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SINUMERIK

SINUMERIK 840D sl, SINAMICS S120

IBN CNC: NCK, PLC, drive

Commissioning Manual

Valid for

Control SINUMERIK 840D sl / 840DE sl Drive SINAMICS S120

Software NCU Software for 840D sl/840DE sl Version 2.6

03/2009 6FC5397-2AP10-5BA0

Preface

Introduction	1
Safety information	2
Requirements for	_
commissioning	3
Example configuration	4
	_
Power on and boot up	5
Connect PG/PC with the PLC	6
	7
PLC commissioning	1
Commissioning SINAMICS drives	8
Commissioning	9
communication NCK<->Drive	3
NCK start-up	10
Optimize the drive.	11
Drive optimization with	40
HMI sl	12
Data backup and	13
standard commissioning	13
File functions for	14
SINAMICS parameters	1-1
Tips for commissioning SINAMICS drives	15
General tips	16
	47
Licensing	17
Fundamentals	18
	Δ
Appendix	

Legal information

Warning notice system

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

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

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

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

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

NOTICE

indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

Trademarks

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

Disclaimer of Liability

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

Preface

Preface

Structure of the documentation

The SINUMERIK documentation is organized in 3 parts:

- General documentation
- User documentation
- Manufacturer/service documentation

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

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

Target group

This document is designed for machine tool manufacturers. The present documentation provides all information required by the manufacturer to start up the software HMI sl.

Standard version

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

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

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

Technical Support

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

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Note

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

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Questions about this documentation

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

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

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

SINUMERIK Internet address

http://www.siemens.com/sinumerik

CompactFlash cards for users

- The SINUMERIK CNC supports the file systems FAT16 and FAT32 for CompactFlash cards. You may need to format the memory card if you want to use a memory card from another device or if you want to ensure the compatibility of the memory card with the SINUMERIK. However, formatting the memory card will permanently delete all data on it.
- Do not remove the memory card while it is being accessed. This can result in damage to the memory card and the SINUMERIK as well as the data on the memory card.
- If you cannot use a memory card with the SINUMERIK, it is probably because the memory card is not formatted for the control system (e.g. Ext3 Linux file system), the memory card file system is faulty or it is the wrong type of memory card.
- Insert the memory card carefully and the right way round into the memory card slot (observe indicators such as arrow or similar). This way you avoid mechanical damage to the memory card or the device.
- Only use memory cards that have been approved by Siemens for use with SINUMERIK. Even though the SINUMERIK complies with the general industry standards for memory cards, it is possible that memory cards from some manufacturers will not function perfectly in this device or are not completely compatible with it (you can obtain information on compatibility from the memory card manufacturer or supplier).
- The "CompactFlash® 5000 Industrial Grade" CompactFlash card from SanDisk has been approved for SINUMERIK (Order Number 6FC5313-5AG00-0AA0).

EC Declaration of Conformity

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

http://support.automation.siemens.com

under the Product Order No. 15257461or at the relevant branch office of the A&D MC Division of Siemens AG.

Table of contents

	Prefac	e	3
1	Introdu	uction	13
	1.1	Commissioning manuals for SINUMERIK 840D sl	13
	1.2	Principle representation of SINUMERIK 840D sI components for commissioning	
	1.3	Initial commissioning procedure	19
2	Safety	information	21
	2.1	Danger notices	21
	2.2	ESD notices	23
3	Requi	ements for commissioning	25
	3.1	General prerequisites	25
	3.2	Software and hardware requirements	27
	3.3	Communication interfaces	29
	3.4	Commissioning tool on PG/PC	
4	Exam	ble configuration	31
5	Power	on and boot up	33
	5.1	Operating and display elements for run-up	
	5.2	NCK and PLC general reset	35
	5.3	Boot completed	37
6	Conne	ct PG/PC with the PLC	39
	6.1	Start SIMATIC Manager	
	6.2	Setting up the communication	40
7	PLC c	ommissioning	41
	7.1 7.1.1 7.1.2 7.1.3 7.1.4 7.1.5 7.1.6	Creating a SIMATIC S7 project Creating a project Inserting a SIMATIC station 300 Insert NCU 7x0 in HW config Configuring the properties of the network interfaces Insert NX in HW Config End hardware configuration and load to the PLC	
	7.2 7.2.1 7.2.2	Creating a PLC program Insert PLC basic program Modifying Ethernet machine control panel in OB100	55
	7.3	Loading the project to the PLC	58
	7.4	Configuring an Ethernet machine control panel	60
	7.5	Triggering a reset (warm restart) for NCK and drive system	61

	7.6	First commissioning of the PLC completed	63
8	Commis	sioning SINAMICS drives	65
	8.1	Introduction to commissioning of SINAMICS drives	66
	8.2	Activate the factory settings	68
	8.3	First commissioning of the drive units	71
	8.4	Updating the component firmware	76
	8.5 8.5.1 8.5.2 8.5.2.1 8.5.2.2	Commissioning using a drive wizard Parameterization of infeed Parameterization of the drives Commissioning of listed motor and encoder via SMC Commissioning of third-party motor and additional second encoder via SMC	
	8.6	First commissioning of SINAMICS drive ended	102
9	Commis	sioning communication NCK<->Drive	103
	9.1	Configuration input/output address and telegram	105
	9.2	Configuration setpoint/actual value	106
	9.3	Commissioning communication NCK<->Drive completed	108
10	NCK sta	rt-up	
	10.1	Overview Commissioning NCK	
	10.2.1 10.2.2 10.2.3 10.2.4 10.2.5 10.2.6 10.2.7 10.2.8 10.2.9 10.2.10 10.3 10.4 10.5 10.5.1	System data Resolutions Normalization of phys. units of machine data and setting data Modifying scaling machine data Loading default machine data Switching over the measuring system traversing ranges Positioning accuracy of the control system Cycle times NCK utilization Velocities Memory configuration Parameter sets of axis/spindle Parameterize axis data Incremental measuring system settings	
	$\begin{array}{c} 10.5.2\\ 10.5.3\\ 10.5.4\\ 10.5.5\\ 10.5.6\\ 10.5.7\\ 10.5.8\\ 10.5.9\\ 10.5.10\\ 10.5.11\\ 10.5.12\\ 10.5.12.\end{array}$	Parameterization of absolute measuring systems	

	10.5.12.3Absolute encoders 10.5.12.4Interface signals and machine data		
	10.6 10.6.1 10.6.2 10.6.3 10.6.4 10.6.5 10.6.6 10.6.7 10.6.8	Parameterization of spindle data Setpoint/actual value channels of spindle Gear stages Spindle measuring systems Speeds and setpoint adjustment for spindle Position spindle Synchronizing spindle Spindle monitoring Spindle data	
11	Optimize	• the drive	
	11.1	Measuring functions	
	11.2 11.2.1 11.2.2 11.2.3	Frequency response measurements Current control loop measurement Speed control loop measurement Position control loop measurement	202 204
	11.3	Circularity test measurement	213
	11.4 11.4.1 11.4.2 11.4.3	Trace Trace overview Servo trace Drive trace	216 216
	11.5	Further optimization options	222
12	Drive op	timization with HMI sl	223
	12.1	Automatic servo optimization	223
	12.2	Overview of navigation	224
	12.3	General operating sequences for automatic servo optimization	225
	12.4	Additional optimization stages - commissioning interpolation axes	230
13	Data bad	kup and standard commissioning	231
	13.1	Data backup	
	13.2	User data backup/Series commissioning	
	13.3	Preassignments when saving PLC data	
	13.4	Series commissioning	
14		tions for SINAMICS parameters	
	14.1	Overview of file functions	
	14.2	Data backup of SINAMICS parameters	
	14.3	Loading the SINAMICS parameter file	
	14.4	Editing the SINAMICS parameter file	
15	•	commissioning SINAMICS drives	
	15.1 15.1.1 15.1.2 15.1.2.1	Changing topology (modular machine) Adding components "Topology" > "Change" menu Changing entry into topology	245 252

	15.1.2.3 15.1.2.4 15.1.2.5 15.1.3 15.1.4 15.1.5 15.1.6	Deleting drive objects Deleting components Enabling/disabling drive object Changing drive object/component names/numbers Replacing SINAMICS S120 components Display options Sorting the topology display Check topology	255 257 259 260 263 265 267
	15.2	Drive diagnostics	
	15.3	Diagnostics for pending alarms	
	15.4	Drive (SERVO) parameter RESET, individual	
	15.5	Firmware version display of drive components	
	15.6	Checking/setting power supply data settings	
	15.7	Identification/Optimization "ALM > Infeed/Configuration"	275
16	General	tips	277
	16.1	Configuration of the properties of the network interface for PROFIBUS	277
	16.2	Separate NCK and PLC general reset	280
	16.3	Configuring the communication between the PLC and the drive	282
	16.4 16.4.1 16.4.2 16.4.3 16.4.4	Integrating PG/PC into the network (NetPro) Integrating PG/PC into NetPro PG/PC interface configuration Assigning interfaces Loading the HW config to NCU	285 287 290
	16.5	NCU 7x0 and NX1x Terminal Assignment	294
	16.6	Overview - Assignment of SINAMICS and NCK machine data for communication via PROFIBUS	299
	16.7	Drive-object assignment for PROFIBUS connection	301
	16.8 16.8.1 16.8.2 16.8.3 16.8.4	PROFIBUS machine control panel on the HMI Configuration of the properties of the network interface for PROFIBUS Load GSD file (contains machine control panel) Adding a machine control panel and handwheel in HW Config Modifying PROFIBUS machine control panel in OB100	304 307 307
17	Licensing]	311
	17.1	Import licensing terms	311
	17.2	Overview	312
	17.3	Web License Manager	313
	17.4	Automation License Manager	313
	17.5	License database	314
	17.6	CF Card and hardware serial numbers	315
	17.7	SINUMERIK License Key	316
	17.8 17.8.1 17.8.2	Assigning via Web License Manager You can execute an assignment via direct access as follows You can execute an assignment via customer login as follows	317

	17.9	Assigning via Automation License Manager	
	17.9.1 17.9.2	Function Overview Installing the Automation License Manager	
	17.9.2	Enabling/disabling SINUMERIK plug-ins	
	17.9.4	Assigning parameters to the TCP/IP communication with a control system	
	17.9.5	How to refresh the navigation view: "Manage"	
	17.9.6	Displaying the license information of a piece of hardware	328
	17.9.7	Creating a control image (offline)	329
	17.9.8	Performing a license requirement alignment for a piece of hardware	
	17.9.9	Transferring license information for a control image (offline) to a control system (online)	
	17.10	Internet links	
18	Fundam	ientals	
	18.1	Basic information on SINAMICS S120	
	18.1.1	Rules for wiring the DRIVE-CLiQ interface	
	18.1.2	Drive Objects (DO's) and Drive components	
	18.1.3	BICO interconnection	339
	18.2	Transfer telegrams	341
	18.2.1	Structure of the telegram with the process data for SINUMERIK 840D sl	
	18.2.2	Process data for receiving and sending	
	18.3	Control- and status-word bits for NCK<->drive communication	
	18.3.1	NCK to drive	
	18.3.2	Drive to NCK	349
	18.4	PLC program	
	18.4.1	Fundamentals of creating a PLC user program	356
	18.5	Machine and setting data	
	18.5.1	Machine data fundamentals	
	18.5.2	Handling the machine data	361
	18.6	Protection levels	
	18.6.1	Protection level fundamentals	364
	18.7	Axis data	
	18.7.1	Axis configuration	
	18.7.2	Axis assignment.	
	18.7.3 18.7.4	Axis names Setpoint/actual value channels	
	18.8	Spindle data	
	18.8.1 18.8.2	Spindle modes	
	18.8.3	Initial spindle state General functionality	
Α	Append	-	
	A.1	Abbreviations	
	A.2	Feedback on the documentation	
	A.3	Overview	
	Glossar	у	393
	Index		399

Table of contents

Introduction

1.1 Commissioning manuals for SINUMERIK 840D sl

Introduction

The commissioning manuals for SINUMERIK 840D sl are divided into:

- IBN CNC: NCK, PLC, drive
- IBN CNC: Base software and HMI-Embedded
- IBN CNC: Base software and HMI-Advanced
- IBN CNC: Base software and HMI sI
- IBN CNC: ShopMill
- IBN CNC: ShopTurn

Basic steps for commissioning SINUMERIK 840D sl

Commissioning a SINUMERIK 840D sl is performed in 2 basic steps:

- 1. Step 1 (described in IBN CNC: NCK, PLC, drive)
 - PLC commissioning
 - Drive commissioning
 - NCK commissioning
- Step 2 (described in IBN CNC: Base software and HMI-Embedded, IBN CNC: Base software and HMI-Advanced, IBN CNC: Base software and HMI sl, IBN CNC: ShopMill, IBN CNC: ShopTurn)
 - Commissioning functions in NCK/PLC

References

The SINUMERIK Safety Integrated Function Manual describes commissioning for SINUMERIK 840D sl/SINAMICS S120 Safety Integrated.

1.1 Commissioning manuals for SINUMERIK 840D sl

Commissioning overview

The following figure is a schematic representation of the commissioning steps that are described in the first step (1) and in step (2):

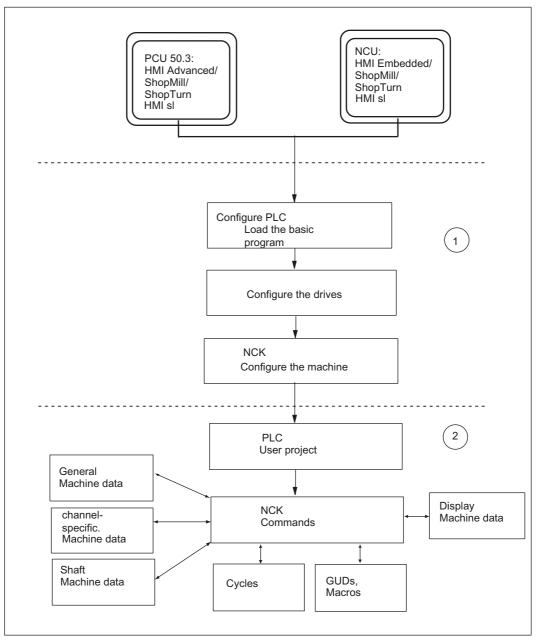


Figure 1-1 Commissioning overview

Introduction

1.2 Principle representation of SINUMERIK 840D sl components for commissioning

1.2 Principle representation of SINUMERIK 840D sl components for commissioning

Introduction

In principle, an NCU 7x0 contains the following components:

- HMI
- NCK
- PLC
- Drive
- CP

The HMI contained in the NCU is designated as **internal HMI** or as HMI-Embedded/ShopMill/ShopTurn/HMI sI.

In addition, a PCU 50.3 can be connected to each NCU, on which the HMI-Advanced then runs (additional optional ShopMill/ShopTurn, HMI sl). This HMI is then designated as **external HMI**.

For commissioning, the HMI Advanced Software is required or the commissioning tool derived from it.

For the commissioning of the PLC, a PG/PC with SIMATIC STEP7 Version 5.3 Service Pack 3 is required.

In order to connect multiple communication partners to socket X120, a network switch or hub (e.g. DMC20) is required.

Commissioning components for internal HMI's

Commissioning of an internal HMI requires a PG/PC. This PG/PC is connected via Ethernet to socket X120.

The internal HMI displays its user interface via TCU (Thin Client Unit), which is connected via the Ethernet machine control panel (e.g. MCP 310) to socket X120.

Commissioning components for external HMI's

External HMIs are connected to socket X120.

A PC/PG is required for commissioning of the PLC of the external HMI. This PG/PC is connected via Ethernet to socket X127.

Note

To use the external HMI (PCU 50.3) without TCU, the internal HMI must be switched off.

1.2 Principle representation of SINUMERIK 840D sI components for commissioning

Commissioning NCU 7x0 with internal HMI

The following figure illustrates an example of a hardware and software arrangement for the commissioning of an NCU 7x0 with internal HMI.

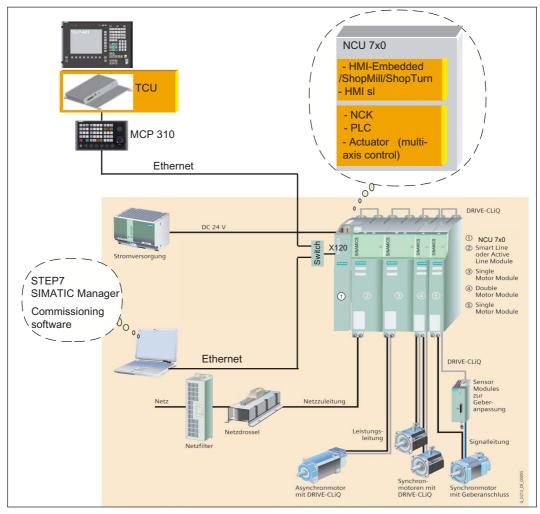
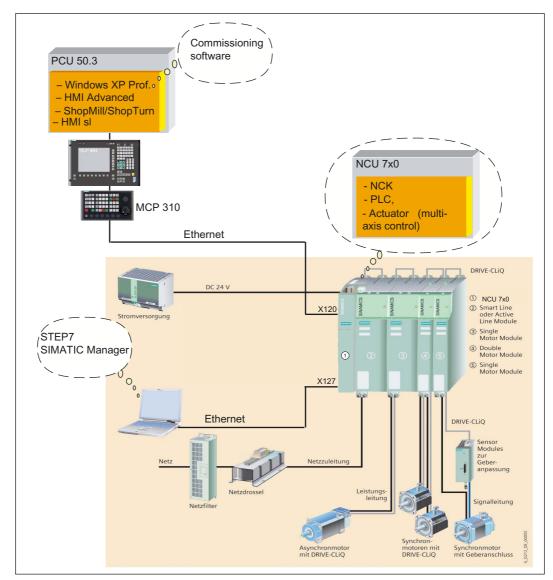


Figure 1-2 Principle representation SINUMERIK 840D sl

1.2 Principle representation of SINUMERIK 840D sI components for commissioning

Commissioning NCU 7x0 with external HMI

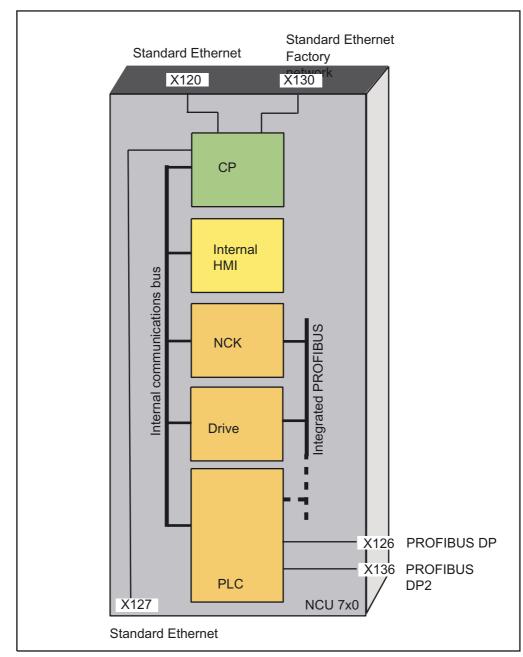


The following figure illustrates an example of a hardware and software arrangement for the commissioning of an NCU 7x0 with PCU 50.3 with external HMI.

Figure 1-3 Principle representation of SINUMERIK 840D sl with PCU 50.3

1.2 Principle representation of SINUMERIK 840D sI components for commissioning

Schematic representation of the NCU 7x0



The following figure is a schematic representation of the NCU 7x0:

Figure 1-4 Schematic representation of NCU 7x0

1.3 Initial commissioning procedure

1.3 Initial commissioning procedure

Introduction

The mechanical and electrical installation of the system must be completed. At the start of installation and start-up, it is important for the control and its components to run-up properly and essential that the system complies with the application EMC Guidelines.

Commissioning steps

The steps required for installation and start-up are described below. The order is recommended but not mandatory:

- 1. Checking the SINUMERIK 840D sl boot
- 2. Making a communication connection to the PLC
- 3. PLC installation and start-up
- 4. Commissioning SINAMICS drives
- 5. Commissioning communication NCK<->Drive
- 6. NCK commissioning
 - Assigning NCK machine data for communication
 - Scaling machine data
 - Parameterizing axis data
 - Parameterizing spindle data
 - Parameterizing the measuring systems
- 7. Drive Optimization

See also

NCK and PLC general reset (Page 35) Setting up the communication (Page 40) Creating a SIMATIC S7 project (Page 41) Commissioning SINAMICS drives (Page 65) Commissioning communication NCK<->Drive (Page 103) Overview Commissioning NCK (Page 109) Further optimization options (Page 222)

Introduction

1.3 Initial commissioning procedure

Safety information

2.1 Danger notices

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

Only appropriately qualified personnel may commission/start-up SINUMERIK equipment.

The personnel must take into account the information provided in the technical customer documentation for the product, and be familiar with and observe the specified danger and warning notices.

When electrical equipment and motors are operated, the electrical circuits automatically conduct a dangerous voltage.

When the system is operating, dangerous axis movements may occur throughout the entire work area.

A potential fire hazard exists due to the energy being transferred in the equipment and the work materials used.

All work on the electrical system must be performed after the system has been switched off and disconnected from the power supply.

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

The details in the catalogs and proposals also apply to the design of special equipment versions.

In addition to the danger and warning information provided in the technical customer documentation, the applicable national, local, and system-specific regulations and requirements must be taken into account.

Only protective extra-low voltages (PELVs) that comply with EN 61800-5-1 can be connected to all connections and terminals between 0 and 48 V.

Should it be necessary to test or take measurements on live equipment, then the specifications and procedural instructions defined in Accident Prevention Regulation VBG A2 must be adhered to, in particular § 8 "Permissible deviations when working on live components". Suitable electric tools should be used.

2.1 Danger notices

/!\warning

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

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

SINAMICS equipment with three-phase motors conforms to EMC Directive 89/336/EEC in the configurations specified in the associated EC Certificate of Conformity.

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

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

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

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

2.2 ESD notices

CAUTION

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

NOTICE

Handling ESD-modules:

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

Safety information

2.2 ESD notices

Requirements for commissioning

3.1 General prerequisites

General

All components are dimensioned for defined mechanical, climatic and electrical environmental conditions. No limit value may be exceeded, neither during operation, nor during transportation.

Limit values

In particular, the following must be observed:

- Power supply conditions
- Pollution burden
- Function-impairing gases
- Ambient environmental conditions
- Storage/transport
- Shock stressing
- Vibration stressing
- Ambient temperature

Prerequirements for components involved

The complete system is connected mechanically and electrically, and has been verified in the following points:

- When handling the components, all ESD measures are observed.
- All screws are tightened with their prescribed torque.
- All connectors are plugged correctly and locked/screwed.
- All components are grounded and connected to shields.
- The load capacity of the central power supply is taken into account.

3.1 General prerequisites

Literature

- All information about the structure of SINAMICS S120 drive components are contained in: SINAMICS S120 Equipment Manual
- You can find all the instructions on how to connect the Ethernet interface here: Equipment Manual NCU
- To initialize an Ethernet, see also: HMI commissioning; TCU commissioning

3.2 Software and hardware requirements

3.2 Software and hardware requirements

Requirements

For the commissioning of SINUMERIK 840D sI, the following points are required:

- Connection to NCU
 - Network switch or hub to socket X120
 - Ethernet connection of PG/PC to socket X120 or socket X127 when commissioning the HMI PLC external
 - Ethernet machine control panel to socket X120
 - Ethernet connection from TCU for internal HMI internal to Ethernet machine control panel or
 - Ethernet connection from PCU 50.3 for HMI external to Ethernet machine control panel
- Software prerequisites
 - SIMATIC STEP 7 as of Version 5.3 Service Pack 3 on PG/PC (SIMATIC Manager)
 - STEP7 package for NCU7x0 on PG/PC (Toolbox)
 - GSD file (Toolbox)
 - CompactFlash Card with software for internal HMI, NCK, PLC and drive
 - External HMI on PCU 50.3 or commissioning tool on PG/PC for the commissioning of internal HMI

Note

The order numbers of the SINAMICS drives, motors and encoders should be at hand. These are used for parameterization.

- Hardware prerequisites
 - CompactFlash Card with software for internal HMI, NCK, PLC and drive attached in NCU
 - Dual ventilator fan/battery module (MLFB 6FC5348-0AA02-0AA0) to NCU (see following figure)

3.2 Software and hardware requirements

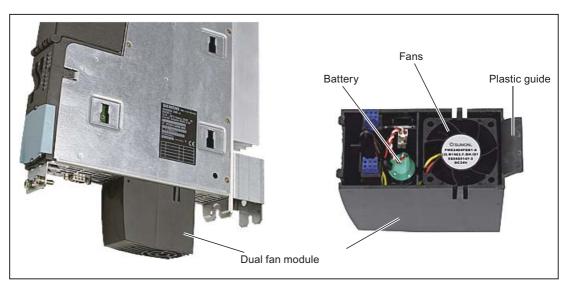


Figure 3-1 Dual fan/battery module

Note

Please dispose of used batteries in the specially provided collection points on site. This will ensure they are reused in the correct manner or treated as special waste.

3.3 Communication interfaces

Introduction

The figure below identifies the interfaces on the NCU that can be used for communication with the components involved in the installation and startup phase. They are:

- X120 Ethernet interface for TCU and/or PCU (a network switch or hub enables expansion)
- X130 Ethernet interface for factory network
- for PG/PC
 - currently X120 Ethernet interface, internal for HMI
 - X127 Ethernet interface, external for HMI (PLC commissioning)
- X126 PROFIBUS interface for machine control panel, for example

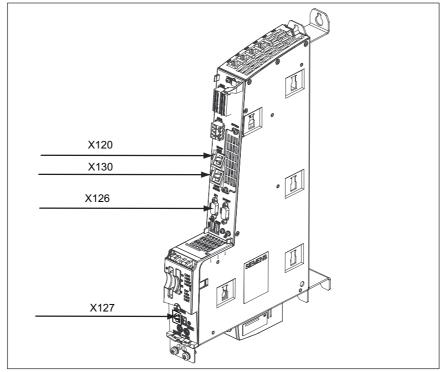


Figure 3-2 Interfaces on the NCU for installation and startup

3.4 Commissioning tool on PG/PC

Network configuration characteristics

For the individual, participating components that are connected with the NCU, the following properties are available for the network configuration.

Table 3-1 Network configuration

Component	socket	Which network?	IP address	Subnet ID
TCU/PCU 50.3 and currently PC/PG for commissioning of internal HMI	X120	Ethernet	192.168.214.1	255.255.255.0
Factory network	X130	Ethernet	Assigned by DHCP server, for example 10.10.255.200	
PG/PC for commissioning of PLC external HMI	X127	Ethernet	192.168.215.1 or DHCP Server	255.255.255.248

3.4 Commissioning tool on PG/PC

Precondition

If a SINUMERIK 840D sI (internal HMI), consisting of a TCU, NCU 7x0 and SINAMICS S120 drive components is commissioned, the commissioning tool on the PG/PC is required.

To carry out a commissioning with PG/PC with the commissioning tool, the following points are required:

- Commissioning tool is installed and started on the PG/PC.
- There is an Ethernet connection to NCU (currently X120).
- Since the standard Ethernet IP address is pre-assigned in the commissioning tool for X120 (192.168.214.1), there are no additional requirements.
- If another Ethernet interface is used, e.g. connected to socket X127, then this must be adapted accordingly in the commissioning tool by selecting "Commissioning" > "HMI" > "NCU connection" > "Standard address" (for example, 192.168.215.1 for socket X127).

Example configuration

Overview

The commissioning described in this manual orientates itself on an example configuration of the SINAMICS drive line-up.

The following figure roughly shows the components.

- An NCU 710 with:
 - A Single Motor Module for a motor with SMI (Sensor Module Integrated)
 - A Double Motor Module for two motors each with an SMC 20 (Sensor Module Cabinet)
- An NX 15 with:
 - A Single Motor Module for a motor with two SMC 20 for the encoder
- An Active Line Module

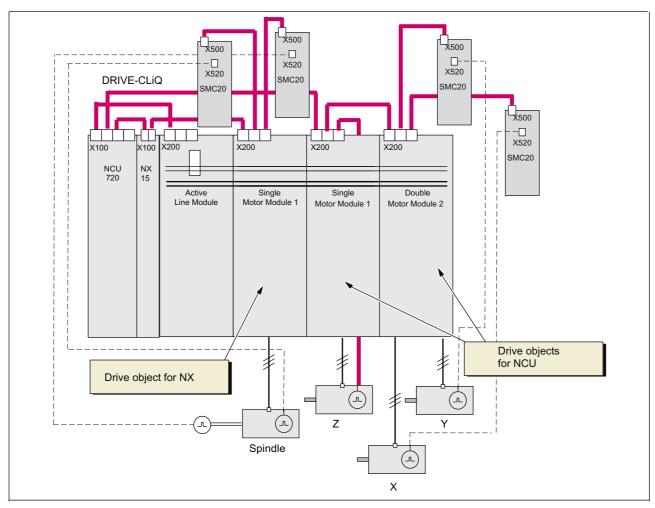


Figure 4-1 Example configuration

Reference

For further available DRIVE-CLiQ components of the SINAMICS drive line-up, see Catalog NC 61, Edition 2007/2008, SINUMERIK & SINAMICS; Order No.: E86060-K4461-A101-A2

Power on and boot up

5.1 Operating and display elements for run-up

Introduction

The figure below shows the operating and display elements of the NCU, which are important for switch-on and run-up of the SINUMERIK 840D sl:

- Various error and status LEDs
- Status display (seven-segment display)
- RESET button
- NCK start-up switch (left)
- PLC mode selector switch (right)
- CompactFlash slot

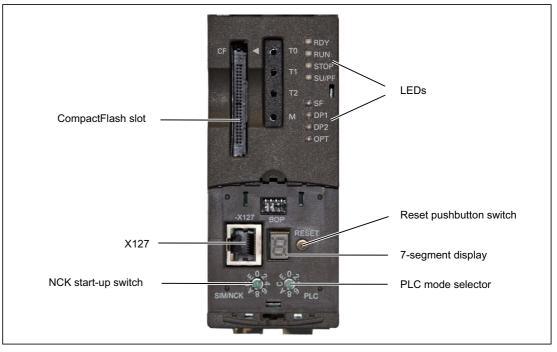


Figure 5-1 Operating and display elements for installation and start-up at the NCU

Note

When you turn the start-up switch or operating mode switch, then the status display indicates the selected number/letters!

5.1 Operating and display elements for run-up

LED display

The following LED displays indicate states at the NCU

- RDY (yellow) -> Write/read access to the CompactFlash card, RDY (red) -> Watchdog (no NCK ready),
 - RDY (green) -> NCK has powered up and is in cyclic operation
- RUN (green) -> PLC running
- STOP (yellow) -> PLC stopped
- SU/PF (yellow) -> Force PLC active
- SF (red) -> general PLC error, see diagnostic buffer
- DP1 (red) -> Error on PROFIBUS (X126)
- DP2 (red) -> Error on PROFIBUS (X136)
- OPT (red) -> Error on option module
- All yellow -> power up not possible (CompactFlash Card not plugged in or empty)

NCK start-up switch

The following switch settings are assigned:

- 0 -> NCK in the operating mode
- 1 -> NCK in the initial clear mode (standard MD)
- 7 -> NCK is not started during run-up
- 8 -> Display IP address for the factory network at X130
 - Turn the NCK start-up switch to "8"
 - Trigger RESET.
 - The individual values of the IP address are displayed as individual digits with points to separate the individual values. The last digit does not have a point. The IP address is displayed again after a short delay. In this state, no NCK operation is possible.

PLC mode selector switch

The following switch settings are assigned:

- 0 -> NC in operating mode
- 1 -> NC in operating mode, protected
- 2 -> NC in operating mode
- 3 -> PLC general reset

5.2 NCK and PLC general reset

Introduction

On initial startup of the PLC, a general reset of the PLC has to be performed after the NCU has been switched on and booted.

To obtain a defined output state of the complete system (NCK and PLC), the NCK must also be deleted.

PLC general reset

General reset puts the PLC in a defined initial state by deleting and initializing all system and user data.

Delete NCK data

After a request to delete NCKs, all user data is deleted and the system data is reinitialized on the next NCK boot, e.g., after NCK Reset.

Operating sequence for NCK and PLC general reset for initial boot

If you want to boot the control for the first time, then the following operating sequence is to be executed for an NCK and PLC general reset:

- 1. On the NCU, turn the startup switch and mode selector to the following positions:
 - NCK startup switch (SIM/NCK label) to "1"
 - PLC mode selector (PLC label) to "3"
- 2. Execute a POWER ON (switch on control).
- 3. Wait until the NCU displays the following continuously:
 - STOP LED flashes
 - SF LED is lit.
- 4. Turn the PLC-mode selector to the following switch positions in succession:
 - Briefly to "2"
 - Back to "3"

LED STOP first flashes with about 2Hz and then illuminates.

- 5. Turn the switch for NCK and PLC back to position "0".
- 6. After an error-free boot, the system generates the number "6" and a flashing point on the status display of the NCU.
 - LED RUN illuminates GREEN continuously.
- 7. Re-execute a POWER ON.
 - \Rightarrow PLC and NCK are in cyclic operation.

5.2 NCK and PLC general reset

Notes

Note

If a hardware RESET or POWER ON is triggered in switch position "3" on the PLC mode selector, then the complete SRAM of the PLC is initialized and the diagnostic buffer is not deleted. All user data must be transferred again.

If position "3" is selected for less than three seconds, no general reset is requested. Furthermore, the STOP LED remains unlit if the sequence "2"-"3"-"2" is not completed winthin three seconds after requesting general reset.

Note

For the first startup, module replacement, battery failure, general reset request via the PLC and PLC upgrade, the PLC general reset is absolutely required.

Note

Since no PLC start is executed after PLC general reset, the following alarms are displayed:

- Alarm: "120201 Communication failed"
- Alarm: "380040 PROFIBUS DP: Configuring error 3, parameter"
- Alarm: "2001 PLC not booted"

These alarms have no influence on how to continue.

See also

Separate NCK and PLC general reset (Page 280)

5.3 Boot completed

Introduction

After an error-free boot of the NCU, it displays the following:

- Number "6" and a flashing point
- LED RUN illuminates GREEN continuously

To resume commissioning on the user interface of the HMI, the following operating sequence is necessary:

Operating sequence for entry into commissioning

- 1. Press <Menu Select>, or the <F10> key on the PG/PC.
- 2. Press "Commissioning".

art-up Chan	CHAN1 nel reset		JOG Ref MPFO Progr	am aborted			
_				ROV			-
lachine	e configural	ion					
NCK Index	Name	Type Driv	Drive e Identifier		Motor Type	Channel	Change
1	X1	Lin				CHAN1	
2	Y1	Lin				CHAN1	Reset.
3	Z1 A1	Lin				CHAN1 CHAN1	
		Lin					
							Passwo
Curren	t access le	vel: Manufact.]	Details.
						\sum	Details.
Machir data		IC Drive syste		нмі			Optimiz. test

Figure 5-2 "Commissioning" menu

- 3. Press "Password...".
- 4. Press "Set password".
- 5. Enter the manufacturer's password "SUNRISE".
- 6. Press "OK".

Run-up has been completed.

In the following step, commissioning of the PLC is done with the SIMATIC Manager.

See also

Triggering a reset (warm restart) for NCK and drive system (Page 61)

Power on and boot up

5.3 Boot completed

Connect PG/PC with the PLC

6.1 Start SIMATIC Manager

Introduction

SIMATIC Manager is a GUI for online/offline editing of S7 objects (projects, user programs, blocks, hardware stations and tools).

The SIMATIC Manager lets you

- manage projects and libraries,
- call STEP 7 tools,
- access the PLC online.

Start SIMATIC Manager

After installation, the SIMATIC Manager icon appears on the Windows desktop, and in the Start menu a "SIMATIC Manager" program item appears under "SIMATIC".

1. Run SIMATIC Manager by double-clicking the icon, or from the Start menu (same as with all other Windows applications).

User interface

A corresponding editing tool is started up when you open the relevant objects. Start the program editor by double-clicking the program block you want to edit.

Online help

The online help for the active window is always called by pressing F1.

6.2 Setting up the communication

6.2 Setting up the communication

Introduction

To load the configuration into the PLC, the communications connection (Ethernet) from PG/PC to the PLC required for the loading must be secured.

Operating sequence for establishing a communications connection to the PLC

The communications connection to the PLC may be set from PG/PC via SIMATIC Manager with the following operating sequence:

- 1. Select menu command: "Extras" > "Set PG/PC interface..."
- 2. On the "Access Mode" tab, look for the interface used in the "Interface parameterization used" selection field, for instance: "TCP/IP -> Realtek RTL8139/810x F..."
- 3. Confirm the parameterization with "OK".

Note

Parameterization of the PG/PC interface can be performed or changed from the SIMATIC Manager at any time.

PLC commissioning

7.1 Creating a SIMATIC S7 project

Introduction

It is necessary to create an S7 project for the basic commissioning of the PLC, the Ethernet and PROFIBUS communication as well as the input/output data areas of the NCK. To do this you will have to perform the following operations:

- Create a project
- Insert a SIMATIC station 300
- Insert NCU 7x0 in HW Config
- · Configure the properties of the network interfaces
- Insert machine control panel and hand wheel

Note

The toolbox must have been installed.

What do you need to be aware of?

Loading the PLC via network interface X130 is also possible if the IP address of the Ethernet interface is known.

Loading an archive may always be carried out if the communication HMI-NCK is available.

Note

Loading the PLC (CP840) is essential for the configuration of the data path for saving/restoring the drive data. See Section "Terminating hardware configuration and loading to PLC" (Page 54)

Reference

The PLC interface signals are described in "Parameter Manual 2"

7.1.1 Creating a project

Introduction

You have started the SIMATIC Manager.

Operating sequence

- 1. To create a new project, select the "File" > "New" menu command in the SIMATIC Manager.
- 2. Enter the following project data in the dialog box:
 - Name (for example: PLC-Erst-IBN 840D sl)
 - Storage location (path)
 - Туре
- 3. Confirm the dialog with "OK".

The SIMATIC Manager opens and displays the project window with an empty structure of the S7 project.

PLC commissioning

7.1 Creating a SIMATIC S7 project

7.1.2 Inserting a SIMATIC station 300

Introduction

Before you introduce required hardware to the S7 project, the following steps are needed:

- Insert a SIMATIC station 300 in the project
- Starting HW-Config

Operating sequence

1. Select <right mouse button> "Insert new object" > "SIMATIC 300-Station" menu.

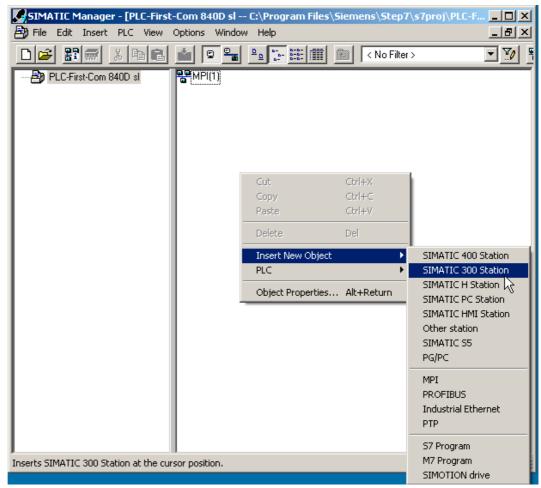
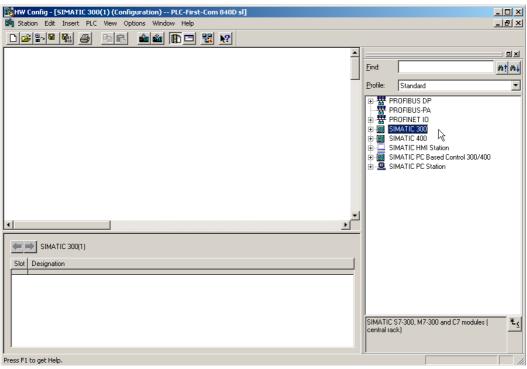


Figure 7-1 Inserting a SIMATIC station 300

- 2. Double-click on the symbol <SIMATIC 300 (1)>.
- 3. Double-click on the symbol <Hardware>.

The HW config for introducing required hardware is started.

4. In the menu, select "View" > "Catalog". The catalog with the modules is displayed (see following picture).





PLC commissioning 7.1 Creating a SIMATIC S7 project

7.1.3 Insert NCU 7x0 in HW config

Introduction

The user interface of "HW config" mostly displays (see the following figure):

• Station window:

The station window is split. The upper part displays the structure of the station graphically, and the lower part provides a detailed view of the selected module.

Hardware catalog

In this catalog, the NCU 7X0 that you need for configuring the hardware is also included.

Use the operating sequence described below to insert an NCU 720.1 as an example.

Operating sequence

- 1. Select "View" > "Catalog".
- Search for the module in the catalog under "SIMATIC 300" > "SINUMERIK" > "840D sl" > "NCU 720.1" (see following figure).

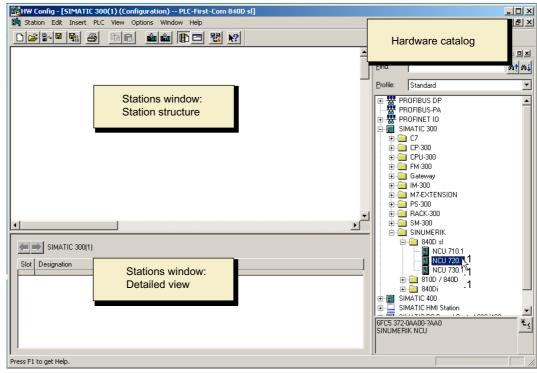


Figure 7-3 NCU 720.1 in the catalog

 Select NCU 720.1 with the left mouse button, hold the mouse button down and drag to the "Station design" station window.

After you release the mouse button, configure in the dialog box the interface properties of processor CP 840D sl located on NCU 720.1 (see next chapter).

7.1.4 Configuring the properties of the network interfaces

Introduction

In the STEP7 project, configure the following network interfaces you want to use to reach the NCU 7X0:

- PROFIBUS DP, only with machine control panel for PROFIBUS (see PROFIBUS machine control panel on the HMI (Page 304))
- Ethernet
- integrated PROFIBUS

When creating a new project using the catalog, the configuration of the PROFIBUS interface is called automatically.

Operating sequence for PROFIBUS DP

- 1. You used the left mouse button to select NCU 720.1 and while holding down the mouse button you dragged it to the "Station design" station window.
- 2. After you release the mouse button, configure the properties of PROFIBUS DP interface for socket X126 (machine control panel) in the dialog box (see figure below).

Properties		interface DP (R0/52.2)		X
rropercies	- PROPIDOS	Incertace DP (K0/32.2)		<u>~</u>
General	Parameters			
Address:		2 💌	If a subnet is selected the next available add	
Subnet:				
not	networked			New Properties Delete
OK			Ca	ncel Help

Figure 7-4 Properties of PROFIBUS DP

- 3. This is an Ethernet machine control panel, which does not require configuration. Select "Cancel".
- Module NCU 720.1 with SINAMICS S120 is inserted into the HW config (see figure below).

Note

With the <F4> key and confirmation of the question regarding "Reorganize", you can reorganize the display in the station window.

PLC commissioning

7.1 Creating a SIMATIC S7 project

HW Config - [SINUMERIK (Con	ew Options Window Help							_ D ×
	PROFIBUS(1): DP master s							
[0] NCU 720.1 2 PLC37 ▲ X136 MRI/DF X126 DP PCU DP	PROFIBUS Integrated: D		em (3)				Eind: Profile: Standard PROFIBUS DP	<u>mt</u> mi •
Opt D/ Mag 3 JM 360 4 2 5 Her co excit								<u> </u>
(0) NCU 720.1					•	<u> </u>	⊕-	
Slot Module 2 PLC317-2DP X15 MR/DP X12 DP	Order number 6FC5 317-2AJ10-0AB0	Firmware	MPI address 2 2	l ad <i>8191*</i> <i>8190*</i>	Q C		■ 0 NCU 720.1 ■ 0 NCU 730.1 ■ 0 810D / 840D ■ 0 840Di	
PO DP Integrated Opt 3 M/J 360 4 M/ZK 5400 s/ 5 5	6E57360-344.01-044.0			8189" 2000 256" 27226	272		GFC5 372-QAA00-?AA0 SINUMERIK NCU	• • •
Insertion possible			· · · · ·			-		Chg //

Figure 7-5 HW config with NCU 720.1

Next, specify the properties for the Ethernet interface.

Operating sequence for Ethernet interface

Note

Use socket X127 for commissioning of the PLC for the external HMI. No configuration of the Ethernet interface is required for this. This interface is set with IP address 192.168.215.1 as a default.

For the first commissioning of a HMI with a PG/PC, it is necessary to configure an Ethernet interface. In our example, this involves the interface to socket X120.

1. Double-click on "CP 840D sl" in the basic rack of the NCU 720.1. The dialog "Properties -Ethernet Interface CP 840D sl" is opened (see figure below).

Properties - CP 840	ID sl - (R0/S5)	×
General Addresse	\$	
Short Description:	CP 840D sl SINUMERIK CP for Industrial Ethernet TCP/IP	*
		v
Order No.:		
Name:	CP 840D st	
Interface		
Type:	Ethernet	
Address:	192.168.215.249	
Networked:	No Properties	
Comment:		
		×
OK	Cancel	Help

Figure 7-6 General properties of the CP 840D sl

2. After clicking on the "Properties" button, a new Ethernet interface can be created.

Properties - Ethernet interface CP 840D sl (F	R0/55) <u>×</u>
General Parameters	
IP address: 192.168.214.1 Subnet mask: 255.255.256.248	Gateway Do not use router Use router Address: 192.168.214.1
Subnet:	New Roperties
OK	Cancel Help

Figure 7-7 Properties of the Ethernet interface

The interface for socket X120 is used to commission the internal HMI. You will have to change the IP address.

- For socket X120, enter the IP address "192.168.214.1" and the Subnet screen form "255.255.255.0".
- 4. Create the Ethernet interface using "New" and then "OK".
- 5. Click on "OK" twice.

Next, specify the properties for the integrated PROFIBUS.

Operating sequence for integrated PROFIBUS

The integrated PROFIBUS for communication with the SINAMICS S120 requires a common Subnet ID. This Subnet ID has to be introduced to the external HMI in the MMC.ini.

- In the station window, click on the bus of the integrated "PROFIBUS PROFIBUS Integrated: DP Master System" and use the right mouse button to select the menu item "Object properties".
- 2. Click on "Properties" on the "General" tab.

Enter the ID "0046-0010" in field "S7 Sub-network ID".

Properties - New su	bnet Industrial Ethernet	x
General		
Name: S7 subnet ID: Project path: Storage location of the project:	Ethernet(1) 0046 - 0010 PLC-First-Com 840D sl C:\Program Files\Siemens\Step7\s7proj\PLC-Fi_1	
Author: Date created: Last modified: Comment:	01.08.2005 14:40:42 01.08.2005 14:40:42	
OK	Cancel Help	

Figure 7-8 Integrated PROFIBUS subnet ID

3. Click on "OK" twice.

Telegram lengths and I/O addresses

The telegram lengths and input/output addresses for communication between the PLC and the drive (can be viewed via the object properties of the integrated SINAMICS) are preassigned by default and do not require any configuration.

As the next step insert a NX component.

See also

Configuring the communication between the PLC and the drive (Page 282)

7.1.5 Insert NX in HW Config

Introduction

A NX component is contained in the example configuration, for the axis to control the spindle. This component must also be inserted in the HW Config when creating the SIMATIC-S7 project.

Operating sequence

- 1. Look for the NX module (NX10, NX15) in the hardware catalog under "PROFIBUS DP" > "SINAMICS" > "SINUMERIK NX...".
- Click with the left mouse button to select the "SINUMERIK NX ..." module and drag it to the "PROFIBUS Integrated DP master system" bus in the "Station design" station window.
- 3. The "DP Slave Properties" dialog box opens.

ieneral Configuration	Clock Synchronization	
Order number: Family: DP slave type:	6SL3040-0NC00-0AA0 SINAMICS SINUMERIK	
Description:	SINUMERIK_NX10	
Addresses Diagnostic address: Address for "slot" 2:	8186	Address: 15 C
SYNC/FREEZE Cap		Response monitoring
Comment:		

Figure 7-9 DP Slave Properties for NX15

Enter the address for the integrated PROFIBUS in this dialog.

The default value for the first NX15 is "15".

Note

The NX must be wired to the NCU via the DRIVE-CLiQ. A fixed DRIVE-CLiQ socket is provided for the relevant address.

The following table contains the wiring:

Integrated PROFIBUS address	DRIVE-CLiQ Socket NCU720	DRIVE-CLiQ Socket NCU710
10	X100	X100
11	X101	X101
12	X102	X102
13	X103	X103
14	X104	-
15	X105	-

1. Enter the address and press "OK".

Insert (41	84:63228)	X
1	Wiring for SINAMICS port X100 X1051 For address 15 the SINAMICS port X105 must be connected.	
🗖 Done	at display this message again.	
OK	-Ç	

Figure 7-10 Insert NX

2. Confirm the wiring notification with "OK".

3. After releasing the mouse button, the NX module is added (see figure below).

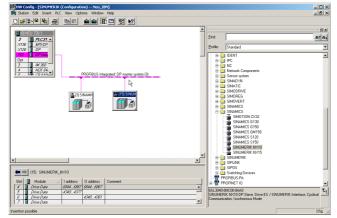


Figure 7-11 NX in HW Config

Note

When deleting and re-inserting NX modules in the hardware config., new slot addresses are issued during addressing. In order to create a unique, and always the same configuration, we would recommend arranging addressing as shown in the following table:

Integrated PROFIBUS address	DRIVE-CLiQ socket, e.g.: NCU720	Start address of first control slot	Start address of last control slot
15	X105	4340	4540
14	X104	4580	4780
13	X103	4820	5020
12	X102	5060	5260
11	X101	5300	5500
10	X100	5540	5740

7.1.6 End hardware configuration and load to the PLC

End hardware configuration and load to the PLC

To end the overall configuration and generate the system data for the PLC, the project must be saved and compiled.

- 1. Select the menu "Station" > "Save and compile".
- 2. Click on the button "Load in module", to load the configuration to the PLC.

The "Select target module" dialog mask automatically displays both configured communication partners (see figure below).

Select Target Module			×
Target modules:			
Module		Racks	Slot
PLC317-2DP		0	2
CP 840D sl		0	5
Select All			
ок 🔎	Cancel	- F	lelp
<u>_</u>			

Figure 7-12 Selecting target module

- 3. Confirm with OK to load into these two modules.
- 4. Confirm the dialog boxes displayed subsequently with "OK" or "No" for the query "...Should the module be started now (restart)?".

Note

You can test the communication interface at "Target system > Diagnosis > Operating mode".

5. Close the "HW config" window.

The next step is to create the PLC program.

7.2 Creating a PLC program

Introduction

The operating sequence for the creation of a PLC program describe how to create a basic program.

The SIMATIC STEP7 documentation describes how to modify and extend an application program.

7.2.1 Insert PLC basic program

Introduction

You have performed hardware configuration, have saved and compiled the project ad have created the system data for the PLC.

You have installed the toolbox software, which also contains the libraries for the PLC basic program of an NCU 7x0.

You are on the main screen of the SIMATIC Manager.

Operating sequence to open library and copy sources, symbols and blocks

1. Select the "File" > "Open" menu and then click on the "Libraries" tab (see figure below).

en Project					
User projects Li	braries Sar	nple projects	Multiprojec	ts	
Name		Storage path			
📚 bp7x0_15		C:\Program P	iles\Siemer	ns\Step7\S7libs	s
🚸 bp7x0_26		C:\Program F	iles\Siemer	ns\Step7\S7libs	
😔 Redundant I () CGP V40	C:\Program F	iles\Siemer	ns\Step7\S7libs	s
📚 Redundant I () CGP V50	C:\Program F	iles\Siemer	ns\Step7\S7libs	s
😔 Redundant I () MGP V30	C:\Program F	iles\Siemer	ns\Step7\S7libs	s
SIMATIC_NE	T_CP	C:\Program P	iles\Siemer	ns\Step7\S7libs	s—
📚 Standard Libr	ary	C:\Program F	iles\Siemer	ns\Step7\S7libs	s 🗣
1 1 1 1 1 1 1 1 1 1		<u> </u>	- 10 ⁻	· · · · · · · · · · · · ·	Γ
	Selected				
Jser projects:					
.ibraries:	1				
ample projects:					
Aultiprojects:				Browse	
ок	,	F	Cancel	Help	
UN		_	Cancer		·

Figure 7-13 Opening the library

 Select the library for the PLC basic program, e.g. "bp7x0_26" and confirm the dialog with "OK". 7.2 Creating a PLC program

You have inserted the library and selected the PLC program under "PLC-Erst-IBN 840D sl" > "SINUMERIK" > "PLC 317 2DP" > "S7 Program" (see figure below).

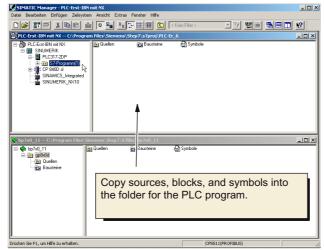


Figure 7-14 Copy the PLC program

3. Copy the sources, modules and symbols to the PLC program

Overwriting OB 1

Inserting blocks overwrites the existing organization block OB1. Confirm the query as to whether you want to overwrite the block with "Yes".

You have now created the PLC basic program.

In the next section you will modify some of the data for the machine control panel in OB100.

7.2.2 Modifying Ethernet machine control panel in OB100

Introduction

The PLC basic program automatically transfers the machine control panel signals (MCP signals) and the addresses of the MCP in the HW config if the configuration is set up as laid out below.

Operating sequence

• Under "Blocks", double-click on "OB100" to open it.

In OB100, the parameters below have to be preset:

```
MCPNum := 1
MCP1IN := P#E 0.0
MCP10UT := P#E 0.0
MCP1StatSend := P#E 8.0
MCP1StatREc := P#E 12.0
```

MCPBusAddress := 192

MCPBusType = B#16#55

You have completed the configuration of the PLC basic program.

In the next step, you will load the project to the PLC.

7.3 Loading the project to the PLC

7.3 Loading the project to the PLC

Introduction

For loading the configured PLC project, the following prerequisites must be fulfilled:

Requirement

- An Ethernet network connection exists between STEP7 and the PLC.
- The configuration to be loaded corresponds to the actual station configuration.
- NCU 7x0 is active
 - NCK is in cyclic mode
 - PLC in RUN or STOP mode

Supplementary condition

The following supplementary conditions regarding the system data blocks must be observed when the configuration is loaded:

• HW Config

When loading the configuration via HW Config, only the system modules and their associated system data blocks selected in HW Config when loading the configuration are loaded into the module. However, global data defined in SDB 210 is not loaded from the HW Config, for example.

You have loaded the HW config to the module in the previous chapter "End hardware configuration and load to the PLC".

SIMATIC Manager

When loading the configuration via the SIMATIC manager all the system data blocks are loaded into the module.

Note

When the PLC program is loaded in the "RUN" mode, each block loaded becomes active immediately. This can result in inconsistencies when executing the active PLC program. It is therefore advised to place the PLC in the "STOP" mode before loading the configuration, if this has not already been done.

Operating sequence for loading system blocks into the module

- 1. To load the configuration of the system blocks change to the SIMATIC Manager.
- 2. In the SIMATIC Manager in the PLC directory, select the directory "Blocks" > right mouse button> "Target system" > "Load" (see figure below), or the "Load" symbol.

SIMATIC Manager - Neu_	IBN					_ 🗆 ×
File Edit Insert PLC View	Options Window Help					
	6 🔬 🔍 🛀	5 🗄 🏢	Ko Filter >	• 10	뫲 🛞	
Neu_IBN C:\Program F	iles\Siemens\Step7\s7pr	oj\Neu_IBN				-OX
Neu_IBN SINUMERIK G= 10 PLC317-20P G= 25-Program G= 25-Program G= 25-Program G= 25-Program G= 25-PadDa a SINUMERIK_N SINUMERIK_N	FC2	OB40 FB1 FB5 FF5 FF10 FC3 Ctrl+X Ctrl+C Ctrl+Y Del	OB82 FR2 FR5 FF6 FF7 FF7			
	Rewire Compare Blocks Reference Data Check Block Consistency Print		CPU Messages Display Force Values Monitor/Modify Variables Hardware Diagnostics			
Bausteine	Rename Object Properties Special Object Properties	F2 Alt+Return	Module Information Operating Mode Clear/Reset Set Time of Day	Ctrl+D Ctrl+I		
Downloads current object to the						

Figure 7-15 Loading system blocks

- 3. If there is no connection to the destination system, you must confirm in sequence the following dialog requests with:
 - "OK" for "Check the required sequence of blocks for correct functioning"
 - "Yes" for "Do you want to load system data?"
 - "Yes" for "Must system data be deleted on the module and replaced by off-line system data?"
 - "No" for "The module is in STOP mode. Do you want to start the module (cold restart)?"

You have loaded the PLC program to the PLC; the PLC is in "STOP" mode.

7.4 Configuring an Ethernet machine control panel

Note

If the PLC is stopped via the SIMATIC Manager, then it also has to be started via the SIMATIC Manager. Starting via the PLC mode selector is also possible.

NOTICE

A reset (warm restart) of the NCK is required for the PLC-NCK synchronization.

7.4 Configuring an Ethernet machine control panel

Note

If you have an Ethernet machine control panel with Ethernet hand wheel, a "7" for "Ethernet" must be entered for the hand wheel in the general machine data MD11350[0] \$MN_HANDWHEEL_SEGMENT.

7.5 Triggering a reset (warm restart) for NCK and drive system

7.5 Triggering a reset (warm restart) for NCK and drive system

Introduction

On the HMI the "Commissioning" menu contains:

art-up	CHAN1		JOG Ref	MPFO			
Chan	nel reset			Program aborted ROV		_	
lachine	e configurati	on					
NCK			Drive		Motor		
Index	Name	Type Dri	ive Identif	ier	Туре	Channel	Change languag
1	X1	Lin				CHAN1	
2	Y1	Lin				CHAN1	Reset
3	Z1	Lin				CHAN1	neset
4	A1	Lin				CHAN1	_
							Passwor
Curren	t access lev	el: Manufact.					
							Details
					_	\sum	_
Machir data	^{ne} N	C Driv syst		PLC HMI			Optimiz. test

Figure 7-16 "Commissioning" menu

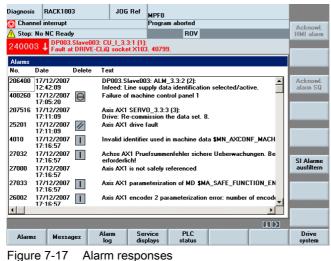
The STOP condition of the PLC which is taken by the PLC for a short time on loading is interpreted by the NC as a PLC failure with an appropriate alarm response.

Alarm response



Press the button and select the "Diagnostics > Alarms" menu.

The system may display the following alarms on the HMI (see figure below):



A "reset" (warm restart) is required for the PLC-NCK synchronization.

7.5 Triggering a reset (warm restart) for NCK and drive system

Operating sequence for initiating an NCK reset

- 1. Press the key and select the "Commissioning" menu.
- 2. Press the "Reset..." softkey.
- 3. Answer the question "Do you want to trigger a reset (warm restart) for the NCK and the entire drive system (all drive units)?" with the "Yes" softkey.

The PLC goes to RUN mode.

 \square

See also

Drive diagnostics (Page 268)

7.6 First commissioning of the PLC completed

First commissioning of the PLC completed

You have completed the first commissioning of the PLC.

The PLC and NCK are in the following state:

- LED RUN illuminates GREEN continuously.
- Status display shows a "6" with a flashing point.
 - \Rightarrow PLC and NCK are in cyclic operation.

Continue with the steps for commissioning the SINAMICS drives.

You can access the HMI as follows:

Start-up CHAN1	JOG Ref MPFO Program aborted ROV	-	
Machine configuration NCK Index Name Type D	Drive ldentifier	Motor Type Channel	Change language
1 X1 Lin 2 Y1 Lin 3 Z1 Lin 4 A1 Lin		CHAN1 CHAN1 CHAN1 CHAN1	Reset
			Password
Current access level: Manufact.			Details
	ive PLC HMI		Optimiz./ test

Figure 7-18 PLC commissioning complete

7.6 First commissioning of the PLC completed

Commissioning SINAMICS drives

Introduction

You have completed commissioning of the PLC.

Startup sequence

The basic commissioning of the SINAMICS drives should be carried out in the following sequence:

- 1. Creating factory settings (if commissioning has been completed)
- 2. Configure the drive unit (including transfer of the DRIVE-CLiQ topology to the drive unit)
- 3. Update the component firmware (if necessary)
- 4. Parameterization of the infeed (if available)
- 5. Parameterization of the drives (SERVOs)
- 6. Optimize the drives

Note

Prior to starting commissioning, switch off all drive enables.

8.1 Introduction to commissioning of SINAMICS drives

8.1 Introduction to commissioning of SINAMICS drives

Introduction

Commissioning of the SINAMICS drives is done in the operating area "Commissioning".

Introduction to commissioning of SINAMICS drives

1. After having completed commissioning of the PLC, you proceed from the following operating interface.

St	art-up	C	HAN1		JOG Ref	MPEO					
1	Chan	nel re	set				am aborted				
							ROV				
ŀ	lachin	e conl	figuration								
	NCK				Drive			Motor			
	Index	Nam	e T	ype Drive	ldentifi	er		Туре	Ch	annel	Change language
	1	X1	Lin						CH	AN1	
	2	Y1	Lin						CH	AN1	Reset
	3	Z1	Lin							AN1	
	4	A1	Lin						СН	AN1	
											Password
[Curren	tacci	ess level: Mar	ufact							
l	Gairon										Details
										\sum	Details
	Machii data		NC	Drive system		LC	нмі				Optimiz./ test
				-					_		· · · · · ·

Figure 8-1 "Commissioning" menu

2. Press the "Drive system" softkey.

There are two different ways to start in the "Commissioning" > "Drive system" menu:

- The drive system has not yet been commissioned (see following figure).

Start-up	CHAN1	JOG Ref	MPF0	
// Channe	el reset		Program aborted ROV	
120402	↓ DP003.Slave003: (CU: Initial start-u	p required	8
Drive setup				
Bus	Drive O Address -Name	bject	-Number	Factory setting
3	3 CU_I_O	03	1	
				Reset
				Load firm ware
				Assign axis
				Identify via LED
Drive devices	Supplies E	Drives		

Figure 8-2 "Drive system" menu

8.1 Introduction to commissioning of SINAMICS drives

This shows an NCU with factory settings that is ready for the first commissioning.

A message appears that a first commissioning is required.

Note

Perform the first commissioning. Start with the operating sequences described in Section "First commissioning of the drive units (Page 71)".

The drive system has already been commissioned.

Then start, for example, with the following user interface:

Sta	art-up Channel	CHAN1 interrupt		JOG Ref	MPF0 Program abo	rted			
∕	Stop: No	Mode Group				ROV			
2	01416	DP003.Sla	ve003: CU_ Comparise	1_3.3:1 (1) co	omponent Moto	r_Module	_5: pology, Compo	nent	
Dr	ive setup	т. э <u>г</u>					- <u>-</u> ,		
Г			Drive Objec	*					
	Bus /	Address	-Name		-1	lumber			Factory
	3	3	CU_I_3.3:1			1			setting
ľ			ALM_3.3:2			2			
			SERVO_3.3	:3		3			
			SERVO_3.3	:4		4			
			SERVO_3.3	:5		5			Reset
	3	15	CU_NX_3.1	5:1		1			Load firm-
			SERVO_3.1	5:2		2			ware
l									Assign axis
									unio
									Identify
]								via LED
	Drive devices	Supplies	Driv	es					
_		~ ~	D ·						

Figure 8-3 Drive system has already been commissioned

Infeed and drives (SERVOs) can be commissioned with the drive wizard (Page 79).

The factory settings can be restored for the drive system with the vertical softkey "Factory settings...". A first commissioning must then be performed again for the drive units.

Note

If commissioning is to be performed using the factory settings, then start with the operating sequence described in the Section "Restoring factory settings" (Page 68).

8.2 Activate the factory settings

8.2 Activate the factory settings

Introduction

If a commissioning has already been performed, then the drive system can be reset to the factory settings with the "Factory settings..." function.

NOTICE

Before restoring the factory settings, ensure that the EP terminal (Enable Pulses) of the infeed (booksize: X21, chassis: X41) is de-energized.

Procedure for activating factory settings

1. You are in the "Commissioning" > "Drive system" menu.

	nel interrupt		Program aborted	
Stop:	No Mode Gro	up Ready	R0V	
20141	6 J DP003.	Slave003: CU_I_3.	1:1 (1) component Motor_Module_5: Iditional component in actual topology. Com	nonent
ive setur	1.1	iy: companyon: <u>a</u>		ponent
ive secul				
Bus	Address	Drive Object -Name	Number	Factor
				setting.
3	3	CU_I_3.3:1	1	
		ALM_3.3:2	2	
		SERV0_3.3:3	3	
		SERV0_3.3:4	4	
		SERV0_3.3:5	5	Reset
3	15	CU_NX_3.15:1	1	1
		SERVO 3.15:2	2	Load firr ware
				Assign
				axis
				Identify
ิล				via LED

Figure 8-4 "Commissioning > Drive system" menu

2. Press the "Factory settings..." softkey.

Start-up	CHAN1		JOG Ref	MPF0				
💮 Channe	el interrupt			Program	n aborted			
🔥 Stop: N	lo Mode Gro	up Ready			ROV			
201416	DP003.	Slave003: CU gy: Compariso	_l_3.3:1 (1) c on, additiona	omponen I compor	t Motor_Mo ient in actua	dule_5: Il topology. C	omponent	
Drive setup								
		Drive Objec	:t					
Bus	Address	-Name			-Number			
3	3	CII I 334			1			
	Start-up							
	Which dri	ve objects do	you wish to	set to the	factory set	ing?		Current DO
								Drive device
								device
3								Drive
								system
								Abort
L								
					_			
Figure	e 8-5	Ques	stion					

3. Press "Drive system" to restore the factory settings for all drive units used in the system (the NCU and NX modules).

	No Mode Grou	ip noddy	R0		
e setur)				
		Drive Object			
Bus	Address	-Name	-Numb	ber	
3	3	CII I 334		1	
	Start-up				
	Disease	uitab tha duina			
	Flease st	vich die unve	system off and on again so the	at the factory	
	settings b	ecome effectiv	system off and on again so the e.	at the factory	
	settings b Commissi	ecome effectiv oning can be o	ystem off and on again so the e. ontinued after communication		
	settings b Commissi	ecome effectiv	e.		
3	settings b Commissi	ecome effectiv oning can be o	e.		
3	settings b Commissi	ecome effectiv oning can be o	e.		
3	settings b Commissi	ecome effectiv oning can be o	e.		
3	settings b Commissi	ecome effectiv oning can be o	e.		
3	settings b Commissi	ecome effectiv oning can be o	e.		
3	settings b Commissi	ecome effectiv oning can be o	e.		

Figure 8-6 Switch factory settings off/on

8.2 Activate the factory settings

4. Switch the control (NCU and NX) off (de-energized drive system) and then on again.

Wait until communication has been established again with the NC.

s	tart-up	CHAN1		JOG Ref	MPF0				
1	🖉 Channe	l reset			Program a				
		_				R0V			
	120402	1 DP003.	Slave003: CU:	Initial start-	up required			Ð	
D	rive setup								
			Drive Objec	:t					
	Bus	Address	-Name			-Number			Factory setting
	3	3	CU_I_003			1			
									Reset
									Load firm- ware
									Assign axis
									Identify via LED
Ľ									THE LED
	Drive devices	Suppl	ies Driv	es					
F	igure	e 8-7	Com	munica	ation r	e-esta	blished		

A message appears that a first commissioning is required.

Start the first commissioning with the operating sequence described in the next section.

8.3 First commissioning of the drive units

8.3 First commissioning of the drive units

Introduction

The following unit configuration is performed during the first commissioning of the drive units:

• Transfer of the DRIVE-CLiQ topology to the drive unit

With the transfer of the topology, all components connected on the DRIVE-CLiQ are detected and the drive-internal data traffic is initialized.

• Drive-object assignment for PROFIBUS connection.

The PROFIBUS connection via the relevant message frames has been specified with the configuration in the HW Config.

Requirement

• The drive unit is in the first commissioning state.

Note the following:

NOTICE

Up to SINAMICS V2.5

It must be ensured that compatible firmware has been loaded on all components. If necessary, stop the operation and first load the firmware from the CompactFlash card to all components of the drive unit(s).

The operating sequence for loading the firmware are described in Section "Update of the component firmware".

Note

As of SINAMICS V2.5, an automatic firmware update is undertaken when powering up if required.

8.3 First commissioning of the drive units

Operating sequence

1. Press the "Drive units" softkey in the "Commissioning" > "Drive system" menu.

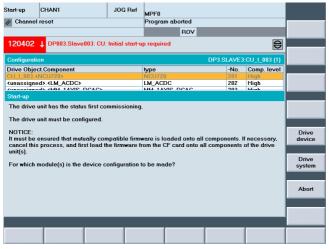


Figure 8-8 "Commissioning" > "Drive system" > "Drive units" menu

You are reminded once again that the drive unit is in the first commissioning state and that a unit configuration must be performed for the drive system.

In the example for first commissioning it is assumed that compatible firmware has been loaded on all components.

2. Press the "Drive system" vertical softkey.

During the unit configuration there are a succession of messages containing information on the respective configuration of the individual drive components.

Depending on the size of the drive system, this can take several minutes.

Before the configuration is completed, the HMI displays the following query:

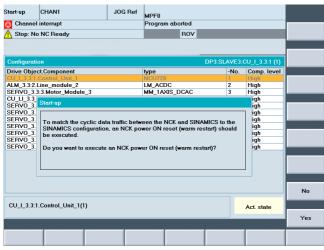


Figure 8-9 Unit configuration, warm restart

8.3 First commissioning of the drive units

3. Press "Yes" to perform an NCK power on restart (warm restart).

Start-up 🖸 ???	777 777			
???	???			
Stop: No NC Ready	DRY ROV M	11	PRT	
120201 Communication failure			HMI	
Configuration	DP3.SI	AVE3:	CU_I_3.3:1 (1)	
Drive Object.Component	type	-No.	Comp. level	
Start-up				
The configuration of drive unit com If necessary, please check and co link' dialog. Then continue with commissioning	rrect the settings in the 'PROFIE	IUS		
CU_I_3.3:1.Control_Unit_1(1)				
Communications to NC failed.				ок

Figure 8-10 Message after the unit configuration has been completed

The unit configuration for the drive units and drive components of the NCU has been completed.

If necessary check and correct the settings in the "PROFIBUS connection" dialog.

4. Press "OK".

If you have selected the NCU, then the drive components of the NCU are displayed.

Start-up	RACK1003	JOG Re	MPF0					
🗑 Cha	nnel interrupt		Progra	m aborted				
	p: No NC Ready			ROV				Drive device+
808	0 🕴 4 option(s) i	is/are activated wi	thout settii	ng the licens	e key		\bigcirc	Drive
Config	juration				DP3.9	SLAVE 3: CU	_1_3.3:1 (1)	device-
Axis	Drive Object	Component	type		-No.	FW-Vers.	C.level	
	CU I 3.3:1	Control Unit 1	NCU720		1	2503201	High	Select
	ALM 3.3:2	Line module 2	LM ACDO	:	2	2503200	High	drive dev
	SERVO 3.3:3	Motor Module 3	MM 2AX	S DCAC	3	2503200	High	diffe def.
	SERV0_3.3:4	Motor_Module_4	MM_2AX	S_DCAC	4	2503200	High	
	CU_LI_3.3_TO_3	CU_LINK_13	NX15	_	13	2503201	High	
	SERVO 3.3:3	SM 14	SMx mod	ule sin/cos	14	2503200	High	Change
	SERVO 3.3:5	Motor Module 5	MM 1AX	S DCAC	5	2503200	High	
	<unassigned></unassigned>	SMI20 16	SMI20	_	16	2502600	High	
	<unassigned></unassigned>	Encoder 17	Analog S	ensor	17		High	Load firm-
	<unassigned></unassigned>	Motor SMI 18	SMI-Moto	r	18		High	ware
	SERV0 3.3:4	SM 9	SMx mod	ule sin/cos	9	2503200	High	
	SERVO 3.3:5	SMI20 6	SMI20		6	2503200	High	
	SERVO 3.3:5	Encoder 7	Analog S	ensor	7		High	Details
	SERV0_3.3:5	Motor_SMI_8	SMI-Moto	r	8		High	D OCUMO
								Sort
<mark>. CU_I_</mark>	_3.3:1.Control_Unit_	.1(1)						Display options
Confi atic		PROFIBUS link	Connec- tions	Inputs / Outputs			Control unit MD	File functions

Figure 8-11 Unit configuration completed, NCU unit configuration

8.3 First commissioning of the drive units

5. Press "Drive unit +".

If you have selected the NX, then the drive components of the NX are displayed.

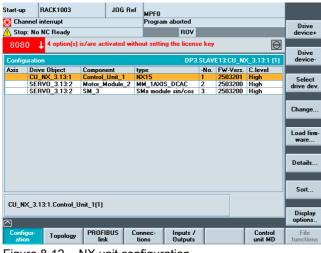


Figure 8-12 NX unit configuration

If necessary you can correct and/or modify the settings in the "PROFIBUS connection" dialog.

6. Press "PROFIBUS connection" > "Change ... ".

7180 12 Input 24 (255) 7180 12 Output 24 4900 13 Act val 38 4900 14 Set val 22 7204 16 Input 24 (255) 4940 17 Act val 38 4940 18 Set val 22 7228 20 Input 24 (255)	Start-up	RACK1003	JOG Ref	MPFO			
8080 4 option(s) is/are activated without setting the license key PROFILIUS link DP3.SLAVE13:CU_NX_3.13:1 (1) 1/20- addr. Slot Length SINAMICS- dive object SINAMICS- telegram type 7132 4 Output 24 4820 5 Act val 38 4820 6 Set val 22 7156 8 Input 24 4860 9 Act val 38 4860 10 Set val 22 7180 12 Input 24 4900 13 Act val 38 4900 14 Set val 22 7204 16 Input 24 4940 17 Act val 38 4940 18 Set val 22 7224 16 Input 24 4940 18 Set val 38 4940 17 Act val 38 4940 18 Set val 22 <td>🗑 Channe</td> <td>el interrupt</td> <td></td> <td>Program abort</td> <td>ed</td> <td></td> <td></td>	🗑 Channe	el interrupt		Program abort	ed		
PROFIBUS ink DP3.SLAVE 13.CU_NX_3.13.1 [1] 1-/O_ addr. Slot Length SINAMICS- SINAMICS- addr. Slot Type [byte] drive object telegram type 7132 4 Output 24 SIEMENS 116 SIEMENS 116 <td>🔥 Stop: N</td> <td>No NC Ready</td> <td></td> <td>R</td> <td>07</td> <td></td> <td></td>	🔥 Stop: N	No NC Ready		R	07		
I -/D addr. Slot Length SINAMICS- SINAMICS- addr. Slot Type [byte] drive object telegram type 7132 4 Output 24 Site Name 4820 5 Act val 38 4820 6 Set val 22 7156 8 Input 24 4860 9 Act val 38 4860 10 Set val 22 7180 12 Input 24 4900 13 Set val 38 4900 14 Set val 38 4900 14 Set val 22 7204 16 Input 24 4940 17 Act val 38 4940 18 Set val 22 7224 16 Output 24 4940 18 Set val 38 4940 18 Set val 22 7228 20 Input 24	8080	4 option(s) is/are	e activated witho	out setting the li	cense key	Ð	
addr. Stot Type [byte] dive object telegram type 7132 4 Output 24 Stervition 32220 Stervition 32220 Stervition 32220 7132 4 Output 24 Stervition 32220 Stervition 32220 Stervition 32220 7132 4 Output 24 Stervition 32220 Stervition 32220 Stervition 32220 7135 8 Input 24 (255) - - 7186 12 Input 24 (255) - - 7180 12 Output 24 (255) - - 7180 12 Output 24 (255) - - 7180 12 Output 24 (255) - - 7204 16 Input 24 (255) - - 7204 16 Output 24 (255) - - 49400 17 Act val 38	PROFIBU	IS link			DP3.SLAVE13:CU_N	K_3.13:1 (1)	
112 4 Imput 24 SERVU 31.3.2(2) SIEMENS 116 2 17132 4 Output 24 38 -			ength SINAMI	CS- SIN	IAMICS-		
17132 4 Output 24 4820 5 Act val 38 4820 6 Set val 22 7156 8 luput 24 4860 9 Act val 38 4860 9 Act val 38 4860 9 Act val 38 7180 12 luput 24 4900 13 Act val 38 7204 16 input 24 4940 17 Act val 38 4940 18 Set val 22 7204 16 input 24 1940 18 Set val 22 7204 16 input 24 1940 17 Act val 38 4940 18 Set val 22 7228 20 input 24 1928 20 input 24		lot Type [t			egram type		
7132 4 Output 24 4820 5 Act val 38 4820 6 Set val 38 4820 6 Set val 22 7156 8 Output 24 4860 9 Act val 38 4860 10 Set val 32 7180 12 Input 24 4860 10 Set val 38 4860 10 Set val 38 4860 10 Set val 22 7180 12 Input 24 4900 13 Act val 38 4900 14 Set val 22 7204 16 Input 24 4940 17 Act val 38 4940 18 Set val 22 7228 20 Input 24 4940 18 Set val 22 728 20 Input 24 128 10 Input 24 <td></td> <td></td> <td></td> <td>3.13:2[2] SIE</td> <td>MENS 116 🔊</td> <td></td> <td></td>				3.13:2[2] SIE	MENS 116 🔊		
Instruct 24 25 - 7156 8 Input 24 (255) - 7156 8 Output 24 (255) - 7156 8 Output 24 (255) - 7180 12 Input 24 (255) - 7180 12 Output 24 (255) - 7180 12 Output 24 (255) - 7180 12 Output 24 (255) - 7204 16 Input 24 (255) - 7204 16 Input 24 (255) - 4940 17 Act val 38 - - 4940 18 Set val 22 - - 7228 20 nput 24 (255) - -							
7155 8 Input 24 (255) 7155 8 Output 24 (255) 4860 9 Act val 38 4860 10 Set val 32 7180 12 Input 24 (255) 7180 12 Output 24 (255) 7180 12 Output 24 (255) 7180 12 Output 24 (255) 7204 16 Input 24 (255) 7204 16 Output 24 (255) 4940 13 Set val 38 About 4940 13 Set val 22 7228 20 Input 24 (255)							
T156 8 Output 24 4860 9 Act val 38 4860 10 Set val 22 7180 12 luput 24 4900 13 Act val 38 4900 13 Act val 38 4900 14 Set val 22 7204 16 Input 24 4940 17 Act val 38 4940 17 Act val 38 4940 18 Set val 22 7224 16 Input 24 4940 18 Set val 22 7228 20 Input 24							
IdeB0 9 Act val 38 (255) (255							
Id80 10 Set val 22 Overvie 7180 12 Input 24 (255) - 4900 13 Act val 38 - - 4900 13 Act val 38 - - 7204 16 Input 24 (255) - 7204 16 Output 24 440 - 4940 17 Act val 38 - - 4940 17 Act val 38 - - 4940 18 Set val 22 - - 7284 16 Input 24 - - Abort							
7180 12 Input 24 (255) 7180 12 Output 24 (255) 4900 13 Act val 36 4900 14 Set val 22 7204 16 Output 24 (255) 4940 7 Act val 38 4940 18 Set val 32 4940 18 Set val 22 7284 16 Output 24 (255)							
T180 12 Input 24 (255) - 7180 12 Output 24 (255) - 4900 13 Act val 38 - - 4900 14 Set val 22 - - 7204 16 Input 24 - - 4940 17 Act val 38 - - 4940 18 Set val 22 - - 7228 20 nput 24 (255) - -							Overview
1900 13 Act val 38 1900 14 Set val 22 7204 16 Input 24 (255) 7204 16 Output 24 400 71 Act val 38 4940 17 Act val 38 4940 18 Set val 22 About 7228 20 Input 24 (255) About							
4900 14 Set val 22 7204 16 Input 24 (255) 7204 16 Output 24 (255) 4940 17 Act val 38 4940 18 Set val 22 7228 20 Input 24 (255)							
7204 16 Input 24 (255) 7204 16 Output 24 (440) 7 Act val 38 4940 17 Act val 38 Abort 4940 18 Set val 22 Abort 7228 20 Input 24 (255)							
7204 16 Output 24 4940 17 Act val 38 4940 18 Set val 22 7228 20 Input 24							
Image: 1940 17 Act val 38 4940 18 Set val 22 7228 20 input 24							
4940 18 Set val 22 Abort 7228 20 Input 24 (255)							
7228 20 Input 24 (255)							
							Abort
	7228 20						
4980 21 Act val 38	4980 21	1 Act val 3	8			¥	04
	\bigcirc						UK
Configur- ation Topology PROFIBUS Connec- tions Dutputs / Control File		Topology					File functions

Figure 8-13 PROFIBUS NX connection

8.3 First commissioning of the drive units

Start-up	nnel int	ACK1003 terrupt		JOG Ref	MPF0 Program a	aborted			
🔨 Stop	: No N	C Ready			-	ROV			
808	0 t	4 option(s) i	s/are activ	ated witho	ut setting	the license key		\ominus	
PROFI	BUS lir	nk				DP3.SLA	VE3:CU_I_3.3	3:1 (1)	
1-70-	addr.	Slot	Length	SINAMI	CS-	SINAMICS-			
addr.	Slot	Туре	[byte]	drive ob		telegram type			
6700	4	Input	24	SERVO	3.3:3 (3)	SIEMENS 6			
6700	4	Output	24						
4100	5	Act val	38						
4100	6	Set val	22						
6724	8	Input	24	SERVO_	3.3:4(4)	SIEMENS 116			
6724	8	Output	24						
4140	9	Act val	38						
4140	10	Set val	22						Overview
6748	12	Input	24	SERVO	3.3:5(5)	SIEMENS 116			
6748	12	Output	24						
4180	13	Act val	38	_					
4180	14	Set val	22						
6772	16	Input	24	(255)					
6772	16	Output	24	_					
4220	17	Act val	38	-					
4220	18	Set val	22	(055)					Abort
6796	20	Input	24	(255)					
6796	20	Output	24	-				~	
4260	21	Act val	38					Ň	ок
									UK
Config		Topology	PROFIBL		nec-	Inputs / Outputs		ntrol t MD	File function:

Figure 8-14 PROFIBUS NCU connection

Check and, if required, correct the settings.

7. Press <RECALL>.

Stop: N	o Mode Gro	up Ready	ROV	
01416	1 DP003.	Slave003: CU_I_3.3:1	(1) component Motor actual topology. Component	
	Topolo	gy: Comparison, addr	tional component in actual topology. Component	
ve setup				
		Drive Object		
Bus	Address	-Name	-Number	Facto
3	3	CU_I_3.3:1	1	
		ALM_3.3:2	2	
		SERV0_3.3:3	3	
		SERV0_3.3:4	4	
		SERV0_3.3:5	5	Reset
3	15	CU_NX_3.15:1	1	Load fi
		SERV0_3.15:2	2	ware.
				Assig
				axis
				Identi
				via LE

Figure 8-15 Overview of drive system

The following section describes how you can perform an update of the component firmware using the "Load firmware..." function.

In the example for first commissioning it is assumed that compatible firmware has been loaded on all components.

In our example, skip this step and continue with the operating sequence for the Commissioning of the drive components (Page 79) (infeed, drive, encoder).

See also

Updating the component firmware (Page 76)

8.4 Updating the component firmware

8.4 Updating the component firmware

Loading firmware update for SINAMICS V2.5 and higher

Note

SINAMICS V2.5 and higher

As of SINAMICS V2.5, an automatic firmware update is undertaken when powering up the drive system if required.

Manual updates for the individual components are not needed in such cases.

After powering up and when operating the control, the drive firmware can however always be loaded from the CompactFlash card.

You activate the "Load firmware ..." function from the "Commissioning > Drive system" menu.

Loading firmware update for up to SINAMICS V2.4

Prior to initial startup, all SINAMICS components should have the same firmware version. The software required for this forms part of the SINAMICS software and is stored on the CompactFlash card. An update of individual components may become necessary, after component replacement for example, and is required if the drive-specific alarm A01006 "Firmware update required for DRIVE-CLiQ component <No.>" appears.

Note

If a firmware update is run before configuring the device, once this is complete continue with the "First commissioning of drive units (Page 71)" operating sequence.

Requirement

All components of the NCU/NX accessible (connected via DRIVE-CLiQ).

8.4 Updating the component firmware

Operating sequence

1. You are in the "Commissioning" > "Drive system" > "Drive units" > "Configuration" menu.

	p: No NC Ready		ROV				Drive device+
808 Config	guration	is/are activated wi	thout setting the licen:			[]	Drive device-
Axis	Drive Object	Component	type	-No.	FW-Vers.	C.level	
	CU I 3.3:1	Control Unit 1	NCU720	1	2503201	High	Select
	ALM_3.3:2	Line_module_2_	LM_ACDC	2	2503200	High	drive dev.
	SERV0_3.3:3_	Motor_Module_3	MM_2AXIS_DCAC	3	2503200	High	unte dev.
	SERV0_3.3:4	Motor_Module_4	MM_2AXIS_DCAC	4	2503200	High	
	CU_LI_3.3_TO_3		NX15	13	2503201	High	Ch
	SERV0_3.3:3_	SM_14	SMx module sin/cos	14	2503200	High	Change
	SERV0_3.3:5	Motor_Module_5	MM_1AXIS_DCAC	5	2503200	High	
	<unassigned></unassigned>	SMI20_16	SMI20	16	2502600	High	-
	<unassigned></unassigned>	Encoder_17	Analog Sensor	17		High	Load firm
	<unassigned></unassigned>	Motor_SMI_18	SMI-Motor	18		High	ware
	SERV0_3.3:4	SM_9	SMx module sin/cos	9	2503200	High	
	SERV0_3.3:5	SMI20_6	SMI20	6	2503200	High	
	SERV0_3.3:5	Encoder_7	Analog Sensor	7		High	Details
	SERV0_3.3:5	Motor_SMI_8	SMI-Motor	8		High	
211 1	3.3:1.Control Unit	1(1)					Sort
<mark>เบ_เ</mark>	_3.3.1.20A001_0A0(_						Display options
		PROFIBUS	Connec- Inputs /			Control	File

Figure 8-16 Loading firmware

- Select the next drive module, the NCU or NX with the vertical softkey "Drive unit+/Drive unit-".
- 3. Press the vertical sotfkey "Load firmware ...".
- 4. The "Load all" softkey loads the firmware from the CompactFlash card to all DRIVE-CLiQ components of the drive unit (NCU or NX).

Note

Depending on the design of the SINAMICS drive group, a complete update of component firmware can take about 30 minutes.

The component, on which a firmware update is performed, is indicated by a flashing LED.

- 5. Answer the query "Must firmware from the CompactFlash card be loaded to the component?" with "Yes".
- 6. After the firmware update has been completed, the entire control (NCU, all NX and all DRIVE-CLiQ components (motor modules, encoder interfaces, etc.)) must be switched off (de-energized) and then switched on again so that the firmware update can take effect.

Follow the instructions displayed on the HMI after the firmware update has been completed.

You can now continue with the commissioning of the drive components (infeed, motor modules, encoders).

8.4 Updating the component firmware

Loading firmware for the entire drive system

The "Commissioning" > "Drive system" menu contains the option for activating a complete component firmware update for the entire drive system.

Note

Depending on the design of the SINAMICS drive group, a complete update of component firmware can take about 30 minutes.

The component, on which a firmware update is performed, is indicated by a flashing LED.

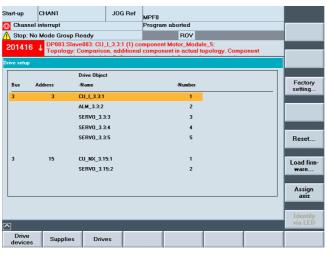


Figure 8-17 Load firmware using the "Commissioning" > "Drive system" menu

8.5 Commissioning using a drive wizard

Introduction

Drive configuration is done with a drive wizard on the HMI. The following drive components are to be configured:

- Active Line Module (infeed)
- Motor module, motor and encoders (drives)

Operating sequence for drive configuration

The drive configuration can be opened by selecting "Commissioning" > "Drive system" in the menu.

art-up	CHAN1		JOG Ref	MPF0		
Chann	el interrupt			Program aborted		
Stop:	No Mode Gro			ROV		
20141(6 1 DP003.	Slave003: CU_L	_3.3:1 (1) co additiona	omponent Motor_Modu I component in actual f	ile_5: topology Component	
ive setup	1.1	97: 00 F			obere 39. eeinteenem	
ive setup		D.1. 011 - 1				
Bus	Address	Drive Object -Name		-Number		Factory
				-Number		
3	3	CU_I_3.3:1		1		
		ALM_3.3:2		2		
		SERV0_3.3:3		3		
		SERV0_3.3:4		4		
		SERV0_3.3:5		5		Reset
3	15	CU_NX_3.15:	1	1		Load fir
		SERV0_3.15:	2	2		ware
						Assign
						axis
_						Identify via LED
]				-		VIA LEL
	Suppli	ies Drives	3			
Drive device	s Suppli	ies Drive	3			

Figure 8-18 Overview of first commissioning

- 1. Press the corresponding softkey for the drive object to be configured.
 - "Infeeds"
 - "Drives" for drive controls (SERVO)
- 2. Configuration is performed in the following sequence:
 - You select the component with the vertical softkey "Infeed+/Infeed-" or "Drive+/Drive-"
 - Press the vertical softkey "Change" and follow the drive wizard with the horizontal softkey "Next >".
 - Parameterize the appropriate configuration in the dialog box that appears.

The following chapters "Parameterization of infeed" and "Parameterization of drive components" list the dialog in detail.

8.5.1 Parameterization of infeed

Introduction

You want to configure/parameterize the Active Line Module of your SINAMICS> You have selected the menu "Commissioning" > "Drive system" > "Infeed". You are in the following menu:

Start-up (CHAN1	101	G Ref						
		300	antei	MPF0					
🥢 Channel r	eset			Program	aborted			_	Supply
					ROV				+
\Supplies\0	Overview					DP3.SLAVE3	ALM_3.3:	2 (2)	Supply
Drive objec	ct name:					ALM	3.3:2	^	
Drive objec							-		Select
PROFIBUS	telegram:						-		a supply
								=	Change
									Netzdaten
									Metzudien
	li li	nfeed has not t Infeed has to							
		meeu nus to	00 010	ugin into	operation.				
								~	
\frown									
Configur- ation	Connec- tions						Supp MD	ly	File functions

Figure 8-19 Menu "Infeed" > "Configuration"

Operating sequence

1. If multiple infeeds are present, select the infeed with "Infeed+/Infeed-".

The system detects that the infeed has not been commissioned and that a commissioning is required (see above figure).

Note

If necessary, check the network data using the "Network data" vertical softkey function (see section "Checking/setting network data settings for power supply (Page 274)").

The commissioning is performed with the "Change" vertical softkey.

2. Press the vertical softkey "Change".

tart-up	CHAN1	JOG Ref	MPF0	
Channel	reset		Program aborted	
			ROV	
\Supplies	s\Configuration - Names		DP3.SLAVE3:ALM_3.3:2	(2)
Supply	ALM 3.3:2			
	drive object name			
Drive ob	ject name:	ALM	_3.3:2	
Acc	cept the drive object nam	e for the Activ	e Line Module.	
- Configure	ation of the Active Line M	odule		
-	f Active Line Modules:		_module_2	
Name of	Active Line Modules.	Line	_module_z	
Operatin	g type:	Net	ein / -rückspeisung	_
			Abort	Next >

Figure 8-20 Menu "Infeed" > "Configuration - names" (Change)

- 3. If required, assign a drive object name or accept the default settings.
- 4. Follow the drive wizard with the horizontal softkey "Next >".

5. The default values in the following dialogs are standard values and can be taken over with "Next >".

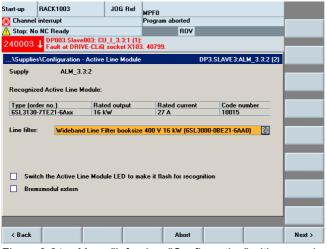
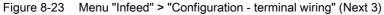


Figure 8-21 Menu "Infeeds > "Configuration" with recognized ALM (Next 1)

Start-up	CHAN1	JO	G Ref MP	=0			
// Channel	reset		Pro	gram aborted			
				ROV			
\Supplies	Configuration -	Additional date	1		DP3.SLAVE3:	ALM_3.3:2 (2)	
Supply	ALM_3	.3:2					
	DC link identifica determined value			0			
Notice	ietermineu valu	es are saveu p	iowenaii-pr	JUIJ			
If the DC lin	ik capacity of the						
(devices re	moved/added),	a new identific	ation will h	ave to be perform	ed.		
Device sup	ply voltage:	4(10	v			
Line rated f	requency:	50		✓ Hz			
PROFIBUS	PZD telegram:	Fr	ee telegrar	n configuration wi	th BICO	¥	
Note							
	ice supply volta as open-loop co			e Line Module is			
			_				
< Back				Abort			Next >

Figure 8-22 Menu "Infeed" > "Configuration - additional data" (Next 2)

Start-up	CHAN1	JOG Ref	MPF0			
// Channe	l reset		Program aborted			
			ROV			
\Supplie	s\Configuration - Terminal	wiring		DP3.SLAVE3:	ALM_3.3:2 (2)	
) connections for standard	l terminal wiri	ng			
si	NAMICS-internal line cont	actor control				
Output	erminal supply control line	e contactor:				
Input te	rminal supply checkback	line contacto	r			
< Back			Abort			Next >



art-up Channe	CHAN1	JOG Ref	MPF0 Program aborted			
			ROV			
\Supplie	s\Configuration - Su	immary		DP3.SLAVE3:A	ALM_3.3:2 (2)	
Supply	ALM_3.3:	2				
he follow	ving supply data ha	ve been entered:				
Supply:	bject name: ALM_3	2.2				
Active	Line Module name:	Line_module_2				
	no.: 6SL3130-7TE21	-6Axx				
Rated	output: 16 kW current: 27 A					
Line fil		N - 4 11 - 4 1 -				
	e Sensing Module: Additional data	Not available				
Line/D	C link identification	on first Power ON: `	r'es			
	e supply voltage: 40 ted frequency: 50 H					
PROFI	BUS PZD telegram					

Figure 8-24 Menu "Infeed" > "Configuration - summary" (Next 4)

6. This completes the configuration for the infeed. You can check the configuration in the summary.

7. Press the "Finish >" softkey.

🖉 Channe	l reset		Program aborted		
			ROV		
\Supplie	s\Configuration - Summa	y	DP3.SLAVE3:AL	M_3.3:2 (2)	
Supply	ALM_3.3:2				
The follow	wing supply data have be	en entered:			
Supply:	Start-up				
Drive Active	I he configuration of in		:2 has been completed.		
Order	infood ALM 2 2:2 is to		latile manner if the configuration of		
Rated Bated	Would you like to store		nfeed ALM_3.3:2 in a non-volatile		
Line fil	1 manner?				
Voltag Supply -					
Line/D Device	()				Abort
	e neu rrequency, ou mz				
Line re	BUS PZD telegram:				
Line re	boor zo telegram.				
Line re	boot 25 telegram.				No
Line re	boo r 25 tologram.				No
Line re	boor 20 talgram.				No Yes
Line re					

Figure 8-25 Saving a configuration

8. Press "Yes".

The data is saved as non-volatile data.

Start-up	CHAN1	JOG	Ref MPF0					
// Channel	reset		Progra	m aborted				Supply
				ROV				suppiy *
							_	Supply
\Supplies	\Overview				DP3.SLAVE3:A	VEM_3.3:		-
Drive obje	ect name:				ALM_	3.3:2	<u>^</u>	
Drive obje	ect number:					2		Select a supply
PROFIBU	S telegram:		Fre	e telegram con	ifiguration with E	BICO		a suppry
-ALM 3.3	2.Line module 2	(Supply)					_	
	ent number:	(2	,		Change
				LOTIN				
Supply	type:				LINE MODULE			
Order n	D.:			6SL31	30-7TE21-6Axx			
Rated o	utput:					kW		
DC link	voltage setpoint:				400			
Geräte-	Anschlussspannu	ing:			400) V		
Netzfree	quenz				50) Hz		
Identify	via LED				0]		
							~	
Configur- ation	Connec- tions					Supp MD		File functions

Figure 8-26 Menu "Infeed" > "Configuration" > "Finish"

9. Press the <RECALL> key in order to parameterize/configure the drives in the next step.

8.5.2 Parameterization of the drives

Introduction

The following components are parameterize/configured with the drive wizard:

- Motor
- encoder
- Interface signals

Parameterizing/configuring

You are in the "Commissioning" > "Drive system" menu.

ALL drives (SERVOs) are configured via the "Drives" softkey.

Note

Motors with SMI (DRIVE-CLiQ) are automatically configured by the drive unit during the device configuration with a drive data set (DDS), but only with the motor measuring system; i.e. motors with SMI only have to be configured with the drive wizard when more than one drive/motor/encoder data set (DDS/MDS/EDS) or a second (direct) measuring system is required.

If a motor module (power section) is connected to a motor of which the encoder is controlled via the SMC (Sensor Module Cabinet), i.e. not with a SMI (Sensor Module Integrated), then you have various configuration options at your disposal.

- Standard motors, listed with corresponding motor data.
- Third-party motors where the motor data can be freely configured.

Commissioning SINAMICS drives

8.5 Commissioning using a drive wizard

	nel interrupt		Program aborted	
<u> </u>	No Mode Gro		ROV I) component Motor_Module_5:	_
20141	6 J Topolo	gy: Comparison, additi	onal component in actual topology. Compone	nt
ive setur)			
		Drive Object		
Bus	Address	-Name	-Number	Factory setting
3	3	CU_I_3.3:1	1	ootting.
		ALM_3.3:2	2	
		SERV0_3.3:3	3	
		SERV0_3.3:4	4	
		SERV0_3.3:5	5	Reset
3	15	CU_NX_3.15:1	1	Load firr
		SERV0_3.15:2	2	ware
				Assign
				axis
	_			Identify via LED
ן				THE LEE

Figure 8-27 Overview of first commissioning

1. Press the "Drives" softkey in order to configure the following drives (SERVOs):

- Drive with listed motor and encoder via SMC (without DRIVE-CLiQ)
- Drive with third-party motor and additional second encoder via SMC (without DRIVE-CLiQ)

The drive wizard identifies the relevant design of the drives and guides you through the configuration in the dialog.

8.5.2.1 Commissioning of listed motor and encoder via SMC

Introduction

In our example a power section is to be configured with a listed motor and encoder. You have selected the "Commissioning" > "Drive system" > "Drives" menu. You are in the following menu:

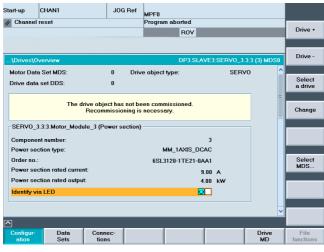


Figure 8-28 "Drives" > "Configuration" menu

Operating sequence

1. Select the drive with the vertical softkey "Drive+/Drive-".

The system detects that the drive object has not been commissioned and that a new commissioning is required (see above figure).

The new commissioning is performed with the "Change" vertical softkey.

2. Press the vertical softkey "Change".

Note

If commissioning has already been performed, press "New commissioning" and "OK".

Commissioning SINAMICS drives

8.5 Commissioning using a drive wizard

Start-up	CHAN1	JO	G Ref	MPE0		
// Channe	l reset			Program aborted		
_				R0V		
1Dair real (Configuration - N	latas Madula			E3:SERVO_3.3:3 (3) ME	200
(Drives)	sonnguration - k	NOTOF MODULE		DFJ.SLAVI	_3.3ERV0_3.3.3 (3) ML	750
Enter the	drive object na	ime				
Drive of	bject name:	SER	VO_3.3	:3	Ø	
Configur	ation of the Mot	or Module				1
Name o	f Motor Module:	Moto	or Mod	ule 3		
Recogn	ized Motor Mod	ule:				
Type (or		Rated output		Rated current	Code number	
6SL3120	-1TE21-0AA1	4.80 kW		9.00 A	10003	
Sw	itch the Motor M	odule LED to m	ake it fl	ash for recognition		
				Abort		Next >

Figure 8-29 Menu "Drives" > "Configuration - motor module" (Change)

- 3. The drive wizard identifies the power section (Motor module). You can assign a new drive object name or accept the default setting.
- 4. Follow the drive wizard with the horizontal softkey "Next >".
- 5. The following dialog boxes are displayed in succession for the configuration:

tart-up CHAN	1	JOG Ref	MPF0					
Channel reset			Program aborted					
			R0V					
			1101		_			
\Drives\Configure	ation - Motor		DP3.SL	AVE3:SERV0_3	.3:3 (3) MDS0			
Name of motor:	Motor_14							
Motor selec.:	tor selec.: 🧿 Select a standard motor from the list							
	O Enter motor data							
		Ji uala		ate nom nst				
Motor type:	1FK6 synchronou	is motor	✓ F	ind:	*			
Select motor								
Type (order no.)	Rated spee	d Rated	torque Rated curr	ent Code num	ber			
1FK6042-6AF7x-xxxx	3000 U/min	2.60 N	m 2.40 A	23604	~			
1FK6044-7AF7x-xxxx	3000 U/min	3.50 N	m 4.00 A	23607	E			
1FK6060-6AF7x-xxxx	3000 U/min	4.00 N	m 3.10 A	23609				
1FK6061-7AF7x-xxxx	3000 U/min	5.40 N	m 5.30 A	23610				
1FK6063-6AF7x-xxxx	3000 U/min	6.00 N	m 4.70 A	23612				
1FK6064-7AF7x-xxxx	3000 U/min	8.00 N	m 7.50 A	23613	~			
					Y			
< Back			Abort			Next >		
	<u> </u>							
igure 8-3	u Menu	i "Drive	es" > "Conf	iguration	- moto	r" (Next		

- 6. In this dialog box, select the "Select standard motor from list" button.
- 7. Select the motor with the "Cursor up / Cursor down" keys.
- 8. Press "Next >".

Start-up	CHAN1	JOG Ref	MPF0	
// Chanr	el reset		Program aborted ROV	
			NUV	
\Drives	Configuration - Motor ho	lding brake	DP3.SLAVE3:SERV0_3.3:3 (3)	MDS0
Motor ho	lding brake configuration	c.		
No moto	r holding brake being us	ed	8	
Ex Ex	panded brake control			
< Bac	()		Abort	Next >

Figure 8-31 Menu "Drives" > "Configuration - motor holding brake" (Next 2)

9. You can select brake control in the "Configuration - motor holding brake" dialog.

If a connected brake is detected during the unit configuration, the system will automatically activate the brake control and will by default display "Brake control according to procedural control" here.

10.Press "Next >".

Start-up	CHAN	1	JOG Ref	MPF0				
// Channel	reset			Program aborted				
				R0V				
\Drives\C	onfigur	ation - Encoder		DP3.SLA	VE3:SERVO 3.3:3 (3) MDS0			
	Which encoder would you like to use? Mask out encoders already assigned to other DOs from the select. List							
M Enco	der	SM_12.Encoder_	13	Y				
Connection of the Sensor Module: SMx module sin/cos: SM_12 (12) X500								
	Switch	the Sensor Modu	le LED to mai	ke it flash for recognitio	in 💼			
Enco	der			v				
Connection	n of the	Sensor Module:						
	Switch	the Sensor Modu	le LED to mal	ke it flash for recognitio	n			
Enco	der			¥				
Connection	n of the	Sensor Module:						
	Switch	the Sensor Modu	le LED to mai	ke it flash for recognitio	in 💻			
< Back				Abort	N	ext >		

Figure 8-32 Menu "Drives" > "Configuration - encoder" (Next 3)

11.Press "Next >".

An identification of the selected encoders is triggered (Encoder 1).

The drive unit can identify encoders with EnDat protocol. These encoders are selected in the encoder list in the follow-up dialog boxes ("Configuration - Encoder 1" menu).

The entry "No encoder" is selected in the encoder list for encoders that the drive unit cannot identify.

Commissioning SINAMICS drives

8.5 Commissioning using a drive wizard

						lden-
\Drives\Configuration	n - Encoder 1		DP3.SLAVE	3:SERV0_3.3:3 (3)	MDS0	tify
lame:	En	coder_13				
ncoder evaluation:	SM	x module sin	s: SM 12 (12) X500			
Select a motor enco						
Type (order no.)	Encoder type			Code number		
	No encoder			0	<u>^</u>	
6SL3055-0AA00-5xxx	Resolver 1 speed			1001	E	
6SL3055-0AA00-5xxx	Resolver 2 speed			1002		Enter
6SL3055-0AA00-5xxx	Resolver 3 speed			1003		data
6SL3055-0AA00-5xxx 6SL3055-0AA00-5xxx	Resolver 4 speed			1004		
6SL3055-0AAUU-5xxx 6SL3055-0AA00-5xxx	2048, 1 Vpp, A/E			2001 2002		
65L3055-0AA00-5xxx	2048, 1 Vpp, A/E	н		2002	~	Details
Select 'Identify', so t	at the drive unit i	dentifies the	nected encoder. Th	is is conditional up	on	Details
he encoder supporti						
Select 'Input data'	n order to param					
Select 'Details' in a	rder to paramete	rize data suc	s the actual-value in	version and extern	al	
ero mark.						

Figure 8-33 Selecting an encoder (Next 4)

The encoder connected via SMC20 must be configured.

art-up Channe	CHAN1		JOG Ref	MPF0 Program abor	ted			
	16361			-	30V	_		
\Drives\(Configuration	- Encoder 1		D	P3.SLAVE3:S	ERVO_3.3:3 (3	B) MDS0	lden- tify
Name:		l.	Encoder_13					_
Encodere	valuation:	5	SMx module	sin/cos: SM_12	(12) ×500			
	notor encode	r: Encoder type			C-	de number	_	
Type (order	no.j	Encoder type No encoder			0	de number		
6SL3055-0/	A00 5	Resolver 1 sp	had		10	01	- <u>^</u>	
6SL 3055-0		Resolver 2 sp			10		_E	
6SI 3055-04		Resolver 3 sp			10			Enter
6SL3055-0/		Resolver 4 sp			10		-	data
6SL3055-0/	A00-5xxx	2048, 1 Vpp, /			20	01		
6SL3055-04	A00-5xxx	2048, 1 Vpp, /			20	02	~	
	entify', so tha er supporting			ne connected e	ncoder. This i	s conditional		Details.
				encoder manu	ally			_
				such as the actu		sion and exte	rnal	
ero mark		•						
	_		_					

Figure 8-34 Selecting an encoder from the list

12.Select the motor encoder from the list: Select the encoder with the "Cursor up / Cursor down" keys.

Note

You can specify the following data using the "Details..." function:

- Inversion of the actual speed value
- Inversion of the actual position value
- External zero mark

Alternatively, the encoder system can be parameterized manually using the "Enter data" softkey.

13.Press "Enter data".

	HAN1	JOG Ref	MPF0				
Channel re	eset		Program abo	rted			
				ROV			
	nfiguration - Encoder 1 ·	Encod		0P3.SL	AVE3:SERVO_	3.3:3 (3) MDS0	
Encoder typ	e	Incremente	l signal				
💿 rotary		Pulse no./re	evolution:		2048		
Meas. syste							
Incremental							
Encoder eve							
SMx module	sin/cos	-Zero mark					
		Configuratio	-		/revolution	Y	
		-		ru mark			
		Zero mark (2048	Steps	
		Number of a	ero I		1		
		Synchroniz	ation				
		Coarse sy		F	ine synchroniz	2	
		O No			🔿 None		Abort
		O Po	le pos. identifi	cat.	Zero mark:	5	Abon
			ll sensors /track				
		U U	JUACK				ок
							UK

Figure 8-35 Enter data

Configure the encoder in the following fields:

- Encoder type
- Incremental tracks
- Zero marks
- Synchronization
- 14.Press "OK".
- 15.Press "Next >".

Start-up	CHAN1	JOG Ref	MPF0						
🥢 Channel	l reset		Program aborted						
			R0V						
\Drives\0	Configuration - Clloop c	ontr. typ	DP3.SLA	VE3:SERVO_3.3	3:3 (3) MDS0				
Select the	closed-loop control typ	e and the PRO	FIBUS telegram type.						
	_				Y				
Clloop co	ontr. type:	Speed control							
PROFIBUS	S PZD telegram:	SIEMENS teleç							
according	The PROFIBUS process data are interconnected with BICO parameters according to the telegram type selected. These BICO parameters cannot be changed at a later stage.								
Number of	f DDSs for this MDS:	1							
		_							
< Back			Abort			Next >			

Figure 8-36 Menu "Drives" > "Configuration - control type/setpoints" (Next 5)

16.Set the number of required drive data sets (DDS). The default setting is the maximum possible number (8) of drive data sets. For optimal utilization of the drive unit, the number of drive data sets should be reduced to the number actually required.

17.Select the control type and the PROFIBUS message frame type.

The default setting is the PROFIBUS message frame 116 for solution line / SINAMICS.

18.Press "Next >".

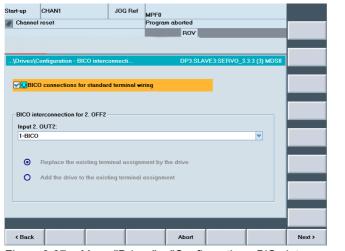


Figure 8-37 Menu "Drives" > "Configuration - BiCo interconnection" (Next 6)

19. Select the assignment for the terminal for Input 2. OFF2 (Page 294).

20.Press "Next >".

Start-up // Channe	CHAN1 Il reset	JOG Ref	MPF0 Program aborte	d)V			
	Configuration - Summary wing drive data have ber		DP	3.SLAVE3:SEI	RVO_3.3:3 (3) MD9	60 	
Motor Mod Name o Type (o Rated o Rated o Code nu Motor: Name o No moto Motor ty Type (o Rated s Rated c	(Motor Module: Motor, Modul der no.): 651:3120-1120-40 dupt: 4.80 kW urrent: 9.00 A miber: 10003 f motor: Motor_14 r holding brake being used pre-11K5 synchronous motor der no.): 11K6060-66F7x.xxx pred: 3000 U/min urrent: 3.10 A urrent: 3.10 A materix: 3209	A1					
< Back			Abo	rt		Ready >	
Figure	e 8-38 Men	u "Driv	es" > "Co	nfigura	tion - sum	imary" (N	ext 7)

- 21. The configuration of the drive (SERVO) with listed motor is completed. You can check the
- configuration in the summary.
- 22.Press the "Finish >" softkey.

Start-up	CHAN1	JOG Ref	MPF0		
// Channe	el reset		Program aborted		
			ROV		
\Drives\	Configuration - Summary	,	DP3.SLAVE3:SERV0_3	.3:3 (3) MDS0	
The follow	wing drive data have be	en entered:			
Drive:					
	jiant name: SERVA 3.3-3				
Motor Mod Name of	Start-up				
Type (or	The configuration of		.3:3 has been completed.		
Rated o Bated c			latile manner for the configuration of Iter a restart.		
Code nu	Would you like to sto		rive SERVO_3.3:3 in a non-volatile		
Motor:	manner?				
Name of No moto					
Motor ty					Abort
Type (or Rated a	peed: 3000 U/min			·	[
	urrent: 3.10 A				
Rated c					1
Rated to	orque: 4.00 Nm				No
Rated to Code nu	umber: 23609			~	No
Rated to	umber: 23609			~	
Rated to Code nu	umber: 23609			~	No Yes
Rated to Code nu	umber: 23609				

Figure 8-39 Menu "Drives > Configuration - summary" >"...save permanently..." (Finish)

- 23.Confirm the query with "Yes".
- 24. The next section describes how you can configure a drive (SERVO) with a third-party motor and a second encoder.

8.5.2.2 Commissioning of third-party motor and additional second encoder via SMC

Introduction

In our example a power section is to be configured with third-party motor and encoder. You have selected the "Commissioning" > "Drive system" > "Drives" menu. You are in the following menu:

Start-up		JOG R	- MPF0							
// Cha	annel reset		Program aborted ROV			Drive +				
\Driv	ves\Overvie w		DP3.SLAVE15	:SERV0_3.15:2	2 (2) MDS0	Drive -				
Moto	r Data Set MDS:	0	Drive object type:	SERV0	^					
Drive	e data set DDS:	0			=	Select a drive				
	The drive object has not been commissioned.									
	Recommissioning is necessary.									
SEP	VO_3.15:2.Motor_Module	_2 (Power sec	tion)							
Com	ponent number:		2							
Pow	er section type:		MM_1AXIS_DCAC	;						
Orde	er no.:		6SL3120-1TE23-0AA1			Select MDS				
Pow	er section rated current:		30.00	A		MD5				
Pow	er section rated output:		15.10	k₩						
Iden	tify via LED		O	l						
						_				
Conf ati		Connec- tions			Drive MD	File functions				

Figure 8-40 Menu "Drives" > "Configuration" (external motor)

Operating sequence

1. Select the drive with the vertical softkey "Drive+/Drive-".

The system detects that the drive object has not been commissioned and that a new commissioning is required (see above figure).

The new commissioning is performed with the "Change" vertical softkey.

2. Press the vertical softkey "Change".

Note

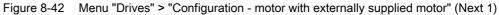
If commissioning has already been performed, press "New commissioning" and "OK".

Start-up	CHAN1		IOG Ref	MPF0		
🥢 Channel	reset			Program aborted		
				R0V		
\Drives\C	onfiguration - Mo	tor Module		DP3.SLAV	E15:SERV0_3.15:2	(2) MDS0
- Enter the	drive object nam	e				
	,					
Drive ob	ject name:	S	ERV0_3.1	5:2	8	
Configure	tion of the Motor	Module				
blama af	Motor Module:		otor Mod	ula 2		
Name of	Motor Module.		0101_14100	ule_z		
Recogni	zed Motor Modul	e:				
Type (ord		Rated out	out	Rated current	Code number	
6SL3120-	1TE23-0AA1	15.10 k₩		30.00 A	10005	
Swit	tch the Motor Mod	tule LED to	make it fl	ash for recognition		

Figure 8-41 Menu "Drives" > "Configuration - motor module" (Change)

- 3. The drive wizard identifies the power section (Motor module). You can assign a new drive object name or accept the default setting.
- 4. Follow the drive wizard with the horizontal softkey "Next >".
- 5. The following dialog boxes are displayed in succession for the configuration:

Start-up CHAN1	JOG Ref	MPF0			
// Channel reset		Program aborted			
		ROV			
					_
\Drives\Configuration - Motor Mo	Jule	DP3.SLAVE1	5:SERV0_3.1	5:2 (2) MDS0	
Enter the drive object name					
Drive object name:	SERVO_3.1	5:2	Ø		
Configuration of the Motor Module	•				
Name of Motor Module:	Motor_Mod	ule_2			
Recognized Motor Module:					
Type (order no.) Rate	d output	Rated current	Code number		
6SL3120-1TE23-0AA1 15.1) kW	30.00 A	10005		
Switch the Motor Module LE	D to make it f	ask for reconstition			
Switch the Motor Module LE	D to make it fi	ash for recognition			
		Abort			Next >



- 6. Select "Enter motor data" and the motor type.
- 7. Press "Next >".

Commissioning SINAMICS drives

8.5 Commissioning using a drive wizard

Start-up // Channel	CHAN1 reset	JOG Ref	MPF0 Program aborted		
10.1.10			ROV		
Motor hold	onfiguration - Motor hol	:	DP3.SLAVE	15:SERV0_3.15:2	
No motor h	iolding brake being use	d		8	
🗌 Expa	nded brake control				
					_
< Back			Abort		Next >

Figure 8-43 Menu "Drives" > "Configuration - motor holding brake" (Next 2)

8. You can select brake control in the "Configuration - motor holding brake" dialog.

If a connected brake is detected during the unit configuration, the system will automatically activate the brake control and will by default display "Brake control according to procedural control" here.

9. Press "Next >".

Addror data, asynchronous motor (rotating): V p304[0] Rated motor voltage 380 V p305[0] Rated motor current 9.76 A p309[0] Rated motor power 3.70 KW p309[0] Rated motor power 5.161 Hz p310[0] Rated motor power factor 0.74 = p310[0] Rated motor speed 1500 rpm p321[0] Rated motor speed 9000 rpm				R0V			
Wotor data, asynchronous motor (rotating): p304(0) Rated motor voltage 380 V p305(0) Rated motor current 9.76 A p306(0) Rated motor power 3.70 kw p308(0) Rated motor power p310(0) Rated motor power factor 0.74 p311(0) Rated motor speed 1500 rpm p325(0) Motor cooling type [1] Forced cool							
Motor data, asynchronous motor (rotating): p304(0) Rated motor voltage 300 V p305(0) Rated motor current 9.76 A p305(0) Rated motor power factor 0.74 p308(0) Rated motor power factor 0.74 p308(0) Rated motor speed 1500 rpm p321(0) Rated motor speed 9000 rpm p325(0) Moximum motor speed 9000 rpm							
p305[0] Rated motor current 9,76 A p307[0] Rated motor power factor 0,74 p308[0] Rated motor power factor 0,74 p308[0] Rated motor frequency 51,61 Hz p311[0] Rated motor speed 1500 rpm p325[0] Moximum motor speed 9000 rpm p335[0] Motor cooling type 11 Forced cod ○ ▼	.\Drives\C	onfiguration - Motor		DP3.SLAVE15:SERVC	3.15:2 (2) MDS0	1
p304(0) Rated motor voltage 380 V ∧ p305(0) Rated motor current 9.76 A p307(0) Rated motor power p307(0) Rated motor power fractor 0.74 p p308(0) Rated motor requency 51.61 Hz p311(0) Rated motor speed 1500 rpm p312(0) Moximum motor speed 9000 rpm p325(0) Moximum motor speed 9000 rpm							
p 205(0) Acted motor current 9.76 A p 207(0) Acted motor power 3.70 kW p 208(0) Rated motor requency 51.61 Hz p 201(0) Rated motor requency 51.61 Hz p 202(0) Moximum motor speed 9000 rpm p 232(0) Motor cooling type [] Forced coo	viotor data	, asynchronous motor (ro	tating):				
9307(0) Rated motor power 3.70 kW 9308(0) Rated motor power factor 0.74 - 93010(0) Rated motor requency 51.61 Hz 9311(0) Rated motor speed 1500 rpm 9322(0) Moximum motor speed 9000 rpm 9335(0) Motor cooling type [1] Forced cool V	p304[0]	Rated motor voltage		380	V		
p308(0) Rated motor power factor 0.74 p310(0) Rated motor frequency 51.61 Hz p311(0) Rated motor speed 1500 rpm p322(0) Moximum motor speed 9000 rpm p335(0) Motor cooling type [1] Forced coo	p305[0]	Rated motor current		9.76			
p310[10] Rated motor frequency 51.61 Hz p3110[10] Rated motor speed 1500 rpm p322[0] Moximum motor speed 9000 rpm p335[0] Motor cooling type [1] Forced coo	p307[0]	Rated motor power		3.70	kW		
p311[0] Rated motor speed 1500 rpm p322[0] Maximum motor speed 9000 rpm p335[0] Motor cooling type 1] Forced cod ↓ ↓	p308[0]	Rated motor power f	actor	0.74		=	
p322[0] Maximum motor speed 9000 rpm p335[0] Matar cooling type [1] Forced cool [1] v	p310[0]		су		Hz		
p335(0) Motor cooling type [1] Forced cod					rpm		
	p322[0]	Maximum motor spee	ed				
Do you want to input the equivalent circuit diagram data?		Motor cooling type		[1] Forced coo		~	
	p335[0]	motor cooling type					

Figure 8-44 Menu "Drives" > "Configuration - motor data 2" (Next 3)

- 10.Use the "Cursor Up/Cursor Down" keys to select the parameters that need to be changed from the list of motor data.
- 11.Enter the motor data.
- 12.Press "Next >". If you have activated "Replacement circuit diagram data" and you select "Next >", the following dialog will appear:

art-up	MC510VG	Jog	MPFO					
Channel	interrupt		Program aborte	d				
Stop: No	o Mode Group Ready		R	DV				
3000	Emergency stop							
. VAntrieb	e\Konfiguration - Motor		DP3.SLAVE	E15:D0_HSP (2) M	DS0 AX6:	HSP		
Equivalen	nt circuit diagram data, a	asynchron.					_	
p326[0]	Motor stall torque	correction fa	ctor	88 📀	2	1		
p341[0]	Motor moment of i			0.00396	kgm2			
p344[0]	Motor weight			15.8	kg			
p348[0]	Speed at the start	of field weal	kening Vdc =	5077.0	rpm			
p350[0]	Motor stator resist			0.27637	Ohm			
p354[0]	Motor rotor resista		amping resist	0.16187	Ohm			
p356[0]	Motor stator leaka			1.20129	mH			
p358[0]	Motor rotor leakag			1.26973	mH			
p360[0]	Motor magnetizing			22.28587	mH			
🔲 Is the	ne overall ratio of the mo	ment of inert	ia to the motor k	nown?				
					_			
< Back			Abo	nt			Next >	
igure	8-45 Men	u "Driv	es" > "Co	onfiguratio	n - m	otor'	> "Re	- eplacement circuit diagram data". (l

4)

13. You can enter additional motor data.

14.Press "Next >".

If more than one encoder has been selected (see following figure), then the parameterization is run through for each individual encoder in succession with "Next > ".

Start-up	CHAN1	JOG Ref	MPF0					
// Channel	reset		Program aborted					
	ROV							
\Drives\C	onfiguration - Encode	er	DP3.SLAVE	15:SERV0_3.1	5:2 (2) MDS0			
Which enc	Which encoder would you like to use? Mask out encoders already assigned to other DOs from the select. list							
🗹 Enco	der SM_5.Encode	er_6	Y					
Connection of the Sensor Module: SMx module sin/cos: SM_5 (5) X500								
Switch the Sensor Module LED to make it flash for recognition								
M Enco	der SM_3.Encode	er_4	Y					
Connection	n of the Sensor Modul	e: SMx m	odule sin/cos: SM_3 (3	3) X500				
	Switch the Sensor M	odule LED to ma	ke it flash for recognitio	on				
Enco	der		¥					
Connection	n of the Sensor Modul	e:						
	Switch the Sensor Me	odule LED to ma	ke it flash for recognitio	on				
< Back			Abort			Next >		

Figure 8-46 Menu "Drives" > "Configuration - encoder" (Next 5)

15.Press "Next >".

An identification of the selected encoders is triggered (Encoder 1/2).

The drive unit can identify encoders with EnDat protocol. These encoders are selected in the encoder list in the follow-up dialog boxes ("Configuration - Encoder" menu).

Commissioning SINAMICS drives

8.5 Commissioning using a drive wizard

			BO	2			
			HU	v			
							lden- tifv
\Drives\Configurat	ion - Encoder 1		DP3.S	AVE15:SE	RVO_3.15:2 (2) MDSU	tity
lame:		Encoder_6					
ncoder evaluation	:	SMx module	sin/cos: SM_5 (5)	<500			
Select a motor enco	der:						
[vpe (order no.)	Encoder typ	e		Co	de number		
SSL3055-0AA00-5xxx	256, 1 Vpp.			20	03		
SL3055-0AA00-5xxx	400, 1 Vpp,			20			
SL3055-0AA00-5xxx	512, 1 Vpp.			20)5		
SL3055-0AA00-5xxx	18000, 1 Vp	p. A/B R distanc	e-coded	20	10	=	Enter
SL3055-0AA00-5xxx	2048, 1 Vpp	, A/B, EnDat, Mu	ltiturn 4096	20	51		data
SL3055-0AA00-5xxx	32, 1 Vpp, A	/B, EnDat, Multi	urn 4096	20	j2		
SL3055-0AA00-5xxx	512, 1 Vpp,	A/B, EnDat, Mul	itum 4096	20	i3		
Select 'Identify', so he encoder suppor Select 'Input data' Select 'Details' in ero mark.	ting the drive u in order to pa	init. rameterize the	encoder manually	<i>ı</i> .			Details
			1	-			

Figure 8-47 Menu "Drives > Configuration" "Encoder 1" (Next 6)

The encoder has been identified.

Note

You can specify the following data using the "Details..." function:

- Inversion of the actual speed value
- Inversion of the actual position value
- External zero mark

Alternatively, the encoder system can be parameterized manually using the "Enter data" softkey.

16.Press "Next >".

	el reset			Program		_		
				_	R0V	_		
\Drives\	Configuration	- Encoder 2			DP3.SLAVE	15:SERV0_3.	15:2 (2) MDS0	lden- tify
lame:			Encoder_4					
ncoder	evaluation:		SMx module	sin/cos: SH	A 3 (3) ×500			
	selection:							
l vpe forde		Encoder type				Code numbr	ar i	
	AA00-5xxx							
SL3055-0	AA00-5xxx	18000, 1 Vpp, A/B R distance-coded 2010						
SL3055-0	AA00-5xxx		EnDat interface			2050		
SSL3055-0	AA00-5xxx	2048, 1 Vpp,	A/B, EnDat, Mu	ultiturn 4096		2051	=	Enter
SL3055-0	AA00-5xxx	32, 1 Vpp, A/	'B, EnDat, Multi	turn 4096		2052		data
SL3055-0	AA00-5xxx	512, 1 Vpp, A	VB, EnDat, Mul	titurn 4096		2053		
		16, 1 Vpp, A/	'B, EnDat, Multi	turn 4096		2054	~	
he encoo Select 'In	entify', so tha ler supporting put data' in etails' in ord c.	the drive un order to par	nit. ameterize the	encoder n	nanually.			Details
		-						

Figure 8-48 Menu "Drives > Configuration" "Encoder 2" (Next 7)

The second encoder has been identified.

Note

If EnDat encoders are detected, no further encoder parameterization need be performed. Parameterizations for the pole position ID/synchronization can be found at "Enter data".

17.Press "Next >".

Start-up	CHAN1	JOC	a Ref	IPF0				
// Channel	reset		P	rogram aborted				
				ROV				
\Drives\C	onfiguration - Cl	loop contr. typ		DP3.SLAVE	15:SERV0_3.1	5:2 (2) MDS0		
Select the	closed-loop cont	rol type and th	e PROFII	BUS telegram type.				
Clloop co	ntr. type:	Speed o	ontrol (wi	ith encoder)		¥		
PROFIBUS	PZD telegram:	SIEMEN	S telegra	am 116, PZD-11/19		¥		
The PROFIBUS process data are interconnected with BICO parameters according to the telegram type selected. These BICO parameters cannot be changed at a later stage.								
Number of	DDSs for this MD	S:	1	0				
		_						
< Back				Abort			Next >	

Figure 8-49 Menu "Drives > Configuration" "Control type..." (Next 8)

- 18.Set the number of required drive data sets (DDS). The default setting is the maximum possible number (8) of drive data sets. For optimal utilization of the drive unit, the number of drive data sets should be reduced to the number actually required.
- 19. Select the control type and the PROFIBUS message frame type.

The default setting is the PROFIBUS message frame 116 for solution line / SINAMICS.

20.Press "Next >".

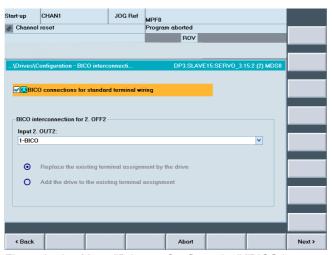


Figure 8-50 Menu "Drives > Configuration" "BICO interconnection" (Next 9)

- 21.Select the assignment for the terminal for Input 2. OFF2 (Page 294).
- 22.Press "Next >".

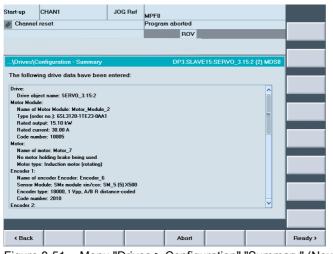


Figure 8-51 Menu "Drives > Configuration" "Summary" (Next 9)

- 23. The configuration of the drive (SERVO) with third-party motor is completed. You can check the configuration in the summary.
- 24.Press the "Finish >" softkey.

Start-up	CHAN1	JOG Re	f MPF0	
// Channel	l reset		Program aborted	
			ROV	
\Drives\0	Configuration - Su	mmary	DP3.SLAVE15:SERV0_3.15:2 (2) MDS0	
The follow	ving drive data ha	ve been entered:		
Drive:				
Drive ob Motor Modu	Start-un	15-7		
Name of				
Type (or Bated or			_3.15:2 has been completed. volatile manner for the configuration of	
Rated ci	drive SERV0_3	3.15:2 to be retaine	d after a restart.	
Code nu	Would you like manner?	to store the data o	f drive SERVO_3.15:2 in a non-volatile	
Motor: Name of	indimer:			
No moto				
Motor ty Encoder 1:				Abort
	encoder Encoder: Er	ncoder b		
		sin/cos: SM_5 (5) X50		
	type: 18000, 1 Vpp, . mber: 2010	A/B R distance-coded		No
Encoder 2:	ilibel. 2010		✓	
				Yes
				res

Figure 8-52 Menu "Drives > Configuration" "...save permanently..." (Finish)

25.Confirm the query with "Yes".

tart-up CHAN1	JOG Ref	MDA2.MPF			
Channel interrupt		Program aborted	_	_	Drive +
Stop: No NC Ready		ROV			2
8080 1 option(s) is/are a	ctivated with	out setting the license ke	y	\ominus	
Overview		DP3.SLAVE13:	SERV0_3.13:2	(2) MDS0	Drive -
??? 1538:	0 Driv	ve objects type:	SERVO	^	
Drive data set DDS:	0				Select drive
PROFIBUS PZD telegram:	SIEMENS	telegram 116, PZD-11/19	4		untoini
Clloop contr. type:		trol (with encoder)	,		Change
					change
SERVO_3.13:2.Motor_Module_3	2 (Power sec	tion)			
Component number:		2	2		
Power section type:		SINAMICS 9	;		
Order no.:		6SL3120-1TE21-0AA1			Select
Power section rated current:		9.00	A		MDS
Power section rated output:		4.80) k₩		
Identify via LED]		
					
<u> </u>					
Configur- Data Con	nec-			Drive	File

Figure 8-53 Menu "Drives > Configuration"

26.Select the drive with the vertical softkeys "Drive+ / Drive-" in order to configure additional drives (SERVOs).

The configuration is again started with the vertical softkey "Change".

8.6 First commissioning of SINAMICS drive ended

8.6 First commissioning of SINAMICS drive ended

First commissioning of SINAMICS drive completed

You have completed the first commissioning of the SINAMICS drives.

The unit configuration and parameterization has been completed successfully:

- All upper LEDs of the drives (SERVOs) are GREEN.
- The lower LEDs of the drives (SERVOs) are always YELLOW.

Continue with the steps for commissioning the NCK. You have chosen the "Commissioning" operating area.

Commissioning communication NCK<->Drive

Introduction

The first commissioning of the PLC and SINAMICS drives is completed.

What will be configured next?

You will configure the NCK machine data, which communicates with the drive. These are:

• General machine data

General machine data required for communication with the drive via PROFIBUS, which have been preset with default values. These values may be taken over during first commissioning. These are:

- The message frame type for transfer
- The logical addresses for the PLC

Note

Up to software 1.5/2.5

For an NX module, the logical address "6516" for the PLC must be entered in the general machine data MD13120[1] CONTROL_UNIT_LOGIC_ADDRESS.

• Axis-specific machine data

The axis component for transfer of the setpoints and actual values for the relevant axis, is set in the axis machine data.

8.6 First commissioning of SINAMICS drive ended

Assigning general and axis-specific machine data

The following table illustrates using the example of an SINAMICS S120 module structure (one NCU (CU), one ALM, three motor modules (MM)) the assignment of the NCK machine data for input/output address/telegram/message frame/actual value:

SINAMICS S120	STEP7 (HW-conf properties	ig) DP slave	NCK machine General MD	data		NCK machin Axis MD ²⁾	e data
Component	Message frame type/length ¹⁾	I/O address ¹⁾	MD13120[0] Control Unit I/O address	MD13050 [0-5] Axis I/O address ¹⁾	MD13060 [0-5] Message frame type ¹⁾	MD30110/3 0220 setpoint/act ual value assignment	MD30130 Type of output Setpoint
MM1	116. PZD-11/19	4100		4100	116	1	1
MM2	116. PZD-11/19	4140		4140	116	2	1
MM3	116. PZD-11/19	4180		4180	116	3	1
X (not available)	116. PZD-11/19	4220		4220	116	-	0
X (not available)	116. PZD-11/19	4260		4260	116	-	0
X (not available)	116. PZD-11/19	4300		4300	116	-	0
CU	391. PZD-3/7	6500	6500				
ALM	370. PZD-1/1	6514					

¹⁾Default value, do not change

²⁾ The axis-specific machine data for configuring setpoints and actual values are preassigned using the "Assign axis" function (see section "Configuration of setpoint and actual value" (Page 106))

9.1 Configuration input/output address and telegram

9.1 Configuration input/output address and telegram

Introduction

The following general machine data are pre-assigned with a standard value for the PROFIBUS connection between the axes and drive (also see previous table).

- MD13050 \$MN_DRIVE_LOGIC_ADDRESS (axis address))
- MD13060 \$MN_DRIVE_TELEGRAM_TYPE (telegram type)
- MD13120 \$MN_CONTROL_UNIT_LOGIC_ADDRESS (CU address)

Note

No adjustment is necessary here since these values correspond to those preassigned values in HW Config.

PROFIBUS connection



The connection between the relevant axes and drive via PROFIBUS can be viewed and sorted on the HMI in the "Commissioning" > "Drive system" > "Drive units" > "PROFIBUS connections" menu.

The following diagram shows an example of the connection between the relevant axes and drive for an NCU.

-		ACK1003	J	OG Ref	MPFO				
🗑 Char	nnel int	errupt			Program a	aborted			
🔥 Stop	: No N	C Ready				ROV			
808	o ↓	4 option(s) is	/are activa	ted witho	ut setting	the license key	y	0	
PROFIL	BUS lin	ık				DP3.	SLAVE 3:CI	J_I_3.3:1 (1)	
1-70-	addr.	Slot	Length	SINAMI	CS-	SINAMICS-			
addr.	Slot	Туре	[byte]	drive ob		telegram type	B		
6700	4	Input	24	SERVO	_3.3:3_(3)	SIEMENS 6	8	~	
6700	4	Output	24						
4100	5	Act val	38]					
4100	6	Set val	22						
6724	8	Input	24	SERVO	3.3:4(4)	SIEMENS 11	6		
6724	8	Output	24						
4140	9	Act val	38						
4140	10	Set val	22						Overview
6748	12	Input	24	SERVO	_3.3:5(5)	SIEMENS 11	6		
6748	12	Output	24						
4180	13	Act val	38						
4180	14	Set val	22						
6772	16	Input	24	(255)					
6772	16	Output	24						
4220	17	Act val	38						
4220	18	Set val	22						Abort
6796	20	Input	24	(255)					
6796	20	Output	24						
4260	21	Act val	38					~	ок
\square									UK
Confi <u>c</u> atio		Topology	PROFIBU: link		inec- ons	Inputs / Outputs		Control unit MD	File functions

Figure 9-1 PROFIBUS NCU connection

9.2 Configuration setpoint/actual value

9.2 Configuration setpoint/actual value

Introduction

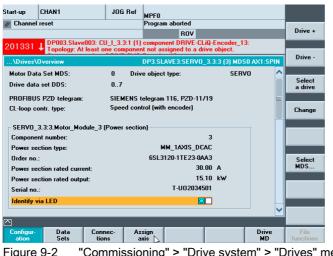
The axis component for transfer of the setpoints and actual values for the relevant axis, is set in the axis machine data. The following axis machine data is to be adjusted for each axis (also see previous table):

- MD30110 \$MA_CTRLOUT_MODULE_NR (setpoint channel)
- MD30220 \$MA_ENC_MODUL_NR (actual value channel)
- MD30130 \$MA_CTRLOUT_TYPE (setpoint type of output)
- MD30240 \$MA_ENC_TYPE (actual value sensing)

These axis/machine data can be automatically adapted using the "Assign axis" function or directly using the "Axis MD" function.

Operating sequence in the "Assign axis" menu

1. Select the "Commissioning" > "Drive system" > "Drives" menu.



"Commissioning" > "Drive system" > "Drives" menu Figure 9-2

Note

The "Assign axis" function can also be activated in the "Commissioning > Drive system" function using the vertical softkey bar. You must have selected a servo drive before doing this.

2. Press the "Assign axis" horizontal softkey

9.2 Configuration setpoint/actual value

	03.Slave003: 0 logy: At least	CU_I_3.3:1 (1) one compone	component DRIVE- it not assigned to a		Drive
xis assignment			D	P3.SLAVE3:SERV0_3.3:4	(4)
Sollwert -> Antrie	b (S	ERVO_3.3:4.M	lotor_Module_4)		Direc
Axis AX2:YM_1					selectio
Istwert <- Geber	1 (S	ERVO_3.3:4.E	ncoder_6)		Chang
Axis				Measuring system	
AX2:YM_1				1	
Istwert <- Geber	2				
Axis				Measuring system	
Profibus link				Change	
Drive number					
DR2, 4140					
0112, 4140					

Figure 9-3 Assignment of setpoints and actual values for axes to drive

- 3. Use "Drive +"/"Drive -"/"Direct selection" to select the corresponding servo.
- 4. Press "Change".

Channe	el reset			MPF0 Program aborted		
				ROV		
01331	DP003.Slav	e003: Cl	U_I_3.3:1 (1)	component DRIVE-CLiQ-Enco t not assigned to a drive obje	oder_13:	
kis assig		u least u	ine componer		3:SERV0 3.3:4 (4)	
na usaig	milent			DI 3.3ENTE	3.3E1110_3.3.4 (4)	
Sollwer	t -> Antrieb	(SE	RVO_3.3:4.₩	lotor_Module_4)		
Axis						
	'M_1, DP3.SLAV	E3:SER	√0_3.3:4, <a< td=""><td>ktiv></td><td>×</td><td></td></a<>	kti v >	×	
AX31:					~	
AV1.C						
	PIN, DP3.SLAVE					
AX2:Y	M 1, DP3.SLAVI	E3:SERV	/0_3.3:4, <al< th=""><th>(tiv)</th><th></th><th></th></al<>	(tiv)		
AX2:Y AX3:Y AX4:A	M_1, DP3.SLAVI M_2, DP15.SLAV M_1, DP15.SLAV	E3:SERV VE15:SE VE15:SE	/0_3.3:4, <al RVO_3.15:2 RVO_3.15:3</al 	(tiv)	<mark></mark> ↓	
AX2:Y AX3:Y AX4:A AX5:B	M_1, DP3.SLAVI M_2, DP15.SLAV M_1, DP15.SLAV B1, DP15.SLAVE	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 	<tiv></tiv>		
AX2:Y AX3:Y AX4:A AX5:B	M_1, DP3.SLAVI M_2, DP15.SLAV M_1, DP15.SLAV	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 	xtiv>		
AX2:Y AX3:Y AX4:A AX5:B	M_1, DP3.SLAVI M_2, DP15.SLAV M_1, DP15.SLAV B1, DP15.SLAVE	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 	xtiv>		
AX2:Y AX3:Y AX4:A AX5:B	M_1, DP3.SLAVI M_2, DP15.SLAVI M_1, DP15.SLAVI B1, DP15.SLAVI C1, DP15.SLAVI C1, DP15.SLAVI	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 		✓	
AX2:Y AX3:Y AX4:A AX5:B AX6:C	M_1, DP3.SLAVI M_2, DP15.SLAVI M_1, DP15.SLAVI B1, DP15.SLAVI C1, DP15.SLAVI C1, DP15.SLAVI	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 		ange	
AX2:Y AX3:Y AX4:A AX5:B AX6:C	M_1, DP3.SLAVI M_2, DP15.SLAVI M_1, DP15.SLAVI B1, DP15.SLAVI C1, DP15.SLAVI C1, DP15.SLAVI s link number	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 		✓	Abort
AX2:Y AX3:Y AX4:A I AX5:B AX6:C Profibus Drive	M_1, DP3.SLAVI M_2, DP15.SLAVI M_1, DP15.SLAVI B1, DP15.SLAVI C1, DP15.SLAVI C1, DP15.SLAVI s link number	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 		✓	Abort
AX2:Y AX3:Y AX4:AI I AX5:B AX6:C Drive Drive DR2,	M_1, DP3.SLAVI M_2, DP15.SLAVI M_1, DP15.SLAVI B1, DP15.SLAVI C1, DP15.SLAVI C1, DP15.SLAVI s link number	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 		✓	
AX2:Y AX3:Y AX4:AI I AX5:B AX6:C Drive Drive DR2,	M_1, DP3.SLAVI M_2, DP15.SLAVI M_1, DP15.SLAVE B1, DP15.SLAVE C1, DP15.SLAVE s link number 4140	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 		✓	Abort
AX2:Y AX3:Y AX4:AI I AX5:B AX6:C Drive Drive DR2,	M_1, DP3.SLAVI M_2, DP15.SLAVI M_1, DP15.SLAVE B1, DP15.SLAVE C1, DP15.SLAVE s link number 4140	E3:SERV VE15:SE VE15:SE E15:SER	/0_3.3:4, <a RVO_3.15:2 RVO_3.15:3 RVO_3.15:3 VO_3.15:4</a 		✓	

Figure 9-4 "Assign axis" > "Change" menu

- 5. Use the cursor keys to select the selection boxes for the setpoint or actual value.
- 6. Use the <INPUT> key to open the selection box.
- 7. Use the cursor keys to select the component.
- 8. Press "Transfer".

9.3 Commissioning communication NCK<->Drive completed

Operating sequence in the "Commissioning" > "Machine data" > "Axis MD" menu

- 1. Select the "Axis MD" softkey in the "Commissioning > Machine data" in the operating range.
- 2. Select the corresponding axis using "Axis+".
- 3. For the setpoint channel, search for MD30110 \$MA_CTRLOUT_MODULE_NR.
- 4. Enter the drive number.
- 5. For the actual value channel, search for MD30220 \$MA_ENC_MODUL_NR.
- 6. Enter the drive number.
- 7. For the setpoint type of output, search for MD30130 \$MA_CTRLOUT_TYPE.
- 8. Enter "1".
- 9. For the actual value sensing, search for MD30240 \$MA_ENC_TYPE.
- 10.Enter "1" for incremental encoder or "4" for absolute value encoder.
- 11.Select the next axis in each case with Axis+ and continue with Step 3 for the next drive.

9.3 Commissioning communication NCK<->Drive completed

Commissioning communication NCK<->PLC completed

You have placed the following in operation:

- PLC
- SINAMICS drives
- Communication NCK-PLC

The basic commissioning is completed. Now you can move the axes.

The next chapter, "Commissioning NCK", describes the parameterization of NCK regarding the connected machine by setting system variables.

10

NCK start-up

10.1 Overview Commissioning NCK

Introduction

The parameterization of NCK regarding the connected machine occurs by setting system variables.

These system variables are called:

- Machine data (MD)
- Setting data (SD).

See also

Machine and setting data (Page 357)

10.2 System data

10.2 System data

10.2.1 Resolutions

The following types of resolution, e.g. resolution of linear and angular positions, velocities, accelerations and jerk, must be differentiated as follows:

- the **input resolution**, i.e. the input of data from the user interface or using the parts programs.
- the **display resolution**, i.e. the display of data on the user interface.
- the **computational resolution**, i.e. the internal representation of the data input through the user interface or the parts program.

Input and display resolution

The input and display resolution is specified via the control panel being used, whereby the display resolution of position values can be changed with MD9004 \$MM DISPLAY RESOLUTION (display resolution).

MD9011 \$MM_DISPLAY_RESOLUTION_INCH (INCH measuring system display resolution) can be used to configure the display resolution for position values with inch setting. This allows you to display up to six decimal places with the inch setting.

For the programming of parts programs, the input resolutions listed in the Programming Guide apply.

Computational resolution

The computational resolution defines the maximum number of effective decimal places for all data the physical unit of which is referred to a length or an angle, e.g. position values, velocities, tool offsets, zero offsets, etc.

The desired computational resolution is defined using the machine data

- MD10200 \$MN_INT_INCR_PER_MM (computational resolution for linear positions)
- MD10210 \$MN_INT_INCR_PER_ DEG (computational resolution for angular positions)

The default assignment is:

- 1000 increments/mm
- 1000 increments/degrees

The computational resolution thus also determines the maximum achievable precision for positions and selected offsets. However, it is essential that the measuring system is adapted to this degree of precision.

Note

Although the computational resolution is generally independent of the input/display resolution, it should have at least the same resolution.

Rounding

The precision of angle and linear positions is limited to the computational resolution by rounding the product of the programmed value with the computational resolution to an integer number.

Example of rounding:

Computational resolution: 1000 increments/mm Programmed path: 97.3786 mm Effective value = 97.379 mm

Note

To keep rounding easily understandable, it is better to use powers of 10 for the computational resolution (100, 1000, 10,000).

Display resolution

In MD9004 \$MM_DISPLAY_RESOLUTION (display resolution), you can set the number of decimal places after the decimal point for the position values on the operator panel.

Input and display limit values

Limitation of the input values depends on the display features and on the input options on the operator panel. The limit is ten digits plus comma and sign.

Example of programming in the $1/_{10}$ - µm range:

All the linear axes of a machine are to be programmed and traversed within the range of values 0.1 to 1000 mm.

In order to position accurately to 0.1 $\mu m,$ the computational resolution must be set to $\geq 10^4$ incr./mm.

MD10200 \$MN_INT_INCR_PER_MM = 10000 [incr./mm]:

Example of related parts program:

N20 G0 X 10000 Y 10000 ;Axes move to position X=10000 mm, Y=10000 mm

N25 G0 X 50002 Y 20003 ;Axes move to position X=50002 mm, Y=20003 mm

NCK start-up

10.2 System data

Machine data

Table 10-1 Resolutions: Machine data

Number Name of identifier		Name / remarks	
General (\$M	ИМ)		
9004	DISPLAY_RESOLUTION	Display resolution	
9011	DISPLAY_RESOLUTION_INCH	Display resolution for INCH system of measurement	

General (\$MN)			
10200	INT_INCR_PER_MM	Computational resolution for linear positions	
10210	INT_INCR_PER_DEG	Computational resolution for angular positions	

Literature

Function Manual Basic Functions; Velocities, traversing ranges, accuracy: Input/display resolution, computational resolution

10.2.2 Normalization of phys. units of machine data and setting data

Standard

Machine and setting data having a physical unit are interpreted in the input/output units listed in the table "Scaling physical units of machine and setting data" by default, depending on the scaling system (metric/inch).

The internally used units which the NC uses are independent and fixed.

Physical unit	Input/output units for the standard basic system		Internally used unit	
	Metric	Inch		
Linear position	1 mm	1 inch	1 mm	
Angular position	1 degree	1 degree	1 degree	
Linear velocity	1 mm/min	1 inch/min	1 mm/s	
Angular velocity	1 rpm	1 rpm	1 deg./s	
Linear acceleration	1 m/s ²	1 inch/s ²	1 mm/s ²	
Angular acceleration	1 rev/s ²	1 rev/s ²	1 degree/s ²	
Linear jerk	1 m/s ³	1 inch/s ³	1 mm/s ³	
Angular jerk	1 rev/s ³	1 rev/s ³	1 degree/s ³	
Time	1 sec	1 sec	1 sec	
Position controller servo gain	1 s ⁻¹	1 s ⁻¹	1 s ⁻¹	
Rev. feedrate	1 mm/rev	1 inch/rev	1 mm/degree	
Compensation value linear position	1 mm	1 inch	1 mm	
Compensation value angular position	1 degree	1 degree	1 degree	

Table 10-2 Normalization of phys. units of machine data and setting data

User-defined

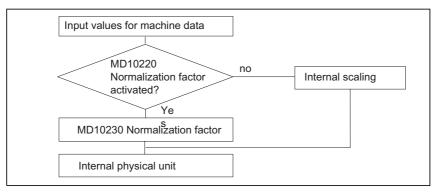
The user can define different input/output units for machine and setting data.

For this purpose,

- MD10220 \$MN_SCALING_USER_DEF_MASK (activation of standardizing factors) and
- MD10230 \$MN_SCALING_FACTORS_USER_DEF[n] (standardizing factors of the physical quantities)

allow you to set the adaptation between the newly selected input/output units and the internal units.

10.2 System data



The following applies:

Input/output unit selected=

MD10230 \$MN_SCALING_FACTORS_USER_DEF[n] * internal unit

The selected I/O unit, expressed in the internal units 1 mm, 1 degree and 1 s must therefore be entered in MD10230 \$MN_SCALING_FACTORS_USER_DEF[n].

Table 10-3 Bit number and index for user definition	Table 10- 3	Bit number and index for user definition
---	-------------	--

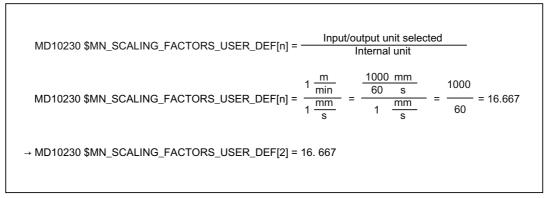
Physical unit	MD10220 bit number	MD10230 index n
Linear position	0	0
Angular position	1	1
Linear velocity	2	2
Angular velocity	3	3
Linear acceleration	4	4
Angular acceleration	5	5
Linear jerk	6	6
Angular jerk	7	7
Time	8	8
K _V factor	9	9
Rev. feedrate	10	10
Compensation value linear position	11	11
Compensation value angular position	12	12

Example 1:

Machine data input/output of the linear velocities is to be in m/min instead of mm/min (initial state). The internal unit is mm/s.

MD10220 \$MN_SCALING_USER_DEF_MASK Bit2 = 1 is used to enter the scaling factor for linear velocities as a user-defined value.

The scaling factor is calculated using the following formula:



Index 2 specifies the "linear velocity" (see above).

Example 2:

In addition to the change in example 1, the machine data input/output of linear accelerations is to be performed in ft/s², instead of m/s² (initial state). (the internal unit is mm/s²).

MD10220 \$MN_SCALING_USER_DEF_MASK = ,H14'; (bit no. 4 and bit no. 2) from example 1 as hex value MD10230 \$MN_SCALING_FACTORS_USER_DEF[n] = $\frac{1 \frac{ft}{s^2}}{1 \frac{mm}{s^2}} = \frac{12*25.4 \frac{mm}{s^2}}{1 \frac{mm}{s^2}} = \frac{1000}{60} = 304.8$ \rightarrow MD10230 \$MN_SCALING_FACTORS_USER_DEF[4] = 304.8

Index 4 specifies the "linear acceleration" (see above).

NCK start-up

10.2 System data

Machine data

Table 10-4 Normalization of phys. units of machine data and setting data: Machine data

Number	Name of identifier	Name / remarks	Reference		
General (\$	General (\$MN)				
10220	SCALING_USER_DEF_MASK	Activation of scaling factors			
10230	SCALING_FACTORS_USER_DEF[n]	Scaling factors of physical quantities			
10240	SCALING_SYSTEM_IS_METRIC	Basic system metric			
10250	SCALING_VALUE_INCH	Conversion factor for switchover to inch system			
10260	CONVERT_SCALING_SYSTEM	Basic system switchover active			
10270	POS_TAB_SCALING_SYSTEM	System of measurement of position tables	T1		
10290	CC_TDA_PARAM_UNIT	Physical units of the tool data for CC			
10292	CC_TOA_PARAM_UNIT	Physical units of the tool edge data for CC			

10.2.3 Modifying scaling machine data

The scaling of machine data having physical units is defined by the following machine data:

- MD10220 \$MN_SCALING_USER_DEF_MASK (activation of standardizing factors)
- MD10230 \$MN_SCALING_FACTORS_USER_DEF (standardizing factors of the physical quantities)
- MD10240 \$MN_SCALING_SYSTEM_IS_METRIC (basic system metric)
- MD10250 \$MN_SCALING_VALUE_INCH (conversion factor for switchover to INCH system)
- MD30300 \$MA_IS_ROT_AX (rotary axis)

When scaling machine data are modified, all machine data affected by this modification due to their physical unit are converted with the next NCK reset.

Example: Redefining an A1 axis from linear to rotary axis.

The control has been started up with default values. Axis A1 is declared as a linear axis.

- MD30300 \$MA_IS_ROT_AX[A1] = 0 (no rotary axis)
- MD32000 \$MA_MAX_AX_VELO [A1] = 1000 [mm/min] (max. axis velocity).

Axis A1 is now declared as a rotary axis containing the following machine data:

- MD30300 \$MA_IS_ROT_AX[A1] = 1 (rotary axis)
- MD32000 \$MA_MAX_AX_VELO [A1] = 1000 [mm/min] (max. axis velocity).

With the next NCK reset, the control system recognizes that axis A1 is defined as a rotary axis and standardizes MD32000 \$MA_MAX_AX_VELO to [rev./min] with reference to a rotary axis.

- MD30300 \$MA_IS_ROT_AX[A1] = 1 (rotary axis)
- MD32000 \$MA_MAX_AX_VELO [A1]= 2.778 [rev./min]

Note

If a scaling machine data item is altered, then the control outputs alarm "4070 Scaling data changed".

Modifying manually

The following procedure is recommended when modifying scaling machine data manually:

- 1. Set all scaling machine data
- 2. Carry out NCK reset
- 3. Set all dependent machine data after the NC has powered up.

10.2 System data

10.2.4 Loading default machine data

The default machine data can be loaded in different ways.

HMI startup

HMI startup via the HMI standard user interface: Operating area menu "Diagnostics" > "NC/PLC"

- Button: "Delete NCK Data"
- Button: "NCK RESET"

NOTICE

With deleting the NCK data, all user data are lost.

To avoid data loss, a series commissioning file should be created before the NCK data are deleted. The way to create a series machine start-up file is laid out in the Chapter "Creating a series machine start-up file".

MD11200 \$MN_INIT_MD

Using the entry values listed below in MD11200 \$MN_INIT_MD (loading the standard machine data for the "next" NC boot), you can load various data storage areas with default values at the next NC boot.

After setting the machine data, an NCK reset must be carried out:

- 1. NCK RESET: The machine data is activated.
- 2. NCK RESET: Depending on the entry value, the corresponding machine data is set to its standard values and the MD11200 \$MN_INIT_MD is reset to value "0".

Input values

MD11200 \$MN_INIT_MD = 1

At the next NC power-up, all machine data (with the exception of the memory configuring data) are overwritten with default values.

MD11200 \$MN_INIT_MD = 2 At the next NC boot, all memory-configuring machine data are overwritten with default values.

10.2.5 Switching over the measuring system

The measuring system is switched over for the entire machine using a softkey in the "Machine" HMI-Advanced operating area. The switchover is only accepted if:

- MD10260 \$MN_CONVERT_SCALING_SYSTEM=1.
- Bit 0 of MD20110 \$MC_RESET_MODE_MASK is set in every channel.
- All channels are in the Reset state.
- Axes are not traversing with JOG, DRF or PLC control.
- Constant grinding wheel peripheral speed (GWPS) is not active.

Actions such as parts program start or mode change are disabled for the duration of the switchover.

If the switchover cannot be performed, this is indicated by a message in the user interface. These measures ensure that a consistent set of data is always used for a running program with reference to the system of measurement.

The actual switchover of the system of measurement is performed internally by writing all the necessary machine data and subsequently activating them with a Reset.

MD10240 \$MN_SCALING_SYSTEM_IS_METRIC and the corresponding G70/G71/G700/G710 settings in MD20150 \$MC_GCODE_RESET_VALUES are switched over automatically and consistently for all configured channels.

The value of machine data: MD20150 \$MC_GCODE_RESET_VALUES[12] varies between G700 and G710.

This process takes place independently of the protection level currently set.

System data

When changing over the measuring system, from the view of the user, all length-related specifications are converted to the new measuring system automatically. This includes:

- Positions
- Feed rates
- Acceleration rates
- Jerk
- Tool offsets
- Programmable, settable and work offsets external and DRF offsets
- Compensation values
- Protection zones
- Machine data
- Jog and hand wheel factors

After switching, all above mentioned data is available in the physical units according to Chapter "Standardizing of physical units of machine and setting data".

NCK start-up

10.2 System data

Data for which no unique physical units are defined, such as:

- R parameters
- GUDs (Global User Data)
- LUDs (Local User Data)
- PUDs (Program global User Data)
- Analog inputs/outputs
- Data exchange via FC21

are not converted automatically. The user is prompted to take the current valid measuring system MD10240 \$MN_SCALING_SYSTEM_IS_METRIC into consideration.

The current system of measurement setting can be read at the PLC interface via the "inch system" signal DB10.DBX107.7. DB10.DBB71 can be used to read out the "system of measurement change counter".

Machine data

Table 10-5 Switching over the unit system: Machine data

Number	Name of identifier	Name / remarks	Reference
General (\$MN)			
10240	SCALING_SYSTEM_IS_METRIC	Basic system metric	
10250	SCALING_VALUE_INCH	Conversion factor for switch-over to inch system	
10260	CONVERT_SCALING_SYSTEM	Basic system switch-over active	

axis spec. (axis spec. (\$MA)			
32711	CEC_SCALING_SYSTEM_METRIC	System of measurement of sag compensation	G2	

Literature

Function Manual; speed, setpoint/actual-value systems, control: Metric/inch measuring system

10.2.6 traversing ranges

Computational resolution and traversing ranges

The range of values of the traversing ranges directly depends on the selected computational resolution (see Subsection "Resolutions" (Page 110)).

With the default assignment of the machine data for the computational resolution

- 1000 inc./mm
- 1000 inc./deg.

the following traversing ranges result:

Table 10-6 traversing ranges

	Traversing range in the metric system	Traversing range in the inch system
Linear axes	± 999,999.999 [mm; deg.]	± 399,999.999 [inch; deg.]
Rotary axes	± 999,999.999 [mm; deg.]	± 999,999.999 [inch; deg.]
Interpolation parameters I, J, K	± 999,999.999 [mm; deg.]	± 399,999.999 [inch; deg.]

10.2.7 Positioning accuracy of the control system

Computational resolution and traversing ranges

The positioning accuracy depends on:

- the computational accuracy (internal increments/(mm or degrees))
- the actual-value resolution (encoder increments/(mm or degrees)).

The rougher resolution of both determines the positioning accuracy of the NC.

The input resolution, the position control and interpolation clock do not affect the accuracy.

Machine data

Table 10- 7	Positioning accuracy: Machine data
-------------	------------------------------------

Number	Name of identifier	Name / remarks	Reference		
General (\$	General (\$MN)				
10200	INT_INCR_PER_MM	Computational resolution for linear positions	G2		
10210	INT_INCR_PER_DEG	Computational resolution for angular positions	G2		
Axisspecifi	Axisspecific (\$MA)				
31020	ENC_RESOL[n]	Encoder pulses per revolution			

10.2 System data

10.2.8 Cycle times

On the SINUMERIK 840D sl the system clock cycle, the position controller cycle, and the interpolation cycle of the NC are based on the DP cycle time configured in STEP 7 HW config. See Chapter "SIMATIC create S7 project".

System basic cycle

The system clock cycle is set fixed to the ratio of 1:1 with regard to the DP cycle time. The active value is displayed in the machine data MD10050 \$MN_SYSCLOCK_CYCLE_TIME (system cycle). It cannot be changed.

Position controller cycle

The position controller cycle (MD10061 \$MN_POSCTRL_CYCLE_TIME) is set to the fixed ratio 1:1 with respect to the system clock cycle. It cannot be changed.

Position control cycle offset

The position control cycle offset T_M is automatically determined in the default setting (MD10062 $MN_POSCTRL_CYCLE_DELAY=0$).

The effective position controller offset is displayed in the MD10063[1].

The following values can be read out via the MD10063 \$MN_POSCTRL_CYCLE_DIGNOSIS:

- MD10063[0]= T_{DX}
- MD10063[1]= T_M
- MD10063[2]= T_M + T_{Lag max}

The following conditions must be met for explicit specification of the position controller cycle offset (MD10062 \$MN_POSCTRL_CYCLE_DELAY!=0):

- The cyclic communication with the DP slaves (drives) must be completed before the position controller is started. Condition: T_M > T_{DX}
- The position controller must be completed before the DP cycle/system clock is completed.

Condition: T_M + T_{Position control max} < T_{DP}

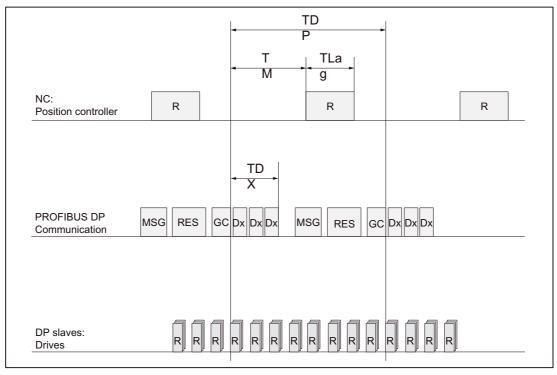


Figure 10-1 Position control cycle offset compared to PROFIBUS DP cycle

Key to Fig. above:

 T_{Lag} :CPU time required by position controller

T_{DP}:DP cycle time: DP cycle time

T_{DX}:Data Exchange Time: Total transfer time for all DP slaves

 T_M :Master time: Offset of the start time for NCK position controller

GC: Global Control: Broadcast message for cyclic convergence of the equidistance between DP master and DP slaves

R: CPU time

Dx: Useful data exchange between the DP master and DP slaves

MSG: Acyclic services (e.g. DP/V1, pass token)

RES: Reserve: "Active pause" until the isochronous (equidistant) cycle has expired

Error response

• Alarm: "380005 PROFIBUS DP: Bus access conflict, type t, counter z"

10.2 System data

Cause of errors/error handling

• t = 1

The position-control cycle offset selected is too small. The cyclic PROFIBUS communication with the drives was not yet completed with the start of the position controller.

- Remedy: Increase the position-control cycle offset.
- t = 2

The position-control cycle offset selected is too large. The cyclic PROFIBUS communication with the drives started before the position controller had finished. The position controller requires more CPU time than available within the DP cycle.

- Remedy: Decrease the position-control cycle offset

Or

- Remedy: Increase the DP cycle time.

The DP cycle time is set using STEP7 "HW-Config". See Chapter "SIMATIC create S7 project".

Interpolation cycle

The interpolator cycle may be chosen freely as a whole multiple of the position control cycle.

MD10070 \$MN_IPO_SYSCLOCK_TIME_RATIO (factor for the interpolation cycle)

Error response

• Alarm: "4240 CPU time overflow on the IPO or position controller level"

Cause of errors/error handling

The DP cycle time/position controller cycle, the interpolation cycle, or the NC CPU time share is set in such a way that not enough CPU time is available for one of the two cyclic levels of the NCK (position controller or interpolator).

Remedial action:

Calculate the maximum values for $T_{\text{pos}\,\text{max}}$ and $T_{\text{IPO}\,\text{max}}$ (see above) and adapt the following machine data:

- MD10185 \$MN_NCK_PCOS_TIME_RATIO (CPU time share NCK)
- MD10070 \$MN_IPO_SYSCLOCK_TIME_RATIO (factor for the interpolation cycle)
- MD10050 \$MN_SYSCLOCK_CYCLE_TIME (system clock cycle)

Note

You must adjust the **system clock cycle** by changing the DP cycle time using STEP7 "HW-Config".

Literature

Function Manual special functions; cycle times

Machine data

Number	Identifier	Name / remarks	Reference	
General (\$MN)				
10050	SYSCLOCK_CYCLE_TIME	System clock cycle/only display data; is always equal to the equidistant PROFIBUS DP cycle.		
		Note: For SINUMERIK solution line for display only!		
10060	POSCTRL_SYSCLOCK_TIME_RATIO	Factor for the position control cycle/is set fixed to the factor 1.		
10061	POSCTRL_CYCLETIME	Position Controller cycle		
10062	POSCTRL_CYCLE_DELAY	Position control cycle offset		
10063	POSCTRL_CYCLE_DIAGNOSIS	[0] = DP cycle time		
		[1] = Position controller cycle offset		
		[2] = Position controller cycle offset + max. computation time needed by the position controller		
10070	IPO_SYSCLOCK_TIME_RATIO	Factor for the interpolator cycle/can be freely selected in integer multiples.		
10185	NCK_PCOS_TIME_RATIO	Computation time ratio NCK		

If you change the cycle times, check the behavior of the controller in all operating modes before you finish commissioning.

Note

The smaller the cycle times (PROFIBUS DP cycle) chosen, the greater the control quality for the drive and the better the surface quality on the workpiece.

10.2 System data

10.2.9 NCK utilization

Introduction

You can view utilization of system resources for the NCK on the HMI under the menu "Diagnostics > Service displays > System resources".

iagnosis MITTE_1	Auto	MPF.DIR TECHNOZYK_2.MF Program aborted	F		
onamorrooox		ROV			Channel
NC utilization		Channel:		REV1 1	Channel
Net runtime (pure calculatio	n time)				
-	current	minimum	ma	ximum	Direct selectio
Position controller	0.097 ms	0.041 ms	0.24	41 ms	
Interpolator	1.006 ms	0.072 ms	1.52	26 m s	Start
Forward motion	0.101 ms	0.048 ms	23.00	89 ms	Giari
Gross runtime (stopped tim	e from beginning to	end)			Stop
	current	minimum	ma	ximum	Stop
Position controller	0.097 ms	0.041 ms	0.2	41 ms	
Interpolator	1.006 ms	0.072 ms	1.5	26 ms	
Forward motion	0.096 ms	0.048 ms	26.3	31 ms	
CU load by position control	and interpolator:	1	1.62% 1.97%	20.75 %	
illing level of interpolator but	ifer:		0%		
-					
5					
Service axis		ystem Config.	Communic.	Action log	Version

Figure 10-2 NC utilization

The following machine data is taken into consideration for displayed runtimes (see Chapter Cycle times (Page 122)):

- MD1061 \$MD_POSCTRL_CYCLE_TIME = MD10050 \$MN_SYSCLOCK_CYCLE_TIME (System basic cycle)
- MD1070 \$MD_IPO_SYSCLOCK_TIME_RATIO (factor for the interpolation cycle)
- MD1071 \$MD_IPO_CYCLE_TIME (interpolation cycle)

What will be displayed?

In the display of the "System resources" menu, the values have the following meaning:

• Area "Nett runtime (purely CPU time)":

Active times (current, minimum and maximum) are displayed in the nett values.

The relation to the machine data can be seen from the displayed values.

• Area "Gross runtime (time from start to end)":

The corresponding total utilization of the system (position controller + interpolator) is displayed, based on the net values.

• Line "NCU load by position controller and interpolator":

Note

The current, minimum and maximum utilization of the NCK is displayed.

In order to have sufficient reserves for program processing, maximum utilization in reset condition when pressing the <Reset> key should be in the range of 60-65%.

• Line "Capacity of interpolator buffer":

The capacity indicator MD28060 \$MC_NUM_IPO_Buffer_SIZE is indicated in %.

This display indicates whether batch preparation for batch processing can commence.

Jerky processing in continuous-path mode, if for instance a number of short traversing blocks have been programmed in succession, is a typical indicator of the IPO buffer idling.

Capacity indication is channel-specific.

10.2 System data

10.2.10 Velocities

Max. axis velocity or spindle speed

The maximum possible axis velocities and spindle speeds depend on the machine design, drive dynamics and the encoder limit frequency of the individual drives.

Max. progr. tool path velocity

The maximum programmable tool path velocity results from the maximum axis velocities of the axes involved in the path programmed.

Max. tool path velocity

The maximum tool path velocity at which traversing is possible within a parts program block results as follows:

V_{max.} = <u>Progr. path length in part program block [mm or degrees]</u> Interpolation cycle [s]

Upper limit

To guarantee that parts program blocks are executed continuously (control margin), the NC limits the tool path velocity within a parts program block to 90% of the max. possible tool path velocity as follows:

V_{max.} $\leq \frac{\text{Progr. path length in part program block [mm or degrees]}}{\text{Interpolation cycle [s]}} * 0.9$

For example, in the case of parts programs generated by means of CAD system, which contain extremely short blocks, this limiting of the path velocity can result in a strong reduction of the path velocity over several parts program blocks.

The function "Online compressor" can help to avoid such sudden velocity dips.

Literature

Programming Manual Work Preparation: Compressor COMPON/COMPCURVE

Voltage limit

The minimum tool path or axis velocity at which traversing is possible results from:

V_{min} $\geq \frac{10^{-9}}{\text{comput. resolution } [\frac{\text{incr.}}{\text{mm or degrees}}]^* \text{IPO cycle [s]}$

(for the computational resolution, see Chapter "Resolutions" If V_{min} is not reached, no traversing movement is carried out.

Literature

Function Manual Basic Functions; Velocities, traversing ranges, accuracy: Velocities

10.3 Memory configuration

10.3 Memory configuration

Introduction

On the SINUMERIK 840D sI, the persistent data are divided into various independent areas:

- SIEMENS
- Vendor
- Users

SRAM

For historical reasons, SRAM is still named as the memory medium at various points in relation to persistent data. For SINUMERIK solution line, this only applies insofar as SRAM is also sometimes used in the context of persistent data management. However, when a SINUMERIK solution line control system is in continuous operation, the data are physically stored in the much more powerful DRAM. Only when the control system is switched off are the data saved to a persistent data storage area. SRAM is also used for specific control systems.

Memory division

The figure below shows how NCK persistent data is divided:

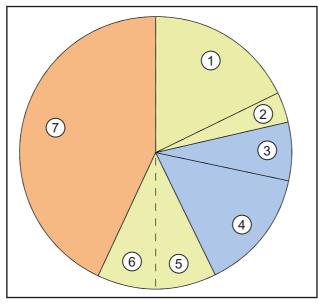


Figure 10-3 Memory division

Legend	Description	User
1	Part programs and OEM cycles can be set via MD 18352 \$MN_U_FILE_MEM_SIZE	User
2	In addition to part programs and OEM cycles, can be set via MD 18353 \$MN_M_FILE_MEM_SIZE	User
3	SIEMENS cycles	Siemens AG
4	Reserved	Siemens AG
5	RAM in NCK	User
6	RAM in NCK, contains the system and user data accessed by the NCK during program execution.	User
	Numbers for tools, frames, etc., are set by default.	
7	Additional memory (optional)	Available to users as an option and can be used for RAM in NCK or for part programs and cycles.

Memory display

The memory available in the NCK is displayed on the user interface, e.g., HMI Advanced, under: Operating area "Commissioning" > "NC" > "NC memory".

See also

Import licensing terms (Page 311)

10.4 Parameter sets of axis/spindle

10.4 Parameter sets of axis/spindle

Per machine axis, six parameter sets are available. They are used as follows

• on an axis:

for accommodation of the own dynamic response to another machine axis, e.g. when tapping or thread cutting on the relevant spindle.

• on a spindle:

for accommodation of the position controller to modified properties of the machine during operation, e.g. when switching the gearbox.

Tapping, thread cutting

The following applies to axes:

• For a machine axis that is not involved in tapping or thread cutting, the 1st set of parameters (index=0) is active in all cases.

The further parameter sets need not be considered.

• Machine axes involved in tapping or thread cutting: the parameter set is activated in accordance with the current gear stage.

All parameter sets must be parameterized in accordance with the gear stages of the spindle.

The following applies to spindles:

• With spindles, each gear stage is assigned a parameter set of its own.

For instance Gearbox step 1 - Parameter set 2 (Index 1). Spindles in axis operation (DB31, ... DBX60.0 = 0) use Parameter set 1 (Index 0). The active gearbox step can be read in the PLC via the signals DB31, ... DBX82.0-2

(Gearbox step setpoint)." The parameter set is selected from the PLC using the interface signal DB31, ... DBX16.0 - 16.2 (actual gear stage).

All parameter sets must be parameterized in accordance with the gear stages of the spindle.

For example, in HMI-Advanced, the active parameter set of a machine axis is displayed in the "Diagnosis" control area in the "Service axis" screen.

The active parameter set can be read in the PLC via the signals DB31, ... DBX69.0-2 (Controller parameter set)."

NCK start-up

10.4 Parameter sets of axis/spindle

Parameter set no.	Axis	Spindle	Gear stage The spindle
0	Standard	Axis mode	as specified by manufacturer input
1	Axis interpolated with spindle (G33)	Spindle mode	1.
2	Axis interpolated with spindle (G33)	Spindle mode	2.
3	Axis interpolated with spindle (G33)	Spindle mode	3.
4	Axis interpolated with spindle (G33)	Spindle mode	4.
5	Axis interpolated with spindle (G33)	Spindle mode	5.

Figure 10-4 Validity of parameter sets for axis and spindle modes

Remarks on the "Axis" column: Switch-over applies to G33 as well as for G34, G35, G331 and G332.

Machine data

The following machine data of a machine axis depend on the parameter set:

n = parameter set number (0 ... 5)

Table 10-9 Parameter-set-dependent machine data

Number	Identifier	Name	Reference
Axis/spind	llespecific (\$MA)		
31050	DRIVE_AX_RATIO_DENOM[n]	Denominator load gearbox	
31060	DRIVE_AX_RATIO_NUMERA[n]	Numerator load gearbox	
32200	POSCTRL_GAIN [n]	K _V factor	
32810	EQUIV_SPEEDCTRL_TIME [n]	Equivalent time constant, of speed control loop for feed forward control	
32910	DYN_MATCH_TIME [n]	Time constant for dynamic matching	
35110	GEAR_STEP_MAX_VELO[n]	Maximum speed for gear change	
35120	GEAR_STEP_MIN_VELO[n]	Minimum speed for gear change	
35130	GEAR_STEP_MAX_VELO_LIMIT[n]	Maximum speed of gear stage	
35140	GEAR_STEP_MIN_VELO_LIMIT[n]	Minimum speed of gear stage	
35200	GEAR_STEP_SPEEDCTRL_ACCEL[n]	Acceleration in speed control mode	
35210	GEAR_STEP_POSCTRL_ACCEL[n]	Acceleration in position control mode	
36200	AX_VELO_LIMIT [n]	Threshold value for velocity monitoring	

10.5 Parameterize axis data

Reference

See also

Axis data (Page 366) Axis assignment (Page 370) Axis names (Page 373)

10.5.1 Incremental measuring system settings

Rotary measuring system

The diagrams below show the general possibilities of arranging a rotary incremental measuring system with regard to motor and load, as well as the resulting values for the appropriate machine data.

Figures equally apply to rotary axes, modulo axis and spindles.

Linear axis with encoder on the machine

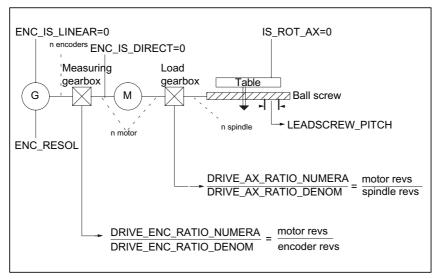


Figure 10-5 Linear axis with encoder on motor

Linear axis with sensor on load

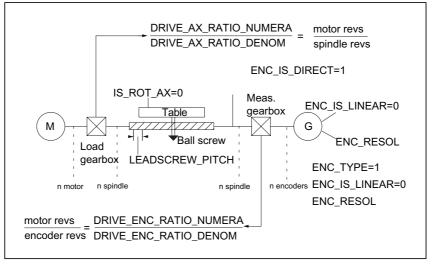


Figure 10-6 Linear axis with sensor on load

Rotary axis with encoder on motor

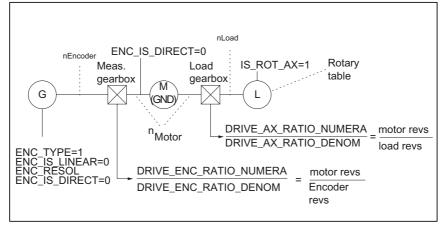


Figure 10-7 Rotary axis with encoder on motor

10.5 Parameterize axis data

Linear axis with encoder on the machine

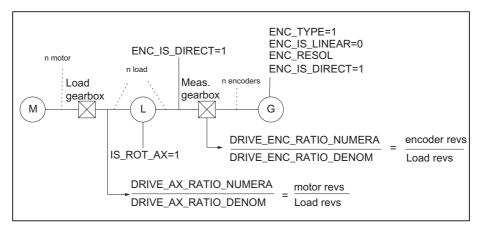


Figure 10-8 Linear axis with encoder on the machine

Machine data

Table 10- 10	Incremental measuring systems: Machine data	a
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Number	Identifier	Name / remarks	Reference		
Axisspecif	Axisspecific (\$MA)				
30240	ENC_TYPE[n]	Actual value acquisition modes 1=incremental raw signal encoder			
30242	ENC_IS_INDEPENDENT[n]	Encoder is independent			
30300	IS_ROT_AX	Rotary axis	R2		
31000	ENC_IS_LINEAR[n]	Direct measuring system (linear scale)			
31020	ENC_RESOL[n]	Encoder pulses per revolution			
31030	LEADSCREW_PITCH	Leadscrew pitch			
31040	ENC_IS_DIRECT[n]	Encoder is connected directly to the machine			
31050	DRIVE_AX_RATIO_DENOM[n]	Denominator load gearbox			
31060	DRIVE_AX_RATIO_NUMERA[n]	Numerator load gearbox			
31070	DRIVE_ENC_RATIO_DENOM[n]	Denominator of resolver gearbox			
31080	DRIVE_ENC_RATIO_NUMERA[n]	Numerator of resolver gearbox			

Linear measuring system

The diagram below shows the general possibilities of arranging a linear incremental measuring system with regard to motor and load, as well as the resulting values for the respective machine data.

Linear axis with linear scale

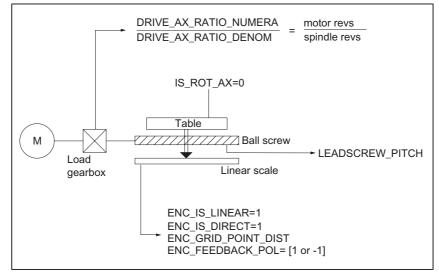


Figure 10-9 Linear axis with linear scale

Machine data

Table 10-11 Linear measuring systems: Machine data

Number	Identifier	Name / remarks	Reference
axisspecif	c (\$MA)		
30240	ENC_TYPE[n]	Actual value acquisition modes 1=incremental raw signal encoder	
30242	ENC_IS_INDEPENDENT[n]	Encoder is independent	
30300	IS_ROT_AX	Rotary axis	R2
31000	ENC_IS_LINEAR[n]	Direct measuring system (linear scale)	
31010	ENC_GRID_POINT_DIST[n]	Distance between reference marks on linear scales	
31030	LEADSCREW_PITCH	Leadscrew pitch	
31040	ENC_IS_DIRECT[n]	Encoder is connected directly to the machine	
31050	DRIVE_AX_RATIO_DENOM[n]	Denominator load gearbox	
31060	DRIVE_AX_RATIO_NUMERA[n]	Numerator load gearbox	
32110	ENC_FEEDBACK_POL[n]	Sign actual value (feedback polarity)	

10.5 Parameterize axis data

10.5.2 Parameterization of absolute measuring systems

Encoder types

The following encoder types are currently supported:

- Single-turn absolute value encoder
- Multi-turn absolute value encoder

with EnDat protocol and incremental sinusoidal encoder signals A and B, e.g. Haidenhain EQN 1325.

EQN 1325

The absolute value encoder EQN 1325 from Heidenhain has the following properties:

- EnDat protocol
- PPR count: 2048 = 2¹¹ (encoder fine resolution)
- Positions/revolution: 8192 (13 bits)
- Differentiable revolutions: 4096 (12 bits)
- Encoder signals A/B: 1Vpp sin/cos

Calibration

Convergence of the measuring system with the machine positions is performed by calibration of the absolute value encoder in absolute measuring systems. For calibration of the absolute value encoder, see Chapter "Axis homing" (Page 166).

Linear axis with absolute value encoder on motor

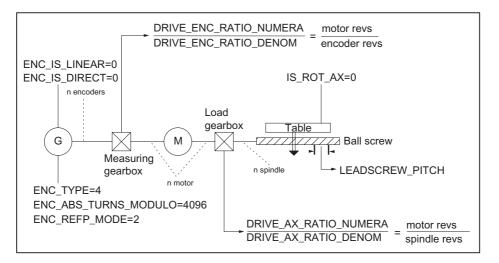


Figure 10-10 Linear axis with absolute value encoder on motor

Rotary axis, modulo axis and spindle with absolute value sensor on motor

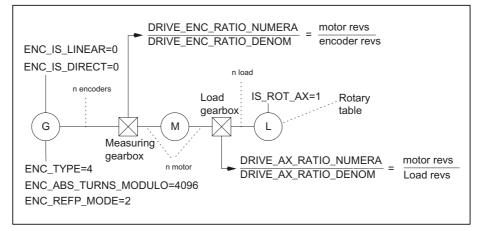


Figure 10-11 Rotary axis, modulo axis and spindle with absolute value sensor on motor

Machine data

Table 10- 12	Measuring	systems:	Machine da	ata
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Number	Identifier	Name / remarks	Reference
axisspecif	c (\$MA)		
30240	ENC_TYPE[n]	Actual-value acquisition modes	
30242	ENC_IS_INDEPENDENT[n]	Encoder is independent	
30260	ABS_INC_RATION[n]	Encoder fine resolution (absolute value encoder)	
30300	IS_ROT_AX[n]	Rotary axis	R2
31000	ENC_IS_LINEAR[n]	Direct measuring system (linear scale)	
31030	LEADSCREW_PITCH[n]	Leadscrew pitch	
31040	ENC_IS_DIRECT[n]	Encoder is connected directly to the machine	
31050	DRIVE_AX_RATIO_DENOM[n]	Denominator load gearbox	
31060	DRIVE_AX_RATIO_NUMERA[n]	Numerator load gearbox	
31070	DRIVE_ENC_RATIO_DENOM[n]	Measuring gearbox denominator	
31080	DRIVE_ENC_RATIO_NUMERA[n]	Measuring gearbox numerator	
34200	ENC_REFP_MODE[n]	Referencing mode	
34210	ENC_REFP_STATE[n]	Status of absolute value encoder	
34220	ENC_ABS_TURNS_MODULO[n]	Absolute value encoder range for rotary encoders (multi-turn resolution)	R2

10.5 Parameterize axis data

10.5.3 DSC (Dynamic Servo Control)

The DSC function eliminates the deadtime that necessarily exists at the speed-setpoint interface normally used between the NCK and drive due to relocation of the position controller into the drive.

This results in the following advantages for an axis operated with DSC:

- Considerably improved fault response/stability of the position control loop
- Improved command behavior (contour precision) if the loop gain (K_V factor) that can be set higher in conjunction with DSC is used.
- A reduction of the cyclic communication load on the PROFIBUS, if the position controller cycle/PROFIBUS cycle is reduced by adjusting the above parameters, even if the control loop performance is the same.

Note

The speed feedforward control can be used in conjunction with DSC.

Requirements

Before you can activate DSC mode, the following preconditions must be fulfilled:

- DSC-capable drive
- A DSC-capable message frame type has been parameterized in the S7 project for the drive.

Switch ON/OFF

The DSC function is switched on via the following axis-specific NCK machine data:

• MD32640 \$MA_STIFFNESS_CONTROL_ENABLE (dyn. Stiffness control)

If DSC operation is switched ON or OFF, it might be necessary to adjust the following machine data:

- MD32200 \$MA_POSCRTL_GAIN (servo gain factor)
- MD32610 \$MA_VELO_FFW_WEIGHT (feedforward control factor)
- MD32810 \$MA_EQUIV_SPEEDCTRL_TIME (substitute time const. of the closed speed control loop)

NOTICE

Before you can switch off DSC operation you might have to adapt (reduce) the $K_{\rm V}$ factor of the axis. Otherwise, instability of the position control loop might result.

Actual value inversion during DSC operation

Note

Actual value inversion during DSC operation (MD32640=1) is undertaken as follows:

- Set the p0410 parameter (encoder inversion actual value) in the drive.
- In the NC in the machine data, set MD32110 \$MA_ENC_FEEDBACK_POL = 0 or 1 (no inversion!).

Actual value inversion via MD32110=-1 is not possible during activated DSC operation. If MD32110=-1 is to be set, the "26017 axis%1 machine data 32110 value not permitted" alarm is output when DSC operation is activated.

Speed setpoint filter

If you use DSC, a speed setpoint filter for rounding the speed setpoint steps is no longer necessary. The speed setpoint filter is then only of any use with differential connection to support the position controller, for example, to suppress resonance.

Machine data

Table 10- 13 DSC: Machine data

Number	Identifier	Name	Reference
Axisspecif	c (\$MA)		
32640	STIFFNESS_CONTROL_ENABLE	Dyn. stiffness control	DD2
32200	POSCRTL_GAIN	K _V factor	G2
32642	STIFFNESS_CONTROL_CONFIG	The dynamic stiffness control is configured.	DD2
		0->standard case: DSC in drive operates with indirect measuring system	
		1->DSC in the drive operates using direct measuring system	

10.5 Parameterize axis data

10.5.4 Rotary axes

Rotary axes

A machine axis is parameterized as a rotary axis in

• MD30300 \$MA_IS_ROT_AX (rotary axis) = 1

The machine data is a scaling machine data. A change results in a conversion of all machine data of the machine axis with length-related units.

For the recommended procedure with respect to scaling machine data, please refer to Subsection "Modifying Scaling Machine Data" .

Modulo display

The display of the rotary axis position modulo 360 degrees is displayed via the following machine data:

• MD30320 \$MA_DISPLAY_IS_MODULO (modulo 360 degrees display for rotary axes)

Endlessly rotating rotary axis/modulo axis

The traversing of the rotary axis modulo 360 degrees is displayed via the following machine data:

• MD30310 \$MA_ROT_IS_MODULO (modulo conversion for rotary axis)

The limit switches are not monitored during this process. The rotary axis can thus rotate endlessly.

The limit switch monitoring can be activated by the PLC interface.

Machine data

Table 10- 14 Rotary axes: Machine data

Number	Identifier	Name	Reference
general (\$	MN)		
10210	INT_INCR_PER_DEG	Computational resolution for angular positions	G2
axisspecif	ic (\$MA)		·
30300	IS_ROT_AX	Axis is rotary axis	
30310	ROT_IS_MODULO	Modulo conversion for rotary axis	
30320	DISPLAY_IS_MODULO	Actual value display modulo	
36100	POS_LIMIT_MINUS	Minus software limit switch	A3
36110	POS_LIMIT_PLUS	Plus software limit switch	A3

Setting data

Table 10- 15 Rotary axes: Setting data

Number	Identifier	Name	Reference			
General (\$SN)						
41130	JOG_ROT_AX_SET_VELO	JOG speed for rotary axes	H1			
Axisspecific (\$SA)						
43430	WORKAREA_LIMIT_MINUS	Working area limitation minus	A3			
43420	WORKAREA_LIMIT_PLUS Working area limitation plus		A3			

Literature

Function Manual Expanded Functions; Rotary axes

10.5 Parameterize axis data

10.5.5 Positioning axes

Positioning axes are channel axes traversing parallel to the path axes without interpolating with them.

Positioning axes can be traversed either from the parts program or from the PLC.

Concurrent machine axes

A channel axis is neutrally defined by default with the following machine data. As a result no REORG takes place if the axis/spindle is traversed by the PLC (FC18) or by synchronous actions.

• MD30450 \$MA_IS_CONCURRENT_POS_AX (concurr. positioning axis) = 1

Positioning axis feedrate

If a positioning axis is programmed in the part program without specifying an axis-specific feedrate, the feedrate entered in the following machine data is automatically applicable to this axis:

• MD32060 \$MA_POS_AX_VELO (initial setting for positioning axis velocity)

This feedrate will apply until an axis-specific feedrate is programmed in the parts program for this axis.

Machine data

 Table 10- 16
 Positioning axes: Machine data

Number	Identifier	Name	Reference			
Channelspecific (\$MC)						
22240	AUXFU_F_SYNC_TYPE Output timing of F functions		H2			
axisspecific (\$MA)						
30450	IS_CONCURRENT_POS_AX Concurrent positioning axis					
32060	POS_AX_VELO	Feedrate for positioning axis				

Interface signals

Table 10- 17 Positioning axes: Interface signals

DB number	Bit, byte	Name	Reference
Axis/spindle-specific		Signals from PLC to axis/spindle	
31,	0	Feedrate override, axis-specific	
31,	2.2	Delete distance-to-go, axis-specific	
		Signals from axis/spindle to PLC	
31,	74.5	Positioning axis	
31,	78-81	F function (feedrate) for positioning axis	

Literature

Function Manual Expanded Functions; Positioning axes

10.5.6 Indexed axes/"Hirth" axes

Indexed axes are rotary or linear axes, which can be traversed to indexed positions by index program instructions.

These indexed positions are approached in JOG mode.

In "normal" positioning, every position can be approached.

Note

Traversing to indexing positions using the parts program or manually is only effective if the corresponding machine axis has been successfully referenced.

Hirth axes are indexing axes with Hirth tooth system. These axes are rotary or linear axes, which may only be traversed to defined positions, the indexing positions, within the traversing range (MD30505 \$MA_HIRTH_IS_ACTIVE).

The indexing positions are stored in tables.

Indexing axis

The following machine data assigns the machine axis the relevant table of indexing positions and also defines the machine axis as an indexing axis:

MD30500 \$MA_INDEX_AX_ASSIGN_POS_TAB[n] (axis is indexing axis)

Indexing position tables

The indexing positions are stored in one of the 2 tables.

- MD10900 \$MN_INDEX_AX_LENGTH_POS_TAB_1 (number of positions of indexing table 1)
- MD10910 \$MN_INDEX_AX_POS_TAB_1 [n] (indexing position table 1)
- MD10920 \$MN_INDEX_AX_LENGTH_POS_TAB_2 (number of positions of indexing table 2)
- MD10930 \$MN_INDEX_AX_POS_TAB_2 [n] (indexing position table 2)

NCK start-up

10.5 Parameterize axis data

Machine data

Table 10- 18 Indexing axes: Machine data

Number	Identifier	Name	Reference
general (\$	MN)		
10260	CONVERT_SCALING_SYSTEM	Basic system switch-over active	G2
10270	POS_TAB_SCALING_SYSTEM	Measuring system of position tables	
10900	INDEX_AX_LENGTH_POS_TAB_1	Number of indexing positions used in Table 1	
10910	INDEX_AX_POS_TAB_1[n]	Indexing position table 1	
10920	INDEX_AX_LENGTH_POS_TAB_2	Number of indexing positions used in Table 2	
10930	INDEX_AX_POS_TAB_2[n]	Indexing position table 2	
Axis/spind	lespecific (\$MA)		
30300	IS_ROT_AX	Rotary axis	R2
30310	ROT_IS_MODULO	Modulo conversion for rotary axis	R2
30320	DISPLAY_IS_MODULO	Position display is modulo 360 degrees	R2
30500	INDEX_AX_ASSIGN_POS_TAB	Axis is indexing axis	
30501	INDEX_AX_NUMERATOR	Numerator for indexing axes with equidistant positions	
30505	HIRTH_IS_ACTIVE	Axis is an indexing axis with Hirth toothing	

Interface signals

Table 10- 19 Indexing axes: Interface signals

DB number	Bit, byte	Name	Reference
Axis/spindle-specific Signals from axis/spindle to PLC			
31,	60.4, 60.5	Referenced/synchronized 1, referenced/synchronized 2	R1
31,	76.6	Indexing axis in position	

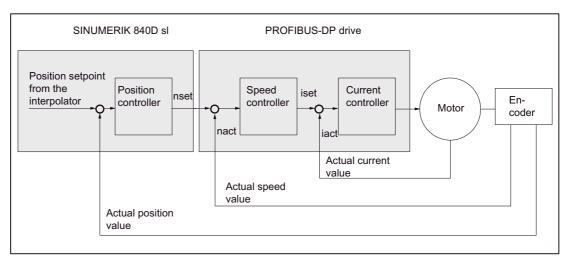
Literature

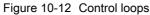
Function Manual Expanded Functions; Indexing axes

10.5.7 Position controller

Control loops

The closed-loop control of a machine axis consists of the cascaded closed-loop control circuits of current controller, speed controller and position controller.





Traversing direction

If the axis does not traverse into the desired direction, the appropriate adaptation is made in the following machine data:

MD32100 \$MA_AX_MOTION_DIR (travel direction)

The value "-1" reverses the direction of motion.

Control direction

If the control direction of the position measuring system is incorrect, it can be adjusted with the following machine data:

MD32110 \$MA_ENC_FEEDBACK_POL (sign of actual value)

Note

When DSC is activated on the incorrect position measuring system, the control direction must also be adjusted in SINAMICS parameter p410.

Servo gain

To obtain high contour accuracy, a high loop gain (K_V factor) of the position controller is required. However, an excessively high K_V factor causes overshoot, instability and impermissibly high machine loads.

The maximum permissible K_V factor is dependent on the dynamic response and the use of the feedforward control or DSC, of the drive and the mechanical system of the machine.

Note

The first commissioning is performed without feedforward control.

A K_V factor of "0" leads to the position controller being cut.

Definition of the KV factor

The $K_{\rm V}$ factor is defined as the ratio of velocity in m/min and the resulting following error in mm

KV =	Velocity	[m/min]
rv –	Following error	[mm]

This means for a K_V factor of 1 that at a velocity of 1m/min, a following error of 1mm results.

The K_V factor of the machine axis is entered via the following machine data:

MD32200 \$MA_POSCTRL_GAIN (servo gain factor)

Note

To adapt the input/output unit of the K_V factor selected by default to the internal unit [1/s], the following machine data is assigned pre-assigned:

- MD10230 \$MN_SCALING_FACTORS_USER_DEF[9] = 16.6666667
- MD10220 \$MN_SCALING_USER_DEF_MASK = 'H200'; (bit no. 9 as hex value)

When entering the K_V factor it is important to note that the gain factor of the whole position control loop is still dependent on other parameters of the controlled system (speed setpoint alignment).

These factors include, among others:

- MD32260 \$MA_RATED_VELO
- MD32250 \$MA_RATED_OUTVAL
- Automatic interface alignment (SINAMICS parameter "Reference speed" p2000)

For drive optimization see Further optimization options (Page 222)

NOTICE

Machine axes that interpolate one with another must have the same dynamic response at the same velocities.

This can be achieved by setting the same $K_{\rm V}$ factor or dynamic response adaptation in the following machine data:

- MD32900 \$MA_DYN_MATCH_ENABLE
- MD32910 \$MA_DYN_MATCH_TIME

The real K_V factor can be checked with the following error in the service display.

• e.g., HMI Advanced: Operating area "Diagnosis" > "Service displays" > "Service axis"

Checking the loop gain

If a K_V factor is already known for a machine type in question, this can be set and checked. To ensure that the drive does not reach its current limit during acceleration and deceleration, the acceleration is reduced for checking via the following machine data:

MD32300 \$MA_MAX_AX_ACCEL (axis acceleration)

The K_V factor must also be checked for high speeds of the rotary axis and spindle (e.g., for spindle positioning, tapping).

The approach behavior at various speeds can be checked by means of the HMI Advanced servo trace software. The speed setpoint is recorded for this purpose.

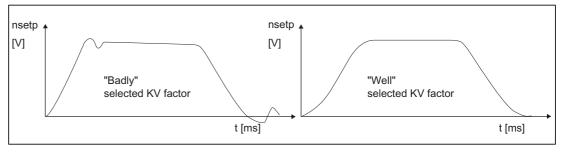


Figure 10-13 Speed setpoint characteristic

No overshoots may occur while the drive is approaching the static states; this applies to all speed ranges.

NCK start-up

10.5 Parameterize axis data

Overshoot in the position control loop

The reasons for an overshoot in the control loop can be:

- Acceleration too high (current limit is reached)
- Rise time too long (re-optimization necessary)
- Mechanical backlash
- Mechanical components canted

For safety reasons, set the $K_{\rm V}$ factor for each axis to a little less than the maximum possible value.

- MD32900 \$MA_DYN_MATCH_ENABLE[n]
- MD32910 \$MA_DYN_MATCH_TIME[n]

For axes interpolating with each other, the same K_V -factor should be set. Normally it is the K_V -factor of the weakest interpolating axis.

Contour monitoring must be set subsequently (MD36400 \$MA_CONTROL_TOL).

Acceleration

In the following machine data machine axes are accelerated and decelerated with the values entered.

MD32300 \$MA_MAX_AX_ACCEL (axis acceleration)

This value should allow the axes to be accelerated and positioned fast and accurately, while ensuring that the machine is not loaded unduly.

Checking the acceleration

The sign of a properly adjusted acceleration of a machine axis is acceleration and positioning free from overshoot at rapid traverse rate and maximum load (max. external moment of inertia).

After the acceleration has been entered, the axis is traversed rapidly and the actual current values and current setpoint are recorded.

This recording shows whether the drive reaches the current limit. Here, the current limit can be reached for a short time.

The current must be well below the current limit, however, before the rapid traverse velocity or the final position is reached.

Load changes during the machining should not result in the current limit being reached, as they may result in contour errors. For this reason, the acceleration value should be a little bit less than the maximum acceleration value.

Machine axes can have different acceleration values, even if they interpolate with each other.

Jerk

For jerk, the following should be noted:

- For indexing program instructions (SOFT), the maximum jerk must be set in the following machine data:
 - MD32431 \$MA_MAX_AX_JERK (maximum jerk)
- For JOG and positioning axes the following machine data should be supplemented:
 - MD32420 \$MA_JOG_AND_POS_JERK_ENABLE
 - MD32430 \$MA_JOG_AND_POS_MAX_JERK

Machine data

Table 10- 20 Position control: Machine data

Number	Identifier	Name/remarks	Reference			
axis spec.	axis spec. (\$MA)					
32100	AX_MOTION_DIR[n]	Traversing direction				
32110	ENC_FEEDBACK_POL[n]	Actual value sign				
32200	POSCTRL_GAIN [n]	KV factor				
32300	MAX_AX_ACCEL[n]	Axis acceleration				
32420	JOG_AND_POS_JERK_ENABLE	Enabling jerk limitation				
32430	JOG_AND_POS_MAX_JERK	Axial jerk				
32431	MAX_AX_JERK	Maximum axial jerk when traversing along the path				
32900	DYN_MATCH_ENABLE[n]	Dynamic response adaptation				
32910	DYN_MATCH_TIME [n]	Time constant for dynamic matching				
36400	CONTROL_TOL	Contour monitoring				

Literature

Function Manual; speed, setpoint/actual-value systems, control: Closed-loop control

Function Manual Extended Functions; Compensation, Section "Dynamic feedforward control (following error compensation)"

10.5.8 Speed setpoint matching

In the case of speed setpoint comparison, the NC is informed, which speed setpoint corresponds to which motor speed in the drive, for parameterizing the axial control and monitoring. Speed setpoint matching can be performed automatically or manually.

Automatic adjustment

It is possible to perform automatic speed setpoint adjustment if the drive supports acyclic services on the PROFIBUS-DP (standard for SINAMICS).

Acyclic services on the PROFIBUS-DP are supported

if in the following machine data the value "0" is entered:

MD32250 \$MA_RATED_OUTVAL (rated output voltage) [%]

During start-up of the NCK, speed setpoint matching between the NCK and the drive is then performed automatically.

The SINAMICS parameter "Reference speed" p2000 may not be changed during operation of the control with the drive.

Note

If automatic speed setpoint matching fails for one axis, the following message is output on a traverse request for this axis:

Message: "Wait, axis enable missing"

This axis and any axes that interpolate with it are not traversed.

Manual comparison

The speed setpoint alignment (interface normalization) is specified in the following machine data:

- MD32250 \$MA_RATED_OUTVAL (rated output voltage) [%]
- MD32260 \$MA_RATED_VELO (rated motor speed)

If a non-zero value is entered into the following machine data, the NCK assumes that speed setpoint matching will be performed manually.

MD32250 \$MA_RATED_OUTVAL (rated output voltage) [%]

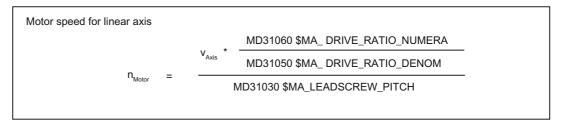
Note

The maximum upper limit for the speed setpoint is set in machine data

• MD36210 \$MA_CTRLOUT_LIMIT (maximum speed setpoint) [%]

Calculation of the motor speed

If the motor speed required for speed setpoint matching is not known directly, it can be calculated as follows with reference to the required axis velocity (linear axis) or load speed (rotary axis/spindle):



Motor speed for rotary axis/spindle $n_{Motor} = n_{Load} * \frac{MD31060 \mbox{MA_DRIVE_RATIO_NUMERA}}{MD31050 \mbox{MA_DRIVE_RATIO_DENOM}}$

- v_{Axis} [mm/min]
- MD31060 \$MA_DRIVE_RATIO_NUMERA (load gearbox numerator)
- MD31050 \$MA_DRIVE_RATIO_DENOM (load gearbox denominator)
- MD31030 \$MA_LEADSCREW_PITCH (leadscrew pitch) [mm/rev]
- n_{Motor} [rpm]
- n_{Load} [rpm]

Checking the trim

Incorrect speed setpoint matching has a negative impact on the real loop gain of the axis.

To check speed setpoint matching it is necessary for a defined traverse velocity to compare the actual following error with the desired following error that should be set if speed setpoint matching is correct.

Desired following error =

Traversing speed MD32200 \$MA_POSCTRL_GAIN

- Desired following error [mm]
- Traversing velocity [m/min]
- MD32200 \$MA_POSCTRL_GAIN (servo gain factor) [(m/min)/mm]

The actual following error is shown in the axis-specific service data:

HMI:

Operating area "Diagnostics" > "Service displays" > "Service axis/spindle"

NCK start-up

10.5 Parameterize axis data

Machine data

 Table 10- 21
 Speed setpoint matching: Machine data

Number	Identifier	Name/remarks	Reference	
Axis-spec.	Axis-spec. (\$MA)			
32250	RATED_OUTVAL	Rated output voltage [%]	G2	
32260	RATED_VELO	Rated motor speed	G2	

Literature

Function Manual Basic Functions; Speeds, setpoint/actual value systems, control, Chapter "Speeds, traversing ranges, accuracy"

10.5.9 Drift compensation

Digital drives

Digital drives are not subject to drift or compensate for it automatically.

Machine data

Table 10- 22 Drift compensation: Machine data

Number	Identifier	Name/remarks	Reference		
axis spec.	axis spec. (\$MA)				
36720	DRIFT_VALUE	Basic drift value, always = 0	G2		
		Note:			
		0 recommended for digital drive.			

10.5.10 Velocity matching (axis)

Max. axis velocity

The value entered in the following machine data is the limit velocity up to which a machine axis can accelerate (rapid traverse limiting). It depends on the machine and drive dynamics and the limit frequency of actual-value acquisition.

MD32000 \$MA_MAX_AX_VELO[n] (max. axis velocity)

The max. axis velocity is used for traversing in the parts program when rapid traverse (G00) is programmed.

The maximum linear or rotary axis velocity should be entered in the machine data in accordance with MD30300 \$MA_IS_ROT_AX[n].

Rapid traverse in JOG mode

The value entered in the following machine data is the velocity at which the machine axis traverses in JOG mode with the rapid traverse override key actuated and with an axial feedrate override of 100%.

- MD32010 \$MA_JOG_VELO_RAPID[n] (rapid traverse in JOG mode) or
- MD32040 \$MA_JOG_REV_VELO_RAPID[n] (revolutional feedrate in JOG mode with rapid traverse override)

The entered value may not exceed the max. permissible axis velocity.

This machine data will not be used for the programmed rapid traverse G00.

JOG axis velocity

The value entered in this machine data is the velocity at which the machine axis traverses in JOG mode with an axial feedrate override of 100%:

- MD32020 \$MA_JOG_VELO[n] (axis velocity in JOG mode) or
- MD32050 \$MA_JOG_REV_VELO[n] (revolutional feedrate in JOG mode)

The velocity from MD32020 JOG_VELO[n] or MD32050 JOG_REV_VELO[n] is used only if

- for linear axes: SD41110 \$SN_JOG_SET_VELO = 0
- for rotary axes: SD41130 \$SN_JOG_ROT_AX_SET_VELO = 0

or

• for reverse feed: SD41120 \$SN_JOG_REV_SET_VELO = 0

If the above mentioned setting data are unequal to 0, the JOG velocity results as follows:

- 1. SD41100 \$SN_JOG_REV_IS_ACTIVE (revolutional feedrate in JOG mode) = 0
 - => Linear feedrate (G94)
 - Linear axes:
 - JOG velocity = SD41110 \$SN_JOG_SET_VELO (JOG velocity for G94)
 - Rotary axes:
 - JOG velocity = SD41130 \$SN_JOG_ROT_AX_SET_VELO (JOG velocity for rotary axes)
- 2. SD41100 \$SN_JOG_REV_IS_ACTIVE (revolutional feedrate in JOG mode) = 1
 - JOG velocity = SD41120 \$SN_JOG_REV_SET_VELO (JOG velocity for G95)

The entered value may not exceed the max. permissible axis velocity.

NOTICE

Depending on MD30300 \$MA_IS_ROT_AX[n], the velocities have to be entered in mm/min, inch/min, or rpm.

If the velocities are changed, MD36200 \$MA_AX_VELO_LIMIT[n] (threshold value for velocity monitoring) must be adapted accordingly.

Machine data

Table 10- 23 Velocities: Machine data

Number	Identifier	Name / remarks	Reference		
axis-spec.	axis-spec. (\$MA)				
30300	IS_ROT_AX[n]	Rotary axis			
32000	MAX_AX_VELO[n]	Maximum axis velocity	G2		
32010	JOG_VELO_RAPID[n]	Rapid traverse in JOG mode			
32020	JOG_VELO[n]	JOG axis velocity			
32040	JOG_REV_VELO_RAPID[n]	Revolutions feedrate in JOG mode with rapid traverse override			
32050	JOG_REV_VELO[n]	Revolutional feedrate in JOG mode			
32060	POS_AX_VELO[n]	Initial setting for positioning axis velocity	P2		
32250	RATED_OUTVAL	Rated output voltage			
32260	RATED_VELO[n]	Rated motor speed			

Setting data

Table 10- 24 Velocities: Setting data

Number	Identifier	Name / remarks	Reference		
General (\$	General (\$SN)				
41100	JOG_REV_IS_ACTIVE	Revolutional feedrate in JOG mode active			
41110	JOG_SET_VELO	JOG velocity for linear axes (for G94)			
41120	JOG_REV_SET_VELO	JOG velocity (for G95)			
41130	JOG_ROT_AX_SET_VELO	JOG speed for rotary axes			
41200	JOG_SPIND_SET_VELO	JOG velocity for the spindle			

Literature

Function Manual Basic Functions;

Speeds, setpoint/actual value systems, control, Chapter "Speeds, traversing ranges, accuracy"

Function Manual, Expanded Functions; Manual and Hand Wheel Travel

10.5.11 Axis monitoring

Static monitoring functions

The static monitoring functions with reference to a machine axis are:

Exact stop coarse

Window around the setpoint position within which exact stop coarse is detected.

- MD36000 \$MA_STOP_LIMIT_COARSE (exact stop coarse)
- IS: DB31,... DBX60.6 (position reached with exact stop coarse)

Exact stop fine

Window around the setpoint position within which exact stop fine is detected.

- MD36010 \$MA_STOP_LIMIT_FINE (exact stop fine)
- IS: DB31,... DBX60.7 (position reached with exact stop coarse)

Delay time exact stop fine

Delay time after which the actual value must have reached the tolerance window "Exact stop fine" when the setpoint position is reached.

- MD36020 \$MA_POSITIONING_TIME (delay time exact stop fine)
- Alarm: "25080 Positioning monitoring" and follow-up mode.

Zero speed tolerance

Position tolerance which a standing machine axis may not leave.

- MD36030 \$MA_STANDSTILL_POS_TOL (standstill tolerance)
- Alarm: "25040 Zero speed control" and follow-up mode.

Delay time zero speed monitoring

Delay time after which the actual value must have reached the tolerance window "Zero speed tolerance" when the setpoint position is reached.

- MD36040 \$MA_STANDSTILL_DELAY_TIME (Zero-speed monitoring delay time)
- Alarm: "25040 Zero speed control" and follow-up mode.

Clamping tolerance

Tolerance window for a standing machine axis while the signal "Clamping active" is present at the PLC interface.

- MD36050 \$MA_CLAMP_POS_TOL (clamping tolerance)
- IS: DB31,... DBX2.3 (clamping active)
- Alarm: "26000 Clamping monitoring"

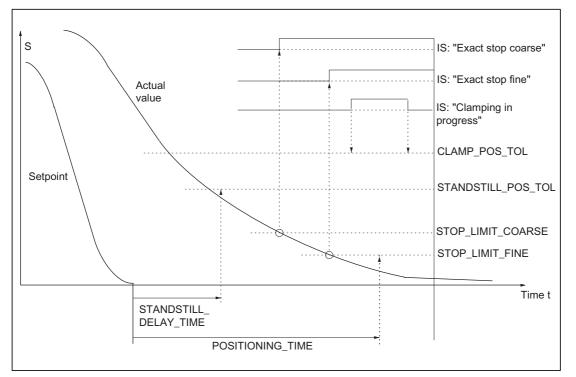


Figure 10-14 Static monitoring functions

Working area limitation

The permissible working area of the machine axes can be adapted to the particular machining situation using the "dynamic" working area limitation.

- SD43400 \$SA_WORKAREA_PLUS_ENABLE (Working area limitation active in the positive direction)
- SD43410 \$SA_WORKAREA_MINUS_ENABLE (Working area limitation active in the negative direction)
- SD43420 \$SA_WORKAREA_LIMIT_PLUS (Working area limitation plus)
- SD43430 \$SA_WORKAREA_LIMIT_MINUS (Working area limitation minus)
- Alarm: "10630 Axis reaching operating range limit +/-"
- Alarm: "10631 Axis is at operating range limit +/- (JOG)"
- Alarm: "10730 Progr. end point is behind working area limitation +/-"

Software limit switches

Two software limit switch pairs are provided per machine axis. The active software limit switch pair is selected in the PLC.

- MD36100 \$MA_POS_LIMIT_MINUS (1st software limit switch minus)
- MD36110 \$MA_POS_LIMIT_PLUS (1st software limit switch plus)
- MD36120 \$MA_POS_LIMIT_MINUS2 (2nd software limit switch minus)
- MD36130 \$MA_POS_LIMIT_PLUS2 (2nd software limit switch plus)
- IS: DB31,... DBX12.2 (2nd software limit switch minus)
- IS: DB31,... DBX12.3 (2nd software limit switch plus)
- Alarm: "10620 Axis reaching software limit switch +/-"
- Alarm: "10621 Axis is at software limit switch +/- (JOG)"
- Alarm: "10720 Progr. end point is behind software limit switch +/-"

NOTICE

All position monitoring functions are only active with valid reference point of the corresponding reference point of the machine axis.

Hardware limit switches

If the PLC signals that a hardware limit switch has been reached, the machine axis is stopped with the parameterized brake response.

- IS: DB31, ... DBX12.1 (hardware limit switch plus)
- IS: DB31, ... DBX12.0 (hardware limit switch minus)
- MD36600 \$MA_BRAKE_MODE_CHOICE (braking behavior on hardware limit switch)
 - 0 = Brake characteristic is complied with
 - 1 = Rapid deceleration with setpoint "0"
- Alarm: "21614 Hardware limit switch [+/-]"

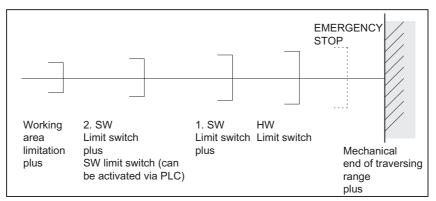


Figure 10-15 Overview of end limitations

Dynamic monitoring functions

The dynamic monitoring functions with reference to a machine axis are:

Speed setpoint monitoring

The speed setpoint monitoring prevents that the max. admissible motor speed is exceeded.

It must be set such that the max. velocity (rapid traverse) can be reached and, in addition, a certain control margin remains.

MD36210 \$MA_CTRLOUT_LIMIT[n] (maximum speed setpoint as %)

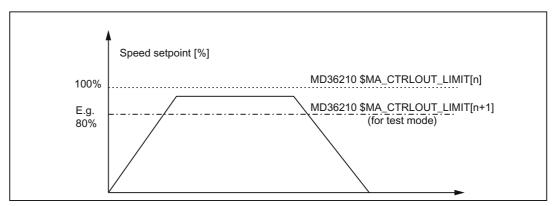


Figure 10-16 Speed setpoint limitation

The following machine data is used to define how long the speed setpoint may remain within the limits before the speed setpoint monitoring responds.

• MD36220 \$MA_CTRLOUT_LIMIT_TIME[n] (delay time for speed setpoint monitoring)

Error response

• Alarm: "25060 Speed setpoint limiting"

and stopping the machine axis using a speed setpoint ramp whose characteristic is set in

• MD36610 \$MA_AX_EMERGENCY_STOP_TIME (braking ramp time when errors occur)

Cause of errors/error handling

- A measuring circuit error or drive error is present.
- Setpoints are too high (accelerations, velocities, reducing factors).
- Obstacle in the machining space (e.g. tool hits working table) => remove obstacle.

The speed setpoint consists of the speed setpoint of the position controller and the feedforward control parameter (if feedforward control is active).

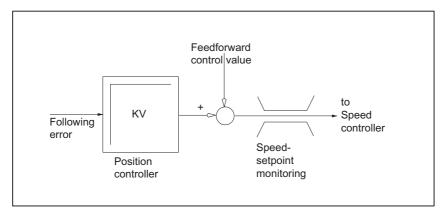


Figure 10-17 Speed setpoint calculation

NOTICE

The limitation of the speed setpoint will turn the control loop into a nonlinear control loop.

Generally, this will result in deviations from the contour and longer dwelling of the machine axis within the speed setpoint limitation.

Actual velocity monitoring

Monitoring due to the actual velocity of the machine axis determined based on the encoder values

• MD36020 \$MA_AX_VELO_LIMIT (velocity-monitoring threshold)

Error response

• Alarm: "25030 Alarm limit of actual velocity"

and stopping the machine axis using a speed setpoint ramp whose characteristic is set in

MD36610 \$MA_AX_EMERGENCY_STOP_TIME (braking ramp time when errors occur)

Remedy

- Check actual values
- Check position control direction (control sense)
- Threshold value for velocity monitoring is possibly too low.

Contour monitoring

Monitoring of the difference between the following error measured and the following error calculated from the position setpoint.

• MD36400 CONTOUR_TOL (contour monitoring tolerance range)

Error response

• Alarm: "25050 Contour monitoring"

and stopping the machine axis using a speed setpoint ramp whose characteristic is set in

• MD36610 \$MA_AX_EMERGENCY_STOP_TIME (braking ramp time when errors occur)

Remedy

Contour errors are caused by signal distortions in the position control loop. Remedy:

- Increase the tolerance band
- Checking the K_V factor:

The real K_V factor must correspond to the desired K_V factor, set via MD32200 $MA_POSCTRL_GAIN[n]$ (K_V factor).

HMI-Advanced

Operating area "DIAGNOSTICS" > "Service displays" > "Service axis"

- · Check optimization of the speed controller
- Check smooth running of the axes
- Check machine data for traversing motions

(Feedrate override, acceleration, max. velocities, ...)

• For operation with feedforward control:

MD32810 \$MA_EQUIV_SPEEDCTRL_TIME (equivalent time constant of speed control loop for feedforward control) or if the machine data is imprecisely set, the MD36400 \$MA_CONTOUR_TOL must be enlarged.

NCK start-up

10.5 Parameterize axis data

Encoder limit frequency monitoring

Monitoring of the limit frequency of the encoder of a machine axis.

• MD36300 \$MA_ENC_FREQ_LIMIT (encoder limit frequency)

Error response

- Alarm: "21610 Encoder frequency exceeded"
- IS: DB31, ... DBX60.2 "Encoder limit frequency exceeded 1"
- IS: DB31, ... DBX60.3 "Encoder limit frequency exceeded 2"

and stopping the machine axis using a speed setpoint ramp whose characteristic is set in

• MD36610 \$MA_AX_EMERGENCY_STOP_TIME (braking ramp time when errors occur)

Remedy

After the axes have come to a stop, the position control is resumed after the alarm (RESET at the machine control panel) is acknowledged.

NOTICE

The axis affected must be re-referenced.

Encoder zero mark monitoring

The zero mark monitoring of the encoder of a machine axis checks whether pulses were lost between two zero mark passes.

MD36310 \$MA_ENC_ZERO_MONITORING (zero-mark monitoring)

is used to enter the number of detected zero mark errors at which the monitoring is to respond.

Special situation:

A value of 100 will additionally disable hardware monitoring of the encoder.

Error response

• Alarm: "25020 Zero mark monitoring"

and stopping the machine axes using a speed setpoint ramp whose characteristic is set in

MD36610 \$MA_AX_EMERGENCY_STOP_TIME (braking ramp time when errors occur)

Error causes

- MD36300 \$MA_ENC_FREQ_LIMIT [n] (encoder limit frequency) set too high.
- Encoder cable damaged.
- Encoder or encoder electronics defective.

Position tolerance when switching over the encoder

It is possible to switch between the two encoders or position measuring systems of a machine axis at any time. The permissible position difference between the two position measuring systems when switching over is monitored.

 MD36500 \$MA_ENC_CHANGE_TOL (max. tolerance on position actual value switchover)

Error response

• Alarm: "25100 Measuring system cannot be switched over"

The requested switchover to another encoder is not carried out.

Error causes

- The specified permissible tolerance is too small.
- The position measuring system to which you want to switch over to is not referenced.

Transmission Monitoring the encoder position tolerance

The position difference between the two encoders or position measuring systems of a machine axis is monitored with

MD36510 \$MA_ENC_DIFF_TOL (measuring system synchronism tolerance)

Error response

• Alarm: "25105 Measuring systems are not synchronous"

and stopping the machine axes using a speed setpoint ramp whose characteristic is set in the following machine data:

MD36610 \$MA_AX_EMERGENCY_STOP_TIME (braking ramp time when errors occur)

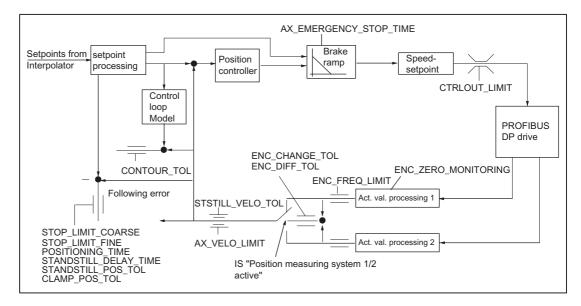


Figure 10-18 Monitoring for SINUMERIK 840D sl

NOTICE

MD36620 \$MA_SERVO_DISABLE_DELAY_TIME (switchoff delay servo enable) must always be selected greater than MD36610 \$MA_AX_EMERGENCY_STOP_TIME (braking ramp time when errors occur) If this is not the case, the braking ramp cannot be kept.

Literature

Function Manual Basic Functions; Axis monitoring: Protection zones

10.5.12 Axis homing

referencing

When referencing a machine axis, the actual position value system of the machine axis is synchronized with the machine geometry. Depending on the encoder type used, the machine axis is referenced with or without traversing movements.

Reference point approach

For all machine axes which are not equipped with an encoder providing an absolute actual position value, referencing is carried out by traversing the machine axis to a reference point; this is called the reference point approach.

The reference point approach can be carried out either manually in JOG mode, submode REF, or using a parts program.

With the operating mode JOG and submode REF, reference point approach is started using traverse direction keys PLUS or MINUS (depending on the parameterized reference point approach direction).

10.5.12.1 Incremental measuring system

Incremental measuring systems

With incremental measuring systems, referencing is carried out using a reference point approach divided into three phases:

- 1. Traversing to the reference cam
- 2. Synchronizing to the encoder zero marker
- 3. Approach reference point

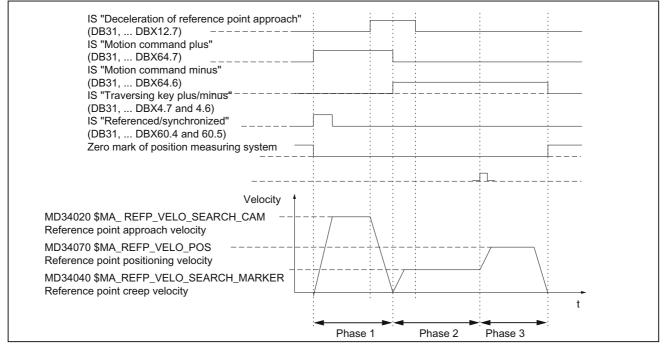


Figure 10-19 Signal chart: Referencing with an incremental measuring system (principle)

Phase-independent data

The following **machine data** and **interface signals** are relevant in each of the individual phases of the reference point approach:

- MD11300 \$MN_JOG_INC_MODE_LEVELTRIGGRD (INC/REF in jog mode)
- MD34000 \$MA_REFP_CAM_IS_ACTIVE (axis with reference cam)
- MD34110 \$MA_REFP_CYCLE_NR (axis sequence for channel-specific reference point approach)
- MD30240 \$MA_ENC_TYPE (encoder type)
- MD34200 \$MA_ENC_REFP_MODE (referencing mode)
- IS: DB21, ... DBX1.0 ("Activate referencing")
- IS: DB21, ... DBX33.0 ("Referencing active")

NCK start-up

10.5 Parameterize axis data

Phase 1: Traversing to the reference cam

The following machine data and interface signals are relevant:

- MD34010 \$MA_REFP_CAM_DIR_IS_MINUS (approach reference cam in minus direction)
- MD34020 \$MA_REFP_VELO_SEARCH_CAM (reference cam approach velocity)
- MD34030 \$MA_REFP_MAX_CAM_DIST (maximum distance to the reference cam)
- MD34092 \$MA_REFP_CAM_SHIFT (electr. cam offset, incremental measuring systems with equidistant zero markers)
- IS: DB21, ... DBX36.2 ("All axes with obligatory reference point are referenced")
- IS: DB31, ... DBX4.7/DBX4.6 ("Traversing keys plus/minus")
- IS: DB31, ... DBX12.7 ("Reference point approach delay")
- IS: DB31, ... DBX60.4, DBX60.5 ("Referenced/synchronized 1, 2")

Properties of phase 1:

- The feedrate override (feedrate switch) is active.
- The feed stop (channelspecific and axisspecific) is active.
- The machine axis can be stopped and restarted with NC-stop/NC-start.
- The machine axis traverses a distance specified in the following machine data from the starting position in the direction of the reference cam, without reaching the reference cam.
 - MD34030 \$MA_REFP_MAX_CAM_DIST (max. distance to reference cam)
- The following interface signal is set to "0". The axis stops, and alarm 20000 "Reference cam not reached" is output.
 - IS: DB31, ... DBX12.7 ("Reference point approach delay") = 0

If the reference cam is not calibrated exactly, it is possible that a wrong zero mark is evaluated after the reference cam has been left. As a result, the control system will take a wrong machine zero.

Software limit switches, protection areas and work area limits will thus also be active for the wrong positions. The difference is equivalent to one encoder revolution in each case.

Danger for man and machine exists.

Phase 2: Synchronizing to the encoder zero mark

The following machine data and interface signals are relevant:

- MD34040 \$MA_REFP_VELO_SEARCH_MARKER (creep velocity)
- MD34050 \$MA_REFP_SEARCH_MARKER_REVERSE (direction reversal on reference cam)
- MD34060 \$MA_REFP_MAX_MARKER_DIST (maximum distance from cam to reference mark)

Properties of phase 2:

• Feed override (the feed override switch) is not active.

If a feed override of 0% is selected via the feed override switch, the traverse movement is stopped.

• Feed stop (channel-specific and axis-specific) is active.

On a feed stop, the traverse movement is stopped and the alarm displayed:

- Alarm 20005 "Reference point approach canceled"
- NC-Stop/NC-Start is inactive.
- With IS: DB31, ... DBX12.7 ("Reference point approach delay") = 0, the machine axis traverses a distance parameterized in the following machine data after leaving the reference cam.
 - MD34060 \$MA_REFP_MAX_MARKER_DIST (max. distance to the reference mark)

Without the zero mark being detected, the machine axis stops and the following alarm is displayed:

Alarm 20002 "Zero mark missing"

Phase 3: Approach reference point

The following machine data and interface signals are relevant:

- MD34070 \$MA_REFP_VELO_POS (reference point positioning velocity)
- MD34080 \$MA_REFP_MOVE_DIST (reference point distance to zero mark)
- MD34090 \$MA_REFP_MOVE_DIST_CORR (reference point offset, additive)
- MD34100 \$MA_REFP_SET_POS (reference point value)
- IS: DB31, ... DBX2.4, 2.5, 2.6, 2.7 ("Reference point value 1...4")
- IS: DB31, ... DBX60.4, DBX60.5 ("Referenced/synchronized 1, 2")

Properties of phase 3:

- Feed override (the feed override switch) is active.
- Feed stop (channel-specific and axis-specific) is active.
- NC-Stop/NC-Start is active.

Literature

Function Manual Basic Functions; Reference point approach: Referencing with incremental measurement systems

10.5.12.2 Distancecoded reference marks

Distancecoded reference marks

When clearance-coded reference marks are used, referencing is divided into 2 phases:

- 1. Synchronize by overriding 2 reference marks
- 2. Traverse to target point

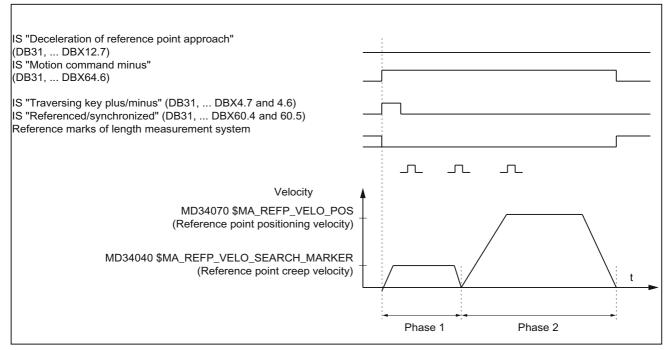


Figure 10-20 Signal chart: Distance-coded reference marks (principle)

Phase-independent data

The following **machine data** and **interface signals** are independent with respect to the individual phases of reference point approach:

- MD11300 \$MN_JOG_INC_MODE_LEVELTRIGGRD (INC/REF in jog mode)
- MD34000 \$MA_REFP_CAM_IS_ACTIVE (axis with reference cam)
- MD34110 \$MA REFP_CYCLE_NR (axis sequence for channel-specific reference point approach)
- MD30240 \$MA ENC_TYPE (encoder type)
- MD34200 \$MA ENC_REFP_MODE (referencing mode)
- MD34310 \$MA ENC_MARKER_INC (interval between two reference marks)
- MD34320 \$MA ENC_INVERS (inverse measuring system)
- IS: DB21, ... DBX1.0 ("Activate referencing")
- IS: DB21, ... DBX33.0 ("Referencing active")

Phase 1: Synchronize by overriding 2 reference marks

The following machine data and interface signals are relevant:

- MD34010 \$MA REFP_CAM_DIR_IS_MINUS (approach reference cam in negative direction)
- MD34040 \$MA REFP_VELO_SEARCH_MARKER (referencing velocity)
- MD34060 \$MA REFP_MAX_MARKER_DIST (maximum distance between 2 reference marks)
- MD34300 \$MA ENC_REFP_MARKER_DIST (reference mark distance)
- IS: DB21 .. 30, DBX36.2 ("All axes to be referenced are referenced")
- IS: DB31, ... DBX4.7/DBX4.6 ("Traversing keys plus/minus")
- IS: DB31, ... DBX12.7 ("Reference point approach delay")
- IS: DB31, ... DBX60.4, DBX60.5 ("Referenced/synchronized 1, 2")

Properties of phase 1:

• If the machine axis travels from the initial position a distance defined in MD34300 \$MA REFP_MARKER_DIST (max. distance to the reference mark) without two reference marks being overridden, then the machine axis stops and

the system issues alarm 20004 "Reference mark missing".

Phase 2: Traversing to the target point

The following machine data and interface signals are relevant:

- MD34070 \$MA REFP_VELO_POS (target point positioning velocity)
- MD34090 \$MA REFP_MOVE_DIST_CORR (absolute offset)
- MD34100 \$MA REFP_SET_POS (target point)
- MD34330 \$MA REFP_STOP_AT_ABS_MARKER (with/without target point)
- IS: DB31, ... DBX60.4, DBX60.5 ("Referenced/synchronized 1, 2")

Properties of phase 2:

- The feed rate override (feed rate switch) is active.
- The feed stop (channelspecific and axisspecific) is active.
- The machine axis can be stopped and restarted with NC stop/NC start.

NCK start-up

10.5 Parameterize axis data

Determining the absolute offset

To determine the absolute offset between the measuring system zero point and the machine zero, the following procedure is recommended:

1. Determining the actual position of the measuring system

After two reference marks following one after the other (synchronized) have been overtraveled, the actual position of the length measuring system can be read on the user interface at "Actual position".

The absolute offset must be zero at this time:

- MD34090 \$MA REFP_MOVE_DIST_CORR = 0
- 1. Determine the absolute machine actual position

Determining the absolute machine actual position, e.g., can be performed by traversing the machine axis to a known position (fixed stop). Alternatively, it can be measured at any position (laser interferometer).

2. Calculating the absolute offset

Linear measurement system non-inverse to machine system:

Absolute offset = machine actual position + actual position of the measuring system

Linear measuring system inverse to machine system:

Absolute offset = machine actual position - actual position of the measuring system

MD34090 \$MA REFP_MOVE_DIST_CORR (reference point/absolute offset)

After you have determined the absolute offset and made an entry in

MD34090 \$MA REFP_MOVE_DIST_CORR (absolute offset)

the position measuring system must be re-referenced.

Literature

Function Manual Basic Functions; Reference point approach: Referencing with length measuring systems with distancecoded reference marks

10.5.12.3 Absolute encoders

Absolute encoder

Initial referencing of the measuring system of a machine axis with absolute encoder is performed by calibrating the encoder.

Follow-up referencing

Follow-up referencing of a machine axis is performed automatically while the NC starts up without axis movement. The following conditions must be fulfilled:

- The measuring system of the machine axis active after the booting of the NC works with the absolute encoder
- The absolute encoder is calibrated:

MD34210 \$MA_ENC_REFP_STATE[n] = 2 (absolute value encoder is calibrated)

Calibration

To calibrate the absolute encoder, the actual value of the encoder is matched with the machine zero once and then enabled.

The SINUMERIK 840D sl supports the following types of calibration:

- Operator-assisted calibration
- Automatic calibration using probe
- Calibration using BERO

The calibration using the probe and BERO is described in:

Literature

Function Manual Basic Functions; Reference point approach: Automatic adjustment with measuring probe, adjustment with BERO

Operator-assisted calibration

During operator-assisted calibration, the machine axis of the absolute encoder is moved to the known machine position (reference position). The position value of the reference position is taken over by the NC as the reference point value.

Recommended procedure

- 1. Parameterization of referencing mode
 - MD34200 \$MA_ENC_REFP_MODE[n] = 0
- 2. Approaching referencing position

Traversing the machine axis to the referencing position in JOG mode. Approach direction according to machine data:

MD34010 \$MA_REFP_CAM_DIR_IS_MINUS (reference point approach in minus direction) (0 = positive, 1 = negative approach direction)

NOTICE

To avoid the actual position of the machine axis being falsified by backlash in the drive train, reference point approach must be performed at low velocity and always from the same direction.

3. Assumption of the reference position in the NC

The reference position is entered in the machine data:

- MD34100 \$MA_REFP_SET_POS[n] (reference point value)
- 4. Enabling encoder calibration

Encoder calibration is performed in the machine data:

- MD34210 \$MA_ENC_REFP_STATE[n] = 1
- 5. Activate changed machine data by NCK reset.
- 6. Completing encoder calibration

When the NC has started up, encoder calibration is completed in mode: JOG > REF for the machine axis by once more pressing the direction key as described in point 2:

- Select JOG > REF mode
- Select machine axis
- Press traverse direction key

Note

Pressing the traverse direction key does not move the machine axis!

The NC then calculates the reference point offset and enters it in the machine data:

MD34090 \$MA_REFP_MOVE_DIST_CORR[n] (reference point offset)

To indicate that calibration has been completed, the value in the machine data changes from 1 = enable encoder calibration to 2 = encoder calibrated:

• MD34210 \$MA_ENC_REFP_STATE[n] = 2

The value from the machine data is shown as the actual position of the machine axis for the current machine position on the user interface:

MD34100 \$MA_REFP_SET_POS[n] (reference point value)

Calibrating several absolute encoders

For time-optimized calibration of the absolute encoders of several machine axes, the following procedure is recommended:

- 1. Depending on the machine design, move all or several machine axes to their reference position. See above: Points 1 to 4.
- 2. Perform an NCK reset. See above: Point 5.
- 3. Complete encoder calibration for all machine axes. See above: Point 6.

Recalibration

Recalibration of the absolute encoder is required after:

- Gear change between load and absolute encoder
- Removal/installation of the absolute encoder (encoder replacement)
- · Removal/installation of the motor with the absolute encoder (motor replacement)
- SRAM data loss of the NC, battery power failure. In this case, it is necessary to load a series startup file.
- PRESET

NOTICE

The status of the absolute encoder is only automatically reset to 1 = "encoder not calibrated" by the NCK on gear change:

MD34210 \$MA_ENC_REFP_STATE[n] = 1

In all other cases, it is the sole responsibility of the NCK user to indicate the uncalibrated state of the absolute encoder by manually resetting the status to "encoder not calibrated" and to perform calibration again.

A recalibration of the absolute encoder is also required when machine data MD34210 \$MA_ENC_REFP_STATE[n] is set to zero under the following conditions:

- Alarm 25020 "Zero mark monitoring of the active encoder" has been issued.
- The control has been switched off during the consistency check.
- The encoder number has changed.

Literature

Function Manual Basic Functions; Reference point approach: Referencing with absolute encoders

10.5.12.4 Interface signals and machine data

Interface signals

DB number	Bit, byte	Name	Reference
Mode-groupsp	ecific	Signals from PLC to mode group	
11,	0.7	Mode group reset	K1
11,	1.2	Machine function REF	K1
Mode-groupsp	ecific	Signals from mode group to PLC	<u>.</u>
11,	5.2	Active machine function REF	K1
Channel-speci	fic	Signals from PLC to channel	<u>.</u>
21,	1.0	Activate referencing	
Channel-speci	fic	Signals from channel to PLC	
21,	28.7	(MMC -> PLC) REF	K1
21,	33.0	Referencing active	
21,	35.7	Reset	K1
21,	36.2	All axes that must have a reference point are referenced	
Axis-specific		Signals from PLC to axis/spindle	
31,	1.5/1.6	Position measuring system 1/position measuring system 2	A2
31,	2.4-2.7	Reference point value 1 to 4	
31,	4.6/4.7	Traversing keys minus/plus	H1
31,	12.7	Reference point approach delay	
Axis-specific		Signals from axis/spindle to PLC	
31,	60.4/60.5	Referenced, synchronized 1/Referenced, synchronized 2	
31,	64.6/64.7	Traverse command minus/plus	H1

Machine data

Table 10- 26 Referencing: Machine data

Number	Name of Identifier Name		Reference
General (\$	SMN)		
11300	JOG_INC_MODE_LEVELTRIGGRD	INC/REF in jog/continuous mode	H1
Channels	pecific (\$MC)		
20700	REFP_NC_START_LOCK	NC start disable without reference point	
axisspecif	ic (\$MA)		
30200	NUM_ENCS	Number of encoders	G2
30240	ENC_TYP	Actual value encoder type	
30242	ENC_IS_INDEPENDENT	Encoder is independent	G2
31122	BERO_DELAY_TIME_PLUS	BERO delay time in plus direction	S1
31123	BERO_DELAY_TIME_MINUS	BERO delay time in minus direction	S1

NCK start-up

Number	Name of Identifier	Name	Reference
34000	REFP_CAM_IS_ACTIVE	Axis with reference cam	
34010	REFP_CAM_DIR_IS_MINUS	Reference point approach in minus direction	
34020	REFP_VELO_SEARCH_CAM	Reference point approach velocity	
34030	REFP_MAX_CAM_DIST	Maximum distance to reference cam	
34040	REFP_VELO_SEARCH_MARKER[n]	Reference point creep speed [encoder number]	
34050	REFP_SEARCH_MARKER_REVERSE[n]	Change of direction on reference cam [encoder number]	
34060	REFP_MAX_MARKER_DIST[n]	Maximum distance to reference mark; Maximum distance to 2 reference marks with distance- coded scales [encoder number]	
34070	REFP_VELO_POS	Reference point positioning velocity	
34080	REFP_MOVE_DIST[n]	Reference point distance/target point with distance-coded system [encoder number]	
34090	REFP_MOVE_DIST_CORR[n]	Reference point/absolute offset, distancecoded [encoder number]	
34092	REFP_CAM_SHIFT	Electronic reference cam shift for incremental measurement systems with equidistant zero marks.	
34100	REFP_SET_POS[n]	Reference point value [reference point number]	
34102	REFP_SYNC_ENCS	Actual value adjustment to the referencing measurement system	
34110	REFP_CYCLE_NR	Axis sequence for channel-specific referencing	
34120	REFP_BERO_LOW_ACTIVE	Polarity change of BERO	
34200	ENC_REFP_MODE[n]	Referencing mode [encoder number]	
34210	ENC_REFP_STATE[n]	Status of absolute value encoder [encoder number]	
34220	ENC_ABS_TURNS_MODULO	Absolute value encoder range for rotary encoders	R2
34300	ENC_REFP_MARKER_DIST[n]	Reference marker distance with distancecoded scales [encoder number]	
34310	ENC_MARKER_INC[n]	Interval between two reference marks with distance-coded scales [encoder no.]	
34320	ENC_INVERS[encoder]	Linear measuring system inverse to machine system [encoder number]	
34330	REFP_STOP_AT_ABS_MARKER[n]	Distancecoded linear measurement system without destination point [encoder number]	
35150	SPIND_DES_VELO_TOL	Spindle speed tolerance S	
36302	ENC_FREQ_LIMIT_LOW	Encoder limit frequency resynchronization	
36310	ENC_ZERO_MONITORING	Zero mark monitoring	
30250	ACT_POS_ABS	Absolute encoder position at time of deactivation.	

Literature

Function Manual Basic Functions; Reference point approach:

10.6 Parameterization of spindle data

10.6 Parameterization of spindle data

Reference

See also

Spindle data (Page 378) Spindle modes (Page 379) Initial spindle state (Page 380) General functionality (Page 381) General functionality (Page 381)

10.6.1 Setpoint/actual value channels of spindle

Parameterization of the setpoint/actual value channels of a spindle is identical to parameterization of the setpoint and actual value channels of an axis. For this, see Section "Setpoint / actual value channels" (Page 375).

10.6 Parameterization of spindle data

10.6.2 Gear stages

Enabling of

The gear stage change is generally carried out in the following machine data:

 MD35010 \$MA_GEAR_STEP_CHANGE_ENABLE (gear stage change possible, spindle has several gear stages)

If this machine data is not set, the system assumes that the spindle has no gear stages.

Multiple gearbox steps

If more than one gearbox step exists, the number of gearbox steps is entered into MD35090 \$MA_NUM_GEAR_STEPS.

Parameter sets

In **spindle mode** of a spindle, the NC will select the parameter set that suits the current gear stage best.

Gear stage x => parameter set (x+1) => index [x]

In **axis mode** of a spindle, the NC always selects the 1st parameter set (index [0], independent of the current gear stage.

The machine data listed in the following are gear stage-dependent machine data of a spindle:

- MD35110 \$MA_GEAR_STEP_MAX_VELO[n] (n_{max} for gear stage change)
- MD35120 \$MA_GEAR_STEP_MIN_VELO[n] (n_{min} for gear stage change)
- MD35130 \$MA_GEAR_STEP_MAX_VELO_LIMIT[n] (nmax for gear stage)
- MD35135 \$MA_GEAR_STEP_PC_MAX_VELO_LIMIT (n_{max} for gearbox step with position control)
- MD35140 \$MA_GEAR_STEP_MIN_VELO_LIMIT[n] (nmin for gear stage)
- MD35200 \$MA_GEAR_STEP_SPEEDCTRL_ACCEL[n] (acceleration in speed-control mode)
- MD35210 \$MA_GEAR_STEP_POSCTRL_ACCEL[n] (acceleration in position control mode)

For further information on parameter sets, see Section "Axis/spindle parameter sets" (Page 132).

Literature

Function Manual Basic Functions; Spindles: Gear stage change

10.6 Parameterization of spindle data

10.6.3 Spindle measuring systems

Encoder matching

When parameterizing the measuring systems of spindles, the same conditions apply as for parameterization of the measuring systems of rotary axes. This multiple is 2048.

For incremental measuring systems see Section "Parameterization of incremental measuring systems" (Page 134).

For absolute measuring systems see Section "Parameterization of absolute measuring systems" (Page 138).

NOTICE

If the motor encoder is used for actual-value sensing, the encoder matching data must be entered in the machine data for each individual gear stage if several gear stages are present.

Pulse multiplication factor

The maximum multiplication of the appropriate drive is always used as the multiplication of the increments.

Examples of encoder adaptation

Example A: encoder on the spindle

Suppose the following conditions are provided:

- The incremental encoder is mounted on the spindle.
- Encoder pulses = 500 [pulses/rev.]
- Pulse multiplication = 128
- Internal precision = 1000 [increment/degree]
- Sensor ratio = 1:1
- Load ratio = 1:1

The machine data are set acc. to the values above:

- MD10210 \$MN_INT_INC_PER_DEG (computational resolution) = 1,000 [incr./degree]
- MD31020 \$MA_ENC_RESOL (encoder resolution) = 500 [pulses/revolution]
- MD31050 \$MA_DRIVE_AX_RATION_DENOM (load rev. denominator) = 1
- MD31060 \$MA_DRIVE_AX_RATION_NUMERA (load rev. numerator) = 1
- MD31070 \$MA_DRIVE_ENC_RATION_DENOM (sensor speed denominator) = 1
- MD31080 \$MA_DRIVE_ENC_RATION_NUMERA (sensor speed numerator) = 1

10.6 Parameterization of spindle data

Internal _	360 degree		*	MD3	1080	_ *	MD310)50	- * MD10210
Resolution	MD31020 * pulse rev	D31020 * pulse rev.		MD31070			MD31060		WD 102 10
Internal _ Resolution	<u>360</u> * <u>1</u> 500 * 128 1	*	_	1 *	1000	=	5,625		increments

One encoder increment corresponds to 5.625 internal increments.

One encoder increment corresponds to 0.005625 degrees (highest possible positioning resolution).

Example B: encoder at motor

Suppose the following conditions are provided:

- The incremental encoder is mounted on the motor.
- Encoder pulses = 2048 [pulses/rev.]
- Pulse multiplication = 128
- Internal precision = 1000 [increment/degree]
- Sensor ratio = 1:1
- Load ratio 1= 2.5:1 [motor speed/spindle speed]
- Load ratio 2= 1:1 [motor speed/spindle speed]

Gear stage 1

Internal	360 degree		MD31080	MD31050
Resolution ⁼	MD31020 * pulse rev.		MD31070	* — * MD10210 MD31060

Internal Resolution $\frac{360}{2048 \times 128} \times \frac{1}{1} \times \frac{1}{2,5} \times 1000 = 0,54932 \qquad \frac{\text{int. increments}}{\text{encoder pulse}}$

One encoder increment corresponds to 0.54932 internal increments.

One encoder increment corresponds to 0.00054932 degrees (highest possible positioning resolution).

Gear stage 2

Internal	360	1	1	1000 = 1,3733	int. increments
Resolution	2048 * 128	1	1	1000 - 1,3735	encoder pulse

One encoder increment corresponds to 1.3733 internal increments.

One encoder increment corresponds to 0.0013733 degrees (highest possible positioning resolution).

10.6 Parameterization of spindle data

10.6.4 Speeds and setpoint adjustment for spindle

Speeds, gear stages

In SINUMERIK solution line, data for five gear stages are implemented. These stages are defined by a minimum and maximum speed for the stage itself and by a minimum and maximum speed for the automatic gear stage changeover.

A new set gear stage is output only if the new programmed speed cannot be traversed in the current gear stage. For the sake of simplification, the oscillation times for gear stage changeovers can be specified directly in the NC; the oscillation function must otherwise be implemented in the PLC. The oscillation function is initiated via the PLC.

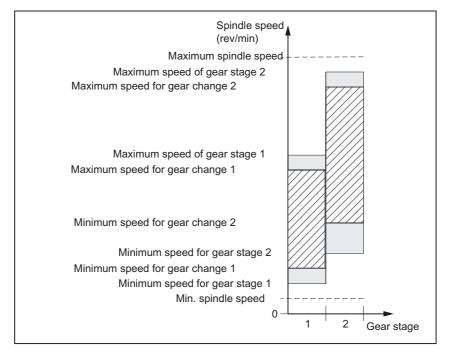


Figure 10-21 Example for speed ranges for automatic gear stage selection (M40)

Speeds for conventional operation

The speeds of the spindle in conventional mode are entered in the machine data:

- MD32010 \$MA_JOG_VELO_RAPID (rapid traverse in jog mode)
- MD32020 \$MA_JOG_VELO (axis velocity in JOG mode)

The direction of rotation is specified via the appropriate directional keys for the spindle on the MCP.

10.6 Parameterization of spindle data

Direction of rotation

The direction of rotation of a spindle corresponds to the traversing direction of an axis.

Setpoint matching

The speeds must be transferred with standardized values for the drive controller. The values are scaled in the NC using the selected load gear and the appropriate drive parameter.

Machine data

Table 10-27 Speeds and setpoint adjustment for spindle: Machine data

Axisspecif	Axisspecific (\$MA)				
31050	DRIVE_AX_RATIO_DENOM	Denominator load gearbox			
31060	DRIVE_AX_RATIO_NUMERA	Numerator load gearbox			
32010	JOG_VELO_RAPID	Rapid traverse in the JOG mode			
32020	JOG_VELO	JOG axis velocity			
35010	GEAR_STEP_CHANGE_ENABLE	Gear stage change possible			
35020	SPIND_DEFAULT_MODE	Basic spindle setting			
35030	SPIND_DEFAULT_ACT_MASK	Activate initial spindle setting			
35040	SPIND_ACTIVE_AFTER_RESET	Spindle active after reset			
35200	GEAR_STEP_SPEEDCTRL_ACCEL[n]	Acceleration in speed control mode			
35220	ACCEL_REDUCTION_SPEED_POINT	Speed limit for reduced acceleration			
35230	ACCEL_REDUCTION_FACTOR	Reduced acceleration			
35400	SPIND_OSCILL_DES_VELO	Oscillation speed			
35410	SPIND_OSCILL_ACCEL	Oscillation acceleration			
35430	SPIND_OSCILL_START_DIR	Oscillation start direction			
35440	SPIND_OSCILL_TIME_CW	Oscillation time for M3 direction			
35450	SPIND_OSCILL_TIME_CCW	Oscillation time for M4 direction			

10.6 Parameterization of spindle data

Interface signals

Table 10-28 Speeds and setpoint adjustment for spindle: Interface signals

DB number	Bit, byte	Name	Reference
Axis-specific	specific Signals from PLC to axis/spindle		
31,	4.6	Traversing keys minus	
31,	4.7	Traversing keys plus	
31,	16.2-16.0	Actual gear stage	
31,	16.3	Gear changed	
31,	16.6	No speed monitoring when changing the gear	
31,	18.4	Oscillation via PLC	
31,	18.5	Oscillation speed	
Axis-specific		Signals from axis/spindle to PLC	
31,	82.2-82.0	Set gear stage	
31,	82.3	Change gear	
31,	84.7	Active spindle control mode	
31,	84.6	Active spindle mode oscillation mode	

10.6.5 Position spindle

The NC provides an oriented spindle stop function with which the spindle can be moved into a certain position and held there (e.g. for tool changing purposes). Several programming commands are available for this function which define the approach and program processing.

Literature

Function Manual Basic Functions; Spindles

Functionality

- To absolute position (0-360 degrees)
- Incremental position (+/- 999999.99 degrees)
- Positioning without influence of block change (SPOSA)
- Block change when block end position is reached (calculated by interpolation)

The control brakes the spindle down to position control speed at the acceleration rate for speed operation.

If position control speed has been reached, the control branches into position control mode and the acceleration rate for position control mode and the K_V factor become active.

The interface signal "Exact stop fine" is output to indicate that the programmed position has been reached (block change when position reached).

Acceleration rate for position control mode must be set such that the current limit is not reached. Acceleration rate must be entered separately for each gear step.

If the spindle is positioned from zero speed, it is accelerated up to a maximum speed corresponding to position control speed; the direction is defined via machine data. If there is no reference, the direction of actuation is as in MD35350 SPIND_POSITIONING_DIR. When position control mode is switched on, contour monitoring is also activated.

10.6 Parameterization of spindle data

Machine data

Table 10- 29 Spindle positioning: Machine data

axisspecific	axisspecific (\$MA)				
35300	SPIND_POSCTRL_VELO	position control activation speed			
35350	SPIND_POSITIONING_DIR	Direction of rotation when positioning from the standstill			
35210	GEAR_STEP_POSCTRL_ACCEL	Acceleration in position control mode			
36000	STOP_LIMIT_COARSE	Exact stop coarse			
36010	STOP_LIMIT_FINE	Exact stop fine			
32200	POSCTRL_GAIN	K _V factor			
36400	CONTOUR_TOL	Contour monitoring			

Interface signals

Table 10- 30 Spindle positioning: Interface signals

DB number	Bit, byte	Name	Reference
Axis-specific		Signals from axis/spindle to PLC	
31,	60.6	Position reached with exact stop "fine"	
31,	60.7	Position reached with exact stop "coarse"	
31,	84.5	Positioning mode	

10.6.6 Synchronizing spindle

To allow the spindle to be positioned from the NCK, its position has to be adjusted using the measuring system. This operation is called "synchronization".

As a rule, synchronizing is done to the zero mark of the connected encoder or to a reference cam as zero mark substitute.

The following machine data defines the actual position of the spindle at the zero mark position:

• MD34100 \$MA_REFP_SET_POS (reference point value)

The zero mark offset is entered in the following machine data:

MD34090 \$MA_REFP_MOVE_DIST_CORR (reference point offset)

The following machine data specifies which signal is used for synchronization:

- MD34200 \$MA_ENC_REFP_MODE (homing mode)
 - 1 = Encoder zero mark 2 = Bero

When is synchronization necessary?

The spindle will be synchronized:

- · after the NC has powered up when the spindle is moved using a programming command
- after a request for resynchronization by the PLC

NST DB31,... DBX16.4 (resynchronize spindle 1)

NST DB31,... DBX16.5 (resynchronize spindle 2)

- after each gear stage change for an indirect measuring system MD31040 \$MA_ENC_IS_DIRECT (direct measuring system) = 0
- when the encoder limit frequency falls below the programmed value after a speed has been programmed which is above the encoder limit frequency.

NOTICE

If the spindle encoder is not mounted directly on the spindle and there are gear ratios between the encoder and spindle (e.g. encoder mounted on motor), then a BERO signal connected to the drive (SERVO) must be used for synchronization. The control system then automatically resynchronizes the spindle after each gear stage change. The user does not have to contribute anything here.

In general, backlash, gearbox elasticity and reference cam hysteresis reduce the accuracy achievable during synchronization.

10.6 Parameterization of spindle data

Machine data

 Table 10- 31
 Synchronizing spindle: Machine data

Axisspecific (\$MA)				
34100	REFP_SET_POS	Reference point value		
34090	REFP_MOVE_DIST_CORR	Reference point offset		
34200	REFP_MODE	Referencing mode		

Interface signals

 Table 10- 32
 Synchronizing spindle: Interface signals

DB number	Bit, byte	Name Refe		
Axis-specific		Signals from PLC to axis/spindle	als from PLC to axis/spindle	
31,	16.4	Synchronize spindle 1		
31,	16.5	Synchronize spindle 2		
Axis-specific Signals from axis/spindle to PLC				
31,	60.4	Referenced/synchronized 1		
31,	60.5	Referenced/synchronized 2		

10.6 Parameterization of spindle data

10.6.7 Spindle monitoring

Axis/spindle stops

If the velocity falls below the one specified in the following machine data, then the interface signal **IS DB31,... DBX61.4 (axis/spindle stops)** is set:

 MD36060 \$MA_STANDSTILL_VELO_TOL (maximum velocity/speed for "Axis/Spindle stopped")

The path feedrate is then released in the following set machine data:

MD35510 \$MA_SPIND_STOPPED_AT_IPO_START (feed enable for "Spindle stopped")

Spindle in setpoint range

If the spindle reaches the tolerance range specified in the following machine data, then the interface signal IS DB31,... DBX83.5 (spindle in setpoint range) is set:

MD35150 \$MA_SPIND_DES_VELO_TOL (spindle speed tolerance)

The path feedrate is then released in the following set machine data:

• MD35510 \$MA_SPIND_STOPPED_AT_IPO_START (feed enable for "Spindle stopped")

Maximum spindle speed

The maximum spindle speed is entered in the following machine data:

• MD35100 \$MA_SPIND_VELO_LIMIT (max. spindle speed)

The NC limits the spindle speed to this value.

Error reaction:

If the speed is nevertheless exceeded by the speed tolerance (drive error), the following signal is output:

- IS DB31,... DBX83.0 (speed limit exceeded) = 1
- Alarm "22150 Maximum number of chucks exceeded"

The following machine data also limits the speed of the spindle:

MD36200 \$MA_AX_VELO_LIMIT (velocity-monitoring threshold)

When the speed is exceeded, an alarm is generated.

In position-controlled mode (e.g. SPCON), the NC limits the specified maximum speed specified in machine or setting data to 90% of the maximum value (control reserve).

10.6 Parameterization of spindle data

Gear stage speed min./max.

The default of a max./min. gear stage speed is entered in the following machine data:

- MD35130 \$MA_GEAR_STEP_MAX_VELO_LIMIT (maximum speed for gear stage)
- MD35140 \$MA_GEAR_STEP_MIN_VELO_LIMIT (minimum speed for gear stage)

The speed cannot leave this range when the appropriate gear stage is engaged.

Programmed Spindle speed limitations

The following functions can be used to specify a spindle speed limitation in an indexing program:

- G25 S... (min. spindle speed)
- G26 S... (max. spindle speed)

The limitation is active in all operating modes.

The function LIMS=... can be used to specify a spindle speed limit for G96 (constant cutting rate):

• LIMS=... (speed limitation (G96))

This limitation is only effective when G96 is active.

Encoder frequency limit

If the sensor limit frequency in the following machine data is exceeded, synchronization of the spindle is lost and spindle functionality is reduced (thread, G95, G96):

• MD36300 \$MA_ENC_FREQ_LIMIT (encoder limit frequency)

The spindle will be re-synchronized automatically once the sensor frequency falls below the value defined in the following machine data:

 MD36302 \$MA_ENC_FREQ_LIMIT_LOW (encoder limit frequency at which the encoder is turned on again)

The encoder limit frequency value must be such that the mechanical encoder speed limit is not exceeded or else the synchronization from high speeds will be incorrect.

10.6 Parameterization of spindle data

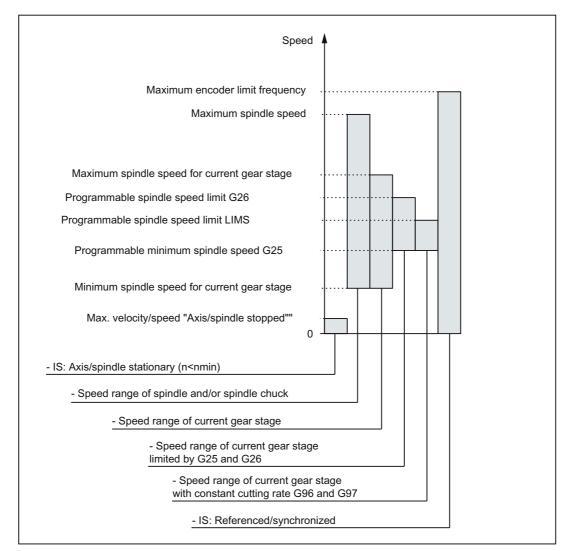


Figure 10-22 Ranges of spindle monitoring functions/speeds

Literature

Function Manual Basic Functions; Spindles: Spindle monitoring

10.6 Parameterization of spindle data

10.6.8 Spindle data

Machine data

Table 10- 33	Spindle: Machine data

Number	Name of identifier	Name
General (\$		
12060	OVR_SPIND_IS_GRAY_CODE	Spindle override with Gray coding
12070	OVR_FACTOR_SPIND_SPEED	Evaluation of spindle speed override switch
12080	OVR_REFERENCE_IS_PROG_FEED	Override reference velocity
Channelsp	pecific (\$MC)	
20090	SPIND_DEF_MASTER_SPIND	Initial setting for master spindle on channel
20092	SPIND_ASSIGN_TAB_ENABLE	Enabling/disabling of spindle converter
20118	GEOAX_CHANGE_RESET	Allow automatic geometry axis change
22400	S_VALUES_ACTIVE_AFTER_RESET	S function active after RESET
Axisspecifi	ic (\$MA)	
30300	IS_ROT_AX	Rotary axis
30310	ROT_IS_MODULO	Modulo conversion
30320	DISPLAY_IS_MODULO	Position display
31050	DRIVE_AX_RATIO_DENOM	Denominator load gearbox
31060	DRIVE_AX_RATIO_NUMERA	Numerator load gearbox
31122	BERO_DELAY_TIME_PLUS	BERO delay time in plus direction
31123	BERO_DELAY_TIME_MINUS	BERO delay time in minus direction
32200	POSCTRL_GAIN	K _V factor
32810	EQUIV_SPEEDCTRL_TIME	Equivalent time constant speed control loop for feedforward control
32910	DYN_MATCH_TIME	Time constant for dynamic matching
34040	REFP_VELO_SEARCH_MARKER	Reference point creep speed
34060	REFP_MAX_MARKER_DIST	Monitoring of zero mark distance
34080	REFP_MOVE_DIST	Reference point distance/destination point for distance- coded system
34090	REFP_MOVE_DIST_CORR	Reference point offset/absolute offset, distancecoded
34100	REFP_SET_POS	Reference point value
34200	ENC_REFP_MODE	Homing mode
35000	SPIND_ASSIGN_TO_MACHAX	Assignment of spindle to machine axis
35010	GEAR_STEP_CHANGE_ENABLE	Gear stage change possible
35012	GEAR_STEP_CHANGE_POSITION	Gear stage change position
35020	SPIND_DEFAULT_MODE	Basic spindle setting
35030	SPIND_DEFAULT_ACT_MASK	Activate initial spindle setting
35040	SPIND_ACTIVE_AFTER_RESET	Spindle active after reset
35100	SPIND_VELO_LIMIT	Maximum spindle speed
35110	GEAR_STEP_MAX_VELO[n]	Maximum speed for gear change
35120	GEAR_STEP_MIN_VELO[n]	Minimum speed for gear change

Number	Name of identifier	Name
35130	GEAR_STEP_MAX_VELO_LIMIT[n]	Maximum speed of gear stage
35140	GEAR_STEP_MIN_VELO_LIMIT[n]	Minimum speed of gear stage
35150	SPIND_DES_VELO_TOL	Spindle speed tolerance
35160	SPIND_EXTERN_VELO_LIMIT	Spindle speed limitation via PLC
35200	GEAR_STEP_SPEEDCTRL_ACCEL[n]	Acceleration in speed control mode
35210	GEAR_STEP_POSCTRL_ACCEL[n]	Acceleration in position control mode
35220	ACCEL_REDUCTION_SPEED_POINT	Speed limit for reduced acceleration
35230	ACCEL_REDUCTION_FACTOR	Reduced acceleration
35300	SPIND_POSCTRL_VELO	position control activation speed
35350	SPIND_POSITIONING_DIR	Positioning direction of rotation for a nonsynchronized spindle
35400	SPIND_OSCILL_DES_VELO	Oscillation speed
35410	SPIND_OSCILL_ACCEL	Oscillation acceleration
35430	SPIND_OSCILL_START_DIR	Oscillation start direction
35440	SPIND_OSCILL_TIME_CW	Oscillation time for M3 direction
35450	SPIND_OSCILL_TIME_CCW	Oscillation time for M4 direction
35500	SPIND_ON_SPEED_AT_IPO_START	Feed enable with spindle in setpoint range
35510	SPIND_STOPPED_AT_IPO_START	Feed enable with stationary spindle
35590	PARAMSET_CHANGE_ENABLE	Parameter set definition possible from PLC
36060	STANDSTILL_VELO_TOL	Threshold velocity "Axis/spindle stationary"
36200	AX_VELO_LIMIT	Threshold value for velocity monitoring

Setting data

Table 10- 34 Spindle: Setting data

Number	Identifier	Name
Spindlesp	ecific (\$SA)	
42600	JOG_FEED_PER_REF_SOURCE	Revolutional feedrate control in JOG mode
42800	SPIND_ASSIGN_TAB	Spindle number converter
42900	MIRROR_TOOL_LENGTH	Mirror tool length offset
42910	MIRROR_TOOL_WEAR	Mirror wear values of tool length compensation
42920	WEAR_SIGN_CUTPOS	Mirror wear values of machining plane
42930	WEAR_SIGN	Invert sign of all wear values
42940	TOOL_LENGTH_CONST	Retain the assignment of tool length components when changing the machining plane (G17 to G19)
43210	SPIND_MIN_VELO_G25	Progr. Spindle speed limiting G25
43220	SPIND_MAX_VELO_G26	Progr. Spindle speed limiting G26
43230	SPIND_MAX_VELO_LIMS	Progr. spindle speed limitation with G96
43300	ASSIGN_FEED_PER_REF_SOURCE	Rotational feedrate for positioning axes/spindles

10.6 Parameterization of spindle data

Interface signals

Table 10- 35	Spindle: Interface signals
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DB number	Bit, byte	Name	
Axis-specific		Signals from PLC to axis/spindle	
31,	0	Feed override	
31,	1.7	Override active	
31,	1.6	Position measuring system 2	
31,	1.5	Position measuring system 1	
31,	1.4	Followup mode	
31,	1.3	Axis/spindle disable	
31,	2.2	Spindle reset/delete distancetogo	
31,	2.1	Servo enable	
31,	3.6	Velocity/spindle speed limitation	
31,	16.7	Delete S value	
31,	16.5	Resynchronize spindle 2	
31,	16.4	Resynchronize spindle 1	
31,	16.3	Gear changed	
31,	16.2-16.0	Actual gear stage A to C	
31,	17.6	Invert M3/M4	
31,	17.5	Resynchronize spindle during positioning 2	
31,	17.4	Resynchronize spindle during positioning 1	
31,	18.7	Direction of rotation setpoint left	
31,	18.6	Direction of rotation setpoint right	
31,	18.5	Oscillation speed	
31,	18.4	Oscillation via PLC	
31,	19.7 - 19.0	Spindle offset H - A	
Axis-specific		Signals from axis/spindle to PLC	
31,	60.7	Position reached with exact stop fine	
31,	60.6	Position reached with exact stop coarse	
31,	60.5	Referenced/synchronized 2	
31,	60.4	Referenced/synchronized 1	
31,	60.3	Encoder limit frequency exceeded 2	
31,	60.2	Encoder limit frequency exceeded 1	
31,	60.0	Axis/no spindle	
31,	61.7	Current controller active	_
31,	61.6	Speed control loop active	
31,	61.5	Position controller active	_
31,	61.4	Axis/spindle stationary (n < nmin)	
31,	82.3	Change gear	
31,	82.2-82.0	Set gear stage AC	
31,	83.7	Actual direction of rotation clockwise	
31,	83.5	Spindle in setpoint range	

10.6 Parameterization of spindle data

DB number	Bit, byte	Name	Γ
31,	83.2	Setpoint speed increased	
31,	83.1	Setpoint speed limited	
31,	83.0	Speed limit exceeded	
31,	84.7	Active spindle control mode	Γ
31,	84.6	Active spindle mode oscillation mode	Γ
31,	84.5	Active spindle positioning mode	Γ
31,	84.3	Rigid tapping active	Γ
31,	86 and 87	M function for spindle	
31,	88-91	S function for spindle	

10.6 Parameterization of spindle data

Optimize the drive.

Start	-up Channel	RACK800 reset	JOG	ù Ref	MPF0 Progra	m aborted ROV	1				Axis +
											Axis -
Sta	rt-up fu	nctions			Ахі	s:	4	21 3	ARM:	1	
		figuration									Direct selection
	Axis typ	e:			Linear	axis					
	Drive ty	pe:			ARM (a	asynchrono	us rotation	motor)			
	Drive ni	umber:			1						
	Slave sl	ot:			3.6	5					
	Current	controller cycle:			0).125 ms					
	Speed o	controller cycle:			0	0.125 ms					
	Position	controller cycle	r:		2	2.000 ms					
\frown										$\mathbf{\Sigma}$	
	rr contr loop	Speed contr.loop	Position contr.loop		nction erator	Circular test	- Tra	ce			

You can optimize the drives in the "Commissioning" > "Optimization/Test" operating area.

Figure 11-1 Optimization/test

The following functions are available:

- Frequency response measurements for the following control loops:
 - Current controller
 - Speed controller
 - Position controller
- Automatic controller setting
- Function generator
- Circularity test
- Trace
 - Servo trace
 - Drive trace

10.6 Parameterization of spindle data

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The measuring functions make it possible to assess the automatic controller action of the respective control loop (frequency response) by the integrated FFT analysis (Fast Fourier Transformation) without external measuring equipment.

The measurement results are represented graphically as a Bode diagram. HMI file functions can be used to archive the diagrams for documentation purposes and to simplify remote diagnostics.

Circularity test

The circularity test serves to set and assess the dynamic response for interpolating axes or to analyze the contour accuracy on the quadrant transitions (circular contours) achieved by means of friction compensation (conventional or neural quadrant error compensation).

Reference

Function Manual Extended Functions, K3 Compensation, Section "Circularity test"

Servo trace

Servo trace provides a graphically assisted analysis of the time response of position controller and drive data.

Drive trace

Drive trace provides a graphically assisted analysis of the time response of drive signals.

11.1 Measuring functions

Explanation

A range of measuring functions allows the time and/or frequency response of drives and closed-loop controls to be displayed in graphic form on the screen. For this purpose, test signals with an adjustable interval are connected to the drives.

Measurement/signal parameters

The test setpoints are adapted to the application in question by means of measurement or signal parameters, the units of which are determined by the relevant measuring function or operating mode. The measurement or signal parameter units are subject to the following conditions:

Size	Unit
Velocity	Metric system:
	Specification in mm/min or rev/min for translatory or rotary movements
	Inch system:
	Specification in inch/min or rev/min for translatory or rotary movements
Distance	Metric system:
	Specification in mm or degrees for translatory or rotary movements
	Inch system:
	Specification in inch or degrees for translatory or rotary movements
Time	Specified in ms
Frequency	Specified in Hz

Table 11- 1	Quantity and units for measurement or signal parameters
	guarity and units for measurement of signal parameters

Note

The default setting for all parameters is 0.

11.1 Measuring functions

Preconditions for starting measuring functions

To ensure that no erroneous traversing movements due to part programs can be carried out, the measuring functions have to be started in <JOG> mode.

CAUTION

When traversing movements are carried out within the framework of measuring functions, no software limit switches and working area limitations are monitored, since these are carried out in follow-up mode.

Prior to starting traversing movements, the user must therefore ensure that the axes are positioned such that the traversing limits specified within the framework of the measuring functions are sufficient to prevent collision with the machine.

Starting measuring functions

Measuring functions initiating a traversing movement are only selected using the specific softkey. The actual start of the measuring function and thus of the traversing movement is always carried out with <NC-START> on the machine control panel.

If the main screen of the measuring function is quitted without the traversing movement being initiated, the selection of the traversing function is canceled.

Once the traversing function has been started, the main screen can be exited without any affect on the traversing movement.

Note

<JOG> mode must be selected when measuring functions are started.

Further safety notices

The user must ensure that when the measuring functions are used:

- The <EMERGENCY STOP> button is always within reach.
- No obstacles are in the traversing range.

Canceling measuring functions

The following events will cancel active measuring functions:

- Hardware limit switch reached
- Traversing range limits exceeded
- Emergency stop
- Reset (mode group, channel)
- NC STOP
- No controller enabling command
- Canceling drive enable
- Canceling traversing enable
- Selection of parking (in position-controlled operation).
- Feed override = 0%
- Spindle override = 50%
- Change in operating mode (JOG) or operating mode JOG not selected
- Actuation of traversing keys
- Actuation of handwheel
- Alarms leading to axis shutdown

11.2 Frequency response measurements

11.2.1 Current control loop measurement

Functionality

The current control loop only needs to be measured for diagnostic purposes if there is a fault or if there is no standard data for the motor / power unit combination (third-party motor).

CAUTION

The user must take special safety measures when measuring the current control loop (e.g. secure drive clamping) for hanging axes without external counterweight.

Operating path

Operating path for measuring the current control loop: Operating area switchover > "Commissioning" > "Optimization/Test" > "Current control loop"

Measuring functions

The following measuring functions are available for measuring the current control loop:

Measuring type	Measured variable
Reference frequency response (downstream of the current setpoint filter)	Torque-generating actual current value / torque-generating current setpoint
Setpoint step change (downstream of the current setpoint filter)	Measured variable 1: Torque-generating current setpoint Measured variable 2: Torque-generating actual current value

Measurement

The measurement sequence is divided into the following steps:

- 1. Setting the traverse range monitoring and the enable logic.
- 2. Selecting the measurement type
- 3. Setting the parameters, softkey "Measuring parameters"
- 4. Displaying the measurement results, softkey "Display"

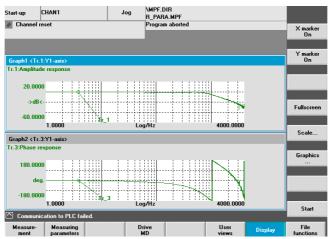


Figure 11-2 Current controller

Measuring parameters

Amplitude

Magnitude of the test signal amplitude. Given in percent of the peak torque. Values from 1% to 5% are suitable.

Bandwidth

The frequency range analyzed with the measurement.

The bandwidth depends on the current controller sampling time.

Example:

125 µs current controller sampling time, set bandwidth 4000 Hz

11.2.2 Speed control loop measurement

Functionality

The response characteristics for the motor measuring system are analyzed when measuring the speed control loop. Various measurement parameter lists are available depending on the basic measurement setting which has been selected.

Operating path

Operating path for measuring the speed control loop: Operating area switchover > "Commissioning" > "Optimization/Test" > "Speed control loop"

Measuring functions

The following measurement functions are available for measuring the speed control loop:

Measuring type	Measured variable
Reference frequency response (downstream of the speed setpoint filter)	Actual speed value motor encoder/speed setpoint after filter
Reference frequency response (upstream of the speed setpoint filter)	Actual speed value motor encoder/speed setpoint after filter
Setpoint step change (downstream of the speed setpoint filter)	 Measured variable 1: Speed setpoint downstream of the filter Actual torque value Measured variable 2: Actual speed value motor encoder
Interference frequency response (fault downstream of the current setpoint filter)	Actual speed value motor encoder / torque setpoint fct. generator
Disturbance variable step change (fault downstream of the current setpoint filter)	 Measured variable 1: Torque setpoint fct. generator Actual torque value Measured variable 2: Actual speed value motor encoder
Speed-controlled system (excitation downstream of the current setpoint filter)	Actual speed value motor encoder/actual torque value
Frequency response of the mechanical parts ¹⁾	Actual speed value measuring system 1/actual speed value measuring system 2
1) The machine axis in question must have both determine the frequency response of the mechanism	•••

Measurement

The measurement sequence is divided into the following steps:

- 1. Setting the traverse range monitoring and the enable logic
- 2. Selecting the measuring type and measured variable
- 3. Setting the parameters, softkey "Measuring parameters"
- 4. Displaying the measurement results, softkey "Display"



Figure 11-3 Speed controller

In the example shown, the speed control loop has not yet been optimized.

A suitable filter parameterization is used to optimize the dynamic response. This can be called with the "Filter" softkey.

The following figure shows the standard settings for a low-pass filter at 1999 Hz (encoder mounting frequency).

tart-up 2 Channe	CHAN1		Jog	\MPF.DIR R_PARA.MPF Program aborted			
		_		r rogram aborceu			Filter +
Current So	stpoint Filter: 1 D	DS: 0		DP3.Slave3:SE	RV0_07(7) AX2:Y	1	Filter -
] [DDS Direct Se
							Deactiv. Filter
Low Pas: Filter 1 I	s P12 Parameters			Speed Control	ler Parameters		Copy Filter
Charact	eristic frequency	1999.000	Hz	KPN	1.200	Nms/rad	Paste
Dampin	9	0.700		TNN KPN adapt	10.000 53.056	ms %	Filter
				TNN adapt	400.000	*	
Commu	inication to PLC fa	led.					Back
Current	Speed Setpoint				Drive MD		

Figure 11-4 Standard settings of the speed control loop filter

Optimize the drive.

11.2 Frequency response measurements

tart-up CHAN1		Jog R	MPF.DIR B_PARA.MPF Program aborted			Filter +
Current Setpoint Filte	a: 2 DDS:0		DP3.Slave3:SERV	/0_07(7) AX2:Y	1	Filter -
]	DDS Direct Se
	<u>I</u>					Deactiv. Filter
Band Stop Filter 2 Parameters Notch frequency	1640.000	Hz	Speed Controlle	r Parameters		Copy Filter
Bandwidth	299.999	Hz	KPN TNN	0.500 10.000	Nms/rad ms	Paste Filter
Notch Depth	-Endless	dB	KPN adapt TNN adapt	53.056 400.000	% %	
Reduction	0.000	dB				
Communication to	PLC failed.					Back
	eed point			Drive MD		

Figure 11-5 Speed control loop filter with rejection band 1190 Hz

The use of a rejection band at 1190 Hz and adaptation of the proportional gain results in the following optimized setting for the speed control loop.



Figure 11-6 Optimized speed control loop

11.2.3 Position control loop measurement

Functionality

This measuring function basically analyzes the response to the active position measuring system. If the function is activated for a spindle without a position measuring system, an alarm is displayed. Depending on the measured variable selected, various measurement parameter lists are displayed.

Operating path

Operating path for measuring the speed control loop: Operating area switchover > "Commissioning" > "Optimization/Test" > "Position control loop"

Measuring functions

The following measuring functions are available for measuring the position control loop:

Measuring type	Measured variable				
Reference frequency response	Actual position/position setpoint				
Setpoint step change	Measured variable 1: Position setpoint				
	Measured variable 2:				
	Actual position value				
	System deviation				
	Following error				
	Actual speed value				
Setpoint ramp	Measured variable 1: Position setpoint				
	Measured variable 2:				
	Actual position value				
	System deviation				
	Following error				
	Actual speed value				

Measurement

The measurement sequence is divided into the following steps:

- 1. Setting the traverse range monitoring and the enable logic
- 2. Selecting the measuring type and measured variable
- 3. Setting the parameters, softkey: "Measuring parameters"
- 4. Displaying the measurement results, softkey: "Display"

The following figure shows an optimized position control loop in which the K_{ν} factor has been adapted via the machine data MD32200 \$MA_POSCTRL_GAIN.



Figure 11-7 Optimized position control loop

Optimize the drive.

11.2 Frequency response measurements

Reference frequency response measurement

The reference frequency response measurement determines the transmission ratio of the position controller in the frequency range (active position measuring system).

The setpoint filters, control loop gain (K_v factor) and feedforward control must be parameterized such that resonance is avoided wherever possible over the entire frequency range.

Measuring parameters

• Amplitude

This parameter determines the magnitude of the test signal amplitude. It should be set to the smallest possible value (e.g. 0.01 mm).

Bandwidth

The bandwidth parameter is used to set the analyzed frequency range. The larger this value, the finer the frequency resolution and the longer the measurement time. The maximum value is specified by the position controller cycle (T_{position controller}):

```
Bandwidth<sub>max</sub> [Hz] = 1 / (2 * T<sub>position controller</sub> [sec])
```

Example:

Position controller cycle: 2 ms

Bandwidth_{max} = 1 / (2 * 2*10⁻³) = 250 Hz

Averaging

The accuracy of the measurement and measurement duration increase with this value. A value of 20 is normally suitable.

Settling time

This value represents the delay between recording of the measured data and injection of the test setpoint and offset. A value of between 0.2 and 1 s is recommended. Do not set too low a value for the settling times or the frequency response and phase diagrams will be distorted.

Offset

The measurement requires a slight speed offset of a few motor revolutions per minute. The offset must be set such that no speed zero crossings occur at the set amplitude.

Measurement: Setpoint step change and setpoint ramp

The transient or positioning response of the position control in the time range, and in particular the effect of setpoint filters, can be assessed with the step and ramp stimulation functions.

Possible measured variables:

- Actual position value (active position measuring system)
- Control deviation (following error)

Measuring parameters

• Amplitude

Determines the magnitude of the specified setpoint step change or ramp.

• Measurement time

This parameter determines the period of time to be recorded (maximum: 2048 position controller cycles).

Settling time

This value represents the delay between measured data recording / test setpoint output and the injection of the offset.

• Ramp time

With default setting: The position reference value is specified with the "Setpoint ramp" according to the set ramp time. In this case, the acceleration limits which currently apply to the axis or spindle are effective.

Offset

The step is stimulated from standstill or starting from the constant traverse speed set in this parameter.

If an offset value other than zero is input, the step change is stimulated during traversal. For the sake of clarity, the displayed actual position value does not include this speed offset.

Optimize the drive.

11.2 Frequency response measurements

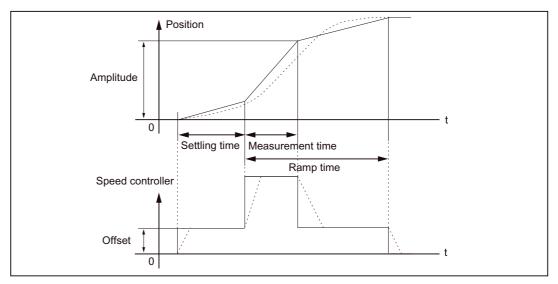


Figure 11-8 Signal chart for position setpoint/ramp measuring function

At maximum axis velocity, there is a (virtual) step change in the velocity (continuous line).

The curves represented by the dashed line correspond to a realistic, finite value. The offset component is excluded from the display graphic in order to emphasize the transient processes.

Measurement: Setpoint step change

To avoid overloading the mechanical system of the machine, the step height is limited to the value specified in the machine data during the "Setpoint step change" measurement:

MD32000 \$MA_MAX_AX_VELO (maximum axis velocity)

This may result in failure to achieve the desired step height.

Measurement: Setpoint ramp

With measurement "Setpoint ramp", the following machine data influence the measurement result:

MD32000 \$MA_MAX_AX_VELO (maximum axis velocity)

The maximum axis velocity limits the ramp gradient (velocity limitation). The drive does not reach the programmed end position (amplitude).

MD32300 \$MA_MAX_AX_ACCEL (maximum axis acceleration)

The maximum axis acceleration limits the velocity change (acceleration limitation). This leads to "rounding" on the transitions at the beginning and end of the ramp.

CAUTION

In normal cases the machine data corresponds exactly with the load capacity of the machine kinematics and should not be changed (increased) as part of the measurements:

- MD32000 \$MA_MAX_AX_VELO (maximum axis velocity)
- MD32300 \$MA_MAX_AX_ACCEL (maximum axis acceleration)

11.3 Circularity test measurement

Functionality

The circularity test serves to set and assess the dynamic response for interpolating axes or to analyze the contour accuracy on the quadrant transitions (circular contours) achieved by means of friction compensation (conventional or neural quadrant error compensation).

Operating path

Operating path to circularity test: Operating area switchover > "Commissioning" > "Optimization/Test" > "Circularity test"

Measuring parameters

The parameters are entered in the "Measurement" menu.

- Axis names and axis numbers
- Circle that is to be traversed and the actual position values recorded

The parameter settings in the input fields "Radius" and "Feed" must correspond to the values from the part program that controls the circular motion of the axes, taking account of the feed override switch setting.

• The "Measuring time" display field shows the measuring time calculated from the "Radius" and "Feed" values for recording the actual position values during the circular movement.

If only parts of the circle can be represented (i.e. measuring time too short) the measuring time can be increased in the menu by reducing the feed value. This also applies if the circularity test is started from the stationary condition.

11.3 Circularity test measurement

Display mode

The following parameter assignments for programming the mode of representation of measurement results can also be made:

- Display based on mean radius
- Display based on programmed radius
- Scaling of the diagram axes

If the measuring time calculated exceeds the time range that can be displayed from the trace buffers (maximum measuring time = position controller cycle frequency * 2048), a coarser sampling rate is used for recording (n * position controller cycle frequency), so that a complete circle can be displayed.

Start-up	CHAN1			Jog		RA.MPF				
🥢 Channel	reset				Progr	am aborte	d	_	_	Axis +
Circularity	test meası	irement								Axis -
Measuren	nent									-
Axis:				Sys. of un	its	Abso	olute posi	tion:	Status:	
X1		~	1	active	~	:	306.980 1	nm	Inactive	
Y1		~	2	active	~	:	371.032 1	nm	Inactive	Start
										<u> </u>
Paramete	r				Rep	resentatio	n:			Stop
Radius	: 100	000	m	m	Res	olution	0.000		mm/grad.	
Feedrate	: <mark>100</mark>	00.000	() ()	m/min	Rep	resent.:	Mean r	adius		
Multiplier	: 1.00	10								
Meas. tim	ne:	37	70 ms							
Communication to PLC failed.										
Measure- ment		vice xis	Axi MC		Drive MD			User views	Display	File functions

Figure 11-9 Circularity test measurement parameters

The two drives selected for measurement must describe a circular interpolation (G2/G3) with the parameters shown in the example via a part program:

Radius=100 mm, F=10000 mm/min

11.3 Circularity test measurement

Measurement

The measurement sequence is divided into the following steps:

- 1. Setting the parameters, softkey "Measurement" (see above figure).
- 2. Start measurement with "Start" softkey.

The selected axes run in the part program.

3. Displaying the measurement results, softkey "Display".

A switchover is made to the graphic illustration of the recorded circular diagram (see following figure).

Note

If required, a QEC / backlash compensation can be performed via MD32200 $MA POSCTRL_GAIN$ for the K_V factor optimization.

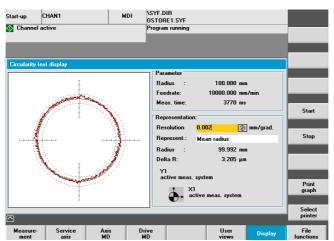


Figure 11-10 Circularity test measurement

11.4 Trace

11.4 Trace

11.4.1 Trace overview

Introduction

A trace shows signals over a time interval (signal charts)

The following functions are available:

Servo trace

Servo trace offers functions for recording and graphically illustrating the temporal characteristics of values for servo signals, e.g. actual position value, following error etc.

• Drive trace

Drive trace offers functions for recording and graphically illustrating the temporal characteristics of values for signals from the drive system, e.g. actual speed value, actual current value etc.

It must be possible for the signals to be recorded to be interconnected via a BICO source.

11.4.2 Servo trace

Basic servo trace display

The basic display of the servo trace function is reached via the operating area "Commissioning" > "Optimization/Test" > "Trace" > "Servo trace".

Start-up	CHAN	1	Joi						
// Channe	el reset			Program				Axis +	
_	_	_	_	_	ROV			7015 *	
Servo trac	ce measi	urement						Axis -	
Signal se	election								
Trace:	Axis	s/spindle name:		Sign	al select:		Status:		
Trace 1:	X1		Y Posit	tion setpoint		*	Inactive	Start	
Trace 2:	X1		Y Posit	Start					
Trace 3:	X1		Y Follo	Stop					
Trace 4:	X1		Y Conte	Contour deviation Y Inactive					
Meas. pa	Meas. parameters							Physical address	
Meas. tir	me: 5	5000	ms	Trigger:	Positive edg	je (trace 1)	v		
Triggerti	ime [.] -	500	ms	Threshold [.]	12.500		ım	Servo trace	
inggoia				rinoonoid.					
								Drive trace	
	_								
Measure ment		ervice Ax axis M		Drive MD		User vie w s	Display	File functions	

Figure 11-11 "Servo trace measurement" basic display

Parameterization in the basic display

The following selection is made in the basic display for the servo trace measurement:

- Axis/spindle selection
- Measuring signal
- Measurement time
- Trigger time
- Trigger type
- Trigger threshold

Signal selection

"Axis/spindle name" input field

The cursor must be positioned on the "Axis/spindle name" list box of the trace concerned. You can select it with the softkeys "Axis+" and "Axis-" or by accepting a value from the dropdown list box.

"Signal selection" input field

The cursor must be positioned on the "Signal selection" list box of the trace concerned. The selection is made through acceptance from the drop-down list box.

The available selection options depend on the existing configuration and activated functions.

Measuring parameters

"Measuring duration" input field

The measuring time is written directly into the "Measuring duration" input field.

"Trigger time" input field

Direct entry of pre-triggering or post-triggering. With negative input values (leading sign minus -) recording begins at the set time before the trigger event.

With positive input values (without sign) recording starts the time set after the triggering event.

Condition: Trigger time + measuring duration ≥ 0 .

11.4 Trace

"Trigger" input field

The trigger type is displayed in the "Trigger" drop-down list box. The trigger always refers to Trace 1. When the trigger condition is satisfied, Traces 2 to 4 are started simultaneously.

Settable trigger conditions:

- "No trigger", i.e. measurement starts by pressing softkey "Start" (all traces are started time-synchronized)
- "Positive edge"
- "Negative edge"
- "Trigger event from the part program"

The trace can be started via an NC part program in conjunction with the system variable \$AA_SCTRACE [axis identifier].

Reference

SINUMERIK 840D sl / 840Di sl System Variable Manual

"Threshold" input field

Direct input of the trigger threshold.

The threshold is only effective with trigger types "Positive edge" and "Negative edge".

The unit refers to the selected signal.

Softkeys "Axis+" and "Axis-"

Selection of the axis/spindle when the cursor is positioned on the appropriate "Axis/spindle name" list field.

You can also select the axis/spindle directly in the list box from the drop-down list using the cursor.

Softkeys "Start" and "Stop"

Trace function recording is started with the softkey "Start".

With the "Stop" softkey or RESET, you can cancel a running measurement.

11.4.3 Drive trace

Basic drive trace display

The basic display of the drive trace function is reached via the operating area "Commissioning" > "Optimization/Test" > "Trace" > "Drive trace".

	CHAN1	Jog	MPF0				
🥢 Channel	reset	_	Program abor	ted ROV		l	Drive device+
Drive trace				DP3.SLA	VE3:CU_I_3.3:1	(1)	Drive device-
Signal sele	ec.					<u>-</u>	
Signal 1	BICO 3:62:0	AX1:X1.SERV0	0_3.3:3 Spe	ed setpoint after	the filter		
Signal 2	BICO 3:61:0	AX1:X1.SERV0)_3.3:3 Spe	ed actual value r	notor encoder		
Signal 3	BICO 3:68:0	AX1:X1.SERV0)_3.3:3 Abs	olute current actu	ial value		Start
Signal 4	BICO 3:81:0	AX1:X1.SERV0	0_3.3:3 Tor	que utilization			
							Stop
Recording							
Dev. cycle	0.125	ms	Max. time	4096	ms		
*Scaling	8		Recording tim	e 2000	ms		
=Trace cy	cle 1	ms					Servo trace
Status:	Trace not active					-	
							Drive trace
Measure- ment				pply Driv ID MD		/	File functions

Figure 11-12 Basic "drive trace" display

When you are in the field for signal selection for a signal, you can press the <SELECT> button to move to a window in which you can determine the signal for interconnecting.

Start-up	CHAN1	Jog	MPF0			
// Channel	reset		Program aborted			Recommend
			ROV			connect.
						All
BICO editor	r Signal 1			DP3.SLAV	E3:CU_I_3.3:1 (1)	
Source driv						
Source unv	ve object.	5	SERVO_3.3:3(3) AX1:	xı	*	
Source par	rameter name or number	: 6	2	Bit/index:	0	
Recommen	nded connections:					
E1 Daire	Data Set DDS effective					
	s word, closed-loop cont	rol			^	
60 Spee	d setpoint before the set	point filter				
61 Speed	d actual value motor end d setpoint after the filter	oder			E	
	d actual value after actu	al value smo	othing			
64 Spee	d controller system devi					
65 Slip fr	requency It frequency					
	it current, maximum				~	
62 Speed s	setpoint after the filter					Abort
—>	DIOO 2-02 0					
Signal 1 = I	DICU 3:62.0					
						ок

Figure 11-13 Drive trace interconnections

11.4 Trace

If you scroll through the basic display, the following parameters are displayed:

Start-up	CHAN1	Jog	MPF0				
🥢 Channel	reset		Program	n aborted ROV			Drive device+
Drive trace					DP3.SLAVE3:0	CU_I_3.3:1 (1)	Drive device-
						^	
Trigger Type	Pos	itive edge			¥		Start
Signal	BICO 3:68:0	AX1:X1.SER		Absolu	te current actua	al value	Stop
Delay TH value	-100 e 0.4		ms A			=	
							Servo trace
Status:	Trace not active					~	Drive trace
Measure- ment			introl it MD	Supply MD	Drive MD	Display	File

Figure 11-14 Basic drive trace display, "Trigger" parameter

Parameterization in the basic display

The following selection is made in the basic display for the drive trace measurement:

- Drive unit selection
- Signal selection
- Record
- Trigger

Reference

SINAMICS S120 List Manual

Signal selection

Signals to be recorded, e.g. actual speed value, actual current value etc. It must be possible for the signals to be recorded to be interconnected, i.e. a BICO source.

Trigger signal

The trigger (signal) can be used to specify the event with which the recording of values is to start, e.g. the actual speed value is not to be recorded straightaway when the drive trace starts but only when the actual current value is > 10 A (here the actual current value trigger is > 10 A).

"Drive unit+" and "Drive unit-" softkeys

Selection of drive unit in which recording is to take place.

Softkeys "Start" and "Stop"

Trace function recording is started with the softkey "Start".



Figure 11-15 Drive trace recording

You can cancel an active recording with the "Stop" softkey or RESET.

11.5 Further optimization options

11.5 Further optimization options

Introduction

You can adapt the following parameters in the operating area "Commissioning" > "Machine data" > "Drive MD" for the drive optimization.

Speed adjustment

• Spindle drive:

p500 = 102, speed setpoint in p322 corresponds to setpoint 4000 0000hex

- Feed drive:
 - p500 = 101, speed setpoint in p311 corresponds to setpoint 4000 0000hex

The speed setpoint can be diagnosed in the corresponding drive in r2050[1+2] or r2060[1].

Brake behavior OFF3

Depending on the requirements, the brake behavior for each drive can be adjusted to the signal 2.OFF3. Default setting: p1135 = 0, brake with maximum current.

Parameters p1135, p1136, p1137 can be used to set a flatter braking ramp for drive-specific parameterization.

Maximum braking ramp setting: 600 secs

12

Drive optimization with HMI sl

12.1 Automatic servo optimization

Introduction

With the HMI sl user interface under the "Commissioning" > "Automat. Servo Opt." menu, you have the following options for automatic axis optimization:

- Selection of individual axis for optimization
- Selection of one strategy from many options
- Reconfiguration of measurement conditions
- · Chart display and activities protocol for optimization process
- Display of current measurement and at the same time the average of previous measurements
- · Checking and processing of optimization results for speed and position controller
- Accept or reject results

Auto servo tuning : Axis s	election	Tune
elect axis for tuning		
Channel 1 Axes		
o ax1:x	Untuned	
D AX2:Y	Untuned	
DAX3:Z	Untuned	Options
O AX4:A	Untuned	
O AX5:C	Untuned	
		Show
		activity log
1		
<u>^</u>		Auto servo

Figure 12-1 Basic display for automatic optimization of SERVO axes

The "Optimization" function can be used for all individual axes (SERVO and direct drives).

Note

The following axes are not supported during automatic optimization with HMI sl version 2.6:

- Gantry
- Master slave

12.2 Overview of navigation

12.2 Overview of navigation

Overview

When optimizing an axis, you navigate via various dialog screens. The following figure shows the navigation options for optimizing an axis:

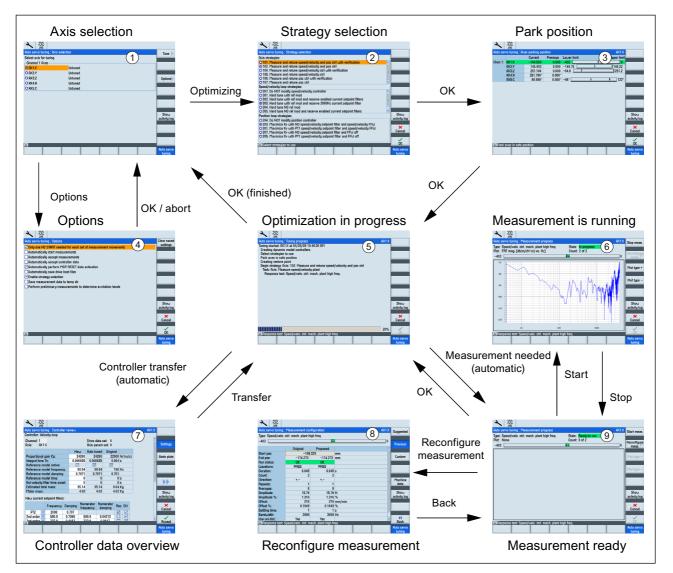


Figure 12-2 Navigation for automatic optimization of an individual axis

Note

The following section "General operating sequences for automatic servo optimization" uses the numbers shown in the above diagram (e.g. dialog screen "Strategy selection" ②).

12.3 General operating sequences for automatic servo optimization

General operating sequences

1. In the "Commissioning" operating area, press the "Automat. servo opt." softkey.

Auto servo tuning :	Axis selection			Tune
Select axis for tuni Channel 1 Axes	ng			
O AX1:X	Untu	ned		
O AX2:Y	Untu	ned		
O AX3:Z	Untu	ned		Options
O AX4:A	Untu	ned		
O AX5:C	Untu	ned		
				Show activity log
<u> </u>				
				Auto servo tuning

"Axis selection" dialog screen appears 1.

Figure 12-3 Axis selection

2. Use the cursor keys to select an axis for optimization.

Note

You can use the "Options" softkey to select special functions for the optimization ④.

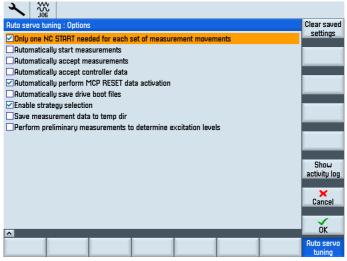


Figure 12-4 Options

- 3. Choose the options for optimization.
- 4. Press "OK".

- 5. In the "Axis selection" dialog screen ①, press the "Optimize" softkey.
- 6. In the "Strategy selection" dialog screen ②, select the strategy for optimization.

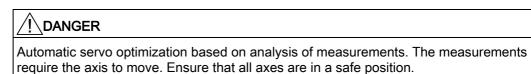
Auto servo tuning : Strategy selection	
Axis strategies:	
O 101. Measure and retune speed/velocity and pos ctrl with verification	
⊙ 102. Measure and retune speed/velocity and pos ctrl	
O 104. Measure and retune speed/velocity ctrl with verification 0 105. Measure and retune speed/velocity ctrl	
O 106. Measure and returne pos ctrl with verification	
O 107. Measure and returne pos ctrl	
Speed/velocity loop strategies:	
O 307. Do NOT modify speed/velocity controller	
O 301. Hard tune with ref mod	
O 302. Hard tune with ref mod and reserve enabled current setpoint filters	
© 303. Hard tune with ref mod and reserve 2000Hz current setpoint filter O 304. Hard tune NO ref mod	
O 304. Hard tune NO ref mod O 305. Hard tune NO ref mod and reserve enabled current setpoint filters	
Position loop strategies:	Show
O 204. Do NOT modify position controller	activity log
© 203. Maximize Kv with NO speed/velocity setpoint filter and speed/velocity FFW	
O 201. Maximize Kv with PT1 speed/velocity setpoint filter and speed/velocity FFW	×
O 207. Maximize Kv with NO speed/velocity setpoint filter and FFW off	Cancel
O 205. Maximize Kv with PT1 speed/velocity setpoint filter and FFW off	
	OK
Select strategies to use	-
	Auto servo tuning

Figure 12-5 Strategy selection

- 7. Press "OK".
- 8. In the "Axis park position" dialog screen ③, move the axes on the machine into a safe position for optimization.

2								
Auto ser		es parking pos	sition				AX1:X	
		Current	Previous	Lower lin	nit		Upper limit	
Chan 1:	AX1:X	-184.560	0.000	-403		+	0	
	AX2:Y	145.993	0.000	-148.76		ĥ	146.22	
	AX3:Z	251.104	0.000	-64.8	ĥ		251.2	
	AX4:A	351.788°	0.000°					
	AX5:C	89.999°	0.000°	-96° 🔛		Ĥ	↓ 122°	
► Park :	axes in safe p	position						Show activity log Cancel OK
								Auto servo tuning

Figure 12-6 Axis park position



9. Press "OK".

Optimization is started 5.

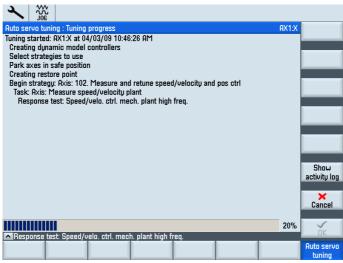


Figure 12-7 Optimization in progress

You will occasionally be asked to enter details so that the process can continue.

This is required because you need to initiate certain machine processes (e.g. measurements which require an <NC START>).

You can abort the coordination process at any stage of automatic servo optimization.

Once optimization has been aborted, all original machine data, which was present in the control and in the drives before optimization was started, is restored.

10.If the optimization process has completed some optimizations for a control loop, a "Controller data overview" dialog screen ⑦ appears.

Auto servo tu	ning : Control	ler re	view								AX1:X	
Controller: Vel	locity loop											
Channel: 1					Drive o						<u>^</u>	
Axis: AX1	:X				Axis p	aram	set: O					Settings
			Ne	ω	Auto tu	ined	Origin	nal				
Proportional	gain Kp:		2	4260	24	260	22	000	N/(m/s)]		Bode plots
Integral time				6835	0.008	835		004	s		=	· ·
Reference m	odel active:]								
	odel frequen			60.94	-	0.94		150	Hz			
	odel dampin	g:	0.	7071	0.7	7071	0.	701				
Reference m				0		0		0				
	filter time cor	ist:		0		0		0				
Estimated to			5	95.14		5.14		3.04	-			
Motor mass:				4.02		4.02		1.02	Kg			Show
New current	setpoint filter	s:										activity log
	Frequency	Da	mping		nerator uencu		merator mping	Re	s EN			× Cancel
PT2 🔽	2000	0.	.707					2				Ualicer
2nd order 🗠	590.9	0.1	7066	59	30.9	0.0	04212					
2nd ordor	333.0	0	1167	21	000	0	0047			_	Ľ	Accept
												Auto servo

Figure 12-8 Controller data overview

You can modify and check the results and either accept or reject the proposed control parameters.

Note

Alternatively the optimized values can also be displayed graphically as a Bode diagram using the "Bode diagram" softkey function.

11.Select "Transfer" to transfer the values calculated.

You can undertake further optimizations.

For example in a typical strategy, the mechanical stretch of closed-loop speed control is measured and gains and filters defined for optimized dynamics behavior (8).

Auto servo tuning	: Measurement cor	nfiguration		AX1:X	Suggested
Type: Speed/velo.	ctrl. mech. plant h	igh freq.			
-403		Ļ	•	0	
	Original	Proposed		^	Previous
Start pos:	-185		mm		
End pos:	-174.273	-174.273	mm		Custom
Run status:	OK	OK			_
Waveform:	PRBS	PRBS			
Duration:	6.645	6.645	s		
Count:	2	2	-		
Direction:	+,-	+,-			Machine
Repeats:	1	1			data
Averages:	8	8			
Amplitude:	15.78	15.78	N		Show
Amplitude %:	1.316	1.316	%		activity log
Offset:	216	216	mm/min		
Offset %:	0.1649	0.1649	%		
Settling time:	1	•	•		
Bandwidth:	3999	3999	Hz		
Use uni.dist.:	Yes	Yes		×	K Back
 Response test: 	Speed/velo. ctrl. m	ech. plant high fr	eq.		
					Auto servo tuning

Figure 12-9 Measurement configuration

12. If you accept the settings for closed-loop speed control by pressing "Transfer", the drive data is updated, and the strategy then runs the measurements for closed loop position control, "Measurement is running" dialog screen ⁽⁶⁾.

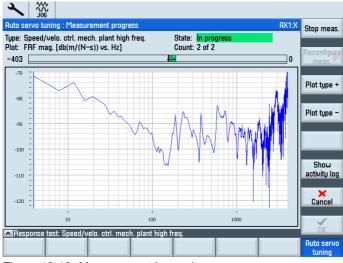


Figure 12-10 Measurement is running

13.Once the optimum values for closed loop position control have been selected, the data is transferred to the CNC and drives, and the strategy runs the next stage which may be e.g. to measure for verification.

12.4 Additional optimization stages - commissioning interpolation axes

12.4 Additional optimization stages - commissioning interpolation axes

Additional optimization stages

Additional optimization stages should be undertaken for axes which make up a collection of interpolations. These optimization stages should be undertaken manually by the commissioning staff using the options provided in the HMI Advanced or start-up tool:

e.g.:

- Circularity test measurement (Page 213)
- Adaptation of servo gains (e.g. smallest servo gain in all interpolating axes without DSC see Position control loop measurement (Page 207))
- When using speed feed forward control, transfer equivalent time constants of the slowest axis (highest value) into all interpolating axes (see Speed control loop measurement (Page 204)).

13

Data backup and standard commissioning

Introduction

Once commissioning of the NCK, PLC and drive has been completed, you can manage the modified data using the functions below:

- Save/Archive user data
- Series commissioning
- Upgrading, as series commissioning

User data

The following user data can be managed:

Table	13- 1	User data	

NCK/HMI	PLC
Machine data	OB (organization blocks)
Setting data	FB (function blocks)
Option data	SFB (system function blocks)
Global (GUD) and local (LUD) user data	FC (functions)
Tool and magazine data	SFC (system functions)
Protection zone data	DB (data blocks)
R parameters	SDB (system data blocks).
Work offsets	
Compensation data	
Display machine data	
Workpieces, global part programs and subroutines	
Standard and user cycles	
Definitions and macros	

13.1 Data backup

13.1 Data backup

Introduction

Data is backed up by means of the HMI. SINUMERIK solution line components can either be backed up individually or jointly. You can select from:

- NCK (NC)
- PLC
- HMI
- Drives

Operating sequence

1. Selection of Data backup menu

Operating range "Services > ETC key ">" > "Standard commissioning".

- 2. You can choose which data you want to back up:
 - HMI
 - NC with compensation data
 - PLC
 - PROFIBUS drives
- 3. Archive name: The suggested archive name depends on the selected area and can be changed if necessary.
- 4. Create the data backup file by selecting the component to which you wish the file to be output:
 - NC card (CompactFlash card)
 - Archive

Data backup DRIVE-CLiQ motors

Note

We would recommend backing up the DRIVE-CLiQ motor data onto a CompactFlash card (NC card).

The p4692 parameter must be set to "1" in the "Commissioning" > "Machine data" > "Control unit MD" operating range.

Data backup and standard commissioning

13.2 User data backup/Series commissioning

13.2 User data backup/Series commissioning

Introduction

Data can be saved and archived in the following ways:

- Reading out the data completely: Series commissioning
- Files are exported/imported area by area.

The following user data can be selected as individual files:

- Machine data
- Setting data
- Tool data
- R parameters
- Zero point offset
- Compensation data (LEC)
- Part programs
- Standard cycles
- User cycles
- PLC programs (binary file)

In the case of a data backup, e.g., following commissioning of the control system, the user data selected via the user interface are written to what is known as a series-commissioning file. Once a series-commissioning file has been imported, the control system returns to its original state, as it was at the time of the data backup.

Time of data backup

Experience has shown that the following times can be recommended for carrying out data backups:

- Following commissioning
- After changing machine-specific settings
- After service, e.g., after replacement of a hardware component, software upgrade, etc.
- Before activation of memory-configuring machine data. A warning prompting you to back up is displayed automatically.

Note

References: Operator's Guides for:

- HMI Advanced
- HMI-Embedded
- ShopMill/ShopTurn

13.3 Preassignments when saving PLC data

13.3 Preassignments when saving PLC data

Introduction

When creating a series-commissioning file that contains PLC data, the PLC image that is saved during this process is dependent on the status of the PLC at the time of creation.

Depending on the status of the PLC, the following PLC images result:

- Original image
- Instantaneous image
- Inconsistent image

Operating sequence for original image

The original image of the PLC is represented by the PLC-data state immediately after loading the S7 project into the PLC.

- 1. Set the PLC to the operating status STOP.
- 2. Load the appropriate S7 project into the PLC using SIMATIC Manager STEP 7.
- 3. Create a series-commissioning file with PLC data.
- 4. Set the PLC to the RUN operating status.

Operating sequence for instantaneous image

If you cannot create an original image, you can save an instantaneous image as an alternative.

- 1. Set the PLC to the operating status STOP.
- 2. Archive PLC data.
- 3. Set the PLC to the RUN operating status.

Operating sequence for inconsistent image

An inconsistent image results if a series-commissioning file with PLC data is created and the PLC is in the RUN state (cyclic operation). The data blocks of the PLC are saved at different times with contents that under certain circumstances may meanwhile have changed. This may result in a data inconsistency that, once the data backup has been copied back to the PLC, may under certain circumstances result in a PLC stop in the user program.

NOTICE

The creation of a series-commissioning file with PLC data while the PLC is in RUN status (cyclic operation) may result in an inconsistent PLC image in the series commissioning archive. After this series-commissioning file has been copied back, this data inconsistency in the PLC user program may under certain circumstances result in a PLC stop.

13.4 Series commissioning

Changing the PLC operating status

The PLC operating status can be changed using:

- SIMATIC STEP7 Manager
- PLC mode selector on the NCU (position "2" -> STOP, position "0" -> RUN)

Series commissioning 13.4

Introduction

Series commissioning means bringing a series of control systems to the same initial state as regards their data.

You can archive/read in your choice of PLC, NC and HMI data for series commissioning. Compensation data can be saved at the same time if necessary. The drive data are saved as binary data which cannot be modified.

Requirement

The password, e.g., with access level 3 (user) is set.

Note

In order to prevent a topology error, Control Unit parameter p9906 (topology comparison stage of all components) should be set to "Medium" to load Control Unit series commissioning.

13.4 Series commissioning

Operating sequence

- 1. Open the menu to create a series-commissioning file:
 - Operating range "Services" > <ETC> key > > "Series IBN".

	ROV	HMI data selection
Create series startup	rchive	Read sta up archiv
Archive contents	🗌 нмі	
	✓ NC ✓ With compensation data	
	PLC	
	Omplete PLC	Disk/
	O PLC hardware upgrade (SDBs only)	Card
	PROFIBUS drives	Archive
	O C ACX format (binary)	
	O ASCII format	NC card
Archive name	ORIGINAL	
Cr. start up archive		$\mathbf{\Sigma}$

Figure 13-1 Series commissioning

- 2. Create an archive for the series-commissioning file: You can select which data you wish to save as the archive contents:
 - HMI
 - NC with compensation data
 - PLC
 - PROFIBUS drives
- 3. Archive name: The suggested archive name depends on the selected area and can be changed if necessary.
- 4. Create the series-commissioning file by selecting the component to which you wish the file to be output:
 - NC-Card
 - Archive

14

File functions for SINAMICS parameters

14.1 Overview of file functions

Functionality

The "File functions" function gives you the following options for SINAMICS parameters of drive objects:

- Backing up on the HMI
- Loading to the drive unit
- Editing on the HMI

The functions are available under "Commissioning" > "Machine data" > <ETC> key > "File functions".

Depending on the machine data area from which the file functions were selected, the corresponding entry is selected from the selection box for selecting data.

The data and parameters available on the control appear in this selection box.

The first three vertical softkeys for "+/-" and "Direct selection" are adapted accordingly and are only visible where there is more than one component.

Start-up	RACK800	JOG Ref	MPFO	
🥢 Chan	nel reset		Program aborted	Drive +
	_		ROV	
File fun	ctions		DP3.SLAVE3:SERV0_3.3:3 (3) AX3:Z	Drive -
Ma	ichine data			
Fi	ile		Data	Direct
ę	SERVO_3_3_3		SINAMICS drive parameters	selection
	SERVO_3_3_3	*	Channel-specific machine data Axis-specific machine data	Delete
			General display Machine data SINAMICS control unit parameters SINAMICS infeed parameters SINAMICS drive parameters SINAMICS communications parameters	Save
				Load
D	irectory			
	Standard directory	*]	Error log
			N	E ditor
	Comm. MD		Display MD	File functions

Figure 14-1 Selecting "SINAMICS drive parameters" file functions

14.2 Data backup of SINAMICS parameters

SINAMICS parameters

You can use a drop down list box in the "Data" window to back up/load the following SINAMICS parameters from the individual drive objects:

- SINAMICS control unit parameters
- SINAMICS infeed parameters
- SINAMICS drive parameters
- SINAMICS communications parameters

Drive objects

Select the respective drive objects using the vertical softkeys. For example the "Drive +"/"Drive -" vertical softkeys for "SINAMICS drive parameters".

14.2 Data backup of SINAMICS parameters

Introduction

Select the "File functions" dialog under "Commissioning" > "Machine data" > <ETC> key.

Operating sequence

Proceed as follows to back up the drive object parameters:

- 1. In the "Data" window, select the data type you require.
- 2. Use the "+/-" or "Direct selection" vertical softkeys to select the component if there is more than one component.
- 3. In the "File" window enter a name or select an existing name from the selection box.
- 4. In the "Directory" window, select the directory under which you want to save the parameters.
- 5. Press "Save".

14.2 Data backup of SINAMICS parameters

The following screen shots show examples of "SINAMICS drive parameters" and "SINAMICS control unit parameters".

Start-up	RACK800	JOG Ref	MPFO		
🥢 Chanr	iel reset		Program aborted ROV		Drive +
File fund	tions thine data		DP3.SLAVE3:SERVO_3.3:3	(3) AX3:Z1	Drive -
Fil			Data SINAMICS drive parameters		Direct selection
9	ERV0_3_3_3	*	J Channel-specific machine dat Axis-specific machine data General display Machine data	.	Delete
			SINAMICS control unit parameters SINAMICS infeed parameters SINAMICS drive parameters SINAMICS communications pa		Save
					Load
_	rectory itandard directory	*]		Error log
				$\mathbf{\Sigma}$	E ditor
	Comm. MD			Display MD	File functions

Figure 14-2 Select "File functions" >"SINAMICS drive parameters"

Start-up	RACK800	JOG Ref	MPFO	
🥢 Channel	reset		Program aborted ROV	Control unit +
File function			DP3.SLAVE3:CU_L_3.3:1 (1)	Control unit -
Mach File CU_	ine data _I		Data SINAMICS control unit parameters	Direct selection
CU	_!	¥		Delete
				Save
- D.				Load
Dires	ctory Indard directory	~		Error log
🛆 Saved ir	:\DG.DIR\MDSINA	MICS.DIR\MD.	_CU.DIR\CU_I.TEA	Editor
	Comm. MD		Display MD	File functions

Figure 14-3 Select "File functions" > "SINAMICS control unit parameters"

14.3 Loading the SINAMICS parameter file

14.3 Loading the SINAMICS parameter file

Introduction

Select the "File functions" dialog under "Commissioning" > "Machine data" > <ETC> key.

Operating sequence

Proceed as follows to load parameters to the individual drive objects:

- 1. In the "Data" window, select the data type you require.
- 2. Use the "+/-" or "Direct selection" vertical softkeys to select the component if there is more than one component.
- 3. Select an existing name from the selection box.

Start-up	RACK800		MPFO	
🥢 Channe	el reset		Program aborted ROV	Control unit +
File funct	ions hine data		DP3.SLAVE3:CU_1_3.3:1 (1)	Control unit -
File			Data SINAMICS control unit parameters	Direct selection
CL	J_I	*		Delete
				Save
				Load
	ectory andard directory	~		Error log
🔿 Saved i	in:\DG.DIR\MDSINAM	ICS.DIR\MD_	CU.DIR\CU_I.TEA	E ditor
	Comm. MD		Display MD	File functions

Figure 14-4 Loading/copying SINAMICS drive parameter file functions

4. Press "Load".

JOG Ref Start-up RACK800 Program aborted 🥢 Channel reset ROV DP3.SLAVE3:SERV0_3.3:4 (4) AX2:Y1 File functions Machine data File Data ~ The source and target drive object numbers are different The data from SERVO_3_3_3 cannot be loaded unchanged into SERVO_3.3:4, they have to be adapted to SERVO_3.3:4. The DRIVE-CLiQ component types of the source and target drive objects are different. Loading the data can therefore lead to a faulty state of the drive unit and/or to hardware damage! Adapt. Select "Adapt..." if the data from SERV0_3_3_3 are to be adapted before loading Select "Cancel..." if the process is to be canceled Abor

The following message will appear if the source and target numbers don't match:

Figure 14-5 Loading/copying SINAMICS drive parameter file functions, "Adapt" query

5. Select "Adapt".

You can now adapt the "Actual values" for the "File" using the "Setpoints".

🖉 Channe	el reset	Program aborted	1		
-		- RO			
Adaptatio	n SERV0_3_3_3.TEA ==>	DP3.SL	AVE3:SERVO 3	.3:4 (4) AX2:Y1	1
		File	Set val	Control	
5121[0]	Power unit component number	3	4 🔾	4	
5131[0]	Motor component number	12	11	11	
5141[0]	Encoder interface (Sensor Module) comp	14	9	9	
142[0]	Encoder component number	15	10	10	_
199	Drive object name	SERV0_3.3:3	SERV0_3.3:4	SERV0_3.3:4	
					Abort
					OK



6. Press "OK".

14.4 Editing the SINAMICS parameter file

14.4 Editing the SINAMICS parameter file

Introduction

Select the "File functions" dialog under "Commissioning" > "Machine data" > <ETC> key.

Operating sequence

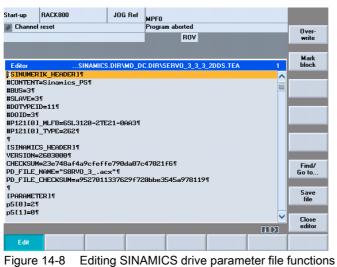
Proceed as follows to display the contents of a file:

- 1. In the "Data" window, select the data type you require.
- 2. Use the "+/-" or "Direct selection" vertical softkeys to select the component if there is more than one component.
- 3. Select an existing name from the selection box.

Start-up	RACK800	JOG Ref	MPF0	
// Channe	el reset	1	Program aborted	Drive +
			ROV	Dilá6 +
File funct	ions		DP3.SLAVE3:SERV0_3.3:3 (3) AX3:Z1	Drive -
Mac	nine data			
File	RV0_3_3_3		Data	Direct selection
			SINAMICS drive parameters →	
SE	ERVO_3_3_3	~	Channel-specific machine data Axis-specific machine data	Delete
			General display Machine data SINAMICS control unit parameters	
			SINAMICS infeed parameters SINAMICS drive parameters	Save
			SINAMICS communications parameters	
				Load
Dire	ectory			
St	andard directory	~]	Error log
			Σ	E ditor
	Comm. MD		Display MD	File functions

Figure 14-7 Select "File functions" > "File"

4. Press "Edit ... "



- 5. The content of the file is displayed and can be viewed.

15

Tips for commissioning SINAMICS drives

Introduction

This chapter describes instructions and tips on:

- Changing topology (modular machine)
- Drive states
- Diagnostics for pending alarms
- Drive (SERVO) parameter RESET, individual
- Version display of the drives (SERVOs)
- Checking/setting power supply data settings
- Identification/Optimization "ALM > Infeed/Configuration"

Tips for commissioning SINAMICS drives

15.1 Changing topology (modular machine)

15.1 Changing topology (modular machine)

Introduction

The topology is changed using the following menus:

• "Commissioning" > "Drive system" > "Drive units" > "Topology".

Start-up	RACI			JOG Ref	MPFO						
// Channel	reset				Program		rted ROV				Drive device+
\Drive d	evices	s\Top(ology - Comp.	topol.			DF	3.SLA	VE3:CU	_I_3.3:1 (1)	Drive device-
			from					1	to		
Drive Obje	ct	-No.	Component	-No.	Socket		Socket	-No.	C	omponent	Select
CU 3.3:1		1	Control Uni	t1 1	X100		X200	2		Module_2 👗	drive dev.
				-	X101		X202	3		Modul	unve dev.
					X102						
					X103						CI
					X104		X100		CU_N	X_3.14:1 🚃	Change
					X105		X500	14		SM_14	
ALM_3.3:2	!	2	Line_Module	e_2 2	X200		X100	1	Contr	ol_Unit_1	
_				-	X201						Configure
					X202						drive unit
SERVO_3.	3:3	3	Motor_Modu	ul 3	X200						
-					X201		X200	4	Motor	Modul	
					X202		X101	1	Contr	ol_Unit_1	
SERVO_3.	3:3	3	SM_14	14	X500		X105	1	Contr	ol_Unit_1	
SERVO_3.	3:4	4	Motor_Modu	ıl 4	X200		X201	3	Motor	Modul	
_					X201		X200	5	Motor	Modul 🔪	bbA
					X202		X500	9		SM 9 🎽	component
from:	CU_I	_3.3 :1	.Control_Uni	L1(1)							component
to:	ALM	3.3:2	Line Module	2(2)							D: 1
		_	-								Display options
Configur- ation	T	opolog	y PROFIE		innec-		puts / utputs			Control unit MD	
Figure	15-	-1	"Drive	units"	> "To	ррс	ology"	me	nu		

• "Commissioning" > "Drive system" > "Drive units" > "Configuration".

Start-u		HAN1	JO		MPF0			
🥢 Ch	annel re	set		1	Program abo			Drive
						ROV		device+
								Drive
\Dri	ve devid	ces\Configura	tion - Comp. to	pol.		DP3.SLAVE3:	CU_I_3.3:1 (1)	device-
Axis	Drive (Component	-No.		type	C.level	
	CU_1_:		Control_Unit_1	1	2603700	NCU720	High	Select
	ALM_3		Line_Module_2	2	2603700	LM_ACDC	High	drive dev.
X1		D_3.3:3	Motor_Module_3		2603700	MM_1AXIS_DCAC	High	
X1	SERVI	D_3.3:3	SM_5	5	2603700	SMx module sin/cos	High	
								Load firm- ware
								Load firm- ware Details
<								ware Details
<				11				ware
	_3.3:1.C	ontrol_Unit_1	(1)					ware Details
< cu_i	_3.3:1.C	ontrol_Unit_1	(1)					ware Details Sort
	_3.3:1.C	ontrol_Unit_1	(1)	IT			>	ware Details

Figure 15-2 "Drive units" > "Configuration" menu

Tips for commissioning SINAMICS drives

15.1 Changing topology (modular machine)

Functions for changing topology

The following functions are provided for changing the topology:

- "Topology" > "Add component..."
- "Topology" > "Change..."
 - Delete drive objects/components
 - Enable/disable drive objects
 - Change drive object name/number
 - Change component name/number
- "Configuration" > "Sort..."
- "Configuration" > "Change..."
 - Change drive object name
 - Change component name
 - Change comparison level

Note

First commissioning is not necessary after changes to the topology.

15.1.1 Adding components

Introduction

If you connect a component (e.g. SMC20) via DRIVE-CLiQ to the drive system for the NCU, SINAMICS detects the change in the actual topology and sends the actual/reference topology difference to the HMI.

The new component must be configured on the HMI and assigned to a drive object (SERVO-DO/Motor Module) via the drive wizard.

Note

Up to version 2.5

A new motor with DRIVE-CLiQ can only be assigned to an existing drive object (SERVO-DO) (see following operating sequence, including "Add component") that has never previously been assigned an encoder interface or another motor with DRIVE-CLiQ and that has not yet ever been commissioned.

Operating sequence

1. Select the "Commissioning" > "Drive system" > "Drive units" menu.

Start-u	•	JOG	MF	PFO			
/ Ch	annel reset		Pr	ogram abc	nted ROV	_	Drive device+
					107		device.
\Dri	ve devices\Configu	ration - Comp. topo	d.		DP3.SLAVE3:	CU_I_3.3:1 (1)	Drive device-
Axis	Drive Object	Component	-No.	FW comp.	type	C.level	
	CU_I_3.3:1	Control_Unit_1	1	2603700	NCU720	High	Select
	ALM_3.3:2	Line_Module_2	2	2603700	LM_ACDC	High	drive dev.
X1	SERV0_3.3:3	Motor_Module_3	4	2603700	MM_1AXIS_DCAC	High	
X1	SERV0_3.3:3	SM_5	5	2603700	SMx module sin/cos	High	
							Load firm ware
							Details
<			m			>	Sort
CU_I	_3.3:1.Control_Unit	_1(1)					
							Display
							options

Figure 15-3 "Drive system" > "Configuration" menu

2. Press "Topology".

Start-up	CHAN1		JOG Ref	MPF0					
// Channel	reset			Prograr	n abc	rted ROV		_	Drive device+
\Drive dev	vices\Top	ology - Comp. t	opol.				DP3.SI	AVE3:CU_I_3.3:1 (1)	Drive device-
		from						to	
Drive Object	-No.		-No.	Socket		Socket	-No.	Component	Select
CU_I_3.3:1	1	Control_Unit_1	1	×100 ×101		×200 ×200	2 4	Line_Module_2 Motor_Module_3	drive dev.
				X102 X103 X104					Change
				X105					
ALM_3.3:2	2	Line_Module_2	2 2	X200		X100	1	Control_Unit_1	
				X201					Configure
				X202					drive unit
SERV0_3.3:3	3	Motor_Module	3 4	X200		X101	1	Control_Unit_1	
				X201 X202		X500	5	SM 5	
SERV0_3.3:3	3	SM 5	5	X500		X202	4	Motor Module 3	
	011133	-	140						Add component
from: to:		1.Control_Unit_ 2.Line Module							
™	, .c.m_3.3.8		(-)		_				Display options
Configur- ation	Topol	gy PROFI		nnec- ons		puts / utputs		Control unit MD	

Figure 15-4 Topology without new component

in the "Topology" menu, you start with the actual status (here an example). The component has not been connected yet.

3. Connect a new DRIVE-CLiQ component (e.g. SMC20) to a Motor Module.

Note

Only plug in (connect) components when the drive unit is switched off.

Start-up	CHAN1			IOG Ref	MPF0						
// Channel	reset				Program	n abo	orted				Drive
							BOV				device+
201416			ave003: CU_I_3 r: Comparison a						. Comp	onent	Drive
\Drive de	vices\T	opolo	igy - Comp. top	ol.				DP3.SL	AVE3:0	CU_I_3.3:1 (1)	device-
			from						to		
Drive Object		No.	Component	-No.	Socket		Socket	-No.		Component	Select
CU_I_3.3:1		1	Control_Unit_1	1	X100		X200	2		Line_Module_2	drive dev.
					X101		X200	4		Motor_Module_3	
					×102 ×102		115.00	201		module sin/cos>	
					X102 X103		X500	201	CSMX	module sin/cos>	Change
					×103 ×104	-					onunge
					X104	-					
ALM 3.3:2		2	Line Module 2	2	X200		X100	1		Control Unit 1	Configure
-					X201						drive unit
					X202						
SERV0_3.3:3		3	Motor_Module_3	4	X200		X101	1		Control_Unit_1	
					X201						
				-	X202		X500	5		SM_5	
SERV0_3.3:3			SM_5 <smx <="" module="" sin="" td=""><td>201</td><td>×500 ×500</td><td></td><td>×202 ×102</td><td>4</td><td></td><td>Motor_Module_3 Control Unit 1</td><td></td></smx>	201	×500 ×500		×202 ×102	4		Motor_Module_3 Control Unit 1	
			COMX module sin/	201	X000		ATUZ			Control_Unit_1	Add component
from: to:	CU_I_3	3.3:1.0	Control_Unit_1(1)						DS	
™. ∧							_				Display options
Configur- ation	Тор	olog	y PROFIBU		nnec- ons		puts / utputs			Control unit MD	

Figure 15-5 Desired state

Start-up	СНАР	11		JOG Ref	MPF0					
🥢 Channel	reset				Progra	m abo	orted			Drive
							ROV			device+
201416			lave003: CU_I y: Comparisor						. Component	Drive
\Drive de	vices\	Topol	ogy - Comp. to	pol.				DP3.SI	AVE3:CU_I_3.3:1 (1)	device-
			from						to	
Drive Object		-No.	Component	-No.	Socket		Socket	-No.	Component	Select
CU_I_3.3:1		1	Control_Unit_1	1	X100		X200	2	Line_Module_2	drive dev.
					X101		X200	4	Motor_Module_3	unve dev.
					X102					
					X102		X500	201	<smx cos="" module="" sin=""></smx>	
					X103					Change
					X104					
					X105					
ALM_3.3:2		2	Line_Module_2	2	X200		X100	1	Control_Unit_1	Configure
					X201					drive unit
					X202					
SERV0_3.3:3		3	Motor_Module_3	3 4	X200		X101	1	Control_Unit_1	
					X201					
					X202		X500	5	SM_5	
SERV0_3.3:3		3	SM_5	5	X500		X202	4	Motor_Module_3	
			<smx module="" si<="" td=""><td>n/ 201</td><td>X500</td><td></td><td>X102</td><td>1</td><td>Control_Unit_1</td><td></td></smx>	n/ 201	X500		X102	1	Control_Unit_1	
										Add component
from: to:	_	_	Control_Unit_ d>. <smx mod<="" td=""><td>• •</td><td>N(201)</td><td></td><td></td><td></td><td>Act. state</td><td></td></smx>	• •	N(201)				Act. state	
₩. ~	vana.	aargine		uie all/COS	*(201)	_	_			Display options
_					_					
Configur- ation	Т	opolo	y PROFIB		nnec- ions		puts / utputs		Control unit MD	

Figure 15-6 Actual state

Start-up	CHAN1			JOG Ref	MPF0							
🥢 Channel i	reset				Program	Drive						
_						R0V						
201416			lave003: CU_ y: Compariso						. Comp	onent	Drive	
\Drive dev	vices\T	opol	ogy - Comp. ti	opol.				DP3.SI	AVE3:0	CU_I_3.3:1 (1)	device-	
			from						to			
Drive Object		-No.	Component	-No.	Socket		Socket	-No.		Component	Select	
CU_I_3.3:1		1	Control_Unit_1	1	X100		X200	2		Line_Module_2	drive dev	
					X101		X200	4		Motor_Module_3		
					×102 ×102		×500	0.04				
					X102 X103		X500	201	<5Mx	module sin/cos>	Change	
					×103						Ondinge	
					X104	-						
ALM 3.3:2		2	Line Module 2	2	X200		X100	1		Control Unit 1	Configure	
_					X201	-					drive unit	
					X202						unve unit	
SERV0_3.3:3		3	Motor_Module_	3 4	X200		X101	1		Control_Unit_1		
					X201							
					X202		X500	5		SM_5		
SERV0_3.3:3		3	SM_5	5	X500		X202	4		Motor_Module_3		
			<smx module="" s<="" td=""><td>in/ 201</td><td>X500</td><td></td><td>X102</td><td>1</td><td></td><td>Control_Unit_1</td><td>Add</td></smx>	in/ 201	X500		X102	1		Control_Unit_1	Add	
											component	
from:	<unase< td=""><td>signe</td><td>d>.<smx mod<="" td=""><td>lule sin/cos</td><td>>(201)</td><td></td><td></td><td></td><td></td><td>Act. state</td><td></td></smx></td></unase<>	signe	d>. <smx mod<="" td=""><td>lule sin/cos</td><td>>(201)</td><td></td><td></td><td></td><td></td><td>Act. state</td><td></td></smx>	lule sin/cos	>(201)					Act. state		
to:	CU_I_3	3.3:1.	Control_Unit_	1(1)								
	_										Display options	
<u>^</u>											opaons	
Configur- ation	Тор	polo	y PROFIE		nnec- ions		puts / utputs			Control unit MD		

Figure 15-7 Component not commissioned yet (201)

SINAMICS detects the change in the actual topology and sends the actual/reference topology difference to the HMI.

 GRAYED OUT -> Desired state, drive object/component not plugged in and/or deactivated in drive system

Use the cursor keys to select the required line. The state is indicated in the bottom part of the window.

- RED -> actual state - present in the actual topology

New components which haven't yet been commissioned have a component number > "200", in this example, the number is "201".

The new component must now be configured in the drive system via the vertical softkey "Add component...".

4. Press "Add component...".

Start-up	CHAN1	JOG Ref	MPF0	MPF0							
// Channel	// Channel reset Program aborted										
						ROV					
201416	DP003.S Topolog	lave003: CU_ y: Compariso	_I_3.3:1 (1) c on additiona	omponer I compon	it Con ent in	trol_Unit_ actual to	1: pology	v. Component			
\Drive de	vices\Topol	ogy - Comp.	topol.				DP3.S	LAVE3:CU_I_3.3:1 (1)			
		from						to			
Drive Object	-No.	Component	-No.	Socket		Socket	-No.	Componer			
CU_I_3.3:1	1	Control_Unit_1	1	X100		X200	2	Line_Module_			
1		1		V101		V200		Matar Madula	2		
Start-up									<u> </u>		
	onents found module sin/o mponents?										
									Abort		
									ОК		

Figure 15-8 Menu "Add component"

A new component has been found.

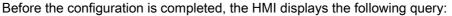
5. Press "OK" to configure and accept this component.

Start-up	CHAN	11	J	OG Ref	MPF0						
// Channel	Channel reset Program aborted ROV										
\Drive de	vices\"	Topol	ogy - Comp. topo from	ol.			DP3.SI	AVE3:CU_I_3.3:1 (1)			
Drive Object		-No.	Component	-No.	Socket	Socket -No.		Component			
	Start-	ıp									
	The	comp	onents are bein	g transfe	rred.						
	the	drive	take up to sever system.			g on the con	figurat	tion of			
	Ihe	displ	ay will then be u	odated							
	SINAMICS is accepting new components										
									Abort		
from:											
to:	_										
Waiting f	or topo	logy	data								
									1		

Figure 15-9 Configuration begins

During the unit configuration there are a succession of messages containing information on the configuration.

Determining the device configuration may take several minutes.



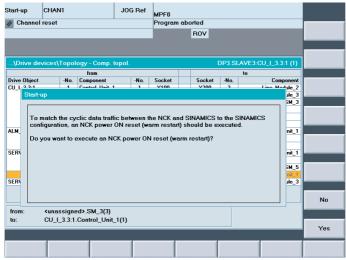


Figure 15-10 Power on reset (warm restart)

6. Press "OK" to perform an NCK power on restart (warm restart).

	HAN1		JOG Re	MPF0						
🥢 Channel re	eset			Progra	m abo	nted ROV	_		_	
				-		RUV				
\Drive devi	ces\Topol	ogy - Comp. t	opol.			1	DP3.SI	LAVE3:C	U_I_3.3:1 (1)	
		from						to		
Drive Object	-No.	Component	-No			Socket	-No.		Component	
CU_I_3.3:1	1	Control_Unit_1	1	×100		X200	2		Line_Module_2	
1		1		V101		V200	4		latar Madula 2	
Start-up										
Select 'Drive	es' to assi	been transfer gn the encode	er to a driv	e now.						
Select 'OK' i	f you want	to assign the	encoder	ater.						
										Drives
										PROFIBUS link
										ок

Figure 15-11 Component accepted

The unit configuration is finished. The component has been accepted.

You have the following options to assign this component (e.g. SMC20 with new encoder) to a drive:

- Press "Drives" to open the drive wizard. Select the drive and run through the drive wizard to the encoder configuration (Page 85).
- Press "OK" and assign this component later to a drive.

Start-up CHJ		J	OG Ref	MPF0 Program	n shr	utod			
	,			riograf		ROV			Drive device+
\Drive device	s\Topol	ogy - Comp. topo	ol.				DP3.SL	AVE3:CU_I_3.3:1 (1)	Drive device-
		from						to	
Drive Object	-No.	Component	-No.	Socket		Socket	-No.	Component	Select
CU_I_3.3:1	1	Control_Unit_1	1	X100		X200	2	Line_Module_2	drive dev
				X101		X200	4	Motor_Module_3	
				X102		X500	3	SM_3	
				X103					
				×104 ×105					
ALM 3.3:2	2	Las Madala 3	2	X105 X200		X100	1	Control Unit 1	
ALM_3.3:2	2	Line_Module_2	2	X200 X201		X100		Control_Unit_1	
				X201					Configure
SERVO 3.3:3	3	Motor Module 3	4	X202		X101	1	Control Unit 1	drive uni
321140_3.3.5	5	motol_module_5	1	X200		7101		CONTOT_ONK_1	
				X201		X500	5	SM 5	
		SM 3	3	×500		X102	1	Control Unit 1	
SERVO 3.3:3	3	SM 5	5	X500		X202	4	Motor Module 3	
from: <ur< td=""><td>accian</td><td>ed>.SM 3(3)</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Add componer</td></ur<>	accian	ed>.SM 3(3)							Add componer
to: CU	_1_3.3:1.	Control_Unit_1(1)		_				Display options
Orafiana	Topolo	y PROFIBUS		nnec- ions		puts / .tputs		Control unit MD	

Figure 15-12 "Topology" menu after "OK"

The actual state is displayed in the topology.

If you select the component with the cursor keys, the HMI informs you in the bottom area of the topology table, which components have been connected to this component via DRIVE-CLiQ.

Note

A non-assigned component must be commissioned with the drive wizard.

You can start the drive wizard via the "Topology" menu with the following operating sequence:

- 1. Press the <RECALL> key.
- 2. Press "Drives".

See also

Drive diagnostics (Page 268)

15.1.2 "Topology" > "Change..." menu

15.1.2.1 Changing entry into topology

Introduction

You have the following options in the "Topology" > "Change..." dialog:

- Delete drive objects/components
- Enable/disable drive objects
- Change drive object name/number
- Change component name/number

Operating sequence for "Topology" > "Change" dialog

You have saved the drive data (see "Data backup of SINAMICS parameters" (Page 238)) You are in the "Commissioning" > "Drive system" > "Drive units" > "Topology" menu.

itart-up		K800	J01	G Ref	MPFO							
🥢 Channe	l reset	:			Program	abo	rted				Drive	
	ROV											
											Drive	
\Drive o	levice	s\Topo	ology - Comp. top	ol.			DP	3.SLA	VE3:CU_I_3.3:1	(1)	device-	
			from						to			
Drive Obje	ect	-No.	Component	-No.	Socket		Socket	-No.	Component		Select	
CU_I_3.3:	1	1	Control_Unit_1	1	X100		X200	2	Line_Module_2		drive dev.	
					X101		X202	3	Motor_Modul			
					X102							
					X103						Change	
					X104		X100		CU_NX_3.14:1		change	
	•			0	X105		X500	14	SM_14			
ALM_3.3:2	2	2	Line_Module_2	2	X200 X201		X100	1	Control_Unit_1		Configure	
					X201	-					drive unit	
SERVO 3	2.2	3	Motor Modul	3	X202	-					diffe diffe	
JEI140_J		J	MOLOI_MOUUI	J	X200		X200	4	Motor Modul			
					X202		X101	1	Control Unit 1			
SERVO 3	.3:3	3	SM 14	14	X500		X105	1	Control Unit 1			
SERVO 3		4	Motor Modul	4	X200		X201	3	Motor Modul			
-			-		X201		X200	5	Motor Modul		bbA	
					X202		X500	9	SM 9	Y	componen	
from:	CU	1 2 2.1	.Control Unit 1f								componen	
to:			Line Module 2(2									
t0:	ALM	_3.3:2	.Line_module_2(2	1							Display	
<u> </u>											options	
Configur- ation		opolog	PROFIBUS		nnec-		puts / utputs		Contro unit M			

Figure 15-13 Changing topology (modular machine) SK "Change"

1. Press "Change ... ".

Start-up 🕢 Channe	RACK800 reset		JOG Ref	MPF0 Program				
	evices\Topa	from				to	3:CU_I_3.3	
ALN We ava		ianges the r nend execut s the proces	eference top ing this proc	ess if a c	urrent drive	rive param data back	up is	Abort
from: to:		.Control_Un Line_Modul						OK

Figure 15-14 Changing topology (modular machine) > query

2. Read the query through carefully.

You have saved the data.

Press "OK".

itart-up RA	CK800	lo	G Ref	MPFO						
// Channel res	et	· · · ·		Program	abo	rted				
						ROV				
\Drive devic	es\Top	oloav -				DP	3.SLA	VE3:CU 3.3:1 (11	
		from						to		
Drive Object	-No.	Component	-No.	Socket		Socket	-No.	Component		
CU_I_3.3:1	1	Control_Unit_1	1	X100		X200	2	Line_Module_2		
				X101		X202	3	Motor_Modul		
				X102						
				X103						Act./deac.
				X104		X100		CU_NX_3.14:1		drive obj.
				X105 OS 1		X500	14	SM_14		
ALM 3.3:2	2	Line Module 2	2	US I X200		X100	1	Control Unit 1		Delete
ALM_3.3:2	2	Line_Module_2	2	X200		7100		Control_Unit_1		component
				X202						component
SERVO 3.3:3	2 3	Motor Modul	3	X200						
0.0.0		Hotor_Houdail	Ŭ	X201		X200	4	Motor Modul		Delete
				X202		X101	1	Control Unit 1		drive obj.
				PO 1		PO 1	12	Motor_12		
CU_LI_3.3_T		CU_LINK_13	13	X100		X104		CU_I_3.3:1		
SERVO 3.3:3	3	SM 14	14	X500		X105	1	Control Unit 1	×	Abort
from: AX	3-71 SE	RVO 3.3:3.Moto	r Modu	le 3(3)						
to:	0.E1.JL			0_0(0)						
										ОК

Figure 15-15 Basic display for "Change topology (modular machine)"

3. You are in the basic display for changing the topology (modular machine).

Activate the following functions from this basic display:

- Delete drive objects/components
- Enable/disable drive objects
- Change drive object name/number
- Change component name/number

The sections below describe the operating sequences for these functions.

15.1.2.2 Deleting drive objects

Operating sequence

1. Use the cursor keys to select a drive object.

Once you have selected a drive object, the vertical "Delete drive object" softkey function is displayed.

Start-up	RACK	(800		JOG Ref	MPF0 Program	a abo	rted					
	10301				riogram	i aba	ROV					
\Drive de	, vices	Top	logu				DE	2 61 4	VE2-CI	J 3.3:1 (11	
(DIIVE U	STICES	ovi opu					DI			J_1_J.J.1 (
Drive Obje	.	-No.	from Component	-No.	Socket	-	Socket	-No.	to	omponent		
CU 3.3:1		-niu.	Control Unit		X100		X200	-110.		Module_2		
0_1_3.3.1		1 ° -	control_ont		X101		X200	3	Line_			
					X102		7202	3	MOLU			
					X102	-		-				Act./deac.
					X104		X100	-	CULA	X 3.14:1		drive obj.
					X105		X500	14	r	SM 14		unve obj.
					05 1		7,000	14		314_14		
ALM_3.3:2		2	Line_Module_	2 2	X200		X100	1	Cont	ol_Unit_1		Delete
		-	Emo_Hodalo_		X201			· ·	Cont			component
					X202							
SERVO 3.3		3	Motor Modul.	. 3	X200							
					X201		X200	4	Moto	r Modul		Delete
					X202		X101	i		ol Unit 1		drive obj.
					P0 1		P0 1	12		Motor 12		
CU_LI_3.3	T	60	CU_LINK_13	13	X100		X104		C	U I 3.3:1		
SERVO 3.		3	SM 14	14	X500		X105	1	Cont	ol Unit 1	\mathbf{Y}	Abort
from:	AV2.	71 66	RVO 3.3:3.Mo	tor Made	da 2(2)							
	MA3:	21.3E	nvu_3.3:3.M0	noi_Moai	ne_3[3]							
to:												ок
								-				UK

Figure 15-16 Menu "Topology" > "Change..." > "SERVO_3_3:2 selected" drive object

2. Press "Delete drive object".

Start-up	RACK800		JOG Ref	MPFO					
// Channe	l reset			Program	aborted				
					ROV				
10.1						D0.01.1			
\Drive d	evices\Topo				L			U_I_3.3:1 (1	
Drive Obje	ct -No.	from Component	-No.	Socket	Socke		to f	Component	
CU I 3.3:		Control Uni		X100	X200			Module 2	
Start-up									
		g component	s are still co	nnected	(exist in the	actual	topolog	y):	
Motor_Mo	dule_3, SM_	.14							
Delete dri	ve object SE	RV0_3.3:3:							
		r_Module_3, m the referen			ncoder_15				
		g drive objec / be deleted		ame multi	component	module	MM_1/	XIS_DCAC,	
SERVO_3	.3:3, SERVO)_3.3:5	_						
									Abort
									014
									OK

Figure 15-17 Menu "Topology" > ""Change..." > "Delete drive object" Note for double motor module

A note regarding the drive object appears and you are again asked whether the drive object is to really be deleted.

3. Press "OK".

The drive object is deleted from the reference topology.

15.1.2.3 Deleting components

Operating sequence

1. Use the cursor keys to select a component.

Once you have selected a component, the vertical "Delete component" softkey function is displayed.

Start-up	RACI	K800	10(ā Ref	MPFO						
// Channe	l reset				Program	ı abo	rted				
_							ROV				
											-
\Drive o	levices	:\Topo	ology -				DP	3.SLA	VE3:CU_I_3.3:1 (1)	
			from						to		
Drive Obje	ect	-No.	Component	-No.	Socket		Socket	-No.	Component		
					X101		X202	3	Motor_Modul	~	
					X102					_	
					X103						
					X104		X100		CU_NX_3.14:1		Act./deac.
					X105		X500	14	SM_14		drive obj.
					OS 1						
ALM_3.3:2	2	2	Line_Module_2	2	X200		X100	1	Control_Unit_1		
					X201						Delete
					X202						component
SERVO_3	.3:3	3	Motor_Modul	3	X200						
					X201		X200	4	Motor_Modul		Delete
					X202		X101	1	Control_Unit_1		drive obi.
					PO 1		PO 1	12	Motor_12		unve obj.
CU_LI_3.3		60	CU_LINK_13	13	X100		X104		CU_I_3.3:1		
SERVO_3	.3:3	3	SM_14 📎	14	X500		X105	1	Control_Unit_1		
L					AN 1		AN 1	15	Encoder 15	× .	Abort
from:	483	71 SE	RVO 3.3:3.5M 1	A(1.A)							
to:			.Control_Unit_1(1								
ιυ.	C0_1	_3.3.	.control_onit_r(i	u –							ок
											JK

Figure 15-18 Menu "Topology" > "Change" > Component SM_2" selected

2. Press "Delete component".

tart-up	RACK800		JOG Ref	MPFO					
// Channel	reset			Program	aborted ROV				
Univo de	evices\Top	ologu -			D	P3 SI AV	E3:CU_I_3.3	8-1 (1)	
1011170 00	C HICCS IT OP	from				to			
Drive Obje	ct -No.		-No.	Socket	Socket	-No.	Compon	ent	
Start-	un	1		0464	U000				
ortaire	ab					00000000000000			
Dele	ete compon	ent SM_14:							
The	componen	t is being ren	noved from t	he referer	ice topology				
ALM		-							
SEF									
								2	
CU_									
SEF									Abort
from:	AX3:Z1.SE	RV0_3.3:3.	SM_14(14)						
to:		1.Control_Ur							
									OK
									UK

Figure 15-19 Menu "Topology" > "Change" > "Delete component" > Note relating to component

- 3. A note regarding the component appears and you are again asked whether the component is to really be deleted.
- 4. Press "OK".

The component is deleted from the reference topology.

itart-up RACK		10	G Ref	MPFO					
🔂 Channel interr	ıpt			Program	abo	rted			
🚹 Stop: No Mode	e Grou	ıp Ready				ROV			
		ilave003: CU_I_3 y: Comparison ad						y. Component	
\Drive devices	\T opc	ology -				DP	3.SLA	VE3:CU_I_3.3:1 (1)	
		from						to	
Drive Object	-No.	Component	-No.	Socket		Socket	-No.	Component	
CU_I_3.3:1 🛛 📎	1	Control_Unit_1	1	X100		X200	2	Line_Module_2 🔥	
				X101		X202	3	Motor_Modul	
				X102					
				X103					Act./deac.
				X104		X100		CU_NX_3.14:1	drive obj.
				X105					
				OS 1					-
ALM_3.3:2	2	Line_Module_2	2	X200		X100	1	Control_Unit_1	Delete
				X201					component
				X202					
SERV0_3.3:3	3	Motor_Modul	3	X200					
				X201		X200	4	Motor_Modul	Delete
				X202		X101	1	Control_Unit_1	drive obj.
				PO 1		PO 1	12	Motor_12	
CU_LI_3.3_T	60	CU_LINK_13	13	X100		X104		CU_I_3.3:1	
SERVO 3.3:4	4	Motor Modul	4	X200		X201	3	Motor Modul 🎽	Abort
		l.Control_Unit_1(.Line_Module_2(
									OK

Figure 15-20 Menu "Topology" > "Change" > "Component deleted" > Warning relating to component

- 5. A warning appears above the topology window if the component is still present in the actual topology.
- 6. Press "OK".

tart-up	RACI		J)G Ref	MPFO					
👌 Channel	interr	upt			Program	abo	rted			Drive
Stop: No	Mod	e Grou	p Ready				ROV			device+
01.110	DF	2003.S	lave003: CU	3.3:1 (1	compon	ent C	ontrol Ur	nit 1:		
201416	🛨 Te	pology	: Comparison a	ditional	compone	ent in	actual to	polog	2. Component	
\Drive de	vices	·\Topo	logy - Comp. to	ool.			DP	3.SLA	VE3:CU_I_3.3:1 (1)	Drive device-
			from					1	to	
Drive Objec	st	-No.	Component	-No.	Socket		Socket	-No.	Component	Select
CU_I_3.3:1		1	Control_Unit_1	1	X100		X200	2	Line_Module_2	drive dev
					X101		X202	3	Motor_Modul	
					X102					
					X103					Change
					X104		X100		CU_NX_3.14:1	change
					X105					
					X105		X500	203	<smx module<="" td=""><td></td></smx>	
ALM_3.3:2		2	Line_Module_2	2	X200		X100	1	Control_Unit_1	Configure
					X201					drive unit
					X202					
SERV0_3.3	3:3	3	Motor_Modul	3	X200			<u> </u>		-
					X201		X200	4	Motor_Modul	
					X202		X101	1	Control_Unit_1	
SERVO_3.3	5:4	4	Motor_Modul	4	X200 X201		X201 X200	3	Motor_Modul Motor Modul	
					X201 X202		X200 X500	9	SM 9	Add
					7202		A300	3	3M 3	componen
from:	CU_I	_3.3:1	.Control_Unit_1	(1)						
to:	ALM	3.3:2	Line Module 2	(2)						
				()						Display options
Configur-				L Co	nnec-	In	outs /		Control	
ation	Т	opolog	PROFIBUS		ions		utputs		unit MD	

Figure 15-21 Menu " Topology" > "Topology comparison" view

- 7. You can see in the window with the "Topology comparison" view that the "SMx module" component in the actual topology is still wired (highlighted in red).
- 8. Remove the module.

15.1.2.4 Enabling/disabling drive object

Introduction

In the "Topology" > "Change..." menu you can disable/enable drive objects directly in the drive system.

Operating sequence

1. Use the cursor keys to select a drive object.

Once you have selected a drive object, the vertical "Enable/disable dr. obj." softkey function is displayed.

Start-up	RAC	(800		JOG	i Ref	MPF0 Program	n abo	rted					
	1636(riogra		ROV					
\Drive de	evices	\T op(_	DP			J_I_3.3:1	[1]	
			from							to			
Drive Obje		-No.	Component		-No.	Socket	_	Socket	-No.		omponent		
CU_I_3.3:1		1	Control_Un	it_1	1	X100		X200	2	Line_	Module_2	~	
						X101		X202	3	Motor	_Modul	-	
						X102							
						X103	_						Act./deac.
						X104		X100		CU_N	IX_3.14:1		drive obj.
						X105		X500	14		SM_14		
						OS 1							
ALM_3.3:2		2	Line_Modu	le_2	2	X200		X100	1	Contr	ol_Unit_1		Delete
						X201							component
						X202							
SERV0_3.3	1	3	Motor_Mod	ul	3	X200							Delete
						X201		X200	4		_Modul		drive obi.
						X202		X101	1		ol_Unit_1		unve obj.
						PO 1		PO 1	12		Motor_12		
CU_LI_3.3		60	CU_LINK_1	3	13	X100		X104			U_I_3.3:1		
SERVO 3.3	3:3	3	SM 14		14	X500		X105	1	Contr	ol Unit 1		Abort
from:	400.	71.00	RVO 3.3:3.		Mandad	- 2(2)							
	AA3:	21.36	nvu_a.a:a.	MOLOI	_moau	ie_ə(ə)							
to:													01
													OK
			_		_		_						
				-	-								

Figure 15-22 "Topology" > "Change" menu

2. Press "Enable/disable dr. obj.".

Follow the instructions given by the messages.

Start-up F	RACK800		JOG	Ref	MPFO					
🗑 Channel i	nterrupt				Program	abo	rted			
🔥 Stop: No I	Mode Gr	oup Ready					ROV			
25000	Axis Z	hardware fa	ult of a	ctive	encoder				1	
\Drive dev	vices\To	pology -					DP	3.SLA	VE3:CU_I_3.3:1 (1)	
		from							to	
Drive Object				No.	Socket		Socket	-No.	Component	
CU_I_3.3:1	1	Control_Ur	nit_1	1	X100		X200	2	Line_Module_2 🔥	
					X101		X202	3	Motor_Modul	
					X102					
					X103	_	114.00		011 101 0 1 1 1	Act./deac.
					X104 X105		X100	14	CU_NX_3.14:1	drive obj.
					05.1		X500	14	SM_14	
ALM 3.3:2	2	Line Modu	2 01	2	X200		X100	1	Control Unit 1	Delete
ALM_3.3.2	2	Line_mout	ne_z	2	X200		~100	· ·	CONTOL ONIC 1	component
					X202					component
SERVO 3.3:	3 2 3	Motor Mod	dul lub	3	X200					
0.0.0					X201		×200	4	Motor Modul	Delete
					X202		X101	1	Control Unit 1	drive obj.
					PO 1		PO 1	12	Motor 12	
CU_LI_3.3	T 60	CU LINK	13	13	X100		X104		CU_I_3.3:1	
SERVO 3.3:	3 3	SM 14		14	X500		X105	1	Control Unit 1	Abort
from: /	AX3:Z1.9	ERVO_3.3:3.	Motor_	Modu	le_3(3)				Deactivated	
1										OK

Figure 15-23 Menu "Topology" > "Change" > SERVO_3_3:2 disabled drive object

- 3. Once successfully disabled, the drive object and the associated components are grayed out.
- If you want to reactivate this drive object, press "Enable/disable dr. obj.".
 Follow the instructions given by the messages.

Tips for commissioning SINAMICS drives

15.1 Changing topology (modular machine)

15.1.2.5 Changing drive object/component names/numbers

Introduction

You have the following options under the menu:

- "Topology" > "Change..."
 - Change drive object name/number
 - Change component name/number

Start-up	RACI	(800		JOG	Ref	MPF0 Program	n abo	rted					
								ROV					
\Drive d	evices	\T opc					_	DP		VE3:CU_	I_3.3:1 (1)	
			from				-			to			
Drive Obje		-No.	Component		-No.	Socket		Socket	-No.		nponent		
CU_I_3.3:1	1	1	Control_Uni	<u>c</u> i	1	X100		X200	2		odule_2	~	
						X101		X202	3	Motor_	Modul		
						X102							
						X103							Act./deac.
						X104		X100		CU_NX	_3.14:1		drive obj.
						X105		X500	14		SM_14		
						OS 1							
ALM_3.3:2	2	20 📎	Line_Modul	e_2	2	X200		X100	1	Control	_Unit_1		Delete
					[X201							component
						X202							
SERVO 3.	3:3	3	Motor Mode	ul	3	X200							
-			_			X201		X200	4	Motor_	Modul		Delete
						X202		X101	1	Control	Unit 1		drive obj.
						PO 1		PO 1	12	M	otor 12		
CU_LI_3.3	T	60	CU_LINK_1	3	13	X100		X104		CU	1 3.3:1		
SERVO 3.	3:3	3	SM 14		14	X500		X105	1	Control	Unit 1	~	Abort
from:			.Line_Modul										
to:	CU_I	_3.3:1	.Control_Un	it_1(1)									
													OK

Figure 15-24 Menu "Topology" > "Change..." > "Drive object no. 2" set to 20

- "Configuration" > "Change..."
 - Change drive object name
 - Change component name
 - Change comparison level

Start-up	RACK800		JOG Ref	MPFO			
🥢 Channe	l reset			Progr	am aborted		
					ROV		
\Drive d	levices\Conf	iguration - C	omp. topol.		DP3.SLAVI	E3:CU_I_3.3:1 (1)	
Drive Obje		Component		-No.	type	C.level	
CU_I_3.3:1				1	NCU720	High	
ALM_3.3:2	2	Line_Modul	e_2	2	LM_ACDC	High	
SERVO_3	.3:3	Motor_Mod	ule_3	3	MM_1AXIS_DCAC	High	
SERVO_3	.3:3	SM_14		14	SMx module sin/cos	High	
SERVO_3	.3:4	Motor_Mod	ule_4	4	MM_1AXIS_DCAC	High	
SERVO 3	.3:4	SM 9	_	9	SMx module sin/cos	High	
SERVO_3	.3:5	Motor_Mod	ule_5	5	MM_1AXIS_DCAC	High	
SERVO 3	.3:5	SM 6		6	SMx module sin/cos	High	
CU LI 3.3	B TO 3.14	CU LINK 1	3	13	NX15	High	
							Abort
CU 3.3	1.Control U	nit 1(1)					
	-	/					
							OK

Figure 15-25 Menu "Configuration" > "Change..." > Name/comparison level

Note

Changing the names and numbers affects data in the reference and actual topology for the drive software.

Changing the comparison level affects the topology comparison in the drive software.

Operating sequence

- 1. Position the cursor in the "Change..." menu on the corresponding field. Specify a new "Name/number/comparison level".
- 2. Press < Input>.

15.1.3 Replacing SINAMICS S120 components

Introduction

The operating sequences describe two procedures for replacing a component:

- Replacing a motor module with a more powerful one.
- Replacing SMI/SMx motor component.

Operating sequence for replacing a motor module with a more powerful one.

The following prerequisites are satisfied:

- The motor modules are of the same type.
- The serial number is different.
- MLFB number differs e.g. instead of 5 A -> 9 A.

Note

DRIVE-CLiQ components simply have different serial numbers

In this case no further configuration is needed.

Note

A permanent change in the drive system should not be undertaken

Before you replace the DRIVE-CLiQ component, change the comparison level.

- 1. Select the "Commissioning" > "Machine data" > "Control unit MD" dialog.
- 2. Change parameters p9907 (component number) and p9908 (comparison level of a component).
- 3. Save (Page 238) the changed drive data before shutting off (power OFF).
- 4. Switch the drive system off (power OFF).
- 5. Replace the component.
- 6. Switch the drive system on (power ON).
- 7. No further configuration is required.

You have replaced the motor module with the drive system switched off.

The motor module should be permanently replaced.

- 1. Select the "Commissioning" > "Machine data" > "Control unit MD" dialog.
- 2. Set the "Device configuration" parameter to control unit: p0009 = 1
- 3. Transfer the new component: Control Unit: p9905 = 2
- 4. Wait until p9905 = 0 is automatically set.
- 5. Set the "Device configuration" parameter to control unit: p0009 = 0
- 6. Save "All": set p977 = 1.
- 7. It is imperative you wait until p977 is automatically written back to "0" this takes about 40 seconds.

The replacement of a single SINAMICS component is automatically acknowledged by the system.

Operating sequence for replacing SMI/SMx motor component

1. You have removed the previous SMI or SMx motor component.

This motor component is missing from the actual topology.

SINAMICS indicates this in the form of a topology error alarm.

The "Commissioning" > "Drive system" > "Drive units" > "Topology" dialog shows the previous motor component awaiting replacement GRAYED OUT (present in reference topology only).

Note

The new SMI/SMx motor component must not yet be inserted!

 In the "Commissioning" > "Drive system" > "Drive units" > "Topology" > "Change..." dialog, remove the SMI/SMx motor component awaiting replacement from the reference topology using the "Delete component" dialog (Page 255).

Note

Save (Page 238) the changed drive data before switching off (power OFF).

- 3. Switch the drive system off and on (power OFF/ON).
- 4. In the "Commissioning" > "Drive system" > "Drive units" > "Topology" dialog, check whether the SMI/SMx motor component has been removed from the reference topology as follows:
 - Topology error alarm no longer active.
 - "Commissioning" > "Drive system" > "Drive units" > "Topology" dialog no longer shows any differences.
- 5. Switch off the drive system.
- 6. Plug in the new SMI/SMx motor component.
- 7. Switch on the drive system.
- Add the new SMI/SMx motor component using the "Commissioning" > "Drive system" > "Drive units" > "Topology" > "Add component" (Page 245) dialog for the reference topology.
- Assign the added SMI/SMx motor component via the "Commissioning" > "Drive system" > "Drives" (Page 85) drive wizard.

15.1.4 Display options

Introduction

The "Display options" function allows you to do things like set which drive object and component properties are to be displayed in the "Configuration" and "Topology" windows.

Operating sequences for "Configuration" window

You are in the "Commissioning" > "Drive system" > "Drive units" menu.

1. Select "Configuration" > "Display options".

	itart-up RACK800 JOG Ref						rted ROV		
A:	Display	options						<u>)</u>	
Ë	Topol	ogy				Filter		- H	
Z	۲	Comparison actu	ual/set	tpoint topolo	gy	0	OFF	1 🗄	
Z' Y'	0	Actual topology				۲	DRIVE CLiQ + option slot	IН	
YX	Z O Comparison actual/setpoint topology Z Y O Actual topology Y Y O Setpoint topology X X X					0	DRIVE CLiQ	E	
Ê	Selec	t columns						- H	
		Axis		Order no.					
		FW comp.		HW versior	1				
		F₩ card		Serial no.					
<		type		C.level				>	Abort
CU	1 3.3:	1.Control_Unit_1(n						
									OK

Figure 15-26 "Configuration" > "Display options" menu.

Define the following properties for the "Configuration" window:

- Topology display
- Columns to be displayed
- Filter for drive objects and components to be displayed

Operating sequences for "Topology" window

You are in the "Commissioning" > "Drive system" > "Drive units" menu.

1. Select "Topology" > "Display options".

Start-up		:K800		JOG Ref		PFO							
🥢 Chan	nel rese	t			P	rogran	ı abo	rted					
						ROV							
\Driv			ology - Comp						3.SLA	VE3:CU			
	from									to			
Drive O	bject	-No.	Component	-No.	S	ocket		Socket	-No.		omponent		
CU I 3	3:1		Control Un			CI UU		X200	1.2	Line I	ul	^	
	Display	option	S								u		
	Topology					Filte							
	Θ	Comparison actual/setpoint te				O OFF							
ALM_3	0	O Actual topology				0	DB	IVE CLiQ	+ onti	on slot	it_1		
-	-					-			· opu	on aloc			
SEBVC	0	Setpoi	nt topology			۲	DR	IVE CLiQ					
JENYL							Disp	olay free o	connec	tions	ul		
											it_1		
SERVC											it_1		
SERVO	3.3:4	4	Motor_Mod	ul 4		<200 <201		X201 X200	3		Modul Modul		
						(202		X500	9	motoi_	SM 9	~	Abort
from:	CII	1331	.Control_Ur	a 101									
to:			Line Modul										
101		_01012					_						OK
												_	

Figure 15-27 "Topology" > "Display options" menu.

Define the following properties for the "Topology" window:

- Topology display
- Filter for drive objects and components to be displayed

When you click on filter "off", even components which are not in the DRIVE CLiQ are displayed.

Start-up	RAC		J	DG Ref	MPFO						
// Channe	el reset				Program	abo	ROV				Drive device+
\Drive	device	s\Topo	ology - Comp. to	pol.			DP	3.SLA	VE3:CU_I_3.3:1 (1)	Drive device-
			from						to		
Drive Obj		-No.	Component	-No.	Socket		Socket	-No.	Component		Select
SERVO_3	3.3:3	3	Motor_Modul	. 3	X200						drive dev.
					X201		X200	4	Motor_Modul		
					X202		X101	1	Control_Unit_1		-
					PO 1		P0 1	12	Motor_12		Change
					PO 1						change
SERVO_3	3.3:3	3	SM_14	14	X500		X105	1	Control_Unit_1		
					AN 1		AN 1	15	Encoder_15		
					AN 1						Configure
SERVO_3	3.3:4	4	Motor_Modul	4	X200		X201	3	Motor_Modul		drive unit
					X201		X200	5	Motor_Modul		
					X202		X500	9	SM_9		
					PO 1		P0 1	11	Motor_11		
					PO 1						
SERVO_3	3.3:3	3	Motor_12	12	P0 1		P0 1	3	Motor_Modul		
					ME 1						bbA
SERVO 3	3.3:5	5	Motor Modul	5	X200		X201	4	Motor Modul	<u> </u>	componen
from: AX3:Z1.SERVO_3.3:3.Motor_Module_3(3)											
to:											Display options
Configur ation	- T	opolog	y PROFIBUS		nnec-		puts / utputs		Control unit MD		

Figure 15-28 "Topology" menu - Filter "off" has been selected for the "Display options".

The colors used in the topology window have the following meanings for the drive objects and components:

 GRAYED OUT -> Desired state, drive object/component not plugged in and/or deactivated in drive system

Use the cursor keys to select the required line. The state is indicated in the bottom part of the window.

RED -> actual state - present in the actual topology

15.1.5 Sorting the topology display

Operating sequence

In the "Drive system" > "Drive units" > "Configuration" menu you can call up a sorting function for the topology display.

Start-up				MPF0						
// Che	annel reset			Program	n aborted			Drive		
					ROV			device+		
\Driv	ve devices\Con	figuration - Con	np. topol.			DP3.SLAVE3:0	CU 3.3:1 (1)	Drive device-		
Axis	Drive Object	Component	<u> </u>). FWrce	omp. type		C.level			
	CU_I_3.3:1	Control_Ur	it_1 1	26037			High	Select		
	ALM_3.3:2	Line_Modu	le_2 2	26037	'00 LM_ACD	C	High	drive dev.		
X1	SERV0_3.3:3	Motor_Mod		26037		(IS_DCAC	High	unve dev.		
X1	SERV0_3.3:3	SM_5	5	26037	'00 SMx mo	dule sin/cos	High			
								Load firm- ware		
								Details		
<	<									
CU_I_	CU_L_3.3:1.Control_Unit_1(1)									
$\overline{}$				_				Display options		
Confi ati		logy PROFI		inec- ons	Inputs / Outputs		Control unit MD			

Figure 15-29 "Drive system" > "Drive units" > "Configuration" menu

1. Press "Sort ... ".

Cha	annel reset		" MPF Prog	u ram abor	ted			
_				1	ROV			
1Dri	ive devices\Config	uration - Comp. topo	4		DP3	SLAVE3:CU	1 3 3 1 (1)	
Axis	Drive Object	Component		₩ comp	F₩ card	type	_1_3.3.1 (1)	
	CU_1_3.3.1	Control_Unit_1	1 2	603600	=	NCU720		
21	ALM_3.3:2 SERVO 3.3:3	Line Module 2	2 2	603600	=	LM_ACDC MM 1AXIS	DCAC	
21	SERVO 3.3:3	Sort				SMx module		
1	SERV0_3.3:4	Sort				MM_1AXIS	DCAC	
71	SERV0_3.3:4					SMx module		
(1	SERV0_3.3:5	🕘 🖸 Drive O	bject			MM_1AXIS		
(1	SERVO_3.3:5 CU_LI_3.3_TO	O Wiring				SMx module NX15	e sin/cos	
	CO_LI_3.3_10			-		nois		
		O Compor	nent num	ber				
		O Axis						
						1		-
(>	Abort
								TIDON
CU_1_	_3.3:1.Control_Uni	L1(1)						
								ОК

Figure 15-30 "Configuration" > "Sort..." menu

- 2. In the "Sort" dialog select from the following sorting options for displays in the topology window:
 - Drive object

The display is sorted by drive object number.

- Wiring

The display is sorted by the wiring of the drive components in the drive system.

- Component number

The display is sorted by component number.

Axis

The display is sorted by axis number.

3. Press "OK".

15.1.6 Check topology

Introduction

After you have parameterized the drive components, you can view the topology on the HMI.

Topology of individual drive components

- 1. Under "Commissioning", press the "Drive system" > "Drive units" > "Topology" softkeys one after the other.
- 2. On the HMI, the topology of individual drive components is displayed, including the component number (see figure below).

You can now check whether the topology displayed conforms with the topology of your system.

Start-up	RACK100	3	JOG Ref	MPFO							
🕤 Channe	l interrupt			Program aborted			Drive				
🔨 Stop: N	o NC Ready	,		ROV	device+						
A 10000	DP003.	Slave003	: ALM 3.3:2 (2)								
240003	240003 UPU03.Stave003: ALM_3.3:2 [2]: Fault at DRIVE-CLiQ socket X103. 40799.										
Topology				DF	3.SLAVE3):CU_I_3.3:1 (1)	Drive device-				
		of			to						
Componer	nt	-No.	Connection	Component	-No.	Connect	Select				
Control_U	nit_1	1	X100	Line_module_2_	2	X201	drive dev				
			X101								
			X102	Motor_Module_3	3	X200					
			X103	CU_NX_3.13:1		X100	Change				
			X104				Crianye				
	X105			SM_14	14	X500					
Line_mod	ule_2_	2	X200								
			X201	Control_Unit_1	1	X100	Configure				
			X202				drive unit				
Motor_Mo		3	X200	Control_Unit_1	1	X102					
Motor_Mo	dule_4	4	X201	Motor_Module_5	5	X202	Track the				
		3	X202	SMI20_16	16	X500	connection				
		4	X203	SM_9	9	X500	connection				
SM_14		14	X500	Control_Unit_1	1	X105					
Motor_Mo	dule_5	5	X200 X201	011100 0	-	×500 ×	Add				
L			X201	SMI20 6	6	X500	component				
from:	CIL 1 3 3	1 Control	Unit 1(1)								
to: ALM 3.3:2.Line module 2 (2)											
							Display				
							options				
Configur- ation	Topolo	gy PR		nnec- Inputs / ions Outputs		Control unit MD	File functions				

Figure 15-31 Topology

You will need the component numbers in order to configure direct measuring systems manually.

See also

Drive diagnostics (Page 268)

15.2 Drive diagnostics

15.2 Drive diagnostics

Introduction

You can view the alarms and faults of the drive in the "Diagnostics" > "Drive system" operating area on the HMI.

4	el interrupt No NC Ready		Program ab	ROV		Drive device +
8080 Ìbersich	4 option(s) is/are a t Antriebszustände	ctivated with	out setting th	e license key DP3.SLAVE3:CU_I_3.3:1	(1)	Drive device -
Axis	Drive Object CU 3.3:1 (1)		State	Operating display (r0002)		Select drive dev
	ALM_3.3:2		8	[46] Einschaltsperre -	-	
	SERVO_3.3:3_ SERVO_3.3:4		(2) (2)	[46] Einschaltsperre - [46] Einschaltsperre -		
	SERVO_3.3:5		8	[46] Einschaltsperre -		
					-	Details
CU_1_3	.3:1 (1) [34] Inbetriebnal	hmemodus be	enden			

Figure 15-32 Overview of drive states, "Diagnostics" > "Drive system" menu

Operating sequence

- 1. Select the relevant drive component with the cursor in the overview of the drive states.
- 2. Press "Details".



Figure 15-33 "Diagnostics" > "Drive system" > "Details" menu

3. Press "Alarms".

gnosis Channel	RACK1003	JOG	MPFO	m aborted			
	o NC Ready		riogra	BOV			Drive device +
3080	4 option(s) is	/are activated	without setti	ng the license	key	Ð	Drive
rive Stat	es Overview - Dri	ve unit warnin	gs	DP3	SLAVE3:CU_I	_3.3:1 (1)	device -
No. 201331	Date 13/03/1972 18:30:37			omponent not er: SMI20_16.	assigned to a d	lrive	Select drive dev.
						E	Faults
						~	Alarms
Topol SMI20	ogy: At least one D_16.	component no	ot assigned to) a drive objec	t. Component n		Details
		Alarm	Service	PLC		ίΣ	Drive
Alarms	Messages						

Figure 15-34 "Diagnostics" > "Drive system" > "Details" > "Alarms" menu

4. Press "Faults".

iagnosis	RACK1003	JOG Ref	MPFO						
🔰 Channel	interrupt		Program aborted		Drive				
📐 Stop: No	NC Ready		ROV		device				
8080	4 option(s) is	are activated witho	out setting the licens	e key	Drive				
Drive State	es Overview - Dri	ve unit faults	DI	93.SLAVE3:CU_I_3.3:1	(1) device	à -			
No.	Date	Text							
240799	05/11/2007 13:50:57	CU-Link: Configu	red transfer end time	exceeded.	Select drive de				
240003	05/11/2007 13:50:57	Fault at DRIVE-C	LiQ socket X103. 40	799.	Fault	s []			
240799	05/11/2007 14:41:37	CU-Link: Configu	red transfer end time	exceeded.					
240003	05/11/2007 14:41:37	Fault at DRIVE-C	LiQ socket X103. 40	799.					
240799	06/11/2007 05:16:48	CU-Link: Configu	red transfer end time	exceeded.	Alarm	s			
CU-Link: Configured transfer end time exceeded.									
				(i)	$\mathbf{\Sigma}$				
Alarms	Messages		rvice PLC plays status		Drive syster				

Figure 15-35 "Diagnostics" > "Drive system" > "Details" > "Faults" menu

See also

Adding components (Page 245) Check topology (Page 267) 15.3 Diagnostics for pending alarms

15.3 Diagnostics for pending alarms

Introduction

Alarms - these are warnings and faults - can be viewed in SINAMICS S120 via parameters.

Warnings

Pending warnings are indicated by parameter r2122 of the relevant drive components in question.

Deleting the warning buffer may be carried out manually:

• Write r2111 of the drive component with "0".

This results in the deletion of all existing warnings of this component and updates the current warnings still pending.

Faults

Fault messages are indicated by parameter r945.

Display on HMI

If you set the MD13150 \$MN_SINAMICS_ALARM_MASK to the hexadecimal value "D0D" on the HMI, then the HMI automatically displays the pending warnings/faults from SINAMICS S120.

15.4 Drive (SERVO) parameter RESET, individual

Introduction

The factory setting (parameter RESET) may be set for each drive (SERVO) individually.

Note

Not just the motor and encoder data are reset. All the configured Binector-Connector logic operations (releases, probe signals) and message frame type are also deleted.

Operating sequence

- 1. Set the factory settings on the selected drive: p0010 = 30
- 2. Activate the factory settings on this drive: p0970 = 1
- 3. Device automatically carries out RESET of all parameters on this drive.
- Save drive-specific: set p971 = 1 or save "All": set p977 = 1
- 5. It is imperative you wait until p977/p971 is automatically written back to "0"; this takes about 40 seconds.

15.5 Firmware version display of drive components

15.5 Firmware version display of drive components

Introduction

The firmware version of the drive components can be viewed under "Commissioning" > "Drive system" > "Drive units" > Configuration" in the "FW comp" column.

Start-u	p CHAN1	JOG	Ref	PF0			
// Ch	annel reset		P	rogram ab	orted		
					ROV		Drive device+
					_		
							Drive
\Dri	ve devices\Config	uration - Comp. top	ol		DP3 SLAVE3	:CU_I_3.3:1 (1)	device-
Axis	Drive Object	Component	-No.	FW comp.	type	C.level	
-tale	CU_I_3.3:1	Control_Unit_1	1	2603700	NCU720	High	
	ALM 3.3:2	Line Module 2	2	2603700	LM ACDC	High	Select drive dev.
X1	SERV0_3.3:3	Motor_Module_3	4	2603700	MM_1AXIS_DCAC	High	drive dev.
X1	SERV0_3.3:3	SM_5	5	2603700	SMx module sin/cos	High	
							Change
							Load firm- ware
							Details
<							Sort
CU_I	_3.3:1.Control_Uni	L1(1)					
							Display
							options
Con	figur- ion Topolog	y PROFIBUS	Conne tions		puts / utputs	Control unit MD	

Example: 2603000, -> Firmware version is 02.60.30.00

Figure 15-36 Menu "Drive system > Configuration"

Using certain parameters from individual drive components, it is also possible to view the relevant firmware version for:

- System software SINAMICS S120
- Firmware from:
 - Drive components
 - SMC or SMI modules

System software SINAMICS S120

The version of the SINAMICS S120-SW available in the system is readable in parameter r18 on the TCU/PCU.

Example:

r18 = 2300700, -> firmware version is 02.30.07.00

15.5 Firmware version display of drive components

Firmware version drive components

The firmware version of all individual components is read out individually in parameters r975[2] and r975[10] for each drive component (NCU, ALM, power unit).

Example:

r975[2] = 230, r975[10] = 700 -> "230" & "700" -> firmware version is 02.30.07.00

Firmware version of all SMC or SMI modules

The firmware version of all SMC or SMI modules is read out in parameter r148[0...2] on the relevant motor module.

Example:

r148[0] = 2300700, -> firmware version of the connected encoder module 1 is 02.30.07.00

15.6 Checking/setting power supply data settings

15.6 Checking/setting power supply data settings

Introduction

The power supply data settings must be checked/set in the SINAMICS during commissioning.

Checking/setting network data when commissioning the infeed

You can use the "Commissioning" > "Drive units" > "Infeed" > "Configuration" > "Network data" menu to view and modify the network data.

Start-up	CHAN1	JOG Ref	MPFO			
🥢 Channel	reset		Program aborted			Supply
			ROV			+
8080	↓ 7 option(s) is/	are activated with	out setting the license	key	\ominus	Supply
\Supplie	s\Configuration -	Netzdaten	DP3.	SLAVE3:ALM_	NE_3.3:2 (2)	-
Supply	ALM_NE	_3.3:2				
		tion on first Power s are saved power				Select a supply
	emoved/added), a	e drive group is su a new identification	ubsequently modified n will have to be			Change
-	pply voltage:	400	v			Netzdaten
Line rated	frequency:	55	✓ Hz			
		ge of over 415V, th rol supply/feedbac	ne Active Line Module ck.	is		
Configur- ation	Connec- tions				Supply MD	File functions
		_				

Figure 15-37 Network data

See also

Identification/Optimization "ALM > Infeed/Configuration" (Page 275)

15.7 Identification/Optimization "ALM > Infeed/Configuration"

15.7 Identification/Optimization "ALM > Infeed/Configuration"

Introduction

On identification of the ALM, control optimization in the ALM is also carried out. Here, the inductance and capacity of the DC link are determined and the optimum control data determined for the set-up converter.

Identification can only be performed after the controller and the drive have been put into operation.

Procedure for automatic identification of the ALM

Identification of the ALM is performed automatically by the system in the current SINAMICS versions as soon as the first drive has been commissioned and enable terminal X122.1 activated. An internal optimization sequence is started automatically; it takes appox. 20 seconds to complete.

During this optimization sequence, enable terminal X122.1 should not be deactivated; otherwise the optimization would be aborted. If optimization is aborted, identification may be carried out manually at a later stage by the user.

Procedure for manual identification of the ALM

Identification of the ALM is carried out as follows:

- 1. Disconnect release (AUS1) ALM (X122.1) by commissioner.
- Select machine data for the infeed (ALM) in the "Commissioning" > "Machine data" > "Infeed MD" menu.
- 3. Initiate identification on the ALM: p3410 = 5.
- 4. Connect release ALM (release has to remain pending during the execution of the first step of the identification).
- 5. ALM controller data are reset automatically and power supply identification starts.
- After identification has occurred, p3410 is automatically written to 0 and the values are saved automatically for the controller data of the ALM. Check: p3402 = 9 (release has to remain during the execution of this step of the identification!).
- 7. Disconnect release ALM (X122.1) by commissioner.
- The optimized ALM data are saved automatically. The data does not need to be saved manually (p977 = 1).

Tips for commissioning SINAMICS drives

15.7 Identification/Optimization "ALM > Infeed/Configuration"

General tips

16.1 Configuration of the properties of the network interface for PROFIBUS

Introduction

In the STEP7 project, you configure the network interfaces PROFIBUS DP, via which you want to reach the machine control panel:

PROFIBUS DP operating sequence

- 1. You used the left mouse button to select NCU 720.1 and while holding down the mouse button you dragged it to the "Station design" station window.
- 2. After you release the mouse button, configure the properties of PROFIBUS DP interface for socket X126 (machine control panel) in the dialog box (see figure below).

Properties		nterface DP (R0/52.2)		X
General	Parameters			
Address:		2 💌	If a subnet is selected the next available add	
Subnet				
not	networked			New Properties Delete
OK			Ca	ncel Help

Figure 16-1 Properties of PROFIBUS DP

- 3. Click the following menu items one after the other:
 - the "New..." button,
 - the "Network settings" tab in the "Properties new subnet PROFIBUS Subnet" dialog box.

16

16.1 Configuration of the properties of the network interface for PROFIBUS

4. Select the transmission rate "12 Mbps" for the "DP" profile (see figure below).

Pro	perties - New subnet PRO	FIBUS			×
0	General Network Settings				
	Highest PROFIBUS Address:	126	Change	Options	
	Transmission Rate:	500 Kbps 1.5 Mbps 3 Mbps 6 Mbps 12 Mbps			
	Profile:	DP Standard User-Defined		Bus Parameters	
_	ок			Cancel Help	

Figure 16-2 Properties of the PROFIBUS interface

5. Click on "Options" and then on the "Equidistance" tab (see figure below).

Options	×
Constant Bus Cycle Time Cables	
Activate constant bus cycle time	
Optimize DP cycle (and Ti, To if necessary): Recalculate	
Number of PGs/OPs/TDs etc. on PROFIBUS Configured: 0 Totat 0	
Time base: Constant DP Cycle: 2 ^{-#} / _# ms Details (min = 0.193 ms; max = 1390.000 ms)	
Slave Synchronization ✓ Times Ti and To same for all slaves (otherwise: make setting in slave properties)	
Time Ti (read in process values): 0.6666 0.0001 ms (min = 0.000 ms; max = 1.334 ms) 0.001 ms 0.001 ms	
Time To (output process values): 0.666 ** ms 0.001 ms (min = 0.000 ms; max = 1.334 ms) **	
OK Cancel Help	

Figure 16-3 Equidistance

16.1 Configuration of the properties of the network interface for PROFIBUS

- 6. To enable reproducible access to peripherals (for hand wheel mode), the PROFIBUS DP must have constant bus cycle time. The following entries are necessary under Equidistance:
 - Click on the "Activate equidistance bus cycle" field
 - Enter the cycle, e.g., "2 ms" for the "Equidistance DP cycle" (for integrated PROFIBUS) (see MD10050 \$MN_SYSOCK_CYCLE_TIME).
 - Click on the "Times Ti and To equal for all slaves" field
 - The fields "Time Ti" and "Time To" must contain a value "< 2ms".
- 7. Click on "OK" three times.
- Module NCU 720.1 with SINAMICS S120 is inserted into the HW config (see figure below).

Note

With the <F4> key and confirmation of the question regarding "Reorganize", you can reorganize the display in the station window.

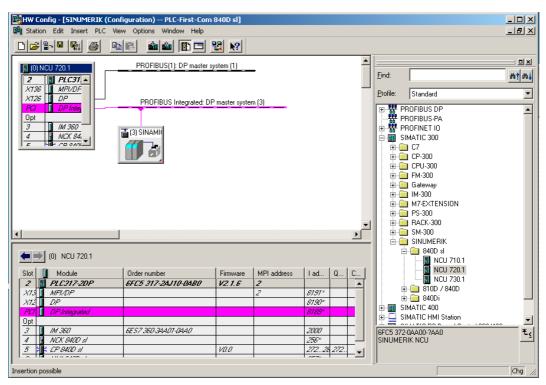


Figure 16-4 HW config with NCU 7x0

As the next step configure a machine control panel with hand wheel.

16.2 Separate NCK and PLC general reset

16.2 Separate NCK and PLC general reset

Introduction

If necessary, you can execute NCK or PLC general reset separately. To do so, proceed as follows:

Operating sequence for NCK general reset

- 1. Turn the NCK commissioning switch (SIM/NCK label) on the NCU to position "1".
- 2. Execute POWER ON or Hardware RESET.
- 3. NCK general reset is requested.
 - The control system boots up,
 - The SRAM is deleted and
 - the machine data is preassigned with standard values.
- 4. After an error-free boot, the system generates the number "6" and a flashing point on the status display of the NCU.
 - The LED RUN illuminates GREEN continuously.
 - The NCK is in cyclic transmission.
- 5. Turn the NCK commissioning switch back to the "0" position.

Note

It is also possible to trigger an NCK boot (corresponds to position "0" on the NCK commissioning switch) via the **NCK RESET** softkey under **Commissioning** on the HMI. In the status bar, the system displays the message "Commissioning successful".

General tips

16.2 Separate NCK and PLC general reset

Operating sequence for PLC general reset with hardware RESET or POWER ON

- 1. Turn the PLC mode selector to position "3".
- 2. Carry out POWER ON or Hardware RESET.
- 3. PLC general reset is requested.
 - LED STOP flashes
 - LED SF illuminates
- 4. Turn the PLC-mode selector in succession to the following switch positions:
 - Briefly to "2"
 - Back to "3"

LED STOP first flashes with about 2Hz and then illuminates.

- 5. After LED STOP lights up, place the PLC mode selector at position "0".
 - LED STOP goes out and LED RUN (GREEN) lights up.
 - PLC has had a general reset and is in cyclic transmission.

Operating sequence for PLC general reset without hardware RESET or POWER ON

- 1. Turn the PLC mode selector to position "2" (STOP operating state).
 - LED STOP illuminates
- 2. Turn to position "3" (operating state MRES, request general reset) and hold in this position (about 3 seconds) until STOP-LED PS lights up again.
 - LED STOP goes off then comes back on
- 3. Within 3 seconds, turn to the positions STOP-MRES-STOP ("2"-"3"-"2").
 - LED STOP first flashes with about 2Hz and then illuminates again.
- 4. After LED STOP lights up, place the PLC mode selector at position "0".
 - LED STOP goes out and LED PR (GREEN) lights up.
 - PLC has had a general reset and is in cyclic transmission.
- 5. After LED RUN (green) is illuminated, place the PLC mode selector in position "0". \Rightarrow PLC has had a general reset and is now in cyclic mode.

16.3 Configuring the communication between the PLC and the drive

16.3 Configuring the communication between the PLC and the drive

Telegram lengths and I/O addresses

Note

In the HW Config, a telegram length and the associated I/O addresses is preassigned per default.

The pre-assignment for SINAMICS Integrated corresponds to telegram 116 for the axes and 391 for the NCU and 370 for the ALM with the max. possible telegram length.

This default can be used to supply all known telegrams; no modification is necessary.

Operating sequence

- 1. To view this configuration, click in the HW Config on the module "SINAMICS Integrated" and select "Object properties", using the <right mouse button>.
- 2. Select the "Configuration" tab and the select the "Overview" tab.

As shown in the figure below, you can view the lengths of the preassigned telegrams.

The figure shows user-defined telegrams for 6 axes.

	Vorbelegung			
Objekt	Telegrammauswahl	Opt	ion	
1	Telegramm 116, PZD-11/19	SI Motion 1	/onitoring	
2	Telegramm 116, PZD-11/19	SI Motion 1	Monito	
3	Telegramm 116, PZD-11/19	SI Motion 1		
4	Telegramm 116, PZD-11/19	SI Motion 1	/onitoring	
5	Telegramm 116, PZD-11/19	SI Motion 1	/onitoring	
6	Telegramm 116, PZD-11/19	SI Motion 1	/onitoring	
7	Telegramm 391, PZD-3/7	Kein Safel	fety 🚽 NC	
8	Telegramm 370, PZD-1/1	Kein Safel	y N	
	Cht { Details /	Objekt einfügen Ot	ojekt löschen ALM	
Station	sinumerik		*	
Komme	entar:		<u>*</u>	

Figure 16-5 Message length

3. Click "OK" to close the dialog.

4. You can view the address areas in the station window in the detail view by clicking on "SINAMICS Integrated". Here, for example, address 4100 corresponds to the address entered in MD13050 \$MN_DRIVE-LOGIC_ADRESS[0]. The addresses have a gap of 40 bytes. The following figure shows how the default values MD13050 \$MN_DRIVE-LOGIC_ADRESS[0...5] correspond to the input/output addresses for standard configuration of the PLC.

					_ D ×
_					
<u> </u>	- 				
PROFIBUS(2): DP-Mastersystem (1)					
	ICU 710.1		JFIBUJ(Z). DF		
2	PLC 317-2DP				
X136	MPI/DP				
X126	DP ·		ROFIBUS Integ	rated: DP-Mastersystem (3)	
PC/	DP Integrated				
0pt 3	IM 360				
4	NCK 840D sl	📷 (3) SI	NAMI		
5	≓ CP 840D sl				
6	HMI 840D sl				
•					
·					
	(3) SINAMICS_Integrate	d			
Slot	Baugruppe	E-Adresse	A-Adresse	Kommentar	
4	Drive Data	67006723	67006723		
5	Drive Data	41004139	-	H MD13050 DRIVE_LOGIC_ADDRESS[0]	
6	Drive Data		41004139		
7	Drive Data				
8	Drive Data	67246747	67246747	MD13050 DRIVE LOGIC ADDRESS[1]	
9	Drive Data	41404179	-	H	
10	Drive Data		41404179		
17	Drive Data Drive Data	67486771	0740 0771		
12	Drive Data	41804219	67486771	MD13050 DRIVE_LOGIC_ADDRESS[2]	
14	Drive Data	470004270	41804219		
15	Drive Data		770007270		
16	Drive Data	67726795	67726795		~
77	Drive Data	42204259	-	MD13050 DRIVE_LOGIC_ADDRESS[3]	
18	Drive Data		42204259	L	
19	Drive Data				
20	Drive Data	67966819	67966819		
21	Drive Data	42604299	-	H MD13050 DRIVE_LOGIC_ADDRESS[4]	
22	Drive Data		42604299		
23	Drive Data	00000 00.10	0000 0040		
24	Drive Data	68206843	68206843		
25	Drive Data Drive Data	43004339	▲ #300 #300	H MD13050 DRIVE_LOGIC_ADDRESS[5]	_
26	Drive Data Drive Data		43004339		
28	Drive Data	65006513			
29	Drive Data	ENDEC. EN// 27	65006505		
30	Drive Data		CONTRACTOR OF CONTRACTOR		
37	Drive Data	65146515			
32	Drive Data		65146515		
33					•
Walter C	The second side and sub-side				Xed
Prucken Sie	e F1, um Hilfe zu erhalten.				Änd /

Figure 16-6 SINAMICS Integrated addresses

16.4 Integrating PG/PC into the network (NetPro)

16.4 Integrating PG/PC into the network (NetPro)

Introduction

To carry out routing functions, it is necessary to integrate a PG/PC in the SIMATIC Manager under NetPro and to configure the interfaces.

Requirements

The following preconditions for integrating a PG/PC in the hardware configuration network must be satisfied:

- inserted NCU 720.1 into the HW config,
- configured the properties of the network interfaces,
- configured the PLC to drive communication,
- inserted the machine control panel (MCP),
- saved and compiled the configuration,
- created a PLC program.

See also

Insert NCU 7x0 in HW config (Page 45) Configuring the properties of the network interfaces (Page 46) Adding a machine control panel and handwheel in HW Config (Page 307) End hardware configuration and load to the PLC (Page 54) Creating a PLC program (Page 55)

General tips

16.4 Integrating PG/PC into the network (NetPro)

16.4.1 Integrating PG/PC into NetPro

Introduction

To enable the communication between PG/PC <-> HMI via Ethernet, the PG/PC should be included in the network configuration of the system.

To integrate the PG/PC, proceed from the following starting situation in the SIMATIC Manager.

You are in the HW config in the created project "PLC-Erst-IBN 840D sl" (see figure below).

HW Konfig - [SINUMERIK (Konfiguration) PLC-Erst-IBN 840D sl]	
🕅 Station Bearbeiten Einfügen Zielsystem Ansicht Extras Fenster Hilfe	
Image: Constraint of the second sec	Sychen: nt ni Profit Standard Profit Standard SINOVERT SINAMICS SINAMICS SINAMICS SINAMICS SINAMERIK SINUMERIK SINUMERIK SINUMERIK SINUMERIK SINUMERIK
(6) SINUMERIK MCP Steckplatz DP-Kennung 1 55 2 24E > Standard+Handrad 3 7	Standard Standard-Usatz E/A Standard-Handrad Standard-Handrad+Zus SINUMERIK MPP Gateway R Kompatible Profibus-DP-Staves
orücken Sie F1, um Hilfe zu erhalten.	Änd

Figure 16-7 HW config project "PLC-Erst-IBN 840D sl"

16.4 Integrating PG/PC into the network (NetPro)

Operating sequence for integrating PG/PC into NetPro

- 1. Click on the "NetPro" button (see previous figure).
- 2. From the catalog under "Stations", insert the PG/PC via Drag&Drop into the network configuration (see figure below).

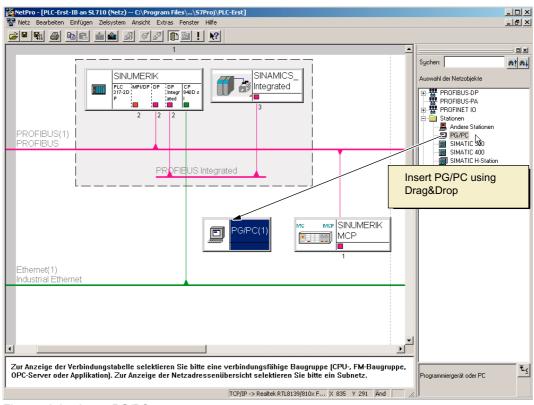


Figure 16-8 Insert PG/PC

The newly inserted symbol PG/PC does not yet contain any interfaces. Next, configure the interfaces.

General tips

16.4 Integrating PG/PC into the network (NetPro)

16.4.2 PG/PC interface configuration

Introduction

Under NetPro, configure the interfaces required for commissioning at the PG/PC. These may include the following interfaces:

- Ethernet for the communication for NCU socket X127
- PROFIBUS

Operating sequence for configuring interfaces

- 1. Highlight the symbol "PG/PC" under NetPro.
- 2. Select "Object properties" <right mouse button >.
- 3. In the "Properties PG/PC" dialog box displayed, select the "Interfaces" tab in the dialog (see figure below).

Under this tab, define/configure all the required interfaces.

	aces Assignment		
Name	Туре	Address	Subnet
New	Properties	Generate LDB	Delete
ок			Cancel Help

Figure 16-9 Properties - PG/PC

16.4 Integrating PG/PC into the network (NetPro)

Operating sequence for configuring interfaces at PG/PC

- 1. Click on "New..." to configure the Ethernet interface first.
- 2. In the type selection field, select "Industrial Ethernet" (see figure below).

New Interface - Type Selection				
Туре:	Industrial Ethernet MPI PROFIBUS			
OK	Cancel Help			

Figure 16-10 Type Industrial Ethernet

- 3. Click "OK".
- 4. In the subsequent dialog box, select the subnet "Ethernet(1)" and enter the IP address and the subnet screen mask of your PG/PC (see figure below). E.g.:
 - IP address, such as, 192.168.0.3
 - Subnet screen form = 255.255.255.0

Properties - Ethernet interface		X
General Parameters		
Set MAC address / use ISO protocol		
MAC address: 08-00-06-01-00-01 If a subnet is selected, the next available addre	esses are suggeste	d.
✓ IP protocol is being used		
IP address: 132.168.0.3 Subnet mask: 255.255.2548 Use router		
Address: 192.10 Subnet:	68.0.3	
not networked Ethemet(1)	New	
	Properties	
	Delete	
	Cancel	Help

Figure 16-11 Properties of the Ethernet Interface

- 5. Click "OK".
- 6. You can configure additional interfaces via "New".

7. When you have configured the interfaces, all the configured interfaces are visible under the "Interface" tab (see figure below).

operties -PG/PC General Interfaces	Assignment		
Name Ethernet port(1)	Type Industrial Ethernet	Address 192.168.0.3	Subnet Ethernet(1)
E dioliter policity		102.100.0.0	2 monteq ()
New	Properties Ger	erate LDB	Delete
OK N			Cancel Help

Figure 16-12 Configured interfaces

The configured interfaces must be assigned in a device-specific manner to the available hardware interfaces on the PG/PC.

The sequence steps are laid out in the following section.

16.4.3 Assigning interfaces

Introduction

The interfaces configured in the previous chapter must now be assigned in a device-specific manner to the available hardware interfaces on the PG/PC.

Operating sequence for assigning an Ethernet interface

- 1. Select the "Assign" tab.
- 2. Select "Ethernet interface(1)" in the selection field "Configured interfaces".
- Select the installed network card "TCP/IP -> Realtek RTL8139/810xF..." in the selection field "Interface parameterizations in PG/PC" (see figure below).

General Interfaces Assignment	
Not Assigned Configured Interfaces:	
Name Type Subnet	
Ethernet port(1) Industrial Ethernet Ethernet(1)	
Interface Parameter Assignments in the PG/PC:	
TCP/IP -> NdisWanlp	
TCP/IP -> Realtek RTL8139/810x F	
TCP/IP(Auto) -> Intel(R) PRO/Wireless TCP/IP(Auto) -> Realtek RTL8139/81	
TCP/IP(Auto) -> Realtek RTL8139/81	
Assigned: Disconnect	
Interface Parameter assign Subnet S7Dnline	
S70NLINE Access:	
Active	
OK Cancel Help	

Figure 16-13 Selecting

4. Click on "Assign" and confirm the subsequent message on processing object properties with "OK".

The assigned interfaces are deleted from the field "Configured interfaces" and these assigned interfaces are displayed in the field "Assigned" (see figure below).

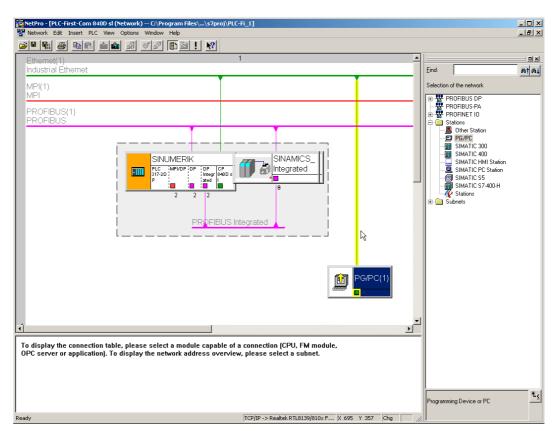
Properties -PG/PC			<u>></u>
General Interfaces	Assignment		
Not Assigned			
Configured Interfaces:			
Name	Туре	Subnet	
Interface Parameter A	ssignments in the PG/P	P.	
CP5511(MPI)		J.	
CP5511(PPI)			
CP5511(PR0FIBUS) ISO Ind. Ethernet ->	ntel(R) PRO/Wire	-	Assign
Licol i pi i co	⇒ ì í n∓rotao		
Assigned:			Disconnect
Interface	Parameter assign	Subnet S70nline -	
Ethernet port(1)	TCP/IP -> Realte	Ethernet(1) Active	SZONLINE Access:
•)	Active
			Active
ОК			Cancel Help

Figure 16-14 Assigning Ethernet interface

5. Now assign the remaining configured interfaces (PROFIBUS).

From those interfaces assigned, one must be marked as "active".

- 6. Select "Ethernet interface" in the field "Assigned" and mark the field next to it as "active".
- 7. Click on "OK" to end the dialog "Properties PG/PC".



In NetPro, the PG/PC interface declared as "active" is highlighted in YELLOW (see figure below).

Figure 16-15 Configured PG/PC in the network configuration

8. Select "Save and compile > Save and check all" and confirm the process with "OK".

The next operating sequence described explains how to load this hardware configuration to the NCU.

General tips

16.4 Integrating PG/PC into the network (NetPro)

16.4.4 Loading the HW config to NCU

Introduction

The newly created network configuration PG/PC must be introduced to NCU.

You have established a connection to the Ethernet interface (X120 or X127) and you load this configuration from the PG/PC to the NCU.

Operating sequence for loading HW config to NCU

- 1. Change from "NetPRO" to "HW Config".
- 2. Press the "Download to module" button.

The target module interactive screenform automatically displays both configured communication peers.

- 3. Confirm the load into the module with "OK".
- 4. Confirm the dialog boxes displayed subsequently with "OK" or "No" for the query "...Should the module be started now (restart)?".

Note

Loading the HW config to NCU is only possible via Ethernet interface.

16.5 NCU 7x0 and NX1x Terminal Assignment

16.5 NCU 7x0 and NX1x Terminal Assignment

Introduction

The following terminals are pre-assigned with the unit configuration:

- NCU 7x0
 - X122
 - X132
- NX1x
 - X122

Terminal assignment X122 (NCU 7x0)

Pin no.	Function	Assignment recommendation	BICO source/sink		Macro number		
1	Input ¹⁾	ON/OFF 1 Infeed Line Module with DRIVE-CLiQ Connection	CU: r0722.0	Infeed p840	1		
		"Infeed Ready Signal" of Line Module without DRIVE-CLiQ connection	SLM X21.1	Drive p864	5		
2	Input	"OFF3 – rapid stop" Function: Braking with a configurable OFF3 ramp (p1135,1136,1137); thereafter, pulse suppression and starting lockout. The drive stops controlled. The braking response can be set separately for each servo.	CU: r0722.1	Each drive 2. OFF3, p849	1 5		
3	Input	SH/SBC - Group 1 SINAMICS Safety Integrated (SH = p9601 release)	CU: r0722.2	p9620 (all drives in the group)	The macro does not perform any		
4	Input	SH/SBC - Group 2 SINAMICS Safety Integrated (SH = p9601 release)	CU: r0722.3	p9620 (all drives in the group)	BICO interconnection; the use of the function requires parameterization by the user.		
5	Ground fo	r pins 1 4					
6	Ground fo	r pins 7, 8, 10, 11					

General tips

16.5 NCU 7x0 and NX1x Terminal Assignment

Pin no.	Function	Assignment recommendation	BICO source/sink		Macro number	
7	Output	SH/SBC - Group 1 SINAMICS Safety Integrated	CU: p0738	r9774 Bit 1 BICO from CU after the first drive in the group	The macro does not perform any BICO interconnection; the use of the function required	
8	Output	SH/SBC - Group 2 SINAMICS Safety Integrated	CU: p0739	p9774 bit 1 BICO from CU after the first drive in the group	function requires parameterization by the user. The pin will be parameterized as output by the macro 1/5.	
9	Ground fo	r pins 7, 8, 10, 11				
10	Input	Bero 1 – equivalent zero mark"	CU: r 0722.10	p495 = 2	The macro does not perform any BICO interconnection; the use of the function requires parameterization by the user.	
11	Input	Probe 1 Central Measuring (check that MD13210 = 0!)	CU: p0680[0] = 3	Each drive p488 [1,2,3]=0	1/5	
		Probe 1 - distributed measurement (control MD13210 = 1)	CU: p0680[0] = 0	Each drive p488 [1,2,3]=3	The macro does not perform any BICO interconnection; the use of the function requires parameterization by the user.	
12	Ground fo	r pins 7, 8, 10, 11	·	·	•	

¹⁾ Low – high edge required!

16.5 NCU 7x0 and NX1x Terminal Assignment

Terminal assigment X132 (NCU 7x0)

Pin no.	Function	Assignment recommendation	BICO source/sink	Macro number		
1	Input	Digital input \$A_IN[1]	CU: r0722.4	CU: p2082[0]	1	
2	Input	Digital input \$A_IN[2]	CU: r0722.5	CU: p2082[1]	5	
3	Input	Digital input \$A_IN[3]	CU: r0722.6	CU: p2082[2]		
4	Input	Digital input \$A_IN[4]	CU: r0722.7	CU: p2082[3]		
		Line contactor, feedback signal		LM : p0860	The macro does not perform any BICO interconnection; the use of the function requires parameterization by the user.	
5	Ground fo	r pins 1 4				
6	Ground fo	r pins 7, 8, 10, 11				
7	Output	Infeed Operation (Line Module with DRIVE-CLiQ Connection)	LM :r0863.0	CU: p0742	1	
		Digital output \$A_OUT[4]	CU: p2091.3		5	
8	Output	Infeed Operational (if Line Module with DRIVE-CLiQ Connection)	LM : r0899.0	CU: p0743	1	
		Digital output \$A_OUT[3]	CU: p2091.2		5	
9	Ground fo	r pins 7, 8, 10, 11				
10	Output	Digital output \$A_OUT[2]	CU: p2091.1	CU: p0744	1/5	
		Line contactor control	LM : r0863.1		The macro does not perform any BICO interconnection; the use of the function requires parameterization by the user.	
	Input	Bero 2 – equivalent zero mark	CU: r 0722.14	Drive: p0495 = 5	The macro does not perform any BICO	
		2. OFF 2		Drive: p0845	interconnection; the use of the function requires parameterization by the user.	
11	Output	Digital output \$A_OUT[4]	CU: p2091.0	CU: p0745	1/5	
	Input	Probe 2 Central Measuring (check that MD13210 = 0!)	CU: p0680[1] = 6	Each drive p489 [1,2,3]=0	The macro does not perform any BICO	
		Probe 2 - distributed measurement (control MD13210 = 1)	CU: p0680[1] = 0	Each drive p489 [1,2,3]=6	interconnection; the use of the function requires parameterization by the user.	
12	Ground fo	r pins 7, 8, 10, 11				

General tips

16.5 NCU 7x0 and NX1x Terminal Assignment

Terminal assignment X122 (NX 10/15)

Pin no.	Function	Assignment recommendation	BICO source/sink		Macro number			
1	Input ¹⁾	ON/OFF 1 Infeed Line Module with DRIVE-CLiQ Connection	NX: r0722.0	Infeed p840	The macro does not perform any BICO			
		"Infeed Ready Signal" of Line Module without DRIVE-CLiQ connection	SLM X21.1	Drive p864	interconnection; the use of the function requires			
2	Input	"OFF3 – rapid stop" Function: Braking with a configurable OFF3 ramp (p1135,1136,1137); thereafter, pulse suppression and starting lockout. The drive stops controlled. The braking response can be set separately for each servo.	NX: r0722.1	Each drive 2. OFF3, p849	parameterization by the user.			
3	Input	SH/SBC 1 - Group 2 SINAMICS Safety Integrated (SH enable = p9601)	NX: r0722.2	p9620 (all drives in the group)				
4	Input	SH/SBC 1 - Group 1 SINAMICS Safety Integrated (SH enable = p9601)	NX: r0722.3	p9620 (all drives in the group)				
5	Ground for	r pins 1 4						
6	Ground for	r pins 7, 8, 10, 11						
7	Output	SH/SBC - Group 1 SINAMICS Safety Integrated	NX: p0738	r9774 bit 1 BICO from CU after the first drive in the group	The macro does not perform any BICO interconnection; the use of the function requires			
8	Output	SH/SBC - Group 2 SINAMICS Safety Integrated	NX: p0739	p9774 bit 1 BICO from CU after the first drive in the group	parameterization by the user.			
9	Ground for	r pins 7, 8, 10, 11						
10	Input	Bero 1 – equivalent zero mark"	NX: r0722.10	Drive: p495 = 2	The macro does not			
11	Input	Bero 2 – equivalent zero mark	NX: r0722.11	Drive: p495 = 3	perform any BICO interconnection; the			
		2. OFF 2	NX: r0722.11	Drive: p0845	requires parameterization by the user.			
12	Ground for	r pins 7, 8, 10, 11						

¹⁾ Low – high edge required!

16.5 NCU 7x0 and NX1x Terminal Assignment

Support for terminal assignment at the HMI

In the following menu you can perform terminal assignment for the drive units (NCU, NX) of the associated SINAMICS drive group.

• "Commissioning" > "Drive system" > "Drive units" > "Inputs/outputs" menu

	RACK1003				MPF0 Program aborted					
Channel ir					riogram a		-	_		Drive
🔥 Stop: No I	NC Ready					R	70			device+
8080 1 4 option(s) is/are activated without setting the license key										
Eingänge //	Ausgänge							DP3.Slav	∎3.CU 003[1]	Drive device-
Signal		In/Out	0/1	Terminal	Terminal	0/1	In/Out	Signal		
Input IN/OU	T1 Infeed	In	0	X122.1	X132.1	0	In	Input \$A_I	N[1]	Select drive dev.
Input 2. OU Drives	ТЗ	In	0	X122.2	X132.2	0	In	Input \$A_I	N[2]	Assist
?-Select Sal (SH) Group		In	0	X122.3	X132.3	0	In	Input \$A_I	N[3]	Assign Terminal
?-Select Sal (SH) Group		In	0	X122.4	X132.4	0	In	Input \$A_I	N[4]	Set
?-Status of ! Group 1	Safe Stop	In	0	X122.7	X132.7	0	Out	Status Infe to operate	ed ready	Defaults
?-Status of ! Group 2	Safe Stop	In	0	X122.8	X132.8	0	Out	Status Infe ready	ed supply	
?-Input exte mark	rnal zero	In	0	X122.10	X132.10	0	Out	?-Output \$	A_OUT[2]	
Input Probe (central)	1	In	0	X122.11	X132.11	0	Out	Output \$A_	_OUT[1]	Show All Targets
Signal Row X	<122.1 (DI 0	AI	_M_:	3.3:2						
1 total targets										
∑Press 'Set	Defaults' to	use stan	dard	terminal v	wiring.					
Configur- ation	Topology	PROF				Input Outo			Control unit MD	File

Figure 16-16 "Inputs/outputs" menu for terminal assignment

16.6 Overview - Assignment of SINAMICS and NCK machine data for communication via PROFIBUS

16.6 Overview - Assignment of SINAMICS and NCK machine data for communication via PROFIBUS

Assignment of SINAMICS and NCK machine data for communication

The table below uses a sample to SINAMICS S120 component configuration to illustrate the assignment of the communication parameters. The SINAMICS S120 drive group comprises the following:

- an NCU (CU),
- an ALM,
- Three Motor Modules (MM)

Note

In the Control Unit Parameter 978, deactivate the process data exchange with the value "0". Cyclic and acyclic data are separated. Components that do not communicate on PROFIBUS are to be preassigned "255".

data	MD30130 Type of output setpoint	~	~	~	0	0	0					- 			
NCK machine data Axis MD	MD30110/30220 Setpoint/Actual value assignment	-	2	ε	4	2	9								
lata	MD13060[0-5] Message frame type1)	116	116	116	116	116	116								
NCK machine data General machine data	MD13050[0-5] Axis I/O address ¹⁾	4100	4140	4180	4220	4260	4300								
Ger	MD13120[0] Control Unit I/O address							6500							
Config) perties	I/O address 1)	4100	4140	4180	4220	4260	4300	6500	6514				to not change		
STEP7 (HW Config) DP slave properties	Message frame 1) type length	116, PZD-11/19	116, PZD-11/19	116, PZD-11/19	116, PZD-11/19	116, PZD-11/19	116, PZD-11/19	391, PZD-3/7	370, PZD-1/1				1) Standard value, do not change		
	Drive parameter p922 Message frame type	116	116	116	×	×	×								
SINAMICS S120	Control Unit Parameter p922 Message frame type					1	1	391			1		Process data (PZD) exchange configured	Does not exist	Not active
SINAN	Control Unit Parameter p978[0-9] List of drive objects	с	4	വ	255	255	255	-	255	0	2			×	255
	HW Module	MM1	MM2	MM3	×	×	×	cn	ALM	×	×				

Figure 16-17 Assignment

16.6 Overview - Assignment of SINAMICS and NCK machine data for communication via PROFIBUS

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General tips

16.7 Drive-object assignment for PROFIBUS connection

16.7 Drive-object assignment for PROFIBUS connection

Introduction

PROFIBUS message frames (internal PROFIBUS, HW Config) are used to specify the process data to be exchanged between the NCK and the drives. The sequence of the drive objects (configurable/configured using HW Config) involved in PROFIBUS process-data exchange is defined via a drive-object list.

List of drive objects

You usually configure eight drive objects (DOs). The drive objects have drive-object (DO) numbers and are input in p978[0...9] as a list of drive objects.

You configure the following from parameter p978 in the index:

- 0...5 -> Motor Module (e.g., DO no. 3...8)
- 6 -> Control Unit (e.g., DO no. 1)
- 7 -> Active Line Module (e.g., DO no. 2),

PROFIBUS message frame 370 is not currently available for the Active Line Module (infeed). However, according to the SINAMICS rule, all DOs from parameter p0101 have to be assigned in parameter p0978. The resulting infeed DO number then has to be entered in index **9** (see table below).

Note

The list of DOs involved in process-data exchange is completed by entering a value of "0". Components that are available, but do not communicate on PROFIBUS, must be preset to "255".

The list of drive objects is already pre-assigned in the following order by the system upon initializing the drive (acceptance of topology):

- ALM, first Motor Module ...n., CU; e.g., 2-3-4-5-1.
- The assignment allocated by the drive when the DRIVE-CLiQ topology is accepted must be reviewed and adapted.

Drive-object numbers

The drive-object numbers (DO numbers) can be viewed under "Commissioning > Machine data > Control Unit MD/Infeed MD/Drive MD" in the component name line. For example, the name for a Control Unit could be: "DP3.Slave3:CU_003 (1)". The DO number appears inside the brackets "(...)".

16.7 Drive-object assignment for PROFIBUS connection

Drive-object assignment

The table below uses the example of a SINAMICS S120 component configuration to illustrate the drive-object assignment to be made for the drive parameters.

For example, the drive group could be configured as follows:

- One Control Unit (CU)
- One Active Line Module (ALM)
- Three Motor Modules

Table 16- 1	Assignment of p978[09] for infeed with DRIVE-CLiQ connection
-------------	--

Component	Index p978	List of drive objects
1. Motor module	0	3
2. Motor module	1	4
3. Motor module	2	5
not found	3	255 ¹⁾
not found	4	255 ¹⁾
not found	5	255 ¹⁾
CU	6	1
ALM, only if protocol 370 is available	7	255 ¹⁾
not found	8	0 ²⁾
ALM (Standard for SINUMERIK)	9	2

1) Not active

2) End of exchange of PZD

Note

The following table describes the assignment of the drive objects in the p978[0...9] for an infeed without DRIVE-CLiQ connection. This assignment is also done for a drive group with NX module.

16.7 Drive-object assignment for PROFIBUS connection

Component	Index p978	List of drive objects
1. Motor module	0	2
2. Motor module	1	3
3. Motor module	2	4
not found	3	255 ¹⁾
not found	4	255 ¹⁾
not found	5	255 ¹⁾
CU	6	1
ALM, only if protocol 370 is available	7	2551)
not found	8	0 ²⁾
not found	9	0

Table 16-2 Assignment p978[0...9] for infeed without DRIVE-CLiQ connection

1) Not active

2) End of exchange of PZD

Procedure for assigning the drive objects in parameter p978

You are now in the "Commissioning > Machine data > Control Unit MD" menu.

p978 can be written using the following sequence:

- 1. Set p9 = 1
- 2. Set p978 [0...9] to the values outlined in the table below (column ...List of drive objects...), e.g., 3-4-5-255-255-1-255-0-2.
 - Motor Module drive objects, ascending order (connected as per DRIVE-CLiQ)
 - Control unit
 - ALM
- 3. Set p9 = 0
- 4. Save "All": set p977 = 1

It is imperative you wait until p977 is automatically written back to "0".

See also

Overview - Assignment of SINAMICS and NCK machine data for communication via PROFIBUS (Page 299)

16.8 PROFIBUS machine control panel on the HMI

Configuration of the PROFIBUS machine control panel

The following is essential for a PROFIBUS machine control panel on the HMI:

- Configuration of the properties of the network interface for PROFIBUS
- Supplementation of the machine control panel and hand wheel in HW Config
- Modification of the machine control panel in OP100

16.8.1 Configuration of the properties of the network interface for PROFIBUS

Introduction

In the STEP7 project, you configure the network interfaces PROFIBUS DP, via which you want to reach the machine control panel:

PROFIBUS DP operating sequence

- 1. You used the left mouse button to select NCU 720.1 and while holding down the mouse button you dragged it to the "Station design" station window.
- 2. After you release the mouse button, configure the properties of PROFIBUS DP interface for socket X126 (machine control panel) in the dialog box (see figure below).

Properties	- PROFIBUS i	nterface DP (R0/52.2)			×
General	Parameters				
Address:		2 💌	If a subnet is selected the next available add		
Subnet					
not	networked			New	
				Properties	
				Delete	
:					
OK			Ca	ncel Help	

Figure 16-18 Properties of PROFIBUS DP

- 3. Click the following menu items one after the other:
 - the "New..." button,
 - the "Network settings" tab in the "Properties new subnet PROFIBUS Subnet" dialog box.

4. Select the transmission rate "12 Mbps" for the "DP" profile (see figure below).

Prope	rties	- New subnet PRO	FIBUS			X
Ger	neral	Network Settings				
	Highes Addres	et PROFIBUS ss:	126 💌	Change	Options	
1	Transn	nission Rate:	500 Kbps 1.5 Mbps 3 Mbps 6 Mbps 12 Mbps	•		
F	Profile:		DP Standard User-Defined		Bus Parameters	
	OK				Cancel Help	

Figure 16-19 Properties of the PROFIBUS interface

5. Click on "Options" and then on the "Equidistance" tab (see figure below).

Options	×
Constant Bus Cycle Time Cables	
Activate constant bus cycle time	
Optimize DP cycle (and Ti, To if necessary): Recalculate	
Number of PGs/OPs/TDs etc. on PROFIBUS Configured: 0 Total: 0	
Time base: Constant DP Cycle: 2# ms Details (min = 0.193 ms; max = 1390.000 ms)	
Slave Synchronization	
(otherwise: make setting in slave properties)	
Time Ti (read in process values): 0.666 + ms 0.001 ms (min = 0.000 ms; max = 1.334 ms) (min = 0.000 ms; max = 1.334 ms) (min = 0.000 ms; max = 1.334 ms) (min = 0.000 ms; max = 1.334 ms)	
Time To (output process values): 0.666 ^{±±±} / _± ms 0.001 ms (min = 0.000 ms; max = 1.334 ms)	
OK Cancel Help	

Figure 16-20 Equidistance

- To enable reproducible access to peripherals (for hand wheel mode), the PROFIBUS DP must have constant bus cycle time. The following entries are necessary under Equidistance:
 - Click on the "Activate equidistance bus cycle" field
 - Enter the cycle, e.g., "2 ms" for the "Equidistance DP cycle" (for integrated PROFIBUS) (see MD10050 \$MN_SYSOCK_CYCLE_TIME).
 - Click on the "Times Ti and To equal for all slaves" field
 - The fields "Time Ti" and "Time To" must contain a value "< 2ms".
- 7. Click on "OK" three times.
- Module NCU 720.1 with SINAMICS S120 is inserted into the HW config (see figure below).

Note

With the <F4> key and confirmation of the question regarding "Reorganize", you can reorganize the display in the station window.

HW Config - [SINUMERIK (Configuration) PLC-First-Com	840D el1						- 🗆 ×
Station Edit Insert PLC View Options Window Help	040D SIJ						
D 🚅 🐂 🖉 🐴 💼 💼 🏙 🏙 🚯 🗖	🔡 🕅						
PROFIBUS(1): DP master s						1:	
	system (1)	-				Find:	mt mi
2 PLC31 -						Turde	A4 i A44
						Profile: Standard	•
PROFIBUS Integrated: DI	P master syste	:m (3)				E - ₩ PROFIBUS DP	
Opt						ROFIBUS-PA	-
1 44 200						PROFINET IO	
4 NCK 84						SIMATIC 300	
						📄 🕀 🧰 C7	
						⊕ □ CP-300 □ □	
						H TEXTENSION	
						😟 💼 PS-300	
					-	🖻 💼 RACK-300	
•						III III SM-300	
						i ⊡ i SINUMERIK i ⊡ i S40D sl	
(0) NCU 720.1						NCU 710.1	
Slot Module Order number	Firmware	MPI address	I ad	Q	c		
2 S PLC317-2DP 6FC5 317-2A/10-0AB0	¥2.1.6	2	1 au	Q	<u> </u>	NCU 730.1	
X13 MP/DP	72.7.0	2	8191*			🗄 💼 🗐 810D / 840D	
X12 DP		-	8190*		-	🗄 💼 840Di	
PCI DP Integrated			8189*			E SIMATIC 400	
Opt					_	SIMATIC HMI Station	
3 M 360 6E57 360-34401-0440			2000		_	6FC5 372-0AA00-?AA0	₹
4 9 NOX 8400 x 5 1 CP 6400 x	100		256× 27226	272		SINUMERIK NCU	
	100	1	27220	272	_ ▼		
Insertion possible							Chg //

Figure 16-21 HW config with NCU 7x0

As the next step configure a machine control panel with hand wheel.

16.8.2 Load GSD file (contains machine control panel)

Introduction

To expand the machine control panel, you need the device data (GSD file) with the SINUMERIK MCP. This file contains information that a DP master system requires to link the MCP as DP slave in its PROFIBUS configuration.

This file is a component of the STEP7 package for NCU7x0 (tool box).

Operating sequences

- 1. Search in the HW config under "Extras" > "Install GSD file..." in the installation directory of the tool box under, for example: C:\temp\tb_sl_1.1.0.0\8x0d\GSD\MCP_310_483 to find the corresponding GSD directory.
- 2. Choose the corresponding language you want to install.
- 3. Click "Install".
- 4. Click "Close".

16.8.3 Adding a machine control panel and handwheel in HW Config

Introduction

The machine control panel (MCP) can be connected via PROFIBUS to the PLC. In later configurations, this will also be possible over the network.

Operating sequence for adding an MCP in HW Config

You have created a NCU and a NX in the HW Config and installed the GSD file for the MCP.

- 1. Search under "PROFIBUS DP" > "Further field devices" > "NC/RC" > "MOTION CONTROL" for the "SINUMERIK MCP" module.
- Click with the left mouse button to select the "SINUMERIK MCP" module and drag it to the chain for the "PROFIBUS DP master system" in the "Station design" station window.
- 3. After releasing the mouse button, the machine control panel is added (see figure below).
- 4. Select "MCP" and enter the PROFIBUS address 6 under "Object properties" > button "PROFIBUS..." > tab "Parameter" > input field "Address".

5. Click on "OK" twice.

Now you can assign the slots of the machine control panel, e.g., "Standard + Hand wheel".

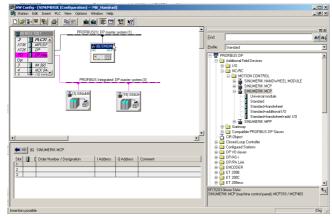


Figure 16-22 Machine control panel in HW Config

6. In the hardware catalog under "SINUMERIK MCP" click with the left mouse button to select the "Standard+Hand wheel" option and drag it to Slot 1 (see figure below).

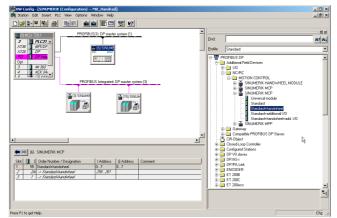


Figure 16-23 Standard+Handwheel for slot

You have configured a machine control panel with handwheel in HW Config.

Note

If a handwheel has been configured, equidistance is required. You set this when you configured the PROFIBUS DP. PROFIBUS address for the machine control panel is "6".

Save, compile and load the configuration to the PLC as the next operating sequence.

16.8.4 Modifying PROFIBUS machine control panel in OB100

Introduction

The PLC basic program automatically transfers the machine control panel signals (MCP signals) and the addresses of the MCP in the HW config if the configuration is set up as laid out below.

Operating sequence

• Under "Blocks", double-click on "OB100" to open it.

In OB100, the parameters below have to be preset:

MCPNum :=1
MCP1IN := P#E 0.0
MCP1OUT := P#E 0.0
MCP1StatSend := P#E 8.0
MCP1StatREc := P#E 12.0
MCPBusAdresse := 6
MCPBusType = B#16#33

17

Licensing

17.1 Import licensing terms

The terms below are important for understanding the license management of SINUMERIK software products.

Term	Description
Software product	"Software product" is generally used to describe a product that is installed on a piece of hardware to process data. Within the license management of SINUMERIK software products, a corresponding license is required to use each software product.
Hardware	In the context of license management of SINUMERIK software products, "hardware" refers to the component of a SINUMERIK control system to which licenses are assigned on the basis of its unique identifier. License information is also saved to remanent memory on this component.
	Example:
	SINUMERIK 840D sl: CF card
	SINUMERIK 840Di sl: MCI board
License	A license gives the user a legal right to use the software product. Evidence of this right is provided by the following:
	CoL (Certificate of License)
	License key
CoL (Certificate of License)	The CoL is the proof of the license. The product may only be used by the holder of the license or authorized persons. The CoL includes the following data relevant for the license management:
	 Product name License number
	 Delivery note number
	Hardware serial number
	Note
	The hardware serial number is located only on a CoL of the system software or if the license was ordered bundled, in other words the system software came together with options.
License number	The license number is the feature of a license that is used for its unique identification.
CF Card (Compact Flash Card)	The CF Card represents, as the carrier of all the remanent data of a SINUMERIK solution line control system, the identity of this control system. The CF Card includes the following data relevant for the license management:
	Hardware serial number
	License information including the License Key
Hardware serial number	The hardware serial number is a permanent part of the CF Card. It is used to identify a control system uniquely. The hardware serial number can be determined by:
	CoL (see: Certificate of License > "Note")
	HMI user interface
	Printing on the CF Card

17.2 Overview

Term	Description
License key	The License Key is the "technical representative" of the sum of all the licenses that are assigned to one particular piece of hardware, which is uniquely marked by its hardware serial number.
Option	One option is a SINUMERIK software product that is not contained in the basic version and which requires the purchase of a license for its use.
Product	A product is marked by the data below within the license management of SINUMERIK software products:
	Product designation
	Order number:
	License number

17.2 Overview

The use of the installed system software and the options activated on a SINUMERIK control system require that the licenses purchased for this purpose are assigned to the hardware. In the course of this assignment, a License Key is generated from the license numbers of the system software, the options, as well as the hardware serial number. Here, access occurs to a license database administered by Siemens A&D via the Internet. Finally, the license information including the License Key is transferred to the hardware.

There are two ways to access the license database:

- Web License Manager
- Automation License Manager

Note

Using SINUMERIK software products for testing purposes

SINUMERIK software products may be temporarily activated and used for testing purposes on a SINUMERIK control system, even without the corresponding License Key.

The license-information "Overview" dialog box on the SINUMERIK user interface, e.g., HMI Advanced, indicates that the License Key is "Insufficient". Also the control system will repeatedly display a corresponding message.

17.3 Web License Manager

By using the Web License Manager, you can assign licenses to hardware in a standard Web browser. To conclude the assignment, the License Key must be entered manually at the control system via the HMI user interface.

Internet address

The Internet address of the Web License Managers is: http://www.siemens.com/automation/license

17.4 Automation License Manager

The Automation License Manager can be used to assign all the licenses required for a piece of hardware (license-requirement comparison). The license information, including the License Key, is transferred electronically via an Ethernet link (TCP/IP).

Preconditions:

- The Automation License Manager must be installed on the computer (PC/PG) that is used to assign the licenses to the hardware.
- The computer (PC/PG) must be able to connect to the license database and the SINUMERIK control system via Ethernet link (TCP/IP):
 - License database: Internet connection
 - SINUMERIK control system: Intranet or PTP connection (Ethernet, Peer-To-Peer)

The individual steps for assigning licenses to hardware (license database) and the transfer of license information from/to the SINUMERIK control system can be performed such that only one connection must be available at any one time.

Licensing

17.5 License database

17.5 License database

The license database contains all the customer-specific license information relevant for the license management of SINUMERIK software products. The central management of the license information in the license database ensures that the existing license information regarding a piece of hardware is always up to date.

License database access

License database access occurs via:

• Direct access

The direct access occurs with:

- Delivery note number
- License number

The direct access enables the direct assignment of licenses for which the license numbers are available, e.g., in the form of a CoL.

Customer login

The customer login occurs with:

- User name
- Password

The customer login enables the assignment of all the licenses available to the user that are delivered at the time of the login and have not yet been assigned to any hardware. Here, the license numbers of licenses that can still be assigned need not be directly at hand, instead these are displayed from within the license database.

Note

Customer login

You can obtain a customer login from Siemens A&D Mall under menu item: "Registration". The Internet address is: http://mall.automation.siemens.com/

Currently, access is not yet possible for all countries.

Various license information

As indicated above, only the license information in the license database represents the current status regarding a piece of hardware. Differences may arise between the license information available for a piece of hardware and that of the license database due to:

- loading older archive data into the NCK (data restoration from a series-commissioning file after a service job)
- assigning licenses to hardware without transferring the modified license information for the hardware control system (online)

As a result, a more limited license requirement (possibly no license requirement) may be displayed than indicated on the HMI user interface of the control system for a license requirement alignment by Automation License Manager.

To align the license information, a transfer should be carried out for the current license information of the license database for the hardware control system (online).

17.6 CF Card and hardware serial numbers

The CF card (Compact Flash card) contains, in addition to the system and user software and the retentive system and user data, that data relevant for the license management of SINUMERIK software products of a control system:

- Hardware serial number
- License information including the License Key

The CF card thus represents the identity of a SINUMERIK control system. For this reason, assigning licenses to a control system always occurs using the hardware serial number.

This has the advantage that the CF card can be slotted into a replacement NCU in the event of failure and all data is retained.

Automation License Manager

Thus, the hardware serial number is always decisive during the transfer of license information to a control system in Automation License Manager and not the set IP address of the control system with which Automation License Manager is currently communicating.

Determining the hardware serial number

The hardware serial number is a permanent part of the CF card. It is used to identify a control system uniquely. The hardware serial number can be determined by:

- CoL (Certificate of License) (see note)
- SINUMERIK user interface, e.g. HMI Advanced
- Printing on the CF card
- Display in the Automation License Manager as supplementary information for the elements below:
 - Control system file
 - Control system (online)
 - Control image (offline)

Note

Hardware serial number and CoL

The hardware serial number is located only on a CoL of the system software or if the license was ordered bundled, in other words the system software came together with options.

17.7 SINUMERIK License Key

Basic information on License Keys

If a license is required for a product, then with the purchase of the license the purchaser receives a CoL as proof for the rights to use this product and a corresponding License Key as to the "technical representative" of this license. In conjunction with software products, the License Key usually must be available on the hardware on which the software product executed.

SINUMERIK License Keys

Depending on the software product, there are License Keys with different technical properties. The essential properties of a SINUMERIK License Key are:

Hardware reference

The hardware serial number included in the SINUMERIK License Key provides a direct link between the License Key and the hardware on which it can be used. In other words, a License Key created for the hardware serial number of a specific CF card is only valid for this CF card and will be rejected on other CF cards as invalid.

Total number of assigned licenses
 A SINUMERIK License Key not only refers to one single license, instead it is the
 "technical representative" of all licenses that are assigned to the hardware at the time of
 its generation.

Copying SINUMERIK License Keys

By the fixed reference to certain hardware, a SINUMERIK License Key may, for example, be copied to various computers (PC/PG) and/or memory media for security or archiving purposes.

17.8 Assigning via Web License Manager

17.8.1 You can execute an assignment via direct access as follows

Background

For the direct access, log on to a computer connected to the Internet (PC/PG) with the delivery note and license number in the Web License Manager. All licenses of the delivery note numbers entered at the login may then be assigned to a piece of hardware. After completing the assignment process, the new License Key is displayed. This must then be entered in the licensing dialog of the HMI components used.

Requirements

The following prerequisites must be met in order to assign a license to a piece of hardware via direct access and HMI user interface:

- The HMI component is connected with the control system (NCU) on which the license should be assigned. Both components have been booted.
- A computer (PC/PG) with Internet connection and browser is available.
- The login data for the direct access (e.g., per CoL) are available:
 - License number
 - Delivery note number

17.8 Assigning via Web License Manager

Assigning a license to a piece of hardware

 Determine the hardware serial number and the product name (HMI Advanced/HMI Embedded: "Hardware type") via the HMI licensing dialog box. HMI Advanced/HMI Embedded:

Operating-area switchover: Commissioning > Key: etc. (">") > Licenses > Overview

Note

Ensure that the hardware serial number displayed is also really the one you want to make the assignment for. The assignment of a license to a piece of hardware cannot be reversed via the Web License Manager.

- 2. Go to the Internet page of the Web License Manager: http://www.siemens.com/automation/license
- 3. Login via "Direct access":
 - License number
 - Delivery note number
- 4. Follow the additional instructions in the Web License Manager.

Note

License Key via e-mail

If you have an e-mail address, you can have the option (checkbox) of receiving the License Key by e-mail. Advantage: the entry of the License Key to the control system is simplified.

 After completing the assignment process, enter the License Key displayed on the Web License Manager into the licensing dialog of the HMI user interface. HMI Advanced/HMI Embedded:

Operating-area switchover: Commissioning > Key: etc. (">") > Licenses > Overview

6. Confirm the entry of the new License Key by pressing the softkey: "Transfer".

17.8.2 You can execute an assignment via customer login as follows

Background

For the customer login, log on to a computer (PC/PG) connected to the Internet with the user name and password in the Web License Manager. All licenses released for this user name in the framework of the license management may then be assigned to a piece of hardware. After completing the assignment process, the new License Key is displayed. This must then be entered in the licensing dialog of the HMI components used.

Requirements

The following prerequisites must be met in order to assign a license to a piece of hardware via customer login and HMI user interface:

- The HMI component is connected with the control system (NCU) on which the license should be assigned. Both components have been booted.
- A computer (PC/PG) with Internet connection and browser is available.
- The login data for the customer login is available:
 - User name
 - Password

17.8 Assigning via Web License Manager

Assigning a license to a piece of hardware

 Determine the hardware serial number and the product name (HMI Advanced/HMI Embedded: "Hardware type") via the HMI licensing dialog box. HMI Advanced/HMI Embedded:

Operating-area switchover: Commissioning > Key: etc. (">") > Licenses > Overview

Note

Ensure that the hardware serial number displayed is also really the one you want to make the assignment for. The assignment of a license to a piece of hardware cannot be reversed via the Web License Manager.

- 2. Go to the Internet page of the Web License Manager: http://www.siemens.com/automation/license
- 3. Login via "Customer login":
 - User name
 - Password
- 4. Follow the additional instructions in the Web License Manager.

Note

License Key via e-mail

If you have an e-mail address, you have the option (checkbox) of receiving the License Key by e-mail. Advantage: the entry of the License Key to the control system is simplified.

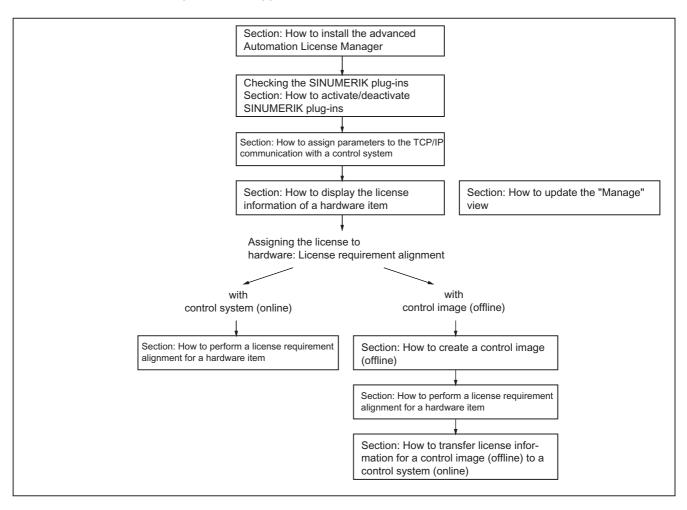
 After completing the assignment process, enter the License Key displayed on the Web License Manager into the licensing dialog of the HMI user interface. HMI Advanced/HMI Embedded:

Operating-area switchover: Commissioning > Key: etc. (">") > Licenses > Overview

6. Confirm the entry of the new License Key by pressing the softkey: "Transfer".

17.9.1 Function Overview

The following figure provides an overview of the functions available and the sequence in which they should be applied.



17.9.2 Installing the Automation License Manager

Background

The following components need to be installed for the license management of SINUMERIK solution line License Keys:

- Automation License Manager
 The Automation License Manager is loaded by the installation routine only if no manager or a manager version with a lower version number is installed on the computer (PC/PG).
- SINUMERIK plug-in The SINUMERIK plug-in is loaded by the installation routine only if it finds a version of the Automation License Manager installed on the computer (PC/PG).
- HMI basic software The HMI basic software is loaded by the installation routine only if no HMI software or a version with a lower number is installed on the computer (PC/PG).

Note

The Automation License Manager is used for all Siemens A&D products, e.g. SIMATIC STEP7. As versions of the Automation License Manager are upwards compatible, we always recommend using the version with the highest version number, irrespective of the source of supply (e.g. SINUMERIK or SIMATIC product CD, download via A&D Mall, etc.).

System requirements

Hardware

- Computer: Industrial PC, programming device, etc.
- Work memory: >= 128 MB
- Free hard-disk storage:
 - 5 MB (SINUMERIK plug-in)
 - + 32 MB (Automation License Manager)
 - + 300 MB (HMI basic software)
- Operating system: Windows XP

Execution

- 1. Launch the installation program for the Automation License Manager from "SETUP.EXE" and follow the instructions for the installation.
- Launch the installation program for the SINUMERIK plug-in from "SETUP.EXE" and follow the instructions for the installation. The HMI basic software can be installed as part of this process.

17.9.3 Enabling/disabling SINUMERIK plug-ins

Background

All of the plug-ins enabled for the Automation License Manager scan the relevant communication interfaces when booting and after specific operator inputs. If there is a large number of enabled plug-ins, this can result in a significantly longer boot and refresh time for the user interface. To prevent this delay, you can disable the plug-in installed for handling the SINUMERIK License Keys in dialog: "Connect to target system".

Procedure

Perform the following actions to enable/disable the SINUMERIK plug-ins:

- 1. Start the Automation License Manager
- 2. Open the "Connect to target system" dialog via menu command: Edit > Connect to target system > SINUMERIK . . .
- 3. In the dialog, open tab: Settings
- 4. Enable/disable the plug-in by selecting/deselecting the appropriate checkbox.
- 5. Close the dialog by pressing the button: OK

Result

The Automation License Manager shows the SINUMERIK-specific license information in accordance with the current status of the SINUMERIK plug-in. See Section:

Note

How to refresh the view manually

If the view is not automatically refreshed, you can refresh the view manually. See Section: "How to refresh the view: Manage"

17.9.4 Assigning parameters to the TCP/IP communication with a control system

Background

To be able to read or transfer license information from or to the CF card of a control system, the Automation License Manager must communicate with the control system via TCP/IP.

Requirements:

- The HMI basic software is installed
- The SINUMERIK plug-in is enabled

Note

HMI Advanced

If the SINUMERIK user interface "HMI Advanced" is installed on the same computer (PC/PG) as the Automation License Manager you can set the IP address using the user interface. The IP address for the control system with which both HMI Advanced as well as the Automation License Manager communicate is set via the following dialog: Operating area switchover > Start-up > HMI > NCU link

This requires at least the password of protection level 2 (manufacturer) to be set.

General communication parameters

The default general communication parameters for the HMI basic software are stored in the following initialization file:

<installation drive>:\Siemens\Sinumerik\HMI-Advanced\mmc2\MMC.INI

User-specific communication parameters

The user-specific communication parameters for the HMI basic software are stored in the following initialization file:

<installation drive>:\Siemens\Sinumerik\HMI-Advanced\user\MMC.INI

During evaluation of the initialization data when booting the HMI basic software, user-specific communication parameters have priority over general communication parameters.

Sections of the initialization file: MMC.INI

The parameters relevant to TCP/IP communication with SINUMERIK control systems are stored in the following sections:

• [GLOBAL]

Section: [GLOBAL] specifies the section (e.g. *AddressParameter*) that contains the communication parameters for the current SINUMERIK control system.

• [AddressParameter]

The name of this section can be any unique ASCII string within the file. The specified IP address is crucial for communication with the current SINUMERIK control system: *IP address*.

Licensing

17.9 Assigning via Automation License Manager

Statements							
[GLOBAL]							
NcddeMachineName = AddressParameter							
NcddeDefaultMachineName = AddressParameter							
NcddeMachineNames = AddressParameter							
[AddressParameter]							
ADDRESS0 = IP address, LINE=10,NAME=/NC, SAP=030d, PROFILE=CLT1CP_L4_INT							
ADDRESS1 = IP address, LINE=10,NAME=/PLC, SAP=0201, PROFILE=CLT1CP_L4_INT							
ADDRESS2 = IP address, LINE=10, NAME=/DRIVE0, SAP=0900, PROFILE=CLT1CP_L4_INT							
ADDRESS3 = IP address, LINE=10, NAME=/DRIVE1, SAP=0a00, PROFILE=CLT1CP_L4_INT							
ADDRESS4 = IP address, LINE=10, NAME=/DRIVE2, SAP=0b00, PROFILE=CLT1CP_L4_INT							
ADDRESS5 = IP address, LINE=10, NAME=/DRIVE3, SAP=0c00, PROFILE=CLT1CP_L4_INT							

Table 17-1 User-specific file: MMC.INI

```
Multiple SINUMERIK control systems
```

If you require communication with multiple SINUMERIK control systems you must create a section

[*AddressParameter*] with a unique name e.g. [840D_001], [840D_002], etc. for each control system with the relevant IP address.

ADDRESS6 = *IP* address, LINE=10, NAME=/DRIVE4, SAP=0d00, PROFILE=CLT1__CP_L4_INT ADDRESS7 = *IP* address, LINE=10, NAME=/DRIVE5, SAP=0e00, PROFILE=CLT1__CP_L4_INT

In the [GLOBAL] section, you must specify the section name for the SINUMERIK control system, e.g. [840D_001], with which communication should occur once the Automation License Manager has booted.

NOTICE

Editing the IP address

The IP address specified in the user-specific initialization file MMC.INI influences not only the Automation License Manager but also all other applications installed on the same computer (PC/PG) that use HMI basic software (e.g. HMI Advanced).

To apply the change to the active IP address, you must close all active applications using HMI basic software (e.g. HMI Advanced). Once you have closed all applications, restart the computer to activate the new IP address.

Requirements

The following conditions must be fulfilled:

- The HMI basic software is installed on the computer (PC/PG) on which the Automation License Manager is running.
- The IP addresses of the SINUMERIK control systems with which the Automation License Manager must communicate are known.

Procedure: Creating parameters for the first time

Perform the following actions when creating user-specific communication parameters for the first time:

- Create the text file: <installation drive>:\Siemens\Sinumerik\HMI-Advanced\user\MMC.INI if it does not already exist.
- 2. Open the file MMC.INI with a text editor.
- 3. Copy the [GLOBAL] section from the table given above: "User-specific file: MMC.INI" to the open file MMC.INI.
- 4. Copy the [*AddressParameter*] section from the table given above: "User-specific file: MMC.INI" to the open file MMC.INI according to the number of available SINUMERIK control systems.
- 5. For all [*AddressParameter*] sections replace the string: "AddressParameter" with a unique name.
- 6. In all [*AddressParameter*] sections replace the string: "IP-Address" with the relevant IP address for the corresponding SINUMERIK control system.
- 7. In the [GLOBAL] section replace the string: "*AddressParameter*" with the section name for the SINUMERIK control system with which the Automation License Manager must communicate after booting. (See note "Changing the IP address" above.)

Procedure: Changing the active control system (online)

Perform the following actions to change the active control system (online), i.e. the SINUMERIK control system with which the Automation License Manager communicates:

- 1. Close the Automation License Manager. (See note "Changing the IP address" above.)
- 2. Open the file: <installation drive>:\Siemens\Sinumerik\HMI-Advanced\user\MMC.INI with a text editor.
- 3. In the [GLOBAL] section, replace the current address string with the section name for the SINUMERIK control system with which the Automation License Manager should communicate after booting.
- 4. Start the Automation License Manager.

Result

After booting the Automation License Manager communicates with the SINUMERIK control system defined in the user-specific communication parameters.

The control system to which you have switched is represented by an "online" control system file in the navigation area of the Automation License Manager.

The control system to which the Automation License Manager was connected before switching is represented by an "offline" control system file, if a control image (offline) exists.

17.9.5 How to refresh the navigation view: "Manage"

Background

After actions which add or remove elements in the navigation area of the navigation view: "Manage" of the Automation License Manager (e.g. deletion of a control image (offline), enabling/disabling of plug-ins), the view is normally refreshed automatically. If the view does not refresh automatically after an operation, you can refresh the view manually.

Execution

Perform the following actions to refresh the navigation view: "Manage" manually:

- 1. Select the following nodes in the navigation area of the Automation License Manager: My Computer
- 2. Refresh the view using one of the following options:
 - Menu command: View > Refresh
 - Key F5
 - Toolbar: 梦

Result

The navigation view of the Automation License Manager is refreshed. All sub-nodes under the node: **My Computer** are closed.

The object view of the Automation License Manager shows the current nodes and drives of the navigation area.

Note

All directories are closed when the view is refreshed. When you select key: ' * ' on the numeric keypad, you can open all directories with a single key.

17.9.6 Displaying the license information of a piece of hardware

Background

To perform one of the following tasks with the Automation License Manager:

- Check the license information for the hardware
- Ascertain the license requirement for the hardware and align if necessary
- Assign new licenses to hardware and transfer updated license information including License Keys to the hardware

you must display the license information for a hardware item.

Requirements

The license information can only be displayed if the Automation License Manager is communicating with the relevant SINUMERIK control system.

Procedure with current control system (online)

Perform the following actions to display the license information for the control system currently connected to the Automation License Manager:

- In the navigation area of the Automation License Manager, open: Technology folder: "SINUMERIK online" > Control folder and choose the control system (online) by clicking with the left mouse button.
- 2. Enable the default object view: "SINUMERIK".

Procedure with control system change over (online)

Perform the following actions to display the license information for a control system not connected to the Automation License Manager:

- 1. Exit the Automation License Manager and all other applications using HMI basic software (e.g. HMI Advanced).
- 2. Switch the active communication parameters to the required control system. See Section:
- 3. Start the Automation License Manager
- 4. In the navigation area of the Automation License Manager, open: Technology folder: "SINUMERIK online" > Control folder and choose the control system (online) by clicking with the left mouse button.

Result

The license information for the control system (online) is displayed in the object area of the Automation License Manager.

Licensing

17.9 Assigning via Automation License Manager

17.9.7 Creating a control image (offline)

Background

It is essential to create a control image (offline) in the following situations:

- The license information must later be transferred to the control system (online).
- The computer (PC/PG) on which the Automation License Manager is installed is not simultaneously connected to the Internet and the control system. This means the license information must be transferred to the control system (online) in three separate steps.
 - Intranet or PTP link to control system: Creating a control image (offline) in the Automation License Manager
 - Internet connection: Transferring license information to the control image (offline) by license requirement alignment
 - Intranet or PTP link to control system: Transferring license information from the control image (offline) to the control system (online) in the Automation License Manager
- The license information for a control system should be saved as an archive file for the purpose of archiving or customer support.

Requirements

A control image (offline) can only be created if the Automation License Manager is communicating with the control system.

Note

A PTP link (Peer-To-Peer) via Ethernet and TCP/IP requires a crossed Ethernet cable (twisted pair crossed 10baseT/100baseTX Ethernet cable).

Procedure using drag-and-drop

Perform the following steps to create a control image (offline) of the control system (online) by drag-and-drop:

- 1. In the navigation area of the Automation License Manager, open: Technology folder: "SINUMERIK online" > Control folder and choose the control system (online) by clicking with the left mouse button.
- 2. Select any line from the license information displayed in the object area by clicking with the left mouse button.
- 3. Drag the selected line to the desired target and release the mouse button.

The following objects can be selected as the target:

- 📕 Computer
- 🔹 🥌 Drive
- Storage folder
- 5 Control folder "offline"
- The second second

Result

A control image (offline) has been created from the license information of the control system (online) in the selected target:

- <computer> → drive C:\<default storage folder>
- e <drive>:\SINUMERIK\<storage folder>\<control folder "offline">
- storage folder>\<control folder "offline">
- The control image (offline): The control image (offline) was overwritten with the license information of the control system (online)

Procedure using menu command: "Upload from target system"

Perform the following actions to create a control image (offline) of the control system (online) using menu command: "Upload from target system":

- 1. In the navigation area of the Automation License Manager, open: Technology folder: "SINUMERIK online" > Control folder and choose the control system (online) by clicking with the left mouse button.
- 2. Create the control image (offline) a using menu command: License Key > Upload from target system

Result

A control image (offline) has been created from the license information of the control system (online) in the default storage folder:

17.9.8 Performing a license requirement alignment for a piece of hardware

Background

If one or more options are active on a SINUMERIK control system, you must assign each license to the hardware. Next, the updated license information including the new license key is transferred to the hardware.

Via the function: "Align requirement" you can perform the alignment automatically for all required licenses based on the control system (online) or a control image (offline). The following actions are performed:

- Determining the hardware serial number for the control system
- Determining the license requirement for the control system
- Taking the required licenses from the customer-specific licenses and assigning these to the hardware
- Transferring the updated license information including License Key to the control system (online) or the control image (offline)

Requirements

The following requirements must be met for the license requirement alignment:

- The address data for the customer login (personalized login) is available:
 - User name
 - Password
- Control (online) or control image (offline)

An "online" control system file or an "offline" control system file with the relevant control image (offline) is available.

Procedure

Perform the following actions for license requirement alignment with a control system (online) or a control image (offline):

1. In the navigation area of the Automation License Manager, open:

- For control system (online)
 Technology folder: SINUMERIK online > Control folder "online"
- For control image (offline)
 Technology folder: SINUMERIK offline > storage folder
 Control folder "offline"

and choose the control system (online) are the control image (offline) are or the control image (offline) are by clicking with the left mouse button.

- 2. Select the menu command: License Key > Align requirement
- 3. Login via your customer login.

4. Start the Automation License Manager and perform the following actions: "Align requirement", "Confirm requirement list" and "Transfer licenses". Follow the instructions displayed on the screen.

NOTICE

Suggested license assignment

Carefully check the suggested license assignment. An adjustment may be required if:

- you wish to use a license number that differs from the number suggested
- · you wish to use a license package rather than single licenses
- you wish to assign greater or fewer licenses than suggested for any reason

You can no longer undo the assignment independently.

The procedure for transferring the updated license information from a control image (offline) to a control system (online) is described in Subsection:

Result

A new License Key has been generated and loaded to the control (online) or the control image (offline).

17.9.9 Transferring license information for a control image (offline) to a control system (online)

Background

It is essential to transfer the license information for a control image (offline) to a control system (online), i.e. the hardware for a SINUMERIK control, in the following situations:

- The computer (PC/PG) on which the Automation License Manager is installed is not simultaneously connected to the Internet and the control system. License information is initially only updated based on a control image (offline). The computer on which the Automation License Manager is running is then disconnected from the Internet and connected to the relevant SINUMERIK control system to transfer the license information.
- After a service call, the license information should be transferred from an archive file to a SINUMERIK control system.

Requirements

The following conditions must met for transmission of a control image (offline) to the control system (online):

- The Automation License Manager must be communicating with the control system.
- The hardware serial number of the control image (offline) and the control system (online) must be identical.

Procedure using drag and drop

Perform the following steps to transfer a control image (offline) to the control system (online) by drag-and-drop:

- In the navigation area of the Automation License Manager, open: Technology folder: "SINUMERIK online" > Control folder "and left-click on the control (online) to select it.
- In the navigation area of the Automation License Manager, open: Technology folder: "SINUMERIK offline" > storage folder: > control folder . Choose the control image (offline) by clicking with the left mouse button.
- 3. Select any line from the license information displayed in the object area by clicking with the left mouse button.
- 4. Drag the selected line to the control system (online) 📱 release the mouse button.

```
Licensing
```

17.10 Internet links

Procedure using menu commands

Perform the following actions to transfer a control image (offline) to the control system (online) using menu command: "Download to target system":

- In the navigation area of the Automation License Manager, open: Technology folder SINUMERIK offline > storage folder: > control folder: and choose the control image (offline) by clicking with the left mouse button: .
- 2. Select the menu command: License Key > Download to target system

Result

The license information of the control system (online) is now identical to the information for the control image (offline), including the license key.

17.10 Internet links

Overview of Internet links used:

No.	Торіс	Address
1	Web License Manager	http://www.siemens.com/automation/license
2	Siemens A&D Mall: Customer login	http://mall.automation.siemens.com/
3	Download server	http://software-download.automation.siemens.com

18.1 Basic information on SINAMICS S120

Reference

18.1.1 Rules for wiring the DRIVE-CLiQ interface

Introduction

When wiring components with DRIVE CLiQ, the following rules apply: The rules are subdivided into **obligatory rules**, which must be observed, and **optional rules**, which enable automatic topology detection if they are adhered to.

Obligatory rules:

- A maximum of 198 DRIVE-CLiQ node components can be connected for each NCU.
- Up to 16 nodes can be connected to a DRIVE-CLiQ socket.
- A maximum of 7 nodes can be connected in one row. A row is always considered from the perspective of the closed-loop control module.
- Ring wiring is not permitted.
- Components must not be double-wired.

Optional rules:

If you follow the optional rules for wiring DRIVE-CLiQ, the components associated with the encoder are automatically assigned to the drives (see figure below) if commissioning is performed via macro 150xxx.

18.1 Basic information on SINAMICS S120

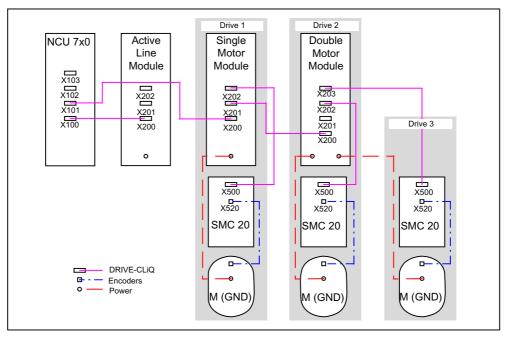


Figure 18-1 Optional rules

- For one motor module, the related motor encoder must also be connected.
- Due to the improved performance utilization, use as many of the DRIVE-CLiQ points on the NCU as possible.
- It is essential you comply with the optional rules when using the macro. This is the only way to achieve a proper assignment of the drive components.

18.1 Basic information on SINAMICS S120

18.1.2 Drive Objects (DO's) and Drive components

Introduction

The components that belong to the drive group are refelcted in the parameterization in a drive object.

Each drive object has its own parameter list.

General procedure

The figure below uses the example of a SINAMICS S120 drive group to illustrate the meaning of the drive components and drive objects.

Example

Drive object 3 is made up of the components Single Motor Module (No. 3), Motor (No. 10), Encoder (No. 9) and SMC (No. 8).

The component number is assigned by the drive after DRIVE-CLiQ topology recognition.

The component number in each case can be viewed in the parameter list for the relevant drive object. E.g.: under operating area "Commissioning > Machine data > Drive MD > Axis +".

Table 18-1 Component numbers in the DO 3

Parameter	Name of the parameter
p121	Component number of power module
p131	Component number of motor
p141	Component number of encoder interface
P142	Component number of encoder

18.1 Basic information on SINAMICS S120

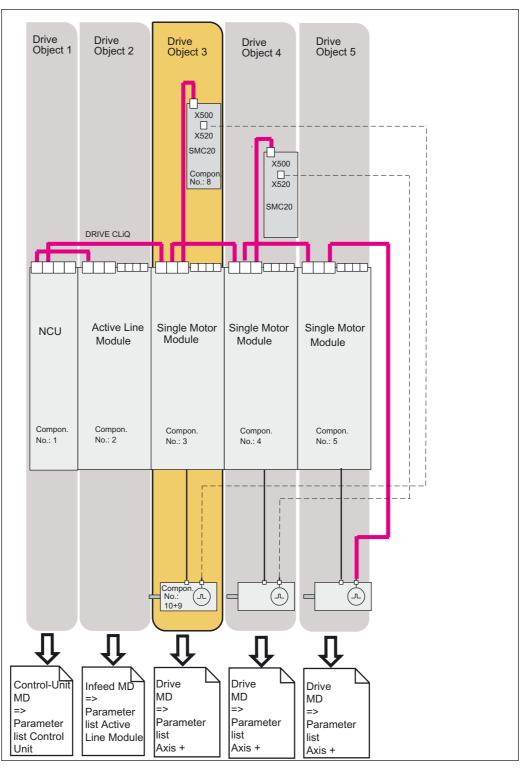


Figure 18-2 Drive group

18.1 Basic information on SINAMICS S120

18.1.3 BICO interconnection

Introduction

Each drive unit contains a large number of interconnectable input and output variables as well as internal control variables.

BICO technology (binector connector technology) allows the drive to be adapted to a wide variety of conditions.

Digital and analog signals, which can be connected freely by means of BICO parameters, are identified by the prefix BI, BO, CI, or CO in their parameter name.

These parameters are identified accordingly in the parameter list or in the function diagrams.

There are:

- Binectors (digital), with BI: binector input, BO: binector output
- Connectors (analog), with CI: connector input, CO: connector output

Interconnecting signals using BICO technology

To interconnect two signals, a BICO input parameter (signal sink) must be assigned to the required BICO output parameter (signal source).

Literature

Commissioning Manual or List Manual for SINAMICS S120 Documentation

18.1 Basic information on SINAMICS S120

Visualization of BICO connections on the HMI

Accessing the following menu allows you to perform a BICO connection of the SINAMICS drive group associated components.

• "Commissioning" > "Drive system" > "Drives/Drive units" > "Connections" menu

Drive device+		Program aborted BOV		eset	Channel re
	on	nfeed: Line supply data identification	M_3.3:2 (2): e 41257142	DP003.Slave003: AL selected/active. Tim	06400 🕹
3) Drive device-	VO_3.3:3 (3)	DP3.SLAVE3:SERVO_3.		Binector Inputs	Connections:
		BI Parameter	In/	ta	Source Data
Select		p806: Inhibit master control	0		0
	5 bit 0 📃	p810: Command Data Set selection CDS bit 0	0		0
anve det		p820: Drive data set selection DDS bit 0	0	Bit O	r2093, bit 0: Bi
		p821: Drive data set selection DDS bit 1	0	Bit 1	r2093, bit 1: Bi
Assian	2	p822: Drive data set selection DDS bit 2	0	Bit 2	r2093, bit 2: Bi
Source	3	p823: Drive data set selection DDS bit 3	0	Bit 9	r2093, bit 9: Bi
	1	p824: Drive data set selection DDS bit 4	0	Bit 10	r2093, bit 10: E
	p828: Motor changeover, feedback signal		0		
Search		p831[0]: Feedback signal, contactor 0	0		0
oodioii		p831[1]: Feedback signal, contactor 1	0		0
		p831[2]: Feedback signal, contactor 2	0		0
D' I		p831[3]: Feedback signal, contactor 3	0		0
Display		p831[4]: Feedback signal, contactor 4	0		0
connecto		p831[5]: Feedback signal, contactor 5	0		0
		p831[6]: Feedback signal, contactor 6	0		0
Display		p831[7]: Feedback signal, contactor 7	0		0
		p831[8]: Feedback signal, contactor 8	0		0

Figure 18-3 "Connections" menu

18.2 Transfer telegrams

Introduction

The transfer telegrams from NCK to the drive are transferred via an internal PROFIBUS on the NCU. They are:

- Send telegrams (drive->NCK)
- Receive telegrams (drive->NCK)

Telegrams

The telegrams are standard telegrams with pre-defined assignment of the process data. These telegrams are interconnected in the drive object using BICO technology.

The drive objects that can exchange process data include the following:

- 1. Active line module (A_INF)
- 2. Basic line module (B_INF)
- 3. Motor module (SERVO)
- 4. Control unit (CU)

The order of the drive objects in the telegram is displayed on the drive page via the parameter list in the "Commissioning" > "Machine data" > "Control Unit MD" operating area in p978[0...15] and may also be changed through it.

Literature

SINAMICS S120 Commissioning Manual

Receive words/send words

By selecting a telegram via p922 of the related drive object (operating area "Commissioning" > "Machine data" > "Drive MD"), the process data is determined which is transferred between the master and slave.

From the perspective of the slave, the received process data comprises the receive words and the process data to be sent the send words.

The receive and send words are comprised of the following elements:

- Receive words: Control words or setpoints
- Send words: Status words or actual values

18.2 Transfer telegrams

Message frame types

The message frame length for communication with the drive must be defined in the hardware configuration. The message frame length to be chosen depends on the axis functions required, e.g., the number of encoders or DSC, or the functions in the drive used.

Note

If you change the message frame length of a drive component in HW config, you also must adjust the selection of the message frame type in the configuration of the interface in the NCK.

What types of message frames are available?

• Standard telegrams

The standard telegrams are structured in accordance with the PROFIdrive Profile V3.1. The internal process data links are set up automatically in accordance with the message frame number setting.

• Manufacturer-specific telegrams

The manufacturer-specific telegrams are structured in accordance with internal company specifications. The internal process data links are set up automatically in accordance with the message frame number setting.

The following vendor-specific telegrams can be set via p0922:

- For axes (SERVO)

116 DSC with torque reduction, 2 position encoders, supplementary data (also parameterization)

- For axes (SERVO)

118 DSC with torque reduction, 2 independent position encoders per axis, supplementary data (also parameterization)

For Control Unit

390 telegram without probe (for NX)

391 message frame for up to 2 probes (for NCU)

18.2.1 Structure of the telegram with the process data for SINUMERIK 840D sl

Introduction

SINUMERIK 840D sl uses the following preferred message frame types:

• For axes

116 DSC with torque reduction, 2 position encoders, supplementary data (also parameterization)

For NX

390 message frame without probe (NX)

For NCU

391 message frame for up to 2 probes (only valid for NCU)

Note

The telegram types 116, 390 and 391 are preset by default via HW Config. It is recommended not to change these.

Telegrams for receiving

The following table contains the structure of the telegrams with the process data for receiving the control words and setpoints (NCK->drive).

PZD receive word	Message frame 116	Message frame 118	Message frame 390	Message frame 391
PZD 1	STW1	STW1	STW1	STW1
PZD2	NSET_B	NSET_B	Digital outputs	Digital outputs
PZD 3				STW_PROBES
PZD 4	STW2	STW2		
PZD 5	M_RED	M_RED		
PZD 6	G1_STW	G2_STW		
PZD 7	G2_STW	G3_STW		
PZD 8	XERR	XERR		
PZD 9				
PZD 10	KPC	KPC		
PZD 11				

Table 18-2 Telegrams with the process data for receiving (NCK->drive)

18.2 Transfer telegrams

Telegrams for sending

The following table contains the structure of the telegrams with the process data for sending the status words and actual values (drive->NCK).

PZD sending word	Message frame 116	Message frame 118	Message frame 390	Message frame 391
PZD 1	ZSW1	ZSW1	ZSW1	ZSW1
PZD2	NACT_B	NACT_B	Digital inputs	Digital inputs
PZD 3				ZSW_PROBES
PZD 4	ZSW2	ZSW2		TIMESTAMP_PROBE _1N
PZD 5	MELDW	MELDW		TIMESTAMP_PROBE _1P
PZD 6	G1_ZSW	G2_ZSW		TIMESTAMP_PROBE _2N
PZD 7	G1_XIST1	G2_XIST1		TIMESTAMP_PROBE _2P
PZD 8				
PZD 9	G1_XACT2	G2_XACT2		
PZD 10				
PZD 11	G2_ZSW	G3_ZSW		
PZD 12	G2_XACT1	G3_XACT1		
PZD 13				
PZD 14	G2_XACT2	G3_XACT2		
PZD 15				
PZD 16	LOAD	LOAD		
PZD 17	TORQUE	TORQUE		
PZD 18	POWER	POWER		
PZD 19	CURR	CURR		

Table 18-3 Telegrams with the process data for sending (drive->NCK)

18.2.2 Process data for receiving and sending

Process data for receiving

The process data for the control words and setpoints are interconnected in the receive buffer.

Overview of control words and setpoints

The table below provides an overview of the process data that are interconnected as target at the receive buffer.

Literature

SINAMICS S120 Commissioning Manual

Abbreviation	Name
STW1	Control word 1
STW2	Control word 2
NSET_A	Speed setpoint A (16-bit)
NSET_B	Speed setpoint B (32-bit)
G1_STW	Encoder 1 control word
G2_STW	Encoder 2 control word
G3_STW	Encoder 3 control word
XERR	Positional deviation
KPC	Positon controller gain factor
M_RED	Torque reduction
A_CSW1	Control word for A_INF/B_INF (infeed)
STW_PROBES	Control word probes

Note

The drive signals are interconnected to the PZD automatically when a telegram type is allocated (parameter p922).

18.2 Transfer telegrams

Process data for sending

The process data for the control words and setpoints are interconnected in the send buffer.

Overview of status words and actual values

The table below provides an overview of the process data that are interconnected as source at the transmit buffer.

Literature

SINAMICS S120 Commissioning Manual

Abbreviation	Name
ZSW1	Status word 1
ZSW2	Status word 2
NACT_A	Speed setpoint A (16 bit)
NACT_B	Speed setpoint B (32 bit)
G1_ZSW	Encoder 1 status word
G1_XIST1	Encoder 1 actual position value 1
G1_XIST2	Encoder 1 actual position value 2
G2_ZSW	Encoder 2 status word
G2_XIST1	Encoder 2 actual position value 1
G2_XIST2	Encoder 2 actual position value 2
G3_ZSW	Encoder 3 status word
G3_XIST1	Encoder 3 actual position value 1
G3_XIST2	Encoder 3 actual position value 2
MELDW	Message word
A_ZSW1	Status word for A_INFEED
LOAD	Drive load
TORQUE	Drive torque setpoint
POWER	Drive efficiency
CURR	Drive actual current
ZWS_PROBES	Status word probe
TIMESTAMP_PROBE_1N	Time stamp probe 1 falling edge
TIMESTAMP_PROBE_1P	Time stamp probe 1 rising edge
TIMESTAMP_PROBE_2N	Time stamp probe 2 falling edge
TIMESTAMP_PROBE_2P	Time stamp probe 2 rising edge

18.3 Control- and status-word bits for NCK<->drive communication

18.3 Control- and status-word bits for NCK<->drive communication

18.3.1 NCK to drive

Introduction

The NCK transfers data to the drive using message frames via a PROFIBUS interface (internal PROFIBUS). Setpoints exist for speed control and torque and are preceded by a control word in the message frame.

PLC interface for STW1

Signal provided by NCK	VDI interface (PLC)	Remarks	Bit in STW1	Meaning
Axis controllable from NCK:	DB(AX).DBX2.1		0	OFF1
Servo enable	DB(AX).DBX1.5/6			
 Measuring system selected and OK 	DB(AX).DBX21.7			
Pulse enable				
•				
Always "1", "TRUE"	No signal		1	OFF2
Always "1", "TRUE"	No signal		2	OFF3
VDI signal pulse enable	DB(AX).DBX21.7		3	Enable inverter
RFGIS	DB(AX).DBX20.1		4	Ramp-function generator enable
RFGIS	DB(AX).DBX20.1		5	Ramp-function generator Start
		NCK controlled parallel to STW1 bit0	6	Setpoint enable
 (DriveReset) is generated by: "RESET signal" or CANCEL KEY, if a simultaneous drive fault is present (ZSW1.bit3 or ZSW1.bit6) 	No signal	Signal "OFF1" is automatically set to FALSE internally, simultaneously to "DriveReset" (user must NOT manipulate the servo enable separately!).	7	Reset fault memory
Selection of NC function generator (via PI service from HMI)	No signal	The user cannot influence the function generator selection via the VDI interface.	8	Activate function generator
Always "0", "FALSE"	No signal	Signal not used	9	Reserved
Is "1", "TRUE", if the NC can control the associated drive AND the drive itself requests that control (ZSW1.bit9)	No signal		10	Control from the PLC
Always "0", "FALSE"	No signal	Signal not used	11	Reserved

18.3 Control- and status-word bits for NCK<->drive communication

Signal provided by NCK	VDI interface (PLC)	Remarks	Bit in STW1	Meaning
"Release holding brake"	DB(AX).DBX20.5		12	Open holding brake
Always "1", "TRUE"	No signal	Signal is used as the identifier to shut down the drive's ramp-function generator (isochronous Profibus drive)	13	Ramp-up time zero for controller enable
Always "1", "FALSE"	No signal	Signal not used	14	Open-loop torque- controlled mode
Customer-specific signal	No signal for SINAMICS		15	Signal not used in conjunction with SINUMERIK, no PROFIDRIVE standard signal

18.3 Control- and status-word bits for NCK<->drive communication

PLC interface for STW2

Signal provided by NCK	VDI interface (PLC)	Remarks	Bit in STW2	Meaning
Drive-parameter-set switchover	DB(AX).DBX21.0	Bit A	0	Parameter-set switchover, bit0
	DB(AX).DBX21.1	Bit B	1	Parameter-set switchover, bit1
	DB(AX).DBX21.2	Bit C	2	Parameter-set switchover, bit2
1. Speed setpoint filter	DB(AX).DBX20.3	Not used for SINUMERIK or SINAMICS (ineffective)	3	1. Speed setpoint filter
Ramp-function generator disable	DB(AX).DBX20.4	Not used for SINUMERIK or SINAMICS (ineffective)	4	Ramp-function gen. inactive
Always "FALSE"		not used	5	Reserved
Integrator inhibit, speed controller	DB(AX).DBX21.6		6	Integrator inhibit, speed controller
Selection of "parking axis" by shutting down the encoder bit on the VDI interface	DB(AX).DBX1.5 = FALSE & DB(AX).DBX1.6 = FALSE		7	Selection of "parking axis"
Traversing to fixed endstop	No signal	Drive fault "speed controller at limit" deactivated	8	Suppress fault 608, "speed controller at limit"
Motor changeover/selection	DB(AX).DBX21.3	Bit A	9	Motor changeover, bit0
	DB(AX).DBX21.4	Bit B	10	Motor changeover, bit1
Motor selection in progress	DB(AX).DBX21.5		11	Motor selection in progress
Master sign-of-life	No signal		12	Master sign-of-life
			13	
			14	
			15	

18.3.2 Drive to NCK

Introduction

The drive transfers the data to the NCK using message frames via a PROFIBUS interface (internal PROFIBUS). Actual values exist for the speed control and torque and are preceded by a status word in the message frame.

18.3 Control- and status-word bits for NCK<->drive communication

PLC interface for ZSW1

Meaning	Bit in ZSW1	Remarks	VDI interface (PLC)	Signal processing in the NCK
Ready to start	0		No signal	
Ready-to-operate/no fault	1		No signal	
Status, controller enable	2	For a combination Bit2 from ZSW1 = 0 and simultaneously Bit11 from the MedW = 1, the drive is in autonomous drive status.	DB(AX).DBX92.4	
Fault active	3		No signal	Alarm 25201/25202, is used to activate error deletion on the NCK.
No OFF2 pending.	4		No signal	Not used
No OFF3 is active	5		No signal	Not used
Power-on inhibit	6		No signal	Used on the NCK to generate the "Acknowledge fault memory" signal.
Warning present	7		No signal	No evaluation
nset = nact	8		No signal	No evaluation
Control from the PLC	9	Signal is primarily set by the drive.	No signal	The NCK itself then sets the associated STW1.bit9, if the drive in the NC is known to be "operational" and "ready" (e.g., bus booted, etc.).
Comparison value reached	10		No signal	No evaluation
Reserved	11		No signal	No evaluation
Reserved	12		No signal	No evaluation
Function generator active	13		DB(AX).DBX61.0	Drive test "travel request"
Only used in "positioning mode": Open-loop torque- controlled mode	14	Irrelevant for SINUMERIK	No signal	No evaluation
Only used in "positioning mode": Spindle positioning ON	15	Irrelevant for SINUMERIK	No signal	No evaluation

18.3 Control- and status-word bits for NCK<->drive communication

PLC interface for ZSW21

Meaning	Bit in ZSW2 1	Remarks	VDI interface (PLC)	Signal processing in the NCK
Parameter set	0	Bit A	DB(AX).DBX93.0	active drive parameter set
	1	Bit B	DB(AX).DBX93.1	
	2	Bit C	DB(AX).DBX93.2	
1. speed-setpoint filter inactive	3	Signal from SINAMICS not operated	DB(AX).DBX92.3	As signal from SINAMICS not operated: Signal always "0", "FALSE"
Ramp-function gen. inactive	4		DB(AX).DBX92.1	Ramp-function-generator disable active
Holding brake open	5		DB(AX).DBX92.5	Holding brake open
Integrator inhibit, speed controller	6		DB(AX).DBX93.6	Speed controller integrator disabled
Status: Parking axis	7	Axis parked via SINAMICS	No signal	NCK cannot respond to the "axis parked" state => alarm 25000,
				An alarm is output if the drive parks even though parking was not requested.
Suppress "speed controller at limit" fault	8		No signal	
Motor data set	9	Bit A	DB(AX).DBX93.3	Active motor
	10	Bit B	DB(AX).DBX93.4	
Motor being changed over	11		No signal	
Slave sign-of-life	12		No signal Drive sign-of-life	Drive sign-of-life
	13			
	14]	
	15			

18.3 Control- and status-word bits for NCK<->drive communication

PLC interface for signalW

Meaning	Bit in signal W	Remarks	VDI interface (PLC)	Signal processing in the NCK
Ramp-up function completed	0		DB(AX).DBX94.2	Ramp-up function completed
M <mx< td=""><td>1</td><td></td><td>DB(AX).DBX94.3</td><td>M<mx< td=""></mx<></td></mx<>	1		DB(AX).DBX94.3	M <mx< td=""></mx<>
Nact <nmin< td=""><td>2</td><td></td><td>DB(AX).DBX94.4</td><td>Nact<nmin< td=""></nmin<></td></nmin<>	2		DB(AX).DBX94.4	Nact <nmin< td=""></nmin<>
Nact <nx< td=""><td>3</td><td></td><td>DB(AX).DBX94.5</td><td>Nact<nx< td=""></nx<></td></nx<>	3		DB(AX).DBX94.5	Nact <nx< td=""></nx<>
DC link overvoltage	4		DB(AX).DBX95.0	Signal not available for SINAMICS 120!
Variable signaling function	5		DB(AX).DBX94.7	Signal not available for SINAMICS 120!
Motor temperature pre- warning	6		DB(AX).DBX94.0	Motor temperature pre-warning
Heatsink-temperature prewarning	7		DB(AX).DBX94.1	Heatsink-temperature prewarning
Nsetp=Nact	8		DB(AX).DBX94.6	
Reserved	9		No signal	No evaluation
Power module current not limited	10		DB(AX).DBX95.7	Signal not available for SINAMICS 120!
Reserved	11	Speed controller active	DB(AX).DBX61.6& DB(AX).DBX61.7	
Reserved	12	Drive Ready	DB(AX).DBX93.5	
Pulses enabled	13	Only for SINAMICS S120 with message- frame types 101ff direct on VDI interface	DB(AX).DBX93.7	
Reserved	14	Only in conjunction with positioning mode, irrelevant for SINUMERIK	No signal	No evaluation
Reserved	15	Only in conjunction with positioning mode, irrelevant for SINUMERIK	No signal	No evaluation

18.4 PLC program

Introduction

The PLC program is constructed modularly. It comprises the two parts:

• PLC basic program

The PLC basic program organizes the exchange of signals and data between the PLC user program and the NCK, HMI, and machine control panel components. The PLC basic program is a part of the tool box delivered with the SINUMERIK 840D sl.

• PLC user program

The PLC user program is the user-specific part of the PLC program by which the basic PLC program has been added to or extended.

PLC basic program

For a complete description of the basic PLC program, its structure and all modules including their call parameters, please refer to:

Literature

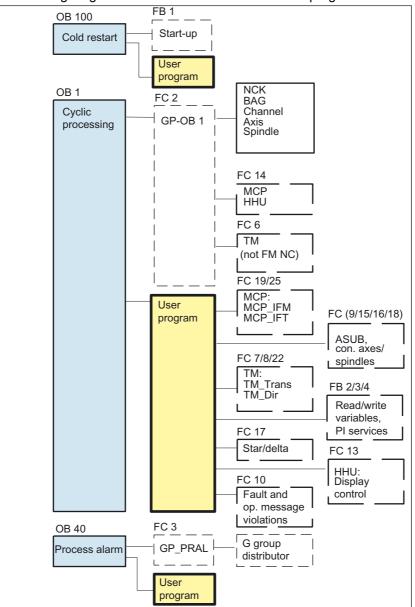
Function Manual Basic Functions; Basic PLC Program

PLC user program

The organization blocks of the basic machine contain the entry points for the appropriate parts of the PLC user program.

- OB100 (cold restart)
- OB1 (cyclic processing)
- OB40 (process alarm)

18.4 PLC program



The following diagram shows the structure of the PLC program:

Figure 18-4 PLC program structure

PLC status

The PLC always starts up in RESTART mode, i.e. the PLC operating system runs OB100 after initialization and starts cyclic operation at the beginning of OB1. There is no re-entry at the point of interruption (e.g. on power failure).

Start-up behavior of the PLC

There are both remanent and non-remanent areas for the markers, times and counter. The areas are continuous and are divided by a parameterizable limit, where the area with the higher-value address range is defined as the non-remanent area. Data blocks are always remanent.

Start-up mode COLD RESTART (OB 100)

If the remanent area has no battery backup (backup battery is empty) start-up is prevented. The following operations are performed during a cold restart:

- · UStack, BStack and non-retentive flags, timers and counters are deleted
- The process output image (POI) is deleted
- Process and diagnostics alarms are cancelled
- The system status list is updated
- Parameterization objects of modules (from SD100 onwards) are evaluated or default parameters are output to all modules in single-processor mode
- Execute cold restart (OB100)
- Read in process input image (PII)
- Cancel command ouptput inhibit (BASP)

Basic program, start-up part (FB1)

FB 1 (start-up block of the PLC program) must be assigned variables.

Parameter FB 1

A precise description of the variables and options for modifying their parameterization is given in:

Literature

Function Manual Basic Functions; Basic PLC Program

Cyclical mode (OB 1)

From a chronological viewpoint, the basic program runs ahead of the PLC user program. The complete processing of the NCKPLC interface is carried out in cyclic mode.

A cyclic monitoring function is activated between PLC and NCK once power-up and the first OB1 cycle have been completed. A PLC failure produces alarm "2000 Sign-of-life monitoring PLC".

See also

Creating a PLC program (Page 55)

18.4 PLC program

18.4.1 Fundamentals of creating a PLC user program

Introduction

The following points must be observed when creating a PLC user program:

- Software and hardware prerequisites
- Installing the toolbox (PLC basic program, slave OEM, GSD files)
- Editing the blocks in the PLC basic program

Software and hardware requirements

- SIMATIC STEP 7 as from Version 5.3, Service Pack 3
- SIMATIC STEP 7 is installed on the PG/PC

Installing the PLC basic program library

To be able to use the blocks of the basic PLC program (OBs, FBs, DBs, etc.) in a SIMATIC S7 project, the library must first be installed in the SIMATIC manager.

Editing the blocks in the PLC basic program

The individual blocks in the basic PLC program can be processed as follows in the SIMATIC manager:

- Select the appropriate block, e.g. OB 100 in the folder Blocks of the corresponding Module
- Use the "Edit" > "Open object" menu command to open the block or double-click the block with the left mouse button
- Edit the block using the LAD/STL/CSF editor. Switch over to the block display using the "View" > "LAD" or STL or CSF menu command

See also

Creating a PLC program (Page 55)

18.5 Machine and setting data

Introduction

Adaption of the control at the machine is carried out using the machine and setting data.

Parameter assignment

- Machine data
 - The machine data (MD) are divided into the following areas:
 - General machine data
 - Channel-specific machine data
 - Axis-specific machine data
 - Machine data for control unit
 - Machine data for infeed
 - Machine data for drives
- Setting data

The setting data (SD) are divided into the following areas:

- General setting data
- Channel-specific setting data
- Axis-specific setting data
- Option data

For enabling options. The option data are included in the scope of delivery.

18.5 Machine and setting data

Overview of machine and setting data

The table below lists the areas for machine and setting data. The List Manual contains a detailed description.

Range	Name		
from 1000 to 1799	Machine data for drives (\$MD)		
from 9000 to 9999	Machine data for operator panel front (\$MM)		
from 10000 to 18999	General machine data (\$MN)		
from 19000 to 19999	Reserved		
from 20000 to 28999	Channel-specific machine data (\$MC)		
from 29000 to 29999	Reserved		
from 30000 to 38999	Axis-specific machine data (\$MA)		
from 39000 to 39999	Reserved		
from 41000 to 41999	General setting data (\$SN)		
from 42000 to 42999	Channel-specific setting data (\$SC)		
from 43000 to 43999	Axis-specific setting data (\$SA)		
from 51000 to 61999	General machine data for compile cycles		
from 62000 to 62999	Channel-specific machine data for compile cycles		
from 63000 to 63999	Axis-specific machine data for compile cycles		

Table 18-4 Overview of machine and setting data

See also

Overview Commissioning NCK (Page 109)

Fundamentals 18.5 Machine and setting data

18.5.1 Machine data fundamentals

Introduction

Machine and setting data are parameterized via:

- Number and identifier
- Activation
- Protection levels
- Unit
- Default value
- Value range (minimum and maximum)

Number and identifier

Machine data and setting data are identified using the number or the name (identifier). The number and name are displayed at the HMI.

The identifier of a machine data is subject to the scheme:

• **\$ M k** _IdentifierString

where the following applies:

- \$System variable
- MMachine data
- **k**Component

k identifies the components of the NC parameterizing the appropriate machine data:

- NNC
- CChannel
- **A**Axis

The identifier of a setting data is subject to the scheme:

• **\$ S k** _ldentifierString

where the following applies:

- \$ System variable
- Setting data
- k Component

k identifies the components of the NC parameterizing the appropriate machine data:

- N NC
- CChannel
- AAxis

18.5 Machine and setting data

Activation

Activation when referring to a machine data indicates the NC status in which a change to a machine data becomes active.

The levels of effectiveness have been listed below in order of priority. Modification of the machine data takes effect after:

- POWER ON (po) NCK RESET
- NEWCONF (cf)
 - "Set MD to active" softkey on MMC
 - <RESET> key on the MSTT
 - It is possible to modify block limits during program operation
- RESET (re)
 - at end of program M2/M30 or
 - <RESET> key on the MSTT
- IMMEDIATE (so)
 - After entry of value

Note

Unlike machine data, changes to setting data always become effective immediately.

Protection levels

Access level 4 (keyswitch position 3) or more is required to display machine data.

To start up the system, the appropriate protection level must generally be enabled by entering the password "EVENING".

Unit

The unit refers to the standard setting of the machine data:

- MD10220 \$MN_SCALING_FACTOR_USER_DEF_MASK
- MD10230 \$MN_SCALING_FACTOR_USER_DEF
- MD10240 \$MN_SCALING_SYSTEM_IS_METRIC = 1.

If the machine data is not based on an engineering unit, then the field is marked with "-".

Default value

The machine data/setting data is preset to this value.

Note

Inputs via HMI are limited to ten digits plus comma and sign.

Value range (minimum and maximum)

Specifies the input limits. If no range of values is specified, the data type determines the input limits and the field is marked with "***".

18.5.2 Handling the machine data

Introduction

To display and input machine data, appropriate screen forms are provided.

Example

Selection of displays:

When you press the <Area switchover> key on the HMI, the menu bar appears with the following areas: "Machine", "Parameter", "Program", "Services", "Diagnostics" and "Commissioning". Press "Commissioning" > "Machine data".

Note

For the input of machine data, the protection level 2 password "EVENING" has to be set at the least.

Screen editor for HEX machine data

A bit editor has been implemented to simplify the matter of setting certain machine data bits. If the input cursor is on a machine data in HEX format in the MD list, you can call up the bit editor by pressing the <Toggle> key (in the middle of the cursor keys).

You can set or reset single bits by clicking on them with the mouse or by selecting them with the cursor keys and then pressing the <Toggle> key.

- With the "Ok" softkey, you can terminate the bit editor and accept the value set.
- With the "Abort" softkey, you can reject the bit editor and accept the value set. The
 previous setting is then valid again.

18.6 Protection levels

Introduction

Access to programs, data and functions is useroriented and controlled via eight hierarchical protection levels. These are divided into

- 4 password levels for Siemens, machine manufacturer, start-up personnel, and end user
- 4 key switch positions for end user

Protection levels

There are protection levels 0 to 7 (see table below), where

- 0 is the highest and
- 7 is the lowest level.

Table 18-5	Protection level concept
------------	--------------------------

Protection level	Locked by	Range
0	Password	Siemens
1	Password: SUNRISE (default)	Machine manufacturer
2	Password: EVENING (default)	Installation engineer, service
3	Password: CUSTOMER (default)	End user
4	Key switch position 3	Programmer, machine setter
5	Key switch position 2	Qualified operator
6	Key switch position 1	Trained operator
7	Key switch position 0	Semi-skilled operator

Interlock

Protection levels

- 0 to 3 are locked by means of a password and
- 4 to 7 by means of keyswitch positions (see table below).

Table 18-6 Keyswitch settings

Keyswitch setting	Retraction pos.	NC password level	User group
	0 or 1 or 2 or 3 Red key	4 (highest access level)	Programmer, machine setter
\bigcirc	0 or 1 or 2 Green key	5 (increasing access rights)	Qualified operator
	0 or 1 Black key	6 (increasing access rights)	Trained operator
$\boxed{\ }$	-	7 (lowest access level)	Semi-skilled operator

Protection levels for machine data

The machine data is assigned different protection levels by default.

Access level 4 (keyswitch position 3) or more is required to display machine data.

Note

To start up the system the appropriate access level must generally be enabled by entering the password "EVENING".

You can find additional change options of protection levels at:

Literature

Function Manual Basic Functions; Diverse Interface Signals

18.6 Protection levels

18.6.1 Protection level fundamentals

Introduction

You can influence the protection levels used with passwords via softkeys.

Press the "HMI" -> "Password" softkey in the "Startup" operating area. The following softkeys are available:

- Setting the password
- Change password
- Delete password

Set password

- 1. Press the softkey "Set password." The "Please enter password:" input window appears.
- 2. Enter one of the possible default passwords (see table "Protection levels concept") and confirm the entry with the softkey "OK." A permissible password is set and the valid access level is displayed. Invalid passwords will be rejected.

Change password

For secure access protection, you should change the default passwords

- 1. Press the "Change password" softkey. The current access level is displayed in the window that opens.
- 2. Mark the area for which you would like to assign the new password. You can select the following areas here:
 - System
 - Vendor
 - Service
 - User
- 3. Enter the new password in the input fields "New password" and "Repeat password."
- 4. Confirm the entry with the softkey "OK." Both entered passwords must match for the modified password to become valid.

Delete password

1. Press the softkey "Delete password" in order to reset the access authorization.

Access authorization is not automatically deleted at POWER ON!

NOTICE

For a system boot in which standard machine data is loaded, the passwords are set to the default values.

18.7 Axis data

18.7 Axis data

Introduction

The term "axis" is often used either as a single term in conjunction with SINUMERIK 840D sl or in compounded form, e.g. machine axis, channel axis, etc. To provide an overview of the philosophy used as the basis, here is a brief explanation of this term.

Definition

Generally, 4 types of axes are distinguished:

- 1. Machine axes
- 2. Channel axes
- 3. Geometry axes
- 4. Special axes

Machine axes

Machine axes are the motion units existing on a machine, which can also be designated as linear or rotary axes, depending on their usable movement.

Channel axes

The total of all machine, geometry and special axes assigned to a channel is designated as channel axes.

In this context, the geometry and special axes constitute the program-technological part of the machining process, i.e. they are used for programming in the parts program.

The machine axes constitute the physical part of the machining process, i.e. they carry out the programmed traversing movements on the machine.

Geometry axes

The geometry axes constitute the rectangular Cartesian basic coordinate system of a channel.

Generally, (Cartesian arrangement of the machine axes) direct imaging of the geometry axes to the machine axes is possible. If the arrangement of the machine axes, however, is not Cartesian at right angles, the imaging is performed using a kinematic transformation.

Special axes

Additional axes are all other channel axes that are not geometry axes. Unlike for geometry axes (Cartesian coordinate system), no geometric context is defined for additional axes, neither between additional axes or with respect to geometry axes.

Literature

Function Manual Basic Functions; Axes, Coordinate Systems, Frames, Workpiece numbers IWS: Axes

18.7.1 Axis configuration

Introduction

The figure below shows the assignment between the geometry axes, special axes, channel axes and machine axes as well as the names of the individual axis types. MD are used for assignment.

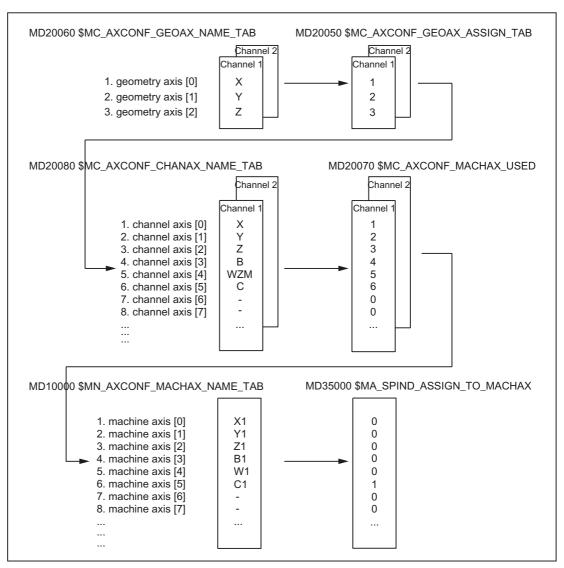


Figure 18-5 Axis configuration

18.7 Axis data

Note

Leading zeroes in user-defined axis identifiers are ignored. Example: MD10000 \$MN_AXCONF_MACHAX_NAME_TAB[0] = X01 corresponds to X1 The geometry axes must be assigned to the channel axes in ascending order leaving no gaps.

Special features

- Three geometry axes are assigned to the channel axes in the MD.
- All channel axes that are not assigned to the three geometry axes are special axes.
- The channel axes are assigned to machine axes.
- The spindles are also assigned to machine axes.

Channel axis gaps

Channel axes need not be defined contiguously in ascending order, in other words, not each channel axis needs to have a machine axis assigned to it (local or link axis). The assignment occurs as follows:

- MD20080 \$MC_AXCONF_CHANAX_NAME_TAB via:
- MD20070 \$MC_AXCONF_MACHAX_USED

Application:

Consistent, semidefined channel axes for various machine versions of a manufacturer's machine series.

Advantages:

- Uniform basic configuration of various machines
- Simple reconfiguration on removal of a machine
- Portability of programs

Fundamentals

18.7 Axis data

Reliability of channel axis gaps

Channel axis gaps must be disconnected via the machine data:

• MD11640 \$MN_ENABLE_CHAN_AX_GAP = 1 (channel axis gap allowed).

If this is not carried out, an entry of 0 in the machine data MD20070 \$MC_AXCONF_MACHAX_USED prevents other machine axes being assigned to channel axes.

Literature

Function Manual, Expanded Functions; Several Control Panels on Multiple NCUs, Decentralized Systems

Example

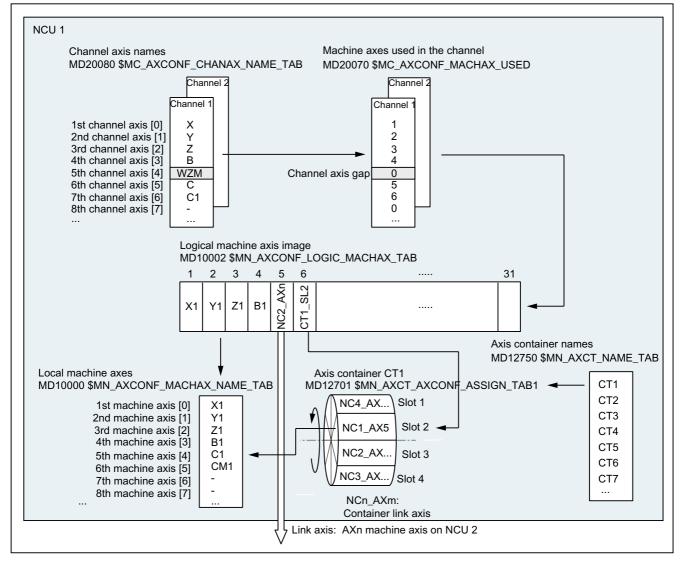


Figure 18-6 Axis configuration with channel axis gap

18.7 Axis data

Note

The gaps count as axes with reference to the number of channel axes and their indices.

If an attempt is made to define a channel axis gap on the geo axis via the machine data MD20050 \$MC_AXCONF_GEOAX_ASSIGN_TAB , the attempt is rejected without an alarm.

Using channel axes in MD24120ff. \$MC_TRAFO_GEOAX_ASSIGN_TAB1...8 and MD24110ff. \$MC_TRAFO_AXES_IN1...8, to which no machine axes are defined using MD20070 \$MC_AXCONF_MACHAX_USED (gap), triggers alarms 4346 or 4347.

18.7.2 Axis assignment

Introduction

The assignment of machine, channel and geometry axes is carried out using the relevant machine data.

Axis assignment

The following diagram illustrates the assignment of the relevant machine data:

- Machine axes of the NC
- Channel axes of the channel
- Geometry axes of the channel

Fundamentals

18.7 Axis data

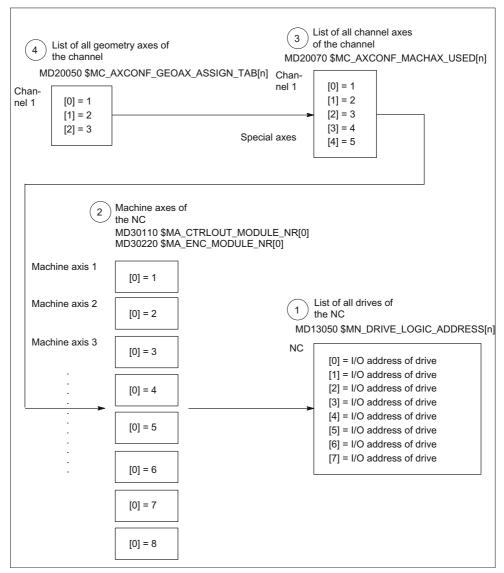


Figure 18-7 Axis assignment

- The I/O addresses of the drives defined in the S7 project using "HW Config" are contained in the following machine data.
 MD13050 \$MN_DRIVE_LOGIC_ADDRESS[n] (I/O address of the drive) The machine data index (n+1) is the logical drive number for the NC.
- (2) Te following machine data are used to assign each individual machine axis to a drive.

MD30110 \$MA_CTRLOUT_MODULE_NR[0] (setpoint assignment) MD30220 \$MA_ENC_MODULE_NR[0] (actual value assignment)

The logical drive number m to be entered in the two machine data refers to the entry with the index n=(m-1) in the list described under Point 1 MD13050 \$MN_DRIVE_LOGIC_ADDRESS[n].

18.7 Axis data

(3) Which channel axis uses which machine axis (explicite) and how many channel axes are present in the channel (implicite) is detemined through the following machine date:

MD20070 \$MC_AXCONF_MACHAX_USED[n] (machine axis number valid in channel)

The machine axis number m to be entered in the machine data (with m=1,2,3...) is referred to the appropriate machine axis m.

(4) Which channel axis uses which machine axis (explicitly) and how many channel axes can be implicitly available in a channel is defined by the following machine data:

MD20050 \$MC_AXCONF_GEOAX_ASSIGN_TAB[n] (assignment geometry axis - channel axis) (n = 0...2)

The channel axis number k to be entered in the machine data (k=1,2,3...) refers to the entry with the index n (n=(k-1)=0,1,2...) in the list of the channel axes MD20070 $MC_AXCONFIG_MACHAX_USED[n]$ (see Point 3)

Machine data

The following machine data are relevant for the axis configuration:

Number	Name of identifier	Name / remarks	
General (\$	General (\$MN)		
13050	DRIVE_LOGIC_ADDRESS	I/O address of drive	
Channelsp	ecific (\$MC)		
20050	AXCONF_GEOAX_ASSIGN_TAB	Assignment of geometry axis to channel axis	
20070	AXCONF_MACHAX_USED	Machine axis number valid in channel	
Axisspecifi	c (\$MA)		
30110	CTRLOUT_MODULE_NR	Setpoint assignment	
30220	ENC_MODULE_NR	Actual-value assignment	

Table 18-7 Axis configuration: Machine data

18.7.3 Axis names

Introduction

Each machine, channel and geometry axis can/must be assigned an individual name unambiguously identifying it in its name range.

Machine axes

The name of the machine axes are defined via the following machine date: MD10000 \$MN_AXCONF_MACHAX_NAME _TAB [n] (machine axis name)

Machine axis names must be unambiguous for the entire NC.

The names and the corresponding index defined in the machine date above is used for:

- Accessing axis-specific machine data (loading, saving, displaying)
- Reference point approach from the parts program G74
- Measuring
- Test point traversing from the parts program G75
- Traversing the machine axis from PLC
- Display of axis-specific alarms
- Display in the actual-value system (machine-related)
- DRF handwheel function

Channel axes

The name of the channel axes are defined via the following machine date:

MD20080 $MC_AXCONF_CHANAX_NAME_TAB[n]$ (name of the channel axis in the channel)

Channel axis names must be unambiguous for the entire channel.

18.7 Axis data

Geometry axes

The name of the geometry axes are defined via the following machine data:

MD20060 \$MC_AXCONF_GEOAX_NAME_TAB [n] (geometry axis in the channel)

Geometry axis names must be unambiguous for the entire channel.

The axis names for channel and geometry axes are used in the parts program for programming general traversing movements or to describe the workpiece contour. The axis names are used for

- Path axes
- Synchronized axes
- Positioning axes
- Command axes
- Spindles
- Gantry axes
- Coupled axes
- Guide value coupling axes

Machine data

The following machine data are relevant for the axis names:

Table 18-8 Axis names	s: Machine data
-----------------------	-----------------

Number	Identifier	Name/remarks	
General (\$	General (\$MN)		
10000	AXCONF_MACHAX_NAME_TAB	Machine axis name	
Channelsp	Channelspecific (\$MC)		
20060	AXCONF_GEOAX_NAME_TAB	Geometry axis name in channel	
20080	AXCONF_CHANAX_NAME_TAB	Channel axis name/special axis name in channel	

18.7.4 Setpoint/actual value channels

Introduction

The following points must be observed for setpoint/actual value channels:

Note

In order to guarantee that the control runs up reliably, all machine axes are declared as simulation axes (without hardware).

- MD30130 \$MA_CTRLOUT_TYPE (output type of setpoint value) = 0
- MD30240 \$MA_ENC_TYPE (actual value acquisition mode) = 0

Traversing of the axes in servo mode is simulated without speed setpoint output, and no hardware-specific alarms are output.

Machine data

MD30350 \$MA_SIMU_AX_VDI_OUTPUT (output of axis signals with simulation axes)

can be used to select whether the interface signals of a simulation axis are output at the PLC interface (e.g. during program test, if there is no drive hardware, used in FC18 in PLC).

Assignment of the setpoint/actual value channels

For each machine axis to which a drive is assigned, the following parameters must be set:

- a setpoint channel and
- at least one actual-value channel

A second actual-value channel can be set up as an option.

NOTICE

The motor measuring system is always used for the speed control function. Motor and motor measuring system must therefore always be connected to the same drive (SERVO).

Index m to the MD13050 \$MN_DRIVE_LOGC_ADRESS of the drive which represents the machine axis must be entered in the two axis-specific machine data:

- MD30110 \$MA_CTRLOUT_MODULE_NR[0] (setpoint assignment: logical drive number)
- MD30220 \$MA_ENC_MODUL_NR[n] (actual value assignment: logical drive number)

The entered value m refers to the drive whose I/O address is defined under the index n = (m-1) in MD13050 \$MN_DRIVE_LOGIC_ADDRESS[n] (see "Drive configuration" section).

18.7 Axis data

NCK Reset

Once the drive configuration and setpoint/actual value assignment have been parameterized, an NCK reset must be executed to initiate a warm restart of the NC. After the NC has powered up, the set configuration is effective.

Measuring system switchover

The following interface signals can be used to switch between the two position measuring systems of a machine axis from the PLC.

- DB31, ... DBX1.5 (position measuring system 1 selected)
- DB31, ... DBX1.6 (position measuring system 2 selected)

Literature

Function Manual Basic Functions; Diverse Interface Signals

Machine data

Table 18-9	Setpoint/actual value channels: Machine data
------------	--

Number	Name of identifier	Name/remarks	Reference
Axisspecific (\$MA)			
30110	CTRLOUT_MODULE_NR	Setpoint assignment: Logical drive number	
30130	CTRLOUT_TYPE	Output of setpoint value 0 = Simulation 1 = Output of speed setpoint	
30200	NUM_ENCS	Number of measuring channels 1 = One position measuring system present 2 = Two position measuring systems present	
30220	ENC_MODULE_NR[0]	Actual value assignment: Logical drive number for position measuring system 1	
30220	ENC_MODULE_NR[1]	Actual value assignment: Logical drive number for position measuring system 2	
30230	ENC_INPUT_NR[0]	Actual value assignment: Position measuring system 1 1 = G1_XIST encoder 1 actual position value 1 2 = G2_XIST encoder 1 actual position value 2	
30230	ENC_INPUT_NR[1]	Actual value assignment: Position measuring system 2 1 = G1_XIST encoder 2 actual position value 1 2 = G2_XIST encoder 2 actual position value 2	
30240	ENC_TYPE[0]	Type of actual value recording 0 = Simulation 1 = Incremental encoder 4 = Absolute encoder with EnDat interface	

Interface signals

Table 18-10 Switchover of position measuring system: Interface signals

DB number	Bit, byte	Name	Reference
Axis/spindle	ndle-specific Signals from PLC to axis/spindle		
31,	1.5	Position measuring system 1	
31,	1.6	Position measuring system 2	

Literature

Function Manual Basic Functions; Speeds, Setpoint/actual-value systems, Control: Setpoint/actual-value system

Function Manual Basic Functions; Diverse Interface Signals: Interface signals to axis/spindle 18.8 Spindle data

18.8 Spindle data

Introduction

The spindle mode of a machine axis is a subset of the general axis functionality. For this reason, the machine data required to start up an axis have also to be set for a spindle.

The machine data to parameterize a spindle are therefore to be found under the axis-specific machine data (from MD 35000 onwards).

Note

After the default machine data have been loaded, no spindle is defined.

Spindle definition

With the following machine data, a machine axis is declared to be an endlessly rotating rotary axis whose programming and display is carried out modulo 360 degrees.

- MD30300 \$MA_IS_ROT_AX (rotary axis/spindle)
- MD30310 \$MA_ROT_IS_MODULO (modulo conversion for rotary axis/spindle)
- MD30320 \$MA_DISPLAY_IS_MODULO (modulo 360 degrees display for rotary axis/spindle)

The machine axis is converted to a spindle by defining the spindle number x (with x = 1, 2, ...max. number of channel axes) in machine data

MD35000 \$MA_SPIND_ASSIGN_TO_MACHAX (spindle number)

The spindle number must be unique within the channel axes of the channel to which the spindle is assigned.

18.8.1 Spindle modes

Spindle modes

The spindle can have the following modes:

- Control mode
- Oscillation mode
- Positioning mode
- Synchronous mode, synchronous spindle

References:

Function Manual, Extension Functions, Synchronous Spindle (S3)

• Rigid tapping

References:

Programming Manual, Fundamentals; Chapter: Motion commands

Axis mode

The spindle can be switched from spindle mode to axis mode (rotary axis) if the same motor is used for spindle and axis operation.

18.8 Spindle data

18.8.2 Initial spindle state

Initial spindle state

The following machine data is used to specify a spindle mode as initial state: MD35020 \$MA_SPIND_DEFAULT_MODE

Value	Initial spindle state
0	Speed control mode, position control deselected
1	Speed control mode, position control activated
2	Positioning mode
3	Axis mode

Time when the initial spindle state takes effect

The time when the initial spindle state takes effect is set in the machine data:

MD35030 \$MA_SPIND_DEFAULT_ACT_MASK

Value	Effective time
0	POWER ON
1	POWER ON and program start
2	POWER ON and RESET (M2 / M30)

18.8.3 General functionality

Why axis mode?

For certain machining tasks (e.g. on lathes with end-face machining), the spindle not only has to be rotated with M3, M4 and M5 and positioned with SPOS, M19 and SPOSA, but also addressed as an axis with its axis identifier (e.g. "C").

Prerequisites

- The same spindle motor is used for spindle mode and axis mode.
- The same position measurement system or separate position measurement systems can be used for spindle mode and axis mode.
- A position actual-value encoder is a mandatory requirement for axis mode.
- If the axis is not synchronized, e.g. M70 is programmed after POWER ON, the axis must first be referenced with G74. Only then does the mechanical position match the programmed one.

Example:

```
M70
G74 C1=0 Z100
G0 C180 X50
```

Configurable M function

The M function used to switch the spindle to axis mode can be configured in the machine data:

MD20094 \$MC_SPIND_RIGID_TAPPING_M_NR

The value on delivery is 70.

Note

From software version 2.6, the control system detects the transition to axis mode automatically from the program sequence (see ""). Therefore, there is no need at all for the explicit programming in the part program of the configured M function for switching the spindle to axis mode (default: M70). However, the M function can continue to be programmed, e.g. to increase the readability of the part program.

Fundamentals

18.8 Spindle data

Functionality

If the axis mode is active and the rotary axis homed, all axis functions can be used. The most important functions are:

- Programming with axis name
- Use of zero offsets (G54, G55, TRANS, etc.)
- G90, G91, IC, AC, DC, ACP, ACN
- Use of kinematic transformations (e.g. TRANSMIT)
- Interpolation with other axes (path interpolation)
- Programming as a positioning axis

References:

Function Manual, Extension Functions; Rotary Axes (R2)

Special points to be noted

- The feed override switch is active.
- NC/PLC IS: DB21, ... DBX7.7 (Reset) does not terminate axis mode as standard.
- The NC/PLC interface signals: DB31, ... DBB16 to DBB19 and DBB82 to DBB91 are not important if: DB31, ... DBX60.0 (axis / no spindle) = 0
- Axis mode can be activated in all gear steps.

If the position actual value encoder is installed on the motor (indirect measuring system), the positioning and contouring accuracy can vary for the different gear steps.

- The gear step cannot be changed when the axis mode is active. The spindle must be switched to control mode. This is done with M41 ... M45 or M5, SPCOF.
- In axis mode, the machine data from the servo parameter set with index zero are effective in order to carry out adaptations in this mode.

Servo parameter set

The relevant machine data from the servo parameter set are:

Machine data	Meaning
MD31050 \$MA_DRIVE_AX_RATIO_DENOM	Measuring gear denominator
MD31060 \$MA_DRIVE_AX_RATIO_NUMERA	Numerator load gearbox
MD32200 \$MA_POSCTRL_GAIN	K _V factor
MD32452 \$MA_BACKLASH_FACTOR	Weighting factor for backlash
MD32610 \$MA_VELO_FFW_WEIGHT	Weighting factor for feedforward control
MD32800 \$MA_EQUIV_CURRCTRL_TIME	Equivalent time constant current control loop for feedforward control
MD32810 \$MA_EQUIV_SPEEDCTRL_TIME	Equivalent time constant speed control loop for feedforward control
MD32910 \$MA_DYN_MATCH_TIME	Time constant for dynamic matching
MD36012 \$MA_STOP_LIMIT_FACTOR	Factor for exact stop coarse/fine and zero speed control
MD36200 \$MA_AX_VELO_LIMIT	Velocity monitoring threshold value

Other notes on the servo parameter set:

References:

Function Manual, Basic Functions; Velocities, Setpoint/Actual-Value System, Closed-Loop Control (G2)

Dynamic response

The dynamic limits of the axis stored in the machine data are applicable in axis operation.

The axis switches to the current feedforward control mode as designated by the MD and the commands FFWON and FFWOF.

```
Fundamentals
```

18.8 Spindle data

Use of resolution changes

When using resolution changes in (analog) drive actuators, the following NC program steps are required:

1. Changeover to axis mode

Programming	Comment
SPOS=	
м5	; Controller enable off (by PLC) \rightarrow is output on PLC
м70	; Switch actuator (by PLC on account of M70) Controller enable on (by PLC)
C=	; NC traverses with axis parameter set

2. Switch back to spindle mode

Programming	Comment
C=	
М71	; \rightarrow Output to PLC
	Closed-loop controller enable off (by PLC)
	Switch actuator (by PLC)
	Switched to spindle parameter set (1-5) internally in the NC, controller enable on (by PLC)
M3/4/5 or SPOS=	; NC traverses with spindle parameter set

Change to spindle mode

The interpolation parameter (set 1 ... 5) is selected according to the currently valid gear step.

The feedforward control function is always activated, except for tapping with compensating chuck. Machine data:

MD32620 \$MA_FFW_MODE (feedforward control type) must always be not equal to 0.

Feedforward control should always be operated with the value 100% to avoid alarms being output during positioning.

Fundamentals

18.8 Spindle data

Parameter set	Axis mode	Spindle mode	
0	Valid		
1		Valid	
2		Valid	
3		Valid	Depending on gear step
4		Valid	
5		Valid	

Figure 18-8 Validity of parameter sets for axis and spindle modes

Master spindle

In order to use diverse spindle functions in one channel, like for instance

- Revolutional feed (G95)
- Tapping with compensation chuck (G63)
- Thread cutting (G33)
- Dwell time in spindle revolutions (G4 S...)

it is necessary to define a master spindle in each channel:

• MD20090 \$MC_SPIND_DEF_MASTER_SPIND (master spindle initial setting in channel)

The spindle number of the channel spindle which is to be the master spindle defined in machine data MD35000 \$MC_SPIND_ASSIGN_TO_MACHAX (spindle number) is entered in this machine data.

Spindle reset

The following machine data defines whether the spindle is to remain active after reset (IS: DB21,... DBX7.7) or end of program (M02/M30).

MD 35040 \$MC_SPIND_ACTIVE_AFTER_RESET (spindle active after reset)

To cancel spindle movements, an independent spindle reset is required:

• IS: DB31,... DBX2.2 (spindle reset)

Literature

Function Manual Basic Functions; Spindles

Fundamentals

18.8 Spindle data

A

Appendix

A.1 Abbreviations

ACX	Compressed format from XML
ALM	Active Line Module
AS	Automation System
Command output disable	Command output disable
BERO	Proximity limit switch
BI	Binector input
BICO	Binector connector
во	Binector output
CF	CompactFlash
CI	Connector input
CNC	Computerized Numerical Control Computerized numerical control
CO	Connector output
CoL	Certificate of License
СР	Communications Processor: Communication processor
CPU	Central Processing Unit Central processing unit
CU	Control unit
DHCP	Dynamic Host Configuration Protocol: Protocol for automatic assignment of IP addresses from a DHCP server to a client computer
DIP	Dual In–Line Package: dual in-line arrangement
DO	Drive objects: Drive object
DP	Distributed I/O
DRAM	Dynamic Random Access Memory
DRF	Differential resolver function: differential-synchro transmitter function
DRIVE-CLiQ	Drive Component Link with IQ
DSC	Dynamic servo control
DWORD	Doubleword
ESD	Electrostatic Sensitive Device
EQN	Designation for an absolute encoder with 2048 sine signals per revolution
EMC	Electro-Magnetic Compatibility
EN	European standard
GC	Global Control
GSD	Device master file
GUD	Global User Data
НМІ	Human Machine Interface: SINUMERIK operator interface for operating, programming, and simulation
IBN	Start up
IPO	Interpolator cycle

Appendix

A.1 Abbreviations

JOG	JOG mode: manual mode for setting up the machine
LAN	Local Area Network
LED	Light Emitting Diode: light-emitting-diode display
LR	Position controller
LUD	Local User Data
MAC	Media Access Control
MCIS	Motion Control Information System
MCP	Machine Control Panel
MD	Machine data
MSGW	Message word
MLFB	Machine-readable product designation
MM	Motor module
MCP	Machine control panel
NC	NCK
NCK	Numerical Control Kernel: NC kernel with block preparation, travel range, etc.
NCU	Numerical Control Unit: NCK hardware unit
IS	Interface signal
NX	Numerical Extension (axis extension module)
OB	Organization block
OLP	Optical Link Plug Optical link plug
PIO	Process output image
PII	Process input image
PCU	PC Unit: computer unit
PELV	Protective Extra-Low Voltage
PG	Programming device
PLC	Programmable Logic Control: programmable logic control (component of the CNC controller)
PUD	Global Program User Data
PD	Process date
RAM	Random Access Memory: Random Access Memory (can be read and written)
RDY	Ready
REF	Reference point
RES	Reset
RTCP	Real Time Control Protocol
SD	Setting Data
SH	Safe standstill
SIM	Single Inline Module
SBC	Safe brake activation
SLM	Solution Line Module
SMC	Sensor Module Cabinet-Mounted
SME	Sensor Module Externally Mounted
SMI	Sensor Module Integrated
SRAM	Static RAM: static RAM (battery-backed)
STW	Control word

Appendix A.1 Abbreviations

GWPS	Grinding wheel peripheral speed
TCU	Thin Client Unit (communication with operator panels)
USB	Universal Serial Bus
VDE	Association of Electrical Engineering, Electronics and Information Technology
VO	Voltage output
STW	Status Word

A.2 Feedback on the documentation

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

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Appendix

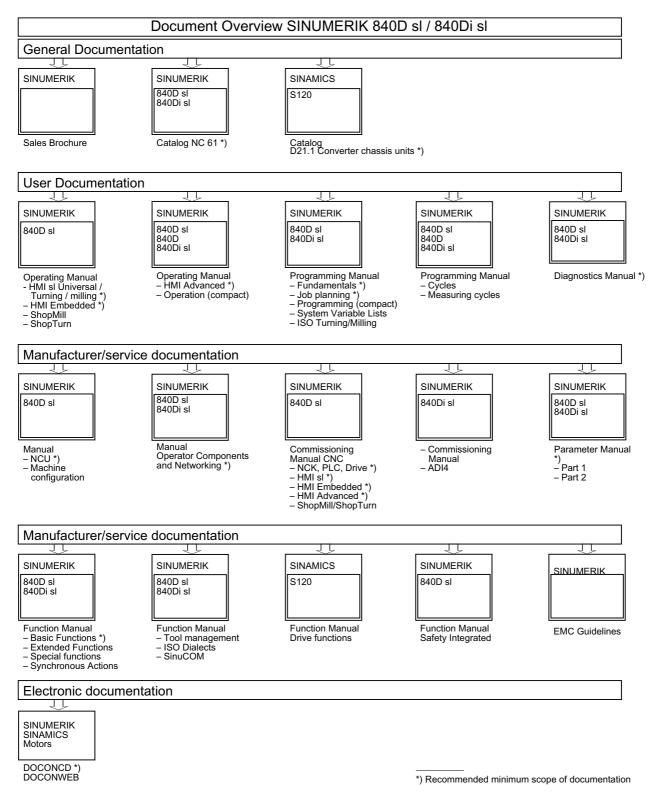
A.2 Feedback on the documentation

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Suggestions and/or corrections

A.3 Overview

A.3 Overview



Glossary

Active Line Module

Controlled, self-commutating feed/feedback unit (with -"IGBT"s in feed/feedback direction), which supplies the DC link voltage for the -> "Motor module".

CompactFlash card

Memory card for non-volatile storage of the drive software and corresponding -> "Parameters". The memory card can be plugged into the -> "Control Unit" from outside.

Control unit

Central control module in which the closed-loop and open-loop control functions for one or more -> "SINAMICS" -> "Line Module"s and/or -> "Motor Module"s are implemented. There are three types of Control Unit:

- SINAMICS Control Units, e.g. -> "CU320"
- SIMOTION Control Units, e.g. -> "D425" and -> "D435"
- SINUMERIK solution line Control Units, e.g. NCU710, NCU720 and NCU730

Control Word

Bit-coded -"Process data" word, transmitted by -> "PROFIdrive" at cyclic intervals to control the drive states.

Double Motor Module

Two motors can be connected to and operated with a Double Motor Module. See -> "Motor Module" -> "Single Motor Module" Former term: -> "Double-axis module"

Drive

The drive includes the motor (electric or hydraulic), the actuator (converter, valve), the control unit, measuring system, and supply components (line infeed module, pressure reservoir).

For electric drives, a distinction is made between a converter system and an inverter system. With a converter system (e.g. -> "MICROMASTER 4"), from the point of view of the user the line infeed, actuator, and control component form a single device; with an inventor system (e.g. -> "SINAMICS S"), the supply is ensured by means of -> "Line Module", thereby realizing a DC line to which the -> "Invertors" (-> "Motor Module"s) are connected. The (-> "Control unit") is implemented as a separate device and connected to the other components by means of -> "DRIVE-CLiQ".

Drive component

Hardware component connected to a -> "Control Unit" via -> "DRIVE-CLiQ", for example. Drive unit are for instance: -> "Motor Module"s, -> "Line Module"s, -> "Motor"s, -> "Sensor Module"s and -> "Terminal Module"s. The overall layout of a Control Unit together with the connected drive components is called -

> "Drive unit".

Drive group

A drive group comprises a -> "Control Unit" and the and the -> "Motor Module"s and -> "Line Module"s connected via -> "DRIVE-CLiQ".

Drive object

A drive object is an autonomous, individual software function with its own -> "Parameters" and may also have its own -> "Fault"s and -> "Alarm"s. Drive objects may exist by default (e.g. On Board I/O) can be created individually (e.g. -> "Terminal Board" 30, TB30) or also as multiples (e.g. -> "Servo Control"). As a rule, each drive object has its own window for parameterization and diagnostic purposes.

drive parameters

Parameters of a drive axis that include, for example, the parameters of the corresponding controllers, as well as the motor and encoder data. The parameters of the higher-level technology functions (positioning, ramp-function generator), however, are called -> "Application Parameters". See -> "Basic Unit System".

Drive system

The drive system includes all the components in a product family (e.g. SINAMICS). A drive system comprises, for example, -The drive system includes all the components in a product family (e.g. SINAMICS). A drive system comprises, for example, SINAMICS. A drive system comprises -> "Line Module"s, -> "Motor Module"s, -> "Sensors", -> "Motors", -> "Terminal Module"s and -> "Sensor Module"s as well as additional components (reactors, filters, cables, etc.). See -> "Drive unit"

Drive unit

The drive unit includes all the components connected via -> "DRIVE-CLiQ" that are required for carrying out a drive task: -> "Motor Module" -> "Control Unit" -> "Line Module" and the required -> "Firmware" and -> "Motor"s, but not additional components, such as filters or reactors. Several -> "Drive"s can be implemented in a drive unit. See -> "Drive System".

DRIVE-CLiQ

Abbreviation of "Drive Component Link with IQ". Communication system for connecting the different components of a SINAMICS drive system (e.g. -> "Control Unit", -> "Line Module"s, -> "Motor Module"s, -> "Motor"s, and speed/position sensors. The DRIVE-CLiQ hardware is based on the Industrial Ethernet standard with twisted-pair

lines. The DRIVE-CLiQ line provides the transmit and receive signals, as well as the +24 V power supply.

DRIVE-CLiQ Hub Module Cabinet

The DRIVE-CLiQ Hub Module Cabinet (DMC) is a star coupler for multiplying -> "DRIVE-CLiQ sockets. The DMC can be clipped onto a rail. The DMC20 is available, for example:

See -> "Hub"

Encoders

An encoder is a measuring system that captures actual values for the speed and/or angular/position values and makes them available for electronic processing. Depending on the mechanical construction, encoders can be integrated in the -> "Motor" (-> "Motor Sensor") or mounted on the external mechanics (- "External Sensor"). Depending on the type of movement, a distinction is made between rotary sensors ("rotary transducers") and translatory sensors (e.g. - Linear Sensors). In terms of measured value provision, a distinction is made between -> "Absolute Sensor"s (code sensors) and -> "Incremental Sensors"s.

See -> "Incremental Sensor TTL/HTL" -> "Incremental Sensor sin/cos 1 Vpp" -> "Resolver".

External Encoder

Position encoder that is not built in or mounted on the -> "Motor", but fitted instead via a mechanical transmission element or mechanical intermediate element. The external encoder (see -> "Externally-Mounted Sensor") is used for -> "Direct Position Detection".

Hub

Central connection device in a network with star-shaped topology. A hub distributes incoming data packages to all connected end devices.

See -> "DRIVE-CLiQ Hub Module Cabinet" (DMCxx)

Line Module

A Line Module is a power component that generates the DC link voltage for one or more – > "Motor Module"s from a 3-phase mains voltage. In SINAMICS, the following three types of Line Module are available: -> "Basic Line Module", -> "Smart Line Module" -> "Active Line Module". The overall function of an infeed, including the required additional components like -> "Line Reactor", proportional computing power in a -> "Control Unit", switching devices, etc., is called -> "Basic Infeed", -> "Smart Infeed", and -> "Active Infeed".

Motor

For the electric motors that can be driven by -> "SINAMICS", a basic distinction is made between rotary and linear motors with regard to their direction of motion, and between synchronous and induction motors with regard to their electromagnetic operating principle. In SINAMICS, the motors are connected to a -> "Motor Module". See -> "Synchronous Motor" -> "Induction Motor" -> "Built-In Motor" -> "Motor Encoder" -

> "External Encoder" -> "Third-Party Motor".

Motor Encoder

A -> "Sensor" (e.g. -> "Resolver", -> "Incremental Sensor TTL/HTL", or -> "Incremental Sensor sin/cos 1 Vpp" that is integrated in or attached to the motor. The sensor detects the motor speed. In the case of synchronous motors, it can also detect the rotor position angle (of the commutation angle for the motor currents). For drives without an additional -> "Direct Position Measuring System", it is also used as a -> "Position Sensor" for position control. In addition to the motor encoders, -> "External Sensor"s for -> "Direct Position Sensing" are available.

Motor Module

A Motor Module is a power component (DC-AC inventor) that supplies the power for the connected motor(s).

Power is supplied through the -> "DC Link" of the -> "Drive Unit".

A Motor Module must be connected to a -> "Control Unit" via -> "DRIVE-CLiQ". The openloop and closed-loop control functions for the Motor Module are stored in the Control Unit. -> "Single Motor Module"s and -> "Double Motor Module"s are available.

Option Slot

Slot for an optional module (e.g. in the -> "Control Unit").

Parameters

Variable quantity within the drive system that the user can read and, in some cases, write. For -> "SINAMICS", all specifications defined in the -> "PROFIdrive" profile are defined by a parameter. See -> "Visualization Parameters" and -> "Adjustable Parameters".

PROFIBUS

Field bus to IEC 61158, Sections 2 to 6. The abbreviation "DP" is no longer included because PROFIBUS FMS is not standardized and PROFIBUS PA (for Process Automation) is now part of the "general" -> "PROFIBUS".

Sensor Module

Hardware module for evaluating speed/position encoder signals and providing detected actual values as numerical values at a -> DRIVE CLiQ Socket".

- Three mechanical Sensor Module variants are available:
- SMCxx = Sensor Module Cabinet-Mounted
- SME = Sensor Module Externally Mounted (with a high degree of protection)

Servo Control

For -> "Motor"s equipped with a -> "Motor Encoder", this control type allows operation with a high level of -> "Accuracy" and -> "Dynamic Response". In addition to speed control, position control can also be implemented.

Servo Drive

An electric servo drive comprises a motor, a -> "Motor Module", a -> "Servo Control" and, in most cases, a speed and position -> "Sensor"

Electric servo drives are normally extremely precise and have a high dynamic response. They are designed for cycle times to less than 100 ms, and often have a short-time overload capacity, which enables quick acceleration. Servo drives are available as rotary and linear drives and are used for machine tools, handling robots, and packaging machines.

SITOP Power

Components for -> "Electronics Power Supply". Example: 24 V DC

Smart Line Module

Unregulated line infeed/feedback unit with a diode bridge for the infeed and stall-protected, line-commutated feedback via -> "IGBT"s. The Smart Line Module supplies the DC link voltage for the -> "Motor Module"s.

Status Word

Bit-coded -> "Process data" word, transmitted by -> "PROFIdrive" at cyclic intervals to control the drive states.

Supply

Input component of a converter system for generating a DC link voltage to supply one or more -> "Motor module"s, including all the required components (e.g. -> "Line module"s, fuses, reactors, line filters, and firmware, as well as proportional computing power (if required) in a -> "Control unit".

Vector Control

Vector control (field-oriented control) is a high-performance control type for induction machines. It is based on an exact model calculation of the motor and two current components that simulate and accurately control the flux and torque by means of software algorithms, thereby enabling predefined speeds and torques to be observed and limited accurately and with a good dynamic response.

Two vector control types exist:

Frequency control (-> "Sensorless Vector Control") and speed-torque control with speed feedback (-> "Sensor").

Index

8

840Di sl, 311

Α

Absolute encoders, 173 Calibration of multiple axes, 175 Operator-assisted calibration, 174 Recalibration, 175 Absolute measuring systems Parameterization, 138 Acceleration, 150 Checking, 150 Actual value inversion, 141 Assign axis, 106 Assigning actual-value channels, 375 Assigning setpoint channels, 375 Assignment General and axis-specific machine data, 104 Automatic servo optimization, 224 Axis selection, 224 Controller data overview, 224 Measurement, 224 Options, 224 Park position, 224 Reconfigure measurement, 224 Strategy selection, 224 Automation License Manager, 313, 322 Axis Monitoring functions, 158 Parameter sets, 132 Reference point approach, 166 Velocity matching, 155 Axis configuration, 367 Axis selection, 224

В

BICO connections on the HMI, 340 Brake behavior OFF3, 222

С

CF card, 311, 315

Changing the password, 364 Changing topology, 243 Channel axes, 366 Circularity test, 198 Clamping tolerance, 159 CoL, 311, 315 Cold restart, 376 Communication parameters, 324 CompactFlash card, 315 Computational resolution, 110 Contour monitoring, 163 Control direction, 147 Control image (offline), 333 Control system (online), 322, 328, 333 Switchover, 326, 328 Controller data overview, 224 Current control loop Measurement, 202 Customer login, 314 Cycle times, 122

D

Data backup DRIVE-CLiQ motors, 232 DB 31, ... DBB16-19, 382 DBB82-91, 382 DBX60.0, 382 DB21, ... DBX7.7, 382 Deleting the password, 365 Detailed view, 45 Direct access, 314 Display resolution, 110, 111 Distancecoded reference marks, 170 Download to target system, 334 drift compensation, 154 Drive components, 337 Drive object, 337 Drive states, 268 DSC, 140 Dynamic monitoring functions, 161 Velocity monitoring, 162 Dynamic servo control, 140

Ε

Encoder Monitoring Cut-off frequency, 164 Cyclic monitoring of position tolerance, 165 Position tolerance when switching over the encoder, 165 Zero mark monitoring, 164 Encoder types Absolute measuring system, 138 Endlessly rotating rotary axis, 142 EQN 1325, 138 Ethernet connection, 313 Exact stop Coarse, 158 Fine, 158 external HMI, 15, 17

F

Factory settings, 68 Firmware version drive components, 273 Firmware version measuring systems, 273 Function Overview, 321

G

GEAR_STEP_PC_MAX_VELO_LIMIT, 179 Geometry axes, 366

Η

Hardware, 311 Hardware limit switches, 160 Hardware reference, 316 Hardware serial number, 311, 315 Hirth axes, 145 HMI Advanced, 17, 315, 324 HMI basic software, 322, 324 HMI Embedded, 16 HW-Config, 45

I

Identification of the ALM, 275 Incremental measuring systems Parameter ization, 134 Indexing axes, 145 Indexing position tables, 145 Input limits, 111 Input resolution, 110 Inputs/outputs, 298 Installed components, 322 Interface signals, 41 Interlock, 363 internal HMI, 15 Internal HMI, 16 Internet, 333 Internet connection, 329 Interpolation cycle, 124 Intranet, 329 Intranet connection, 313 IP address, 325

J

JOG axis velocity, 155

Κ

Key *, 327 F5, 327 KV factor Definition, 148

L

License, 311 License database, 313, 314 License information, 315, 328 License key, 312 License Key, 316 copying, 316 SINUMERIK, 316 License number, 311 License requirement, 328 Linear axis With linear scale, 136 With rotary encoder on motor, 134 With rotary encoder on the machine, 135 Linear measuring system, 136

Μ

M70, 381 Machine axes, 366 Machine data Changing scaling, 117 Loading of default data, 118 Normalization of physical quantities, 113 Manufacturer-specific telegrams, 342

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Max. axis velocity, 155 MCI board, 311 MD10000, 368 MD10002, 368 MD10050 \$MN_SYSCLOCK_CYCLE_TIME, 126 MD1061 \$MD_POSCTRL_CYCLE_TIME, 126 MD1070 \$MD_IPO_SYSCLOCK_TIME_RATIO, 126 MD1071 \$MD_IPO_CYCLE_TIME, 126 MD11640, 369 MD20050, 370 MD20070, 368, 369, 370 MD20080, 368 MD20094, 381 MD24110, 370 MD24120, 370 MD31050, 383 MD31060, 383 MD32200, 383 MD32452, 383 MD32610, 383 MD32620, 384 MD32800, 383 MD32810. 383 MD32910, 383 MD35020, 380 MD35030, 380 MD36012, 383 MD36200, 383 Measurement of autom. servo optimization, 224 Measurement of speed control loop, 204 Measuring functions, 198, 199 Cancel, 201 Start. 200 Measuring system switchover Interface signals, 376 Menu command Connect to target system, 323 Download to target system, 334 Edit, 323 PlugIn SINUMERIK, 323 Refresh, 327 Upload from target system, 330 View, 327 MMC.INI, 324 Modular machine, 243 Modulo axis, 142 Modulo display, 142 My Computer, 327

Ν

NC utilization, 126

0

Option, 312 Options for autom. servo optimization, 224 Overview of functions, 321

Ρ

Parameter sets of the position controller, 132 Park position, 224 Peer-to-Peer, 313 Position control loop Measurement, 207 Overshoots, 150 Reference frequency response, 209 Setpoint step change, 210 Step height, 211, 212 Position controller cycle, 122 Positioning accuracy of the control system, 121 Positioning axes, 144 Process data Actual values: G1 XACT1, 346 Actual values: G1 XACT2, 346 Actual values: G2 XACT1, 346 Actual values: G2_XACT2, 346 Actual values: G3_XACT1, 346 Actual values: G3_XACT2, 346 Actual values: NACT_A, 346 Actual values: NACT_B, 346 Control words: A STW1, 345 Control words: STW1, 345 Control words: STW2, 345 Control words:G1 STW, 345 Control words:G2 STW, 345 Control words:G3_STW, 345 Setpoints: NSET A, 345 Setpoints: NSET B, 345 Setpoints: TRQRED, 345 Setpoints: KPC, 345 Setpoints:XERR, 345 Status words: A ZSW1, 346 Status words: G1_ZSW, 346 Status words: G2_ZSW, 346 Status words: G3 ZSW, 346 Status words: MELDW, 346 Status words: ZSW1, 346 Status words: ZSW2, 346 Process data for receiving, 345 Process data for sending, 346 Product, 312 Protection levels, 362 for machine data, 363 Influence via softkeys, 364

PTP link, 313, 329 Pulse multiplication factor, 180

R

Ramp-up time, 323 Rapid traverse in the JOG mode, 155 Reference point approach, 166 Resolutions, 110 Rotary axes Drive Optimization, 142 Rotary axis With rotary encoder on motor, 135 With rotary encoder on the machine, 136 Rotary measuring system, 134

S

safe operation, 21 Safety Integrated, 13 Section, 324 Servo gain, 148 Checking, 149 Servo trace, 198 Setting data Normalization of physical quantities, 113 Setting the axis-specific setpoint parameters, 375 Setting the axis-specific setpoint/actual value parameters, 375 Setting the password, 364 Signal distortion, 163 SIMATIC, 322 SIMATIC Manager, 39 start, 39 SIMATIC S7 project, 41 SinuCom Update Agent, 232 SINUMERIK 840Di sl, 311 SINUMERIK plug-in, 322, 324 enable/disable, 323 Software limit switches, 160 Software product, 311 Speed adjustment, 222 Speed setpoint matching, 152 Speed setpoint monitoring, 161 spindle modes, 379 Spindle Encoder matching, 180 Gear stages, 179, 182 Measuring systems, 180 Monitoring functions, 189 Parameter sets, 132, 179

Positioning, 185 Setpoint matching, 183 setpoint/actual value channels, 178 Synchronization, 187 Velocities, 182 Spindle data, 192 Standard telegrams, 342 Static monitoring functions, 158 Strategy selection, 224 Switching over the measuring system, 119 System basic cycle, 122 System data, 110 System requirements, 322 System resources, 126 System software SINAMICS S120, 272

Т

TCP/IP. 313 Telegram assignment, 303 Telegrams Manufacturer-specific, 342 Standard, 342 Telegrams for receiving, 343 Telegrams for sending, 344 Terminal assignment Inputs/outputs, 298 Support on the HMI, 298 X122, 294, 297 X132.296 Thread Tapping/thread cutting, 132 Toolbox, 27 Topology of individual drive components, 267 Transfer license information Drag-and-drop, 333 using menu commands, 334 Traversing direction, 147 traversing ranges, 121

V

Velocities, 128 Max. axis velocity, 128 Max. tool path velocity, 128 Maximum spindle speed, 128 Upper limit, 128 Voltage limit, 129 Velocity monitoring Actual, 162 W Working area limitation, 159

Ζ

Zero speed tolerance, 158