Module. The mounting fixtures fit exactly in the five cutouts on the NX.
3. Push the two units together.
4. Press down on the NX until it engages and is securely connected to the Line Module.

Dimension drawing

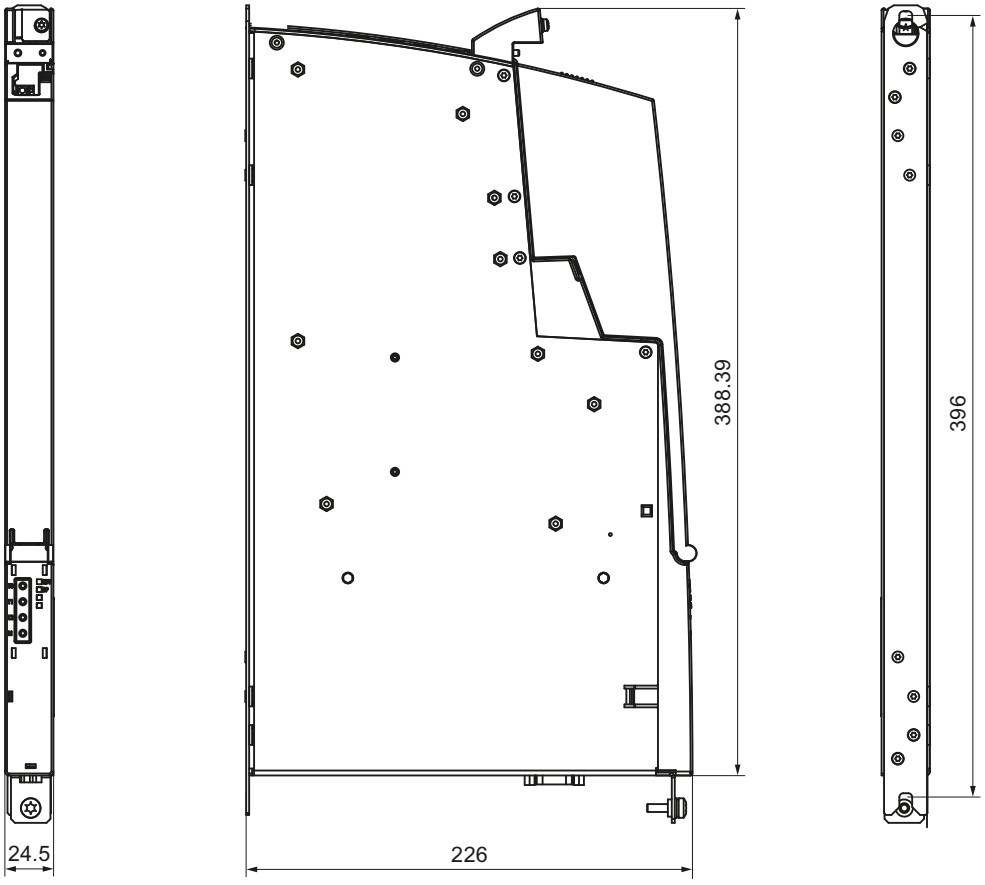


Figure 10-61 Dimensions NX10.3 / NX15.3

10.10.3 Connecting

X124 power supply pin assignment

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

Pin	Signal name		Meaning
1	+	(Voltage input)	Electronics power supply
2	+	(Voltage input)	Electronics power supply
3	M	(Voltage output)	Ground
4	M	(Voltage output)	Ground

Note

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

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

Note

Current consumption

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

X122 digital inputs/outputs pin assignment

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

Pin	Signal name	Meaning
1	DI0	Digital input 0
2	DI1	Digital input 1
3	DI2	Digital input 2
4	DI3	Digital input 3
5	DI16	Digital input 16
6	DI17	Digital input 17
7	M1	Reference potential for terminals 1 to 6
8	M	Ground
9	DI/DO8	Digital input/output 8 (rapid input)
10	DI/DO9	Digital input/output 9 (rapid input)
11	M	Ground
12	DI/DO10	Digital input/output 10 (rapid input)
13	DI/DO11	Digital input/output 11 (rapid input)
14	M	Ground

An open input is interpreted as "low".

Note

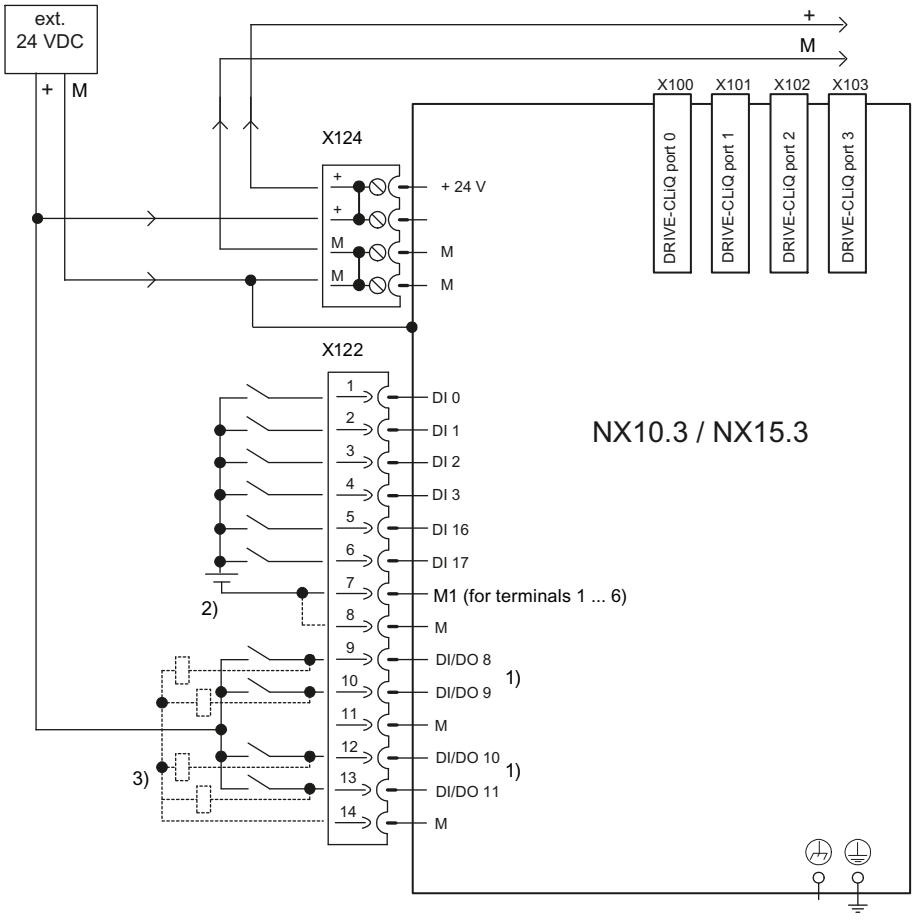
Terminal M1 must be connected for the digital inputs (DI) 0 to 3 and 16/17 to function. This can be done as follows:

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

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

Connection example

The digital inputs/outputs are connected appropriately during commissioning.



1) Rapid inputs must be shielded.
2) Jumper open, electrical isolation for digital inputs (DI)
3) Can be parameterized as either input or output

Figure 10-62 Connection example for the NX10.3 / NX15.3

See also

For the pin assignment of the DRIVE-CLiQ interfaces X100 - X103, please refer to Section "DRIVE-CLiQ (Page 175)".

For further information on DC voltage and standards, please refer to Section "Power supply (Page 150)".

10.10.4 Technical Data

Technical data of the NX10.3 / NX15.3

Parameter	Value
Input voltage	24 V DC
Permissible range	20.4 V - 28.8 V DC
Current (without DRIVE-CLiQ and digital outputs)	0.8 A
Inrush current	1.6 A
PE/ground connection	At the housing with screw M5/3 Nm
Number of axes, maximum	
• NX10.3:	3
• NX15.3:	6
Digital inputs	6
Digital inputs/outputs parameterizable	4
Cooling	Open-circuit ventilation
Pollution degree in acc. with EN 61800-5-1	2
Protection class in acc. with EN 61800-5-1	III (DVC A, PELV)
Degree of protection in acc. with EN 60529	IP20
Approvals	CE, cULus
Relative humidity:	
• Storage	5 ... 95 %
• Transport	5 ... 95 %
• Operation	5 ... 95 %
Ambient temperature:	
• Storage	-25 ... +55 °C
• Transport	-40 ... +70 °C
• Operation	0 ... +55 °C
Dimensions:	
• Width	25 mm
• Height	414 mm
• Depth	272 mm
Weight, approx.	2.58 kg

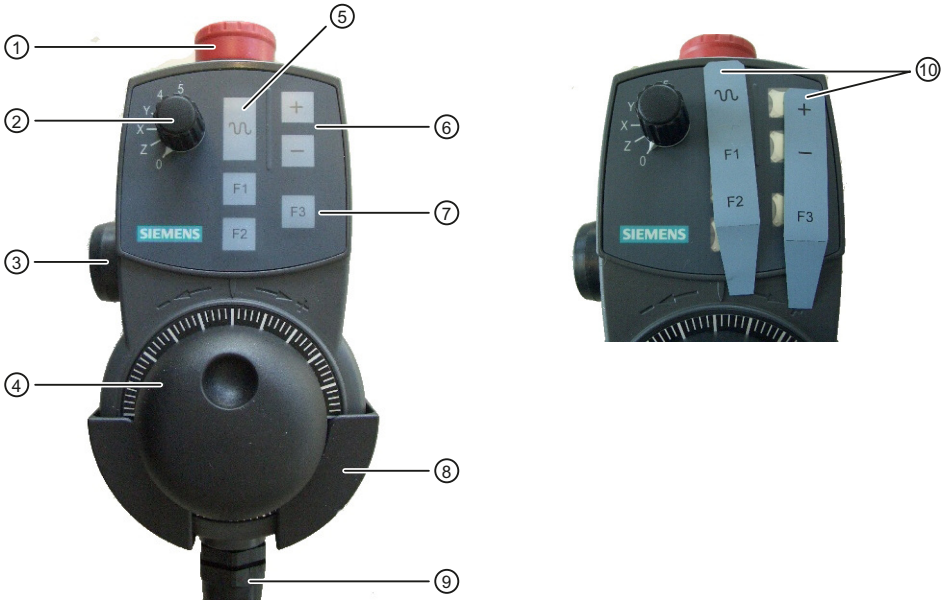
10.11 Mini handheld unit

Description

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

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

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



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

Figure 10-63 Operator controls of the mini handheld unit

10.11.1 Operator controls

Operator controls of the mini handheld unit

Features of the operator controls:

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

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

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

10.11.2 Mounting

Dimensions of the mini handheld unit

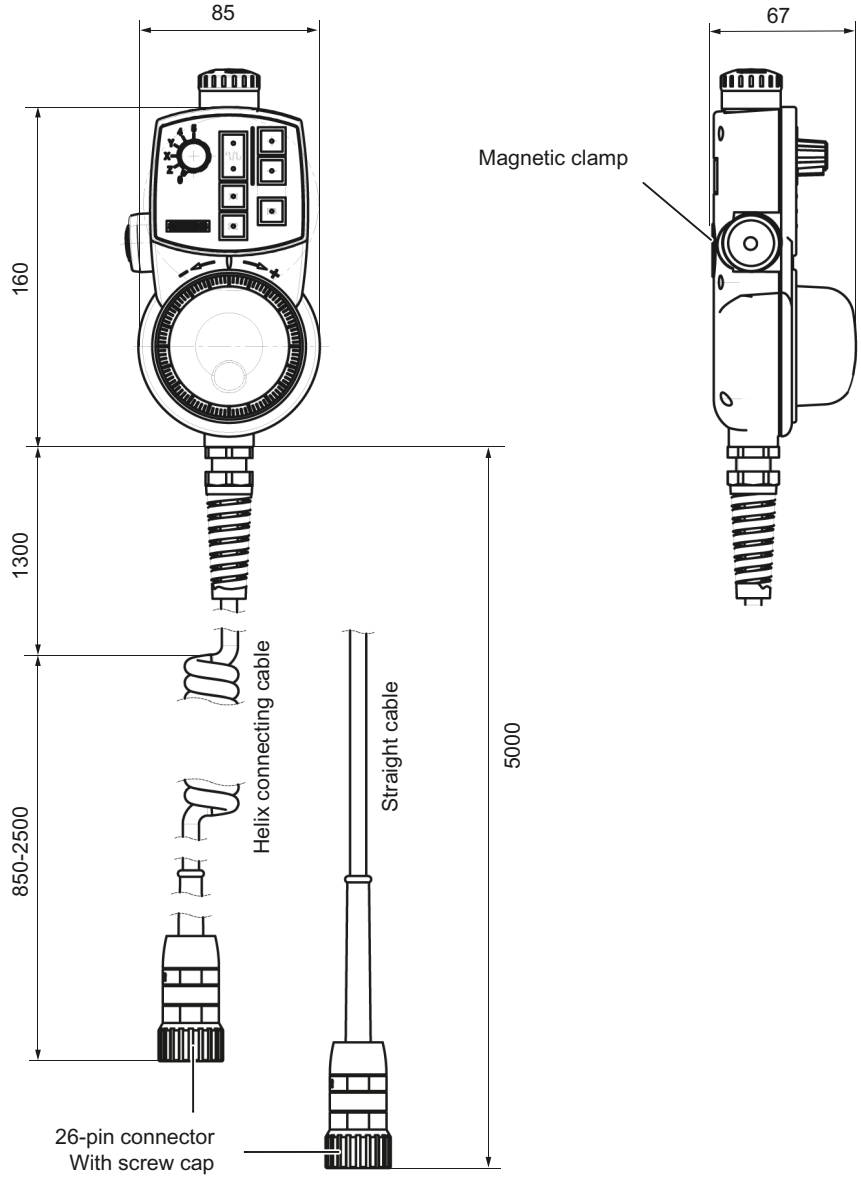


Figure 10-64 Dimension drawing of the mini HHU

Installing the connection kit

Procedure:

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

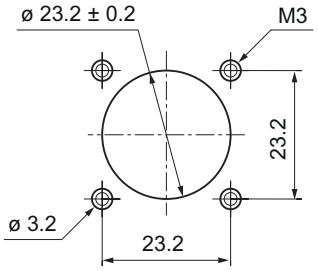


Figure 10-65 Hole pattern for mounting

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

Additional options

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

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

Note

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

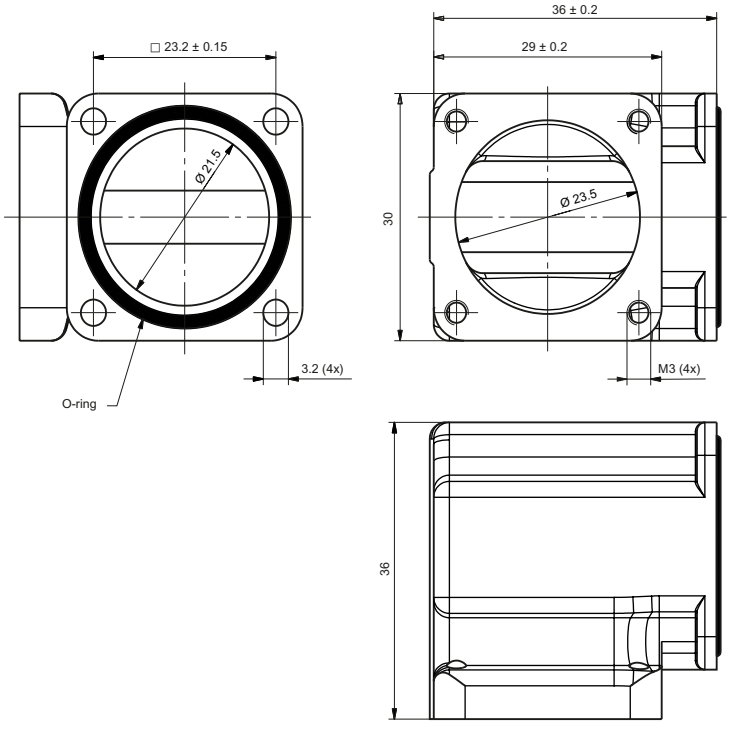


Figure 10-66 Dimension drawing of angled socket

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

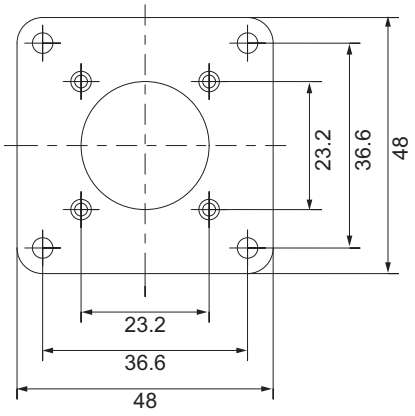


Figure 10-67 Dimension drawing of the adapter plate

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

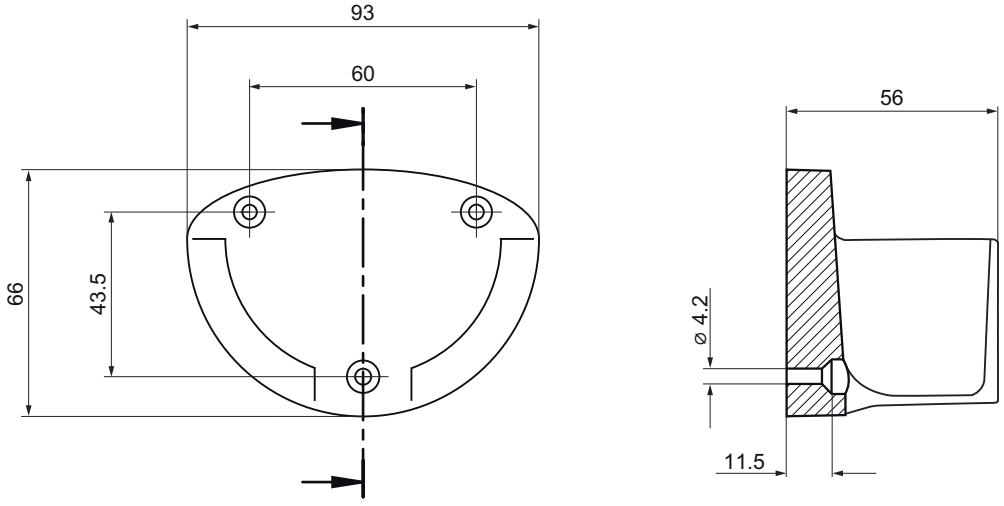


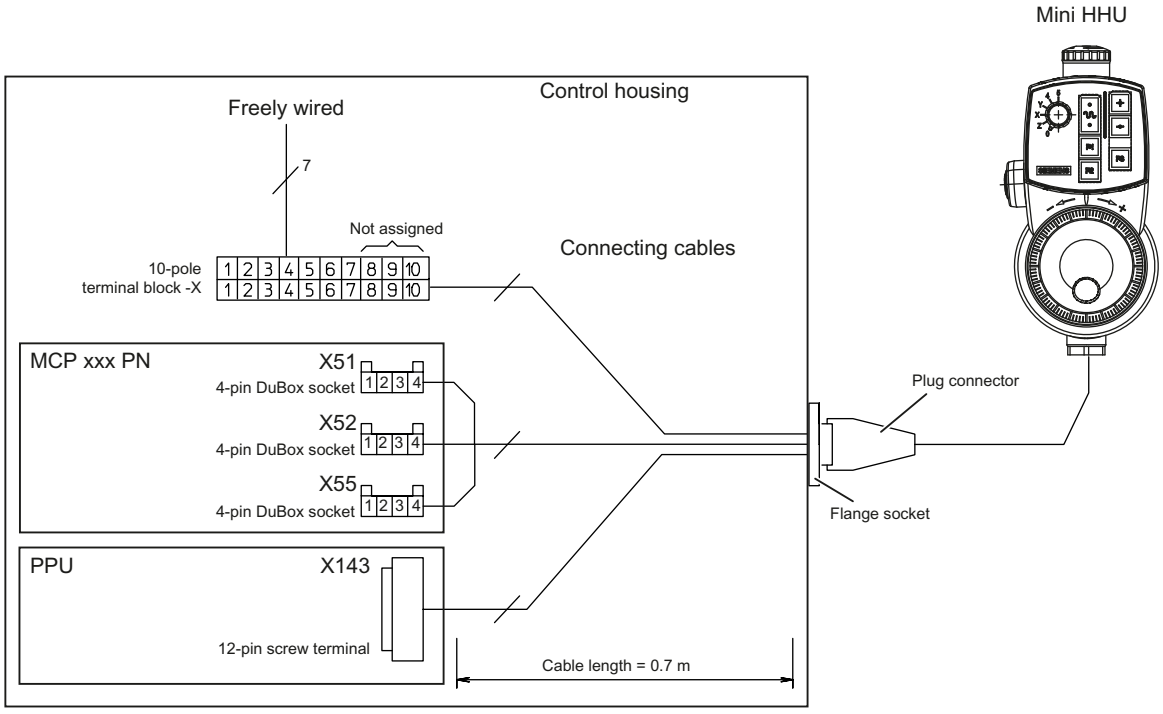
Figure 10-68 Dimension drawing of the holder

- **Slide-in labels**
  You can replace the slide-in labels. To do this, you must release the six Torx screws at the rear of the housing. The housing can now be taken apart. You can now withdraw the slide-in labels out of the guide on the front panel and replace them.
  Make sure that no connecting cables are pinched or crushed when reassembling.

10.11.3 Connecting

Connection diagram overview

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



MCP xxx PN: MCP 1200U-H, MCP 1200U-V

Figure 10-69 Connection using a prefabricated connection kit

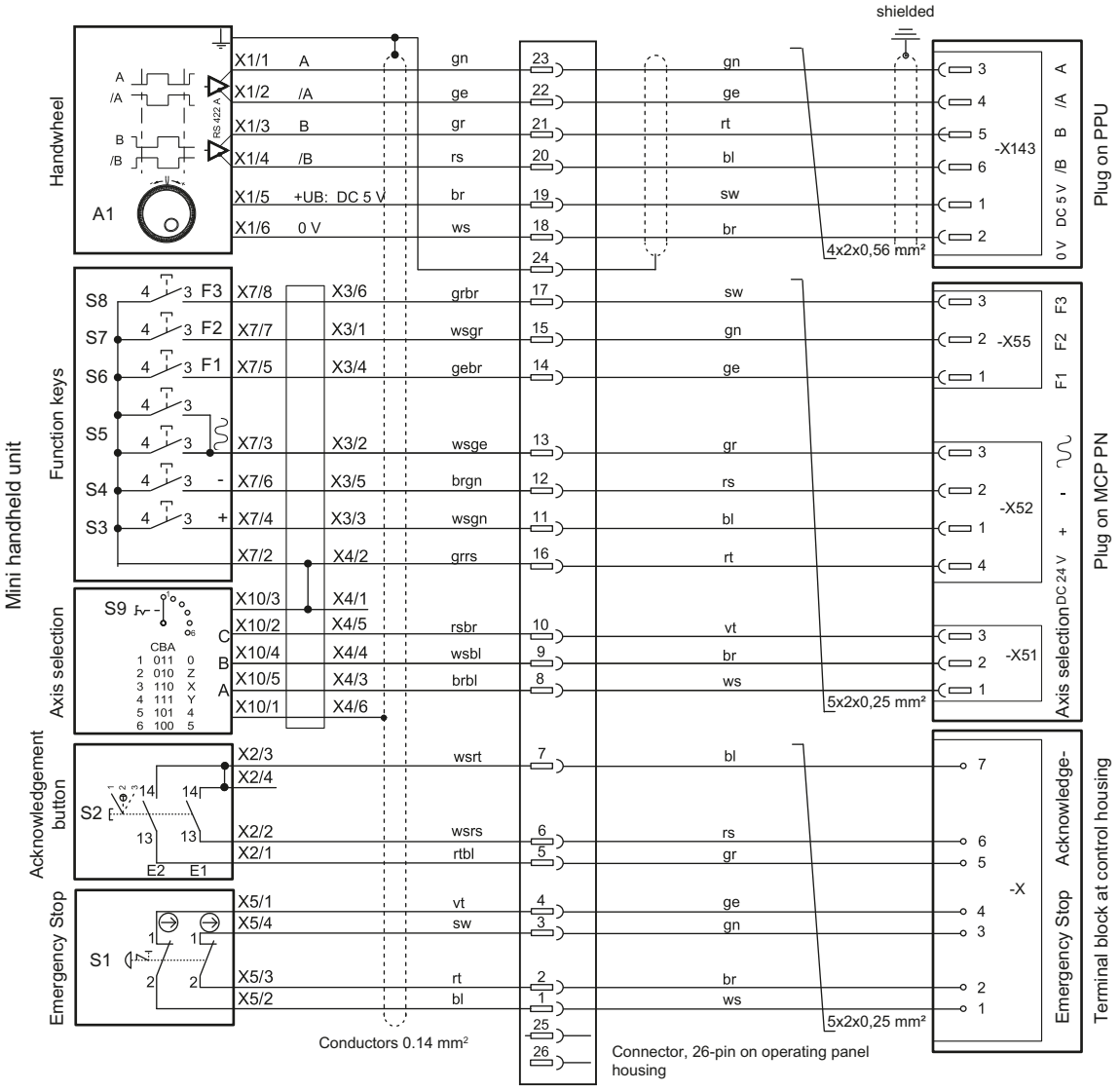
Note

Connecting the mini HHU to the MCP 1200U-H and MCP 1200U-V:

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

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

Circuit diagram



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

Figure 10-70 Circuit diagram of the mini HHU with prefabricated connection kit

Connection of the flange socket

Procedure:

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



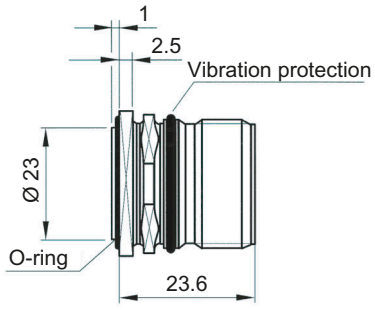


Figure 10-71 Flange socket

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

Note

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

10.11.4 Parameterization

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

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

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

On machine control panels **MCP 1200U-H and MCP 1200U-V**, the customer keys are assigned to input bytes **EB122 and EB123**.

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

Note

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

10.11.5 Technical data

Mini handheld unit

Parameter	Value	
Input voltage for switching signals	24 V DC	
Power supply for the handwheel	5 V DC	
Current drawn at 5 V DC	Approx. 90 mA	
Handwheel	100 pulses/rev	
Handwheel signals	RS422	
Emergency Stop button	24 V DC, 2 A	2 x NC contact
Enabling buttons	24 V DC	2 x NO contacts
Axis selector switch	24 V DC: 0.2 W	Gray code
Degree of protection without shaft input according to EN 60529	IP65	
Reliability, Emergency Stop button and enabling buttons	B_{10d} = 100 000	
Relative humidity:	Condensation not permissible	
• Storage	5 ... 95 %	
• Transport	5 ... 95 %	
• Operation	5 ... 95 %	

Parameter	Value
Ambient temperature:	
• Storage	-20 ... 60 °C
• Transport	-20 ... 60 °C
• Operation	0 ... 55 °C
Dimensions:	
• Height	180 mm
• Width	90 mm
• Depth	67 mm
Weight	Approx. 0.5 kg without connecting cable Approx. 1.3 kg with connecting cable
Max. cable length	25 m
Approvals	CE, cULus

Note

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

Operator controls

Element	Specification	
Acknowledgment button	Isolated, 2-channel	NO contact, 3-pole
Emergency Stop button according to EN ISO 13850	Isolated, 2-channel	NC contact, released by twisting
Axis selector switch	5 axes: X, Y, Z, 4. Axis, 5 Axis and neutral position	
	Jog key: rapid traverse	
	Jog key: positive traversing direction	
	Jog key: negative traversing direction	
Function keys F1, F2, F3 • Switching current • Contact rating	NO contact max. 0.1 A max. 1 W	

10.11.6 Spare parts and accessories

List of the spare parts

The following spare parts are available:

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

Ordering address:

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

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

Accessories

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

Component	Description	Article number
Connection kit	Assembled, metal version, with terminating connector	6FX2006-1BG20
Connection kit	Non-assembled, metal version, with terminating connector	6FX2006-1BG03
Angled socket	Metal design, for non-assembled connection kit	6FX2006-1BG56
Adapter plate	Non-assembled, plastic on metal version	6FX2006-1BG45
Holder	including three M4 screws	6FX2006-1BG70

Technical data

11

11.1 Technical Data

PU 272.5, PPU 26x.5, and PPU 27x.5

Parameter	PU 272.5	PPU 270.5 vertical	PPU 271.5 horizontal	PPU 260.5 vertical	PPU 261.5 horizontal
Input voltage	24 VDC + 20% / - 15%				
Rated current	1.7 A	2.1 A		1.5 A	
Power consumption, max.	41 W	50 W		41 W	
Power loss	25 W	36 W			
Cooling	Open-circuit ventilation				
Degree of protection according to EN 60529	IP20	IP65 (front) IP20 (rear)			
Protection class according to EN 61800-5-1	III (DVC A, PELV)				
Degree of contamination according to EN 61800-5-1	2				
Climatic and mechanical environmental conditions (Page 71)	Storage according to EN 60721-3-1 (2002) Transport according to EN 60721-3-2 (1997) Operation according to EN 60721-3-3 (2002)				
Display:					
Size	12.1"				
Resolution (pixel)	1280 x 800				
Pixel error	Error class II acc. to DIN EN ISO 9241-307				
Buffer time of the real time clock	4-6 weeks (after this time has elapsed, it may be necessary to set the system time)				
Dimensions:					
• Width	220 mm	326 mm	464 mm	326 mm	464 mm
• Height	345 mm	380 mm	237 mm	380 mm	237 mm
• Depth	74 mm	110 mm	110 mm	97 mm	97 mm
Weight, approx.	2.3 kg	5.5 kg	5.2 kg	4.7 kg	4.5 kg
Basic color of the front	614 anthracite (similar to RAL 7021)	614 anthracite (similar 804 black, RAL 9017 to RAL 7021)			

Further technical specifications for the PU and PPU can be found in chapter Interface description.

PPU 290.5

Parameter	PPU vertical
Input voltage	24 VDC + 20% / - 15%
Rated current	2.4 A
Power consumption, max.	72 W
Power loss	28 W
Cooling	Open-circuit ventilation
Degree of protection according toEN 60529	IP65 (front) IP20 (rear)
Protection class according toEN 61800-5-1	III (DVC A, PELV)
Degree of contamination according toEN 61800-5-1	2
Climatic and mechanical environmental conditions (Page 71)	Storage according to EN 60721-3-1 Transport according to EN 60721-3-2 Operation according to EN 60721-3-3
Display:	
Size	15.6"
Resolution (pixel)	1920 x 1080
Pixel error	Error class II acc. to DIN EN ISO 9241-307
Real time clock buffering time	≥30 days (minimum@40°C)
Dimensions:	
• Width	398 mm
• Height	464 mm
• Depth	110 mm
Weight, approx.	6 kg
Basic color of the front	614 anthracite (similar 804 black, RAL 9017 to RAL 7021)

Further technical specifications for the PU and PPU can be found in chapter Interface description.

Certificates

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

EC Declaration of Conformity

CE

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

Relevant directives and standards

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

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

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

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

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

Note

The PPU26x.5 variant does not have UL certification.

- **UK Conformity Assessed marking**

  UK
  CA

  The SINUMERIK 828D products comply with the designated British standards (BS) for programmable logic controllers published in the official consolidated list of the British Government. The SINUMERIK 828D products meet the requirements and protection targets of the following regulations and related amendments:

  – Electrical Equipment (Safety) Regulations 2016 (Low-Voltage)
  – Electromagnetic Compatibility Regulations 2016 (EMC)
  – Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016 (Explosion Protection)
  – Regulations on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2012 (RoHS)

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

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

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

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

  When the equipment is connected to an unsuitable power supply (Page 65) and/or insufficiently grounded or rear cover, exposed components may carry a hazardous voltage that might result in serious injury or death. Only use power supplies that provide PELV (Protective Extra Low Voltage) output voltages acc. to UL 61010 for all connections and terminals of the electronics modules.

EMC limit values in South Korea

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

The EMC limit values to be observed for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3 of category C2 or the limit value class A, Group 1 to KN11. By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are observed.

Further, additional measures may be required, such as using an additional radio interference suppression filter (EMC filter). The measures for EMC-compliant design of the system are described in detail in this manual respectively in the EMC Installation Guideline Configuration Manual (https://support.industry.siemens.com/cs/de/en/view/60612658).

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

Ground symbols

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

Recommended connectors

12

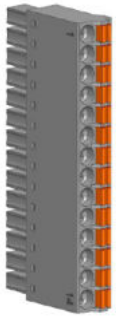
Accessory pack

Note

The connectors are not in scope of delivery for the PPU. You can buy the connectors as accessories.

To connect the cables with PPU, the accessory pack for PPU offers connectors, the accessory pack is available for purchase under MLFB 6FC5348-3AA00-0AA0.

The following variants of connectors are available in the accessory pack for PU/PPU:

Type	Quantity	Description
X1: Power supply 	1 pc	Supply 24V to PPU, 4 pin, wire type: Cu, 0.5–2.5 mm² (solid or stranded)
X122, X132: digital inputs and outputs X242, X252: digital inputs and outputs 	4 pcs	Provide the digital input and output, 14 pin, wire type: Cu, 0.2–1.5 mm² (solid or stranded).
X143.1, X143.2: Handwheel 	2 pcs	Connect to the handwheel, 6 pin, wire type: Cu, 0.2–1.5 mm² (solid or stranded)

Type	Quantity	Description
Cable set for X60 	1 pc	Signal cable pre-assembled for incremental encoder TTL Length • 5 m 6FX8002-2CD01-1AF0 • 7 m 6FX8002-2CD01-1AH0 • 10 m 6FX8002-2CD01-1BA0
Terminal strip converter see Chapter 10.9.7 (Page 339)	1 pc	Terminal strip converter from 50-pin IDC connector to Screw terminals for 1 to 1 connection O. LED
Cable set for X301/ X302	1 pc	Cable set for self-assembly, Ribbon cable, 50-pin, length 6 m (19.7 ft), with 8 insulation displacement connectors, 50-pin and strain relief clamp

Reference

For more information on type of delivery, cross-section, length, and technical specifications, refer the below manual.

- Catalog NC 82: SINUMERIK 828 Equipment for Machine Tools (https://support.industry.siemens.com/cs/document/109746977/)

Spare part and accessories

13

13.1 Ordering data

Ordering data

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

Designation	Article number
Panel Processing Unit without system software	
• PPU 261.5 horizontal	6FC5370-3AA50-0AA0
• PPU 260.5 vertical	6FC5370-2AA50-0AA0
• PU 272.5 standalone	6FC5370-7AA50-0AA0
• PPU 271.5 horizontal	6FC5370-5AA50-0AA0
• PPU 270.5 vertical	6FC5370-6AA50-0AA0
• PPU 290.5 vertical	6FC5370-8AA50-0BA0
SD card with system software and license	
• for SW 24x turning	6FC5835-1GY50- ☐ YA0
• for SW 24x milling	6FC5835-2GY50- ☐ YA0
• for SW 24x grinding	6FC5835-3GY50- ☐ YA0
• for SW 26x turning	6FC5834-1GY50- ☐ YA0
• for SW 26x milling	6FC5834-2GY50- ☐ YA0
• for SW 26x grinding	6FC5834-3GY50- ☐ YA0
• for SW 28x turning	6FC5836-1GY50- ☐ YA0
• for SW 28x milling	6FC5836-2GY50- ☐ YA0
• for SW 28x grinding	6FC5836-3GY50- ☐ YA0

Components

Designation	Article number
Machine control panels:	
• MCP 398C	6FC5303-0AF25-0AA0
• MCP 1200U-H	6FC5303-0AF32-1AA1
• MCP 1200U-V	6FC5303-0AF33-1AA1
• MCP 1500U	6FC5303-0AF34-1AA1
• Interface module MCP Interface PN	6FC5303-0AF03-0AA0
Handheld electronic handwheel	6FC9320-5DE02
Mini handheld unit:	
• With spiral connection cable	6FX2007-1AD03

Designation	Article number
• With straight cable	6FX2007-1AD13
I/O modules:	
• PP 72/48D PN (only digital I/O)	6FC5311-0AA00-0AA0
• PP 72/48D 2/2A PN (digital and analog I/O)	6FC5311-0AA00-1AA0
Increased number of axes:	
• Numeric Control Extension NX10.3	6SL3040-1NC00-0AA0
• Numeric Control Extension NX15.3	6SL3040-1NB00-0AA0

Accessories

Designation	Article number
Set of clamps (9x)	6FC5248-0AF14-0AA0
SENTRON PAC2200 Power Monitoring Device	7KM2200-2EA40-1EA1
SIMATIC DP PN/PN coupler	6ES7158-3AD10-0XA0
Terminal strip converter, 50-pin	6EP5406-5AA00
Blanking plates for the DRIVE-CLiQ interface	6SL3066-4CA00-0AA0
Stabilized power supply SITOP lite 10 A 24 VDC, 1-phase	6EP1334-1LB00
Stabilized power supply SITOP smart 10 A 24 VDC, 1-phase	6EP1334-2AA01-0AB0
Stabilized power supply PSU100S 20 A 24 VDC, 1-phase	6EP1336-2BA10
Stabilized power supply PSU300S 10 A 24 VDC, 3-phase	6EP1434-2BA10
Stabilized power supply PSU300S 20 A 24 VDC, 3-phase	6EP1436-2BA10

Appendix

A

A.1 Abbreviations

ALM	Active Line Module
ASIC	Application Specific Integrated Circuit
AWG	American Wire Gauge
BERO	Proximity limit switch
CAT5	Quality class (category) for shielded twisted pair network cables. Class 5 states that these cables have a particularly low damping factor, making them suitable for 100 Mbit/s-FastEthernet networks.
CE	The CE marking (Conformité Européenne, which means "compliance with EU directives") for products is a marking according to EU law in relation to product safety.
CNC	Computerized Numerical Control
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
DRIVE-CLiQ	Drive Component Link with IQ
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electro-Static Discharge: elektrostatische Entladung
LEDs	Light-emitting diode light-emitting-diode display
MAC	Media Access Control
MCP	Machine control panel
MLFB	Machine-Readable Product Code
N.C.	Not connected: Connection unassigned
NCK	Numerical Control Kernel: NC kernel with block preparation, traversing range, etc.
NX	Numerical eXtension (axis extension module)
OP	Operator Panel : Operator panel front
PCU	PC Unit: Computer unit
PG	Programming device
PLC	Programmable Logic Control: Programmable logic control (component of the CNC controller)
PN	PROFINET
QWERTY	keyboard assignment: American keyboard layout, the first six letters in the top row of letters, read from left to right.
RAM	Random Access Memory: Program memory which can be read and written into
SI	Safety Integrated
SLM	Smart Line Module
SMC	Cabinet-mounted sensor modules
SME	Sensor Module External

S/R	Steps per revolution: Pulses per revolution
USB	Universal Serial Bus: Bus system for connecting additional devices to a computer
VDE	Association of Electrical Engineering, Electronics and Information Technology (Germany)

Index

8

828D MCP
  USB interface, 206, 232

A

Air-conditioning
  Operation, 72, 74
  Storage and transport, 71, 74
Ambient conditions, 71, 73
Axis expansion, 351, 353

B

BERO proximity switches, 171

C

Cables
  Digital inputs/outputs, 165
  Ethernet, 154
  Handwheel, 179
  Power supply, 152
  PROFINET, 155
Connection options, 148, 149

D

Diagnostics
  Ethernet, 154
  PROFINET, 156
  System, 183
Digital inputs/outputs
  Cables, 165
  Technical data, 172
  wiring, 165
Dimension drawing
  MCP 1500U,
  MCP 1200U-H, 205
  MCP 1200U-V, 230
  MCP Interface PN, 276
DIP switch of the PN component, 348
DRIVE-CLiQ
  Interface, 175
  Wiring rules, 122
DRIVE-CLiQ Hub Module, 176
DRIVE-CLiQ wiring
  Safety Integrated functions, 134, 135, 137, 138, 139
  with NX 15.3, 139
  with NX10.3, 129, 130, 134, 135, 138
  without NX, 137

E

EKS identification system
  MCP 398C, 193
Emergency stop button
  MCP 1200U-H, 215
  MCP 1200U-V, 239
  MCP 1500U, 264
  MCP 398C, 198
Emergency Stop circuit
  828D MCP, 202
  MCP USB, 228
  MCP1500U, 253
Equipotential bonding connections, 69
Ethernet
  cable specification, 154
  Pin assignment, 153
Example with Safety Integrated functions and with NX15.3, CU320, 144

F

Finger gestures, 50
Function-impairing dust, 72, 75

G

Grounding measures, 65, 67, 216, 240, 265

H

Handwheel
  Portable, 295

I

Installation cutout
  PPU, 107
Installing the PPU, 99, 109

Installing the PU, 90, 93
Interface
X60 (Spindle encoder), 174
Interfaces
MCP Interface PN, 277
IP address, 348

K

Key assignment
MCP 1200U-H, 211
MCP 1200U-V, 236
MCP 1500U, 262
Key caps
MCP 398C, 193
Keys on the PPU, 47

L

LED displays
Ethernet, 154
I/O module, 303
MCP Interface PN, 275
PLC I/O interface port, 156
PROFINET, 319
Line connection, 66, 68
Line Module, 176

M

MAC address label, 303
MCP
PROFINET address, 289
MCP 1200U-H
Current consumption, 213
Emergency stop button, 215
Power consumption, 213
MCP 1200U-V
Current consumption, 238
Emergency stop button, 239
Power consumption, 238
MCP 1500U
Current consumption, 262
Emergency stop button, 264
Power consumption, 262
MCP 398C
Current consumption, 196
EKS identification system, 193
Emergency stop button, 198
Key caps, 193
Power consumption, 196
MCP 398C
Expansion modules, 194
Standard version, 193
MCP1500U
USB interface, 257
Mini handheld unit
Connection kit, 363
Description, 360
Motor Module, 176
Mounting position
MCP Interface PN, 275

N

Noise immunity, 69
NX10.3 / NX15.3
Connection example, 358
Mounting, 354
Mounting sequence, 353

O

Ordering data, 381

P

Panel cutout
Horizontal variant, 100
Vertical variant, 103
Vertical variant with touch screen, 104
Parameter assignment
AI/AO I/O module, 332
DI/DO I/O module, 331
MCP 1200U-H, 209
MCP 1200U-V, 234
MCP 1500U, 260
MCP Interface PN, 290
Pin assignment
Digital inputs/outputs, 158
DRIVE-CLiQ, 175
Ethernet, 153
Handwheel, 178
Power supply, 151
PN component
Addressing, 348
PN/PN coupler
Device name, 343
PROFINET IO network, 342
Potential equalization, 216, 240, 265
Power cables, 69
PPU variant horizontal, 37, 39

PPU variant vertical, 36, 37, 39
PROFINET
Pin assignment, 156
Pt100
Terminal assignment, 327

R

Radio interference, 73, 75
Recommended gloves, 49

S

SD card, 44
Sensor Module, 176
Servo motor, 62
Shielded signal cables, 69
Signal cables, 69
SIMOTICS S, 62
SIMOTICS T, 62
SINAMICS S120 Booksize Compact, 176
SINAMICS S120 Combi, 176
SINUMERIK 828D
Features, 31
Quantity structure, 32
Smart Line Module
Enabling signal, 147
Standard
Long-term storage, 71, 73
Stationary operation, 71, 73
Transport, 71, 73
System configuration
MCP Interface PN, 274
System error, 185, 190

T

Technical data, 196, 213, 238, 262
MCP Interface PN, 292
Mini HHU, 369
NX10.3 / NX15.3, 359
Terminal strip converter, 339
Technical specifications
PP 72/48D 2/2A PN, 338
PP 72/48D PN, 338
PPU 26x.5, 373
PPU 27x.5, 373
PPU 290.5, 374
PU, 373
Terminal Module, 177
The NCK rotary switch, 189
Topology
SINAMICS S120 booksize, 128, 129, 134, 135
SINAMICS S120 chassis+booksize, 130, 137, 138
SINAMICS S120 Combi+ booksize, 139
Torque motor, 62
Type plate
I/O module, 303
MAC address, 43
NX10.3 / NX15.3, 351
PU, 43
Type plates
MAC address, 41
PU, 41

W

Wiring rules DRIVE-CLiQ, 122
Work gloves, 49