SIEMENS

SINUMERIK 840D

Configuring the NCU

Manual

Valid for

Control
SINUMERIK 840D
SINUMERIK 840DE (export version)
SINUMERIK 840D powerline
SINUMERIK 840DE powerline

Drive
SIMODRIVE 611 digital

03/2006 Edition

SINUMERIK® documentation

Printing history

Brief details of this edition and previous editions are listed below.

The status of each edition is shown by the code in the "Remarks" column.

Status code in the "Remarks" column:

A . . . . . New documentation.
B . . . . . Unrevised reprint with new Order No.
C . . . . . Revised edition with new status.

Edition	Order No.	Remarks
06.94	6FC5297-0AC10-0BP0	**A**
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09.95	6FC5297-3AA01-0BP0	**Description of differences**
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12.98	6FC5297-5AC10-0BP0	**C**
08.99	6FC5297-5AC10-0BP1	**C**
04.00	6FC5297-5AC10-0BP2	**C**
10.00	6FC5297-6AC10-0BP0	**C**
09.01	6FC5297-6AC10-0BP1	**C**
11.02	6FC5297-6AC10-0BP2	**C**
11.03	6FC5297-6AC10-0BP3	**C**
12.04	6FC5297-7AC10-0BP0	**C**
03.06	6FC5297-7AC10-0BP1	**C**

Trademarks

All product names mentioned may be trademarks or product designations of Siemens AG or their suppliers, whose use by third parties for their own purposes may infringe the rights of the trademark owners.

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

We have checked that the contents of this document correspond to the hardware and software described. Nevertheless, differences might exist and therefore we cannot guarantee that they are completely identical. However, the information contained in this document is reviewed regularly and any necessary changes included in subsequent editions. We welcome suggestions for improvement.

Subject to change without prior notice.

Preface

SINUMERIK Documentation

The SINUMERIK documentation is subdivided into 3 parts:

- General Documentation

- User documentation

- Manufacturer/Service documentation

A list of documents with the respective available languages is updated on a monthly basis and is available on the Internet at:
http://www.siemens.com/motioncontrol
Select "Support" → "Technical Documentation" → "Overview of Documents".

The Internet version of the DOConCD (DOConWEB) is available at:
http://www.automation.siemens.com/doconweb

Information on the training offerings and on FAQs (frequently asked questions) can be found in the Internet under:
http://www.siemens.com/motioncontrol and menu item "Support".

Target group

This documentation is intended for:

- Project engineers, electricians and installers

- Maintenance and service personnel

Benefits

The information in this manual enables installation of the SINUMERIK 840D Numerical Control and measures for maintenance and service to be carried out.

Standard version

This documentation only describes the functionality of the standard version. Extensions or changes made by the machine tool manufacturer are documented by the machine tool manufacturer. Other functions not described in this documentation might be executable in the control. This does not, however, represent an obligation to supply such functions with an initial delivery or when servicing.

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

Technical Support

If you have any questions about the control, please contact the hotline:

Europe and Africa time zone

A&D Technical Support
Tel.: +49 (0) 180 / 5050 222
Fax: +49 (0) 180 / 5050-223
Internet: http://www.siemens.com/automation/support-request
E-mail: mailto:adsupport@siemens.com

Asia and Australia time zone

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America time zone

A&D Technical Support
Tel.: +1 423 262 2522
Fax: +1 423 262 2289
Internet: http://www.siemens.com/automation/support-request
E-mail: mailto:adsupport@siemens.com

Note

Country-specific telephone numbers for technical support are provided under the following Internet address:

 http://www.siemens.com/automation/service&support

Questions about the manual

For questions on the documentation (suggestions, corrections), please send a fax or e-mail to the following address:
Fax: +49 (0) 9131 / 98 - 63315
E-mail: mailto:motioncontrol.docu@siemens.com

Fax form: See the reply form at the end of the brochure

SINUMERIK Internet address

http://www.siemens.com/sinumerik

EC Conformity Declaration

The EC conformity declarations on EMC are to be found at/can be obtained from:

- In the Internet:
  http://www.ad.siemens.com/csinfo
  under the product/order no. 15257461

- At the relevant branch office of the A&D MC group of Siemens AG.

Safety information

This manual contains information which you should observe in order to ensure your own personal safety, as well to avoid material damage. Notices which are relevant to your own personal safety are highlighted by a safety alert symbol; notices which are relevant only to equipment and property damage have no safety alert symbol. The warnings appear in decreasing order of risk as given below.

Danger

Indicates that death or serious injury **will** result if proper precautions are not taken.

Warning

Indicates that death or serious injury **may** result if proper precautions are not taken.

Caution

With a safety alert symbol, indicates that minor personal injury **may** result if proper precautions are not taken.

Caution

Without a safety alert symbol, indicates that property damage **can** result if proper precautions are not taken.

Notice

Indicates that an undesirable event or state **may** arise if the relevant notes are not observed.

If several hazards of different degrees occur, the hazard with the highest degree must always be given priority. If a warning note with a warning triangle warns of personal injury, the same warning note can also contain a warning of material damage.

Qualified personnel

Startup and operation of the device / equipment / system in question must only be performed using this documentation. Only **qualified personnel** should be allowed to commission and operate the device/system. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Proper use

Please note the following:

Warning

The equipment may only be used for single purpose applications explicitly described in the catalog and in the technical description and it may only be used along with third-party devices and components recommended by Siemens. To ensure trouble-free and safe operation of the product, it must be transported, stored and installed as intended and maintained and operated with care.

Danger notes Should it be necessary to test or take measurements on live equipment, then the specifications and procedures defined in Accident Prevention Regulation of the Berufsgenossenschaft BGV A3 (German employer's liability insurance association) must be adhered to, in particular § 8 "Permissible deviations when working with live components". Suitable electric tools should be used.

> **Danger**
>
> Operating electrical equipment has parts and components that are at hazardous voltage levels.
>
> After disconnecting all the supply voltages, a hazardous voltage will be present in the DC link of all SIMODRIVE modules for another 5 minutes!
> See Operating Guide

> **Danger**
>
> - Repairs to devices that have been supplied by our company must only be carried out by **SIEMENS Customer Service** or by repair centers **authorized by SIEMENS**. When replacing parts or components, only use those parts that are included in the spare parts list.
>
> - Before opening the equipment, always ensure that the power is off.
>
> - EMERGENCY STOP devices complying with EN 60204 (VDE 0113 Part 1) must remain effective in all automation equipment modes. Resetting the EMERGENCY STOP device must not cause an uncontrolled or undefined restart.
>
> - Anywhere in the automation equipment where faults might cause major material damage or even physical injury, in other words, where faults could be dangerous, additional external precautions must be taken, or facilities must be provided, that guarantee or enforce a safe operational state, even when there is a fault (e.g. using an independent limit value switch, mechanical interlocks etc.).

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

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

ESDS information   **E**lectrostatically **S**ensitive **D**evices

!

Important

Handling of modules containing devices sensitive to electrostatic discharge:

- When handling components which can be destroyed by electrostatic discharge, it must be ensured that personnel, the workstation and packaging are well grounded!

- Generally, electronic modules must not be touched unless work has to be carried out on them. Only touch electronic modules after you have grounded yourself.

- Touch components only if:

  – you are constantly grounded via an ESD arm band,

  – ESD-shoes or ESD-shoe grounding strips if there is an ESD floor.

- Modules may be placed only on electrically conductive surfaces (table with ESD top, conductive ESD foam plastic, ESD packing bags, ESD transport containers).

- Keep modules away from visual display units, monitors or TV sets (minimum distance from screen 10 cm).

- Do not bring ESD-sensitive modules into contact with chargeable and highly-insulating materials, such as plastic, insulating table tops or clothing made of synthetic materials.

- Measurements on modules are allowed only if

  – the measuring instrument is properly earthed (e.g. equipment grounding conductor), or

  – before measuring with a potential-free measuring instrument, the probe is briefly discharged (e.g. touch the unpainted metal parts of the control housing).

Additional notes

!

Important

This notice indicates important facts that must be taken into consideration.

Note

This note contains additional important information.

Notes

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SINUMERIK 840D Configuring Manual NCU (PHD) – 03.06 Edition

Contents

System Overview

1

1.1 System configuration

Introduction

A numeric control is modular in design. The central control units of an 840D system are shown in Fig. 1-1:
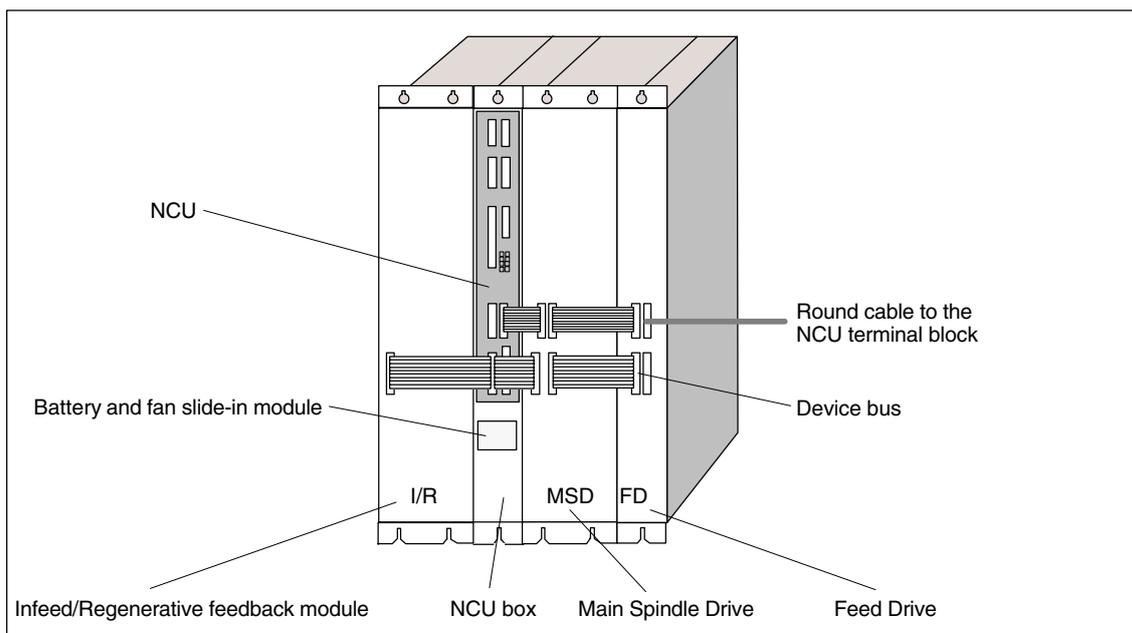
Fig. 1-1   Central control units SINUMERIK 840D

The subject of this document is the NCU, the central processing unit of the 840D controller. It contains the NC-CPU and the PLC-CPU.

The NCU has the following tasks:

- Execute the NC program
- Maintain communication with the peripherals.

Note

When using I/O devices, ensure that they are suitable for industrial use!

The NCU is installed in a housing called the NCU box. This housing also contains a power supply and a fan subassembly.

Connection   The NCU can communicate with the peripheral components via numerous inter-
configuration   faces. These are shown in Fig. 1-2 with their connections to the NCU and ex-
                        plained in more detail in Table 1-1:
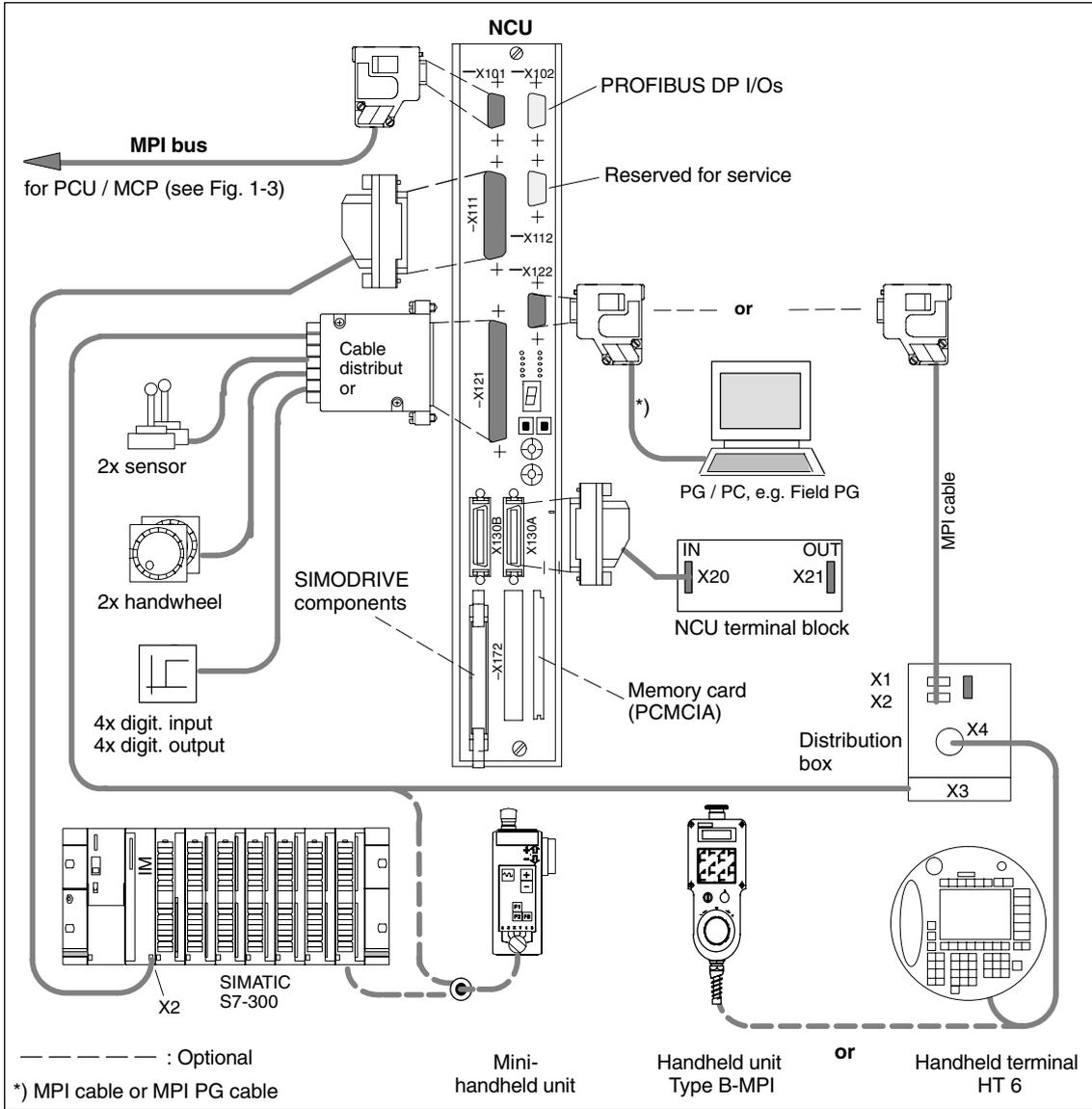
Fig. 1-2   SINUMERIK 840D system overview

Table 1-1   Components of the 840D

Component	Description
NCU	Central processing unit of 840D
Cable distributor	• Connection of up to 2 probes • Connection of up to 2 handwheels • Connection of up to 4 digital inputs and outputs • 24V supply for connection to MPI connector
SIMODRIVE components	**References:** /PJU/, Configuration Manual Converters
NCU terminal block	High-speed NC I/Os • Analog I/Os • Digital I/Os
Memory card (PCMCIA)	• Contains the system program • Can be plugged into the NCU
Distribution box	• For linking the handheld unit/handheld terminal to the MPI bus • Connection for EMERGENCY STOP circuit, enable keys, handwheel, 24 V DC
Mini-handheld unit	see [1])
Handheld unit [1])	• Connect handheld unit/handheld terminal via MPI • Handwheel, EMERGENCY STOP button, key-actuated switch, override, agreement buttons, display, unassigned keys
Handheld Terminal HT 6 [1])	see [1])

The components marked with [1]) are described in:
References: /BH/, Operator Components Manual

Note

If additional SIMODRIVE monitoring modules are used, they must be switched at the same time as the infeed unit. In a multi-tier configuration, all the infeed supply units must be connected simultaneously.
For cable, see
Reference: Catalog NC 60, MOTION-CONNECT cables and connections

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1.1   System configuration

**PCU–MCP
configuration**

Fig. 1-3 shows an OP 012-PCU 50 combination. It is connected to the NCU via the MPI bus (see Fig. 1-2).
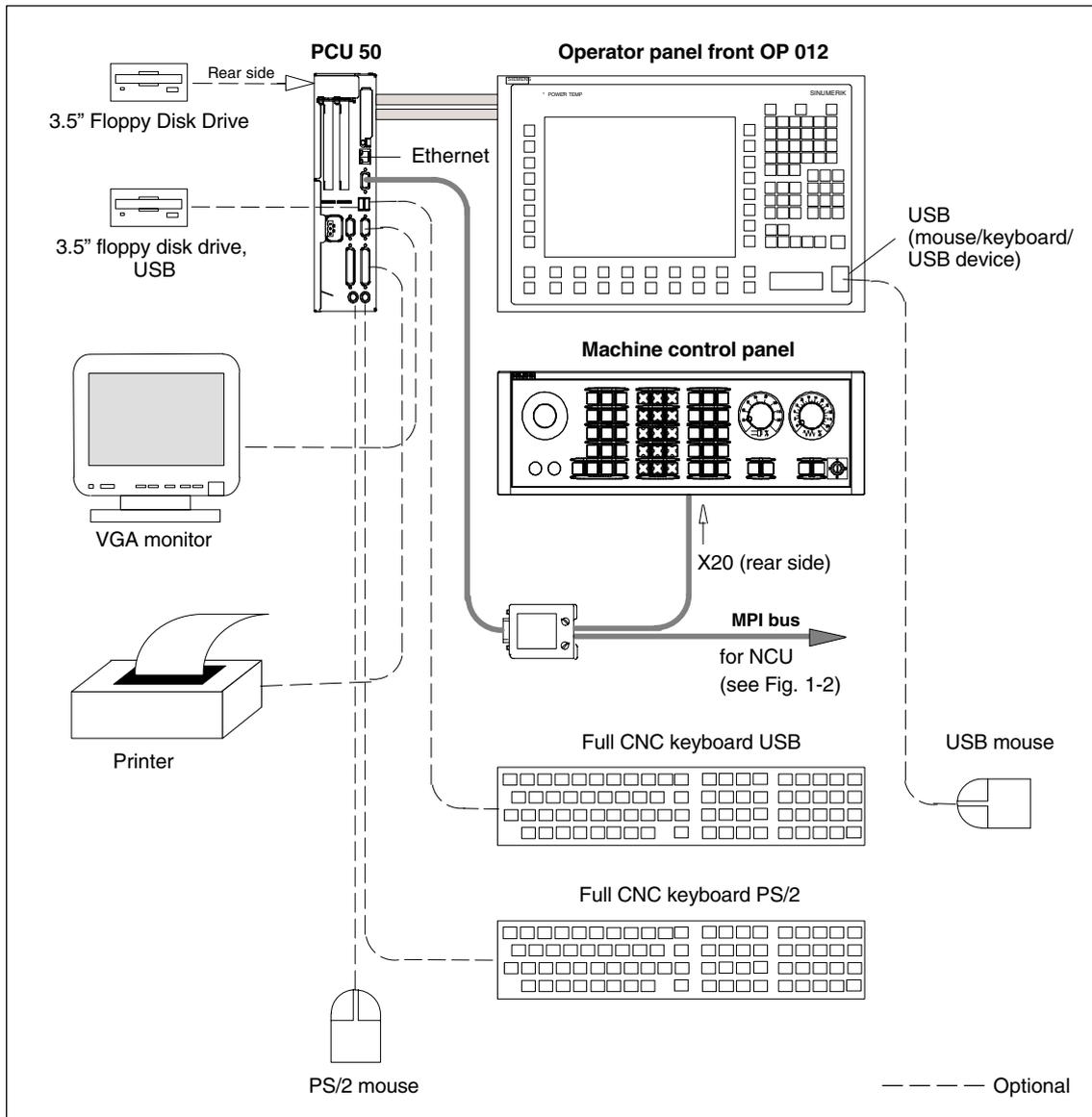
Fig. 1-3   Components of the OP 012-PCU 50 configuration

All the components, except for the printer, mouse and monitor are described in:

Reference: /BH/, Operating Components Manual

SW – HW combinations   The following tables show the possible combinations of software and hardware:

Table 1-2   Software - hardware combination options for NCU 5xx.3 to SW 6.4

NCU system software		NCU hardware			
Designation	**Order No.**	**561.3**	**571.3**	**572.3**	**573.3**
NCU system software 2 axes on PC card, Export 840DE	6FC5250-☐PX10-☐AH☐	✔	✔	–	–
NCU system software 6 axes on PC card, Export 840DE	6FC5250-☐BX10-☐AH☐	–	✔	–	–
NCU system software 12 axes on PC card • Standard 840D • Export 840DE	 6FC5250-☐BX30-☐AH☐ 6FC5250-☐BY30-☐AH☐	 – –	 – –	 ✔ ✔	 ✔ ✔
NCU system software 12 axes on PC card, standard 840D incl. software version-specific additional functions	6FC5270-☐BX30-☐AH☐	–	–	✔	✔
NCU system software 31 axes on PC card • Standard 840D • Export 840DE	 6FC5250-☐AX30-☐AH☐ 6FC5250-☐AY30-☐AH☐	 – –	 – –	 ✔ ✔	 ✔ ✔
NCU system software 31 axes on PC card, standard 840D incl. software version-specific additional functions	6FC5270-☐AX30-☐AH☐ 6FC5270-☐AX31-☐AH☐ 6FC5270-☐AX32-☐AH☐	–	–	✔	✔

✔ combination possible; **–** combination not possible

Table 1-3   Combination possibilities for software and hardware for NCU 5xx.4 and NCU 5xx.5, SW 6.5 or higher

NCU hard-ware	NCU system software			
	2 axes	6 axes	12 axes	31 axes
561.4/.5	max. 2 out of 2 axes, max. 2 channels	max. 2 out of 2 axes, max. 2 channels	max. 2 out of 2 axes, max. 2 channels	max. 2 out of 2 axes, max. 2 channels
571.4/.5	max. 2 out of 2 axes, max. 2 channels	max. 6 out of 31 axes, max. 2 channels	max. 6 out of 31 axes, max. 2 channels	max. 6 out of 31 axes, max. 2 channels
572.4/.5	max. 2 out of 2 axes, max. 2 channels	max. 6 out of 31 axes, max. 2 channels	max. 12 out of 31 axes, max. 2 channels *)	max. 31 out of 31 axes, max. 10 channels
573.4/.5	max. 2 out of 2 axes, max. 2 channels	max. 6 out of 31 axes, max. 2 channels	max. 12 out of 31 axes, max. 2 channels *)	max. 31 out of 31 axes, max. 10 channels

*) for SW 7.2 or higher: max. 4 channels

1.2   Labels and stickers

In case of technical queries or service, please quote all data on the rating plate to the local SIEMENS office responsible for your equipment.

One of the following labels is attached to the components and modules:

PCBs with screen printing

Example:

Component number: 570 573.9001.00
Product version: B (last cross)
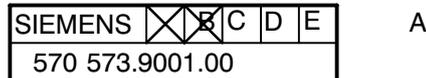
NCU

Example:

Component name: NCU 573.4
MLFB: 6FC5357-0BB34-0AE0
Component number: GWE-570038963520
Version F (printed)

NCU box

Example:

Component name: NCU box
MLFB: 6FC5247-0AA00-0AA2
Component number: GWE-570038901611
Version H (printed)
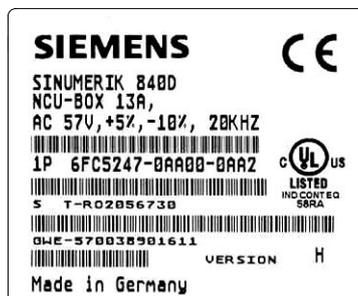
1.3   Non-Siemens keyboards

**Standard PC
keyboard**

When standard PC keyboards are used, ensure that they have a CE symbol
and correspond to industrial requirements. Otherwise, there may be problems
with the PC keyboard.

If you encounter problems, contact the relevant regional office.

■

Notes

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Connection Conditions

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

2.1 Secondary electrical conditions

Compliance with the connection conditions

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

- These environmental conditions are maintained when storing, transporting and operating the equipment,

- Original components and spare parts are used. This applies in particular to the use of specified cables and plug connectors,

- The equipment has been correctly mounted/installed.

⚠ **Danger**

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

Assistance and support

The connection conditions must be carefully maintained for the complete system. Please contact your local Siemens office or representative for any assistance.

2.1.1 Power supply

Demands on DC power supplies

Warning

- The DC power supply is always referenced to ground and must be generated by a safety transformer.

- User interfaces must be powered via a DC power supply with safe isolation to EN 61800–5–1.

- In the case of supply cables > 10 m, protective elements must be fitted at the device input in order to protect against lightning (surge voltage).

- The DC power supply must be connected to the ground/shield of the NC for EMC and/or functional reasons. For EMC reasons, this connection should only be made at one point. As a rule, the connection is provided as standard in the S7-300 I/Os. If this is not the case in exceptional circumstances, the ground connection should be made to the grounding rail of the NC cabinet; also refer to /EMC/ EMC Configuration Guideline.

Table 2-1   Requirements of the DC power supply

Rated voltage	In accordance with EN 61131–2	24 VDC
	• Voltage range (mean value)	20.4 VDC to 28.8 VDC
	• Voltage ripple peak-to-peak	5% (unfiltered 6-pulse rectification)
	• Booting time at POWER ON	Any value
Non-cyclic overvoltage		$\leq$ 35 V
	• Duration	$\leq$ 500 ms
	• Recovery time	$\geq$ 50 s
	• Events per hour	$\leq$ 10
Transient voltage interruptions	• Idle time	$\leq$ 3 ms
	• Recovery time	$\geq$ 10 s
	• Events per hour	$\leq$ 10

2.1.2   Safe isolation to EN 61800–5–1

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

End user interfaces (UI)

UIs are all the interfaces that are freely accessible to the machine operator without the need for tools or aids. These user interfaces are designed with safe isolation to EN 61800–5–1.

Interfaces for servicing, startup and maintenance

Danger

The interfaces for servicing, start-up and maintenance purposes are provided **without** safe isolation.

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

Danger

Safe isolation can only be ensured if the system configuration specified below is strictly adhered to. When mounting additional components (e.g., S7-300 FM, IP) with a UI, please make sure that the UI has basic insulation for at least 230 V AC.

2.1   Secondary electrical conditions
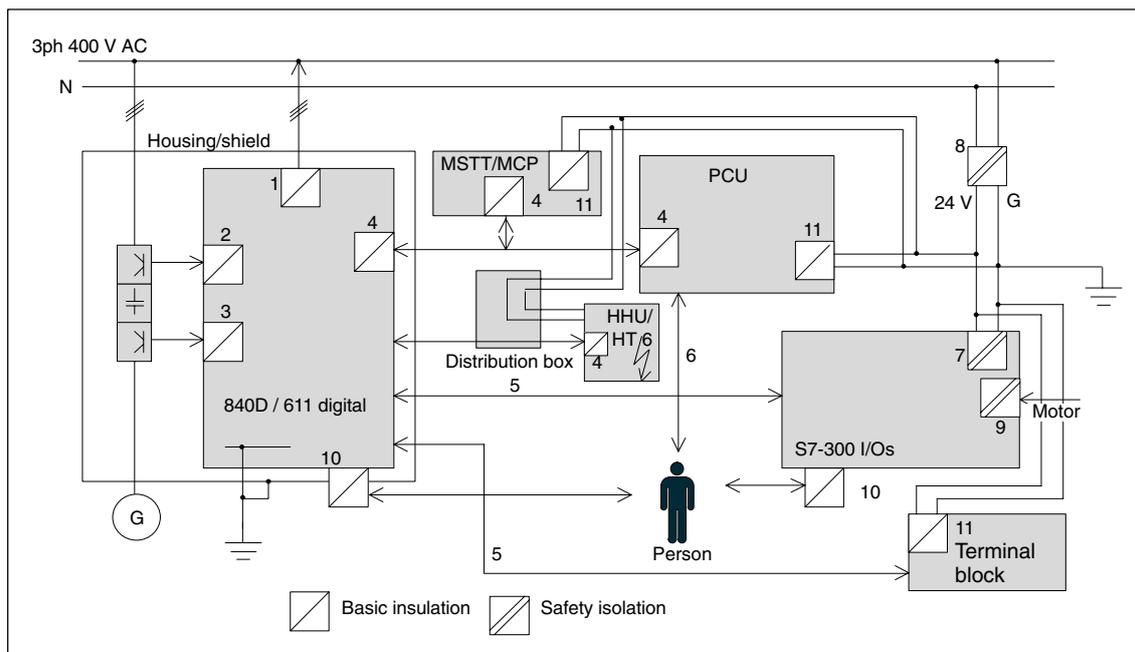
Fig. 2-1   Safe isolation to EN 61800–5–1

Fig. 2-1 shows the various electrical potentials of the 840D/611D/S7-300 system. Legend:

1. Floating power supply of the SIMODRIVE electronics unit with 230 V AC basic insulation.

2. Floating transistor triggers for the three-phase rectifier bridge with 230 V AC basic insulation.

3. Floating transistor triggers for each axis of the three-phase inverter bridge with 230 V AC basic insulation.

4. Floating signal connection from the NCU to the PCU or HHU with 230 V AC basic insulation.

5. Non-floating signal connection between NCU and I/O devices.

6. Non-floating end user interface with protective separation for 230 VAC through interfaces 1 to 4 and 7.

7. Protectively separated 5 V DC power supply, fed from a protectively separated 24 V DC supply.

8. 24 V DC power supply unit for external devices and for the machine adaptation control according to applicable standards in the form of a PELV (Protective Extra Low Voltage) circuit featuring safe isolation.

9. Floating interfaces to the machine (not accessible to the end user).

10. Floating signal interfaces directly accessible to the end user (e.g., V.24). For these interfaces, you must always make sure that there is either safe isolation with respect to the line supply voltage or that there are two basic insulation levels, for 230 V AC each.

11. 5 V DC power supply with basic insulation, fed from a safely-isolated 24 V DC supply.

2.1.3   Grounding concept

The SINUMERIK 840D system consists of a number of individual components, each of which must comply with the appropriate EMC and safety standards. The individual system components are:

- NCU box

- Machine control panel MCP

- Keyboard

- Operator panels (operator panel front + PCU/TCU)

- NCU terminal block

- Distributor box and handheld unit

- S7-300 I/O with IM 361 interface module

- Single I/O module

The NCU box is a 50 mm wide cassette that is integrated into the infeed/regenerative feedback (I/RF) unit, FSD and MSD.

The individual modules are attached to a metal cabinet panel by means of screws. Make sure that near the screws a low-impedance contact of the NCU box with the cabinet wall can be made. Insulating paints at the contact point must be removed. The electronic grounding points of the modules are interconnected via the device and drive bus and at the same time conducted to the X131 terminal of the I/RF module.

The ground and module ground M should be connected at the power supply terminal of the IM 361. Further, for the EFP, "SHIELD" and "M24" must be connected in connector X1.
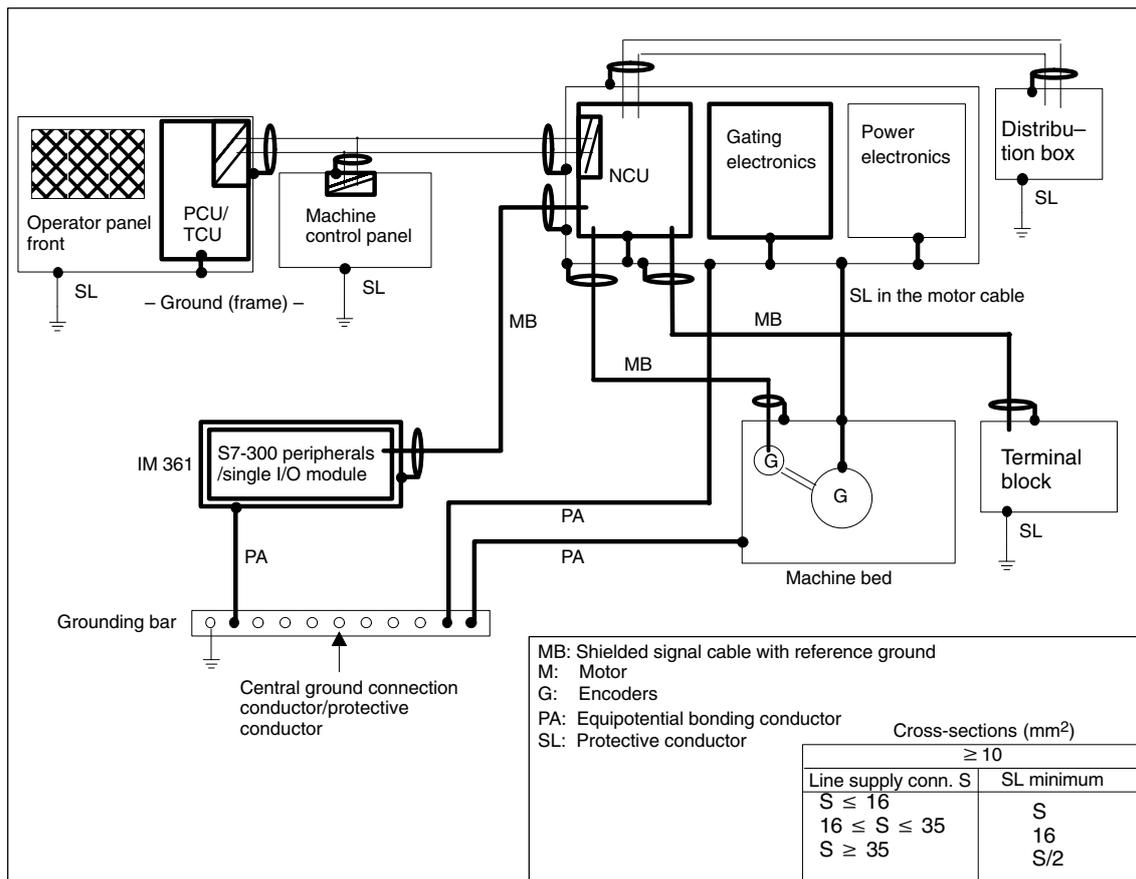
Fig. 2-2   Grounding concept

References: /EMC/   EMC Configuring Guidelines

2.1.4   RI suppression measures

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

Shielded signal cables

To ensure safe, interference-free operation of the installation, it is essential to use the cables specified in the individual diagrams.

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.).

These external devices may not be connected to the control during normal operation. However, if the system cannot be operated without them, then the cable shields must be connected at both ends. Furthermore, the external device must be connected to the control via an equipotential bonding cable.

Cable definitions

Definition:

- Signal cables (example)

  – Data cables (MPI, sensor cables, etc.)

  – Binary inputs and outputs

  – EMERGENCY OFF lines

- Load cables (example)

  – Low-voltage supply cables (230 V AC, +24 V DC etc.)

  – Supply cables to contactors (primary and secondary circuit)

Rules for routing cables

In order to achieve the best possible noise immunity of the complete system (control, power module, machine), the following EMC measures must be carefully observed:

- Signal cables and load cables must be routed at the greatest possible distance from one another.

- If necessary, signal and load cables may cross one another (if possible, at an angle of 90°), but must never be laid close or parallel to one another.

- Only cables provided by the manufacturer should be used as signal cables from and to the NCU.

- Signal cables may not be routed close to strong external magnetic fields (e.g. motors and transformers).

- Pulse-carrying HC/HV cables must always be laid completely separately from all other cables.

- 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 PE conductor (routed together)

!

Important

For further notes on interference suppression measures and the connection of shielded cables, please refer to
References: /EMC/   EMC Configuring Guidelines

SINUMERIK 840D Configuring Manual NCU (PHD) – 03.06 Edition   2-25

2.2   Climatic and mechanical environmental conditions

Test standards   Vibration load: EN 60068–2–6
                        Shock load: EN 60068–2–27
                        Climate: EN 60068–2–1/EN 60068–2–2/EN 60068–2–14
                                              EN 60068–2–30/EN 60068–2–31/EN 60068–2–32/
                                              EN 60068–2–33/EN 60068–2–34

Requirement   Long-term storage: EN 60721–3–1
standards   Transport: EN 60721–3–2
                        Stationary operation: EN 60721–3–3

2.2.1   Transport and storage conditions

Components in   The following specifications apply to components in transport packaging:
original packaging

Table 2-2   Ambient climatic conditions per EN 60721–3–1/–3–2,
                 class 1K3/2K4

	Transport	Bearings	
Temperature range	–40 ... 70 °C	–25 ... 55 °C	
Temperature change	< 18 K	< 18 K	Within one hour
Relative humidity	10 to 95%	10 to 95%	
Permissible change in relative humidity	max 0.1 %	max 0.1 %	Within 1 minute

Table 2-3   Test limits for mechanical environmental conditions

Vibration to EN 60068–2–6	Frequency range	5 to 9 Hz
	Constant deflection	7.5 mm
	Acceleration amplitude	9 to 200 Hz: 2*g*
Shock resistance to EN 60068–2–27	Acceleration	30*g*
	Duration of nominal shock	6 ms
	Number of nominal shocks	18 shocks
	Shock form	Half-sine

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

Shipment of backup batteries

Backup batteries must only be transported in the original packaging. No special authorization is required to ship backup batteries. The lithium content is approximately 300 mg.

Note

The backup battery is classified as a hazardous substance, Class 9, in accordance with the relevant air-freight transportation regulations.

Danger

Incorrect handling of backup batteries can lead to a risk of ignition, explosion and combustion. The stipulations of EN 60086-4, in particular regarding avoidance of mechanical or electrical tampering of any kind, must be complied with.

For more information on handling batteries, see Chapter 8.1.

2.2.2 Operating conditions

Climatic environmental conditions

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

Table 2-4   Climatic environmental conditions to EN 60721–3–3, Class 3K3

Temperature range	0 to 55 °C	
Temperature change	max. 0.5 K	Within 1 minute
Relative humidity	5 to 90 %	
Permissible change in the relative air humidity	max. 0.1%	Within 1 minute
Moisture condensation and ice formation	Not permitted	
Dripping water, spray, splash water, water jets	Not permitted	
Supply air	Without caustic gases, dusts and oils	
Air pressure	1060 to 920 kPa	0 to 1000 meters above mean sea level
Derating	At altitudes of 1000 to 4000 m above SL, the upper limit temperature is to be lowered by 3.5 °C/500 m.	

SINUMERIK 840D Configuring Manual NCU (PHD) – 03.06 Edition   2-27

**Mechanical
environmental
conditions**

Table 2-5   Test limits for mechanical environmental conditions

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

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

**Gases that can
adversely affect
the function**

Degree of severity 3C2 as per EN 60721–3–3

**Dust that can
adversely
affect the function**

When working in areas where gases, dust and oils may be hazardous to functionality, the controller must be operated in a control cabinet with a heat exchanger or with suitable supply air.

Maximum permissible dust contents in the air circulating in the cabinet:

– Suspended solids   0.2 mg/m^3

– Deposits   1.5 mg/m^2/h

Note

The dust precipitate must be removed at appropriate time intervals.

Radio interference

Relevant standards: EN 61000–6–3 and –4

Table 2-6   Limit values for radio interference in industrial environments

	Limit class as per EN 61000–6–4
Conducted radio interference	A (industry)
Interference radiation	A (industry)

Note

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

If compliance with limit class B (residential areas) is required, please contact your local Siemens office or sales representative.

2.3   MPI/OPI network rules

Use   The following devices can be interconnected across the MPI bus:

- NCU
- PCU
- HT 6
- HHU
- MSTT/MCP

The MPI interconnecting cables are available in different lengths.

**Network
installations**   When installing a network, observe the following basic rules:

1. The MPI connection can be routed from one user to the next by plugging the MPI connector of the outgoing cable onto the MPI connector of the incoming cable.

2. The bus line must be terminated at **both ends**. To do this, enable the terminating resistor in the MPI connector of the first and last node and disable the remaining terminating resistors (see Fig. 2-3).

Note

- Only two inserted terminating resistors are permitted.

- In the case of the HHU/HT 6, bus terminating resistors are **permanently** integrated in the device.

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3. **At least** 1 terminal must be supplied with **5 V**.
   This is done by connecting an MPI connector with the terminating resistor connected to an energized device.

Note

The NCU must be located at the end of the connection.

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4. Drop cables (feeder cable from bus segment to node) should be as short as possible.

Note

Unused spurs must be removed.

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5. Every MPI node must **first** be connected and then activated.
   When disconnecting an MPI node, **first** deactivate the connection and then remove the connector.

6. A maximum of two of the HHU and HT 6 components can be connected for each bus segment.

Another possibility is two identical components, provided they have different node addresses.

For setting the addresses (also see corresponding component section):

– HHU: Via DIP switch or display (see "Handheld unit" section),

– For HT 6, by adapting the address before commissioning (refer to Operating Components "Handheld Terminal HT 6").

No bus terminating resistors may be inserted at the distributor boxes of an HHU or HT 6 (refer to the note on item 2.)

If required, more than one HHU/HT 6 can be connected to a bus segment using intermediate repeaters.

7. The following cable lengths for MPI or OPI for standard use without repeater may not be exceeded:

MPI (187.5 kbaud):   Max. total cable length is 1000 m

OPI (1.5 Mbaud):   Max. total cable length is 200 m.
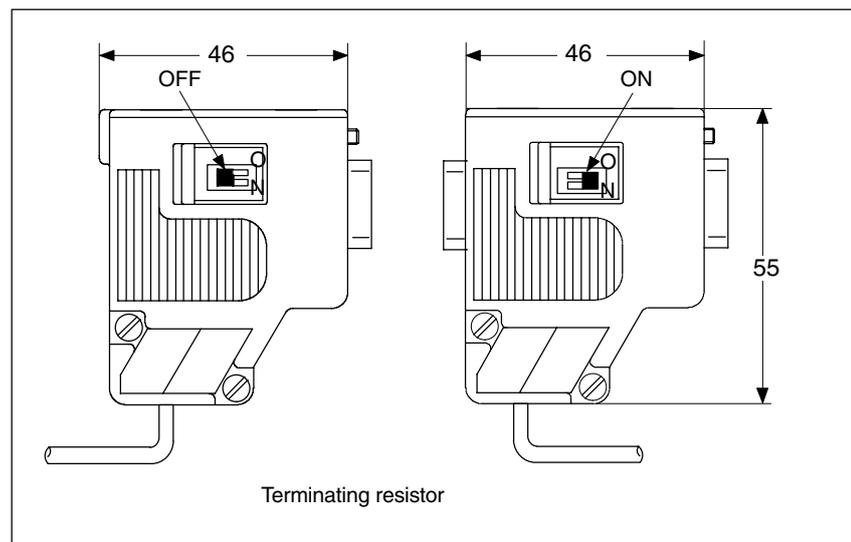
Fig. 2-3   MPI connector

Reference: Catalog IK PI – Industrial Communication for Automation and Drives

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Structure and Installation

3

3.1 Structure of the SINUMERIK 840D

SINUMERIK 840D   The SINUMERIK 840D consists of two components:

1. NCU box (sheet metal housing with a combined battery/fan slide-in module) for housing the NCU module.

2. NCU module (Numeric Control Unit)
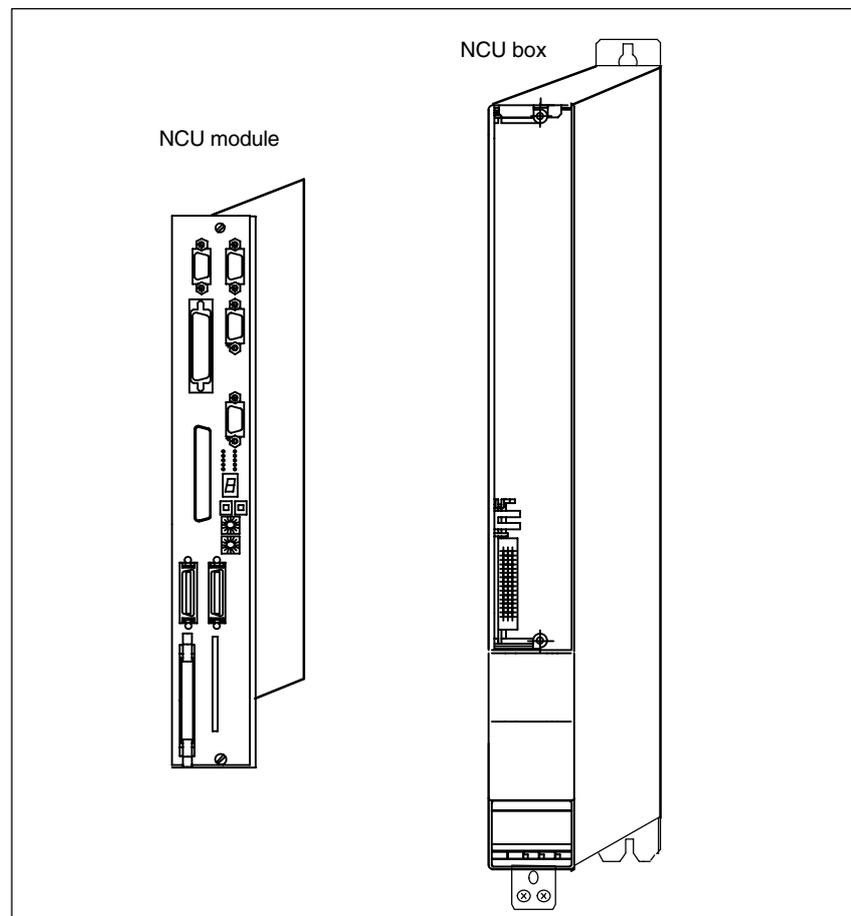
Fig. 3-1   Components of the SINUMERIK 840D

3.2 Installation of the SINUMERIK 840D

Preparing for installation

You need the following tool to assembly the SINUMERIK 840D:

- Screwdriver for slot-head screws sizes 0 and 1

- Screwdriver for Torx screws M4 and M5

Note

The NCU is exclusively intended for installation in ESD-protected zones. The ESD interference immunity limits relevant to CE compliance can only be achieved by installation in a cabinet. Make contact only while taking suitable ESD protective measures (see ESD information in the preface).

Assembly of the NCU box

The NCU box is installed between the SIMODRIVE power supply and the first SIMODRIVE drive module. To secure the NCU box, two M5 screws are recommended.
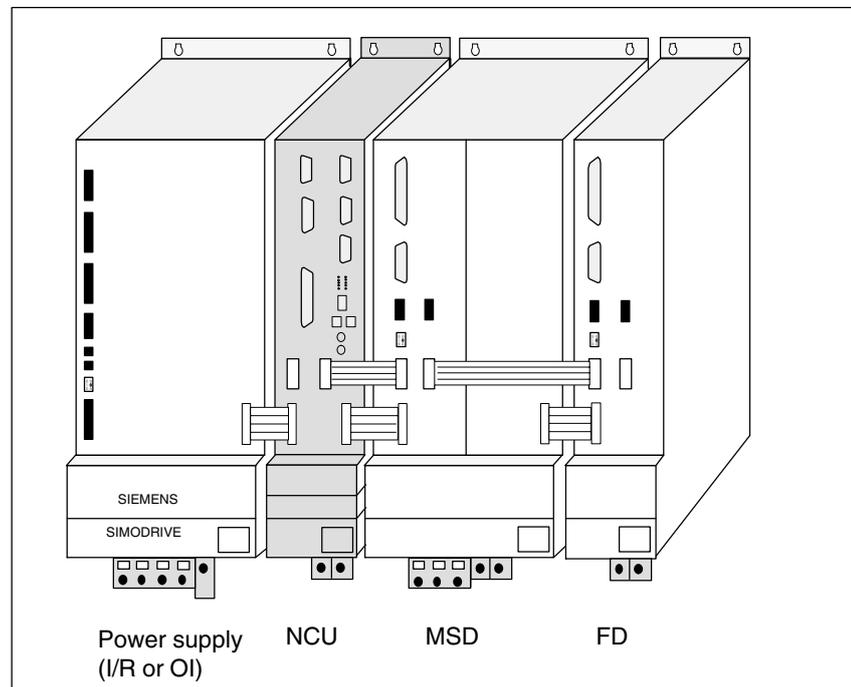
Fig. 3-2   Position of the NCU in the overall configuration

Danger

A hazardous voltage will be present for a further 5 minutes after the system has been shut down.

Mounting the DC link busbar

1. Remove the plastic cover over the DC link busbars by loosening it with a flat screwdriver in the gap on the top and then folding it forward and down.

2. Remove the DC link busbars at the module to the right of the NCU box.

3. Now mount the DC link busbars from the accessory kit of the NCU box between the power module and the first drive module. Use the screws located on the modules (observe tightening torque, M4: 1.8 Nm, M5: 3 Nm).

4. Place the cover into the matching cut-outs with the plastic lugs facing downward and close the DC link by folding the cover backward until the topside latch clicks.

Inserting the NCU

The NCU module is secured when it clicks into the NCU box.

In order to guarantee the vibration resistance, both slotted screws (1) must be tightened (see Fig. 3-3).

The battery/fan module is delivered completely assembled with the NCU box.
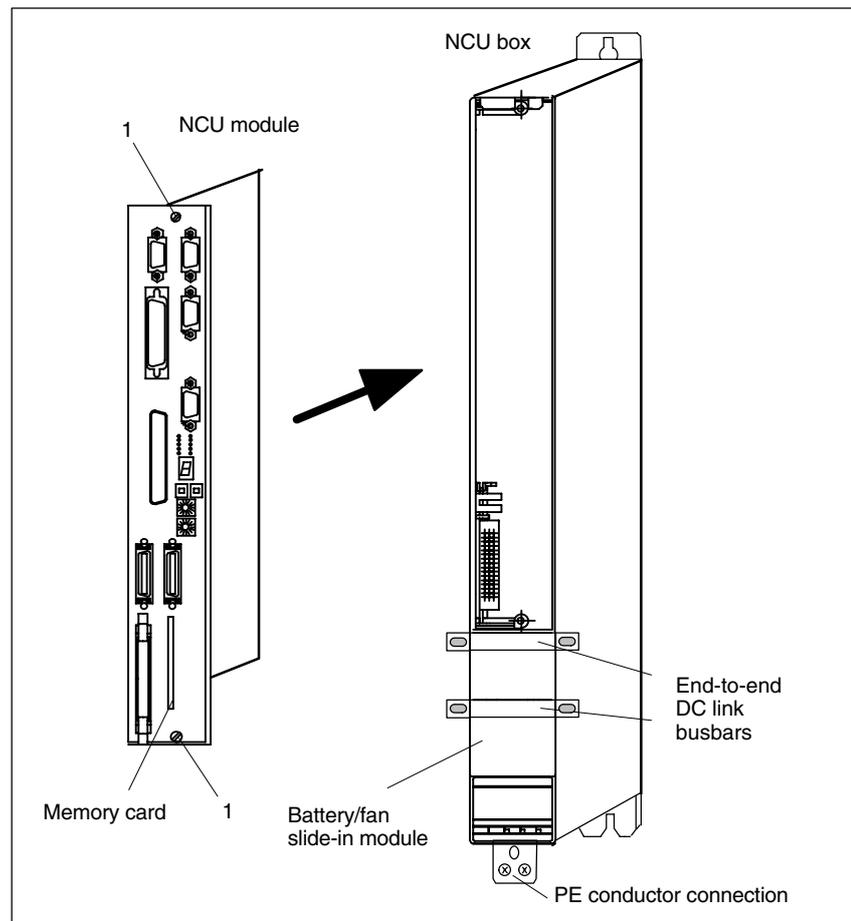
Fig. 3-3   Installation of the NCU module in the NCU box

Maintaining distances   Certain distances must be maintained with regard to cable routing and open ventilation when mounting the NCU box.
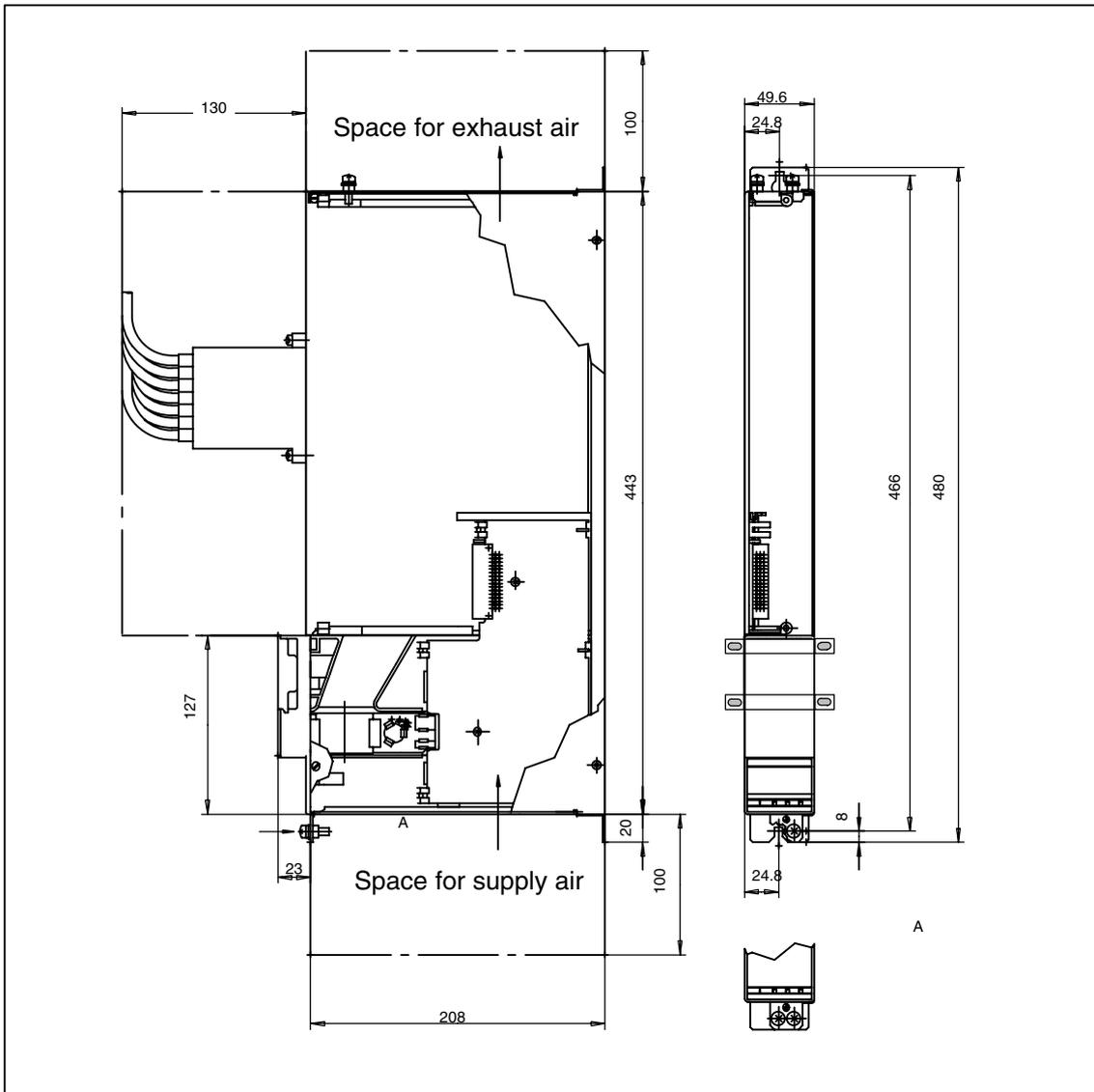
Fig. 3-4   NCU cassette for Sinumerik 840D, dimensional drawing and installation instructions
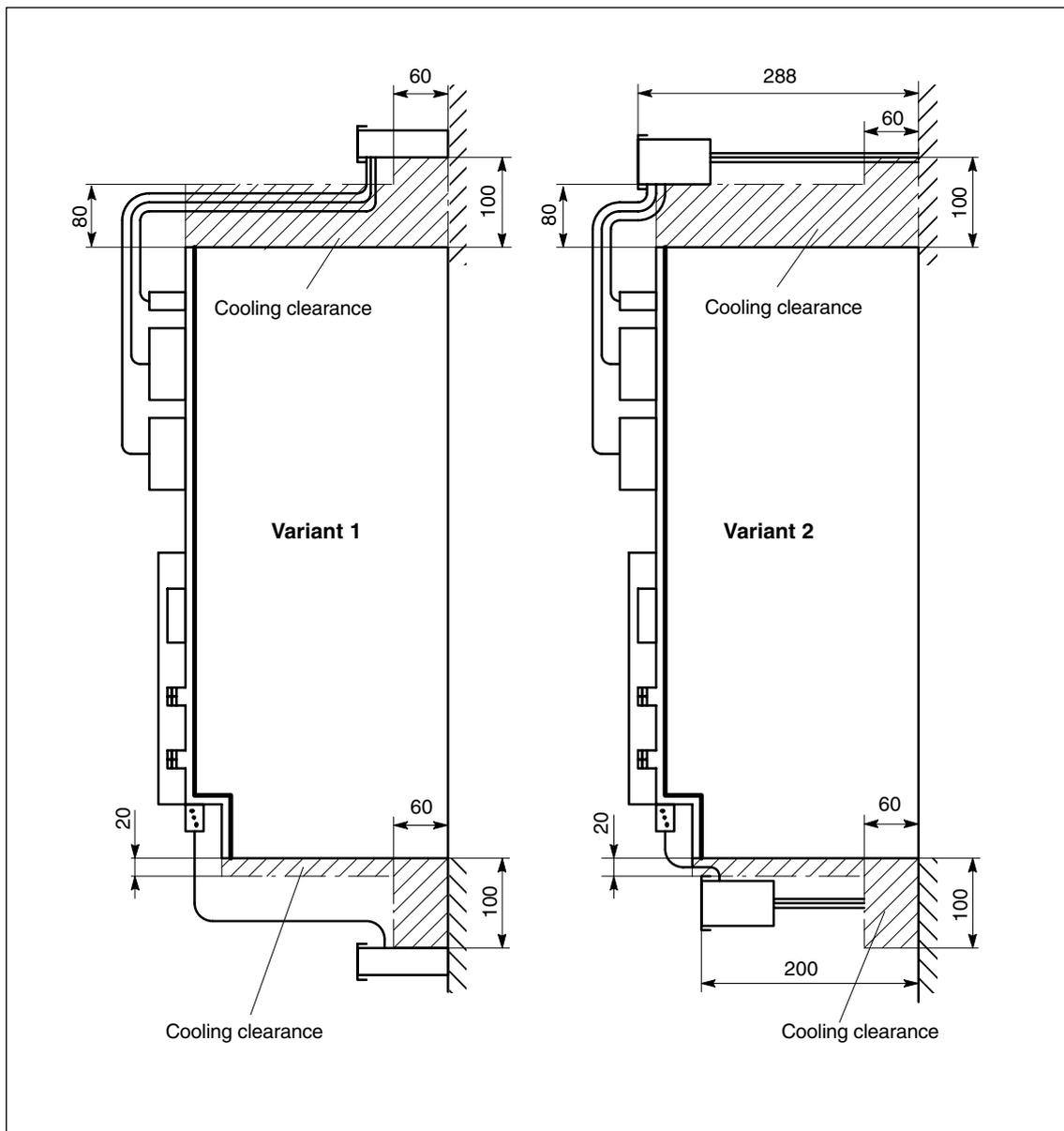
Fig. 3-5   Cable routing and ventilation space when mounting modules

Mounting the link module

For installation, it is recommended that the front plate at the link module be re-moved and then reattached after the installation.

Notes

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Description of the NCU

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

4.1   Components

Configuration
The components of the SINUMERIK 840D are compatible with the module series SIMODRIVE 611D. The 840D is operated with the power supply of SIMODRIVE 611 and the SIMODRIVE 611D drive modules.

NCU module
The NCU module (Numeric Control Unit) is the CPU of the SINUMERIK 840D. It takes over all the CNC, PLC and communication tasks. It is available in various performance variants:

Table 4-1   Components from the NCU 5xx.3 series:

NCU	Order no. (MLFB)	Processor	CNC user memory min. / max.	PLC	PLC memory min. / max.	Front plate	Fan box
561.3	6FC5356-0BB11-0AE1	Intel 486 DX4 100 MHz	0.25/1.5 MB	PLC 315-2DP	96 / 288 KB	Type 1	No
561.3	6FC5356-0BB13-0AA1	Celeron 400 MHz	0.5/2.5 MB *)	PLC 315-2DP	96 / 288 KB	Type 3	No
571.3	6FC5357-0BB11-0AE1	Intel 486 DX4 100 MHz	0.25/1.5 MB	PLC 315-2DP	96 / 288 KB	Type 1	No
571.3	6FC5357-0BB13-0AA1	Celeron 400 MHz	0.5/2.5 MB *)	PLC 315-2DP	96 / 288 KB	Type 3	No
572.3	6FC5357-0BB22-0AE0	AMD K6-2 233 MHz	0.25/1.5 MB	PLC 315-2DP	96 / 288 KB	Type 2	No
572.3	6FC5357-0BB23-0AA0/1	Celeron 400 MHz	0.5/2.5 MB *)	PLC 315-2DP	96 / 288 KB	Type 3	No
573.3	6FC5357-0BB33-0AE2	Pentium III 500 MHz	2.5/2.5 MB *)	PLC 315-2DP	96 / 288 KB	Type 3	Yes
573.3	6FC5357-0BB33-0AE3	Celeron 650 MHz	2.5/2.5 MB *)	PLC 315-2DP	96 / 288 KB	Type 3	No
573.3	6FC5357-0BB33-0AA0/1	Celeron 650 MHz	2.5/2.5 MB *)	PLC 315-2DP	96 / 288 KB	Type 3	No

*) With technological cycles and measuring cycles, max. 1.5 MB available for users. With ShopMill/ShopTurn 1.2 MB available to users in the basic configuration and no other CNC user memory options are possible.

4.1   Components

Table 4-2   Components from the NCU 5xx.4 series:

NCU	Order no. (MLFB)	Processor	CNC user memory min. / max.	PLC	PLC memory min. / max.	Front plate	Fan box
561.4	6FC5356-0BB12-0AE0	AMD K6-2 233 MHz	0.5/2.5 MB *)	PLC 314C-2DP	96 / 480 KB	Type 2	No
561.4	6FC5356-0BB14-0AA0	Celeron 400 MHz	0.5/3 MB *)	PLC 314C-2DP	96 / 480 KB	Type 3	No
571.4	6FC5357-0BB12-0AE0	AMD K6-2 233 MHz	0.5/2.5 MB *)	PLC 314C-2DP	96 / 480 KB	Type 2	No
571.4	6FC5357-0BB14-0AA0	Celeron 400 MHz	0.5/3 MB *)	PLC 314C-2DP	96 / 480 KB	Type 3	No
572.4	6FC5357-0BB23-0AE0	AMD K6-2 233 MHz	0.5/2.5 MB *)	PLC 314C-2DP	96 / 480 KB	Type 2	No
572.4	6FC5357-0BB24-0AA0	Celeron 400 MHz	0.5/3 MB *)	PLC 314C-2DP	96 / 480 KB	Type 3	No
573.4	6FC5357-0BB34-0AE0	Pentium III 500 MHz	2.5/2.5 MB *)	PLC 314C-2DP	96 / 480 KB	Type 3	Yes
573.4	6FC5357-0BB34-0AE1	Celeron 650 MHz	2.5/2.5 MB *)	PLC 314C-2DP	96 / 480 KB	Type 3	No
573.4	6FC5357-0BB34-0AA0	Celeron 650 MHz	2.5/3 MB *)	PLC 314C-2DP	96 / 480 KB	Type 3	No

*) With technological cycles and measuring cycles, max. 1.5 MB available for users. With ShopMill/ShopTurn 1.2 MB available to users in the basic configuration and no other CNC user memory options are possible.

Table 4-3   Components from the NCU 5xx.5 series:

NCU	Order no. (MLFB)	Processor	CNC user memory min. / max.	PLC	PLC memory min. / max.	Front panel	Fan box
561.5	6FC5356-0BB15-0AA0	Celeron 400 MHz	3 **) / 6 MB	PLC 317-2DP	128 / 768 KB	Type 3	No
571.5	6FC5357-0BB15-0AA0	Celeron 400 MHz	3 **) / 6 MB	PLC 317-2DP	128 / 768 KB	Type 3	No
572.5	6FC5357-0BB25-0AA0	Celeron 650 MHz	3 **) / 6 MB	PLC 317-2DP	128 / 768 KB	Type 3	No
573.5	6FC5357-0BB35-0AE0	Pentium III 933 MHz	3 **) / 6 MB	PLC 317-2DP	128 / 768 KB	Type 3	No
573.5	6FC5357-0BB35-0AA0	Pentium III 933 MHz	3 **) / 6 MB	PLC 317-2DP	128 / 768 KB	Type 3	No

**) Available to the user in the basic configuration:
   – with technological cycles and measuring cycles max. 1.5 MB
   – with ShopMill/ShopTurn 1.2 MB

Features of the NCU modules:

- Standard PCMCIA card

- 4 High-speed NC inputs and 4 rapid NC outputs

- 2 Measuring pulse inputs

- 2 Handwheel inputs

- Voltage and temperature monitoring

NCU box	The NCU box is the module rack of the NCU module and consists of:

- NC rack assembly with cable distributor

- Battery/fan slide-in module

- Sheet metal housing with integrated guide bars for accommodating the NCU and the fan/battery slide-in modules and power supply unit

Order number: 6FC5247-0AA00-0AA3

Fan box	The fan box is absolutely required for the 573.3 (Pentium III) and 573.4 (Pentium III) NCUs. Mount the fan box to the NCU box if necessary.

Order number: 6FC5247-0AA30-0AA0

PLC module   As a submodule of the NCU, the PLC module supports machine monitoring and represents a PLC-CPU that is compatible to the S7-300 family of products. Via the P bus, three external lines can be connected for every eight S7-300 peripheral modules.

Reference: Installation manual for setting up the S7-300: CPU

COM module 187.5 kBd/1.5 MBd   The COM module is a submodule of the NCU. It is used for communication with the PCU and peripherals.

Driver module 187.5 kBd/1.5 MBd   The driver module is a submodule of the NCU (...-...-0AEx). It forms the interface to the operator panel front, to the programming device, to the decentralized peripherals and to S7-300 peripherals.

PCMCIA card   The NCU contains a plug-in unit for standard PCMCIA cards (PC card or NC card), via which all flash cards of type II up to 8 MB storage capacity can be operated.

The PCMCIA card serves as a bulk memory for the NC system software (NC card).

In addition to the software upgrade, the PCMCIA card can also be used for series start-up; see
References: /IAD/ Commissioning Manual 840D

Caution

Plugging the PCMCIA card in and out while energized will cause data to be lost!

**Link module
(option for
NCU 573.3/4/5)**

The link module is a submodule of the NCU 573.3/4/5. If it is plugged in, you can reach the interface via the front plate of the NCU (above X122).

The module allows synchronization and an additional data exchange between several NCU 573.3/4/5 in a group.

Order No.: 6FC5212-0AA01-1AA0
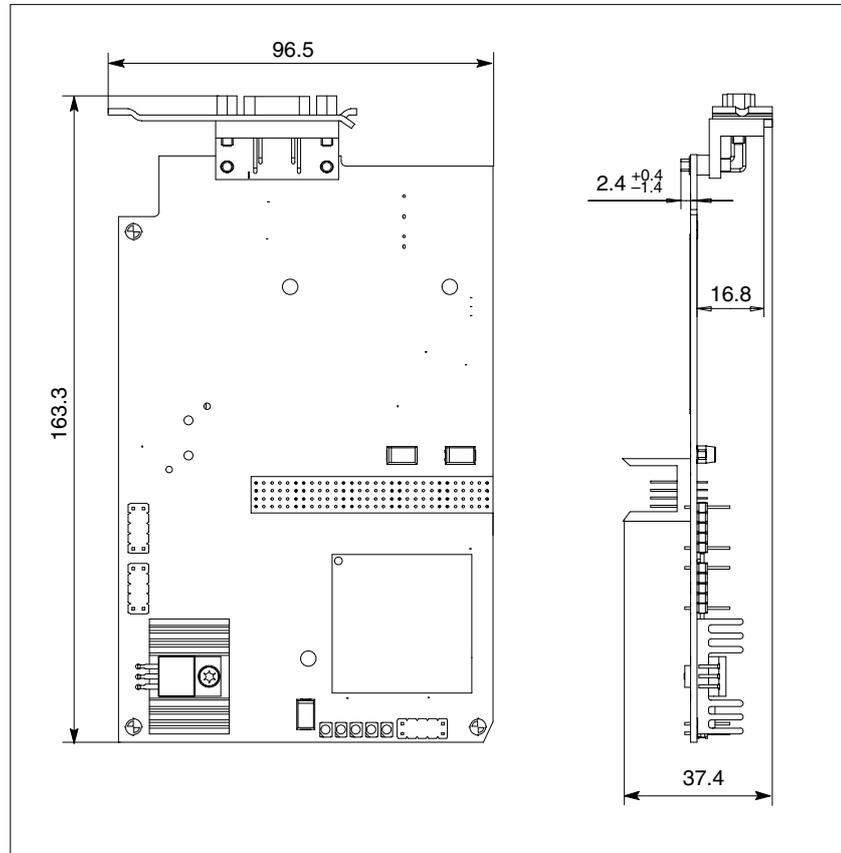
Fig. 4-1   Link submodule

Link cable   Standard Profibus cable

4.2 Mounting

4.2.1 NCU box without a fan box
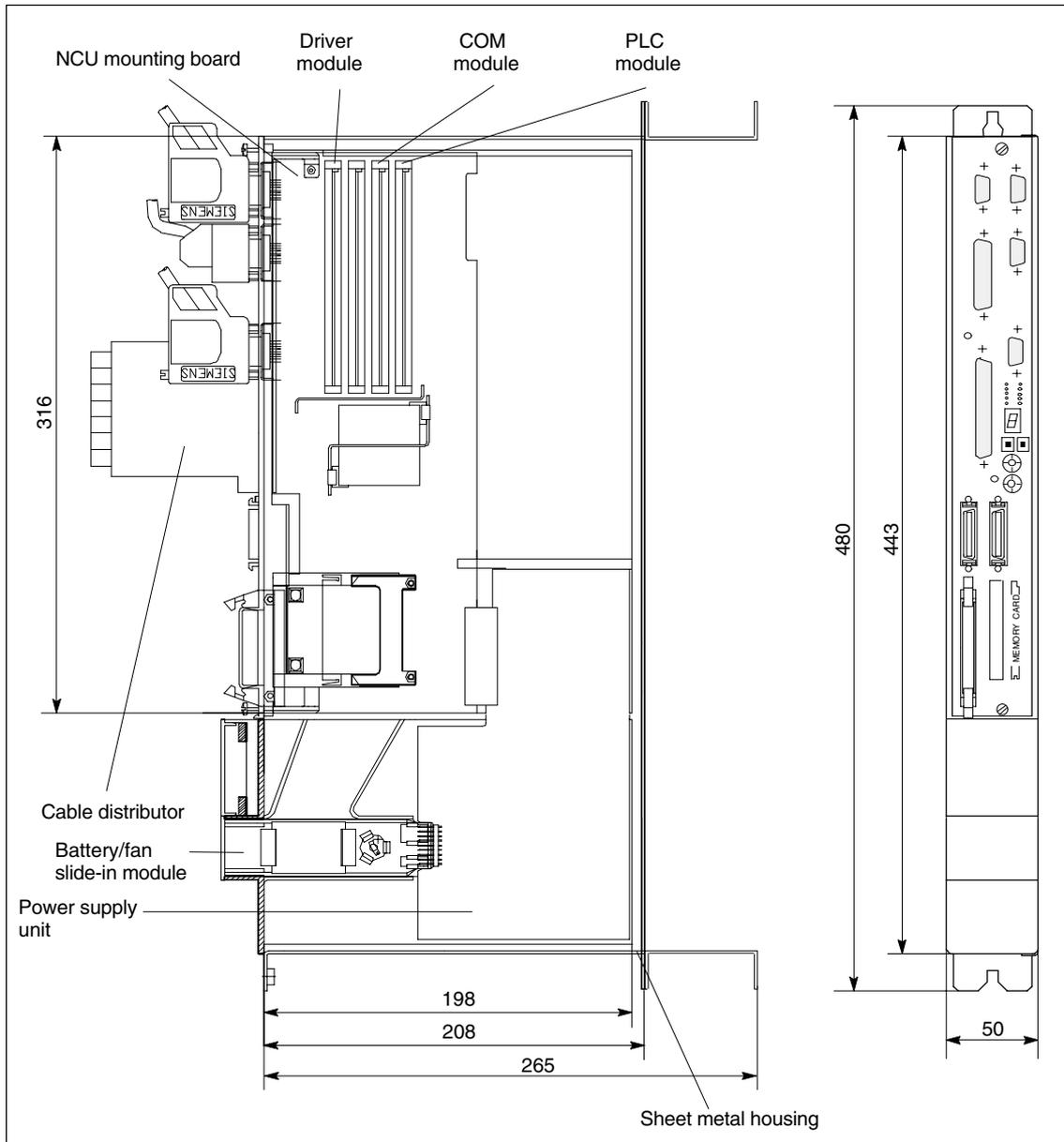
Fig. 4-2   Example: complete NCU box without a fan box with NCU 561.3

4.2.2 NCU box with a fan box
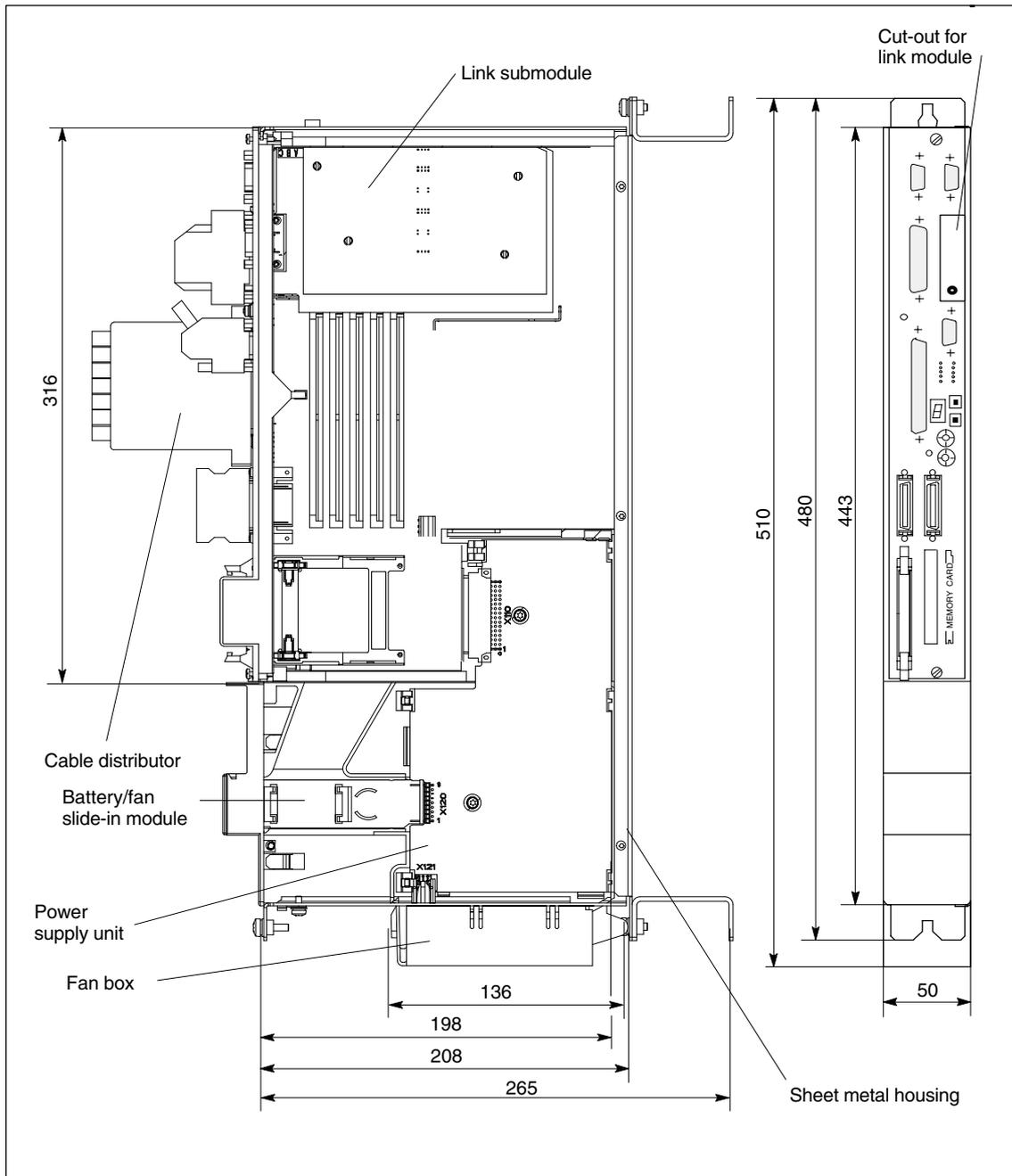
Fig. 4-3   Example: complete NCU box with fan box and NCU 573.3 (Pentium III)

Monitoring the fans   An alarm is issued if a fan fails.

**Mounting
the fan box**

1. Slide the back of the fan box into the locking mechanism on the NCU box.

Fan box

1
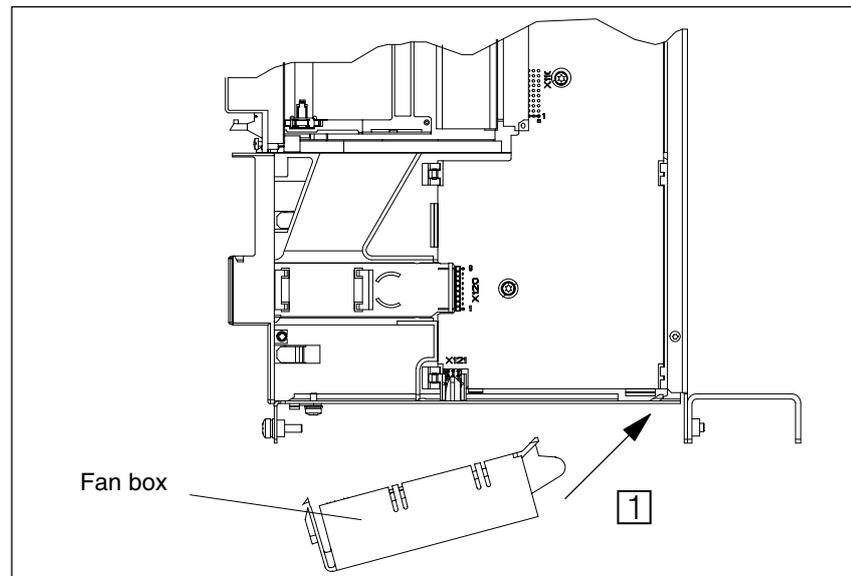
2. Push the front section into the guide until the spring locks.

Guide

2
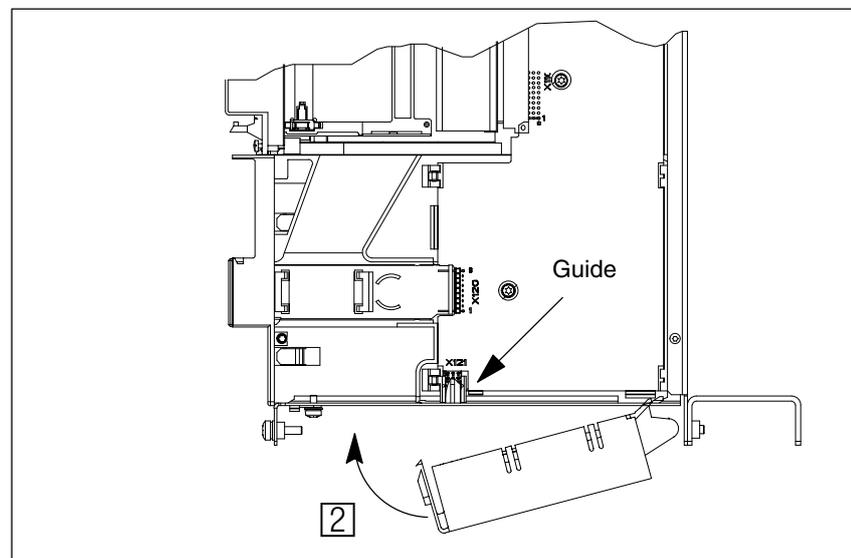
Replacement

For replacing the fan box

1. Apply pressure to the locking spring on the front section of the fan box and

2. Slide the fan box downward.
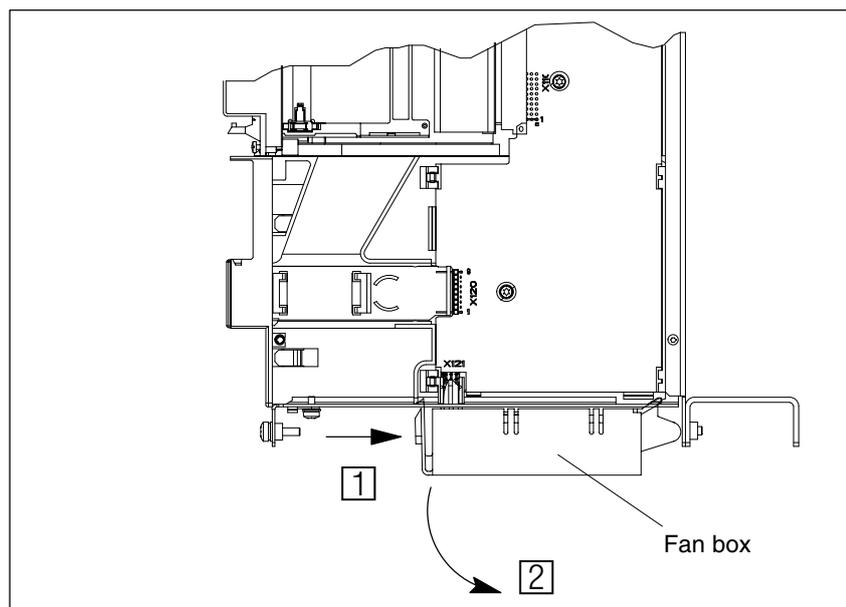
Fan box

⚠ **Warning**

- Only trained personnel may replace a fan box. The regulations for handling electrostatic sensitive devices must be observed.

- Completely switch off the system. Check that it is safely isolated from the supply and safeguard against unauthorized switch-on.

4.3   NCU module interfaces

Brief description   The NCU module has the following interfaces:
of the interfaces

- Operating panel front interface X101 (MPI 1.5 MBaud, floating)

- PROFIBUS DP X102 interface

- SIMATIC S7 I/O bus X111 (P/C bus)

- Link interface (option for NCU 573.3/4/5)

- Connection for handwheel, sensor, NC-I/O X121 (cable distributor)

- Interface for programming device X122 (MPI 187.5 KBaud, non-isolated)

- SIMODRIVE 611D interface X130A (611D module and NCU terminal block)

- Device bus connection X172

- PCMCIA slot X173

- Displays for faults, status, start-up

- Operating elements for start-up, general reset, reset

Interfaces,   For component assignments, see Section 4.1
Operator Controls
and Displays
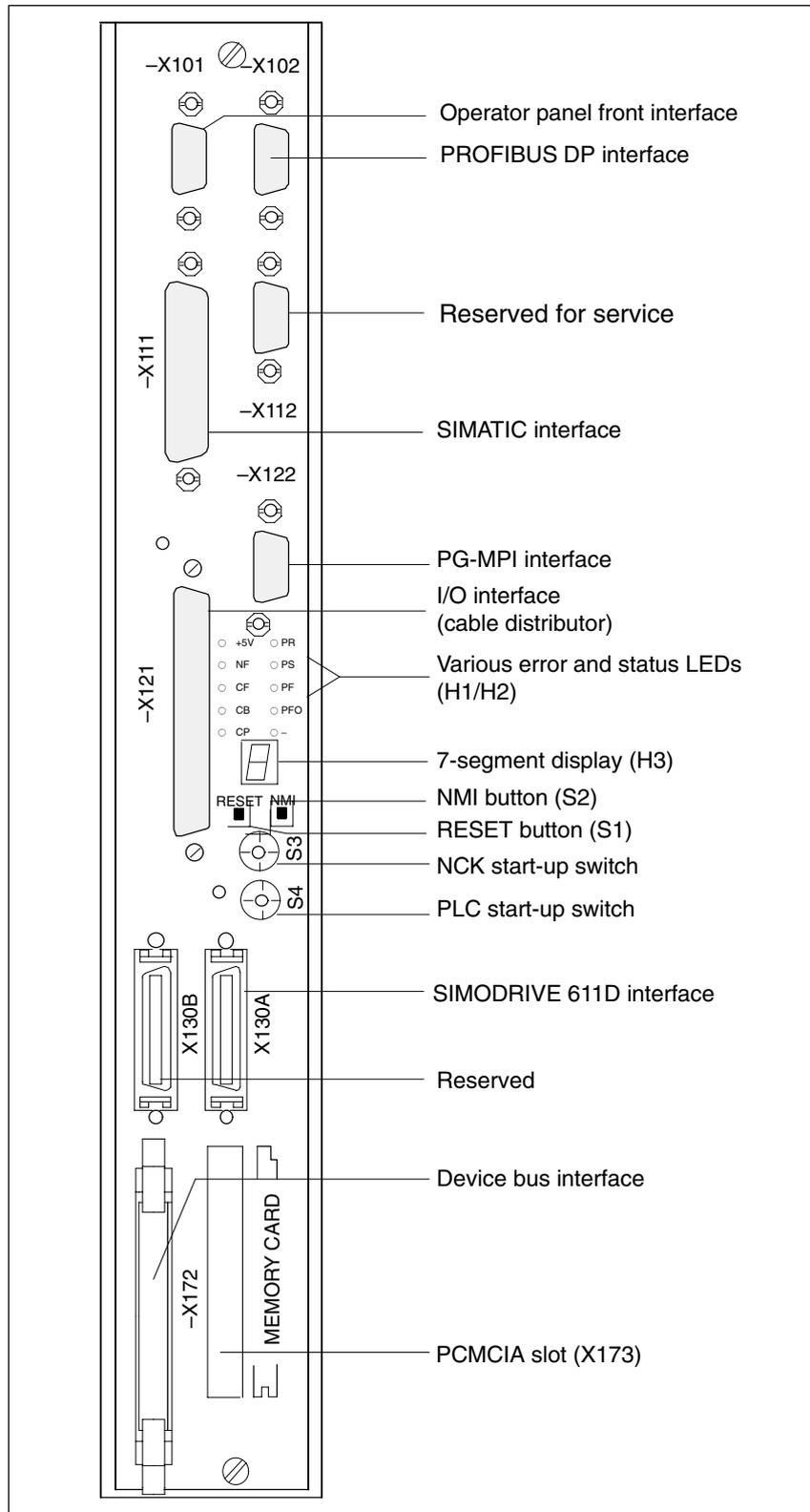
Fig. 4-4   Front plate type 1
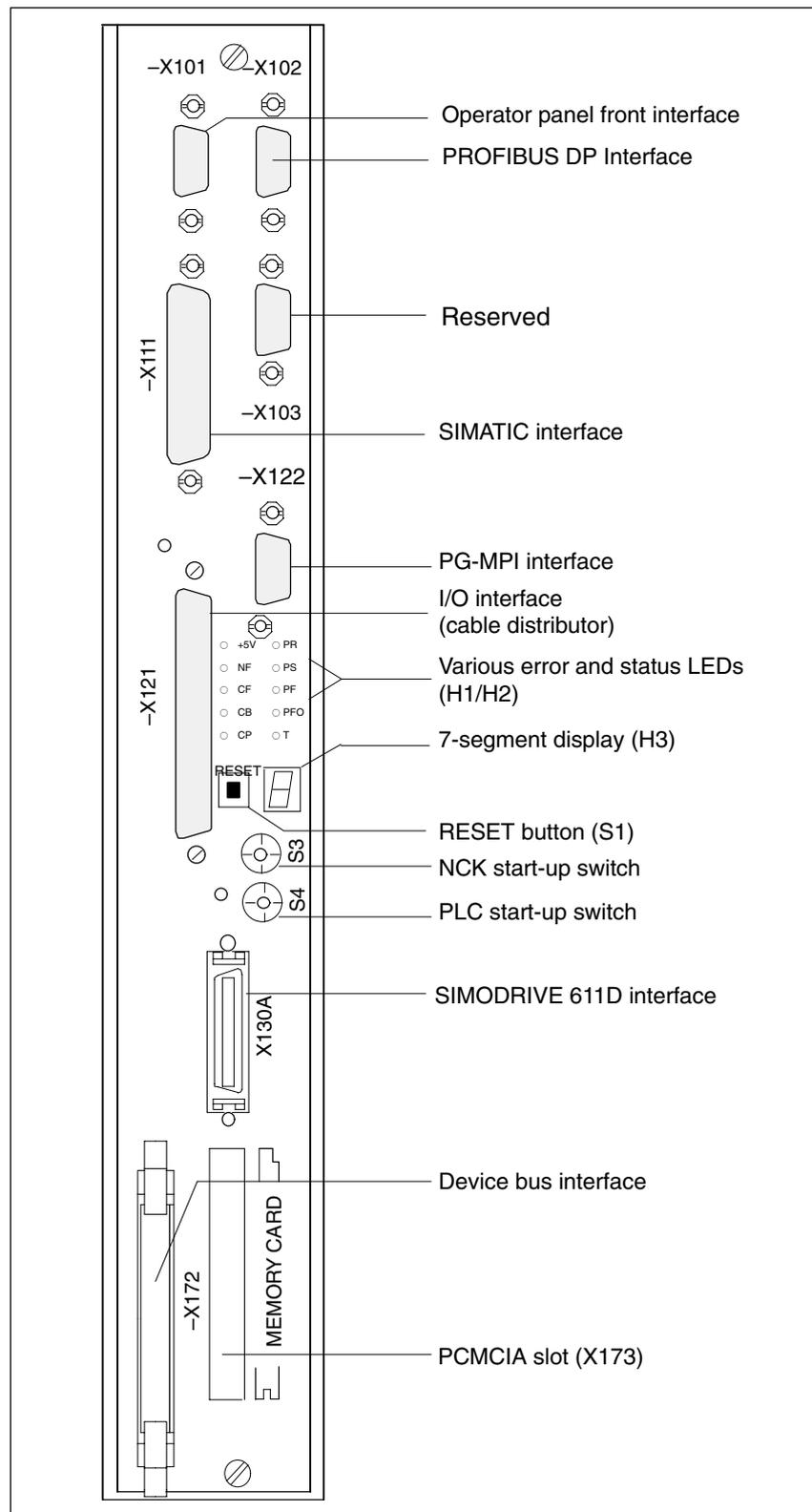
Fig. 4-5   Front plate type 2
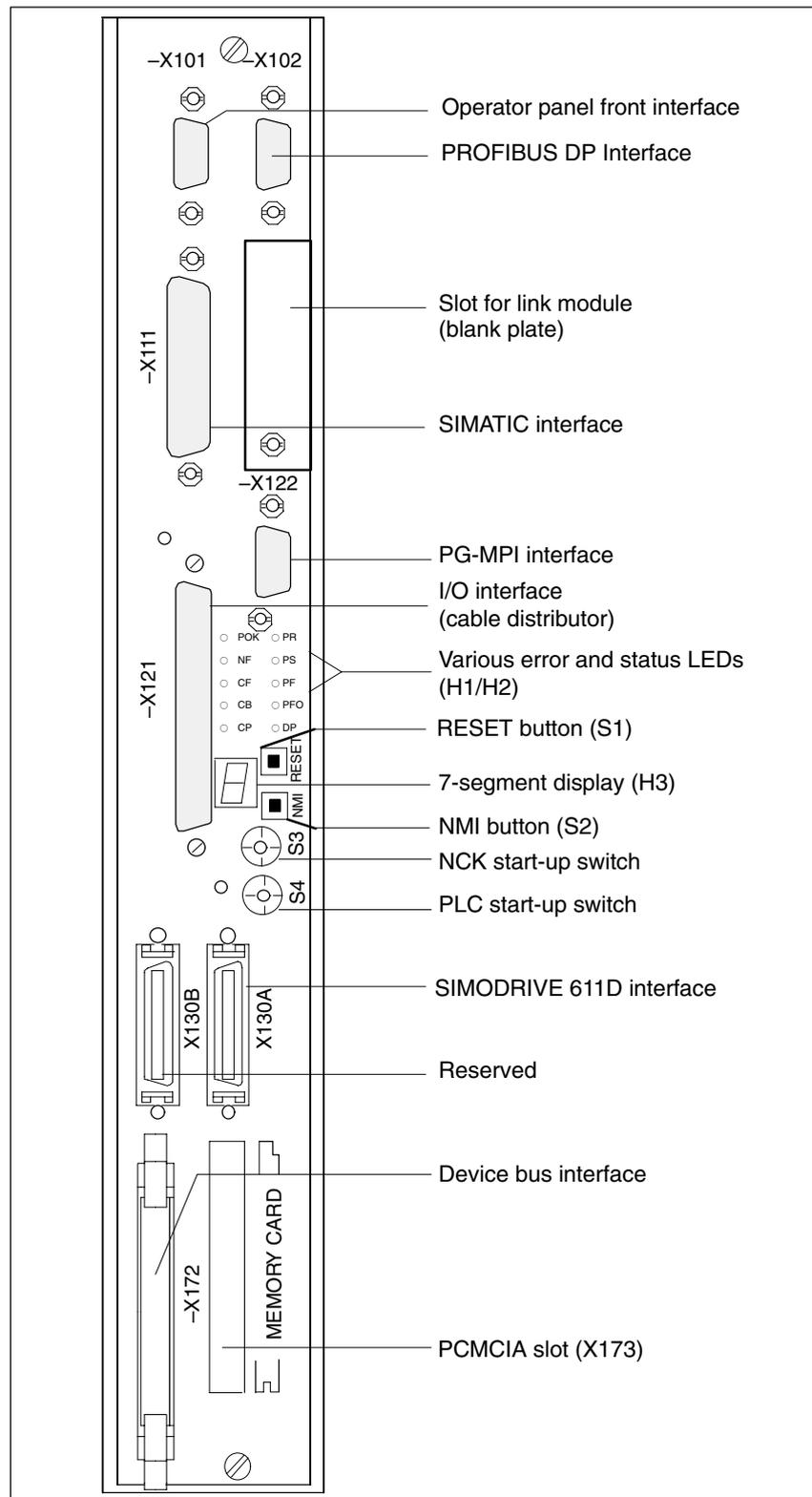
Fig. 4-6   Front plate type 3

X101　　　　　　　　　　**Operator panel front interface (MPI)**

Connector name:　　　　　　　**X101**
Connector type:　　　　　　　9-pole sub D socket connector
Maximum cable length:　　　　200 m
Special features:　　　　　　Isolation (safe isolation)

Table 4-4　　　　Pin assignments on connector X101

X101					
Pin	**Name**	**Type**	**Pin**	**Name**	**Type**
1	Not assigned		6	2P5	VO
2	Not assigned		7	Not assigned	
3	RS_OPI	B	8	XRS_OPI	B
4	RTSAS_BTSS	O	9	RTSPG_BTSS	I
5	2M	VO			

Signal names

XRS_BTSS, RS_BTSS	differential RS485 data – BTSS
RTSAS_BTSS	Request to Send AS – BTSS
RTSPG_BTSS	Request to Send PG – BTSS
2M	Signal Ground, isolated
2P5	+ 5 V, isolated
P24ext, M24ext	24 V supply voltage

Signal type

B	Bidirectional
O	Output
VO	Voltage Output
I	Input

X102　　　　　　　　　　**PROFIBUS DP interface**

Connector name:　　　　　　　**X102**
Connector type:　　　　　　　9-pole sub D socket connector
Maximum cable length:　　　　200 m
Special features:　　　　　　Isolation (safe isolation)
　　　　　　　　　　　　　　1.5 MBaud

Table 4-5　　　X102 pin assignments

X102					
Pin	**Name**	**Type**	**Pin**	**Name**	**Type**
1	Not assigned		6	VP	VO
2	M24ext *)	VO	7	P24ext *)	VO
3	RS_PROFIBUSDP	B	8	XRS_PROFIBUSDP	B
4	RTSAS_PROFIBUSDP	O	9	RTSPG_PROFIBUSDP	I
5	DGND	VO			

*) 24 V only present if 24 V is fed to X121 (cable distributor).

Signal names

XRS_PROFIBUSDP,	
RS_PROFIBUSDP	Differential RS485 data – PROFIBUSDP
RTSAS_PROFIBUSDP	Request to Send AS – PROFIBUSDP
RTSPG_PROFIBUSDP	Request to Send PG – PROFIBUSDP
DGND	Signal Ground, isolated
VP	+ 5 V, isolated
P24ext, M24ext	24 V supply voltage

Signal type

B	Bidirectional
O	Output
VO	Voltage Output
I	Input

X111

SIMATIC interface

Connector name:	**X111**
Connector type:	25-pole sub D socket connector
Maximum cable length:	10 m
Special features:	Non-isolated (basic isolation)

X112
(only NCUs with front plate type 1)

Serial interface RS232 (reserved for service)

Connector name:	**X112**
Connector type:	9-pole sub D male connector
Maximum cable length:	10 m
Special features:	Non-isolated (no safe isolation)

Table 4-6   X112 pin assignments

X112					
Pin	**Name**	**Type**	**Pin**	**Name**	**Type**
1	Not assigned		6	Not assigned	
2	RxD	I	7	RTS	O
3	TxD	O	8	CTS	I
4	Not assigned		9	Not assigned	
5	G	VO			

Signal names

RxD	Receive Data
TxD	Transmit Data
RTS	Request to Send
CTS	Clear to Send
M	Ground

Signal type

O	Output
I	Input
VO	Voltage Output

Only NCU 573.3/4/5 with link module

Link module interface

Connector name: None
Connector type: 9-pole sub D socket connector
Maximum cable length: 100 m

Table 4-7   Pin assignment of plug X112 at the link module

X112					
Pin	**Name**	**Type**	**Pin**	**Name**	**Type**
1	Not assigned		6	VP	VO
2	Not assigned		7	Not assigned	
3	RS_LINK	B	8	XRS_LINK	B
4	Not assigned		9	Not assigned	
5	DGND	VO			

Signal names

XRS_LINK, RS_LINK   Differential RS485 data – LINK
XRS_CLKCY; RS_CLKCY   Differential RS485 data – CLKCY
DGND   Signal Ground, isolated
VP   +5 V, isolated

Signal type

B   Bidirectional
O   Output
VO   Voltage Output
I   Input

X121   **I/O interface (cable distributor)**

Connector name: **X121**
Connector type: 37-pole sub D male connector
Maximum cable length: 25 m for all functions
Special features: Isolation for binary inputs/
                           outputs, handwheels non-isolated

Table 4-8   X121 pin assignments

X121					
X121					
Pin	**Name**	**Type**	**Pin**	**Name**	**Type**
1	M24EXT	VI	20	P24EXT	VI
2	M24EXT	VI	21	P24EXT	VI
3	OUTPUT 1	O	22	OUTPUT 3	O
4	OUTPUT 0	O	23	OUTPUT 2	O
5	INPUT 3	I	24	MEXT	VI
6	INPUT 2	I	25	MEXT	VI
7	INPUT 1	I	26	MEXT	VI
8	INPUT 0	I	27	MEXT	VI
9	MEPUS 0	I	28	MEPUS 1	I
10	MEPUC 0	I	29	MEPUC 1	I
11	MPG1 XA	I	30	MPG1 A	I
12	MPG1 5 V	VO	31	MPG1 0 V	VO
13	MPG1 5 V	VO	32	MPG1 0 V	VO
14	MPG1 XB	I	33	MPG1 B	I
15	MPG0 XA	I	34	MPG0 A	I
16	MPG0 5 V	VO	35	MPG0 0 V	VO
17	MPG0 5 V	VO	36	MPG0 0 V	VO
18	MPG0 XB	I	37	MPG0 B	I
19	Not assigned				

Signal names

MPG 0/1 5V   supply voltage handwheel 0/1. 5 V, max. 500 mA [1]
MPG 0/1 0V   supply voltage handwheel 0/1.0 V
MPG 0/1 A/XA   differential handwheel input 0/1, A/XA
MPG 0/1 B/XB   differential handwheel input 0/1, B/XB
MEPUS 0/1   measuring pulse signal 0/1 [2]
MEPUC 0/1   measuring pulse common (reference ground) 0/1
INPUT [0...3]   binary NC input 0...3 [2]
MEXT   external ground (reference ground for binary NC inputs)
OUTPUT [0...3]   binary NC output 0...3 [3]
M24EXT   external 24 V infeed (–) for binary NC outputs
P24EXT   external 24 V infeed (+) for binary NC outputs

[1]   Max. 500 mA per handwheel, i.e. a total of max. 1 A
[2]   High level: rated value 24 V, limits 15 ...30 V / 2 mA...15 mA
      Low level: rated vale 0 V or open, limits –3...5 V
[3]   The binary outputs are short-circuit proof.
      Max. switching current per output: 500 mA (coincidence factor 100%).
      For an inductive load, an external protective circuit is required for unloading
      the inductivity

Signal type

O	Output
VO	Voltage Output
I	Input
VI	Voltage Input

X122

PG-MPI interface

Connector name: **X122**
Connector type: 9-pole sub D socket connector
Maximum cable length: 200 m
Special features: Non-isolated (no safe isolation)

Table 4-9   X122 pin assignments

X122					
Pin	**Name**	**Type**	**Pin**	**Name**	**Type**
1	Not assigned		6	P5	VO
2	M24EXT *)	VO	7	P24EXT *)	VO
3	RS_KP	B	8	XRS_KP	B
4	RTSAS_KP	O	9	RTSPG_KP	I
5	G	VO			

*) 24 V only present if 24 V is fed to X121 (cable distributor).

Signal names

RS_KP, XRS_KP	Differential RS485 data – C bus from PLC
RTSAS_KP	Request to Send AS – C bus from PLC
RTSPG_KP	Request to Send PG – C bus from PLC
M	Ground
P5	5 V

Signal type

B	Bidirectional
O	Output
VO	Voltage Output
I	Input

X130A

SIMODRIVE 611D interface

Connector name: **X130A**
Connector type: 2x36-pole Micro Ribbon
Maximum cable length: 10 m
Special features: Non-isolated (no safe isolation)

X172   **Device bus interface**

Connector name: **X172**
Connector type: 2x17-pole ribbon cable connector, male

Table 4-10   X172 pin assignments

X172					
Pin	**Name**	**Type**	**Pin**	**Name**	**Type**
1	HF1	VI	18	P27	VI
2	HF2	VI	19	M27	VI
3	HF1	VI	20	G	VI
4	HF2	VI	21	Not assigned	
5	Not assigned		22	G	VI
6	Not assigned		23	Not assigned	
7	Not assigned		24	G	VI
8	Not assigned		25	Not assigned	
9	P15	VI	26	G	VI
10	Not assigned		27	Not assigned	
11	P15	VI	28	Not assigned	
12	Not assigned		29	Not assigned	
13	N15	VI	30	Not assigned	
14	Not assigned		31	SIM_RDY	OC
15	N15	VI	32	Not assigned	
16	I2T_TMP	OC	33	Not assigned	
17	Not assigned		34	Not assigned	

Signal names

HF 1, 2   Voltage supply $\pm$ 57 V, 20 kHz
P15   + 15 V
M   Ground
P27   + 27 V fan supply
M27   Reference ground to P27
N15   – 15 V
I2T_TMP I^2t advance warning (NC-specific: fan/temperature alarm)
SIM_RDY   Drive and NC operationally ready

Signal type

OC   Open Collector
VI   Voltage Input

X173   **PCMCIA slot**

Connector name: **X173**
Connector type: 68-pole PCMCIA card connector, male

Operator controls
and displays

Table 4-11   Operator controls and displays

Designation	Type	Meaning	Feature
RESET (S1)	Button	Triggering a hardware reset to reset the control and drive followed by a complete restart.	
NMI (S2)	Button	Triggering an NMI request at the processor	
S3	Rotary switch	NCK-startup switch Position 0: normal mode Position 1: startup position Positions 2 to 7: reserved	
S4	Rotary switch	PLC-mode switch Position 0: PLC–RUN Position 1: PLC–RUN–P Position 2: PLC–STOP Position 3: MRES	
H1 (left row)	LED	**Illuminates if ...** **+5V/POK**: ... supply voltage is in tolerance range. **NF:** ... NCK-Watchdog has activated and during the startup phase. **CF**: ... COM-Watchdog has activated. **CB**: ... data transfer takes place via BTSS. **CP**: ... data transfer takes place via PG MPI interface. For NCUs with the MLFB ...-...-0AA0, the following applies: **NCU-internal voltage monitoring has switched off the power supply (retentive) of the module if ...** **POK** : Off **NF** : On **CF/CB/CP** : undefined **H2** : undefined Therefore, ensure that the recovery time after shutdown (re-activation via power ON) is at least 10 s, because otherwise the voltage monitoring can be activated.	green red red yellow yellow

H2 (right row)	LED	**Illuminates, ...**
		PR: ... if PLC-status = RUN
		PS: ... if PLC-status = STOP
		PF: ... + **PR** + **PS** + **PFO**: if PLC Watchdog has activated.
		PFO: ... if PLC status = FORCE
		T/DP [1]**:** PLC-DP-status:
		
		    – LED is off:
		      DP is not configured or
		      DP is configured, all slaves are found.
		
		    – LED is flashing:
		      DP is configured, at least one slave is missing.
		
		    – LED illuminates:
		      error (e.g. bus short-circuit, no token circulation)
			green
			red
			red
			yellow
			yellow

H3	7-segment	Software-assisted output of test and diagnostics messages	

---

[1] On the SIMATIC CPU 315-2DP, the LED is called "**BUSF**".

4.4 Cable distributor (distributor box)

Cable distributor (I/O interface)

The cable distributor splits the X121 interface of the NCU into

- two connections of differential handwheel,
- two connections of meas. pulse input,
- four connections of binary NC input,
- four connections of binary NC output and
- single connection 24 V/M24$_{ext}$

using max. seven single cables. To supply the binary NC outputs, an external 24 V supply is possible at the cable distributor.

Cable
6FX2002-4AA21-0☐☐☐

Cable
6FX2002-4AA41-0☐☐☐

90
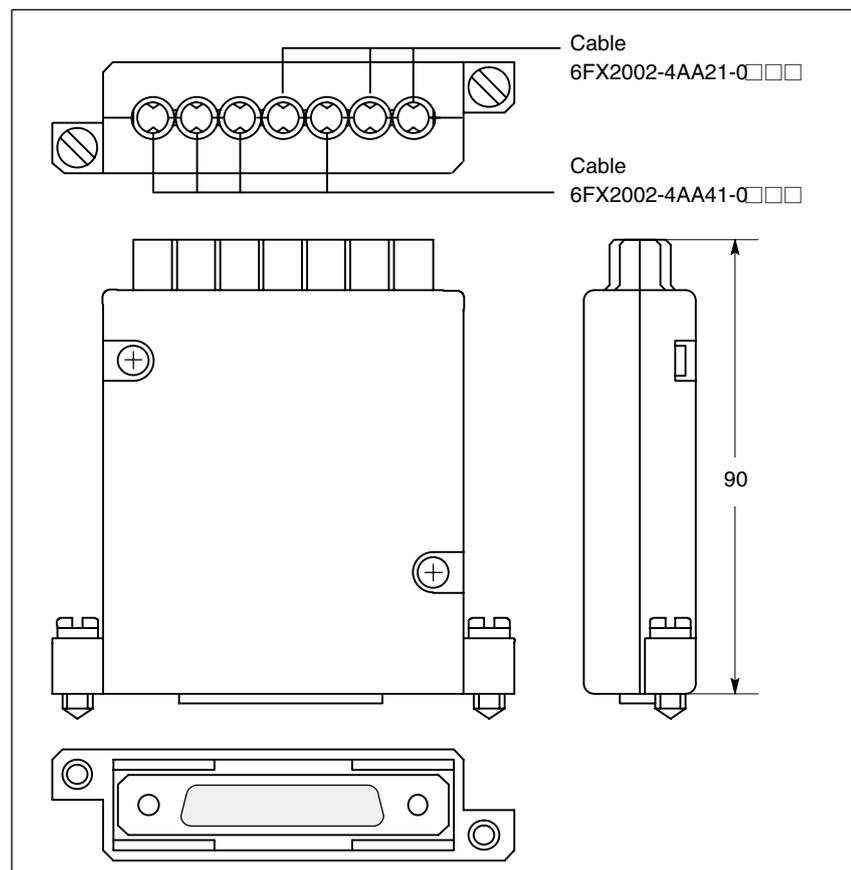
Fig. 4-7   Cable distributor

The cable distributor (37-pole) consists of connector housing (SINUMERIK version) for a 37-pole sub D connector with an enlarged interior. The rear contains seven cable inputs where the cables must be attached as shown in Table 4-14.

Plug the cables into connectors X1 to X10 in the opened cable distributors and route the cable into the cable entry. Make sure that the free stripped shield jackets have a large conductive connection to the metallic contact areas as shown in the Figure showing the position of the interfaces of the cable distributor (see below).

Insert the upper terminal bar in such a way that its "teeth" are facing the "teeth" of the lower terminal bar and then secure the upper housing section.

This will reliably press the cable shields between the contact areas of the contact springs and contact them. Securing to the front panel of the NCU routes the shield potential via the contact springs of the cable distributor.

Status table for switches S1...S5 (Order No. 6FX 2006-1BA00)

The DIP FIX switches in the cable distributor must be set as follows:

Table 4-12   Setting the DIP-FIX switches in the cable distributor (S1...S5)

Switch	S1	S2	S3	S4	S5
Open	x	x	x	x	x
Closed					

Status table for switches S1...S6 (Order No. 6FX 2006-1BA01)

The DIP FIX switches in the cable distributor must be set as follows:

Table 4-13   Setting the DIP-FIX switches in the cable distributor (S1...S6)

Switch	S1	S2	S3	S4	S5	S6
Open	x	x	x	x		
Closed					x	x

Location of interfaces
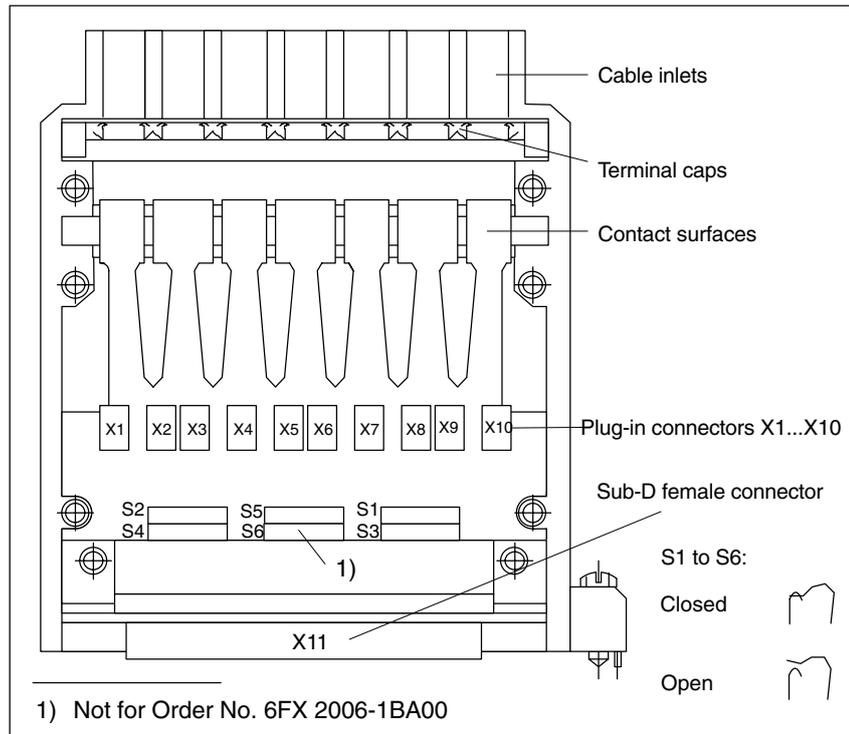
1) Not for Order No. 6FX 2006-1BA00

Fig. 4-8   Position of the interfaces of the cable distributor

Connector assignments

Table 4-14   Connector assignments

Connector No.	Cable No.	Peripherals
X1	1 (top)	1. Hand wheel
X2		
X3	2	2. Hand wheel
X4		
X5	3	2. Probe
X6	4	4 binary inputs
X7		
X8	5	4 binary outputs
X9	6	Supply for 4 binary outputs
X10	7 (bottom)	1. Probe

Connector coding

○ = coding pin

+ = no coding pin

Viewing direction:
from behind toward the cable distributor

Pin 1

Fig. 4-9   Position of the coding pins

Note

When assembling the cable distributor, make absolutely sure that the supplied insulating washer is installed correctly and the coding pins are installed.

Pin assignment

Connector designation: **X1...X10**
Connector type: DU-BOX plug connectors

Table 4-15   Cable distributor pin assignment

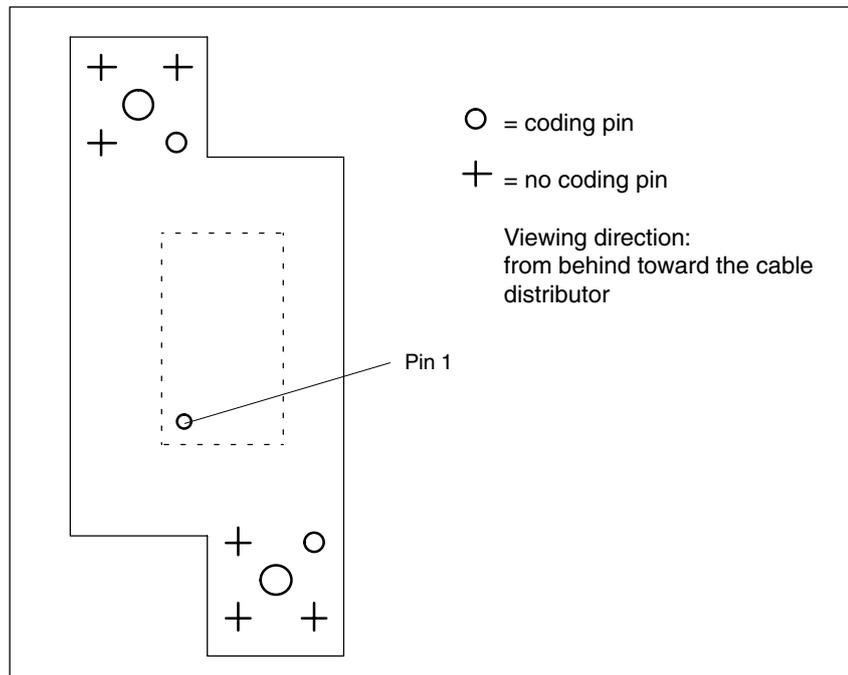| Pin no. 37-pin connector	Signal name	DU BOX connector No./pin	Cable No.	Cable Order No. 6FX2002-4AA	Core color	I/Os	Terminal
9	– MEPUS 0	X10/2 X10/1			rd or	1. Probe	Signal +24 V
10	– MEPUC 0	X10/4 X10/3	7	41–0□□□	br bk shield	1. Probe	Reference signal 0 V
1	M24EXT	X9/2			rd		Ground 24 V
20	P24EXT	X9/1			or	Supply	24 V
2	M24EXT	X9/4	6	41–0□□□	br	of the 4 binary	Ground
21	P24EXT	X9/3			bk shield	outputs	24 V
3	OUTPUT 1	X8/2			rd		2. Output
22	OUTPUT 3	X8/1			or	4 binary	4. Output
4	OUTPUT 0	X8/4	5	41–0□□□	br	outputs	1. Output
23	OUTPUT 2	X8/3			bk shield		3. Output
5	INPUT 3	X7/2			rd		4. input
24	MEXT	X7/1			or		ground
6	INPUT 2	X7/4			br		3. Input
25	MEXT	X7/3			bk	4 binary	ground
7	INPUT 1	X6/2	4	21–0□□□	gn	inputs	2. Input
26	MEXT	X6/1			ye		ground
8	INPUT 0	X6/4			vio		1. Input
27	MEXT	X6/3			bl shield		ground
28	– MEPUS 1	X5/2 X5/1			rd or	2. Probe	Signal + 24 V
29	– MEPUC 1	X5/4 X5/3	3	41–0□□□	br bk shield	2. Probe	Reference signal 0 V
11	MPG1 XA	X4/2			rd		XA
30	MPG1 A	X4/1			or		A
12	MPG1 5V	X4/4			br		5 V
31	MPG1 0V	X4/3			bk	2. Handwheel	0 V
13	MPG1 5V	X3/2	2	21–0□□□	gn		5 V
32	MPG1 0V	X3/1			ye	6FC9320-5DB	0 V
14	MPG1 XB	X3/4			vio		XB
33	MPG1 B	X3/3			bl shield		B
15	MPG0 XA	X2/2			rd		XA
34	MPG0 A	X2/1			or		A
16	MPG0 5V	X2/4			br		5 V
35	MPG0 0V	X2/3			bk	1. Handwheel	0 V
17	MPG0 5V	X1/2	1	21–0□□□	gn		5 V
36	MPG0 0V	X1/1			ye	6FC9320-5DB	0 V
18	MPG0 XB	X1/4			vio		XB
37	MPG0 B	X1/3			bl shield		B

Signal names

MPG 0/1 5V   supply voltage handwheel 0/1. 5 V [1]
MPG 0/1 0V   supply voltage handwheel 0/1.0 V
MPG 0/1 A/XA   differential handwheel input 0/1, A/XA
MPG 0/1 B/XB   differential handwheel input 0/1, B/XB

MEPUS 0/1	measuring pulse signal 0/1
MEPUC 0/1	measuring pulse common (reference ground) 0/1
INPUT [0...3]	binary NC input 0...3 [2]
MEXT	external ground (reference ground for binary NC inputs)
OUTPUT [0...3]	binary NC output 0...3 [3]
M24EXT	external 24 V infeed (–) for binary NC outputs
P24EXT	external 24 V infeed (+) for binary NC outputs

[1] Max. 500 mA per handwheel, i.e. a total of max. 1 A

[2] High level: rated value 24 V, limits 15 ..30 V / 2 mA...15 mA
     Low level: rated vale 0 V or open, limits –3...5 V

[3] The binary outputs are short-circuit proof.
     Max. switching current per output: 500 mA (coincidence factor 100%).
     For an inductive load, an external protective circuit is required for unloading
the inductivity

4.5   Technical data

Table 4-16   General technical data

Security		
Protection class	I (protective conductor) as per EN 61800–5–1	
Degree of protection per EN 60529	IP20 (with NCU box) or IPXXB	IP00 (without NCU box)
Approvals	CE / cULus	
Degree of contamination	2	
Cooling	Open circuit ventilation	
Mechanical ambient conditions		
Transport (in transport packaging)	2M2 according to EN 60721–3–2	
Bearings	1M2 according to EN 60721–3–1	

Table 4-17   Electrical and mechanical data of the individual components

Component	CPU	Power loss *) in W	Dimensions width x height x depth in mm	Weight in kg
NCU 561.3 571.3	Intel 486 DX4	33	50 x 316 x 115	0.68
	Celeron 400 MHz	32	50 x 316 x 207	0.72
NCU 561.4 571.4 572.3/.4	AMD K6-2	36	50 x 316 x 115	0.68
	Celeron 400 MHz	32	50 x 316 x 207	0.72
NCU 573.3/.4	Pentium III 500 MHz	45	50 x 316 x 207	1.05
	Celeron 650 MHz	36	50 x 316 x 207	0.72
NCU 561.5 571.5	Celeron 400 MHz	32	50 x 316 x 207	0.72
NCU 572.5	Celeron 650 MHz	36	50 x 316 x 207	0.72
NCU 573.5	Pentium III 933 MHz	40	50 x 316 x 207	0.72
NCU box	–	–	Without fan box: 50 x 480 x 265 With fan box: 50 x 510 x 265	3.2
Fan box	–	–	50 x 47 x 136	0.14

*) NCU with NCU box, without handwheel and I/O

Note

The NCU is supplied with power via the device bus (HF1/2) from the SIMODRIVE infeed module (see Table 4-10).

■

Notes

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I/O Modules

5

5.1 Single I/O module

Short description

The single I/O module has 64 inputs and 32 short-circuit-proof outputs (isolated). Each output can be loaded with 0.5 A. The coincidence factor is 75%.

Up to three single I/O modules can be connected to the SINUMERIK 840D; combinations with SIMATIC S7-300 lines are possible.

Connection to 840D

The single I/O module (connector X3 IN) is connected to the SINUMERIK 840D (connector X111). The max. cable length is 10 m. Two cable variants are available for the connection from one single I/O module to the next:

- For single mounting: 6ES7368-3□□□0-0AA0

- For single-tier configuration with several single I/O modules: 6FC5 411-0AA80-0AA0, length 150 mm
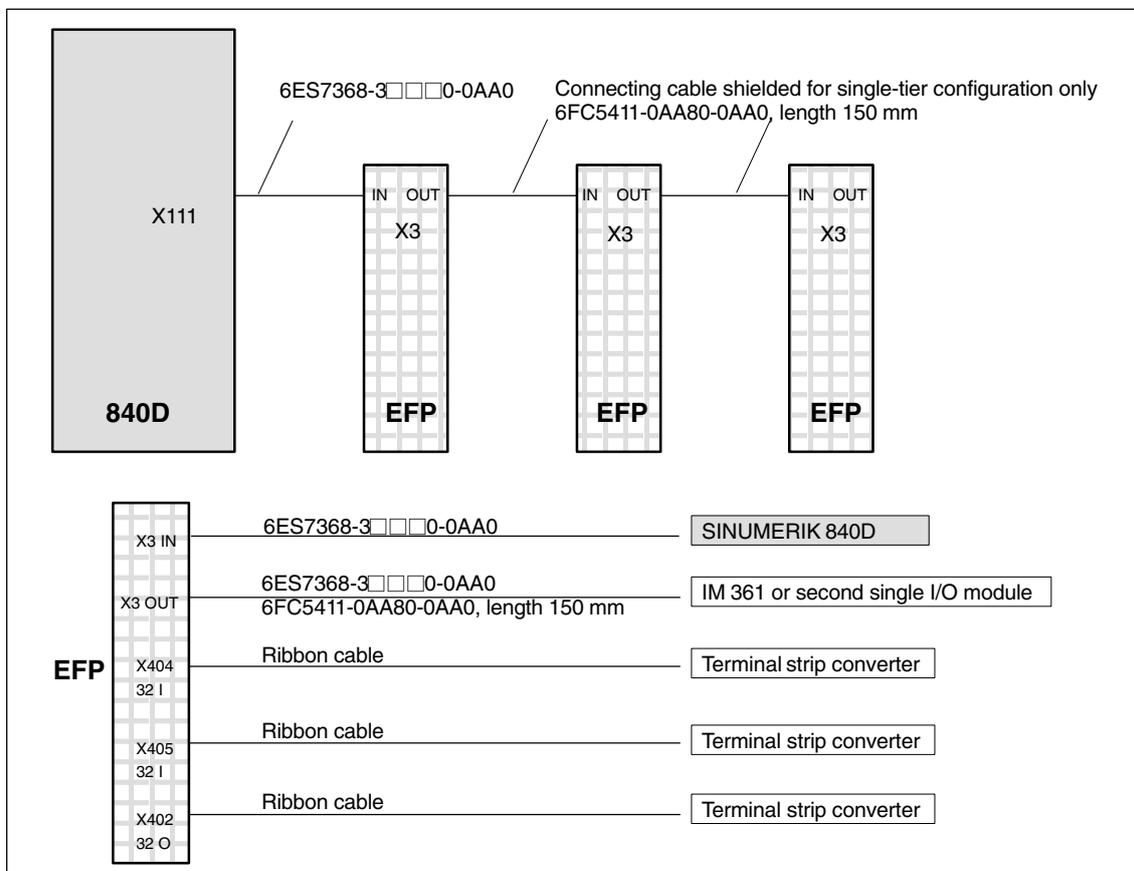
Fig. 5-1   Overview of connections, single I/O modules on the SINUMERIK 840D
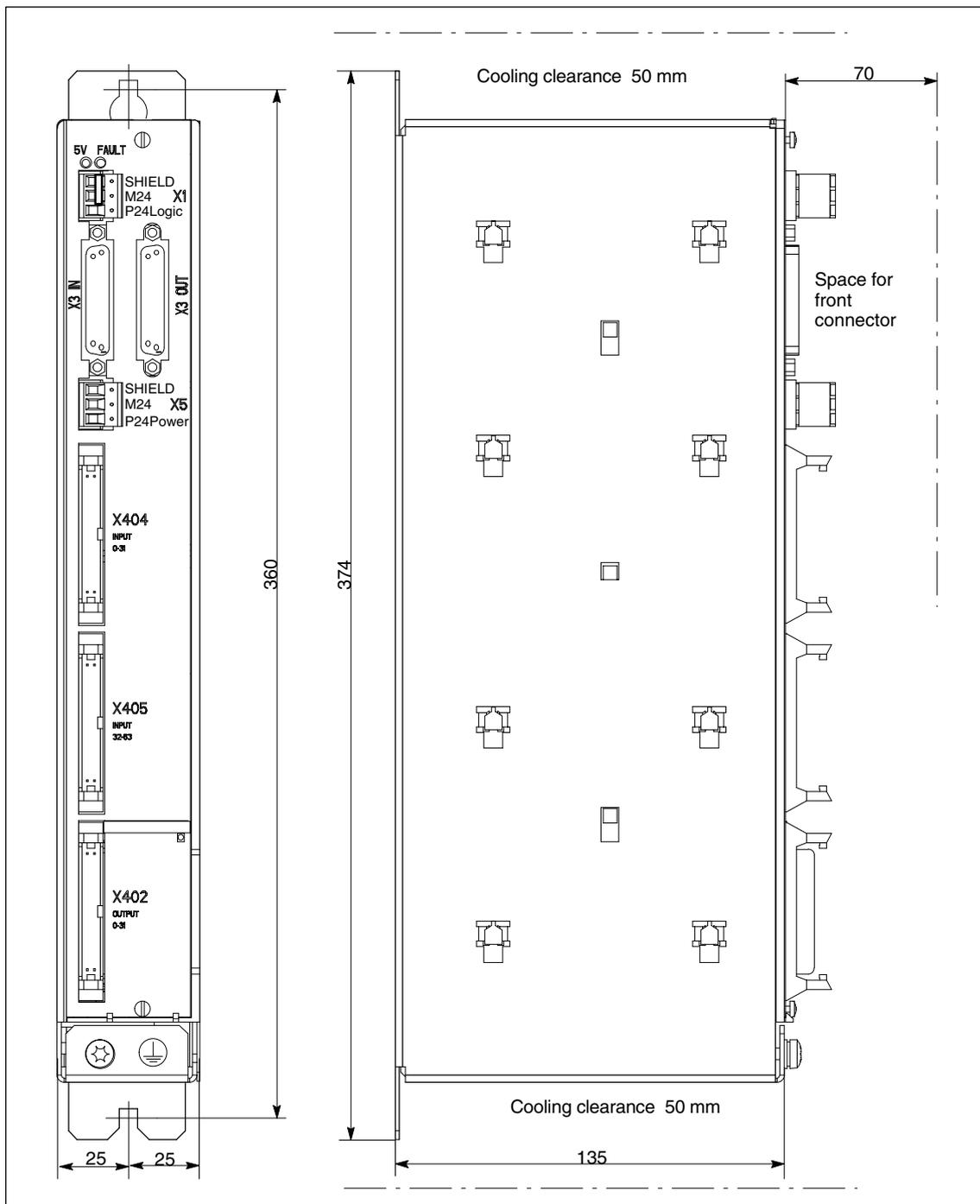
Fig. 5-2   Dimension drawing of single I/O module

EMC measures   The single I/O module has an equipotential bonding terminal. To conduct inter-ference currents away, a low-resistance finely stranded bonding conductor to the ground bus is required (see Subsection 2.1.3) with a cross-section of at least 10 mm^2. The connection must be as short as possible. When the PE and interference conductors are in common, the PE conductor rules in EN 61800–5–1 must be followed.

Technical data

Table 5-1   Technical data of the single I/O module

Power supply for LOGIC (X1) and POWER (X5)		
	– Nominal value	DC 24 V
	– Perm. range	18.5 ... 30.2 V
	– Ripple	3.6 V ss
	– Polarity reversal protection	yes
	– Fuse-protection	LOGIC: 1 A/250 V POWER: no
Current consumption	– LOGIC	type: 0.3 A , max. 1 A
	– POWER	max. 12 A
Power loss	– LOGIC	type: 7.2 W, max. 30.2 W
	– POWER	max: 362 W
Inputs		
	Number of inputs	64 digital inputs
	Signal level for signal "0"	−3 V to + 5 V
	Signal level for signal "1"	+ 15 V to +30 V
	Isolation	yes (optocoupler)
	Input current 1-signal	2–15 mA, type: 6 mA
	Input current 0-signal	−9 mA to 1 mA
	Delay time T_{PHL}	0.5 to 3 ms
	Delay time T_{PLH}	0.5 to 3 ms
	Noise immunity (DIN 57847)	2 kV
	Cable length terminal block	max. 3 m
Outputs		
	Number of outputs	32 digital outputs
	Signal level for signal "0"	open
	Signal level for signal "1"	U_{Power} – 0.5 V
	Isolation	yes (optocoupler)
	Short-circuit-proof	yes
	Max. output current	resistive: 0.6 A inductive: 0.6 A lamp: 6 W
	Switching frequency	ohmic load: 100 Hz inductive load: 2 Hz lamp load: 11 Hz
	Noise immunity (DIN 57847)	2 kV
	Cable length terminal block	max. 3 m
Overtemperature protection		block-specific shutdown
Coincidence factor Total of all nominal currents within each group of 0.5 A		75%
Degree of protection		IP20 or IPXXB
Weight		1.7 kg

5.1 Single I/O module

Connection of the electronics power supply

The 24 V DC power supply is connected to X1 via a 3-way angled Phoenix screw terminal connector (2.5 mm^2).

| X1 | | SHIELD (pin 3)
M24 (Pin 2)
P24Logic (pin 1) |

Table 5-2   X1 pin assignment

X1 LOGIC power supply		
Pin	**Name**	**Type**
3	**SHIELD**	
2	**M24**	**VI**
1	**P24 Logic**	**VI**

Signal names

P24 Logic	+24 V electronics power supply external
M24	Electronics power supply ground external

Signal type

VI	Voltage Input

Note

SHIELD and M24 must be bridged.

Connection of the load power supply

The 24 V DC load power supply is connected to X5 via a 3-way angled Phoenix screw terminal connector (2.5 mm^2).

| X5 | | SHIELD (pin 3)
M24 (Pin 2)
P24 Power (pin 1) |
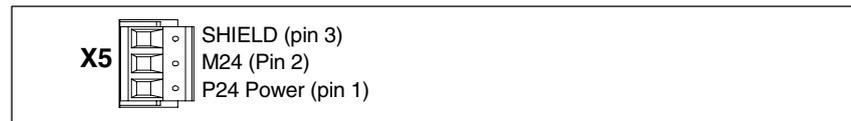
Table 5-3   Assignment of connector X5

X5 POWER power supply		
Pin	**Name**	**Type**
3	**SHIELD**	
2	**M24**	**VI**
1	**P24 Power**	**VI**

Signal names

P24 Power	+24 V electronics load power supply external
M24	Electronics load power supply ground external

Signal type

VI	Voltage Input

Connection of the   The inputs/outputs are connected via ribbon cables (max. 3 m length). The fol-
inputs/outputs   lowing 34-pole terminal strip converters can be used for this purpose:
                        see **References:**   Catalog NC Z
                        Terminal strip converter without LED: 6FC9302-2AA
                        Terminal strip converter with LED red: 6FC9302-2AB (0.5 A)
                                                                  6FC9302-2AL (2 A)
                        Terminal strip converter with LED green: 6FC9302-2AD
                        Assignment of the ribbon cable is compatible with the I/O modules (logic mod-
                        ules) of the SINUMERIK 840D.

Meanings   The module status of the single I/O module is indicated via two LEDs.
of the LEDs
                        LED green: 5 V Power OK
                        LED red: Group error

X402   Connecting the outputs
outputs 0–31
                        Connector name: X402 OUTPUT 0–31
                        Connector type: 34-pole DIN ribbon cable connection
                        Length of the ribbon cable: Max. 3 m to the terminal strip converter

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Note

The outputs must be protected externally against voltage surges by inductive
loads. (free-wheeling diodes, RC elements, . . .)

1	Not assigned		2	Not assigned	
3	OUT0[0]	O	4	OUT0[1]	O
5	OUT0[2]	O	6	OUT0[3]	O
7	OUT0[4]	O	8	OUT0[5]	O
9	OUT0[6]	O	10	OUT0[7]	O
11	OUT1[0]	O	12	OUT1[1]	O
13	OUT1[2]	O	14	OUT1[3]	O
15	OUT1[4]	O	16	OUT1[5]	O
17	OUT1[6]	O	18	OUT1[7]	O
19	OUT2[0]	O	20	OUT2[1]	O
21	OUT2[2]	O	22	OUT2[3]	O
23	OUT2[4]	O	24	OUT2[5]	O
25	OUT2[6]	O	26	OUT2[7]	O
27	OUT3[0]	O	28	OUT3[1]	O
29	OUT3[2]	O	30	OUT3[3]	O

SINUMERIK 840D Configuring Manual NCU (PHD) – 03.06 Edition   5-67

| 31 | OUT3⌈4⌉ | O | 32 | OUT3⌈5⌉ | O |
| 33 | OUT3⌈6⌉ | O | 34 | OUT3⌈7⌉ | O |

Signal names

OUTi[j]   Output j of output byte i

Signal type

O   Output

X404
inputs 0 to 31

Connecting inputs 0 to 31

Connector name: X404 INPUT 0–31
Connector type: 34-pole DIN ribbon cable connection
Length of the ribbon cable: Max. 3 m to the terminal block

1	Not assigned		2	Not assigned	
3	INP0⌈0⌉	I	4	INP0⌈1⌉	I
5	INP0⌈2⌉	I	6	INP0⌈3⌉	I
7	INP0⌈4⌉	I	8	INP0⌈5⌉	I
9	INP0⌈6⌉	I	10	INP0⌈7⌉	I
11	INP1⌈0⌉	I	12	INP1⌈1⌉	I
13	INP1⌈2⌉	I	14	INP1⌈3⌉	I
15	INP1⌈4⌉	I	16	INP1⌈5⌉	I
17	INP1⌈6⌉	I	18	INP1⌈7⌉	I
19	INP2⌈0⌉	I	20	INP2⌈1⌉	I
21	INP2⌈2⌉	I	22	INP2⌈3⌉	I
23	INP2⌈4⌉	I	24	INP2⌈5⌉	I
25	INP2⌈6⌉	I	26	INP2⌈7⌉	I
27	INP3⌈0⌉	I	28	INP3⌈1⌉	I
29	INP3⌈2⌉	I	30	INP3⌈3⌉	I
31	INP3⌈4⌉	I	32	INP3⌈5⌉	I
33	INP3⌈6⌉	I	34	INP3⌈7⌉	I

Signal names

INPi[j]   Input j of input byte i

Signal type

I   Input

X405
inputs 32 to 63

Connecting inputs 32 to 63

Connector name: X405 INPUT 32–63
Connector type: 34-pole DIN ribbon cable connection
Length of the ribbon cable: Max. 3 m to the terminal block

1	Not assigned		2	Not assigned	
3	INP4[0]	I	4	INP4[1]	I
5	INP4[2]	I	6	INP4[3]	I
7	INP4[4]	I	8	INP4[5]	I
9	INP4[6]	I	10	INP4[7]	I
11	INP5[0]	I	12	INP5[1]	I
13	INP5[2]	I	14	INP5[3]	I
15	INP5[4]	I	16	INP5[5]	I
17	INP5[6]	I	18	INP5[7]	I
19	INP6[0]	I	20	INP6[1]	I
21	INP6[2]	I	22	INP6[3]	I
23	INP6[4]	I	24	INP6[5]	I
25	INP6[6]	I	26	INP6[7]	I
27	INP7[0]	I	28	INP7[1]	I
29	INP7[2]	I	30	INP7[3]	I
31	INP7[4]	I	32	INP7[5]	I
33	INP7[6]	I	34	INP7[7]	I

Signal names

INPi[j]   Input j of input byte i
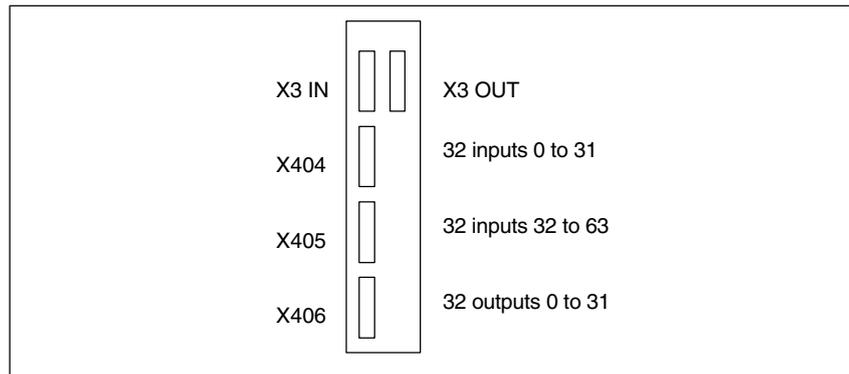
Signal type

I   Input

Address space

From the PLC's viewpoint, the 840D single I/O is equivalent to a S7-300 I/O chain with the following configuration:

- P-bus interface IM-R

- 2 x 32-bit input module

- 1 x 32-bit output module

5.1   Single I/O module

This results in the following address space:

1. Input range
    Input byte (chain number *32) to (chain number *32) +7, i.e. from input byte
    32 to input byte 39 for operation in chain 1

2. Output range
    Output byte (chain number *32) +8 to (chain number *32) +11, i.e. from out-
    put byte 40 to output byte 44 for operation in chain 1

Only one I/O module is possible per chain.

The address range is assigned automatically during start-up. Parameterization
is not required.

In HW-Config, it is possible to treat the 840D I/Os as the equivalent arrange-
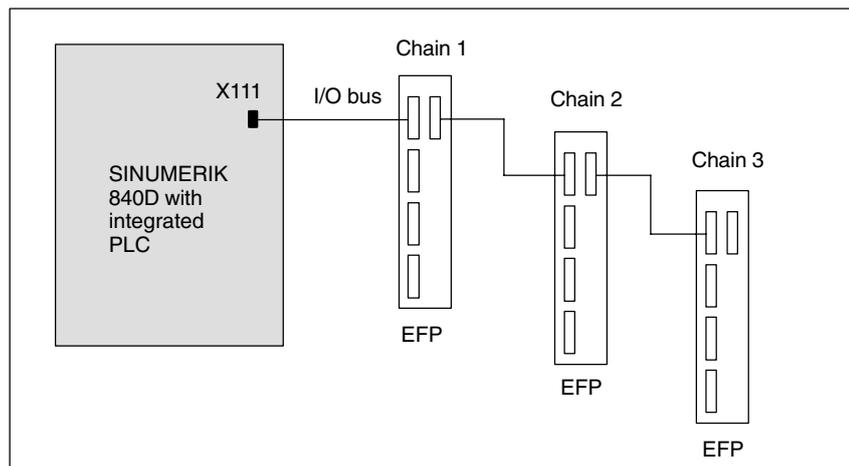ment of S7-300 modules.

Fig. 5-3   SINUMERIK 840D with 3 I/O chains (max. configuration)

■

Terminal Block

6.1 NCU terminal block 6FC5211-0AA00-0AA0

X20: Interface with the drive bus

X21: Interface with the next NCU terminal block

2.5 mm²
0 V   24 V
4 3 2 1

X9: Terminal external 24 V logic power supply

Shielding plate

100

DMP compact module slots

1   2   3   4   5   6   7   8

74,4

PE conductor connection

Status LED green : 5V OK
Status LED yellow : Internal fault terminal block
Status LED red : External fault (drive bus interface)

237

257

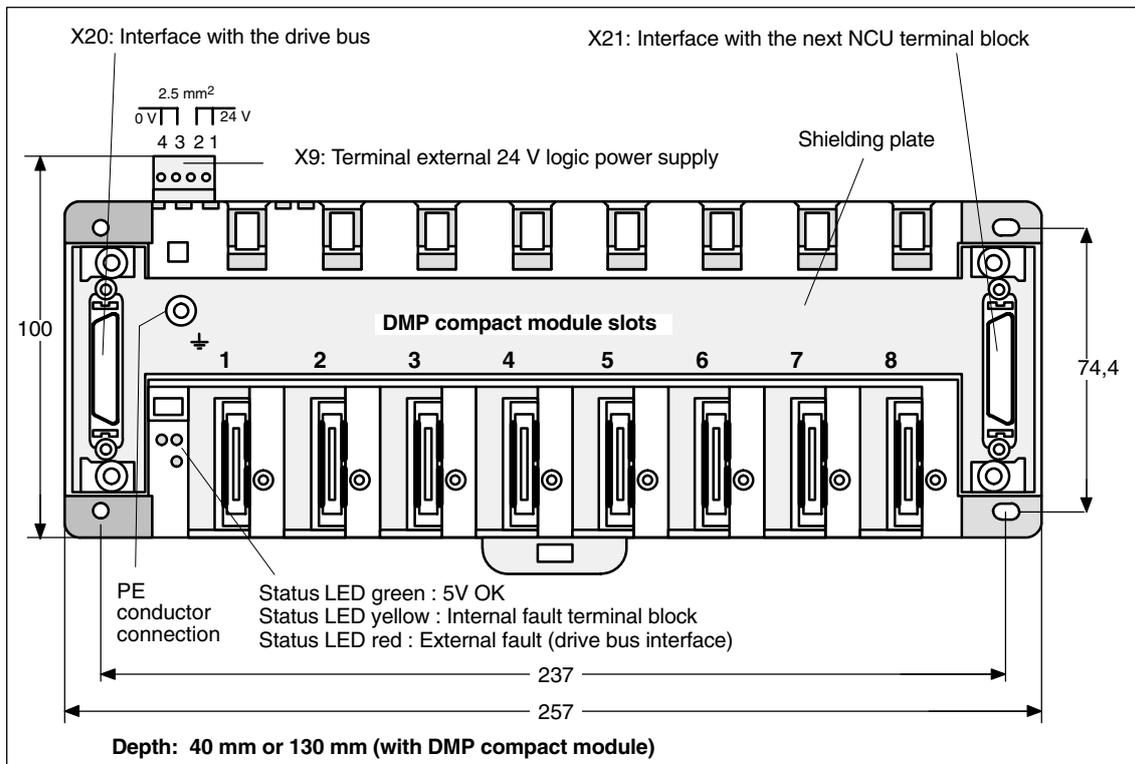**Depth: 40 mm or 130 mm (with DMP compact module)**

Fig. 6-1   Front view of NCU terminal block

Mounting

In order to ensure optimum heat dissipation of the DMP compact module, the terminal block should be secured horizontally, so that the modules can be suspended vertically.

**Connection to the
drive bus**

The terminal block is connected to connector X20 on the drive bus of the last
drive module via round cables. These cables are available in different lengths.
(cable lengths 1, 2, 5, and 10 m). Up to 2 terminal blocks can be operated (in
accordance with the available NCK addresses for rapid analog and digital I/Os).
The round cables are also used in conjunction with individual terminal blocks.

!   **Important**

Please make sure that the total length of the cable connections does not
exceed 10 m.

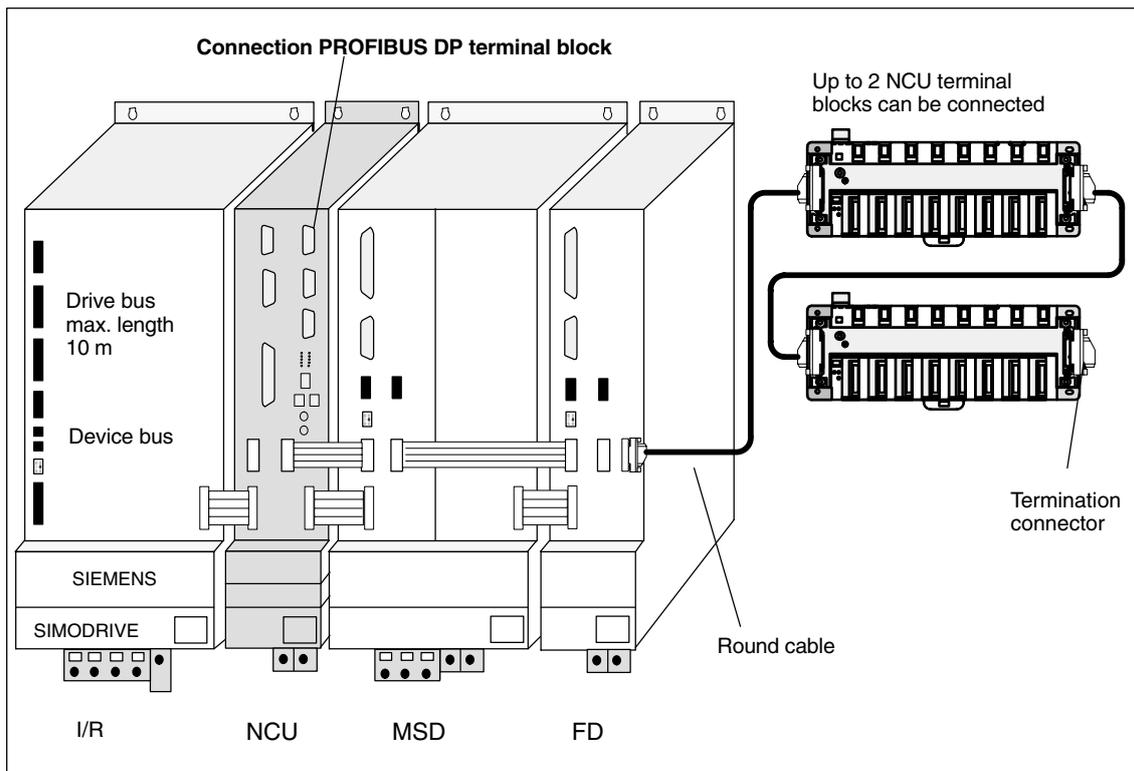Fig. 6-2   Connection of terminal block to 840D

Terminator

The termination connector must be plugged into slot X21 on the last NCU termi-
nal block.

**Protective
conductor**

When the PE and interference conductors are in common, the PE conductor
rules in EN 61800–5–1 must be followed. PE conductor connection, see
Fig. 6-1.

6-72

SINUMERIK 840D Configuring Manual NCU (PHD) – 03.06 Edition

EMC measures

The PE conductor connection is also used to conduct interference currents away from:

- the shields of the DMP casing,
- the DMP compact plug-in modules,
- the 24 V logic power supply.

To ensure that these interference suppression measures are effective, there must be a low-resistance connection between the shielding plate and ground potential.

The low-resistance bonding conductor should be a fine stranded cable with a cross-section of at least 10 mm^2 and a length of at least < 30 cm, if possible.

DMP compact modules

No more than 8 DMP compact modules can be connected per NCU terminal block.

Module type	Max. number	Distinction
DMP compact module 16 I	2	Digital inputs
DMP compact module 16 O	2	Digital outputs 0.5 A
DMP compact module 8 O	4	Digital outputs 2.0 A
DMP compact module 1I analog	8	Analog input 13 bits
DMP compact module 1I NC analog IN	4	High-speed analog input 75 μs, 12 bits
DMP compact module 1A analog	4	Analog output 14 bits

Maximum number of components in all terminal blocks of a controller:

Peripherals	Number
Digital inputs	32
Digital outputs	32
Analog inputs	8
Analog outputs	8

!

Important

No more than 4 analog outputs and 4 analog inputs can be plugged in at the same time for each NCU terminal block.

⚠

Caution

After the load supply voltage for the DMP compact modules has been switched off during operation, the outputs do not reliably reestablish through-connection when the load supply voltage is switched on again. If switch-off during operation cannot be avoided, the DMP outputs have to be reset via the PLC program when the load supply voltage is switched off. The outputs are set again after the voltage has been switched on again.

Monitoring

- +5 V monitoring

- Temperature monitoring 60° C $\pm$ 3°C

- Configuration monitoring

- Sign-of-life monitoring (watchdog) of the microcontroller

- Sign-of-life monitoring of the NC

Error	Acquisition	Effect
Undervoltage (< 4.75 V)	Limit monitor	Disabling of the NC outputs, LED (green) off
Ambient temperature	Temperature sensor	Status signal to NC, screen display
Sign of life NCU	Cyclic signaling	Disabling of the NC outputs, LED (red) on
Watchdog	Timing	Disabling of the NC outputs, LED (red) on
Hardware combination	Hardware configuration	Disabling of the NC outputs LED (red, yellow) an, status signal to NC

The binary and analog outputs are switched to a safe state (0 V at the output) with the XOUTDS signal in the event of disturbances or faults in the NCU, the microcontroller, and power failure.

Power supply

DC 24 V (20.4 V DC to 28.8 V DC)
Connector designation: X9
Connector type: 4-pole terminal block, 2.5 mm^2 Terminal

Table 6-1 X9 pin assignments

X9		
Pin	Name	Type
1	P24 ext	VI
2	P24 ext	VI
3	M24 ext	VI
4	M24 ext	VI

Note

Pins 1 and 2 or 3 and 4 are bridged in a group on the module.

Signal names

P24 ext   +24 V power supply external
M24 ext   Power supply ground external

Signal type

VI   Voltage Input

X20/X21   Drive bus interface
                           Connector name: X20 (IN)   X21 (OUT)
                           Connector type: 36-pole micro ribbon
                           Special features: Non-isolated, no protective separation
                           Caution: Max. length of the drive bus is 10 m

X11–X18   Module connector
                           Connector name: X11 ... X18 (slots 1 ... 8)
                           Connector type: 30-pole male connector ELCO Microleaf

Table 6-2   Technical data of the NCU terminal block

Mechanical data			
Dimensions	Height	Width	Depth
	100 mm	257 mm	40 mm
Weight	Approx. 0.5 kg		
Ambient conditions			
Degree of protection	IP20 or IPXXB		
Power consumption (24 V)			
During operation	150 – 500 mA		

■

Notes

DMP Compact Modules

7

Mounting   The following dimensions must be observed when mounting:

Table 7-1   Dimensions of the DMP compact modules

Width	25 mm
Height	90 mm
	115 mm with plugged in connecting plugs
	130 mm with terminal block
Depth	108 mm
Degree of protection	IP20 or IPXXB

7.1   DMP compact module 16E 6FC5111-0CA01-0AA0

The DMP compact module 16E is an encapsulated module. It can be plugged into a slot of the (PROFIBUS DP or NCU) terminal block as a plug-in module.
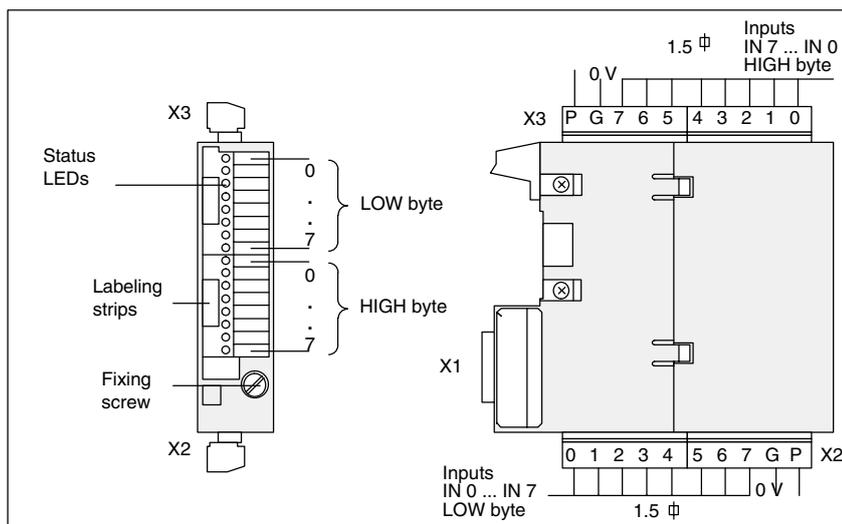

Fig. 7-1   Front view and side view of a DMP compact module 16E

Interfaces   •   A 30-pole connector X1 for connection to the NCU terminal block.

                       •   Two 10-terminal X2 and X3 (Phoenix, Type MC1.5/10-ST-3.81 GREY, Order
                           No. for X3 and X2: 18 28 171) for connecting the 16 inputs and the load
                           power supply.

                       •   The terminals are pluggable and can be mechanically coded by the custo-
                           mer.

                       •   The 24 V terminal P (24 V) is not used

Display elements   16 LEDs as a status display for the logical states of the inputs.

                       LEDs lit: Input on.

Table 7-2   Technical data DMP compact module 16 I

Number of inputs		16 digital inputs
Galvanic isolation		Yes
Power supply V_{LOAD}		
	– Rated value	24 V DC
	– Perm. range	20.4 V to 28.8 V
	– Ripple	3.6 Vpp
Input voltage		
	– Rated value	24 V DC
	– For signal "0"	–3 to +5 V
	– For signal "1"	+13 V to +33 V
Input current for signal "1"		+2 mA to +5 mA
Delay time	for tp_{LH}	tp_{LH} = type 1 ms
Delay time	for tp_{HL}	tp_{HL} = type 1 ms
Length for cables	Maximum	30 m
Weight	About	125 g

7.2 DMP compact module 16 A 6FC5111-0CA02-0AA1

The DMP compact module 16O is an encapsulated module. It can be plugged into a slot of the (PROFIBUS DP or NCU) terminal block as a plug-in module.
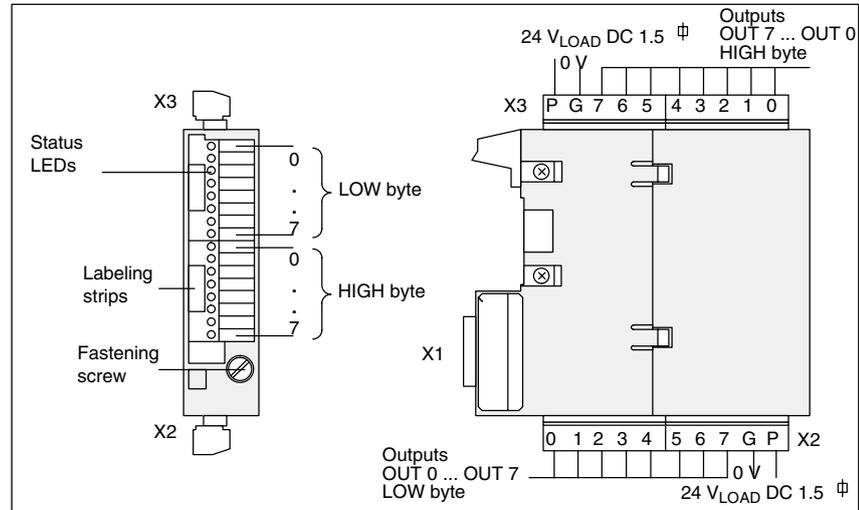

Fig. 7-2   Front view and side view of a DMP compact module 16A

Interfaces
- A 30-pole connector X1 for connection to the NCU terminal block.

- 10-terminal X2 and X3 (Phoenix, Type MC1.5/10-ST-3.81 GREY, Order No. for X3 and X2: 18 28 171) for connecting the 16 outputs and the load power supply.

- The terminals are pluggable and can be mechanically coded by the customer.

Display elements

16 LEDs as a status display for the logical states of the outputs. As from product version B, the LEDs go out when the load voltage fails.

LEDs lit: Output on.

Table 7-3   Technical data of DMP compact module 16O

Number of outputs	16 digital outputs
Galvanic isolation	Yes
Power supply V_{LOAD}	
– Rated value	24 V DC
– Perm. range	20.4 V to 28.8 V
– Ripple	3.6 Vpp
Signal level of the outputs (typically)	
– For signal "0"	Open
– For signal "1"	V_{load} –250 mV

Table 7-3   Technical data of DMP compact module 16O

Output load for signal "1" (rated value)		
	– Ohmic load	500 mA
	– Lamp load	5 W
	– Inductive load	500 mA
Short-circuit protection		Yes
Power loss at 30 V		max. 3.8 W
Operating frequency for		
	– Ohmic load	100 Hz
	– Lamps	11 Hz
	– Inductive load (for rated load, higher values are permissible for lower loads)	2 Hz
Derated loading at 55 °C (relative to the total of the rated currents of all outputs)		50%
Delay time	for tp_{LH}	tp_{LH} = max. 0.5 ms
Delay time	for tp_{HL}	tp_{HL} = max. 0.5 ms
Length for cables	Maximum	30 m
Weight	About	160 g

Important

As of version C, a new output driver is used for the DMP compact module 16A. The following behavior is to be observed:
In the event of a fault triggered by overcurrent or short-circuit, the outputs automatically reconnect after the fault has been rectified. (previously: a retentive shutdown until the output is energized again by the PLC user program).
When an output is short-circuited, the three additional outputs of the corresponding half byte can also be shutdown.
In normal mode, with currents of < 0.7 A, no opposing effect occurs.

8 outputs each are powered by a power supply. For each group of 8 outputs (2 x outputs 0 ... 7), the total of the output currents must not be greater than 2 A. (This corresponds to a coincidence factor of 50% if each output is under full load). All 16 outputs can be loaded simultaneously with 0.25 A for example.

Important

If inductive loads are used, switching voltage peaks must be limited by external free-wheeling diodes or RC connections.

7.3 DMP compact module 8 A (6FC5111-0CA03-0AA1)

The DMP compact module 8O is an encapsulated module. It can be plugged into a slot of the (PROFIBUS DP or NCU) terminal block as a plug-in module.
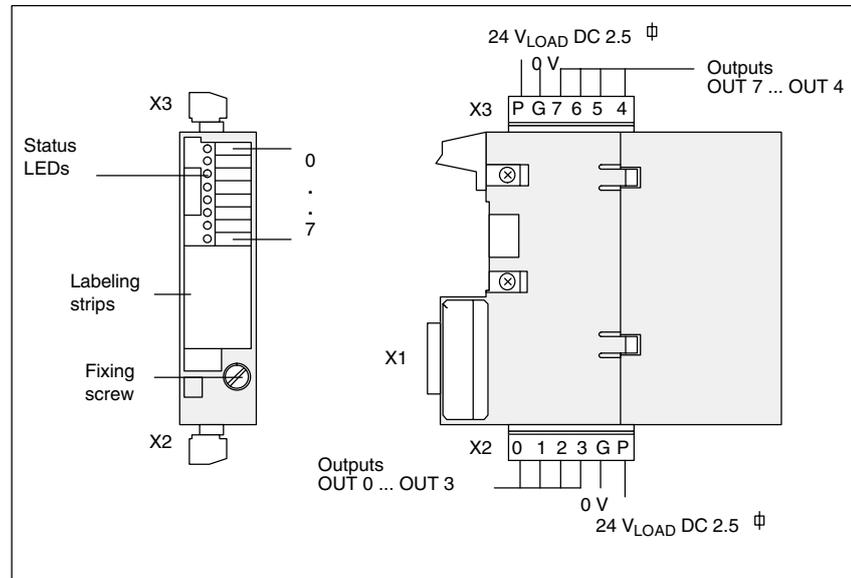

Fig. 7-3   Front view and side view of a DMP compact module 8A

Terminal	P	G	7/3	6/2	5/1	4/0
X3	24 V	0 V	OUT 7	OUT 6	OUT 5	OUT 4
X2	24 V	0 V	OUT 3	OUT 2	OUT 1	OUT 0

Interfaces
- A 30-pole connector X1 for connection to the NCU terminal block.

- 6-pole terminals X3 and X2 (Phoenix, type MSTB2.5/6-ST-5.08 GRAY Order No. for X3 :18 28 647 and for X2: 18 28 168) for connecting the 8 outputs and the load power supply.

- The terminals are pluggable and can be mechanically coded by the customer.

Display elements
8 LEDs as a status display for the logical states of the outputs. As of product version B, the LEDs go out when the load voltage fails.

LEDs lit: Output on

7.3   DMP compact module 8 A (6FC5111-0CA03-0AA1)

Table 7-4   Technical data of DMP compact module 8O

Number of outputs	8 digital outputs
Galvanic isolation	Yes
Power supply V_{LOAD}	
– Rated value	24 V DC
– Perm. range	20.4 V to 28.8 V
– Ripple	3.6 Vpp
Signal level of the outputs (typically)	
– For signal "0"	Open
– For signal "1"	V_{load} –80 mV
Output load for signal "1" (rated value)	
– Ohmic load	2000 mA
– Lamp load	25 W
– Inductive load	2000 mA
Short-circuit protection	Yes
Power loss at 30 V	max. 3.1 W
Operating frequency for	
– Ohmic load	100 Hz
– Lamps	11 Hz
– Inductive load (for rated load, higher values are permissible for lower loads)	2 Hz
Derated loading at 55 °C (relative to the total of the rated currents of all outputs)	50%
Delay time for tp_{LH}	tp_{LH} = max. 0.5 ms
Delay time for tp_{HL}	tp_{HL} = max. 0.5 ms
Length for cables Maximum	30 m
Weight About	145 g

4 outputs each are powered by a power supply. For each group of 4 outputs (outputs 0 to 3 and 4 to 7), the total of the output currents must not be greater than 4 A. (This corresponds to a coincidence factor of 50 % if each output is under full load). All 8 outputs can be loaded simultaneously with 1 A for example.

!

Important

If inductive loads are used, switching voltage peaks must be limited by external free-wheeling diodes or RC connections.

7.4 DMP compact module 1I analog 6FC5 111-0CA04-0AA0

The DMP compact module 1I analog is an encapsulated module. It can be plugged into a slot of the (PROFIBUS DP or NCU) terminal block as a plug-in module. The conversion time is a max. of 60 ms in the rated range and a max. of 80 ms in the overshoot range.
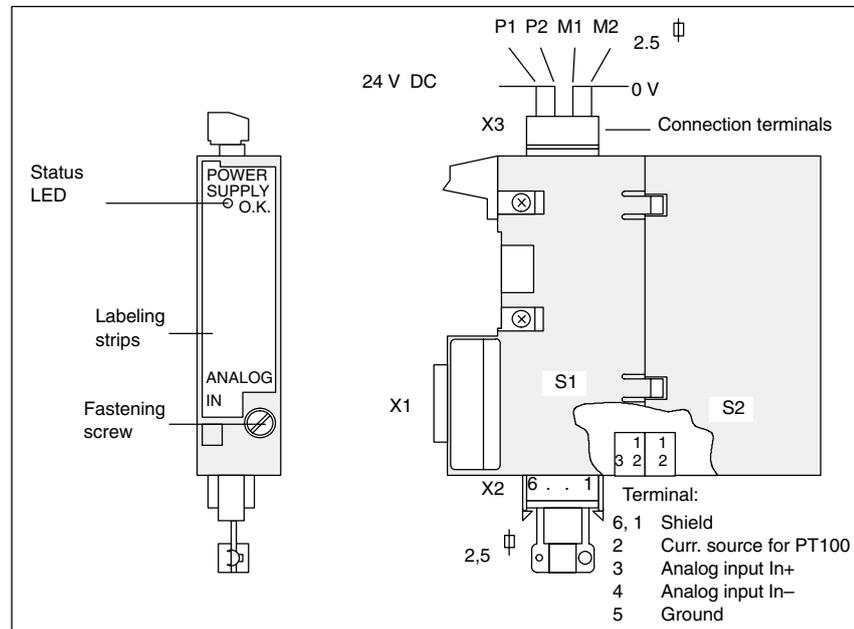

Fig. 7-4   Front view and side view of a DMP compact module 1E analog

Interfaces

- A 30-pole connector X1 for connection to the NCU terminal block.

- 4x terminal X3 (Phoenix, Type MSTB2.5/4-ST-5.08 GREY, Order No. for X3: 18 48 407) for connecting the power supply for the analog part and 6x terminal X2 (Phoenix, Type MSTB2.5/6-ST-5.08 GREY, Order No. for X2: 17 87 076) for connecting the analog input.

- The terminals are pluggable and can be mechanically coded by the customer.

Display elements

1 LED as a status display for the power supply.

LED lit: Internal power supply OK

Jumpering

S1:   Setting of the measurement range
        1–2 closed: +10 V
        1–3 closed: +500 mV

S2:   Setting the line frequency
        closed: for 50 Hz systems
        open: for 60 Hz systems

7.4   DMP compact module 1I analog 6FC5 111-0CA04-0AA0
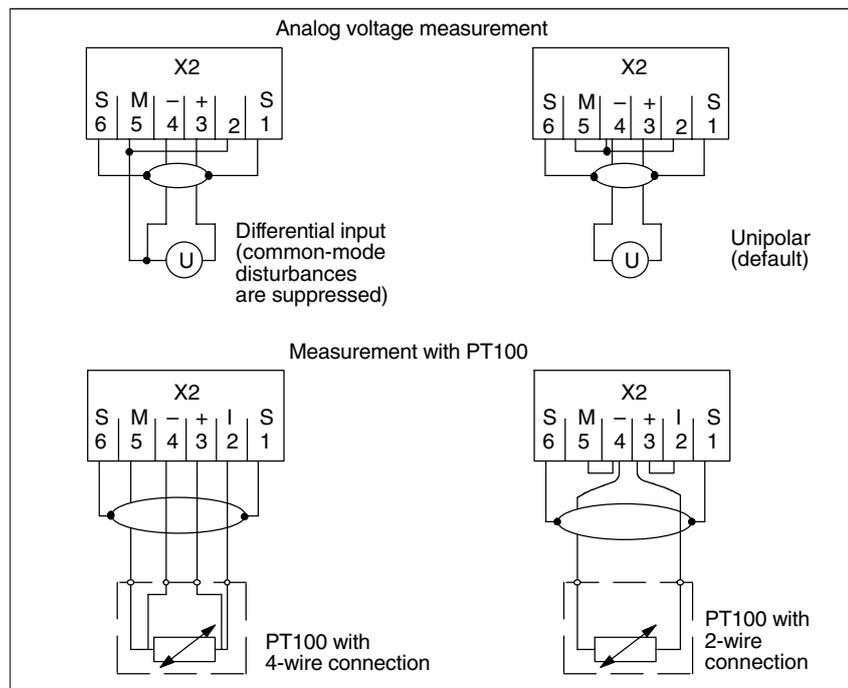
Example circuits

Fig. 7-5   Example circuits for DMP compact module 1I analog

Note

If the power source is not required, it must be short-circuited.

Table 7-5   Technical data DMP compact module 1I analog

Number of inputs		1 analog input
Galvanic isolation		Yes
Power supply V_{LOAD}	– Rated value – Perm. range – Ripple	24 V DC 20.4 V to 28.8 V 3.6 Vpp
Input voltage	– Rated range – Overshoot range	± 10 V or ± 500 mV+ ± 20 V or ± 1 V
Input resistance		40 kΩ or 1 MΩ
Power consumption (24 V)		45 mA
I_{const} for PT100		2.5 mA
Connection of signal generators		See below
Digital representation of the input signal		12 bits + sign
Error message on overrange (± 20 V; ± 1 V)		Yes
Basic error limits		$\pm 0.2\%$
Operational limits (0 °C to 60 °C)		$\pm 0.5\%$
Length of cables (shielded)	max.	30 m
Weight	about	150 g

The DMP compact module 1I analog is used to input and digitize an analog voltage value. This voltage value is measured by an isolated differential input.

In conjunction with the installed constant current source (2.5 mA), it is possible to connect PT100 resistance thermometers.

Conversion time

The conversion time depends on the level of the input voltage.
Input voltage in the dimensioning range —> conversion time < 60 ms
input voltage in the overshoot range —> conversion time < 80 ms
The integration time is included in the conversion time, which determines the noise suppression:
S 2 closed—> Integration time 20 ms 50 Hz noise suppression.
S 2 open —> Integration time 16 2/3 ms 60 Hz noise suppression.

Table 7-6   Digital analog value representation for DMP compact module 1E analog

Input word	IB m								IB m+1								Analog input voltage	
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	10V range	500 mV range
Significance	VZ	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	0	0R	PF		
Digital value	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	19.995 V	999.76 mV
						:								:			:	:
	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	10.005 V	500.24 mV
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10 V	500 mV
	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	9.995 V	499.76 mV
						:								:			:	:
	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0.005 V	0.24 mV
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 V	0 mV
	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	–0.005 V	–0.24 mV
						:								:			:	:
	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	–9.995 V	–499.76 mV
	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	–10 V	–500 mV
	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	–10.005 V	–500.24 mV
						:								:			:	:
	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	–19.995 V	– 999.76 mV

0   =   Always 0

OR=   Overflow bit, input voltage is greater than 20 V or 1 V (double input range)

PF =   Power supply failure of the analog part

7.5   DMP compact module 1E NC analog
6FC5211-0AA10-0AA0

The DMP compact module 1E NC analog is an encapsulated high-speed analog input module with 75μs access time. It can be plugged into a slot of the NCU terminal block as a plug-in module.

The DMP compact module 1E NC analog serves for inputting and digitizing an analog voltage value. This voltage value is measured by an isolated differential input.
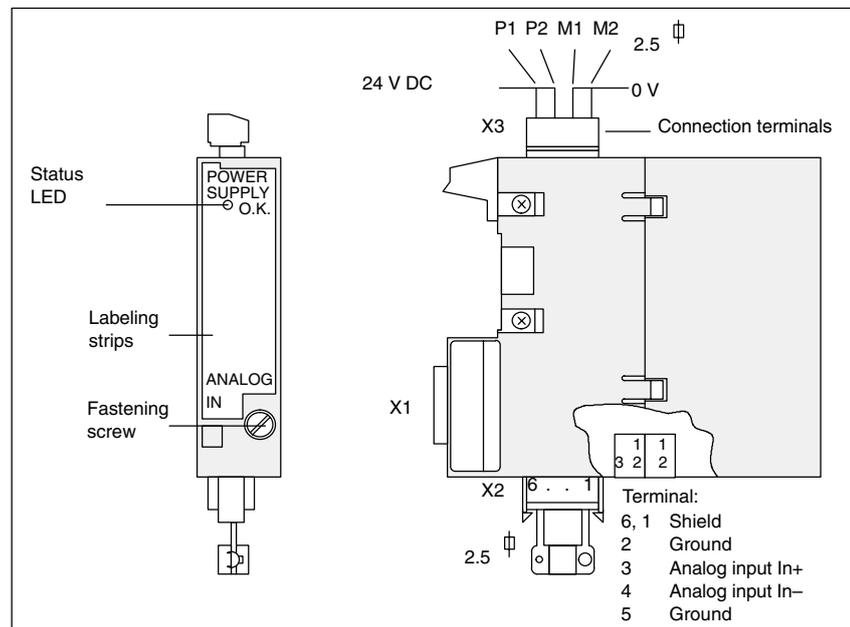

Fig. 7-6   Front view and side view of a DMP compact module 1E NC analog

Interfaces
- A 30-pole connector X1 for connection to the NCU terminal block.

- 4x terminal X3 (Phoenix, Type MSTB2.5/4-ST-5.08 GREY, Order No. for X3: 18 48 407) for connecting the power supply for the analog part and 6x terminal X2 (Phoenix, Type MSTB2.5/6-ST-5.08 GREY, Order No. for X2:   17 87 076) for connecting the analog input.

- The terminals are pluggable and can be mechanically coded by the customer.

Display elements

1 LED as a status display for the power supply.
LED lit: internal power supply OK.

Analog-value representation

The converter result is available to the user as two's complement. The resolution is 4.88 mV for one bit. The duration for a converter cycle (from triggering of conversion to the time at which the result can be read out) is max. 75 μs.

Table 7-7   Digital analog value representation for DMP compact module 1I NC analog

Input word	IB m								IB m+1								Analog input voltage
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	Range +/− 10 V
Significance	VZ	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	0	0	0	PF	
Digital value	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	9.995 V
					:						:				:		:
	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.005 V
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 V
	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	−0.005 V
					:						:				:		:
	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	−9.995 V
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	−10 V

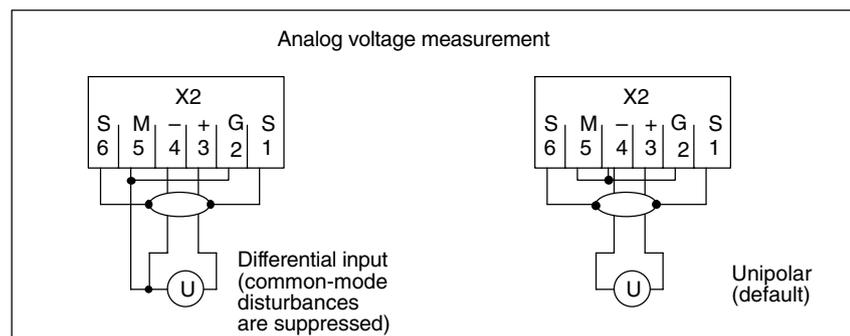0   =   always 0,   PF=failure of the power supply of the analog part

Example circuits

Fig. 7-7   Example circuits for DMP compact module 1I NC analog

Table 7-8   Technical data DMP compact module 1I NC analog

Number of inputs		1 analog input
Galvanic isolation		Yes
Power supply V_{LOAD}	– Rated value – Perm. range – Ripple	24 V DC 20.4 V to 28.8 V 3.6 Vpp
Input voltage	– Rated range	± 10 V
Input resistance		100 kΩ
Power consumption (24 V)		85 mA
Connection of signal generators		See below
Digital representation of the input signal		11 bits + sign
Total error over temperature range 0 to 55 °C including zero error		± 0.6 %
Length of cables (shielded)	Max.	30 m
Weight	Approx.	160 g

7.6   DMP compact module 1A analog
6FC5111-0CA05-0AA0

The DMP compact module 1A analog is an encapsulated module. It can be plugged into a slot of the (PROFIBUS DP or NCU) terminal block as a plug-in module.
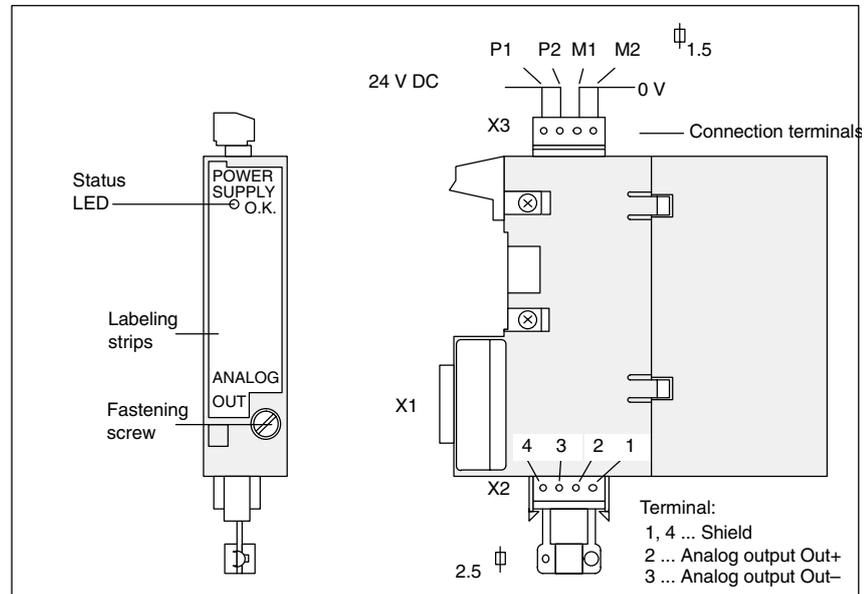

Fig. 7-8   Front view and side view of a DMP compact module 1A analog

Interfaces

- A 30-pole connector X1 for connection to the NCU terminal block.

- 4x terminal X3 (Phoenix, Type MC1.5/4-ST-3.81, Order No. for X3: 1828126) for connecting the power supply for the analog part and X2 (Phoenix, Type MSTB2.5/4-ST-5.08 GREY, Order No. for X2: 18 40 942) for connecting the analog output.

- The terminals are pluggable and can be mechanically coded by the customer.

Conversion time

The pure conversion time is a max. of 10 μs. Because the analog signal is smoothed by an RC element, its time constant determines the total conversion time:

- Product version A: 100 μs

- As of product version B: 330 μs

Display elements

1 LED as a status display for the power supply.

LED lit: internal power supply OK

Table 7-9   Technical data DMP compact module 1A analog

Number of outputs	1 analog output
Galvanic isolation	Yes
Power supply V_{LOAD}	
– Rated value	24 V DC
– Perm. range	20.4 V to 28.8 V
– Ripple	3.6 Vpp
Power consumption (24 V)	60 mA
Output voltage – Rated range	± 10 V DC
Output current	± 3 mA
Load resistance at voltage outputs Min.	3.3 kΩ
Digital representation of the input signal	13 bits + sign
Short-circuit protection	Yes
Length of cables (shielded) Max.	30 m
Weight About	140 g

Table 7-10   Digital analog value representation DMP compact module 1A analog

Output word	QB m								QB m+1								Analog output voltage
Signifi-cance	7 SG	6 2^{12}	5 2^{11}	4 2^{10}	3 2^{9}	2 2^{8}	1 2^{7}	0 2^{6}	7 2^{5}	6 2^{4}	5 2^{3}	4 2^{2}	3 2^{1}	2 2^{0}	1 always 0	0	
Digital value	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	+9.9988 V
	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	+1.22 mV
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 V
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	−1.22 mV
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	−10 V

■

Notes

Maintenance and Service

8.1 Battery and fan replacement
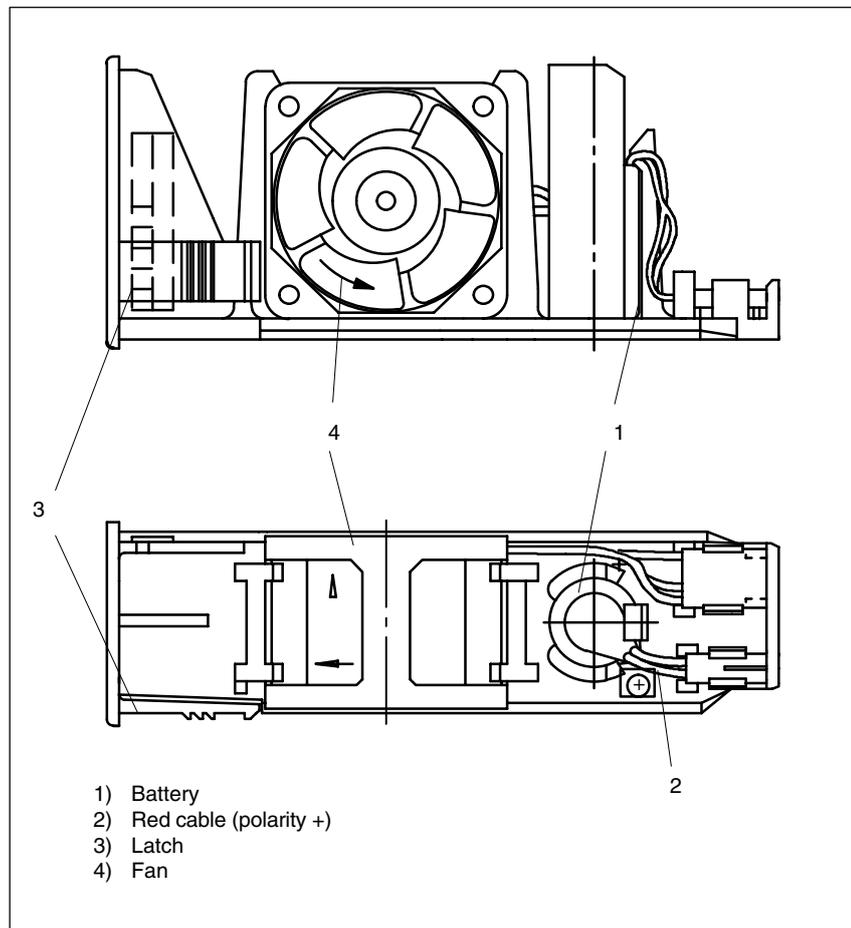
Fig. 8-1   Battery/fan slide-in module

1) Battery
2) Red cable (polarity +)
3) Latch
4) Fan

⚠

Danger

Do not attempt to reactivate discharged batteries with heat or by any other means. The batteries must not be recharged because this could cause leakage and/or explosion.

Non-compliance can cause injury to people or damage to property.

The NCU features battery-backed SRAMs and clock modules. The NCU monitors the backup voltage. The battery must be replaced within 6 weeks of a monitoring response. The battery/fan slide-in module in the NCU box can only be changed after switching off the controller. The data is backed up for a period of approx. 15 minutes.

Backup time

The service life of the batteries used is at least 3 years.

Replacement of the battery/fan slide-in module

The battery/fan subassembly is located under the DC link busbars (see Fig 3-3). The slide-in module is replaced in its entirety.

Order number of the battery/fan slide-in unit: **6FC5247-0AA06-0AA0**

1. Switch off the control.

2. Pull out the slide-in module. There is a latch (3) on the lower side of the slide-in module, see Fig. 8-1. Press this latch (3) up and pull the slide-in module forwards and out at the same time.

3. Install the new slide-in module. (within 15 minutes)

4. Switch the controller on again, the battery alarm should now be off.

                                                                                 ■

Abbreviations

A

AC	Alternating Current
C Bus	Communication Bus
CE	Communauté Européenne – European Community
CNC	Computerized Numerical Control
COM	Communication Module
CPU	Central Processor Unit
DC	Direct Current
DE	Automation System
DMIO	Distributed Machine Peripherals (I/Os)
DP	Distributed I/Os
EFP	Single I/O Module
EGB	Electrostatic Sensitive Device
EMC	Electromagnetic Compatibility
ESD	Electro Static Discharge
FD	Feed Drive
HHU	Handheld Unit
HMI	Human Machine Interface: Operator function of SINUMERIK for operation, programming and simulation.
HW-Config	SIMATIC S7 Tool for configuring and parameterizing S7 hardware within an S7 project
I/O bus	Peripherals Bus
I/R	Infeed/regenerative feedback module
IM	Interface Module: SIMATIC S7-300 interface module
IM address	Interface Module Address
ISA	Industry Standard Architecture
LED	Light Emitting Diode
LFT	Handheld Terminal
MCP	Machine Control Panel
MLFB (Order no.)	Machine-Readable Product Designation (order no.)
MPI	Multi Point Interface: Multi-point serial interface

MSD	Main Spindle Drive
NC	Numerical Control
NCK	Numerical Control Kernel: NC kernel with block preparation, traversing range, etc.
NCU	Numerical Control Unit – Hardware Unit of the NCK
NE	Mains Supply
NMI	Non Maskable Interrupt
OI	Unstabilized power supply
OP	Operator Panel: Operator panel front
OPI	Operator Panel Interface
PCMCIA	Personal Computer Memory Card International Association
PCU	Personal Computer Unit: NC controller component which allows the operator to communicate with the machine and vice versa.
PG	Programming device
PLC	Programmable Logic Control
PROFIBUS	Process Field Bus: Serial data bus
PS	Power Supply: SIMATIC S7-300 power supply
RAM	Random Access Memory: Program memory that can be read and written to
SRAM	Static RAM: Static memory (battery-backed)
UI	End User Interface
VGA	Video Graphics Adapter

■

Index

A

Abbreviations, A-93
Assembly of the NCU box, 3-32

B

Backup battery, transport, 2-27
Backup time, battery, 8-92
Battery replacement, 8-91
Battery/fan slide-in module, 8-92

C

Cable distributor
    Connector assignments, 4-58
    Set up and connection, 4-56
    Status table for S1–S6, 4-57
Cable routing, 3-35
Climatic environmental conditions, 2-26
    Operation, 2-27, 2-28
    Transport and storage, 2-26
COM module, 4-39
Connection assignment, cable distributor, 4-59
Connector coding, 4-58
Constraints, electric, 2-19
Conversion time
    DMP compact module 1A analog, 7-88
    DMP compact module 1I analog, 7-83, 7-85
Cooling clearance, 3-35

D

DC power supplies, 2-20
Description of the NCU, 4-37
Device bus interface, X172, 4-54
Distribution box, 4-56
DMP compact module 8O, 7-81
DMP compact module 16I, 7-77
DMP compact module 16O, 7-79
DMP compact module 1A analog, 7-88
DMP compact module 1I analog, 7-83
DMP compact module 1I, NC analog, 7-86
DMP compact modules, 6-73, 7-77
Driver module, 4-39
Dust, that can adversely affect function, 2-28

F

Fan box
    Mounting, 4-39
    Replacement, 4-43
Function-impairing gases, 2-28

G

Gases, function-impairing, 2-28
Grounding concept, 2-23

I

I/O interface (cable distributor), X121, 4-52
I/O modules, 5-63
Installation of the SINUMERIK 840D, 3-32
Installing the NCU module, 3-33

L

L2-DP interface, X102, 4-49
Link module interface, X112, 4-51
Link submodule, 4-40

M

Maintaining distances, 3-34
Mechanical environmental conditions
    Operation, 2-28
    Transport and storage, 2-26
Mounting the DC link busbar, 3-33
MPI/OPI network rules, 2-29

N

NCU, description, 4-37
NCU box, 4-39
NCU box with a fan box, dimensions, 4-42
NCU box without a fan box, dimensions, 4-41
NCU module, 4-37
NCU module interfaces, 4-45
NCU switch positions, meaning, 4-55
NCU terminal block, 6-71

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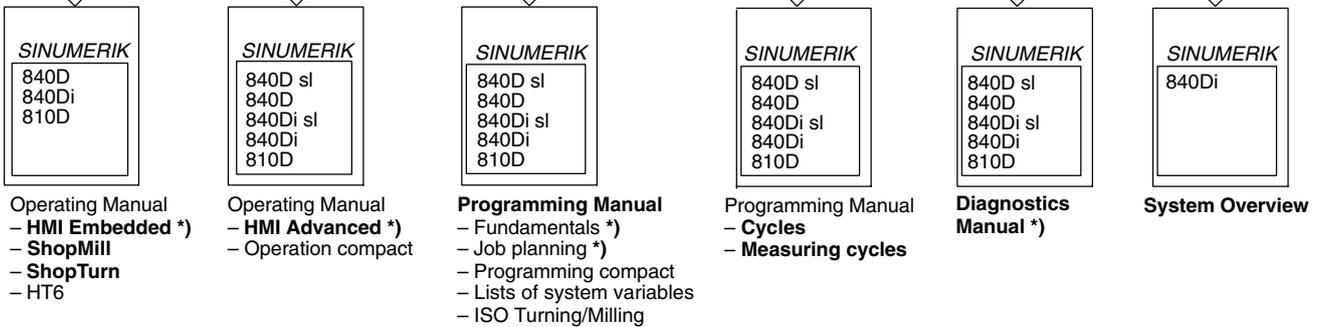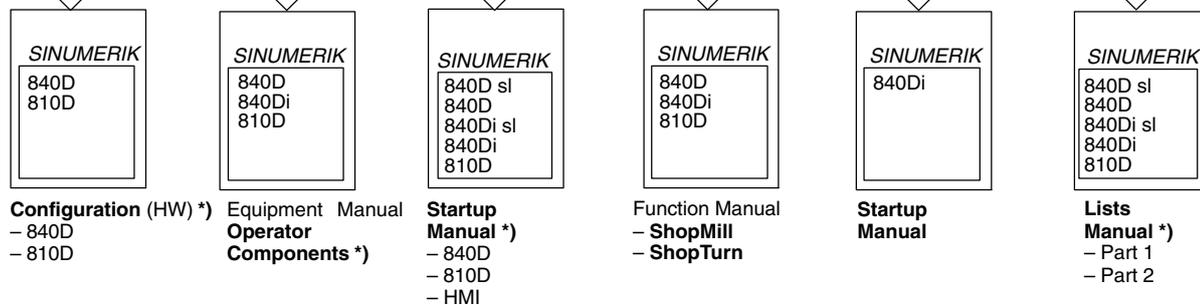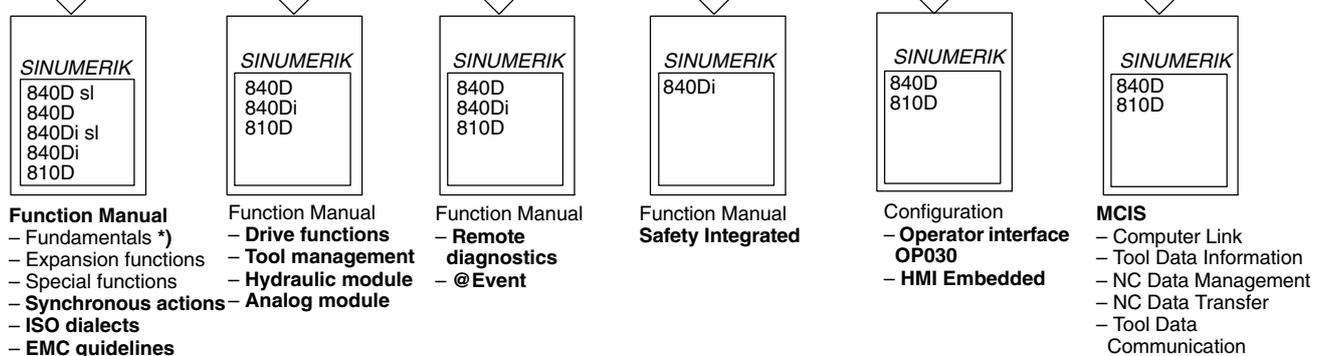840Di
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– Lists of system variables
– ISO Turning/Milling

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– 840D
– 810D

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840Di
810D

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840Di
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– 840D
– 810D
– HMI

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– Part 2

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– Special functions
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– **Analog module**

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– **@ Event**

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