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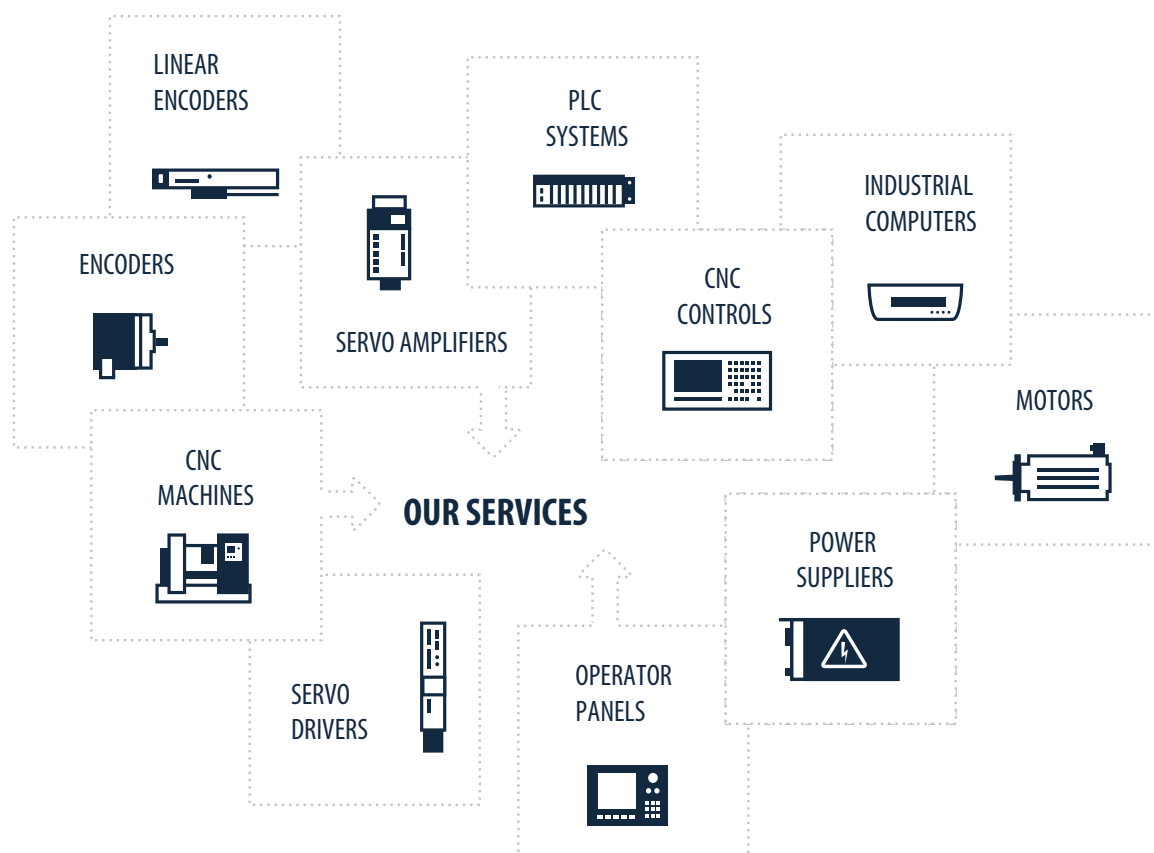


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Manual 11/2002 Edition

sinumerik

Hardware Configuration
SINUMERIK 810D

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SINUMERIK 810D

Hardware Configuration

Manual

Valid for

<i>Control</i>	<i>Software Version</i>
SINUMERIK 810D	3
SINUMERIK 810DE (export version)	3
SINUMERIK 810D powerline	6
SINUMERIK 810DE powerline	6

11.2002 Edition

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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" columns.

Status code in the "Remarks" column:

A New documentation.

B Unrevised reprint with new order no.

C Revised edition with new status.

If factual changes have been made on the page within the same software version, this is indicated by a new edition coding in the header on that page.

Edition	Order No.	Remarks
12.95	6FC5 297-1AD10-0BP0	A
07.96	6FC5 297-1AD10-0BP1	C
08.97	6FC5 297-2AD10-0BP0	C
12.98	6FC5 297-3AD10-0BP0	C
08.99	6FC5 297-3AD10-0BP1	C
04.00	6FC5 297-3AD10-0BP2	C
10.00	6FC5 297-4AD10-0BP0	C
12.01	6FC5 297-4AD10-0BP1	C
03.02	6FC5 297-6AD10-0BP0	C
11.02	6FC5 297-6AD10-0BP1	C

This manual is included in the documentation available on CD-ROM (**DOCONCD**)

Edition	Order No.	Remarks
11.02	6FC5 298-6CA00-0BG3	C

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Further information is available on the Internet under:
<http://www.ad.siemens.de/sinumerik>

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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 for service cases.

We have checked that the contents of this document correspond to the hardware and software described. Nonetheless, differences might exist. The information contained in this document is, however, reviewed regularly and any necessary changes will be included in the next edition. We welcome suggestions for improvement.

Subject to change without prior notice

Order No. 6FC5 297-6AD10-0BP1
Printed in Germany

Siemens Aktiengesellschaft

Preface

Notes for the reader

SINUMERIK documentation is split into three levels:

- General Documentation
- User Documentation
- Manufacturer/Service Documentation.

For more detailed information on SINUMERIK 810D publications and other publications covering all the SINUMERIK controls, please contact your local SIEMENS office.

You will also require the following

References: /PJU/ SIMODRIVE Planning Guide

SINUMERIK 810D powerline

As from 12.2001,

- SINUMERIK 810D powerline and
- SINUMERIK 810DE powerline

are available with improved performance. A list of the available **powerline** modules can be found in the hardware description:

References: /PHC/ Configuration Manual SINUMERIK 810D

Subject matter of this manual

Armed with the information contained in this manual, it is possible to install the SINUMERIK 810D numerical control and take measures to maintain and service it.

Hotline

If you have any questions, please call the following hotline:

A&D Technical Support

Phone: +49(0)180-5050-222

Fax: +49(0)180-5050-223

Email: adsupport@siemens.com

For questions about the documentation (suggestions for improvement, corrections) please send a fax to the following number or send an email:

Fax: +49 (0) 9131 98 - 2176

E-mail: motioncontrol.docu@erl.siemens.de

Fax form: see feedback page at the end of this publication.

Internet address

<http://www.ad.siemens.de/sinumerik>

Who is this manual intended for?

- Project planning engineers, electricians and fitters
- Service and operating personnel.

Danger notices

The following notices are intended firstly for your personal safety and secondly to prevent damage occurring to the products described or any connected devices and machines.

**Warning**

When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment.

After all power has been cut off, there will still be dangerous voltages present in the intermediate circuit of all SIMODRIVE modules for a further 5 minutes! See operating instructions.

Unqualified operator action of the device/system or failure to observe the warning notices may result in serious physical injury or material damage. Only suitably **qualified personnel** trained in assembling, installing, activating or operating the product, should operate this device/system.

Additional notices

Should measurements or tests need to be carried out on the active device, it is important to comply with the definitions and implementation instructions of accident prevention regulation VBG 4.0, in particular § 8 "Permissible differences when working on active components". Suitable electric tools should be used.

**Danger**

This warning notice indicates that death, serious physical injury or considerable material damage **will** occur if the relevant safety precautions are not taken.

**Warning**

This warning notice indicates that death, serious physical injury or considerable material damage **may** occur if the relevant safety precautions are not taken.

**Caution**

This warning notice (with warning triangle) indicates that slight physical injury or some material damage **may** occur if the relevant safety precautions are not taken.

Caution

This warning notice (without a warning triangle) indicates that some material damage may occur if the relevant safety precautions are not taken.

Attention

This warning notice indicates that an unwelcome event or unwanted situation **may** occur if the relevant notices are ignored.



Important

This notice indicates that there is an important issue to be considered.

Note

This notice indicates that there is a further issue to be considered.



Warning

- 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 device, always disconnect the power supply.
 - EMERGENCY STOP devices complying with EN 60204 IEC 204 (VDE 0113) 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. caused by an independent limit switch, mechanical interlocks, etc.).
-



Caution

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



Warning

Proper transportation, expert storage, installation and mounting, as well as careful operation and maintenance are essential for this device to operate correctly and reliably.

If warning notices are ignored, serious physical injury or material damage may result.



Warning

The modules contain electrostatic sensitive components. Before touching an electronic module, the persons carrying out the work must themselves be electrostatically discharged. The simplest way of doing this is to touch an electrically conducting earthed object (e.g. a bare metal part of a switchboard or a plug socket protective conductor).

ESD notices**Electrostatic Sensitive Devices****Important**

Handling ESD modules:

- When dealing with electrostatic components, make sure that people, work-places and packaging are well earthed!
- The fundamental principle here is that you should only ever touch electronic modules if this is unavoidable because work needs to be carried out. Under no circumstances should you take hold of printed circuit boards so that you touch component pins or printed conductors.
- You should only ever touch the units if
 - you are permanently earthed by an ESD armband,
 - you are wearing ESD shoes or ESD shoe grounding strips in connection with an ESD base.
- Modules must only be put on conductive supports (machine table with ESD layer, conductive ESD foam, ESD packing bag, ESD transport container).
- Do not place modules near to display units, monitors or television sets (minimum distance to screen > 10 cm).
- Modules must not be brought into contact with chargeable and highly insulating materials, such as plastic sheets, insulating table tops or clothing made of synthetic fibers.
- Measurements must only be carried out on modules if
 - the measuring instrument is grounded (e.g. by protective conductors) or
 - before measuring, with an isolated measuring instrument, the measuring head is briefly discharged (e.g. touching a bare metal control housing).

Intended use

The device must only be put to the uses prescribed in the manual and only in conjunction with third party devices and components recommended or approved by SIEMENS.

Contact persons

Should any problems or questions arise while you are using this manual, please contact the Siemens office concerned using the form provided at the end of this manual.



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System Overview

1.1 SINUMERIK 810D powerline

As from 03.2002

- SINUMERIK 810D powerline and
- SINUMERIK 810DE powerline

are ready for delivery. The following powerline modules are now available with enhanced performance:

Table 1-1 powerline modules for SINUMERIK 810D/810DE

Module	Description
CCU3	with additional pulse interface and two machining channels

Note

The SINUMERIK 810D powerline and SINUMERIK 810DE powerline are supplied with SW 6.
Earlier system software versions of the SINUMERIK 810D cannot be used on the SINUMERIK 810D powerline or SINUMERIK 810DE powerline.

1.2 System configuration

1.2 System configuration

Components

A fully-equipped SINUMERIK 810D system consists of various individual components. These are listed below.

Table 1-2 Components of 810D at maximum configuration (excluding motors)

Components	Order No.	Description
Mains supply (MS)	see Reference: /PJ2/ SIMODRIVE Planning Guide	Mains supply for supplying power to electronics and drives. Either open-loop control (OI 5kW-28kW) or closed loop control as an infeed/regenerative feedback module (I/RF module), 16kW-120kW and over; optional filter modules.
SINUMERIK 810D - CCU box (3 axes)	6FC5447-0AA00-0AA1	Subrack for mounting the CCU with integrated power modules: 1 x 18/36A (FDD) or 24/32A (MSD) and 2 x 6/12A (FDD), internal cooling only
- CCU box (2 axes)	6FC5447-0AA01-0AA0	Subrack for mounting the CCU with integrated power modules: 2 x 9/18A (FDD), internal or external cooling
- CCU3 (Compact Control Unit)	6FC5 410-0AY03-1AA0 CCU	The central processing unit of the 810D contains: NCK, PLC AS 315, communication functions, standard digital closed-loop control Additional functions: - 16MB DRAM, 2MB SRAM - Handling with 6 axes - 2nd Channel with 6 axes
- CCU2 (Compact Control Unit)	6FC5 410-0AX02-1AA0 CCU	The central processing unit of the 810D contains: NCK, PLC AS 315, communication functions, standard digital closed-loop control Additional functions: - 8MB DRAM, 2MB SRAM - Handling with 5 axes - 2nd channel with 5 axes - Connection for HPU
- CCU 1 (Compact Control Unit)	6FC5 410-0AY01-0AA0	Same as CCU with the following changes: - Supports a full-functional sixth axis - Hardware/software separation: supplied with export software; Miscellaneous functions on PCMCIA card
Operator panel front 1)		Display, keyboard and operator controls for the 810D
PCU 20/50/70 ¹⁾		SINUMERIK PCU (Personal Computer Unit)
Machine control panel ¹⁾		SIEMENS MCP or interface for customer MCP V_03_01_01 or higher
ISA adapter ¹⁾		Allows AT modules to be used in conjunction with the PCU
Full CNC keyboard 1)		Full keyboard can be connected to PCU
Memory card (PCMCIA)		Slot for PCMCIA card on CCU PCMCIA card for software updates, SW 3 and higher (not 810DE) The system software of the CCU1/2 is stored on internal flash EPROM for software version < 3.1
Disk drive unit ¹⁾		Rack-mounting unit for connection to the PCU
Cable distributor	6FX2 006-1BA02	Connection of two handwheels and two probes to the CCU
Cable		References: /Z/, Catalog of accessories NC Z.
Axis expansion plug-in unit, left	6FC5 412-0FA12-0AA0	CCU3 only: place between I/RF module and 810D for axis expansion when installing in a SIMODRIVE 611 D single-axis power module References: /PJ/, SIMODRIVE 611 Planning Guide
Axis expansion plug-in unit	6FC5 412-0FA10-0AA0	For installing in a SIMODRIVE 611 power module (1-axis or 2-axis), References: /PJ/, SIMODRIVE 611 Planning Guide

Components	Order No.	Description
SIMATIC components		References: /S7H/, Manual
Single I/O module (EFP)	6FC5 411-0AA00-0AA0	PLC I/O module with 64 inputs and 32 short-circuit-proof outputs
NCU terminal block ¹⁾	6FC5 211-0AA00-0AA0	High-speed digital and analog NC I/Os on the SINUMERIK 810D drive bus
Handheld unit (HHU) ¹⁾	6FX2 007-1AC..	Handheld unit with handwheel, Emergency Stop button, keyswitch, override, enabling switches, display, user-assignable keys, connection via MPI bus and cable distributor
Handheld Terminal (HT 6) ¹⁾	6FC5 403-0AA10-0AA0	Handheld device combining the functions of the operator panel front and MCP with <ul style="list-style-type: none"> - Display, - Keyboard, enable key, Emergency Stop and Override button - RS-232 interface for archiving programs and data - Connection via cable and distributor to SINUMERIK 810D/840Di/840D and FM357-2H
Distributor box ¹⁾	6FX2 006-1BC00	For connection of the handheld unit to the MPI bus Connection for Emergency Stop circuit, enabling, handwheel, 24VDC
Mini handheld unit ¹⁾	6FX2 006-1BG00	Small handheld unit for setting up and operating simple machines in the JobShop sector or similar applications. Can be used with 810D, 840C, 840D and FM-NC.

Components marked with ¹⁾ are described in:

References: /BH/, Operator Components Manual.

1.2 System configuration

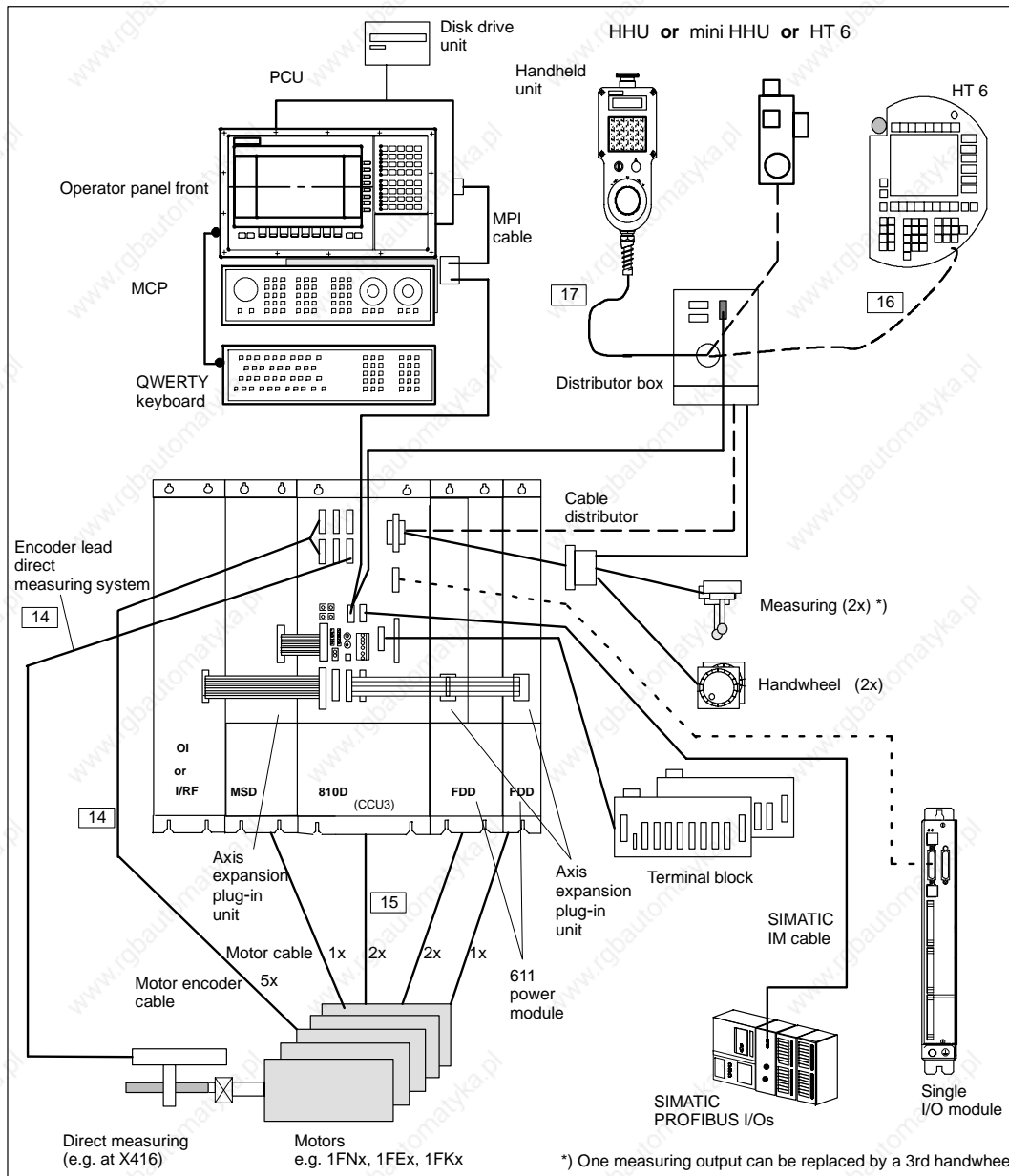


Fig. 1-1 The SIMUMERIK 810D system showing example of CCU3

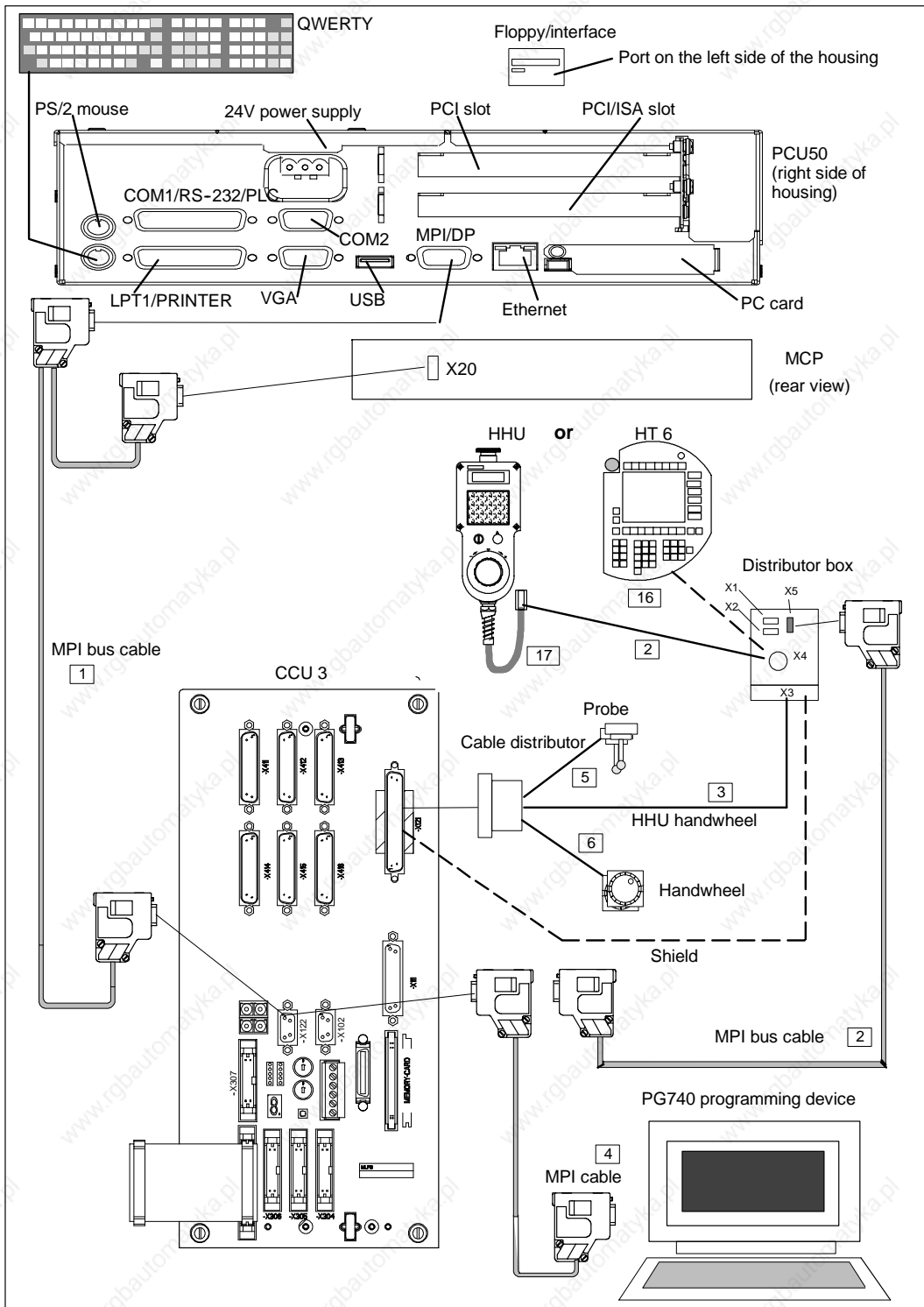


Fig. 1-2 SINUMERIK 810D connection configuration for the MPI bus, HHU, HPU and cable distributor

1.2 System configuration

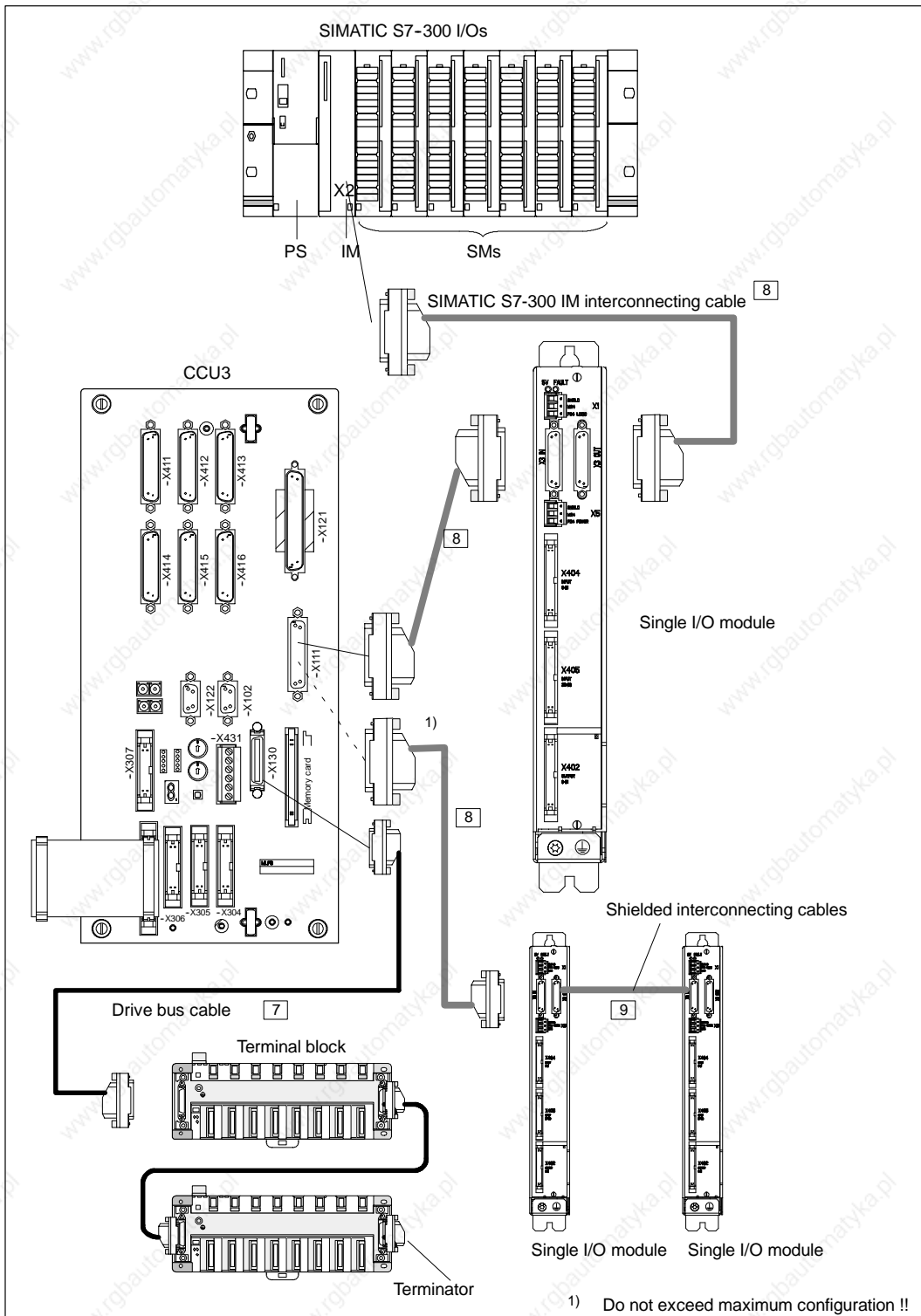


Fig. 1-3 SINUMERIK 810D connection configuration for PLC I/Os and NCU terminal block

Interconnecting cables

The following interconnecting cables are used for the SINUMERIK 810D

Table 1-3 Interconnecting cables for the SINUMERIK 810D

No.	Order No.	Designation
1	6FX2 002-4EA0□-1□□0 ¹⁾	MPI bus cable from operator panel front to MCP and CCU
2	6ES7 901-0BF00-0AA0	MPI bus cable from distributor box (HHU) to CCU
3	6FX2 002-4AA21-1□□0 ¹⁾	Interconnecting cable from distributor box to cable distributor on CCU (for handwheel pulses from HHU)
4	Included in the scope of supply for the PG740	MPI bus cable to the PG
5	6FX2 002-4AA41-1AB0	Probe connecting lead to cable distributor, length: 5m
6	6FX2 002-4AA21-1□□0 ¹⁾	Connecting cable for electronic handwheel to cable distributor on CCU
7	6FX2 002-1CB01-1AB0	Drive bus cable (1m) to the NCU terminal block connector
8	6ES7 368-3□□□0-0AA0 ¹⁾	Connecting lead for Step7-300 I/Os (IM361 or single I/O module)
9	6FC5 411-0AA80-0AA0	Shielded interconnecting cable for single-tier installation with several single I/O modules
10	6FC5 412-0FA80-0AA0	Cable set for external SIMODRIVE 611 closed-loop control, for connecting device bus and drive bus
11	6FX2003-0DA00-0AA0	Terminator, drive bus (only when using a drive bus)
12	¹⁾	Ribbon cable to terminal strip converter
13	²⁾	Motor encoder cable - incremental - absolute
14	6FX2002-2CG00-1AA0 6FX2002-2CH00-1AA0	Cable for connecting direct measuring systems to CCU - incremental - absolute
15	²⁾	Power leads for the motor
16	6FX2-002-1AA□3-1□□□	Round cable from HT6 to distributor box
17	²⁾	Round cable from HHU to distributor box

Each cable is assigned its own number.

You can find these numbers (1 to17) in the previous diagrams.

1) For the length code, see **References:** /Z/ Catalog NC Z

2) see **Reference:** /PJ2/SIMODRIVE Configuration

PCU 50/70, MCP and HHU/HT6

There are four possible versions:

- HHU/HT6 without PCU50/70/MCP
- PCU 50/70/20 + MCP MPI bus cable with cable no. 1
- PCU 50/70/20 MPI bus cable with cable no. 2
- MCP MPI bus cable with cable no. 2

1.2 System configuration

Axis expansion on the 810D

The number of axes on the SINUMERIK 810D can be expanded:

- to five axes including spindle with CCU2 and CCU1 (< SW 3.1)
- to six axes including spindle with CCU1 (SW 3.1 and higher) and CCU3 (a closed-loop control card is required for the 6th axis with CCU1)

There are two ways of doing this:

- either** an axis expansion plug-in unit and a SIMODRIVE 611 power module connected at the axis expansion terminal
- or** SIMODRIVE 611D closed-loop control module with SIMODRIVE 611 power module connected to the drive bus/device bus

Axis expansion plug-in unit

Axis expansion plug-in units are always used when no more than six measuring channels are required for the SINUMERIK 810D. The unit is plugged into a SIMODRIVE 611 power module. Axis expansion plug-in units are designed for 1-axis and 2-axis power modules. The plug-in unit is supplied complete with ribbon cables.

Axis expansion closed-loop control module

If six SINUMERIK 810D measuring channels are not enough, SIMODRIVE 611 closed-loop control modules must be installed in the SIMODRIVE 611 power modules to connect further measuring systems (connection via drive bus with drive bus terminator). When using 611D closed-loop control modules, it may be necessary to connect the NCU terminal block to the free drive bus connector on the 611D closed-loop control.
See Chapter 5, Axis Expansion

Power modules

CCU1/2:

1-axis or 2-axis power modules can be used for axis expansion. 2-axis power modules can be used for axes and spindles. Power modules must always be installed on the right of the SINUMERIK 810D.

CCU3:

The new CCU3 can control up to 6 axes "onboard". A new left expansion plug-in unit is available in addition to the existing axis expansion units.

All power sections of the 611D series can be connected for axis expansion as external power modules.

Combinations

With SW 3.1 or lower, it is not possible to combine the two types of axis expansion. The number of drives is limited to 5 for CCU1/2.

With SW 6.3 and higher, the limitation for CCU3 is six drives.

Many different drive combinations can be used to implement expansion levels 1-6. If the spindles are to be operated on the internal power module, this must be connected to the 24A/32A power section (A1).

Table 1-4 Possible combinations for 1-6 drives with the SINUMERIK 810D

Number of drives	Internal drives 1 x 18/36A (FDD) *or 24/32A (MSD) 2x9/18 / 2 x 6/12A		Drives via axis expansion
	3 power modules	2 power modules	
1	1	1	0
	0	0	1
2	2	2	0
	1	1	1
	0	0	2
3	3	-	0
	2	2	1
	1	1	2
	0	0	3
4	3	-	1
	2	2	2
	1	1	3
5	3	-	2
	2	2	3
6 (not CCU2)	3	-	3
	2	2	4

CCU 3 with 3-axis CCU box plus
3-axis power module to right of CCU
1-axis power module to right of CCU

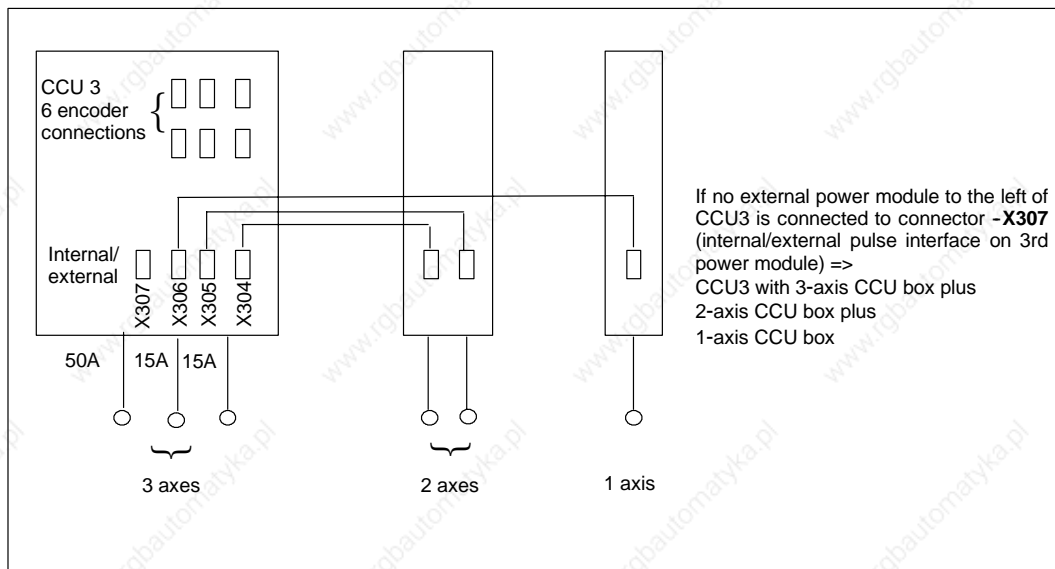


Fig. 1-4 First option for operating 6 axes on CCU 3 with internal 3-axis CCU box

1.2 System configuration

CCU 3 with 3-axis CCU box or 2-axis CCU box plus
 2-axis power module to right of CCU
 1-axis power module to right of CCU
 1-axis power module to left of CCU

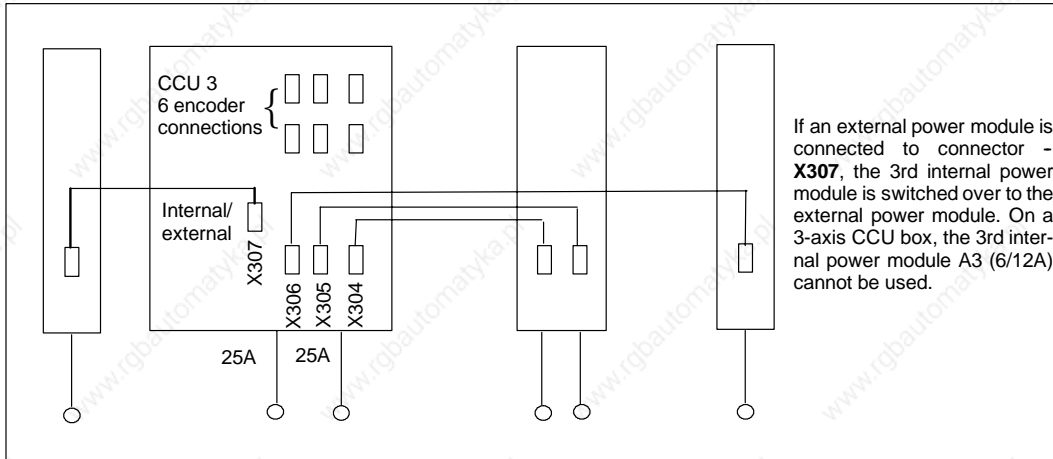


Fig. 1-5 Second option for operating 6 axes on CCU 3 with 2-axis CCU box

Restrictions

- Mains supply: $\leq 55\text{kW}$ (from 07.99: 120kW).
- The DC link busbar of the 810D is has an effective load capability of 120A (from 07.99: 200A).
- The length of the ribbon cable of the left axis expansion plug-in unit for connecting the SIMODRIVE 611 power module is 300mm.
- The ribbon cable of the right axis expansion plug-in unit is long enough for a module width of 100mm (from 07.99: 150mm).
- The length of the cable set for axis expansion with the 611D closed-loop control module is:
 62mm for the drive bus and 150mm for the device bus.

1.3 Labeling and adhesive labels

If you contact your local Siemens office for technical information or because servicing is necessary, please provide all data given on the rating plate.

The components and modules are provided with one of the following labels:

Silk-screened PCBs

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

SIEMENS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	C	D	E
570 573.9001.00						

OP, PCU, HD, ISA adapter, PCMCIA

Example: Component name: OP 031
Order No. (machine-readable): 6FC5203-0BA10-0AA0
Component number: GE.570 038.9001.00

SIEMENS
OP 031 6FC5203-0BA10-0AA0 GE. 570 038.9001.00 A B C

CCU1 plug-in unit

Example: Component name: CCU1
MLFB: 6FC5410-0AA00-0AA0
Component number: GE.570039.9001.01

CCU1	6FC5 410-0AY01-0AA0	GE.570039.9001.01	A B C
------	---------------------	-------------------	-------

CCU box

Example: Component name: SINUMERIK 810D
PS module 2x15A+1x50A
MLFB: 6FC5447-0AA00-0AA0
Product version: A (last cross)

SIEMENS
SINUMERIK 810D PS module 2x15A + 1x50A 6FC5 447-0AA00-0AA0
Made in Germany
<input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C

ESD symbol**Warning**

The modules contain electrostatic sensitive components. Before touching an electronic module, the persons carrying out the work must themselves be electrostatically discharged. The simplest way of doing this is to touch an electrically conducting earthed object (e.g. a bare metal part of a switchboard or a plug socket protective conductor).



Installation Conditions

2.1 Secondary electrical conditions

Compliance with the connection conditions

The control is tested for compliance with the ambient conditions specified below. Trouble-free operation is guaranteed only if:

- these ambient conditions are maintained in operation and transportation.
- original components and spare parts are used. This applies in particular to the use of specified cables and plug connectors.
- mounting is carried out properly.

The control must not be started up until it has been confirmed that it complies with the provisions of the 98/37/EC Directive.

Additional information

Reference: /EMV/, EMC Installation Guideline

Assistance and advice

The installation conditions must be complied with for the complete system. Please contact your local Siemens office or representative for assistance and advice.

2.1 Secondary electrical conditions

2.1.1 Electromagnetic compatibility (EMC)

Radio interference

Relevant standards: EN 50081-1 and -2, EN 55011, EN 55022, EN 61800-3

Table 2-1 Limit values for radio interference

	Limit value in accordance with
Interference suppression in cables	Limit value class A for use in industrial areas
Interference radiation	Limit value class A for use in industrial areas

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

Note

Radio interference suppression must be considered by the user for the complete installation. Particular attention should be paid to cables. Please contact your local Siemens office or representative for assistance and advice.

Noise immunity

Relevant standards: EN 50178, EN 61000-3-2 and -3-3, EN 61000-6-2, EN 61000-4-2, -3, -4, -5, -6, -8, and -11
EN 61800-3

Tested phenomena:

- Static discharging
- Radio frequency irradiation
- Conducted interference (burst)
- Surge voltages
- HF flow on cables
- Magnetic fields with electrical power frequencies
- Voltage dips and interruptions
- Voltage fluctuations and flicker
- Harmonic currents.

2.1.2 Power supply

Requirements for the AC supply

The AC power supply is required for external equipment and accessories only and is not included in the standard scope of delivery.

Table 2-2 Requirements for the AC supply

Rated voltage	<ul style="list-style-type: none"> • Tolerance • Frequency • Booting time after switching on 	230VAC -20%, +10% (184V to 253V) 50/60Hz $\pm 10\%$ Optional
Harmonic content	according to EN 50178	$\leq 10\%$
Transient voltage dips	<ul style="list-style-type: none"> • Voltage interruptions at rated voltage and current • Restoration time • Events per hour 	$\leq 3\text{msecs}$ $\geq 10\text{secs}$ ≤ 10

Requirements for DC supplies



Warning

- The DC supply is always earth-referenced and must not be generated by an auto-transformer.
- To ensure safe isolation of the user interface, the DC power supply must be provided with safe isolation. See Subsection 2.1.3.
- In the case of supply cables > 10m, protection elements must be fitted at the device input in order to protect against lightning (surge voltage).
- The DC supply voltage 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; see also /EMC/ SINUMERIK, SIROTEC, SIMODRIVE, EMC Guideline (06.99).

2.1 Secondary electrical conditions

Table 2-3 Requirements for the DC supply

Rated voltage	in accordance with IEC 65A (Co) 22-1 <ul style="list-style-type: none"> Voltage range (mean value) Voltage ripple at rated voltage and current peak-to-peak Booting time after switching on 	24VDC 20.4VDC to 28.8VDC 5% (unfiltered 6-pulse rectification) Optional
Harmonic content	according to EN 50178	≤10%
Non-periodic overvoltages	<ul style="list-style-type: none"> Duration of overvoltage Restoration time Events per hour 	≤ 35V ≤ 500msecs ≥ 50secs ≤ 10
Transient voltage dips	<ul style="list-style-type: none"> Duration of voltage dips Restoration time Events per hour 	≤ 5ms ≥ 10secs ≤ 10

Configuring the 810D power consumption

The EP and AP points for the power section modules are only valid in connection with the SINUMERIK 810D (axis expansion). When using SIMODRIVE 611D modules with closed-loop control modules, the EP and AP points from the NC60.1 catalog apply.

Table 2-4 EP and AP points for 810D components

Component	Electronics points (EP)	Control points (AP)
810D	2	4.5
EnDat encoder	0	0.3
Power section module ≤ 50A	0,6	0.5
Power section module > 50A ≤ 80A	0.75	1.0
Power section module > 80A, ≤ 120A	1.5	1.5
611D module MSD or FDD	See NC 60.1 catalog	See NC 60.1 catalog

Table 2-5 Typical supply power calculation four axes / one spindle for the 810D

Module	Electronics points (EP)			Control points (AP)		
	Weighting factor single module	Number of modules	Product	Weighting factor single module	Number of modules	Product
810D	2	1	2	4.5	1	4.5
EnDat encoder	0	2	0	0.3	2	0,6
LTM 50A	0,6	1	0,6	0.5	1	0.5
LTM 80A	0.75	1	0.75	1	1	1

Table 2-5 Typical supply power calculation four axes / one spindle for the 810D

Electronics points (EP)		Control points (AP)	
	Sum of products	3.35	Sum of products
	For I/RF unit 16kW	≤ 7.5	For I/RF unit 16kW
			≤ 16.50

2.1.3 Safe electrical isolation

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

User interfaces (UI)

User interfaces are interfaces freely accessible to the machine operator, i.e. tools or other aids are not required. These user interfaces have been designed to provide safe isolation in accordance with EN 60204-1 and EN 50178.

Interfaces for servicing/installation and start-up/maintenance



Warning

The Interfaces for servicing/installation and start-up/maintenance purposes are **not** provided with safe isolation.

If necessary, these interfaces can be isolated safely using a supplementary adapter (insulation voltage 230VAC). These adapters are not included in the Siemens scope of delivery. You can buy these parts from your local dealer who will help you to make the proper choice.

Table 2-6 Servicing interfaces

Component	Interface designation	Function
810D CCU module	X341, X342, X351, X352	DAC test sockets for analog signals



Warning

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

2.1 Secondary electrical conditions

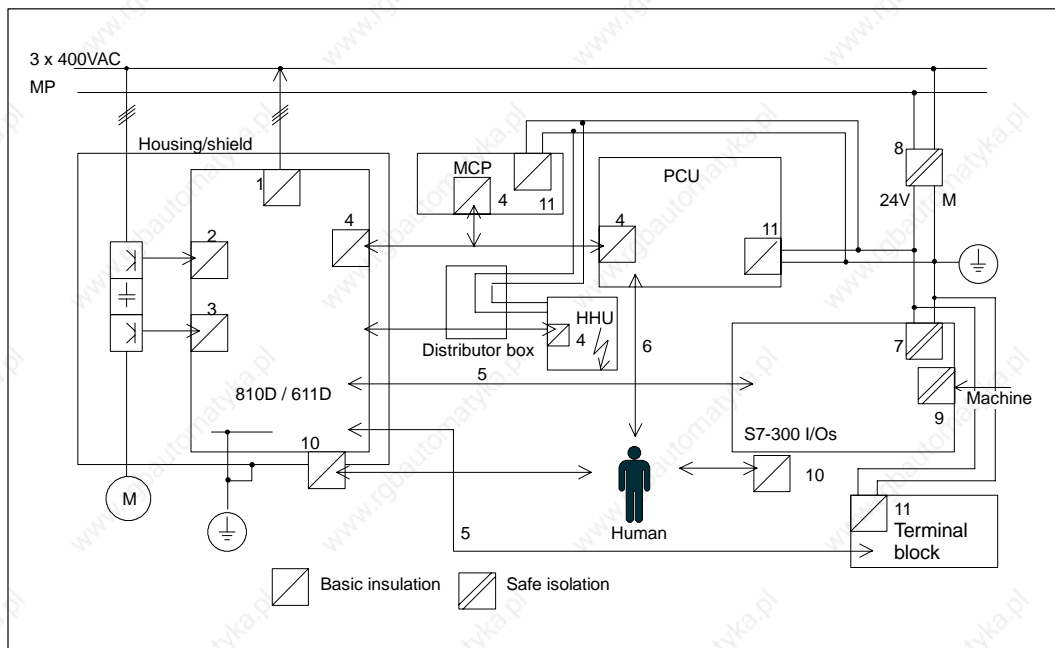


Fig. 2-1 Safety electrical isolation

Fig. 2-1 shows the total potential of the 810D/611D/S7-300 system.

Meaning of reference numbers:

1. Floating power supply for SIMODRIVE electronics with 230VAC basic insulation.
2. Floating transistor triggers for the three-phase rectifier bridge with 230VAC basic insulation.
3. Floating transistor triggers for each axis of the three-phase inverter bridge with 230VAC basic insulation.
4. Floating signal connections from the NC to the PCU or HHU with 230VAC basic insulation.
5. Non-floating signal line between NC and I/O devices.
6. Non-floating user interface with safe electrical insulation for 230VAC through interfaces 1 to 4 and 7.
7. Safe separation of 5VDC power supply fed from a 24VDC supply unit.
8. 24VDC power supply unit for external devices and for the machine matching control according to applicable standard in the form of a PELV (Protective Extra Low Voltage) circuit designed with safe electrical isolation.
9. Floating interfaces to the machine (not accessible to the user).
10. Floating signal interfaces directly accessible to the end user (e.g. RS-232-C). Make sure that either safe electrical isolation to the mains voltage or two basic insulations each for 230 VAC are provided for these interfaces.
11. 5VDC power supply with basic insulation, fed from a 24VDC supply.

2.1.4 Earthing concept

The 810D system consists of a number of individual components, each of which, in its own right, complies with EMC and safety standards.

The CCU box and the SIMODRIVE components are screwed to a metal cabinet wall. Make sure that a low-impedance contact of the CCU box with the cabinet wall can be made near the screws. Insulating varnishes should be removed if possible. Keep the connection free of corrosion.

The electronic earths of the modules are interconnected via the device and drive bus and at the same time conducted to the X151 terminal of the MS module.

References: /EMV/, EMC Installation Guideline

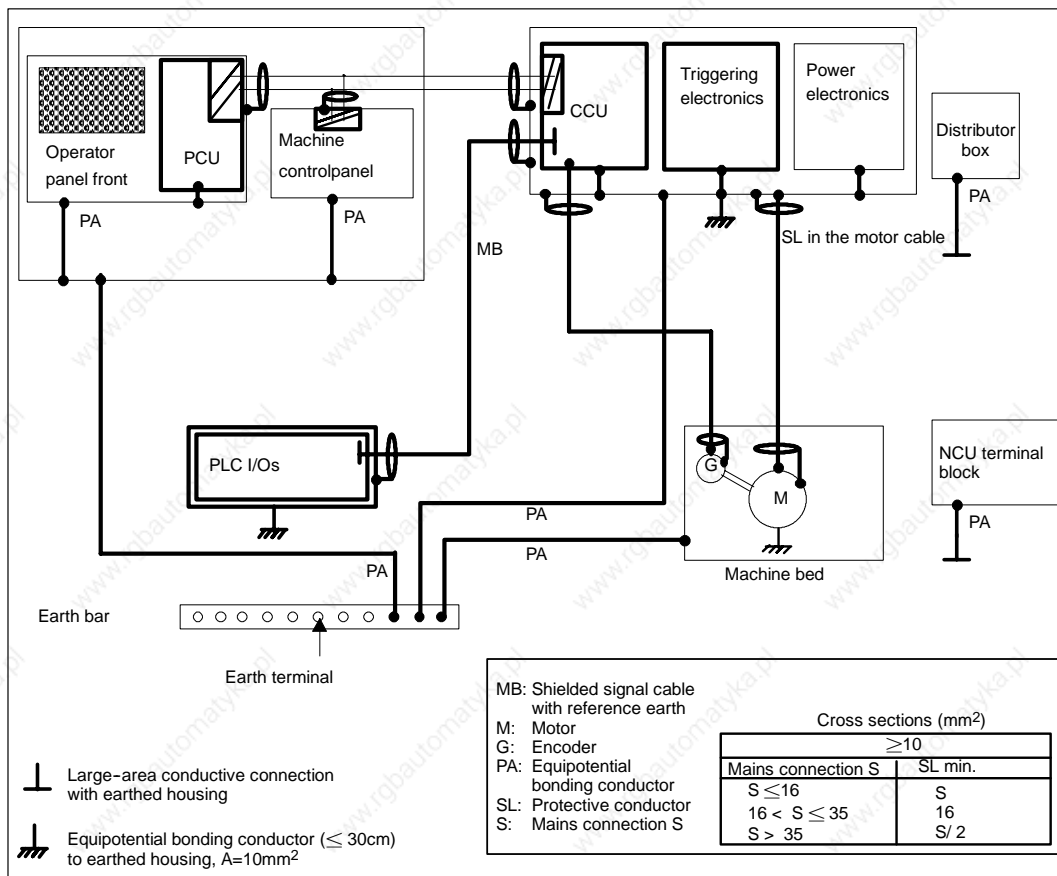


Fig. 2-2 Earthing concept

2.1 Secondary electrical conditions

2.1.5 RI suppression measures

In addition to the protective earthing of system components, special precautions must be taken to guarantee safe, interference-free operation of the system. These measures include shielded signal cables, special equipotential bonding and earthing conductors.

Shielded signal cables

Only use the cables specified in the individual diagrams to ensure safe interference-free operation of the system.

For digital signal transmission, the shield must have a conductive connection to both sides of the housings.

Exception:

- Standard screened cables grounded on only one side can be used for devices of other makes (printers, programming devices, etc.).

These devices must, however, not be connected to the control during normal operation. Whenever operation with devices of other makes is unavoidable, the shields must be connected to both housing sides. In cases like this, the device must additionally be connected to the control by means of an equipotential bonding conductor.

Cable definitions

Definition:

- Signal cables (e.g.)
 - Data cables (MPI, sensor cables, etc.)
 - Binary inputs and outputs
 - Emergency Stop cables
- Load cables (e.g.)
 - Low-voltage supply cables (230VAC, +24VDC etc.)
 - Supply cables to conductors (primary and secondary circuit).

References: /EMC/ SINUMERIK, SIROTEC, SIMODRIVE
EMC Installation Guideline

Installation specifications

Comply with the following EMC measures to achieve the best-possible noise immunity for the complete system (control, power section, machine):

- The largest possible clearance must be left between signal and load cables.
- 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 offered by the NC manufacturer should be used as signal cables from and to the NC or PLC.
- Signal cables must not be routed close to strong external magnetic fields (e.g. motors and transformers).
- Pulse-loaded heavy current/high voltage cables must always be laid completely separate from all other cables.

2.1 Secondary electrical conditions

- Whenever sufficient spacing is not possible, signal cables must be laid in shielded cable ducts (metal).
- The spacing (interference irradiation area) between the following cables must be as small as possible:
 - Signal cable to signal cable.
 - Signal cable to associated equipotential bonding conductor.
 - Equipotential bonding conductor to accompanying protective earth conductor.

**Important**

For further information on interference suppression measures and the connection of shielded cables refer to

References: /EMC/ SINUMERIK, SIROTEC, SIMODRIVE
EMC Installation Guideline

2.2 Ambient climatic and mechanical conditions

2.2 Ambient climatic and mechanical conditions

2.2.1 Transport and storage conditions

Relevant standards

IEC 68-2-1, IEC 68-2-2, IEC 68-2-3

Components in original packaging

The following specifications apply to components in transport packaging:

Table 2-7 Climatic conditions

Temperature range	See technical data of the relevant component	
Relative air humidity U	Annual average	$U \leq 75\%$
	up to 30 days (24 hours) per year	$U \leq 95\%$
Temperature change	Within one hour	< 10K
Atmospheric pressure	The values specified apply to a transportation altitude of up to 3265m above mean sea level	66kPa to 108kPa

Table 2-8 Mechanical conditions during transportation in original packaging

Vibratory load (according to IEC 68-2-6)	Frequency range 5–9Hz over 9–200Hz	Const. displacement 3.5mm Ampl. of acceleration 9.8 m/sec ²
---	--	---

Transportation of backup batteries

Backup batteries must be transported in original packaging only. No special approval is needed for transporting backup batteries. The lithium content is approximately 300mg.

Note: The backup battery is classified in dangerous materials class 9 in accordance with the relevant air-freight transportation regulations.

Applicable standards: DIN EN 60086(-4)

**Warning**

Improper handling of backup batteries involves the risk of ignition, explosion and burning.

2.2 Ambient climatic and mechanical conditions

Rules for the handling of backup batteries

The following regulations of DIN EN 60086(-4) must be adhered to:

Backup batteries

- must not be charged.
- must not be heated or thrown into fires.
- must not be pierced or squeezed.
- must not be tampered with mechanically or electrically in any way!

Rules for handling MMC 101/102

The MMC hard disk unit is provided with vibration absorbers. The following rules must nevertheless be followed when handling this unit.

**Important****Hard disk unit**

- Transportation in original packaging only
- Do not throw the unit or subject it to other shocks
- Do not remove the unit from its mechanical assembly
- Do not tamper with the springs.

2.2.2 Operating conditions**Relevant standards**

IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-3, EN 60721

Ambient climatic conditions

If the specified values cannot be maintained, a heat exchanger or an air conditioning unit must be provided.

Table 2-9 Ambient climatic conditions

Temperature range	See technical data of the relevant component	
Permissible change in relative air humidity EN 60721-3-3, Class 3K5	Within 1 minute	max. 0.1%
Condensation	Not allowed	
Temperature variation	Within 1 minute	Max. 0.2K
Atmospheric pressure	When operated at an altitude 1500m above mean sea level. For greater altitudes, the upper limit temperature must be reduced by 3.5°C/500m.	86kPa to 108kPa

2.2 Ambient climatic and mechanical conditions

Table 2-10 Ambient mechanical conditions

Vibratory load (according to IEC 68-2-6)	Frequency range 10–58Hz	Const. displacement 0.075mm Ampl. of acceleration 9.8m/sec ²
	over 58–200Hz	
Shock load (test group E, test Ea according to IEC 68, Part 2-27)	Acceleration	15m/sec ²
	Acceleration for visual display units	2m/sec ²
	Duration of nominal shock	11msec/30ms for drive units
	Acceleration for drive unit components	5 m/sec ²

2.2.3 Exposure to contaminants

Table 2-11 Gases liable to impair functionality

Sulfur dioxide (SO₂) (to IEC 68-2-42)	Severity	10 cm ³ /m ³
	Temperature	25°C ± 2°C
	Relative humidity	75% ± 5%
	Test duration	10 days
Hydrogen sulfide (H₂S) (to IEC 68-2-43)	Severity	1 cm ³ /m ³
	Temperature	25°C ± 2°C
	Relative humidity	75% ± 5%
	Test duration	10 days

Dust hazards

When working in areas where there is an unacceptably high dust hazard, the control must be operated in a cabinet with a heat exchanger or in a cabinet with a suitable air intake.

Maximum permissible dust content in cabinet ventilation:

- Suspended proportion 0.2 mg/m³
- Deposit 1.5 mg/m²/h.

2.3 Technical data of the individual components

Table 2-12 Mechanical data and temperature ranges

Component	Dimensions (width x height x depth in mm)	Weight approx. (in g)	Degree of protection according to DIN 40050	Temperature ranges in use or during Storage/transportation in °C
CCU box 3 axes 2 axes)	150x490x268 Internal ventilation Internal and external vent.	11300 11400	IP 20	0...+55 -20...+60
CCU (Compact Control Unit)	150x307x220	1600	Front: IP 20	0...55 -20...+60
Single I/O module (EFP)	50x374x153	1700	IP 20	0...55 -20...+60
NCU terminal block	257x89.4x36.1	500	IP 00	0...+55 -20...+60

Table 2-13 Electrical data

Components	Rated voltage and tolerance	Max. power loss at rated voltage	Max. current	Deg. of protect. DIN VDE 0160
CCU box 3 axes 2 axes	- -	Approx. 350W internal/external/com- plete 69/ 111 /180W	see Table 2-5	1
CCU	Supply via SIMODRIVE 611 mains supply (I/RF or OI module). Supply via other devices not allowed.	approx. 25W	see Table 2-5	1
Single I/O module	24V for logic supply, 24V for load supply,		0.3A 12A	1
NCU terminal block	24V for logic supply, load supply directly at DMP module		0.5A	1

2.4 MPI network

2.4 MPI network

2.4.1 MPI interconnecting cables

The MPI interconnecting cables are available in different lengths. The cables are used to make the following connections:

- CCU to operator panel front
- Operator panel front to MCP
- PLC (S7) to e.g.: PG 740
- CCU to handheld unit via distributor box.

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.

Cables with a switchable terminating resistor

Enable the terminating resistor in the MPI connector of the first and last node and disable the remaining terminating resistors.

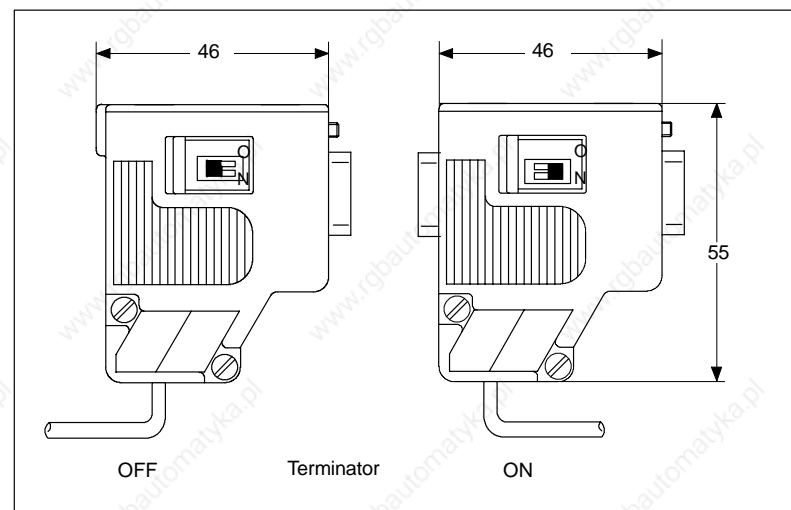


Fig. 2-3 MPI connector

References: /Z/, Accessories and Equipment for Special Machines

2.4.2 MPI network rules

When installing a network, observe the following rules:

1. The bus line must be terminated at **both ends**. To do this, you switch on the terminating resistor in the MPI connector of the first and last user, and switch off any other terminators.

Note

- Only two enabled terminators are permitted.
- The HHU has **integrated** bus terminators.

-
2. **At least 1** terminator must be supplied with **5V voltage**. For this, the MPI connector with inserted terminating resistor must be connected to a powered device.

Note

The connection on the NC control system can be used for this purpose.

-
3. Tap lines (feeding cable from the bus segment to the node) should be as short as possible.

Note

Tap lines not used should be removed if possible.

-
4. Each MPI node must **first** be connected and then enabled. When disconnecting an MPI node, **first** deactivate the connection, then remove the connector.
 5. One handheld operator unit and one handheld programming unit, or two handheld units or handheld programming units can be connected for each bus segment. **No** bus terminators must be inserted at the distributor boxes of an HHU or HPU. If more than one HHU/HPU are connected to a bus segment, this can be done with an intermediate repeater.
 6. The following cable lengths for MPI may not be exceeded for the standard case without repeater:
MPI (187.5 kbaud): Max. cable length in total 10m.



2.4 MPI network

Notes

Design and Installation of the 810D

3.1 Design of the SINUMERIK 810D

The SINUMERIK 810D consists of three components:

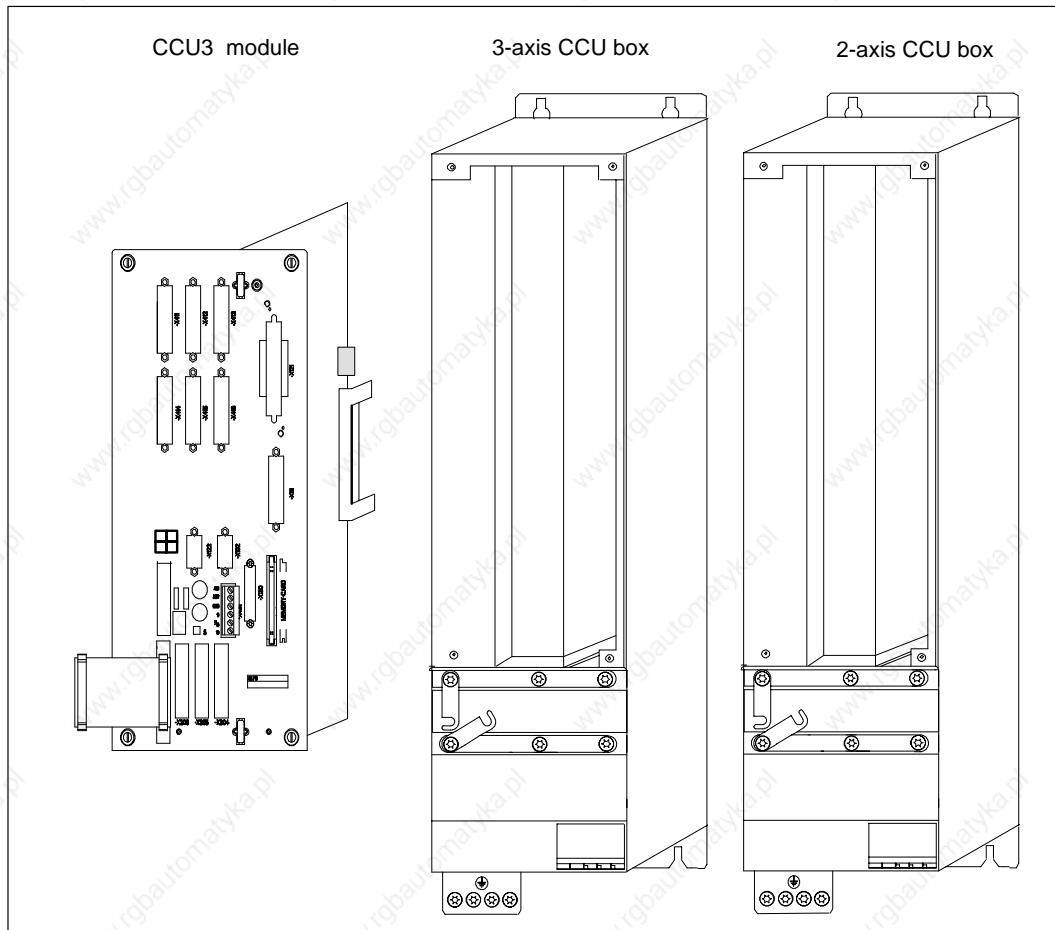


Fig. 3-1 SINUMERIK 810D components

1. CCU module (Compact Control Unit).
2. 3-axis CCU box (metal casing with three integrated power modules for accommodating the CCU module) with internal cooling or
3. 2-axis CCU box with external and internal cooling (metal casing with two integrated power modules for accommodating the CCU module).
 Delivery condition: Internal cooling.
 Modification: Use a screwdriver (Torx for M6) to unscrew the mounting bracket and fit the four grounding springs (see installation instructions)

3.2 Installing the SINUMERIK 810D

Preparation

For assembling the SINUMERIK 810D control, you need the following tools:

- Screwdriver for slotted screws size 0 and 1
- Screwdriver for M4 and M5 Torx screws.

Position in the overall installation

The CCU box must be mounted to the right of the SIMODRIVE mains supply module.

With the CCU3, a further power module can be mounted to the left of the box.

Installing the CCU box

The CCU box is mounted to the right of the mains supply. The use of four M5 screws is recommended for fastening.

1. Remove the plastic cover above the DC link busbars by loosening it with a screwdriver at the top and tilting it downwards and forwards.
2. Use two M4 Torx screws to join the DC link busbars of the MS unit and the CCU box and if applicable, the next module.
Check that all the screws connecting the DC links are tight.
3. Place the cover with the plastic lugs at the base of the corresponding cut-outs and close the DC link busbars by snapping the cover back until the latch on the top snaps into place.

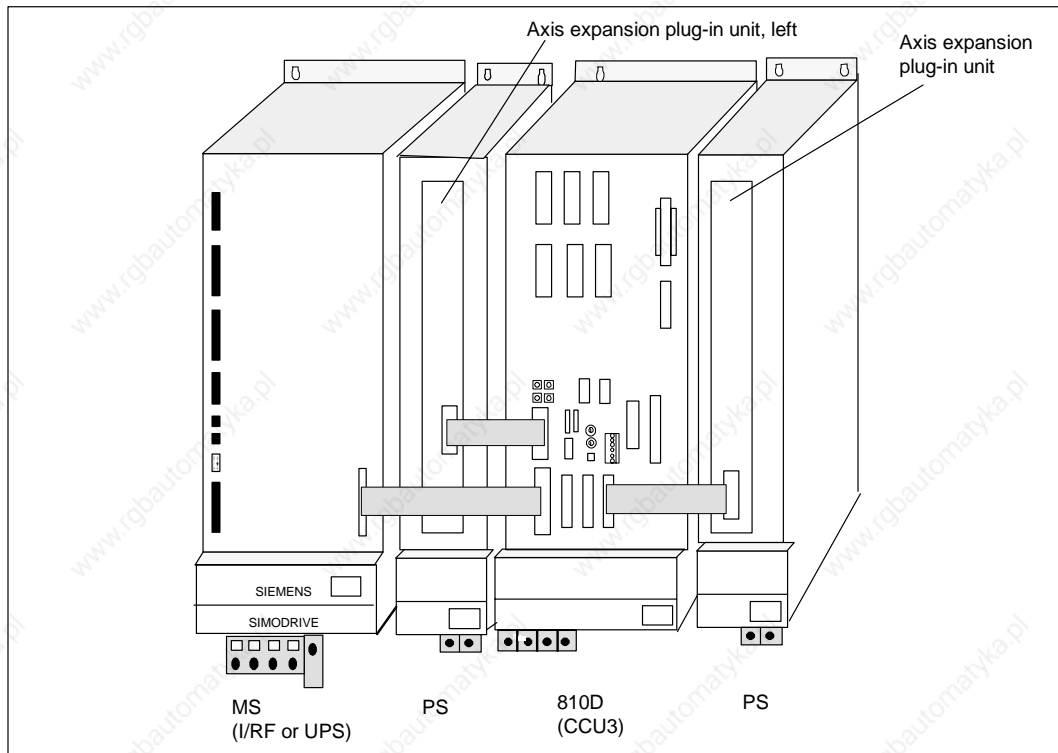


Fig. 3-2 SINUMERIK 810D overall configuration with SIMODRIVE 611 power module

Installing the CCU

Sequence of operations:

1. Connect the battery on the CCU module
2. Place the CCU module in the guide rails of the CCU box and secure it.

The slotted screws (1) must be tightened (see Fig. 3-3) to ensure compliance with EMC requirements and to guarantee the necessary vibration resistance.

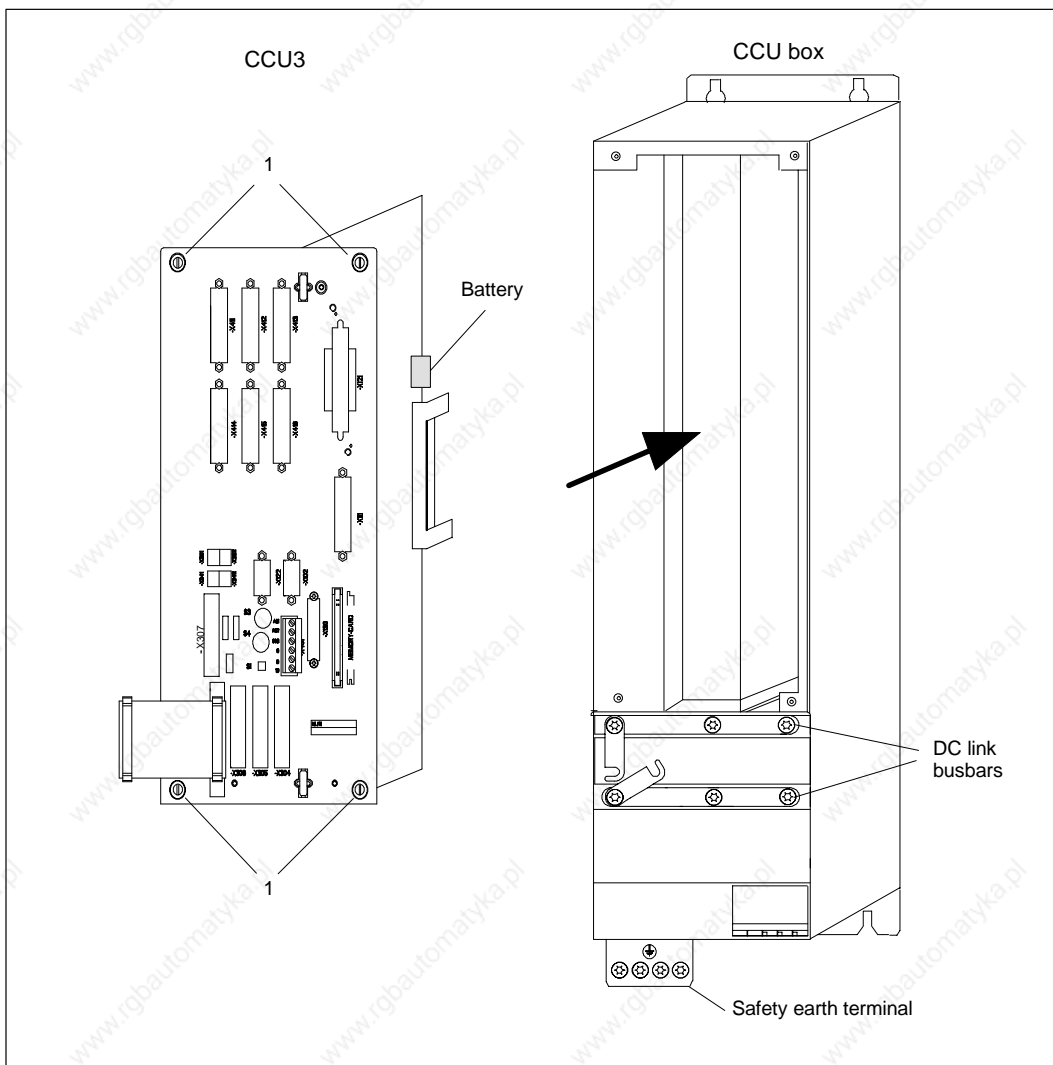


Fig. 3-3 Assembling the SINUMERIK 810D

Installation notes

When mounting the SINUMERIK 810D, please observe the following points:

1. Ventilation gap above and below approx. 100mm
2. The shields of the motor leads must be connected after the shield plate has been installed, see Subsection 2.1.4.
3. The equipotential bonding conductor must be connected at each motor
4. Additional mounting depth is needed to install the connectors.
5. Keep to the specified screw tightening torques.
6. Tighten all the DC link busbar screws.

Attaching the shield plate

The shield plate is attached to the bottom of the 3-axis CCU box by means of three screws; for the 2-axis CCU box, see the shield plate installation diagram). The shield plate is included in the box. The tube clip for shield connection is included in the scope of supply for the preassembled SIEMENS motor connecting lead.

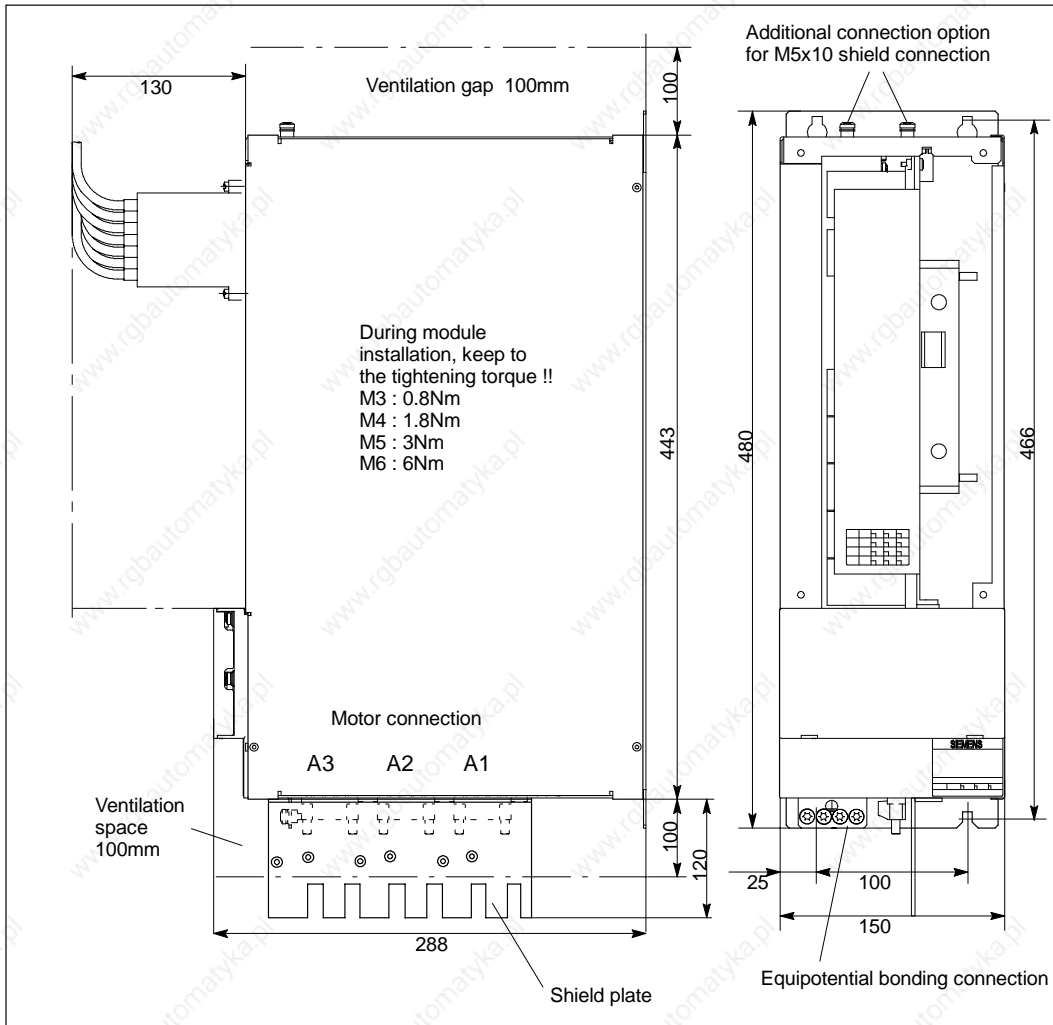


Fig. 3-4 Dimension drawing of the 3-axis CCU box

3.2 Installing the SINUMERIK 810D

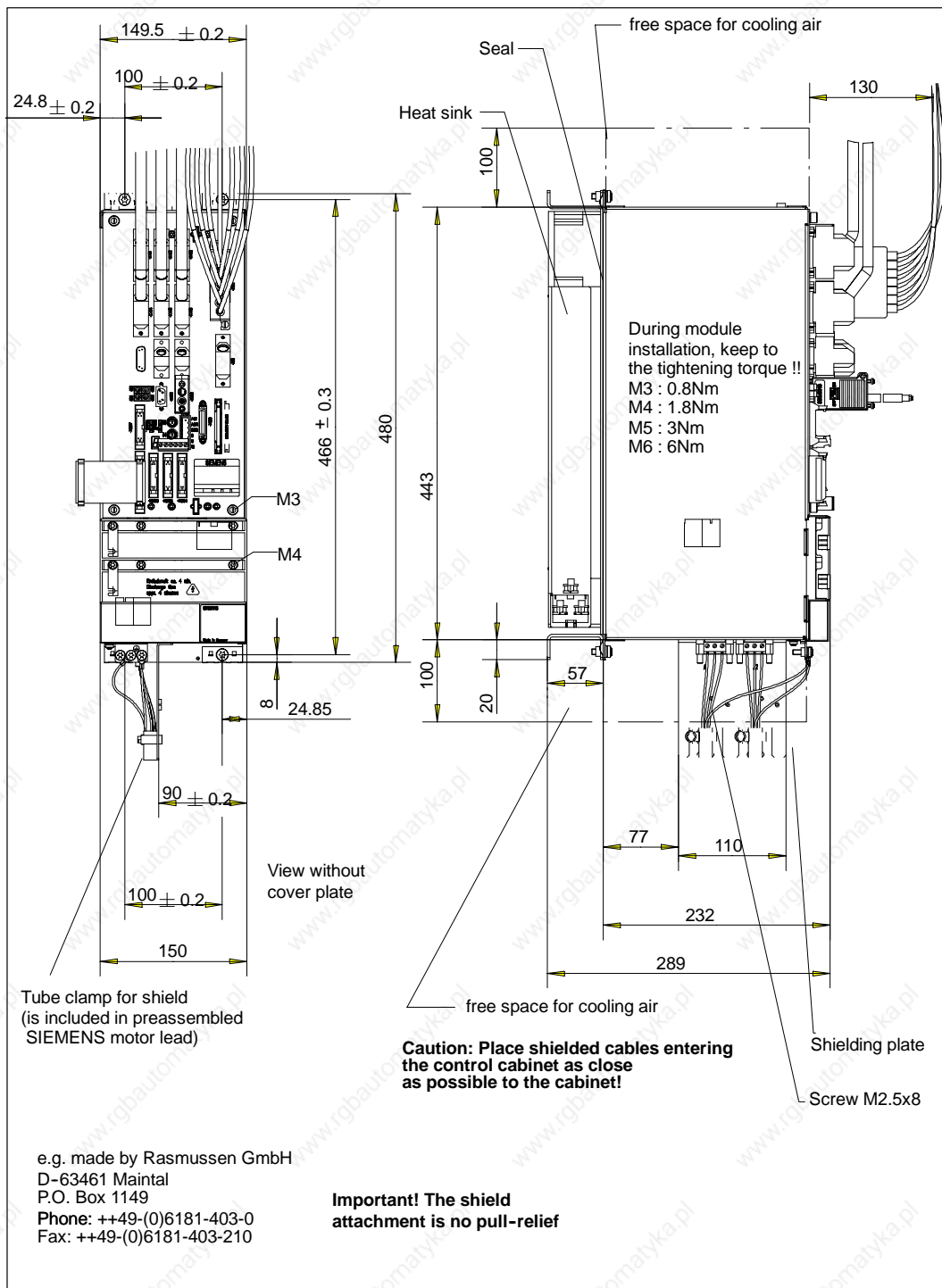


Fig. 3-5 Dimension drawing of the 2-axis CCU box

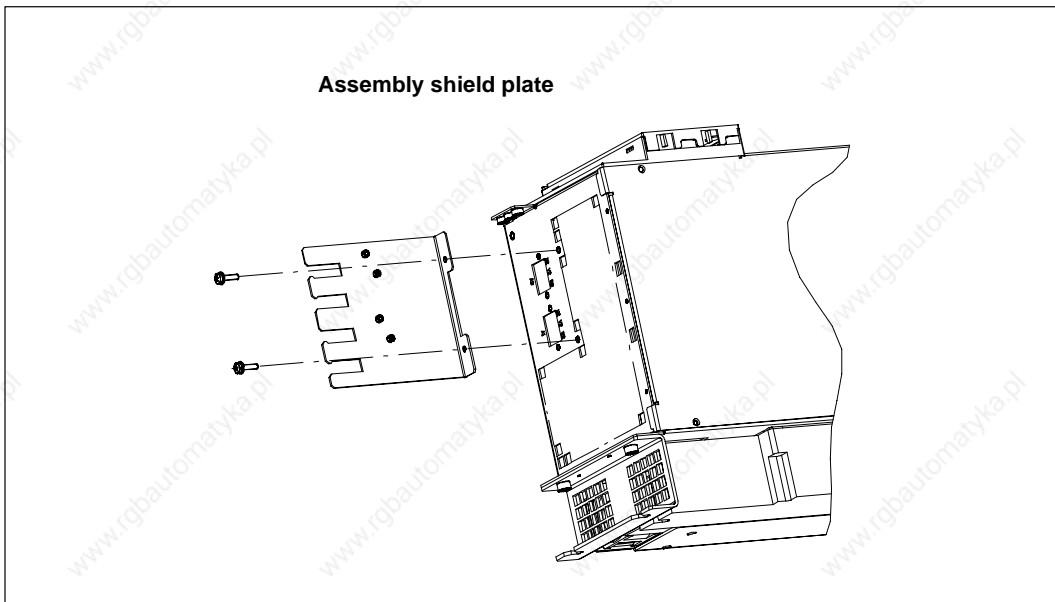


Fig. 3-6 2-axis CCU box: Installing the shield plate

3.2.1 Modification for external cooling, 2-axis CCU box (SW 5 and higher)

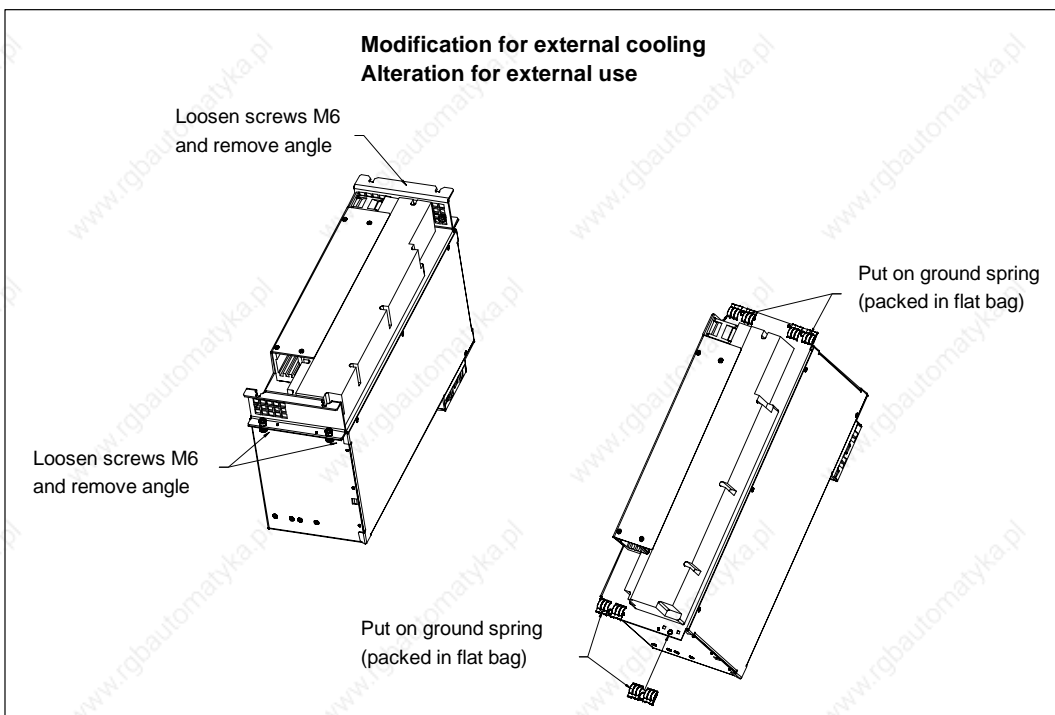


Fig. 3-7 2-axis CCU box: Modification for external cooling

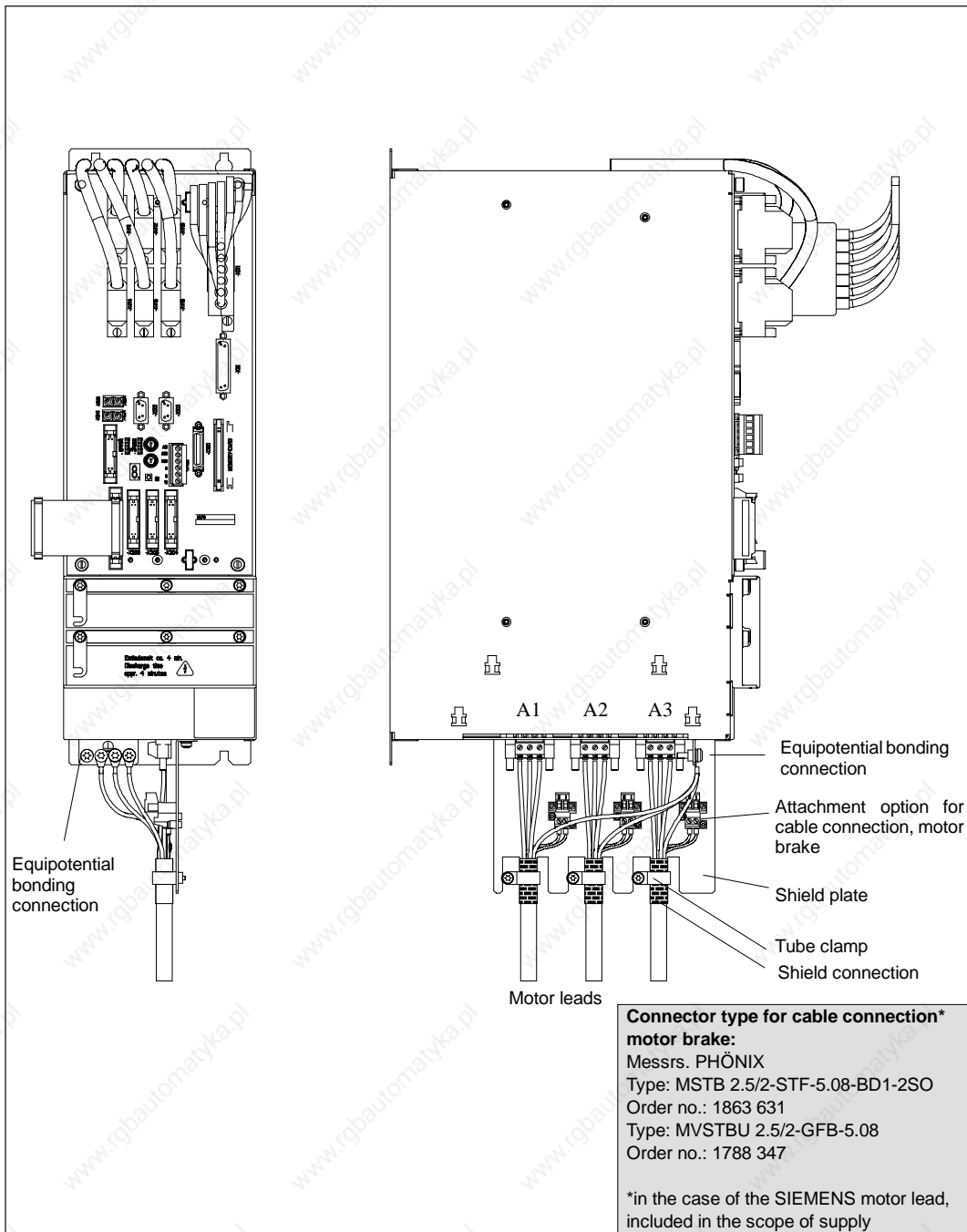


Fig. 3-8 Connecting the motor and encoder leads (3-axis CCU box)

3.3 Mains supply (MS)

Mains supplies (MS) are available as a closed-loop control infeed/regenerative feedback module (I/RF module) and as an open-loop control infeed module (OI). They provide the requisite operating voltages and the necessary power for the particular system in different rating classes.

With I/RF modules, excess DC link power (e.g. in braking mode) can be fed back into the system. The OI modules discharge the braking power to a pulsed resistor.

The mains supply module is arranged as the first module on the left in the drive assembly.

It is necessary to use mains filters to comply with the EMC guidelines of the CE Standard.

Terminals 72, 73, 74

Ready signal from the NC and the drive.
In the correct state, terminals 72 and 73 are closed.

Permissible modules

- Mains supply : OI 5kW, OI 10kW, OI 28kW,
I/RF 16kW, I/RF 36kW, I/RF 55kW (from 07.99: 120kW)
- SIMODRIVE filter modules or commutating reactor

Note

The mains supply and filter modules/reactors are described in the 6SN1 197-0AA00 Planning Guide (setting options, technical data, recommended circuits).



Warning

The equipment is still under hazardous power for approx. 5 minutes after all power has been disconnected.



Description of the SINUMERIK 810D

4.1 Components of the SINUMERIK 810D

4.1.1 Overview

The design of the SINUMERIK 810D is compatible with the SIMODRIVE 611 digital module range. The SINUMERIK 810D is powered by the SIMODRIVE 611 mains supply (OI or I/RF modules).

3-axis CCU box

Basic housing with fan for accommodating the CCU module with three integrated power modules 1x18A/36A (FDD) or 24A/32A (MSD) and 2x6A/12A (FDD) and slot for CCU module (internal cooling).

2-axis CCU box (as from 02.99)

Basic housing with fan for accommodating the CCU module with two integrated power modules 9A/18A (FSD) and slot for CCU module (internal and external cooling).

CCU module

The CCU module (Compact Control Unit) of the SINUMERIK 810D handles all CNC, PLC, communication and closed-loop control tasks. The CCU has 6 measuring channels. Each drive needs a measuring channel for the motor measuring system. If there are any basic unit measuring channels remaining, the user can assign these as direct measuring channels, e.g. for the spindle.

To obtain additional measuring channels, use a 611D closed-loop control module (1- or 2-axis closed-loop control module) with or without a direct measuring system (DMS). The 611D closed-loop control module then takes over drive control. The user can assign any measuring channels that are not used.

SW 2.x and lower:

The system software of the SINUMERIK 810D is stored on an internal flash EPROM and is included in the scope of supply (also valid for CCU3 Export SW 6). The PCMCIA card is only used when the software is upgraded. Also valid for CCU3 Export.

4.1 Components of the SINUMERIK 810D

PCMCIA card (NC card) **SW 3 and higher:**
The NC card with the system software **must remain inserted during operation.**

Note

When upgrading the software, the export software can be copied onto the internal flash EPROM.

SW 6.3 and higher:

Also valid for CCU3 standard software.

In addition to software upgrading, the PCMCIA card can also be used as a memory for series machine startup; see

References: /IAC/ Installation Guide 810D.

6th axis (SW 3.2 and higher)

SW 3.2 and higher, a 6th axis can be operated on CCU1; see Section 4.8.

CCU3 module

Differences to CCU1/2:

- Software compatible with NCU SW 6.
- Up to six axes and two channels can be operated simultaneously.
- 2Two MSDs are supported.
- The complete motor range can be used (1FE, 1FN, 1FW ...).

Closed-loop control

Closed-loop control corresponds to 611D standard closed-loop control, with the following restrictions:

Main restrictions for NCU 840D

The following are not available:

- 5-axis transformation
- Safety Integrated
- Analog axis
- Hydraulic drives
- Independent drive stop/retract
- 3D clearance control.

**SIMODRIVE 611D
drive functions**

The following table shows drive functions and values which differ according to the individual modules.

Table 4-1 Function differences for SIMODRIVE 611 digital

Function	Standard 2		Performance 1		Performance 2 (2-axis)	CCU3 (6-axis/810D)
	1-axis	2-axis (FDD only)	1-axis	2-axis (FDD only)		
Pulse suppression via NCK (Safety)	No		No		Yes	Yes
Encoder limit frequency for direct measuring system	200kHz		300kHz		350kHz	300kHz
Motor data blocks expansion from 2 to 4 for MSD	No		No		Yes	Yes
Speed actual value filter for analog 611U	No		No		Yes	Yes
i ² t power module limitation	No		No		Yes	Yes
Minimum current controller cycle	125µsecs		62.5 µsecs	125µsecs	62.5µsecs 31.25µsecs ¹⁾	Standard 156.5µsecs (Optional 125µsecs)
Minimum speed controller cycle	125 µsecs	500 µsecs	62.5 µsecs	125 µsecs	62.5µsecs 31.25µsecs ¹⁾	Standard 312µsecs (Optional 125µsec)
Minimum position controller cycle	2 msec	4 msec	0.5 msec	1 msec	0.5 msec	1.5msecs up to 3 axes; 2.5msecs 3 axes and above (2.5msecs standard)
Speed controller rise time	1.4 msec	4 msec	0.8 msec	1.4msecs	0.8msecs	approx. 1.4msecs
Characteristic frequency of closed speed controller loop	550Hz	160Hz	1kHz	550Hz	1kHz	at 125µsecs approx. 550Hz; at 312µsecs approx. 300Hz
Max. motor speed (4-pole)	18000rpm		36000 rpm	18000 rpm	42000rpm	18000rpm
Max. electrical fundamental frequency for motor	666Hz		1333Hz	666Hz	1400Hz	666Hz at 125µsecs current controller cycle
Smooth running	0.2µm	1.5µm	0.1µm	0.2µm	0.1µm	approx. 1.5µm
Pulse multiplication factor	128		2048		2048	128
1)	As from drive software version 6.4.2 for FDD single/axis					

4.2 Interfaces of the SINUMERIK 810D

4.2.1 Brief description

CCU1/CCU2

The CCU/CCU2 modules have the following interfaces:

- Optical encoders (max. six measuring systems for raw voltage signal encoders, 1V_{PP}, incremental/absolute with the EnDat interface)
- Three axis expansion terminals for up to three ext. power sections
- Drive bus for axis expansion with 611D modules and connection of NCU terminal block
- PCMCIA slot
- On-board backup battery
- Connection for cable distributor (handwheel, probe)
- MPI interface for operator panel front, programming device, etc.
- PLC I/O bus (P/C bus)
- Option: PROFIBUS DP on CCU2 from SW 3
- Ext. pulse enable jointly for all drives
- Starting lockout, terminals AS1, AS2
- BERO input for ext. zero marker (spindle)
- Displays for error, status and booting
- Operator control elements for start-up, delete, reset
- Four test sockets for diagnostics
- Device bus interface.

CCU3

The CCU3 module has an additional pulse interface.

4.2.2 Hardware interfaces overview

Table 4-2 Overview of hardware interfaces

	Interface	CCU1	CCU2	CCU3
Closed-loop control	Pulse interfaces (6 axes)	3 *)	3 *)	4 **)
	Optical encoders	6	6	6
	DAC test sockets	Yes	Yes	Yes
	BERO input	Yes	Yes	Yes
	Terminals (AS1, AS2, 663, 9,19)	Yes	Yes	Yes
NCK/PLC	I/O bus/C bus	Yes	Yes	Yes
	MPI interface	Yes	Yes	Yes
	Drive bus (611D interface)	Yes	Yes	Yes
	Connector for diff. handwheel	Yes	Yes	Yes
	Two measuring pulse inputs	Yes	Yes	Yes
	PCMCIA interface	Yes	Yes	Yes
	PROFIBUS DP	No	Yes	Yes
Miscellaneous	Electronic power supply (backplane)	Yes	Yes	Yes

*) incl. one spindle

**) incl. two spindles

4.2.3 CCU1/CCU2: Description of the interfaces, operating and display elements

Overview

Position of the interfaces, control and display elements

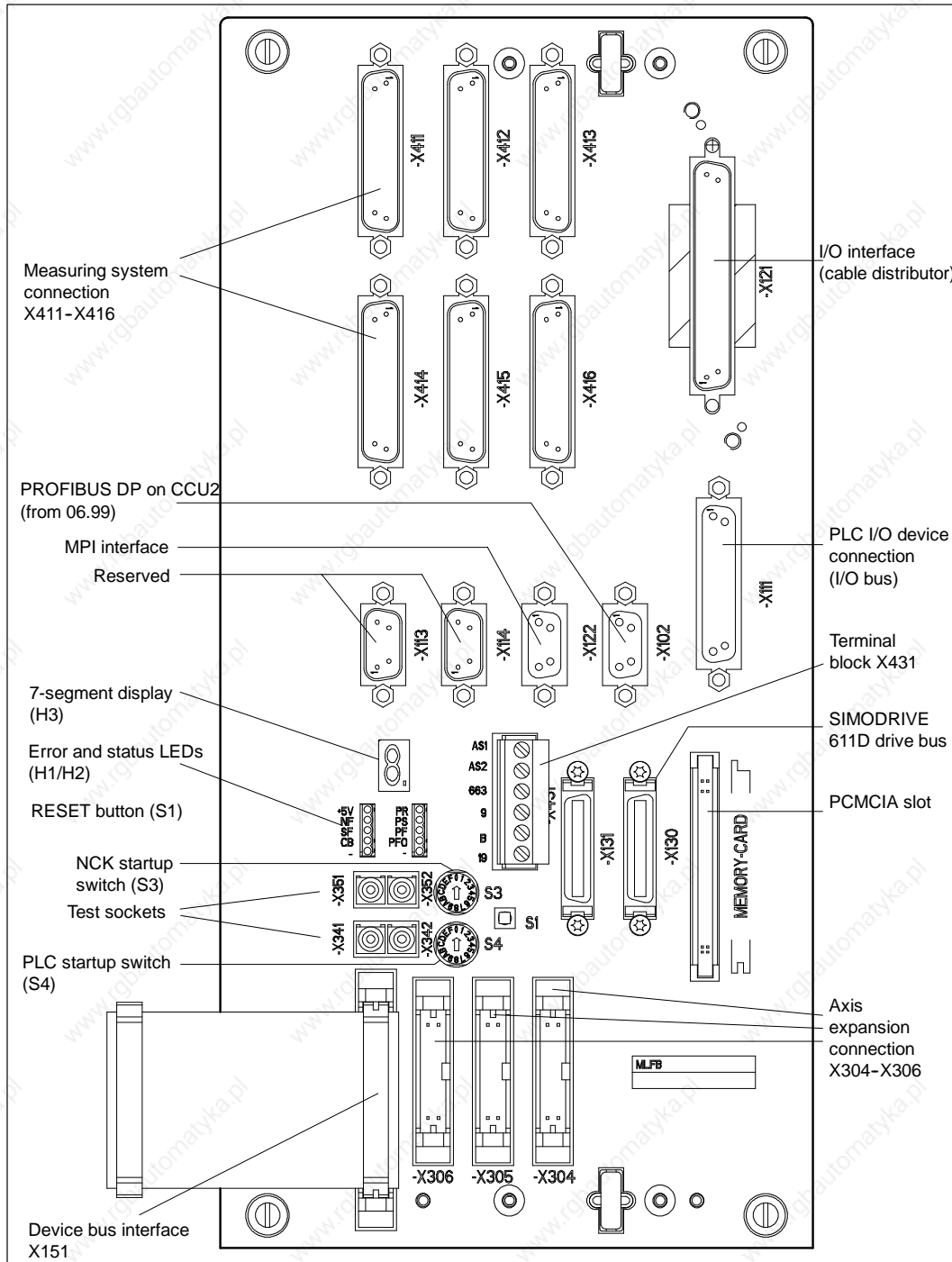


Fig. 4-1 SINUMERIK 810D with CCU 1/2, position of the interfaces, operating and display elements

Signal names

The meaning of the signal names in the tables below is as follows:

P5	5V logic supply
M	Logic ground reference potential
P5EXT	5V floating logic supply
M5EXT	Logic reference potential for P5EXT

Signal types

The meaning of the signal types in the tables below is as follows:

B	Bidirectional
I	Input
O	Output
V	Voltage
OC	Open Collector

**X102
(from 06.99,
CCU2 only)****PROFIBUS DP interface**

Connector designation:	X102
Connector type:	9-way Sub-D socket connector
Maximum cable length:	200m
Special features:	Floating (safe isolation) 12 Mbaud

Table 4-3 Pin assignments on connector X102

X102					
Pin	Name	Type	Pin	Name	Type
1	Unassigned		6	P5EXT	VO
2	M24EXT	VO	7	P24EXT	VO
3	RS_L2DP	B	8	XRS_L2DP	B
4	RTSAS_L2DP	O	9	IRTSPG_L2DP	I
5	M5EXT	VO			

Signal names

RS, XRS	RS485 data
ORTSAS	Request to Send programmable logic controller
IRTSPG	Request to Send programming device

X111**I/O bus/C bus****Connection of S7-300 I/O devices and single I/O module**

Connector designation:	X111
Connector type:	25-way sub-D socket connector
Maximum cable length:	10m
Special features:	Non-floating, no safe isolation

4.2 Interfaces of the SINUMERIK 810D

Table 4-4 Pin assignment of I/O bus/C BUS terminal X111

X111					
Pin	Name	Type	Pin	Name	Type
1	RS_ALARM_N	I	14	RS_ALARM	I
2	IM_ADR0_N	O	15	IM_ADR0	O
3	IM_ADR1_N	O	16	IM_ADR1	O
4	IM_ADR2_N	O	17	IM_ADR2	O
5	M	VO	18	K<2>	O
6	KBUS_B_N	B	19	KBUS_B	B
7	RS_OD_N	O	20	RS_OD	O
8	RS_DIDO_N	B	21	RS_DIDO	B
9	RS_CLK_N	O	22	RS_CLK	O
10	RS_COM_N	O	23	RS_COM	O
11	RS_LAT_N	O	24	RS_LAT	O
12	RS_READY_N	O	25	RS_READY	I
13	Unassigned	-			

Signal names

RS_ALARM, RS_ALARM_N
 IM_ADRi, IM_ADRi_N I/O bus line number
 KBUS_B, KBUS_B_N
 RS_OD, RS_OD_N
 RS_DIDO, RS_DIDO_N I/O bus data
 RS_CLK, RS_CLK_N I/O bus clock
 RS_COM, RS_COM_N I/O bus command
 RS_LAT, RS_LAT_N
 RS_READY, RS_READY_N I/O bus ready signal

X113/X114**Reserved****X121****I/O device interface (cable distributor for handwheel and probe)**

Connector designation: **X121**
 Connector type: 37-pin sub-D plug connector
 Maximum cable length: 25m for all functions
 Special features: Handwheels non-floating

Table 4-5 Pin assignment of cable distributor interface X121

X121					
Pin	Name	Type	Pin	Name	Type
1-2	M24_EXT	VI	18	MPG0 *B	I
3	OUTPUT_1	O	19	Unassigned	-
4	OUTPUT_0	O	20/21	P24_EXT	VI
5	INPUT_3	I	22	OUTPUT_3	O
6	INPUT_2	I	23	OUTPUT_2	O
7	INPUT_1	I	24-27	MEXT	VI
8	INPUT_0	I	28	MEPUS 1	I
9	MEPUS 0	I	29	MEPUC 1	I
10	MEPUC 0	I	30	MPG1 A	I
11	MPG1 *A	I	31/32	M	VO
12/13	PENC1	VO	33	MPG1 B	I
14	MPG1 *B	I	34	MPG0 A	I
15	MPG0 *A	I	35/36	M	VO
16/17	PENC2	VO	37	MPG0 B	I

The terminals highlighted in gray are not assigned.

Signal names

PENC1	P5 supply for handwheel 1
PENC2	P5 supply for handwheel 2
MPGi_B	Measuring pulse generator (handwheel generator) track B (i={1..0})
MPGi_*B	Measuring pulse generator (handwheel generator) track B inverted (i={1..0})
MPGi_A	Measuring pulse generator (handwheel generator) track A (i={1..0})
MPGi_*A	Measuring pulse generator (handwheel generator) track A inverted (i={1..0})
MEPUCi	Measuring pulse
MEPUSi	Measuring pulse

X122

MPI interface (187.5kBaud)

Connector designation:	X122
Connector type:	9-way Sub-D socket connector
Maximum cable length:	200m

Table 4-6 Pin assignment on connector X122

X122					
Pin	Name	Type	Pin	Name	Type
1	Unassigned	-	6	P5EXT	VO
2	M24EXT	VO	7	P24EXT	VO
3	RS	B	8	XRS	B
4	ORTSAS	O	9	IRTSPG	I
5	M5EXT	VO			

Signal names

Same as X102, as appropriate (Tab. 4-3)

4.2 Interfaces of the SINUMERIK 810D

X130**SIMODRIVE 611D drive bus interface and I/O expansion**

Connector designation: **X130**
 Connector type: 36-pin micro ribbon
 Maximum cable length: 10 m
 Special features: Non-floating, no safe isolation

X131**Reserved****X151****"Device bus interface (power supply)**

Connector designation: **X151**
 Connector type: 34-pin ribbon cable, plug connector

X304, X305, X306**Connection for axis expansion plug-in unit**

Connector designation: **X304, X305, X306**
 Connector type: 20-pin ribbon cable, plug connector

**X341, X342,
X351, X352****Test sockets for the output of three analog signals. The software assigns the measured values to be output.**

Connector designation: **X341, X342, X351, X352**
 Connector type: Test socket 2mm

Table 4-7 Assignment of test sockets X341 to X352

Test socket	Position on the CCU	Meaning	range
X351	⊗ ⊙ ⊙ ⊙	DAC 1	0 - 5V
X352	⊙ ⊗ ⊙ ⊙	DAC 2	0 - 5V
X341	⊙ ⊙ ⊗ ⊙	DAC 3	0 - 5V
X342	⊙ ⊙ ⊙ ⊗	Ground for all DACs	

X411-X416**6x measuring system connections for indirect and direct position sensing**

Connector designation: **X411-X416**
 Connector type: 25-way, sub-D plug connector
 The signals with a gray background are not required for a direct measuring system.

Table 4-8 Assignment of measuring system connection X411-X416

X411-X416					
Pin	Name	Type	Pin	Name	Type
1	PENC1/2	VO	14	PENC1/2	VO
2	M	V	15	ENCDATI	B
3	APi	I	16	M	V
4	ANi	I	17	RPi	I
5	M	V	18	RNi	I
6	BPi	I	19	CPi	I
7	BNi	I	20	CNi	I
8	M	V	21	DPi	I
9	Unassigned	-	22	DNi	I
10	ENCCLK	O	23	XENCDATI	B
11	Unassigned	-	24	M	V
12	XENCCLK	O	25	THMOTCOM	I
13	THMOTi	I			

The signals with a gray background are not assigned when a direct measuring system is connected.

Signal names

<Signalname>i means signal of measuring system i where i = 1, ..., 6

PENC1/2 Encoder power supply (PENC1:
X411-X413, PENC2: X414-X416)

APi	Incremental signal A	BPi	Incremental signal B
ANi	Incremental signal \bar{A}	BNi	Incremental signal \bar{B}
ENCCLK	BMI clock signal	RPi	Incremental signal R
XENCCLK	BMI clock signal	RNi	Incremental signal \bar{R}
THMOTi	Motor temperature	CPi	Incremental signal C
ENCDATI	BMI data signal	CNi	Incremental signal \bar{C}
XENCDATI	BMI data signal		
DPi	Incremental signal D		
DNi	Incremental signal \bar{D} (not for direct measuring system)		
XB MIDAT	BMI data signal		
THMOTCOM	Motor temperature		

Note

The encoder power supply is not automatically controlled; this means: no Remote/Sense mode. As a result, the length of the encoder cable is limited.

- EQN 1325: $\leq 18\text{m}$
- ERN 1387: $\leq 25\text{m}$
- External encoder with power consumption $\leq 300\text{mA}$: $\leq 18\text{m}$

4.2 Interfaces of the SINUMERIK 810D

X431**Terminal block for connecting starting lockout, pulse enable (all drives) and external zero marker (BERO)**

Connector designation: **X431**
 Connector type: 6-pin Combi-Con terminal (Phoenix connector), for 1.5 mm² conductor cross section

Table 4-9 Terminal signals drive X431

Terminal	Signal	Front panel marking	Function	Type
1	FR-	19	Reference ground for enabling potential	V
2	BERO	B	Input for external zero marker (BERO)	I
3	FR+	9	Enabling potential + 24V, reference terminal is terminal 19	V
4	KL663	KL663	Pulse enable for all drives (FSD and MSD).	I
5	AS2	AS2	Starting lockout relay (checkback signal terminal 663)	
6	AS1	AS1	Starting lockout relay (checkback signal terminal 663)	

Signal names

AS1 Checkback signal for drive enable (normally closed contact)
 AS2 Checkback signal for drive enable (normally closed contact)
 KL663 Actuation of SH relay
 BERO BERO input
 FR+ Enable voltage (+24V)
 FR- Enable voltage (24V reference)

Note

The "startup disable" relay is switched with terminal 663. When the contact is opened, the actuation pulses are disabled and the motors are switched to torque-free mode.

Operating and display elements

The position of the operating and display elements on the front panel of the CCU1/2 is shown in Fig. 4-1.

Table 4-10 Operating and display elements on the CCU1/2 module

Designation	Type	Meaning
RE-SET(S1)	Button	Triggers a hardware RESET for resetting the control and drive and subsequent full bootup.
S3	Rotary switch	NCK start-up switch Position 0: Normal operation Position 1: General NCK reset Position 2: NCK software update from memory card Positions 3 - 7: Reserved
S4	Rotary switch	PLC mode selector switch Position 0: PLC RUN Position 1: PLC RUN P Position 2: PLC STOP Position 3: MRES
LEDs (left row)	green LED red LED red LED yellow LED	+5V: Lights up when the supply voltage is within the tolerance range. NF: Lights up when the NCK or the PLC watchdog has responded SF: Lights up whenever drive errors occur. Goes out after the system is booted in error-free condition. CB: Lights up when data transfer takes place over the MPI interface.
LEDs (right row)	green LED red LED red LED yellow LED yellow LED	PR: PLC-RUN status PS: PLC-STOP status PF: Lights up if a PLC error occurs PFO: PLC FORCE status -: Not used (lights up briefly on reset)
H3	7-segment	Software-supported output of test and error messages

DAC test sockets

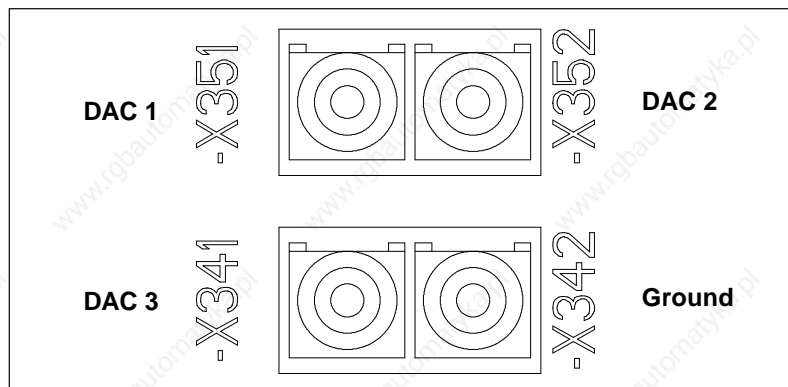


Fig. 4-2 DAC test sockets on the CCU1/2 modules

4.2 Interfaces of the SINUMERIK 810D

4.2.4 CCU3: Description of the interfaces, operating and display elements

Overview

Position of the interfaces, operating and display elements

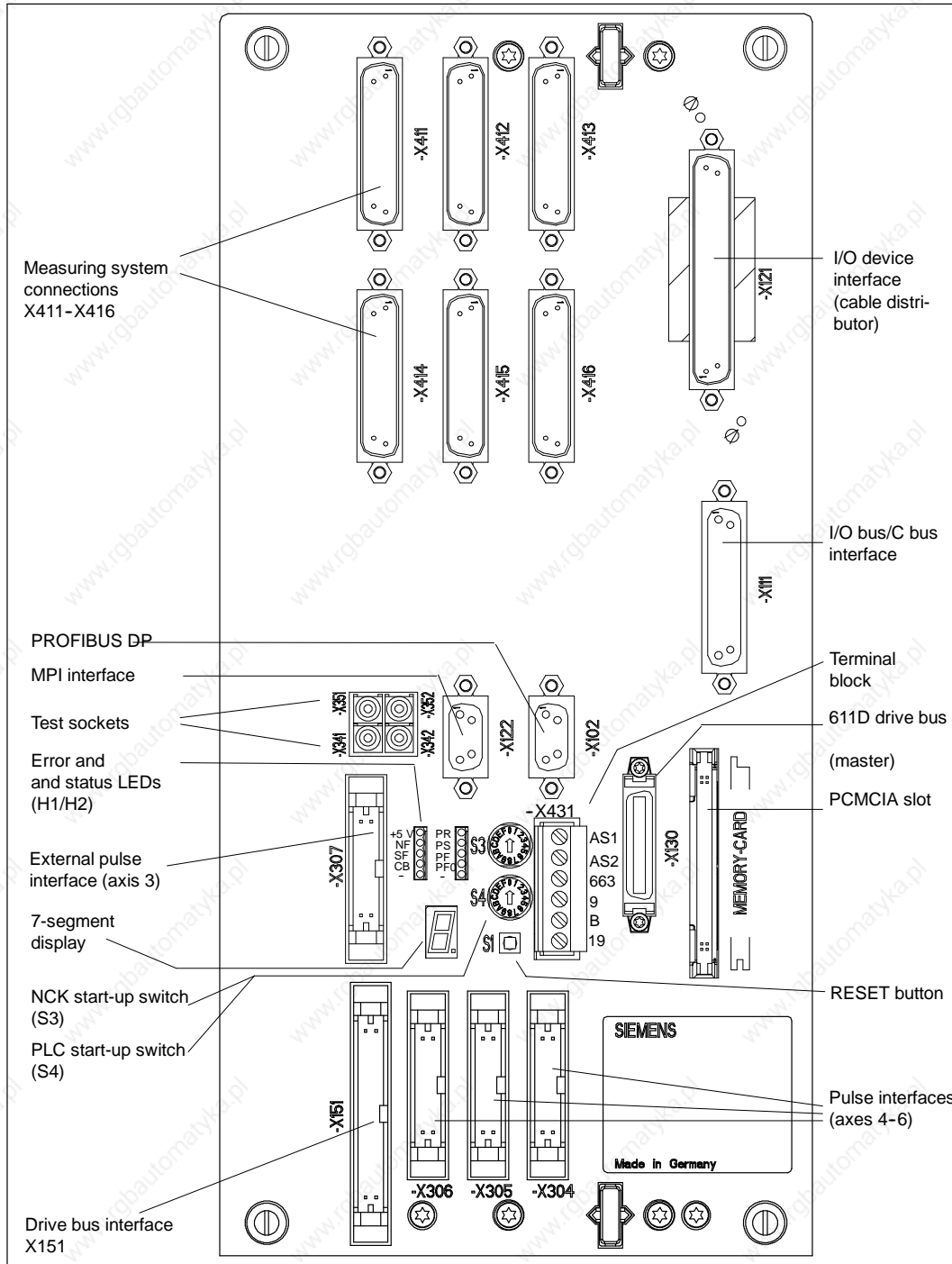


Fig. 4-3 SINUMERIK 810D with CCU 3, position of the interfaces, operating and display elements

The interfaces, operating and display elements of the CCU3 are the same as on the CCU1/2 (see Subsection 4.2.3 with the following differences:

X307**Additional pulse interface (axis 3)**

Connector designation: **X307**
Connector type: 20-pin ribbon cable, plug connector

X113, X114, X131

-are omitted

Operating and display elements

The operating and display elements on the front panel of the CCU3 correspond to Table 4-10, with the exception of the two bottom LEDs (see Fig. 4-3)

Table 4-11 Meaning of the control LEDs on the CCU3 module

Designation	Color	Meaning
LEDs (left row)	Green	+5V: Lights up when supply voltages P5, P3V3, Pcore and N5 are within the tolerance range.
	Red	NF: Lights up when the NCK or the PLC watchdog has responded.
	Red	SF: Lights up if there are drive errors. Goes out after the system is booted in error-free condition.
	Yellow	CB: Lights up when data transfer takes place over the MPI interface.
	Yellow	P24: Lights up if the 24 V power supply fails
LEDs (right row)	Green	PR: PLC RUN status
	Red	PS: PLC STOP status
	Red	PF: Lights up if a PLC error occurs
	Yellow	PFO: PLC FORCE status
	Yellow	RST: Lights up briefly on reset

4.2.5 Cable distributor

Cable distributor (I/O device interface) X121

Interface X121 of the CCU is split in the cable distributor into

- two differential handwheel connections
- two measuring pulse input connections

in max. of seven single cables.

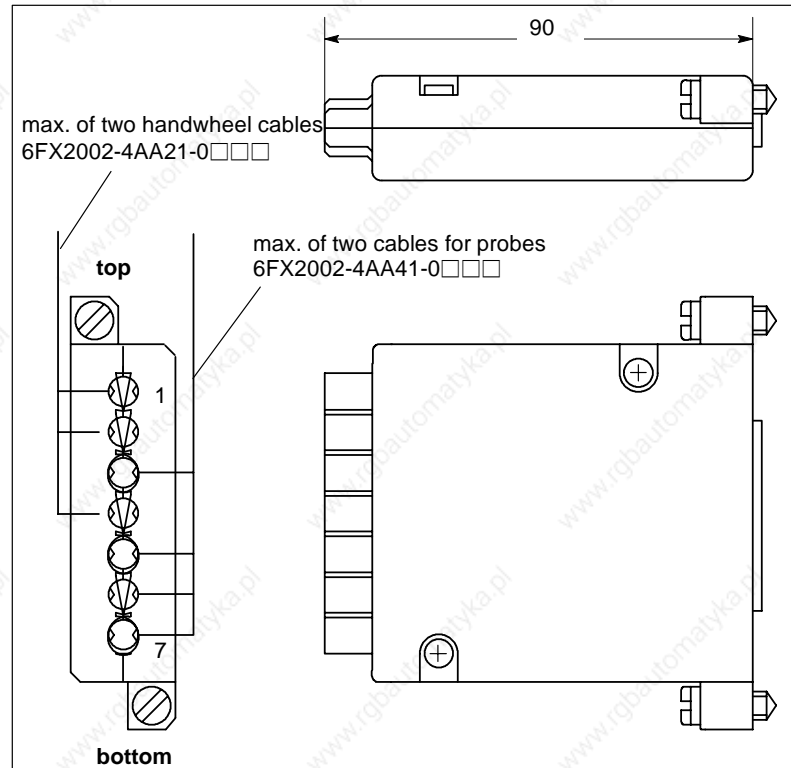


Fig. 4-4 Cable distributor

The 37-way cable distributor consists of a connector housing (SINUMERIK version) for a 37-way sub D plug-in connector with enlarged interior. Seven cable inlets are provided at the rear of the cable distributor to which the cables have to be connected as shown in Table 4-13.

Push the cables into the open cable distributor to plug-in connectors X1 to X10 and place the cable in the cable inlet. Make sure that the exposed shield jackets have a large-area conductive connection with the metal contact surfaces as shown in Fig. 4-5. Insert the upper terminal clip in such a way that its "teeth" are facing the "teeth" of the lower terminal clip and then fasten the upper housing member.

As a result, the cable shields are forced in between the contact surfaces of the contact springs and make contact. By fastening them to the front panel of the CCU, the shield potential is conducted via the contact springs of the cable distributor.

The DIP FIX switches inside the cable distributors 6FX 2006-1BA01 must be set as follows:

Table 4-12 Setting the DIP-FIX switches (S1-S6) in the cable distributor

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

Position of the interfaces

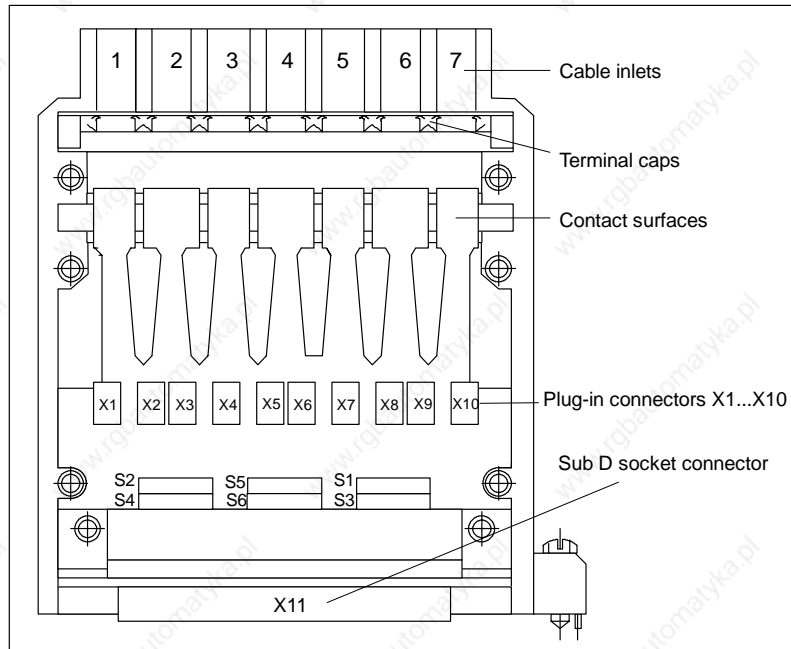


Fig. 4-5 Position of the interfaces of the cable distributor

Connector X1-X10

Table 4-13 Connector assignments

Connector No.	Cable inlet	I/Os
X1	1 (top)	1st handwheel
X2		
X3	2	2nd handwheel
X4		
X5	3	2nd probe
X6	4	Reserved
X7		
X8	5	Reserved
X9	6	Reserved
X10	7 (bottom)	1st probe

4.2 Interfaces of the SINUMERIK 810D

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

Table 4-14 Cable distributor terminal assignments

Pin no. 37-way connector	Signal name	DU BOX connector No./pin	Cable guide	Cable order no. 6FX2002-4AA	Core color	I/Os	Terminal
9 10	- MEPUS 0 - MEPUC 0	X10/2 X10/1 X10/4 X10/3	7	41-0□□□	rd or br blk Shield	1st Probe 1st probe	Signal +24V Reference signal
1 20 2 21		X9/2 X9/1 X9/4 X9/3	6	41-0□□□		Reserved	
3 22 4 23		X8/2 X8/1 X8/4 X8/3	5	41-0□□□		Reserved	
5 24 6 25 7 26 8 27		X7/2 X7/1 X7/4 X7/3 X6/2 X6/1 X6/4 X6/3	4	21-0□□□		Reserved	
28 29	- MEPUS 1 - MEPUC 1	X5/2 X5/1 X5/4 X5/3	3	41-0□□□	rd or br blk Shield	2nd Probe 2nd probe	Signal +24V Reference signal
11 30 12 31 13 32 14 33	MPG1 \bar{A} MPG1 A MPG1 5V MPG1 0V MPG1 5V MPG1 0V MPG1 \bar{B} MPG1 B	X4/2 X4/1 X4/4 X4/3 X3/2 X3/1 X3/4 X3/3	2	21-0□□□	rd or br blk gn ye vio bl Shield	2nd handwheel 6FC9320-5DB	\bar{A} A 5 V 0 V 5 V 0 V \bar{B} B
15 34 16 35 17 36 18 37	MPG0 \bar{A} MPG0 A MPG0 5V MPG0 0V MPG0 5V MPG0 0V MPG0 \bar{B} MPG0 B	X2/2 X2/1 X2/4 X2/3 X1/2 X1/1 X1/4 X1/3	1	21-0□□□	rd or br blk gn ye vio bl Shield	1st handwheel 6FC9320-5DB	\bar{A} A 5 V 0 V 5 V 0 V \bar{B} B

Signal names

MPG0/1 5V Handwheel supply voltage 0/1, 5 V¹⁾
 MPG0/1 0V Handwheel supply voltage 0/1, 0 V
 MPG0/1 A/ \bar{A} Differential handwheel input 0/1 A/ \bar{A}
 MPG0/1 B/ \bar{B} Differential handwheel input 0/1 B/ \bar{B}
 MEPUS 0/1 Measuring pulse signal 0/1
 MEPUC 0/1 Measuring pulse common (reference ground) 0/1

1) Total of max. 1A, i.e. max. 500mA for each handwheel

4.3 Measuring system

4.3.1 Measuring system and motor connection assignments

Motor measuring system and motor connection

A specific motor connection is permanently assigned to each measuring system.

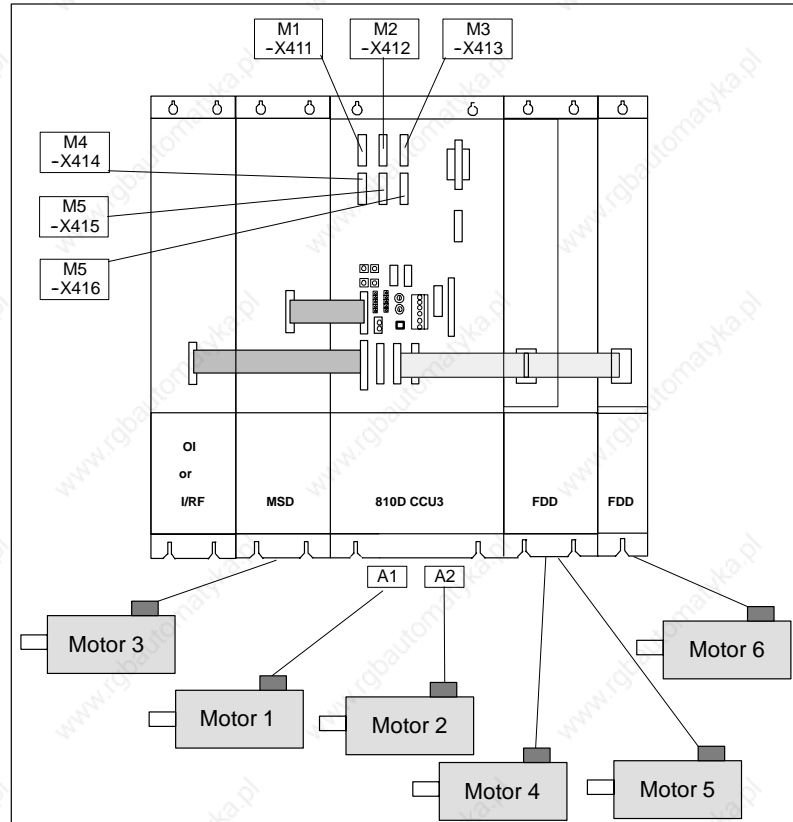


Fig. 4-6 Measuring system to motor connection assignments

Table 4-15 Measuring system to motor connection or axis expansion assignments

Measuring system connection	Motor connection	Axis expansion connection
X411	A1 internal	-
X412	A2 internal	-
X413 Alternative (CCU3 only)	A3 internal A3 external	- X307
X414	-	X304
X415	-	X305
X416	-	X306

4.3 Measuring system

4.3.2 Evaluative encoder systems

Incremental measuring systems

Incremental systems with two 90 degree offset sinusoidal voltage signals A and B and a reference mark R.

e.g. ERN 1387 (motor measuring system)

Transmission:	Differential signals A, \bar{A} ; B, \bar{B} and R, \bar{R}
Amplitude A - \bar{A}	typically 1 Vpp
Amplitude B - \bar{B}	typically 1 Vpp
Amplitude R - \bar{R}	typically 0.5 Vpp - 1 Vpp
Voltage supply:	5V \pm 5%
Maximum supply current:	300mA
Max. evaluative encoder signal frequency:	350kHz

Note

At the frequency stated above, the signal amplitude must be $\geq 60\%$ of the nominal amplitude and the deviation from the ideal phase displacement of 90° between track A and B \leq must be $\pm 30^\circ$.

Note the encoder signal frequency response.

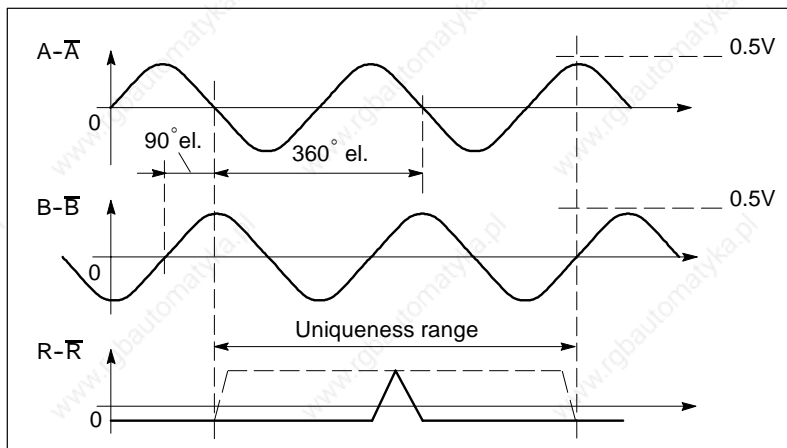


Fig. 4-7 Signal chart for incremental encoders at clockwise rotation

Absolute (EnDat) measuring systems

Singleturn, multiturn and linear absolute measuring systems with two 90° degree offset sinusoidal voltage signals A and B and an EnDat interface.
e.g. multiturn encoder EQN 1325, singleturn encoder ECN 1313 or linear absolute measuring system LC181.

Transmission of incremental signals:	Differential signals A, \bar{A} and B, \bar{B}
Amplitude A - \bar{A}	typically 1 Vpp
Amplitude B - \bar{B}	typically 1 Vpp
Transmission of serial signals:	Differential signals data, $\overline{\text{data}}$ and clock, $\overline{\text{clock}}$
Level:	Acc. to EIA 485
Voltage supply:	5V \pm 5%
Maximum supply current:	300mA
Max. evaluative encoder signal frequency:	350kHz

Note

At the frequency stated above, the signal amplitude must be $\geq 60\%$ of the nominal amplitude and the deviation from the ideal phase displacement of 90° between track A and B $\leq \pm 30^\circ$.

Note the encoder signal frequency response.

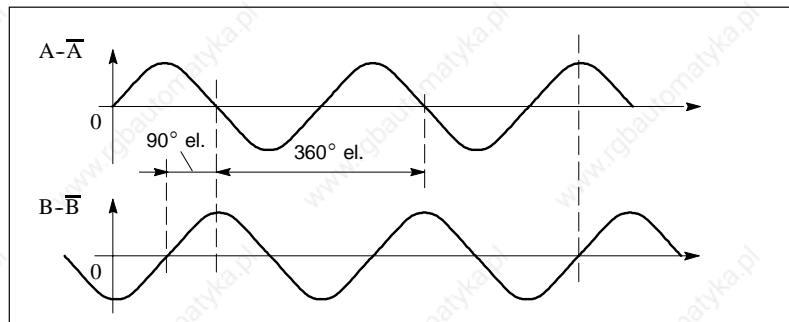


Fig. 4-8 Signal chart for incremental signals at clockwise rotation

4.3 Measuring system

4.3.3 Measuring channels, indirect and direct measuring systems

Measuring channels on the SINUMERIK 810D

The six measuring channels on the SINUMERIK 810D can be used both for indirect and for direct position sensing. A spare measuring channel can be used for a direct spindle measuring system, for example. To obtain additional measuring channels, use a 611D standard closed-loop control module with or without a direct measuring system.

Interconnecting cables

The following interconnecting cables are used for the SINUMERIK 810D:

Table 4-16 Interconnecting cables for the SINUMERIK 810D

No.	Order No.	Designation
1	6FX2 002-2CA31-1□□0 ¹⁾	Incremental motor measuring system cable, 25-way connector
2	6FX2 002-2CG00-1□□0 ^{1), 2)}	Connecting cable for a direct measuring system, 25-way connector (for connection to CCU only)
3	6FX2 002-2CH00-1□□0 ^{1), 2)}	Connecting cable for multiturn absolute EnDat encoder, 25-way connector (for connection to CCU only)
4	6FX2 002-2CA11-1□□0 ¹⁾	Connecting cable for a direct measuring system, 15-way connector (for connection to 611D closed-loop control only)
5	6FX2 002-2AD00-1□□0 ¹⁾	Connecting cable for multiturn absolute EnDat encoder, 15-way connector (for connection to 611D closed-loop control only)
6	6FX2 002-2EQ00-1□□0 ¹⁾	Absolute motor measuring system cable, 25-way connector
7	6FX2 002-2EQ10-1□□0 ¹⁾	Absolute motor measuring system cable, 25-way connector

1) For the length code, see **References:** /Z/ Catalog NC Z

2) Round connector, measuring system end

Each cable is assigned its own number.
These numbers (1–7) can be found in the diagrams below.

Indirect measuring system FDD

The motor measuring system is also used for position sensing.

Two encoder systems are available:

- Incremental encoder
- Absolute encoder.



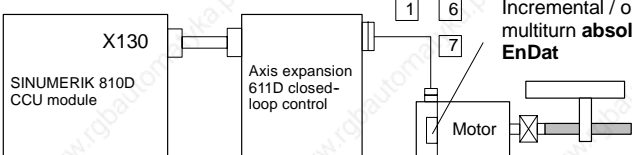
<p style="text-align: center;">Indirect position (motor rotor position) and motor speed sensing</p> <p style="text-align: center;">FDD</p>	<p>M: Max. possible measuring steps G: Accuracy of the encoder system</p>
	<p>M = 128 x Z per 360 degrees mech. Z...encoder lines Z = 2048 G = 0.006 degrees</p>
	<p>M = 128 x Z per 360 degrees mech. Z...encoder lines Z = 2048 G = 0.006 degrees Multiturn absolute: 4096 revolutions</p>
	<p>M = 128 x Z per 360 degrees mech. Z...encoder lines Z = 2048 G = 0.006 degrees Multiturn absolute: 4096 revolutions</p>

Fig. 4-9 Indirect position sensing with digital closed-loop control FDD

4.3 Measuring system

Direct measuring system FSD

The motor measuring system is only used to detect the motor position. If necessary, a second measuring system, e.g. a scale, can be used for position sensing at the load end. Incremental encoders, distance-coded incremental encoders or EnDat absolute value encoders can be used (voltage signals).

<p>Direct position sensing with spare CCU measuring channel FSD</p>	<p>M: Max. possible measuring steps G: Accuracy of the encoder system</p>
<p>Voltage signals</p> <p>Incremental motor position</p> <p>1</p> <p>2 or 3</p> <p>Linear measuring system incremental/absolute</p> <p>Motor *)</p>	<p>M = 128 per encoder signal period or graduation</p> <p>G is a function of the accuracy of the encoder system at the load end.</p>
<p>Direct position sensing for axis expansion with external 611D closed-loop control</p>	
<p>Voltage signals and EnDat absolute</p> <p>2 or 3</p> <p>Motor position incremental/absolute</p> <p>1</p> <p>Linear measuring system incremental or incremental and absolute</p> <p>Motor *)</p>	<p>M = 128 or 2048 with 611D enhanced closed-loop control per encoder signal period or graduation</p> <p>G is a function of the accuracy of the encoder system at the load end.</p>
<p>Voltage signals and EnDat absolute</p> <p>Incremental motor position</p> <p>4 or 5</p> <p>1</p> <p>Linear measuring system incremental or incremental and absolute</p> <p>Motor *)</p>	<p>M = 128 per encoder signal period or graduation</p> <p>G is a function of the accuracy of the optional encoder system.</p>

Fig. 4-10 Indirect position sensing with digital closed-loop control FDD

*) e.g. 1FK7

Indirect measuring system MSD

The motor measuring system is also used for position sensing.

One encoder system is available:

- Optical/incremental (1PH motor).

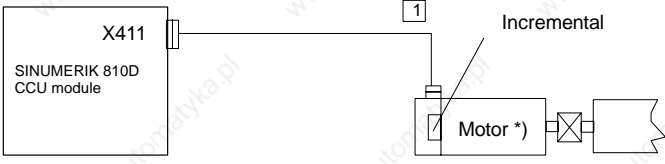
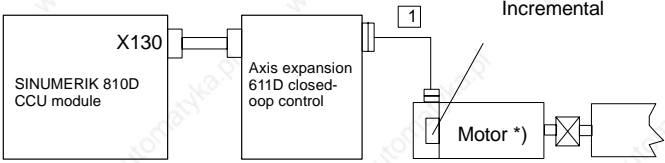
Indirect position (motor rotor position) and motor speed sensing MSD	M: Max. possible measuring steps G: Accuracy of the encoder system
 <p>The diagram shows a SINUMERIK 810D CCU module (X411) connected to a motor (Motor *) via an incremental encoder. A line labeled '1' indicates the encoder's output to the CCU module.</p>	<p>M = 128 x Z per 360 degrees mech. Z...encoder lines Z = 2048 G = 0.006 degrees</p>
 <p>The diagram shows a SINUMERIK 810D CCU module (X130) connected to an Axis expansion 611D closed-loop control module, which is then connected to a motor (Motor *) via an incremental encoder. A line labeled '1' indicates the encoder's output to the axis expansion module.</p>	<p>M = 128 x Z per 360 degrees mech. Z...encoder lines Z = 2048 G = 0.006 degrees</p>

Fig. 4-11 Indirect position sensing with digital closed-loop control MSD

*) e.g. 1PH7

4.3 Measuring system

Direct measuring system MSD

The motor measuring system is only used to detect the motor position. If necessary, a second measuring system, e.g. a rotary position inducer, can be used for position sensing at the load end. Only encoders with voltage signals can be used with the SINUMERIK 810D.

Direct position sensing with spare CCU measuring channel MSD	M: Max. possible measuring steps G: Accuracy of the encoder system
	<p>M = 128 per encoder signal period or graduation</p> <p>G is a function of the accuracy of the optional encoder system.</p>
	<p>M = 128 V Z per 360 degrees mech. Z...encoder lines Z = 2048</p> <p>G = 0.006 degrees</p>
Direct position sensing for axis expansion with external 611D closed-loop control	
	<p>M = 128 x Z per 360 degrees mech. Z...encoder lines Z = 2048</p> <p>G = 0.006 degrees</p>
	<p>M = 128 x Z per 360 degrees mech. Z...encoder lines Z = 2048</p> <p>G = 0.006 degrees</p>

Fig. 4-12 Direct position sensing with MSD

*) e.g. 1PH7

4.4 Integrated power sections: 3-axis CCU box

Description

With the SINUMERIK 810D, three integrated power sections are mounted in the 3-axis CCU box on a heatsink:

- Power section for 2x 6A/12A (FDD)
- Power section for 1x 18A/36A (FDD) or 24A/32A (MSD)
- Heatsink temperature sensor.

Table 4-17 Motor connection and power module assignments

Motor connection	Power section	Continuous current, rated current (sine, rms)
A1 (back)	18A/36A (FDD) or 24A/32A /MSD)	240
A2 (center)	6A/12A (as FDD only)	60
A3 (front)	6A/12A (as FDD only)	60

Note

On the integrated power section, the spindle must only be used at "A1".

Current reduction depending on ambient temperature

All technical data are valid for ambient temperatures up to max. 40°C. In the event of ambient temperatures > 40°C currents must be reduced linearly as for the OI mains supply. At a maximum ambient temperature of 55°C: current reduction to 60% of the 40°C value.

Current reduction depending on site altitude

All the specified load currents are valid up to a site altitude of 1000m. For site altitudes > 1000m, load currents must be reduced in accordance with the OI mains supply chart.

Rated load cycles FSD

For use as an FSD power section (A1-A3)

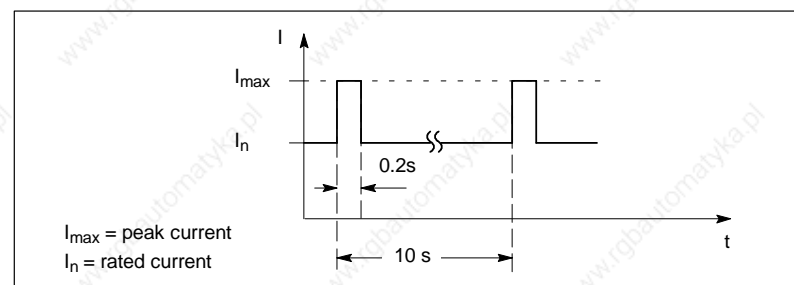


Fig. 4-13 Peak current load cycle with previous load at FSD

4.4 Integrated power sections: 3-axis CCU box

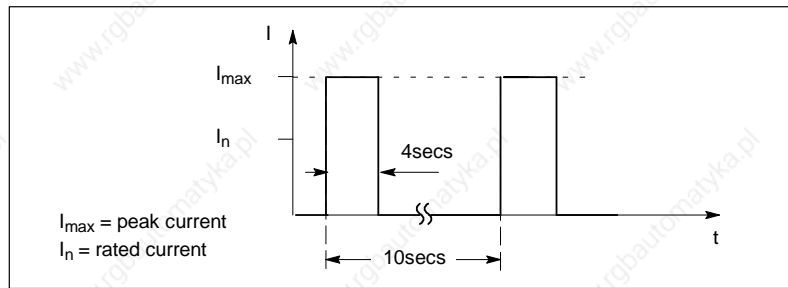


Fig. 4-14 Peak current load cycle without previous load for FSD

**Rated load cycles
MSD**

Only for the MSD power section with 24A/32A

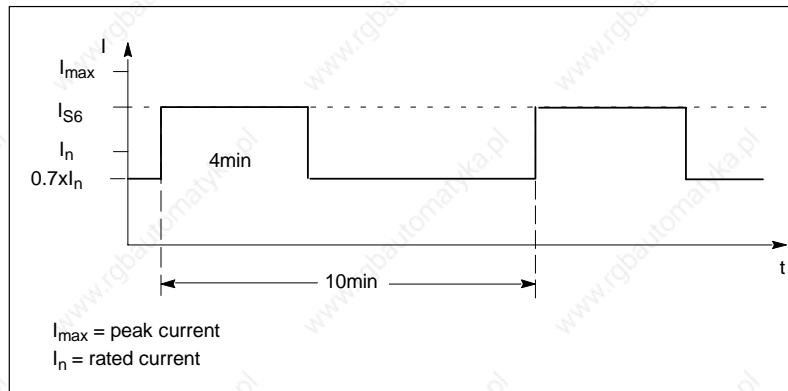


Fig. 4-15 S6 load cycle with previous load at MSD

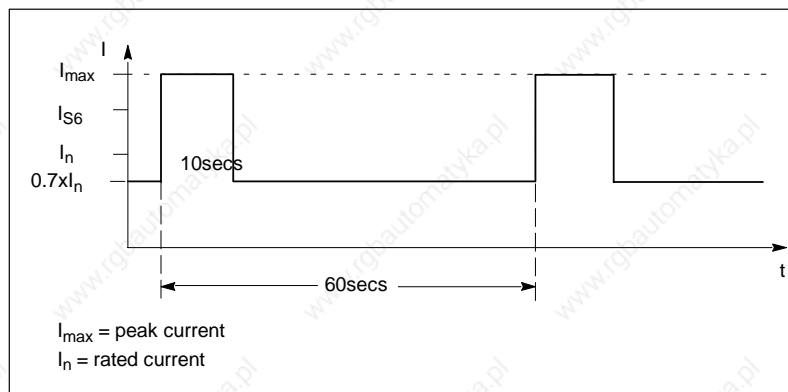


Fig. 4-16 S6 peak current load cycle with previous load at MSD

**Simultaneity factor
(GZF)**

At simultaneous continuous operation, power sections A2 and A3 must only operate on average at 63% of their rated current. There is no simultaneity restriction for A1.

4.5 Integrated power sections: 2-axis CCU box

Description

With the SINUMERIK 810D, two integrated power sections are mounted in the 2-axis CCU box on a heatsink:

- Power section for 9A/18A (FDD)
- Heatsink temperature sensor.

The 2-axis CCU box can be fitted either with internal cooling or with external cooling.

Table 4-18 Motor connection and power section assignments

Motor connection	Power section	Continuous current, rated current (sine, rms)
A1 (back)	9A/18A (as FSD only)	90
A2 (front)	9A/18A (as FSD only)	90

Note

The third drive number, "A3", cannot be used for an axis with CCU1/CCU2, it must not be assigned. Measuring encoder input X413 can be parameterized for a direct measuring system.

CCU3: The third drive number, "A3", can be used for an axis in the "left axis expansion plug-in unit".

Current reduction depending on ambient temperature

All technical data are valid for ambient temperatures up to max. 40°C. In the event of ambient temperatures > 40°C currents must be reduced linearly as for the OI mains supply. At a maximum ambient temperature of 55°C: current reduction to 60% of the 40°C value.

Current reduction subject to site altitude

All the specified load currents are applicable up to a site altitude of 1000m. For site altitudes > 1000m, load currents must be reduced in accordance with the OI mains supply chart.

Rated load cycles FSD

For use as an FSD power section (A1-A2).

4.6 PLC module

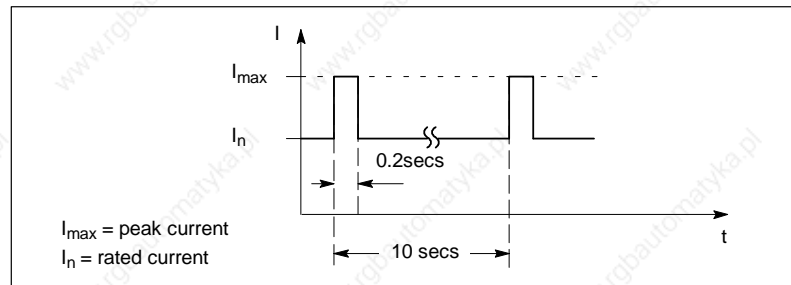


Fig. 4-17 Peak current load cycle with previous load for FDD

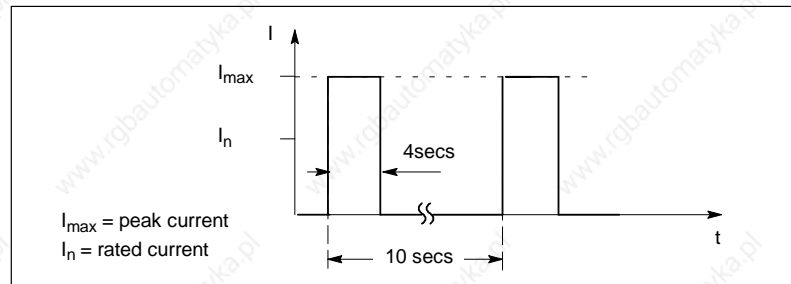


Fig. 4-18 Peak current load cycle without previous load for FSD

References: /PJ1/ SIMODRIVE Planning Guide

4.6 PLC module

PLC module

The PLC module is a PLC CPU compatible with the S7-300 product line. Three external lines each with eight S7-300 peripheral modules can be connected via the X111 PK bus. Up to three single I/O modules can be connected. It is possible to mix IM361s and EFPs.

References: /S7H/, Manual: Assembly, CPU Data

4.7 PCMCIA card (memory card)

A slot is available on the CCU for standard PC cards supporting all Type II flash cards up to 8MB memory capacity.

Recommendation: use Siemens PC cards.

CCU1/2

- SW 2.x and lower:
The PC card is only used for software upgrades.
- SW 3 and higher:
The PCMCIA card with the system software **must remain inserted during operation**.
In addition to software upgrades, the PC card can be used as a memory for series machine start-up; see
References: /IAC/ Installation Guide 810D.

CCU3

The PC card is only used for software upgrades or for standard software.

**Caution**

Removing or inserting the PCMCIA card when the system is energized results in destruction of the PCMCIA card!

4.8 CCU1: 6th axis (SW 3.2 and higher)**Required components**

- | | |
|-----------------------------------|---|
| • 611 digital closed-loop control | 6SN1118-0D□□1-0AA□ |
| • 611D power section | 6SN112□-1AA0□-0□A1 |
| • Drive bus cable | 6SN1161-1CA00-0□A0 |
| • Terminator for the drive bus | 6FX2003-0DA00 |
| • Device bus cable | 6FC5247-0AA28-0AA0
GWE: 462008006403 |

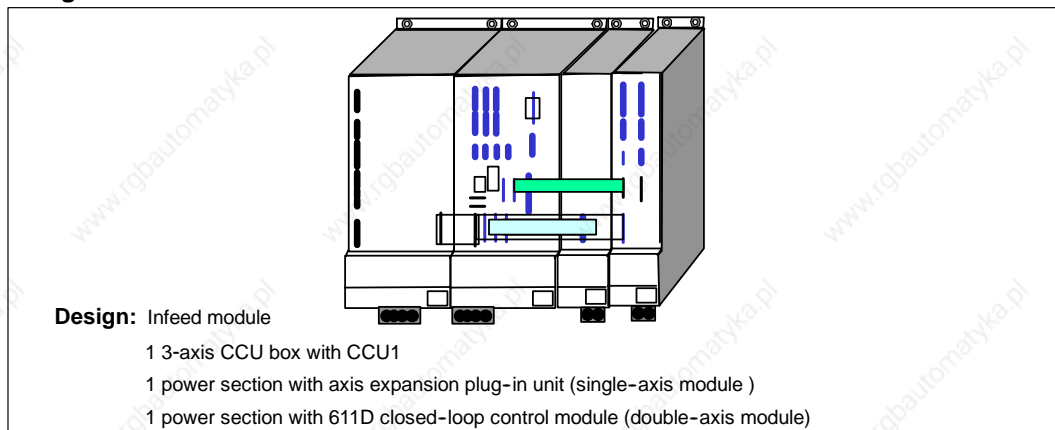
Design

Fig. 4-19 Typical configuration

4.8 CCU1: 6th axis (SW 3.2 and higher)

Connecting cables

Table 4-19 Recommended choice of lengths for drive bus cables

Order no.	Module width to be bridged in mm	Comments
6SN1161-1CA00-0BA1	50	Drive bus cable, round cable, shielded
6FC5247-0AA28-0AA0 GWE: 462008006403	50 50	Device bus cable Device bus cable
6SN1161-1AA00-0BA0	<50	Device bus cable 400mm
NC60 Catalog: choose length + 50mm	<50	Drive bus cable, round cable, shielded



Axis Expansion

5.1 Axis expansion plug-in unit

Application

The axis expansion plug-in unit is mounted in a SIMODRIVE 611 power module and then connected to the SINUMERIK 810D at axis expansion terminal X304–X306. The plug-in unit is designed for use in 1-axis and 2-axis power modules.

A left axis expansion plug-in unit is available for the CCU3 with the terminal of connector X307 (CCU3) and X301 (expansion plug-in unit) at the same height.

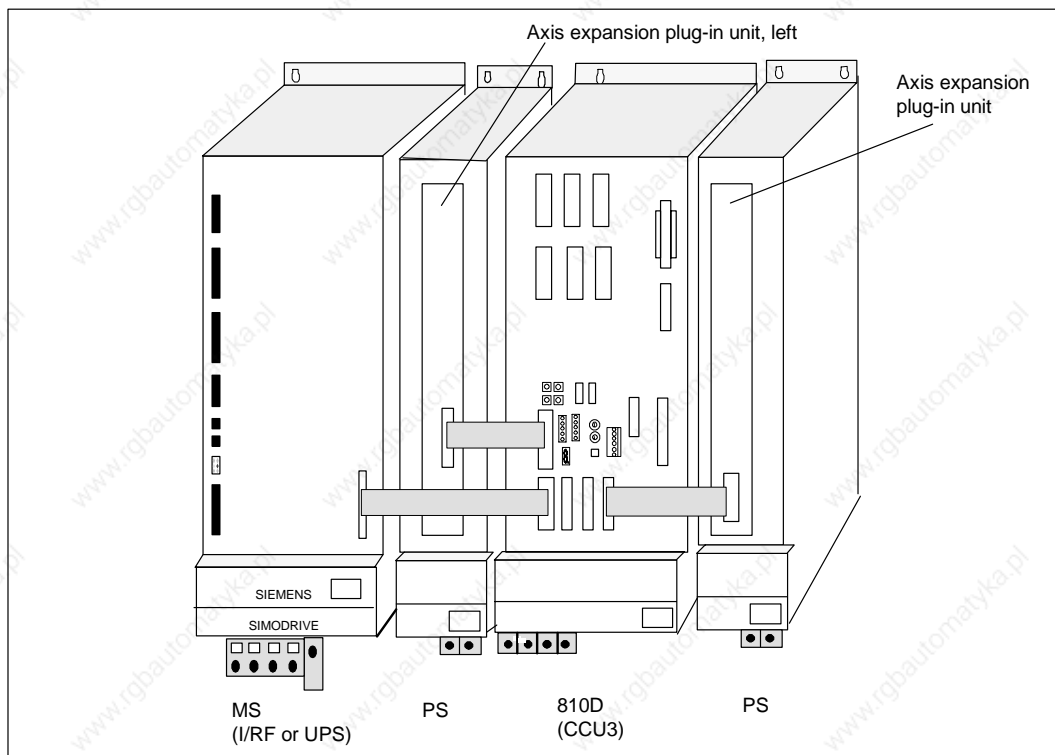


Fig. 5-1 Left and right axis expansion plug-in unit for SINUMERIK 810D with SIMODRIVE 611 power modules

5.1 Axis expansion plug-in unit

Note

When PS modules are more than 50mm in width and have an integrated device bus, the free end of the device bus must be located in the 34-way device bus connector on the module.

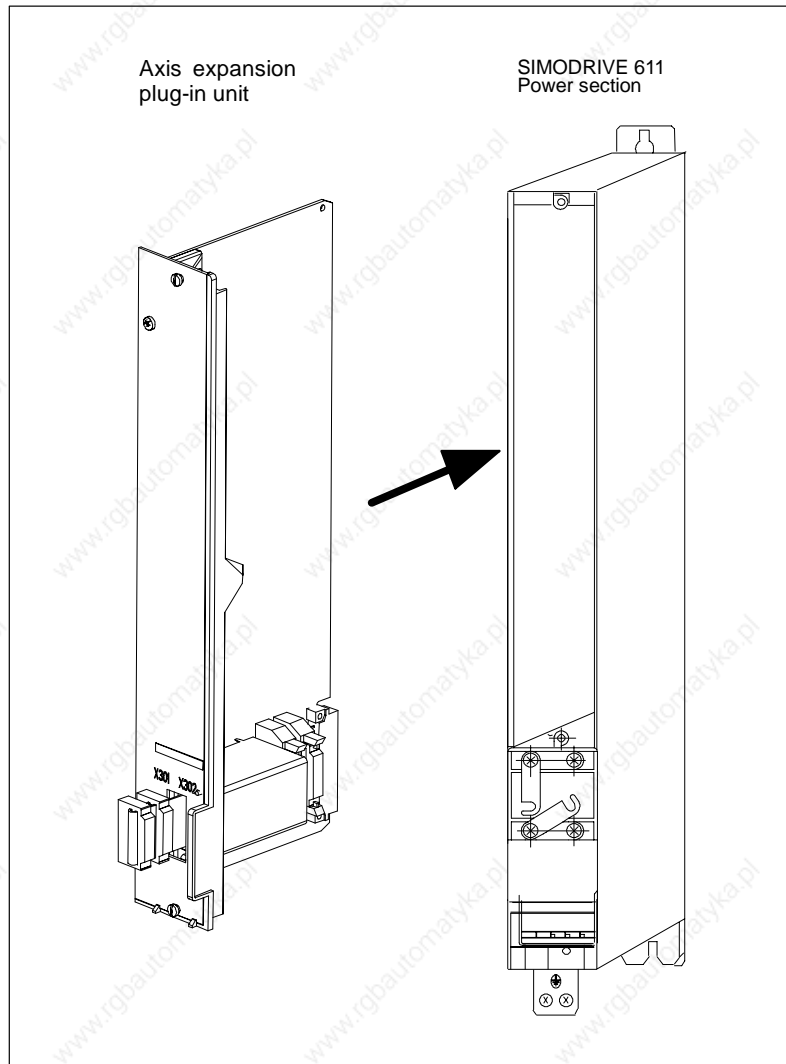


Fig. 5-2 Installing the axis expansion plug-in unit in the power section

Ribbon cable connection

The axis expansion plug-in unit has two connectors, X301 and X302. When inserting in a single-axis power section, use connector X301. If you are using a 2-axis power section, connector X301 is assigned to the first axis and connector X302 to the second axis.

Table 5-1 Ribbon cable connection for the axis expansion plug-in unit

Ribbon cable connector	1-axis power section	2-axis power section
X301	1st axis	1st axis
X302	unassigned	2nd axis

Installation

1. Insert the ribbon cable for the X301 connector through the slot on the front panel with the notch facing forward and plug it in.
2. If applicable, attach the ribbon cable for connector X302 in the same way (for the 2nd axis).

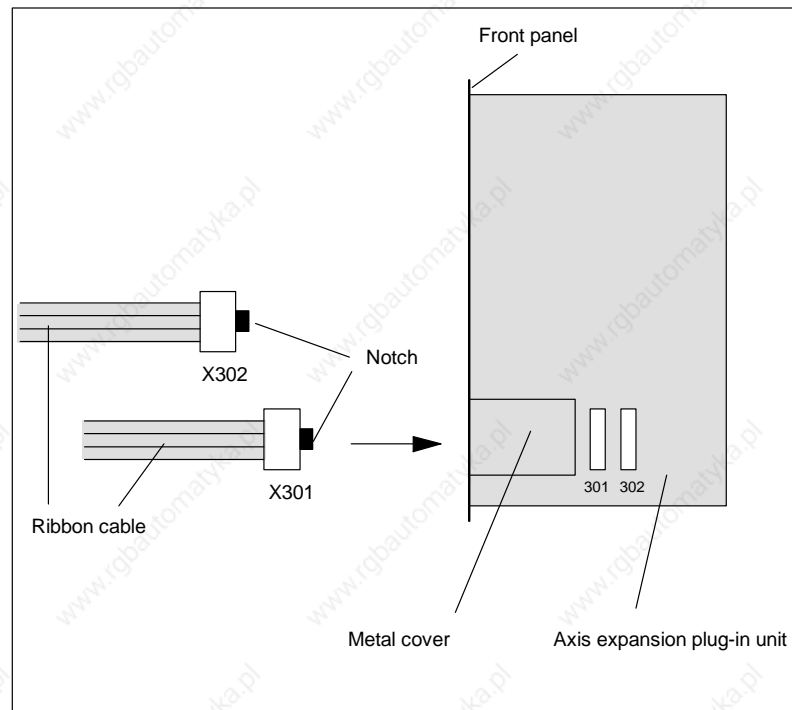


Fig. 5-3 Installing the axis expansion ribbon cable

3. Once you have inserted the axis expansion plug-in unit and connected it to the CCU, push the excess length of cable into the space provided under the metal cover of the axis expansion plug-in unit.

5.2 Axis expansion with the SIMODRIVE 611D closed-loop control module

Use Axis expansion with the SIMODRIVE 611D closed-loop control module is only used when there are insufficient measuring channels on the SINUMERIK 810D or higher performance is required.

Installation The SIMODRIVE 611D module is mounted as the first module to the right of the SINUMERIK 810D. When connecting the DC link busbars, all screws must be tightened (note the torque).

Connection You need a special cable set to connect the SIMODRIVE 611D closed-loop control module. This cable set contains the connection to the drive bus and another device bus cable.

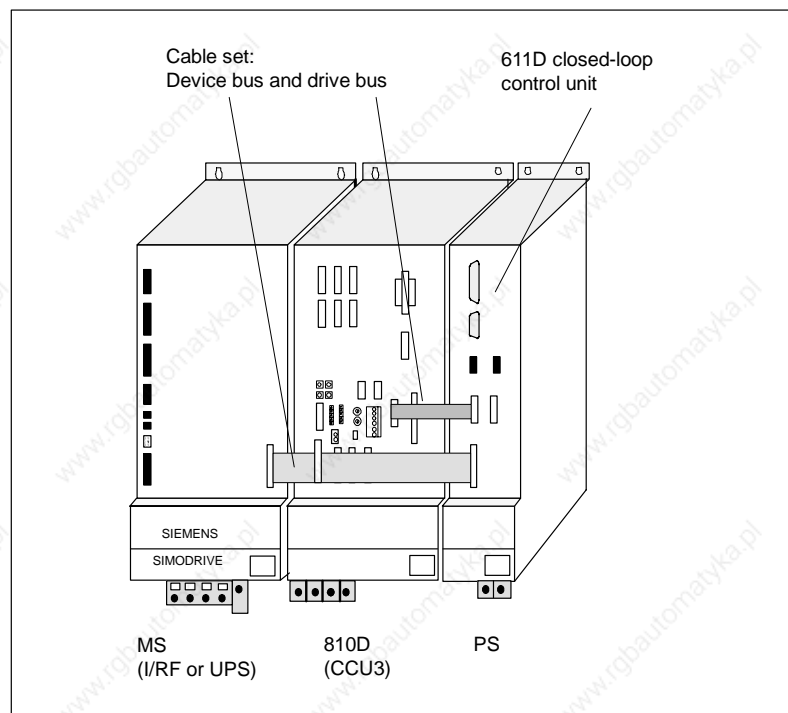


Fig. 5-4 Axis expansion for the SINUMERIK 810D with the SIMODRIVE 611D module

Note

For a CE-compliant installation, you have to use shielded motor cables in conjunction with the shield connection plates available for the SIMODRIVE power modules, see

References: /PJ2/ SIMODRIVE Planning Guide

5.2 Axis expansion with the SIMODRIVE 611D closed-loop control module

Cable set for axis expansion

For connecting the SIMODRIVE 611D closed-loop control module located to the immediate right of the 810D.

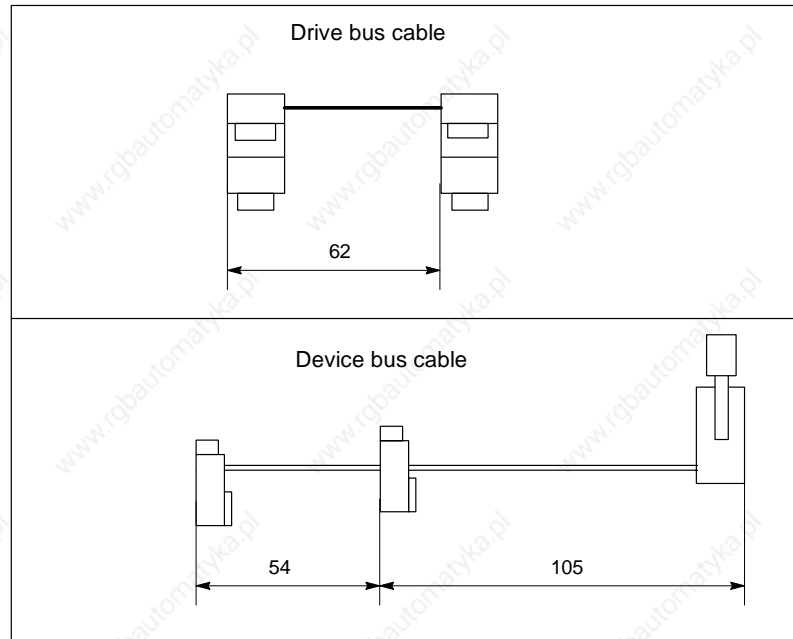


Fig. 5-5 Cable set for axis expansion with the SIMODRIVE 611D module



I/O Modules

6.1 Single I/O module

Brief description The single I/O module has 64 inputs and 32 short-circuit-proof outputs (isolated). Each output has a load rating of 0.5A. The simultaneity factor is 75%.

Up to three single I/O modules can be connected to the SINUMERIK 810D. Combinations with SIMATIC S7-300 phases are permissible.

Connection to the 810D The compact I/O module (connector X3 IN) is connected to the SINUMERIK 810D (connector X111). The max. cable length is 10m. Two different cable versions are available for connecting one single I/O module to the next:

- For installation of one module: 6ES7 368-3□□□0-0AA0
- For single-tier installation of several single I/O modules: 6FC5 411-0AA80-0AA0, length 150mm.

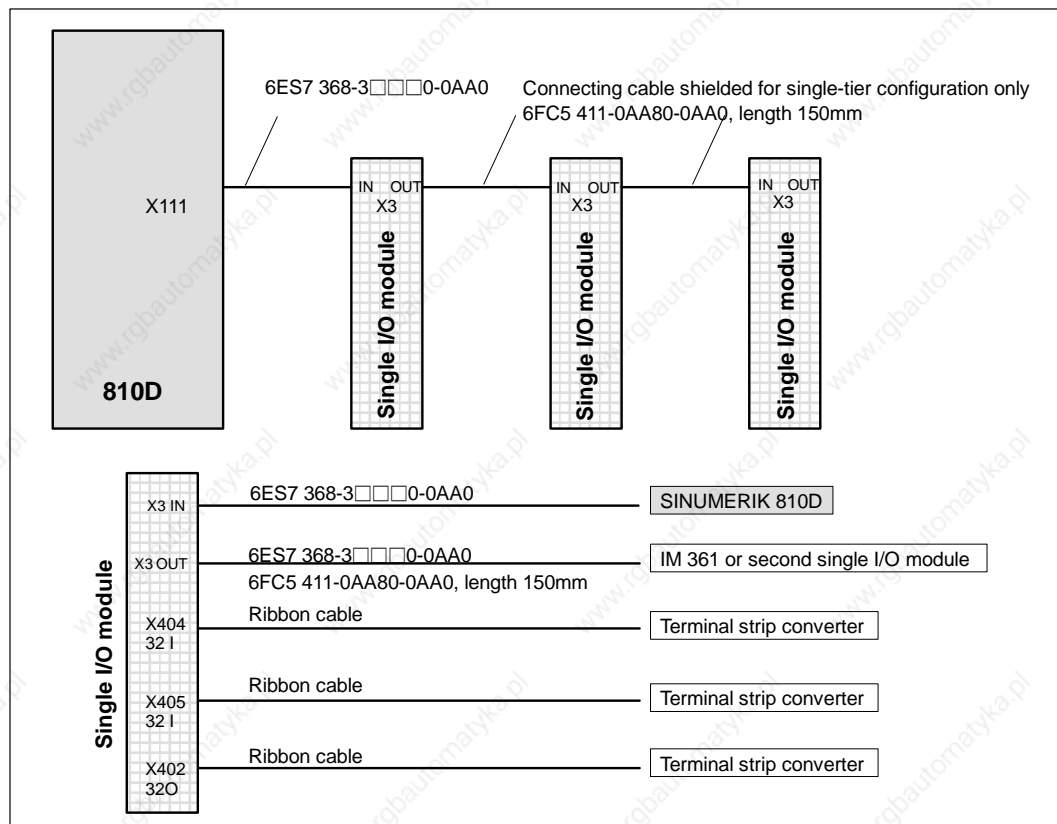


Fig. 6-1 Connection overview of single I/O module on the 810D

6.1 Single I/O module

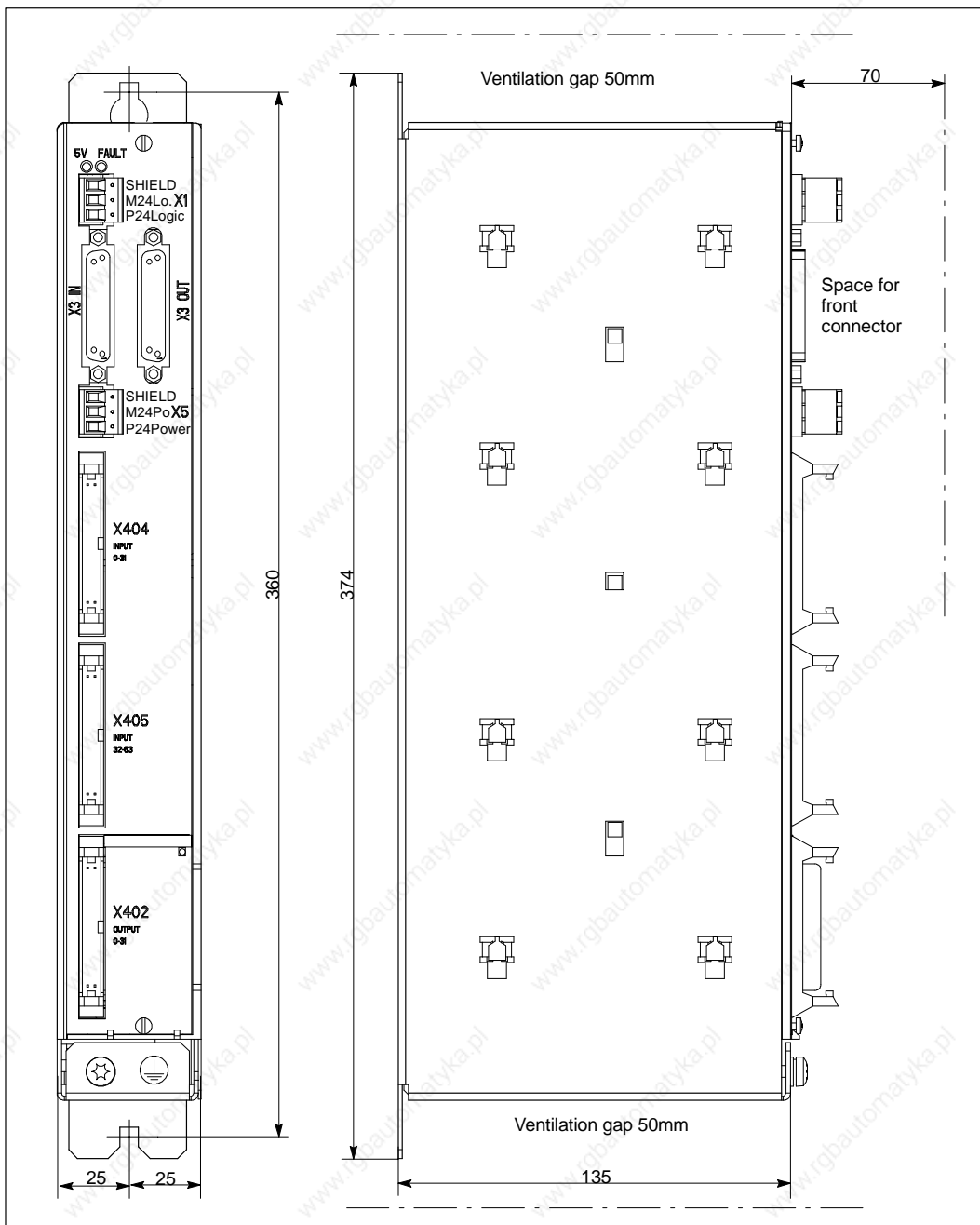


Fig. 6-2 Dimension drawing single I/O module

EMC measures

The single I/O module has an equipotential bonding connection at the front. A low-resistance finely stranded connection cable to the grounding bar (see Subsection 2.1.4) with a cross-section of at least 10 mm² is required to divert interference currents. The connection must be as short as possible. In the case of common protection and interference voltage, the protective conductor regulations according to VDE 0100 and VDE 0160 must always be complied with.

Technical data

Table 6-1 Technical data of the single I/O module

Supply voltage for LOGIC (X1) and POWER (X5)	<ul style="list-style-type: none"> - Rated value - Perm. range - Ripple - Reverse polarity protection - Protection 	24VDC 18.5 ... 30.2V 3.6Vpp yes LOGIC: 1 A/250V POWER: No
Power input	<ul style="list-style-type: none"> - LOGIC - POWER 	Type: 03A , max. 1A max: 12A
Power loss	<ul style="list-style-type: none"> - LOGIC - POWER 	Typically: 7.2VA , max. 30.2VA max. 362VA
Inputs	<ul style="list-style-type: none"> Number of inputs Signal level for signal "0" Signal level for signal "1" Electrical isolation Input current 1 signal Input current 0 signal Delay time T_{PHL} Delay time T_{PLH} Noise immunity (DIN 57847) Cable length terminal block 	64 digital inputs -3V to +5V +15V to +30V yes (optocoupler) 2-15mA, Type: 6mA -9mA to 1mA 0.5 to 3ms 0.5 to 3ms 2kV max. 3m
Outputs	<ul style="list-style-type: none"> Number of outputs Signal level for signal "0" Signal level for signal "1" Electrical isolation Short-circuit proof Max. output current Switching frequency Noise immunity (DIN 57847) Cable length terminal block 	32 digital outputs open $V_{Power} - 0.5V$ yes (optocoupler) yes resistive: 0.6A inductive: 0.6A lamp: 6W resistive load: 100Hz inductive load: 2Hz lamp load: 11Hz 2kV max. 3m
Overtemperature protection		Module-specific disconnection
Simultaneity factor Sum of all nominal currents, in each case within 0.5A group		75%
Insulation class to DIN 57110 b		A
Humidity rating according to DIN 40040		F
Weight		1.7kg
Degree of protection according to DIN 40050		IP 20
Resistance to vibration to SN 29010		Class 12
Temperature range	Storage: Operation:	-40 °C to +70 °C 0° C to + 55 °C

6.1 Single I/O module

Connection of electronics power supply

The 24 VDC supply is connected to X1 via a 3-pin right-angled Phoenix screw-type terminal (2.5 mm²).



Table 6-2 Pin assignments on connector X1

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

Signal names

P24 Logic 24V external electronics power supply
M24 Logic Ground of external electronics power supply

Signal type

VI Voltage Input

Connection of load power supply

The 24VDC load power supply is connected via a 3-pin right-angled Phoenix screw-type terminal (2.5 mm²) to X5.

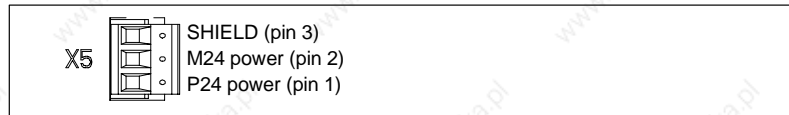


Table 6-3 Pin assignments on connector X5

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

Signal names

P24 power 24V external load power supply
M24 power Ground of external load power supply

Signal type

VI Voltage Input

Connection of inputs/outputs

The inputs/outputs are connected via ribbon cables, max. 3m in length. For this, the following 34-way terminal strip converters can be used:

see **Reference:** /Z/ Catalog NCZ
 Terminal strip converter without LED: 6FC9302-2AA
 Terminal strip converter with red LED: 6FC9302-2AB (0.5A)
 6FC9302-2AL (2 A)
 Terminal strip converter with green LED: 6FC9302-2BB01

The assignment of the ribbon cable is compatible with that of the I/O modules (logic modules) of the SINUMERIK 810.

Meaning of the LEDs

The status of the single I/O module is indicated by two LEDs.

Green LED 5V power OK

Red LED Group error

X402 outputs 0-31

Connection of outputs

Connector designation: X402 OUTPUT 0-31
 Connector type: 34-way DIN ribbon cable connector
 Length of ribbon cable: Max. 3m to terminal strip converter

Note

The outputs must be connected through inductive loads externally for protection against overvoltages. (Freewheeling diodes, RC elements, . . .)

1	Unassigned		2	Unassigned	
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
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

6.1 Single I/O module

**X404
Inputs 0-31**

Connection of inputs 0-31

Connector designation: X404 INPUT 0-31
 Connector type: 34-way DIN ribbon cable connection
 Length of ribbon cable: Max. of 3m to terminal block

1	Unassigned		2	Unassigned	
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 namesINP_i[j] Input j of input byte i**Signal type**

I Input

**X405
Inputs 32-63**

Connection of inputs 32-63

Connector designation: X405 INPUT 32-63
 Connector type: 34-way DIN ribbon cable connection
 Length of ribbon cable: Max. of 3m to terminal block

1	Unassigned		2	Unassigned	
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

INP*i*[*j*] Input *j* of input byte *i*

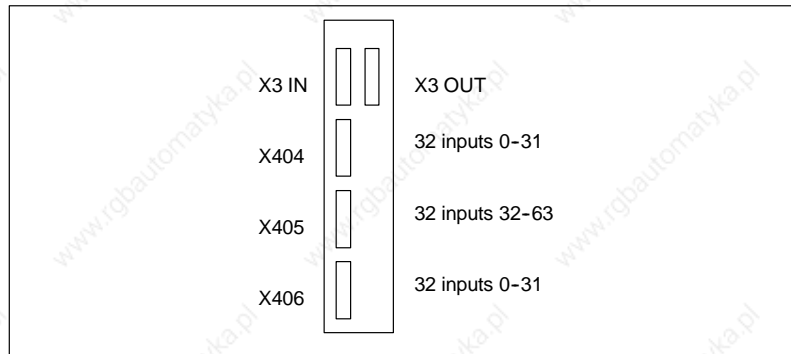
Signal type

I Input

Address space

As seen from the PLC, the 810D single I/O module is an S7-300 I/O line comprising the following:

- P bus interface IM-R
- 2x 32-bit input module
- 1x 32-bit output module.



resulting in the following address space:

1. Input range
Input byte (line number *32) to (line number *32) +7, i.e. from input byte 32 to input byte 39 during operation in line 1
2. Output range
Output byte (line number *32) +8 to (line number *32) +11, i.e. from output byte 40 to output byte 44 during operation in line 1

Each line can only contain one I/O module.

The address space is automatically assigned during start-up. Parameterization is not necessary.

In AS-PARAM, the 810D I/Os are treated like a corresponding arrangement of S7-300 modules.

6.1 Single I/O module

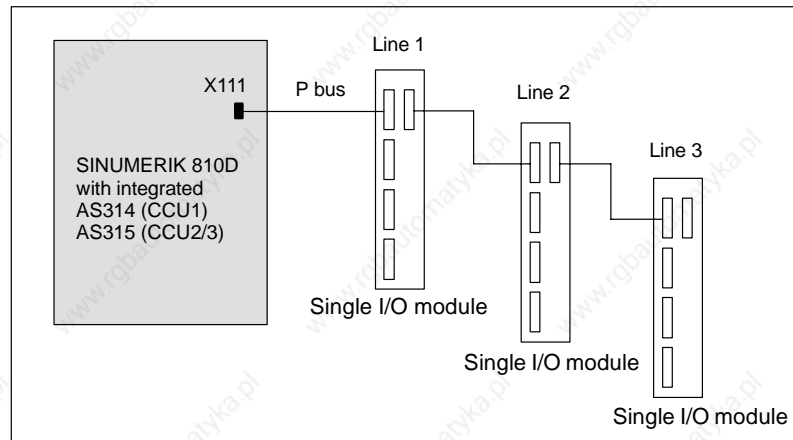


Fig. 6-3 SINUMERIK 810D with three peripheral lines (full configuration)



NCU Terminal Block

7

6FC5 211-0AA00-0AA0

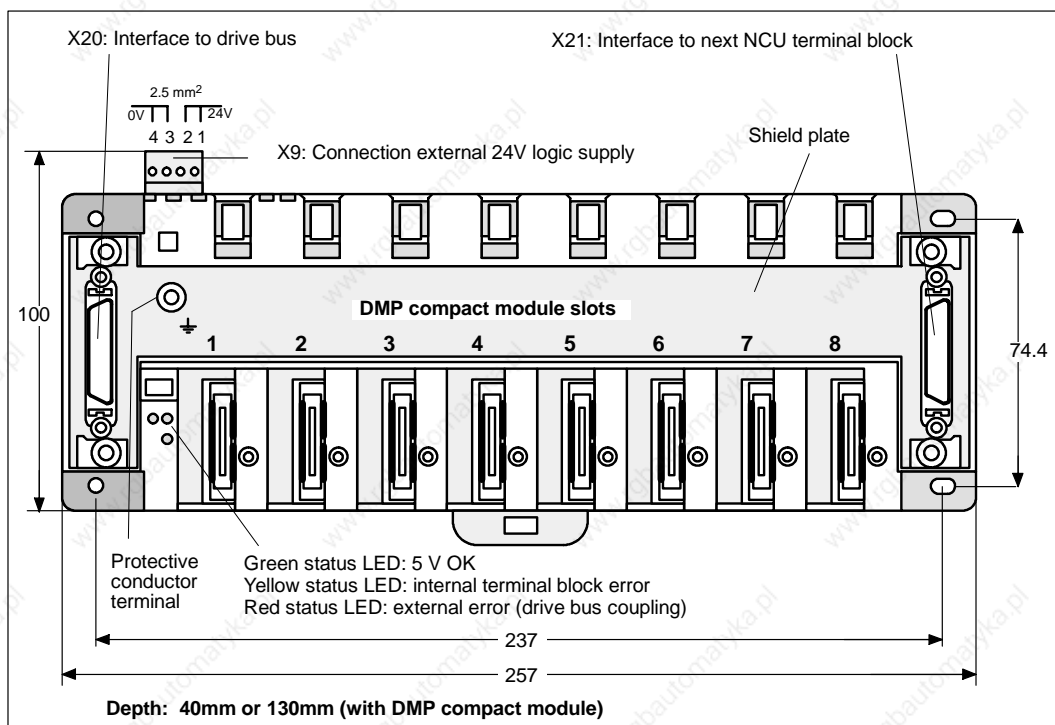


Fig. 7-1 NCU terminal block front view

Connection to the drive bus

The terminal block is connected to the drive bus of the last drive module via the round cable at connector X20. These cables are available in various lengths (cable lengths 1, 2, 5 and 10m). A maximum of two terminal blocks can be operated (in accordance with the NCK addresses available for fast analog and digital I/O devices). The round cables are also used to connect the individual terminal blocks.



Important

Ensure that the overall length of the cable connections does not exceed 10m.

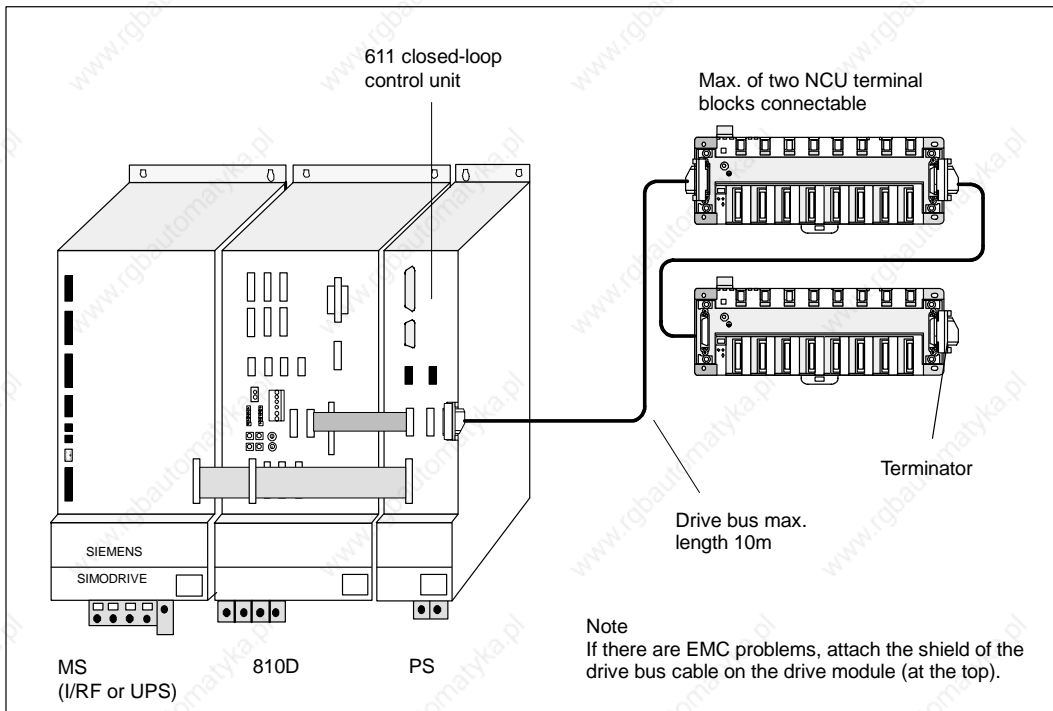


Fig. 7-2 Connection of the NCU terminal block

Terminator

The terminator for the drive bus must be inserted in slot X21 on the last NCU terminal block.

Protective conductor

In the case of common protection and interference voltage, the protective conductor regulations according to VDE 0100 and VDE 160 must always be complied with.

See protective conductor connection in Fig. 7-1.

EMC measures

The protective-conductor terminal is also used to discharge interference currents from:

- the shields of the DMP module holder,
- the DMP compact plug-on module,
- the 24V logic power supply.

To ensure that these interference suppression measures are effective, make sure there is a low-resistance connection between shield plate and earth potential.

The low-resistance connecting conductor should be a fine-core conductor with a cross-section of at least 10 mm² and a length of less than 30 cm, if possible.

DMP compact modules

A maximum of eight DMP compact modules can be connected for each NCU terminal block.

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

Placement in max. of two terminal blocks of a control:

I/Os	Number
Digital inputs	32
Digital outputs	32
Analog inputs	8
Analog outputs	8



Important

A maximum of four analog outputs and four analog inputs can be connected to each NCU terminal block at any one time.



Caution

If the load supply voltage for the DMP compact modules is switched off during operation, the outputs will not switch through reliably when the load supply voltage is switched on again. If switching off during operation cannot be avoided, the DMP outputs must be reset via the PLC program. The outputs must be set anew after the voltage has been switched on again.

Monitoring functions

- +5V monitoring
- Temperature monitoring 60°C ± 3°C
- Configuration level monitoring
- Microcontroller sign-of-life monitoring (watchdog)
- NC sign-of-life monitoring (watchdog).

Error	Recording	Effect
Undervoltage (< 4.75V)	Limit value signal	Disabling of the NC outputs, LED (green) off
Ambient temperature	Temperature sensor	Status message to NC, Screen display
NCU sign-of-life	Cyclic message	Disabling of the NC outputs, LED (red) on

Watchdog	Time recording	Disabling of the NC outputs, LED (red) on
Hardware combination	Hardware configuration	Disabling of the NC outputs, LED (red, yellow) on, Status message to NC

The digital and analog outputs are switched to a safe status (0V at the output) with the XOUTDS signal in the event of interference or faults in the NCU, in the microcontroller and in the case of a power failure!

Power supply

24VDC (20.4VDC to 28.8VDC)

Connector designation: X9

Connector type: 4-way terminal block, 2.5 mm² connection

Table 7-1 Pin assignments on connector X9

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

Signal names

P24 ext +24V external power supply

M24 ext External ground of power supply

Signal type

VI Voltage Input

X20 / X21

Drive bus interface

Connector designation:

X20 (IN) X21 (OUT)

Connector type: 36-way micro ribbon

Special features: Non-floating, no safe isolation

Caution: Max. length of drive bus is 10m

X11-X18

Module connector

Connector designation: X11 ... X18 (slots 1 ... 8)

Connector type: 30-way ELCO Microleaf pin connector

Table 7-2 Technical data NCU terminal block

Mechanical data			
Dimensions	Height	Width	Depth
	100mm	257mm	40mm
Ambient conditions			
Temperature ranges	Application/operation		Storage/transportation
Limit values	0...55°C		-20...60°C
Temperature variation	within 1 minute max. 0.2K		
Permissible change in relative air humidity EN 60721-3-3, class 3K5			
Within 1 minute		max. of 0.1%	



Notes

DMP Compact Modules

8.1 DMP compact module 16I (6FC5 111-0CA01-0AA0)

The DMP compact module 16I is an encapsulated module. It can be inserted into an NCU terminal block slot as a plug-on module.

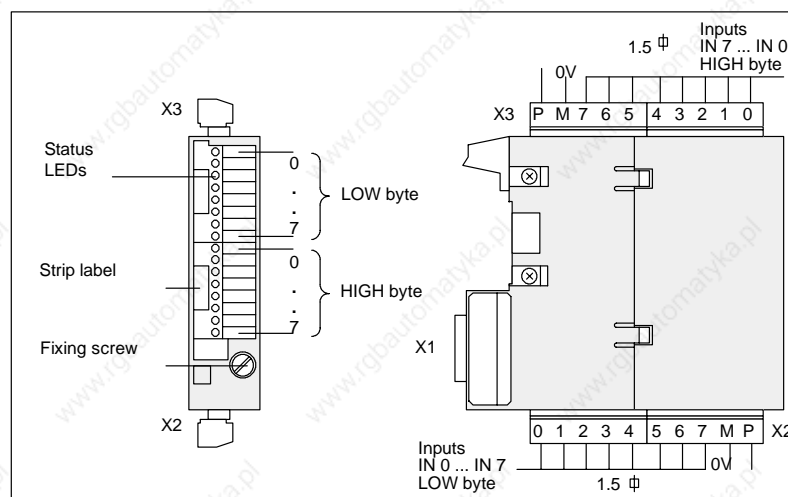


Fig. 8-1 Front and side view of DMP compact module 16I

Interfaces

- One 30-way plug-in connector X1 for connection to the NCU terminal block.
- Two 10-way terminals X2 and X3 (Phoenix, type MC1.5/10-ST-3.81 GRAY, Order No. for X3 and X2: 18 28 171) for connecting the 16 inputs and the load supply voltage.
- The terminals are of the plug-in type and can be mechanically coded by the user.
- The 24V connection terminal P (24V) is not used.

Display elements

16 LEDs for status display indicating the logical states of the inputs.

LEDs light up: Input ON.

8.1 DMP compact module 16I (6FC5 111-0CA01-0AA0)

Table 8-1 Technical data DMP compact module 16I

Number of inputs	16 digital inputs
Floating	Yes
Supply voltage V_{LOAD}	<ul style="list-style-type: none"> - Rated value - Permissible range - Ripple
Input voltage (rated value)	24VDC
Input voltage	
	<ul style="list-style-type: none"> - For "0" signal - For "1" signal
Input current for "1" signal	+ 2mA to + 5mA
Delay time for t_{pLH}	t_{pLH} = type 1msec
Delay time for t_{pHL}	t_{pHL} = type 1msec
Cable length	max. 30m
Weight	approx. 125g
Degree of protection according to DIN 40050	IP20
Humidity rating according to DIN 40040	F

8.2 DMP compact module 16O (6FC5 111-0CA02-0AA1)

The DMP compact module 16O is an encapsulated module. It can be inserted into an NCU terminal block slot as a plug-on module.

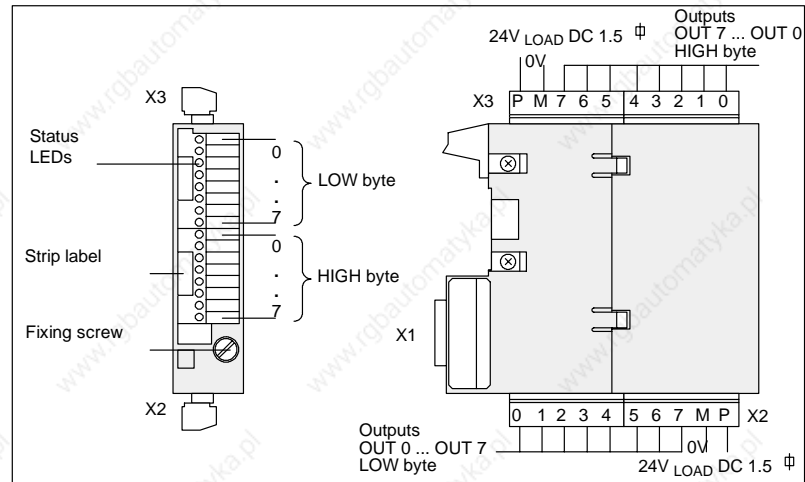


Fig. 8-2 Front and side view of DMP compact module 16O

Interfaces

- One 30-way plug-in connector X1 for connection to the NCU terminal block.
- 10-way terminals X3 and X2 (Phoenix, type MC1.5/10-ST-3.81 GRAY, Order No. for X3 and X2: 18 28 171) for connecting the 16 outputs and the load supply voltage.
- The terminals are of the plug-in type and can be mechanically coded by the user.

Display elements

16 LEDs for status supply indicating the logical statuses of the outputs. As from product version B the LEDs will go out if the load voltage fails.

LEDs light up: Output on

Table 8-2 Technical data DMP compact module 16O

Number of outputs	16 digital outputs
Floating	Yes
Supply voltage V_{LOAD}	
- Rated value	24VDC
- Permissible range	20.4V to 28.8V
- Ripple	3.6Vpp
Signal level of outputs (typical value)	
- For "0" signal	Open
- For "1" signal	$V_{LOAD} - 250mV$

8.2 DMP compact module 16O (6FC5 111-0CA02-0AA1)

Table 8-2 Technical data DMP compact module 16O

Output loading at "1" signal (rated value)	
- Resistive load	500mA
- Lamp load	5W
- Inductive load	500mA
Short-circuit protection	Yes
Power loss at 30V	Max. 3.8W
Switching rate at	
- Resistive load	100Hz
- Lamps	11Hz
- Inductive load (at rated load, higher values permissible at lower load)	2Hz
Total load capacity at 55°C (as referred to the sum of the rated currents of all outputs)	50%
Delay time for t_{pLH}	$t_{pLH} = \text{max. } 0.5\text{msecs}$
Delay time for t_{pHL}	$t_{pHL} = \text{max. } 0.5\text{msecs}$
Cable length	max. 50m
Weight	approx. 160g
Degree of protection according to DIN 40050	IP20
Humidity rating according to DIN 40040	F

Important

A new output driver is used for the DMP compact module 16A as from product version C. Observe the following behavior:

In the event of malfunction, caused by overcurrent or short circuit, the outputs will automatically switch through again after the fault has been removed (previously: latching switchoff until output is reselected by the PLC user program). In the case of a short-circuit of one output, the three other outputs of the same half byte can likewise switch off.

There will be no interaction in normal operation with currents < 0.7A.

Eight outputs each are fed from one power supply. The sum of the output currents must not exceed 2A for eight outputs (2x outputs 0 ... 7) (this corresponds to a simultaneity factor of 50% at full load of the individual outputs). All 16 outputs may be loaded simultaneously, e.g. with 0.25A.

Important

Switching surges must be neutralized by external free-wheeling diodes when using inductive loads.

8.3 DMP compact module 8O (6FC5 111-0CA03-0AA1)

The DMP compact module 8O is an encapsulated module. It can be inserted into an NCU terminal block slot as a plug-on module.

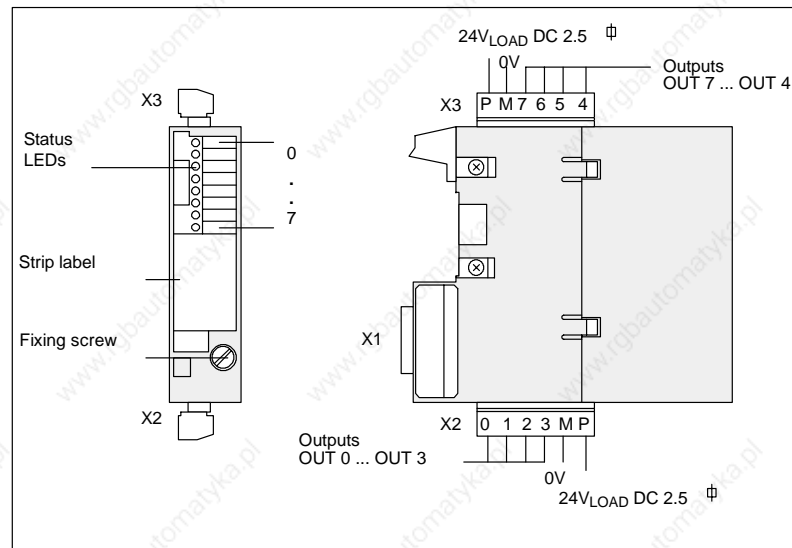


Fig. 8-3 Front and side view of DMP compact module 8O

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

Interfaces

- One 30-way plug-in connector X1 for connection to the NCU terminal block.
- 6-way 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 eight outputs and the load supply voltage.
- The terminals are of the plug-in type and can be mechanically coded by the user.

Display elements

Eight LEDs as status display for the logic output states. As from product version B the LEDs will go out if the load voltage fails.

LEDs light up: Output ON.

8.3 DMP compact module 8O (6FC5 111-0CA03-0AA1)

Table 8-3 Technical data DMP compact module 8O

Number of outputs	8 digital outputs
Floating	Yes
Supply voltage V_{LOAD}	
- Rated value	24VDC
- Permissible range	20.4V to 28.8V
- Ripple	3.6Vpp
Signal level of outputs (typical value)	
- For "0" signal	Open
- For "1" signal	$V_{LOAD} - 80mV$
Output loading at "1" signal (rated value)	
- Resistive load	2000mA
- Lamp load	25W
- Inductive load	2000mA
Short-circuit protection	Yes
Power loss at 30 V	Max. 3.1W
Switching rate at	
- Resistive load	100 Hz
- Lamps	11 Hz
- Inductive load (at rated load, higher values permissible at lower load)	2 Hz
Total load capacity at 55 °C (as referred to the sum of the rated currents of all outputs)	50%
Delay time for t_{pLH}	$t_{pLH} = \text{max. } 0.5\text{msecs}$
Delay time for t_{pHL}	$t_{pHL} = \text{max. } 0.5\text{msecs}$
Cable length	max. 50m
Weight	approx. 145g
Degree of protection according to DIN 40050	IP20
Humidity rating according to DIN 40040	F

Four outputs are fed from one power supply. The sum of the output currents must not exceed 4A for four outputs (outputs 0 ... 3 and 4 ... 7) (this corresponds to a simultaneity factor of 50% at full load of the individual outputs). All 8 outputs may be loaded simultaneously, e.g. with 1A.

Important

Switching surges must be neutralized by external free-wheeling diodes when using inductive loads.

8.4 DMP compact module 1I analog (6FC5 111-0CA04-0AA0)

The DMP compact module 1I analog is an encapsulated module. It can be inserted into an NCU terminal block slot as a plug-on module. (maximum of four modules per terminal block)

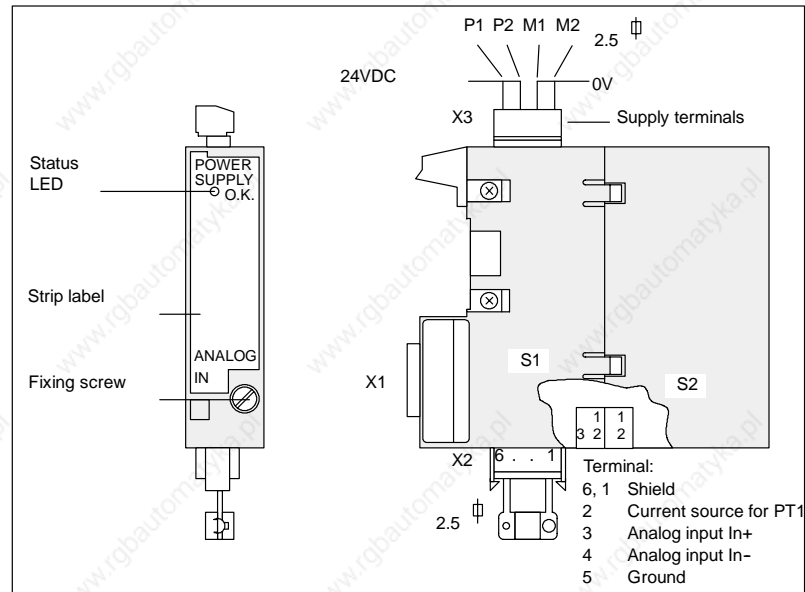


Fig. 8-4 Front and side view of DMP compact module 1I analog

Interfaces

- One 30-way plug-in connector X1 for connection to the NCU terminal block.
- 4-way terminal X3 (Phoenix, type MSTB2,5/4-ST-5,08 GRAY, Order No. for X3: 18 48 407) for connecting the supply voltage for the analog section and 6-way terminal X2 (Phoenix, type MSTB2,5/6-ST-5,08 GRAY, Order No. for X2: 17 87 076) for connecting the analog input.
- The terminals are of the plug-in type and can be mechanically coded by the user.

Display elements

One LED as status display for power supply.

LED lights up: Internal power supply OK.

Jumpering

S1: Setting of measuring range
 1-2 closed: + 10V
 1-3 closed: + 500mV

S2: Setting of mains frequency
 closed: for 50Hz systems
 open: for 60Hz systems.

8.4 DMP compact module 1I analog (6FC5 111-0CA04-0AA0)

Typical circuits

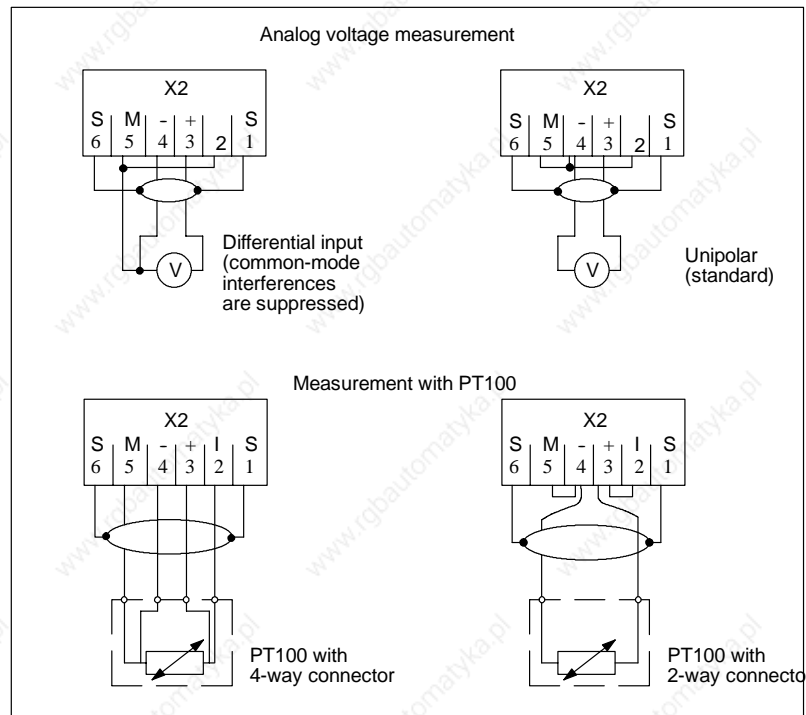


Fig. 8-5 Typical circuits for the DMP compact module 1I analog

Note

The current source must be short-circuited when not used.

Table 8-4 Technical data DMP compact module 1I analog

Number of inputs	1 analog input
Floating	Yes
Supply voltage V_{LOAD}	- Rated value 24VDC - Permissible range 20.4V to 28.8V - Ripple 3.6Vpp
Rated value input ranges	$\pm 10V$ or $\geq 500mV+$
Overload range	$\geq 20V$ or $\geq 1V$
Power consumption (24V)	45mA
I_{const} for PT100	2.5mA
Sensor connection	See below
Digital representation of input signal	12 bits + sign
Error message for over-range ($\pm 20V$; $\geq 1V$)	Yes
Intrinsic current limits	$\pm 0.2\%$
Operating error limits (0°C to 60°C)	$\pm 0.5\%$
Cable length (shielded)	max. 30m
Weight	approx. 150g
Degree of protection according to DIN 40050	IP20
Humidity rating according to DIN 40040	F

8.4 DMP compact module 11 analog (6FC5 111-0CA04-0AA0)

The DMP compact module 11 analog is used for input and digitizing of an analog voltage value. This voltage value is measured by a floating differential input.

Resistance thermometers PT100 can be connected in conjunction with the built-in stabilized voltage source (2.5mA).

Table 8-5 Digital representation of analog values for DMP compact module 11 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	500mV range	
Significance	VZ	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2	2 ⁴	2 ³	2 ²	2 ¹	2	0	OR	PF			
Digital value	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	19.995V	999.76mV
								:							:	:	:		
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.005V	500.24mV
	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10V	500mV
	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	9.995V	499.76mV
								:							:	:	:		
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.005V	0.24mV
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0V	0mV
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	-0.005V	-0.24mV
								:							:	:	:		
	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-9.995V	-499.76mV
	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-10V	-500mV
	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	-10.005V	-500.24mV
								:							:	:	:		
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-19.995V	-999.76mV

0 = Always 0

OR= Overflow bit, input voltage exceeds 20V or 1V (double the input range)

PF = Failure of power supply to analog part.

8.5 DMP compact module 1I NC analog (6FC5 211-0AA10-0AA0)

The DMP compact module 1I NC (6FC5 211-0AA10-0AA0) analog is an encapsulated rapid analog input module with an access time of 75µs. It can be inserted into an NCU terminal block slot as a plug-on module (maximum of four modules per terminal block).

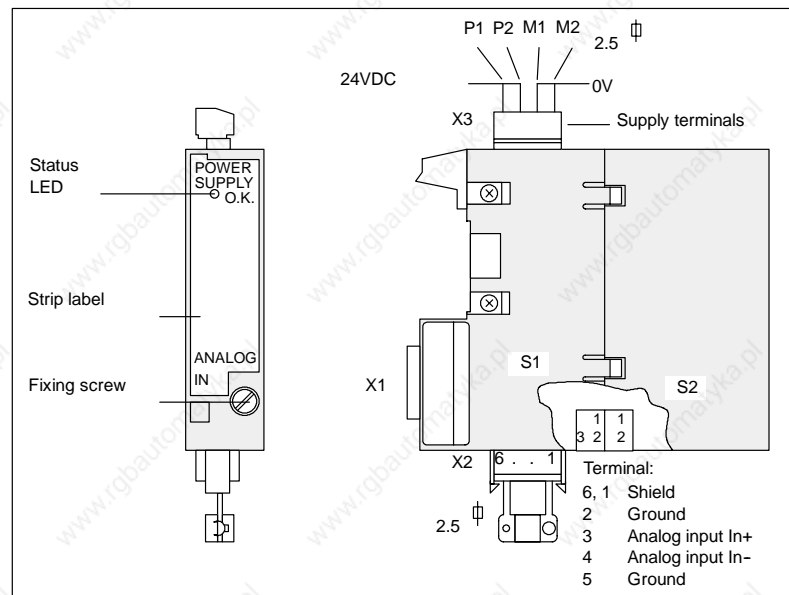


Fig. 8-6 Front and side view of DMP compact module 1 I NC analog

Interfaces

- One 30-way plug-in connector X1 for connection to the NCU terminal block.
- 4-way terminal X3 (Phoenix, type MSTB2,5/4-ST-5,08 GRAY, Order No. for X3: 18 48 407) for connecting the supply voltage for the analog section and 6-way terminal X2 (Phoenix, type MSTB2,5/6-ST-5,08 GRAY, Order No. for X2: 17 87 076) for connecting the analog input.
- The terminals are of the plug-in type and can be mechanically coded by the user.

Display elements

One LED as status display for power supply.

LED lights up: internal power supply OK.

8.5 DMP compact module 11 NC analog (6FC5 211-0AA10-0AA0)

Typical circuits

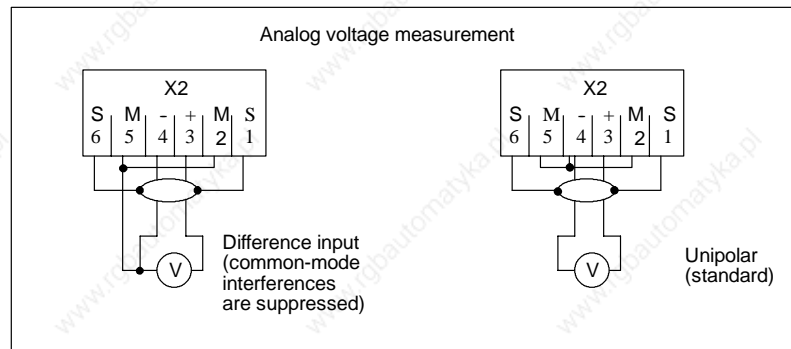


Fig. 8-7 Typical circuits for the DMP compact module 11 NC analog

Table 8-6 Technical data DMP compact module 11 NC analog

Number of inputs	1 analog input
Floating	Yes
Supply voltage V_{LOAD}	- Rated value 24VDC - Permissible range 20.4V to 28.8V - Ripple 3.6Vpp
Input ranges (rated value)	$\pm 10V$
Power consumption (24V)	85mA
Sensor connection	See below
Digital representation of input signal	11 bits + sign
Total error over temperature range 0 to 55°C including residual deflection	$\pm 0.6\%$
Cable length (shielded)	max. 30m
Weight	approx. 160g
Degree of protection according to DIN 40050	IP20
Humidity rating according to DIN 40040	F

The DMP compact module 11 NC analog is used for input and digitizing of an analog voltage value. This voltage value is measured by a floating differential input.

Analog value representation

The result from the converter is available to the user as a two's complement. The resolution is 4.88mV for one bit. The duration of a converter cycle (from initiating the conversion until the moment the result can be read) is max. 75 μ secs.

8.5 DMP compact module 1I NC analog (6FC5 211-0AA 10-0AA0)

Table 8-7 Digital representation of analog values 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 +/- 10V
Significance	VZ	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2	2 ³	2 ²	2 ¹	2	0	0	0	PF	
Digital value	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	9.995V
								:								:	:
	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.005V
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0V
	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	-0.005V
								:								:	:
	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	-9.995V
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-10V

0 = Always 0

PF = Failure of power supply to analog part

8.6 DMP compact module 1O analog (6FC5 111-0CA05-0AA0)

The DMP compact module 1O analog is an encapsulated module. It can be inserted into an NCU terminal block slot as a plug-on module. (maximum of four modules per terminal block)

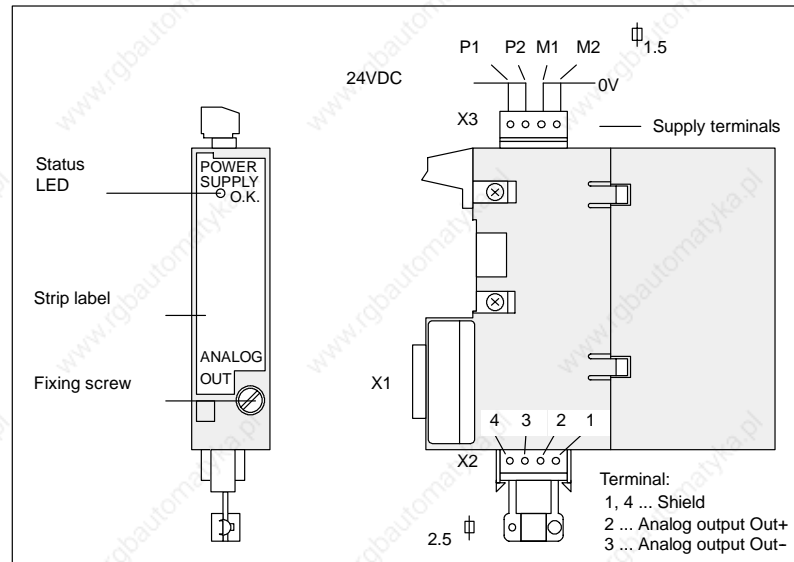


Fig. 8-8 Front and side view of DMP compact module 1 O analog

Interfaces

- One 30-way plug-in connector X1 for connection to the NCU terminal block.
- 4-way terminal X3 (Phoenix, type MC1.5/4-ST-3.81, Order No. for X3: 1828126) for connecting the supply voltage for the analog part and X2 (Phoenix, type MSTB2.5/4-ST-5.08 GRAY, Order No. for X2: 18 40 942) for connecting the analog output.
- The terminals are of the plug-in type and can be mechanically coded by the user.

Display elements

One LED as status display for power supply.
LED lights up: internal power supply OK.

8.6 DMP compact module 1O analog (6FC5 111-0CA05-0AA0)

Table 8-8 Technical data DMP compact module 1O analog

Number of outputs	1 analog output
Floating	Yes
Supply voltage V_{LOAD}	24VDC
- Rated value	20.4V to 28.8V
- Permissible range	3.6Vpp
- Ripple	60mA
Power input (24V)	± 10VDC
Output ranges (rated value)	± 3mA
Output current	min. 3.3 K Ω
Load impedance at voltage outputs	max. 30m
Digital representation of output signal	approx. 140g
Short-circuit protection	13 bits + sign
Cable length (shielded)	Yes
Weight	IP20
Degree of protection according to DIN 40050	F
Humidity rating according to DIN 40040	

Table 8-9 Digital representation of analog values for DMP compact module 1A analog

Output word	QB m								QB m+1								Analog output voltage
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
Significance	VZ	2 ¹²	2 ¹¹	2 ¹⁰	2 ⁹	2 ⁸	2 ⁷	2 ⁶	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰	1	0	always 0
Digital value	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	+9.9988V
	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	+1.22mV
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0V
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	-1.22mV
	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-10V



Maintenance and Service

9.1 Warning notices



Warning

When operating electrical devices, it is impossible to avoid applying hazardous voltages to certain parts of the equipment.

Failure to properly maintain the equipment can result in death, serious bodily injury or substantial material damage.

When carrying out maintenance work on this equipment, all instructions given in this manual and on the product itself must be followed.

- Maintenance must be performed by qualified personnel only.
- Before carrying out any maintenance and service work, the equipment must be disconnected from the mains (except when replacing the batteries).
- Use authorized spare parts only.
- The servicing intervals and the instructions for repair and replacement must be strictly followed.

**Warning**

After all voltages have been switched off, a dangerous voltage remains present for five minutes at all modules.
See operating instructions.

9.2 Battery replacement (6FC5 247-0AA18-0AA0, GWE-570 665 000 101)



Caution

Do not attempt to reactivate discharged batteries by heating or other means. Batteries must not be recharged, as this can lead to leakage and/or explosion.

Failure to comply with these regulations can lead to bodily injury or material damage.

Battery-backed SRAMs and clock chips are installed on the CCU module and the PCU 50/70. The back-up voltage is monitored by the control and a monitoring signal is output. When a monitoring signal has been triggered, the battery must be replaced within six weeks. The battery of the SINUMERIK 810D can be replaced after disconnecting the control and removing the CCU module without any loss of data, as the data is backed-up for a period of approx. 15 minutes.

Backup time

The backup time of the batteries used is at least five years.

The battery must be removed before the module is stored.

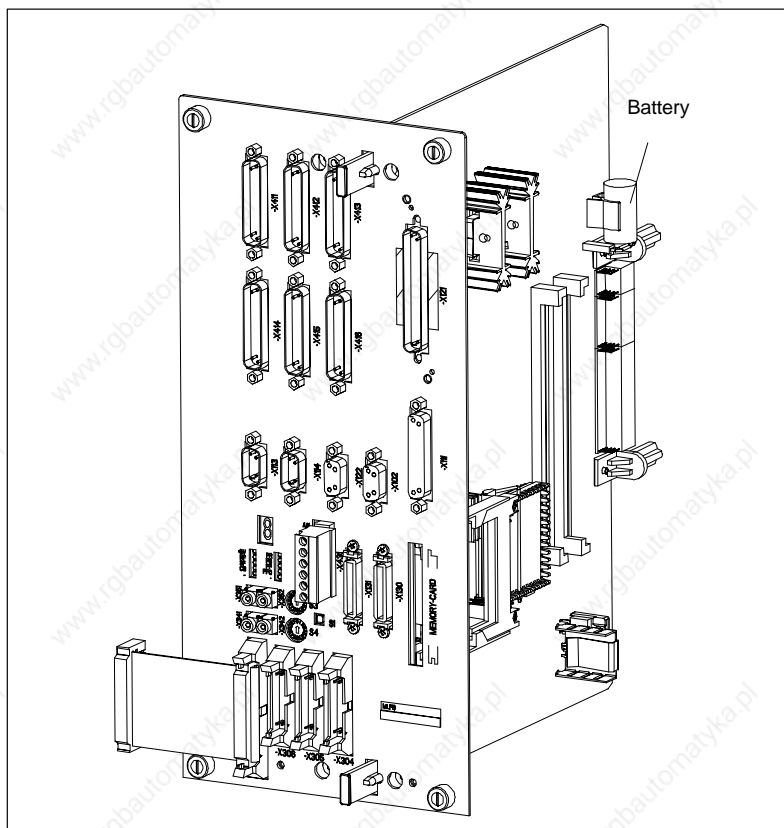


Fig. 9-1 SINUMERIK 810D CCU module

Replacing the battery on the CCU module

The battery is located on the CCU module (see Fig. 9-1). Before withdrawing the CCU module, please comply with the ESD measures in the preface of this Planning Guide.



Warning

The modules contain electrostatic sensitive components. Before touching an electronic module, the persons carrying out the work must themselves be electrostatically discharged. The simplest way of doing this is to touch an electrically conducting earthed object (e.g. a bare metal part of a switchboard or a plug socket protective conductor).

1. Shut off the control.
 2. Comply with the ESD note !
 3. Loosen all connectors, marking them first, if necessary.
 4. Loosen the four CCU module fastening screws and take out the module.
 5. Remove the battery and pull out the battery connector. A capacitor will back up the data for approx. 15 mins.
 6. Connect the new battery (check polarity) and push it back into the bracket.
 7. Re-insert the CCU module and tighten the screws.
 8. Insert all the connectors correctly.
-

Notes

Abbreviations

A

AS PARAM	SIMATIC parameterization tool
AT	Advanced Technology
HHU	Handheld Unit
OPI	Operator Panel Interface
CCU	Compact Control Unit
DMP	Distributed machine I/Os
UI	User Interface
EFP	Single I/O module
ESD	Electrostatic Sensitive Devices
EMC	Electromagnetic Compatibility
EnDat	Absolute encoder interface, Messrs. Heidenhain
I/RF	Infeed/Regenerative Feedback Unit
HD	Hard Disk
HMI	Human Machine Interface: SINUMERIK operating functions for operating, programming and simulating: The meaning of HMI is identical with MMC.
MSD	Main Spindle Drive
HT	Handheld Terminal
IM	Interface Module (SIMATIC S7-300)
IM Address	Interface Module Address
ISA	Industry Standard Architecture

C Bus	Communications bus
LED	Light Emitting Diode
PS	Power Section module
MLFB	Machine-readable product designation, order number
MMC	Human Machine Communication. The meaning of HMI is identical with MMC.
MPI	Multi-Point Interface
MCP	Machine Control Panel
NC	Numerical Control
MS	Mains Supply
NMI	Non-Maskable Interrupt
OP	Operator Panel
P bus	I/O (peripherals) bus
PCMCIA	Personal Computer Memory Card International Association
PER	I/O (peripherals) module
PG	Programming Device
PLC	Programmable Logic Control modules
PS	Power Supply (SIMATIC S7-300)
PCU	Personal Computer Unit
SM	Signal Module SIMATIC S7-300, e.g. I/O module
SW	Software
UPS	Unregulated Power Supply
VGA	Video Graphics Adapter
FSD	Feed Spindle Drive



References

General Documentation

- /BU/** SINUMERIK 840D/840Di/810D/802S, C, D
Ordering information
Catalog NC 60
Order no.: E86060-K4460-A101-A9 -7600 (English)
- /IKPI/** Catalog IK PI 2000
Industrial communication and field devices
Order no. of bonded edition: E86060-K6710-A101-A9
Order no. of single sheet edition: E86060-K6710-A100-A9
- /ST7/** SIMATIC
SIMATIC S7 Programmable Logic Control
Catalog ST 70
Order no.: E86 060-K4670-A111-A3
- /ZI/** SINUMERIK, SIROTEC, SIMODRIVE
Cables & Connections & System Components
Catalog NC Z
Order no.: E86060-K4490-A001-A8 -7600 (English)

Electronic Documentation

- /CD1/** The SINUMERIK system (Edition 11.02)
DOC ON CD
(containing all SINUMERIK 840D/840Di/810D/802 and SIMODRIVE
documentation)
Order no.: 6FC5 298-6CA00-0BG3

User Documentation

/AUK/	SINUMERIK 840D/810D AutoTurn Operator Action Short Guide Order no.: 6FC5 298-4AA30-0BP2	(Edition 09.99)
/AUP/	SINUMERIK 840D/810D AutoTurn Graphic Programming System Programming/setup Order no.: 6FC5 298-4AA40-0BP3	(Edition 02.02)
/BA/	SINUMERIK 840D/810D MMC Operator's Guide Order no.: 6FC5 298-6AA00-0BP0	(Edition 10.00)
/BAD/	SINUMERIK 840D/840Di/810D HMI Advanced Operator's Guide Order no.: 6FC5 298-6AF00-0BP2	(Edition 11.02)
/BEM/	SINUMERIK 840D/810D HMI Embedded Operator's Guide Order no.: 6FC5 298-6AC00-0BP2	(Edition 11.02)
/BAH/	SINUMERIK 840D/840Di/810D HT 6 Operator's Guide Order no.: 6FC5 298-0AD60-0BP2	(Edition 06.02)
/BAK/	SINUMERIK 840D/840Di/810D Operator Action Short Guide Order no.: 6FC5 298-6AA10-0BP0	(Edition 02.01)
/BAM/	SINUMERIK 840D/810D Operation/Programming ManualTurn Order no.: 6FC5 298-6AD00-0BP0	(Edition 08.02)
/BAS/	SINUMERIK 840D/810D Operation/Programming ShopMill Order no.: 6FC5 298-6AD10-0BP1	(Edition 11.02)
/BAT/	SINUMERIK 840D/810D Operation/Programming ShopTurn Order no.: 6FC5 298-6AD50-0BP2	(Edition 03.03)
/BNM/	SINUMERIK 840D/840Di/810D Measuring Cycles User's Guide Order no.: 6FC5 298-6AA70-0BP2	(Edition 11.02)
/CAD/	SINUMERIK 840D/840Di/810D Operator's Guide CAD-Reader Order no.: (part of online help)	(Edition 03.02)

/DA/	SINUMERIK 840D/840Di/810D Diagnostics Guide Order no.: 6FC5 298-6AA20-0BP3	(Edition 11.02)
/KAM/	SINUMERIK 840D/810D ManualTurn Short Guide Order no.: 6FC5 298-5AD40-0BP0	(Edition 04.01)
/KAS/	SINUMERIK 840D/810D ShopMill Short Guide Order no.: 6FC5 298-5AD30-0BP0	(Edition 04.01)
/KAT/	SINUMERIK 840D/810D ShopTurn Short Guide Order no.: 6FC5 298-6AF20-0BP0	(Edition 07.01)
/PG/	SINUMERIK 840D/840Di/810D Fundamentals Programming Guide Order no.: 6FC5 298-6AB00-0BP2	(Edition 11.02)
/PGA/	SINUMERIK 840D/840Di/810D Programming Guide Advanced Order no.: 6FC5 298-6AB10-0BP2	(Edition 11.02)
/PGK/	SINUMERIK 840D/840Di/810D Programming Short Guide Order no.: 6FC5 298-6AB30-0BP1	(Edition 02.01)
/PGM/	SINUMERIK 840D/840Di/810D Programming Guide ISO Milling Order no.: 6FC5 298-6AC20-0BP2	(Edition 11.02)
/PGM/	SINUMERIK 840D/840Di/810D Programming Guide ISO Turning Order no.: 6FC5 298-6AC10-0BP2	(Edition 11.02)
/PGZ/	SINUMERIK 840D/840Di/810D Cycles Programming Guide Order no.: 6FC5 298-6AB40-0BP2	(Edition 11.02)
/PI /	PCIN 4.4 Software for data transfer to and from the MMC module Order no.: 6FX2 060 4AA00-4XB0 (Ger., Eng., Fr.) Order from: Fürth plant	
/SYI/	SINUMERIK 840Di System Overview Order no.: 6FC5 298-6AE40-0BP0	(Edition 02.01)

Manufacturer/Service Documentation

a) Lists

/LIS/	SINUMERIK 840D/840Di/810D SIMODRIVE 611D Lists Order no.: 6FC5 297-6AB70-0BP3	(Edition 11.02)
--------------	---	-----------------

b) Hardware

/BH/	SINUMERIK 840D/840Di/810D Operator Component Manual (hardware) Order no.: 6FC5 297-6AA50-0BP2	(Edition 11.02)
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/BHA/	SIMODRIVE Sensor Absolute Encoder with PROFIBUS DP User's Guide (hardware) Order no.: 6SN1197-0AB10-0BP1	(Edition 02.99)
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/EMV/	SINUMERIK, SIROTEC, SIMODRIVE EMC Installation Guideline Planning Guide (hardware) Order no.: 6FC5 297-0AD30-0BP1	(Edition 06.99)
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/GHA/	ADI4 - Analog drive port for 4 axes Equipment manual Order no.: 6FC5 297-0BA01-0BP0	(Edition 09.02)
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/PHC/	SINUMERIK 810D Configuration Manual (hardware) Order no.: 6FC5 297-6AD10-0BP0	(Edition 03.02)
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/PHD/	SINUMERIK 840D Configuration Manual NCU 561.2-573.4 (hardware) (Edition 10.02) Order no.: 6FC5 297-6AC10-0BP2	
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/PMH/	SIMODRIVE Sensor Hollow-Shaft Measuring System SIMAG H Configuring/Installation Guide (HW) Order no.: 6SN1197-0AB30-0BP1	(Edition 07.02)
--------------	---	-----------------

c) Software

/FB1/	SINUMERIK 840D/840Di/810D Basic Machine Description of Functions (Part 1) (Edition 11.02) (the books contained therein are listed below) Order no.: 6FC5 297-6AC20-0BP2	
--------------	---	--

A2	Various interface signals
A3	Axis monitoring, protection zones
B1	Continuous-path mode, exact stop and look ahead
B2	Acceleration
D1	Diagnostic aids

D2	Interactive programming
F1	Travel to fixed stop
G2	Speeds, setpoint/actual value systems, closed-loop control
H2	Auxiliary function output at the PLC
K1	Mode group, channel, program operation
K2	Axes, coordinate systems, frames, actual-value system for workpiece, external zero offset
K4	Communication
N2	EMERGENCY STOP
P1	Transverse axes
P3	Basic PLC program
R1	Reference point approach
S1	Spindles
V1	Feed rates
W1	Tool compensation

/FB2/

SINUMERIK 840D/840Di/810D(CCU2)
Description of Extended Functions (Part 2) (Edition 11.02)
 including FM NC: Turning, stepper motor
 (the books contained therein are listed below)
 Order no.: 6FC5 297-6AC30-0BP2

A4	Digital and analog NCK I/Os
B3	Various operator panels and NCUs
B4	Operator action via PG/PC
F3	Remote diagnosis
H1	Manual travel and handwheel travel
K3	Compensation
K5	Mode groups, channels, axis replacement
L1	FM NC local bus
M1	Kinematic transformation
M5	Measuring
N3	Software cam(s), limit signals
N4	Punching and nibbling
P2	Positioning axes
P5	Reciprocation
R2	Axes of rotation
S3	Synchronous spindle
S5	Synchronized actions (SW 3 and lower)
S6	Stepper motor control
S7	Memory configuration
T1	Indexing axes
W3	Tool change
W4	Grinding

/FB3/

SINUMERIK 840D/840Di/810D(CCU2)
Basic Machine Description of Functions (Part 3) (Edition 11.02)
 (the books contained therein are listed below)
 Order no.: 6FC5 297-6AC80-0BP2

F2	3 to 5-axis transformation
G1	Gantry axes
G3	Cycle times
K6	Contour tunnel monitoring
M3	Coupled axes and ESR
S8	Constant tool speed for centerless grinding
T3	Tangential control
TE0	Installation and activation of compile cycles
TE1	Clearance control

TE2	Analog axis
TE3	Speed/torque linking, master/slave
TE4	Handling transformation package
TE5	Setpoint exchange
TE6	MCS coupling
TE7	Retrace support
TE8	Cycle-independent path-synchronized switching signal output
V2	Preprocessing
W5	3D tool radius compensation

/FBA/

SIMODRIVE 611D/SINUMERIK 840D/810D
Description of Functions Drive Functions (Edition 11.02)
 (the chapters included therein are listed below)
 Order no.: 6SN1 197-0AA80-0BP9

DB1	Event messages/alarm responses
DD1	Diagnostic functions
DD2	Speed control loop
DE1	Enhanced drive functions
DF1	Enabling
DG1	Encoder parameterization
DL1	Linear motor MD
DM1	Calculating motor/power section parameters and controller data
DS1	Current control loop
DÜ1	Monitoring/limitations

/FBAN/

SINUMERIK 840D/SIMODRIVE 611 digital
Description of Functions
ANA Module (Edition 02.00)
 Order no.: 6SN1 197-0AB80-0BP0

/FBD/

SINUMERIK 840D
Description of Functions Digitizing (Edition 07.99)
 Order no.: 6FC5 297-4AC50-0BP0

DI1	Installation and Startup
DI2	Scanning by tactile sensor (scancad scan)
DI3	Scanning by laser (scancad laser)
DI4	Creating a milling program (scancad mill)

/FBDN/

IT Solutions
NC data management server (DNC NT-2000) (Edition 01.02)
 Description of Functions
 Order no.: 6FC5 297-5AE50-0BP2

/FBDT/

SINUMERIK 840D/840Di/810D
 IT-Solutions
SinDNC NC Data transmission via network (Edition 09.02)
 Description of Functions
 Order no.: 6FC5 297-5AE70-0BP0

/FBFA/	SINUMERIK 840D/840Di/810D Description of Functions ISO Dialect for SINUMERIK Order no.: 6FC5 297-6AE10-0BP2	(Edition 11.02)
/FBFE/	SINUMERIK 840D/840Di/810D Description of Functions Remote Diagnosis Order no.: 6FC5 297-0AF00-0BP2	(Edition 11.02)
/FBH/	SINUMERIK 840D/840Di/810D HMI Configuring kit Order no.: (supplied with the software) Teil 1 Operator's Guide Teil 2 Description of Functions	(Edition 11.02)
/FBHLA/	SINUMERIK 840D/SIMODRIVE 611 digital Description of Functions HLA Module Order no.: 6SN1 197-0AB60-0BP2	(Edition 04.00)
/FBMA/	SINUMERIK 840D/810D Description of Functions ManualTurn Order no.: 6FC5 297-6AD50-0BP0	(Edition 08.02)
/FBO/	SINUMERIK 840D/810D Configuring OP 030 User Interface Description of Functions Order no.: 6FC5 297-6AC40-0BP0 BA Operator's guide EU Development environment (configuring package) PS Online only: configuring syntax (configuring package) PSE Introduction to configuring the user interface IK Screen kit: software update and configuration	(Edition 09.01)
/FBP/	SINUMERIK 840D Description of Functions C PLC Programming Order no.: 6FC5 297-3AB60-0BP0	(Edition 03.96)
/FBR/	SINUMERIK 840D/810D IT-Solutions Description of Functions Computer Link (SinCOM) Order no.: 6FC5 297-6AD60-0BP0 NFL Interface to the host computer NPL Interface to PLC/NCK	(Edition 09.01)
/FBSI/	SINUMERIK 840D / SIMODRIVE 611 digital Description of Functions SINUMERIK Safety Integrated Order no.: 6FC5 297-6AB80-0BP1	(Edition 09.02)
/FBSP/	SINUMERIK 840D/810D Description of Functions ShopMill Order no.: 6FC5 297-6AD80-0BP1	(Edition 11.02)

/FBST/	SIMATIC Description of Functions FM STEPDRIVE/SIMOSTEP Order no.: 6SN1 197-0AA70-0BP4	(Edition 01.01)
/FBSY/	SINUMERIK 840D/840Di/810D Description of Functions Synchronaktionen Order no.: 6FC5 297-6AD40-0BP2	(Edition 10.02)
/FBT/	SINUMERIK 840D/810D Description of Functions ShopTurn Order no.: 6FC5 297-6AD70-0BP2	(Edition 03.03)
/FBTC/	SINUMERIK 840D/810D IT-Solutions SINUMERIK Tool Data Communication SinTDC Description of functions Order no.: 6FC5 297-5AF30-0BP0	(Edition 01.02)
/FBTD/	SINUMERIK 840D/810D IT solutions Tool Data Information System (SinTDI) with online Help Description of functions Order no.: 6FC5 297-6AE00-0BP0	(Edition 02.01)
/FBU/	SIMODRIVE 611 universal/universal E Closed-loop control components for speed control and positioning Description of functions Order no.: 6SN1 197-0AB20-0BP5	(Edition 02.02)
/FBW/	SINUMERIK 840D/840Di/810D Description of Functions Tool Management Order no.: 6FC5 297-6AC60-0BP1	(Edition 10.02)
/FBWI/	SINUMERIK 840D/840Di/810D Description of Functions WinTPM Order no.: (supplied with the software)	(Edition 02.02)
/HBA/	SINUMERIK 840D/840Di/810D Manual@Event (Edition 03.02) Order no.: 6AU1900-0CL20-0BA0	
/HBI/	SINUMERIK 840Di Manual Order no.: 6FC5 297-6AE60-0BP1	(Edition 09.02)
/INC/	SINUMERIK 840D/840Di/810D Start-up tool SINUMERIK SinuCOM NC System description Order no.: (supplied with the online help for the start-up tool)	(Edition 02.02)

/PAP/	SIMODRIVE encoder User's guide Order no.: 6SN1197-0AB10-0BP1	(Edition 02.99)
/PFK/	SIMODRIVE Planning Guide 1FT5-/1FT6-/1FK6-Motors Three-phase servo motors for feed drives and main spindle drives Order no.: 6SN1 197-0AC20-0BP0	(Edition 12.01)
/PJE/	SINUMERIK 840D/810D Configuring Package HMI Embedded Description of Functions : Software Update, Configuration, Installation Order no.: 6FC5 297-6EA10-0BP0 (the publication PS Configuring Syntax is a component of the software consignment and is available as a pdf)	(Edition 08.01)
/PJFE/	SIMODRIVE Planning Guide Synchronous Integrated Motor 1FE1 Three-Phase Motors for Main Spindle Drives Order no.: 6SN1 197-0AC00-0BP1	(Edition 09.01)
/PJLM/	SIMODRIVE Planning Guide Linear Motors 1FN1, 1FN3 ALL General information on the linear motor 1FN1 Three-phase linear motor 1FN1 1FN3 Three-phase linear motor 1FN3 CON Cables & Connections Order no.: 6SN1 197-0AB70-0BP2	(Edition 11.01)
/PJM/	SIMODRIVE Planning Guide Motors Three-phase motors for feed drives and main spindle drives Order no.: 6SN1 197-0AA20-0BP5	(Edition 11.00)
/PJTM/	SIMODRIVE Planning Guide Integrated Torque Motors 1FW6 Order no.: 6SN1 197-0AD00-0BP0	(Edition 08.02)
/PJU/	SIMODRIVE 611 Planning Guide Converters Order no.: 6SN1 197-0AA00-0BP5	(Edition 05.01)
/PMS/	SIMODRIVE Planning Guide ECO motor spindles for main spindle drives Order no.: 6SN1 197-0AD04-0BP0	(Edition 04.02)
/POS1/	SIMODRIVE POSMO A Decentralized Positioning Motor on PROFIBUS DP, User's Guide Order no.: 6SN2197-0AA00-0BP3	(Edition 08.02)

/POS2/	SIMODRIVE POSMO A Installation instructions (supplied with every POSMO A)	(Edition 12.98)
/POS3/	SIMODRIVE POSMO SI/CD/CA Decentralized Servo Drive Technology, User's Guide Order no.: 6SN2197-0AA20-0BP3	(Edition 08.02)
/PPH/	SIMODRIVE Planning Guide 1PH2/1PH4/1PH7 Motors Three-phase asynchronous motors for main spindle drives Order no.: 6SN1 197-0AC60-0BP0	(Edition 12.01)
/PPM/	SIMODRIVE Planning Guide Hollow-Shaft Motors Hollow-shaft motors for 1PM4 and 1PM6 Order no.: 6SN1 197-0AD03-0BP0	(Edition 10.01)
/S7H/	SIMATIC S7 300 - Reference manual: CPU data (Hardware Reference Manual) - Reference manual: Module data - Technological Functions Manual - Installation Guide Order no.: 6ES7 398-8FA10-8BA0	(Edition 2002)
/S7HT/	SIMATIC S7 300 Manual: STEP 7, Basic Knowledge, V. 3.1 Order no.: 6ES7 810-4CA02-8BA0	(Edition 03.97)
/S7HR/	SIMATIC S7 300 Manual: STEP 7, Reference Manuals, V. 3.1 Order no.: 6ES7 810-4CA02-8BR0	(Edition 03.97)
/S7S/	SIMATIC S7 300 Positioning Module FM 353 for Stepper Drive Order together with the configuring package	(Edition 04.97)
/S7L/	SIMATIC S7 300 Positioning Module FM 354 for Servo Drive Order together with the configuring package	(Edition 04.97)
/S7M/	SIMATIC S7 300 Multi-Axis Module FM 357.2 for Servo and Stepper Drives Order together with the configuring package	(Edition 01.01)
/SP/	SIMODRIVE 611-A/611-D, SimoPro 3.1 Program for Configuring Machine Tool Drives Order no.: 6SC6 111-6PC00-0BA□, Order from: Fürth plant	

d) Installation and Start-Up**/IAA/****SIMODRIVE 611A****Installation & Startup Guide**

(Edition 10.00)

Order no.: 6SN 1197-0AA60-0BP6

/IAC/**SINUMERIK 810D****Installation & Startup Guide**

(Edition 03.02)

(incl. description of the commissioning software SIMODRIVE 611D)

Order no.: 6FC5 297-6AD20-0BP0

/IAD/**SINUMERIK 840D/SIMODRIVE 611D****Installation & Startup Guide**

(Edition 11.02)

(incl. description of the commissioning software SIMODRIVE 611D)

Order no.: 6FC5 297-6AB10-0BP2

/IAM/**SINUMERIK 840D/840Di/810D****HMI/MMC Installation & Startup Guide**

(Edition 11.02)

Order no.: 6FC5 297-6AE20-0BP2

AE1	Updates/options
BE1	Supplementing the user interface
HE1	Online Help
IM2	Installation & Startup HMI Embedded
IM4	Installation & Startup HMI Advanced
TX1	Creating foreign language texts



Notes

EC Declaration of Conformity

SIEMENS

EG-Konformitätserklärung EC Declaration of Conformity

No. E002 V 26/03/99

Hersteller: Siemens AG
Manufacturer:
Anschritt: Siemens AG A&D MC
Address: Frauauracherstraße 80
91056 Erlangen
Produkt- SINUMERIK 805, 805SM-P, 805SM-TW, 810, 810D
bezeichnung: 820, 840C, 840CE, 840D, 840DE, FM NC
Product SIMATIC FM 353, FM 354, FM 357
description SIROTEC RCM1D, RCM1P
SIMODRIVE 610, 611, MCU, FM STEPDRIVE

Das bezeichnete Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischer Richtlinie überein:

The product described above in the form as delivered is in conformity with the provisions of the following European Directives:

89/336/EWG Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit
(geändert durch 91/263/EWG, 92/31/EWG, 93/68/EWG und 93/97/EWG).

Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility (amended by 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC)

Die Einhaltung dieser Richtlinie setzt einen EMV-gerechten Einbau der Produkte gemäß EMV-Aufbaurichtlinie für SINUMERIK, SIROTEC, SIMODRIVE (Best. Nr. 6FC 5297-0AD30-0AP0) in die Gesamtanlage voraus. Anlagenkonfigurationen, bei der die Einhaltung dieser Richtlinie nachgewiesen wurde, sowie angewandte Normen, siehe:

For keeping the directive, it is required to install the products according to "EMC Mounting regulation for SINUMERIK, SIROTEC, SIMODRIVE" (Order No. 6FC 5297-0AD30-0BP0). For details of the system configurations, which meet the requirements of the directives, as well as for the standards applied see:

- | | |
|--|--|
| - Anhang A1 - A17 (Anlagenkonfigurationen) | - Annex A1 - A17 (system configurations) |
| - Anhang B1 - B7 (Komponenten) | - Annex B1 - B7 (components) |
| - Anhang C (Normen) | - Annex C (standards) |

Siemens AG

Erlangen, den 26.08.1999

R. Müller
Entwicklungsleitung

Name, Funktion
Name, function

Unterschrift
signature

K. Krause
Qualitätsmanagement

Name, Funktion
Name, function

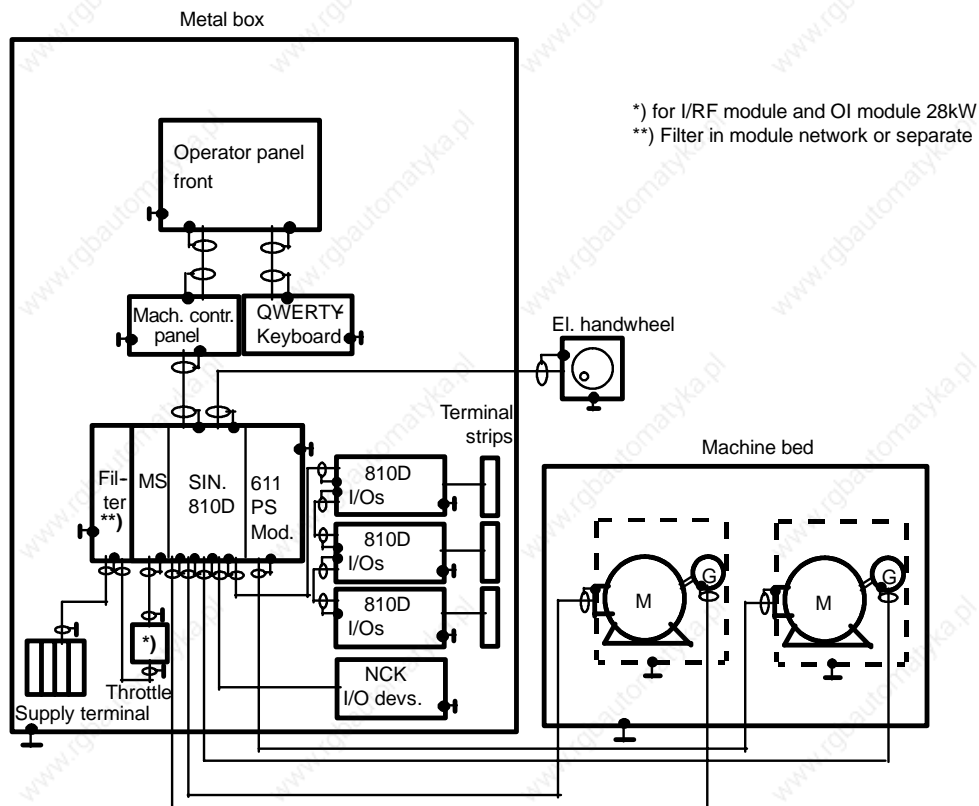
Unterschrift
signature

Diese Erklärung bescheinigt die Übereinstimmung mit der genannten Richtlinie, ist jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

This declaration certifies the conformity to the specified directives but contains no assurance of properties. The safety documentation accompanying the product shall be considered in detail.

Appendix A to EC Declaration of Conformity No. E002 V 26/03/99

A11: Typical system configuration SINUMERIK 810D



- All the components that according to the ordering information are approved for the system network of SINUMERIK 810D comply with directive 89/336/EC within the network.
- For conformity to the standards, see Appendix C.

Note

The sketch of the system configuration shows only the basic measures for conformance with directive 89/336/EC for a typical system configuration.

In addition to this, especially if the system configuration is not the same, you must follow the installation instructions for an EMC-compliant system configuration contained in the product documentation and in the EMC installation guideline for SINUMERIK; SIROTEC and SIMODRIVE (Order No.: 6FC5297-0AD30-0AP1).

Appendix C to the EC Declaration of Conformity No. E002

The conformity of products to council directive 89 / 336 / EC including updates 91 / 263 / EC, 92 / 31 / EC, 93 / 68 / EC and 93 / 97 / EC was demonstrated by testing them according to the following product standard, technical basic standards and the basic standards listed therein. Different standard requirements apply for the SINUMERIK, SIMOTION, SIMATIC, SIROTEC and SIMODRIVE product categories.

C1 product category SINUMERIK^{*)}, SIMOTION, SIMATIC, SIROTEC:

Technical basic standard radio interference/industrial sector: EN 50081-2 1)

<u>Basic standards:</u>	<u>Test topic:</u>
EN 55011 + A1 + Bbl. 1	2) Radio interference

Technical basic standard immunity to noise/industrial sector: EN 61000-6-2 3)

<u>Basic standards:</u>	<u>Test topic:</u>
EN 61000-4-2 + A1	4) Static discharge
EN 61000-4-3 + A1	5) High-frequency irradiation (amplitude modulated)
EN 61000-4-4	6) Rapid transients (burst)
EN 61000-4-6	7) HF flow on cables
EN 61000-4-8	8) Magnetic fields with electrical power frequencies
EN 61000-4-11	9) Voltage dips and voltage interruptions

C2 Product category SIMODRIVE, SINUMERIK 810D:

<u>Product standard:</u>	<u>Test topic:</u>
EN 61800-3 + A11	10) Variable speed electrical drives; EMC product standard including special test procedures

C3 Standards thus complied with:

1):	VDE 0839 Part 81-2	6):	VDE 0847 Part 4-4 IEC 61000-4-4
2):	VDE 0875 Part 11+ Bbl. 1 IEC/CISPR 11 + A1 + 28	7):	VDE 0847 Part 4-6 IEC 61000-4-6
3):	VDE 0839 Part 6-2 IEC 61000-6-2	8):	VDE 0847 Part 4-8 IEC 61000-4-8
4):	VDE 0847 Part 4-2 + A1 IEC 61000-4-2 + A1	9):	VDE 0847 Part 4-11 IEC 61000-4-11
5):	VDE 0847 Part 4-3 IEC 61000-4-3 + A1	10):	VDE 0160 Part 100 IEC 61800-3

^{*)} except SINUMERIK 810D

Notes

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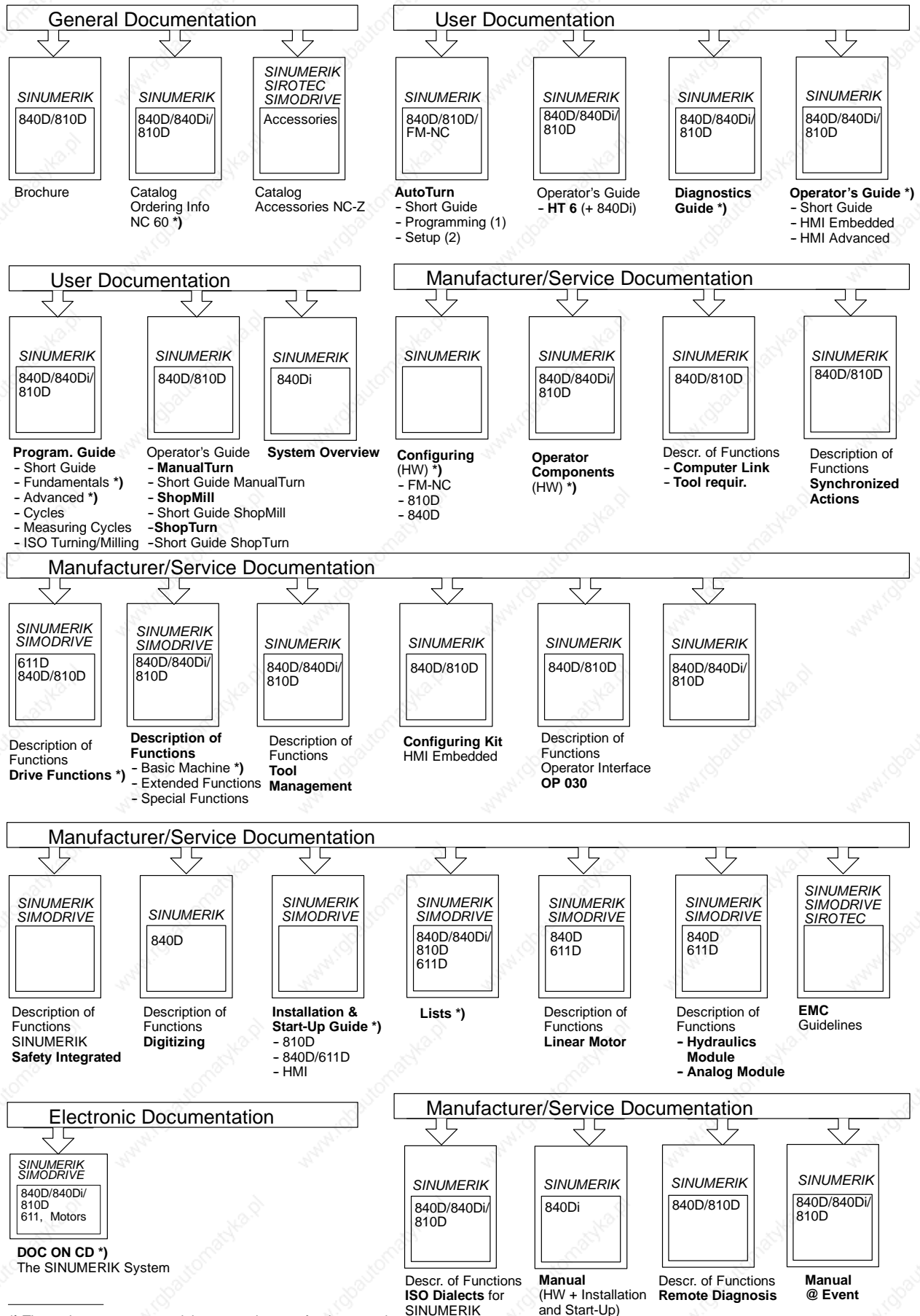
Notes

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Suggestions and/or corrections

Overview of SINUMERIK 840D/840Di/810D Documentation (11.02)



*) These documents are a minimum requirement for the control

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Automation & Drives

Motion Control Systems

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Subject to change without prior notice
Order No: 6FC5297-6AD10-0BP1

Printed in Germany